Deploying IPv6-only Samba 4 Environments

Samba XP
2015

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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
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?
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 (?)
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
HISTORY AND STATUS OF IPV6 AND SAMBA
# Differences in IPv6 Windows Networks

<table>
<thead>
<tr>
<th>Feature</th>
<th>IPv4</th>
<th>IPv6</th>
</tr>
</thead>
<tbody>
<tr>
<td>NBT/NetBIOS</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>WINS</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>NT Domains</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>SMB/CIFS: File Sharing</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows XP</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Windows 2003</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Active Directory</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Windows Vista</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Windows 7</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>Windows Server 2008</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

Including file sharing and *everything*…
Windows/Samba and IPv6 Name Resolution Options

- NetBIOS name resolution
  - IPv4 Only
- WINS
  - IPv4 Only
- Hosts file
- 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
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
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?)
BENEFITS OF IPV6-ONLY SAMBA 4
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...
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
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
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
Evolution of NAT and CGN

Pre NAT44

Public Addresses

Content Provider

IPv4 Internet

IPv4 ISP Access Network

IPv4 Subscriber Network

End User

One IP = 1 Node

Post NAT44

Content Provider

IPv4 Internet

IPv4 ISP Access Network

IPv4 Subscriber Network

End User

One IP = 1 End User Network

Applications become NAT aware

ALGs
UPnP
NAT-PMP
STUN
TURN
ICE
PCP
Port Forwarding

Applications become NAT and CGN aware

Some applications will not work

Post CGN

Content Provider

IPv4 Internet

IPv4 ISP Access Network

IPv4 Subscriber Network

End User

One IP = MANY End User NETWORKS

Applications become NAT and CGN aware

ALGs
UPnP
NAT-PMP
STUN
TURN
ICE
PCP
Port Forwarding

Applications become NAT and CGN aware

Some applications will not work

Shared Addresses

RFC6598

Private Addresses

RFC1918

One IP = 1 End User Network

One IP = MANY End User NETWORKS

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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
DEPLOYING IPV6-ONLY SAMBA 4
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
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
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
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
**Literal Addresses NSS**

- **Optionally** configure Literal Addresses
  - 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.example.com.) 56 data bytes
  64 bytes from fc12.example.com.: icmp_seq=1
  ```
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/xllmnnrd
- I have not tested this ...
- Open source NSS based solution would be useful in rare cases
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
```
IPv6-only DC Listeners

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
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.eronv6.com -k

<table>
<thead>
<tr>
<th>Sharename</th>
<th>Type</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>demoshare</td>
<td>Disk</td>
<td></td>
</tr>
<tr>
<td>IPC$</td>
<td>IPC</td>
<td>IPC Service (Samba 4.2.0)</td>
</tr>
</tbody>
</table>

member.eronv6.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
- Occasional syntax constraints
- Samba internal DNS does not support EDNS0
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
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
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.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
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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)
Questions

Thank you for listening