Introduction to IPv6 - Lab

Structure and function of IPv6 addresses

NALINI ELKINS

INDUSTRY NETWORK TECHNOLOGY COUNCIL

PRESIDENT@INDUSTRYNETCOUCIL.ORG

Getting Ready

If you want to follow along during the class, you might want:

- On Windows, open Command prompt
- On Linux, open terminal window
- On MAC, open terminal window
- On Android or iPhone, install "Net Analyzer" app

You can do the commands that we talk about on your own system.

If this is not possible for you, don't worry! We will provide the recording of this session.

Collaborative Project

- India Internet Engineering Society (IIESoc) and Industry Network Technology Council (INTC)
- Funding: Grant from ISIF Asia
- Thank you!

https://www.iiesoc.in/

https://industrynetcouncil.org/

Vision

Multi-year project: IPv6 deployment at enterprises.

Collaboration with American Registry for Internet Numbers (ARIN)

- Provide training,
- Analysis of security and application conversion,
- Help enterprises plan their IPv6 deployment.

Classes

- Introduction to IPv6 : Feb 4, 2021 ✓
- Lab: IPv6 basics : Feb 11, 2021
- Neighbor Discovery: March 4, 2021
- Lab: Neighbor Discovery: March 18, 2021
- IPv6 Address Planning: April 8, 2021
- Lab: IPv6 Address Planning: April 15, 2021
- IPv6 Transition Mechanisms: May 6, 2021
- Lab: IPv6 Transition Mechanisms: May 13, 2021

- DHCPv6: June 3, 2021
- Lab: DHCPv6: June 10, 2021
- IPv6 and Cloud: June 17, 2021
- Lab: IPv6 and Cloud: June 24, 2021
- Introduction to IPv6 Security July 8, 2021

The next sessions are sponsored by a generous grant from ARIN.

- Trace Reading: August 12, 2021
- Troubleshooting: August 19, 2021

A few words about me

- President: Industry Network Technology Council
- Founder & CEO: Inside Products, Inc.
- Advisory Board: India Internet Engineering Society
- RFCs: RFC8250 (Embedded performance and diagnostics for IPv6) and others
- Product developer (OEMed by IBM and others)
- Working with IPv6 for 15 years
- Working with network management, diagnostic, performance issues at large brick-and-mortar enterprises for over 30 years

Mike Ackermann

- Michael Ackermann is the **Lead Network Engineer of the System Management and Monitoring Team, at Blue Cross Blue Shield of Michigan.**
- He is responsible for all aspects of **planning, engineering, deployment and administration** for all enterprise wide Management, Monitoring and Diagnostic activities.
- Mike also serves as a **chief architect** for all Plan related IT issues. He has been a member of the BluesNet and Network Advisory Group committees since their inception and has served as committee and subcommittee chair on numerous occasions. Mike has also been a member of several advisory boards and is currently **active in the IETF and INTC**.

Agenda

- Suggested Review:
  - Types of IPv6 addresses
  - IPv6 prefixes
  - Multicast addresses
  - Multicast scopes

- Hands-on lab
  - Do I have an IPv6 address?
  - What is it?
  - Why do I have so many?
  - Who gave them to me?
  - What is my router address?
  - Can I talk to anyone?
  - What is all this background chatter?

Please review!

- Types of IPv6 addresses
- IPv6 prefixes
- Multicast addresses
- Multicast scopes

HTTPS://INDUSTRYNETCOUNCIL.ORG/PAST-WEBINARS

Mike’s Intro

Objectives

- When first getting started with IPv6, it is sometimes not obvious what to do, where to look, and what commands or definitions are initially important.
- I know I expended a lot of time/effort attempting to discern the above and frequently was lost or stalled.
- The information contained is an attempt to impart what I wish I initially knew, that could have saved the most time and effort.

Hands-on (live!)

Mike and Nalini will explain

If you have an iPhone or Android, this would be a good time to bring up the Net Analyzer app. Other folks, please bring up terminal or command window as appropriate for your OS.

Do I have an IPv6 address?

What is my IPv6 address?

Why do I have so many?

Who gave them to me?

What is my router address?

How to look

- Is IPv6 installed & active in my kernel?
  - Usually yes.
- Is IPv6 active on an interface
  - It depends.
  - Let’s look.
  - Do we have a Link-Local address?
  - Do we have a Global Unicast address
- To find out:
- Do IPConfig or IFConfig command

Can I talk to anyone?
(AKA having fun with multicast!)

More Information

- The appendixes provide commands and examples that can be immediately used in your own network and/or in INTC Labs.

- We hope the consternation regarding IPv6 will be reduced or eliminated. Quite a bit of IPv6 is already on our networks and platforms.

- One final success factor, is to stay connected to IPv6 SMEs, in case you do have questions or need assistance (E.G. Nalini, IETF, INTC, ARIN, etc.).

Classes

- Introduction to IPv6 : Feb 4, 2021 ✓
- Lab: IPv6 basics : Feb 11, 2021 ✓
- Neighbor Discovery: March 4, 2021
- Lab: Neighbor Discovery: March 18, 2021
- IPv6 Address Planning: April 8, 2021
- Lab: IPv6 Address Planning: April 15, 2021
- IPv6 Transition Mechanisms: May 6, 2021
- Lab: IPv6 Transition Mechanisms: May 13, 2021

- DHCPv6: June 3, 2021
- Lab: DHCPv6: June 10, 2021
- IPv6 and Cloud: June 17, 2021
- Lab: IPv6 and Cloud: June 24, 2021
- Introduction to IPv6 Security July 8, 2021

The next sessions are sponsored by a generous grant from ARIN.

- Trace Reading: August 12, 2021
- Troubleshooting: August 19, 2021

Next Steps

- INTC Survey: Help Enterprise Advisory Council to decide on most important topics:

  https://www.surveymonkey.com/r/INTC-EACSurvey

- Call for Participation: Enterprise IPv6 Survey

  https://www.surveymonkey.com/r/EnterpriseIPv6CallForParticipation

- Call for Participation: Universities

  https://www.surveymonkey.com/r/UniversityIPv6CallForParticipation

Questions?

Contact:

info@iiesoc.in

president@industrynetcouncil.org

Appendix 1

IPv6 Prefix Cheat Sheet

Important IPv6 Prefix Notations

/8

```
11111111xxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx
```

```
00xx::
FFxx::
```

/16

```
1111111111111111.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx
```

```
0000::
FFFF::
```

/32

```
1111111111111111.1111111111111111.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx
```

```
0000:0000::
FFFF:FFFF::
```

/48

```
1111111111111111.1111111111111111.
1111111111111111.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx
```

```
0000:0000:0000::
FFFF:FFFF:FFFF::
```

/56

```
1111111111111111.1111111111111111.
1111111111111111.11111111xxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx
```

```
0000:0000:0000:00xx::
FFFF:FFFF:FFFF:FFxx::
```

/64

```
1111111111111111.1111111111111111.
1111111111111111.1111111111111111.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx.
xxxxxxxxxxxxxxxx.xxxxxxxxxxxxxxxx
```

```
0000:0000:0000:0000::
FFFF:FFFF:FFFF:FFFF::
```

Appendix 2

Interesting Commands for Linux

Linux Kernel

- Is IPv6 installed and active in my kernel –
  sudo sysctl -a|grep ipv6|grep disable

  Returns:

  net.ipv6.conf.all.disable_ipv6 = 0

  (shows IPv6 is not disabled)

- For other kernel parameters and definitions –
  sudo sysctl -a|grep ipv6

Linux Connectivity

- Show all interfaces with IPv6 addresses

Ip -6 addr

Ifconfig -a

- Display IPv6 routes (can also use netstat)

Ip -6 route

- Show IPv6 neighbors (Try multicast Ping first)

Ip -6 neigh

- Show all IPv6 network statistics

netstat -an |grep 'tcp6\|udp6'

Linux Connectivity

- Unicast PING / Traceroute

ping6 2600:1500:2001:ad02::xxyy

ping6 ens192 fe80::250:56ff:feb9:xxxx (Remember, link-local requires -I)

ping6 -I ens192 fe80::250:56ff:feb9:xxxx

traceroute -6 2600:1500:2001:ad02::zzzz

- Multicast PING (All nodes on local link)

ping6 -c 2 -I ensxxx ff02::1

(Replace ”enxxxx” with your own interface)

Appendix 3

Interesting Commands for Windows

Windows OS

Is IPv6 installed and active in my Windows server or client

- GUI:

Look in network options for the adapter. IPv6 is checked.

- CLI:

netsh interface ipv6 show global

(lots of information returned if IPv6 is active)

Windows Interface

Install and activate IPv6 on an interface -

- GUI:

  Can see change / add in network options for the adapter properties.

- CLI:

netsh interface ipv6 show int

netsh interface ipv6 show addr

netsh interface ipv6 show global

netsh interface ipv6 add address 2607:5501:3000:2972::2

Windows IPv6 Interface Info

- Show all interfaces with IPv6 addresses

Ipconfig /all

- Detailed IPv6 definitions for interface 5

netsh int ipv6 show int 5

- Show IPv6 neighbors (try multicast PING first)

netsh int ipv6 show neigh

Windows IPv6 Connectivity

- Unicast test connectivity

ping -6 google.com
ping -6 2607:f8b0:400a:805::200e

- Multicast test connectivity

ping -6 -n 2   ff02::1

Appendix 4

iPhone and Android

Net Analyzer App

Lots of others available!