

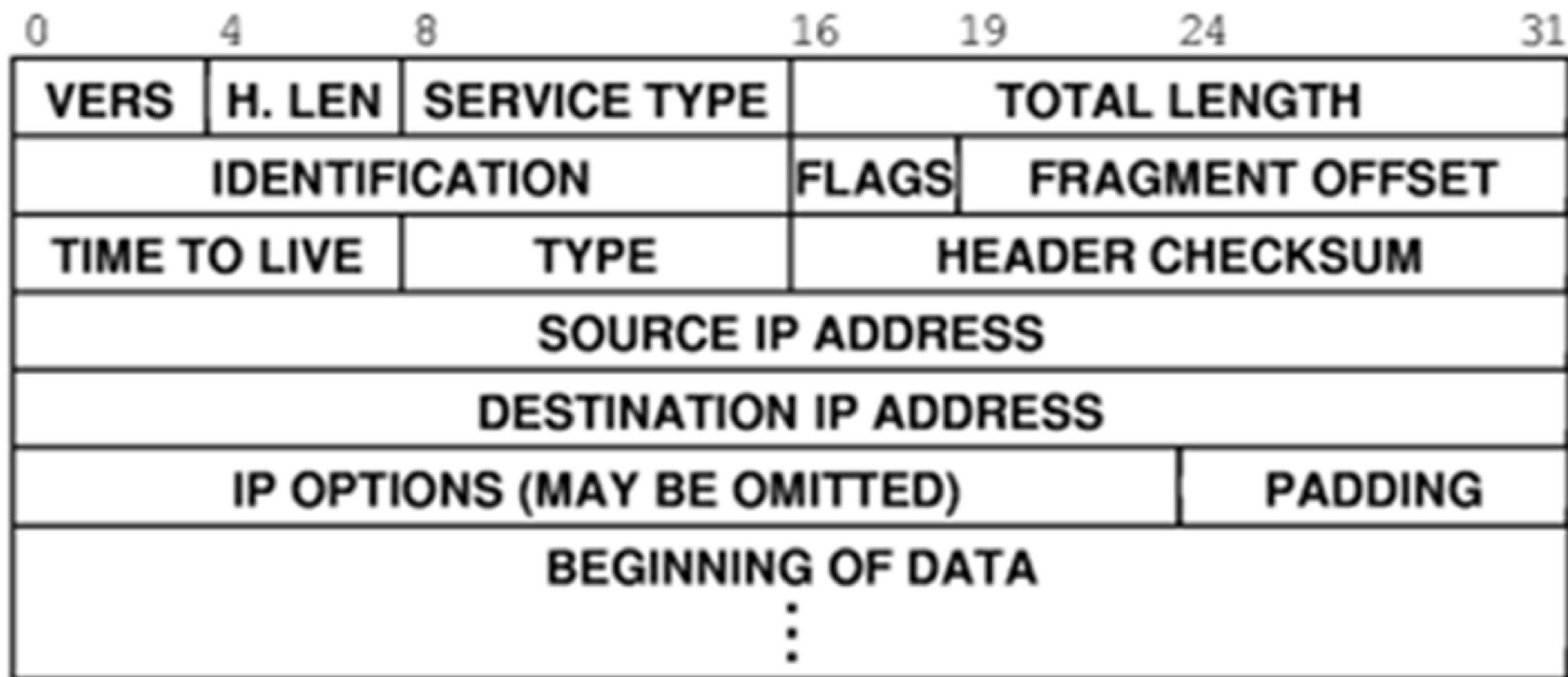
# Format of Internet Packets

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- ◆ The IP software defines its own internet packet format known as an *IP datagram*.
- ◆ It is a *universal, virtual* packet which has a particular format/structure which is very different to that of a hardware frame.
- ◆ It can carry a *single* octet of data or multiple octets up to a maximum of *64K* octets (including the header).

# The IP Datagram Header Format

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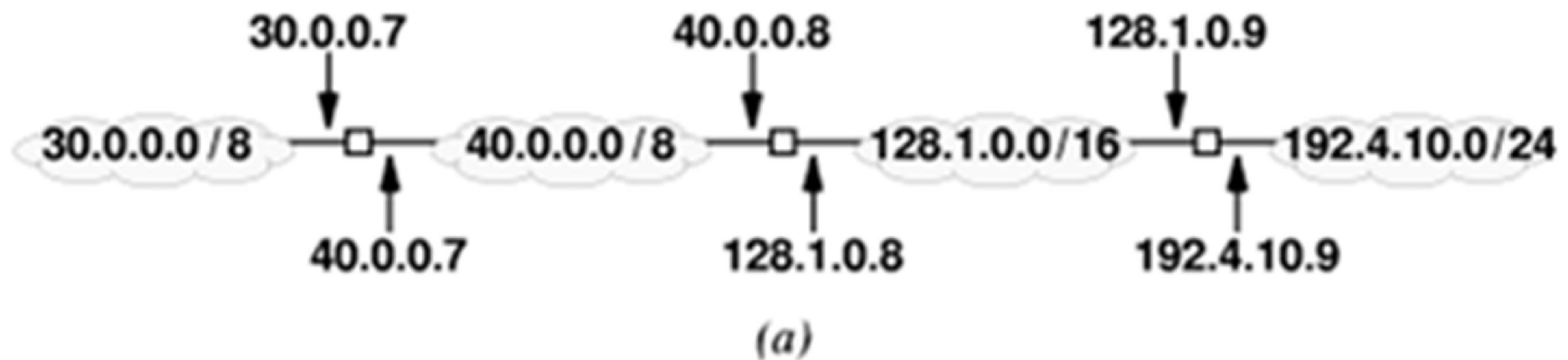
# Forwarding an IP Datagram

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- ◆ Recall that a router makes its routing decision based on the *destination IP address*.
- ◆ Routing information is stored in a *routing table*.
  - This table must be *initialized* on boot-up and updated if the topology changes:
- ◆ The next three slides show example ***Routing Tables***:
  - The first slide recalls a high-level ***Routing Table*** from previous discussions,
  - The second and third slides shows a ***Routing Table*** from a real router.

# Example IP Routing Table

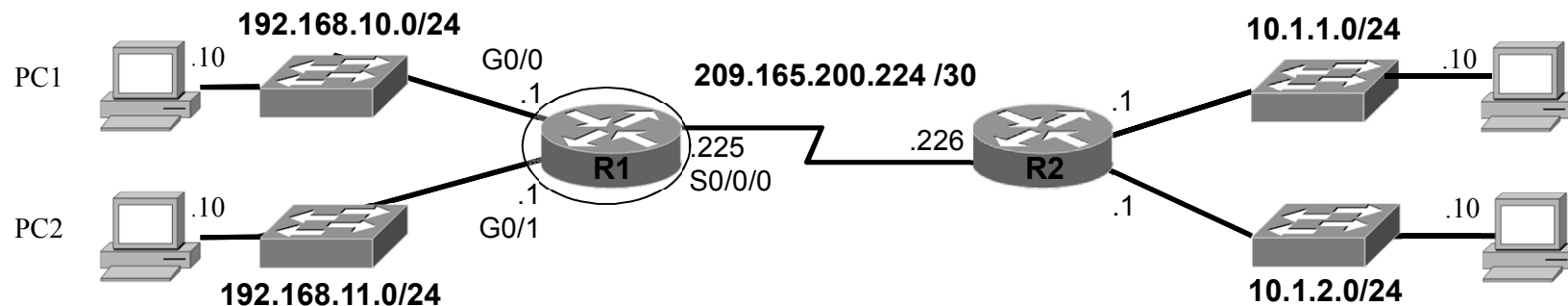
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Destination	Mask	Next Hop
30.0.0.0	255.0.0.0	40.0.0.7
40.0.0.0	255.0.0.0	deliver direct
128.1.0.0	255.255.0.0	deliver direct
192.4.10.0	255.255.255.0	128.1.0.9

# Example IP Routing Table

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- ◆ Note the network numbers and the connections to the routers.
- ◆ The Routing Table router 1 (R1) is shown on the next slide.

# Example IP Routing Table

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```
R1#show ip route
```

```
Codes: L - local, C - connected, S - static, R - RIP, M - mobile, B - BGP  
D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area  
N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2  
E1 - OSPF external type 1, E2 - OSPF external type 2, E - EGP
```

```
* - candidate default, U - per-user static route, o - ODR  
P - periodic downloaded static route
```

```
Gateway of last resort is not set
```

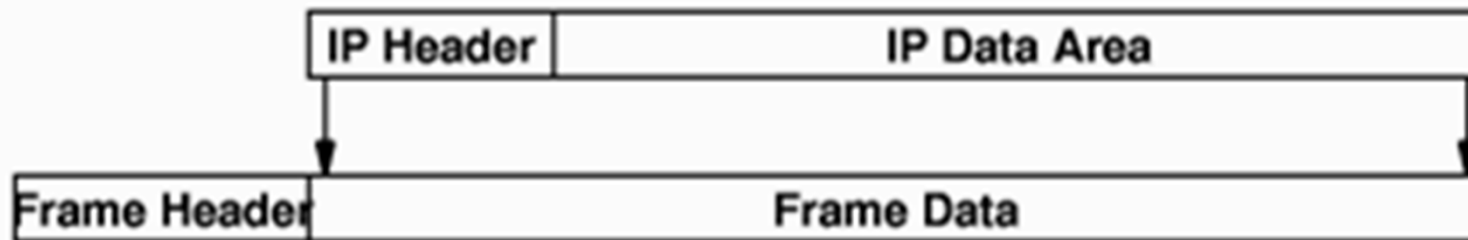
```
10.0.0.0/8 is variably subnetted, 2 subnets, 2 masks  
D    10.1.1.0/24 [90/2170112] via 209.165.200.226, 00:00:05, Serial0/0/0  
D    10.1.2.0/24 [90/2170112] via 209.165.200.226, 00:00:05, Serial0/0/0  
192.168.10.0/24 is variably subnetted, 2 subnets, 3 masks  
C    192.168.10.0/24 is directly connected, GigabitEthernet0/0  
L    192.168.10.1/32 is directly connected, GigabitEthernet0/0  
192.168.11.0/24 is variably subnetted, 2 subnets, 3 masks  
C    192.168.11.0/24 is directly connected, GigabitEthernet0/1  
L    192.168.11.1/32 is directly connected, GigabitEthernet0/1  
209.165.200.0/24 is variably subnetted, 2 subnets, 3 masks  
C    209.165.200.224/30 is directly connected, Serial0/0/0  
L    209.165.200.225/32 is directly connected, Serial0/0/0
```

```
R1#
```

# IP Encapsulation

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- ◆ The *physical network* does not understand the datagram format.
- ◆ Instead the *datagram* is placed in the data area of a *hardware frame*.
- ◆ This is known as *encapsulation*.



# IP Encapsulation

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- ◆ This process is applied on each leg of the transmission path.
- ◆ The *datagram* is stored in memory without the additional *frame header* information.
- ◆ The size of the *frame header* may vary as it traverses different network technologies.



# Encapsulation at work

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