Internet Protocol - Addressing and Subnetting Fundamentals

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Course Overview

Network Topologies and the OSI Model

**Internet Protocol –
Addressing and Subnetting Fundamentals**

Internet Protocol –
ARP and DNS Fundamentals

Internet Protocol - Routing Packets

Routing Packets with Linux

Investigating TCP Internals

Troubleshooting Network Issues

Module Overview

IP Addressing

Anatomy of an IP

IP Subnetting

Classful and Classless Routing

VLSM

Special IP Addressing

Public and Private Addressing

Network Address Translation

IP Address

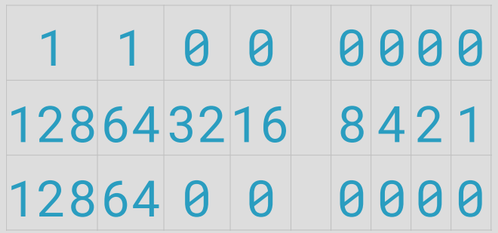
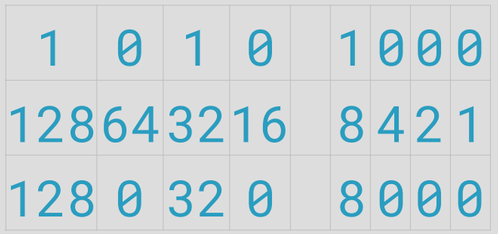
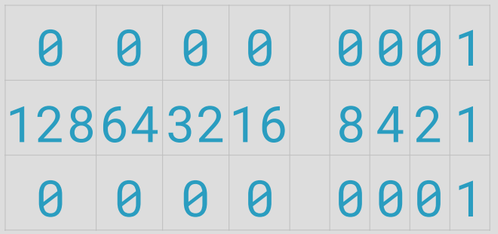
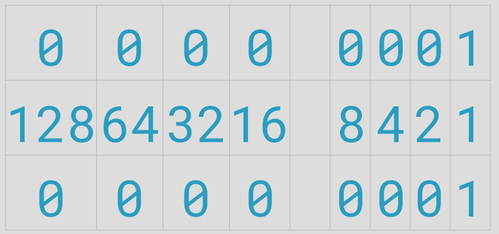
A unique addressed used to locate devices on a network

- **Identification and location**
- **Assigned to all network devices on an IP based network**
- **Layer 3 of the OSI Model**

Subnet (network)

A logically grouped collection of devices on the same network

Anatomy of an IP address

192	168	1	1
1100 0000	1010 1000	0000 0001	0000 0001
			
128+64=192	128+32+8=168	1	1

Network Masks and IP Subnets

Partitioning larger networks

Separates the portion of the network bits from the host bits

Network/Subnet mask

All nodes on a network segment should have the same network mask

Anatomy of an IP address - Subnet Mask

192	168	1	1
1001 0010	0110 1000	0000 0001	0000 0001
255	255	255	0
1111 1111	1111 1111	1111 1111	0000 0000
Network			Host
192.168.1.0/24			1-254

Subnet Masks

Classful - networks are on the octets bit boundary

	Network bits	Host bits	Mask	Networks	Hosts
A	8	24	255.0.0.0	128 (2^7)	16777216 (2^{24})
B	16	16	255.255.0.0	16384 (2^{14})	65536 (2^{16})
C	24	8	255.255.255.0	2097152 (2^{21})	256 (2^8)

Classful subnetting
leads to inefficient
allocation of addresses

Variable Length Subnet Masks (VLSM)

Using varying length masks based on needs.

Classless Inter Domain Routing (CIDR)

Partitioning a subnet into smaller IP networks
based on moving the bits in the mask.
Summarizing the routes.

Anatomy of an IP address - VLSM

192	168	1	0
1001 0010	0110 1000	0000 0001	0000 0001
255	255	255	128
1111 1111	1111 1111	1111 1111	1000 0000
Network /25			Host

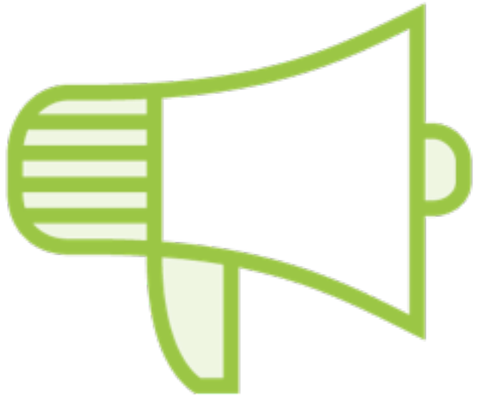
Anatomy of an IP address - CIDR

192	168	1	0-127
192	168	1	128-255
255	255	255	128
1111 1111	1111 1111	1111 1111	1000 0000
Network /25			Host

Special Addresses

Network

first address
on the network
(first host with all 0's)



Broadcast

last address
on the network
(last host with all 1's)

Loopback

127.0.0.1
(often called localhost)

Special Addresses (con't)

Reserved addresses for private networks

10.0.0.0/8

172.16.0.0/12

192.168.0.0/16

https://en.wikipedia.org/wiki/Reserved_IP_addresses

Public and Private Addressing

Reserved addresses are used for private networks

Public addresses are used for publicly accessible resources

- Addresses are assigned by your ISP who get them from IANA

IP Conservation

Security

Network Address Translation

Allows a privately addressed resource to be available on a public IP

Requires a firewall or router

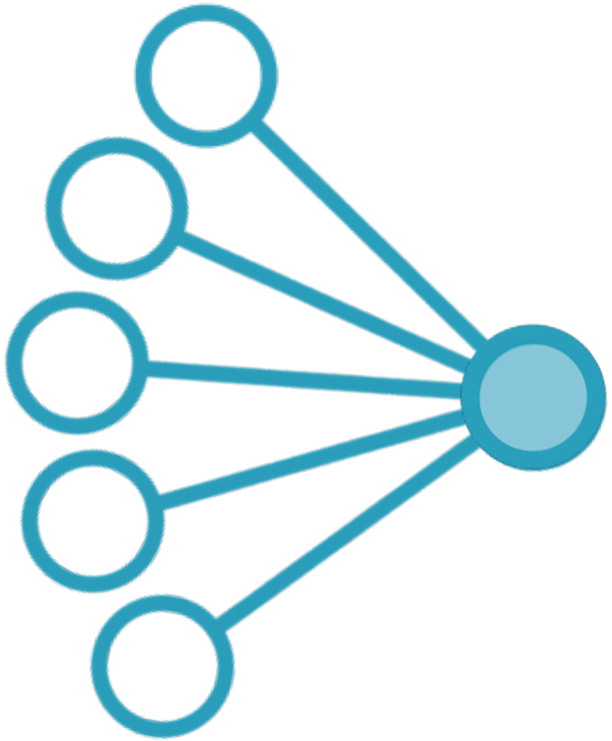
IP Conservation

Security

Network Address Translation

One to One

Translating one IP to another



Many to One

Translating hosts on a network to one IP. Port address translation.

IPv4 and IPv6

$2^{32} = 4{,}294{,}967{,}296$

Take out network and broadcast addresses, reserved ranges, special addressing

Device proliferation

NAT an CIDR have helped significantly

$2^{128} = 3.4 \times 10^{38}$

Demo

Lab Environment

- Review host IP configuration
- Configure VLSM on this host
- Example NAT configuration

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NAT

What's Next!

Internet Protocol – ARP and DNS Fundamentals

References

- **Internetworking with TCP/IP Vol. 1** by Douglas Comer - http://amzn.to/29X7dyT