15. SUBNETTING (VLSM): PART 3

Introduction

Subnetting Class A Networks

Given a `10.0.0.0/8` network, we need to create **2000 subnets** distributed across various enterprises.

Steps:

1. Determine the number of bits to borrow:
    - 2^10 = 1024 (not enough), so 2^11 = 2048 (sufficient).
    - Borrow 11 bits (from left to right).
2. Update the subnet mask:
    - Original subnet mask: `/8`.
    - Add borrowed bits: `/8 + /11 = /19`.

Calculations:

- **Subnet Mask**: `255.255.224.0`.
- **Hosts per Subnet**:
    - Remaining host bits = 32 - 19 = 13.
    - Hosts = 2^13 - 2 = 8190 hosts per subnet.

Variable-Length Subnet Masks (VLSM)

Key Concepts

- **FLSM (Fixed-Length Subnet Masks)**: All subnets use the same prefix length (e.g., `/26` for a Class C network).
- **VLSM**: Subnets of different sizes are created to optimize IP address usage.

Example Scenario

Requirements:

- **TOKYO LAN A**: 110 hosts.
- **TORONTO LAN B**: 45 hosts.
- **TORONTO LAN A**: 29 hosts.

- **TOKYO LAN B**: 8 hosts.
- **Point-to-Point Connection**: 2 hosts.

Starting Network:

`192.168.1.0/24`

Step-by-Step Subnet Allocation

1. TOKYO LAN A (110 Hosts)

- Hosts required: 110.
- Next power of 2: 2^7 = 128 (sufficient).
- Borrow 1 host bit, leaving 7 host bits.

Details:

- **Network Address**: `192.168.1.0/25`.
- **Subnet Mask**: `255.255.255.128`.
- **Broadcast Address**: `192.168.1.127/25`.
- **Usable Hosts**: 126 (2^7 - 2).
- **Range**: `192.168.1.1` to `192.168.1.126`.

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2. TORONTO LAN B (45 Hosts)

- Hosts required: 45.
- Next power of 2: 2^6 = 64 (sufficient).
- Borrow 2 host bits, leaving 6 host bits.

Details:

- **Network Address**: `192.168.1.128/26`.
- **Subnet Mask**: `255.255.255.192`.
- **Broadcast Address**: `192.168.1.191/26`.
- **Usable Hosts**: 62 (2^6 - 2).
- **Range**: `192.168.1.129` to `192.168.1.190`.

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3. TORONTO LAN A (29 Hosts)

- Hosts required: 29.
- Next power of 2: 2^5 = 32 (sufficient).
- Borrow 3 host bits, leaving 5 host bits.

Details:

- **Network Address**: `192.168.1.192/27`.
- **Subnet Mask**: `255.255.255.224`.
- **Broadcast Address**: `192.168.1.223/27`.
- **Usable Hosts**: 30 (2^5 - 2).
- **Range**: `192.168.1.193` to `192.168.1.222`.

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4. TOKYO LAN B (8 Hosts)

- Hosts required: 8.
- Next power of 2: 2^4 = 16 (sufficient).
- Borrow 4 host bits, leaving 4 host bits.

Details:

- **Network Address**: `192.168.1.224/28`.
- **Subnet Mask**: `255.255.255.240`.
- **Broadcast Address**: `192.168.1.239/28`.
- **Usable Hosts**: 14 (2^4 - 2).
- **Range**: `192.168.1.225` to `192.168.1.238`.

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5. Point-to-Point Connection (2 Hosts)

- Hosts required: 2.
- Next power of 2: 2^2 = 4 (sufficient).
- Borrow 6 host bits, leaving 2 host bits.

Details:

- **Network Address**: `192.168.1.240/30`.
- **Subnet Mask**: `255.255.255.252`.
- **Broadcast Address**: `192.168.1.243/30`.
- **Usable Hosts**: 2 (2^2 - 2).
- **Range**: `192.168.1.241` to `192.168.1.242`.

Summary Table:

Subnet	Network Address	Broadcast Address	Prefix	Usable Hosts	Host Range

TOKYO LAN A	192.168.1.0	192.168.1.127	/25	126	192.168.1.1 - 192.168.1.126
TORONTO LAN B	192.168.1.128	192.168.1.191	/26	62	192.168.1.129 - 192.168.1.190
TORONTO LAN A	192.168.1.192	192.168.1.223	/27	30	192.168.1.193 - 192.168.1.222
TOKYO LAN B	192.168.1.224	192.168.1.239	/28	14	192.168.1.225 - 192.168.1.238
Point-to-Point	192.168.1.240	192.168.1.243	/30	2	192.168.1.241 - 192.168.1.242

Additional Resources

- SubnettingQuestions.com
- Subnetting.org
- SubnettingPractice.com (**Preferred site**).