

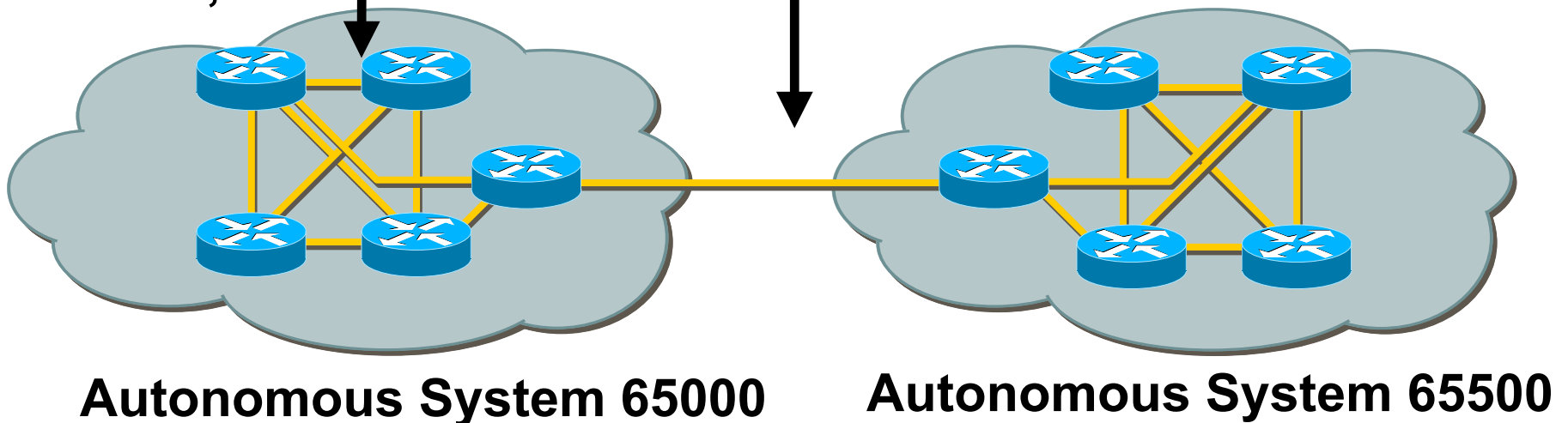
# Border gateway Protocol - BGP

## Internetworking - Module 13

BGP is the only actively used EGP on the Internet

**IGPs: RIP, IGRP, OSPF, EIGRP**

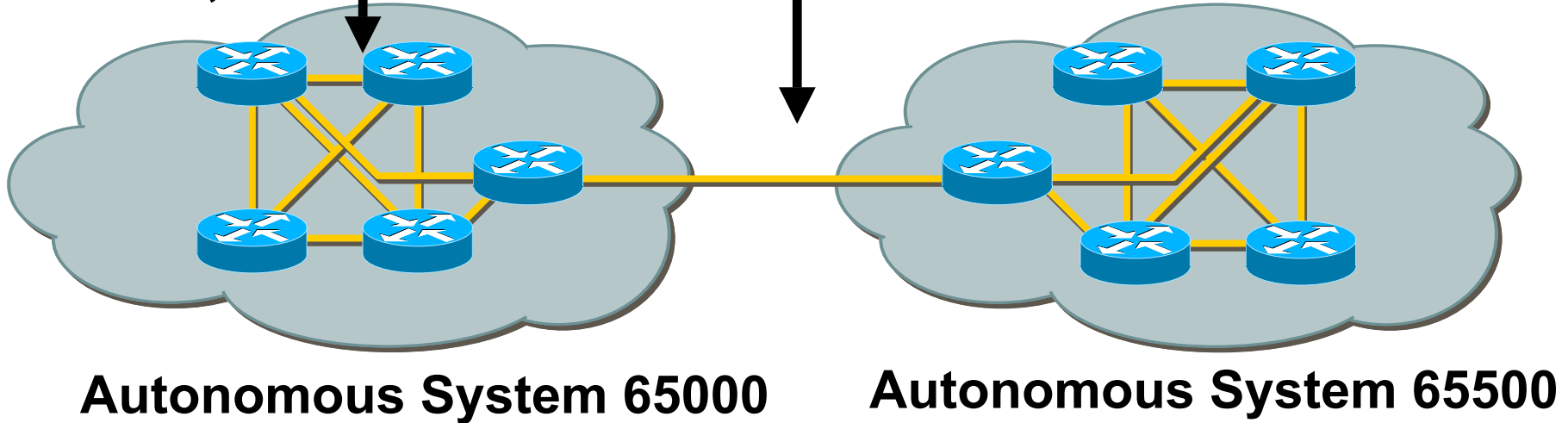
**EGPs: BGP**



# Autonomous Systems

**IGPs: RIP, IGRP, OSPF, EIGRP**

**EGPs: BGP**



- ⊠ An autonomous system (AS) is a collection of networks under a a single technical administration
- ⊠ IGPs operate within an autonomous system
- ⊠ EGPs connect different autonomous systems

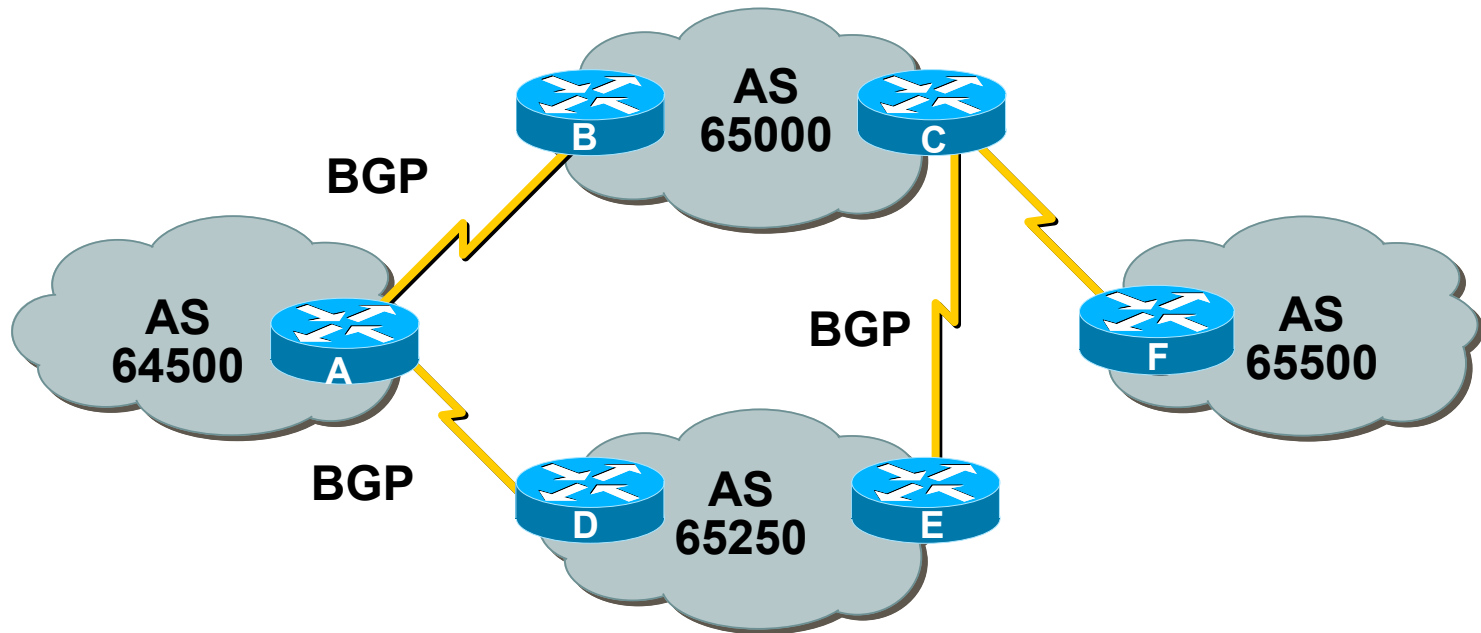
# Exterior Gateway Protocols

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- EGP was an old EGP
- BGP is the modern EGP on the Internet
- Used to transfer routing information between autonomous systems
- BGP is called a path-vector routing protocol
- Can be used between autonomous systems and within an autonomous system

# BGP Is Used Between Autonomous Systems

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- ⊠ BGP is used between autonomous systems
- ⊠ Guarantees exchange of loop-free routing information

# Scalable Routing Protocol Comparison

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Protocol	Interior or Exterior	DV or LS	Hierarchy Required	Metric
OSPF	Interior	LS	Yes	Cost
EIGRP	Interior	Advanced DV	No	Composite
BGP	Exterior	Advanced DV	No	Path vectors or attributes

# When to Use BGP

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- BGP is most appropriate when at least one of the following conditions exist:
  - ⊗ An AS allows packets to transit through it to reach other autonomous systems (for example, a service provider)
  - ⊗ An AS has multiple connections to other autonomous systems
  - ⊗ The flow of traffic entering and leaving your AS must be manipulated
- And the effects of BGP are well understood

# How Big Is the Internet?

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- A BGP router in the Internet has:
  - ⊗ A routing table that uses more than 30 Mb
  - ⊗ Over 70,000 routes
  - ⊗ Over 6,500 AS numbers

# When Not to Use BGP

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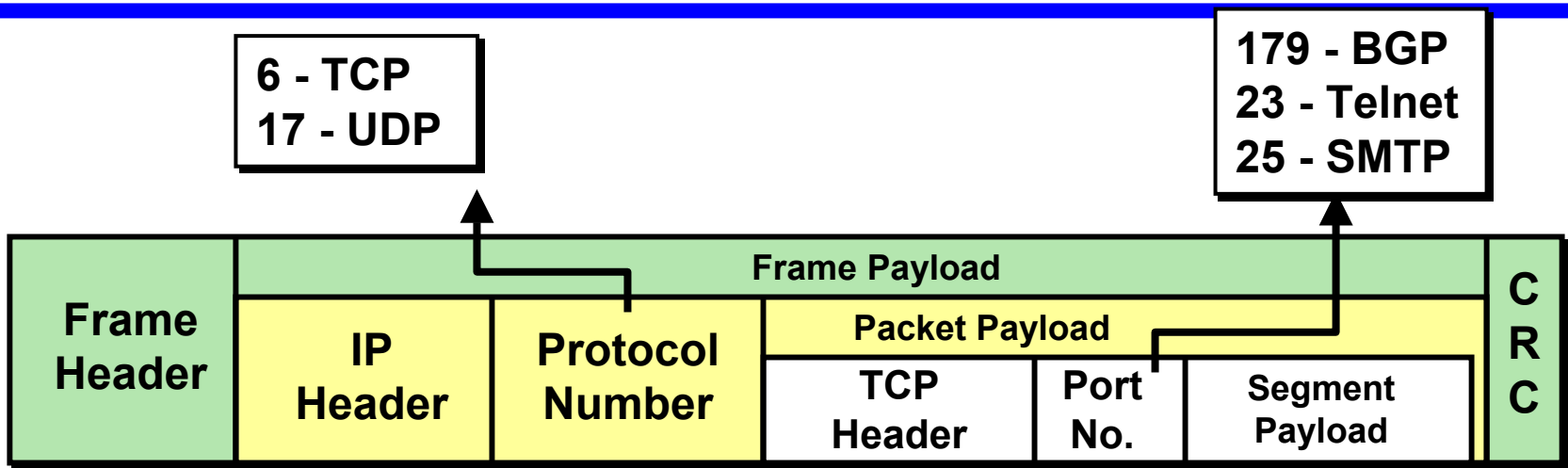
- BGP is not always appropriate. Don't use BGP if you have one of the following conditions:
  - ⊗ A single connection to the Internet or other AS
  - ⊗ Routing policy and route selection are not a concern for your AS
  - ⊗ Lack of memory or processor power on BGP routers to handle constant updates
  - ⊗ Limited understanding of route filtering and BGP path selection process
  - ⊗ Low bandwidth between autonomous systems
- Use static routes instead

# BGP Characteristics

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- BGP is a distance vector protocol with enhancements:
  - ⊗ Reliable updates—BGP runs on top of TCP (port 179)
  - ⊗ Incremental, triggered updates only
  - ⊗ Periodic keepalives to verify TCP connectivity
  - ⊗ Rich metrics (called path vectors or attributes)
  - ⊗ Designed to scale to huge internetworks (for example, the Internet)

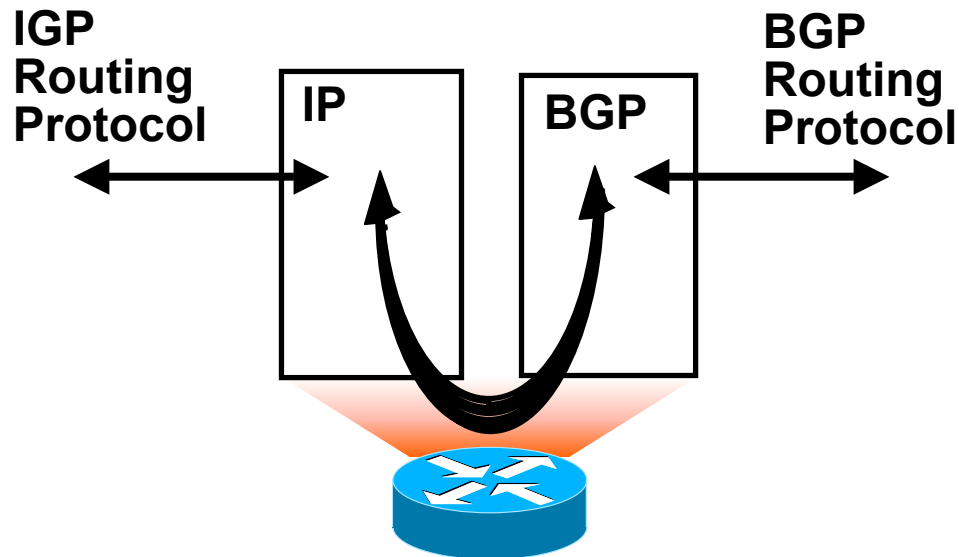
# BGP in IP Packets



- BGP is an advanced distance vector routing protocol
  - Relies on TCP for reliable session management
  - Uses port number 179

# Tables

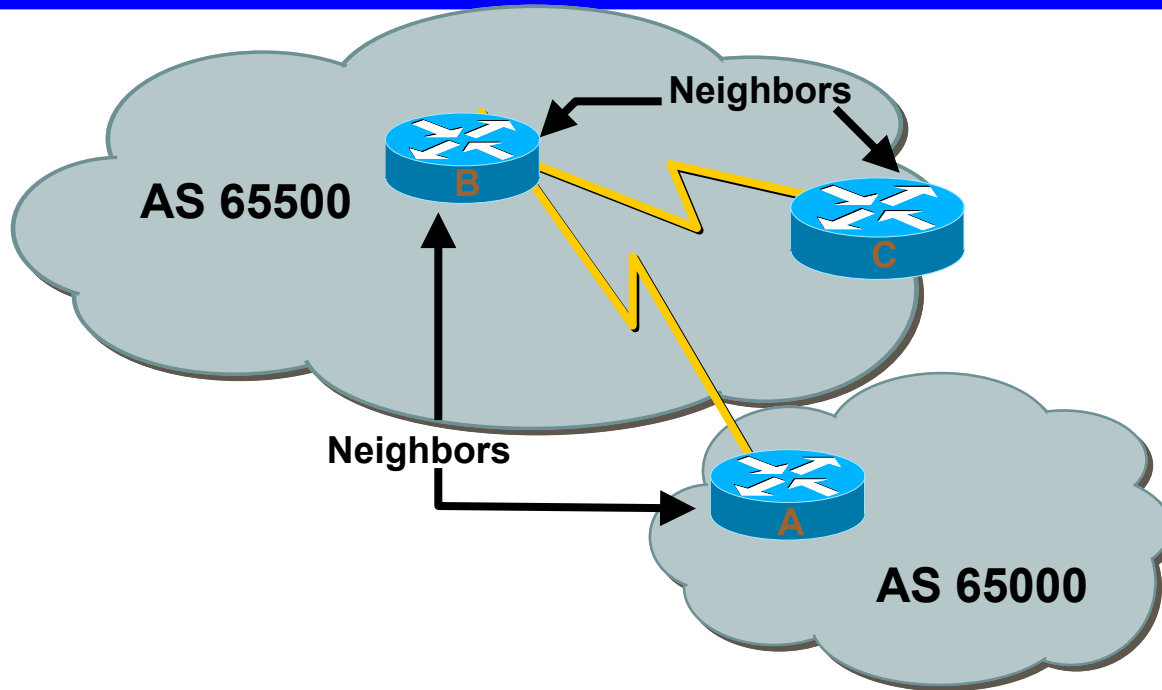
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- ⊠ BGP has its own table, in addition to the IGP routing table
- ⊠ Information can be exchanged between the two tables

# Peers = Neighbors

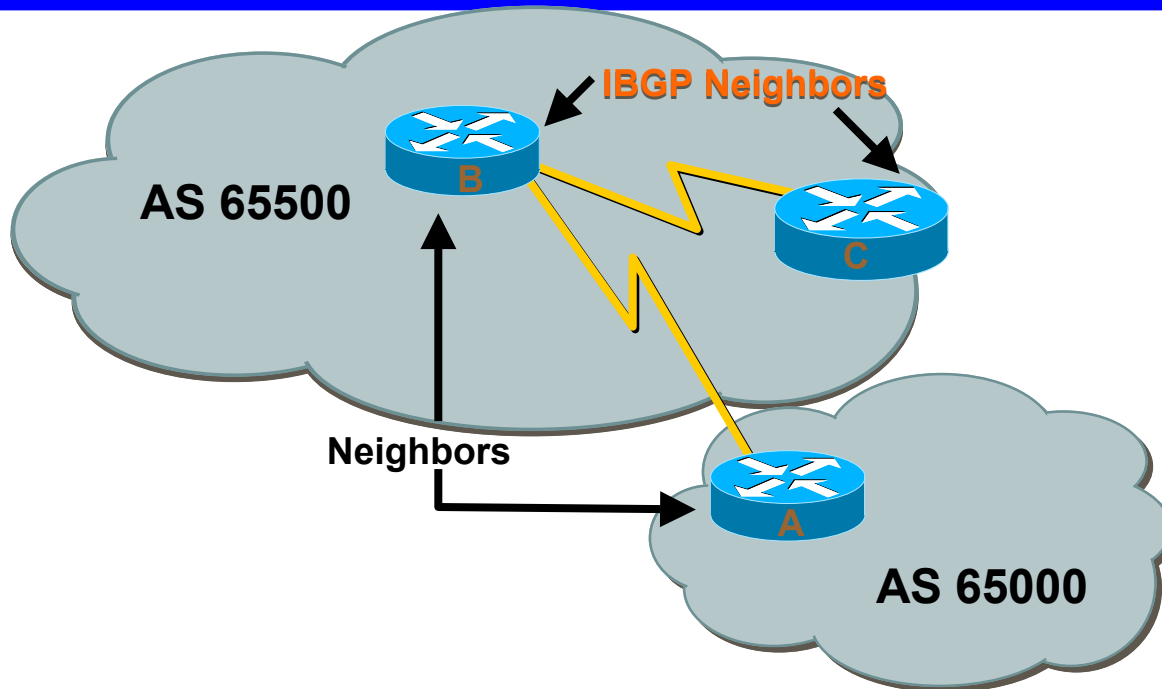
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- Any two routers that have formed a TCP connection in order to exchange BGP routing information are called peers or neighbors

# Internal BGP

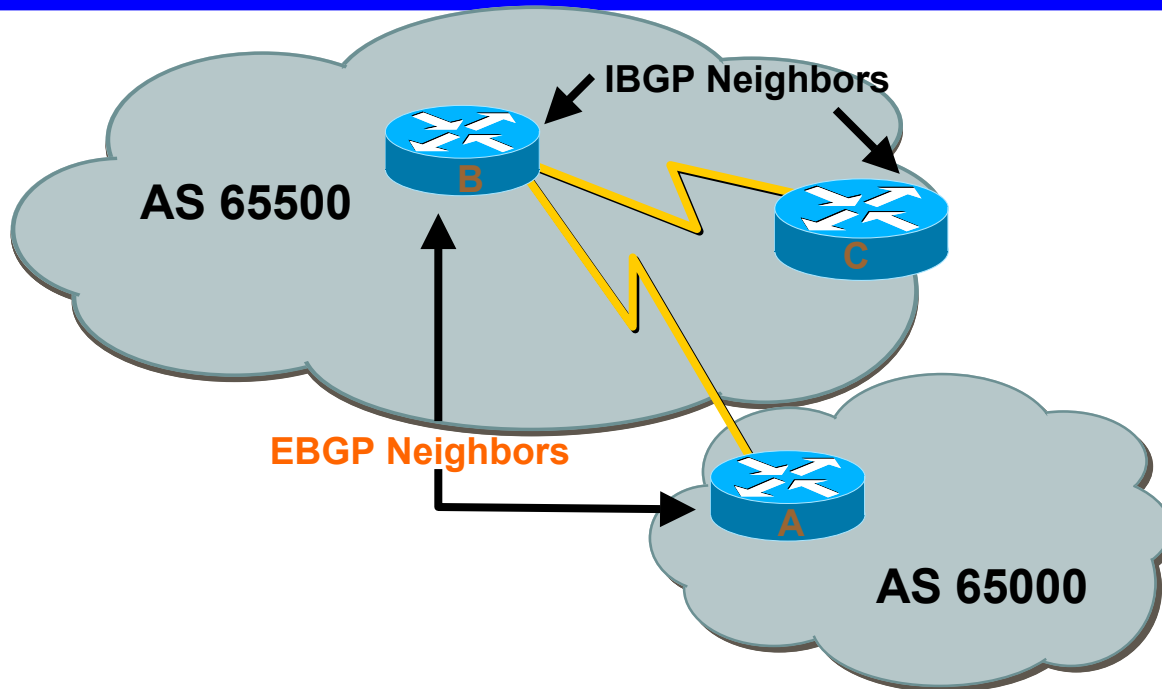
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- **When BGP neighbors belong to the same AS**
- **Neighbors do not have to be directly connected**

# External BGP

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- **When BGP neighbors belong to different autonomous systems**
- **Neighbors should be directly connected**

# Policy-Based Routing

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- BGP allows administrators to define policies, or rules, for how data will flow through the autonomous systems
- BGP and associated tools cannot express all routing policies
  - ⊗ BGP does not enable one AS to send traffic to a neighbor AS, intending that the traffic take a different route from that taken by traffic originating in the neighbor AS
- However, BGP can support any policy conforming to (implementable by) the hop-by-hop routing paradigm

# BGP Attributes

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- BGP metrics are called path attributes
- Characteristics of attributes include:
  - ⊗ Well-known versus optional
  - ⊗ Mandatory versus discretionary
  - ⊗ Transitive versus nontransitive
  - ⊗ Partial

# BGP Message Types

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- BGP defines the following message types:
  - ⊗ Open
    - Includes hold time and BGP router ID
  - ⊗ Keepalive
  - ⊗ Update
    - Information for one path only (could be to multiple networks)
    - Includes path attributes and networks
  - ⊗ Notification
    - When error detected
    - BGP connection closed after sent

# Last Words About BGP

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- 10-20 “tier 1” ASs which are the Internet backbone
- Clearly convergence is an issue – why?
- Black holes are always a potential problem
- There are lots of BGP updates every day!
- BGP is really the heart of the Internet
- BGP is a means by which network operators control congestion in the Internet.