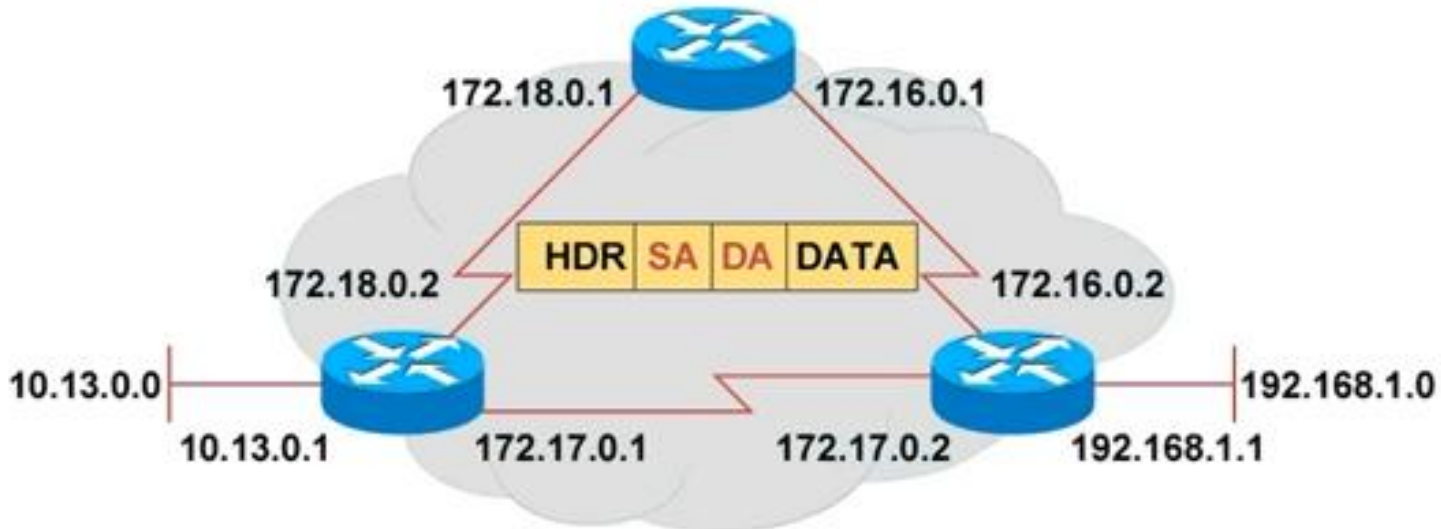
IP Adressing
&
Subnetting

What is Subnetting

- A subnet (short for subnetwork) may represent all the machines at one geographic location, in one building, or on the same LAN

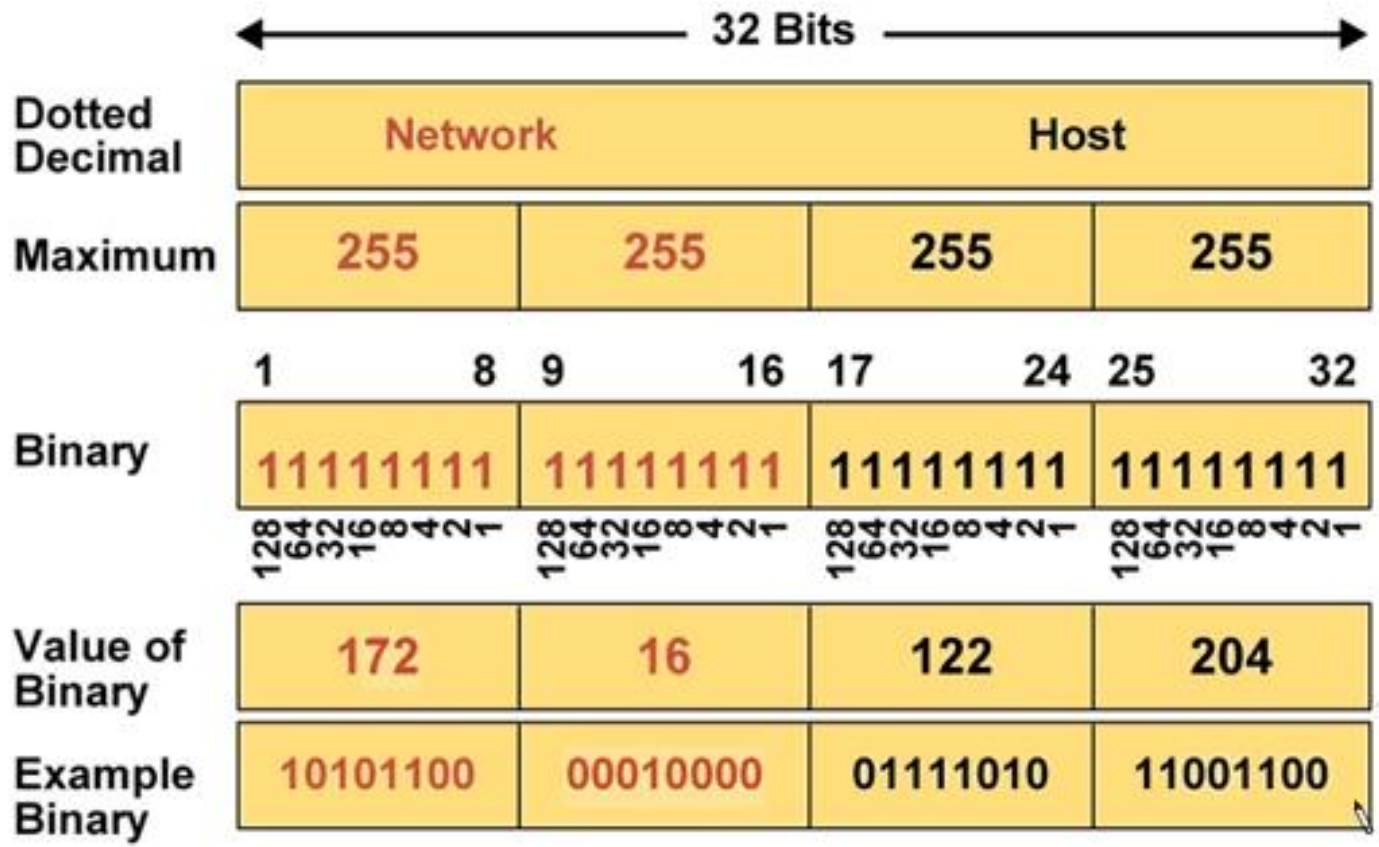
Introducing IP Addresses



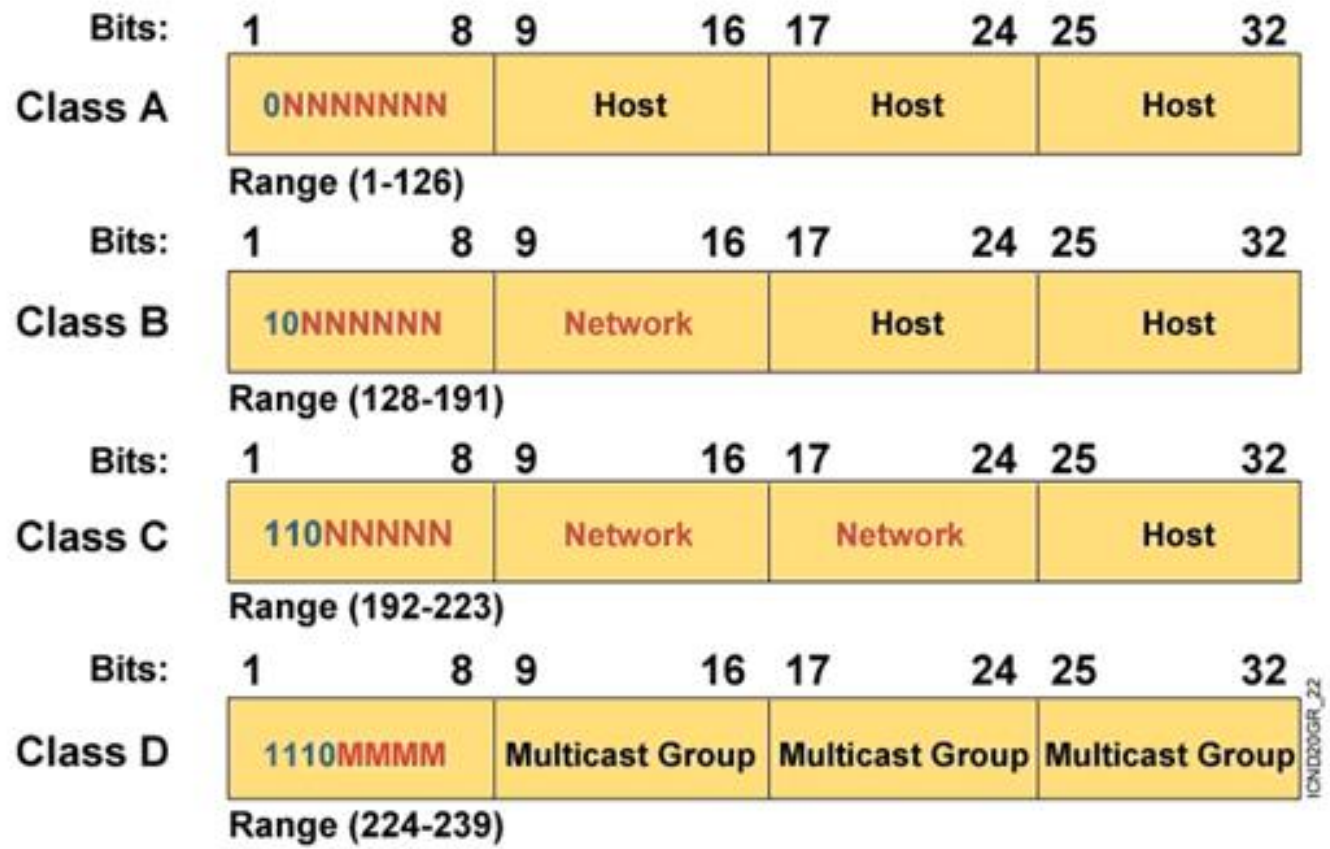
- Unique addressing allows communication between end stations.

  Path choice is based on destination address.

IP Addressing



IP Address Classes



Class A

No of network = 2^7-2 = 126

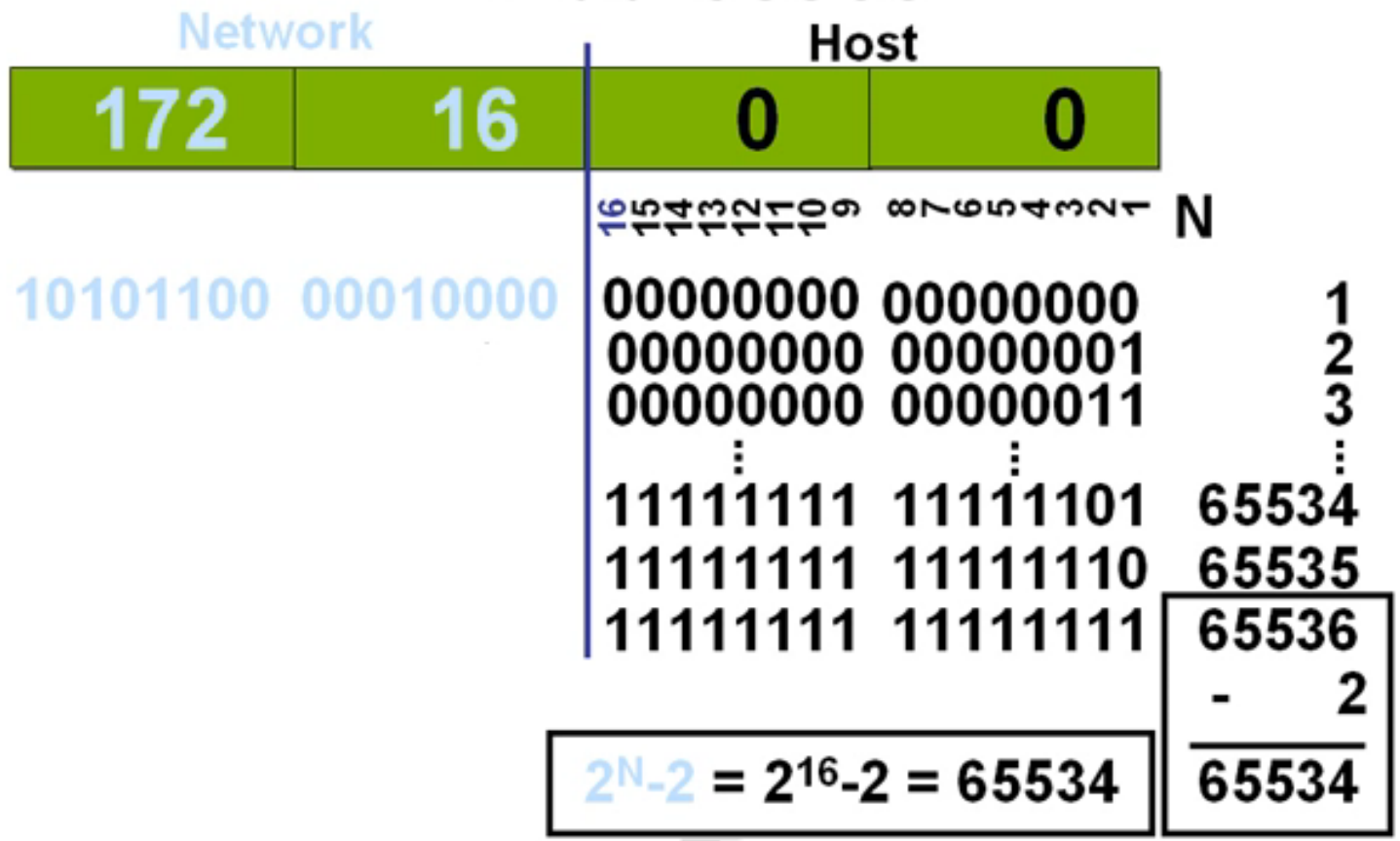
No of host = 2^24-2 = 16,777,214

Class B

No of network = 2^14-2 =16,382

No of host = 2^16-2 =65,534

Determining Available Host Addresses



Class C

No of network = 2^21-2 =2,097,152

No of host = 2^8-2 =254

IP Address Classes Exercise

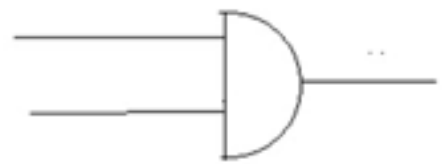
Address	Class	Network	Host
10.2.1.1			
128.63.2.100			
201.222.5.64			
192.6.141.2			
130.113.64.16			
256.241.201.10			

IP Address Classes Exercise Answers

Address	Class	Network	Host
10.2.1.1	A	10.0.0.0	0.2.1.1
128.63.2.100	B	128.63.0.0	0.0.2.100
201.222.5.64	C	201.222.5.0	0.0.0.64
192.6.141.2	C	192.6.141.0	0.0.0.2
130.113.64.16	B	130.113.0.0	0.0.64.16
256.241.201.10	Nonexistent		

10.15.13.2 172.16.2.160 200.50.40.5

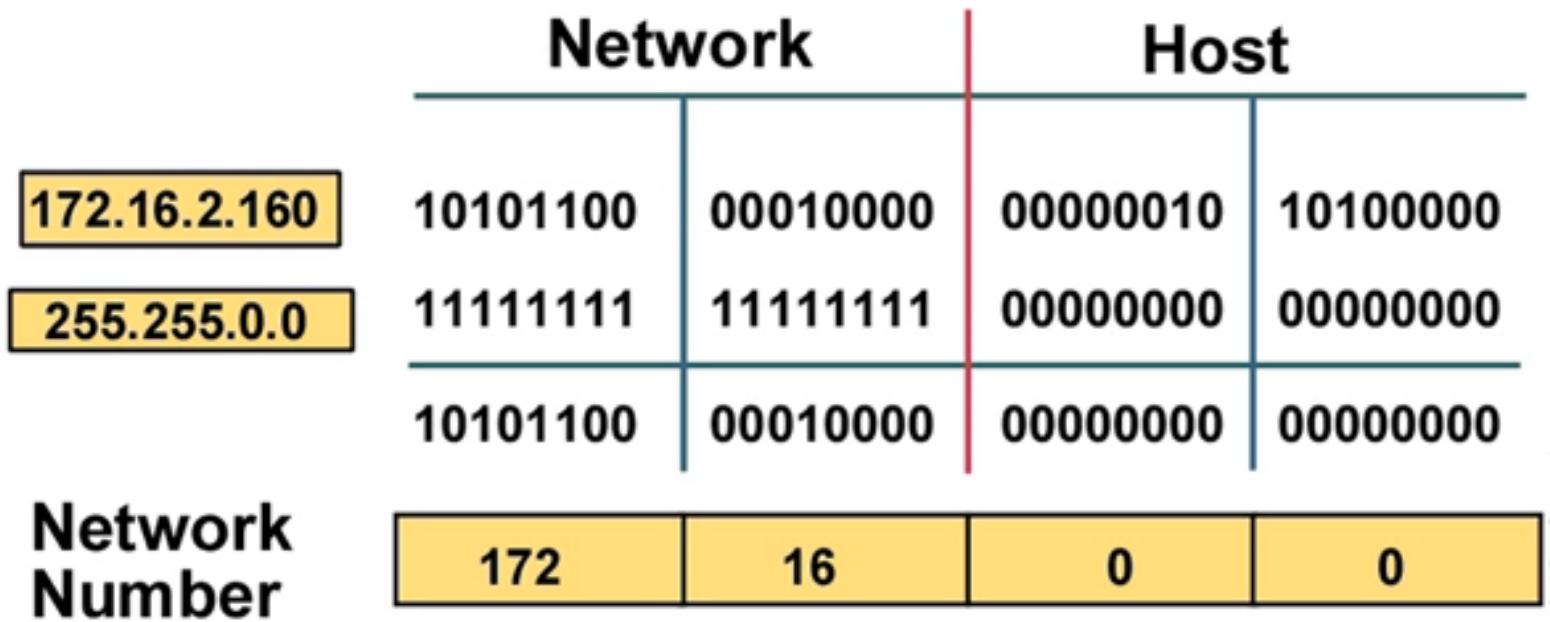
X	Y	Z
0	0	0
0	1	0
1	0	0
1	1	1



1*X=X

0*X=0

Default subnet

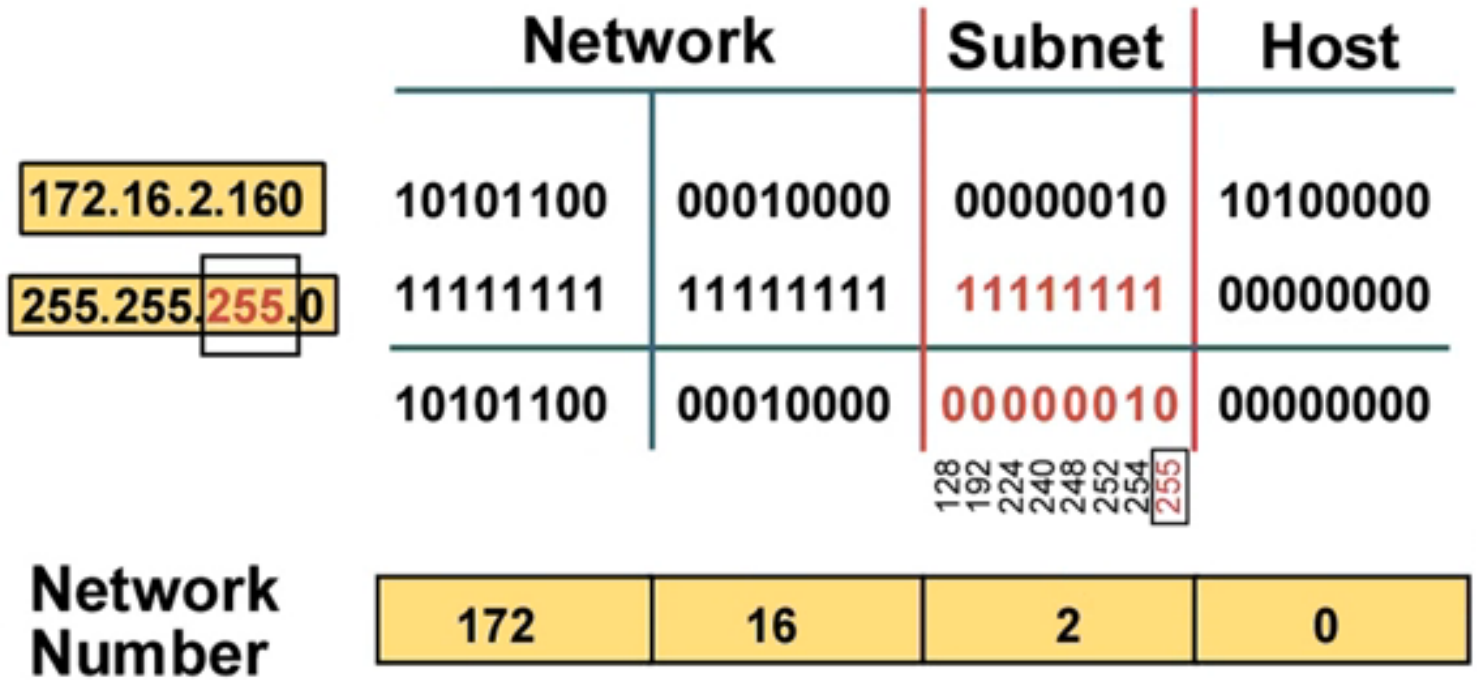


10. 15.13.2	172.16 . 2.160
255.0. 0. 0	255.255.0 .0
---	---
10. 0. 0. 0	172.16.0.0

200. 50 . 40 .5
255.255.255.0

200.50. 40 . 0

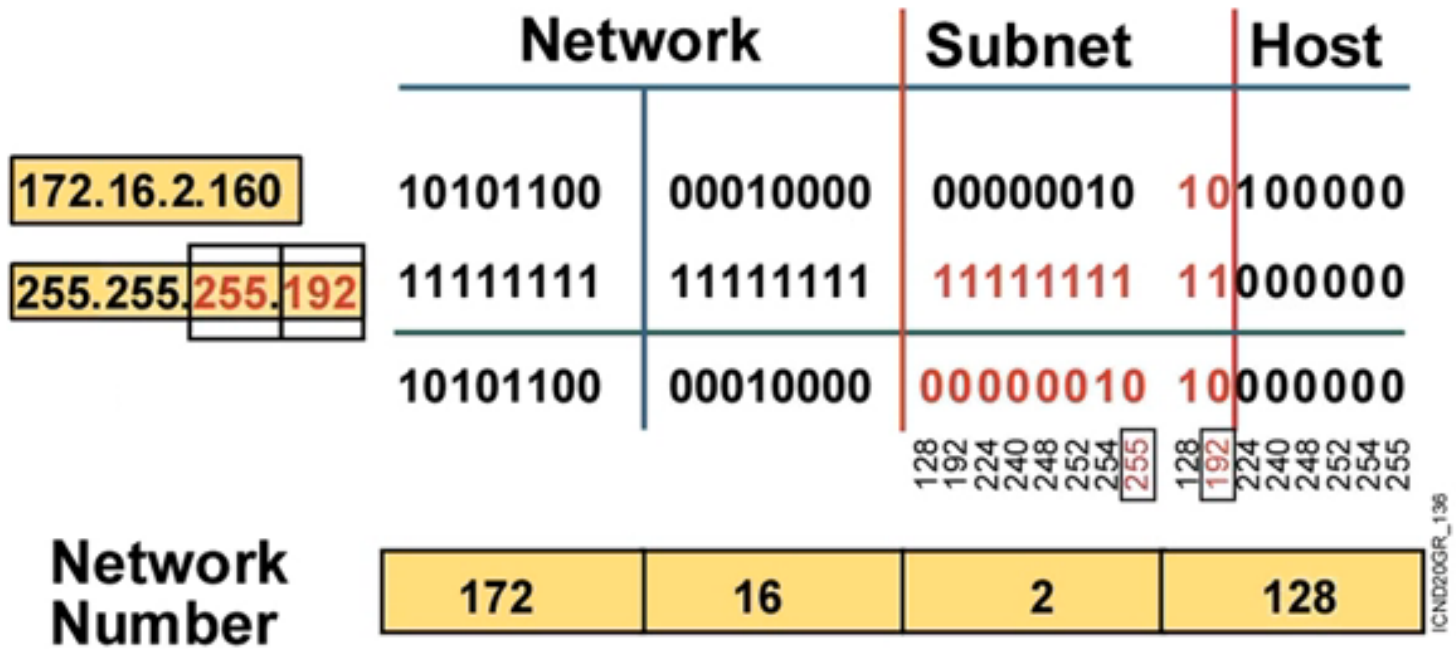
Subnet Mask with Subnets



Network number extended by eight bits •

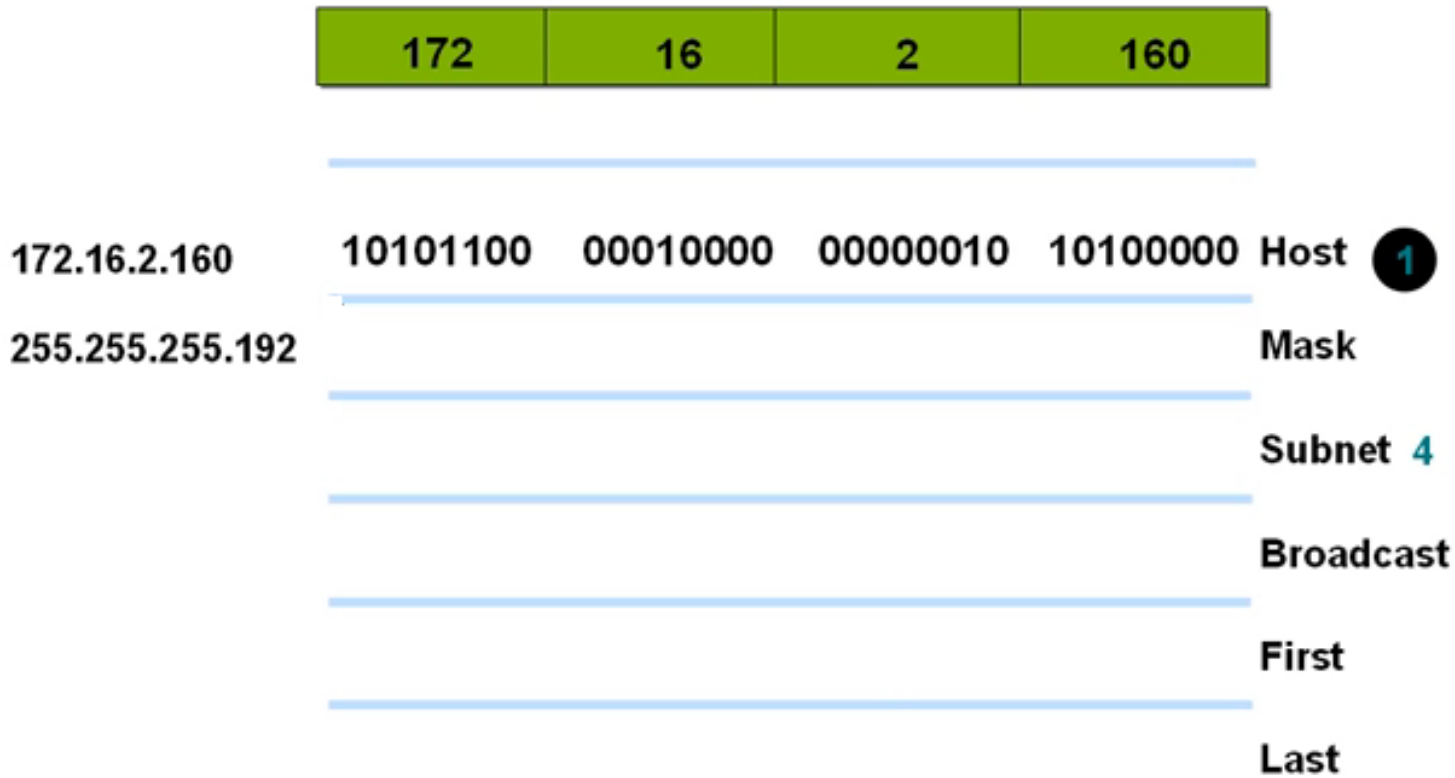
10. 15. 13.2	172.16 . 2. 160
255.255. 0. 0	255.255.255.0
---	---
10. 15. 0. 0	172. 16. 2. 0

Subnet Mask with Subnets (Cont.)

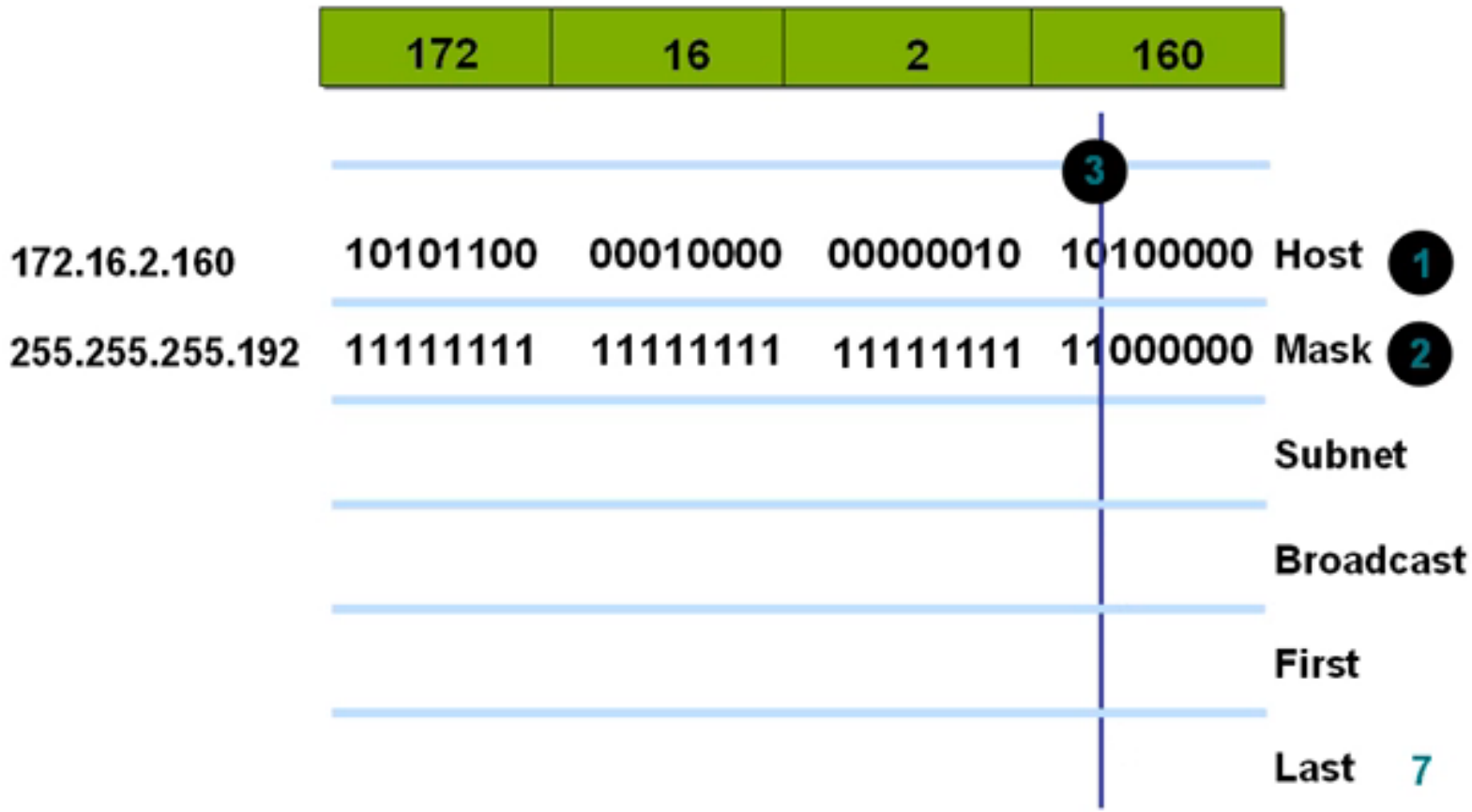


- Network number extended by ten bits

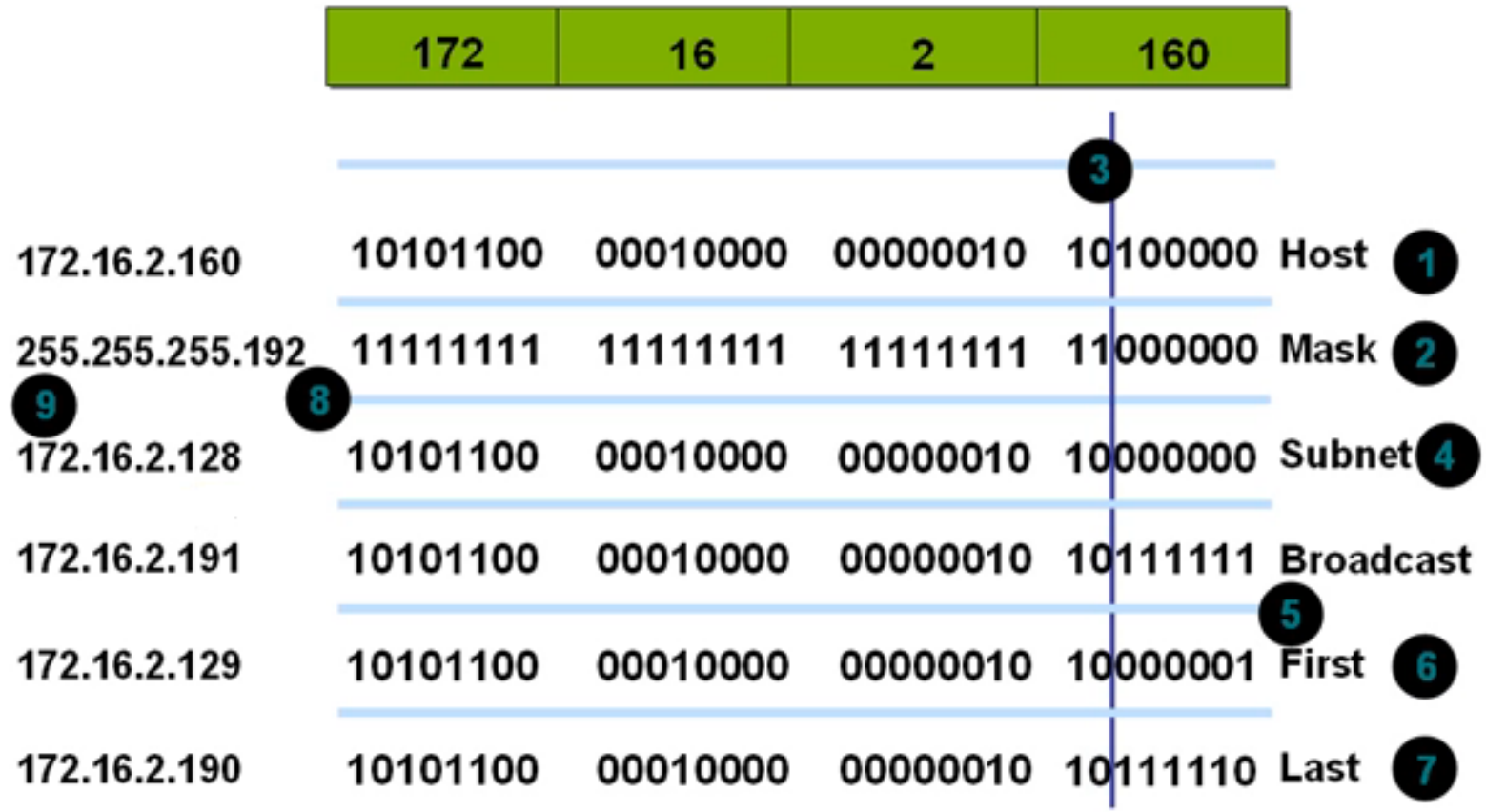
Addressing Summary Example

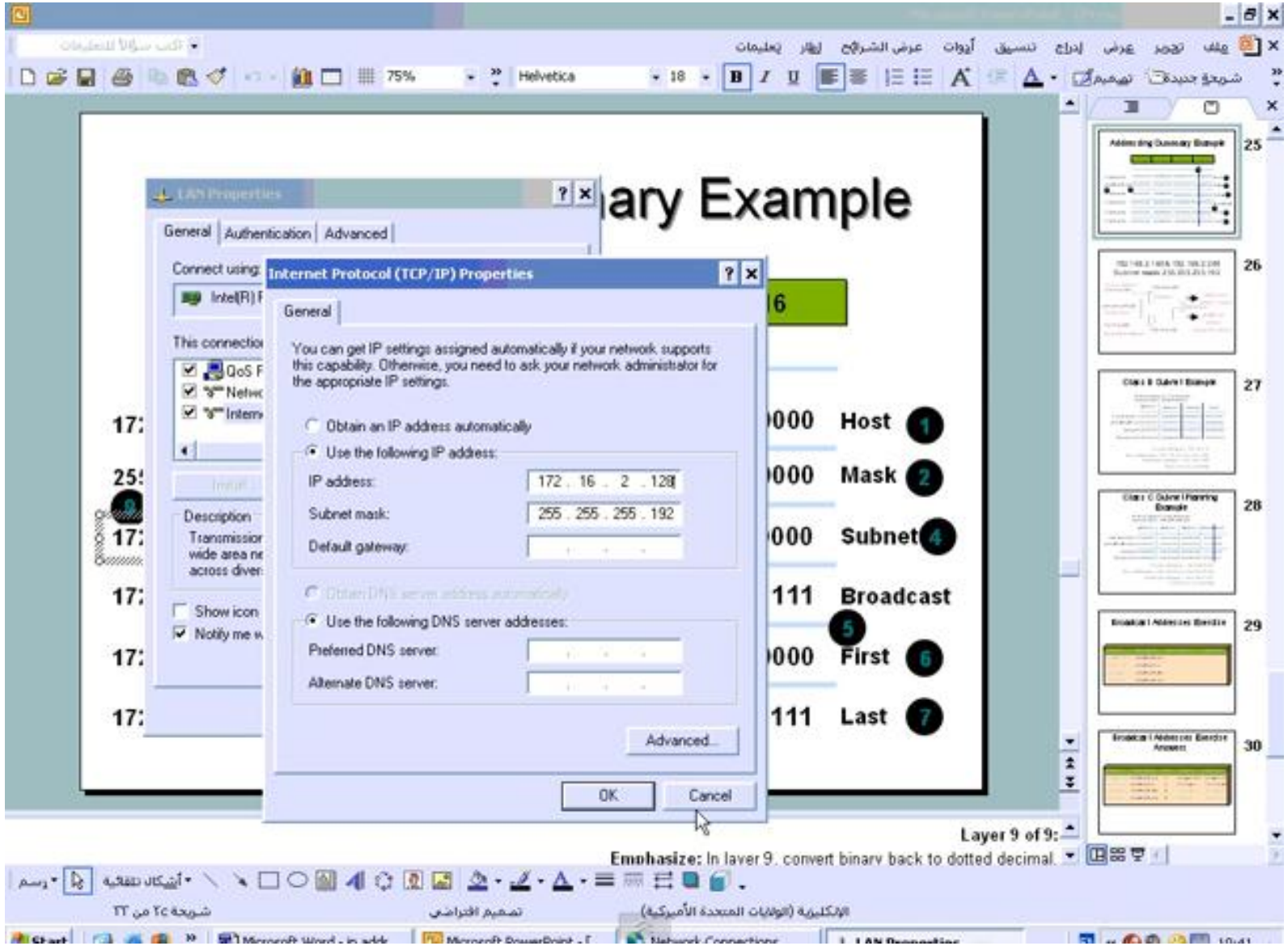


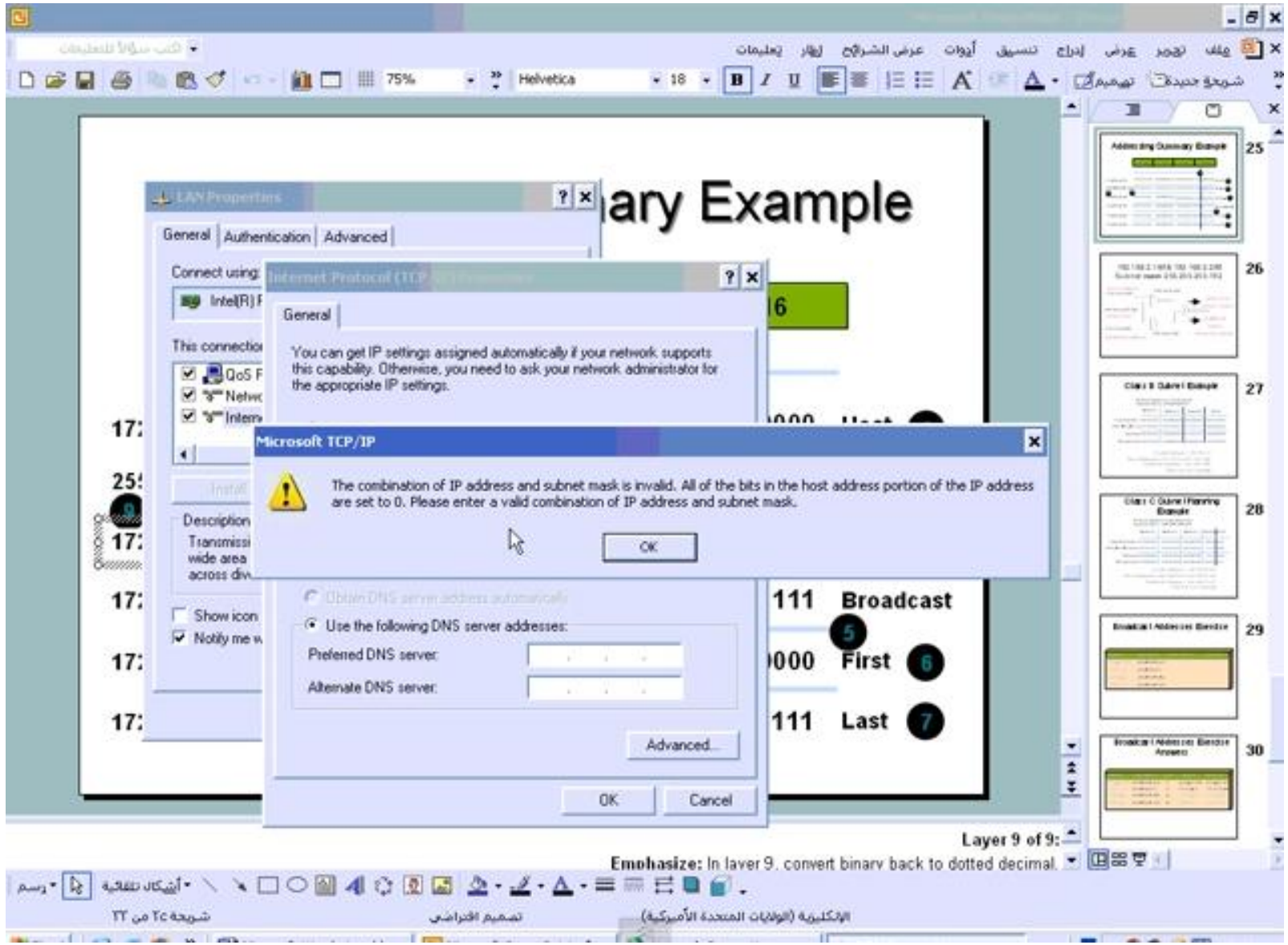
Addressing Summary Example

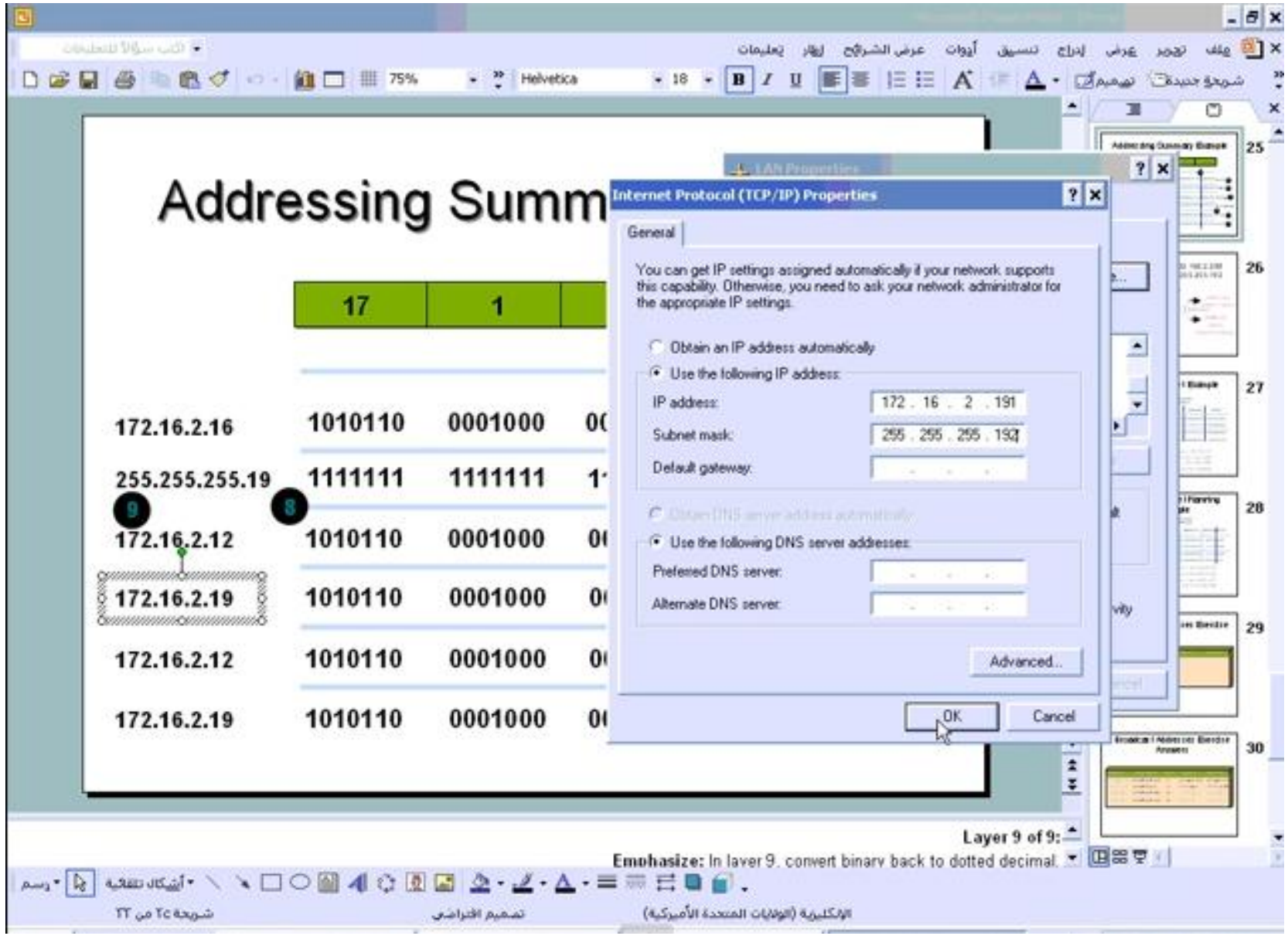


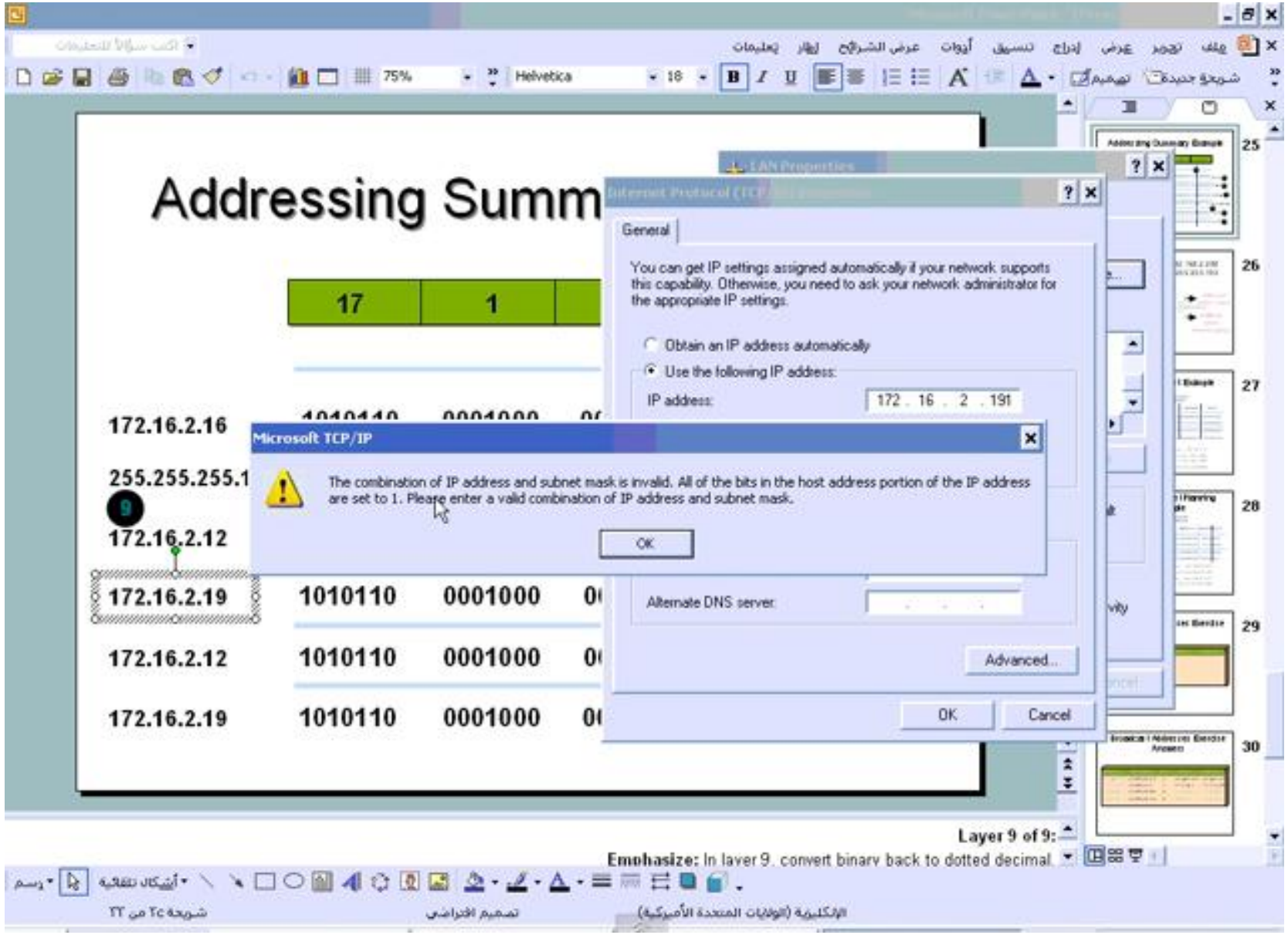
Addressing Summary Example

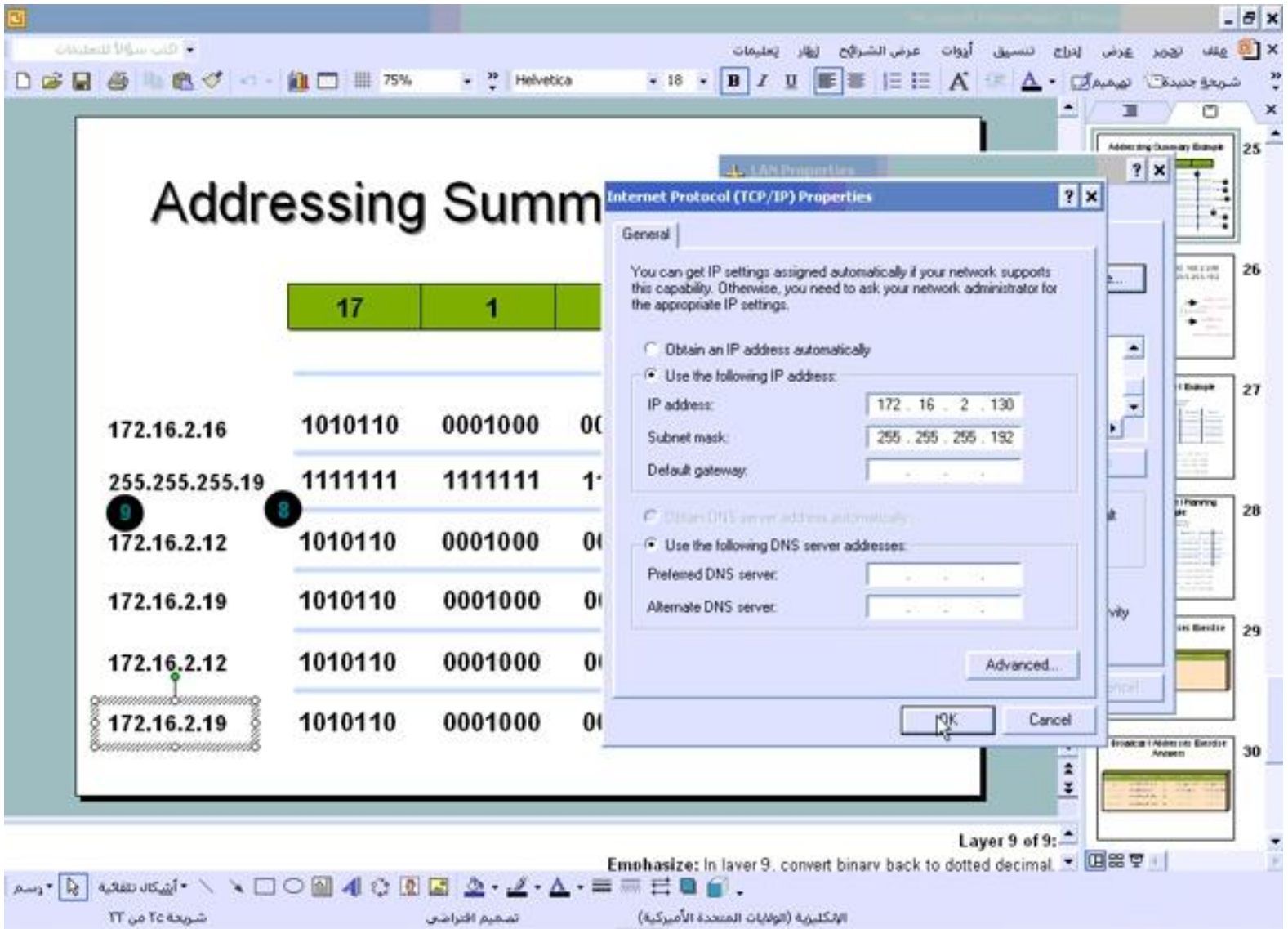



ary Example
LAN Properties
General
Authentication
Advanced
Connect using:
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 172 . 16 . 2 . 128
Subnet mask: 255 . 255 . 255 . 192
Default gateway:
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel
Description
Show icon
Host 1
Mask 2
Subnet 4
Broadcast 5
First 6
Last 7
Layer 9 of 9:
Emphasize: In layer 9, convert binary back to dotted decimal.

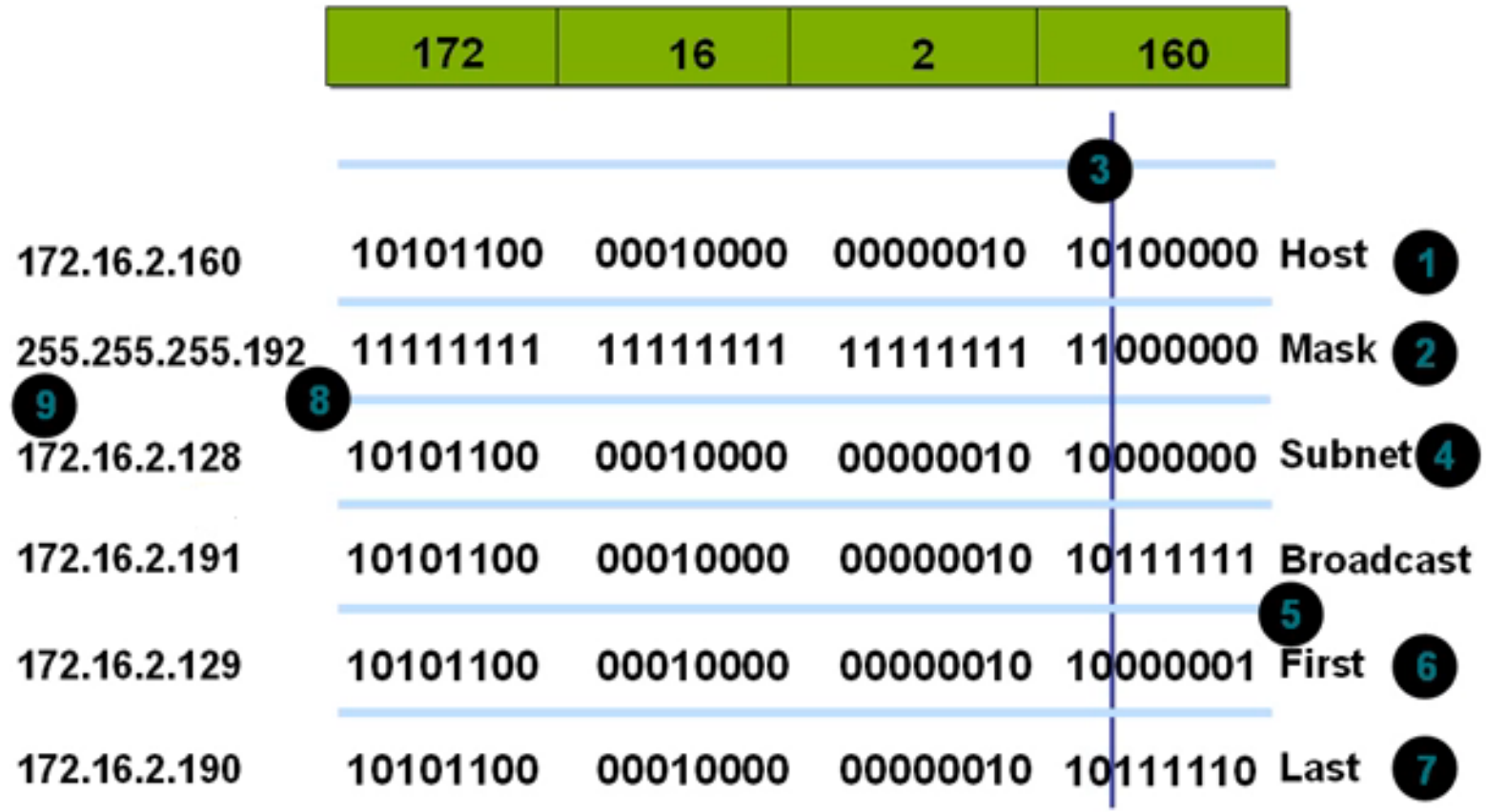

ary Example
LAN Properties
General
Authentication
Advanced
Connect using:
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Microsoft TCP/IP
The combination of IP address and subnet mask is invalid. All of the bits in the host address portion of the IP address are set to 0. Please enter a valid combination of IP address and subnet mask.
OK
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel
Broadcast
First
Last
Layer 9 of 9:
Emphasize: In layer 9, convert binary back to dotted decimal.


Addressing Summ
17
1
172.16.2.16
1010110
0001000
255.255.255.19
1111111
1111111
9
8
172.16.2.12
1010110
0001000
172.16.2.19
1010110
0001000
172.16.2.12
1010110
0001000
172.16.2.19
1010110
0001000
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
172 . 16 . 2 . 191
Subnet mask:
255 . 255 . 255 . 192
Default gateway:
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel
Layer 9 of 9:
Emphasize: In layer 9, convert binary back to dotted decimal.

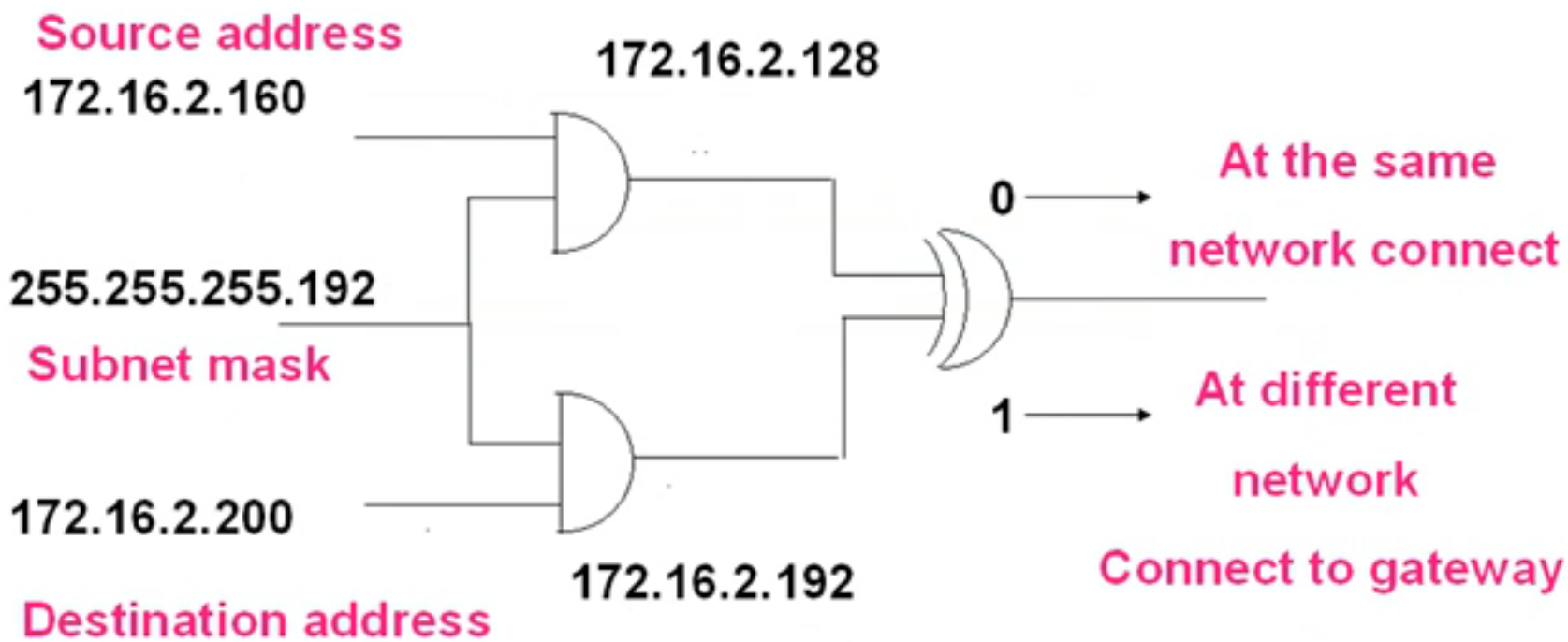

Addressing Summ
17
1
172.16.2.16
255.255.255.1
172.16.2.12
172.16.2.19
1010110
0001000
172.16.2.12
1010110
0001000
172.16.2.19
1010110
0001000
Microsoft TCP/IP
The combination of IP address and subnet mask is invalid. All of the bits in the host address portion of the IP address are set to 1. Please enter a valid combination of IP address and subnet mask.
OK
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
172 . 16 . 2 . 191
Alternate DNS server:
Advanced...
OK
Cancel
Layer 9 of 9:
Emphasize: In layer 9, convert binary back to dotted decimal.

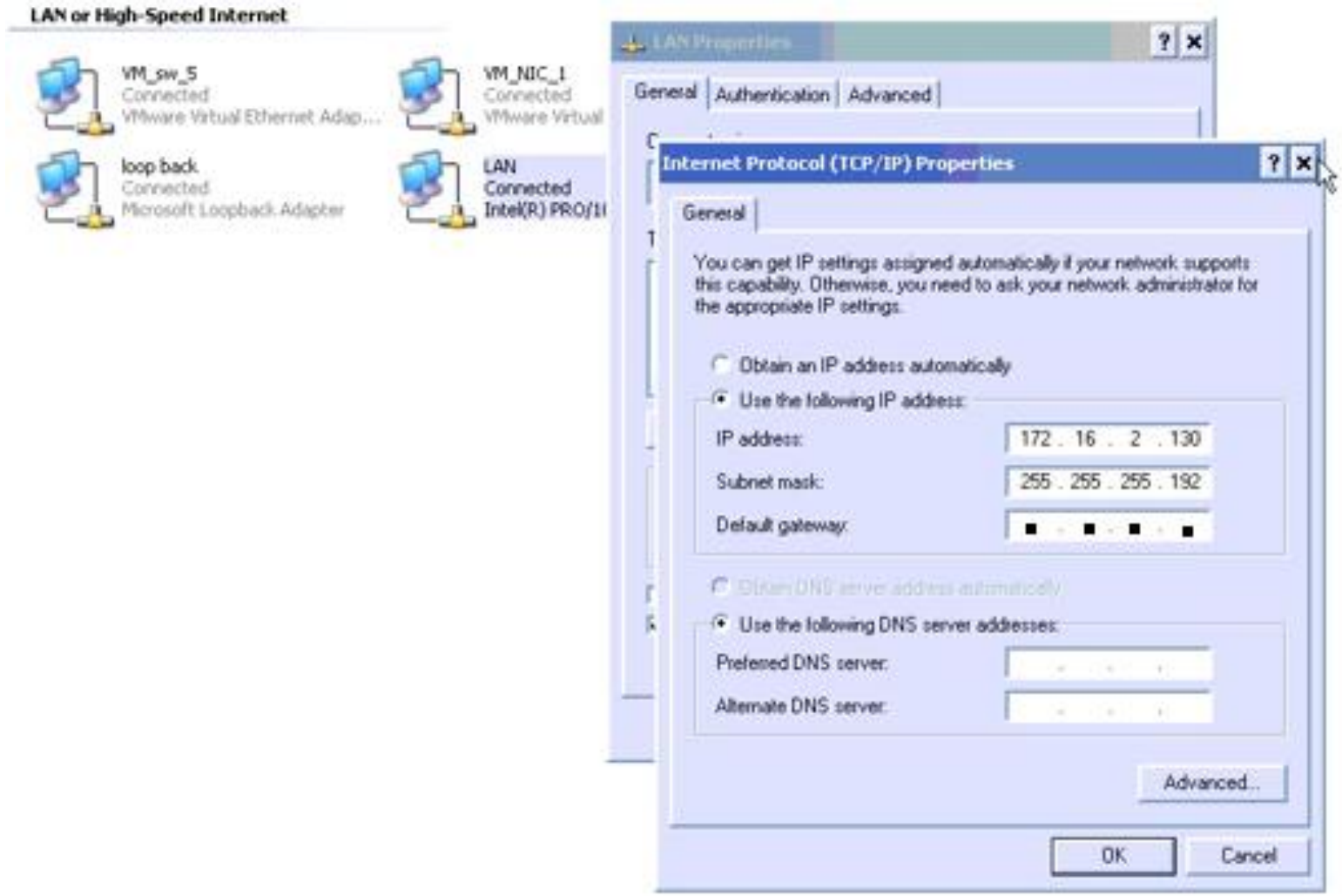

Addressing Summ
17
1
172.16.2.16 1010110 0001000
255.255.255.19 1111111 1111111
9
8
172.16.2.12 1010110 0001000
172.16.2.19 1010110 0001000
172.16.2.12 1010110 0001000
172.16.2.19 1010110 0001000
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address: 172 . 16 . 2 . 130
Subnet mask: 255 . 255 . 255 . 192
Default gateway:
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel
Layer 9 of 9:
Emphasize: In layer 9, convert binary back to dotted decimal

Addressing Summary Example



192.168.2.160& 192.168.2.200
Subnet mask 255.255.255.192




LAN or High-Speed Internet
VM_sw_5
Connected
VMware Virtual Ethernet Adap...
VM_NIC_1
Connected
VMware Virtual
loop back
Connected
Microsoft Loopback Adapter
LAN
Connected
Intel(R) PRO/1
LAN Properties
General
Authentication
Advanced
Internet Protocol (TCP/IP) Properties
General
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
172 . 16 . 2 . 130
Subnet mask:
255 . 255 . 255 . 192
Default gateway:
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

Class B Subnet Example

IP Host Address:
Subnet Mask: 255.255.255.0

	Network	Network	Subnet	Host
172.16.2.121	1010110	0001000	0000001	01111001
255.255.255.0	1111111	1111111	1111111	0000000
Subnet:	1010110	0001000	0000001	0000000
Broadcast:	1010110	0001000	0000001	1111111

- Subnet Address = 172.16.2.0
- Host Addresses = 172.16.2.1–172.16.2.254
- Broadcast Address = 172.16.2.255
- Eight bits of subnetting

Class C Subnet Planning Example

IP Host Address: 192.168.5.121
Subnet Mask: 255.255.255.248

	Network	Network	Network	Subnet	Host
192.168.5.121:	11000000	10101000	00000101	01111	001
255.255.255.248:	11111111	11111111	11111111	11111	000
Subnet:	11000000	10101000	00000101	01111	000
Broadcast:	11000000	10101000	00000101	01111	111

- Subnet Address = 192.168.5.120
- Host Addresses = 192.168.5.121–192.168.5.126
- Broadcast Address = 192.168.5.127
- Five Bits of Subnetting

Broadcast Addresses Exercise Answers

Address	Subnet Mask	Class	Subnet	Broadcast
201.222.10.60	255.255.255.248	C	201.222.10.56	201.222.10.63
15.16.193.6	255.255.248.0	A	15.16.192.0	15.16.199.255
128.16.32.13	255.255.255.252	B	128.16.32.12	128.16.32.15
153.50.6.27	255.255.255.128	B	153.50.6.0	153.50.6.127

design

- 192.168.10.0/24 5 Dept, 25 user
- First note 192.168.10.0 class c
- Default mask = 255.255.255.0

No of network = 2^n-2 >= 5 …….n=3

For check

No of host = 2^5 – 2 = 30 > 25

Ok

The subnet mask is 255.255.255.11100000

255.255.255.224

192.168.5.32	192	168	5	00100000	Host
255.255.255.224	255	255	255	11100000	Mask
192.168.5.32	192	168	5	00100000	Subnet
192.168.5.63	192	168	5	00111111	Broadcast
192.168.5.64	192	168	5	01000000	Subnet
192.168.5.95	192	168	5	01011111	Broadcast
192.168.5.96	192	168	5	01100000	Subnet
192.168.5.127	192	168	5	01111111	Broadcast

192.168.5.0	192	168	5	00000000	Host
255.255.255.224	255	255	255	11100000	Mask

Factor = 2^5 = 32

192.168.5.0

+32

192.168.5.32

+32

192.168.5.64

+32

192.168.5.96

+23

192.168.5.128

Subnetting Homework

1: A service provider has given you the Class C network range 209.50.1.0. Your company must break the network into 20 separate subnets.

2: Your company would like to break the Class B private IP address range 172.16.0.0 into 60 different subnets

3: A service provider has given you the Class C network range 209.50.1.0. Your company must break the network into as many subnets as possible as long as there are at least 50 clients per network.

4: Your company would like to break the Class B private IP address range 172.16.0.0 into as many subnets as possible, provided that they can get at least 300 clients per subnet

5: You are given the following IP address and subnet mask: 192.168.1.58 255.255.255.240 Identify the original range of addresses (the subnet) that this IP address belongs to