CMSC417 Spring 2016 Lecture # 11 3/9/2016

Agenda:
⇒ Administrivia

⇒ CIDR
⇒ Route Aggregation
⇒ BGP

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CIDR | Classless Inter-Domain Routing

⇒ problem with classful routing
- everyone has > 256 hosts
- nobody needs > 65K hosts
- thus everyone wants class B addresses and they run out

⇒ How can we reallocate class A and C space to make more class Bs

⇒ short version is to move from the division between net/host addr being static based on the first 3 bits to it being dynamic and passed with routing information

8.x.x.x ⇒ 8/8
192.168.1.x ⇒ 192.168.1/16

<address>/<# of bits in net addr>

⇒ also called supernetting

Different from subnetting |
⇒ prefix-based instead of mask-based
192.168.1.0/24 instead of 192.168.1.0/255.255.255.0
what does this mean?

⇒ subnetting can only break up a class and only if all subnets are physically co-located
- CIDR can aggregate adjacent classes
- since routing sends the # bits, broken up classes can be in separate locations

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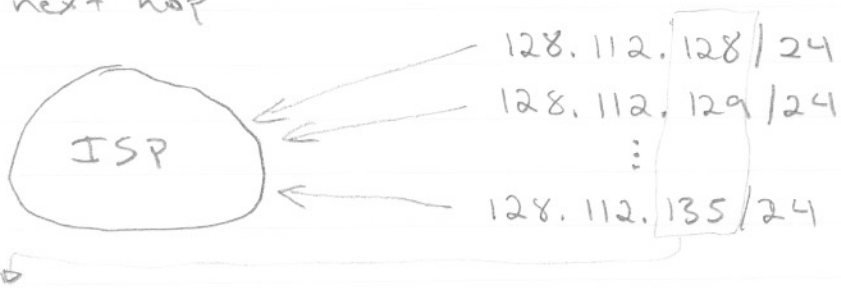
Aggregation

⇒ CIDR allowed aggregation of adjacent addresses into a prefix to use as a network ID

⇒ the same can be done at routers for routing table entries with the same next hop to save space

⇒ also in routing advertisements w/o needing the same next hop



3rd byte

128	1000 0000
129	1000 0001
⋮	
135	1000 0111

5 bits same

we know how to reach all IPs with the given first 16+5 bits ⇒ 128.112.128/19

advertise a single route to 128.112.128/19 instead of 8 routes

Multiple matches in CIDR

⇒ 179.69/16 and 179.69.10/24 both in RT

⇒ use longest-prefix (most-specific) match

- 179.69.10/24 in this case

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BGP introduction

⇒ early days: NSF Net had a single backbone and was a tree
- D just go up and down the tree
- D careful structure to avoid loops
- D stopped in 1993

Goals

⇒ scale (currently 500,000 routes)
⇒ avoid loops
⇒ federated (different organizations need not agree)
- D allow organizations to pick worse paths by distance if they want
- D allow organizations to not re-advertise routes if they want
- D etc.

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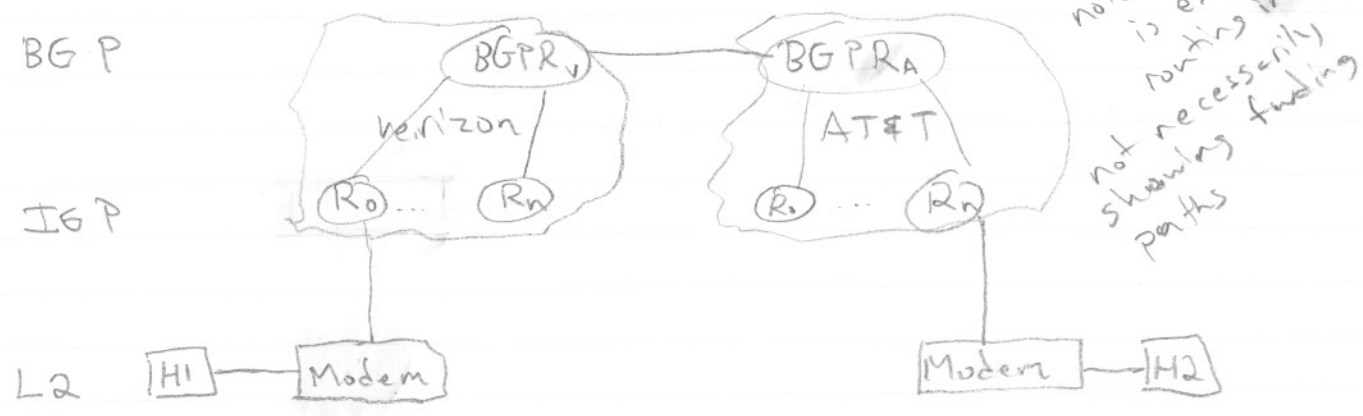
BGP

⇒ finally build a "scalable" routing protocol for global scale
⇒ handles inter-domain routing, e.g., different administrators
  - it's how Verizon tells AT&T about routes

High-Level Idea

⇒ path-vector protocol
⇒ advertises CIDR prefixes (aggregated)
⇒ on behalf of Autonomous Systems (ASes)
  - ASes are a group (possibly one) of routers all under the same administrative control

⇒ split routing to within an AS (uses OSPF, RIP, etc. called an IGP) from routing across ASes (using BGP)

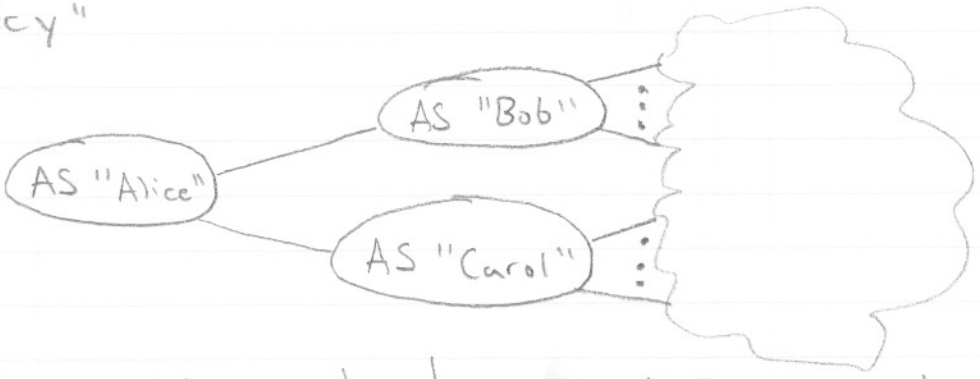


3 levels of hierarchy for routing

⇒ L2 (not really routing, but to connect L3 Rs)
⇒ L3 (w/in a domain)
⇒ BGP / ASes (still L3)

BGP cont'd

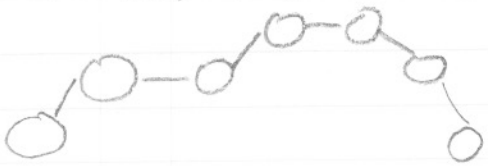
⇒ because inter-domain routing is fundamentally cross-organization, a lot of focus is on "policy"



Alice might want to say "I want to use Bob's routes first and Carol's only if I have to."

⇒ AS relationships are (nearly) always economic:
- customer-provider (customers pay providers for service)
- peers (peers gain "roughly" equal value and agree to exchange traffic w/o exchanging money)

⇒ valley-free routing
- traffic flows up from customers to providers and then back down to customers (and possibly between peers),
- never back from a provider to customer unless it's "on the way down"



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