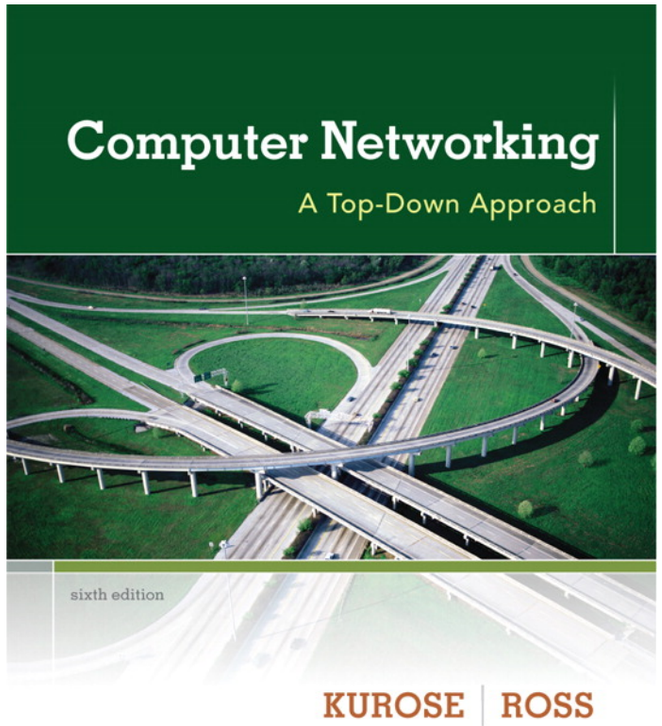
CN-Advanced
L44

OSPF

Dr. Ram P Rustagi
rprustagi@ksit.edu.in
http://www.rprustagi.com
https://www.youtube.com/rprustagi

Chapter 4
Wireless and Mobile Networks



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Thanks and enjoy! JFK/KWR

Computer Networking: A Top Down Approach
6th edition
Jim Kurose, Keith Ross
Addison-Wesley
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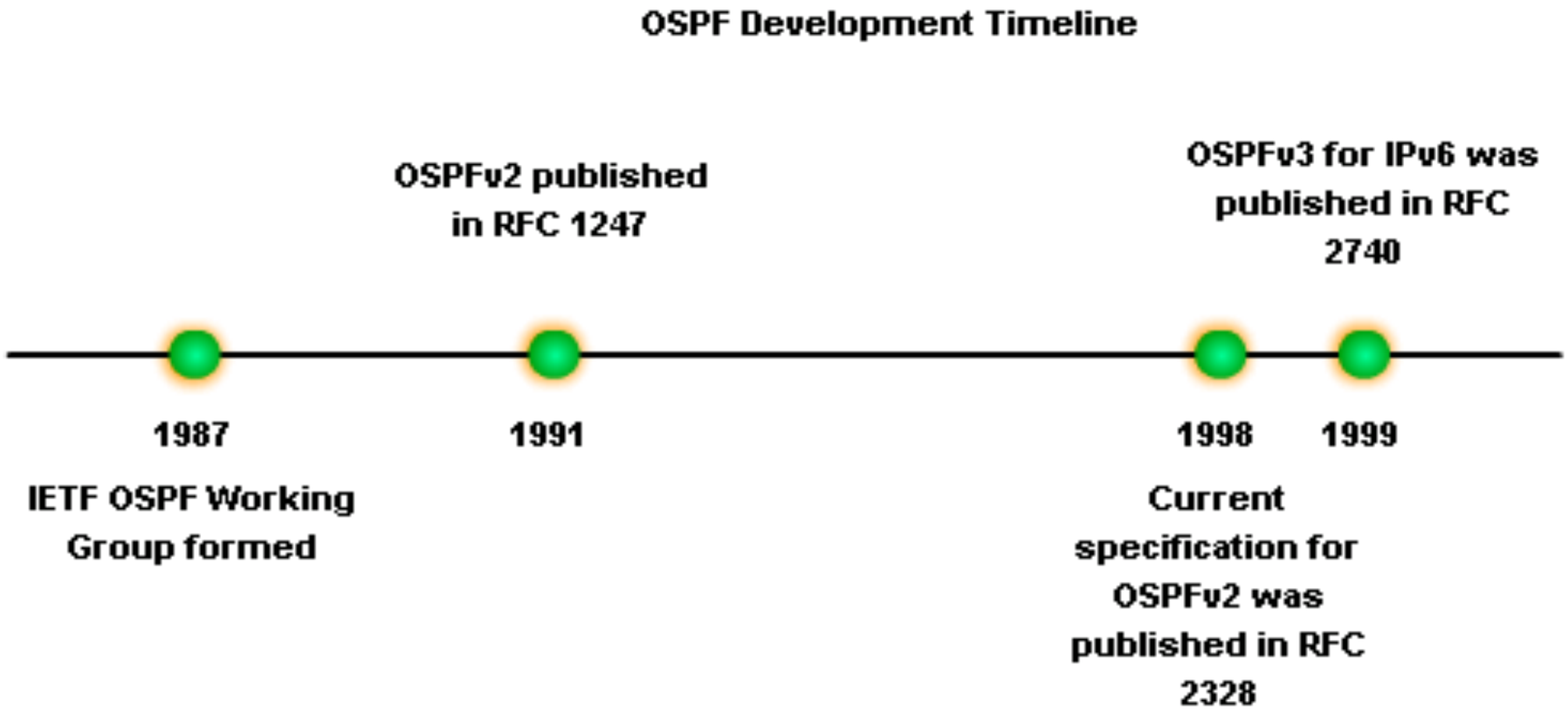
OSPF

- **Open**
  - implies it is for any one to use
  - it is not a proprietary protocol
- **SPF** - Shortest Path First
  - comes from Link State Routing protocol
- A Link State routing protocol
  - each router maintains identical database
    - topology of Autonomous System
- Fast convergence
- OSPF advertisements flooded to entire AS
  - Carries one entry per neighbour
  - Runs directly over IP (no TCP or UDP)

OSPF (Open Shortest Path First)

- Began in 1987
- 1989 OSPFv1 released in RFC 1131
- This version was experimental & never deployed
- 1991 OSPFv2 released in RFC 1247
- 1998 OSPFv2 updated in **RFC 2328**
- 1999 OSPFv3 (IPv6) published in RFC 2740



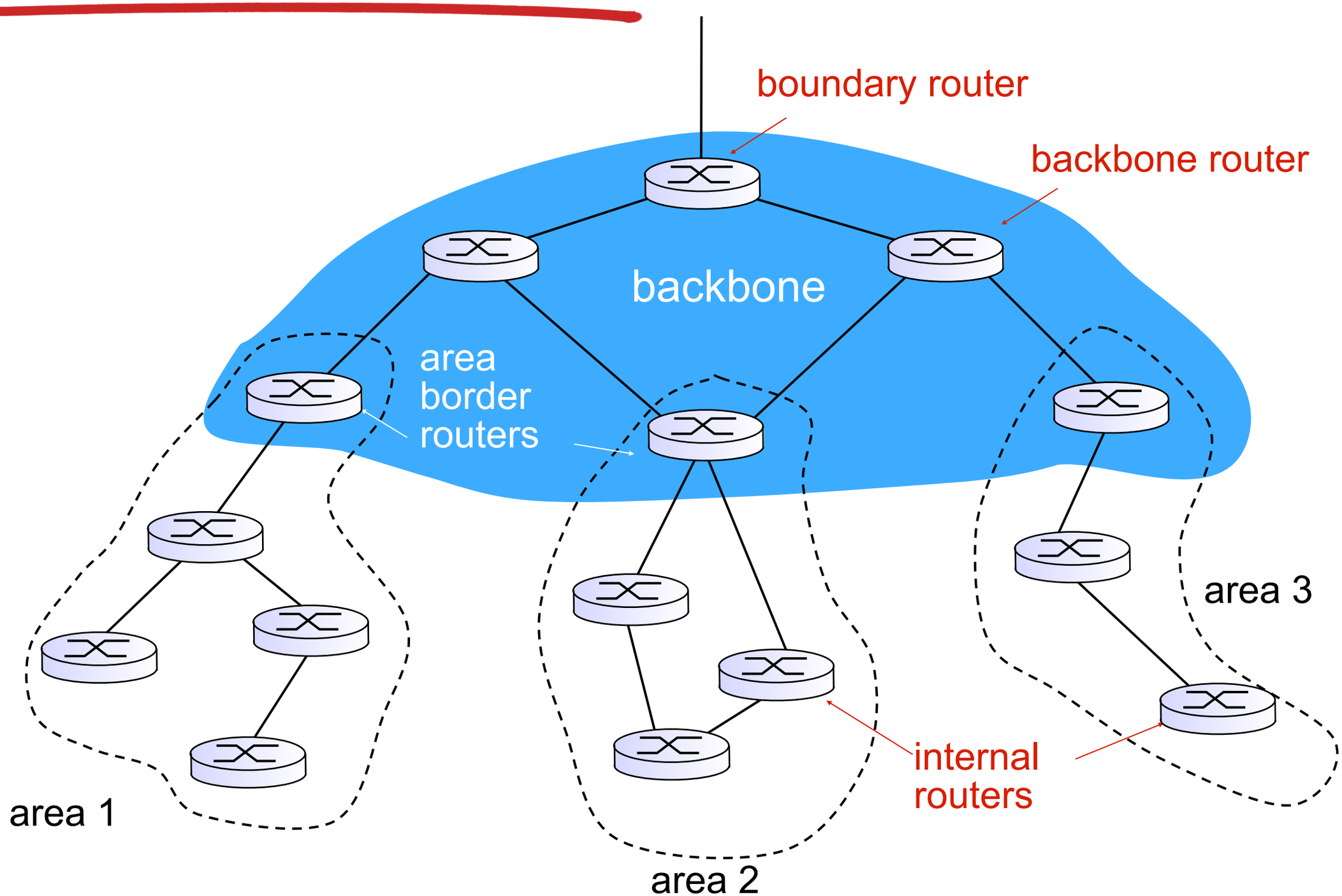
OSPF

- Designed specifically for TCP/IP networks
  - Should work for both small and large AS
  - Allows variable length subnetting
- Provides for authentication of updates
- Utilizes multicast when sending updates
- Routes packets based solely on destination address
- Uses the concept of Areas (using 32 bits)
  - Backbone (Primary) area area and secondary areas
  - Topology of the area is hidden from rest of AS
  - Enables reduction of routing traffic
  - Can be considered as generalization of IP Subnetting

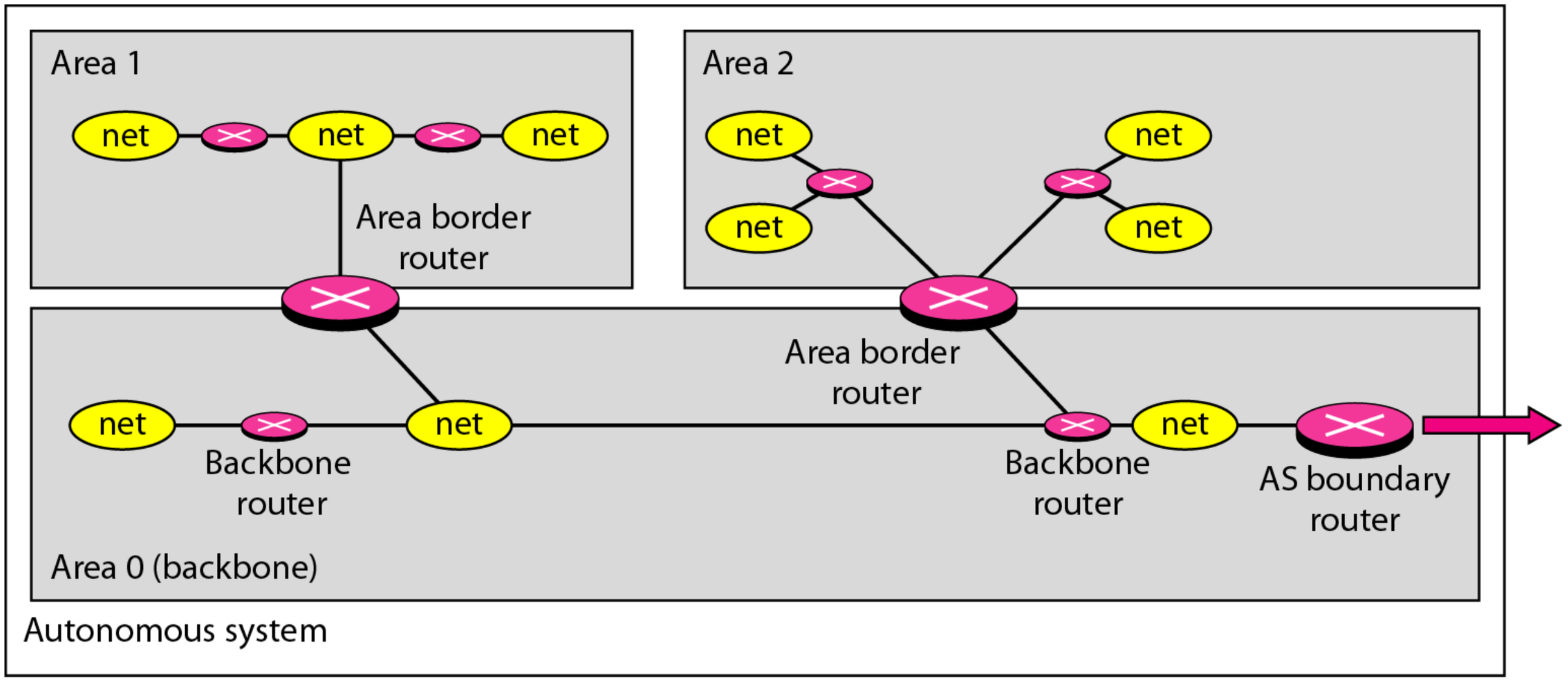
OSPF "advanced" features (not in RIP)

- *security:* all OSPF messages are authenticated (to prevent malicious intrusion)
  - Simple password communication
  - MD5 based: uses a shared secret key
- multiple same-cost paths allowed (only one path in RIP)
  - for each link, multiple cost metrics for different TOS
    - e.g., satellite link cost set "low" for best effort ToS
    - high for real time ToS)
- integrated uni- and multicast support:
  - Multicast OSPF (MOSPF) uses same topology data base as OSPF
- hierarchical OSPF in large domains.

Hierarchical OSPF



OSPF



Src: Computer Networks by Forouzan

Hierarchical OSPF

- *two-level hierarchy:* local area, backbone.
  - link-state advertisements only in area
  - each nodes has detailed area topology;
  - only know direction (shortest path) to nets in other areas.
- *area border routers:* "summarize" distances to nets in own area, advertise to other Area Border routers.
- *backbone routers:* run OSPF routing limited to backbone.
- *boundary routers:* connect to other AS's.

OSPF Areas

- Backbone Area
  - it is the special area, called area 0
  - typically written as 0.0.0.0
    - areas are generally written as IP addresses
  - responsible for distributing information to other areas
  - must be contiguous (logically)
    - need not be physically contiguous
    - can use virtual links
    - connects to all other areas

OSPF

- OSPF vs RIP
  - OSPF can calculate separate routes
    - For each TOS
    - For same destination, multiple routes
  - Each i/f is assigned a dimensionless cost
    - Based on throughput, RTT, reliability etc
  - Allows load balancing on equal cost route
  - Supports subnet masks
  - Point to point links do not need IP address
  - Supports authentication
  - Uses multicasting instead of broadcasting
  - Works directly on top of IP
  - Fast convergence

Interdomain Routing - Challenges

- Policies for an AS
  - Send traffic via X than Y
  - Can send traffic to Y but
    - not from X to Y (no transit)
    - paid them only to carry my traffic
  - Would like to keep policies private
  - Can have more complex policies
    - Use Y only for routes R1, R2
    - Use X for other routes
  - Does not advertise all routes

Inter Domain Routing - Challenges

- Each domains runs its own protocol
- Practically impossible to calculate meaningful path costs. Why?
  - Costs of one AS could be quite different from cost of other AS
- Issues of trust
  - Relates to complex policies
    - Trust X only if it advertises routes to R1, … Rk

Summary

- OSPF
  - Open
  - SPF
- OSPF Hierarchy
- OSPF Areas
- Inter domain routing challenges