BGP

Border Gateway Protocol

EE122 Section 3
Border Gateway Protocol

• Protocol for inter-domain routing
• Designed for **policy** and **privacy**
• Why not distance-vector?
  – Shortest path may not be policy-compliant
  – ...and policies vary across domains!
• Why not link-state?
  – Everybody knows everything – privacy goes for a toss!
• **Enter path vector!**
BGP: Path Vector

A: 1

B: 2
BGP: Path Vector

1
A

2
B

A: 1
A: 0 1
B: 0 2
B: 0 2
B: 2

0
BGP: Path Vector

```
A: 1
B: 1 0 2

A: 2 0 1
B: 2
```
BGP: Path Vector

Withdrawal - B: 0 2
Advertise - B: 0

A: 1
B: 1 0

A: 0 1
B: 0

A: 2 0 1
B: 2

A

B

1

2
BGP Relationships

- Provider -> Customer:
- Peer <-> Peer:
It’s all about the money!

- Customer pays provider
- Peers don’t pay each other
  - Assume equal flow both ways

- Routing *policies* try to minimize payment
Packets flow where money flows

• **Route Selection**
  – Preference Order: Customer > Peer > Provider

• **Route Export Policy**
  – Peers provide transit between their customers
  – Peers do not provide transit to each other
Route Selection: Customer > Peer

- Provider -> Customer:  
- Peer <-> Peer:  

![Diagram of network connections with nodes A, B, and C, and labels A: 1, B: 1, C: 0, A: 1 0, B: 1 0, C: 0, A: 1 2, B: 2, C: 0 2. Arrows indicate direction of data flow.]
Route Selection: Peer > Provider

- Provider -> Customer: 
- Peer <-> Peer:
Route Selection: Provider (no choice)

- Provider -> Customer:  
- Peer <-> Peer: 

A: 1  
B: 1  
C: 0

A: 1  
B: 2  
C: 0

A: 10  
B: 10  
C: 0
Packets flow where money flows

- **Route Selection**
  - Preference Order: Customer > Peer > Provider

- **Route Export Policy**
  - Peers provide transit between their customers
  - Peers do not provide transit to each other
Route Export policy: Advertise customers

• Provider -> Customer:  
• Peer <-> Peer:  

A: 1  
B: 1  
C: 0
BGP Routing Game!

• No talking! Communicate via pieces of paper

• **Route selection precedence**
  – Customer > Peer > Provider

• **Export policy**: Advertise customers

• Message format:
  – Withdrawal - <host network>: <path>
  – Advertise - <host network>: <path>

• **Goal**: Reach steady state
AS 2

A: ?
B: ?
C: ?
AS 3

A: ?
B: 3
C: ?