

CMSC417 Spring 2016 Lecture # 11 3/5/2016

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 > 65 K 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

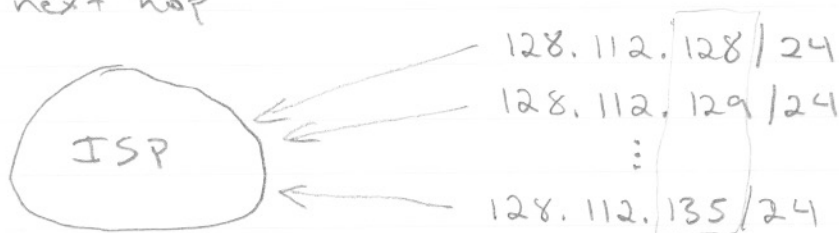
what does this mean?

- ⇒ 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
  - just go up and down the tree
  - careful structure to avoid loops
  - stopped in 1993

### Goals

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

## 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)

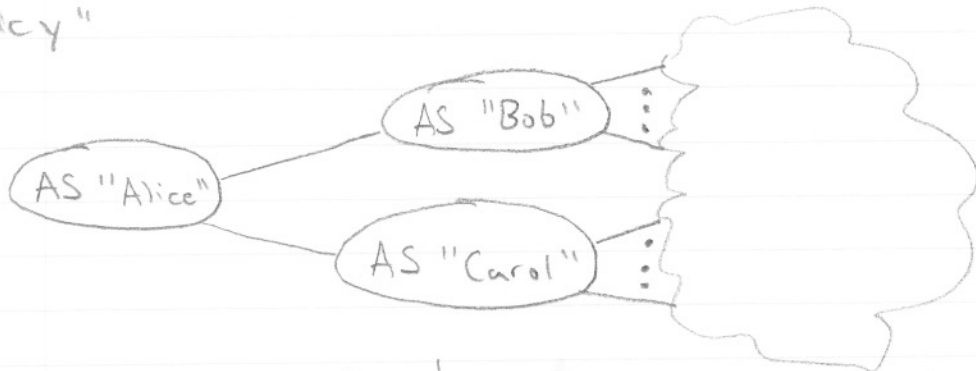


### 3 levels of hierarchy for routing

- ⇒ L2 (not really routing, but to connect L3 R's)
- ⇒ 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"

