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| **Networking Infrastructure**  Diploma in CSF / IT  April 2022 Semester 3 | Week 6 |
| Session 1 |
| IP Subnetting | |

**OBJECTIVES**

After completing this session, you should have a better understanding of special IP addresses and the various aspects of IP subnetting.

**Activity 1: Special IP Addresses**

There are several IP addresses that are used for different purposes.

Explain whether the following IP addresses are valid or invalid host assignment [invalid meaning that the IP address cannot be assigned to a PC host]. Also identify whether the address is a private IP address or not. Assume that each address is using its default subnet mask. Explain your answers.

1. 225.1.1.1

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| It is a public IP address. It is not a valid host assignment. As it is a class D address it is used for multicast group ID and cannot be used to assign a PC host. |

1. 241.1.1.1

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| It is a public IP address. It is not a valid host assignment. It is a class E address, and it is reserved and cannot be assigned to a PC host. |

(c) 255.255.255.255

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| It is a limited broadcast ip address. Thus, it cannot be used to PC host assignment, invalid host assignment |

1. 161.1.255.255

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| This is a directed broadcast address, and it is an invalid host assignment. |

1. 165.1.1.1

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| It is a valid host assignment as the last octet is in a usable host range seeing that its subnet mask is 255.255.0.0. It is a public ip address. |

1. 127.0.0.1

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| Invalid host assignment, it is a loopback address and is reserved hence it cannot be used. |

1. 192.168.1.1

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| Valid host assignment. Private IP address. |

1. 0.0.0.0

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| Default Route hence invalid host assignment. |

1. 201.1.1.0

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| **Invalid host assignment as last octet is 0 which is reserved for network ID. Public ip address if last octe was not 0 or 255.** |

**Activity 2: IP Subnetting**

1. Explain the purpose of subnet mask
2. Explain the reasons for subnetting

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| 1. **The subnet mask helps is used to help identify which portion of the IP address belongs to the network and which portion belongs to the host.** 2. **Subnetting is needed to divide a single network into multiple networks. This gives benefits such as** 3. **Reduced traffic in the network as broadcasts from the PCs will be contained in their own subnet. Faster network speeds.** 4. **Security, as if one subnet is compromised, the other subnets will not be as vulnerable as when the entire network is just 1 network.** |

**Activity 3: IP Subnetting Technique**

A class C address with network-id **198.20.30.0** is assigned to your organization. You are required to set up subnets for **4 departments (SALES, ENGINEERING, MARKETING and ADMIN departments)** with spares for a maximum of **3 more** new departments in the future. The number of staff in each department **will not exceed 10**.

1. Determine the number of lending bits (numbers of bits to borrow from host portion to be subnet bits);

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| Lend 2 bits. With 2 bits, there will be 4 subnets which is required. As there can only be a maximum of 3 more spare subnets, having 3 bits will increase the total subnets to 8 and spare subnets to 4 which would be inappropriate.  Assume can use first and last subnet. Do not need to minus 2. |

1. State the new subnet mask; what is the purpose of subnet mask?

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| Subnet mask = 192.20.30.192  The purpose of the subnet mask is to identify whether a bit in the ip address belongs to the network component or the host component.  If the subnet mask is a 1 then the corresponding bit in the ip address belongs to the network component and a 0 indicates that the corresponding bit belongs to the host component of the ip address. |

1. Determine the first 4 usable subnets and their IP address ranges;

[Sales dept is assigned first useable subnet; Marketing is assigned second; Engineering dept is assigned third and Admin dept is assigned fourth useable subnet)

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| * 192.20.30.0 192.20.30.0 🡪 192.20.30.63. Sales * 192.20.30.64 192.20.30.64 🡪 192.20.30.127. Marketing * 192.20.30.128 192.20.30.128 🡪 192.20.30.191. Engineering * 192.20.30.192 192.20.30.192 🡪 192.20.30.255. Admin |

1. What are the number of usable subnets and number of hosts per subnet if the subnet mask is 255.255.255.248 is used?

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| No. of usable subnets = 32 subnets  No. of hosts = 6 hosts (excluding network ID and broadcast host) |

1. A PC in the network has an IP address of 198.20.30.70 with subnet mask of 255.255.255.240.

(i) How do you represent the IP address in prefix form?

(ii) Determine the subnet address that this address is in.

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| 1. 192.20.30.0 /28 2. Number of hosts in one subnet is 16 (14 usable) (2 ^ 5), 16 total subnets (2 ^ 4)   Thus as 70/16 ~ 5 (round up)  It is in the fifth subnet  Subnet address of 1st subnet = 192.20.30.0  Subnet address of 2nd subnet = 192.20.30.16  Subnet address of 3rd subnet = 192.20.30.32  Subnet address of 4th subnet = 192.20.30.48  Subnet address of 5th subnet = 192.20.30.64 –->80  Ans: 192.20.30.64 |

(f) Sketch a network diagram to show the subnet implementation.

Provide an IP addressing scheme for the network. It should include the following:

* + Useable IP address range for PCs in each department;
  + IP addresses of the router’s interfaces;
  + Default gateway addresses for PCs.

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| Diagram, schematic  Description automatically generated |