School of Advanced Technology

Networking Basics

Week 7
IPv4 Basic Subnetting – Part 1

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Topics

- Subnetting
  - What?
  - Why?
  - How?
  - Examples
- Case study

Subnetting

- What
  - Allows creating multiple networks from a single address block
- Why
  - Maximise addressing efficiency
  - Extend the life of IPv4
  - Public IPv4 addresses are scarce
- How
  - Transform host bits into network bits creating additional networks from a single address block

Examples

- Subnetting base address 192.168.1.0/24
  - 11111111 11111111 11111111 00000000
- Transform 1 host bit into a network bit
  - 11111111 11111111 11111111 10000000
    - 2^b networks
    - 2^h-2 hosts per new network
    - New prefix length /25
      - 255.255.255.128
- Transform 2 host bits into network bits
  - 11111111 11111111 11111111 11000000
    - 2^b networks
    - 2^h-2 hosts per new network
    - New prefix length /26
      - 255.255.255.192

0./25
0.28/25

2 new network

2

(2^7)-2 = 126

4

(2^6)-2 =62

2

4 new

.0/26
.64/26
.128/26
.192/26

maximum number of IP is 62

Formulas and Variables

- h=number of host bits
- b=number of host bits tranformed into network bits (aka borrowed bits)
- n=number network bits

- Number of new networks resulting from the subnetting:
  - 2^b
- Number of hosts per new network
  - 2^h-2

Subnet masks

Mask	Number of hosts	Host bits
255.255.255.0	254 hosts	8
255.255.255.128	126 hosts	7
255.255.255.192	62 hosts	6
255.255.255.224	30 hosts	5
255.255.255.240	14 hosts	4
255.255.255.248	6 hosts	3
255.255.255.252	2 hosts	2

Example

- Subnet base address: 200.10.21.0/24
  - Objective:
    - The largest network segment requires a maximum of 25 IP addresses
    - Subnet the base address in order to yield the maximum address utilization
  - 2^h-2 => 25 – what is the smallest value of h that meets the criteria
    - h=5
  - b= 32-(n+h) = 32-(24+5) = 3
    - 2^3=8 new networks
    - 30 hosts per network
  - New mask
    - 255.255.255.224/27

Case study

- Base: 99.0.0.0/8
  - Mask 255.255.254.0/23
  - b = (23-8) = 15 bits
    - 2^15 = 32768 new networks
  - h=32-(15+8)=9
    - 2^9-2=510 hosts per network

Summary

- In order to extend the life of IPv4, several changes had to be implemented to the original addressing scheme, including subnetting.

Next

- Subnetting basics part 2
- More subnetting examples