Deploying IPv6-only Samba 4 Environments

Samba XP

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Deploying IPv6-only Samba 4 Environments

- Why IPv6 and why IPv6-only?
- History of Samba support for IPv6
- Status of Samba4 support for IPv6
- Benefits of IPv6-only Samba4
- Deploying IPv6-only Samba4
  - Preparing your infrastructure for IPv6
  - Deploying IPv6 with Samba 4
- Conclusions

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WHY IPV6 AND IPV6 ONLY?

Why IPv6?

- **No more IPv4 addresses**
- Today **70%** of a dual-stack user's traffic is IPv6
- Over **46%** of top web sites are IPv6 enabled
- Number of IPv6-capable users doubles annually
  - At this rate everyone will be using IPv6 by 2020

Please sir can I have some more?

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What is driving IPv6-only?

- Easier to manage one protocol rather than two
- No “multi-islands” of private address space
- No Network Address Translation (NAT)
  - No Carrier Grade NAT (CGN)
    - CGN increasingly common
    - Can break most things, even *simple* web sites
  - No NAT/CGN traversal required:
    - No need for: ICE, STUN, UPnP, PCP, TURN, port forwarding, ALGs etc...
  - Restores possibility of end-to-end connectivity
- Use new IPv6 features (?)

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Samba Must Support IPv6-only Operation

- IPv6-only is becoming increasingly common
- Large fixed and mobile operators
- Data centres and cloud providers

- Has significant operational benefits
- Samba is used in all these environments

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HISTORY AND STATUS OF IPV6 AND SAMBA

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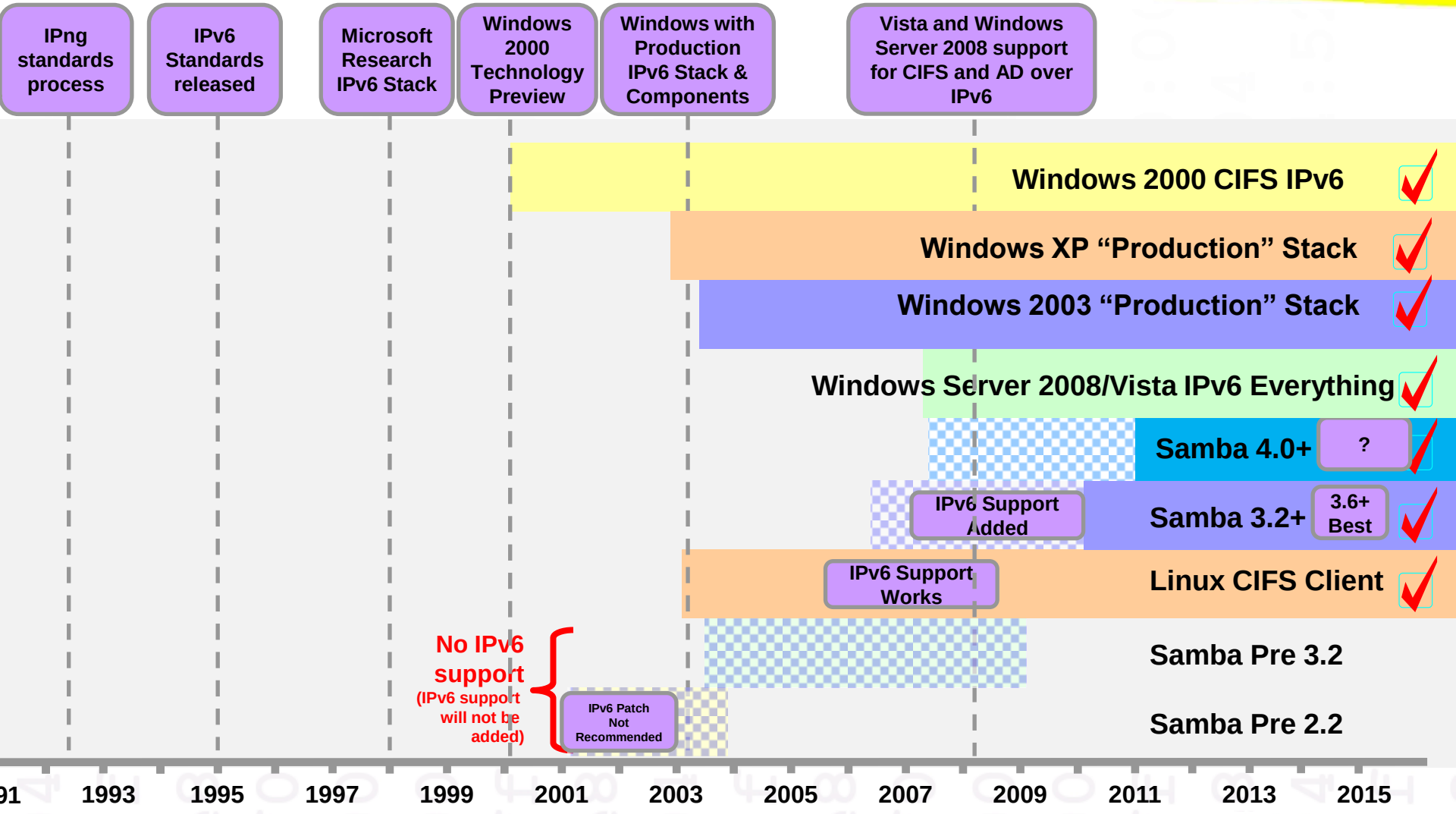
History of Samba & IPv6



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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 ✓
	Windows 2003	Yes	Yes ✓
Active Directory Including file sharing and *everything…*	Windows Vista	Yes	Yes ✓
	Windows 7	Yes	Yes ✓
	Windows Server 2008	Yes	Yes ✓

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Windows/Samba and IPv6 Name Resolution Options

- NetBIOS name resolution — IPv4 Only
- WINS — IPv4 Only
- **Hosts file** — IPv4 and IPv6 
- **Link-local Multicast Name Resolution (LLMNR)** — IPv4 and IPv6 
  Note: Windows Only
- **DNS** — IPv4 and IPv6 
- **Literal Addresses** — IPv4 and IPv6 
  Linux/Unix NSS module

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Samba 4 and IPv6 Status

- Samba 4 is “IPv6 ready” ✓
- Dual-stack environment (IPv4 & IPv6) **works** ✓
  - Majority of functionality is IPv6 ready ✓

- IPv6-only environment **problematic** ✗
  - Some features retain IPv4-only code ✗
  - Some issues remain ✗
  - Workarounds possible ✗
  - Almost, but not quite, suitable for production use ✗
  - Future versions of Samba 4 will be able to operate in IPv6-only environment ✓

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IPv6 only Potential Issues

- Bugs in Samba (fixed in next release?)
- Configuring **`/etc/hosts`** aliases
- Dynamic DNS updates with **`samba-tool`** or **`nsupdate`** expect IPv6 addresses to be written in full will all zeros included - no shorthand
- Anything that needs NetBIOS name resolution or WINS must be changed to use DNS
- Can't use LLMNR for link-local addresses
- Configuration issues
- Support for legacy IPv4 (use NAT64?)

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BENEFITS OF IPV6-ONLY SAMBA 4

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IPv6-Only Benefits

- *Real* benefit for IPv6-only Samba 4
  - Supporting current and future IPv6-only users who have been driven to deploy IPv6-only environments for operational reasons
  - **This is the most important driver for IPv6-only Samba**

- *Theoretical* benefits for Samba 4
  - Potential (theoretical) performance improvements
  - Potential benefits from “new” features
  - Lets look at some potential benefits...

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Samba 4 and Jumbograms

- IPv6 supports multi-megabyte datagrams
  - Performance benefits in specific scenarios
  - IPv4 is limited to max MTU of 64KB
- Possible performance benefit with Samba?
  - SMB 2.1 allows for Multi-Credit (Large MTU)
  - Increases maximum size from 64KB to 1MB
  - Has to be supported in datalink for IPv6 to make any difference; TCP over IPv6 jumbograms *is* supported, *but still needs datalink with large MTU*
  - (Note: Infiniband with Samba?)
- Possible IPv6 future benefit but requires datalink

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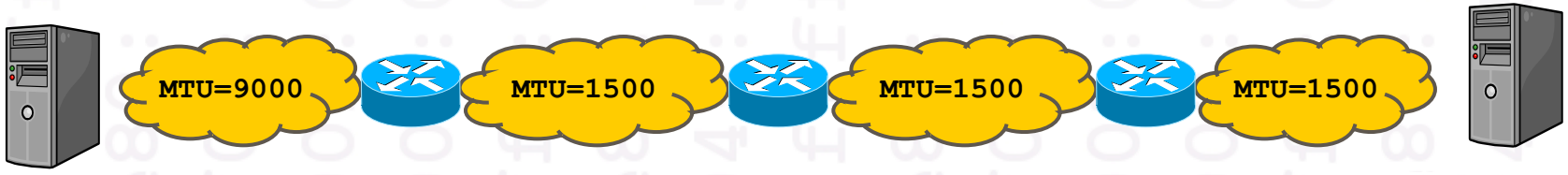
IPv6-only Samba 4 and MTUs

- Possible to use large MTUs in internal network (improving file sharing performance) without fragmentation
- IPv6 *avoids* fragmentation using Path MTU discovery – no downside
- IPv4 *may* result in lots of fragmentation

```
Internet Protocol Version 6
▷ 0110 .... = Version: 6
▷ .... 0000 0000 .... ....
  .... .... .... 0000 0000
  Payload length: 1456
  Next header: IPv6 fragmen
  Hop limit: 64
  Source: 3101::100 (3101::
  Destination: 3101::101 (3
▽ Fragmentation Header
    Next header: ICMPv6 (0x
    0000 0000 0000 0... = C
    .... .... .... ...1 = M
    Identification: 0x00000
```



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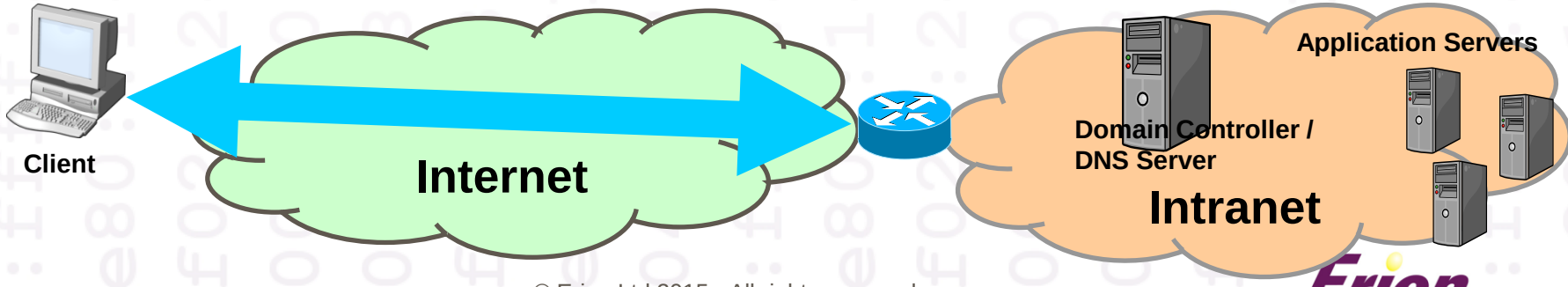
IPv6 only Samba 4 – no NAT

- No NAT (or CGN) means:
  - Global access to AD domain no need for VPNs!
  - SMB connections can be secured using IPsec (no NAT traversal required)
  - Microsoft solution: DirectAccess
- In IPv4, NAT (or CGN) makes:
  - End-to-end connectivity difficult or impossible
  - It difficult to secure traffic end-to-end using IPsec



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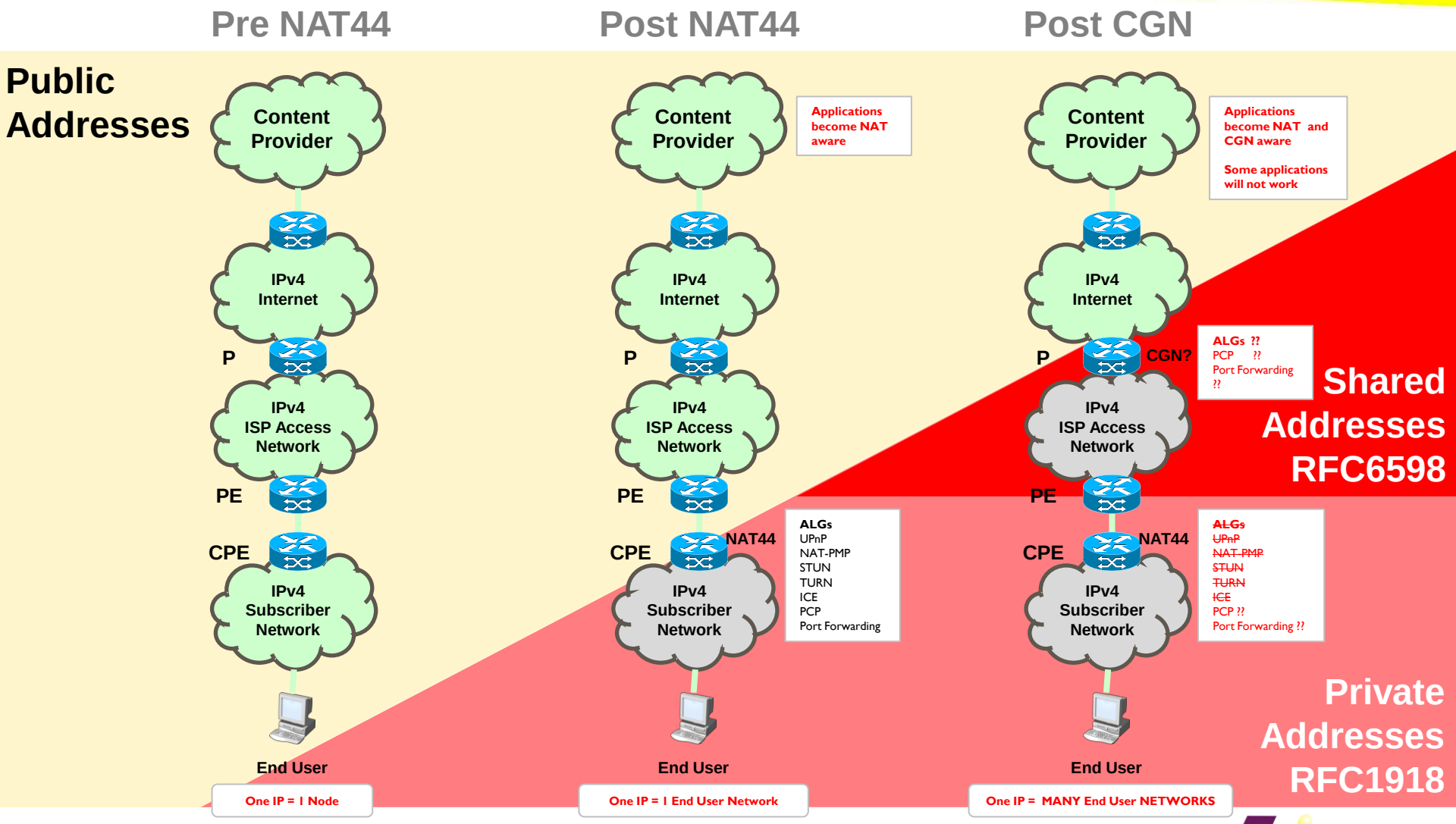
Evolution of NAT and CGN



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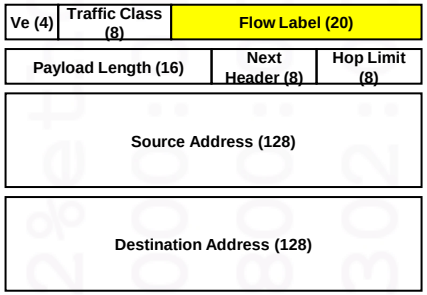
There are other Benefits

- Mobility
  - IPv6 provides only realistic option for global mobile IP nodes
- Quality of Service
  - Flow label makes IntServ realistic possibility where low latency is paramount



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DEPLOYING IPV6-ONLY SAMBA 4

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How to: IPv6-only Samba 4

- Configure IPv6 networks
  - See previous presentations at Samba XP
- Configure IPv6-only nodes
  - No IPv4 addresses
- Build/Install Samba 4 with bug fixes for IPv6
- Provision DC
- Configure member servers
- Join domain
- Manage Samba

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Build/Install Samba 4

- You can use current versions of Samba 4 to create IPv6-only environment, but:
  - Manual workarounds required
  - Some features/tools will not work
- Samba 4 is being fixed for IPv6-only operation
  - Small number of current patches will make this possible in next release
  - However, still a number of issues that need addressing

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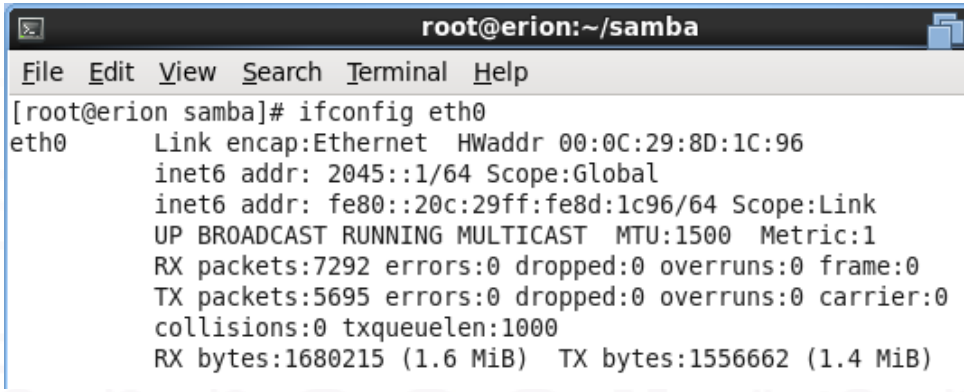
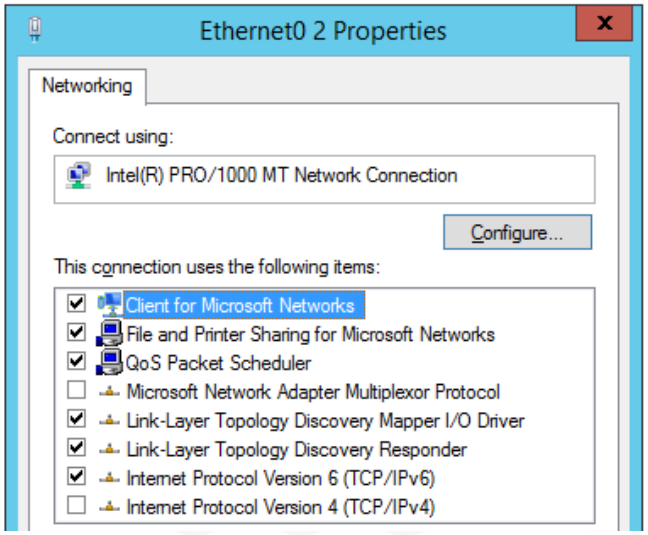
Configure IPv6-only Nodes

- Configure IPv6 manually, using SLAAC or DHCPv6
  - See Samba XP 2011 Presentation

    http://www.ipv6consultancy.com/ipv6blog/?p=76





- Do not configure IPv4

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IPv6-only Name Resolution

- Configure hosts file (**/etc/hosts**)

```
2045::1 erion.erionv6.com erion
```

  - Ensure FQDN comes first (it should do)
- DNS resolver (e.g **/etc/resolv.conf**)
  - On domain controller

```
::1 erion.erionv6.com erion
```

  - On member server

```
2045::1 erion.erionv6.com erion
```

- Do not configure WINS or NetBIOS broadcasts these won't work with IPv6

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Literal Addresses NSS

- **Optionally** configure Literal Addresses
- 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
```


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Link-local Multicast Name Resolution (LLMNR)

- Microsoft's multicast DNS (*not* mDNS!)
- No true open source option
- Not required in an AD domain as only resolves link-local addresses
- Bounty source implementation at http://www.vx68k.org/xllmnrd
- I have not tested this ...
- Open source NSS based solution would be useful in rare cases

```
TCP    [fe80::85cc:a568:4656:fb20%8]:49167  [fe80::6463:a7a0:d182:adc8%8]:445  ESTABLISH
```


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IPv6-only Provision

```
# samba-tool domain provision --option="interfaces=lo eth0" --
option="bind interfaces only=yes" --use-rfc2307 --interactive
Realm [ERIONV6.COM]:
 Domain [ERIONV6]:
 Server Role (dc, member, standalone) [dc]:
 DNS backend (SAMBA_INTERNAL, BIND9_FLATFILE, BIND9_DLZ, NONE)
[SAMBA_INTERNAL]:
 DNS forwarder IP address (write 'none' to disable forwarding) [none]:
Administrator password:
Retype password:
Looking up IPv4 addresses
No IPv4 address will be assigned
Looking up IPv6 addresses

...
Server Role:           active directory domain controller
Hostname:              erion
NetBIOS Domain:        ERIONV6
DNS Domain:            erionv6.com
DOMAIN SID:            S-1-5-21-1196754207-3207730780-3488315545
```


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IPv6-only DC Listeners

```
# netstat -an --inet6 -p
Active Internet connections (servers and established)
Proto Recv-Q Send-Q Local Address               Foreign Address             State       PID/Program name
tcp        0      0 2045::1:53                  :::*                        LISTEN      58017/samba
tcp        0      0 ::1:53                      :::*                        LISTEN      58017/samba
tcp        0      0 2045::1:88                  :::*                        LISTEN      58010/samba
tcp        0      0 ::1:88                      :::*                        LISTEN      58010/samba
tcp        0      0 2045::1:636                 :::*                        LISTEN      58008/samba
tcp        0      0 ::1:636                     :::*                        LISTEN      58008/samba
tcp        0      0 ::1:445                     :::*                        LISTEN      58005/smbd
tcp        0      0 2045::1:445                 :::*                        LISTEN      58005/smbd
tcp        0      0 2045::1:1024                :::*                        LISTEN      58004/samba
tcp        0      0 ::1:1024                    :::*                        LISTEN      58004/samba
tcp        0      0 2045::1:3268                :::*                        LISTEN      58008/samba
tcp        0      0 ::1:3268                    :::*                        LISTEN      58008/samba
tcp        0      0 2045::1:3269                :::*                        LISTEN      58008/samba
tcp        0      0 2045::1:389                 :::*                        LISTEN      58008/samba
tcp        0      0 ::1:3269                    :::*                        LISTEN      58008/samba
tcp        0      0 ::1:389                     :::*                        LISTEN      58008/samba
tcp        0      0 2045::1:135                 :::*                        LISTEN      58004/samba
tcp        0      0 ::1:135                     :::*                        LISTEN      58004/samba
tcp        0      0 ::1:139                     :::*                        LISTEN      58005/smbd
tcp        0      0 2045::1:139                 :::*                        LISTEN      58005/smbd
tcp        0      0 2045::1:464                 :::*                        LISTEN      58010/samba
tcp        0      0 ::1:464                     :::*                        LISTEN      58010/samba
udp        0      0 2045::1:53                  :::*                        58017/samba
udp        0      0 ::1:53                      :::*                        58017/samba
udp        0      0 ::1:88                      :::*                        58010/samba
udp        0      0 ::1:464                     :::*                        58010/samba
udp        0      0 ::1:123                     :::*                        58010/samba
udp        0      0 ::1:88                      :::*                        58010/samba
udp        0      0 2045::1:389                 :::*                        58009/samba
udp        0      0 ::1:389                     :::*                        58009/samba
```

- Notice that Samba is not listening on link-local addresses
- This is a BUG but for most use cases it will still work
- This is a result of using `--option="interfaces=lo eth0" --option="bind interfaces only=yes"` during the domain provision
- Without these options Samba listens on IPv6 wildcard address

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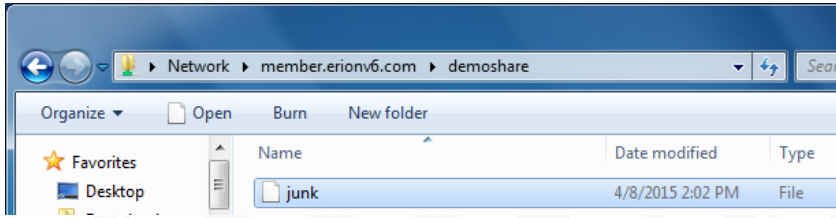
IPv6-only Works But...

- Most things work on patched Samba 4
  - We have tested a range of scenarios and most Samba tools
  - General AD operations and file services work
  - 99% of most common functionality is OK

```
[root@member ~]# smbclient -L //member.erionv6.com -k
Domain=[ERIONV6] OS=[Windows 6.1] Server=[Samba 4.2.0]

        Sharename       Type      Comment
        ---------       ----      -------
        demoshare       Disk
        IPC$            IPC       IPC Service (Samba 4.2.0)
member.erionv6.com is an IPv6 address -- no workgroup available
```



- However ... there are still a few issues

Some Things Fail

- Problems remain most are trivial
  - IPv6 DDNS updates to Samba internal DNS fail
  - Some command line tools fail

```
# net ads dns gethostbyname 2045::1 member.erionv6.com
do_gethostbyname returned ERROR_DNS_SUCCESS (0)
```

Not success!!

  - Occasional syntax constraints

```
# samba-tool dns delete erion.erionsmb.com erionsmb.com member \
AAAA 2045:5249:4f4e:a00::2
Password for [administrator@ERIONSMB.COM]:
ERROR: Record does not exist
# samba-tool dns delete erion.erionsmb.com erionsmb.com member AAAA \
2045:5249:4f4e:0a00:0000:0000:0000:0002
Password for [administrator@ERIONSMB.COM]:
Record deleted successfully
```

Both address formats are legal

  - Samba internal DNS does not support EDNS0

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Other Issues

- Tests – all combinations need to be considered
  - IPv4 – only
  - IPv4 & IPv6 dual stack
  - IPv6 – only
  - Cannot assume correct by just testing IPv4
- Code – sometimes not IPv6 best practice
  - Mix of approaches
  - Major functionality is good

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Conclusion

- It is possible to use Samba 4 in an IPv6-only environment
  - Requires workarounds
  - Nearly production ready
  - Problems will be fixed soon
- Necessary for increasing number of IPv6-only environments
- Greatly simplifies network management
- Has potential performance benefits
- Allows for end-to-end connectivity outside of internal Intranet

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IPv6 and Samba References

- EU IPv6 Curricula Day
  - http://www.ipv6consultancy.com/ipv6blog/?p=70
- Samba XP 2011 Presentation
  - http://www.ipv6consultancy.com/ipv6blog/?p=76
- 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

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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

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Profile: David Holder

- Co-Founder and Managing Director Erion Ltd
- Over 25 years experience in IT industry senior technical and IT management posts
- Chairman of IPv6 Task Force Scotland
- Founder of IPv6 Future Enablers conference
- Regular speaker at global conferences on IPv6
- Extensive experience of IPv6 spanning over a sixteen years
- Customers include; Microsoft, IBM, HP, Cisco, RIM, Orange, Ofcom, BT, Dell, Sophos, Deloittes, Atos Origin
  - PhD in electronic engineering (Microwave Semiconductor Devices)
  - Fellow of IET (FIET)
  - Member of IEEE (MIEEE)
  - Chartered Engineer (CEng)

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Questions

Thank you for listening