HURRICANE ELECTRIC
INTERNET SERVICES

Customer BGP Community Usage

Thinking as a customer network

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Introduction

- We (nearly) all provide community control to customers
- Examples of usage from the real world:
  - To show how BGP global routing operates today
  - To show how BGP global routing could improve
- Explaining BGP communities to customers
  - To help networks operate better
- Where does this affect peering and the peering world?

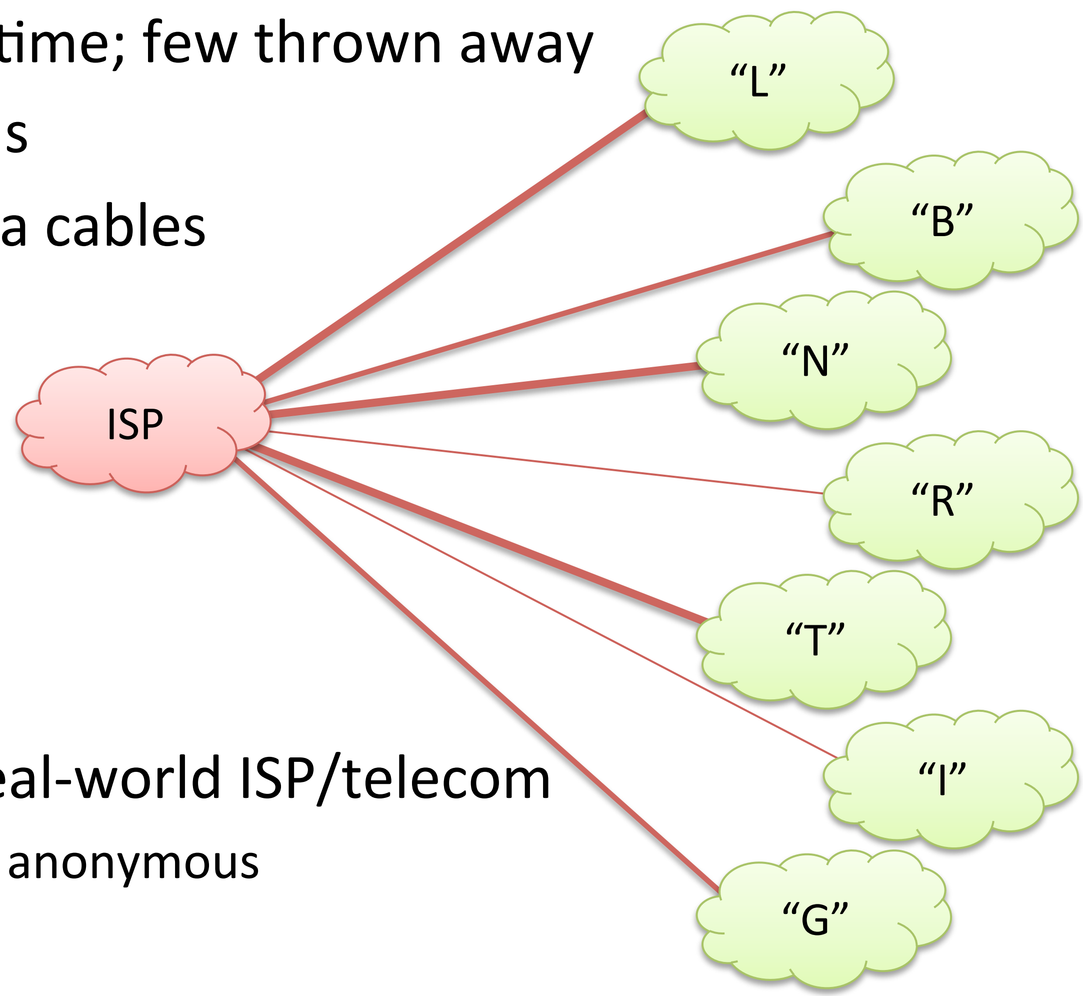
Notes for this presentation

Put yourself in your
end-customers
network operations mindset

A REAL WORLD EXAMPLE

Our sample (real-world) ISP/telecom example

- IP transits added over time; few thrown away
- Mixed bandwidth levels
- Mainly tied to undersea cables



- This is all based on a real-world ISP/telecom
  - All ASNs are somewhat anonymous

Situation today

- Nothing is wrong today
  - ISP interconnects via many upstream networks
  - Full connectivity is provided to all of ISPs customers
- But, things could be better
  - Cleaner routing makes for easier operations
  - Cleaner routing makes for a better customer experience
- One step at a time
  - Routing improvements will require bandwidth balancing

Basic rules – the ones that work

- Methodology's that are taught today:
  - BGP prepends for traffic engineering
  - Route de-aggregation for traffic engineering
  - Announcing a subset of routes to an upstream neighbors for traffic engineering
- Methodology's that don't actually work:
  - BGP prepends for traffic engineering
  - Route de-aggregation for traffic engineering
  - Announcing a subset of routes to an upstream neighbors for traffic engineering
- The new world (not so new world) order:
  - Heavy use of BGP community signaling
  - Careful control of depth of route announcements
  - Announce a full set of your routes to ALL upstream neighbors
- Is this hard to learn?
  - No!

THE MANY UPSTREAM PROVIDERS PROBLEM

Visualizing routing – the ISP's upstream #routes

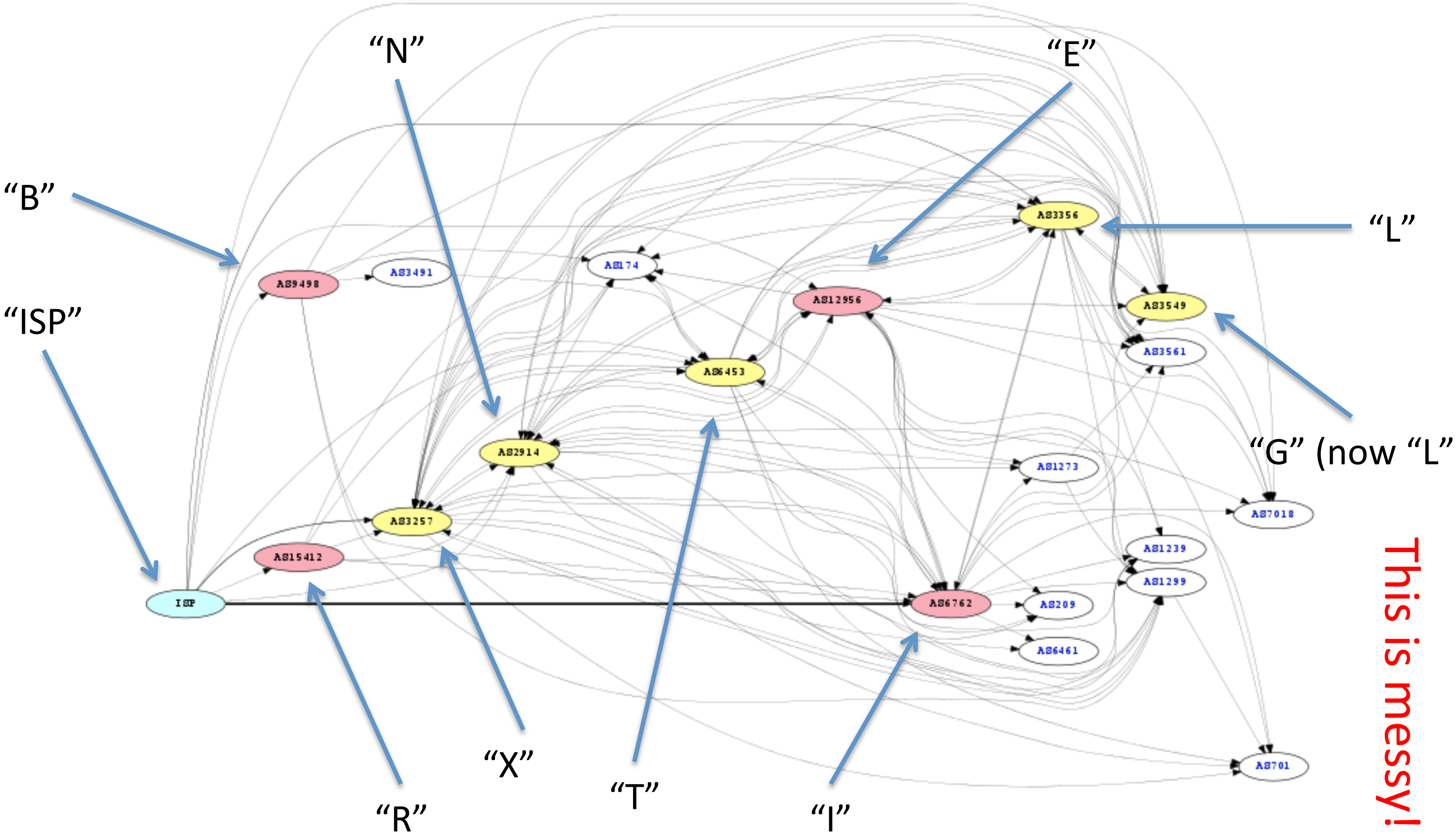
- Presently a different list of routes is sent to each upstream
  - No single upstream gets all ~1,700 routes
  - Different aggregated routes to different upstreams
  - Very few routes (read: customers) are actually multihomed
  - Very few routes (read: customers) get efficient routing

- See next page

Real world BGP routes

ASN	Count	Name
AS2***	192	"N"
AS3***	1,080	"X"
AS3***	440	"L"
AS3***	265	"G" (now "L")
AS6***	1	"T"
AS6***	484	"I"
AS9***	8	"B"
AS1****	42	"E"
AS1****	28	"R"

Visualizing routing – The ISP via all upstreams



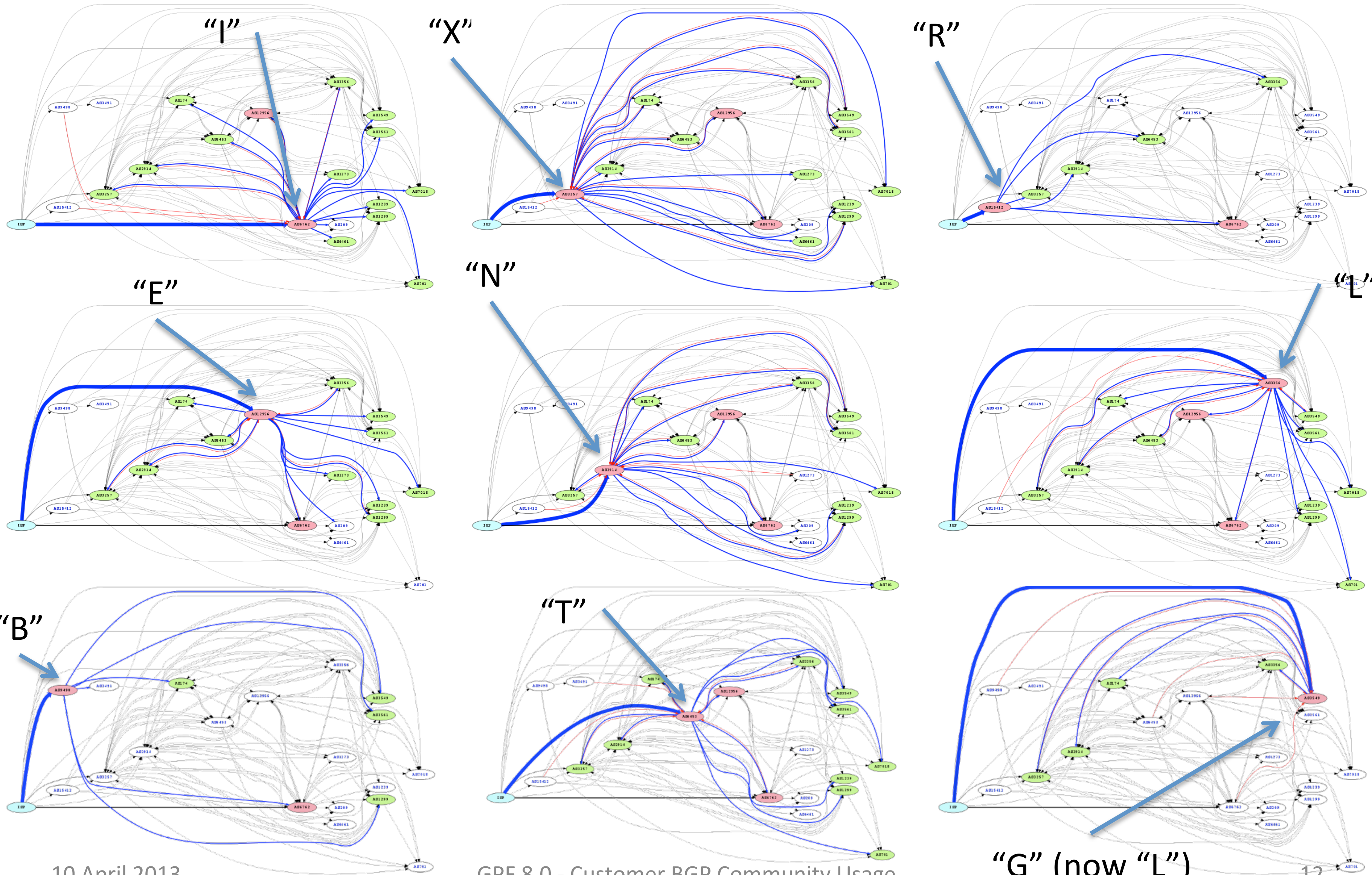
This is messy!

Reading the visualized routing graphs

- Blue lines show routes being propagated
  - This is good
- Red lines show routes being propagated backwards
  - This is bad; it shows a route that could be more direct
- The many lines are caused by de-aggregation of routes and varied announcements (and prepends)
- A cleaner diagram is better (with networks connected closer)
- Colored network ovals are considered major networks
- This specific ISP doesn't have an unusual diagram

Diagrams from http://bgp.he.net/

Visualizing routing – The routing via upstreams

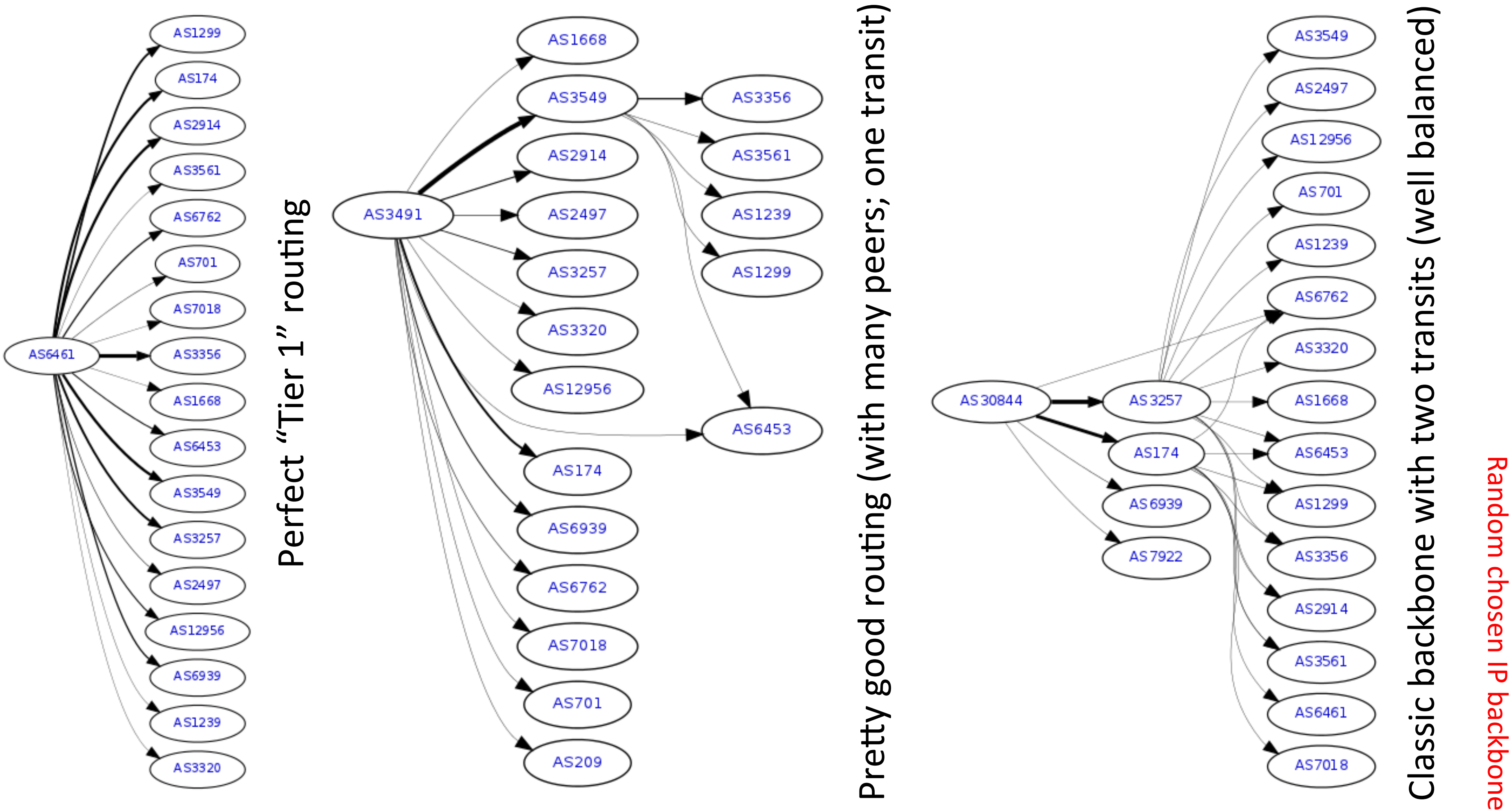


HOW TO IMPROVE GLOBAL ROUTING USING COMMUNITIES

Sending all routes to all upstreams

- In theory; all routes would be sent to all upstreams
  - This could cause excessive bandwidth over limited pipes
- Controlling the transit level of a route could help
  - A route not re-advertized would provide better routing
- BGP communities help with this process
  - A community can be set on a route to control depth
- This is a well documented process; but seldom used
  - It's NEVER in the interest of the transit provider to explain this
  - It works very well
  - It potentially reduces the upstream Renesys ratings

Visualizing perfect (or near perfect) routing



BGP COMMUNITIES PRACTICAL EXAMPLES

BGP communities – and how they help

- BGP backbones publish their information (One Step has collected many of them)
  - http://www.onesc.net/communities/
  - etc …
- Specific IP backbone information can be found via specific URLs
  - Telecom Italia AS6962 @ http://etabeta.noc.seabone.net/communities.html
  - Level3 AS3356 @ http://www.onesc.net/communities/as3356/
  - Tinet AS3257 @ http://www.as3257.net/communities.txt
  - NTT/Verio AS2914 @ http://www.us.ntt.net/support/policy/routing.cfm
  - Flag/Reliance AS15412 @ https://apps.db.ripe.net/whois/lookup/ripe/aut-num/AS15412.html
  - Verizon/UUnet AS701 @ http://www.onesc.net/communities/as701/
  - etc …
- Setting a community on a route is very powerful
  - Can be used to control re-announcement
  - Can be used to control geography
  - Can be used to control style of route (peering/transit)
- Communities can be set on a per-route basis
  - Hence an upstream could receive all routes; but only re-announce some routes

BGP communities – an example

- Fixing Level3 routing
  - Announce all routes; set some routes to peering
- The goal
  - Bring all Level3 connectivity closer
  - Don't overrun bandwidth on Level3 connection
  - Don't produce a black holed route
- Customer experience?
  - Vastly improved!
- Relationship with upstream? (Level3)
  - Unchanged; but they now know you're smarter at operating your routing!
- Complexity level?
  - Low; once understood

Random chosen IP backbone

BGP communities – an example

- Example
  - Three routes are setup as peering
  - Two routes as peering + AS3320 DTAG
  - Remainder - full transit (the default)

- access-list methodology
  - Could be as-path filter

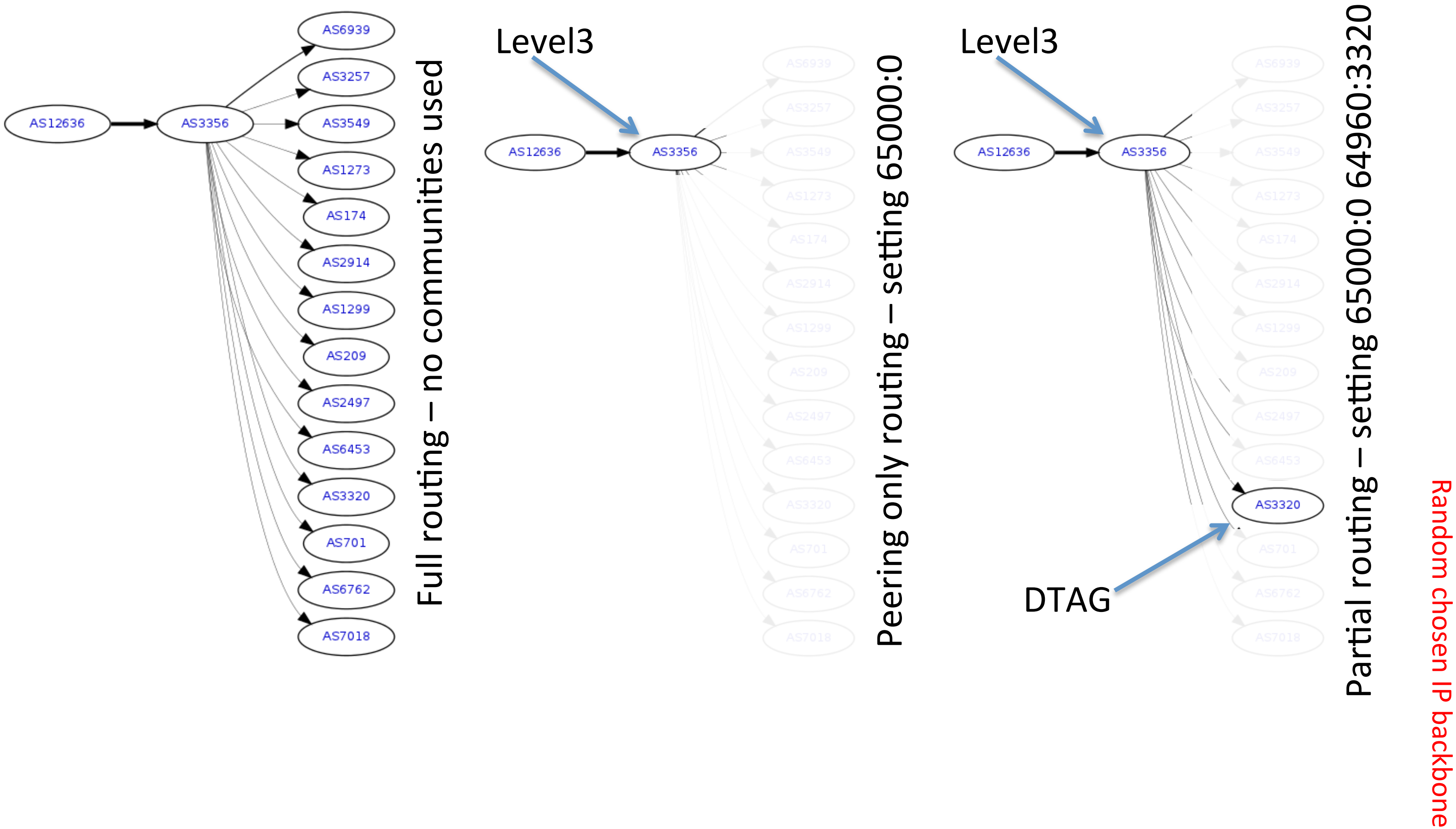
- Communities can be expanded

```
!
ip classless
ip bgp-community new-format
!
access-list 100 permit ip 10.7.0.0/12
access-list 100 permit ip 10.9.0.0/13
access-list 100 permit ip 10.22.0.0/17
!
access-list 110 permit ip 172.16.0.0/19
access-list 110 permit ip 172.17.0.0/19
!
route-map isp-out-as3356 permit 10
  match ip-address 100
  set community 65000:0
route-map isp-out-as3356 permit 20
  match ip-address 110
  set community 65000:0 64960:3320
!
router bgp ****
  network ...
! Level3
  neighbor x.x.x.x remote-as 3356
  neighbor x.x.x.x send-community
  neighbor x.x.x.x route-map isp-out-as3356 out
!
```

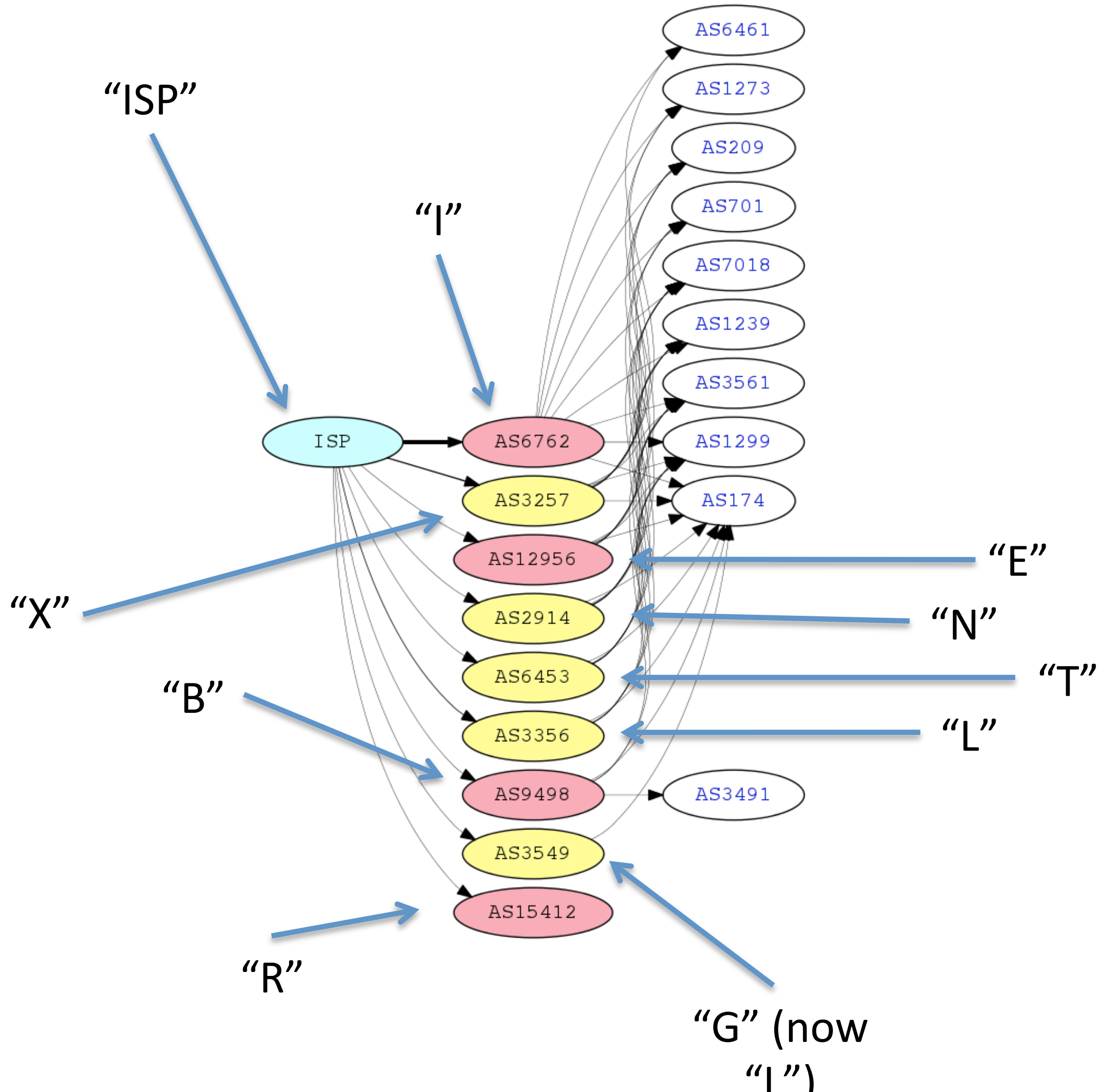
Pseudo code example - don't type into a router

Random chosen IP backbone

BGP communities in use – a visual example



BGP communities – The ISP cleaned up



This is very clean!

The affect on the peering world

- Do communities really help the customers?
  - Or do we (as large backbones) know better?
- Does community control invalidate peering agreements?
  - Do peering requirements insist on consistent announcements?
- Does community control ever get used by customers?

Could produce inconsistent announcements

Community String	Effect
174:970	Do not send route to NA (North America) - not accepted in NA.
174:971	Do not send route to NA peers.
174:975	Set local preference to 10 in NA.
174:980	Do not send route to EU (Europe) - not accepted in EU.
174:981	Do not send route to EU peers.
174:985	Set local preference to 10 in EU.
174:990	Do not send route to BGP customers, or peers.
174:991	Do not send route to peers.

Random chosen IP backbone

SUMMARY

Summary

- BGP communities have been around for a long time
  - Well understood
  - Provide many controls; these examples show depth control
  - Rarely used by customers
- BGP communities can be dangerous
  - Could restrict a routes global reachability
  - Harder to debug (using the upstreams looking glass sometimes works)
- Could lower your #routes announced (reduce deaggregation?)
  - Reduce router configuration complexity
- Customers using communities could reduce Renesys ranking

?

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