

Deploying Samba in IPv6 Networks

**Samba XP
2011**

Dr David Holder CEng FIET MIEEE

david.holder@erion.co.uk

<http://www.erion.co.uk>

The logo for Erion, featuring the word "Erion" in a bold, purple, italicized sans-serif font. A yellow sphere is positioned above the letter 'i'. A horizontal yellow line is located below the text.A smaller version of the Erion logo, consisting of the word "Erion" in purple with a yellow sphere above the 'i'.

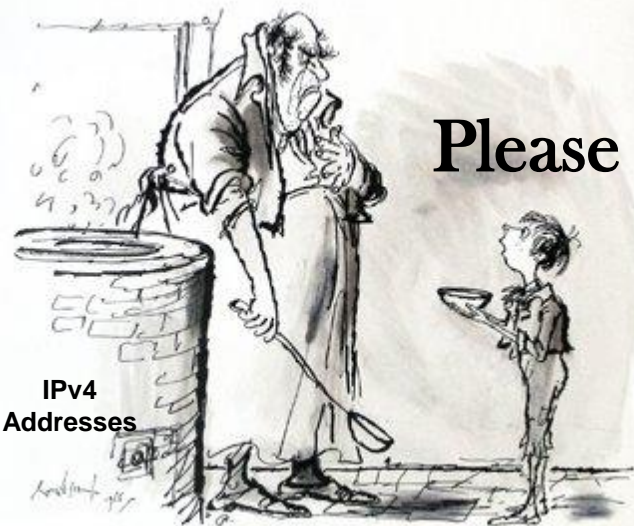
Deploying Samba in IPv6 Networks

- Urgent need to deploy IPv6
- Status of Samba support for IPv6
- What is different in IPv6 Windows Networks?
- How to Deploy IPv6
 - Preparing your infrastructure for IPv6
 - Deploying IPv6 with Samba 3
- The Future

Urgent Need to Deploy IPv6

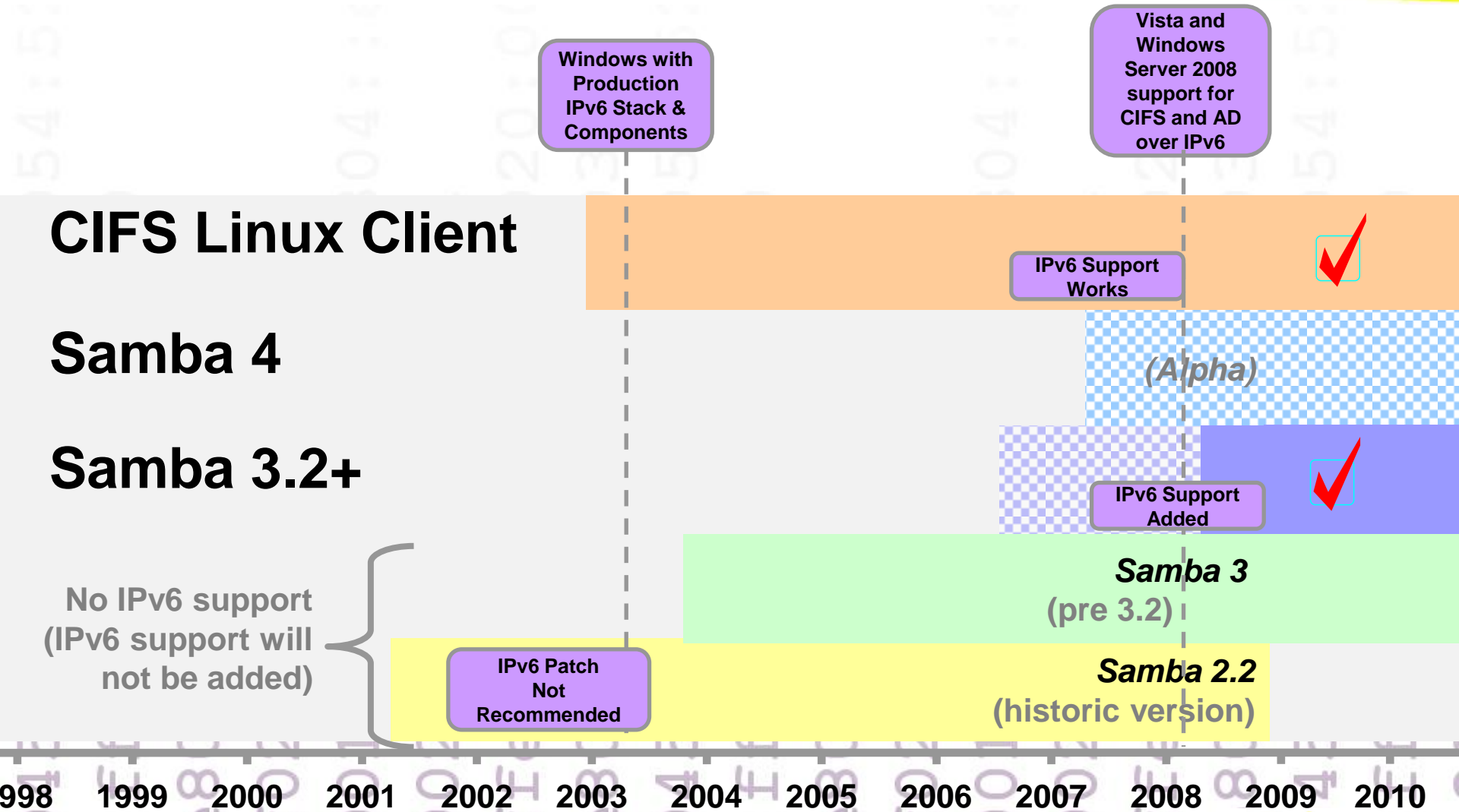
- IPv4 address pool is empty
- Regional registrars will run out of stock in 2011
- IPv4 is a legacy protocol
- Linux, Unix, Windows, etc. all have **IPv6** stacks

Please sir can I have some more IPv4 addresses?



IPv4
Addresses

Status of Samba IPv6 Support



CIFS Linux Client

Samba 4

Samba 3.2+

No IPv6 support
(IPv6 support will
not be added)

Windows with
Production
IPv6 Stack &
Components

Vista and
Windows
Server 2008
support for
CIFS and AD
over IPv6

IPv6 Support
Works

(Alpha)

IPv6 Support
Added

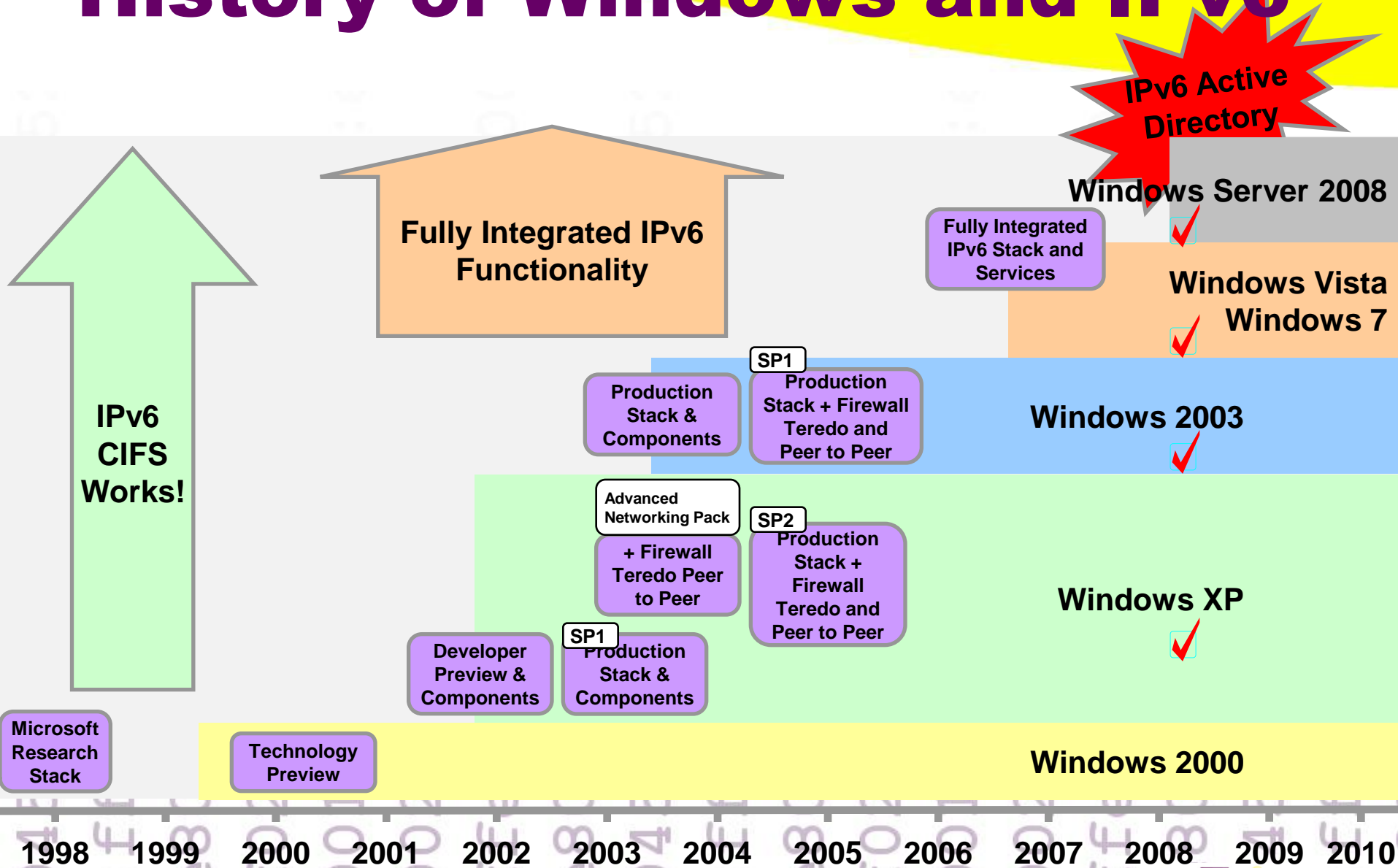
Samba 3
(pre 3.2)

Samba 2.2
(historic version)

IPv6 Patch
Not
Recommended

1998 1999 2000 2001 2002 2003 2004 2005 2006 2007 2008 2009 2010

History of Windows and IPv6



Differences in IPv6 Windows Networks

		IPv4	IPv6
	NBT/NetBIOS	Yes	No
	WINS	Yes	No
	NT Domains	Yes	No
SMB/CIFS File Sharing	Windows XP	Yes	Yes <input checked="" type="checkbox"/>
	Windows 2003	Yes	Yes <input checked="" type="checkbox"/>
Active Directory Including file sharing and <i>everything...</i>	Windows Vista	Yes	Yes <input checked="" type="checkbox"/>
	Windows 7	Yes	Yes <input checked="" type="checkbox"/>
	Windows Server 2008	Yes	Yes <input checked="" type="checkbox"/>

Linux CIFS and IPv6

- Kernel CIFS module is IPv6 enabled by default
 - Since SambaXP 2007

- `mount.cifs`



Steve French (IBM) and David Holder (Erion) The first ever CIFS client connection over IPv6

```
# mount -t cifs //W2008KENT/TESTSHARE /mnt/erion \
user=Administrator,pass='Pa$$w0rd'
```

```
Local Address      Foreign Address    State
[2a01:348:13e:0:fc6f:d88f:6507:4ad]:445  [2a01:348:13e:0:20c:29ff:fea0:3883]:35906  ESTABLISHED
\Administrator>
```

- Just works – easy



Samba 3.x and IPv6

- IPv6 enabled by default
 - Samba 3.2 onwards
 - **Tip: Use 3.6...**
- IPv6 transport works!
 - Client and server side functionality over IPv6
 - Join Windows Server 2008 AD domains over IPv6
 - Serve shares and printers over IPv6

IPv6 Samba 3.2 Join to Windows Server 2008 Domain

Wednesday, January 30th, 2008

Yesterday I carried out the first every join of a Samba 3.2 server to a Windows domain over IPv6.

(see: <http://www.ipv6consultancy.com/ipv6blog/?p=25>)

Samba 4 and IPv6

- IPv6 *not* enabled by default
- Samba3 & 4 merge will bring IPv6 support
- **Samba4 will be released with IPv6 support**
- IPv6 was enabled with Erion hack
 - **WARNING – Hack NOT production code (Don't use)**
 - See <http://www.ipv6consultancy.com/ipv6blog>
 - IPv6 client and server side functionality
 - IPv6 domain controller functionality
 - Join Samba4 domains over IPv6

Deploying Samba in IPv6 Networks

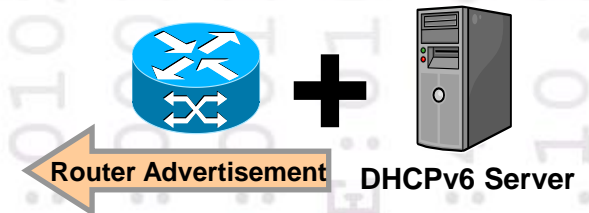
- Urgent need to deploy IPv6
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- What is different in IPv6 Windows Networks?
- How to Deploy IPv6
 - **Preparing your infrastructure for IPv6**
 - Deploying IPv6 with Samba 3
- **The Future**

Prepare IPv6 Infrastructure

- No need to turn IPv6 on (on by default)

- Assign IPv6 addresses

- Static (manual)
- SLAAC (StateLess Address Auto-Configuration)
- SLAAC and Stateless DHCPv6
- DHCPv6



- Configure basic network services

- Name Services (DNS)
- *No WINS or NetBIOS for IPv6*

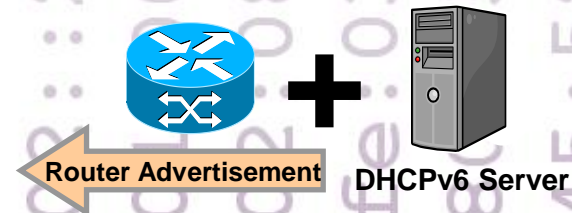


Choosing IPv6 Addresses

- Not all IPv6 addresses are equal

Tips

1. Understand IPv6 address types (important)
2. Usually do not use link-local addresses for Samba
3. Use global addresses for production
4. Use native IPv6 addresses (if available)
5. Assign static addresses to servers and routers
6. Use SLAAC and DHCPv6



IPv6 Addresses – Quick Test

2045:5249:4f4e:2054:5241:494e:494e:4720 

::ffff:50.10.1.10

fe80::1%1

ff02::2%eth0

2001:0000:0102:0304::ffff:f6ff:ffffe

2002:0800:0001::1

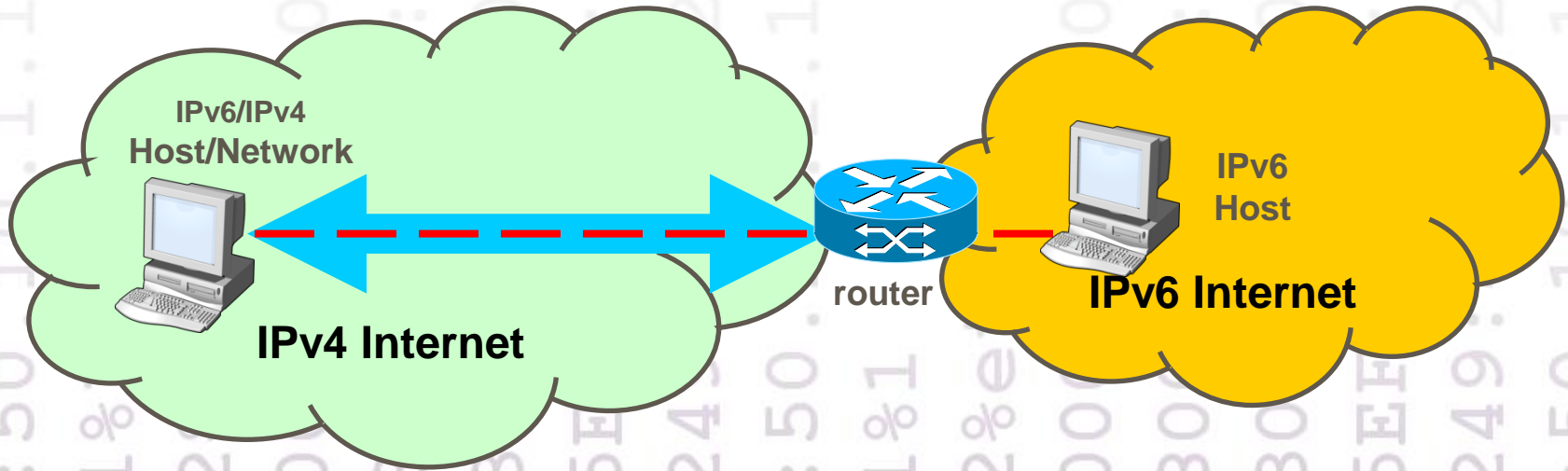
3ffe:0302:0011:0020:0000:5EFE:0102:0304

fe80::5EFE:C0A8:0104

- You **should** know what these different addresses are and **when** to use them

Get An Address Prefix

- **Go Native – if possible!**
- Tunnel if not – it is free and easy
 - **/48** (64,536 subnets with 18,446,744,073,709,551,616 hosts each)



Example Tunnel Brokers

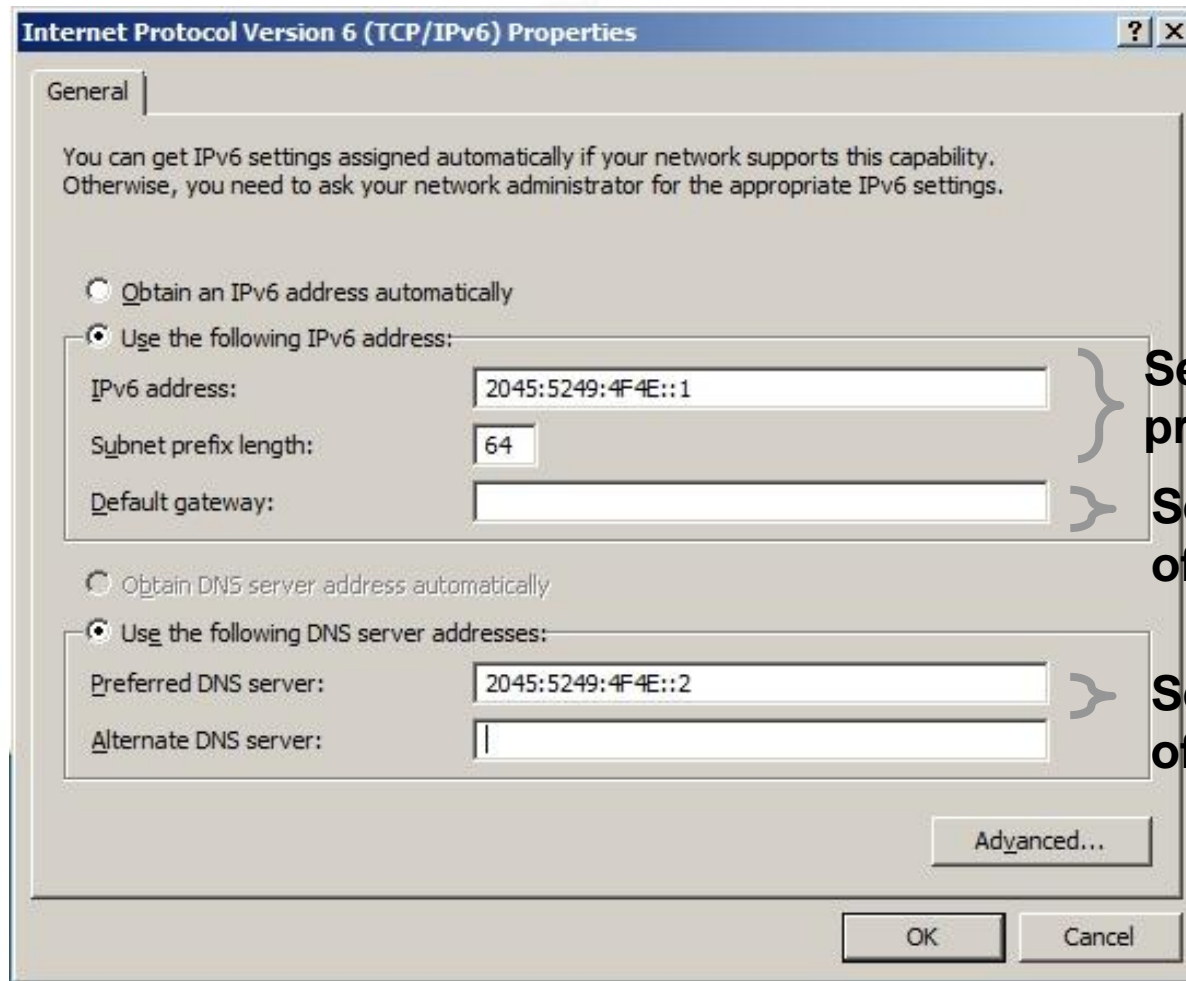


HURRICANE ELECTRIC
INTERNET SERVICES



Windows: Assign Addresses

- On Windows use GUI or command line (**netsh**)



Set address and prefix length

Set link local address of default router

Set global addresses of DNS server/s

Linux: Assign Addresses

- On **Linux/Unix** use **ifconfig**, **ip**, GUI etc...

```
# ifconfig eth0 add 2045:5249:4F4E::1
```

```
# ip -f inet6 addr add 2045:5249:4F4E::1/64 dev eth0
```

- IPv6 **ifconfig** syntax not consistent
- On Linux set IPv6 addresses in init scripts

```
# ifconfig eth0
eth0      Link encap:Ethernet  HWaddr 00:0C:29:BB:47:5F
          inet6 addr: 2045:5249:4f4e::2/64 Scope:Global
          inet6 addr: fe80::20c:29ff:febb:475f/64 Scope:Link
          UP BROADCAST RUNNING MULTICAST  MTU:1500  Metric:1
          RX packets:1672 errors:0 dropped:0 overruns:0 frame:0
          TX packets:545 errors:0 dropped:0 overruns:0 carrier:0
          collisions:0 txqueuelen:1000
          RX bytes:1987499 (1.8 MiB)  TX bytes:68438 (66.8 KiB)
          Interrupt:19 Base address:0x2024
```

Prepare SLAAC and DHCPv6

- IPv6 router essential for IPv6 SLAAC & DHCPv6
- Linux/Unix Example (`radvd.conf`)

```
interface eth0
{
    AdvSendAdvert on;
    prefix 2045:5249:4F4E::/64
    {
        AdvManagedFlag off;
        AdvOtherConfigFlag off;
    };
};
```



Router Advertisement



DHCPv6 Server
Stateful OR
Stateless

- **Note:** DHCPv6 different from DHCPv4 in many ways...

DHCPv6

- No router option
- Exclusions on Windows rather than ranges

New Scope Wizard

Add Exclusions
Exclusions are addresses or a range of addresses that are not distributed by the server.

Type the IPv6 address range that you want to exclude for the given scope. If you want to exclude a single address, type an identifier in Start IPv6 Address only.

Start IPv6 Address: 2045:5249:4f4e:: 1

End IPv6 Address: 2045:5249:4f4e:: 1000

Excluded address range:
2045:5249:4f4e::1 to 2045:5249:4f4e::1000

Add

Remove

Check IPv6 Configuration

- On Windows use GUI, netsh, ipconfig or other

Property	Value
Connection-specific DN...	Static Configuration
Description	Intel(R) PRO/1000 MT Network Connecti
Physical Address	00-0C-29-85-44-99
DHCP Enabled	No
IPv4 Address	192.168.50.11
IPv4 Subnet Mask	255.255.255.0
IPv4 Default Gateway	
IPv4 DNS Server	
IPv4 WINS Server	
NetBIOS over Tcpip En...	Yes
IPv6 Address	2045:5249:4f4e::1 2045:5249:4f4e:0:21f7:b57e:f1b4:9bb9
Link-local IPv6 Address	fe80::21f7:b57e:f1b4:9bb9%11
IPv6 Default Gateway	fe80::20c:29ff:febb:475f%11
IPv6 DNS Server	2045:5249:4f4e::2

Windows Server 2008

Close

Property	Value	SLAAC
Connection-specific DN...		
Description	VMware Virtual Ethernet Adapter for VI	
Physical Address	00-50-56-C0-00-01	
DHCP Enabled	No	
IPv4 Address	192.168.50.1	
IPv4 Subnet Mask	255.255.255.0	
IPv4 Default Gateway		
IPv4 DNS Server		
IPv4 WINS Server		
NetBIOS over Tcpip En...	Yes	
IPv6 Address	2045:5249:4f4e:0:781e:e740:97e6:d9;	
Temporary IPv6 Address	2045:5249:4f4e:0:bc8b:a06f:df1e:a7c1	
Link-local IPv6 Address	fe80::781e:e740:97e6:d92a%46	
IPv6 Default Gateway	fe80::20c:29ff:febb:475f%46	
IPv6 DNS Servers	fec0:0:0:ffff::1%1 fec0:0:0:ffff::2%1	

Windows 7

Close

Test IPv6 Connectivity

- Use **ping** or **ping6** (platform dependent)

- Link-local:

```
# ping6 fe80::9416:bd6b:8d9c:7490%eth0
```

- Global:

```
# ping6 2045:5249:4f4e::1
```

- **Tip:** Default Windows firewall blocks IPv6 ICMPv6 echo
- Routing problems
 - Use **tracert**, **netstat**, **route**, **netsh** on Windows
 - Use **tracert6**, **netstat**, **route** or **ip** on Linux

Samba 3.x Client IPv6 Test

```
# smbclient -L //2045:5249:4F4E::1 -U Administrator
Enter Administrator's password:
Domain=[WIN2008] OS=[Windows Server (R) 2008 Enterprise 6001
Service Pack 1] Server=[Windows Server (R) 2008 Enterprise 6.0]
```

Sharename	Type	Comment
-----	----	-----
ADMIN\$	Disk	Remote Admin
C\$	Disk	Default share
IPC\$	IPC	Remote IPC
Testshare	Disk	
Users	Disk	

```
2045:5249:4F4E::1 is an IPv6 address -- no workgroup available
```

```
# smbclient -L //fe80::9416:bd6b:8d9c:7490%eth0 -U Administrator
```

Windows/Samba and IPv6 Name Resolution Options

- NetBIOS name resolution
- WINS
- **Hosts file**
- **Link-local Multicast Name Resolution (LLMNR)**
- **DNS**
- **Literal Addresses**

IPv4 Only

IPv4 Only

IPv4 and IPv6



IPv4 and IPv6



Note: Windows Only

IPv4 and IPv6



IPv4 and IPv6



Linux/Unix NSS module

Configure DNS Clients

- Configure DNS clients (manually or via DHCPv6)

- Linux/Unix (**/etc/resolv.conf**)

```
nameserver 2045:5249:4f4e::2
```

- Windows

Use the following DNS server addresses:

Preferred DNS server:

2045:5249:4F4E::2

Test IPv6 DNS Samba Client

- Test with **dig**, **host** and **nslookup** first then...

```
# smbclient -L //win2008.example.com. -U Administrator
Enter Administrator's password:
Domain=[WIN2008] OS=[Windows Server (R) 2008 Enterprise 6001
Service Pack 1] Server=[Windows Server (R) 2008 Enterprise 6.0]
```

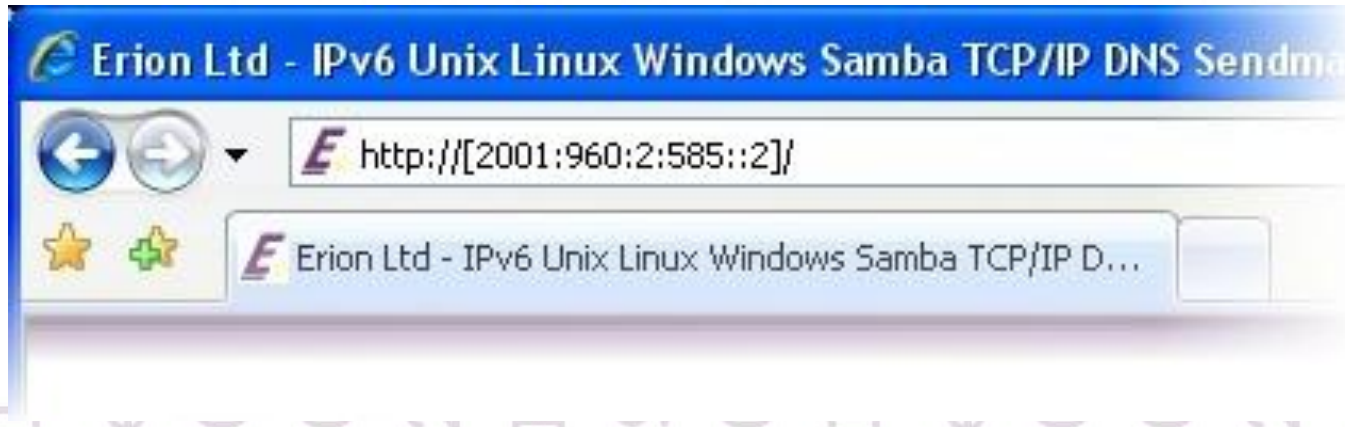
Sharename	Type	Comment
-----	----	-----
ADMIN\$	Disk	Remote Admin
C\$	Disk	Default share
IPC\$	IPC	Remote IPC
Testshare	Disk	
Users	Disk	

```
Win2008.example.com. is an IPv6 address -- no workgroup
available
```

- **Tip:** Do not put link-local addresses in DNS, also if possible avoid transition addresses in DNS

Textual Address Formats

- URLs, URIs and UNCs (not RFC2821 SMTP)
 - Use IPv6 in square brackets in URIs and URLs
[3000:0:20:0:3de2:17ca:d07d:5f10]

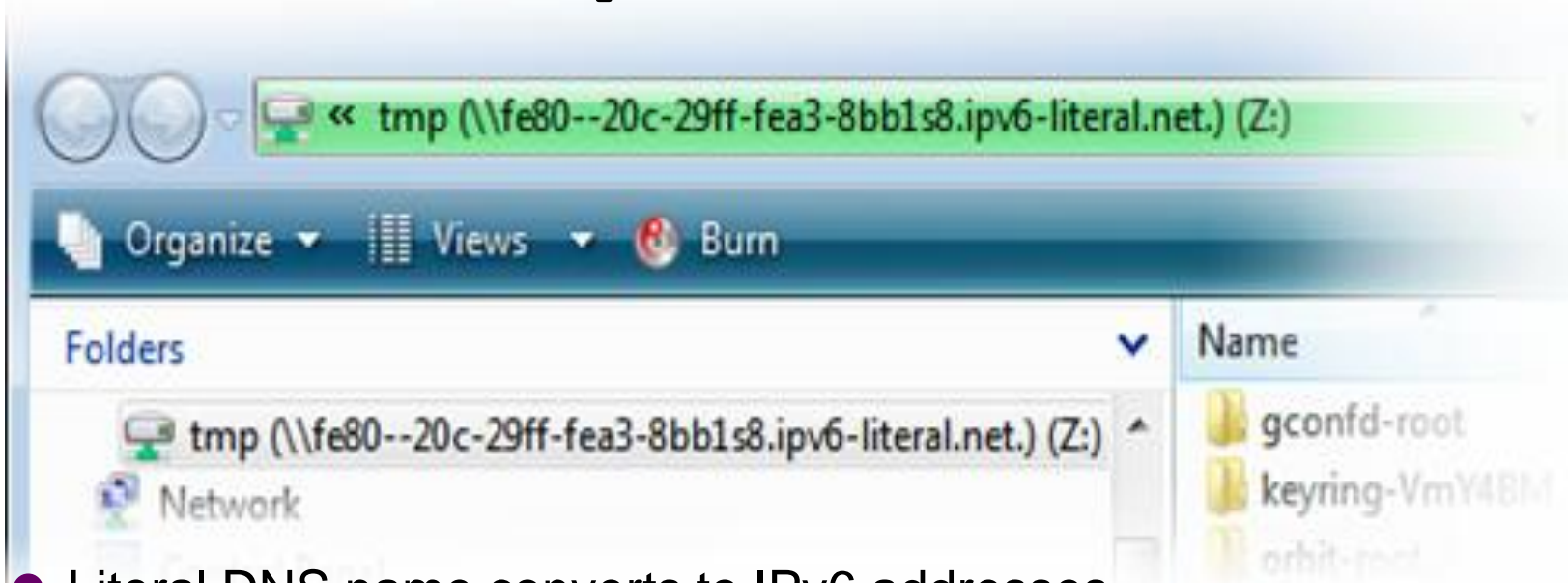


- Not in UNCs (use ipv6-literal.net. names instead)
3000-0-20-0-3de2-17ca-d07d-5f10.ipv6-literal.net.

```
TCP [3000:0:20:0:3de2:17ca:d07d:5f10]:49165 [3000:0:20:0:20c:29ff:fef1:925b]:445 ESTABLISHED
```

Literal Addresses

- In UNC paths can use ipv6-literal.net. names
`2045-5249-4f4e--1.ipv6-literal.net`



- Literal DNS name converts to IPv6 addresses
- Hyphens replace colons in domain name
- s indicates interface
- NSS module `nss-ipv6literal` provides this on Linux/Unix

Literal Addresses NSS

- <http://www.samba.org/~idra/code/nss-ipv6literal/>
 - Thanks to Simo Sorce
- Linux/Unix (**/etc/nsswitch.conf**)

```
hosts:          files ipv6literal dns
```

- Just works

```
# ping6 2045-5249-4f4e--2.ipv6-literal.net
PING 2045-5249-4f4e--2.ipv6-literal.net (fc12
64 bytes from fc12.example.com.: icmp_seq=1
```

Link-local Multicast Name Resolution (LLMNR)

- Performs name resolution without DNS
- DNS over multicast (*not* mDNS)
- Works for IPv4 *and* IPv6 hosts
- Uses multicast addresses
 - IPv6 **FF02::1:3**
 - IPv4 **224.0.0.252**

```
TCP [::]:49155 [::]:0 LISTENING
TCP [::]:49156 [::]:0 LISTENING
TCP [::]:49157 [::]:0 LISTENING
TCP [fe80::85cc:a568:4656:fb20%8]:49167 [fe80::6463:a7a0:d182:adc8%8]:445 ESTABLISH
C:\Users\dauid>
```

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- **The Future**

Samba 3.x IPv6 smb.conf (1)

- IPv6 addresses can be used in most places

```
[global]
  bind interfaces only=yes
  interfaces=::1
```

```
# smbclient //::1/ipv6share
```

- Excepting things that don't work with IPv4!
- Behaviour changes in Samba 3.6.x

```
%i
```

the local IP address to which a client connected.

Before 3.6.0 it could contain IPv4 mapped IPv6 addresses, now it only contains IPv4 or IPv6 addresses.

Samba 3.x IPv6 smb.conf (2)

- IPv6 addresses can be used access control

```
C:\Users\Administrator>x:
Access is denied.

C:\Users\Administrator>x:
X:\>dir
Volume in drive X is ipv6share
Volume Serial Number is 78EC-0B71

Directory of X:\

05/10/2011  10:40 AM    <DIR>
```

```
[ipv6share]
    comment = IPv6 Share
    path = /home/ipv6share
    public = yes
    writable = yes
    printable = no
    create mask = 0765
    hosts allow = 2045:5249:4f4e::1
```

Samba 3.x Server Test

- Windows Server 2008 or Windows 7 Client

```
C:\Users\Administrator>net use x: \\2045-5249-4f4e--2.ipv6-literal.net\ipv6share
Enter the user name for '2045-5249-4f4e--2.ipv6-literal.net': root
Enter the password for 2045-5249-4f4e--2.ipv6-literal.net:
The command completed successfully.
```

```
C:\Users\Administrator>net use
New connections will be remembered.
```

```
Status          Local          Remote          Network
-----
OK              X:             \\2045-5249-4f4e--2.ipv6-literal.net\ipv6share
                                                Microsoft Windows Network
The command completed successfully.
```

```
# netstat --inet6 -an
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address          Foreign Address        State
tcp        0      0 2045:5249:4f4e::2:445 2045:5249:4f4e::1:49158 ESTABLISHED
```

```
C:\Users\Administrator>net use x: \\fc12.example.com\ipv6share
Enter the user name for 'fc12.example.com': root
Enter the password for fc12.example.com:
The command completed successfully.
```

IPv6 Just Works

exampletraceoverip6.pcap - Wireshark

Filter: ipv6

No.	Time	Source	Destination	Protocol	Info
109	100.2045:5249:4f4e::2	2045:5249:4f4e::1	2045:5249:4f4e::2	SMB	Trans2 Request, QUERY_FILE_INFO, FID: 0x4e63, Query File Basic
110	100.2045:5249:4f4e::1	2045:5249:4f4e::2	2045:5249:4f4e::1	SMB	Trans2 Response, FID: 0x4e63, QUERY_FILE_INFO
111	100.2045:5249:4f4e::2	2045:5249:4f4e::1	2045:5249:4f4e::2	SMB	Trans2 Request, QUERY_FS_INFO, Query FS Attribute Info
112	100.2045:5249:4f4e::1	2045:5249:4f4e::2	2045:5249:4f4e::1	SMB	Trans2 Response, QUERY_FS_INFO
113	100.2045:5249:4f4e::2	2045:5249:4f4e::1	2045:5249:4f4e::2	SMB	Trans2 Request, QUERY_FILE_INFO, FID: 0x4e63, Query File Basic
114	100.2045:5249:4f4e::1	2045:5249:4f4e::2	2045:5249:4f4e::1	SMB	Trans2 Response, FID: 0x4e63, QUERY_FILE_INFO
115	100.2045:5249:4f4e::2	2045:5249:4f4e::1	2045:5249:4f4e::2	SMB	Trans2 Request, QUERY_FS_INFO, Query FS Size Info
116	100.2045:5249:4f4e::1	2045:5249:4f4e::2	2045:5249:4f4e::1	SMB	Trans2 Response, QUERY_FS_INFO
117	100.2045:5249:4f4e::2	2045:5249:4f4e::1	2045:5249:4f4e::2	SMB	Trans2 Request, SET_FILE_INFO, FID: 0x4e63
118	100.2045:5249:4f4e::1	2045:5249:4f4e::2	2045:5249:4f4e::1	SMB	Trans2 Response, FID: 0x4e63, SET_FILE_INFO
119	100.2045:5249:4f4e::2	2045:5249:4f4e::1	2045:5249:4f4e::2	TCP	[TCP segment of a reassembled PDU]
120	100.2045:5249:4f4e::1	2045:5249:4f4e::2	2045:5249:4f4e::1	TCP	[TCP segment of a reassembled PDU]
121	100.2045:5249:4f4e::2	2045:5249:4f4e::1	2045:5249:4f4e::2	TCP	[TCP segment of a reassembled PDU]
122	100.2045:5249:4f4e::1	2045:5249:4f4e::2	2045:5249:4f4e::1	TCP	[TCP segment of a reassembled PDU]
123	100.2045:5249:4f4e::2	2045:5249:4f4e::1	2045:5249:4f4e::2	TCP	[TCP segment of a reassembled PDU]

Frame 116 (162 bytes on wire, 162 bytes captured)

- Ethernet II, Src: Vmware_85:44:99 (00:0c:29:85:44:99), Dst: Vmware_bb:47:5f (00:0c:29:bb:47:5f)
- Internet Protocol Version 6
 - 0110 = Version: 6
 - 0000 0000 = Traffic class: 0x00000000
 - 0000 0000 0000 0000 0000 0000 = Flowlabel: 0x00000000
 - Payload length: 108
 - Next header: TCP (0x06)
 - Hop limit: 64
 - Source: 2045:5249:4f4e::1 (2045:5249:4f4e::1)
 - Destination: 2045:5249:4f4e::2 (2045:5249:4f4e::2)
- Transmission Control Protocol, Src Port: 49158 (49158), Dst Port: microsoft-ds (445), Seq: 2839, Ack: 4006, Len: 88
- NetBIOS Session Service
- SMB (Server Message Block Protocol)

Frame (frame), 162 bytes Packets: 4706 Displayed: 4691 Marked: 0 Profile: Default

- Traffic is all IPv6
- Works if you block legacy traffic (AKA IPv4)

Benefits of IPv6 for Samba



- Auto Configuration is easy
 - Very useful for appliances
- End to end connectivity is restored (no NAT)
 - Access Samba from anywhere
- End to end security is possible (Addresses + IPsec)
 - Secure access for Samba from anywhere
- IPv6 is mandatory in many environments
 - Stops Samba being automatically rejected from tenders...
- Theoretical possibilities
 - QoS, Jumbo datagrams etc
- See Microsoft DirectAccess and RemoteAccess

Finally – Watch out for:

- Don't Underestimate the Need for IPv6 Training
- Don't Assume IPv6 = IPv4 + Longer Addresses
- Old Habits Must be Unlearned for IPv6
- Remember that Detail *is* Important in IPv6
- Common Problem: Name Resolution *not* IPv6
- Common Problem: Misuse of Addresses
- What out for Security: Two Protocols Complex Interactions

IPv6 and Samba References

- EU IPv6 Curricula Day
 - <http://www.ipv6consultancy.com/ipv6blog/?p=70>
- Storage Developers Association 2010
 - <http://www.ipv6consultancy.com/ipv6blog/?p=64>
- SambaXP 2008 Presentation
 - <http://www.ipv6consultancy.com/ipv6blog/?p=34>
- Google IPv6 Conference 2008 (YouTube)
 - <http://youtube.com/watch?v=iK0nzdtzjvM>
- Google CIFS Workshop Presentation
 - <http://www.ipv6consultancy.com/ipv6blog/?p=21>
- SambaXP 2007 Presentation
 - <http://www.sambaxp.org/files/SambaXP2007-PDF/Holder-SambaVistawithIPv6V2.pdf>
 - <http://www.ipv6consultancy.com/ipv6blog/?p=8>
- Linux CIFS Client
 - <http://www.ipv6consultancy.com/ipv6blog/?p=9>
- Samba4 Hack (old version don't use)
 - <http://www.ipv6consultancy.com/ipv6blog/?p=12>

Further Information

- IPv6 Services

- <http://www.erion.co.uk/ipv6.html>

- IPv6 Blog

- <http://www.ipv6consultancy.com/ipv6blog>

- IPv6 Training

- <http://www.ipv6training.com>

- IPv6 Consultancy

- <http://www.ipv6consultancy.com>

- Contact david.holder@erion.co.uk



Profile: David Holder

- Co-Founder and Managing Director Erion Ltd
- Over 20 years experience in IT industry senior technical and IT management posts
- Chairman of IPv6 Task Force Scotland
- Regular speaker at global conferences on IPv6
- Extensive experience of IPv6 spanning over a decade
- Customers include; Microsoft, IBM, HP, Cisco, RIM, Orange, 3Com, Atos Origin
 - PhD in electronic engineering (Microwave Semiconductor Devices)
 - Fellow of IET (FIET)
 - Member of IEEE (MIEEE)
 - Chartered Engineer (CEng)



Questions

Thank you for listening