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Olympic-Caliber Computing

February 1997

International Technical Support Organization
San Jose Center

International Technical Support Organization

SG24-4279-00

Olympic-Caliber Computing

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Take Note!

Before using this information and the product it supports, be sure to read the general information in Appendix C, “Special Notices” on page 153.

First Edition (February 1997)

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Preface

This redbook is unique in its detailed coverage of IBM′s contribution to the 1996 Olympic Games. It focuses on the technical elements of the solutions provided. It provides information about the software, the hardware, the integration of non-IBM products, and the consulting and services deployed for the major applications:

- The Results System and the Commentator Information System
- The Info ′96 System
- The Olympic Games World Wide Web Site
- The Games Management Systems, in particular:
  - Accreditation
  - Games Staffing
  - Use of CAD and 3-D visualization
  - Security Incident Tracking
  - Ticketing

This redbook was written for customers, systems integrators, and solution architects who are, or will be, building mission-critical client/server solutions. This book will provide them with the opportunity to learn about one of the most complex and globally visible client/server solutions, the Olympic Games, and the applicability of these solutions to other business enterprises.

Some knowledge of networking, application development, distributed data, and transaction processing is assumed.

How This Redbook Is Organized

Chapter 1, "Atlanta Committee for the Olympic Games: The Enterprise and its Business Challenges"

Describes the complexity of the requirements that must be addressed by the systems, such as number and types of users, response times, number of venues, contingencies, visibility, and of course, the functions that must be performed.

Chapter 2, "IBM and the Olympic Movement: An Enduring Partnership"

Reviews IBM′s involvement with past Olympic Games. It then defines the designation of Worldwide Information Technology Sponsor, and the responsibility that this designation brings to IBM′s involvement with the Olympic Summer Games in Atlanta, and with future Olympic Games.

Chapter 3, "IBM′s Technology in Atlanta: Client/Server in Action"

Provides a brief introduction to the major Olympic Games IT applications. It then concentrates on the architecture solution and on the supporting networking, software, and hardware infrastructures.

Chapter 4, "The Results System"

Focuses solely on the Results System, the hardware and software components that make up the system, configurations, service levels, and issues. If a customer has business requirements that match those of the Results System, the solution is defined to the level of detail that could be applied to any similar set of requirements.

Chapter 5, "The Info ′96 System"

Describes a system incorporating multimedia and kiosk components for use by the Olympic Family, including broadcast and print media, athletes, and dignitaries. The Info ′96 System is driven by AS/400s and networked to kiosks and IBM personal computers, where a touchscreen display, a keyboard, or both allows users to gain information about event and transportation schedules, weather reports, results, Olympic news, and athlete biographies.

Chapter 6, "The Internet and the Olympic Games"

Describes the Internet enablement of the first Web site in the history of the Olympic Games, provided by IBM.

Chapter 7, "Operation Management Systems"

Introduces the Operation Management Systems, encompassing high-profile Games Management Systems such as Accreditation, Games Staffing, CAD and 3-D Visualization, Security-Incident Tracking, and Ticketing, as well as the essential back-office Enterprise Operations Systems.

Chapter 8, "The Accreditation Subsystem"

Focuses on the Accreditation Subsystem: the hardware and software components that constitute the system, configurations, services levels, and issues.

Chapter 9, "Games Staffing"

Covers the mammoth human resources challenge of Games Staffing, for which IBM created a solution integrating imaging and intelligent character recognition technologies to process the huge volumes of applications.

Chapter 10, "CAD and 3-D Visualization"

Provides an overview of the use of design technologies (CAD, automated mapping/GIS, and 3-D visualization) for the 1996 Olympic Summer Games. The ACOG enterprise has been a dynamic environment, demanding innovative design technologies. CAD has been utilized as a ″communication″ tool, not just as drafting or design software, and has enriched the Olympic Games experience.

Chapter 11, "Security Incident Tracking System"

Discusses the solution which allowed security personnel and venue managers to share information in real-time about incidents, people, and inventory at the Games, and facilitated immediate response to security issues.

Chapter 12, "Olympic Ticketing System"

Highlights the partnership of IBM and ProTix put in place to deliver the most effective ticket sales system in Olympic history.

Appendix A, "Comparison of Technology at Lillehammer, Atlanta, and Nagano"

Appendix B, "Information Sources on the Internet"

The Team That Wrote This Redbook

This redbook was produced by a team of IBM specialists from around the world working in Atlanta and in San Jose for the International Technical Support Organization, San Jose Center.

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- Cathy Baker
- Pat Bridgforth
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- Luis Estrada
- Tim Phillips
- David Swanz

Comments Welcome

Your comments are important to us!

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Part 1. Going For Gold—The Right Preparation

Chapter 1. Atlanta Committee for the Olympic Games: The Enterprise and its Business Challenges

This chapter describes the complexity of the requirements that the system had to address, such as the numbers and types of users, response times, number of venues, contingencies, visibility, and of course, the functions that were being performed by IBM.

1.1 The Challenge

When the modern Olympic Games began in 1896, they picked up the thread of a glorious, ancient tradition and extended it by adding new sports and by enlarging the Games′ reach as the premier international showcase for athletes.

The Olympic Games have always been about challenge; the challenge of stretching human potential, of competing with the best of the best. When the IBM Corporation accepted the Atlanta Committee for the Olympic Games (ACOG) offer to be the Games′ IT provider five years ago, it also accepted a challenge: to develop the best integrated solution to the total information needs of the 1996 Olympic Games.

But what is the **business** of the Olympic Games?

1.2 Customer Expectations

From one point of view, facts and information are the real business of the Olympic Games.

Starting July 19, 1996, the attention of two-thirds of the world′s population was riveted for 17 days on Atlanta, Georgia, and the 1996 Olympic Summer Games. Those billions of fans watching the Olympic Games on television were information consumers:

- How fast did she run?
- How high did he jump?

But with every Games, customer expectations rise:

- They want more information.
- They want it faster.
- It must be absolutely accurate and reliable.
- They want it available to news agencies and others around the globe, 24 hours a day.

Shelf-life of this data? Try 0.3 to 0.7 of a second.

1.3 A Tough Assignment

This was a tough assignment for any business solutions company:

- The whole system had to be built from the ground up in 3 years.
- The delivery date was non negotiable.
- There were no dry runs.
- User training had to be minimal since most of the users were volunteers.

- The whole event had a 17-day lifespan.
- There was absolutely no room for bugs, glitches, mistakes, or downtime.
- Naturally, there was a finite, limited budget!

1.4 The Business of ACOG

And that was the easy part. How about **managing** the Games as a total enterprise?

In the last few years, ACOG grew from a handful of organizers in one office to a $1.7 billion Fortune 500 company—the ultimate startup success story.

It had the same administrative needs as any big corporation: all the typical back-office functions, such as accounting, payroll, and personnel.

And that explosive growth was just as hard to manage.

1.5 The Size of It All

This summer in Atlanta, over 10,000 athletes from 197 countries competed in 271 medal events in 26 sports. Besides the 15,000 media representatives there were 135,000 members of the extended Olympic family: officials, coaches, and staff. More than 2.5 million spectators bought 640,000 hotel room nights. Plus there were 3,000 hours of live TV coverage for 3.5 billion TV viewers worldwide. If these statistics aren′t enough to convince you of the enormous magnitude of the Games, here are the rest:

- 5,500 coaches and officials
- 11.2 million tickets
- 67% of the world viewed
- Over 100 heads of state attended
- 37 disciplines (including diving, swimming, synchronized swimming, water polo)
- 540 competitive sessions
- 30 competition venues
- 8 athlete villages (1 major village in Atlanta)
- 71,000 ACOG staff and volunteers
- Over 1 million meals served (athletes, coaches, officials)
- 150,000 members of the Olympic family

There were 26 sports and within these sports, 37 disciplines selected for competition at the 1996 Olympic Summer Games. This placed challenges on the Results System, which had to be designed to incorporate the different elements for team, head-to-head, judged, and timed sports—each of which had its own design and technology requirements. In effect, the Results System was made up of a base system, and 37 separate system towers, each representing one of the 37 sporting disciplines.

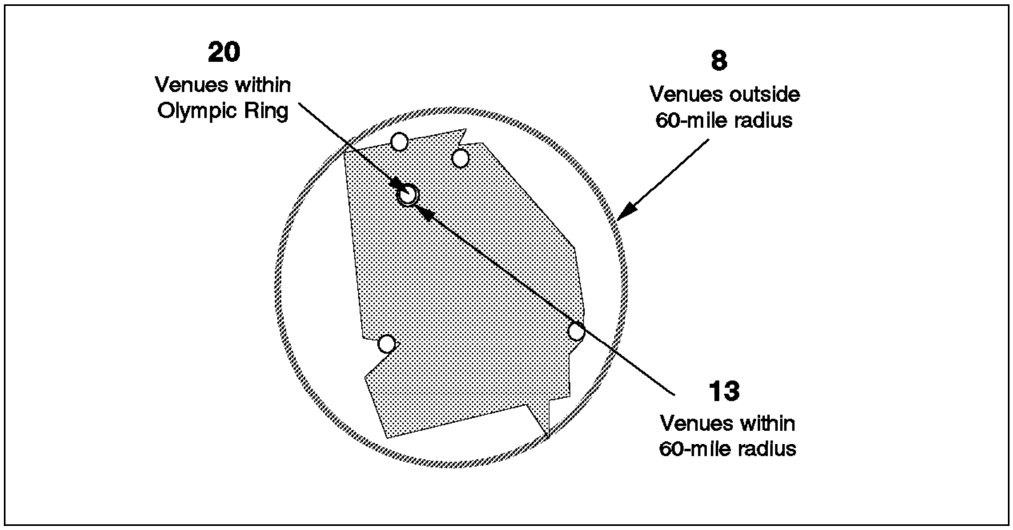

Figure 1. The Size of it All—The Dispersed Nature of Venues

Figure 1 shows the distribution of the 41 Olympic venues, highlighting their dispersed nature:

- 20 occurred within the downtown Atlanta ″Olympic Ring,″ an imaginary 1.5-mile circle extending outward from the center of downtown Atlanta
- 13 occurred outside the Ring, but still within a reasonable proximity to downtown Atlanta
- The final 8 occurred either elsewhere in the state of Georgia (Savannah, Athens, Columbus, Lake Lanier), or in other states of the USA. Venues as far afield as Washington D.C., Florida, and Alabama were used for soccer. The white water canoe and kayak events were held on the Ocoee River in neighboring Tennessee.

All sports venues placed similar demands on the IT infrastructure, and all end users, particularly the media, had similar performance and response time expectations, regardless of remoteness of venue.

1.6 ACOG′s Technology Charter

IBM was charged by ACOG “to provide integrated, state-of-the-art technology solutions responsive to the needs of ACOG and the participants of the 1996 Atlanta Centennial Olympic Games.”

1.6.1 The Technology Objectives

Technology solutions for the 1996 Atlanta Centennial Games had these objectives:

- Deliver ″high tech/high touch″ support and be a major contributor to participant satisfaction.
- Be designed for ease of use.
- Reflect a high degree of technology integration.
- Be designed for maximum availability and flexibility.

1.7 The ACOG Technology Solution

The 1996 Centennial Games were the most technologically advanced sporting event in history. The information technology systems for the 1996 Olympic Games featured some of the latest high-capacity networking, wireless communication, multimedia, and cellular technologies available in the marketplace, and almost instantaneously connected participants and media from around the world.

Split-second Swiss Timing interfaced with the latest-results computer systems to provide precise results recording. State-of-the-art biometric hand-print scanners and radio-frequency security badges were used by the athletes and officials to gain entrance to secured-access areas such as the Olympic Village.

Cost-effective wireless local area networks (LANs) eliminated the need for miles of cable, allowing for faster and easier installation. And the information technology was accessible even to the novice user.

The 1996 Olympic Games technology shopping list included the items listed in Table 1. Just as the Lillehammer Olympic Games provided a technology base, the comprehensive nature of the 1996 Atlanta system provided a legacy of knowledge, architecture, and people skills for future Olympic Games in Nagano, Sydney, and beyond.

Table 1. The Technology Scope

Device or Facility	**Number**
Telephones	13,000
TV sets	11,500
Pagers	6,000
Mobile radios	2,000
Portable radios	7,300
Accreditation stations	35
Security-access control points	450
Computer terminals	6,000
Cable installations	80,000
Staff, volunteers, sponsors	105,000
Budget	$150,000,000

1.8 Where Does IBM Fit In?

IBM has been a key player in the Olympic Movement in technology since 1960 in Squaw Valley, California. As the official information technology sponsor of the Olympic Games, IBM customized systems to make the Olympic Summer Games in Atlanta the best Olympic experience for athletes and viewers alike.

In its sponsorship arrangement, IBM was assigned to provide the computer hardware and software, the professionals, and the services to integrate all information technology into a smoothly functioning operation.

Highlights of the information technology IBM provided for the 1996 Olympic Summer Games include:

- Client/Server implementations, in which, depending upon the application, the System/390s (S/390s), AS/400s, or IBM personal computers were the servers to IBM personal computer clients.
- Four IBM S/390 Enterprise Servers handled the primary data distribution control of the overall enterprise network and network management. The S/390 was a major control point for the DB2 and CICS implementations that existed on all the platforms.
- IBM storage system hardware and software products provided systems and data management with availability, reliability, flexibility, and high performance for both the S/390- and AS/400-based systems to meet the mission-critical requirements of the Olympic Games.
- In addition to operating systems and CICS across the platforms, IBM software products supported databases, data management, network, performance analysis, and program development.
- Helping ACOG tie this all together was the Integrated Systems Solutions Corporation (ISSC), an IBM wholly-owned subsidiary, charged with developing, in partnership with ACOG, the Centennial Olympic Games Results System and integrating major applications.

To transform ACOG into the $1.7 billion corporation it became, IBM helped to design a platform with its customer, ACOG, that provided information systems, technology, and services crucial to the successful staging of the Centennial Olympic Games in Atlanta.

Because of the mission-critical nature of the Olympic Games, the platform combined proven technologies with evolving technologies such as radio-frequency badging and palm-geometry recognition. In some cases, such as the Results System, staff experience and applications from previous Olympic Games was utilized and enhanced.

IBM′s role in Atlanta, as Worldwide Olympic Information Technology Sponsor, included:

- Information systems integrator
- Hardware and software provider
- Systems design
- Maintenance
- Technical support
- Training
- Application design and development
- Consulting
- Backup and recovery

1.9 Integration With Other Technology Providers

Although IBM is the Worldwide Information Technology Sponsor for the Olympic Games through the year 2000, other companies made important technology contributions to the 1996 Olympic Games. IBM worked in partnership with all of the other technology sponsors to help fulfill ACOG′s mission.

The long list of Olympic sponsors whose products and services were integrated into the technology solution includes:

Swatch:

Timing and scoring, scoreboard systems and server, providing feeds from timed, judged, and all other sports

Xerox:

Copiers, printers, facsimiles, and scanners

BellSouth:

Local telecommunications products and services (the Bell South wireless laptop feed permits reporting anywhere)

Scientific Atlanta:

Broadband advanced digital video distribution, including cable feed of nine key sports working with IBM systems

Panasonic:

Audio, TV, and video equipment

Sensormatic:

Electronic security systems, including foolproof hand-print ID for athletes′ security

Kodak:

Accreditation image capture and management providing easy badging for over 150,000 participants

AT&T:

Long distance telecommunications equipment and services

Motorola:

Wireless communications

Protix Ticketing:

With IBM CallPath, the ability to issue refunds.

Please refer to Chapter 12, “Olympic Ticketing System” on page 145, for further information on the RS/6000-based Olympic Ticketing System.

1.10 Big Project, Big Risk

The solution IBM created for the Centennial Olympic Games was a sprawling complex of hundreds of LANs, four System/390 Enterprise Servers, 80 AS/400s, 30 RS/6000s, and 7,000 PCs and ThinkPads, all integrated into a single network. IBM securely managed over three terabytes of information, developed more than 400 unique software applications, and created the Web site for the Atlanta Committee for the Olympic Games.

1.10.1 Overall Perspective

All of this technology literally elevated the world′s premier sports event—delivering more information, faster, and in greater context to more people than ever before:

- For the first time, fans of more obscure sports like team handball and fencing received complete, up-to-date results via the Web, even as track and field or swimming dominated newspaper headlines and television newscasts.
- The convenience of ticket buying over the Internet was enjoyed by thousands of people worldwide. They snapped up 130,000 tickets worth more than $5 million.
- More than 100,000 images from 47 cameras at 40 athletic venues were posted for cyber fans. Those with hot enough desktops could download video feeds and play audio clips.
- Commentators bringing the Games to television audiences worldwide used touchscreen systems that delivered results from Olympic venues—usually within a second of the results going final.
- Close to 100,000 e-mail messages came in from people around the world, who took the opportunity to write to an Olympic athlete or team, courtesy of IBM′s FanMail program.

1.10.2 What Went Wrong

Working with ACOG, IBM set out to use technology to vastly enhance people′s enjoyment of the Games and to improve the efficiency of managing such a big event. IBM tested many parts of the system during test athletic events prior to the Games. IBM also ran extensive simulations, but there is nothing that can perfectly simulate the actual Games when you have dozens of sporting events underway simultaneously and hundreds of thousands of people accessing the systems.

There was a 21-year-old athlete whose age appeared as 97 (someone misentered the information during accreditation), and the German medalist whose country was listed as Ghana (a software error that was quickly fixed). But the most numerous, most bizarre—and certainly the most publicized—glitches with the Olympics systems centered around the World News Press Agency (WNPA) system.

IBM learned from its experiences in Atlanta, and each section of this document will address the issues and the lessons learned for the particular system discussed.

Chapter 2. IBM and the Olympic Movement: An Enduring Partnership

This chapter reviews IBM′s involvement with past Olympic Games. It then defines the designation of Worldwide Information Technology Sponsor and the responsibility that this designation brought to IBM′s involvement with the Olympic Summer Games in Atlanta, and with future Olympic Games.

For more than three decades, an integral part of the Games has been technology, which has been bequeathed from one Olympics to the next. Similarly, current technical advances were an important legacy for ACOG to pass on to future generations—enabling them to enjoy the traditions of the Games more fully.

IBM has contributed to the Olympics since 1960, and is the Worldwide Information Technology Sponsor for the Olympic Games through the year 2000. For the 1996 Centennial Olympic Games in Atlanta, IBM contributed its technology and integration services to make the 1996 Olympic Games the most efficient and accessible Olympic Games to date.

In addition to its computer hardware, IBM provided software and related services to plan, run, and manage the Olympic Games.

2.1 Chronology of IBM′s Track Record with the Olympic Movement

In Summary:

Since 1960, IBM has been an Olympic sponsor, through the host country, for all Games except:

- 1968 - Mexico City Summer Games
- 1972 - Sapporo Winter Games
- 1972 - Munich Summer Games

1960

Where it all started for IBM: The Squaw Valley Games and the Rome Games broke new ground. These were the first Olympic Games using electronic data processing, with IBM as the supplier. IBM used the company′s state-of-the-art technology, the IBM 305 RAMAC computer. Results data collection was done by punched cards, and the result lists were printed centrally.

During the Squaw Valley Games, Walter Kronkite delivered the nightly TV news directly from IBM′s computer room, marveling at the technology of the 305 RAMAC computer.

1964

The Results application was still the main application for both Winter and Summer Games, in Innsbruck and in Tokyo. On-line IBM terminals were used for the first time to collect results data, and results lists were printed at each venue. The hardware used included the IBM 1401 for the Winter Games and the IBM 1410 for the Summer Games.

1968

In 1968, the Winter Games were hosted by Grenoble, and for the first time results were displayed for radio and TV commentators by TV cameramen zooming straight in on IBM displays, and thus providing up-to-the-minute news on the standings of the top ten competitors. The IBM System/360 Model 40 computer was interfaced to wire services transmitting result lists to press agencies.

IBM was not a sponsor of the Mexico City Olympic Summer Games in 1968.

1972

IBM was not a sponsor of either the Sapporo Winter Games or the Munich Summer Games.

1976

At previous Games, computers were used for the Results application. In the Montreal 1976 Summer Games, the Games Management applications were started by running Accreditation together with the Results application on the IBM System/370 Model 135.

1980

The base for the application software used in the Moscow Summer Games in 1980 was the Montreal software. 250 IBM terminals were installed to collect results data and the IBM System/370 Model 148 was linked electronically to world news agencies. In addition, a Soviet-made copy of an IBM System/360 was installed to run sports statistics.

1984

In 1984, there were significant extensions to the applications, both in the Games Management systems and the Information Retrieval systems. Electronic mail was introduced for the first time in Sarajevo on an IBM 4381 system. The birth of the current Results application also took place at these Games.

At the Summer Games in Los Angeles, IBM PCs were used for the first time and, as in Moscow, the Results software was based on the Montreal development, running on IBM 4381s. IBM System/38s were used in the Games Management application area.

In Los Angeles, IBM for the first time sponsored the Games.

1988

While the applications for the Calgary Games in 1988 were based mainly on further developments of the Sarajevo software running on IBM 3090s, these were the Games that first used DB2. The applications in Seoul were developed by third parties. The Results system in Seoul ran on IBM System/36s in each venue and on a central IBM 4381 system. Games Management ran on an IBM 3090 system.

1992

In Barcelona and in Albertville, IBM made available for both Summer and Winter Games a new E-mail system on PS/2s, based on OfficeVision/MVS. Multiple IBM 3090s and IBM ES/9000 systems were used as central site systems; LAN networks with IBM PS/2s were used at venues; and the Organizing Committee′s headquarters systems ran on IBM AS/400s. Multimedia systems were introduced in Albertville.

For the Barcelona Games, a new development was introduced by IBM′s Scientific Center in Madrid: an interactive radio and TV Commentator Information System based on IBM PS/2s with touch screens—very well accepted by the TV commentators.

1994

For the 1994 Lillehammer Games, only two years after the Albertville and Barcelona Games, the hardware installed included IBM ES/9000s, AS/400s and PS/2s. In addition, a number of IBM RS/6000 systems running Architecture and Engineering Series (A&ES) software were used for venue design. The Results, Games Management and Information Retrieval systems were transported from Albertville. The Commentator Information System was transported from Barcelona and fully developed for all winter sports. The Lillehammer developments became the base for all current Games application software, now being further developed in Atlanta and Nagano.

2.2 IBM Becomes Worldwide Information Technology Sponsor

The organizing and staging of the Games has become more and more complex. As a result, the need for an integrated offering of information technology products, services, and Games experience has become more evident.

In December 1993, IBM made a long-term commitment to the International Olympic Committee (IOC), and to its marketing affiliate, ISL Marketing, as the **Worldwide Information Technology Sponsor** for four Olympic Games.

This carries IBM as a significant partner of the Olympic Movement through:

- The Winter Games in Lillehammer (1994)
- The Summer Games in Atlanta (1996)
- The Winter Games in Nagano (1998)
- The Summer Games in Sydney (2000)

providing systems and people to help plan, manage, and run the Olympic Games. It also allows IBM the right to use the Olympic Rings in advertising or promotion, as shown in Figure 2 on page 14.

36 USC 380

IBM

Worldwide Information Technology Sponsor

Figure 2. IBM: Worldwide Information Technology Sponsor

The agreement also gives IBM an option to continue through:

- The 2002 Winter Games in Salt Lake City
- The Summer Games in 2004.

This grants the IOC continuous and cohesive IT support throughout this period. Games application software and know-how will be transported from Olympics to Olympics, representing a very valuable service to the Olympic Movement.

IBM′s involvement extends beyond the Games—it includes IOC headquarters and museum support in Lausanne, Switzerland, U.S. National Olympic Training Centers, other National Olympic Committee support, and carries with it the following designations:

- The Worldwide Information Technology Sponsor
- Worldwide Olympic Sponsor
- Proud Sponsor of the Centennial Olympic Games
- Proud Sponsor of the U.S. Olympic Committee
- Proud Sponsor of the 1996 U.S. Olympic Team

2.2.1 The Vitality of Information Technology

With each passing Games, the information technology undergoes vast improvements in usability, speed, range, and capacity. IBM must balance the proven stability of older technology with the benefits of the new, leading-edge technology of the day. Appendix E details the technological enhancements that have been incorporated from the Lillehammer Winter Games of 1994 through to the as-yet unplayed 1998 Winter Games in Nagano.

2.3 Technology and Knowledge Transfer

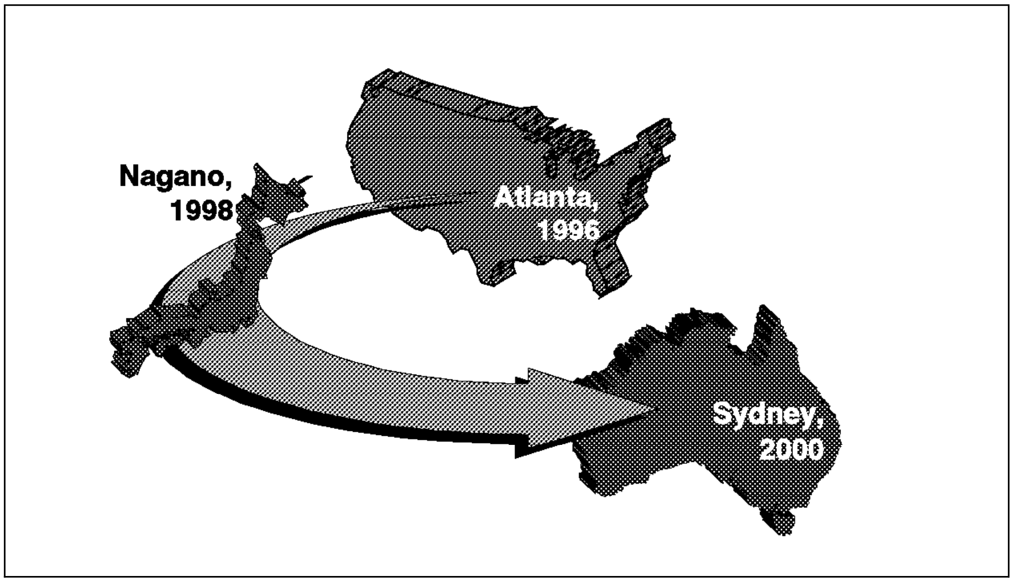

Figure 3. Technology and Knowledge Transfer

2.3.1 IBM Teams Up With Nagano Olympic Organizing Committee

The Nagano Olympic Organizing Committee (NAOC) for the 1998 Olympic Winter Games and IBM Japan have begun implementation of Information Technology Systems for the Nagano Games.

Through IBM′s 1993 long-term agreement with the IOC, IBM will fully support NAOC in implementing the information technology systems for the Nagano Olympic Winter Games.

In previous Olympic Games, each Organizing Committee (OCOG) has provided its own information technology systems and implemented the applications. In accordance with the long-term agreement, in Nagano a common set of application software used at both Summer and Winter Games will be implemented, after adding Winter Games applications to systems from the 1996 Atlanta Olympic Summer Games. This system will be the base for follow-on systems through the Olympic Games in Sydney, in 2000.

In accordance with the provisions of this long-term agreement, Olympic Games application software will be implemented in the following four areas:

- Results System: includes results calculation and distribution functions.
- Info′96 System: provides history, results, weather information, transportation schedules, and electronic mail services to the media and to the members of the Olympic Family.
- Games Management System: includes accreditation, medical services, accommodation, transportation, and the like.
- Headquarters Applications: include financial, payroll and personnel, and office business management.

IBM will support the Nagano Games in various dimensions, including technological innovations such as multimedia. With the start-up of systems implementation, an international cooperative relationship with ACOG is being built, and NAOC and IBM Japan have sent technical staff members to ACOG in preparation for the Nagano Olympic Winter Games.

2.3.2 Toward Sydney 2000: IBM is ″Team Millennium″ Sponsor

As the Olympic Movement′s Worldwide Information Technology Sponsor, and one of the Sydney Organizing Committee for the Olympic Games′ (SOCOG) first announced ″Team Millennium″ sponsors, IBM will provide the computer hardware, system software, consultancy services, system integration, training, and service support needed to run the Olympic Summer Games in Sydney in 2000.

The Sydney Olympic Games will be a showcase for the information technology, skills, and expertise of IBM Australia and the other Australian software companies who will be contracted by IBM to customize many applications for local conditions.

And, as the IBM RS/6000s and IBM personal computers used before and during the Olympic Games will be manufactured at IBM′s Wangaratta Plant, the event will provide a further boost for Australian manufacturing.

Chapter 3. IBM′s Technology in Atlanta: Client/Server in Action

IBM partnered with ACOG to plan, implement, and run one of the most advanced information technology infrastructures ever built: the Centennial Olympic Games.

The sophisticated client/server solution leveraged innovative technologies and proven methodologies, providing an end-to-end solution in a mission-critical environment. This was no small feat. The specifications for this solution were more stringent than for most commercial clients. Furthermore, the systems were used by many thousands of volunteers. This required the systems to be intuitive, allowing for minimal training.

The 1996 Centennial Olympic Games information systems emulated the back-office, front-end, and computer communications structure of a large multinational corporation. Like a large insurance company, a multinational bank, or any other information-intensive corporate enterprise, ACOG required a system combining mission-critical transaction processing, real-time data distribution, remote system management, and customer-focused applications.

The IBM systems, computer networking, database, tools, and services used for the Olympic Games are being used by IBM′s customers throughout the world.

3.1 Olympic Games Applications Overview

The major systems that comprised the Olympic Games applications, as well as the interactions among them are depicted in Figure 4 on page 18.

Some of these systems were adapted from former Olympics and others were built from scratch. Each of these systems had its own functional specifications and special requirements, but due to the volunteer status of the end users, a common requirement was an extremely easy-to-use interface. There were hundreds of thousands of users, with no time at all to be trained on the interface. ACOG expected an average user to learn the systems in seconds.

In addition, technologies from other official sponsors, such as Swatch, AT&T, Xerox, Motorola among others, had to be integrated by IBM in the Olympic Games IT architecture.

Furthermore, the due date for the whole system could not be extended. On July 19, 1996 the Centennial Olympic Games started, whether IBM was ready or not.

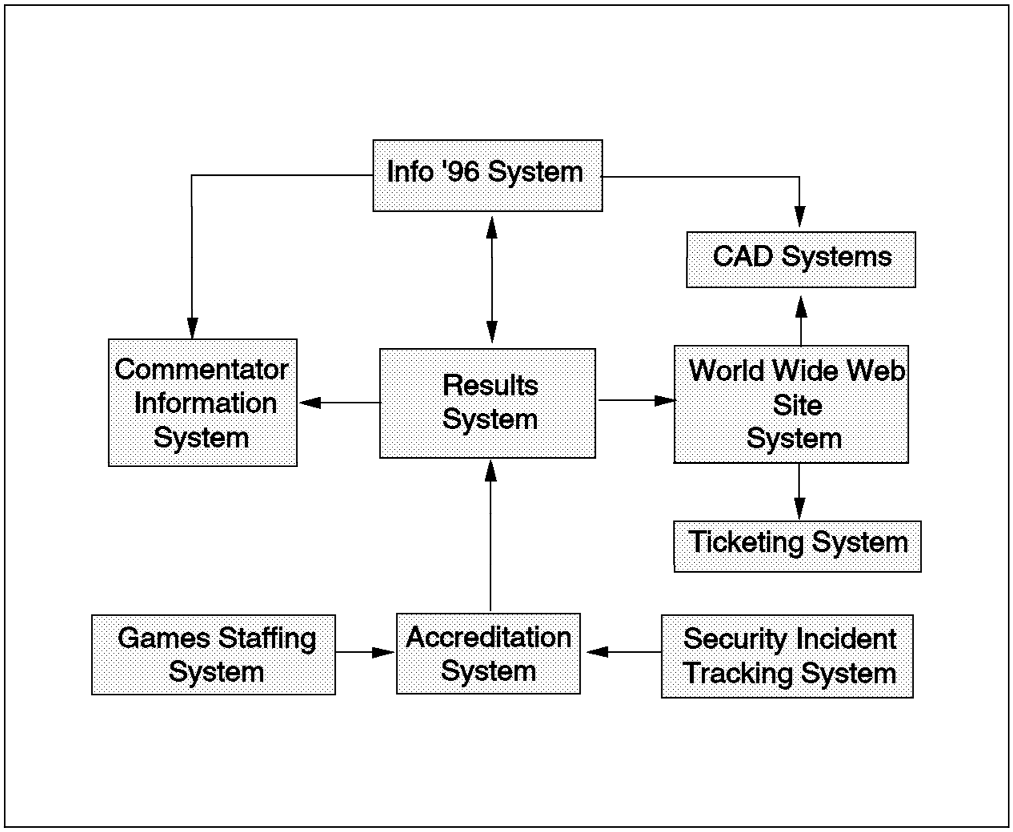

Figure 4. Major Olympic Games Applications

This book will focus on the systems shown in Figure 4, as well as on their corresponding IT architecture and infrastructure. A brief introduction of each follows:

The Results System:

The **Results System**, modeled after a highly-efficient corporate network, shared competition results across IBM platforms. This application allowed ACOG to track 10,000 athletes competing in 37 sporting disciplines at 41 competitive venues.

The **Commentator Information System** was operational throughout the event and was fed by the Results System with start-list information, intermediate results, and judges′ final determinations.

Obtaining the information needed for results required interfacing with timing and scoring devices provided by Swatch. Results and scoring were transferred to an IBM personal computer server, sent to a S/390, then distributed back to the IBM PC servers located on the client/server network. The process took between 0.5 and 1 second for an end user (for example, network announcers) to see the results via the Commentator Information System, even when the events took place miles away from where reporters and commentators were located.

For a detailed coverage of the Results System and of the Commentator Information System, please refer to Chapter 4, “The Results System” on page 41.

The Info ′96 System:

The Info ′96 System is a touch-screen interactive kiosk system which informed the media, athletes, officials, VIPs, and other accredited participants about such things as competition-event scheduling, event start lists, athlete biographies, results, transportation, weather reports, cultural events, and news.

The Info ′96 system also provided an electronic mail system for its 150,000 users.

For detailed coverage of the Info ′96 System, please refer to Chapter 5, "The Info ′96 System" on page 73.

The Olympic Games WWW Site System:

ACOG′s home page on the World Wide Web is where Web users could follow event results, up-to-date information about their favorite Olympians, and other information about the Olympic Games. For the Internet user, ticketing availability and buying information was available before and during the Games.

For a detailed coverage of the Internet solution, please refer to Chapter 6, "The Internet and the Olympic Games" on page 85.

In addition to the three primary systems built by IBM for the 1996 Olympic Summer Games, the various Games Management Systems, in particular Accreditation, Games Staffing, CAD and 3-D Visualization, Security Incident Tracking, and Ticketing are very important to managing administrative and logistical details of staging the Olympic Games.

For a detailed coverage of these Games Management applications, please refer to:

Chapter 7, "Operation Management Systems" on page 95
Chapter 8, "The Accreditation Subsystem" on page 99
Chapter 9, "Games Staffing" on page 125
Chapter 10, "CAD and 3-D Visualization" on page 135
Chapter 11, "Security Incident Tracking System" on page 141
Chapter 12, "Olympic Ticketing System" on page 145

3.2 Overall Technology Overview

On July 19, 1996, the Centennial Olympic Games began in Atlanta, Georgia. IBM built the complete technological underpinning for the event, which was viewed by 3.5 billion people around the world. That is, IBM provided computer hardware, software, network, integration, service, and support solutions for the 1996 Centennial Olympic Games. Those solutions also served as the information technology foundation for future Olympic Games.

IBM partnered with ACOG to build the most highly accessible, efficient system ever created for the Olympic Games. The three-tier, completely integrated, client/server infrastructure supported more than 100 applications. The system was structured on the model of a vast, diverse corporate enterprise of 150,000 users on-site with millions of customers worldwide who wanted access to information. The model is scalable and can be applied to small and midsized organizations with distributed information needs, as well as to the very largest organizations.

3.2.1 System Requirements

With a clean drawing board and an immovable deadline, building the Olympic Games IT infrastructure challenged IBM to maintain a steady focus and rapid development path.

The initial system requirements specified by ACOG included the following:

- Flexibility
- Performance
- Availability
- Security
- Data integrity

IBM provided the hardware products that form nearly all core application platforms and their systems and, as the world′s largest software developer, provided the Olympic Games with a full range of IBM software solutions to develop and run its core applications.

In addition, it was critical that the IBM-provided solutions included:

- Accommodating and migrating legacy systems
- Structuring a database that was entirely scalable, from host systems to end-user workstations
- Ensuring data security, integrity, and availability at over 40 sites, 24 hours a day, 7 days a week for nearly 3 weeks
- Creating systems that were easy to use.

The Olympic Games information challenges were similar to the IT issues facing today′s corporate enterprises. For both, the ultimate test of success is whether the right information goes to the right user at the right time. The Olympic Games, however, present some unique twists. There are thousands of end users of quite a few different varieties, and the right time often means real time.

3.2.2 Building a True Client/Server Enterprise Environment

IBM began the project with a sophisticated data modeling approach using an information engineering methodology provided and adapted by the IBM Consulting Group. To meet time constraints, data modeling exercises ran parallel to the design of core applications, creating a focused and highly dynamic development environment.

The data and communication needs of the core application systems of the Olympic Games were evaluated and then mapped to the appropriate IBM hardware and software products. The needs and contributions of other Olympic Games technology partners (including Bell South, Kodak, Swatch, Xerox, and Scientific Atlanta) were examined and analyzed to optimize integration. As a result of these efforts, key fundamental decisions were made as to how to best build and administer an enterprise-wide client/server implementation expected to manage nearly 3 terabytes (TB) of data.

For years, client/server has been touted as the right solution to most enterprise information models. However, most organizations are still migrating to a complete implementation of this distributed environment. The Olympic Games information model is an excellent demonstration of how a true client/server installation can add data flow efficiencies and other computing benefits to the enterprise.

Figure 5 on page 21 summarizes the client/server infrastructure defined to meet ACOG′s requirements.

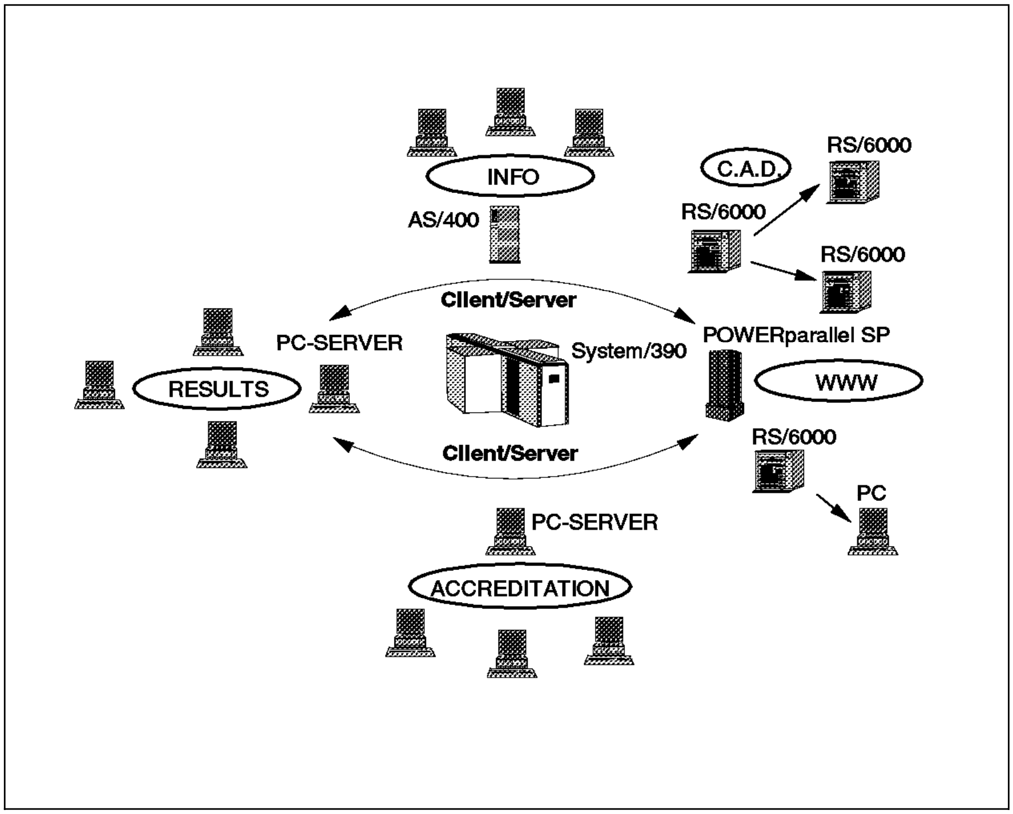

Figure 5. The Client/Server Delivery Infrastructure for Applications

The **System/390** was the central information warehouse and application server to ACOG′s massive multiplatform, multitier client/server system. It was the large server that stored, managed, and processed millions of transactions during the Games. It also distributed the data immediately to the venues connected by the Olympic Games network infrastructure, for midrange to PC servers.

IBM AS/400 Advanced Series played a crucial role in ACOG′s information technology. It stored and managed the largest database ever assembled for the Olympic Games, containing 60 gigabytes (GB) of information. Through the Info ′96 System, it provided instant statistical and background information for the 150,000 Olympic Family members, including journalists and broadcasters covering the Olympic Games

Another important characteristic of the AS/400 is its scalability. Its vast product range allowed granular sizing of CPUs to the requirements of individual venues, which range from small nonsport venues to the largest sporting ones.

RS/6000 products supported ACOG′s centralized physical planning system and the Olympic Games Web Server. Applications such as weather forecast and 3-D venue graphics display were well-suited to run on this platform.

The volume of information and number of hits to the Olympic Games Web Server certainly increased as the beginning of the Games got closer and closer, and during the 17 competition days. The RS/6000 Scalable POWERparallel (SP) System was chosen as the platform for the Web Server because it is so easily scaled up, allowing more users to access the WWW site simultaneously.

Powerful **IBM PC Servers** had a very critical role at each venue. These units performed many of the statistical computations, maintained files, and supported all LAN communications within the venue. The flexibility of the IBM PC product line allowed some of the same computers used for end users to be equipped with appropriate software configuration to perform important functions in the network.

3.2.3 Migrating Legacy Systems

Few enterprise-wide infrastructures are completely first-generation and the IBM solutions used to run the Olympic Games are no exception.

IBM′s involvement began with punch card technology in 1960 at the Rome Olympic Summer Games and has progressed to much more modern solutions at Barcelona in 1992 and Lillehammer in 1994. However, even a few years can mean a vast difference in the sophistication of technical solutions.

IBM′s challenge was to port legacy code from Barcelona to Atlanta for use in distributing accreditation data. The requirement was to preserve host-based code while making a 3270 version upgrade. IBM VisualAge was selected as the development tool. VisualAge uses object-oriented technology for quick development. Using IBM′s Smalltalk, VisualAge helps engineers take advantage of already-created data instructions, such as class libraries and code objects, in a dynamic, graphical format. VisualAge was also an essential part of the development environment for the Info ′96 System.

3.2.4 The Database Choice

The database for the Olympic Games had to comply with the following requirements:

- Scalable across multiple platforms
- Ensure data integrity on all platforms
- Allow for the technology to be extended.

The DB2 family of products was a natural choice as the common database structure for the Olympic Games. DB2 from IBM is scalable across all platforms, helping to ensure data integrity from PCs to PC servers and from midrange systems through enterprise host systems. Using DB2 created a flexible, homogeneous database for all core applications while allowing integration into environments and systems provided by other Olympic Games technology partners in accordance with IBM′s Open Blueprint approach.

The DB2 model allows Structured Query Language (SQL) to be ported to any platform. DB2′s flexibility even allows SQL to make quick changes and updates from the database to accommodate a variety of presentation formats. For instance, it was the SQL access into a DB2 database that sent formatted information to a variety of output devices, including electronic scoreboards and video character generators for broadcast commentators.

Figure 6 on page 23 shows the data movement related to the major systems described in this book.

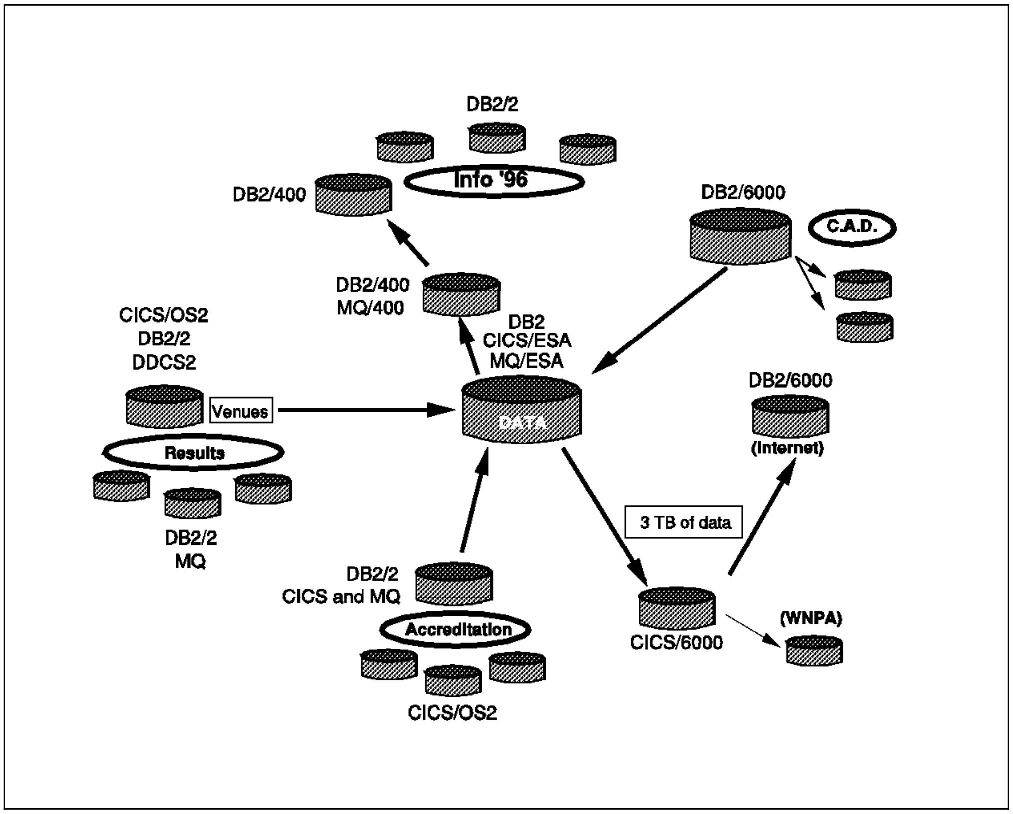

Figure 6. Data Movement of Major Systems

Additionally, DB2 offered the Olympic Games development efforts some added bonuses. Because DB2 is an industry standard, it offered a ready skill pool for the thousands of Olympic Games technical volunteers and ensured an extendible solution to both the upcoming Olympic Winter Games in Nagano, Japan, and the Olympic Summer Games in Sydney, Australia.

3.2.5 Transaction Processing

A variety of solutions were employed to ensure smooth data rollup and downflow. For instant distribution of time-sensitive information, Customer Information Control System (CICS) was the transaction processor of choice between PC servers and AS/400 midrange systems up to the S/390 host. The fault-tolerant, superpowered strength of CICS online processing allowed millions of transactions to flow instantly across all tiers of the Olympic Games network, allowing critical information like approved competition results to find their way to eager audiences in a fraction of a second.

For critical, nearly real-time updates, MQSeries from IBM provided a fast, buffered store-and-forward mode. MQSeries was used to carry Olympic Games accreditation information throughout the network.

3.2.6 Communication Processing

Each major system used the communication protocol that suited it best. Generally, NETBIOS was used for broadcast sessions while TCP/IP managed queues for the wide area network′s (WAN′s) massive print operation. Overall, the entire WAN was Systems Network Architecture (SNA) based, taking advantage of SNA′s ability to create a solid deterministic network and to allow automatic traffic prioritization by packet.

3.2.7 Middleware

The 1996 Olympic Games in Atlanta presented the ultimate mission-critical challenge for a client/server system. During the 17 days of the Olympic Games, the system handled the flow of millions of transactions about Olympic Games scores generated by the intense competition of 10,000 athletes; managed the collection and distribution of 3 TB of data about the Olympic Games, athletes, and associated events to the press, spectators, and officials; and provided and managed a database and associated transactions for badging and e-mail addresses for 150,000 members of the Olympic Family and others at the Olympic Games.

As shown in Figure 7, the system consisted of three tiers of processors: the S/390 Enterprise Server, midrange servers including the RS/6000 and the AS/400 Advanced Servers, and more than 7,000 PCs on 250 LANs at the sporting venues.

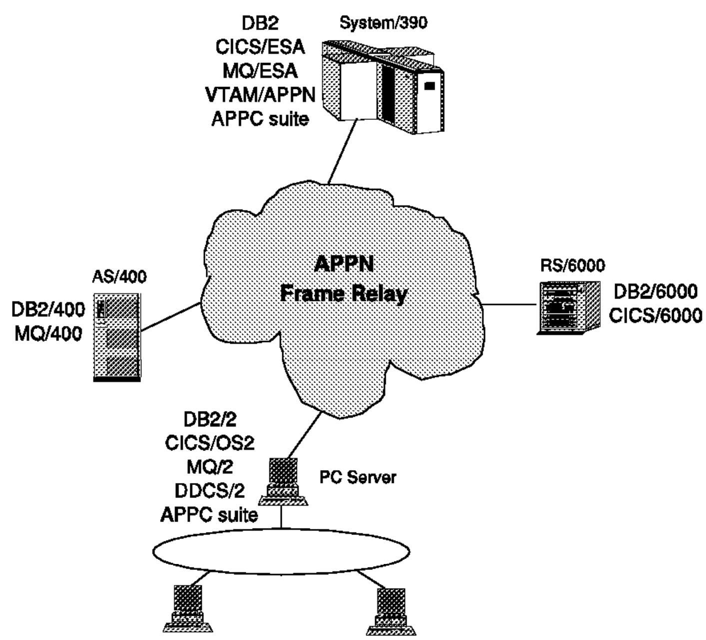

Figure 7. Middleware

The IT architecture designed to manage such a complex dataflow relied on three types of middleware products, as listed below:

- **DB2 Database Family**

  Consistent and reliable database management at each platform level of the client/server system.

- **CICS Family**

  Industrial-strength processing of millions of scores, information, and badging requests that coursed through the system daily.

- **Messaging and Queuing**

Message queuing products that kept the spectators, press, athletes, and officials up-to-date with fresh, reliable information and statistics.

In addition, the logical network design was based on the usage of the SNA APPN technology. In this technology all devices communicate on a peer-to-peer basis using the APPC or LU6.2 protocol.

To illustrate the selected middleware technology exploitation, let us take for example, the Commentator Information System (CIS). CIS is a subset of the Results System. It is a LAN-based database, updated in real-time on nine key sports, that allowed commentators to report on multiple sporting events from one location. With the combination of DB2, CICS, and messaging technology, the system handled this multirole responsibility with ease. For a detailed description of the Results System and CIS, refer to Chapter 4, "The Results System" on page 41.

Each LAN was designed to function independently from the rest of the network, maintaining data on the sport at the venue on a DB2/2 database on its LAN and sending updates to a DB2 database on the S/390 Enterprise Server. If service to the host was disconnected, the LAN continued to function, making use of the data on the DB2/2 database on the LAN, refreshing it when communication was restored. The transaction flow at the WAN level was handled by CICS for OS/2.

CICS is an on-line transaction processor, used in thousands of applications around the world, including airline reservation systems, retail systems, bank teller machines, and process control systems. It allows thousands of users on the system at the same time, keeping the transactions separate, while permitting them to share resources. For the application developer, CICS hides the system complexity from the application, such as exactly what terminals or printers, or other resources are being used. CICS handles the transactions across all levels of the client/server system, from mainframe to midrange to PCs on the LANs.

IBM′s DB2 Family offers premier database products used widely in business, government, and other organizations, with a worldwide license base of over 350,000. It allows databases to grow from a single user to hundreds of thousands of users. And with IBM′s Distributed Data Connection Services (DDCS), local applications, such as those at the LAN level, have transparent access to enterprise servers which use IBM′s Distributed Relational Database Architecture (DRDA). DB2 also has features that increase the availability and flexibility of database operation in challenging distributed environments.

Through DB2, the database on the S/390 updated the Info ′96 System database, which resided on 80 AS/400 Advanced Servers. The Info ′96 System was queried by 1,800 PC clients used by Olympic Family members for everything from competition starting times to biographies on the athletes, the weather, and transportation, not to mention a database on the past 100 years of Olympic Games records and athletes. For more information on this system, please refer to Chapter 5, "The Info ′96 System" on page 73.

The Olympic Games client/server systems use two different types of messaging technology:

- **DDCS**

  DDCS was used for high-speed messaging of sports results from each competition to thousands of PCs across the Olympic Games venues. DDCS helped IBM achieve its goal of distributing sports results in 0.3 second or less after the scores had been received from the Swatch timing devices and validated by the judges.

- **MQSeries**

  For slower, but highly reliable messaging, for accreditation of 150,000 Olympic Family members, and other applications that did not have to be delivered in less than a fraction of a second, MQSeries was used. This technology allowed many different hardware and software products to talk to each other, allowing IBM to replicate data across a client/server network without rewriting applications. The accreditation database was also a directory for the e-mail system used by the Info ′96 System, and as a result, MQSeries also propagated the listing to the Info ′96 System. The way it worked is that every time an update was made to the mainframe DB2 database, it is also replicated with MQSeries down to the local server. Then, if the mainframe became unavailable, the local server allowed local processing. Updates were sent to the mainframe when it became available.

3.2.8 Networking

The network architecture of the Atlanta Olympic Games technology solution was driven by data movement requirements in the three-tier, highly distributed client/server application environment. In that environment, data must move to many locations very quickly. To meet the need for subsecond response times in applications such as the Results System, the network must be extremely fast and deliver high performance. The performance demanded of the Olympic Games technology network mandated that it be highly available, extremely reliable, easily implemented, and managed, and that it exploit new technologies where prudent and appropriate.

During the 1996 Olympic Games more than 3 TB of data had to be managed and transported over the network, comprising a WAN that linked independent LANs to the client/server host computer.

3.2.9 Network Infrastructure

To help ensure continuous network uptime, the Olympic Games network used a new networking architecture concept called a Virtual WAN (VWAN). The VWAN combined private frame relay networks with public networks (such as those of AT&T and BellSouth) into configurations that could be changed on the fly. Figure 8 on page 27 illustrates the network infrastructure for the Games.

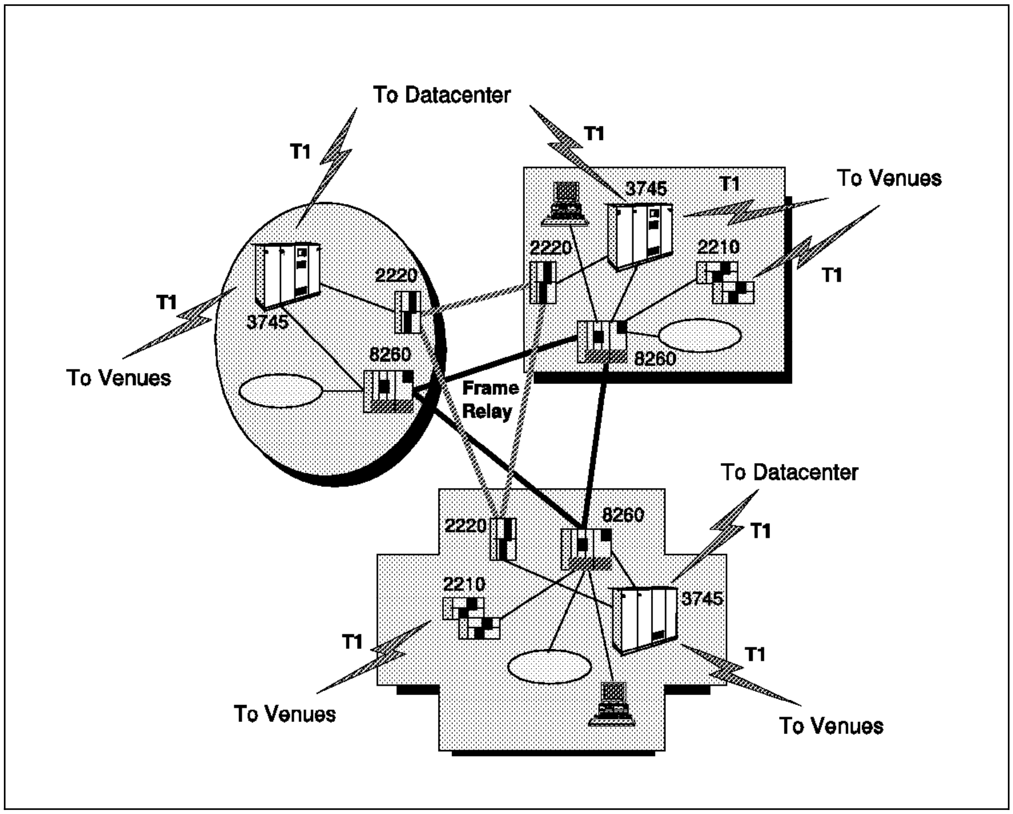

Figure 8. Olympic Games Network Infrastructure

Frame relay is combined with public networks through IBM 3745 network controllers and T1 network links. These links are then split into three sublinks, each running frame relay. In addition, 2220 controllers split T3 network links for the 3745s. On the Olympic Games network, the 3745s could be switched among the smaller links instantaneously, moving data along a different route if any node failed. This ability to dynamically manage bandwidth brought the virtual benefit to the Olympic WAN.

In addition, Advanced Peer-to-Peer Networking (APPN) and Advanced Program-to-Program Communication (APPC) were the selected networking technologies for the 1996 Olympic Games′ client/server environment. This was an advance over the past use of Systems Network Architecture (SNA) in a hierarchical computing environment. APPN was a bridge between older Olympic Games systems and the new Atlanta client/server solution. It allowed the different computing platforms found in the 1996 solution to communicate, while concurrently permitting legacy 3270 terminal-based applications to coexist on the network. In APPN, all devices communicate peer to peer through APPC. The network comprises end nodes (EN) and network nodes (NN) that provide the transport mechanism for the devices to communicate.

Some of the APPN features that led IBM to select it as the logical network technology for the Olympic Games were:

- As NNs join the network, the topology of the network is automatically communicated to the other NNs in the network, greatly reducing the number of network definitions, when compared with SNA.
- As devices and ENs join the network, their presence and function is automatically registered with the NN they belong to.

- When connections between two ENs or NNs fail, an alternate path is determined automatically. Sessions can be reestablished over the new route.

In the ACOG network, the network machine and all the 3745s were considered one logical NN.

3.2.10 Venue LAN Design

The Olympic Games network linked 41 distributed venues. Based upon a preliminary investigation regarding the applications that a venue had to support and the data communication requirements with the host system, three different sizes of venues were defined, as shown in Figure 9.

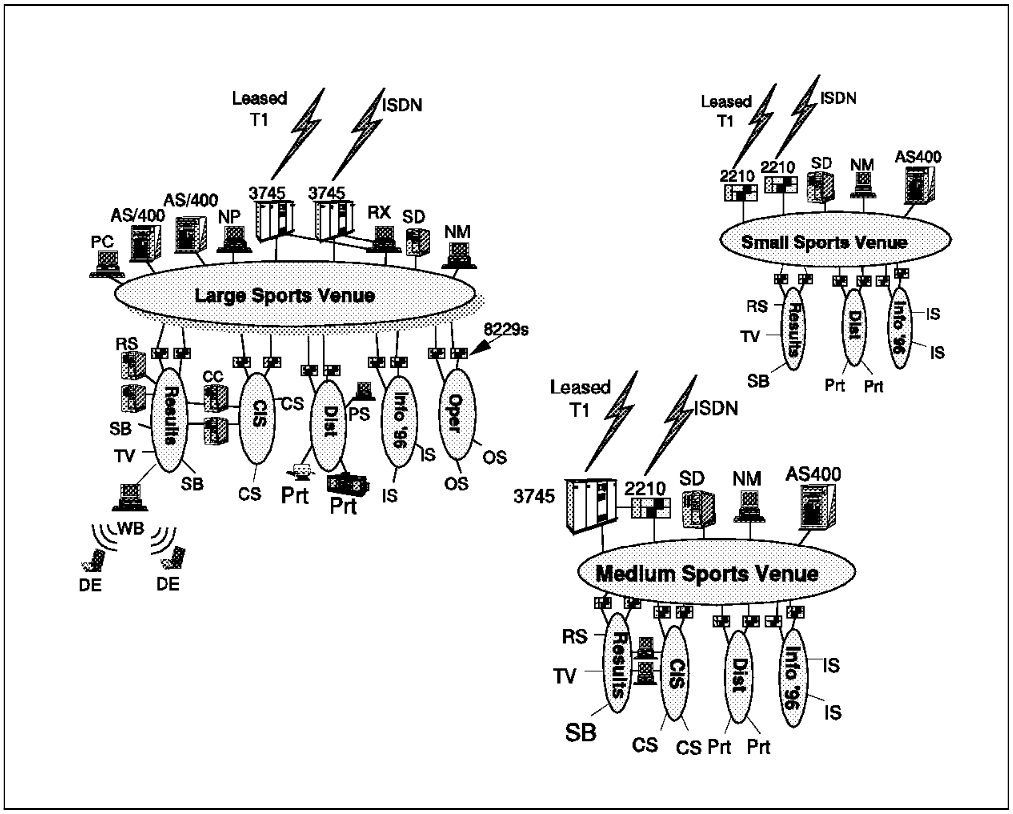

Figure 9. Venues Network Infrastructure

Starting at a venue level, each LAN was fully functional as a stand-alone, so it could remain completely operable if its connection to the main network was broken.

Within the venue, there were separate networks for the Results System, the Commentator Information System, and the Info '96 System, with optional LANs for information distribution and operations, as shown in Figure 9.

This architecture helped ensure maximum uptime. For example, if a particular venue lost its connection to the host, the competitions could continue without interruption because the venue was not solely dependent on the host to access the Results System; each venue was independently running its own copy of the Results System.

Additionally, the host system was the repository for all Olympic Games competition results data. Information from the Results Systems for each sport competition was automatically sent to the host from the venue LAN, as the competition results were finalized.

From a logical point of view, the venues were connected to a consolidation center by primary (leased T1) and backup (ISDN) lines, as shown in Figure 10.

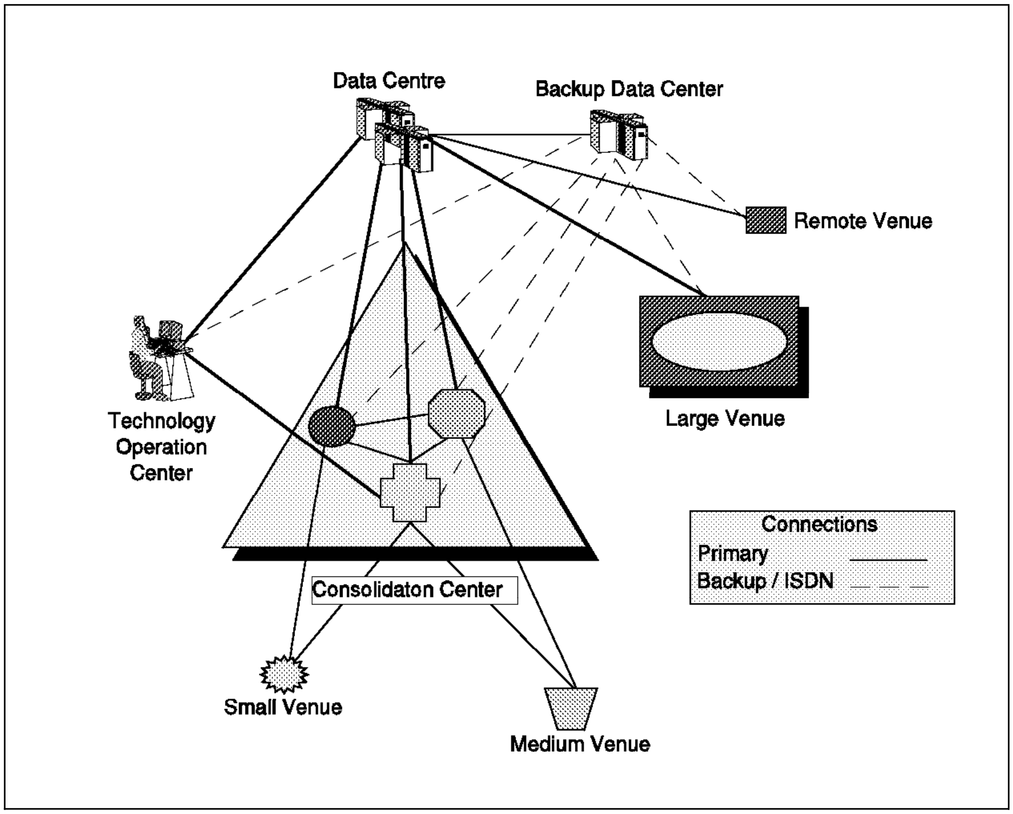

Figure 10. Consolidation Center

The consolidation center was connected to two physical data centers: the main Olympic Games data center and a backup site. Remote venue links ran through the consolidation center using frame relay and were connected directly to the data center and the backup site using ISDN.

3.2.11 Network Security

IBM used several approaches to make certain that network security was unbreachable. PC workstations for public use could not gain network access or have the floppy drives disengaged. Sophisticated network management software diligently monitored and proactively corrected any potential system abnormalities and unauthorized attempts at alteration.

Because it was critical that each sports venue remain functional in case of host unavailability, each venue′s Results System was completely autonomous from other core applications; results were sent instantly to the host but were also held locally. In addition, the overall network was controlled by a trio of host and midrange servers located in close proximity and connected by AT&T lines to a centralized command center for data and network management. Another functioning network hub was located offsite to add redundancy.

3.2.12 Network Management

The network management capabilities built into the Olympic Games network were designed to be as customizable as possible. If desired, management could go down to control even the smallest of details, as for example, which of the hundreds of Lexmark or other Olympic Games printers needed its toner cartridge changed.

All this was possible through an enterprise-wide implementation of NetView. While each platform used a local manager, NetView helped centralize network management. From its control console, a single administrator could edit any file, identify the presence of any program faults, and reboot any machine, no matter how remote. The end result was a network that was proactively managed, simply and easily from one location.

Figure 11 lists the products that were part of the Olympic Games systems management solution.

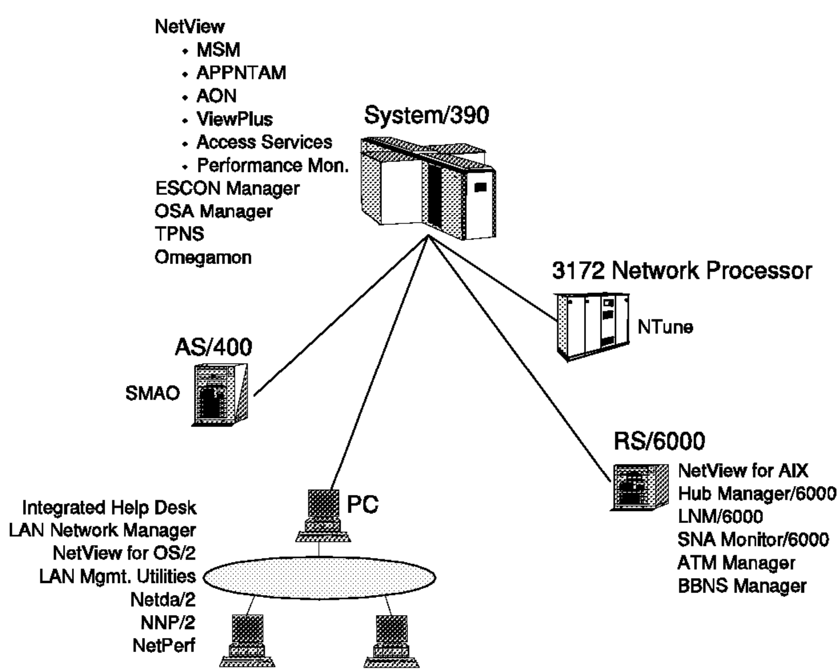

Figure 11. Systems Management Technology

As one of the industry's only management distribution solutions for enterprise-wide networks, LAN Server was the centralized workhorse for distributing software updates and print commands to over 50 separate domains. Working with the Named Pipes utility, LAN Server provided a scalable distribution topology for all platforms. NetFinity provided superior network management of the network's PC and server components as part of the overall, centralized SystemView management.

3.3 Mainframe, Network Configuration

The drawing in Figure 12 shows the overall configuration.

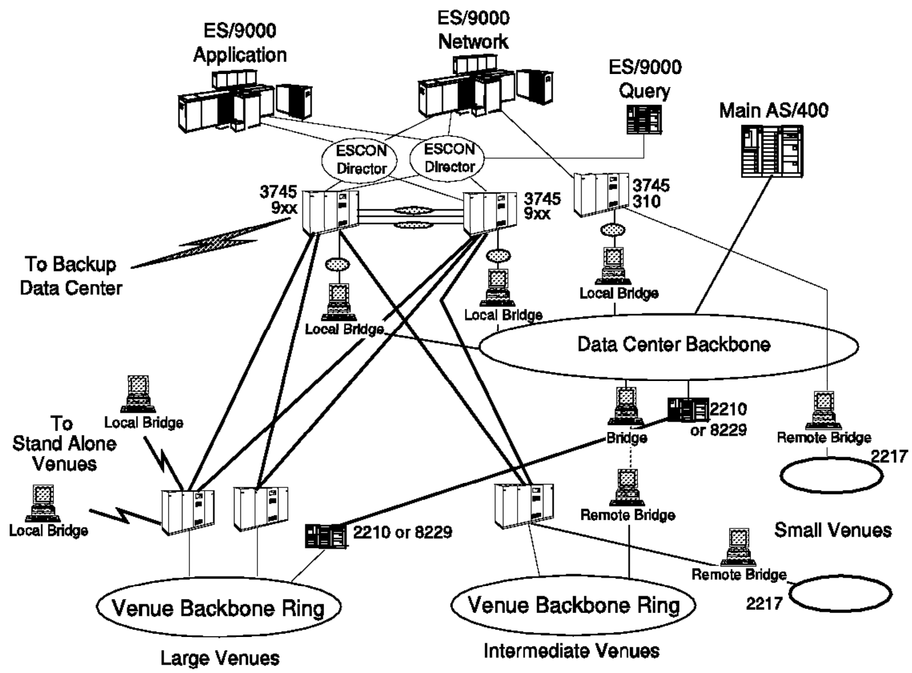

Figure 12. Overall Mainframe Configuration

S/390 Host Server:

ACOG began its mainframe work in 1993 with a single IBM S/390 660 processor and a relatively small complement of tape, DASD, console, and telecommunications I/O. This configuration grew in stages until, in 1996, it consisted of four processors (one in a backup data center) with sufficient I/O to handle the Games.

LPARs:

The logical partitioning (LPAR) feature of the S/290 Enterprise Server was used to logically subdivide and physically separate the kinds of workload beginning with the initial configuration. Table 2 shows the LPARs in use as well as those planned for introduction throughout the Games. Also shown are the systems on which each LPAR runs.

Table 2 (Page 1 of 2). LPARs in Mainframe

LPAR Name	Description	System
ACOP	**Production System** handled all production workload.	S/390-942 (System 2)

Table 2 (Page 2 of 2). LPARs in Mainframe

LPAR Name	Description	System
ACOD	**Development Support** provided all mainframe support for application design, development, and testing; change and problem management; and systems support design, development, and testing.	S/390-660 (System 1)
ACOT	**System Test & Evaluation** initially provided a platform on which new versions of the operating system were prepared and tested.	S/390-942 (System 2)
ACON	**Network/Backup** served the dual function of providing all network functions for the primary data center and the first stage of backup for critical Games applications.	9021-660 (System 1)
ACOQ	**Query Processor** was used for most DB2 query work.	DB2 Query Processor (System 3)
ACOB	**Backup Processor** provided a second level of backup protection for the critical Games applications.	S/390 9673 (System 4) in the backup data center

Primary Data Center Mainframe Configuration

The drawing in Figure 13 shows the mainframe configuration.

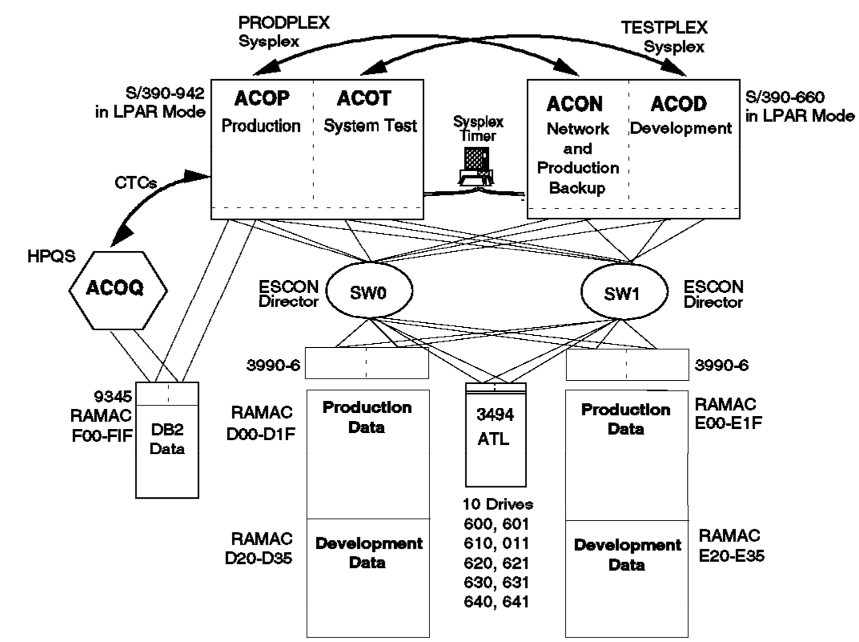

Figure 13. Data Center Mainframe Configuration

Backup Data Center Mainframe Configuration

The backup data center mainframe configuration that was installed as shown in Figure 14

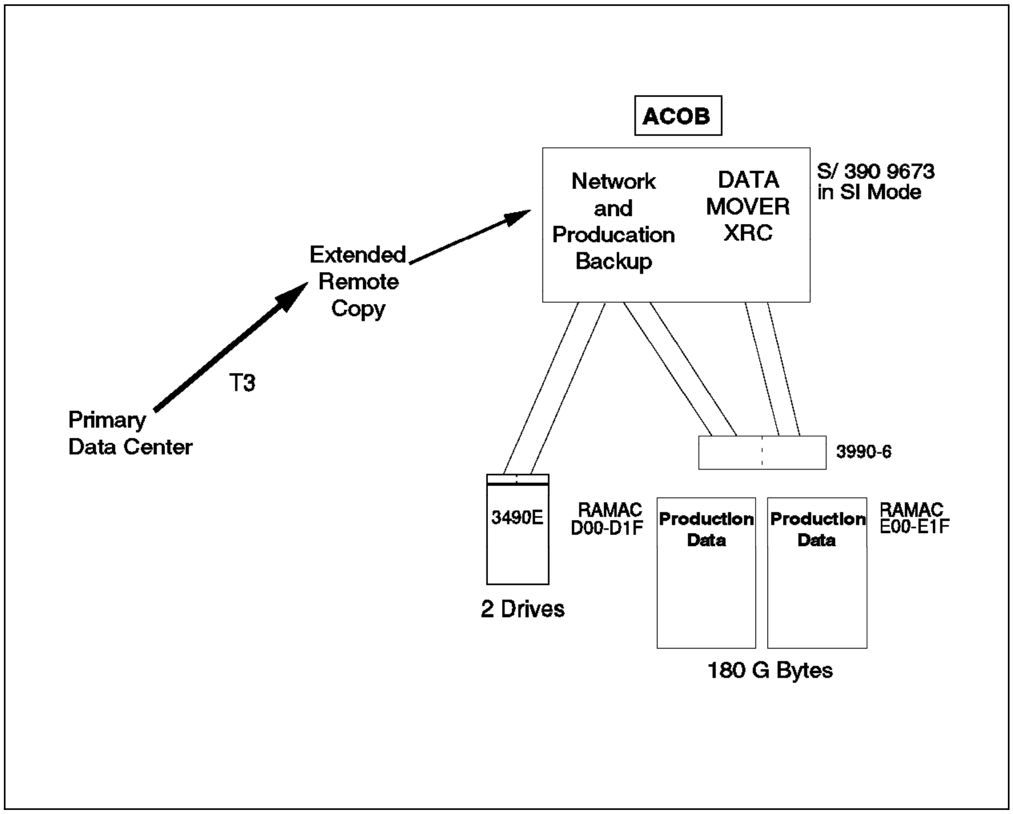

Figure 14. Alternate Data Center Mainframe Configuration

3.3.1 Network Configuration

All computing equipment used during the 1996 Olympic Games was interconnected through a large number of both WANs and LANs. The size of a particular venue and the application that must be provided to each of these venues determined how these WANs and LANs were implemented.

Every venue had at least one backbone LAN, with application-specific LANs attached to the backbone using a LAN bridge. Each of these backbone LANs was connected via remote LAN bridges to both the primary and backbone LANs in the data center. Telecommunication data circuits with transmission speeds ranging from 56 KB to T1 were used for remote bridge connections. Telecommunication data circuits ranging from 128 KB to T3 transmission speeds were used to connect the 3745s in a WAN configuration.

The Info′96 System used the AS/400 platform as the application server machine. Each venue that had the requirement for Info′96 had at least one, sometimes two, AS/400 computers. The Info′96 AS/400s were connected to multiple token-ring networks via multiple token-ring cards. A master Info′96 server was located at the primary data center. This master server was responsible for distributing all of the necessary Info′96 data to each of the venue-based Info′96 servers.

3.3.1.1 WAN Design

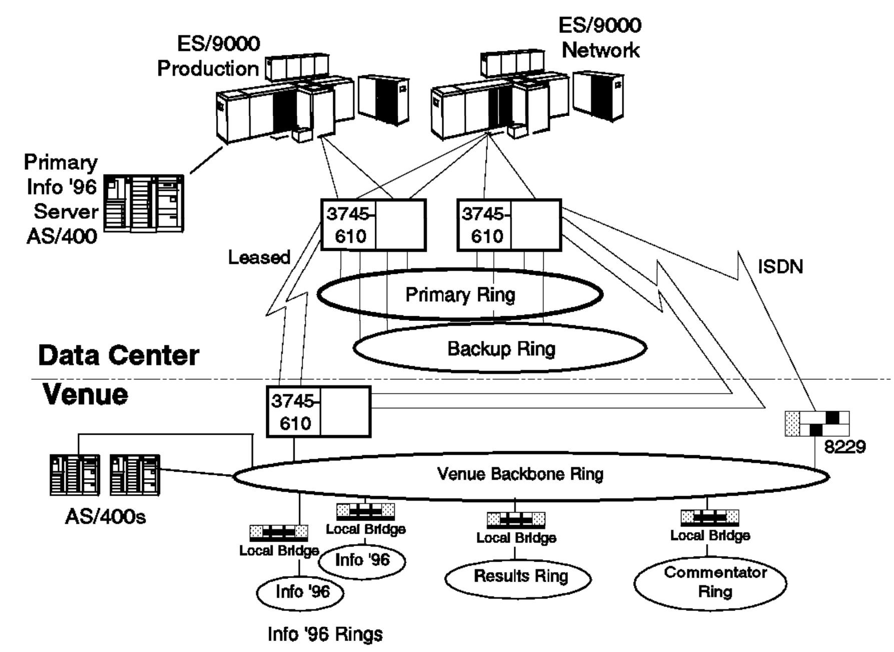

Figure 15. Network Design (Host to and from Large Venue)

Figure 15 illustrates the WAN and LAN network design connection for a large venue.

The primary communication vehicle between the data center and the venue was the WAN connection between the 3745s in the venue and in the data center. In the large-venue configuration, the large 3745s were connected to the data center 3745s by dual data circuit connections. This was done for two reasons:

1. In the event that something should go wrong with one-half of either of the 3745s, there would be redundancy.
2. The communications load could be shared between the dual connections of a pair of 3745s.

Figure 15, as well as Figure 16 on page 36 and Figure 17 on page 37 shows LAN connections between the backbone networks in the data center and the venue backbone. This connection existed primarily as a backup connection between the application workstations at the venue and the host at the data center. In the unlikely event that the 3745 connections were totally lost between the data center and the venue, this connection would be used to support the critical applications. A second use for this connection was in support of LAN management activities.

Through the use of the LAN-to-LAN bridge connection LAN management and monitoring equipment at the Technology Operations Center, it was possible to determine the health of each of the venue LANs.

Figure 16 on page 36 and Figure 17 on page 37 illustrate the other two examples of the WAN/LAN configuration used for the Games in 1996. Figure 16 on page 36 is an illustration of the configuration for a medium-sized venue. Figure 17 on page 37 illustrates the configuration for a small venue.

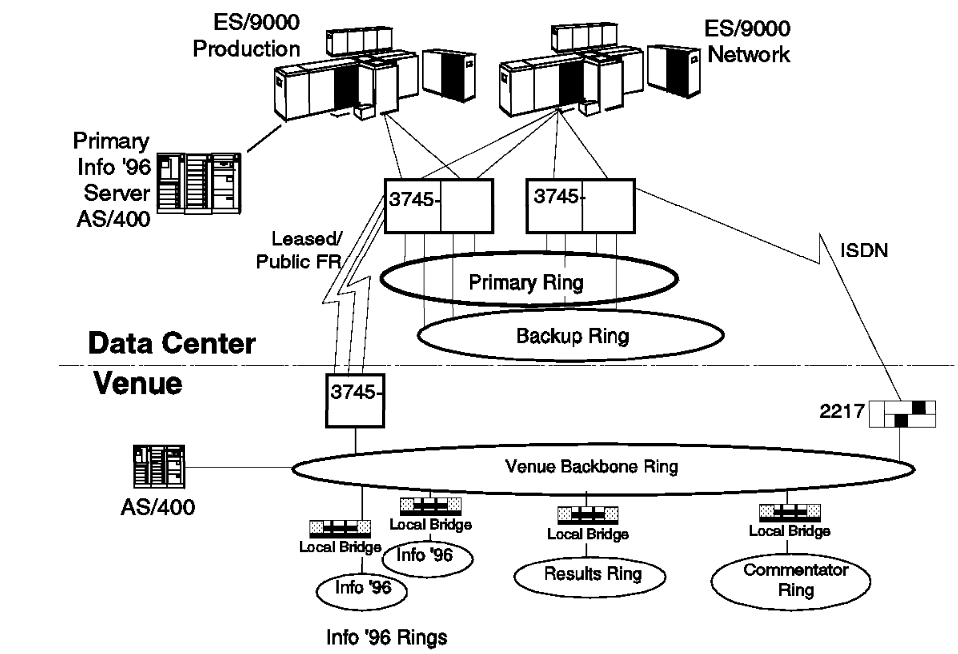

Figure 16. Network Design (Host to and from Medium Venue)

The major difference between Figure 16 and Figure 15 on page 35 is the WAN connection between the data center and the venue. Where Figure 15 on page 35 showed two 3745 connections existed, Figure 16 shows a single venue 3745 connected to the data center via multiple data circuits.

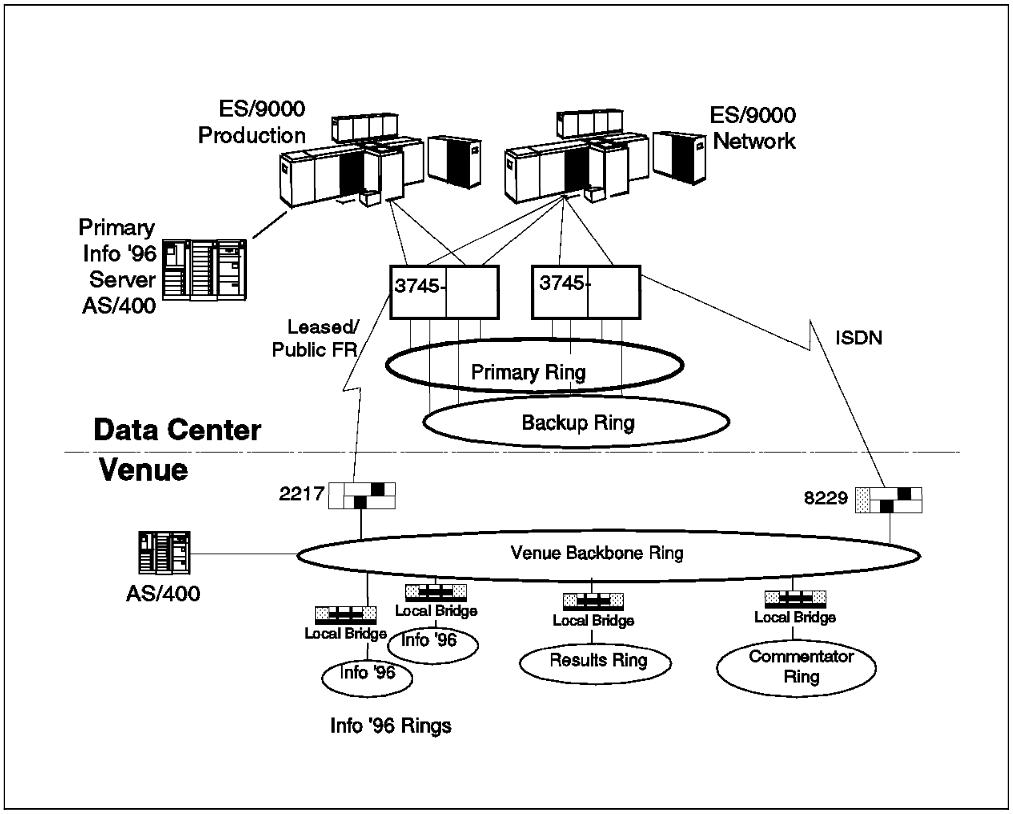

Figure 17. Network Design (Host to and from Small Venue)

In Figure 17, the WAN connection is provided by the dual LAN bridge connections between the venue token-ring networks and the data center token ring networks.

It is important to note what distinguishes the large venue from the medium, and small venue. Preliminary design investigation of each of the venues indicated the applications a venue must support, and the data communication requirements to and from the host mainframe. Based upon this preliminary work, the three configurations shown above were developed, keeping in mind the desire to develop models that could be used across many venues. It was the final detailed design that determined the final configuration for each of the venues.

3.3.1.2 LAN Design

The major design points for adding logical rings were:

- Grouping like workstation functions for manageability
- Isolating workstations that use ″noisy″ protocols from the backbone.

As we look closely at the venue, the logical design of each venue becomes apparent. The requirements for each of the functions were defined as:

Backbone:

Provides common services, management services, and communications services for the venue.

Info ′96:

The Info ′96 rings were connected to the Info ′96 AS/400 server and isolated from the venue backbone because of the multimedia requirements for Info ′96.

Because of this isolation, additional token-ring adapters were placed in the software distribution server and domain controller to allow workstations on these rings to access the software distribution system.

Results:

The Results rings were connected to the backbone by dual bridges for high availability. They also had a 3745 TIC available on the primary segment to reduce the reliance on the local bridges for transport.

Commentator Information System (CIS):

The CIS rings had two control stations that talked NETBIOS to the Results System and browse to CIS commentator stations. Because of this implementation, an additional bridge had to be connected between the backbone and the CIS rings to talk with the host by CICS and to provide the software distribution system with access to those workstations.

Those functions are illustrated in Figure 18 which shows a more detailed view of the shaded area.

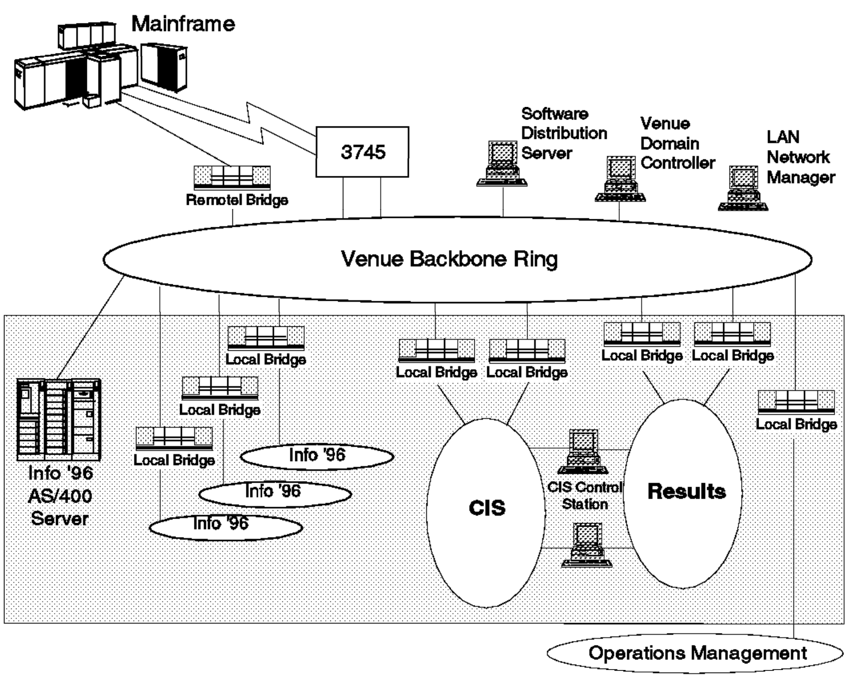

Figure 18. Typical Venue Detail

Part 2. The Games Applications: RESULTS

Chapter 4. The Results System

The Results System written for the Atlanta Olympic Games was primarily a new system; it was, however, based on the experience and systems used in previous Olympic Games beginning in Sarajevo in 1984. For the Atlanta Olympic Games, modules unique to the Summer Games were built from a base system.

4.1 The Major Requirements

The Results System had to manage all competition events and report the results of the competition to the world. The main ACOG objective was to:

> Provide accurate and prompt results information as the competition progressed and ensure data integrity of results information, including all scores, marks, or times achieved by the athletes as they were captured, recorded, and maintained by the Results System, as the single source for results information.

Some aspects of this system were unique:

- The system had to interface with different technologies such as:
  - Swatch timing
  - Panasonic scoreboards
  - TV sets
- Every competition venue required a commentator information system that allowed commentators to comment simultaneously about different sports.
- Result information of a venue had to be distributed in real-time to TV broadcasters, to cable TVs, and to commentators at other venues.
- A competition venue had to run independently of the others and be able to function stand-alone.
- Results had to be printed and distributed inside the venue to the International Broadcast Center (IBC), the Main Press Center (MPC), and others.
- Results had to be distributed (not real-time) to the World News Press Agencies (WNPA).
- The system had to interface with the Accreditation Subsystem and the Info '96 System.
- The system had to support the different rules of 37 different sports.

4.1.1 Service Levels

The Results System was designed and developed to meet these service levels:

> Sub-second basic service level
> Transparent backup
> 2 seconds to 5 minutes recovery time.

4.2 IBM Solution and Role

In order to meet the basic requirements, the Results System was designed to incorporate the different elements for team, head-to-head, judged, and timed sports, each of which had its own design and technology requirements. In effect, the Results System was made up of 37 separate modules, each representing one of the 37 sporting disciplines.

This highly integrated system consisted of three subsystem modules for each of the 37 sports of the Olympic Games, as follows:

Event Management Subsystem

The Event Management Subsystem provided the competition manager with an effective tool for all aspects of the competition, from setting up the venue and selecting judges to determining athlete line-ups by a computer-generated sort.

The Results Capture Transmit Subsystem

The Results Capture Transmit Subsystem captured statistical information and event data at the venue, computed the meaning of the data, then transmitted it to a variety of integrated information systems.

Commentator Information System (CIS) Subsystem

The CIS Subsystem was developed by IBM Spain for the Barcelona Olympic Games and communicated directly with the mainframe and IBM personal computers that were running the Results System. A closed cable network enabled commentators to change channels on the television to watch events in nine of the most viewed sports in the other venues. A touch-screen interface allowed them to pull up information about other sports, allowing one commentator to comment on multiple events while stationed in one venue.

Another technology explored was the broadcast paging technology that provided information on results that were bounced off a satellite through paging services and a laptop computer′s pager attachment. Any reporter with a serial interface port (RS232) and a pager was able to access the data.

All three subsystems were customized for each specific sport.

For the Results Capture Transmit Subsystem, IBM PCs, laptops, and OS/2 servers collected event times or judges′ entries, then calculated scores based on the rules of each individual sport. The information was immediately relayed to other systems and peripherals, including the large-display Panasonic scoreboards used at the Olympic Games, Xerox printers, and Motorola wireless communications devices.

By tying together networked components and integrating non-IBM peripheral hardware and components, the Results System acted as a model for enterprises developing and implementing high-transaction systems in which performance and reliability are critical.

The Results System, which provided connectivity to electronic Swatch timers, gathered, calculated and tabulated information from the timing, scoring, and judging stations to provide and distribute this information to broadcast and scoreboards, as well as to the mainframe that distributed the data to other venues.

In many sports, an IBM personal computer interfaced with timing. This timing IBM personal computer received Swatch timing signals for timed sports—in some cases it made calculations and in other cases it recorded time—to determine the standing for each competitor in the event. A personal computer running OS/2 and IBM LAN Server software tied together the IBM personal computers and provided the channel to the mainframe via the IBM 3745 data communications controller.

At each venue there was a backbone token-ring network connected to the token-ring networks for the CIS, Results, and Info ′96 Systems.

4.3 Results System Configuration

Based on ACOG′s requirements and expected service levels, the Results System comprised the platforms and network described below. Figure 19 depicts the platform configuration for the Results System. The bottom portion of the figure (Venue) was replicated for every sporting venue.

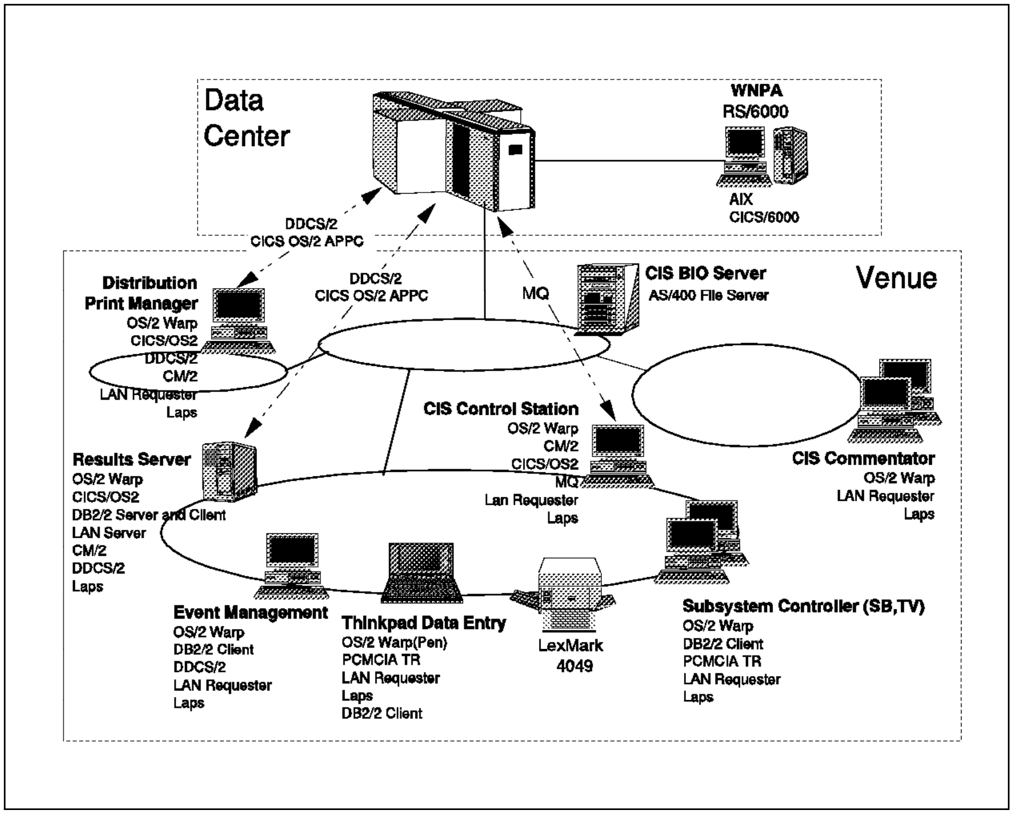

Figure 19. Delivery Systems: Results System Configuration

The main function and related products of the main nodes that were part of the Results System follows:

- **Results Server**

Products	***Function***
OS/2 Warp	DB2/2 server
DB2/2 Server and Client	-Primary and backup
CICS/OS2	Venue file server
LAN Server	CICS/OS2
CM/2	-Connect to CICS/ESA
DDCS/2	-Host trigger transport
	-Report and data update notification

- **Event Management**

Products	***Function***

OS/2 Warp DB2/2 Client DDCS/2 LAN Requester	Event Management -Pre-Event Management -Report processing -Phase progressions Event Control -Event data database update -Event status monitor -Data error corrections Scoring Validation -Accept timing input -Allow operator verification

- **Data Entry**

Products	***Function***
OS/2 Warp DB2/2 Client PCMCIA TR	Team and head-to-head sports Statistical data entry Pen-based application Data sent to event control

- **Subsystem controllers (Scoreboard/TV Interface)**

Products	***Function***
OS/2 Warp DB2/2 Client LAN Requester	Scoreboards -Daktronics -Swatch AOB -Infinite video character generator NBC serial data line Press Data System

- **Timing Gateway**

Products	***Function***
OS/2 Warp DB2/2 Client LAN Requester	Dedicated PC Serial interface Monitoring and control

- **CIS Control Station**

Products	***Function***
OS/2 Warp CM/2 MQ LAN Requester CICS/OS2 TR Results LAN TR CIS LAN	Results output clients CIS control Local venue Results link Remote venue distribution

- **CIS Commentator Station**

Products	***Function***
OS/2 Warp LAN Requester	CIS output station Process Results data from control Request athlete biographical data

4.3.1 Results Venue Configuration

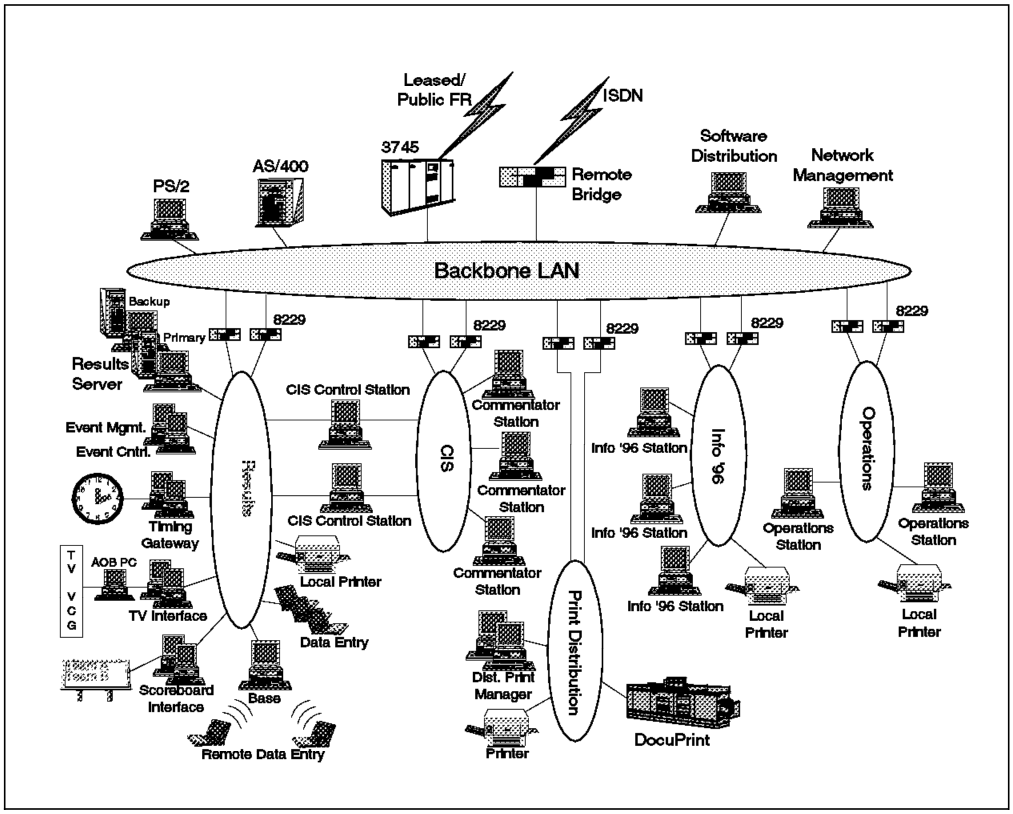

Figure 20. Results Venue Configuration

Figure 20 shows the venue detail configuration.

4.4 Results System Services

The Accreditation Subsystem supplied information about athletes and officials to the Results System prior to the competitions. Additional information was captured during the participant registration process. During competition, Results System Services in each sports venue captured all relevant scoring, timing, distance, and statistical information. Calculations were performed on the data to provide information required, such as athlete or team standings and Olympic records. Then, the results were distributed.

Results distribution occurred in two phases, real time and delayed, as depicted in Figure 21 on page 46:

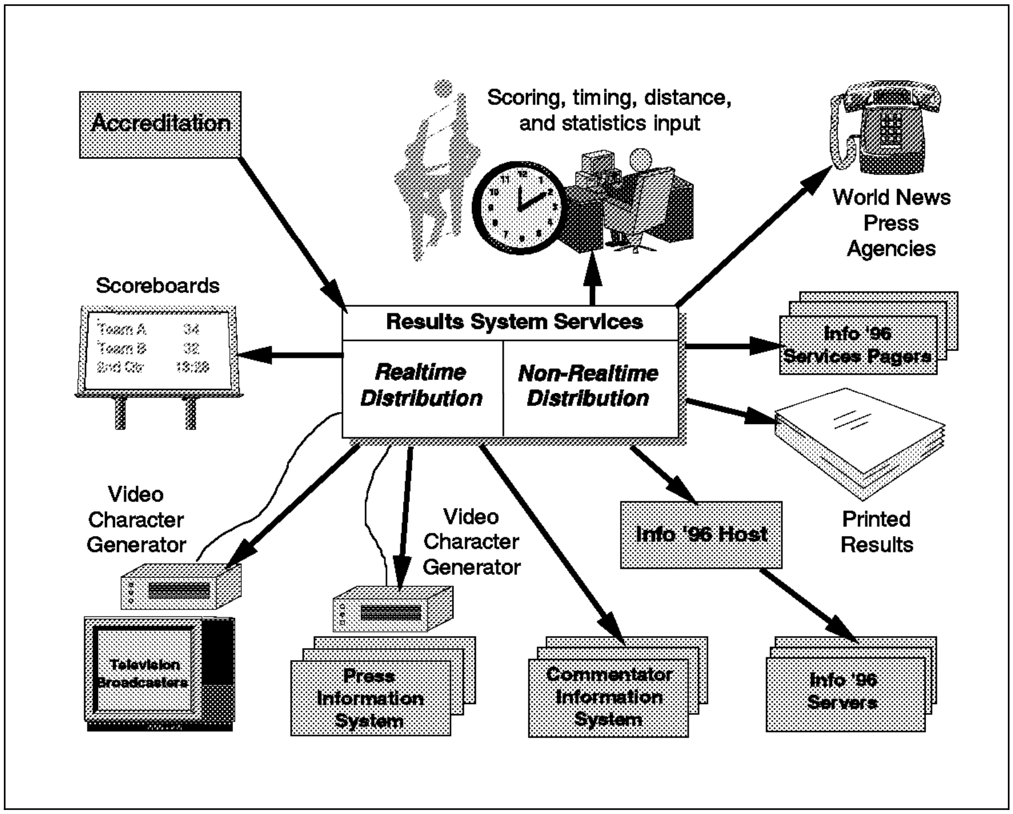

Figure 21. Results System Services Functional Flow

- Real-time distribution supplied results information within one second to the scoreboards, broadcaster video character generators, a video character generator used to provide information to the Press Information System, and the Commentator Information System.
- Delayed distribution provided similar results information within seconds to other facilities including the Info'96 System, the World News Press Agencies, and high-speed printers to produce hardcopy results information.

The master Results System database resided on the ES/9000 mainframe computer and contained such data as information about the athletes and officials, competition schedules, start lists, world and Olympic records, and results from in-progress and completed competitions. Information from the central database was downloaded as needed via CICS transactions to each venue, where it was stored in the IBM PS/2 Results server in the sports venue.

Figure 22 on page 47 illustrates this process.

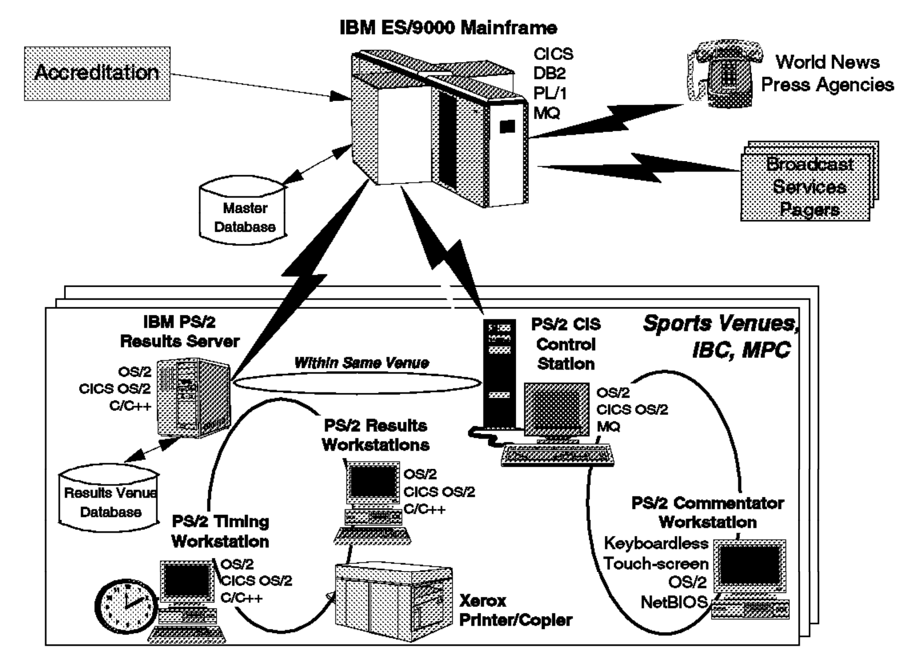

Figure 22. Results System Services Logical Architecture

As the competition took place, scoring, timing, distance, and statistics information was entered through several IBM PS/2 Results workstations located in the venue and then sent to the PS/2 Results server. Many of the needed calculations were performed on the PS/2 Results server giving the venue some degree of independence from the ES/9000 mainframe.

The PS/2 Results server also initiated some parts of the results information distribution. Real-time information distribution was, for the most part, handled within the venue. Information destined for the scoreboard and video character generators (both broadcaster and Press Information System) was distributed from the PS/2 directly or through other PS/2 workstations configured with special adapters. The PS/2 Servers also originated information destined for the Commentator Information System. It was directed to the IBM PS/2 Commentator Control Station in the same venue via the LAN that connected the two servers and via the ES/9000 mainframe for all other venues.

Delayed information (nearly real time) was developed cooperatively by applications running on the PS/2 and ES/9000 mainframe computer. This information provided input to the Info′96 System and was used to produce the hard-copy results information, which was printed on high-quality, high-volume Xerox DocuPrint network printers at many different Olympic venues. The press agency information was also produced on the ES/9000 mainframe computer and directed to an RS/6000 station configured with special adapters for interfacing to the wire services.

The Commentator Information System consisted of an IBM PS/2 Commentator Control Station and several keyboardless, touch-screen workstations. Real-time results information from active sports venues received data from the Results

System (local venue results) and from the ES/9000 mainframe computer (remote venue results). When information about a particular competition was selected by a commentator, it is obtained from the Commentator Control station and automatically refreshed with new information until a different selection is made.

4.5 Solution: Process Walkthrough

The solution involves a variety of processes and complex interactions.

4.5.1 Venue Results Subsystem

The main purpose of the Venue Results Subsystem was to collect and control timing and scoring data and use them as the basis for the time-critical activities of each sporting event.

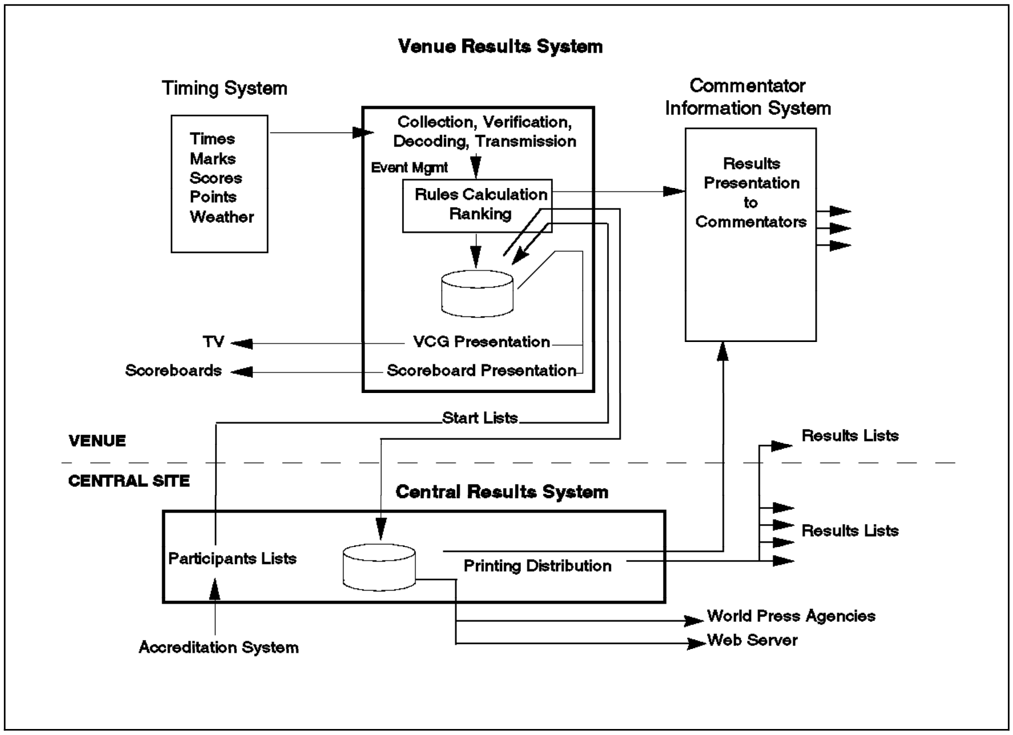

Figure 23. Flow of Venue Results Subsystem

As illustrated in Figure 23, the subsystem specifically:

- Received timing and scoring data from the Timing Subsystem.
- Transferred timing and scoring data to the Central Results Subsystem.
- Performed local calculations (for scoreboards, VCGs, and so on) and did ranking according to the sport and event rules.
- Presented local results to TV VCG systems.
- Presented local results to scoreboard systems.

All programs executed under OS/2 running on IBM PS/2s connected via a dedicated token-ring LAN in the sporting venue. All programs which required user interaction provided a graphical user interface (GUI).

The subsystem had a modular design with two major parts: the user interface and the core ranking modules. These two parts were common to all sports and devices. Sport-specific code (″sports towers″) was separated into Dynamic Load Libraries (DLLs), with one for each sport. All device-specific code (TV VCGs and scoreboards) was also separated into DLLs. Different tasks were divided among three types of subsystems:

- Event Management
- Results (server and transmit workstation)
- Timing workstation

Event Management

The Event Management controller was in the Venue Results Subsystem. The controller:

- Detected all timing broadcasts on the network.
- Initiated retransmission of out-of-sequence data.
- Performed continuous calculation and ranking according to the rules of the sport and event.
- Received data requests from Results and Timing workstations, formatted the response and issued SQL to the Results server database.
- Updated the Results server database and informed the TV, scoreboard, and CIS control stations of the event.

Results Server

The Results server was the central database server in the Venue Results Subsystem.

Results Transmit Workstation

The main task performed by the Results transmit workstations was to control and provide information to the interface controllers driving peripheral output devices in the local sporting venue (usually TV VCG systems or scoreboard controllers). One Results transmit workstation was required for each type of external interface supported.

Each Results transmit workstation was associated with a target Results server. The target was automatically selected by the station; however, the target could be changed manually (for example, to balance performance) and automatically changed if the Results server failed.

The Results transmit workstation requested data from the Results server, formatted the received response (list) depending on the attached device, and forwarded the data to this device. The Results transmit workstations could also request display of bus messages for a particular runner (for running time on a TV VCG or scoreboard) from the Timing Subsystem (via the Timing workstations).

Timing Workstation

The supplier of timing and scoring equipment was responsible for all timing including backup systems for all events in all venues. The supplier delivered all necessary field equipment, including start gates, photo cells, headsets, table displays, single number, time, and round counting displays, and all timing systems.

The Venue Results Subsystem interfaced to the Timing Subsystem via two primary and one backup system. The Timing Subsystem delivered two types of data: data bus (number and time data) and display bus (running times) in RS232 format. No video signal was delivered from the Timing Subsystem. Modification or correction of Timing data was only performed in the Timing Subsystem during competitions. Retransmission of data was possible only during an event.

Two Timing workstations performed data collection and distribution functions in each sporting venue and interfaced to the venue Timing Subsystem. Each workstation received data from Timing, forwarded it to the Results servers and Results workstations, and formatted and sent it to the Central Results Subsystem.

Central Results Subsystem

The Central Results Subsystem provided the cross-venue and multivenue Results functions required by the Olympics. These functions included:

- Results server
- Printed Results reports creation and distribution
- World News Press Agency (WNPA) interfaces
- Commentator Information System interface
- Info′96 interfaces
- Accreditation interfaces
- Broadcast data paging service interface
- Publishing

The technical solution integrated the Central Results infrastructure used in Lillehammer in 1994 (which was in turn an improved version of the system used in Albertville in 1992), with enhancements to improve the consistency and synchronization of Results calculations performed by the Venue Results Subsystem and the Central Results Subsystem.

Commentator Information System

The IBM Commentator Information System, developed by IBM Spain for the 1992 Summer Olympic Games in Barcelona and modified for the 1994 Winter Olympic Games in Lillehammer was used to deliver Results information to TV commentators. Results from selected venues was available to commentators as they occurred. In addition, biographical information on athletes from the Info′96 System was available.

CIS was implemented using dedicated LANs located in each of the sporting venues as well as the Main Press Center and the International Broadcast Center. The CIS LAN was connected to the Results LAN by an IBM PS/2 CIS control station (and its backup) for Results information of the same venue. The CIS LAN also was connected to the Central Results Subsystem by a PS/2 CIS control station for Results information of other venues. Results were presented to commentators via IBM PS/2 CIS workstations with touch-driven, easy-to-use screens.

CIS Control Station

The Venue Results Subsystem communicated with the CIS control station using NETBIOS. The Central Results Subsystem communicated with the CIS control station using MQ. The Venue Results Subsystem calculated ranking, updated the Results server database, and sent inform messages to the CIS control station using triggers. CIS control stations received the trigger, analyzed it, read data from the Results server database, and distributed data to the CIS commentator station. Data was then sent to the Central Results Subsystem for the CIS of other venues. The Results information was sent via MQ from the Central Results Subsystem to the CIS control station in a predefined, sport-independent format. The CIS control station distributed Results information to all of the CIS commentator stations on the venue LAN via broadcast mode, NETBIOS datagrams.

CIS Commentator Stations

Each CIS commentator station (one per commentator station in each venue and in the MPC and IBC) was an IBM PS/2 running OS/2 with a touch-screen, keyboardless interface. NETBIOS (broadcast mode datagrams) was used to communicate with the CIS control station.

Results System Communication

The conceptual model of the network was a communication pool, where all partners have an equal opportunity to send to any other partner, or to all present partners in a simple manner.

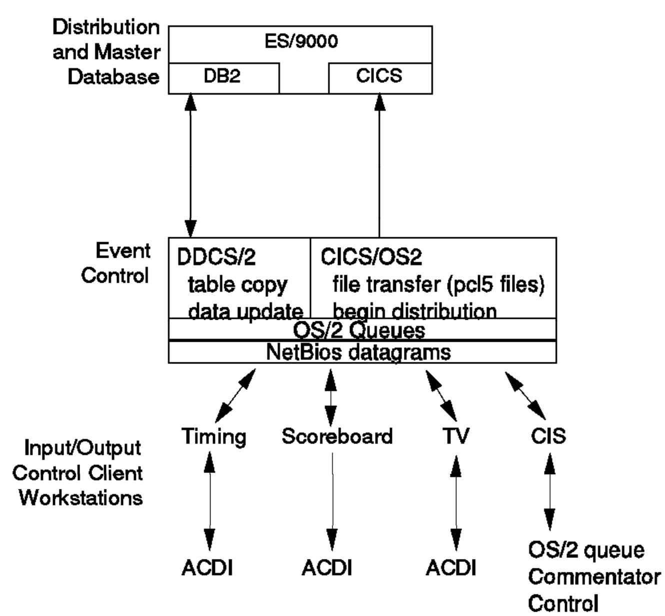

Figure 24. Results System Communication Model

NETBIOS Solution

The existing NETBIOS solution (Figure 24) used the Group-Addressed Datagram facility. This tool gave the full flexibility of adding and removing partners dynamically, while giving all partners the ability to speak to any other or all partners on the logical network (the domain). NETBIOS made it easy to communicate with the naming service in real time. No major setup was needed for the NETBIOS solution. NETBIOS allowed a one-to-many network.

4.5.2 Data Flow from Timing Gateway to Scoreboard or TV

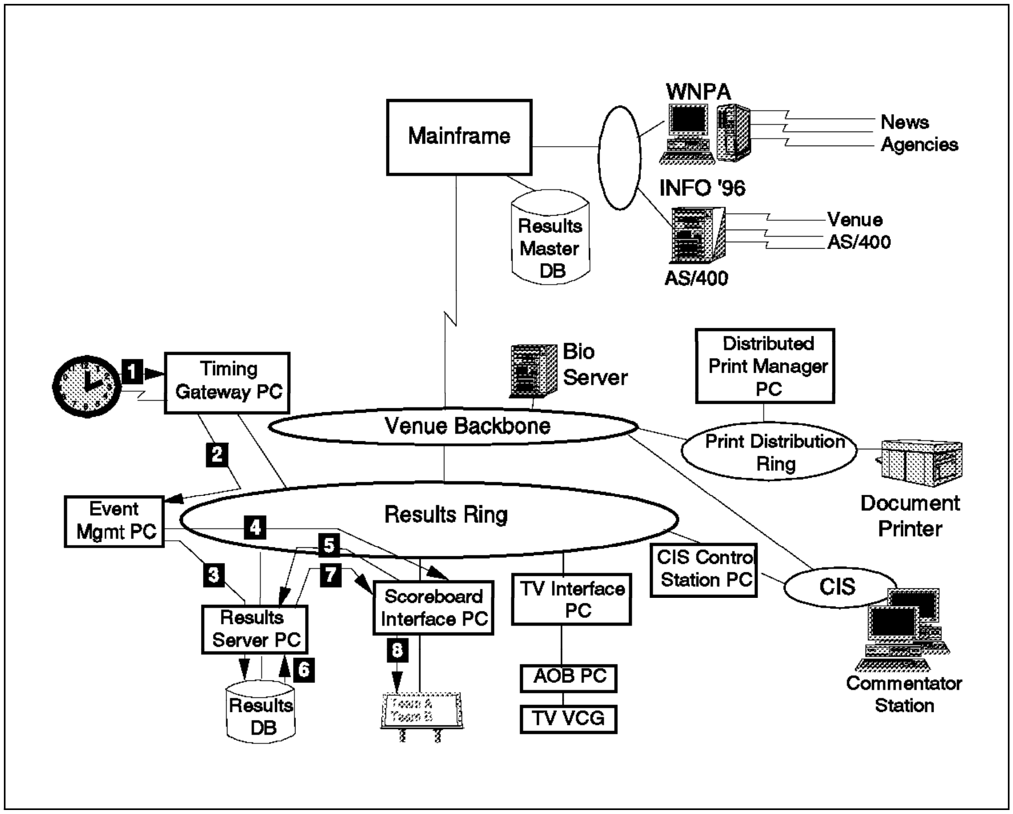

Figure 25. Data Flow from Timing Gateway to Scoreboard

Numbers refer to Figure 25.

1 The Timing gateway received data from official timer.

2 The Timing gateway PC received Swatch data and transferred it to the Event Management Subsystem.

3 The Event Management Subsystem calculated ranking and updated the Results server database.

4 The Event Management Subsystem informed the scoreboard interface by a triggered message.

5 The scoreboard interface requested data from the Results server.

6 The Results server read data.

7 The Results server sent data to the scoreboard.

8 The scoreboard interface formatted and sent data to the scoreboard controller.

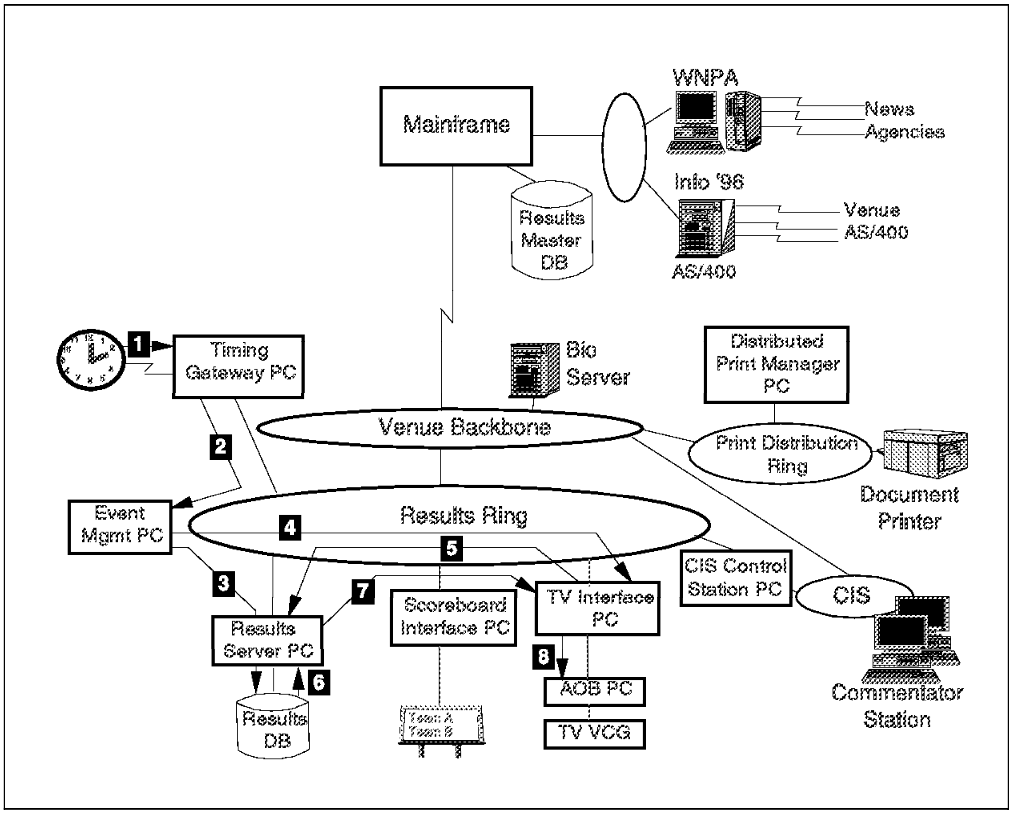

Figure 26. Data Flow from Timing Gateway to TV

Numbers refer to Figure 26.

1 The Timing gateway received data from official timer.

2 The Timing gateway PC received Swatch data and transferred it to Event Management.

3 Event Management calculated ranking and updated the Results server database.

4 Event Management informed TV interface PC of the event by trigger message.

5 The TV interface PC requested data of the Results server.

6 The Results server read data.

7 The Results server sent data to the TV interface PC.

8 The TV interface PC formatted and sent data to the Atlanta Olympic Broadcasting (AOB) PC.

4.5.3 Data Flow of Results Process for TV

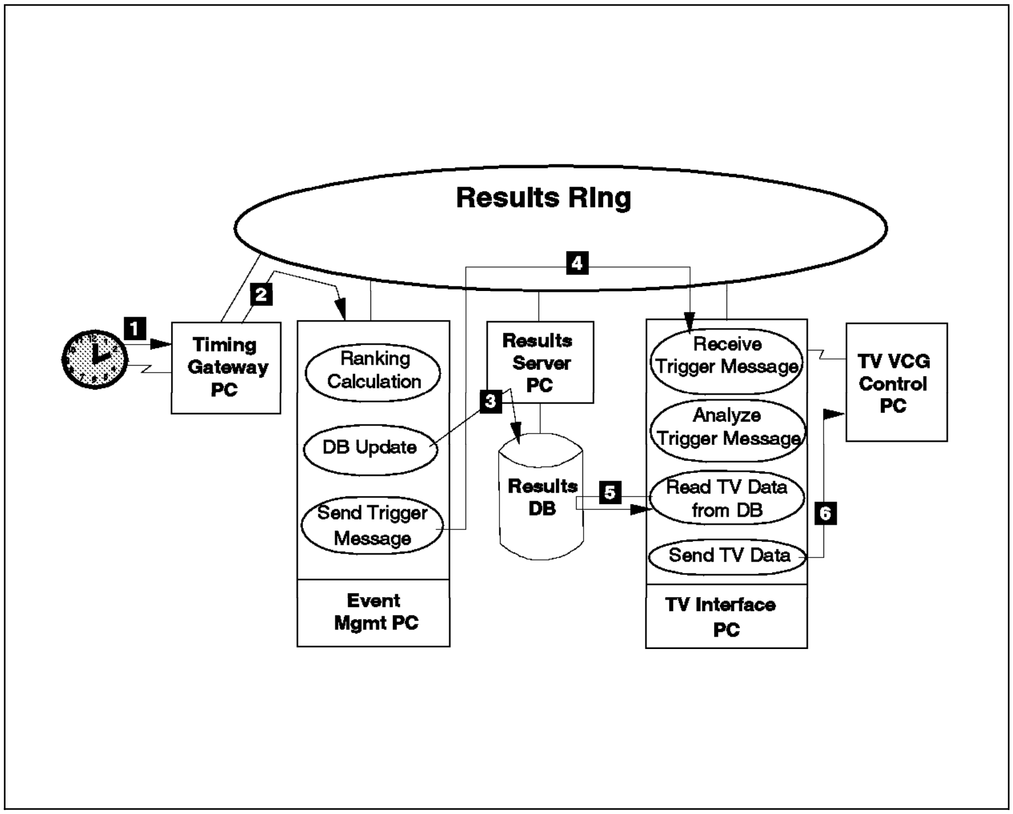

Figure 27. Detail Data Flow of Results Process for TV

Numbers refer to Figure 27.

1 The Timing data came from Swatch.

2 The Timing gateway PC received Swatch data and transferred data to Event Management.

3 Event Management calculated ranking and updated it on disk.

4 Event Management informed the TV interface PC by trigger.

5 The TV interface PC requested data from the Results server and read updated data.

6 The formatted data is sent to the TV interface PC.

4.5.4 Data Flow of Printing and Host Database Update

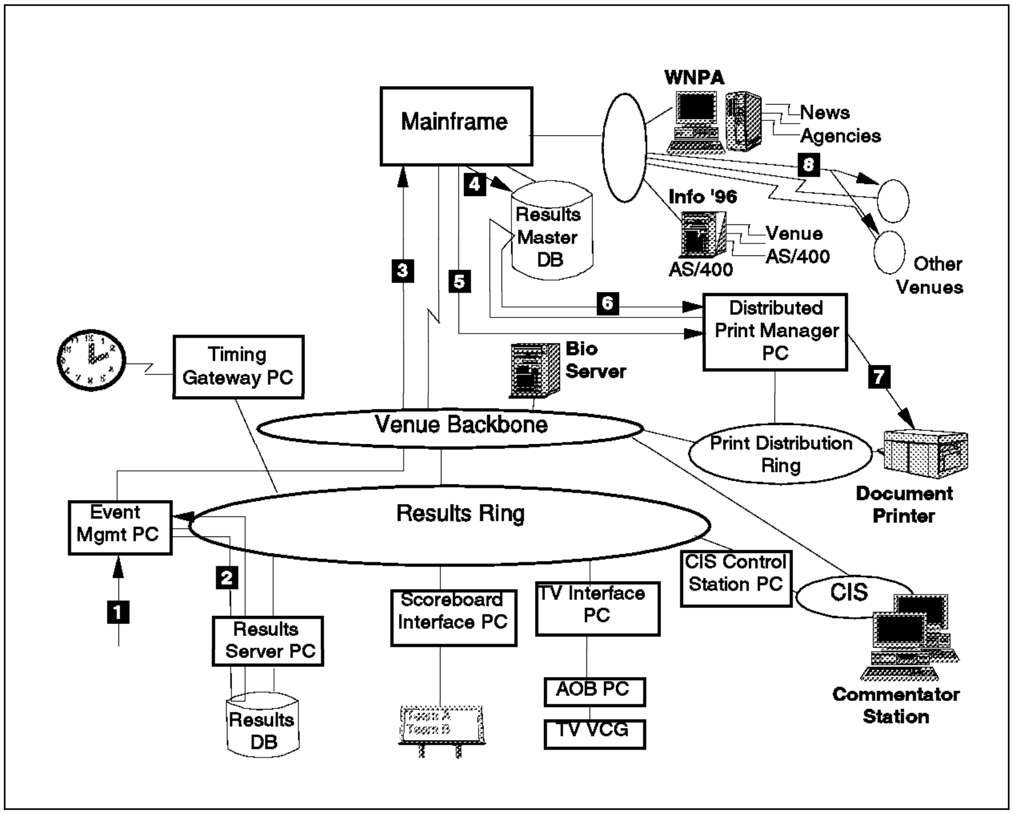

Figure 28. Data Flow of Printing and Host Database Update

Numbers refer to Figure 28.

1 Operator at a Event Management PC selected print menu and requested print.

2 Data to be printed read from Results server database.

3 Operator selected print for central or distribution, current Results data was read from Results server. Results data sent and a print data trigger message sent to the host.

4 Host updated database.

5 Trigger message sent to distributed print manager PC.

6 Distributed print manager PC requested print data from Host.

7 Data printed.

8 Host sent print trigger message to distributed print manager PC at other venues. Those print managers requested data from host and print manager printed.

4.5.5 CIS Process

This section covers the design and architectural plans for the Commentator Information System. Where appropriate, we discuss differences between the Atlanta CIS and the Lillehammer CIS. The intention of this section is to set forth the framework within which the implementation of the CIS for the Atlanta Olympic Games was started.

The IBM CIS was used successfully in Barcelona in 1992 and in Lillehammer in 1994. The design presented in this section attempts to incorporate the best of both prior implementations to meet the CIS requirements for Atlanta.

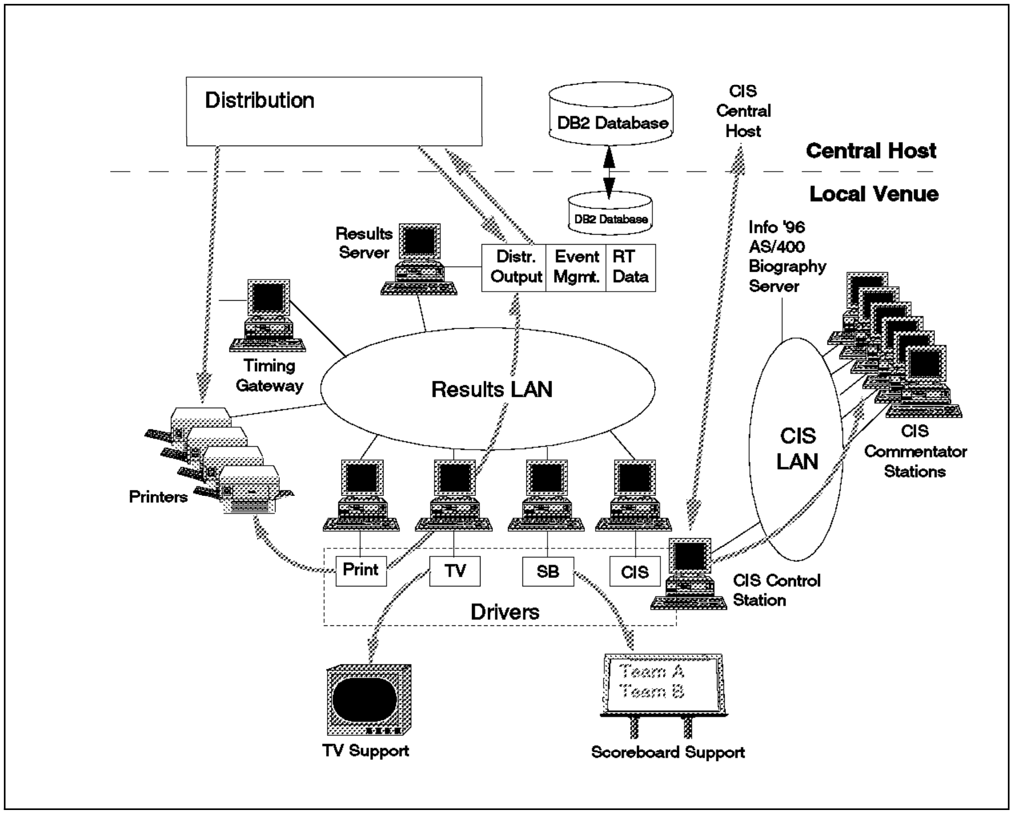

Figure 29. CIS Architecture

CIS is a subsystem within the Results System of the ACOG Delivery Systems Architecture. Within the context of this document, a functional component is considered to be a program (or programs) that provide a logically related set of functions within CIS. Functional components may reside on separate computer systems, may share computer systems with other functional components, or may span multiple computer systems in performing their related functions.

The major functional components of this CIS design are:

- CIS-Results System interface
- CIS control station
- CIS central host ES/9000
- Commentator station
- Biography server
  - Biography access program
  - Biography update method

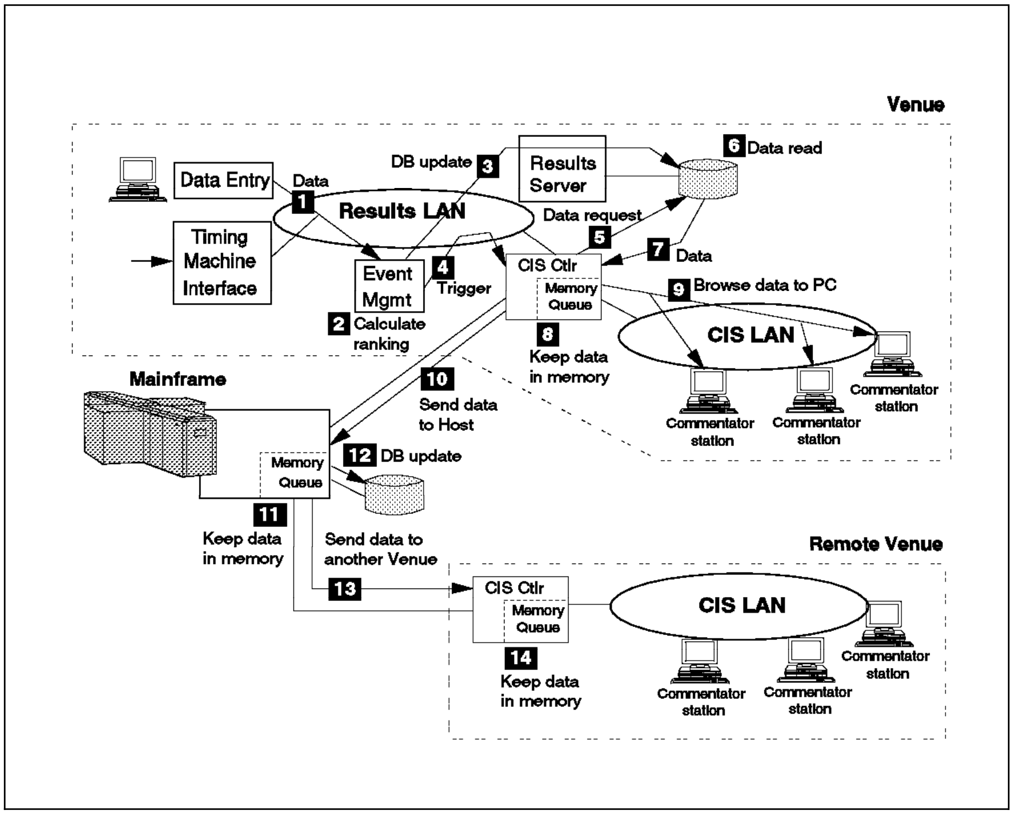

Figure 30. CIS Data Flow

CIS-Results System Interface

Results System client workstations had the ability to request lists from a Result server in order to feed them to drivers that formatted the lists into data streams suitable for their designated targets. The CIS-Results System interface was a Results System client workstation that formatted Result System lists into CIS Net-Change messages and sent them to the CIS control station.

CIS Control Station

The CIS control station, as the name implies, centralized all the control and distribution functions of the dynamic CIS information originating from the Results System that was to be distributed within the venue and to the CIS central host. It received data from the Results System (local venue results) and from the CIS central host (remote venue results) and sent the local venue results to the commentator stations within the venue and to the CIS central host for distribution to other venues.

CIS Central Host

The CIS central host centralized all the control and distribution functions for the dynamic CIS information originating from the Results System that was to be distributed between the different venues. It received the data from the CIS control station at each venue and sent it to the CIS control stations in other sports and nonsports venues.

Commentator Stations

Commentator stations were located at the commentary positions in specified venues as well as in specified broadcaster areas. All commentator interaction was through an OS/2 Presentation Manager touch-screen interface.

The primary users of the commentator stations were the TV and radio broadcast commentators; however, the system was used by other Olympic Family members, such as venue producers, announcers, sports officials, and so on.

Users selected the language for all screen presentations on their respective stations, and this language setting was retained from session to session and day to day, unless explicitly changed by the user. Similarly, a country might be selected for focus by the user and the chosen country was highlighted whenever it was presented on the screen unless explicitly changed by the user.

Biography information requests were serviced by the Biography server, and the requested data shown on the commentators′ screen.

Biography Server

The Biography server provided access to athlete, official, and horse biography information by making available biography files in ASCII format on a disk accessible by the Biography Access Program which resided on each commentator station. This Biography server function was fulfilled by a separate system on the CIS ring which functioned as a file server, by the local Info′96 AS/400 functioning as a file server, or by each commentator station storing its own copy of the files. Each of the possible access methods will be examined below.

Functional Component Relationships

Figure 31 on page 59 shows the relationships between the functional components of CIS.

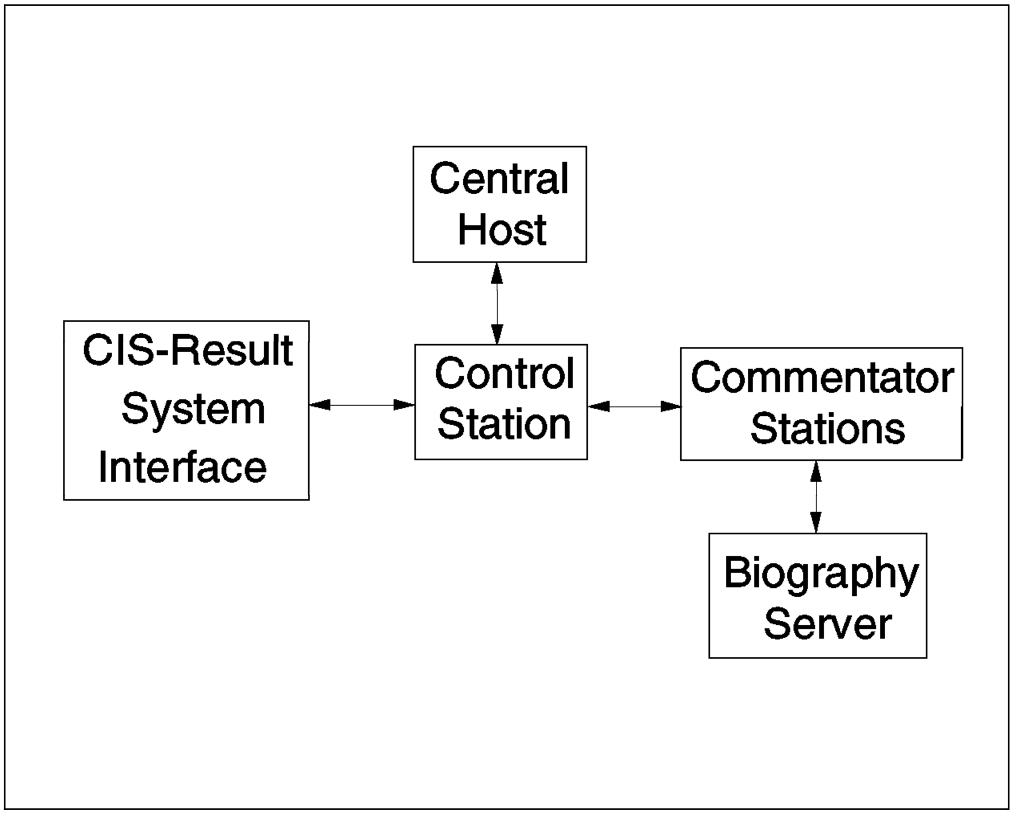

Figure 31. CIS Functional Components

Data and protocol information was passed between each functional component using internal CIS message and data structures.

4.5.6 Print Distribution

The entire print-distribution system consisted of three major components: the Results station, the host distribution process, and the venue print server. All sport-specific printed output was created at the Venue Results station in PCL5 format. This report was captured and stored at the host. The host then transferred the report to the print server according to distribution list stored in the routing table. During this process, the host created header information for local print control. Olympic level reporting, such as medal summaries, was created from a central workstation connected to the same DB2 database.

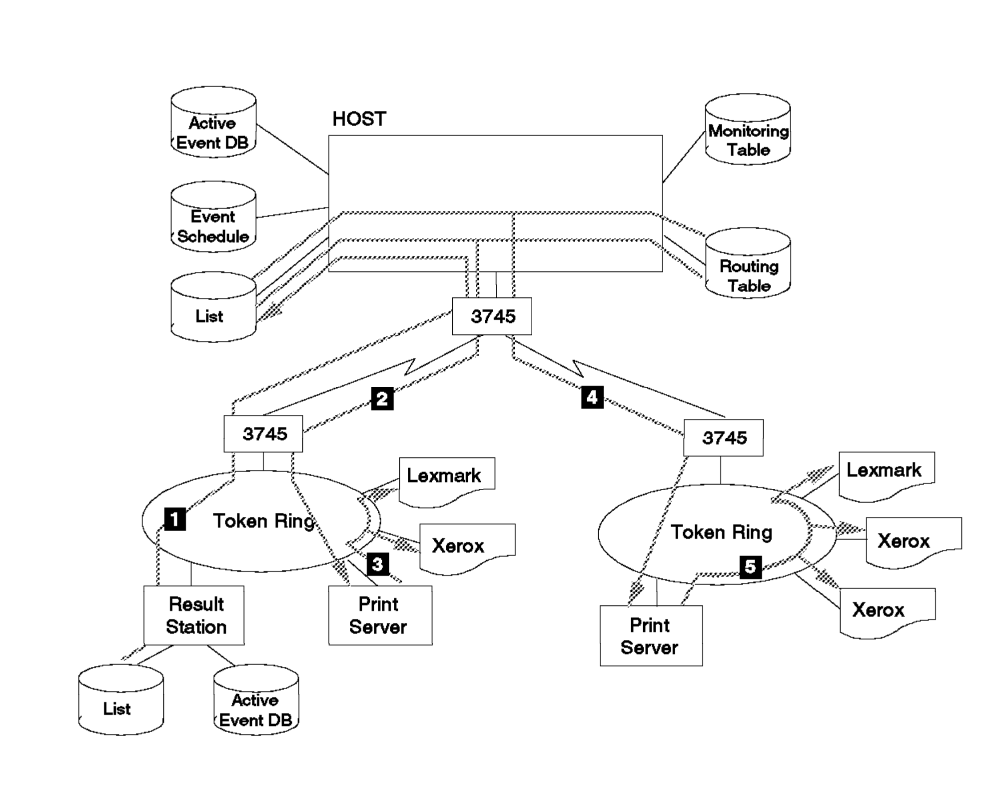

Figure 32. Print Distribution Data Flow

Numbers refer to Figure 32.

1 The formatted report was sent to the host and stored in the repository.

2 The captured report was first sent to the print server in the venue where the data originated.

3 The report was routed to the printers by the print server.

4 The report was then sent to the remote venues.

5 The report was routed by the print server.

The distribution processes were executed based on predefined data on the distribution routing tables. However, the system provided the capability to update all entries (color of paper, number of copies, and printer to be printed out) to all users with the appropriate authorization. The system also provided a tracking feature of the distribution progress and a command interface for the user to either suspend, restart, or purge a report from the printer queue and the routing process.

The major components of the print distribution were these:

- Print server
- Interface to print server
- Device availability registration
- Report capturing
- Identification of distribution destination
- Report routing to the print server

- Altering distribution information
- Distribution status monitoring
- Retransmission mechanism

4.5.7 Swatch Timing Interface Process

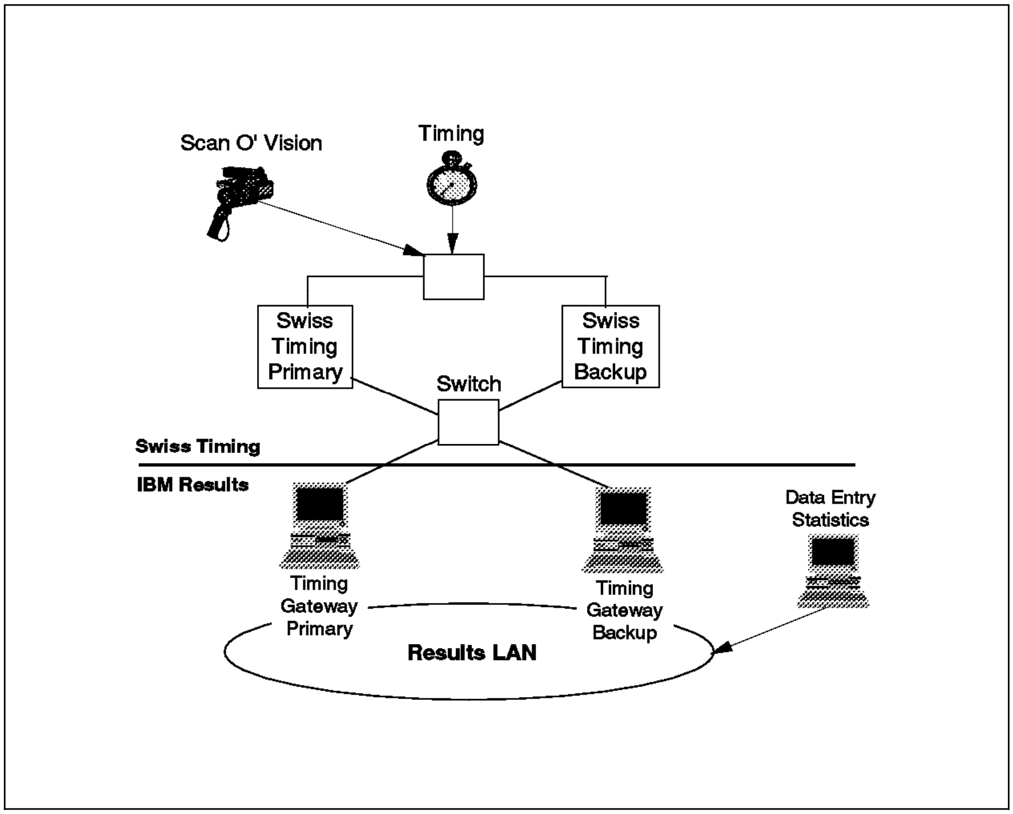

Figure 33. General Swatch Timing Architecture for All Venues

Figure 33 shows the general architecture for all venues. Swatch Timing provided a primary and backup data line to the primary and to the backup Results System timing gateway. Swatch Timing provided and managed a switch to change the feed to the Results System from the primary timing source to the backup timing source, if required.

Communications Protocol

Figure 34 on page 62 details the flow of messages between Swatch Timing and the Results System:

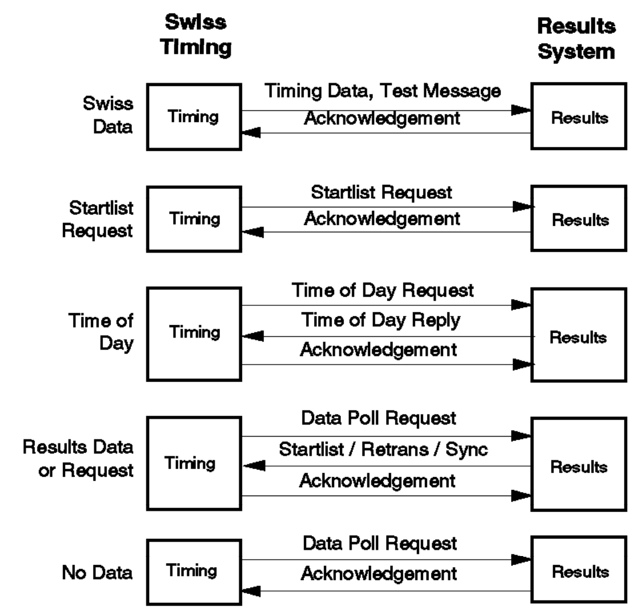

Figure 34. Swatch Timing Interface Architecture

The transmission protocol between Swatch Timing and the Results System was a variation of polling. All transmissions by Results were in response to an invitation by Swatch Timing. The messages sent to Results from Swatch Timing were timing data, start-list request, time-of-day request, and poll. After a poll from Swatch Timing, Results sent a start-list record, retransmit request, synchronize request, or a poll acknowledge (no data to transmit). The polling latency was a maximum of 1 second. Even if data needed to be sent to Results, Swatch Timing sent a poll to Results at least every second. Test messages containing the last sequence number sent for the event was sent at least every 10 seconds. The service level for this interface was defined as no greater than 3 seconds downtime.

Hardware Specification

The protocol was based upon the RS422 specification for serial communication:

- Full duplex
- 19,200 baud
- 8 data bits
- 1 stop bit
- Odd parity
- 9-pin subminature D connectors

Data Interface

Swatch Timing provided an historical log of all transmitted messages, each individually sequenced within an event unit, whereby the ACOG equipment could have requested a retransmission of an arbitrary record at any time during a competition.

If, on some venues, it was decided to use RS232C instead of RS422, Swatch Timing provided galvanically isolated communication (optical coupling) in both directions between the Swatch Timing equipment and the ACOG equipment.

Clock Interface

Sports that require direct clock input required a second serial connection. This connection provided only clock data without the Results header for the event unit.

4.5.8 World News Press Agency

The Results System needed to transmit the results to various press agencies around the world. The World News Press Agency (WNPA) Subsystem defined a message format for conveying this information. Each press agency was connected via a leased communication line to an RS/6000 running the CICS/6000 transaction monitor. The RS/6000 was configured with a separate serial communication (TTY) port for each agency. Each port was dedicated to an agency. The host CICS WNPA system maintained the association between the specific agency and its TTY port number.

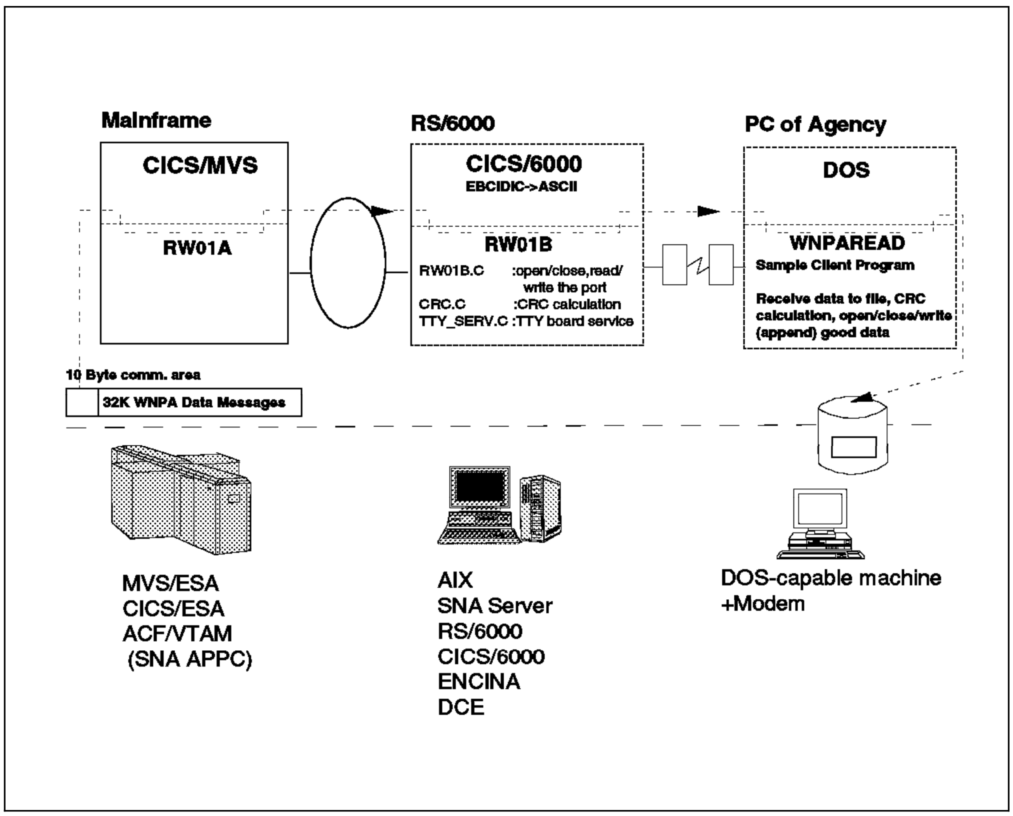

Figure 35. WNPA Overview

When a WNPA message was sent to an agency, the host CICS program RW01A built a COMMAREA which contained a prefix field and the actual text of the message to be sent to the agency. RW01A supplied the TTY port number, whether the agency was expected to respond with an ACK or NAK to message, and the actual length of the message text. RW01A then issued a CICS LINK PROGRAM call for module RW01B. Via the miracle of CICS ISC communications, the RW01B program in RS/6000 was called and passed the COMMAREA built by RW01A.

RW01B performed a series of validations of the received COMMAREA. If any of the edits failed, RW01B put an appropriate code in the return code file field of the message prefix and returned. If all the edits were successful, RW01B computed a communications CRC value over the message text and inserted it at the end of the message. RW01B then opened the designated TTY port and wrote the text data to port. If the agency was expected to respond to the massage, as indicated in the prefix, RW01B issued a read command to the port. Either an ACK, a NAK, some other character, or no response occurred within 2 seconds. Regardless of which event occurred, RW01B posted an appropriate code in the return code field. RW01B then closed the TTY port and returned control to CICS.

RW01B performed all TTY port access by way of a statically linked general-purpose subroutine, *tty_serv*. RW01B communicated with tty_serv through a data structure *tty_rb*. RW01B allocated and initialized this structure and passed a pointer to it to tty_serv. The tty_serv routine obtained from the tty_rb all needed information about the TTY port, the desired operation, the buffer length and location, and processing options. After performing the requested operation, tty_serv set appropriate fields in the tty_rb, including a return code, and returned control to RW01B.

The tty_serv routine contained within itself a stand-alone (non-CICS/6000) driver program to exercise its functions. If the tty_serv module was compiled with an appropriate option, the driver code was included. The version of the object module included in the CICS/6000 environment did not contain the driver code.

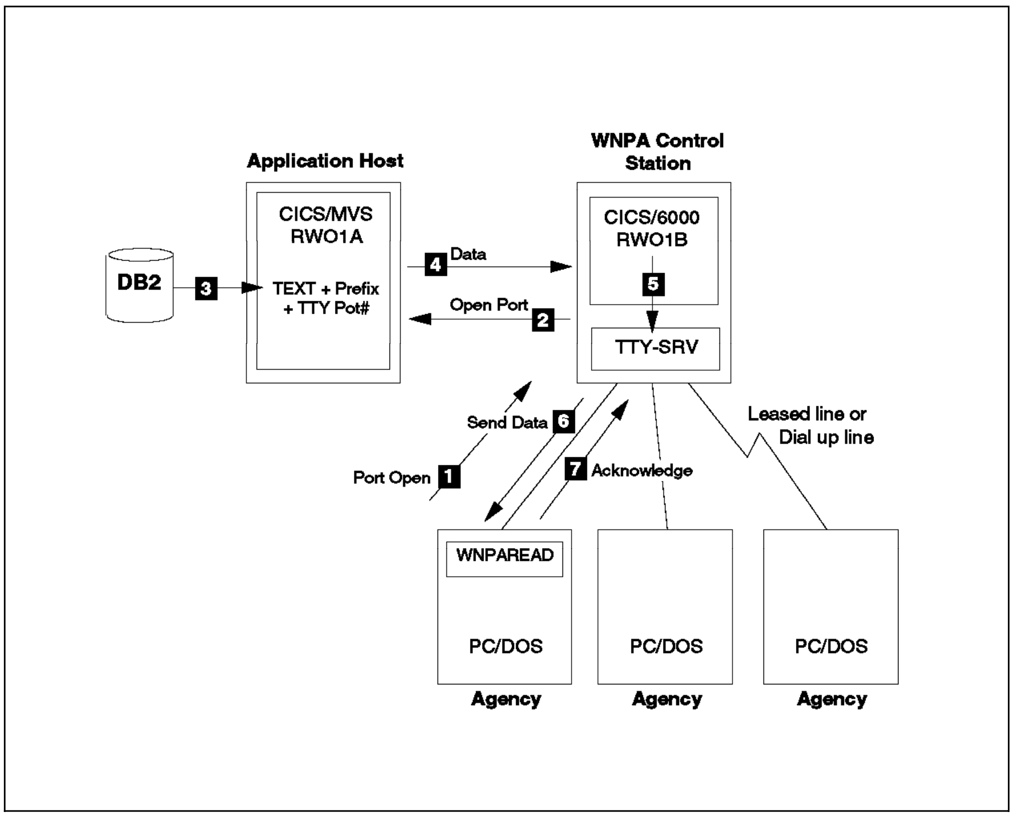

Figure 36. WNPA Data Flow

4.6 Backup and Recovery Solution

Backup and recovery depended on designs that included redundancy and rapid response.

4.6.1 Venue Results

The Venue Results was structured as shown in Figure 37. Swatch Timing provided a dual feed to the Results servers at the venue. Swatch maintained an onboard record (journal) of all timing records sent to the Results server. In the event both servers were lost, a sporting event could have been recreated on an alternate hardware platform. The primary Results server did all calculations and stored them in a local DB2/2 database. After the calculations are completed, the server sent them to CIS, scoreboards, TV VCG, and to the primary or master DB2 database on the host at a logical sport break. (A logical sport break is an inning, quarter, period, or other interval.)

The Results System ensured that synchronous data existed between the primary and recovery Results servers. In the event of a hardware error, an immediate switch could have been made manually. The print server was fed from the host, not from the local Results server. The method at the ring was for the user to accept a NETBIOS trigger and respond with a DB2/2 SQL command from the local Results server. Print was the exception since this was a CICS/ESA host-driven application.

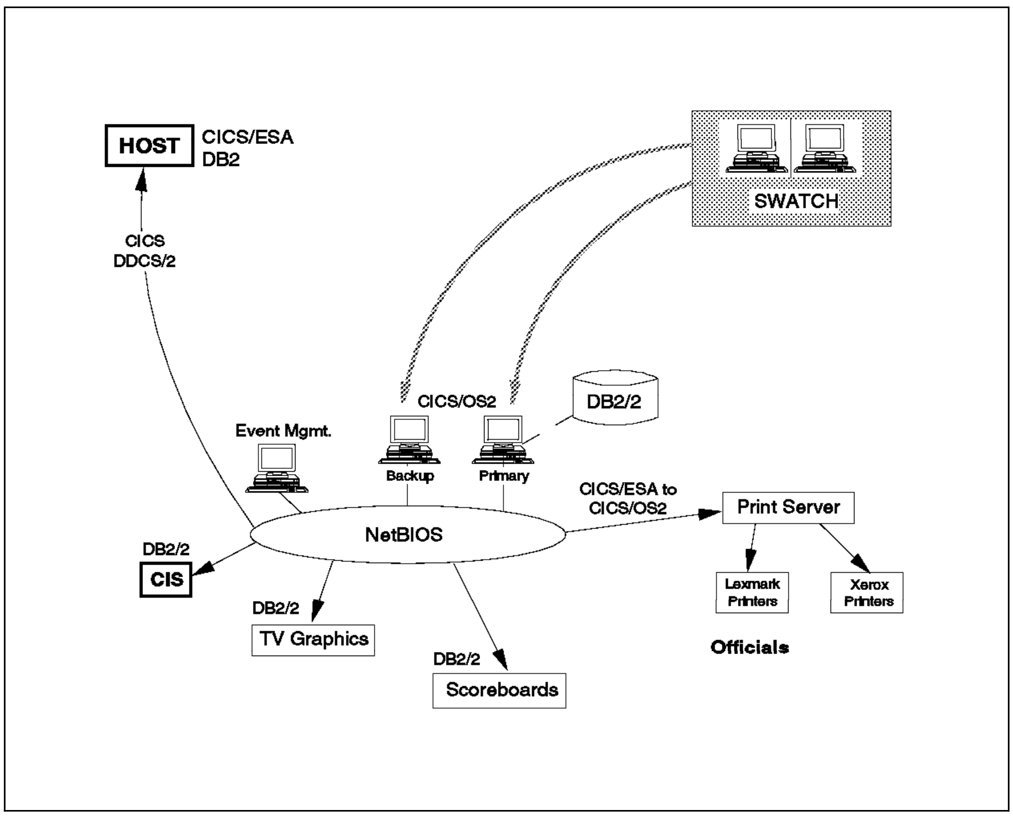

Figure 37. Recovery for Venue Results

4.6.2 Results Server to Host Communications

The Results server to host data transfer was accomplished using two software technique, as illustrated in Figure 38. Database-to-database updates were made using DDCS/2 to DDF data transfer. All transaction-type changes were made using CICS/OS2 to CICS/ESA.

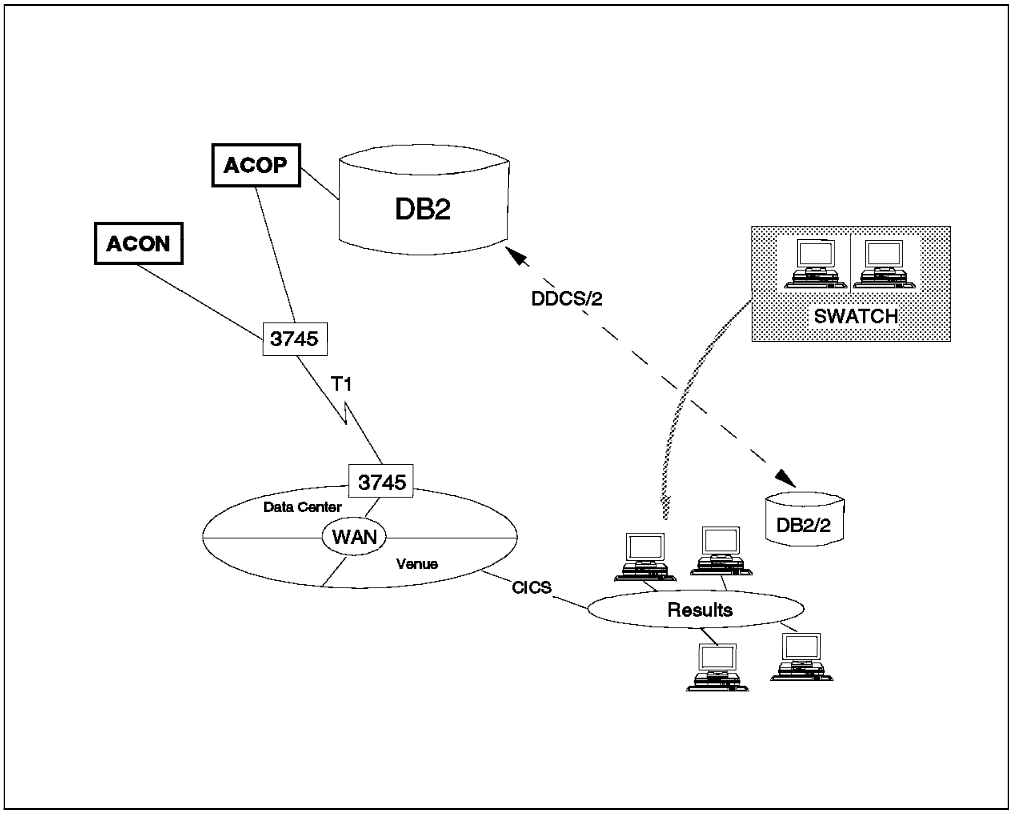

Figure 38. Relation of Venue Database and Host Database

There were dual bridges, routers, or 3745s on each Results ring. Each ring was effectively duplexed. Each venue had both primary and backup ISDN connections to the data center. APPN was used to communicate on the WAN, providing a great deal of flexibility when recovering from a hardware or element failure.

4.6.3 Venue Backup and Recovery Techniques

There were two backup and recovery techniques in the Venue Results system:

- Timed sports and judged sports used DataPropagator Relational (DPropR)
- Team sports and head-to-head sports used dual event control.

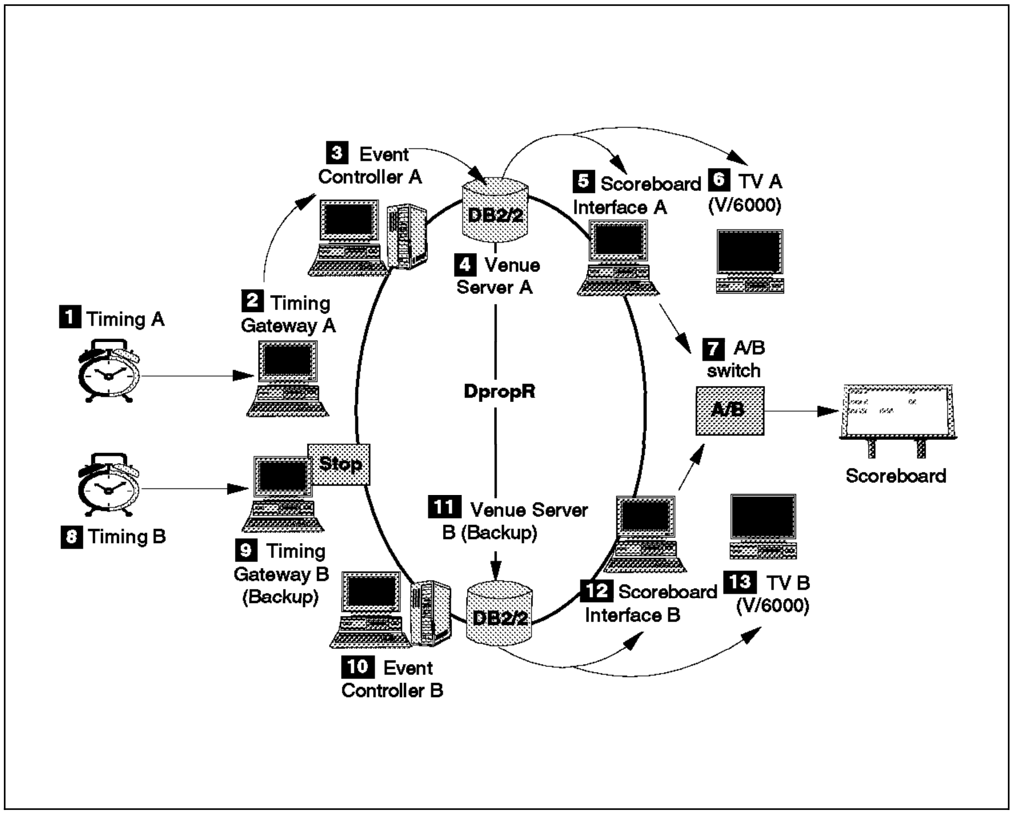

Figure 39. Backup and Recovery Processes for Timed Sports and Judged Sports

The numbers in parentheses refer to Figure 39.

- If CheckSum error, Timing gateway (2/9) requested resend to Timing (1/8).
- If TimeOut error at Event controller (3) or Timing gateway (2), activate the Timing gateway (8) manually. Event controller (3) requested token-ring to resend the lost messages.
- When the venue server database (4) was updated, the venue server backup database (11) was updated by DPropR.
- Timing gateway (8) was running in backup mode, so it did not distribute messages to the token-ring.
- If the scoreboard interface (5) or TV (6) failed, switch to B side by switch (7).
- If the venue server database (4) (4) failed, switch to venue server backup database (11), then request Timing (1) to resend.

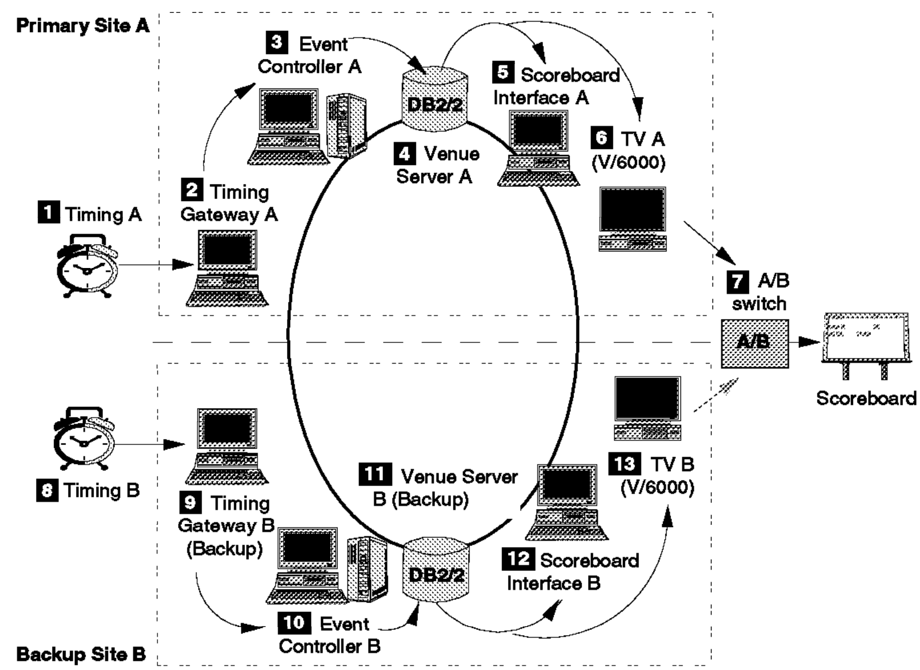

Figure 40. Backup and Recovery for Dual Event Case (Team and Head-to-Head Sports)

The numbers in parentheses refer to Figure 40.

- If CheckSum error, Timing gateway (2/9) requested Timing (1/8) to resend.
- Primary site A and Backup site B processed concurrently, with the same steps.
- If the database failed at the venue server database (4), a TimeOut error occurred at the Event controller (3), Timing gateway (2), or scoreboard interface (5/6), changed the A/B switch box (7) to the B site manually.

4.7 Lessons Learned

Media reports about performance issues during the start-up period focused primarily on one system, which was designed to provide major news organizations with results automatically formatted for dissemination. The World News Press Agency (WNPA) system sought to reduce or eliminate time-consuming manual data entry of information into the column-and-row grids that appear in newspaper sports pages.

The WNPA system was built on an RS/6000 running CICS/6000 as the transaction monitor. Each agency had a dedicated serial communication port on the system and was connected via a leased or dial-up line. The association between communication ports and specific agencies were maintained by CICS/MVS.

When the agency requested data, the request was passed to CICS/MVS, that built a message containing the information, and sent it over an APPC conversation to CICS/6000. CICS/6000 converted the data into ASCII format and sent it to the requesting agency.

So what happened? Several things:

Some of WNPA′s specifications were written without a clear understanding of certain Olympic events. For example, formats for beach volleyball and volleyball were identical, even though each sport played a different number of sets. Consequently, results were dropped into the wrong columns, making the data incomprehensible.

Press agencies and IBM never confirmed the requirement document. There were several misunderstandings that could have been cleared up before the Games started, had proper project management disciplines been adhered to more stringently.

The news agencies ordered their own equipment to use with WNPA. Some used modems that were too slow to handle the high volume of information WNPA pumped to them. IBM offered to install faster modems, which some agencies accepted.

In this particular instance, service level agreements and all the components that could effect them were not well-understood by the various parties. The speed of the lines and the modems were a critical factor that detrimentally impacted the over-all perception of the entire WNPA system. Since IBM was the service provider, a minimum hardware configuration should have been stipulated by IBM and agreed upon by the agencies.

On opening day, WNPA received a massive amount of data, but only a trickle was going out. Part of the problem was that WNPA was set up to send out information synchronously—one transmission to one news agency at a time. The system waited for acknowledgement that data had been received before sending out more. This scheme ensures that data transmits correctly, but even in ideal conditions, it is slower than broadcasting data to all receivers simultaneously. Also, the data that was being transmitted was not prioritized so that newsworthy information, such as world records, was not being sent as fast as possible.

This was a case of bad design logic. Fortunately, it had a rather binary outcome—it brought the system to its knees. Fortunate because IBM was able to detect the problem easily and fix it. This could have been avoided by more testing and a walk-through of the system with multiple agencies.

IBM was reminded by these experiences that when working on a project, especially a project of the magnitude of the Olympic Games, there is not just one customer, but to consider the customer′s customer. IBM also learned the need to have a very clear understanding of exactly what every one of those customers expects.

IBM learned a lot about defining customer requirements in a large, unconstrained user environment. IBM has considerable experience dealing with process-driven customers who come with detailed technical requirements, but those were not the kinds of users the Olympics represents. IBM learned that to be successful in the future, proactive involvement in determining architecture, total requirements, and user expectations is mandatory.

Part 3. The Games Applications: INFO′96 and the World Wide Web Site

Chapter 5. The Info ′96 System

The Info ′96 System was the primary communications interface for the 150,000 accredited members of the Olympic Family. The **major** clients of the Info ′96 System were:

- 15,000 **accredited media representatives** made up of:
  - 10,000 broadcast media people
  - 5,000 print media people
- 11,000 **athletes**
- Other accredited persons, including coaches, sports officials, IOC dignitaries, other VIPs, ACOG staff, and volunteers.

The Info ′96 System was also available to a limited number of nonaccredited persons, in restricted locations such as in VIP lounges and hosting boxes, and in sponsors′ hotels. Info ′96 was not planned to be accessed by the general public. Access to Info ′96 was limited by:

- The physical location of touch-screen kiosks, which were placed in restricted access areas
- Access control via passwords for workstations with keyboards, used for electronic mail
- Or both physical and access control.

The general public was expected to use the Internet for a similar breadth of Games-related information. Contractual arrangements between ACOG and its Internet service provider were such that some historical and biographical information, available in Info ′96, was not available via the World Wide Web (WWW).

5.1 The Contents of the Info ′96 System

Info ′96 had 1,855 kiosk touch-screen displays or workstations with keyboards located throughout the Olympic Villages, competition venues, and other locations, to allow accredited users to gain information, crucial to their effective management of the Olympic Games. Information provided included:

- Competition event schedules
- Event results
- Athlete biographies
- Olympic records
- Weather forecasts
- Transportation schedules
- Olympic news

Information could be accessed in either English or French, the two official IOC languages.

The Info ′96 System also provided electronic mail capabilities, including mail boxes, bulletin boards, notification to pagers, and directories.

5.1.1 The Info ′96 System Design Points

Vital to the success of Info ′96 were:

- An easy-to-use interface:

  The touch-screen monitor interface was designed so that Olympic Family members could learn how to navigate the system in less than 15 seconds, a critical factor in making Info ′96 useful for 150,000 potential users with varying degrees of computer skills.

- Quick system response time:

  Average response time was planned to be 2.0 seconds.

- Timely availability of competition results:

  The target here was 2 minutes maximum replication to the last AS/400 Info ′96 Server. Please refer to subsection 5.3.2, "Info ′96 Detailed Functional Data Flow" on page 80, for further information.

- Completeness of competition data
- Accuracy of the information provided

5.1.2 The Full Information Scope of the Info ′96 System

Table 3 shows the immense quantity of information through which a computer novice could navigate, quickly and accurately, using the combination of a touch screen, and behind-the-scenes technologies of a graphical user interface (VisualAge Smalltalk), the appropriate back office hardware (AS/400) and middleware (DB2).

Table 3 (Page 1 of 2). Info ′96: Available Buttons on Main Menu

TOUCH BUTTON	INFORMATION
Biographies	Athlete biographies (including biographies of horses in the equestrian events)
Games Results	• Results of an event completed less than 2 minutes ago, compared with those of a similar event completed up to a century earlier. • Results viewed by sport, country, or athlete. • Sports competition schedule, participant lists, start lists, event results, medal summary, records, daily summary, country summary, and competition rules.
Records	• Today′s records, all records, records subset, World and Olympic, area, all comers, national, progressions, and rankings.
News	• General news or today′s news: by country, by sport, by topic, by organization.
Historical Results (Olympic history)	• Personal bests of athletes currently competing, checked against the bests of over 80,000 athletes over the past 100 years • Olympic, World championships, other competitions, all-time bests, 1996 bests, and team qualification.
Medals	Who won which medal.
Schedules	• For all days of the Olympic Games. Sporting and nonsporting events listed by activity, by venue, or both. • Sports (start times), press conferences, Olympic Arts Festival, Olympic Village, ceremonies.
ACOG	• General information on ACOG departments and programs, as well as Olympic sponsors and VIP biographies.

Table 3 (Page 2 of 2). Info ′96: Available Buttons on Main Menu

TOUCH BUTTON	INFORMATION
Olympic Arts Festival	• History of Cultural Olympiad, events, artist and performer biographies
Olympic Movement	• IOC, NOCs, IFs, Olympic Games, Olympic participation, Olympic symbols, Olympic ceremonies, VIP biographies
Olympic Village and Venues	• General information, athlete services, NOC services, maps, descriptions of and directions to venues.
Facts and Figures	• Olympic Games history, Olympic sports, Olympic medals, athlete facts and figures
Weather (by venue or international city)	• By venue for all 41 Olympic venues, 11 cities, 4 states, on land and sea • Also includes weather feeds for athletes′ home countries • Updated every 15 minutes by National Weather Service, with wind speed, temperature, humidity, and sea conditions • Today′s forecast, tomorrow′s forecast, extended forecast, and weather bulletins.
Transportation	Supports ACOG-provided services only • Start of service, end of service, frequency and duration of trip, and so on.
Guest Services	E-mail
• Within Info ′96 system • To pagers • To the Internet	
High-Frequency Requests	• Today′s sports, finals, medalists, records, news • Database entries sought most often

This information was crucial for keeping the more than 150,000 Olympic Games participants informed on the results and logistics of the 271 medal events, and for giving members of the press background information and context for reporting complete stories. The e-mail and bulletin board capabilities also helped to facilitate communication between Olympic Games athletes and their families back home, the press and their publications, and between Olympic Family members.

5.2 The Major Components of the Info ′96 System

Info ′96 was comprised of four major components:

An Information Retrieval Facility:

The information retrieval facility, Info ′96, gave Olympic Family members access to a wide range of information (outlined in Table 3 on page 74), about the Olympic Games, the competitions, and the city of Atlanta.

The Info ′96 System was integrated with the Commentator Information System, to retrieve biography data from Info ′96 for television commentators using CIS, in real time.

A Games Communication (e-mail) Facility:

The e-mail facility allowed users to send e-mail to one another, as well as to personal pagers that were registered with ACOG.

Users who elected to use the e-mail facility to communicate outside the Olympic Family, were each required to provide a monetary deposit to ACOG′s X.400 service provider, AT&T. The system employed a security firewall that prohibited outside users from sending e-mail into the Info ′96 System.

The e-mail option had the same VisualAge Smalltalk front end as Info ′96, and used an Office Vision/MVS engine and PagerPac/400 software.

Olympic Family members were required to enter their user ID and password. The user ID was obtained via a link to the Accreditation Subsystem, and was activated when the user had completed the accreditation process. All e-mail users were required to identify themselves the first time they logged on by entering their Accreditation (registration) number, last name, and date of birth. During the initial logon process, the first-time user was required to enter a personal password, used for all subsequent logons to the e-mail system.

A Data Collection Facility:

Most of the information was entered into Info ′96 by ACOG staff members using AS/400 Host attached terminals or workstations.

For other data collection, there were links to the Results System, to information prepared by the ACOG Research Team, and to the National Weather Service.

For more detail on the high resolution weather forecasting, and its direct feed every 15 minutes, please refer to subsection 5.2.1, "Info ′96 and High-Resolution Weather Forecasting."

Translation:

For Info ′96 availability in French, translation software Translation Manager 2 (TM/2) coupled with FlowMark, gave ACOG staff and volunteers, who provide the translations, the facility to control the translation process.

Most translations were expected to be prepared and available in under 2 minutes, except at peak news times.

Info ′96 also provided hardcopy support. A printed copy of any information or e-mail message could be selected by the user and printed on a nearby printer. If the user had entered a user ID, his or her name appeared on each page of the printed output.

These functional relationships are shown in Figure 41 on page 77.

5.2.1 Info ′96 and High-Resolution Weather Forecasting

Textual weather data and statistical graphing were available at Info ′96 kiosks and workstations. Additionally, weather forecasts were posted on the Olympic Games′ WWW page, the National Weather Service′s WWW page, and IBM′s Home Page.

IBM provided a 30-node RS/6000 SP system and support for the National Weather Service to perform high-resolution weather forecasting for the Olympics.

Through the power of the RS/6000 SP system, the National Weather Service was able to forecast weather down to a 2-kilometer grid and provide 3-, 6-, and 12-hour forecasts at 3-hour intervals.

IBM′s Visualization Data Explorer allowed graphical viewing of forecast model results and other information such as Doppler radar, barometric pressure, and temperature. The meteorological data was converted into 2-D or 3-D images and high-resolution models which enabled meteorologists to provide much more accurate forecasts.

The RS/6000 SP system ran RAMS Meteorology software developed at Colorado State University for the weather forecasting, which exploited the vast processing and memory capacity of the SP2 to generate very high-resolution forecasts.

The weather forecasting was a joint project of IBM, the National Weather Service and the Forecast Systems Laboratory of the National Oceanic and Atmospheric Administration (NOAA).

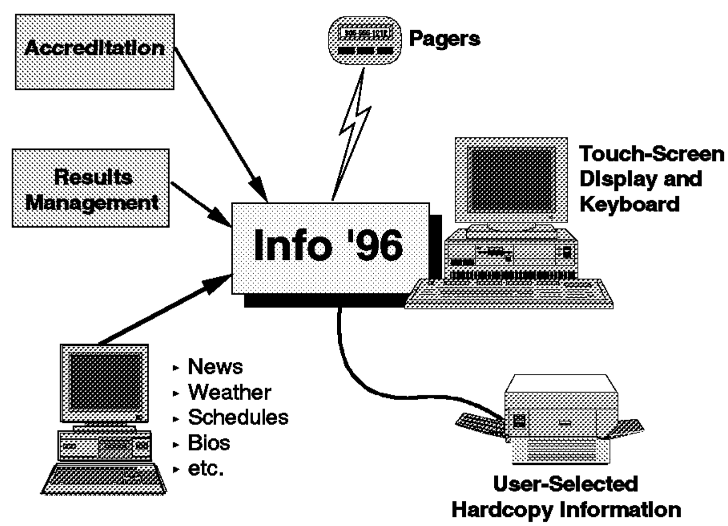

Figure 41. Info ′96 Application Functional Relationships

5.3 Info ′96 Detailed System Architecture

The logical architecture required to support the information retrieval portion of the Info ′96 System is shown in Figure 42 on page 78.

The infrastructure consisted of:

- The ES/9000 mainframe
- A central Info ′96 AS/400 host system
- One or more AS/400 Info ′96 servers in most of the 41 Olympic sports venues
- A number of touch-screen PS/2 workstations in the Olympic venues and other locations, some of which used wireless LANs in open areas lacking wiring, such as sponsors′ hotels.

Olympic venues having a large number of Info ′96 workstations required more than one AS/400 Info ′96 server.

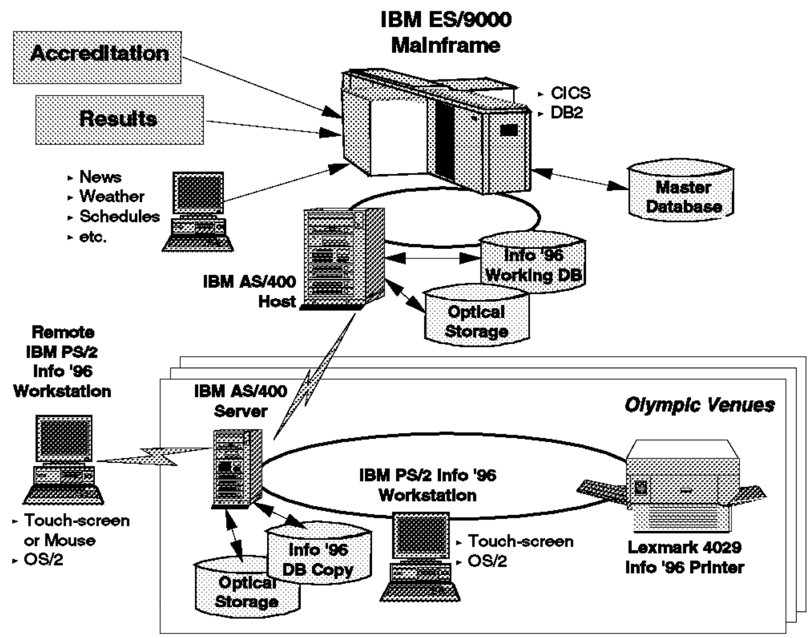

Figure 42. Info ′96 System Logical Architecture

The central AS/400 host maintained the master database for all Info ′96 information, and handled distribution of this information to the AS/400 Info ′96 servers. The AS/400 host portion of Info ′96 communicated:

- With other applications such as Accreditation and Results on the ES/9000 mainframe through the LAN, and
- With the AS/400 Info ′96 servers through the ACOG telecommunications network.

The AS/400 Info ′96 server maintained a shadow copy of the Info ′96 database, and provided direct support to its Info ′96 client workstations. Each Info ′96 workstation was driven by the AS/400 Info ′96 server which supported it, except for access to e-mail, which communicated directly with the ES/9000 host. Since the information database was used for reference only, no database updates originated at the AS/400 Info ′96 server.

The IBM touch-screen workstation handled all interaction with the user. All information (except e-mail) was obtained from the AS/400 Info ′96 server.

User-selected hardcopy information was printed on a network-attached desktop laser printer located near the IBM workstation.

5.3.1 Architecture for E-Mail

The logical architecture required to support the Games Communication (e-mail) portion of Info '96 is shown in Figure 43.

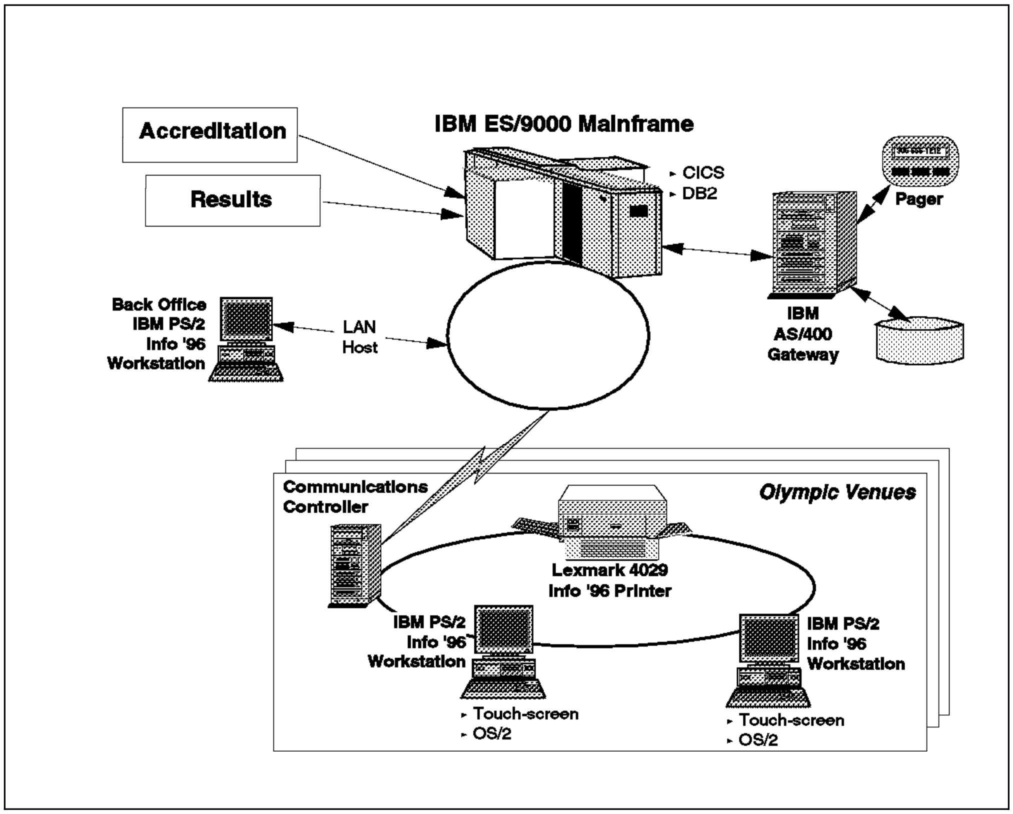

Figure 43. Info '96 E-Mail Application Logical Architecture

The infrastructure consisted of the ES/9000 mainframe, an AS/400 gateway for external communication (X.400, fax, and pager support), a number of touch-screen PS/2 workstations in the Olympic venues, and PS/2s without touch screens for back office use.

The mainframe functioned as the e-mail server, providing message storage and distribution. The AS/400 provided a gateway to allow e-mail messages to be exchanged with the external users via an X.400 service provider, and to send e-mail messages to alphanumeric pagers that were registered with ACOG technology. Users interacted with the e-mail applications via PS/2 touch screens in the venues, or by keyboard-driven back office PS/2s.

The e-mail application was not dependent on either the venue AS/400 Info '96 server or the master AS/400 host.

User-selected hardcopy information was printed on a network-attached desktop printer near the PS/2.

5.3.2 Info ′96 Detailed Functional Data Flow

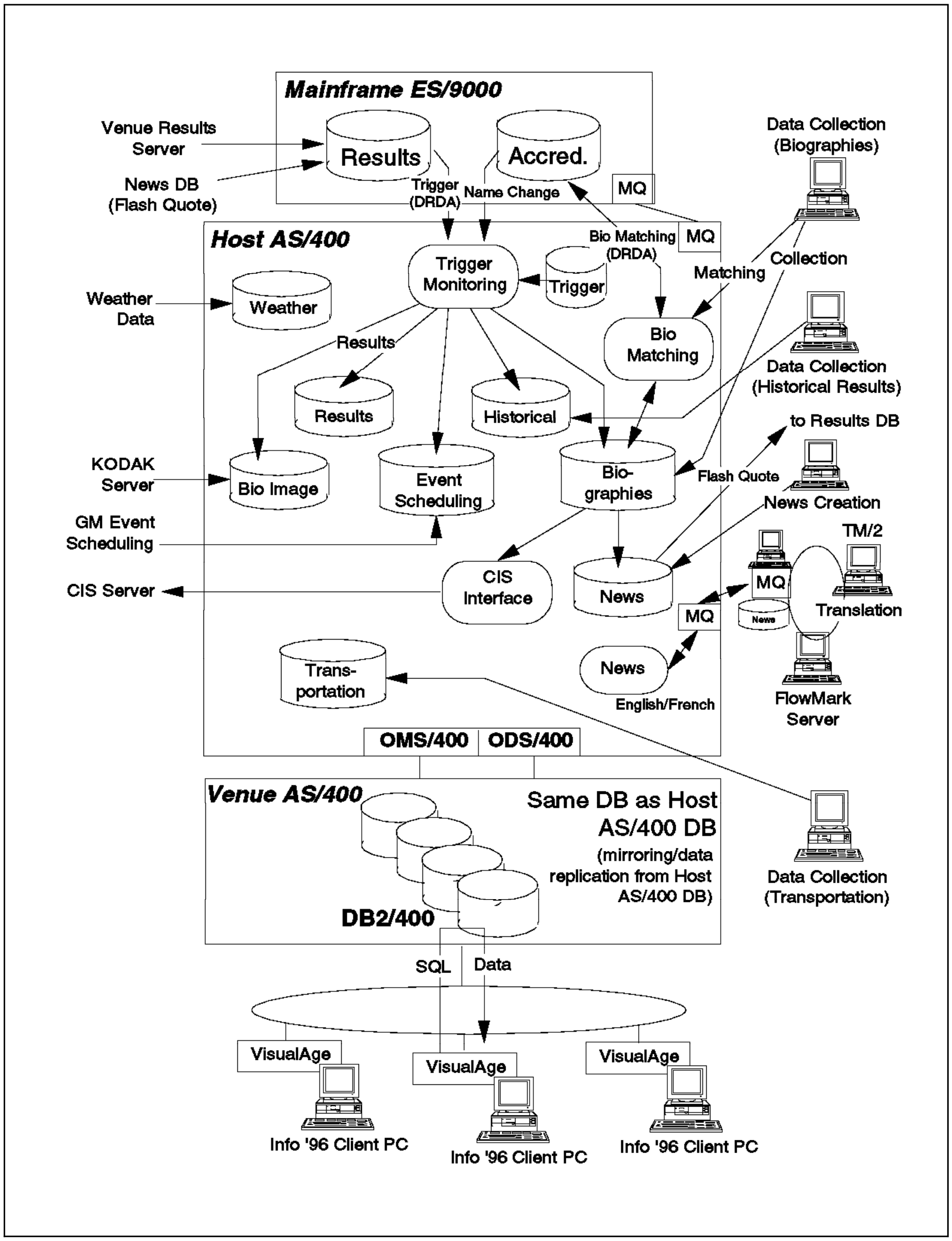

Figure 44. Info ′96 Functional Data Flow

To make the 60 GB—enough for 384,000 typewritten pages—easily accessible, IBM used a multitiered client/server approach. The ES/9000 mainframe supplied results, venue, and accreditation data to an AS/400 host, which acted as a distribution server. From there, 80 AS/400 Info ′96 servers in sports venues and elsewhere received the data, as well as other Olympic information such as weather feeds and news feeds.

These Info ′96 servers supplied the data to the 1,855 IBM PC clients. Over 1 million data fields supplied information for more than 750 screen images.

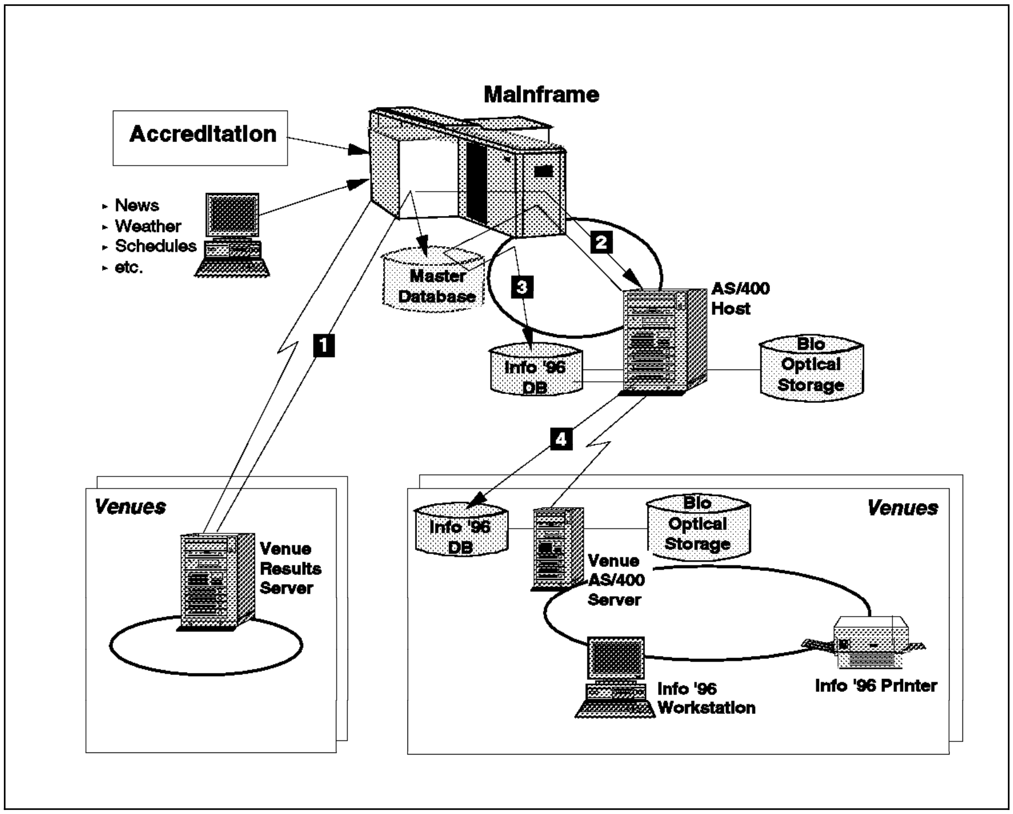

Figure 45. Info ′96 Detailed Functional Data Flow

Numbers refer to Figure 45:

1 The Results System distributed validated competition data to Info ′96 by sending a DB2 transaction to the venue Results server for uploading to the master database on the ES/9000; thus the new Results data, and a trigger message, went to the ES/9000 host. The ES/9000 master DB2 database was updated.

2 The ES/9000 server then alerted the Info ′96 AS/400 host (distribution server) that a sports event had just completed, so that the AS/400 could pull the new information into its database; that is, the ES/9000 sent a trigger message to Info ′96.

3 Using DRDA, a database architecture which allows database-to-database communication and SQL statements, the AS/400 host read the new information.

4 The AS/400 host then distributed the new information to the 80 venue AS/400 servers.

Less than 2 minutes elapsed before most Results data was available to the local Info ′96 client, after event judges′ official validation. Some results are provided to Info ′96 intermittently, such as after a diving round had completed, rather than after every individual dive.

5.4 Info ′96 Product Information at a Glance

The Info ′96 system used the following:

- 80 AS/400 30S servers
- 1,855 IBM PCs
- Touch-screen monitors on PC workstations
- Lexmark 4029 Laser Printers
- Xerox Printers
- VisualAge Smalltalk
- FlowMark and Translation Manager 2 (TM/2)
- C + +
- OS/2 Warp
- DB2 for OS/400
- OMS/400 (mirroring and data replication tool)
- MQSeries
- CICS

5.5 Changes Since Barcelona

The Info ′96 System grew out of conceptually similar systems used at the Olympic Games in Lillehammer, Barcelona, and Albertville. New technology included:

- Graphical, touch-screen, and highlight button interfaces, providing intuitive data access for a culturally diverse audience
- Client/server database implementation using object-oriented technology
- Developed using VisualAge object-oriented software technology. Modular design providing foundation for 1998 and 2000 Olympic Games.

5.6 Key Business Messages

The technology that supported Info ′96 can be used anywhere that large amounts of data need to be available in a user-friendly environment. This database application can be used to distribute information from a central warehouse to a variety of alternative distribution points.

Existing and potential uses for Info ′96 technology include:

- Banking, with the main bank distributing financial information to its branches
- Human Resources, as an employee information system offering information about benefits or internal training
- Guide kiosks for a city, an airport, a shopping mall, a large sports venue, or an office building
- Catalogue sales through a toll-free number to advise consumers of product availability, product specifications, past order information
- An ″executive information system″ for any industry
- Insurance, customer service kiosks, as for insurance purchases

This system could be used by:

- Governments
- Travel and transportation companies
- Banking corporations

- Insurance companies
- Telecommunications and media companies
- Educational institutions

In a similar application, information kiosks installed in Spain′s largest bank are used by bank customers for numerous functions, such as:

- On-line banking
- Payment of utility bills
- Payment of taxes
- Purchase of tickets for cultural events

The bank′s IBM ValuePoint computers with touch-screen displays serve hundreds of customers daily with bar-code scanners and magnetic stripe readers providing security and access control.

5.7 Lessons Learned

The Info ′96 System provided general information on Atlanta, the athletes, and Olympic history, as well as results information and e-mail services to all members of the Olympic Family—athletes, officials, and journalists. It was an AS/400-based system, with over 1,800 OS/2 client workstations distributed at all sporting and many public gathering locations.

There were some inaccurate and incomplete results in Info ′96. Some were due to programming and data formatting errors, and some were due to data specification miscommunications.

Part of the problem can be traced to discrepancies between the original d specifications and the actual way some sports report their results. Results were not always immediately available after an event was completed because judges had to declare them official and managers of the sports venues had to approve the release of official results. Official results typically reached Info ′96 in 3 to 5 minutes. For some events, however, it took longer until the official results were posted. For example, in the men′s marathon, official results couldn′t be posted until the final finisher completed the course—after 4 hours, 49 minutes— more than 2 hours and 30 minutes after the winner had crossed the line. In some events, like kayak or canoe slalom, there is a mandatory 30-minute waiting period, to allow results to be contested by athletes, before the result is considered official.

There were also some useability issues that surfaced such as the number of buttons required to be pushed to navigate through the system, not supplying interim and unofficial results, general stability of the system, and inconsistent French translation of data. Each of these issues are surmountable given enough time to test and modify. Unfortunately, the inflexible nature of an Olympic Games does not allow for time extensions. One of the valuable lessons IBM learned in the case of Info ′96 was that it is impossible to predetermine how a self-navigating system will be used. It was thought that the WWW site would be used to access much of the information that was available on Info ′96.

Chapter 6. The Internet and the Olympic Games

ACOG′s Official Home Page is the first Web site in the history of the Olympic Games. This chapter describes the Internet access provided by IBM.

6.1 1996 Olympic Games Information on World Wide Web

IBM worked with ACOG to make the 1996 Olympic Games information accessible to more people worldwide, and in more ways, than ever before.

For the first time in Olympic Games history, information was presented to sports fans in a fully interactive way, making use of the latest Web technologies. The Olympic Games Web Server content was easily accessible, virtually taking Olympic fans from around the world to the heart of the Centennial Olympic Games.

The Olympic Games Web Server provided a wealth of continuously updated facts, figures, photos, illustrations, video, and audio content, all aimed at providing the latest news possible on the what, when, and where of the sports, as well as ticket availability and buying information, throughout the entire competition period.

The primary server for the Olympic Summer Games World Wide Web site was a 30-node RS/6000 SP computer, supplemented by specific servers for video, audio, and electronic commerce, allowing the Internet user to execute a myriad of functions, such as finding what happened minutes before in their favorite sport, to buying tickets or Official Olympic Games products in a secure way.

Millions of people around the world were able to access official information about the 1996 Olympic Games by connecting to the Web Server on the Internet. They just pointed their browser to *http://www.atlanta.olympic.org* and there it was: the 1996 Olympic Games Home Page.

Figure 46 on page 86 is an example of the Olympic Games Home Page (not all of it). It should be seen as a representative example, since the page content was updated constantly.

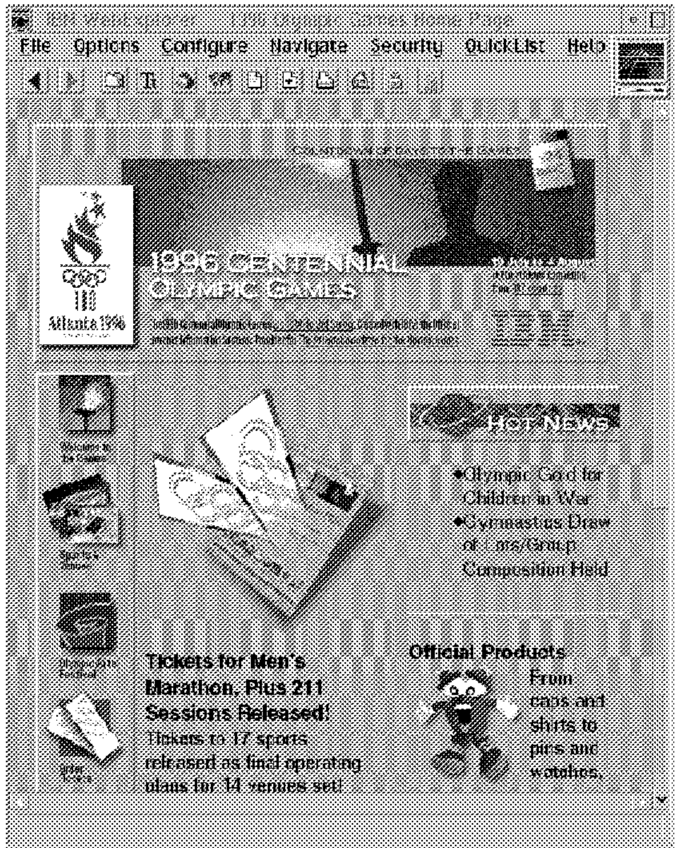

Figure 46. Example of the Olympic Games Home Page

6.2 The Major Requirements

Interest in the 1996 Olympic Games was worldwide. The Internet is an extremely effective means of responding to that interest and providing the most up-to-date information possible. The basic problem was getting timely information about the Games and making it available to the general public worldwide.

Important aspects of the problem included the following:

- **Distributing Olympic Games information worldwide**

  Because interest was worldwide, the information had to be made available to everyone, everywhere in the world, as close as possible to the occurrence of the relevant event.

- **Allowing retrieval of information while preventing removal or manipulation**

  The integrity of the information had to be assured and maintained. Anyone could browse, but strong security had to be in place to avoid unauthorized data access and manipulation.

- **Scalability**

  As the Games approached, it was anticipated that the number of accesses to the information as well as the amount of related data would increase. It was, therefore, mandatory that the solution seamlessly support additional processors and disk space, as the need arose.

- **Real-time news and information updates**

  The information supplied had to be timely.

- **Latest technology tools**

  In keeping with the other Olympic Games solutions, dissemination of information about the Olympic Games had to employ leading-edge technology.

- **Support for multimedia interface**

  All types of media interfaces, including text, photograph, video, and audio had to be supported.

- **Electronic commercial interaction**

  The system had to be able to support electronic commerce through a secure interface between the potential customers and the enterprise.

6.3 The Solution and the IBM Role

IBM supplied all hardware, systems software, WWW applications, technical support, systems integration services, operations, facilities, document design, HTML implementation, security and access tracking for the 1996 Olympic Games server. IBM Internet security products allowed retrieval of WWW information via the Internet, but prevented removal or manipulation of data.

IBM Scalable POWERparallel Systems (SP2) and RS/6000s were selected as the platform for the Web servers, in order to easily scale up with additional processors and disk storage as the volume of information and access to the Olympic Games Web server increased during the 1996 Olympic Games. This turned out to be a wise decision since, during the Games, millions of hits were made to the Web site. The SP2 systems assigned different tasks to each node, serving database information, video, or acting as a Web server. Each of the nodes worked in parallel or independently, whichever was faster, responding to user requests and allowing for more users to access the 1996 Olympic Games WWW site simultaneously.

In order to satisfy ACOG′s requirements, the Olympic Games Web server was an integral part of the Games network. It was meant to be dynamic and as such, during the Games, it was updated with results from all venues, allowing the Internet user to be aware of what was happening in all sports, even the ones not covered by the media in real time.

Figure 47 on page 88 shows how the 1996 Olympic Games Web server tied into the rest of the Olympic Games network.

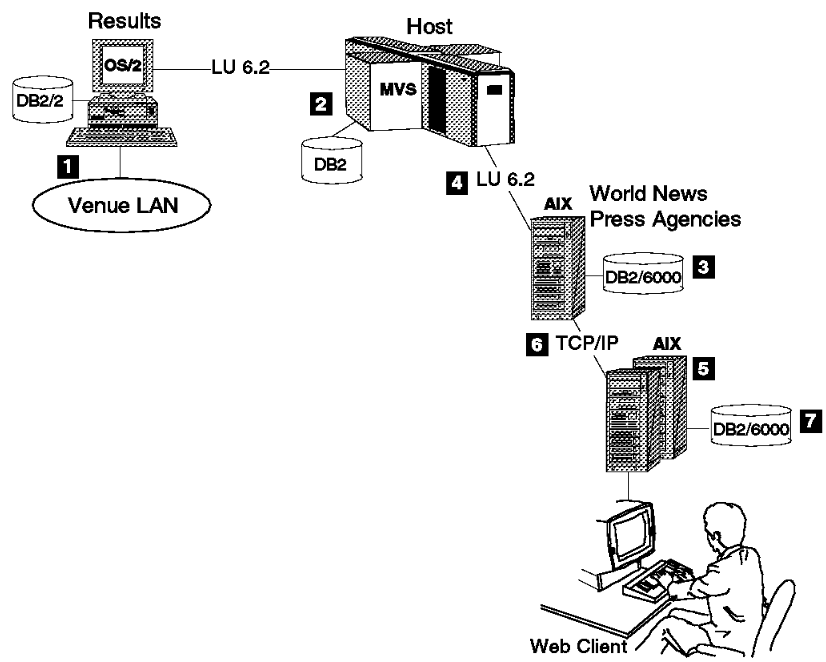

Figure 47. Olympic Games Web Server

The numbers refer to Figure 47.

1 The Results information originated at the various venues.

2 The information was locally stored in the DB2/2 at the venue. CICS was used over an LU6.2 connection to update the DB2 database on the host system.

3 CICS was also used to update the WNPA system where the information was stored in DB2/6000.

4 The connection of WNPA′s system to the host was based on LU6.2 protocol.

5 The Web server was a collection of mirrored RS/6000 SP2 systems running AIX.

6 The connection from the Olympic Games Web server to the WNPA system used TCP/IP. CICS/6000 was used to transfer the information from the WNPA system to the Web servers.

7 On the Web servers, the information was stored in a DB2/6000 database.

6.3.1 Dealing with Diverse Technologies

Figure 48 on page 89 depicts the infrastructure built to allow all this information to be available to the Internet user. Diverse technologies from different technology providers were used. Also notice that to speed up answers to requests for the complex mixture of digital, text, and Web data, the tasks were distributed among a variety of servers in several states. State-of-the-art routers, hubs, and LAN technology linked the SP2 systems primary Olympic Games Web server to the other SP2s for quicker access by the Internet user.

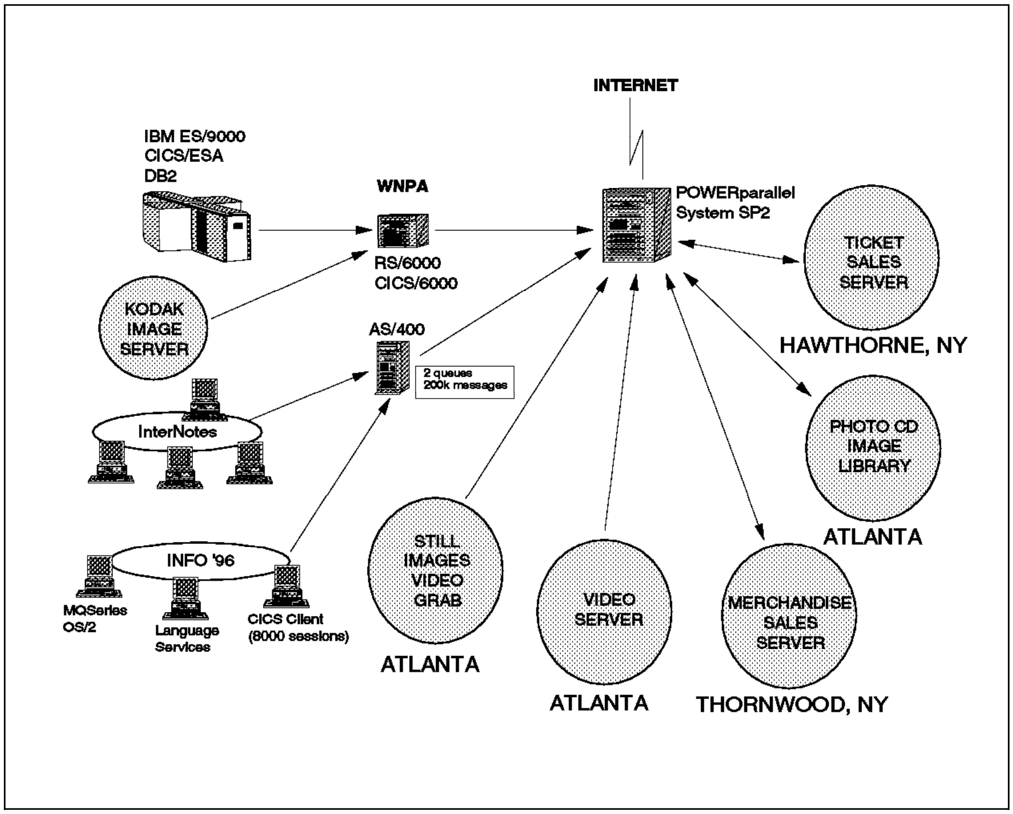

Figure 48. 1996 Olympic Games Web Server Infrastructure

6.4 1996 Olympic Games Web Server Content

Listed at *http://www.atlanta.olympic.org*, the 1996 Olympic Games Web server presented an array of information under the following major headings:

Welcome Both video and audio greetings to Internet users, the 1996 Olympic Games at a glance, and answers to frequently asked questions.

Sports and Venues Explanations of the sports of the 1996 Olympic Games, competition formats and a 3-D look at the venues that hosted the events, housed the athletes, and provided the settings for visitors to gather.

Schedule Time, date, location, and more about every one of the more than 561 sports sessions of the 1996 Games. It was presented to give Internet users schedule information by sport, by day, or by venue. It also allowed users to generate their own Olympic schedule by selecting event, day, and location.

Travel Information A look at Atlanta and an update on accommodations and transportation.

Tickets When and where Olympic ticket brochures were to be available, how to order, and getting Olympic tickets as easily as possible.

Official Products They were attractive and popular, and purchasing them helped support the U.S. Olympic Team and the 1996 Olympic Games. What was available, where to buy, and how to get a newly published consumer catalog were all part of the information presented.

Sponsors The companies whose contributions and support funded the 1996 Olympic Games, and the many roles these companies played in the 1996 Games.

Olympic Arts Fest Since 1912, the Olympic Games have celebrated sports and the arts. With a spectacular array of art exhibits, dance, theater, and music, the 1996 Olympic Arts Festival was an exciting and entertaining component of the Centennial Olympic Games.

During the Games, ACOG and IBM continuously updated the Olympic Games Home Page, not only with almost real-time results, but also with the latest and hottest information on what was happening in the Games.

6.4.1 Olympic Games Information

The following information was available at the Olympic Games Home Page, prior to the Games′ opening ceremony:

- Competition program on-line ticket availability and sales of Olympic Games tickets
- Venue information, including frequently updated construction photographs and 3-D visualization tours through Atlanta′s new stadium
- Web-site-visitor guest book
- List server to enable automatic receipt of all electronically posted mail
- Olympic Games news
- Atlanta maps and travel information
- Complete program for Atlanta Olympic Arts Festival
- Olympic Games broadcast coverage video clips from WXIA (NBC Atlanta affiliate)
- Atlanta weather forecasts
- Fun Site for Kids featuring Izzy the Olympic Games mascot

6.4.2 During the Olympic Games

IBM and ACOG′s plan to update the Olympic Games Web server during the Games was as follows:

- Live start lists, results, and medal standings.
- Near-real-time access to official results from all venues.
- Still images from the field of play at all the competition venues, including events and photo-finish photography updated regularly.
- Access to Info ′96 databases, providing competition rules, athlete profiles, athlete photos, team information, and news releases.
- Weather conditions in Atlanta and forecasts for the next 3 hours, 6 hours, 12 hours, down to an area 2 kilometers square, updated eight times a day.

6.4.3 The Web Object Manager

For technicians, planners, and webheads, the Web Object Manager (WOM) was the site′s greatest triumph. Designed, constructed, and coded by IBM, this single, intelligent program administered and integrated thousands of templates, graphics, data objects, and applets. It fed the information to five mirrored server sites around the world to speed its passage across the Web. It tracked visitor habits and responded dynamically to browser capability. The result was a custom-built page for every request, delivered as required and on demand. This ability to host unprecedented amounts of simultaneous access to a site foreshadows the next generation of Web business applications.

6.5 Olympic Games and IBM Electronic Commerce

The Olympic Games Web server allowed Internet users to buy tickets and official merchandise for the Games. By the time the Games began, sports fans had purchased tickets by the tens of thousands via the Olympic Ticket Server.

The Ticket Server represented the first real-world application of IBM′s Net.Commerce server software, which makes it possible for businesses to quickly, easily, and safely create virtual storefronts on the Internet.

The Ticket Server provided a major advantage over purchasing tickets by phone or mail: visitors could create customized itineraries on the fly with up-to-the-minute information, prior to ordering tickets. The Ticket Server allowed a visitor to build a schedule via the following options:

- List of sessions still available for purchase
- Search based on:
  - Sport
  - Date
  - Location

Each available session was listed by sport or discipline, as well as date, time, location, description, and ticket price.

To make purchasing secure for Olympic ticket buyers, IBM employed Secure Sockets Layers (SSL). SSL, an industry-wide communications protocol, encrypts the buyer′s data as it is entered at the browser, ensuring that when it is sent through the wire, no other Internet user will be able to see it. In order to buy a ticket, after the selections were made, Internet users filled in an electronic purchase form with their personal information, including credit card account number. This information was then encrypted and sent to the seller′s system—in this case, the Olympic Games Ticket System. The purchaser received an electronic mail confirmation of the purchase within 24 hours.

6.6 Lessons Learned

The official 1996 Olympic Web Site—*www.atlanta.olympic.org* —was built and maintained by two IBM teams working 750 miles apart in Atlanta and Southbury, Connecticut. It was labeled the richest content site on the Web, and drew an average of 11 million hits daily during the games—a total of nearly 190 million.

But more important records were broken long before these. The sale of more than 130,000 Olympic event tickets valued at more than $5 million established the site as the world′s largest for electronic commerce, and it proved the viability of secure transaction processing via the Internet.

The lessons learned from this success were learned by those external to IBM: that a single Web site can handle enormous traffic data streams (10 gigabytes an hour or more), while providing secure transaction processing, and acceptable response time.

Part 4. The Games Applications: GAMES MANAGEMENT

Chapter 7. Operation Management Systems

Being the Worldwide Information Technology sponsor of the 1996 Olympic Games meant not only supporting the most visible elements of the Olympic Games—the competitions and events—managing results, and making them available and visible worldwide efficiently and accurately, but it also meant supporting information technology needs equal to those of a FORTUNE 500 company.

These needs included accounting, payroll, personnel, and other back-office functions, like those organizations face every day, plus specialized processes such as staffing, security authorizations, incident tracking, ticketing, accommodation, and other specific management and logistic functions.

ACOG had to provide these critical information and services, ensuring the smooth transition from event to event as well as the security of a global constituency, all the while maintaining peace and harmony among those from countries that may be at war—a tough job for any company.

From this point of view, the ACOG basic requirement was to create highly accurate, reliable systems that were easy to use. That meant defining a networked mission-critical IT infrastructure able to support 80 different ACOG-managed sites, 8 athlete villages, 41 sports venues, the needs of more than 25,000 Olympic Family members, the staffing of 40,000 volunteers, and the accreditation of 150,000 people.

As with any business, managing the components was often complex. IBM worked in partnership with all of the other technology sponsors and with business partners to create an array of fully integrated applications, in this way creating the solutions to handle the extensive management aspects of the Olympic Games.

From the point of view of information technology, the implemented solutions can be divided into two logical groups of systems:

- The Games Management System
- The Enterprise Operations System

7.1 The Games Management System

Games Management was made up of the following subsystems:

- Accommodation Allocation Tracking
- Accreditation
- Arrival and Departure
- Event Calendaring
- Games Staffing
- Internet
- Materials Management and Logistics
- Resource Booking
- Security Incident Tracking
- Ticketing
- Transportation

- Venue Design

We discuss a number of the Games Management subsystems in depth. They are related to the Olympic management functions and include a collection of organizational internal projects used by personnel and volunteers of ACOG. They were developed on the platforms that were most familiar to the users and the least expensive for the organization.

The platforms and architecture were varied; they ran on ES/9000s, AS/400s, RS/6000s, and PS/2s, and used a variety of development tools for each platform.

The Games Management subsystems were critical to the mission because they were the entry and validation point for the information that all the ACOG systems had to manage. As a consequence, they had interfaces for capturing data from the office system, between themselves, and with the most visible systems of the Olympics: Info '96 and Results.

7.2 The Enterprise Operations System

Enterprise Operations included the following subsystems:

- Data Access
- E-Mail
- Finance
- Human Resources
- Payroll
- Presentations
- Project Management
- Spreadsheet
- Word Processing

The Enterprise Operations subsystems are not discussed in this document. They are mainly previously-owned ACOG solutions based on software packages such as Finance (JDEdwards), Human Resources (PeopleSoft), and commercial office solutions such as Word Processing (MicroSoft Word), Presentations (MicroSoft PowerPoint), and Spreadsheet (MicroSoft Excel).

Figure 49 on page 97 shows the association between some of the mentioned subsystems:

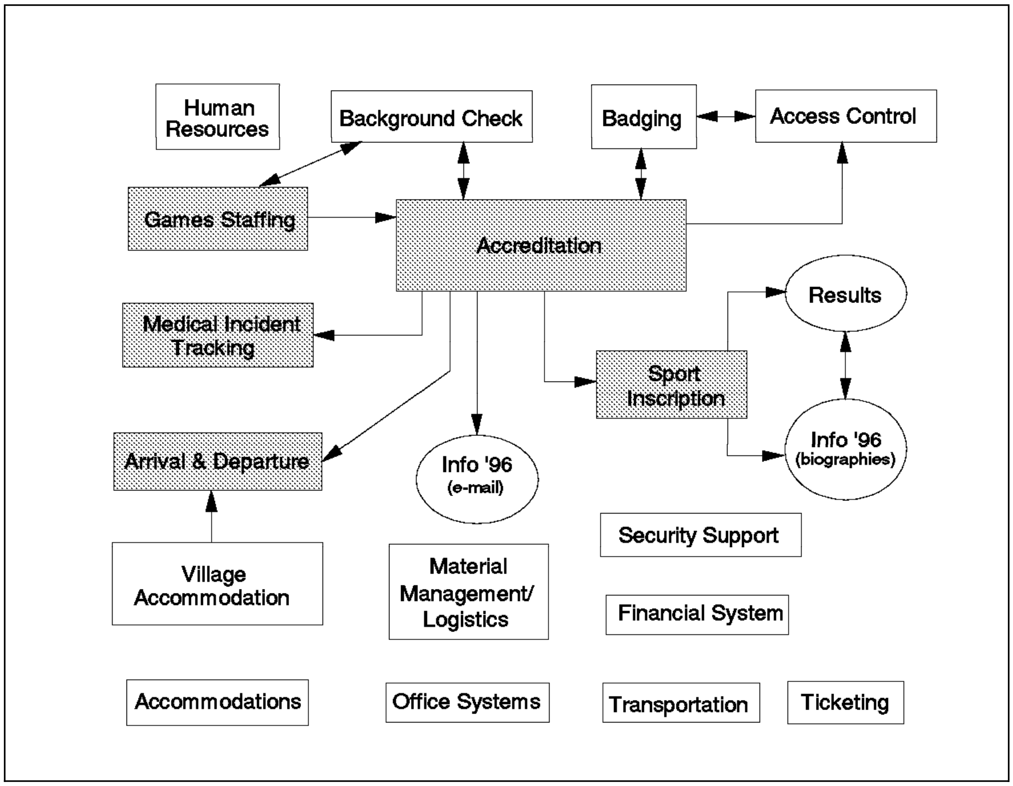

Figure 49. Games Management: Subsystem Relationships

Chapter 8. The Accreditation Subsystem

A major subsystem within Games Management was Accreditation. It provided a timely, accurate process for registering, authenticating, credential checking, and badging for some 150,000 Olympic participants who required access to 80 Olympic venues and facilities.

The badge-making process relied on communication among the ES/9000, Kodak Envoy 5000 workstations, and OS/2 LAN servers in the various Accreditation centers. Key Sensormatic access control applications resided on the RS/6000 that interfaced with the ES/9000.

Two new elements of the Accreditation Subsystem—radio-frequency and hand-print technology— implemented by Sensormatic Electronics Corporation, were used in the 1996 Atlanta Olympic Games to enhance the safety of the athletes. Integrated into every identification badge was a photo image and a bar code, as in previous Olympic Games. However, for athletes and others who needed access to high-security areas such as the Olympic Village, badges included radio-frequency (RF) technology (for transmitting and receiving signals) that was cross-referenced with hand-print geometry for additional corroboration and security.

IBM′s open platforms tied the video imaging, sensoring, bar code, and radio-frequency technologies of the other vendors to provide a secure, efficient method of access control.

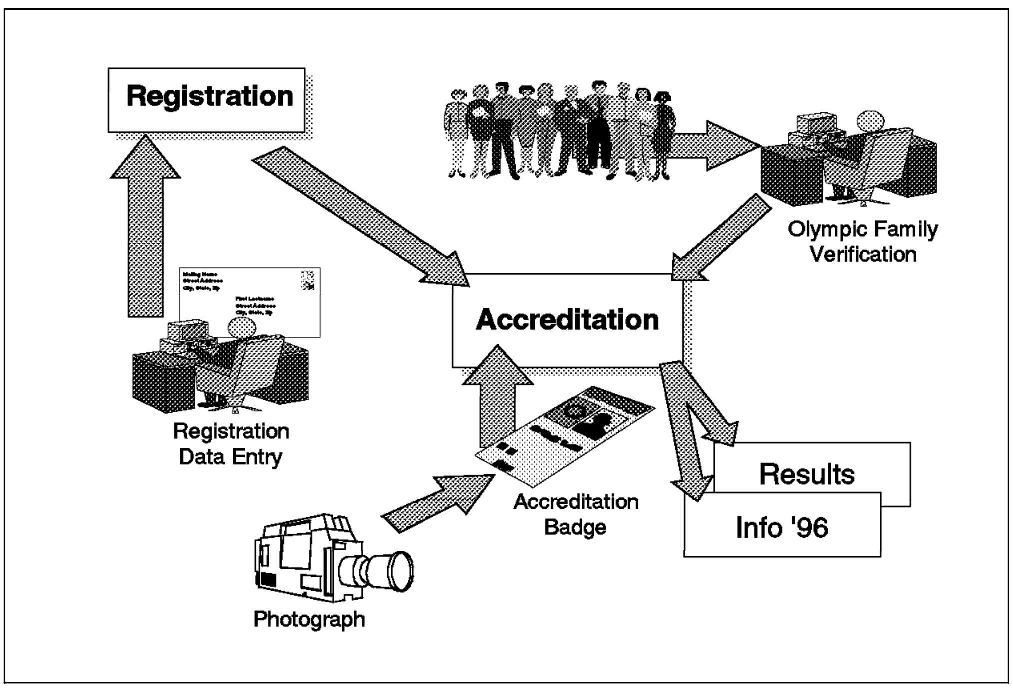

Figure 50. Overview of the Accreditation Subsystem

8.1 Scope of the Accreditation Subsystem

The scope entailed delivering an accreditation system that would provide for registration of all individuals to be accredited, would assign access and other rights to individuals, would produce the identification badge, reaccreditation, access control, and management reporting.

An estimate of the numbers and types of people to be accredited is given in Table 4.

Table 4. Accreditable People

Category	**Olympic Family**	**Estimated Population**
IOC, NOC, Sports Federations	Yes	3,000
Athletes, Officials, Referees	Yes	20,200
Media (Press and Broadcasters)	Yes	15,000
Sponsors, VIPs	Yes	3,800
ACOG Staff, Volunteers, Vendors	No	105,000
Total		147,000

8.2 Functional Flow

The majority of the people had to be accredited before the opening of the 1996 Centennial Olympic Games. The process began with the distribution of registration forms to the authorized representative of each responsible organization. Most members of the Olympic Family received an Olympic Identity card, which served as a visa for people entering the U.S. from a foreign country. To receive that card, the registration forms were completed and returned to the ACOG Accreditation Program and the information entered into the Accreditation database. Any forms that were incomplete or in error were returned to the responsible organization with a letter describing the problem. Athletes had an additional registration requirement, which involved entering information about their particular sport and event.

The ACOG Accreditation Department, working with the Olympic Family Protocol Department, and other groups, determined the individual′s access rights and privileges. A security background check was performed by the Security Department prior to accreditation if the person preregistered. For ACOG Staff, volunteers, and vendors, information from the Games Staffing Subsystem was downloaded to the Accreditation Subsystem beforehand to facilitate the accreditation process.

Formal accreditation took place when the individual arrived at the Games. The personal information was validated, access rights verified, and financial obligations checked before the person was photographed and the badge produced. The badge displayed a photograph, the individual′s access rights and privileges, his or her organization, category, and other essential information. The badge was the mechanism used by Access Control to control entry into the venues and the zones within the venue.

Reaccreditation is the same as the accreditation process and happened when a badge was lost or when access privileges changed. The process was needed to prevent any individual from having more than one active badge.

The Accreditation Subsystem provided the Access Control function at each venue with badge numbers valid for that venue. Radio-frequency technology was used as validation for the badge number, to provide an automated venue access system. Other information was provided from Accreditation to the Human Resources, Accounts Receivable, Info ′96, Results, Arrival and Departure, Transportation, Medical Services, and Accommodations Subsystems.

Reporting was a big part of the Accreditation Subsystem. Info ′96 and Results needed information about the athletes. Management reports had to be submitted identifying the number of people registered, accredited, and reaccredited each day. In addition to these planned reports, other reports were provided on request.

8.3 Environment

Accreditation used a mainframe-based system with distributed processing. Each Accreditation Center was configured with an OS/2 Client Server LAN, OS/2 workstations, Kodak digital cameras, high-resolution laser printers, and an OS/2 server. The OS/2 server communicated with the host mainframe for data sharing using the APPC protocol.

In the case of a host system outage, the Accreditation Center had to be able to continue the accreditation process.

Table 5 shows the number of Accreditation workstations and printers required at each Accreditation Center.

Table 5. Accreditation Workstation and Printer Requirements

Location	**Workstations**	**Printers**
Atlanta (includes the airport, Olympic Village, the Olympic Family Hotel, and the Inforum)	31-36	31-36
Soccer Venues	6	6
Cleveland, TN	2	2
Savannah, GA	2	2
Total	41-46	41-46

8.3.1 Storage Requirements

The Accreditation Subsystem required:

- Host server program storage of 130,000 KB
- Host server data storage of 300,000 KB
- Backup database server storage of 80,000 KB.

The Badging function required:

- Client badging station program storage of 2,000 KB
- Client data storage of 20,000 KB.

The image storage platform required:

- External hard drive image storage of 1 GB.

8.3.2 Print Requirements

The Accreditation Subsystem had to be able to print at least:

- 240,000 status report pages
- 200,000 mailing labels.

The subsystem had to issue color badges as follows:

- 31 color badges per hour per badging station, maximum
- 15 color badges per hour per badging station, average
- 600 color badges per hour (maximum) with bulk printing
- 400 color badges per hour (average) with bulk printing.

8.3.3 Client/Server Transactions

The number of servers of each type was as follows:

- Host Accreditation servers: 1
- Backup database servers: 10
- IBM LAN servers: 10

The number of transactions handled by those servers was as follows:

- Maximum of 18 client workstations accessing a single server
- Average of 6 client workstations accessing a single server
- Maximum of 360 transactions per hour between server and clients
- Average of 90 transactions per hour between server and clients
- Maximum block size flow of 100 KB in a single C/S transaction
- Average block size flow of 100 bytes in a single C/S transaction.

8.4 Availability and Performance

Up to six terminals were provided in a central location to accommodate the entry of registration information prior to the Games. The peak time for registration was 30-60 days before the Opening Ceremony. Volunteer and staff information was downloaded from the Games Staffing Subsystem to facilitate the staff badging process.

Accreditation for the Olympic Family began 3 to 4 weeks prior to the Games and peaked 3 to 5 days before the Opening Ceremony. All the Accreditation centers had to be open 5 days before the start of the Games. Additional performance requirements included these:

- 24-hour operation
- Down-time of 5 minutes or less during scheduled operational hours
- On-line response time of less than one second
- Data transmission time from and to badging device of no more than 3 seconds
- 2 minutes to print a color badge
- Support for up to 60 simultaneous user sessions.

8.5 Key Assumptions and Limits

The design of the Accreditation Subsystem had to meet the following requirements:

- The Accreditation Subsystem was assigned the responsibility for collecting, updating, and delivering access control information to the Access Control function. Registration, Accreditation, and Access Control functions were provided for all individuals who required access to controlled areas. Distribution of the Accreditation information to the access control points was the assigned responsibility of the Access Control function.
- The Accreditation Subsystem determined and visually displayed the identity of each accredited individual and showed the access rights and privileges to which that person was entitled.
- One and only one active accreditation badge was permitted for an individual at any time.
- The Accreditation Subsystem supported multiple Accreditation centers operating in an OS/2 LAN environment with a link to the mainframe for central database processing and for interfacing to other critical systems, such as Results and Info ′96.
- The Accreditation database was the primary source of information about individuals for other groups involved in the Olympic Games.
- Registration began months before the Games, and had a data entry function for Olympic Family members and a download process for ACOG staff and volunteers.
- Over 150,000 people needed accreditation.

8.6 Planned Reporting

A wide range of lists was provided from the database. Examples are: category, function, tasks by function, organization, summon for photograph, alphabetical, participant privileges, sports registration by event, sports registration by NOC, and so on.

A complete range of reports were provided for editing and for ensuring data integrity. Examples are: summoned but not yet photographed, duplicate registrations, Games Staffing download anomalies, and unused registration numbers.

8.7 Batch Workload

The Accreditation Subsystem required some batch processing. A large part of the batch processing was in support of the bulk badge-printing process. A typical batch job was to query the host DB2 database for a selected group of registration records and download those records to a bulk badging station. Once the accreditation of those records had been completed, another batch job would upload the updated records to the host database.

The bulk badge printing required 24-hour-a-day operation at some points because of the large number of badges (over 100,000) that were not ready for production until just before the Games began.

8.8 Data Security

The accuracy of the Accreditation data was vital to the security of the Olympic Games. Therefore, the master Accreditation database used state-of-the-art safeguards to keep this data secure during development and operation of the Games. Techniques used include these:

- Multiple levels of system security (no log-on without valid password).
- Procedures to ensure system backup and recovery.
- Procedures to limit the effect any one use can have on the system.
- Olympic Identification number control.

8.9 Development Approach

ACOG purchased from an external supplier (SEMA), the accreditation system that was used in Barcelona for the 1992 Summer Olympic Games. The SEMA package provided the basic functions needed for accreditation, but needed to be reengineered to meet ACOG requirements for the 1996 Games support. These included new and changed mainframe application interfaces and any accreditation application function required to support the new client/server design.

The development approach had to consider the Kodak system that produced the Accreditation badge. The Accreditation Subsystem provided the information that had to be integrated with the picture and printed on the badge.

8.10 Accreditation Functional Overview

This topic focuses on the Accreditation Subsystem functions from a logical process point of view.

The Accreditation Subsystem assisted in officially recognizing all of the individuals that had a responsibility associated with administering, performing, or conducting the 1996 Olympic Games. In the same way that government or any large industry needs their Personnel and Human Resources organizations to accredit employees, ACOG registered, authenticated, and badged about 150,000 Olympic Family members—athletes, coaches, trainers, press, volunteers, and VIPs—who needed access to one or more of the 80 Olympic venues and facilities.

The major functions of the Accreditation Subsystem are shown in Figure 51 on page 105:

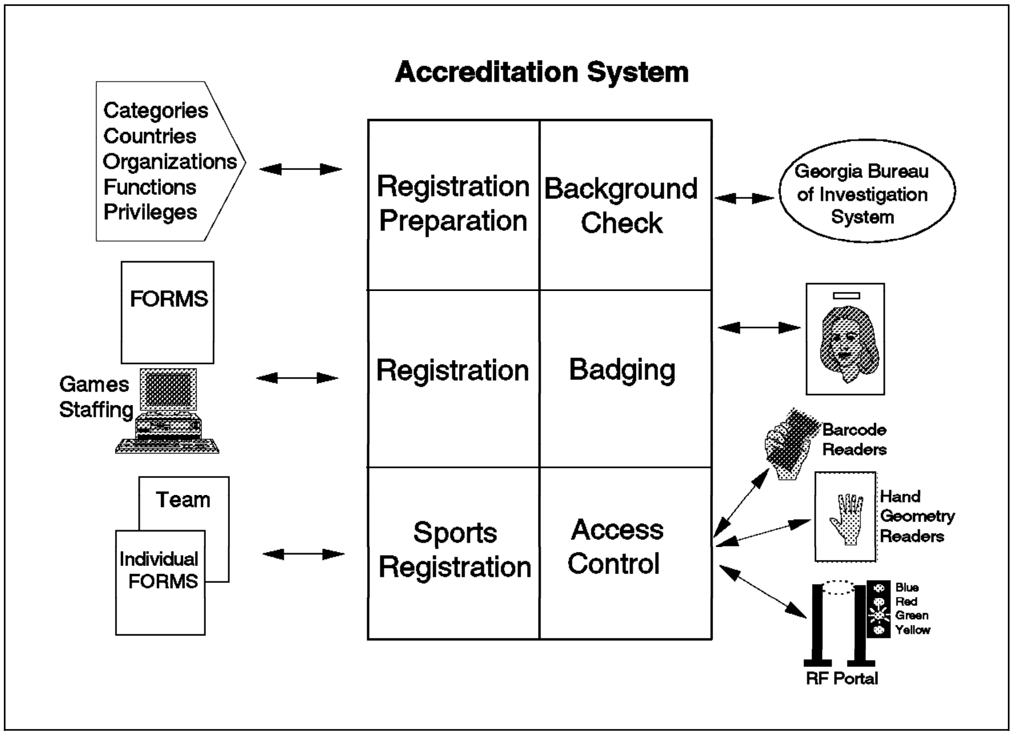

Figure 51. Relationship of the Major Accreditation Subsystem Functions

8.10.1 Registration Preparation

The basic structure that supported Registration Preparation had to deal with codes and descriptions representing the 30-some official categories used to classify the 150,000 accredited individuals. Registration Preparation had to accommodate many countries, organizations, functions, privileges, and sport codes. Because the ranges of allowable registration numbers for each category and organization were entered into the system beforehand, numbered registration forms could be used. Data entry screens that allowed adding, deleting, and updating these critical codes and descriptions were essential. The system also supported the linkage of key codes such as Category and Function.

8.10.2 Registration

Registration entered major classifications such as Olympic Family, vendors, security, volunteers, and ACOG staff into the Registration database. The database was populated by keying in data from registration forms and by file transfer of data from another subsystem such as Games Staffing.

The data was edited to insure consistency of category, organization, function, and so on before the database was populated. Privilege codes were assigned to each individual from the privilege matrix based on the individual category and functions.

Various operations were performed in support of Registration:

- Amending privileges for an individual, or an entire category or a function.
- Changing the registration status (cancelling, for example).
- Preventing duplicate registrations (so no one is registered as a volunteer and separately, as a vendor).

- Compiling mailing lists for persons requiring a photo or to report to a venue.
- Sending information to the Background Check function.

A thorough range of inquiry and reporting capabilities were available to help manage Registration and individuals already registered by category, organization, or function.

8.10.3 Sports Registration

Athletes submitted biographical and past-performance data through their local sports federation. Registration information about individuals participating as individuals or as a member of a team were keyed into the system from registration forms. The information was entered for each sport event and was tied to the individual in the main Registration database. This linkage allowed the system to report on registered participants for a particular event by organization and or by country. At the time the start list was created for an individual sporting event, control of the Sports Registration data was transferred to the Results System.

Data gathering for Olympic Games accreditation was very similar to that done by many other business organizations, from small to large. The athlete accreditation included biography, past performance data, and the official background-check information used in Human Resource departments or health care and insurance agencies; biographies of athletes could be compared with resumes of employees, medical histories, or insurance applications.

8.10.4 Background Check

The obligation of the host committee for each Olympics is to provide the safest environment possible for athletes, officials, and spectators. Examining the background of the employees, contractors, volunteers, and others who are working in various capacities is essential to meeting that obligation.

The Background Check function enabled the Accreditation Subsystem to collect personal data gathered by the Registration function, and provide it to the existing system of the Georgia Bureau of Investigation (GBI). In addition, Background Check controlled the data that the Registration function updated, and determined when to send the data to the GBI. At the end, Background Check entered the code returned by the GBI, adding to it the personal data of an individual.

Background Check was used for the Games Staffing Subsystem as well.

8.10.5 Badging

The Badging function allowed the Kodak badging device to retrieve data from the Registration database (name, category, function, organization, privileges), for the purpose of producing the official Olympic accreditation badge. Badging also supported the bulk picture taking and the ability to download data on groups of individuals to the badging station for bulk badging purposes.

A problem-resolution function allowed access to the registration database for purposes of amending registration or privilege data. As soon as the badges were created by the badging station, the main database was updated to reflect the status change.

8.10.6 Access Control

Two new elements, radio-frequency recognition and hand-print technology, implemented by Sensormatic Electronics Corporation were used in the 1996 Atlanta Olympic Games to enhance the safety of the athletes. As in previous Olympic Games, the identification badge carried an integrated photo image and a bar code; however, for athletes and others who had access to high-security areas such as the Olympic Village, badges included radio-frequency tranceivers for transmitting and receiving signals to be cross-referenced with hand-print geometry for additional corroboration and security.

The Access Control function controlled the access to the venues. At each security check point, it provided services to read the bar code of the badge and verify the access right and privileges to the venue, as well as making sure that the badge had not been cancelled or reported stolen. The registered person passed through the radio-frequency portal; if his or her authorization to pass matched the biometric information, the match was accepted.

The Olympics used a combination of Kodak digitized imaging, a 3-D bar code, radio-frequency technology, and Sensormatic hand-print geometry. Although hand-print geometry recognition is not as complex as fingerprinting, it serves the same purpose. This security, verification, and access-clearance combination can relate to government or any large industry with numerous locations, factories, or offices. For example, bank auditors traveling from the main to branch offices can have access through a single network-wide security system.

8.11 Accreditation Subsystem Configuration

This topic focuses on the networking system configuration and hardware and software components that supported the Accreditation Subsystem.

8.11.1 Accreditation Subsystem Network Environment

The Accreditation Subsystem used a client/server architecture with the host server resident on the ES/9000 mainframe and the client/server PS/2 workstations operating on the LAN. The logical view of the Accreditation Subsystem network environment is graphically described in Figure 52 on page 108:

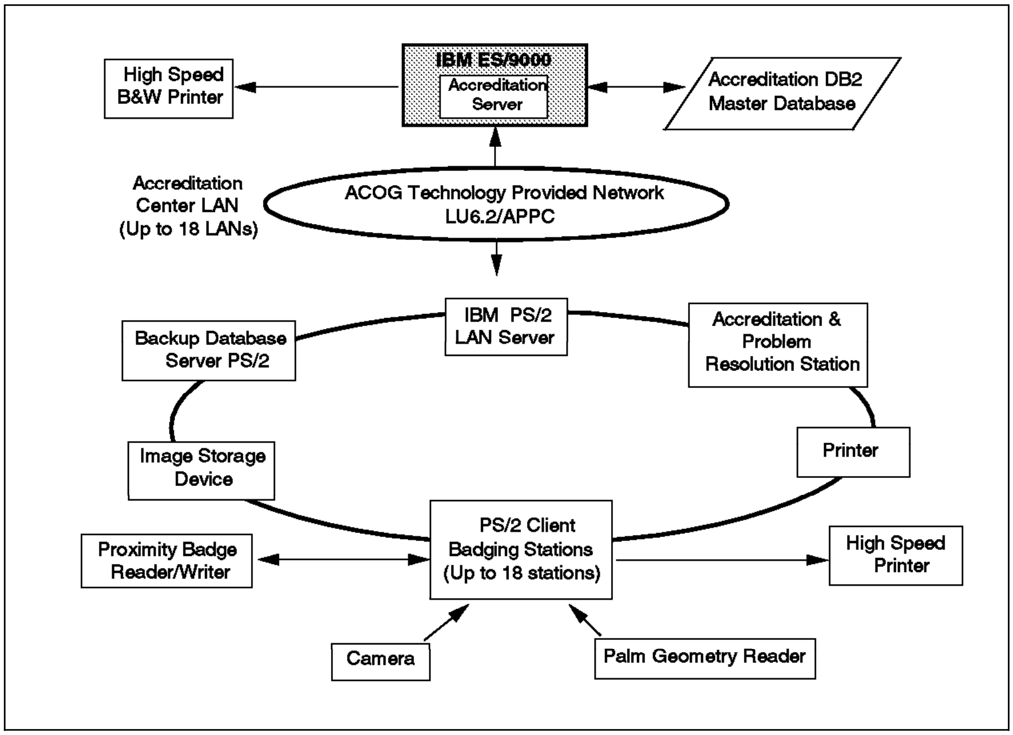

Figure 52. Accreditation Subsystem Network Environment

The host server was connected via a WAN using LU6.2 APPC protocol to the Accreditation centers throughout the metropolitan Atlanta area and Savannah. Client workstations located at the Accreditation centers used LANs for connection to local devices. Each Accreditation center was LAN-configured with an IBM PS/2 LAN server, and with one or more PS/2 client Badging and Accreditation workstations. Each client workstation had a hand-print geometry reader device and a proximity badge reader/writer directly connected via RS232 serial ports. Each client workstation also had a digital video camera connected via a DVI/RGB port.

To provide color printing capability, high-speed color printers were directly connected to the client workstations. The LAN included an image storage device (1 GB external hard drive) that stored all of the captured image and hand-print geometry templates in an indexed file.

Bridges and multiplexers at each Accreditation center supported the LAN and WAN connectivity. Figure 53 on page 109 shows the configuration.

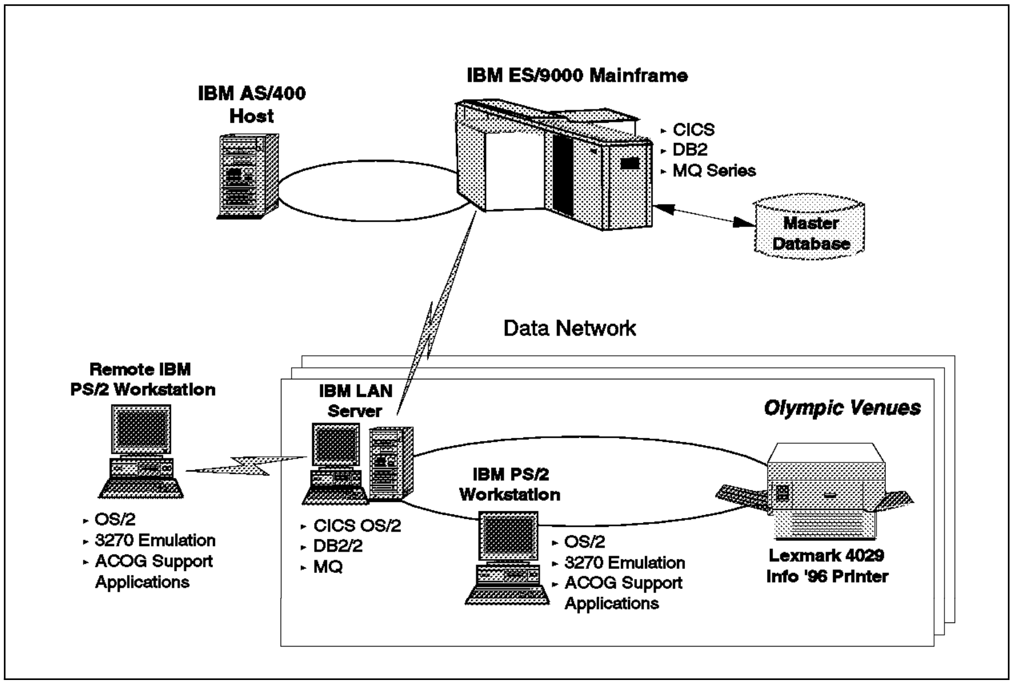

Figure 53. Accreditation Subsystem Configuration

The physical view of the Accreditation Subsystem network environment is graphically described in Figure 54.

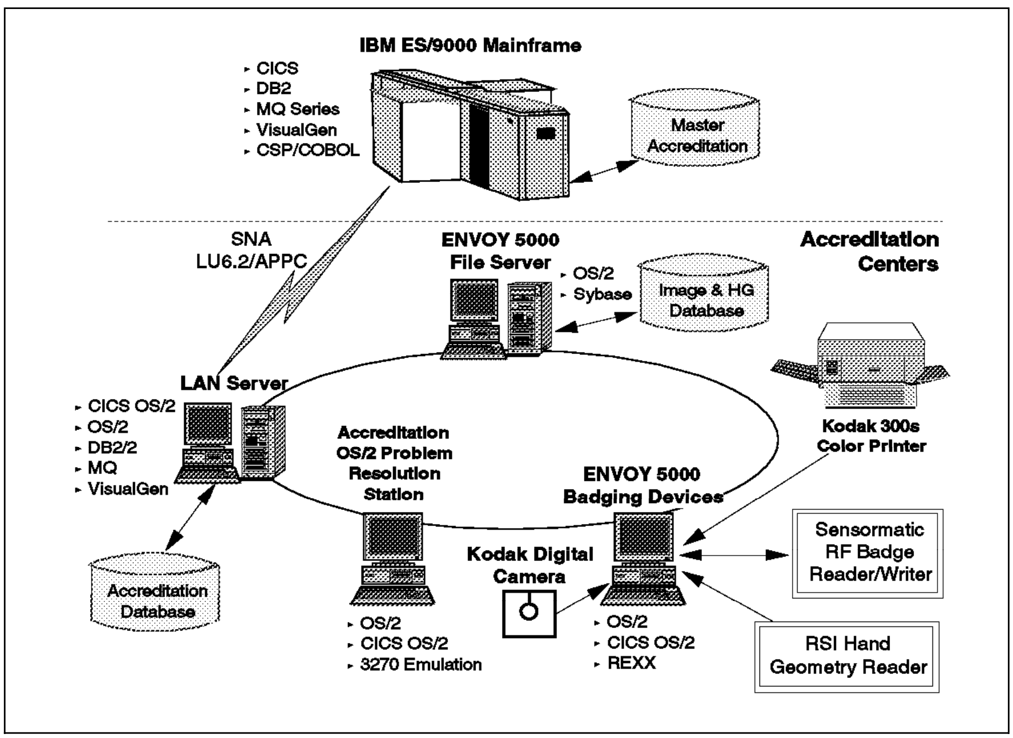

Figure 54. Accreditation Subsystem Physical Network Environment

8.11.2 Hardware

Tables Table 6 through Table 9 on page 111 describe the devices supporting the Accreditation subsystem and the connectivity needs:

Table 6. Devices that the ES/9000 Interfaced With

Device Name	Manufacturer	Vendor	Connectivity
IBM PS/2 LAN server	IBM	IBM	WAN LU6.2 APPC
High-speed black and white printer	Xerox	Xerox	WAN LU6.2 APPC

Table 7. Devices that the IBM PS/2 LAN Server Interfaced With

Device Name	Manufacturer	Vendor	Connectivity
ES/9000 host mainframe	IBM	IBM	WAN LU6.2 APPC
PS/2 client badging stations	EDICON	KODAK	LAN
PS/2 problem resolution station(*)	IBM	IBM	LAN
Backup database server PS/2	IBM	IBM	LAN

(*) If a participant had a registration or accreditation problem, he or she was sent from the badging client workstation to a problem resolution workstation to complete accreditation and receive a badge.

Table 8. Devices that the PS/2 Client Badging or Problem Resolution Workstation Interfaced With

Device Name	Manufacturer	Vendor	Connectivity
IBM PS/2 LAN server	IBM	IBM	LAN
Mouse	IBM	IBM	Mouse port
Video camera	KODAK	KODAK	DVI/RGB port
Proximity reader/writer	Sensormatic	Sensormatic	RS232 serial port
Hand-print geometry reader	Recognition Systems, Inc.	Sensormatic	RS232 serial port
External hard disk for image storage	EDICON	KODAK	LAN
High-speed color printer	KODAK	KODAK	PS/2 parallel port
High-speed black and white printer	Xerox	Xerox	LAN

Table 9 on page 111 shows the typical configuration of the Accreditation PS/2 workstations, including local server (database and transaction processing (TP)) and client workstations (Accreditation and problem resolution).

Table 9. Accreditation LAN Server and Problem Resolution Workstation Configuration	
Problem resolution client workstation	**Local OS/2 server**
IBM PS/2 50 MHz, 32 MB RAM, 300 MB HD	IBM PS/2 66 MHz, 64 MB RAM, 2 GB HD
	A second disk drive for isolating DB2 log files
	A second disk drive for isolating MQ log files

8.11.3 Software

This topic describes the major system software components required to implement the networked Accreditation Subsystem:

ES/9000 Host

MVS/ESA SP 5.1
RACF 2.1
CICS/ESA 4.1
Message Queue Manager 1.1
DB2 3.1
LAN File Services 1.1.2
ACF/Network Control Program 7.1
ACF/VTAM 4.2
APPC Application Suite 1.1
TCP/IP 3.1
COBOL/370 1.1
Language Environment/370 1.3
CSP/370 Runtime Services 2.1
VisualGen Host Services 1.1
Accreditation server

IBM PS/2 LAN Server

OS/2 3.0
LAN Server 4.0
LAN Requester 4.0
Communication Manager/2
CICS OS/2 2.0.1
MQSeries 2.0
DB2/2 2.1
DDCS/2 2.1
VisualGen Workgroup Services 1.1
MicroFocus COBOL
Accreditation server
Database server

IBM PS/2 Client Problem Resolution Station

OS/2 3.0
LAN Requester 4.0
Communication Manager/2
CICS OS/2 2.0.1
DB2/2 2.1
DDCS/2 2.1
3270 Emulation

ENVOY 5000 File Server

OS/2 3.0

LAN Server 4.0
Microsoft SQL Server

ENVOY 5000 Client Badging Device Station

OS/2 3.0
LAN Requester 4.0
Communication Manager/2
CICS OS/2 2.0.1
Network Transport Services/2
ENVOY 5000 Software
Badge layout and logo design
Report requester
Tape backup software
Remote diagnostics modem and software
Accreditation REXX programs

8.11.4 Access Control Function Network Environment

The Access Control function used a client/server architecture based on two different platforms. The Olympic Village Residential Zone used an RS/6000 system. All other locations used PS/2 workstations. Both these platforms were connected to the ES/9000 host mainframe that provided access control information from the Accreditation Subsystem.

The Access Control network environment is graphically described in Figure 55:

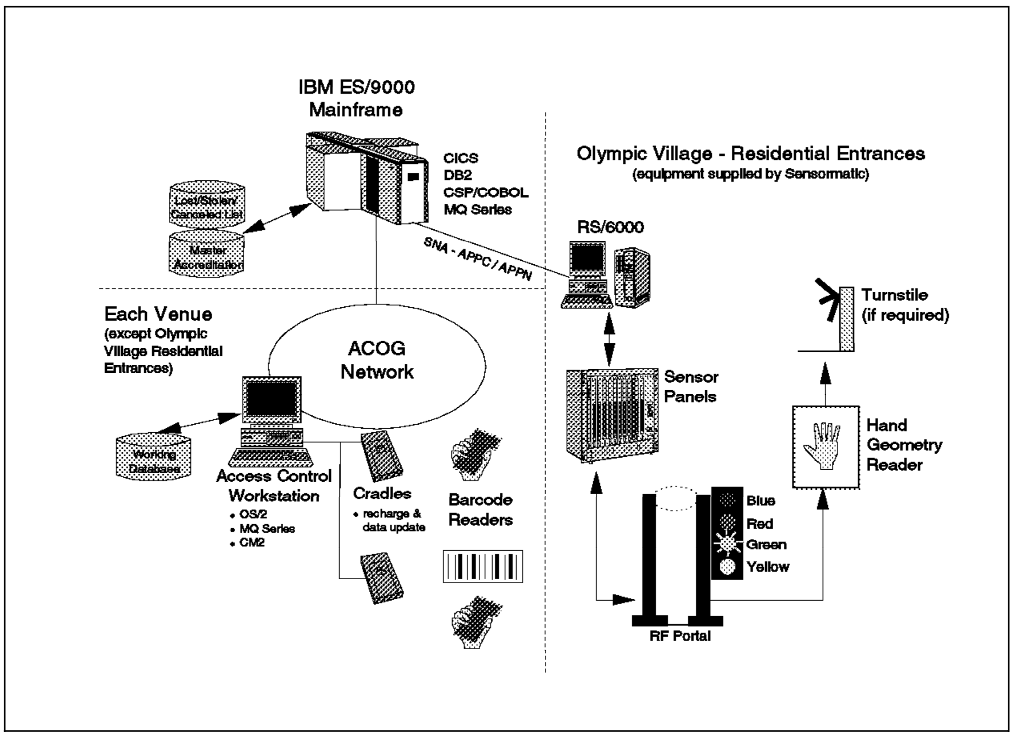

Figure 55. Access Control Network Architecture

The major system software components required to implement the Access Control function includes the following:

RS/6000 Server

TCP/IP 3.1

IBM PS/2 Workstation

OS/2 3.0
LAN Server 4.0
LAN Requester 4.0
Communication Manager/2
CICS OS/2 2.0.1
MQSeries 2.0
DB2/2 2.1
DDCS/2 2.1

8.12 Accreditation Subsystem Logic

This topic focuses on the logic, transactions, and interfaces implemented by the Accreditation Subsystem.

8.12.1 Process Description

A person could attend a 1996 Olympic event or enter an Olympic venue by purchasing a ticket or by presenting an accreditation badge. The Accreditation Subsystem provided all the functions needed to register participants, produce an accreditation badge, and carry out the access control security checks.

The Accreditation Subsystem was a three-tier client/server solution. Each Accreditation center LAN was connected to the host ES/9000 mainframe via LU6.2 APPC communication. Each Accreditation LAN was composed of one PS/2 LAN server, multiple Accreditation and resolution workstations, badging stations, and one image file server.

Before the Accreditation centers were opened, existing Accreditation data was downloaded into a DB2/2 database in each Accreditation PS/2 LAN. During accreditation, the ACOG Accreditation staff used the LAN-connected Accreditation client workstation to access the PS/2 LAN server-based Accreditation data. All the client workstations had CICS OS/2, routing the transactions to the CICS OS/2 residing on the PS/2 Accreditation LAN server.

In addition to providing Accreditation information to the workstations, the PS/2 Accreditation LAN server, when working in standard mode, rerouted the transactions to CICS/ESA where the Accreditation software resided and, in turn, updated the master DB2 Accreditation database with any changes to an individual′s accreditation record. Changes in the master DB2 Accreditation database were communicated via CICS transactions to all Accreditation PS/2 LAN servers in the Accreditation centers to ensure that the information there was current.

When the mainframe became unavailable, the Accreditation server was switched to local mode. In local mode, the CICS OS/2 on the Accreditation server performed the transactions locally, allowing the Accreditation center to function (in a slightly degraded mode) independently from the host. The IBM Message and Queuing Series (MQ) software provided the transport mechanism to queue all the Accreditation records updated on the local DB2/2 databases during the local mode working period, and then to synchronize the master DB2 Accreditation database with the local databases when the access to the host ES/9000 mainframe became available.

The mainframe database was the central point for all the personal data. It was widely used to provide information for other subsystems. A DB2 copy database was provided on a High-Performance Query System (HPQS). This system provided the query services to the whole organization. In addition, it served users that had office query tools to create their own reports. The mainframe-generated reports were printed on Lexmark 4039 printers attached to the network.

The process and the major components of the Accreditation Subsystem are shown in Figure 56.

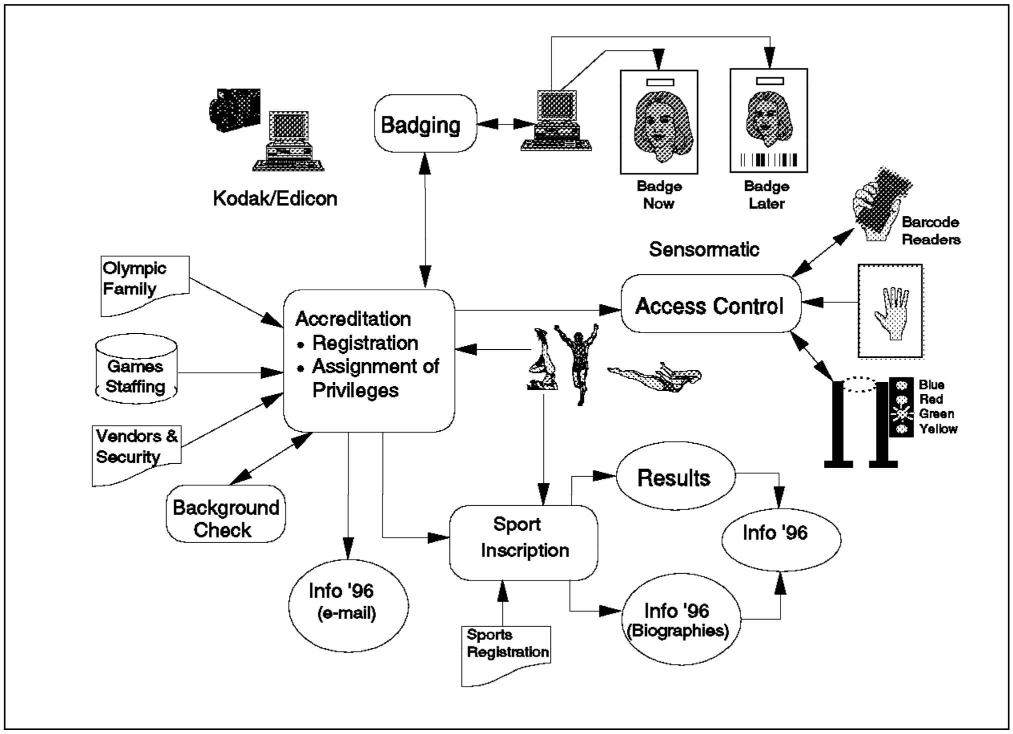

Figure 56. Accreditation Solution

8.12.2 Registration and Assignment of Privileges

The process of registration and privilege assignment collected the individual's information, certified that an individual had a responsibility, and assigned a category associated with the Olympics, such as Athlete or Security. It indicated the functions that the individual was to perform, such as Boxer, President of the Volleyball Federation, or Volunteer Ticket Taker, and where (site or venue) the person had the right to perform that function.

The main data repository for all individuals who had a responsibility associated with the Games was stored in the master DB2 Accreditation database on the host ES/9000 mainframe. The core system for the accreditation, registration, and privilege assignment ran CICS/ESA programs written in IBM Cross System Product (CSP) and IBM COBOL, which were loaded on the host ES/9000, and accessed via the PS/2 Accreditation LAN client workstations using 3270 emulation.

A portion of the Accreditation Subsystem was installed on the PS/2 Accreditation LAN server to continue some of the Accreditation functions whenever the connection to the host went down. The local software components were shadow copies of the same components on the host.

The LAN server used DB2/2 to store the data and IBM VisualGen for OS/2 Development Tool with MicroFocus COBOL running under CICS OS/2 to perform the functions. An important part of the work was done in batch mode, with IBM COBOL and QMF processes.

The process started about a year before the 1996 Olympic games with the Registration Preparation function. It provided data entry screens that allowed the addition, deletion, and updating of the critical tables, codes, and descriptions at the base of the subsequent processes. This basic table structure supported Registration—for example with codes and descriptions representing the 30-some official categories used to classify the accredited individuals. Registration procedures dealt with countries, organizations, functions, privileges, sports codes, and all the ranges of allowable registration numbers. Inquiry screens and printed reports were available to report on the status and completeness of establishing this basic structure.

Registration allowed major classifications of people such as Olympic Family, vendors, security, volunteers, and ACOG staff to be entered into the master DB2 Accreditation database. The database was populated by data entry screens (from the input registration forms), and by data interface from the Games Staffing Subsystem. The data was edited against the system tables to insure consistency in category, organization, and function before the database was populated.

Privileges consisted of access rights and services to be provided, many of which were dictated by the IOC. Privileges were assigned manually or automatically by the system to each individual through the use of algorithms and a privilege matrix based on the individual′s category and function.

A further Registration task was Sport Registration. This data entry function mainly benefited the sports departments and the Results System. Sport Registration gathered additional sports-related information on registered athletes and officials. The information was specific to each sport, examples included ″Event competing in;″ ″Best performance in previous events;″ ″Position on the team″ (for example, Center in Basketball); ″Starter or substitute″. At the time the start list was created for each individual sporting event, control of the Sport Registration data was transferred to the Results system.

Various operations that supported Registration could be performed using specific on-line functions; for example, to amend privileges for an individual, an entire category, or function; to change the registration status; to modify sports data; to create mailing lists; to send information to the external GBI Background Check function.

The Background Check function provided personal data on Olympic Family members, contracted security people, and vendor participants, to the existing system of the Georgia Bureau of Investigation. In addition, it controlled the data and determined when to send the data to the GBI system. The GBI system provided the result of the background check in terms of a pass or fail code that the Background Check function used to update the personal data of each individual in the master DB2 Accreditation database. The data was communicated via APPC communications between an ACOG CICS region on the host ES/9000 mainframe and the GBI system. The data was controlled through an intermediate DB2 table, that also served as an intermediate repository between the moment of the extraction of the data (normally done in batch) and the moment of sending the data to the GBI (on line).

A graphical description of the Accreditation registration activities is shown in Figure 57.

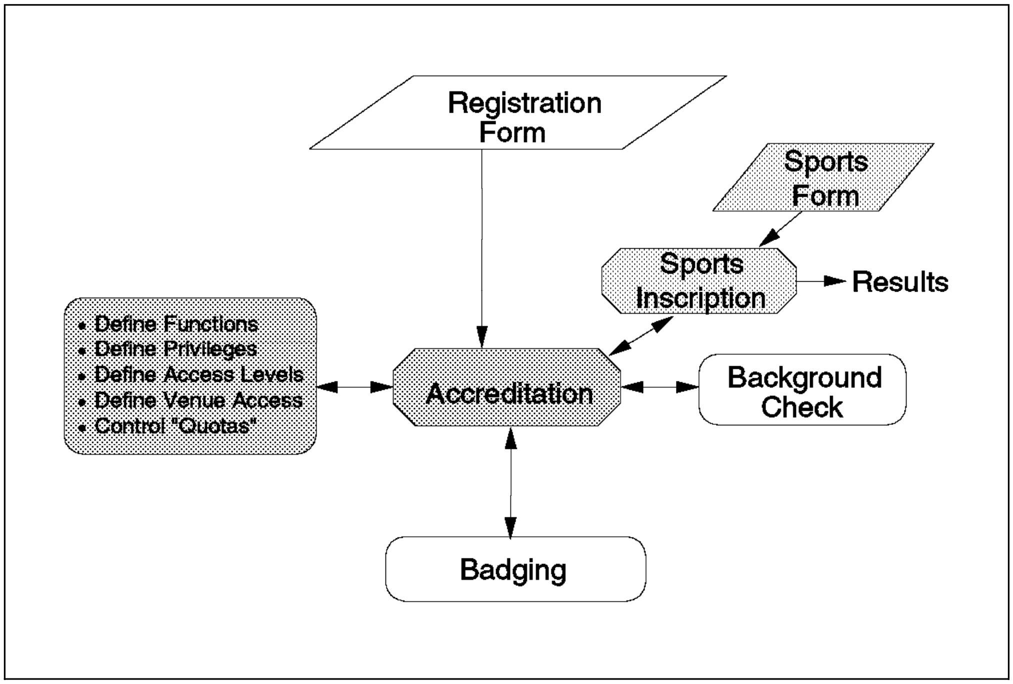

Figure 57. Accreditation Registration Activities

8.12.3 Badging

Once the registration, background check, and privilege assignment activities were completed, the individual record was tagged ″ready for badging.″ Badging provided communication services between the Accreditation data and the ENVOY 5000 Edicon badging station and was responsible for assimilating all the components that made up an accreditation badge. In addition, it provided a common user interface in the badging station, converting the Accreditation character screens to graphical screens similar to those used on the Edicon system.

When Badging needed a participant′s registration record, it requested the record from Accreditation. During normal operations, Accreditation retrieved the registration record from the host DB2 database. During backup operations (without host connectivity), the record was retrieved from the local backup database server via the LAN.

In both normal and backup operations, the process used robust and secure CICS-based transaction processing functions. Badging then merged the data in the Registration record with the image, hand-print geometry, and proximity ID. Then, Badging printed the accreditation badge on a high-speed color printer. Once Badging completed the badging process, it then handed-off the updated record to Accreditation to update the host DB2 database.

All records updated during backup operations were forwarded to the host as soon as the connection was restored. The host-based Accreditation Subsystem then replicated the updates to the backup servers at the other Accreditation centers via MQ software.

Badging ran on the OS/2 badging station provided by Edicon. The Badging main code and the screens were built using Vx/REXX and the conversion of the 3270 screens was done with C programs, interpreting the HLLAPI protocol.

Figure 58 shows the Badging activities.

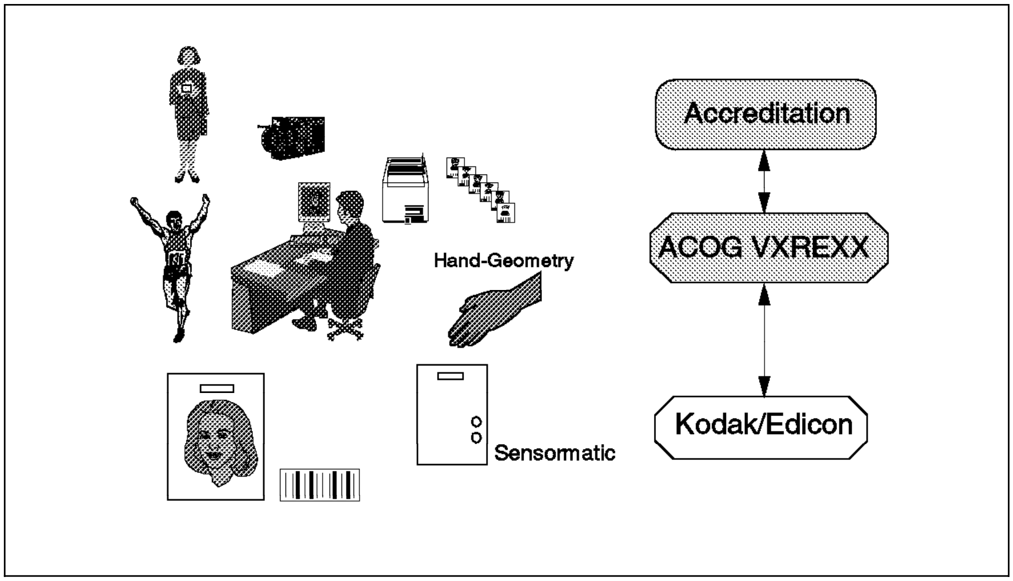

Figure 58. Badging Activities

Badging was made up of two distinct subprocesses:

Process Now, Badge Later
Process Now, Badge Now.

Process Now, Badge Later pertained to the staff, volunteers, security, and vendors. In this scenario, the person′s picture and hand-print geometry were captured as early as six months before the Games and before it was known what their functions, privileges, or access rights would be. Later, as the privileges were assigned, it was possible to create the badges in bulk for an entire population (such as venue staff) without requiring the volunteers to come in to an Accreditation center for the sole purpose of getting a badge. The bulk badging configuration produced about 600 badges per hour.

Process Now, Badge Now involved the National Olympic Committees (NOCs), sports federations, IOC members, athletes, media, VIPs, team officials, and referees. In this scenario, registration and the assignment of privileges had already been completed: the remaining step was verifying that the Registration data in the system was valid and then taking the picture, capturing the hand-print geometry template, writing the hand-print geometry and Olympic ID to the proximity card, adding the text, laminating, inspecting, and giving the badge to the person who needed it. This process took no more than 5 minutes per person, and was available 24 hours a day, with the capacity to produce one thousand badges per hour.

The OS/2 client badging station contained the software and the firmware required to perform the Badging operations. It provided the interface between the badging device and the Accreditation data. The seven steps performed by Badging were:

1. Acquire the individual′s registration record from the Accreditation Subsystem.
2. Capture and save the individual′s image.
3. Capture and write the individual′s hand-print geometry template to the proximity card.
4. Write the Olympic ID to the proximity card.
5. Print the accreditation badge, including color image. Final badge has print on two sides.
6. If required, laminate proximity card to accreditation badge (manual process).
7. Transmit the updated record back to the master DB2 Accreditation database.

As part of Badging, the Accreditation Subsystem notified the Info ′96 e-mail system of the creation of the badge. The e-mail system for all Olympic Family members set up an in-basket and a profile record.

A graphic representation of this process is provided in Figure 59.

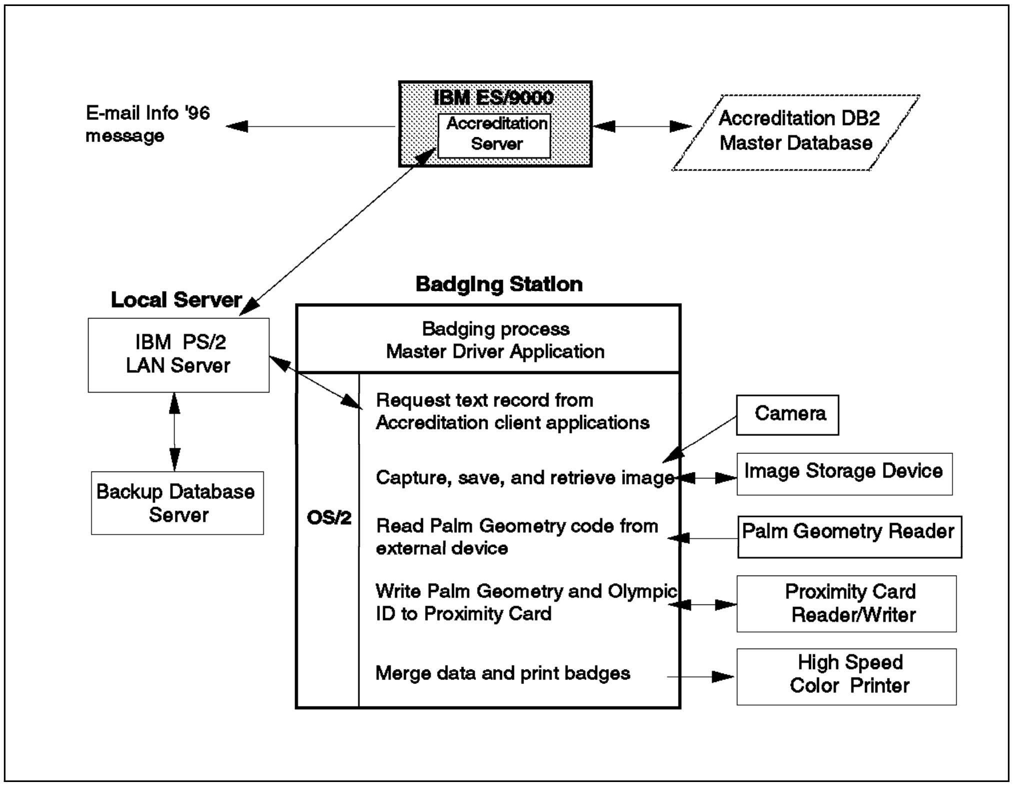

Figure 59. Badging Process

Badging had the capability of producing six different badge types:

Individual Badge Had the bar code, accompanied by an RF badge encoded with a hand-print geometry and accreditation number. Individual badges were issued only to Olympic Family members (athletes, officials, VIPs, and the like), Games staff, volunteers, media, vendor, and law enforcement personnel who required access to the Atlanta or Savannah Olympic Village Residential Zone.

When people requested accreditation, Badging retrieved their records via the Accreditation Subsystem. This retrieval was based on a registration number or any combination of name, organization, passport number, nationality, or sport, supplied by the requestors.

If the record could not be located or appeared to be inaccurate, accreditation was terminated and the individual was directed to a problem-resolution client workstation located in the Accreditation center. Once a record was retrieved and determined to be ready for accreditation, the Accreditation Subsystem updated the status of the record from registered to accredited in the host database.

At this point, Badging received a copy of the data record to produce the accreditation badge. The Badging device peripheral captured the individual hand-print geometry, then a video image of the individual, saved the image, hand-print geometry template, and registration number on the ENVOY 5000 file server (using Sybase DBMS).

Just before the badge stock was fed into the printer, the hand-print geometry template and accreditation number were electronically written to the RF badge. After writing to the RF badge, the encoder immediately read the badge to verify the write was successful, then all of the necessary accreditation information (name, accreditation number, organization, function, category, privileges, photo, and bar code) was printed directly to the individual badge, via the Kodak ID300 color printers. Once the individual badge was printed, it was immediately laminated to the RF badge.

Remote Badge Had bar code (identical to the individual badge, but without the RF badge). The remote badge was exactly like the individual badge, except that when it was produced, Badging did not produce an accompanying RF badge. Therefore, the remote badge was issued only to those who did not have access privileges to the Olympic Village Residential Zone.

Personalized Badge Had no bar code (part one of the two part badge). Two-part badging was used by Accreditation to produce badges for many vendor and uniformed law enforcement personnel who did not need access into areas requiring hand-print geometry. In order to gain access to controlled areas, those personnel had to carry two separate badges: a personalized badge and a privilege badge.

The personalized badge contained the bearer's image, name, organization, category, and accreditation number, but did not contain privilege information.

Upgrade Badge This badge with bar code was generated by Badging to produce a pictureless Accreditation badge that temporarily gave an accredited individual additional privileges. It contained an organization, accreditation number, access privileges, and bar code, but had no image.

Typically, these badges were issued to the IOC, International Federations, and National Olympic Committees.

When someone′s permanent accreditation failed to provide them access to a venue, then the Access Control personnel scanned the bar code on the upgrade badge to determine entry authorization. The distribution and collection of these upgrades badges was managed by the receiving organization. The Accreditation database records for this type of badge were created at the same time as the badges.

Privilege Badge Had a bar code and contained a category, organization, accreditation number, access privileges, and bar code, but had no image. The privilege badge was the second part of the two-part badge.

8.12.4 Access Control

The purpose of Access Control was to regulate the movement of accredited persons, safely and efficiently, into and within Olympic venues. This was done in accordance with the access privileges granted accredited persons through Accreditation, and in keeping with the access privileges registered on their accreditation badge.

Access Control then implemented what Accreditation had defined. Accreditation created the Olympic ID badge with venue access privileges in the form of sport pictograms, venue pictograms, and zone codes. The right to access the perimeter of a venue was displayed (and encoded) on the accreditation badge through the use of these pictograms.

The main user of Access Control was ACOG Security. Access Control was but one component of the overall Olympic Security Plan; beyond the scope of this document, but of equal concern to Security in providing a safe environment, were several other control activities for access to specific venue internal zones, access control at training venues, access control at spectator entrances, venue sanitization, and vehicle inspection.

Access Control checked the accreditation badge validity and confirmed that the appropriate pictograms existed on the individual accreditation badge, thereby permitting that person entry into the venue, or refusing entry in the absence of the required pictogram. Confirmation was performed by Access Control staff positioned at venue entrances. At all times, it was possible to confirm access privileges through visual reading of the accreditation badge; however, the use of electronics (bar code readers and RF sensors) to officially confirm or contest instantaneously the validity of an accreditation badge provided the added advantage of allowing Access Control staff to concentrate on other aspects of their task. This included such functions as comparing the photo on the badge to the bearer, or looking for cards that had been tampered with. Once an accredited person entered a venue, zone privileges identified where that person could circulate within the venue.

In summary, the main steps performed by Access Control were these:

- Verified access privileges and determined whether:
  - Badge was valid for particular access point.
  - Badge was valid for Olympics, but not valid for particular access point
  - Badge was not valid (was cancelled, reported lost, or reported stolen).
- At an entrance to specific athletes residential zone, Access Control personnel performed additional positive verification of identity.
- If all access conditions were met, granted access to the accredited person.

A manned security help desk at each Access Control point assisted or advised persons whose access privileges could not be electronically (or visually) verified, or who were refused admittance. If Security could not resolve the exception, the accredited person was referred to the venue accreditation problem resolution station for further assistance.

The Access Control process exploited an advanced dual approach, provided by an IBM solution that integrated sensoring components of other vendors with bar code and RF control systems to provide a secure and efficient method of access control.

This high-tech access system marked the first time that IBM, Kodak, and Sensormatic produced a joint application. The fundamental components of this solution included RF identification and hand-held bar code readers.

Radio Frequency ID At the security priority locations of Athlete Residences, the method of access control was Sensormatic RFID, which entailed:

- Sensor*ID portals (*)
- Sensor*ID sensor panels (*)
- RSI hand-print geometry units (*)
- Electromechanical waist-high turnstiles (*)
- Sensor*ID Olympic badges encoded with hand-print geometry for those requiring residential access
- One central Access Control application running on an RS/6000 system, providing:
  - Positive verification of access rights
  - History log of badge access
  - Notification of ″access denied″ via portal indicator lights.

(*) The first four elements were integrated.

Hand-held Bar Code Readers The IOC hotel and all competition venues except for Ocoee, Columbus, and the remote soccer sites used a Sensormatic-provided bar code solution. The solution integrated software developed by Integrated Systems Development, Inc. and hand-held bar code readers provided through Symbol Technologies, Inc. Elements of this solution included:

- Online, hand-held bar code readers
- Olympic badges with venue access privileges encoded in bar code and printed on badge
- Individual PCs at venues, connected through the ACOG network, running the bar code application
- Negative list of voided badge IDs and positive list of valid access pictograms.

Access Control controlled access to the venues using this dual technical approach.

At each security point, it provided services to read the bar code of the badge and verify that the badge showed right of access to the venue. Moreover, it provided at the Olympic Village, a biometric method of verifying the person′s identity, scanning and translating (with a hand reader) the biometric geometry of the badge-holder′s hand into a 18-digit field of data, and instantly matching the hand-print data against the hand characteristics data stored in the proximity chip embedded into the person′s badge.

The platform of the Access Control function at the Olympic Village Residential Zone was an RS/6000 running an Informix database.

At periodic intervals, Accreditation transferred to a DB2 ESA table information on new, changed, and cancelled badges. Access Control read the DB2 table through a DDCS/6000 gateway and updated the Informix database following a set of predefined rules, providing in this way a positive list of valid access privilege badges. Upon finishing, Access Control deleted the processed rows from the DB2 ESA table, and sent the Informix database information to the RF portals at each Access Control point of the Residential Zone.

The RF portal, via a special Sensormatic RF antenna, interrogated the proximity chip Sensormatic transceiver embedded in the individual′s badge that instantly provided the encoded information: badge accreditation number and hand-print geometry code.

Access control at the Olympic Village Residential Zone included a list of IDs, enhanced by RF hand-print geometry. The RF portal validated the accreditation badge number by matching it to the list generated by Accreditation, and then checked the hand-print geometry code against the scanned biometric information of the person wearing the badge. The people with authorization to pass and with a match in the biometric information were accepted and the light on the access point turned green. If the badge had been reported lost or stolen, however, the system showed a blue light and access was denied. If the badge did not match the hand-print geometry, a red light showed, and if it simply did not recognize the badge, a yellow light showed; in either case, access was denied. The persons registered with valid access privileges for the Access Control point, and that did match the voided badges accreditation numbers, were accepted.

A graphic representation of how the Accreditation data was provided to Access Control is shown in Figure 60 on page 123.

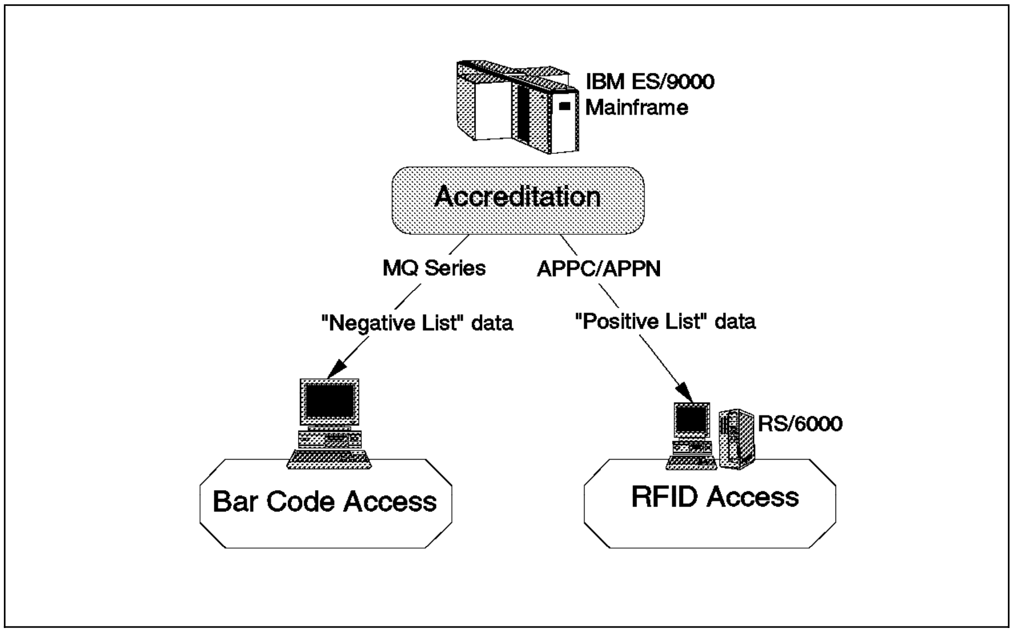

Figure 60. Accreditation to Access Control Data Flow

Chapter 9. Games Staffing

In Atlanta, ACOG received up to 200,000 applications from people all over the world interested in 40,000 volunteer positions.

To address this human resources challenge, IBM created the Games Staffing Subsystem, which integrated IBM imaging and intelligent character recognition technologies to process the application forms.

The document-processing application system was similar to ones IBM created for credit card and insurance policy processing, where applications are received on paper and must be qualified for acceptance or refusal, assigned credit limits, premiums, interest rates, and so on.

The solution matched skill with available positions and replied to applicants in a timely fashion.

9.1 Games Staffing Subsystem Requirements

This topic focuses on the scope, purpose, and key requirements met by the Games Staffing Subsystem.

9.1.1 Project Scope

The Games staff, composed of volunteers, paid employees, vendors, and contractors, provided expertise for the planning and execution of the Games. The Games Staffing Subsystem captured data from prospective volunteer and employee applications, and then matched individual candidates to potential job assignments, tracked personal information, scheduled various personnel events that each staff member had to attend, interfaced to Accreditation so that access privileges for the staff members could be assigned, and handled the security background check required for all staff members.

9.1.2 Functional Flow

Applicant information was submitted to Games Staffing via a standard volunteer application or loaded directly from files of the Human Resources system, depending on the source and type of staff member.

This information consisted of personal data and relevant skills possessed by the individual.

The departments of ACOG submitted their Games staffing requests centrally, classifying their general job category needs. The compiled demand was compared with the supply of applicants meeting the qualifications for each job category to identify any shortage and forecast new recruiting needs.

Each venue manager determined the staffing requirements for every job at the venue.

Applicant information was checked through an external GBI background check. People passing this security check were officially accredited through the Accreditation Subsystem. An Olympic uniform was then ordered for each Games staff member, the style depending on the position.

Games staff members were summoned by the ACOG for various purposes before the Games began. For example, every staff member had to attend a general orientation session, participate in an interview, and come to some location to receive their Olympic uniform.

Figure 61 shows the functions of Games Staffing.

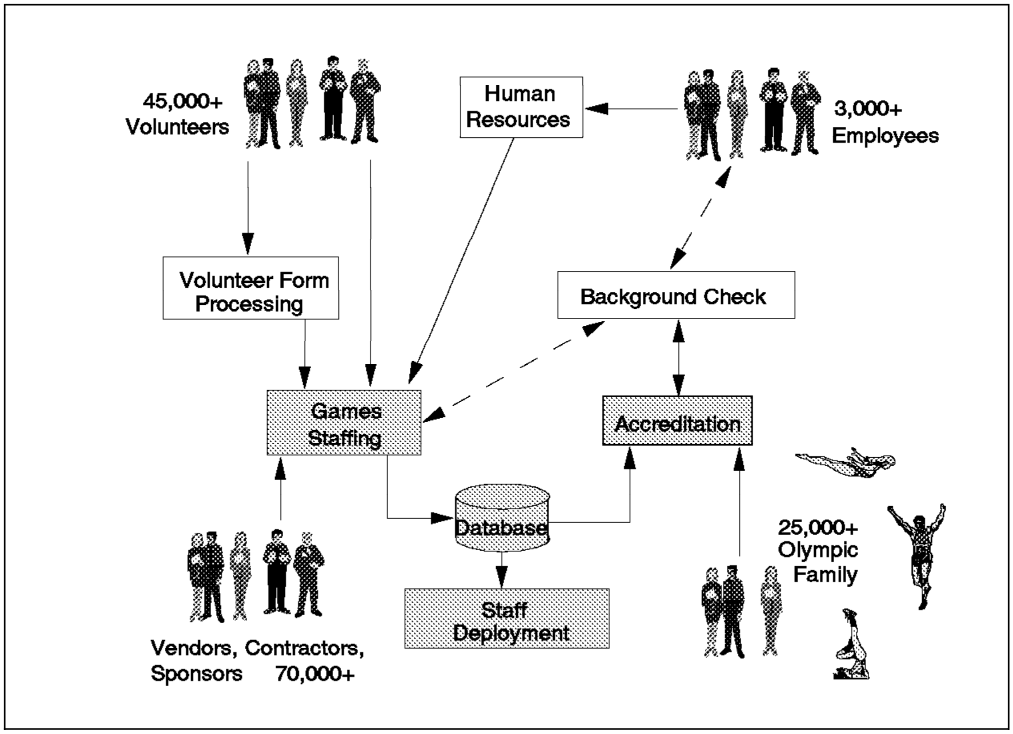

Figure 61. Games Staffing—Functional Flow

9.1.3 Environment

Games Staffing was accessed from an ES/9000 server by ACOG users at personal computer workstations working in 3270 emulation, linked on a token-ring LAN. This approach, which extended the use of IBM network computing across Olympic Games support functions, was integrated with a complementary imaging application for processing volunteer forms. This advanced imaging solution used a combination of IBM imaging and intelligent character recognition (ICR) technology. The ICR portion was PS/2 based and the imaging portion was AS/400 based.

Table 10 gives the number of terminals with Games Staffing capabilities at each site.

Table 10 (Page 1 of 2). Games Staffing: Terminal Requirements

Site	**Number of Terminals**
Inforum	10
Main Games Staffing Processing Center (GSPC)	10
Savannah GSPC	2
Athens GSPC	2
Ocoee GSPC	1

Table 10 (Page 2 of 2). Games Staffing: Terminal Requirements	
Site	**Number of Terminals**
Columbus GSPC	2

9.1.4 Availability and Performance

Games Staffing was fully operational from 7:00 a.m. to 11:00 p.m. on weekdays, from 8:00 a.m. to 5:00 p.m. on Saturday, and from 12:00 noon to 5:00 p.m. on Sundays. During those times, outages could last no more than 4 hours.

Additional performance requirements included online response time of less than one second, and the capacity to support the total number of system terminals simultaneously.

9.1.5 Key Assumptions

The purpose of the Games Staffing Subsystem was to provide an automated system, using the system design from Barcelona as a foundation, to enable those responsible for managing the staffing of the Games to meet their objectives. The key assumptions that were supported were these:

- Efficient capture and maintenance of relevant Games staff information.
- Definition of job categories and their minimum qualifications.
- Assignment of individuals to relevant job categories.
- Provision of information to Security for background check.
- Assignment of job candidates to positions (specific venues and functional areas within the job category assigned).
- Provision of position information to Accreditation for the assignment of access privileges.
- Summoning of individuals for interviews, orientation, uniform issuance, drug screening, and the like.
- Provision of quantities and styles needed to the Olympic uniform supplier, and tracking of the distribution of the uniforms to Games staff members.
- Access to the application via terminals with user-friendly prompts.
- Provision of flexible, ad hoc reporting that could be requested by authorized users. Ability to query and sort on multiple fields to support online and reporting queries.
- Provision of proper backup capability and restoration procedure.
- Perform online data validations with user friendly error and confirmation messages.

9.1.6 Print Requirements

Games Staffing required print capabilities wherever a user was stationed. The rapid, and sometimes unforeseen, distribution of the users required the maximum flexibility possible. Games Staffing usually printed in batch, but as it could not deny printing under CICS in special circumstances, the printer address of a report had to be either remote or local.

Games Staffing users required print capability from the standard Lexmark laser printers. These printers were used for most of the reports generated from Games Staffing. For some high-volume reporting, such as mailing labels or a mass summons, host printing was required.

Table 11. Games Staffing: Print Requirements

	Reports :	**High Volume Reports (40,000 pages)**	**Label Printing (Avg volume)**	**Label Printing (High volume)**
Inforum	Yes	Yes	Yes	Yes
Main Games Staffing Processing Center (GSPC)	Yes	Yes	Yes	Yes
Savannah GSPC	Yes	No	Yes	No
Athens GSPC	Yes	No	Yes	No
Ocoee GSPC	Yes	No	Yes	No
Columbus GSPC	Yes	No	Yes	No

9.1.7 Online Transactions

The online system had the following characteristics:

- Host Servers = 1
- Maximum block size flow in a single transaction = 1920 bytes
- Average block size flow in a single transaction = 200 bytes

9.2 Games Staffing Subsystem Configuration

This topic focuses on the system configuration, hardware, and software components supporting Games Staffing.

Games Staffing used a network computing approach based on an ES/9000 mainframe server, where the Games Staffing core application and database resided and OS/2 LAN-connected workstations working in 3270 emulation. The integrated complementary imaging application for processing volunteer forms used a token-ring network consisting of an AS/400 connected to the ES/9000 mainframe, IBM PC workstations running OS/2, scanners, color displays, and compact disk storage units.

The physical view of the Games Staffing Subsystem network environment is shown in Figure 62 on page 129.

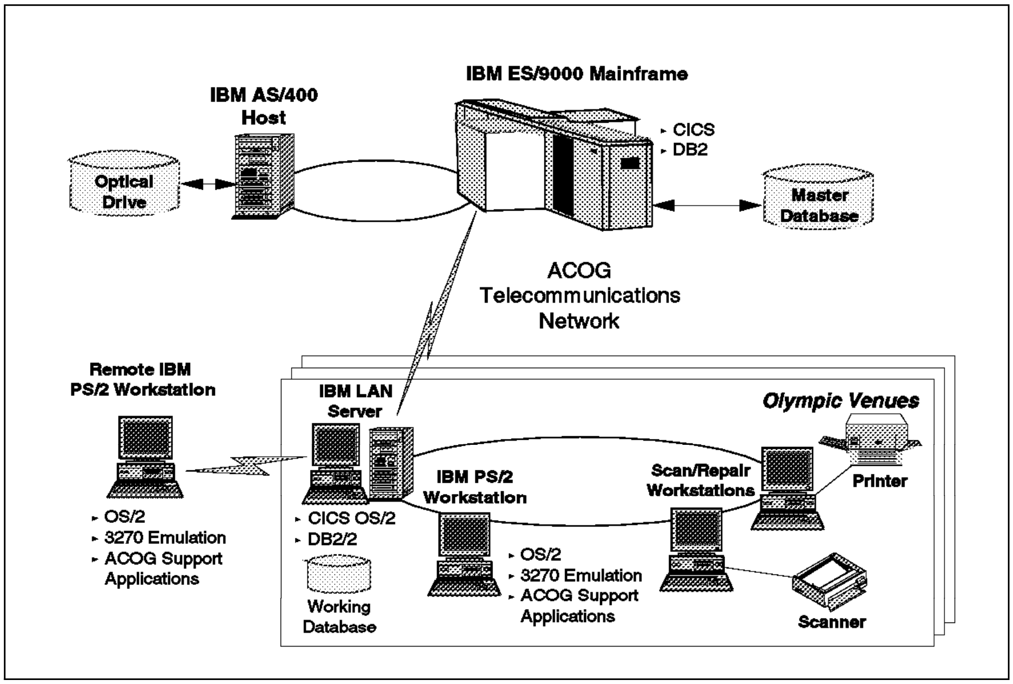

Figure 62. Games Staffing Subsystem Configuration

The major system software components required to implement Games Staffing were as follows:

ES/9000 Host

MVS/ESA SP 5.1
RACF 2.1
CICS/ESA 4.1
Message Queue Manager 1.1
DB2 3.1
LAN File Services 1.1.2
ACF/Network Control Program 7.1
ACF/VTAM 4.2
APPC Application Suite 1.1
TCP/IP 3.1
COBOL/370 1.1
Language Environment/370 1.3
CSP/370 Runtime Services 2.1

IBM PS/2 Client

OS/2 3.0
Communication Manager/2
DB2/2 2.1
DDCS/2 2.1
3270 Emulation

9.3 Games Staffing Solution

This section examines the functions, logic, transactions, and interfaces implemented by the Games Staffing Subsystem. Games Staffing dealt with about 100,000 individuals. Roughly half of the paid staff, volunteers, contractors, and vendors who were under ACOG supervision were processed through Games

Staffing. The others (mainly vendors not directly supervised by ACOG) entered Accreditation directly.

The major functions of Games Staffing are shown in Figure 63.

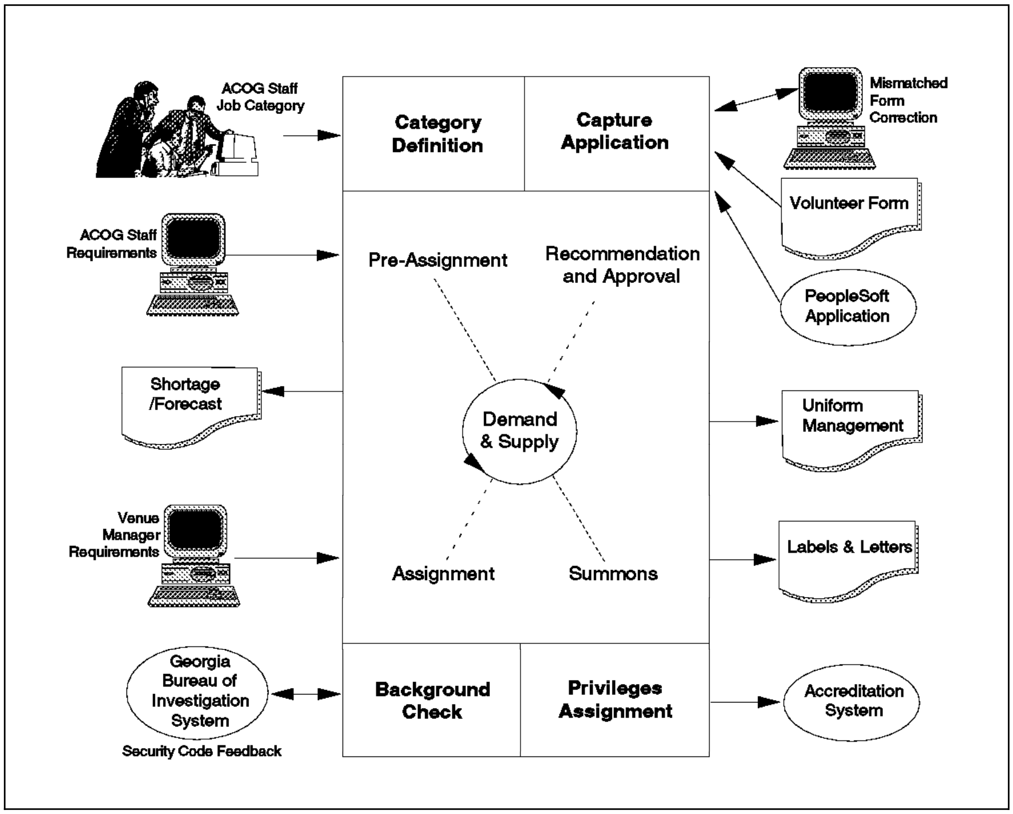

Figure 63. Games Staffing Major Functions

9.3.1 Category Definition

Game Staffing worked with the other ACOG functions to determine total staff needs, reconciled staffing needs with budget, and determined total staff distribution between paid staff, volunteers, contractors, and so on. The requests for volunteers were analyzed to establish organization-wide job titles and to formulate general job categories and minimum qualifications. Basic system tables were populated with the job titles, categories, and qualifications using 3270 online functions.

9.3.2 Capture Application

Applicant information was submitted to Games Staffing via a standard volunteer application form or loaded directly via file transmission from the Human Resources system, depending on the source and type of staff member.

9.3.2.1 PeopleSoft Interface

The Human Resource function hired and supported permanent staff (such as paid employees or contractors), administered salary and benefits, dealt with outplacement, and maintained data for all the above using JDEdwards′ PeopleSoft package. An interface transferred personal employee data from PeopleSoft to the Games Staffing DB2 database residing on the ES/9000 mainframe.

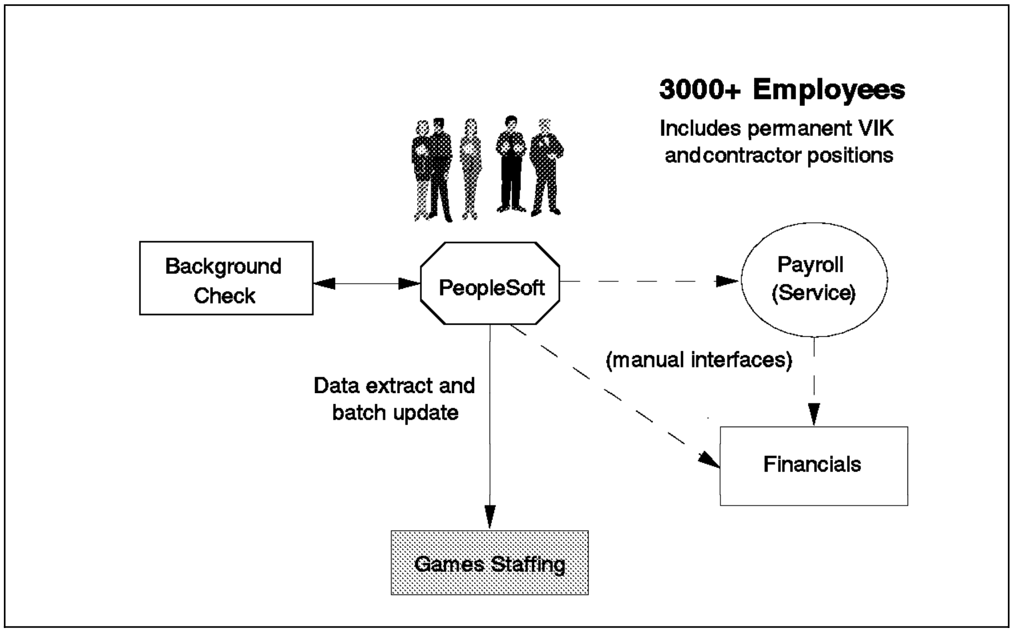

Figure 64. Human Resources Functions

9.3.2.2 Volunteer Application Form

The volunteer process began with 10 pages of instructions and questions and a one-page application form ″laboriously designed,″ to minimize entry errors. The blank-box format required hand-printed letters and numbers for personal data and simple, fill-in circles for preference and experience information. The design also allowed ACOG to pack an astonishing amount of information onto a single page. Included were personal and background data, volunteer activity and preferences, language and sports skills, education, leadership experience, licenses held, and availability.

All relevant information was captured and loaded into the Games Staffing database by form scanning and manual key entry. Several methods were considered including manual data entry, to enter hundreds of thousands of applications into the computer system. Cost, available skills, and probability of data entry errors ruled them out.

After reviewing all the options, an advanced technology combination was chosen that used an enhanced version of the ImagePlus/400 document management product and intelligent character recognition (ICR) software. Although ImagePlus and ICR software existed as individual offerings, this was one of the first times they were used together.

The ImagePlus/400 solution is a high-speed, accurate, and cost effective way of processing high-volume paper by automatically scanning documents—in this case volunteer applications—into a computer system. Using a token-ring network consisting of an AS/400 connected to the ES/9000 mainframe, IBM PC workstations running OS/2, with scanners, color displays, and compact disk storage units, the system scanned handwritten applications at high speed (applications were scanned and evaluated at the rate of 3,000 a day) into the AS/400, using the ImagePlus/400 system. The system entailed electronic capture, import, indexing, storage, retrieval, display, processing distribution, faxing, and printing of image information. Data was extracted from the forms by the ICR/OCR software and then the resulting digitized images had names and indexing information added so they could be properly filed and retrieved from online storage. The online image object retained the exact appearance of the paper application form.

The electronic forms were permanently indexed and stored on a CD drive. During this process, ICR attempted to recognize all characters on an application form. Those that could not be read were flagged by the system as needing repair. An operator pulled up the form and data on his or her workstation, matched the original form with the data extracted on the screen, and added the correct characters.

Figure 65 shows the processing scheme.

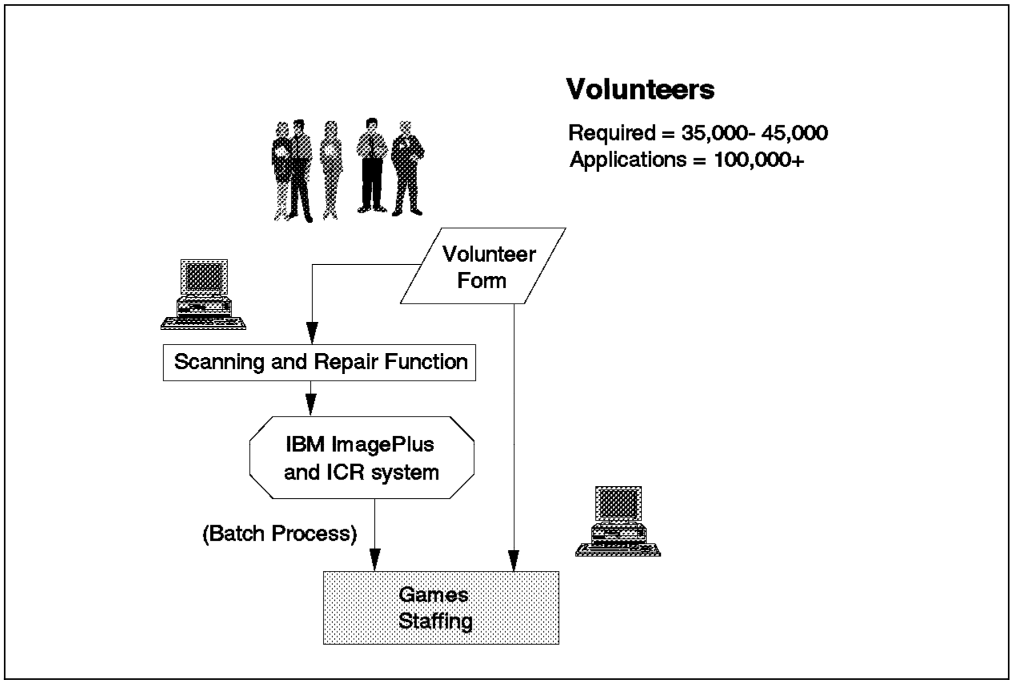

Figure 65. Volunteer Form Processing

The AS/400 then populated a DB2/400 database with the character data. A batch COBOL job on the mainframe read the DB2/400 database through the DRDA communication capability, transmitted the data to the Games Staffing DB2 database on the ES/9000 mainframe and updated the DB2/400 records as processed.

A variety of applications exist for IBM′s enhanced version of the ImagePlus/ICR product used in volunteer staffing for the Games. The system is expected to improve speed, accuracy, and cost effectiveness for industries such as finance, health, insurance, and legal that require high-volume paper processing. Credit agencies that use a handwritten application form to qualify an individual for credit or establish financial limits can easily read, review, and store the desired data.

9.3.3 Matching Demand and Supply

The entire process was a demand and supply exercise, where the demand was represented by the over 40,000 positions classified as volunteer opportunities. The reconciliation of demand and supply was an iterative process using the following steps:

1. Preliminary assignment
2. Assignment
3. Summons
4. Recommendation and approval

The database used to perform these steps was the DB2 Games Staffing database that resided on the IBM ES/9000 mainframe. The core process used to perform the grouping, preliminary assignment, and assignment of positions was performed in 3270 emulation on IBM PS/2 workstations, running CICS/ESA programs written in CSP and COBOL. The users performed these operations by building selection criteria over different fields of the DB2 database, which were then interpreted, converted, and executed in a batch process. A large amount of work was done in batch mode by processes written in COBOL and QMF.

9.3.3.1 Preliminary Assignment

Volunteers loaded in the system were matched against the general job categories, based on the criteria specified and their skills, and tentatively assigned to a particular job category. The preliminary assignment associated individuals with the requested job categories and removed them from the pool of resources for other job categories.

Understanding the supply is a prerequisite to successful preliminary assignment. Supply knowledge influenced the sequence that preliminary assignments were executed. Those job categories with less supply were considered first to ensure that the less relevant skills of an individual did not assign him or her to another job category.

For example, Romanian is a language whose speakers are scarce while French speakers are plentiful, so the process made sure that an individual fluent in both Romanian and French was given a preliminary assignment to the Romanian job category.

Two types of preliminary assignments were available:

Mass Upon submission of the transaction, the system automatically searched the database for individuals meeting the criteria for the job category.

Direct A specific individual was assigned to a job category regardless of criteria.

To fill 50 positions, many more applicants had to be screened, in case some were no longer available, or proved to be unqualified for the job category.

Comparing the demand to the supply of applicants meeting the qualifications indicated any shortage and the need to recruit for that job category.

9.3.3.2 Assignment

Each venue manager determined the staffing requirements for the venue, and the number of persons required for each job. Persons were assigned to a position based on their preliminary job category assigned and other criteria. This function is known as assignment. Both direct (manual) and mass assignments were supported by the system. Job positions for paid staff and contractors were loaded in the Games Staffing Subsystem and all assignments for these individuals made by the direct assignment method in the system.

9.3.3.3 Summons

Games staff members were summoned by ACOG for various purposes before the Games began, such as attendance at general orientation and photography sessions, interviews, and uniform pick-up. The system supported the direct summons (for a specific individual) as well as the mass summons (all those to be issued guide uniforms, for example). The record of each person summoned was updated by the system to reflect their attendance. This attended or not-attended status code was used to allow the resummoning process of people who did not attend a session. Games Staffing facilitated the summons process and generated mailing labels and form letters.

9.3.3.4 Recommendation and Approval

After a person had been assigned to a specific position, he or she was recommended for approval by the manager of the position and a recommendation code was set up. The recommendation code was used to group those positions that were ready for approval. The approval step enabled the manager of the selected volunteer to approve or reject the candidate for the position. People could be approved online one at a time or in batches.

Olympic uniforms were ordered for approved Games staff members; the type depended on the position. Games Staffing generated a report to be given to the uniform supplier that detailed the number of uniforms of each type required and other data required by the supplier to estimate the average sizes needed. Only those persons contained in the Games Staffing database were included in the report.

9.3.4 Background Check

The obligation of the host committee was to provide the safest environment possible for athletes, officials, and spectators. This included checking the background of the employees, contractors, volunteers, and others who worked in various capacities. The Background Check process consisted of collecting personal data captured from the volunteer application forms and providing it to the existing system of the Georgia Bureau of Investigation (GBI). In addition, the Background Check process controlled the data that Registration updated, and determined when to send the data to the GBI.

9.3.5 Assignment of Privileges

The specific position an individual was assigned to was passed to Accreditation. In Accreditation, the data was used to create a matrix that defined the access privileges associated with each position defined in Games Staffing. The access privileges and the other volunteer data was used by Accreditation to produce the personal accreditation badge.

Chapter 10. CAD and 3-D Visualization

This chapter provides an overview of the use of design technologies (CAD, Automated Mapping/GIS, and 3-D Visualization) for the 1996 Olympic Summer Games. ACOG built a dynamic environment, demanding innovative design technologies. For example, CAD was used as a communication tool, not just as a drafting and design tool.

10.1 Centralized Physical Planning System

The Centralized Physical Planning System was supported by powerful RS/6000 systems and IBM computer-aided design (CAD) software which enabled architects, engineers, and facilities planners to tackle numerous logistical tasks. These tasks included designing new venues, creating virtual tours of new venue models, providing automated mapping of the geography surrounding the venues, and sharing core data among the planning teams. The system also allowed planners to determine travel routes to Atlanta′s new 85,000-seat stadium, locate TV camera placements, and identify spectator access points and athlete assembly areas.

IBM′s RS/6000 server linked RS/6000 workstations and IBM personal computers, providing hardware support for the centralized physical planning system. CAD software products residing on the server included AutoCAD and IBM′s ProductManager.

The Centralized Physical Planning System enhanced the quality of facilities planning by both promoting innovation and collaboration, while controlling overall costs.

At ACOG, there were two groups of clients for the Centralized Physical Planning System: users, who operated their own CAD systems and only required direction and support; and clients, who required complete CAD services.

10.1.1 Users of CAD

Atlanta Olympic Broadcasting (AOB)

AOB was a major user for positioning cameras, platforms, and broadcast compounds. AOB also designed the temporary International Broadcast Center in-house.

ACOG Technical Services

Planned technical facilities, cabling, radios, computer networking, closed-circuit television, TV monitor placement, copiers—any technology item in a venue that needed to be supported.

ACOG Village Department

Did logistical planning, space allocation, Olympic Village building assignments (with Georgia Tech), and planning for other remote villages.

ACOG Construction Division

Managed the construction process. Collected requirements and contracts with outside design firms for CAD drawings and blueprints. Formatted the drawings, then transferred them to the CAD Systems department for standards processing and dissemination to the ACOG enterprise.

ACOG Office of Facility Management

Planned and managed ACOG office space.

Security

Planned safety, flow, and access control of various attendee groups, as well as security zones.

ACOG Logistics

Planned space, furniture, and equipment allocation and placement in venues and warehouses.

10.1.2 Clients of CAD

IOC Venue Planning and Management

Physical Planning department′s major customer. Negotiated among interested parties such as broadcasters, logistics, spectator services, medical, and sports regarding requirements and locations; provided proposed changes to the CAD Systems′ official plan of record.

IOC Venue Managers and Construction

The Construction Division determined if the planned alterations approved by the venue managers were feasible. The final approved CAD drawing became a plan for the actual operation of the venue.

Atlanta Transit Transportation

CAD routing was used to schedule buses between venues, identify staging areas for buses and taxis, route access to remote park-and-ride lots.

City of Atlanta Mapping

Mapping for the Atlanta Olympic Ring was done by CAD; an imaginary circle was drawn with a radius of 2.75 km, extending from the southern tip of the new Centennial Olympic Park.

ACOG Marketing

CAD was used for locating signs, billboards, and businesses in relation to transportation routes and accommodations to control ambush marketing.

10.1.3 IBM ProductManager Software

Change management was a critical issue for ACOG, with numerous entities such as television, ticket sales, and visiting dignitaries vying for space and seats at more than 30 competition venues. A separate directory tree structure for every venue allowed Physical Planning to maintain control of the plan of record, but CAD users could make a copy of it to work on their own requirements. If users made changes that affected other users, the updated CAD files had to go through a review procedure before the base plan was altered. Each venue manager was responsible for deciding the outcome of user negotiations and disputes.

Space was needed not only for the sports competitions, but also for Press Operations and Public Information, Lost and Found, Ushering, Security, Medical, Ticket taking, the Olympic Family, and technical equipment. An example of the process in operation was the request of ACOG′s broadcasting group to relocate a major operational facility in the stadium closer to their work space. One possible location didn′t work because it blocked a major corridor. A section of the planned Olympic Family lounge was more feasible. The Olympic Family group looked at the proposal on CAD and agreed to give 1,000 square feet to the broadcasters.

The broadcasting organization could alter placements of cameras, panels, and platforms—anything related to their own operation— in directories referencing the CAD Systems′ base plan. As long as the changes affected only their allotted space, the broadcasters could change the main database. If other groups were affected, however, they and the venue planner had to approve the proposed alterations, and the Construction department had to agree to any budget impact. Only then did CAD Systems change a venue′s base plan.

ACOG used ProductManager′s Document Control Manager component for collecting, storing, and delivering 1996 Olympic Games CAD documentation. ProductManager was designed to manage data created from a variety of applications and tools working in an open systems environment of personal computers, workstations, and mainframes.

Document Control Manager enabled users to establish a central database, maintain a centralized vault for critical business documents such as CAD drawings, establish document-to-document associations and formats, provide administration capabilities such as document registration, check-in/check-out, security, versioning, and change control. In addition, the software offered the ability to view and redline documents using native tools directly from Document Control Manager screens and to create a history of events file for document creation and approval.

Other ProductManager components used were these:

- Application Services Manager, which provided the ability to customize ProductManager, manage the system, access and share information in a distributed environment and, extend functions as requirements grew.
- Product Change Manager, which managed the engineering design and release process, and allowed implementation of structured change and release processes within an enterprise. It helped the CAD Systems group to create, maintain, and release engineering changes for new or existing products, and helped establish an automated engineering change review process that supported automated creation, distribution, review and approval of documents.
- Product Structure Manager, which managed the product definition and configuration process. This facilitated creation, maintenance, and retrieval of product definition data, helped in generation of online reports, and conversion of product data to CAD Systems control.

10.1.4 Collaboration and Innovation

ACOG′s Centralized Physical Planning System used existing files containing the best available industry standards. Collaboration and reuse of existing data was critical to the success of the project, not because of finite resources and unanticipated (and unbudgeted) needs but also because ACOG was operating on a schedule with a definitive completion date. The Centennial Olympic Games had to begin as scheduled on July 19th.

Several innovative applications were being developed for the 1996 Olympic Summer Games:

- Physical plans for the 30-plus sports venues, such as space planning, furniture allocation, equipment fit and placement, proximity to the field of play, and medal storage.
- Architectural design services through in-house designers, using 3-D visualization to show what the venues would look like.
- Automated local mapping via geographical information systems.
- Technology support to ACOG organizations that did their own planning, such as the Olympic Village Department and the Security Department.

10.1.5 Data Sharing

One of the major services provided to ACOG′s CAD users was the sharing and centralization of core data. This enabled different departments to see not only what their own operations looked like, but also how they related to each other. The CAD Systems group employed local contractors to provide computer graphic designs for new venues, then they converted this data to ACOG′s CAD standards. The base plans for the competition venues were modified to be easily understood by facilities planners and nontechnical staff. Standardized naming conventions allowed each group′s drawings to fit into a cohesive, enterprise package.

For some existing venues such as Atlanta′s 30-year-old baseball stadium where only manual drawings were available, CAD Systems architects collected a set of blueprints that described the building. They then hired an outside firm to redraft the blueprints into CAD from scratch, because scanning them in would introduce inaccuracies that would be costly to find and correct.

In order to make the review copies of the plans easier to read, the CAD Systems team removed the dimensions and complicated engineering notations that would confuse the average layperson. This made the documents look less like blueprints than CAD drawings, so they could be used as planning tools for all of ACOG.

10.1.6 Architectural Design Services

Additional services offered by the CAD Systems group included acquisition of existing drawings and in-house architectural designs and layouts for various ACOG departments. CAD Systems contributed space layouts and exhibit designs for the 1995 review meeting of the Association of National Olympic Committees in Atlanta. The group mapped world and United States routes for the 1996 Torch Run, and assisted with special events such as groundbreakings and grand openings.

10.1.7 3-D Visualization Projects

CAD Systems provided dynamic venue tours with the aid of a new virtual reality product: the IBM 3-D Interaction Accelerator (3DIX). This browsing software package enabled interested parties to walk through models of the various venues. For example, when 500 officials from nearly 200 National Organizing Committees NOCs traveled to Atlanta for a mandated progress report, their understandable desire to tour the new Olympic Stadium posed a problem. The stadium was under construction and on a tight schedule, so ACOG couldn′t shut down the site. Instead, the CAD Systems team prepared a 3-D video animation from the CAD base plan, then translated that into the IBM 3DIX system for a guided tour that gave the NOC officials more detail than they could have gotten on an actual physical tour.

The 60 second stadium video required about 12 hours to complete; it would have taken at least 600 hours using conventional PC-based animation techniques. A 3-D overview tour targeted to a large group was programmed, then videotaped. This allowed ACOG′s guests to take away the animated walk-through of the stadium to share with their colleagues at home.

Security people also found IBM 3-D views helpful in planning access points, surveillance, and tactics. It was also used in the classroom to help train the many thousands of employees and volunteers.

IBM′s 3-D program enables engineers and designers to take real-time walk-through tours of highly complex CAD models such as engines, airplanes, factories, warehouses, power plants, offices, molecules, and the human body. A natural gesture-driven interface allows mouse or Spaceball control.

10.1.8 Automated Mapping/Geographical Information Systems

In addition to 3-D visualization, the CAD Systems department used geographical information systems (GIS) software to provide automated mapping. Typical mapping functions included planning for roadblocks, transportation corridors, location of fences and placement of elements outside fences, where and how transit services should drop off spectators, dignitaries, officials, and athletes.

10.1.9 Technology Support

The CAD Systems included RS/6000s and desktop and portable personal computer workstations; a central repository of CAD data for all users, a Xerox large-format color electrostatic plotter, IBM and Xerox small-format printers, and a customizable CAD interface based on application needs and user requirements.

Central to the department′s technology support were IBM DB2 linkages to local and wide area network users. In addition to coordinating change management, this client networking enabled the CAD Systems department to provide online technical assistance with engineering design hardware, software, and process problems.

10.2 IBM Manufacturing

IBM′s Manufacturing Industries Solution Unit, based in Charlotte, North Carolina, provided core technology used to design and manage many of the facilities for the 1996 Olympic Summer Games.

IBM′s Manufacturing Industries Solution Unit has more than 70 product and service offerings designed specifically to address the needs of manufacturers worldwide. Select offerings include: CAD/CAM solutions, including Product Data Management software, MES and SCADA systems, ERP services, industrial computers and data collection hardware, a wide range of consulting services, and customized offerings.

Chapter 11. Security Incident Tracking System

In order to help the Olympic Games security staff to keep a watchful eye on the security and safety of the Olympic family members as well as visitors to the Games, a system to track security and other incidents at all Olympic venues was needed.

This chapter discusses ACOG′s requirements and the IBM solution, which used Lotus Notes Release 4.

11.1 ACOG′s Business Problem

Over 150,000 Olympic Family members, millions of visitors, and VIPs in Atlanta during the 1996 Centennial Olympic Games made on-the-ground security an issue of paramount importance. The challenge was compounded by the geographical dispersion of the 1996 Olympic Games: there were 41 sporting venues and a total of more than 80 Olympic Games venues located in eleven cities and four states. ACOG needed an efficient and unobtrusive way to prevent crime and to track security breaches.

Like any business for which timely communication is a top priority, ACOG wanted an open system that would be easy to use and maintain. With 52 separate agencies involved in security at the Games, including the Department of Defense, the Secret Service, the Federal Bureau of Investigation, the Georgia Bureau of Investigation, the Atlanta Police Department, and contracted security services, ease of use was a major requirement.

11.1.1 Major System Requirements

The challenge was to develop a system meeting mission-critical requirements, as follows:

- Provide instant access to information
- Allow varying levels of response for each event classification
- Assign priorities according to the urgency of the event or incident
- Have varying levels of security for 52 law enforcement agencies
- Deliver instantaneous data to all Venue Command Centers
- Provide immediate response to security risks.

In addition, the system required a high degree of availability and data integrity.

11.1.2 The IBM Solution

IBM developed the Incident Tracking System, which allowed security personnel and venue managers to share information in real-time about incidents, people, and inventory at the Games, and facilitated immediate response to security issues; for example, allowing alerts to be sent through pager gateway to security personnel. Lotus Notes was the foundation for the Olympic Games Incident Tracking System.

Lotus Notes is commonly recognized as a popular choice for workgroup computing in traditional corporate environments. The 1996 Olympic Games provided unique opportunities for implementation of its technology.

The Lotus Notes application provided for incident tracking, reporting, and follow-up. Use by ACOG was developed to provide information and guidelines on how Olympic Games management should respond to various security issues. The application was linked to the Georgia Bureau of Investigations and the Georgia State Police, enabling security issues of regional and national stature to be tracked and resolved. To authorized users, the overwhelming advantage of the Lotus Notes-based approach was universal access to consistent information to enable appropriate security action.

Each entry in the Incident Tracking System generated an incident report in the system′s database. All security personnel involved with the Olympic Games, from the Atlanta police to the FBI, could access the reports and add comments and information.

Each venue had seven to eight client machines on a LAN connected to two central command centers. Security guards at each venue were able to quickly request whatever was needed, such as backup for crowd control, or an ambulance for a medical emergency. Venue managers were able to use the system to access supplies, such as extra chairs or water. The system also tracked borrowed equipment, such as cellular phones, to ensure the safe return of those items.

Every user on the Incident Tracking System network, which had 250 terminals, could enter and retrieve information, receiving constant updates.

Besides allowing all 52 security agencies represented at the security tracking command center to work together seamlessly, Lotus Notes was also used to track security staff inventory, notably hand-held, two-way radios. Using Lotus Notes, IBM was able to develop a Radio Inventory Tracking Application in only 3 hours.

Figure 66 on page 143 illustrates the infrastructure for the Incident Tracking System for the Olympic Games.

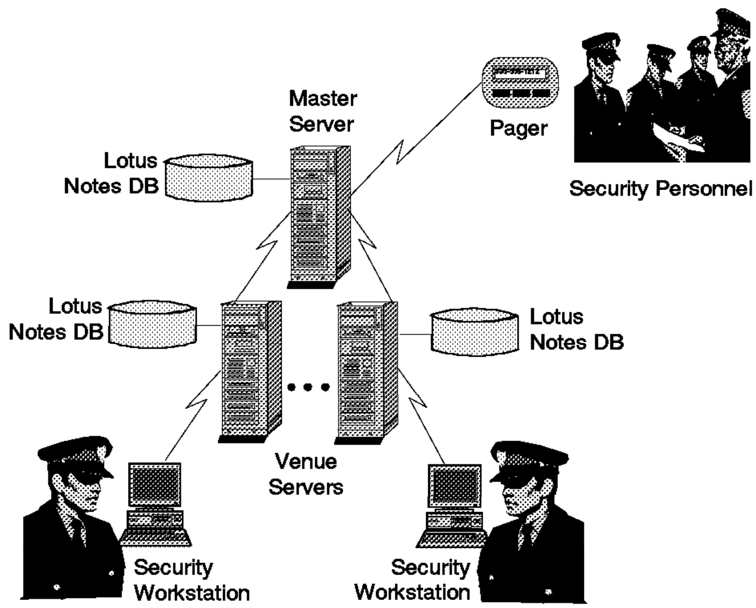

Figure 66. Incident Tracking System Infrastructure

A Lotus Notes server was located at each security substation. These substation servers updated every 5 minutes from the central server, so everyone had access to all information. For ACOG as with business, frequent replication and updating meant stability and minimized down time.

The Incident Tracking System interface featured maps of the Olympic environment and the ability to hone in on venue-specific incidents. Thanks to the easy to learn and easy to use navigation of Notes, users just pointed at venue tabs and clicked. Command center tabs looking like file folders, made it possible to drill down for deeper information.

A critical feature of the system was the reports that cataloged upcoming events specific to each venue. Each day's events included a Dignitary Timeline, plus a comprehensive listing of all events in all venues. The log was color-coded to immediately record venue-specific incidents, with the following standard:

green informational

yellow intermediate

red critical

Quick Steps listed the four or five immediate incident-specific steps to follow, which helped ensure that response to incidents was both swift and coordinated.

If an incident report was critical, an alphanumeric pager message was automatically sent to all security team members in that area. Incidents reports could be viewed in several ways since Lotus Notes provides several ways to search for documents, as for example, by type, severity, or number, and even allows users to view pictures, video, sound, and graphics.

The forms-based structure of Lotus Notes allowed a feature-rich Incident Tracking System to be developed in only 4 weeks, that was accessible from any

Olympic Games venue. The workgroup-based Lotus Notes system was a vast improvement over previous Incident Tracking applications, which were paper-based and thus not conducive to the efficient replication and sharing of information.

11.1.3 System Architecture

Each venue had dedicated security personnel. After receiving a radio or telephone report of an incident, a venue security operator entered the information on a customized form. In the Incident Tracking System, event or incidents were prioritized in the Lotus Notes database by level of urgency, ensuring that high-priority entries were prominently displayed; after inputting the incident information, the operator assigned the priority.

The Incident Tracking System provided the operator with recommended next steps, assigned the incident a security risk rating, and logged the information. The information was instantaneously transmitted to the central Notes server and, to ensure full access to security information across all venues, it was replicated back out to the venue servers every few minutes. The speed of replication varied according to the severity of the incident. A Lotus Notes pager gateway allowed critical incidents, such as a lost child report, to be sent instantaneously to appropriate parties via pager.

Replication over a dedicated network was chosen to ensure that if a venue′s link to the main data network was broken, venues could still have access to critical security information.

The Incident Tracking System had numerous features built into it to prevent break-ins. It was a hardwired system utilizing encryption and authentication based on person and location. A firewall and differing levels of data access helped preclude unauthorized access. Varying programmed response time updates to Lotus Notes database added an additional layer of security.

11.2 Benefits

The Incident Tracking System was a clear example of how to exploit state-of-the-art technology to automate administrative and critical processes related to a business need:

- The application model is appropriate for a number of commercial uses in database management, communications, and for security at concerts, sports arenas, shopping malls, factories, and for equipment inventory at all of these.
- The system′s design inherently delivered consistent information about incidents, and consistent guidelines for reactions to security issues.
- The Lotus Notes technology is robust, reliable, and advanced; pictures, graphs, videos and sound were incorporated into the Incident Tracking databases.
- Incident Tracking′s forms-based processing was easy to use and required minimal training.

Chapter 12. Olympic Ticketing System

No other event compared to the ticket sales processing needs of the 1996 Olympic Games. ACOG had more tickets available for sale than the combined total of the 1984 and 1992 Olympic Games, including more baseball tickets than were available for the entirety of the 1994 Winter Olympic Games in Lillehammer, Norway. The 1996 inventory included 542 ticketed sessions spanning 26 sports taking place in a total of 31 venues. In addition, the system processed requests for the 1.2 million tickets to the 1996 Olympic Arts Festival (OAF), an eight-week production of ACOG′s Cultural Olympiad which accompanied the Olympic Games. OAF events included 200 performances, 25 exhibitions and took place in more than 30 venues.

The Olympic Ticketing System was comprised of the following subsystems:

- Non-domestic sales plus space inventory management
- Domestic mail sales
- Domestic secondary sales
- Seat inventory management
- Ticket printing
- Box sales

Table 12 outlines the functions each subsystem delivered.

Table 12. Ticketing Subsystems

Subsystem	**Functions**
Non-Domestic Sales and Space Inventory Management	Sales planning, ordering, accounting, reporting, and space inventory
Domestic Mail Sales	Domestic Mail Sales
Domestic Secondary Sales	Domestic secondary sales, and information service
Seat Inventory Management	Maintenance of seat map, handling of seat kill, automatic seat assignment, manual seat assignment and maintenance, and management reporting
Ticket Printing	Ticket printing
Box Sales	Box sales

Because the ticket sales program for the Atlanta Summer Games was larger and more varied than that of any previous Olympic Games, a system was needed that was tailored to meet the needs of the 1996 Games.

IBM partnered with ProTix, who provided the services to sell tickets by mail, by phone, and over-the-counter, while IBM provided the technology, project management, and systems integration. IBM managed all aspects of the project, including the ticket system′s design and integrating the use of other technologies, such as telecommunications and optical scanning technology to process customers′ completed ticket request forms. ProTix customized existing software for the ticket sales system and provided IBM with staffing and training services for ticket sales phone operators.

Figure 67 on page 146 illustrates the logical flow for ticket sales operations.

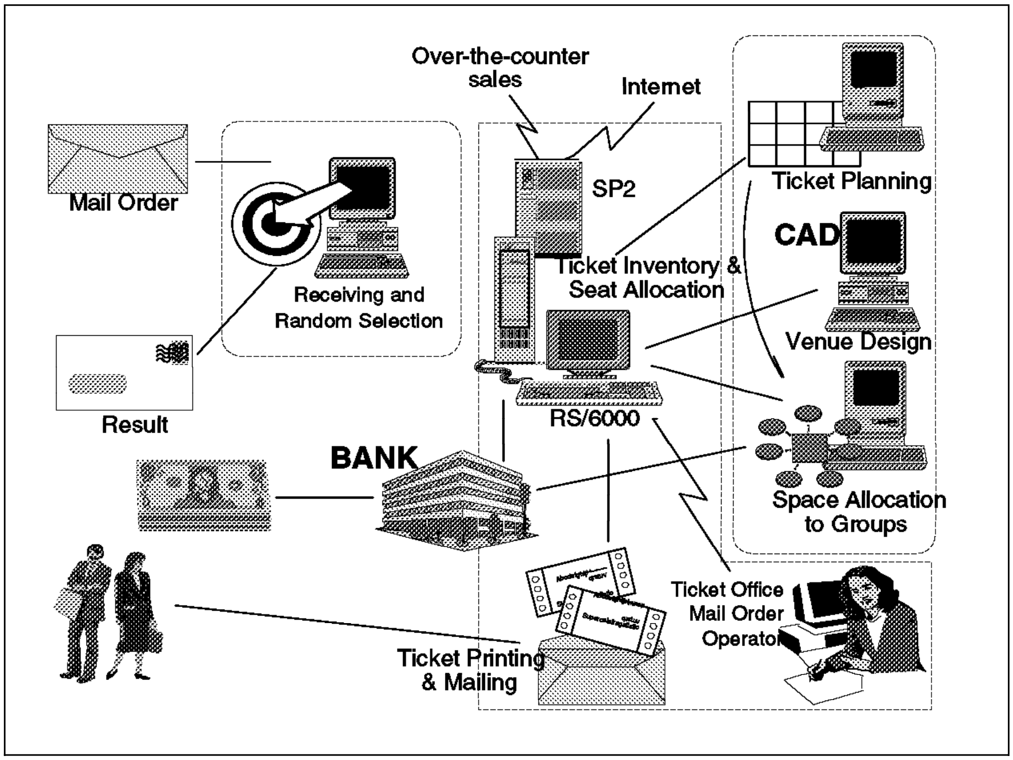

Figure 67. Ticket Sales System Logical Flow

12.1 Ticket Sales Planning Subsystem

The Ticket Sales Planning Subsystem was responsible for assisting the strategic planning effort as it related to ticket pricing and space allocation. The allocation of space process began as ACOG attempted to allocate seat space to accommodate the IOC and NOCs, along with corporate sponsors.

12.1.1 Objectives of the Ticket Sales Planning Subsystem

The goals and objectives of the subsystem were these:

- Provide the user with the ability to support the building of financial models to explore revenue impact when there were changes in pricing, capacity, sales estimates, and other variables.
- Generate a demand model that closely approximates customer demand.
- Generate the quotas per market segment based on the demand model and supply.
- Generate a corresponding allocation model for each scenario.
- Generate the initial space allocation that was used (through an interface) to initialize the Ticketing Information System.

12.1.2 Functions of the Ticket Sales Planning Subsystem

The Ticket Sales Planning Subsystem consisted of the following activities:

- Define the ticket supply
- Create the demand model
- Aid in the development of market segment allocation quotas
- Allocate space to customer groups
- Create and maintain databases
- Calculate revenue from estimated ticket sales
- Perform what-if scenario analyses regarding capacity planning, ticket pricing, and so on.

12.1.3 Implementation Environment

The Ticket Sales Planning Subsystem was developed using FoxPro 2.5 for Windows 3.1. The executable modules and data tables were loaded on the server, and each user had definitions that allowed them to access and execute the system.

The Ticket Sales Planning Subsystem did not require an hardware other than those workstations already installed for each user in the Financial Planning and Analysis department.

12.2 Ticket Management and Sales

The Ticket System included many customer-oriented features such as:

- Interactive Voice Response (IVR) that offered recorded information 24 hours a day via telephone to help consumers complete their ticket request forms.
- Telephone operators available at specified times offering consumers personal assistance completing their ticket form, providing additional service for mail order customers, and handling phone sales of tickets.
- FairTix(tm), a custom-developed program that processed requests received in the first 60 days of mail-order sales. FairTix randomly awarded tickets and assigned seats for those sessions that were oversubscribed. Ticket requests that were postmarked later than June 30, 1996, were processed on a first-come, first-served basis.
- Dial-in look-up services were made available in the fall of 1995 allowing mail-order customers to check the status of their ticket requests and receive up-to-the-minute ticket availability.
- Box office locations at all 31 competition venues, Centennial Olympic Park, Hartsfield International Airport, Atlanta′s Welcome South Visitors Center, and other downtown Atlanta sites, such as the Main Press Center, allowed customers to buy tickets to any event at any location.

12.2.1 Technology Supporting the Ticketing System

Hardware supporting the system consisted of two IBM RS/6000 servers, with a third RS/6000 server used to develop the FairTix system. All were running AIX, IBM′s industry-leading UNIX operating system

At its peak, as many as 500 terminals were linked to the system, supporting phone operators and including up to 300 box office workstations that were on-line during the Games handling over-the-counter ticket sales.

During the mail-order phase, 24 operators at a time staffed the Atlanta-based phone center. In all, the ticket sales staff numbered 200, including box office staff.

12.2.2 Internet

As mentioned in Chapter 6, "The Internet and the Olympic Games" on page 85, the Internet was used extensively and successfully as an alternate ticket sales channel. The convenience of ticket buying over the Internet was enjoyed by thousands of people worldwide. The purchase of 130,000 tickets worth more than $5 million established the site as the world's largest for electronic commerce.

12.3 Conclusion

The partnership of IBM and ProTix provided the resources needed to create the most effective ticket sales system in Olympic history. They were able to bring to the table the best in customer service, the highest standards of quality, and the greatest flexibility in building a single, integrated system that handled every phase of the ticket sales requirement.

Appendix A. Comparison of Technology at Lillehammer, Atlanta, and Nagano

Table 13. Technology Enhancements: Lillehammer - Atlanta - Nagano

Key Item	Lillehammer Winter Games 1994	Atlanta Summer Games 1996	Nagano Winter Games 1998
Mainframe	ES/9000 X 3 9121-610 87 ITR 173.88GB	ES/9000 X 4 Query DB Server 9021-942 282 ITR 340.2GB	S/390 PTS 9672-R44 180 ITR 540.0GB
Midrange	AS/400 X 1	AS/400 X 80	SP2 X 2 (for Intranet) SP2 X 2 (for Internet) RS/6000 X 50 (CAD, NWmgt,DNS,etc) AS/400 X 2 (for HQ & Secondary)
Workstations	Intel 386/486 IBM PS/2 OS/2 16/32-bit 4,000 PCs	Intel 486 Pentium IBM PC OS/2 32-bit 6,000+ PCs	 New IBM PC OS/2 Warp 4,000+ PCs
Network	3745-based WAN TR-based LAN PC Bridges 8230 TR HUB Netview	3745-based WAN TR-based LAN 6611 Routers 8230 TR HUB Netview/6000	ATM based Backbone Network 8260 Switched Base WAN TR based LAN 2210 Nways Routers 8260/8230 TR/ATM HUB Netview/6000
RESULTS Platform	IMS/DB 313 PCs	DB2-DB2/2 DRDA 824 PCs	DB2-DB2/2 DRDA 339 PCs
INFO '96 Platform	PS/2 Server CICS OS/2 Client/Server 905 PCs	AS/400 Server VisualAge Object Oriented 1,820 PCs	SP/2 Server Intranet Architecture HTML,HTTP,DB2WWW 1,070 PCs
CIS Platform	Host Based 753 PCs	Local Based 1,447 PCs	Local Based 900 PCs
CAD Platform	A&ES INGRES DB RS/6000 X 28	AutoCAD Windows RS/6000 X 10	A&ES TIPS DB2/6000 RS/6000 X 30
OA Platform	OV/400	EMC/TAO MS-Windows	LOTUS Notes OS/2 (LOTUS Appl)

Appendix B. Information Sources on the Internet

In its role as the Official Internet Information Systems Provider for ACOG, IBM supplies information on the 1996 Centennial Olympic Summer Games at *http://www.atlanta.olympic.org* on the Internet World Wide Web.

For more information about:

- Integrated information solutions, browse IBM′s home page at *http://www.ibm.com*
- Software solutions, see the IBM Software Home Page at *http://www.software.ibm.com*
- Client/server computing, see the IBM Client/Server Computing Home Page at *http://www.csc.ibm.com*
- Storage solutions, see the IBM Storage Home Page at *http://www.storage.ibm.com/storage*
- Personal software products, see IBM′s OS/2 Warp (Product Family) Home Page at *http://austin.ibm.com/pspinfo/os2.html*
- System/390, see the IBM System/390 Home Page at *http://www.s390.ibm.com*
- AS/400, see the IBM AS/400 Home Page at *http://www.as400.ibm.com*
- RISC System/6000, see the IBM RISC System/6000 Products & Services Home Page at *http://www.rs6000.ibm.com*
- Personal Computers, see the IBM Personal Computers Home Page at *http://www.pc.ibm.com*
- Lexmark printers, see the Lexmark International Inc. Home Page at *http://www.lexmark.com*
- ISSC, see the ISSC Home Page at *http://www.issc.ibm.com*
- Availability Services, see the Availability Services Home Page at *http://www.as.ibm.com*
- Business Recovery Services, see the IBM Business Recovery Services Home Page at http://www.brs.ibm.com
- Manufacturing Solutions,see the IBM Manufacturing Solutions Home Page at *http://www.clearlake.ibm.com/MFG/*

Appendix C. Special Notices

This publication is intended to help customers, systems integrators, and solution architects to define and recommend viable solutions to mission-critical client/server applications. The information in this publication is not intended as the specification of any programming interfaces that are provided by any of the program products discussed. See the PUBLICATIONS section of the IBM Programming Announcement for the various program products discussed for more information about what publications are considered to be product documentation.

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CICS/6000	COBOL/370
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DB2/2	DB2/400
DB2/6000	Distributed Relational Database Architecture
DRDA	ES/9000
FlowMark	IBM
ImagePlus	Integrated Systems Solutions
ISSC	Language Environment
MQ	MQSeries
MVS	MVS/ESA
NetFinity	NetView
Nways	OfficeVision/MVS
Open Blueprint	OS/2
OS/400	POWERparallel
Presentation Manager	ProductManager
PS/2	QMF
RACF	RAMAC
RISC System/6000	RS/6000
S/390	Scalable POWERparallel Systems
SP	SP2
System/360	System/370
System/390	SystemView
ThinkPad	ValuePoint
VisualAge	VisualGen
Visualization Data Explorer	

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- Informix
- JDEdwards
- Kodak
- Motorola
- Panasonic
- PeopleSoft
- ProTix
- Recognition Systems, Inc.
- Scientific Atlanta
- Sensormatic
- Swatch
- Sybase
- Xerox

Appendix D. Related Publications

The publications listed in this section are considered particularly suitable for a more detailed discussion of the products covered in this redbook.

D.1 Redbooks on CD-ROMs

Redbooks are also available on CD-ROMs. **Order a subscription** and receive updates 2-4 times a year at significant savings.

CD-ROM Title	Subscription Number	Collection Kit Number
System/390 Redbooks Collection	SBOF-7201	SK2T-2177
Networking and Systems Management Redbooks Collection	SBOF-7370	SK2T-6022
Transaction Processing and Data Management Redbook	SBOF-7240	SK2T-8038
AS/400 Redbooks Collection	SBOF-7270	SK2T-2849
RS/6000 Redbooks Collection (HTML, BkMgr)	SBOF-7230	SK2T-8040
RS/6000 Redbooks Collection (PostScript)	SBOF-7205	SK2T-8041
Application Development Redbooks Collection	SBOF-7290	SK2T-8037
Personal Systems Redbooks Collection	SBOF-7250	SK2T-8042

D.2 Other Sources

The best source of current information on IBM and its involvement with the Olympic Games is the Internet. The following homepages are a small representation of the sites containing relevent information.

- *http://www.software.ibm.com*
- *http://www.nagano.olympic.org*
- *http://www.csc.ibm.com*

How to Get ITSO Redbooks

This section explains how both customers and IBM employees can find out about ITSO redbooks, CD-ROMs, workshops, and residencies. A form for ordering books and CD-ROMs is also provided.

This information was current at the time of publication, but is continually subject to change. The latest information may be found at URL http://www.redbooks.ibm.com.

How IBM Employees Can Get ITSO Redbooks

Employees may request ITSO deliverables (redbooks, BookManager BOOKs, and CD-ROMs) and information about redbooks, workshops, and residencies in the following ways:

- **PUBORDER** — to order hardcopies in United States
- **GOPHER link to the Internet** - type GOPHER.WTSCPOK.ITSO.IBM.COM
- **Tools disks**

  To get LIST3820s of redbooks, type one of the following commands:

  ```
  TOOLS SENDTO EHONE4 TOOLS2 REDPRINT GET SG24xxxx PACKAGE
  TOOLS SENDTO CANVM2 TOOLS REDPRINT GET SG24xxxx PACKAGE (Canadian users only)
  ```

  To get BookManager BOOKs of redbooks, type the following command:

  ```
  TOOLCAT REDBOOKS
  ```

  To get lists of redbooks:

  ```
  TOOLS SENDTO USDIST MKTTOOLS MKTTOOLS GET ITSOCAT TXT
  TOOLS SENDTO USDIST MKTTOOLS MKTTOOLS GET LISTSERV PACKAGE
  ```

  To register for information on workshops, residencies, and redbooks:

  ```
  TOOLS SENDTO WTSCPOK TOOLS ZDISK GET ITSOREGI 1996
  ```

  For a list of product area specialists in the ITSO:

  ```
  TOOLS SENDTO WTSCPOK TOOLS ZDISK GET ORGCARD PACKAGE
  ```

- **Redbooks Home Page on the World Wide Web**

  http://w3.itso.ibm.com/redbooks

- **IBM Direct Publications Catalog on the World Wide Web**

  http://www.elink.ibmlink.ibm.com/pbl/pbl

  IBM employees may obtain LIST3820s of redbooks from this page.

- **REDBOOKS category on INEWS**
- **Online** — send orders to: USIB6FPL at IBMMAIL or DKIBMBSH at IBMMAIL
- **Internet Listserver**

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How Customers Can Get ITSO Redbooks

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	IBMMAIL	**Internet**
In United States:	usib6fpl at ibmmail	usib6fpl@ibmmail.com
In Canada:	caibmbkz at ibmmail	lmannix@vnet.ibm.com
Outside North America:	dkibmbsh at ibmmail	bookshop@dk.ibm.com

- **Telephone orders**

United States (toll free)	1-800-879-2755
Canada (toll free)	1-800-IBM-4YOU
Outside North America	(long distance charges apply)
(+45) 4810-1320 - Danish	(+45) 4810-1020 - German
(+45) 4810-1420 - Dutch	(+45) 4810-1620 - Italian
(+45) 4810-1540 - English	(+45) 4810-1270 - Norwegian
(+45) 4810-1670 - Finnish	(+45) 4810-1120 - Spanish
(+45) 4810-1220 - French	(+45) 4810-1170 - Swedish

- **Mail Orders** — send orders to:

IBM Publications	IBM Publications	IBM Direct Services
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United States (toll free)	1-800-445-9269
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- **1-800-IBM-4FAX (United States)** or **(+1)001-408-256-5422 (Outside USA)** — ask for:

  Index # 4421 Abstracts of new redbooks
  Index # 4422 IBM redbooks
  Index # 4420 Redbooks for last six months

- **Direct Services** - send note to softwareshop@vnet.ibm.com
- **On the World Wide Web**

Redbooks Home Page	http://www.redbooks.ibm.com
IBM Direct Publications Catalog	http://www.elink.ibmlink.ibm.com/pbl/pbl

- **Internet Listserver**

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Company

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Telephone number Telefax number VAT number

- Invoice to customer number

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Credit card expiration date Card issued to Signature

We accept American Express, Diners, Eurocard, Master Card, and Visa. Payment by credit card not available in all countries. Signature mandatory for credit card payment.

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Glossary

Access Control. The application function mandated to implement the rules of accreditation regarding access to controlled Olympic venues by all accredited persons.

Accredit. To give official recognition to.

Accreditation application. Is responsible for all the accreditation functions, with the exception of producing an accreditation badge and performing access control.

Accreditation center. Is a data processing center equipped with a Local Area Network (LAN) and connectivity via a Wide Area Network (WAN) to the Host ES/9000 mainframe.

Accreditation database. Is the central DB2 accreditation database residing on the host.

Accreditation process. Is the second process of the Accreditation System (Registration Process is the first). This process is made up of two distinct subprocesses: ″Process Now,Badge Later″ and ″Process Now,Badge Now″.

Accreditation System. Consists of applications responsible for processing the registration, accreditation, badging, and access control of all individuals who require access to controlled areas.

ACOG. The Atlanta Committee for the Olympic Games. Responsible for staging the Centennial Olympic Summer Games in 1996.

ACOG Staff. Volunteers and paid contractors who are supervised by ACOG and wear the uniform.

ACOP. Atlanta Centennial Olympic Properties. The cooperative marketing entity established between the Atlanta Committee for the Olympic Games (ACOG) and the United States Olympic Committee (USOC).

Agreement. The contract that IBM has signed with ACOP and the International Olympic Committee.

APOC. Atlanta Paralympic Organizing Committee. Like ACOG, this group is responsible for planning and organizing the Paralympic Games to be held in Atlanta in August 1996.

Assignment. Refers to the procedure of assigning an individual to a specific job position (job category, venue, and functional area).

Background check. Verification to be performed on the criminal and driving records of each individual seeking accreditation.

Badge. Issue a badge to a registered participant in order to accredit.

Badging device. Is a combination of software and firmware installed on each badging station and is responsible for integrating all of the steps involved in producing an accreditation badge.

Badging station. Is a PS/2 client workstation that integrates the badging device with the Accreditation Subsystem.

Bulk printing. Is the ability to initiate a batch job to print 600 badges per hour from the master Accreditation database. Bulk printing will be used during the ″Process Now,Badge Later″ process.

Composite logo configuration. Combination of IBM eight-bar logo with any available Olympic marks, and their designations and proprietary notices into a single graphic element.

Composite mark. See composite logo configuration.

Contractor. A person who has been contracted through an external company to work for ACOG. Generally, a contractor is supervised by ACOG personnel and is wears an Olympic uniform during the Games.

COP. Centennial Olympic Games Partner. The name for the elite Atlanta Games sponsorship status achieved through an agreement with ACOP.

Demand. Refers to the total quantity of individuals required to fill job positions or job categories and the minimum criteria needed. The demand for Game positions is specified by the ACOG departments.

Designations. Approved phrases that define IBM′s sponsorship relationship to the Olympic entities. They must accompany every Olympic mark in an IBM application.

Free Pool. Refers to the pool of potential staff available for pre-assignment to a job category. Only individuals considered free are eligible for pre-assignment.

Host country. The country whose city is hosting a specific Olympic Games.

IF. International Federation. The worldwide governing body of each Olympic sport responsible for organization, rules, and competition.

Interactive Voice Response. Refers to a technology that provides phone access to information contained in a database with the proper access password. A caller would be given some basic information and then given some options that may be selected by pressing a number on the phone key pad.

IOC. The International Olympic Committee. Caretaker of the Olympic Movement worldwide.

ISL Marketing. International Sports, Leisure and Culture Marketing, Inc. The marketing agency of record for the IOC responsible for sponsor representation and sale of worldwide Olympic sponsorship.

Job Category. Job title and optionally job requirements (skills, availability). accreditation center′s networked badging stations.

Maintenance. The ability to add, delete, update, or inquire a database.

Marks/Emblems. Interchangeable reference to the various Games and country logos used in the marketing of Olympic sponsorship and events. Graphic element used to represent an Olympic organization or a specific set of Games to which IBM has licensing rights through a negotiated agreement.

NAOC. The Nagano Olympic Committee. Responsible for staging the Olympic Winter Games in Nagano, Japan in 1998.

National Governing Body. Depending on the country, the National Governing Body of each Olympic sport maintains authority over the competition of that sport as it leads to participation in the Olympic Games.

National Olympic Committee. Just as the USA has the USOC, so Japan has the JOC, Australia the AOC and so on. Each of these entities is responsible for fielding an Olympic Team and overseeing the marketing of its marks and licenses in their country.

Negative List. A method and set of criteria used to determine whether an Olympic badge-wearer should be granted access to or excluded from an Olympic venue: the badge must contain the appropriate access privilege; the badge must not be on the list of badges identified by Accreditation as lost, stolen, or canceled; the photo on the badge must be visually verified.

Olympic Family. Athletes, Judges, Foreign nationals.

Olympic Symbol/Mark. The five Olympic Rings appearing as a single logo or unit.

Operations personnel. Refers to personnel at ACOG that were sent to the Accreditation Subsystem via the Games Staffing Subsystem. This included volunteers, ACOG paid staff, contractors, and some vendors.

Organization. Group to which a participant belongs for the purpose of the Games.

Organizing Committee of the Olympic Games. The organization that wins the IOC bid and produces the Games within a country (Atlanta 1996 = ACOG, Nagano 1998 = NAOC, Sydney 2000 = SOCOG, Salt Lake City 2002 = SLOOC).

Paid staff. Personnel that were on the ACOG payroll, loaned executives, and Value in Kind (VIK) personnel. During the Games, these individuals wore Olympic uniforms.

Palm geometry. Is a biometric technique used with a percentage of the accredited group, during the accreditation process. The coded biometric template will be stored in the individual′s registration record for high security area access control purposes.

Palm-geometry reader. Is an I/O device used during the accreditation process and by the Access Control Subsystem to read an individual′s hand characteristics and produce a biometric code to be stored or verified.

Pictogram. A graphic description of an access privilege assigned by Accreditation and displayed on the Olympic ID badge.

Position. This is defined by venue, functions, and job category.

Positive List. A method and set of criteria used to determine whether an Olympic badge-wearer should be granted access to or excluded from an Olympic venue: the badge ID must be on the list of badges identified by Accreditation as having access to this location; the badge must not be on the list of badges identified by Accreditation as lost, stolen, or canceled; the photo on the badge must be visually verified.

Pre-assignment. Refers to the procedure of assigning an individual to a specific job category when his or her profile (skills, languages, geography, and so on) matched the job category requirements.

Premiums. Items of merchandise that bear Olympic marks and IBM trademarks.

Privilege. A right granted by Olympic Accreditation to persons who have a function to perform within the Olympics that gives them access to Olympic facilities.

Product. The specific IBM goods and services outlined in the Product Category found in the agreements. These are the only IBM products that are allowed to be affiliated with Olympic marks and themes.

Proprietary Notices. Trademarks and copyright information that must accompany any use of Olympic marks.

Proximity Badge. Is an access control/identification badge that utilizes radio frequency (RF) circuits in microchip form. The encoded chips are imbedded into a badge and transmit encoded information when activated.

Quadrennium. The four years during which a specific set of Winter and Summer Games occur. Lillehammer ′94 and Atlanta ′96 are part of the same quadrennium, as are Nagano ′98 and Sydney 2000.

Register. Record participant details.

Registration process. Is the first process involving the Accreditation Subsystem.

Registration record. Is a DB2-based record within the master Accreditation database which contains all of the accreditation and access control information for an individual.

Remote site. Physical place where the Games Staffing department performed the necessary processing for the Staff and potential staff living outside the Atlanta metropolitan area, for activities such as interviews, orientation, uniform delivery, and the like. Remote sites in this document refer to Savannah, Ocoe, Columbus, Athens, and the football preliminary sites.

Resolution station. Is a PS/2 client workstation at the Accreditation centers dedicated to handling registration and accreditation problems.

Scanning. Refers to a technology that provided for scanning of information contained in a document directly into a database.

SOCOG. The Sydney Organizing Committee for the Olympic Games. Responsible for staging the Olympic Summer Games in Sydney, Australia in 2000.

Sports. The competitions to take place at the Olympic Games.

Stand-alone logo configuration. Combination of IBM eight-bar logo with any available Olympic mark, and their designations and proprietary notices as separate graphic elements with an established proportional relationship.

Supply. Potential staff; refers to the pool of persons in the system.

The Olympic Partners. The IOC′s sponsorship package, available to sponsors for each quadrennium. It is a four-year agreement for the worldwide rights to the IOC mark, Games mark(s) and NOC emblems.

USOC. The United States Olympic Committee is responsible for fielding the U.S. Olympic team and overseeing the marketing of its marks and licenses in the United States.

Vendors. Companies that have been contracted to provide a service to ACOG.

Venue. Olympic sites.

Venue cluster. A logical or convenient grouping of Olympic venues or buildings.

VIK. Value In Kind. Refers to IBM personnel, representing a broad range of specialized skills, who are provided free to ACOG to develop, implement, manage and run the IT applications and systems at the 1996 Olympic Summer Games.

Volunteers. Person working free of pay for ACOG.

Worldwide Sports Office. An IBM group at Corporate Headquarters that manages all of IBM′s sports sponsorships, including the Olympic Games.

Zone. A restricted area, primarily within competition venues. There are ten zones: Zones 0 through 7 apply to internal areas within competition venues, Zones V and R apply to the Olympic Village, with Zone V representing the International Zone, and Zone R representing the Residential Zone.

List of Abbreviations

ACOG	Atlanta Committee for the Olympic Games
ACOP	Atlanta Centennial Olympic Properties
AOB	Atlanta Olympic Broadcasting
APOC	Atlanta Paralympic Organizing Committee
APPC	Application Program to Program Communication
CICS	Customer Information Control System
COP	Centennial Olympic Games Partner
DB2	Data Base 2
DDCS	Distributed Data Communication System
DDE	Dynamic Data Exchange
DRDA	Data Relational Database Architecture
DUI/RGB	Refers to PS/2 port for camera connection
ESA	Enterprise System Advanced
FBI	Federal Bureau of Investigation
GBI	Georgia Bureau of Investigation
GSPC	Games Staffing Processing Center
GUI	Graphical User Interface
HPQS	High Performance Query System
IBC	International Broadcast Center
IBM	International Business Machines Corporation
ICR	Intelligent Character Recognition
IF	International Federation
IMS	Information Management System
IOC	International Olympic Committee
ITSO	International Technical Support Organization
IVR	Interactive Voice Response
LAN	Local Area Network
MPC	Main Press Center
NAOC	Nagano Olympic Committee
NGB	National Governing Body
NOC	National Olympic Committee
OCOG	Organizing Committee of the Olympic Games
OCR	Optical Character Recognition
OLTP	On Line Transaction Processing
PROFS	Professional Office System
QMF	Query Management Facility
RACF	Resource Access Control Facility
RF	Radio Frequency
SOCOG	Sydney Organizing Committee for the Olympic Games
TCP/IP	Transmission Control Protocol / Internet Protocol
TOP	The Olympic Partners
VIK	Value in Kind
WAN	Wide Area Network
WNPA	World News Press Agency
WOM	Web Object Manager
WOTT	World Olympic Transfer Team
WWSO	Worldwide Sports Office
4GL	4th Generation Language

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W

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SG24-4279-00

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Profile	EDFPRF40
Service Level	0022
SCRIPT/VS Release	4.0.0
Date	97.03.13
Time	12:28:37
Device	3820A
Number of Passes	4
Index	YES
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Formatting values used:

Annotation	NO
Cross reference listing	YES
Cross reference head prefix only	NO
Dialog	LABEL
Duplex	YES
DVCF conditions file	(none)
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Folio-by-chapter	NO
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