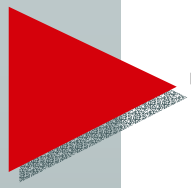
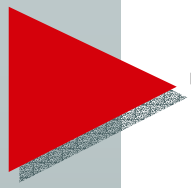

OSPF



Today's Talk

- Introduction
- Distance Vector Protocol
- Link State Protocol
- OSPF operation
- Neighbor & Adjacency
- OSPF in broadcast networks



Today's Talk ...

- Exercise-1
  - simple OSPF network
- Scalability
- Exercise-2
  - multiple areas
- Redistribution
- Exercise-3
  - redistribution of routes

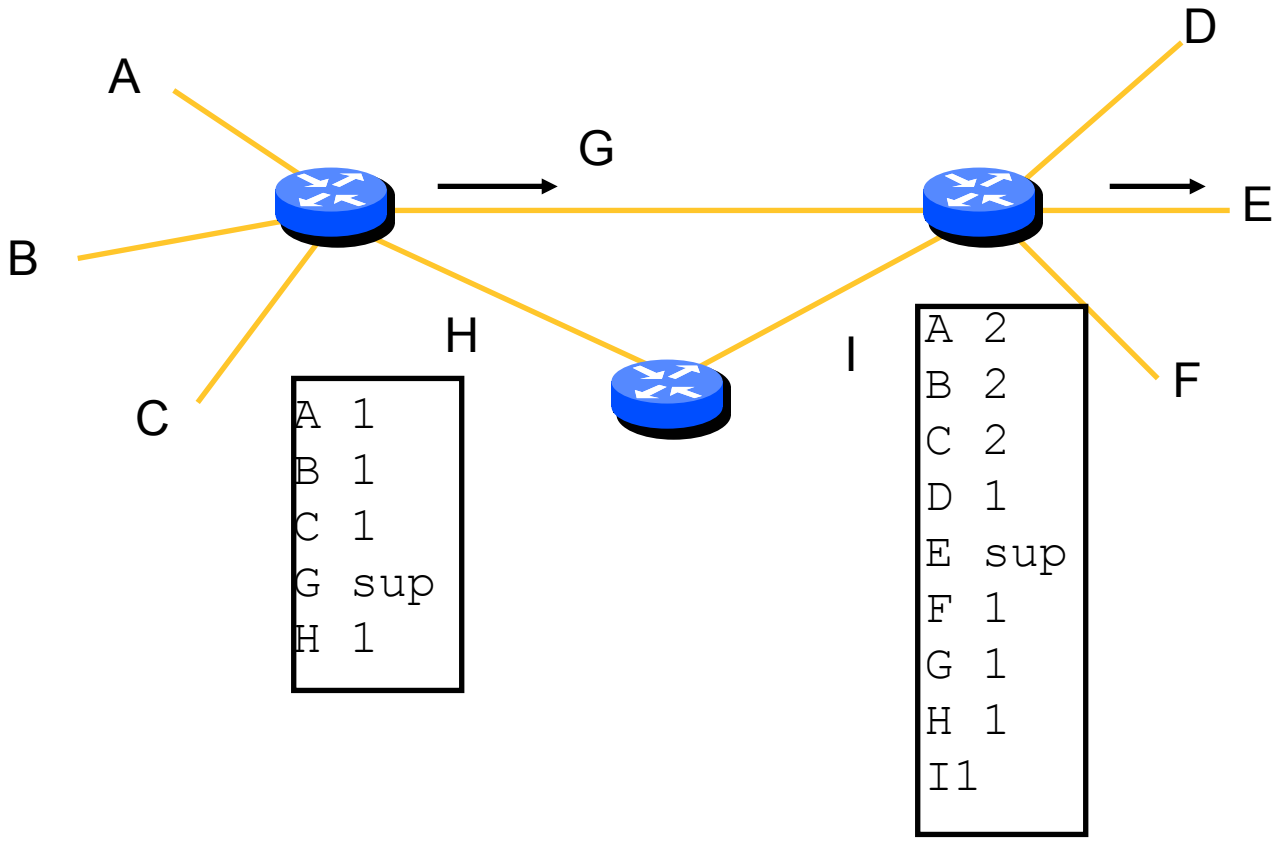
Introduction

- Open Shortest First Path protocol
- Preferred IGP
- The myth : OSPF is hard to use
- Evolved from IS-IS protocol
- Link state protocol

Distance Vector Protocols

- Listen to neighboring routers
- install routes in table, lowest distance wins
- Advertise all routes in table
- Very simple
- Very stupid

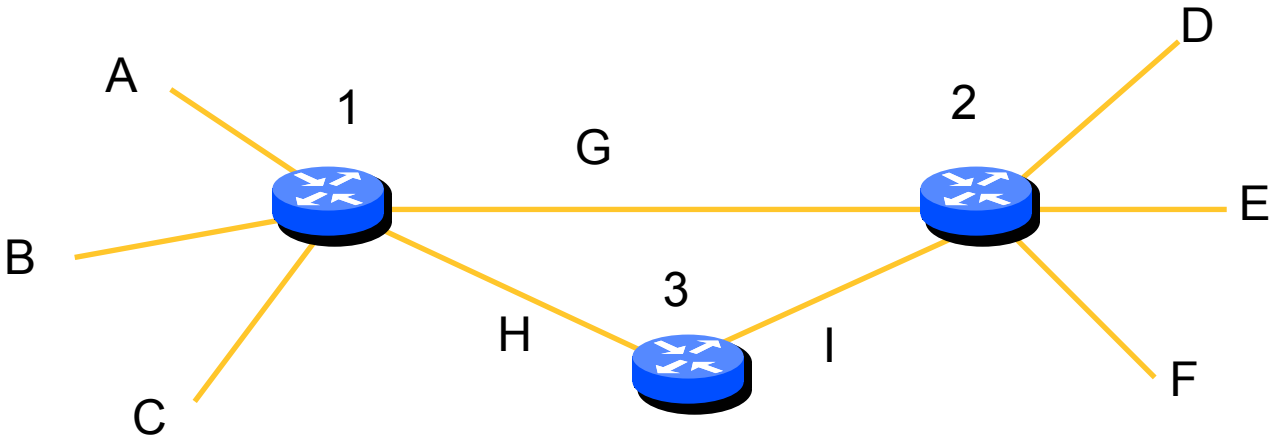
Distance Vector Protocols



Link State Protocols

- information about adjacencies sent to all routers
- each router builds a topology database
- a "shortest path" algorithm is used to find best route
- converge as quickly as databases can be updated

Link State Protocols



router 1
A, B, C, G, H

router 3
H, I

router 2
D, E, F, G, I

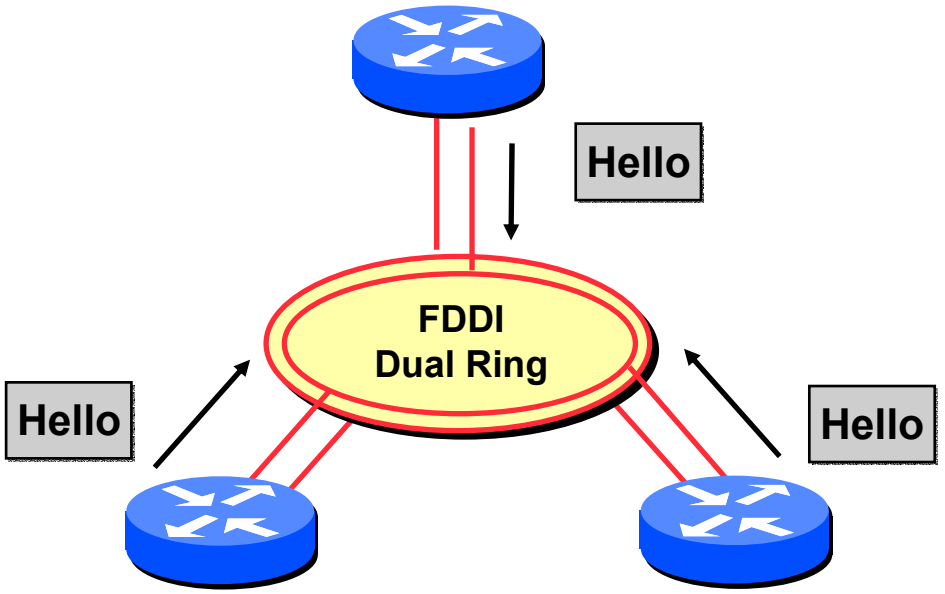
A - 1 - G - 2 - D

OSPF Operation

- Every OSPF router sends out 'hello' packets
- Hello packets used to determine if neighbor is up
- Hello packets are small easy to process packets
- Hello packets are sent periodically (usually short interval)

The Hello Packet

- Router priority
- Hello interval
- Router dead interval
- Network mask
- List of neighbors



OSPF Operation

- Once an adjacency is established, trade information with your neighbor
- Topology information is packaged in a "link state announcement"
- Announcements are sent ONCE, and only updated if there's a change
  - (or every 45mins...)

OSPF Operation

- Change occurs
- Broadcast change
- Run SPF algorithm
- Install output into forwarding table

Neighbor

- Bi-directional OSPF communication
- Result of OSPF hello packets
- Need not exchange routing information

Adjacency

- Between OSPF neighbors
- Exchange routing information
- Point-to-point or Broadcast media
- Point-to-point - neighbors are adjacent
- Broadcast media - not all neighbors are adjacent

Broadcast Media - problems

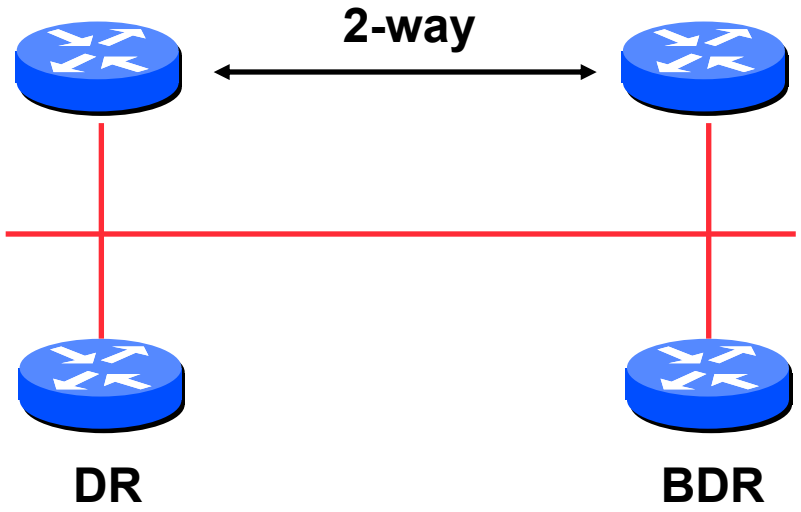
- N neighbors - order of N square adjacency
- Not optimal
- Wasted bandwidth
- Does not scale

Broadcast Media

- Select a neighbor - Designated Router(DR
- All routers become adjacent to DR
- Exchange routing information with the DR
- DR updates all the neighbors
- Scales
- Backup Designated Router

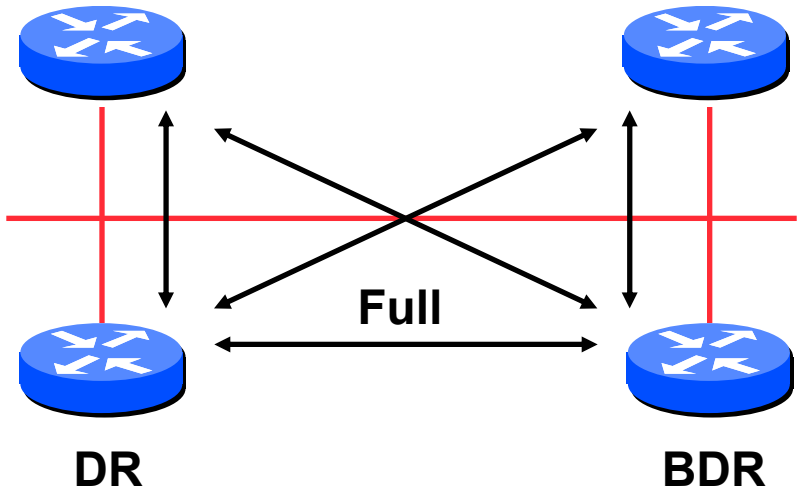
Neighboring States

- 2-way
  - –Router sees itself in other Hello packets
  - –DR selected from neighbors in state 2-way or greater

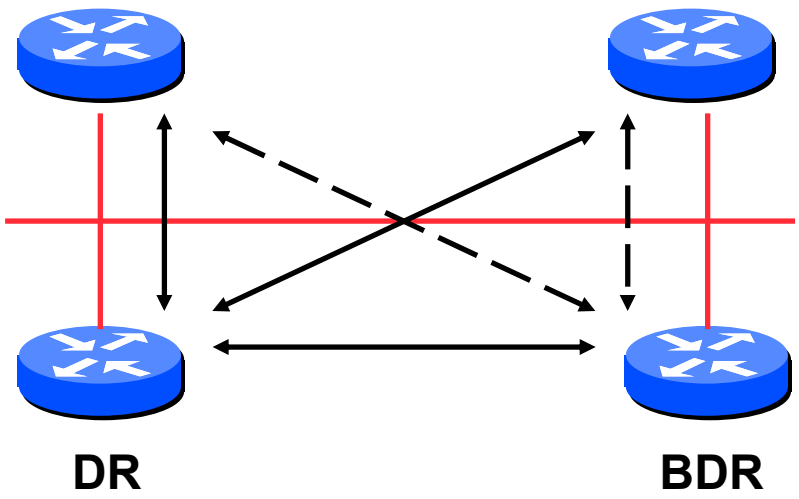


Neighboring States

- Full
  - Routers are fully adjacent
  - Databases synchronized
  - Relationship to DR and BDR



LSAs Propagate Along Adjacencies



- LSAs acknowledged along adjacencies

General cisco Concepts:

- Ability to run multiple routing protocols in the same router
- Same prefix could be learnt via more than one routing protocol
- Adminstrative distance is used to discriminate between multiple source
- Connected, Static and other dynamic protocols

Exercise - 1: cisco configuration

- console
- ‘?’ for help
- command completion
- ‘show’ commands
- ‘show configuration’
- ‘configuration’ command

Exercise - 1: cisco configuration

- ‘configure terminal’
- Different modes
- Example ‘interface ethernet 1’
  - ‘ip address x.x.x.x m.m.m.m’
- ‘exit’ to exit a mode
- ‘show ip route’
- ‘show ip route x.x.x.x’

Exercise - 1

Simple OSPF network

- ‘show ip route’
- ‘show ip ospf neighbor’
- ‘show ip ospf int’
- ‘show ip protocol’
- ‘show ip ospf database’
- many debug commands
- ‘debug ip ospf ?’

Exercise - 1

Simple OSPF network

- ‘network x.x.x.x m.m.m.m area <area-id>
- ‘m.m.m.m’ wildcard mask
- ‘0’ do not care bit
- ‘1’ check bit
- ‘0.0.0.0’ mask for exact match
- ‘network 203.167.177.10 0.0.0.0 area 0’
- ‘network 203.167.177.0 0.0.0.255 area 0’

Exercise - 1

Simple OSPF network

- **Need to create OSPF routing process**
  - **router configuration command**
  - **‘router ospf <process number>**
- Specify the network running ospf
- Should also specify the area

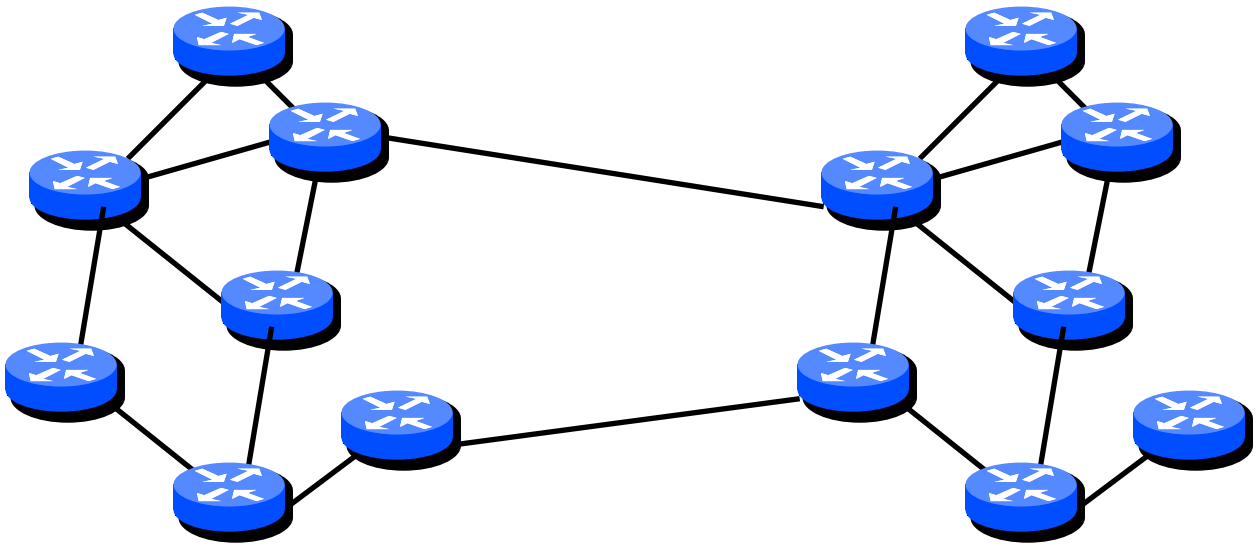
Exercise1 Verification:

- show ip ospf
- show ip ospf neighbor
- show ip route
- show ip route ospf
- show ip ospf interface
- show ip ospf database

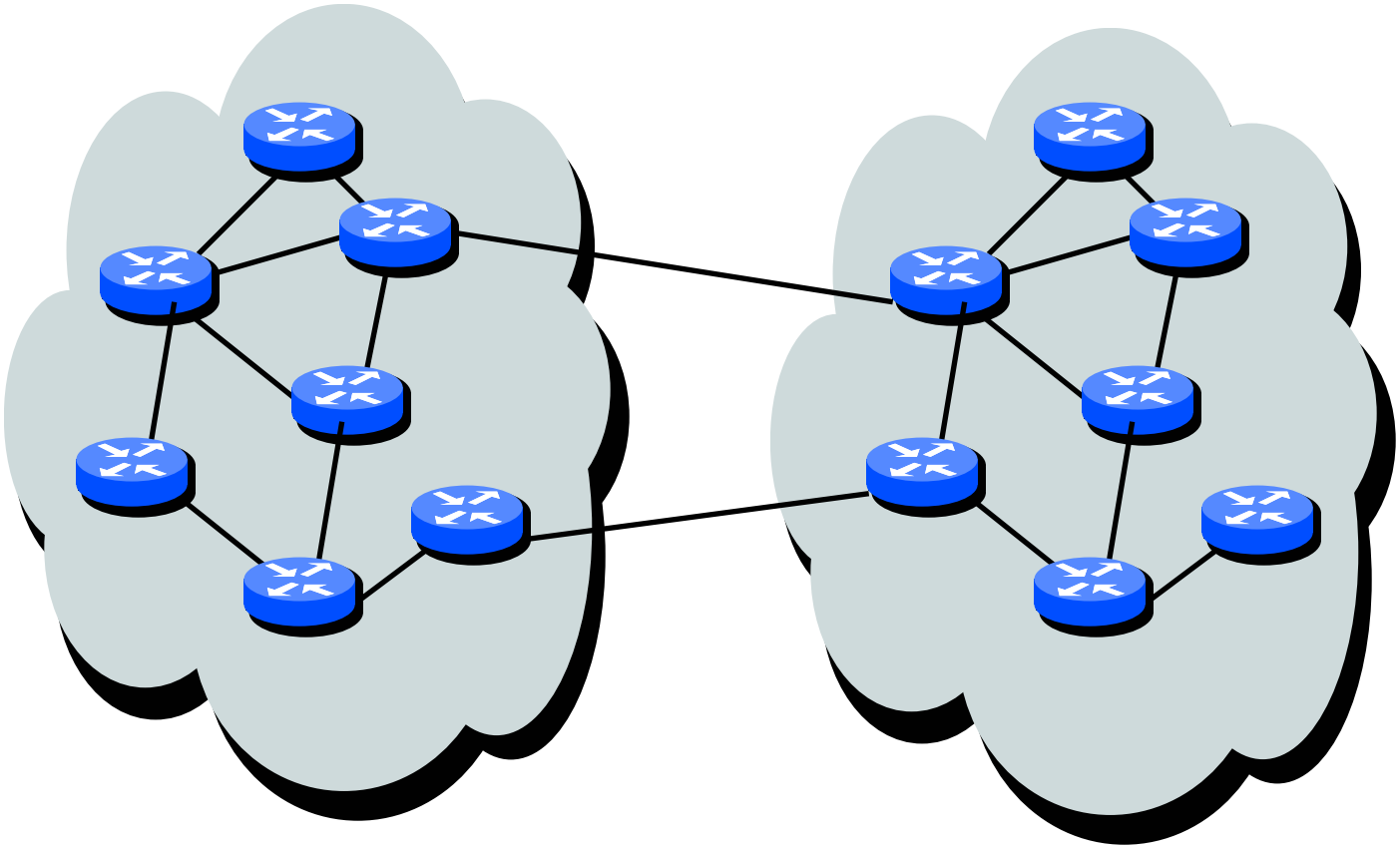
Scaling OSPF

- Each link transition causes a broadcast and SPF run
- OSPF can group routers to appear as one single router
- OSPF areas

OSPF areas (before)



OSPF areas (after)



Scaling OSPF

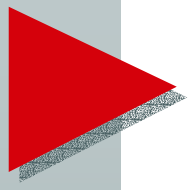
- Rule of thumb:
  no more than 150 routers/area
- Reality:
  no more than 500 routers/area
- Backbone "area" is an area
- Always ‘area 0’
- Proper use of areas reduce bandwidth & CPU utilization

Scaling OSPF

- Route could be summarized are area boundary
- Instability is limited within each area
- Divide and conquer

Exercise - 2: OSPF with area

- Use ‘network ... area <area-id> command
- Each interface only in 1 area
- Multiple areas per router
- If more than on area, the router should be in area 0
- ‘area 0’ used for inter-area traffic



Redistribution

- injecting route from other protocol
- Often useful during transition
- Need to be careful about feedback
- Need to set metric