
Configuration of the DHCP server

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Overview

This chapter provides general guidelines to configure a host with a Dynamic Host Configuration Protocol (DHCP) server to support the i2004 Internet Telephone.

Note 1: This chapter assumes that you are familiar with RFC 2131, RFC 1533, and the Help manual for the DHCP server on your host. A convenient source for RFCs is <http://www.ietf.org/>

Note 2: For a general overview of DHCP server technology, refer to Appendix F: “DHCP Supplementary Information” on page 275.

i2004 Internet Telephone

The i2004 Internet Telephone is an IP Telephone, which functions as a terminal to the Meridian 1. It encodes voice as binary data and packetizes the data to transmit it over an IP Network to the ITG Line 2.0 card or to another i2004 Internet Telephone.

The Nortel Networks i2004 Internet Telephone can act as a DHCP client in one of two modes:

- Partial DHCP mode
- Full DHCP mode

Partial DHCP mode

When the i2004 Internet Telephone is configured to operate in partial DHCP mode, the DHCP server needs no special configuration to support i2004 Internet Telephones. What it gets from the DHCP server is the following network configuration parameters:

- IP address configuration for the i2004 Internet Telephone set
- Subnet mask for the i2004 Internet Telephone IP address
- Default gateway for the i2004 Internet Telephone LAN segment

Full DHCP mode

In full DHCP mode, the DHCP server requires special configuration. The i2004 Internet Telephone obtains network configuration parameters and also connect server configuration parameters from specially configured DHCP server.

The following configuration parameters are provided for the primary and secondary connect servers:

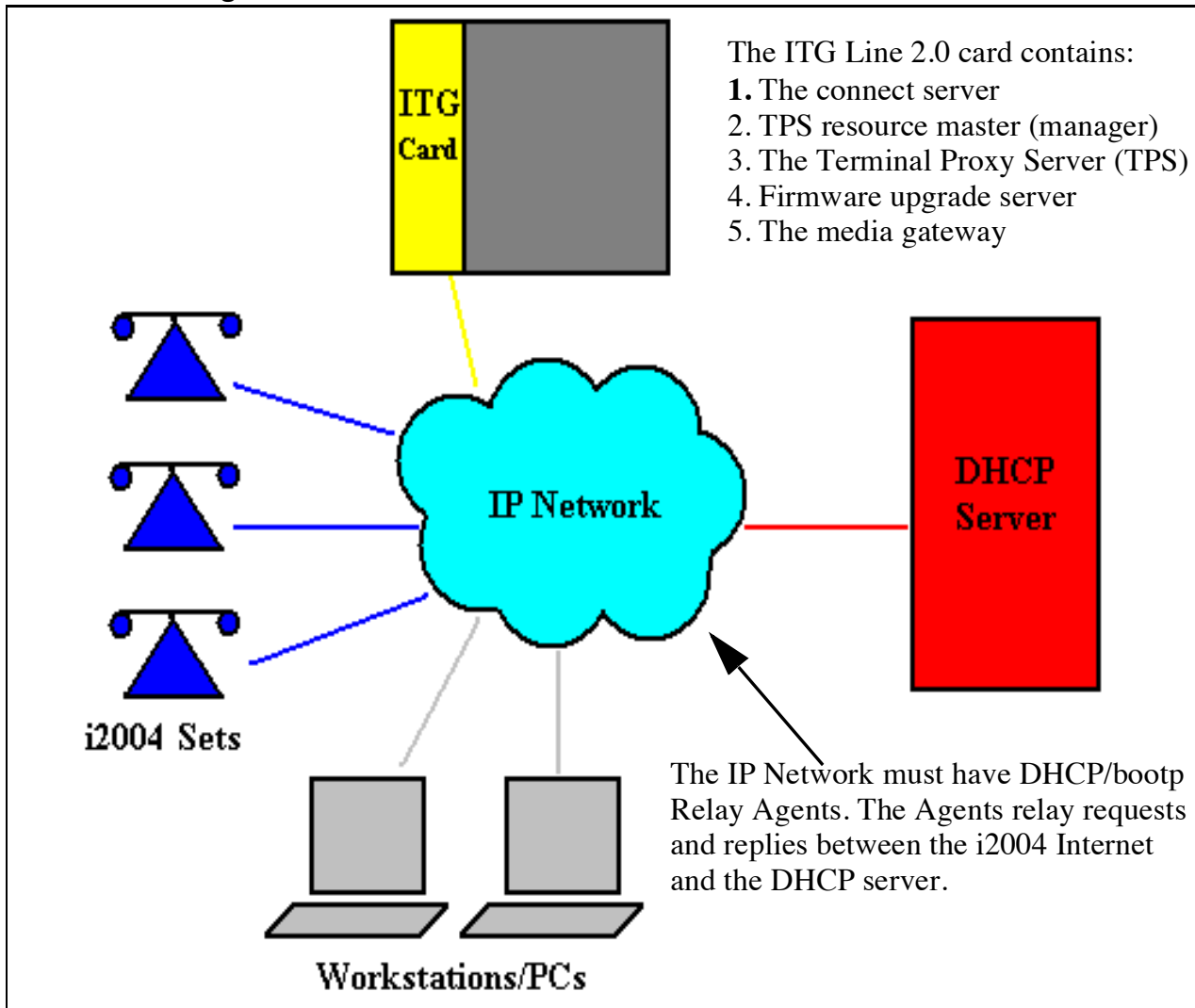
- Connect server IP address. For ITG Line 2.0, the connect server IP address is the ITG line node 2.0 IP address.
- A port number of 4100.
- A command value of one, that identifies the request to the connect server as originating from an i2004 Internet Telephone.
- A retry count typically equal to 10.

All the configuration parameters for the i2004 Internet telephones can be entered manually. However, this method is tedious since each i2004 Internet Telephone requires the network configuration parameters, connect server parameters, as well as ITG 2.0 node ID and Virtual TN. If there are many i2004 Internet Telephones to configure, manual configuration is time consuming and error prone. Using Full or Partial DHCP to configure the i2004 Internet Telephones automatically is more efficient and flexible; ensuring that current up-to-date information is used.

Note 1: The ITG Line 2.0 node ID and virtual TN must always be configured manually even in Full DHCP mode.

Note 2: In Partial DHCP mode the connect server parameters must be entered manually as well as the node ID and VTN.

Figure 9
DHCP block diagram



ITG Line 2.0 card

An ITG Line 2.0 card is an interface between the i2004 Internet Telephone and the Meridian 1 PBX. It provides interfaces to:

- the terminal proxy server for signalling between the i2004 and Meridian 1 virtual TN
- the media gateway channel for voice media conversion between an IP packet-switched network, and the circuit-switched private and public telephone network.

During start-up, the i2004 Internet Telephone registers itself with the terminal proxy server on the ITG Line 2.0 card and also the Virtual TN with configuration parameters on the Meridian 1. The media gateway channel provides an interface between the packet switched IP network and the circuit switched network of the Meridian 1.

Configuring DHCP server to support Full DHCP mode

The DHCP capability feature of the i2004 Internet Telephone, enables the set to get network configuration parameters and specific connect server parameters. This section describes the i2004 Internet Telephone's unique class identifier and requested network configuration and connect server parameters for automatic configuration.

i2004 Internet Telephone class identifier

The i2004 Internet Telephone is designed with a unique class identifier that the DHCP server can use to identify the i2004 Internet Telephone. All i2004 Internet Telephones use the same text string, "Nortel-i2004-A", to identify itself. The ASCII string is sent inside the Class Identifier option of the i2004 Internet Telephone's DHCP messages.

The DHCP server also includes this string in its responses to the i2004 Internet Telephone DHCP client. This makes it possible to notify the i2004 Internet Telephone that the server is i2004 Internet Telephone-aware, and that it is safe to accept the server's offer. This string appears in the beginning of the list of the specific ITG Line 2.0 card information that the i2004 Internet Telephone DHCP client requests.

When the DHCP server has been configured to recognize the i2004 Internet telephone as a special class, the DHCP server can treat the i2004 Internet Telephone differently than other DHCP clients. DHCP host configuration parameters can then be grouped by class and only information relevant to the i2004 DHCP client is supplied. In particular, the i2004 Internet Telephone connect server parameters.

Also, the administrator can design the network according to the client's class, if necessary, making maintenance easier. Depending on the capabilities and limitations of the DHCP server used and the design of the network, some of these advanced functions may not be available.

Requested Network Configuration Parameters

Nortel's i2004 Internet Telephone, using Full DHCP mode, has the ability to be configured automatically by an i2004 Internet Telephone-aware DHCP server by requesting a list of connect server configuration parameters. The i2004 Internet Telephone uses DHCP, an industry standard protocol, to request and receive the information.

i2004 Internet telephones operating in Partial DHCP mode can receive an IP address from *any* DHCP server. In Full DHCP mode, the server must be configured to respond to the request for the vendor specific encapsulated options.

Table 20 lists the network configuration parameters requested by the i2004 Internet Telephone in the Parameter Request List option (Option Code 55) in the DHCPDISCOVER and DHCPREQUEST messages. The DHCPOFFER and the DHCPACK reply messages from the DHCP server must contain the options in Table 20.

Table 20
i2004 Internet Telephone Network Configuration Requirements

Parameter Request (Option Code 55)	DHCP Option Code
Subnet mask - the client IP subnet mask.	1
Router/Gateway(s) - the IP address of the client's default Gateway.	3
Lease Time - implementation varies according to DHCP server.	51
Renewal time - implementation varies according to DHCP server.	58
Rebinding interval - implementation varies according to DHCP server.	59
ITG Line 2.0 Site Specific or Vendor Specific encapsulated/site options	43, 128, 144, 157, 191, 251

The first five parameters in Table 20 are standard DHCP options and have predefined option codes. The last parameter is for ITG Line 2.0 card information, which does not have a standard DHCP option. The server administrator must define a vendor encapsulated and/or site specific option to transport this information to the i2004 Internet Telephone.

This non-standard information includes the unique string indentifying the i2004 Internet telephone and the connect server parameters for the primary and secondary servers. The i2004 Internet Telephone must receive the connect server parameters in order to connect to the ITG Line 2.0 node.

The administrator must use one of the five site specific or vendor encapsulated option codes to implement the ITG Line 2.0 card information. Then, this user-defined option can be sent as is, or encapsulated in a Vendor Encapsulated option with option code 43. Which method to use depends on the DHCP server's capabilities and what options are already in use by other vendors.

The i2004 Internet Telephone rejects any DHCP Offers/Acks that does not contain:

- A Router option. The i2004 requires a default gateway (router)
- A Subnet Mask option
- Either
 - a Vendor Specific option < see Note 1: >
 - a Site Specific option < see Note 2: >

Note 1: The Vendor Specific option is 43. Windows NT DHCP Server (up to SR4) supports only 16 octets of data for the vendor-specific option, which is insufficient to support the minimum length of the i2004-specific string. If you use a Windows NT DHCP Server, you must select the Site Specific option to accommodate the i2004-specific string.

Note 2: The Site Specific options are all DHCP options between 128 (0x80) and 254 (0xFE). These options are reserved for Site Specific use by the DHCP RFCs.

Format for Nortel Networks i2004 Internet Telephone DHCP Class Identifier Option

All i2004 Internet Telephones fill in the Class ID option of the DHCP Discovery and Request messages with the null-terminated, ASCII-encoded string Nortel-i2004-A, where A identifies the version number of the i2004 Internet Telephone.

The Class Identifier Nortel-i2004-A must be unique in the DHCP server domain.

Format for Nortel Networks i2004 Internet Telephone DHCP Encapsulated Vendor Specific Option

The following definition describes the Nortel i2004 specific, Encapsulated Vendor Specific option. This option must be encapsulated in a DHCP Vendor Specific Option (Refer to RFC 1533) and returned by the DHCP server as part of each DHCPOFFER and DHCPACK message for the i2004 to accept these messages as valid. The i2004 will extract the relevant information out of this option and use it to configure the connect server IP address, the port number (4100), a command value of one, and retry count for the primary and secondary connect server.

Note that either this encapsulated vendor specific option or a similarly encoded site-specific option must be sent (see below), that is, configure the DHCP server to send one or the other - not both. The choice of using either Vendor Specific or Site Specific option is provided to allow WinNT DHCP servers to be used with the i2004 Internet Telephone (WinNT servers do not properly implement the Vendor Specific Option, and as a result, WinNT implementations must use the Site Specific version).

The format of the Encapsulated Vendor Specific option is Type, Length, and Data as shown below.

Type (1 octet):

There are five choices:

0x80 (Site Specific option 128)

0x90 (Site Specific option 144)

0x9d (Site Specific option 157)

0xbf (Site Specific option 191)

0xfb (Site Specific option 251)

Providing a choice of five types allows the i2004 to work in environments where the initial choice may already be in use by a different vendor. Pick only one value for TYPE byte.

Length (1 octet)

The Length value is variable. Count only the number of octets in the data field (see below).

Data field (variable number of octets)

The data field contains an ASCII-encoded character string that can be optionally null-terminated.

"Nortel-i2004-A,iii.jjj.kkk.lll:ppppp,aaa,rrr;iii.jjj.kkk.lll:pppp,aaa,rrr."

where,

"Nortel-i2004-A" - uniquely identifies that this is the Nortel option and is a response from a server that can provide the correct configuration information to the i2004 Internet Telephone.

Additionally, the "-A" signifies the version of the i2004 Internet Telephone.

ASCII ",", separates fields

ASCII ":" separates the IP address of the bootstrap server node IP from the Transport Layer port number

ASCII ";" separates the Primary from Secondary bootstrap server information. The bootstrap server is the Active Leader of the ITG Line 2.0 node.

ASCII "." signals end of structure

"iii.jjj.kkk.lll:ppppp" - identifies IP address and port number for server (ASCII encoded decimal)

"aaa" - identifies Action for server (ASCII encoded decimal, range 0..255)

"rrr" - identifies retry count for server (ASCII encoded decimal, range 0..255)

This string may be NULL terminated although the NULL is not required for parsing.

Notes:

- 1 "aaa" and "rrr" are ASCII encoded decimal numbers with a range of 0..255. They identify the "Action Code" and "Retry Count", respectively, for the associated TPS server. Internally to i2004 they will be stored as 1 octet (0x00..0xFF). Note that these fields must be no more than 3 digits long.
- 2 First server is always considered "Primary", second server always considered "Secondary".
- 3 If only one server is required, terminate primary TPS sequence immediately with "." instead of ";" for example, "Nortel-i2004-A,iii.jjj.kkk.lll:ppppp,aaa,rrr."
- 4 Valid options are one or two servers (0 or 3 is not allowed). However, it is recommended that the two server option be used. For i2004 Internet Telephone firmware version 3002B00, the valid option is two servers.
Note: If there is only one connect server (i.e. only one ITG 2.0 node is configured), enter the same information for server 1 and server 2.
- 5 Action code values:
 - 0- reserved
 - 1- UNISlim Hello (currently only this type is a valid choice)
 - 2..254 - reserved
 - 255 - reserved
- 6 iii,jjj,kkk,lll are ASCII encoded, decimal numbers representing the IP address of the server. They do not need to be three digits long as the . and : delimiters will guarantee parsing. For example, '001', '01' and '1' would all be parsed correctly and interpreted as value 0x01 internal to the i2004. Note that these fields must be no more than 3 digits long each.
- 7 ppppp is the port number in ASCII encoded decimal. It does not need to be 5 digits long as the : and , delimiters will guarantee parsing. For example, '05001', '5001', '1', '00001' etc. would all be parsed correctly and accepted as correct. The valid range is 0-65535 (stored internally in i2004 as hexadecimal in range 0..0xFFFF). Note that this field must be no more than 5 digits long.

- 8 In all cases, the ASCII encoded numbers are treated as decimal values and all leading zeros are ignored. More specifically, a leading zero does not change the interpretation of the value to be OCTAL encoded. For example, 0021, 021 and 21 are all parsed and interpreted as decimal 21.

Format for Nortel Networks i2004 Internet Telephone DHCP Site Specific Option

The following definition describes the Nortel i2004 specific, Site Specific option. This option uses the "reserved for site specific use" DHCP options (128 to 254 - Refer to RFC 1541 and RFC 1533) and must be returned by the DHCP server as part of each DHCP OFFER and ACK message for the i2004 to accept these messages as valid. The i2004 will pull the relevant information out of this option and use it to configure the IP address etc. for the primary and (optionally) secondary TPS's. Note that either this site specific option must be present OR a similarly encoded vendor-specific option must be sent (as described above), that is, configure the DHCP server to send one or the other - not both. The choice of using either Vendor Specific or Site Specific options was provided to allow WinNT DHCP servers to be used with the i2004 (WinNT servers do not properly implement the Vendor Specific Option and as a result, WinNT implementations must use the Site Specific version).

Format of field is: Type, Length, Data.

Type (1 octet):

5 choices 0x80, 0x90, 0x9d, 0xbf, 0xfb (128, 144, 157, 191, 251).

Providing a choice of five types allows the i2004 to work in environments where the initial choice may already be in use by a different vendor. Pick only one TYPE byte.

Length (1 octet):

variable - depends on message content.

Data (length octets):

- ASCII based

- format

"Nortel-i2004-A,iii.jjj.kkk.lll:ppppp,aaa,rrr;iii.jjj.kkk.lll:pppp,aaa,rrr."

where,

"Nortel-i2004-A" - uniquely identifies this as the Nortel option

Additionally, the "-A" signifies the version. Future enhancements could use "-B" for example.

ASCII "," is used to separate fields

ASCII ";" is used to separate Primary from Secondary server info

ASCII "." is used to signal end of structure

"iii.jjj.kkk.lll:ppppp" - identifies IP:port for server (ASCII encoded decimal)

"aaa" - identifies Action for server (ASCII encoded decimal, range 0-255)

"rrr" - identifies retry count for server (ASCII encoded decimal, range 0-255)

This string may be NULL terminated although the NULL is not required for parsing.

Notes:

- 1 "aaa" and "rrr" are ASCII encoded decimal numbers with a range of 0-255. They identify the "Action Code" and "Retry Count", respectively, for the associated TPS server. Internally to i2004 they will be stored as 1 octet (0x00..0xFF). Note that these fields must be no more than 3 digits long.
- 2 First server is always considered "Primary", second server always considered "Secondary".
- 3 If only one server is required, terminate primary TPS sequence immediately with "." instead of ";" for example
"Nortel-i2004-A,iii.jjj.kkk.lll:ppppp,aaa,rrr."
- 4 Valid options are one or two servers (0 or 3 is not allowed). However, it is recommended that the two server option be used. For i2004 Internet Telephone firmware version 3002B00, the valid option is two servers.

Note: If there is only one connect server (i.e. only one ITG 2.0 node is configured), enter the same information for server 1 and server 2.

5 Action code values:

- 0 - reserved
- 1 - UNISlim Hello (currently only this type is a valid choice)
- 2-254 - reserved
- 255 - reserved

6 *iii,jjj,kkk,lll* are ASCII encoded, decimal numbers representing the IP address of the server. They do not need to be 3 digits long as the . and: delimiters will guarantee parsing. For example, '001', '01' and '1' would all be parsed correctly and interpreted as value 0x01 internal to the i2004. Note that these fields must be no more than 3 digits long each.

7 *ppppp* is the port number in ASCII encoded decimal. It does not need to be 5 digits long as the : and , delimiters will guarantee parsing. For example, '05001', '5001', '1', '00001' etc. would all be parsed correctly and accepted as correct. The valid range is 0-65535 (stored internally in i2004 as hexadecimal in range 0..0xFFFF). Note that this field must be no more than 5 digits long.

8 In all cases, the ASCII encoded numbers are treated as decimal values and all leading zeros are ignored. More specifically, a leading zero does not change the interpretation of the value to be OCTAL encoded. For example, 0021, 021 and 21 are all parsed and interpreted as decimal 21.

----- *End of Notes* -----

