



**IPV6 IMPLEMENTATION CASE
STUDY**

**ITU IPv6 and
IoT Workshop**

IPV6 READINESS ASSESSMENT APPROACH

The scope of the readiness assessment cover all networking equipment, operating system, application and services.

Automated discovery tool was used to gather system details directly from each device in some segments.

Manual identification of entities by the network administrator as the list of the network entities is also used.

Discovery of the network devices, services and applications in preparation of IPv6 was done using **Nmap**.

Nmap ("Network Mapper") is a free and open source (license) utility for network discovery and security auditing.

IPV6 READINESS ASSESSMENT APPROACH

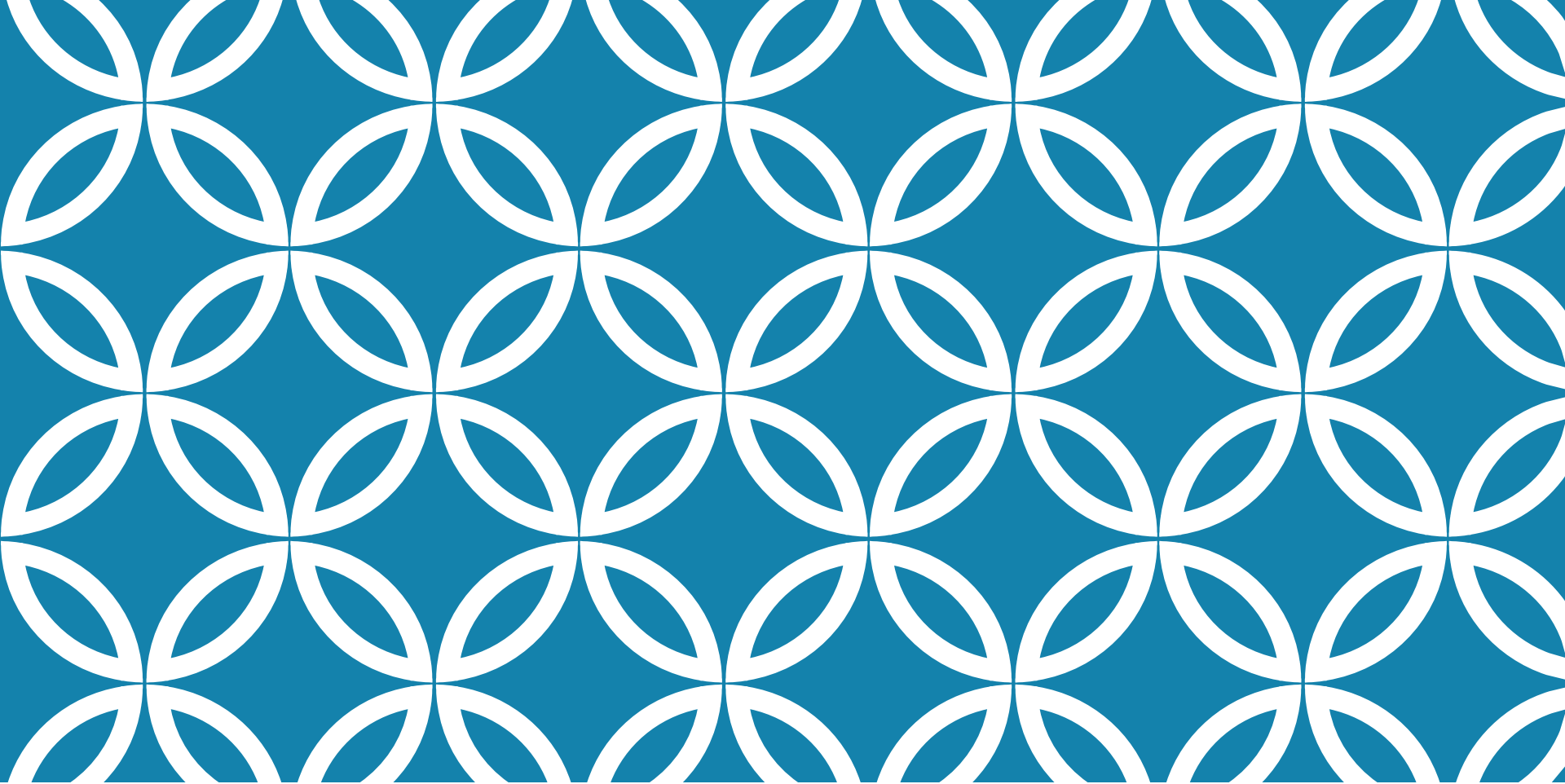
Based on the entities discovered and/or listed, we identified and categorize each in one of three ways:

- Already IPv6 capable.
- Requires an upgrade.
- Lack of Information/Requires Further Investigation

LOCATIONS COVERED

Five locations are covered in this assessment:

- Data Center 1 (DC).
- Data Center 2 (DC).
- Data Center 3 (DC).
- HQ
- Branch



Location 1

DATA CENTER 1 (DC) |

IPV6 READINESS ASSESSMENT SUMMARY

1324 network entities were discovered in Client's network

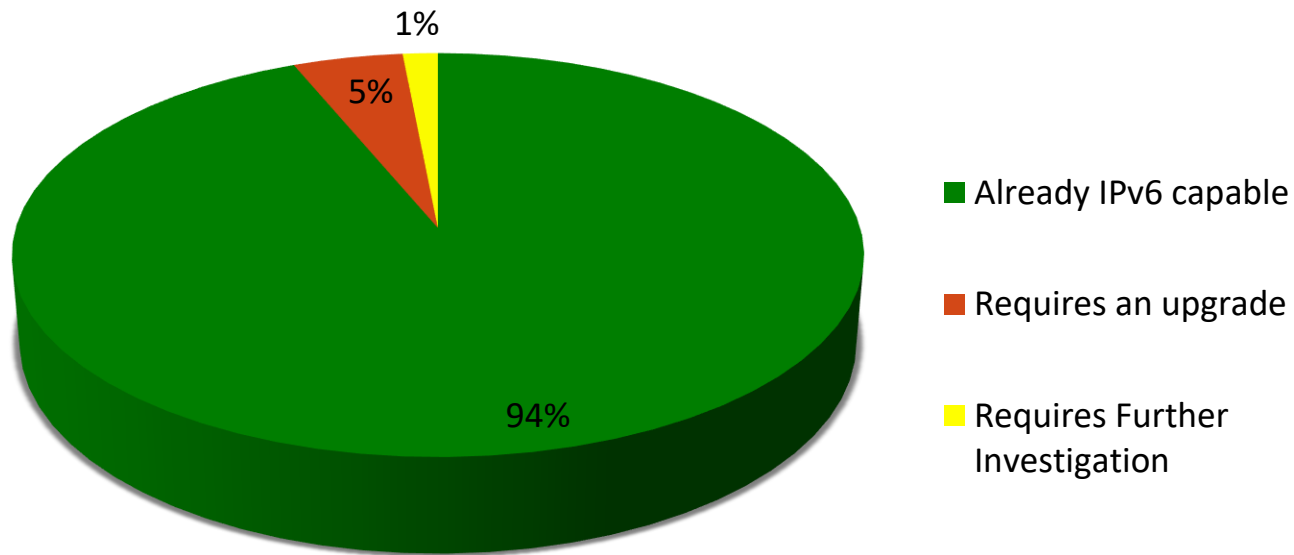
1241 are IPv6 capable entities

63 requires upgrade

20 entities requires further investigation

IPV6 READINESS ASSESSMENT SUMMARY

Network Entities Discovered in Client's Network



NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
Microsoft Windows 7 / 8 / 8.1	12		
Microsoft Windows 2003	81	Yes	IPv6 not installed by default. Recommended to upgrade to Windows Server 2008
Microsoft Windows 2008	171	Yes	
Microsoft Windows 2012	265	Yes	
VMWare ESXi 5.5	112	Yes	
IBM AIX 6.1	53	Yes	
IBM HMC	5	Yes	
HP HP-UX 11.11	5	Yes	
HP HP-UX 11.23	11	Yes	
Linux kernel 2.6.x - 3.10	15	Yes	Linux Kernel 2.6.x and above support IPv6

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
Red Hat Enterprise Linux (RHEL) 5.0 – 5.11	120	Yes	
Red Hat Enterprise Linux (RHEL) 6.2 – 6.8	163	Yes	
Red Hat Enterprise Linux (RHEL) 7.1 – 7.2	9	Yes	
Solaris 10	41	Yes	
Solaris 11	32	Yes	
SuSE Linux Enterprise Server 9	1	Yes	Not full support. Upgrade to SuSE Linux Ent Svr 11 for full IPv6 support
Aruba A7220 running 6.3.1.16_49356	1	Yes	
Brocade Switch running OS v6.4.1a / OS v7.3.1d	5	Yes	BR support IPv6 starting from OS v6.0.1
Cisco WS-C3750 IOS 15.0	2	Yes	
Cisco 3845 IOS 12.4Y or 12.4T	10	Yes	
Cisco ASA5520 8.2 or 9.1 / ASA5540 8.2 Adaptive Security Appliance	22	Yes	

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
Cisco MDS 9100 NX-OS 5.0	2	Yes	
Cisco C3900 IOS (15.2 – 15.3)	3	Yes	
Cisco N7K-C7010 NX-OS 6.2	9	Yes	
Cisco Nexus 7000 switch (NX-OS 6.0)	3	Yes	
Cisco N5K-C5596UP NX-OS 6.0	12	Yes	
Cisco WS-C2960 IOS 15.0	2	Yes	
Cisco 7206 IOS 12.4	1	Yes	
Cisco n5000 NX-OS 6.0	3	Yes	
Cisco C2900 IOS 15.4	1	Yes	
Cisco 3745XM IOS 12.4(9)T3	1	Yes	
Cisco 2801 and 2821 IOS 12.4	2	Yes	It is better if upgrade to 12.4T
Cisco ASA Running 8.2 - 9.6	7	Yes	

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
Cisco ACS 5.5	1	Yes	
F5 Networks BIG-IP vCMP Guest Running 11.4.1 / 11.5.1 / 11.5.4	17	Yes	Beginning in BIG-IP 11.2.0, F5 supports assigning either IPv6 or IPv4 addresses to the management interface.
F5 Networks BIG-IP VPR-C2400 Running 11.4.1	2	Yes	Beginning in BIG-IP 11.2.0, F5 supports assigning either IPv6 or IPv4 addresses to the management interface.
Fortinet FortiGate 1500D v5.2.5	4	Yes	
CSACS-1121-K9 running Cisco ADE-OS 2.0	1	Yes	Cisco ADE-OS 2.0 support IPv6
Windows Server 2008 running IBM Security SiteProtector	2	Yes	IPv6 analysis and policy management is supported by IBM Security SiteProtector
Linux 2.6.16.46 running IBM NIPS GX5008	3	Yes	Linux Kernel 2.6.x support IPv6. For IBM NIPS, appliance management via IPv6 is limited to appliances with firmware 4.1 or greater

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
AsynchOS 9.1.1 Web Security Appliance	1	Yes	
RHEL Server 6.7 running IBM QRadar 7.2.6	4	Yes	RHEL 6.7 support IPv6. IPv6 addressing is supported for network connectivity and management of IBM Security QRadar software and appliances.
Windows Server 2012 running IBM Wincollect 7.2.3	1	Yes	
RHEL Server 6.8 running SYSLOG server	1	Yes	SYSLOG server support IPv6 by the OS (RHEL 6.8)
Nessus 6.1.2 Tenable Appliance 3.2.0.x86_64	1	Yes	
FireEye7400 - wMPS 7.7.1	1	Yes	FireEye OS 7.1 and above support IPv6
FireEye AFO 1G Switch	2	Yes	This bypass switch is based on layer 2 (Data Link)

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
RHEL Server 6.6 running Rapid 7 Nexpose 6.4.18	2	Yes	
Windows Server 2012 running Rapid 7 Nexpose 6.4.18	2	Yes	
Windows Server 2008 running SQL Server 2012	1	Yes	
Windows Server 2008 running SQL Server 2008 R2	1	Yes	
Windows Server 2008 running Symantec DLP 14.0	4	Yes	Symantec Data Loss Prevention (DLP) 14.0 and later support IPv6
Windows Server 2008 running Symantec EPM 12.1	2	Yes	Symantec Endpoint Encryption support IPv6 from version 11.0.1 onwards
Windows Server 2008 running Symantec CSP 5.2.9	1	Yes	
Windows Server 2008 running Symantec CCS 11	2	Yes	

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
Windows Server 2008 running nCipher	2	Yes	nCipher support IPv6
Aruba ClearPass Policy Manager 6.5.5	1	Yes	Aruba ClearPass Policy Manager 6.4.0 onwards support IPv6
Microsoft Windows 2000	3	Limited Support	Windows 2000 support basic IPv6. Upgrade to Windows 2008 or Above for full IPv6 support
Red Hat Enterprise Linux (RHEL) 4.0	2	Limited Support	RHEL 4 has limited support for IPv6. Upgrade to RHEL 5 or higher for full IPv6 support
Solaris 8	3	Limited Support	Solaris 8 has limited support for IPv6. Upgrade to solaris 9 or higher for full IPv6 support
Cisco WS-C3560 IOS 12.2	20	Limited Support	IOS 12.2 has limited IPv6 support. Since this is Layer 2 switch it is not required to have full support. Upgrade to 12.42T or above for full IPv6 support
Cisco WS-C2960 IOS 12.2	2	Limited Support	IOS 12.2 has limited IPv6 support. Since this is Layer 2 switch it is not required to have full support. Upgrade to 12.42T or above for full IPv6 support

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
Cisco 3845 IOS 12.3(11)T5	1	Limited Support	IOS 12.3 has limited IPv6 support. Upgrade to 12.42T or above for full IPv6 support
Windows Server 2008 running NetIQ IDM	7	Limited Support	Windows Server 2008 support IPv6. Make sure to have NetIQ IDM 4.5 for IPv6 support
RHEL Release 4 running SYSLOG	1	Limited Support	RHEL 4 has limited support for IPv6. Upgrade to RHEL 5 or higher for full IPv6 support so that SYSLOG server will support IPv6
Red Hat Enterprise Linux (RHEL) 3.2	2	No	RHEL 3.2 is based on kernel 2.4 that doesn't support IPv6. Upgrade to RHEL 5 or higher for full IPv6 support
Cisco WS-C2950 IOS 12.1	7	No	IOS 12.1 doesn't support IPv6. Since this is Layer 2 switch it is not required to support IPv6. Upgrade to 12.42T or above for full IPv6 support
Cisco 3508 IOS 12.0	4	No	IOS 12.0 doesn't support IPv6. Since this is Layer 2 switch it is not required to support IPv6. Upgrade to 12.42T or above for full IPv6 support

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
Cisco WS-C6509 CatOS 7.5	1	No	CatOS 7.5 doesn't support IPv6. Since this is Layer 2 switch it is not required to support IPv6.
Cisco WS-C2948 CatOS 5.5	1	No	CatOS 5.5 doesn't support IPv6. Since this is Layer 2 switch it is not required to support IPv6.
Cisco AIR-CT5508-K9 Rel 7.4.121.0	2	No	Upgrade to Rel 8.0.100.0 to support IPv6
Cisco 3660 router IOS 12.1	2	No	IOS 12.1 doesn't support IPv6. Upgrade to 12.42T or above for full IPv6 support
Cisco C6MSFC2 IOS 12.1	1	No	IOS 12.1 doesn't support IPv6. Upgrade to 12.42T or above for full IPv6 support
Riverbed 5050H Running 7.0.4	1	No	SteelHeads start supporting IPv6 on RiOS version 8.5
Riverbed scsbs8150 Running 5.3.1	1	No	SteelHeads start supporting IPv6 on RiOS version 8.5

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
CentOS 5.8 Running Symantec Encryption Server 3.3.2	1	No	CentOS 5.8 support IPv6. Symantec Encryption Management Server does not support IPv6 configuration.
RHEL Server 6.8 running Carbon Black (CB) Response	1	No	IPv6 support is not implemented yet in CB Response
IBM Virtual I/O Server	2	---	Consult Product vendor for IPv6. Release 2.2.3.50 should support full IPv6
F5 Labs Inc. BIG-IP	2	---	Consult Product vendor for IPv6 Readiness.
Fortinet	1	---	Consult Product vendor for IPv6 Readiness.
Frontier Software Development 2995D1	1	---	Consult Product vendor for IPv6 Readiness.
NetScout PFS 3901	1	---	Consult Product vendor for IPv6 Readiness.
Imperva M160 Management Server 6.3	1	---	Consult Product vendor for IPv6 Readiness.

NETWORK ENTITIES DISCOVERED

Network Entity	No of Nodes	IPv6 Capable	Remark
Imperva X4510 Gateway 6.3	1	---	Consult Product vendor for IPv6 Readiness.
Windows Server 2012 running ObservelT	3	---	ObservelT supported IPv6 from version 5.6.4 onwards
Windows Server 2012 running ID Governance	1	---	Consult Product vendor for IPv6 Readiness.
Windows Server 2008 running Symantec IT Analytics	1	---	Consult Product vendor for Symantec IT Analytics IPv6 support.
Windows Server 2008 running Master SAM PUM / PMS	6	---	Consult Product vendor for IPv6 Readiness.

NETWORK DEVICES (LAYER 2)

Layer 2 switches do not require IPv6 capability.

Layer 2 switches are working based on MAC addresses and not affected by the IP layer.

Only need to upgraded If switch management required through IPv6.

NETWORK DEVICES (LAYER 3)

Most layer 3 switches are capable of handling both IPv4 and IPv6 traffic.

Cisco 3845 running IOS 12.3(11)T5 have limited support for IPv6 and its recommended to upgrade to IOS 12.42T or above.

Cisco 3660 router IOS 12.1 and Cisco C6MSFC2 IOS 12.1 may not support IPv6 and its firmware should be upgraded to a newer version with IPv6 support.

SECURITY INFRASTRUCTURE

Most of the security devices and applications support IPv6.

NetIQ IDM from Micro Focus support IPv6 if it runs version 4.5 or above.

Symantec Encryption Management Server does not support IPv6 configuration.

Consult product vendor for IPv6 support of the Carbon Black Response.

NETWORK MANAGEMENT TOOL

Some of the network management tools do not support IPv6.

These tools need to be upgraded to to IPv4/IPv6 dual-stack capable system.

Consult Product vendor for upgrading.

NETWORK MANAGEMENT TOOL

Name	Model	Firmware	Manufacturer	IPv6 Support
Mobility Controller	A7220	6.3.1.16_49356	Aruba Networks Inc.	Yes
Virtual Clustered Multiprocessing	BIG-IP vCMP Guest	11.4.1, 637.0	F5 Networks Inc.	Yes
Virtual Clustered Multiprocessing	BIG-IP vCMP Guest	11.5.1, 5.0.147	F5 Networks Inc.	Yes
Virtual Clustered Multiprocessing	BIG-IP vCMP Guest	11.5.4, 1.0.286	F5 Networks Inc.	Yes
Application Delivery Controller	BIG-IP VPR-C2400	11.4.1, 637.0	F5 Networks Inc.	Yes
Application accelerator	5050-H	7.0.4	Riverbed	No
Central Management Console	8150	5.3.1	Riverbed	No
Packet Flow Switch	3901		NetScout	N/A

DATABASE SERVER

The SQL Server are able to handle IPv6 traffic.

RECOMMENDATION

Upgrade all layer-3 switches that don't support IPv6 to dual-stack ones.

The current Layer-2 switches can be retained, as IPv6 does not require configuration on Layer-2 devices. You can upgrade the none IPv6 supported switches to IPv4/IPv6 dual-stack capable one if you want to manage the switches using IPv6.

Follow the recommendation stated in the remark column in table 1.

CONCLUSION

93% of the entities discovered in Client's network supports IPv6.

Numerous entities found in the network are not IPv6 capable or requires further investigation.

Some devices/services need to be upgraded/replaced to ensure IPv6 deployment can be carried out seamlessly

PROJECT OBJECTIVES

Overview

Client would like to migrate the current corporate websites to support both IPv4 and IPv6

Objectives

The proposed work scope under the Phase 1 Website Migration involved only migrating the following corporate websites.

- www.abc.com.my
- www.def.com.my

ORIGINAL PROJECT SCOPE OF WORK

1. 0 Migration Planning

1.1 Identify, validate, and confirm the whether the following hardware and software supports IPv6 for hosting the above mention websites.

Firewall

Web Server

DB Server

DNS Server

Programming language

Operating Systems

1.2 IPv6 addressing planning for the webservers

- Discussion and planning whether to use NAT 666 addressing or using IPv6 Global Unicast address only.

PROJECT SCOPE OF WORK

2.0 Migration of www.abc.com.my to support dual stack

Check the existing IPv4 address coding in the existing website.

Verify whether the website IPv4 address are hard coded or using dynamic coding.

Verify the IPv4 functions in the scripts such as PHP, CGI and etc.

Host the IPv6 version of website on an IPv6 ready server.

Register the AAAA record on a DNS serving the IPv6 global community.

PROJECT SCOPE OF WORK

3.0 Migration of `www.def.com.my` to support dual stack

Check the existing IPv4 address coding in the existing website.

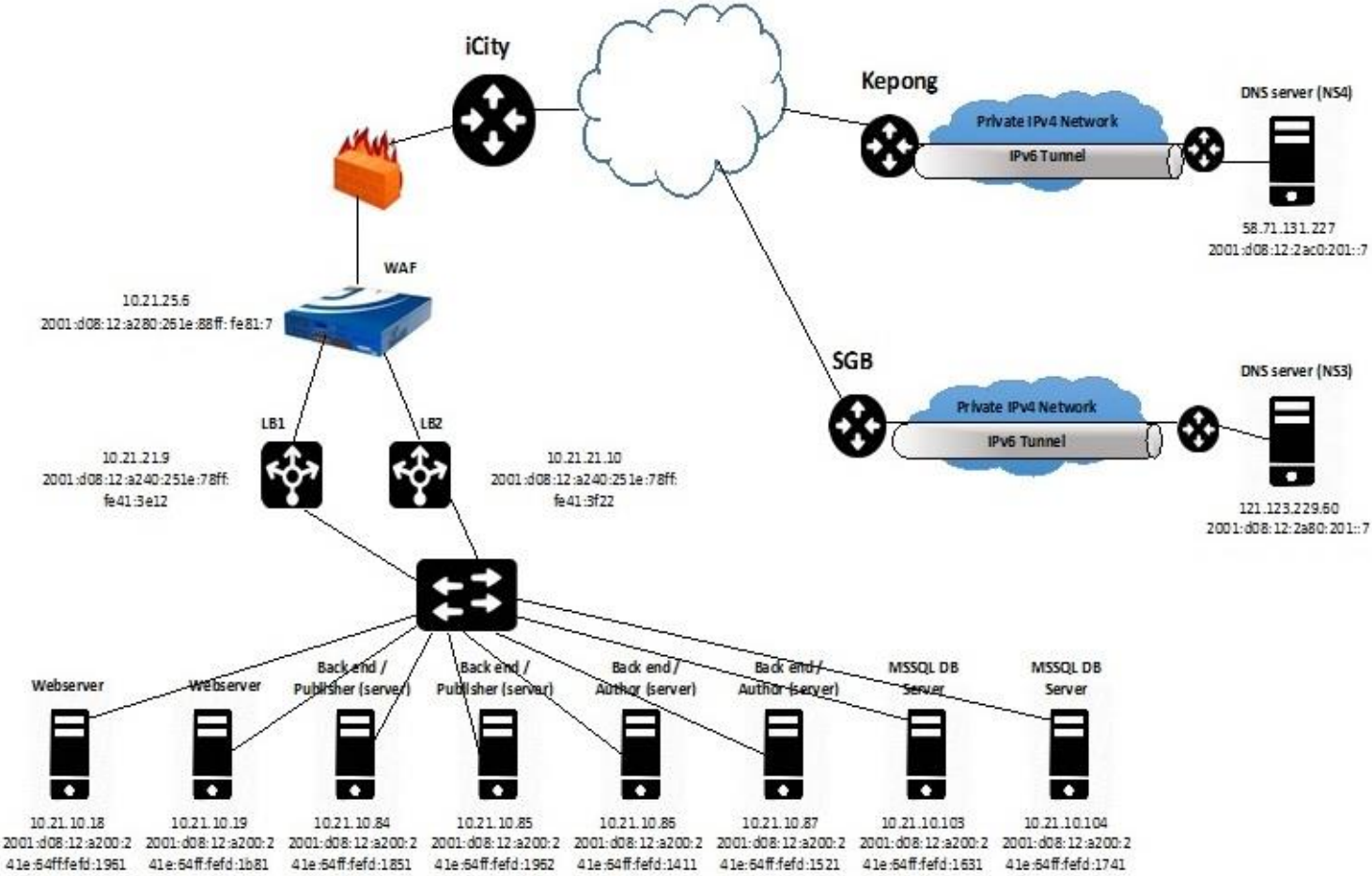
Verify whether the website IPv4 address are hard coded or using dynamic coding.

Verify the IPv4 functions in the scripts such as PHP, CGI and etc

Host the IPv6 version of website on an IPv6 ready server (provider)

Register the AAAA record on a DNS serving the IPv6 global community.

PROPOSED IPV6 TRANSITION



PROJECT SCOPE OF WORK

4.0 User Acceptance Test

Browse the migrated website from IPv4 host and record the results.

Browse the migrated website from IPv6 host and record the results.

Prepare report and submit for endorsement.

PROJECT WORK SCOPE

Assign IPv6 address for the following devices and servers in Branch site

WAF – 1 unit

Load Balancer – 2 units

Servers

- Webservers – 2 units
- Backend /Publisher – 2 units
- MSQl DB – 2 units

Note : Client team agreed to configure ASR, N5K switch, Fortigate IPS and ASA Firewall

PROJECT WORK SCOPE

To access the DNS servers ie. NS3 and NS4 in Location A and B, create tunnel between Data Centre site and these sites.

LB IPV6 ADDRESS CONFIGURATIONS

The f5 load balancer is IPv6 ready.

Configure virtual servers, pools and nodes for IPv6 based on existing IPv4 setup and policy.

WAF IPV6 ADDRESS CONFIGURATIONS

- SecureSphere provides comprehensive IPv6 support for web traffic inspection and communication between SecureSphere system components.
- This comprehensive support is available in version 9.0 and apply to WAF only.
- Based on Imperva, the feature is enabled by default and cannot be disabled.



THANK YOU