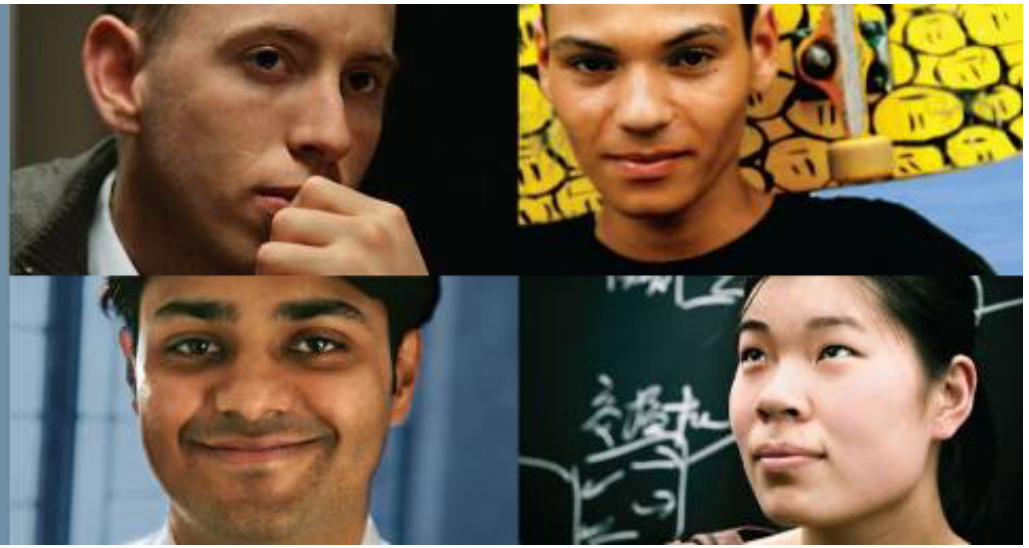
TNE10006/TNE60006: Networks and Switching



IPv4 Subnetting

Cisco | Networking Academy®
Mind Wide Open™

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

Outline

- The Subnet Mask
- What is Subnetting
- Slash Notation
- Things to Remember

SWINBURNE CENTRE FOR ADVANCED INTERNET ARCHITECTURES

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

The Subnet Mask

- IP Addresses divided in two
  - Network Portion
  - Host Portion
- Network Portion
  - Most significant (left-most) bits of IP Address
  - Defines the network to which the IP Address belongs
  - All IP Addresses with an equal Network Portion are in the same subnet
- Host Portion
  - Least significant (right-most) bits of IP Address
  - Defines a host within a subnet

Network Portion bits + Host Portion bits = 32

SWINBURNE CENTRE FOR ADVANCED INTERNET ARCHITECTURES

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

The Subnet Mask

- The subnet mask is used to define which bits of an IP Address make the network portion and which bits make the host portion
- Subnet Mask = 32 bits

  1-bit specifies that this bit in the IP Address is part of the Network Address

  0-bit specifies that this bit in the IP Address is part of the Host Identifier
- Since network = left-most **AND** host = right-most

  Subnet Mask **MUST** consist of a string of '1' bits followed by a string of '0' bits **ONLY**

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

Subnet Mask Restrictions

- The Subnet Mask

  Left-most bits form the network address

  Right-most bits form the host ID

  Subnet mask **ALWAYS** consists of a string of ‘1’ bits followed by a string of ‘0’ bits

- Real restrictions

  Need at least eight ‘1’ bits (since the Internet respects Class A addresses)

  Need at least two ‘0’ bits (this equates to four host IDs of which two are unusable – ’00’ and ’11’)

SWINBURNE CENTRE FOR ADVANCED INTERNET ARCHITECTURES

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

Subnetting
Definition

- We are allocated a Network
  - Eg. We are given a Class B network (65536 hosts)
  - Subnet mask – 255.255.0.0
- We can break this into smaller subnets
  - Borrow bits from the host ID and allocate them to the network portion
  - Internet still considers our original subnet as an entire network
  - Within our network we break this up into multiple smaller subnets
  - Achieve better usage of network addresses
  - Can logically (and physically) separate different groups of users

SWINBURNE CENTRE FOR ADVANCED INTERNET ARCHITECTURES

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

Example – Swinburne

- Swinburne network 136.186.0.0 – Class B
- Default Subnet Mask – 255.255.0.0

Network Address:	10001000	10111010	00000000	00000000
Subnet Mask:	11111111	11111111	11111111	00000000

- Originally

  Network = 136.186.0.0 – 136.186.255.255

- Now

  Subnet 0 = 136.186.0.0 – 136.186.0.255

  Subnet 1 = 136.186.1.0 – 136.186.1.255

  Subnet 2 = 136.186.2.0 – 136.186.2.255

SWINBURNE CENTRE FOR ADVANCED INTERNET ARCHITECTURES

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

Slash Notation

- Traditional to write IP address and subnet mask

  eg. – 192.168.0.27 255.255.255.192

- Shorter and more convenient notation

  eg. – 192.168.0.27/26

  Sometimes called slash notation

  Shows IP address and that the first 26 bits defines the network portion (remaining 6 bits define host ID)

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

Things to Remember

- All subnet masks string of ‘1’ bits followed by string of ‘0’ bits
- Number of host IDs in subnet is defined by number of ‘0’ bits in subnet mask
- Number of ‘0’ bits = ***h***
- Number of host IDs

  2^h
- Number of usable host IDs

  $2^h - 2$

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

Things to Remember

- Host IDs no longer range

  0 – 255

  0.0 – 255.255

  0.0.0 – 255.255.255

- Example – 64 hosts (***h*** = 6)
- Host ranges:

  0 – 63, 64 – 127, 128 – 191, 192 – 255

- This means that if IP address = 192.168.0.200

  Host ID = 8

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential

Summary

In this lecture, we covered:

- The Subnet Mask
- What is Subnetting
- Slash Notation
- Things to Remember

© 2008 Cisco Systems, Inc. All rights reserved. Cisco Confidential