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Link

Lava I/O News

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LAVA

Dynamic Host Configuration Protocol

What is DHCP?

Dynamic Host Configuration Protocol (DHCP) is a means of automatically assigning IP addresses to devices throughout a network, and of re-assigning those addresses as they are no longer needed by the device that used them. It provides an effective alternative to manually assigning IP addresses to every client, server, and printer. Apart from eliminating the manual effort of creating and maintaining a list of IP address assignments for network devices, DHCP also provides a measure of protection against the mistakes that can arise when the process of IP addressing is manual. For example, when two devices are mistakenly given duplicate IP addresses, only one of them—the first to boot—will be able to communicate on the network at any given time. Finally, DHCP makes it unnecessary to manually re-assign IP addresses when a computer is moved from one subnet to another.

How does DHCP work?

DHCP is essentially, as its name suggests, a protocol that enables client stations joining a network to obtain an IP address from a DHCP server. DHCP servers lease IP addresses from a pool of IP addresses they are authorized to dispense (the DHCP server's *scope*), and are themselves configured with static addresses—a DHCP server cannot itself be a client.

DHCP clients do not need to know the IP address of the DHCP server itself to communicate with DHCP servers on their subnet, as DHCP uses UDP network broadcasts to initiate connection between a DHCP client (it could be an Ether-Serial Link) and a DHCP server.

When a DHCP client boots, the following basic steps occur:

1) The DHCP client loads a minimal version of TCP.

2) It then broadcasts an "IP address lease request" packet (a "DHCPDISCOVER" packet). This packet includes the MAC address of the DHCP client, and may contain other configuration information as well. The DHCPDISCOVER packet is sent to a specific TCP port number that is recognized as that used by DHCP servers. The packet causes all DHCP servers receiving it to offer an IP address that the client can use, with a "DHCPOFFER" packet.

3) The DHCP client then selects the first offer it receives and broadcasts another packet (a "DHCPREQUEST" packet) requesting that it can keep the IP address it has on offer. DHCP clients can also arbitrate between offers from numerous DHCP servers in a number of other ways that are outside the scope of this discussion.

4) The DHCP server that offered the selected IP address then starts the client's IP address lease. It also broadcasts an acknowledgement to the client, sending a "DHCPACK" packet. Other DHCP servers with outstanding lease offers for that client will also receiver the acknowledgement packet and withdraw their offers at this point. If the IP address on offer becomes unavailable in the interval between a server's offer of an IP address (marked by the DHCPOFFER packet) and the client's request to accept the offer (marked by the DHCPREQUEST packet), the DHCP server offering the IP address will instead send a negative acknowledgement to the client (a "DHCPNACK" packet). The process of negotiating an IP address must then begin again, with the client issuing a new DHCPDISCOVER packet.

5) When a DHCP client is finished with its IP address, it can release that address to let it be made available again to the pool of IP addresses in the DHCP servers' scope. This is done with a "DHCPRELEASE" packet. Alternatively, the address may be retained and re-established the next time that that device re-joins the network.

By default, each time it boots, a DHCP client will attempt to renew its IP address lease. If the

Ether-Serial Links and DHCP

Lava's Ether-Serial Links can easily be configured to operate under a DHCP address server, simply by checking a configuration checkbox. When this network option is selected, the Ether-Serial Link will no longer operate with a fixed IP address stored in its firmware, but will instead accept its IP address from a DHCP server operating on its network.

This in itself is not sufficient to remove the pain that might arise when DHCP is implemented. Stations that are looking for a port on an Ether-Serial Link will no longer find that port at the expected IP address if DHCP reassigns the IP address of the Ether-Serial Link box on which that port exists. (Remember, each port becomes a TCP socket, with an IP address and port number).

Lava's solution to this difficulty is found in the unique "port binding" feature implemented in its Ether-Serial Links. Stations that wish to use an Ether-Serial Link port will by default look for that port at a "known" IP address. However, other methods of looking for a port can be used, either singly or in combination with IP addressing. As well as using IP addresses, a user can configure their system to look for an Ether-Serial Link port at either the MAC address of the box on which that port is located, or at that device's "name."

Port binding of this type ensures that client systems will be able to find ports, if not at the IP address they look, in at least one of a couple of other ways. Not only does this system give stability to Ether-Serial Link connections when IP addresses are not static, it adds the ability for an administrator to manage access to Ether-Serial Link ports with power and flexibility in other ways as well. For example, an administrator can replace one Ether-Serial Link with another that has the same network name, and clients that have their Ether-Serial Link ports bound to the network name will automatically find the new device and re-establish the connection.

Dynamic Host Configuration Protocol (*continued*)

client cannot communicate with a DHCP server, it will continue to use the IP address it has on lease until that lease expires. Clients also will attempt to renew their leases halfway through the lease period (by default in Windows, after four days).

DHCP across subnets

Imagine a situation with multiple subnets joined by routers, and no DHCP server on the same subnet as a DHCP client needing an IP address. This scenario needs a mechanism for DHCP clients to communicate with the DHCP server so broadcasts with DHCPDISCOVER packets can reach outside the subnet, making direct contact with the DHCP server possible. Three solutions are usual:

1) Routers can be configured with BOOTP support

With this solution, BOOTP (the bootstrap protocol) can enable routers to forward IP address lease requests issued by DHCP clients. DHCP is designed to work with BOOTP conventions. Some additional network traffic will result with this solution, as DHCP communications will be forwarded to other subnets.

2) DHCP servers can be installed on each subnet

This solution may be expensive, particularly if DHCP servers for each subnet are not already available. On the other hand, the drawback of added network traffic discussed above does not exist.

3) A DHCP relay agent can be configured

A DHCP relay agent is essentially a gateway that resides on a DHCP subnet and listens for DHCP lease requests from clients on its subnet. It is configured with the IP address of a DHCP server on a subnet different from the one it resides on, and forwards broadcast lease requests to that DHCP server.

The DHCP server makes its lease offer back to the DHCP relay agent. In turn, the DHCP relay agent broadcasts that lease offer to the subnet, where it can be collected by the DHCP client that initiated the process in the beginning.

Advantages of DHCP relay agents are that they can be inexpensively configured on client computers sitting an a given subnet, yet limit the subnet-to-subnet traffic caused by DHCP communications.

This discussion of DHCP can only touch the surface of the protocol and its operation, but should provide the information necessary to assess the need for DHCP in your networks.

Additional references:

RFC 2131 Dynamic Host Configuration Protocol http://www.ietf.org/rfc/rfc2131.txt

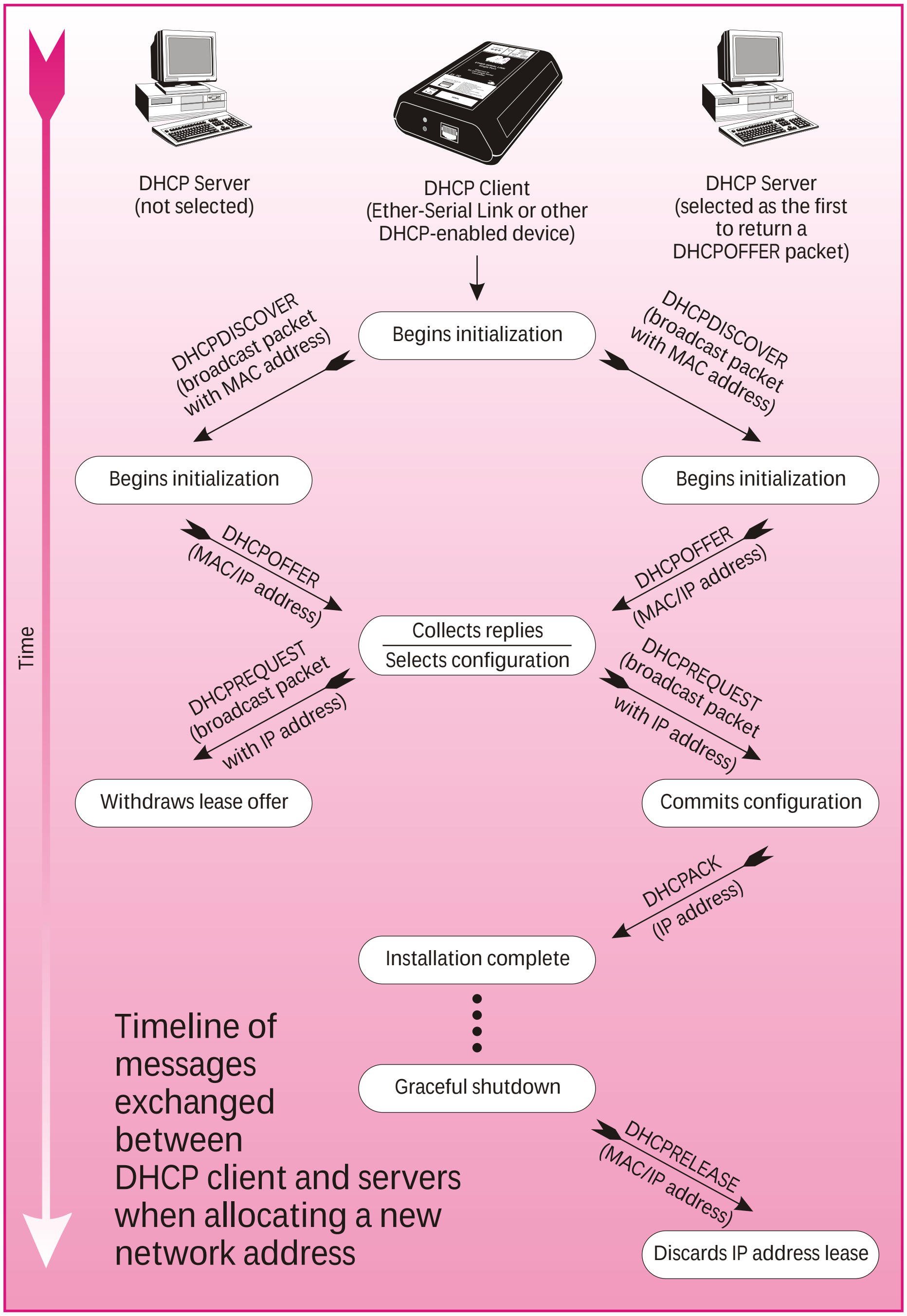
This RFC defines DHCP, as well as giving leads on similar or related dynamic addressing schemes (RARP, TFTP, ICMP, NIP, etc.).

RFC 951 Bootstrap Protocol (BOOTP) http://www.ietf.org/rfc/rfc0951.txt

RFC 1534 Interoperation Between DHCP and BOOTP http://www.ietf.org/rfc/rfc1534.txt

Dynamic Host Configuration (dhc) Official Charter http://www.ietf.org/html.charters/dhc-charter.html

A good source for all things related to DHCP, with useful summaries of current initiatives and listings of related DHCP extensions.



Timeline of messages exchanged between DHCP client and servers when allocating a new network address

How are other manufacturers' Ethernet-to-serial devices handling DHCP?

That depends on the product and manufacturer, but in general DHCP is not well handled by devices competing with the Lava Ether-Serial Link. Some companies' products simply don't handle DHCP at all. Other companies describe DHCP configuration in detail, but only on close inspection do you realize that you are not in fact configuring their *product* to handle DHCP, you are configuring the DHCP server to *not* dynamically configure that product's IP address. In other words, they tell you how to make an exception of their product, to keep its IP address static.

Upcoming Shows

Lava will be attending the following shows in the next couple of months:

RFID World 2004
Denver, Colorado
April 20-22, 2004

KioskCOM
Las Vegas, Nevada
April 26-28, 2004

Retail Systems Show
Chicago, Illinois
May 18-20, 2004

We'd love to see you at one of these shows!

Coming in the next LINK

The next issue of LINK will take a look at a quickly-developing technology—Radio Frequency Identification, or RFID.

If you have not yet come across RFID in your work, you may yet have encountered RFID in your daily life, perhaps without even being aware of it.

RFID systems have tiny chips, called "tags," that contain some piece of identifying information, and may contain other data as well. RFID chips reply to signals sent from RFID readers, devices that in turn interface with computers. Start by thinking of a conventional Point-of-Sale barcode reader, and you have RFID in its simplest mode: it can identify a package.

Next, think of RFID tags as barcodes that can be read without a direct line of sight. No need to unpack the skid in order to scan its boxes. Things start getting interesting.

And next, think of RFID tags as mini databases., or as barcodes that can be written to, and that can carry that information along with them. Things get very interesting, and some would even say spooky.

Read the next issue of LINK for the details.

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ETHER-SERIAL LINK PRODUCT SUMMARY

Product	Ports: 1	2	4	8	16	Connectors: DB-9	RJ-45	Powered	Modes: RS-232	RS-422	RS-485	TTL
Ether-Serial Link 1-DB9	✔					✔			✔			
Ether-Serial Link 2-DB9		✔				✔			✔			
Ether-Serial Link 4-DB9			✔			✔			✔			
Ether-Serial Link 8-DB9				✔		✔			✔			
Ether-Serial Link 16-DB9					✔	✔			✔			
Ether-Serial Link 1-RJ45	✔						✔	✔	✔			
Ether-Serial Link 2-RJ45		✔					✔	✔	✔			
Ether-Serial Link 4-RJ45			✔				✔	✔	✔			
Ether-Serial Link 8-RJ45				✔			✔	✔	✔			
Ether-Serial Link 16-RJ45					✔		✔	✔	✔			
Ether-Serial Link 1-DB9/422	✔					✔				✔		
Ether-Serial Link 2-DB9/422		✔				✔				✔		
Ether-Serial Link 4-DB9/422			✔			✔				✔		
Ether-Serial Link 8-DB9/422				✔		✔				✔		
Ether-Serial Link 16-DB9/422					✔	✔				✔		
Ether-Serial Link 1-RJ45/422	✔						✔	✔		✔		
Ether-Serial Link 2-RJ45/422		✔					✔	✔		✔		
Ether-Serial Link 4-RJ45/422			✔				✔	✔		✔		
Ether-Serial Link 8-RJ45/422				✔			✔	✔		✔		
Ether-Serial Link 16-RJ45/422					✔		✔	✔		✔		
Ether-Serial Link 1-DB9/485	✔					✔					✔	
Ether-Serial Link 2-DB9/485		✔				✔					✔	
Ether-Serial Link 1-RJ45/485	✔						✔	✔			✔	
Ether-Serial Link 2-RJ45/485		✔					✔	✔			✔	
Ether-Serial Link 4-RJ45/485			✔				✔	✔			✔	
Ether-Serial Link 1-TTL	✔											✔

OTHER LAVA PRODUCTS

Serial Boards

PCI	SSerial-PCI	Single 9-pin serial, 16550 UART
	SSerial-PCI/LP	Single 25-pin serial, 16550 UART, low profile
	SSerial-PCI 3.3V	Single 9-pin serial, 16550 UART, for 3.3 volt PCI
	RS422 SS-PCI	Single 9-pin serial, 16550 UART, RS-422 pinouts
	DSerial-PCI	Dual 9-pin serial, 16550 UARTs
	DSerial-PCI/LP	Dual 9-pin serial, 16550 UARTs, low profile
	DSerial-PCI 3.3V	Dual 9-pin serial, 16550 UARTs, for 3.3 volt PCI
	RS422 DS-PCI	Dual 9-pin serial, 16550 UARTs, RS-422 pinouts
	Quattro-PCI	Four-port 9-pin serial, 16550 UARTs
	Quattro-PCI 3.3V	Four-port 9-pin serial, 16550 UARTs, for 3.3 volt PCI
	Quattro-550/RJ	Four 10-wire RJ-45 serial, 16550 UARTs
	Quattro-950/RJ	Four 10-wire RJ-45 serial, 16950 UARTs
	RS422 Quattro-PCI	Four-port 9-pin serial, 16550 UARTs, RS-422 pinouts
	Octopus-550	Eight-port 9-pin serial, 16550 UARTs
	LavaPort-650	Single 9-pin serial, 16650 UART
	LavaPort-PCI	Dual 9-pin serial, 16650 UARTs
	LavaPort-Quad	Four-port 9-pin serial, 16650 UARTs
ISA	SSerial-550	Single 25-pin serial, Com 1-4, 16550 UART, IRQ 3/4/5/7
	DSerial-550	Dual 9-pin serial, Com 1-4, 16550 UARTs, IRQ 2/3/4/5/7/10/11/12/15
	RS422-550	Dual 9-pin serial, 16550 UARTs, RS-422 pinout
	LavaPort-ISA	Single 9-pin serial, Com 1-4, 16650 UART, IRQ 2/3/4/5/10/11/12/15
	LavaPort-PnP	Single 9-pin serial, 16650 UART, Plug and Play

Serial Port Bank

PCI	SPB-16/RJ	Sixteen port 10-wire RJ-45 serial, 16550 UARTs, 1U rack mount, with switching power supply and PCI interface board

Parallel Boards

PCI	Parallel-PCI	Single EPP parallel
	Parallel-PCI/LP	Single EPP parallel, low profile
	Parallel-PCI 3.3V	Single EPP parallel, for 3.3 volt PCI
	Dual Parallel-PCI	Dual EPP parallel
ISA	Parallel Bi-dir.	Single bi-directional parallel port, LPT 1/2/3, IRQ 5/7
	Parallel-ECP/EPP	Single ECP/EPP parallel, LPT 1-6, IRQ 2/3/4/5/7/10/11/12

Combo Boards

PCI	SP-PCI	Single 9-pin serial, 16550 UART + single bi-directional parallel
	2SP-PCI	Dual serial (9 & 25-pin), 16550 UARTs + single EPP parallel
	LavaPort-Plus	Dual serial (9 & 25 pin), 16650 UARTs + single EPP parallel
ISA	2SP-550	Dual 9-pin serial, Com 1-4, 16550 UARTs + single bi-dir. parallel, LPT 1-2

USB 2.0 & 1.1 Devices

USB 2.0 Host	Dual USB 2.0 ports, 480 Mbps, fits in PCI slot
USB 1.1 Host	Dual USB 1.1 ports, 12 Mbps, fits in PCI slot
SPH-USB 1.1 Hub	Three powered USB 1.1 ports, parallel port, serial port, connects to USB

IEEE 1394 (FireWire®) Devices

IEEE 1394 FireHost	Dual IEEE 1394 ports, 400 Mbps, fits in PCI slot
IEEE 1394/IDE Controller	FireWire®-to-IDE hard drive interface

Specialty Boards

PCI	8255-PIO	8255 PIO interface card

Speak to us about your design needs. Apart from the products listed here, Lava customizes and modifies designs to suit specific customer needs.

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LAVA LIFETIME WARRANTY