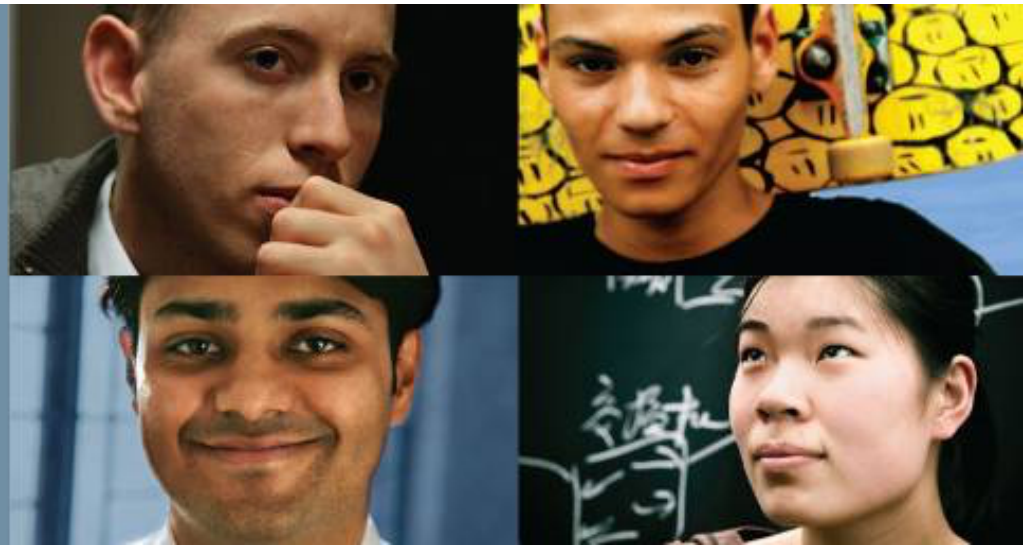
TNE10006/TNE60006: Networks and Switching



How to Subnet (VLSM)

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Outline

- Subnetting Requirements
- Calculating Masks
- Address Ranges
- VLSM
- Subnetting Procedure

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Subnetting Requirements

Introduction

- Typically given requirements
  - A Subnet needs at least ***h*** hosts per subnet
  - A Subnet needs at least ***h*** **usable** hosts per subnet
  - We need at least ***m*** subnets
- Must always take into account the word ***usable***
  - Remembering that the first and last host ID in each subnet are unusable (network/broadcast address)

Hosts per Subnet

- If we need ***h*** hosts for a subnet

  x bits required to represent ***h*** hosts

  $2^x \geq h$

  Power of 2 greater than or equal to ***h***

- If we need ***h*** usable hosts for a subnet

  We need at least (***h*** + 2) hosts – first and last host ID are unusable

  $2^x \geq (h + 2)$

Hosts per Subnet

- Examples
- A Subnet needs at least 49 hosts
  - ***h*** bits required to represent 49 hosts
  - $2^h \geq 49$
  - $h = 6$ ($2^5 = 32$; $2^6 = 64$)
  - At least 6 bits are needed to represent the host ID
  - The subnet will have 64 host IDs of which 62 are usable
- A Subnet needs at least 511 usable hosts
  - ***h*** bits required to represent 513 = (511 + 2) hosts
  - $2^h \geq 513$
  - $h = 10$ ($2^9 = 512$; $2^{10} = 1024$)
  - At least 10 bits are needed to represent the host ID
  - The subnet will have 1024 host IDs of which 1022 are usable
- In both cases we have spare (unused) host ID addressing space
  - Due to limitation of 2^x host IDs in each subnet

Determining Address Ranges

- If we know the number of host IDs in a subnet
  - First IP address is the network address – unusable
  - Adding number of host IDs gives network address of next subnet
  - Subtract one to get the last (broadcast) address – unusable
  - All remaining addresses are usable
- Example – 64 host IDs per subnet, network = 140.20.43.128/26
  - Network address = 140.20.43.128
  - Next network = 140.20.43.(128+64) = 140.20.43.192/26
  - Broadcast = 140.20.43.191 Usable range = 140.20.43.129 – 140.20.43.190
- Example 1024 host IDs per subnet, network = 129.11.16.0/22
  - Network address = 129.11.16.0
  - Next network = 129.11.16.0 + 1024 = 129.11.20.0/22
  - Broadcast = 129.11.19.255 Usable range = 129.11.16.1 – 129.11.19.254

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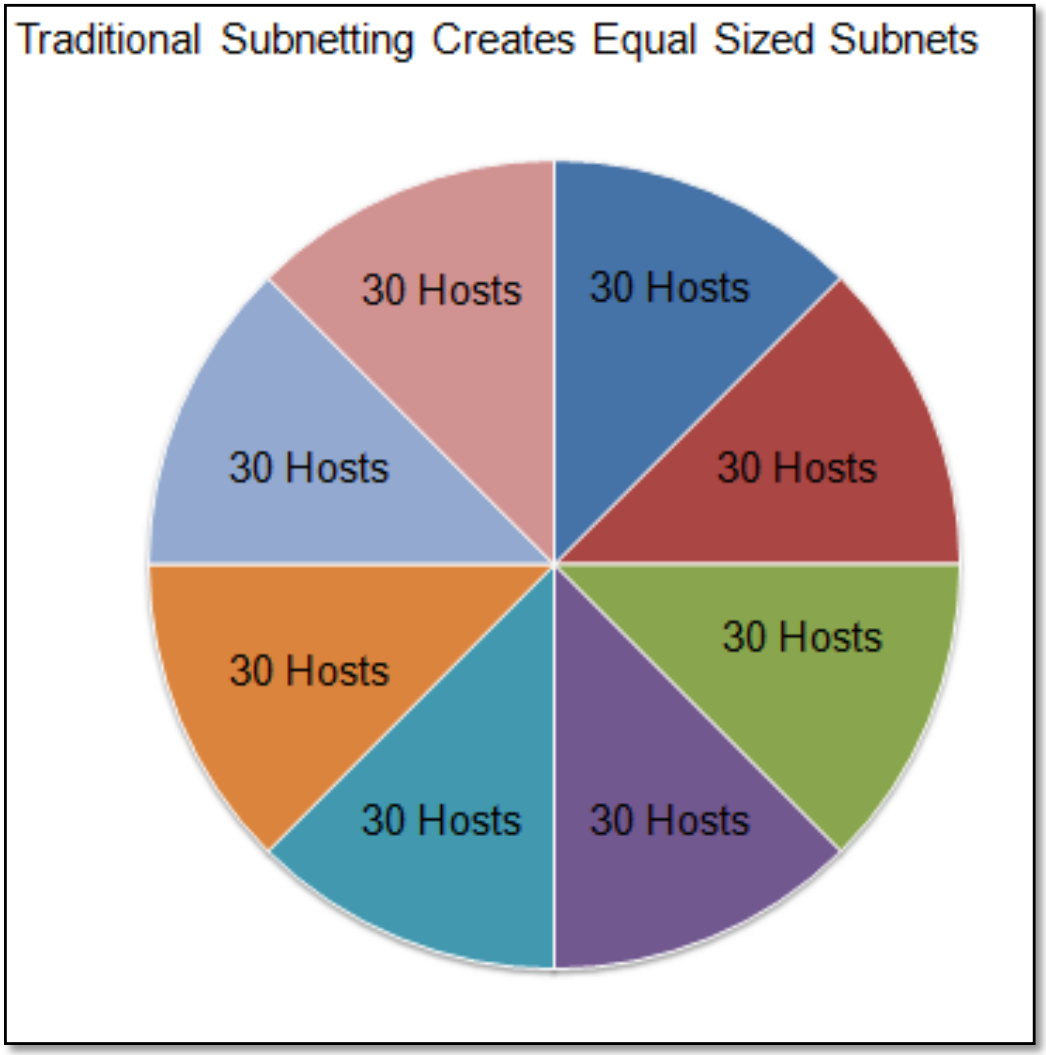
VLSM – Variable Length Subnet Mask

- Nothing says that the subnet masks must be a certain length
- Subnetting involves sub-dividing a network
- Each subnet can be a variable size
  - Each will have a different subnet mask
  - Each will have a different number of hosts
- They may also be the same size…

VLSM – Variable Length Subnet Masking

Traditional Subnetting Wastage

- Same number of addresses is allocated for each subnet
- Subnets that require fewer addresses have unused (wasted) addresses



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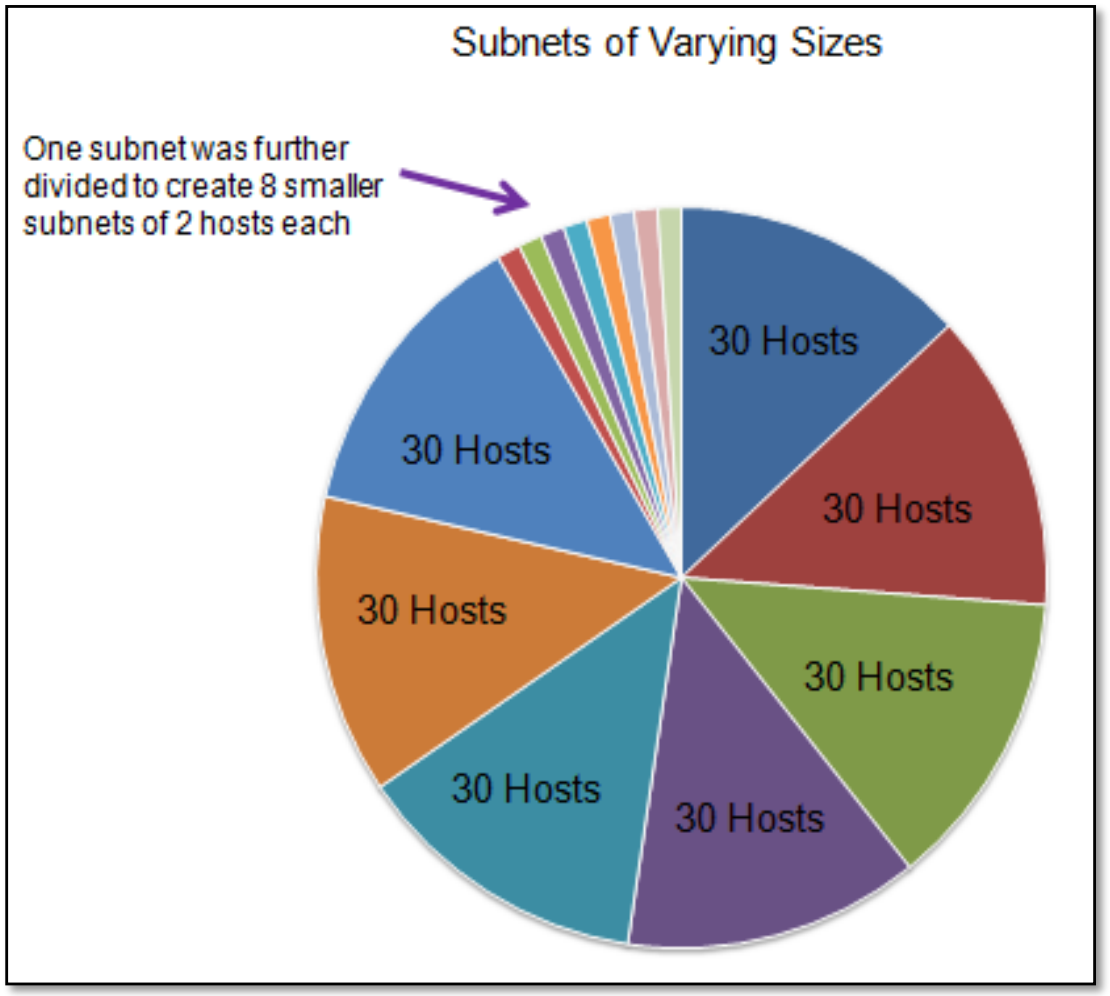
Benefits of VLSM

- More efficient use of addresses
- Allows network space to be divided in unequal parts
- Subnet mask varies, depending on how many bits have been borrowed for a particular subnet



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Dividing up a Network

- Remember that subnetting is about further dividing a network into smaller networks
- We are allocated a network
  - Continuous (binary) range of addresses
  - We own all addresses in this range (and none outside)
  - Need to sub-divide this into non-overlapping binary ranges
- Requirements tell us how many hosts a subnet requires

VLSM Subnetting

Example

- Want to maximise remaining addresses for future expansion
- Best approach is to allocate subnets in order from largest to smallest
- Example

  Start with a **/24** network – 200.57.3.0/24

  Need 1 subnet with 58 hosts

  2 subnets with 29 hosts

  1 subnet with 10 hosts

  2 subnets with 2 hosts

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VLSM Subnetting

Example – Solution

- 200.57.3.0/26 – 64 hosts
- 200.57.3.64/27 – 32 hosts
- 200.57.3.96/27 – 32 hosts
- 200.57.3.128/28 – 16 hosts
- 200.57.3.144/30 – 4 hosts
- 200.57.3.148/30 – 4 hosts
- Unused

  200.57.3.152 – 200.57.3.255

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Summary

In this lecture, we covered:

- Subnetting Requirements
- Calculating Masks
- Address Ranges
- VLSM
- Subnetting Procedure