Border Gateway Protocol – Part 2

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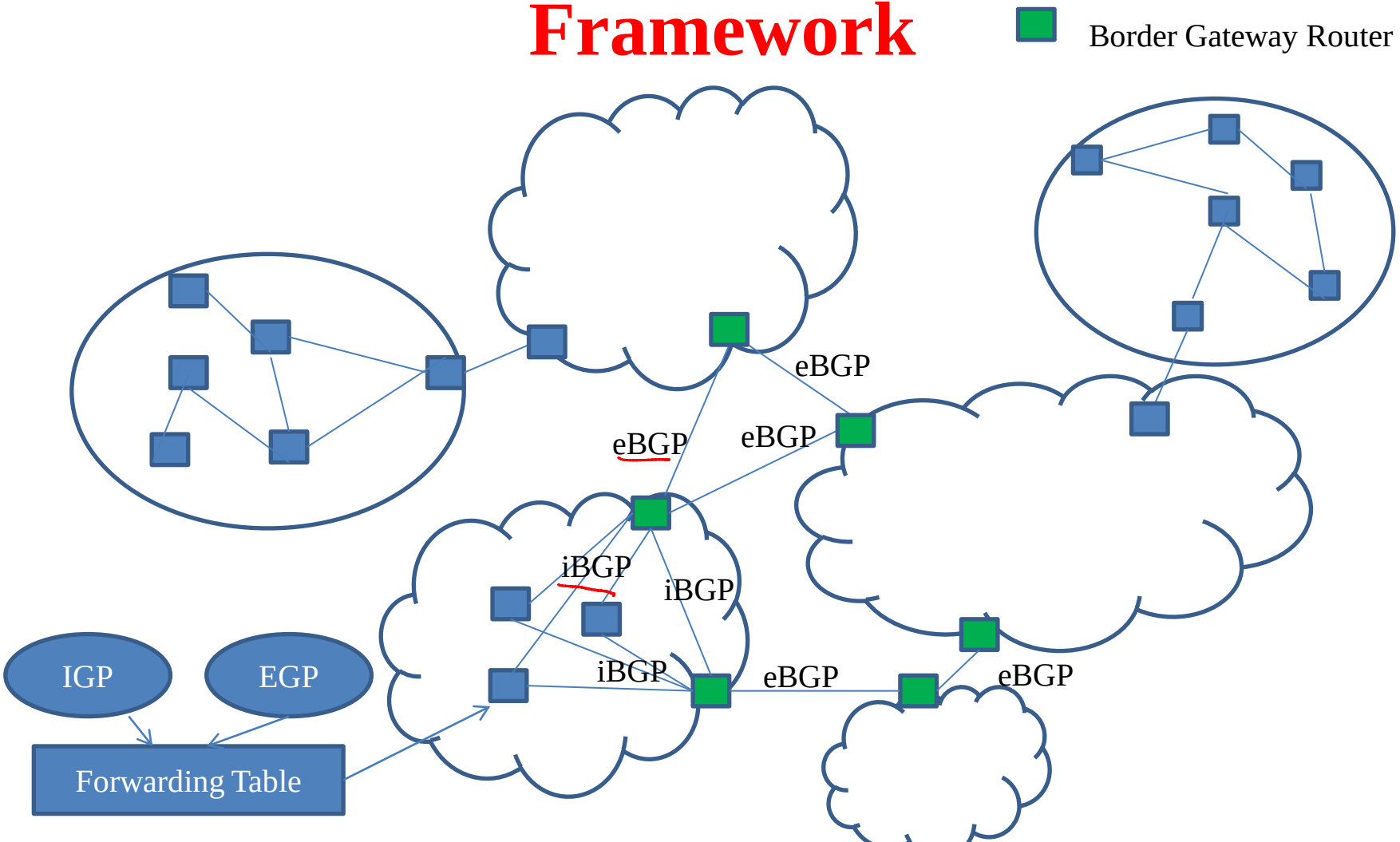
Framework


Border Gateway Router
eBGP
eBGP
eBGP
iBGP
iBGP
iBGP
eBGP
eBGP
IGP
EGP
Forwarding Table

Summary of Framework

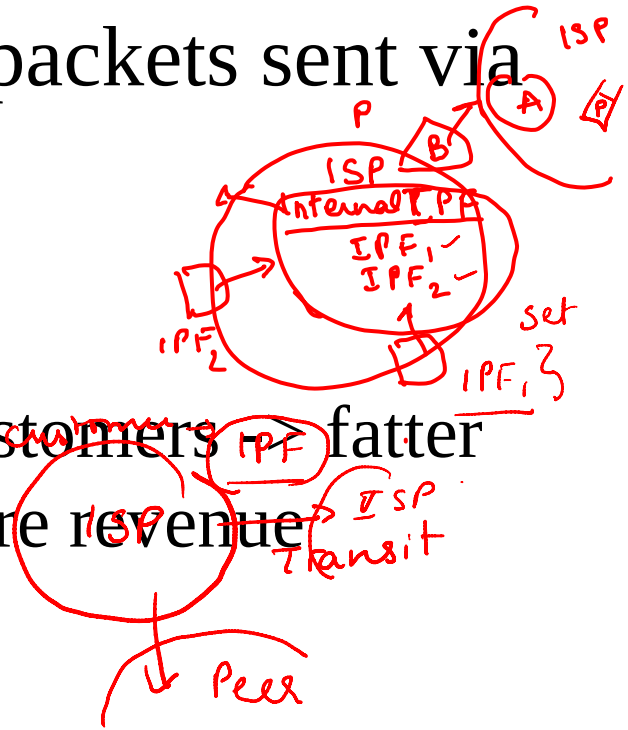
- Border gateway routers employ eBGP to exchange IP prefix information
  - Underlying route determination (which next hop AS to take) is based on path vector
  - An AS need not export all the IP prefixes it has learnt (to be covered under exporting routes)
  - When there are multiple routes to a given destination, policy takes precedence over optimality (to be covered under importing routes)

Summary of Framework

- Learned information via eBGP is injected within AS via iBGP sessions
  - Border gateway routers form a mesh of iBGP sessions with all routers within AS
- A forwarding table at a router is dictated by both the IGP and EGP protocols

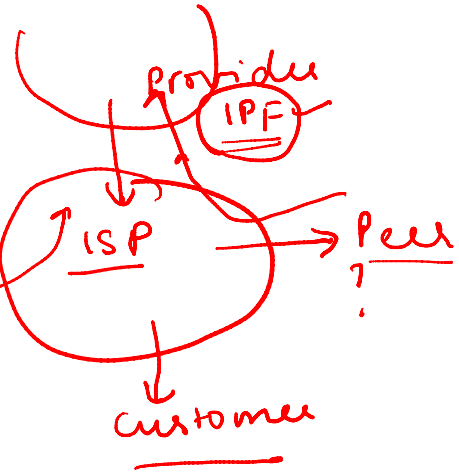
Exporting Routes

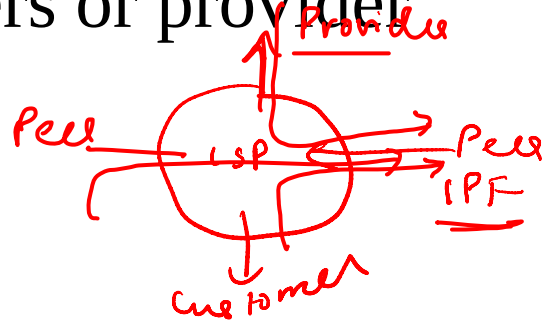
- Route advertisement B → A, for a destination prefix P means B will forward packets sent via A to any destination in P
- Transit Customer Routes
  - Export to all: More traffic for customers -> fatter pipes customers will need -> more revenue



Exporting Routes

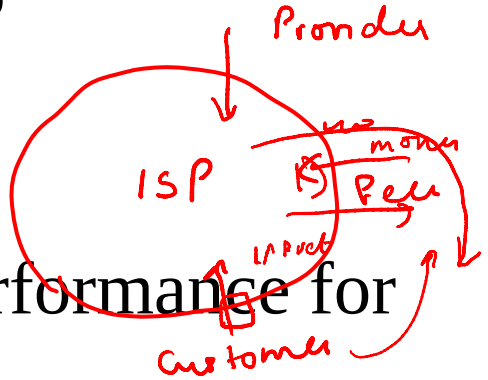
- Transit Provider Routes
  - Export to customers but not to peers
- Peer Routes
  - Export to customers but not to peers or provider



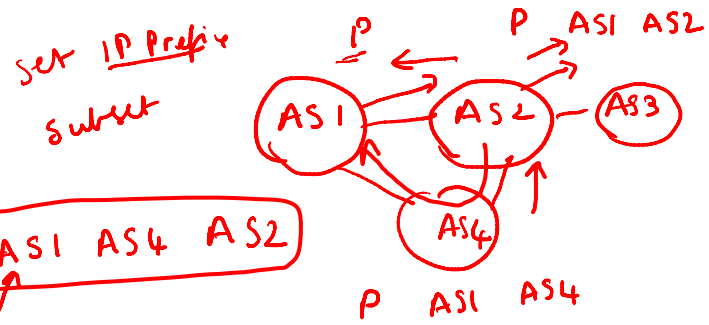


Importing Routes

- Router hears many possible routes to a given destination. Which routes to install?
- Customer > Peer > Provider
  - Customer because you want better performance for them
  - Peer over provider since for provider you have to pay money



Routing



- Path vector routing
- Advertise complete paths: List of ASs to reach a particular network
  - Each AS is assigned a unique number (16-bit) by a central authority
  - Prevents routing loops
  - Permits policy based routing

Integrating Intra and Inter Domain Routing

Prefix	BGP Next HOP
7.5.0.0/16	A
16.12.3.0/24	A
20.0.0.0/8	C
17.19.0.0/16	F

BGP Table for the AS

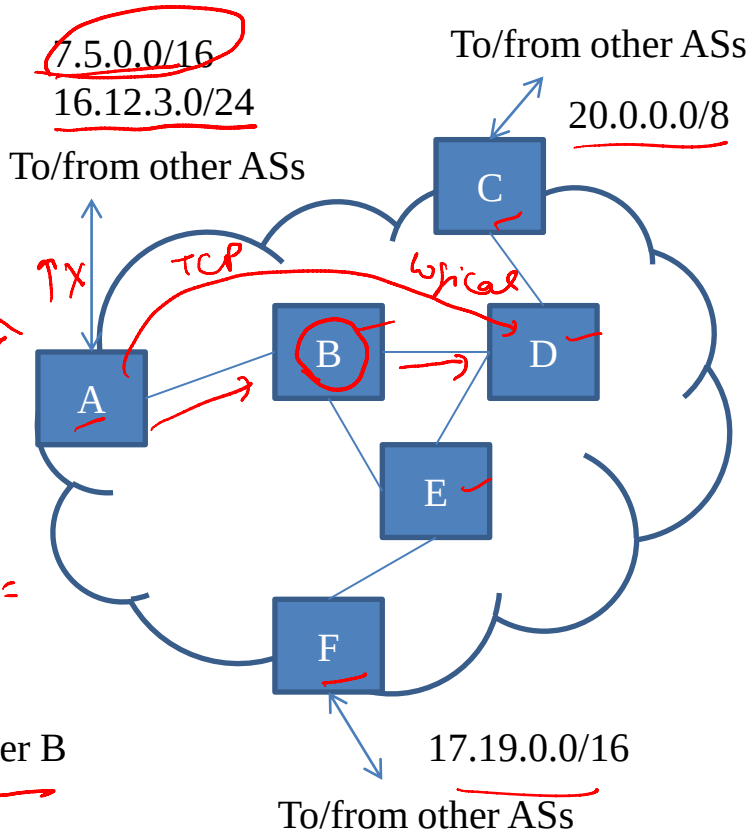
Router	IGP Path
A	A
C	D
D	D
E	E
F	E

IGP Table for Router B

↳ RIP, OSPF

Prefix	Next Hop
7.5.0.0/16	A
16.12.3.0/24	A
20.0.0.0/8	D
17.19.0.0/16	E

Forwarding table at Router B



Inter vs Intra Domain Routing

- Policy:
  - ISPs want control over how their traffic is routed and who routes through their network.
  - Within an AS, no policy decisions needed
- Performance:
  - In interdomain, policy dominates performance
  - In intradomain, one can focus on performance

Inter vs Intra Domain Routing

- Scale:
  - Handled via imposing additional hierarchy (via inter and intra domain routing)
  - EGP complexity order of the number of ASs
  - IGP complexity is of the order of number of networks in a single AS.

Summary

- Internet architecture is complex with different relations between ISPs → complicates routing
- Complexity handled via inter and intra domain routing
- Policy is an important component of interdomain routing
- BGP is a protocol common across ASs that handles interdomain routing via eBGP and iBGP sessions
  - Exporting and importing routes based on policy
  - Saw how intra and inter domain routing work together to build forwarding tables