IPV6 USAGE WITH VARIOUS OPERATING SYSTEMS

September 2007

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PURPOSE

The purpose of this whitepaper **IS NOT** to describe in detail the benefits and features of IPv6 or to delve into the minutiae of the bit- or stack-level details of the specification or implementation. The purpose **IS** to highlight some of the usage differences/nuances Dell Storage discovered while implementing IPv6 in our Tape Automation products (PV124T, TL2000/TL4000, and ML6000). The usage statements below are largely in the context of accessing the RMU (Remote Management Unit) screens of these products, but are generally applicable.

INTRODUCTION TO IPv6

Brief Description of IPv6

A simple internet search on "IPv6" will return nearly countless results. Some useful ones include:
http://www.ipv6.org/
http://en.wikipedia.org/wiki/IPv6
http://research.microsoft.com/msripv6/
http://www.cisco.com/univercd/cc/td/doc/cisintwk/ito_doc/ipv6.htm
and many, many more.

In a nutshell, IPv6 (Internet Protocol version 6) is the successor to the most common Internet Protocol today (IPv4). This is largely driven by the fact that IPv4's 32-bit address is quickly being consumed by the ever-expanding sites and products on the internet. IPv6's 128-bit address space should not have this problem for the foreseeable future. Additionally, the industry expects the US Federal government to start requiring IPsec (IP security) as part of the IPv6 requirements after June 30th 2008 in their RFQs for most products.

Comparison of IPv4 & IPv6

Feature	IPv4	IPv6	Comment
Address Space	32-bit	128-bit	IPv6 offers virtually unlimited addresses
Address Type	Class A Class B Class C …	Unicast Multicast Anycast	
Auto-configuration	Windows only	Stateless	
Packet size	64KB	4GB	

IPv6 Notation

IPv6 addresses, in addition to being longer, are distinguished from IPv4 addresses by the use of colons (:) [exceptions below]. An IPv4 address is noted by 4 sets of decimal numbers separated by periods (.), e.g., 192.168.22.12. IPv6 addresses are 8 4-digit hexadecimal digits separated by colons (:), e.g., 3001:0000:0000:0000:0000:0000:0000:0b0b. IPv6 also allows for some "short hand" by eliminating leading zeros and replacing blocks of zeros (:0000:) with double colons (::).

E.g., 3001:0000:0000:0000:0000:0000:0000:0b0b is equivalent to 3001::b0b. There are some limitations such as only one (1) double colon (::) may be used in an address. Please refer to the internet articles (hyperlinks above) for more in-depth descriptions.

USES WITH VARIOUS OPERATING SYSTEMS

Use in Microsoft Windows 2000
IPv6 is available using Windows 2000 by installing the IPv6 Technology Preview package. This package has **no support** from Microsoft, though it will add an IPv6 protocol to Windows 2000's network stack.

Use in Microsoft Windows 2003/XP
IPv6 support in Windows 2003 is not turned on by default. Use the following instructions to enable IPv6 support.
- Go to "Control Panel" -> "Network Connections", and right-click on the Local Area Connection interface that is to be enabled with IPv6 support.
- Select "Properties" from the drop-down menu, and the "Local Area Connection Properties" window should open. Click on the "Install" button.
- In the new "Select Network Component Type" window, select "Protocol" and click on the "Add" button.
- In the "Select Network Protocol" window, select "Microsoft TCP/IP version 6" and click on the "Ok" button. IPv6 is now enabled.

Windows 2003 and XP come with a WinINet.dll API that does not fully support literal IPv6 addresses in URLs. Upgrading to Internet Explorer 7 in Windows 2003 is recommended for IPv6 browser support as the WinINet API is updated with the installation of Internet Explorer 7. Third party browsers (such as Firefox) also use the WinINet API either directly or indirectly, so an upgrade to IE7 will be recommended for all users.

As multiple IPv6 addresses can be assigned to one physical interface, Windows 2003 and XP use an interface number associated with each link-local IPv6 address that must be included for connectivity via a link-local IPv6 address. The interface number must then be appended to any outgoing link-local IPv6 traffic; otherwise the IPv6 packet does not know from which logical interface to egress.
- The interface number can be determined through the command line of Windows.
    - Go to Start -> Run and type "cmd" to enter the command prompt.
    - At the command prompt, type "ipconfig" and find the IPv6 address. Appended to the end of this will be a "%x" where x is the interface number.
- Browser connectivity
    - An IPv6 address is not be entered into a browser window the same way an IPv4 address is. There are two (2) methods for doing so:
        - After upgrading the WinInet API (by upgrading to IE 7), the library RMU can be accessed by the link-local IPv6 address from the browser by using the following format:
            - Replace all ":" with "-"
            - Append "s<Interface #>.ipv6-literal.net" to the end of the IPv6 address.
            - For example, if the IPv6 address is "fe80::1234:5678:abc" and the interface number is "13", the address to browse to would be http://fe80--1234-5678-abcs13.ipv6-literal.net

- Another alternative to this would be to edit the "HOSTS" file in the <Windows Base Directory>\system32\drivers\etc\ directory by adding the following line: "fe80::1234:5678:abc%13 *<hostname>*".
    - The address to browse to would be http://*<hostname>*/
    - Note that the interface number can change with a reboot of the Windows host, and the "HOSTS" file entry will need to be modified to point to the appropriate interface number should this occur.
  - For global-unicast addressing, the RMU is browser accessible using the following convention:
    - http://[<IPv6 address>]/, where <IPv6 address> is a non-link-local IPv6 address.

Use in Microsoft Vista

Vista natively supports IPv6. Also, interface numbers are predicted in Windows Vista. All that is needed to browse to an address would be to add brackets ("[]") around the IPv6 address. Thus, if the IPv6 address is "fe80::1234:5678:abc", enter http://[fe80::1234:5678:abc] into the browser window.

(Preview) Use in Microsoft's newest (unreleased) OS

Windows Server 2008 also natively supports IPv6. As with Vista, interface numbers are predicted in Windows Server 2008. All that is needed to browse to an address would be to add brackets ("[]") around the IPv6 address. Thus, if the IPv6 address is "fe80::1234:5678:abc", enter http://[fe80::1234:5678:abc] into the browser window.

Use in Linux

While IPv6 is supported under Linux, IPv6 link-local literals are not currently supported in Linux browsers, so the RMU will not be accessible in Linux via IPv6 link-local addresses. Other types of IPv6 addresses are supported using Firefox browser 2.0.0.4 and beyond.