

IBM NetVista Thin Clients



Using DHCP
An Overview

July 2000



Objectives



- **How DHCP works in the context of the NetVista Thin Clients**
- **How DHCP data is obtained by NS Boot**
- **How DHCP data is processed by the DHCP client**
- **How DHCP data is passed to the operating system by NS Boot**
- **Differences with the WBT**



Notes



Objective:

The objective of this short presentation is to provide some understanding of how the configuration parameters supplied via either the NS BOOT Setup menu or DHCP are used and transmitted to the underlying operating system.

There have been changes lately to how DHCP offers are accepted or rejected, and so this presentation attempts to provide some understanding of the underlying mechanism or logic used to process these configuration parameters.

This information is based mainly on our own experience and tests and does not necessarily represent the whole truth and nothing but the truth, but it should be close.



What Network Data is Required?



- **Basic IP Data (for PCs and Thin Clients)**
 - IP Address
 - Network Mask
 - Gateway (Router)
 - Domain Name Server and/or WINS Server(Optional)

- **Additional Data for Thin Clients**
 - Boot Server IP Address
 - Boot Server Path and filename for the kernel
 - Boot Server Protocol
 - Configuration Server IP Address
 - Configuration Server path
 - Configuration Server protocol
 - Authentication Server Protocol/IP Address



Notes



What network data does a Thin Client require in order to operate?

To begin with, all workstations, whether they are fat PCs or thin clients, require the basic data such as an IP address, network mask, and gateway.

DNS and/or WINS information is often optional, dependent on the applications being used on the workstation, and we will discuss this later.

A NetVista Thin Client **booting from the network** requires all of the additional data. However, in many cases, defaults are assumed (by NS Boot) for data that is not specified.

- For example, if the configuration server IP address is not supplied, it defaults to the boot server IP address

A NetVista Thin Client **booting from flash** requires all of the additional data. However, in many cases, NS Boot can use pre-configured values applicable to flash boot if these values are not all supplied.

A NetVista Windows-based Terminal (WBT) only requires basic IP data.



How is Network Data Supplied?



- **Network Data is supplied to/obtained by the NS Boot component on the thin client**
- **NS Boot is then responsible for passing this data (and possibly default values) to the operating system after the boot sequence is complete**
- **Network Data may be supplied to NS Boot in two ways:**
 - Using NVRAM
 - ▶ Basic and additional data is entered by an administrator using the NS Boot Setup menus at one time
 - ▶ Some values can be left empty and NS BOOT then uses a default value
 - Using BOOTP/DHCP
 - ▶ The same basic and additional data is entered on a DHCP server
 - ▶ NS Boot obtains the data from the DHCP server when it boots
 - ▶ **If DHCP was enabled via the simple configuration menu**, NS Boot accepts basic data from DHCP and supplements this basic data with additional data values required for booting from flash



Notes



Network Data is either supplied to the thin client by an administrator entering the data into the NS Boot setup menus in NVRAM and booting the unit using the NVRAM data, or by configuring the unit to boot from DHCP in which case the NS Boot component obtains the data from a DHCP server.

In both cases, the NS Boot component is then responsible for passing this data (and possibly default values) to the operating system after the boot sequence is complete.

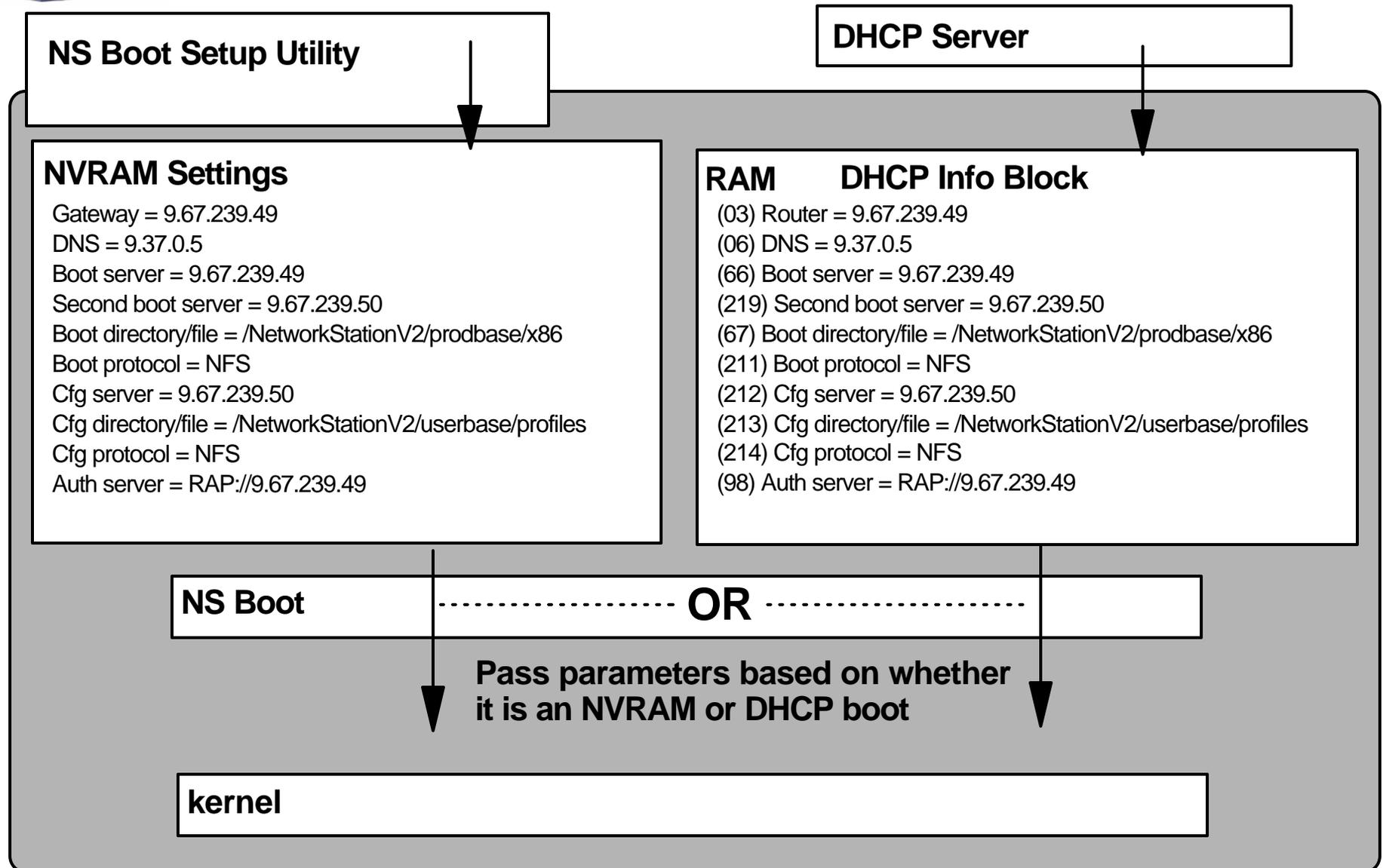
In the case of NVRAM, if all the values are not present, NS BOOT may use default values before passing the data to the operating system.

In the case of DHCP, the process is the same as NVRAM, except that **in the case where DHCP was enabled via the simple configuration menu**, NS Boot can accept basic data from the DHCP server and supplements this basic data with additional data values required for booting from flash. Note that this behavior is different than if DHCP was enabled via the Advanced configuration menu, in which case a basic DHCP offer would not be accepted.

Note: The Simple Configuration menu on NS BOOT was introduced sometime in early 2000, with the availability of the NetVista Express offering.



NVRAM or DHCP Settings?





Notes



Here is an illustration of what we have been discussing so far. Suppose that the same IP data has been entered both in NVRAM and in a DHCP server.

On the left is the data as it was entered in NVRAM, and on the right is the data as it is received from a DHCP server if the unit is booted using DHCP.

Today (June 2000), these values are passed to the operating system (kernel) by the NS Boot code when it turns control over to the operating system, based on the method that was used for the boot. If the boot was a DHCP boot, it passes along only the DHCP information; if the boot was an NVRAM boot, then only the NVRAM information is passed to the kernel.

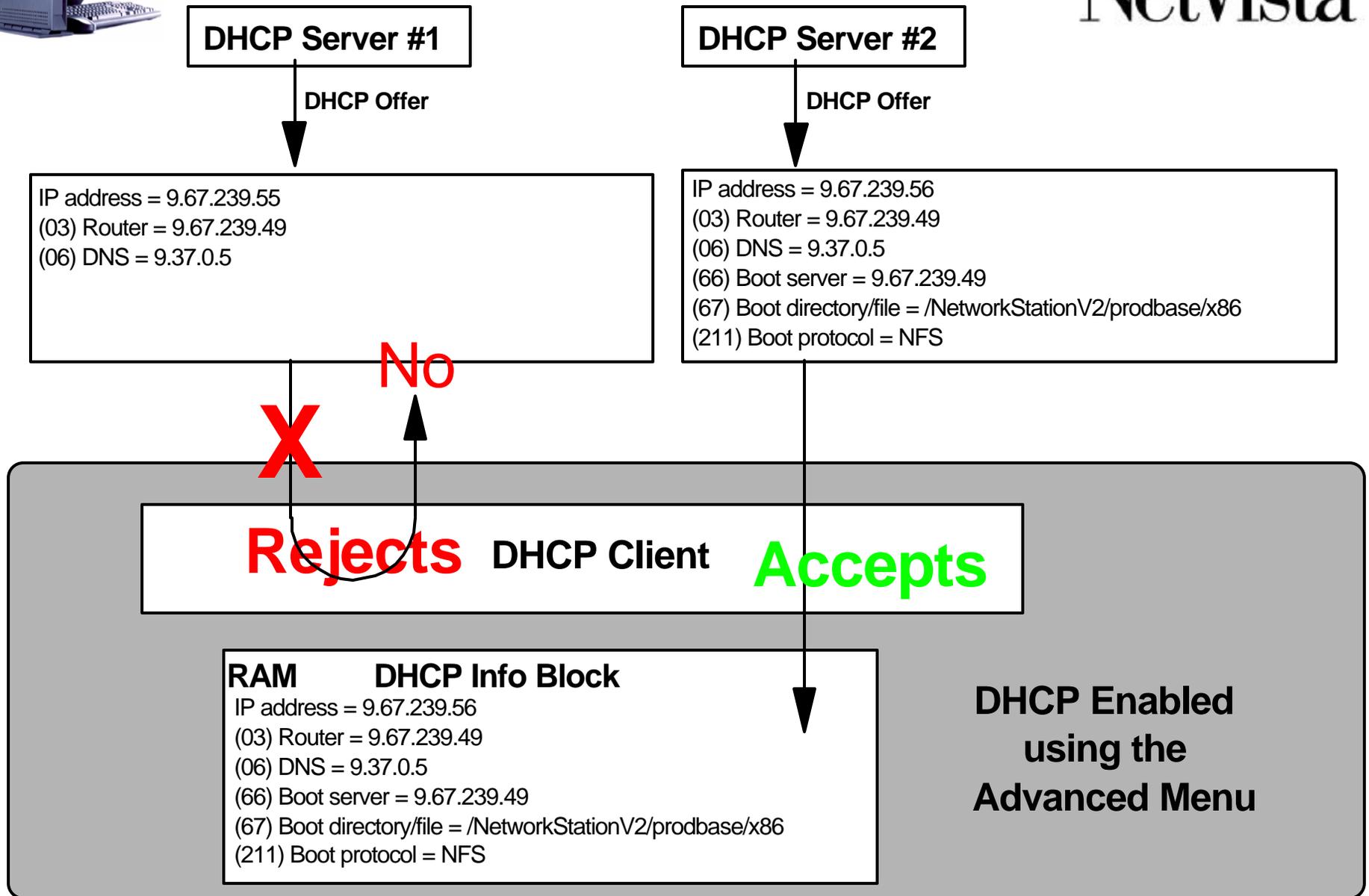
If settings are missing from one set of parameters, NS Boot may supply a default value instead but values from one set of parameters (say DHCP) are not replaced by settings from the other set of parameters (NVRAM).

However, in the next few PTFs, there will be a way to supplement, and even override, one set of parameters with the other.

Now let us examine more closely what happens when parameters are supplied via DHCP.



DHCP Offer - Advanced Menu





Notes



As a reminder, when using DHCP, a DHCP client in NS BOOT broadcasts a request on the network asking for a DHCP server to respond. One (or more) DHCP server may respond with an offer. The DHCP client in NS BOOT is programmed to accept or reject offers based on whether they are acceptable or not.

Why would an offer not be acceptable? As discussed earlier, a thin client booting from the network must have additional data in addition to basic data, so an offer that contained only basic data (OK for a PC) would not be acceptable to a thin client because it would not contain the address of a boot server.

To illustrate this, here is a situation where a station receives two DHCP offers:

- The DHCP server on the left (#1) sends an offer that contains only the basic options, as would normally be sent to a PC
- The DHCP server on the right (#2) sends an offer that also contains the options required by a thin client to boot from a boot server.

In this example, it is important to note that DHCP was enabled through the Advanced configuration menu of NS BOOT. This is important because it affects the behavior of the DHCP client and the way that it processes the offer it receives from a DHCP server.

Because DHCP was enabled via the Advanced menu, the DHCP client in NS boot rejects the offer on the left because it does not contain the options required by a thin client. The offer on the right is accepted because it does contain all the required options.

Note: If there are more than one acceptable offer similar to the one on the right, it accepts the first one that was received.



Advanced and Simple Menus



MENU03

IBM NetVista Thin Client
Advanced Configuration

Change language setting
Change keyboard setting
Change display settings

Configure network settings

Change boot file server sett
Change workstation configur
Change authentication serv

Display hardware information
Display boot log

Change verbose diagnostic sett

Simple configuration menu

Service Aids

Use cursor

Enter=Continue F10=Reboot thin cli

MENU04

IBM NetVista Thin Client
Simple configuration menu

Change keyboard setting
Change display settings

Configure IP settings

Display hardware information
Display boot log

Use cursor key to select task.

Enter=Continue F5=Advanced configuration F10=Reboot thin client



Notes



This chart illustrates the differences between the simple and advanced configuration menus in NS BOOT Setup.

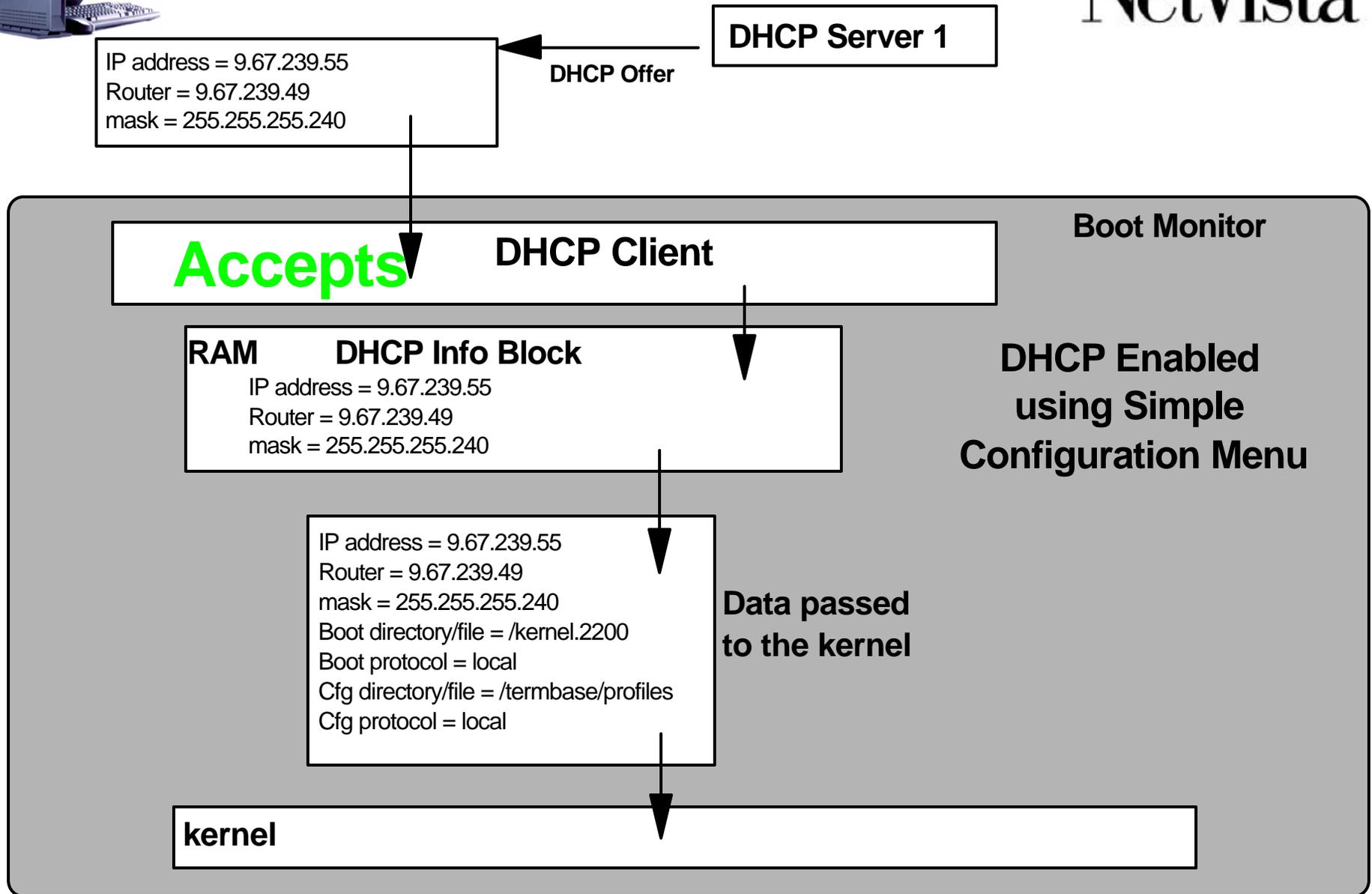
In the Advanced Configuration menu, DHCP is enabled on the Configure Network Settings panel.

In the Simple Configuration Menu, DHCP is enabled in the Configure IP settings panel.

Notice that on the Advanced Configuration Menu, a selection takes you to the simple menu, where PF5 takes you back to the Advanced menu.



DHCP Offer - Simple Menu





Notes



In this example, the change we made is that we enabled DHCP via the Simple Configuration menu in NS Boot instead of the Advanced Configuration menu.

This causes the DHCP client to behave differently and to consider DHCP offers that only contain the basic options as being acceptable offers. In the diagram, we have only one DHCP server and it only sends offers that contain basic data.

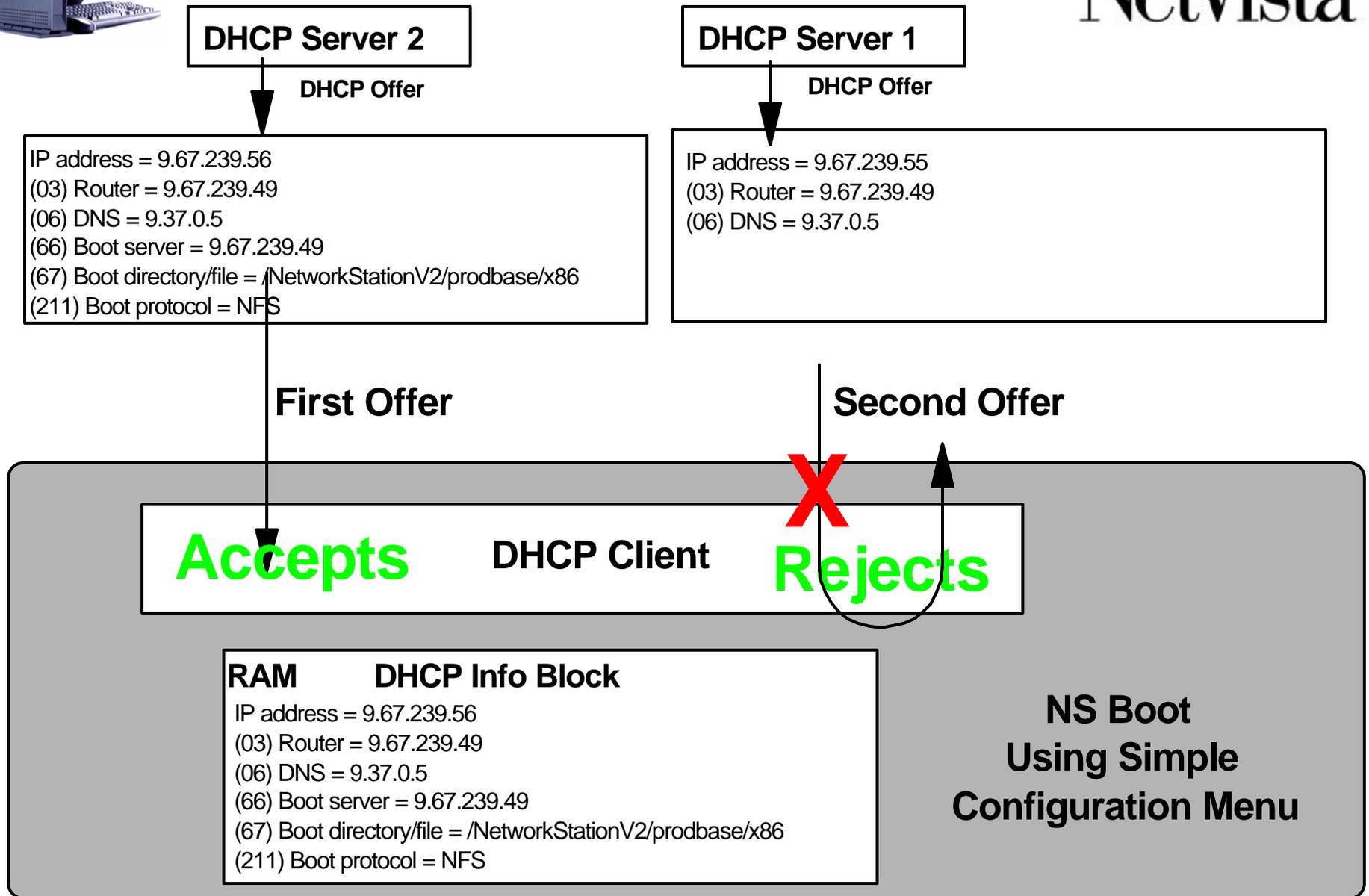
When the DHCP client accepts the offer, it assumes that this is for a unit booting from flash (as does the Express unit normally) and supplements the basic data received from the DHCP server with the data required to boot from flash.

As illustrated here in a simplified fashion, the data that is passed to the operating system contains a boot server directory/filename (option 67) as /kernel.2200 and a configuration server path (213) is /termbase/profiles and the protocol for the boot and cfg server is local, indicating flash.

With this feature of the NS BOOT DHCP client, thin clients such as the N2200e Express can be on the same network as PCs and use the same DHCP server as PCs to obtain their basic IP data, and still be able to boot from flash.



Multiple DHCP Offers





Notes



What about the case where DHCP offers are received from more than one DHCP server?

- The first action is for the DHCP client to determine whether the offer is valid or not? To be valid, an offer must have the basic options if DHCP was enabled via the simple menu and it must have the additional options if it was enabled via the Advanced menu.
- Once all the valid offers are retained, if there is more than one acceptable offer, the first one received is usually the one that is selected and accepted, but that might not always be the case. **Note:** We have not been able to determine the exact logic used by the DHCP client when there are multiple valid offers. It might be that the number of options also has an influence on which offer is accepted.

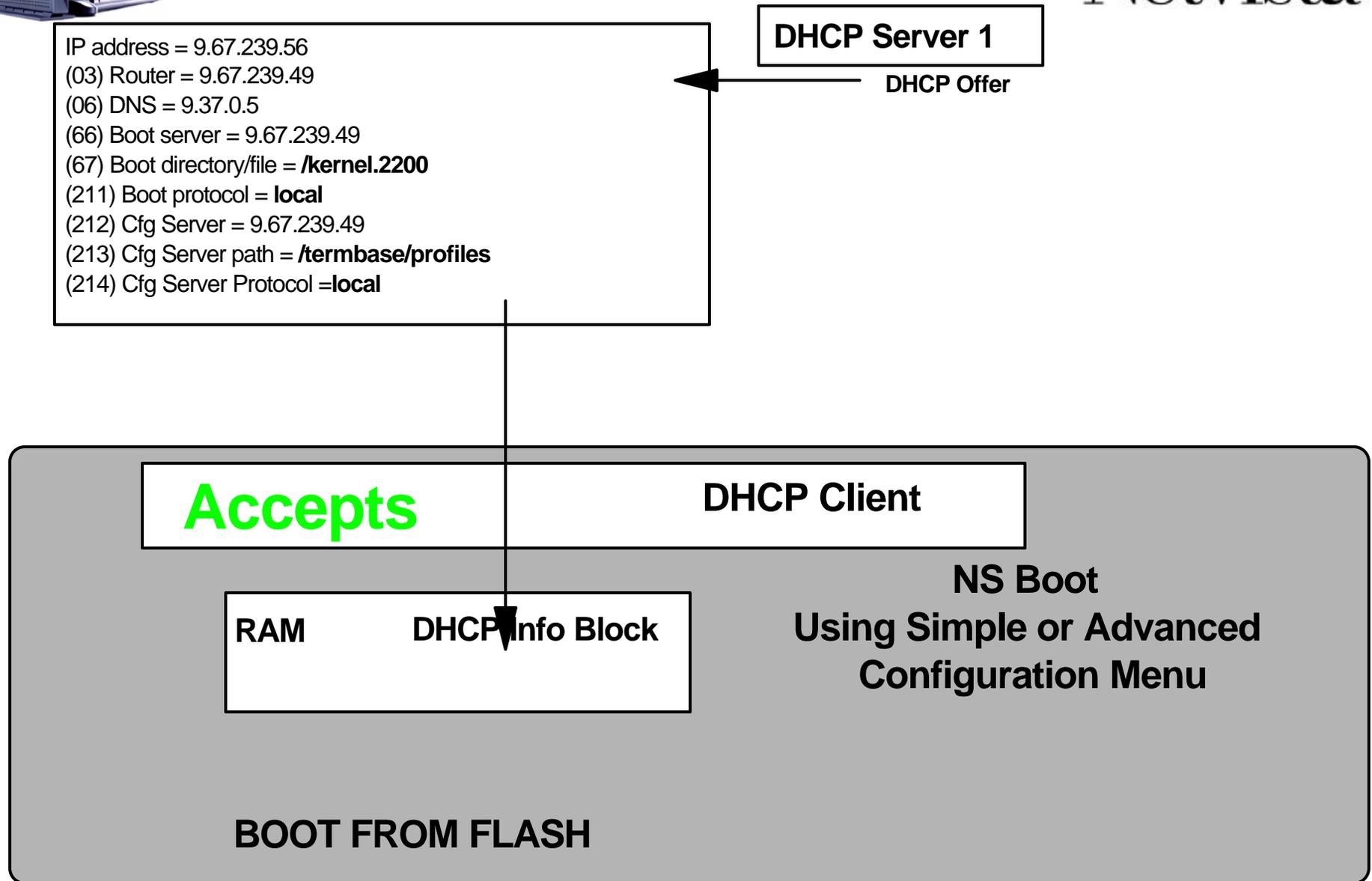
In the example illustrated here, two offers are received and they are both valid.

The offer from DHCP server # 1 is valid because the simple menu was used to enable DHCP and therefore basic options are valid, and the offer from DHCP server #2 is also valid because it has all the options.

Since the offer on the left (DHCP Server #2) was received first, it is that offer which is accepted and the other one is rejected (even though it is valid).



DHCP Offer - Boot from Flash





Notes



In this example, only one offer is received, and it contains the other options required by a thin client, and these options are set with values that will cause the unit to boot from flash.

In this case, it does not matter whether DHCP was enabled using the simple or advanced configuration menu. What matters is that the options present (especially 211 and 214) indicate that the unit is to boot from flash (and not from the network), and so it does.



What About the N2200w (WBT)?



- **NS BOOT is NOT used (operationally) by the WBT, except:**
 - To reflash the Boot PROM (Change the level of the NS BOOT code)
 - To do Problem Determination using the Service Aids menu
 - (To reflash the flash card)
- **IP Network Data (including DNS and/or WINS) is configured:**
 - Manually via WBT's Setup Wizard
 - or Manually via Terminal Properties/Network Tab
 - or Supplied via DHCP
- **client is the WBT's DHCP client (not the NS BOOT DHCP client)**
 - DHCP frames are handled by the WBT code, not the NS BOOT code and the behavior is therefore different than on an Express or full TCM V2R1 station



Notes



What about the behavior though of the NetVista Windows-based Terminal?

It is important to note an important distinction that on the NetVista Windows-based terminal (N2200w), the NS BOOT code is not used by the WBT except when there is a need to reflash the boot PROM to replace the NS BOOT code on the PROM or possibly to use the Service Aid menu to do some problem determination (although one should be careful to use it in that way since it is not the WBT code which is in control at the time NS BOOT is running and some functions may be different).

Note therefore that all IP Network Data (including DNS and/or WINS) is configured either manually via the WBT's own Setup Wizard when it initially comes up for the first time, or manually via the Terminal Properties/Network Tab at any time, or supplied via DHCP at boot time.

The DHCP client on the WBT is different from the NS BOOT DHCP client and is the only DHCP client used on the WBT. This DHCP client accepts basic DHCP offers just like regular PCs because it does not require any of the thin client options (66, 67, 211, etc.).

WBT - IP Network Data



WBT Setup Wizard

IP Address

Some or all of the IP information required for this terminal could not be automatically obtained. You may choose to use the automatically gathered information by clicking on the Yes button. We recommend that you enter IPs statically for best results

Yes, use the Ip information supplied by DHCP

No, I will enter static IP information

WBT Setup Wizard

Fill in the following optional information to configure the terminal's name resolution.

Enable DNS

Default Domain Name:

Primary Server IP: . . .

Secondary Server IP: . . .

Enable WINS

Primary Server IP: . . .

Secondary Server IP: . . .

< Back Next >

WBT Setup Wizard

Specify an IP Address

You must specify the following network information. If you do not know this information, ask your network administrator.

IP Address: 0 . 0 . 0 . 0

Subnet Mask: 0 . 0 . 0 . 0

Gateway: 0 . 0 . 0 . 0

Terminal Name IBMWBT

< Back Next >



Notes



The panel in the top left hand corner here is the WBT Setup Wizard panel where the user chooses to use DHCP or not.

If DHCP is chosen, none of the two other panels shown here are used.

If static IP information is chosen instead of DHCP, then the two other panels allow entry of the required data.

Notice that both DNS and/or WINS servers can be specified.