**In class activity (4.6 Routing in the Internet)**

**1) Intra-AS routing protocols = interior gateway protocols**

1. **Routing Information Protocol (RIP) - a type of DV alg. (Fig. 4.36)**
   * Used in lower-tier ISPs
   * Path cost =# of hops (subnets) in shortest path from source router to destination subnet
   * RIP advertisementsare exchanged between neighbors every 30 seconds
   * Implemented in “application layer” - *Routed application* using UDP , port# 520
2. **Open Shortest Path First (OSPF) – LS alg.**
   * Used in upper-tier ISPs
   * Each router creates a graph of all routers in an AS then runs Dijkstra’s with itself as the root
   * OSPF advertisementsare exchanged between all routers in the AS
   * Advertisements are sent (1) every 30 seconds and (2) if any links change
   * Implemented as OSPF messages over IP
   * Advantages of OSPF

* Security – simple and MD5 authentication
* Can use multiple same-cost paths
* Integrated support for unicast and multicast routing
* Support for hierarchy within a single AS

**2) Inter-AS routing protocols – use Border Gateway Protocol (BGP)**

* Uses TCP to connect separate ASs
* BGP peers are connected by BGP sessions
  + **eBGP session** = TCP connection between two routers in different ASs
  + **iBGP session** = TCP connection between two routers in the same AS
* BGP uses (exchanges) CIDR prefixes, autonomous system numbers (ASN), and other attributes
* Route = a BGP prefix and its attributes shared with other BGP peers
  + **AS-PATH** = list of ASs through which the advertisement has passed
  + **NEXT-HOP** = attribute having the router IP addr. that starts AS-PATH; helps create forwarding tables 🡺 link between inter-AS and intra –AS routing protocols
* BGP route selection (p.396) and selective BGP advertising (pg.397, Fig.4.42)
* ISP agreement – pg. 399: traffic across an ISP backbone net must have src or dst (or both) in one of it customer nets
* Read Principle and Practice-pg. 392, 396

**Area border routers** = route packets outside the AS area

**Backbone** = area in the AS containing all the area border routers

-Intra-AS routing

1) RIP – Routing Information Protocol (a type of DV alg.)

* cost=# of hops
* exchange info ever 30 sec.
* mssg uses UDP at port # 520
* implemented in Application Layer

2) OSPF – Open Shortest path First (LS alg.)

* cost = 1 (or 1/linkCapacity)
* broadcast routing table to all routers in AS
* has authentication
* allows for many same-cost paths 🡺 balanced load on links

-Inter-AS routing – uses BGP (Border Gateway Protocol)

* external (between ASs) and internal (inside AS) BGP sessions