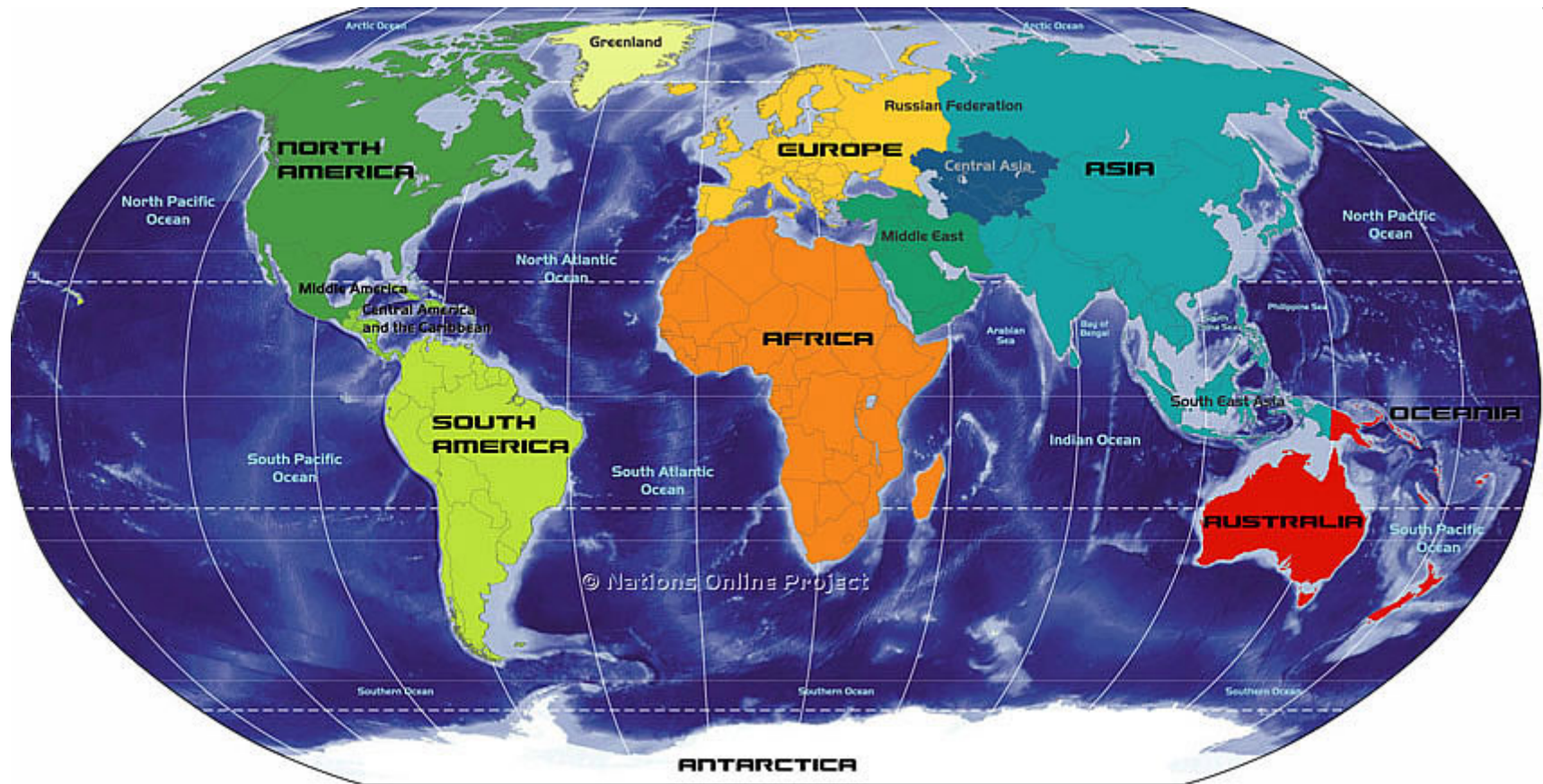


Peering and Network Deployment at 10G



Nigel Titley

Introductions

- Thanks very much for inviting me to speak to you
- Currently Head of Peering and Transit at Easynet Ltd
- RIPE NCC Board Chairman
- Peering Coordinator at British Telecom, Level 3 (Europe and Asia), PacketExchange, and Flag Telecom

Agenda

- What am I talking about?
- What is peering and why you should do it
- Peering policy – what is it?
- Peering strategy – what is it?
- Exchange points and direct peering
- Building a peering network
- Tools of the trade
- Conclusions
- Questions and Answers

What is Easynet?

- UK and European ISP specialising in Corporate customers
- 1G European network: France, Germany, Italy, Belgium, Netherlands, Spain
- Local Loop unbundling in the UK (over 1000 exchanges unbundled)
- Bought by BSkyB satellite broadcaster (owned by News International)
- Over 1M domestic broadband customers and 40G of traffic
- Traffic mostly eyeballs

What am I talking about?

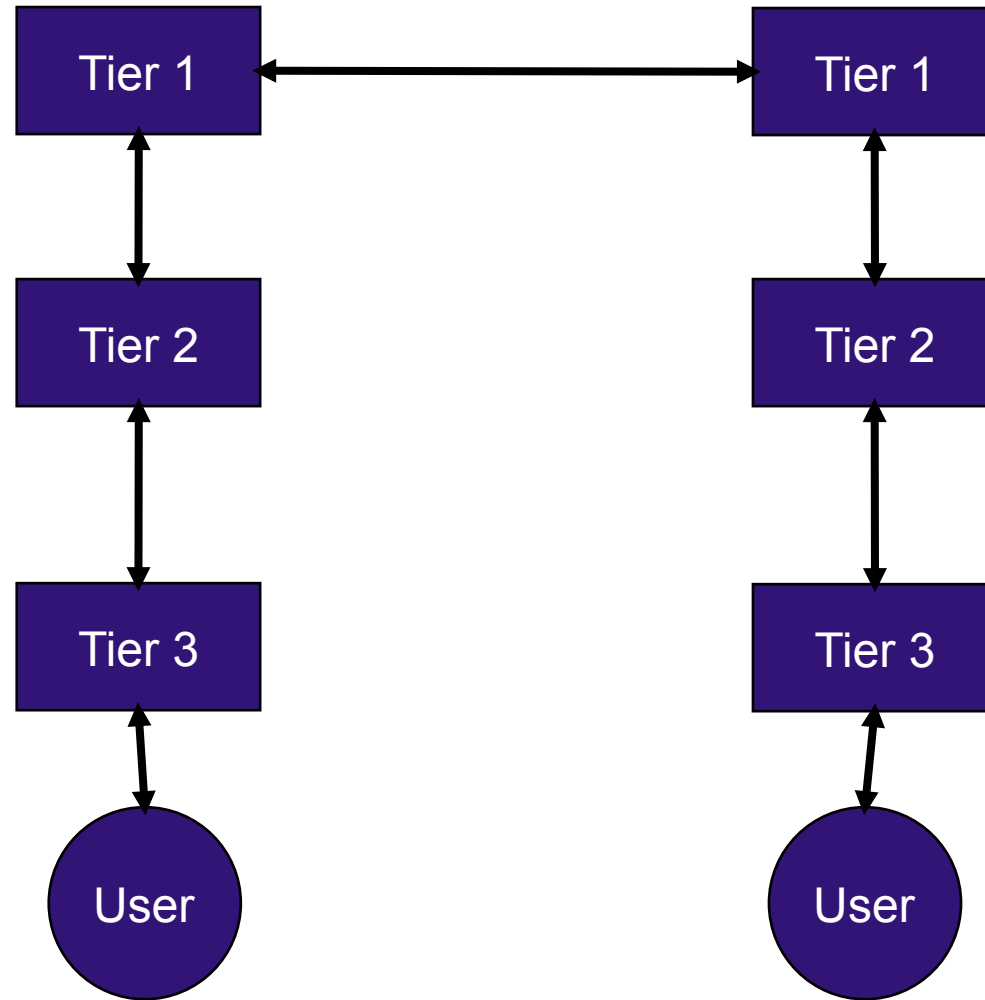
- Peering and why you should do it
- Why Easynet invested 2.5M in building a 10G network just for peering
- Peering tools of the trade

Definition?

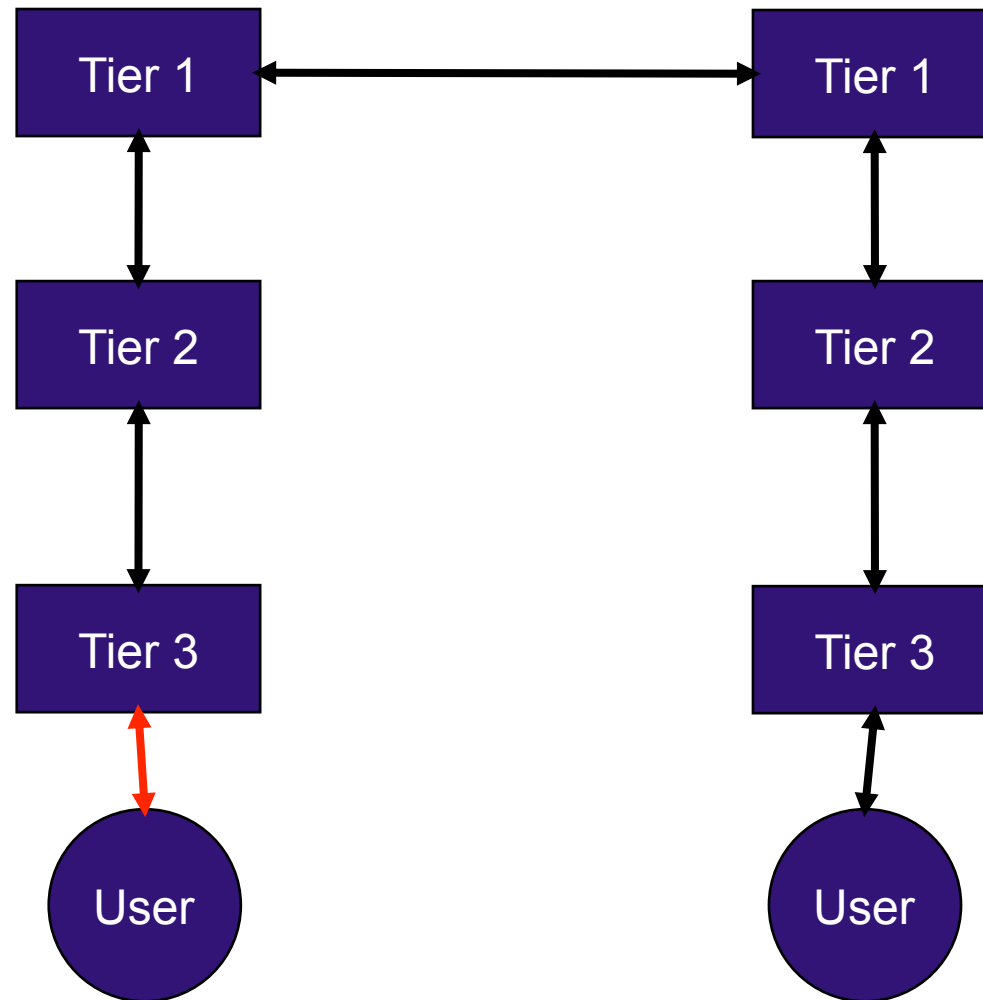
Peering:

- The act of one national Internet backbone provider accepting and passing traffic from another national provider. See [NAP](#).

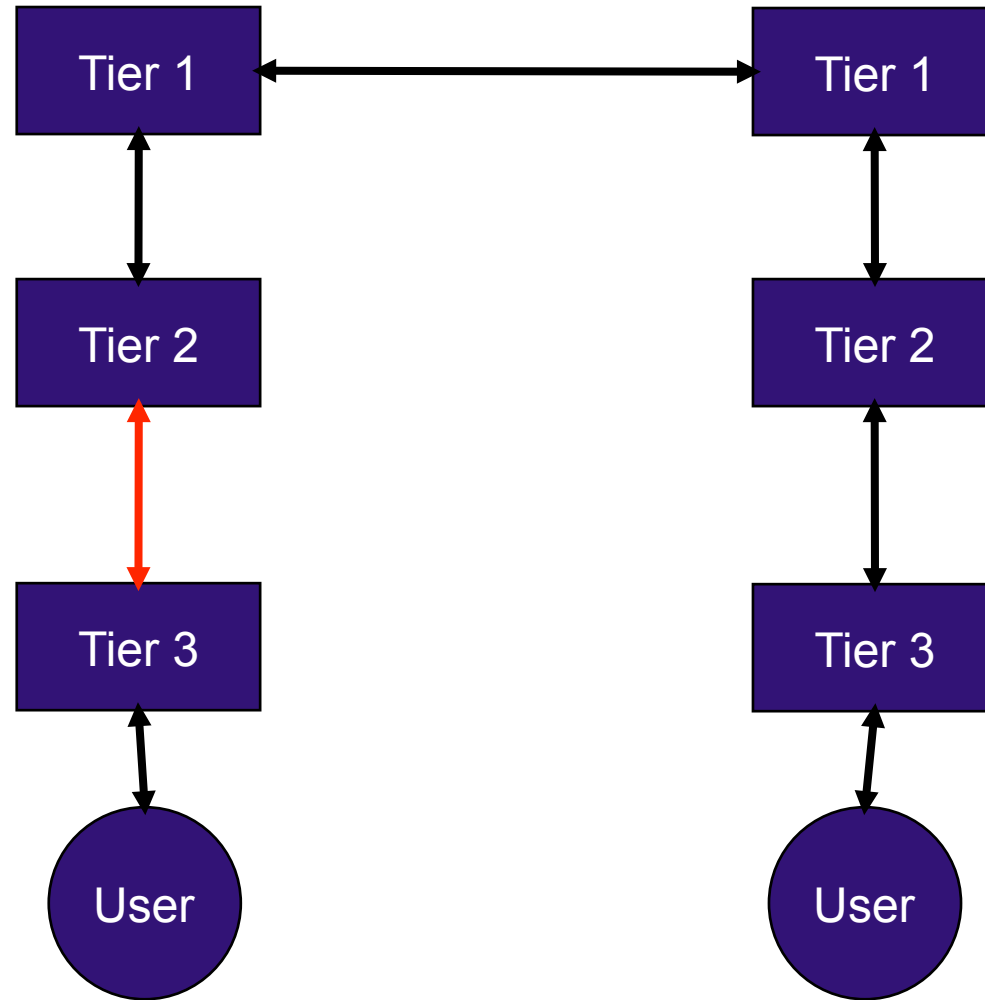
Peering – what is it?



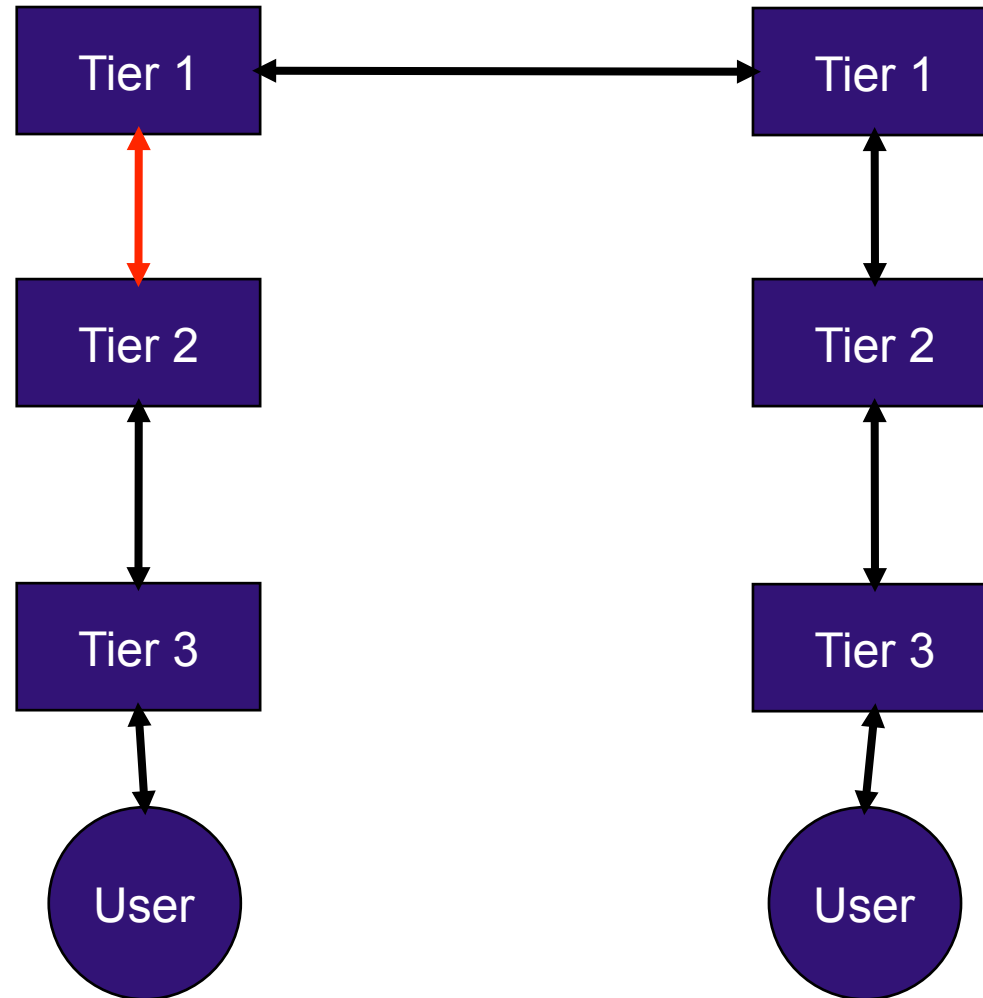
Peering – what is it?



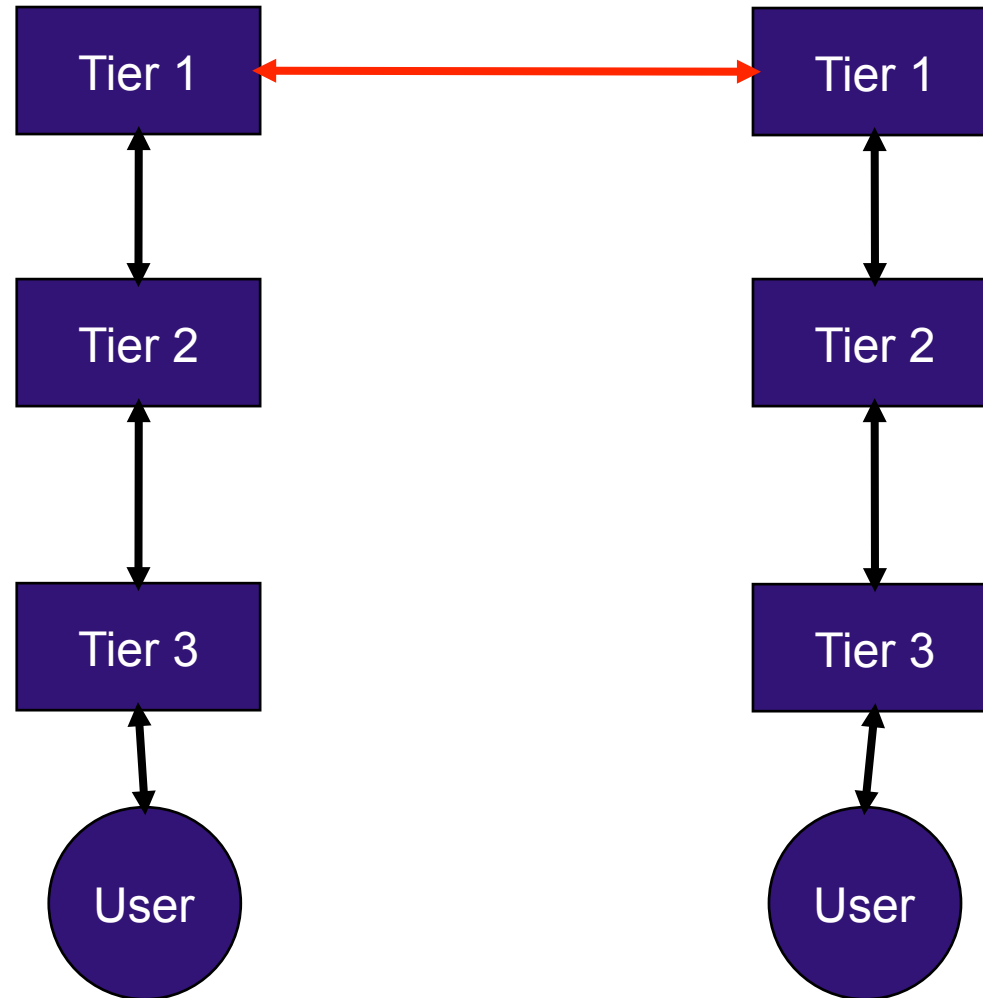
Peering – what is it?



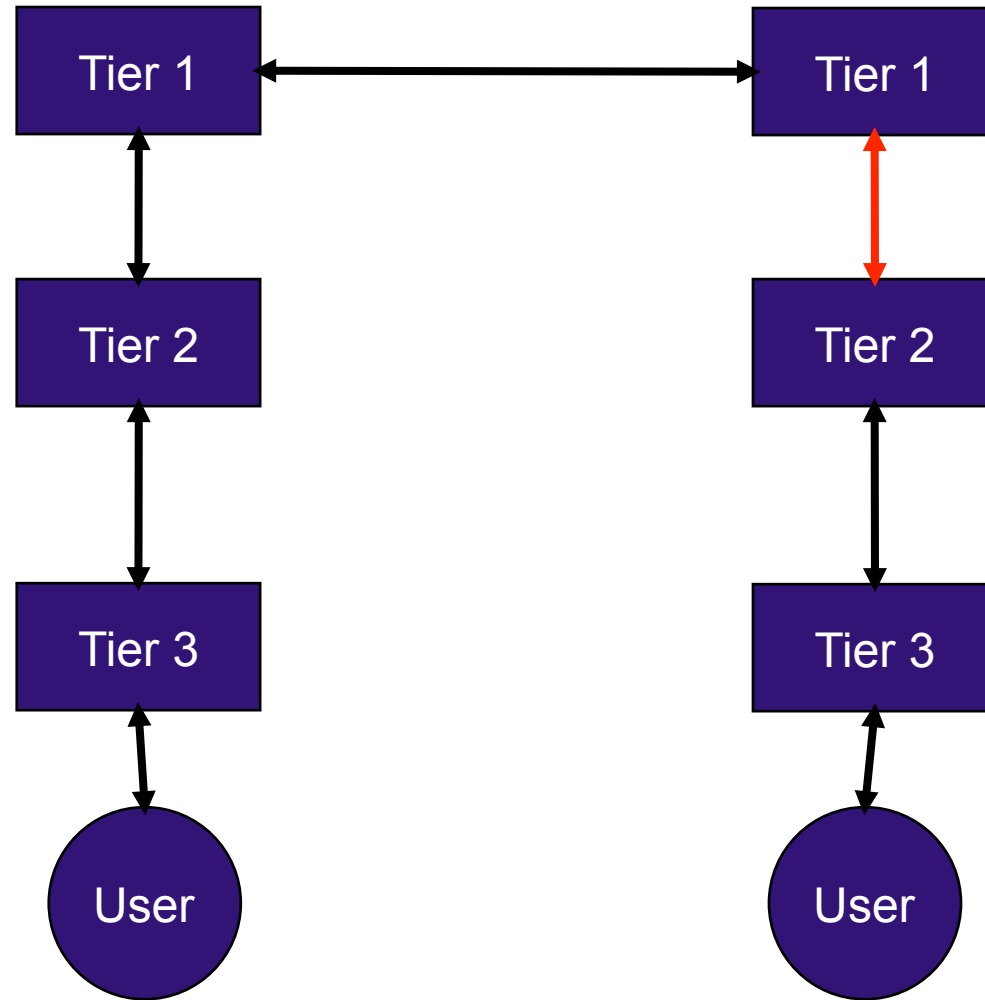
Peering – what is it?



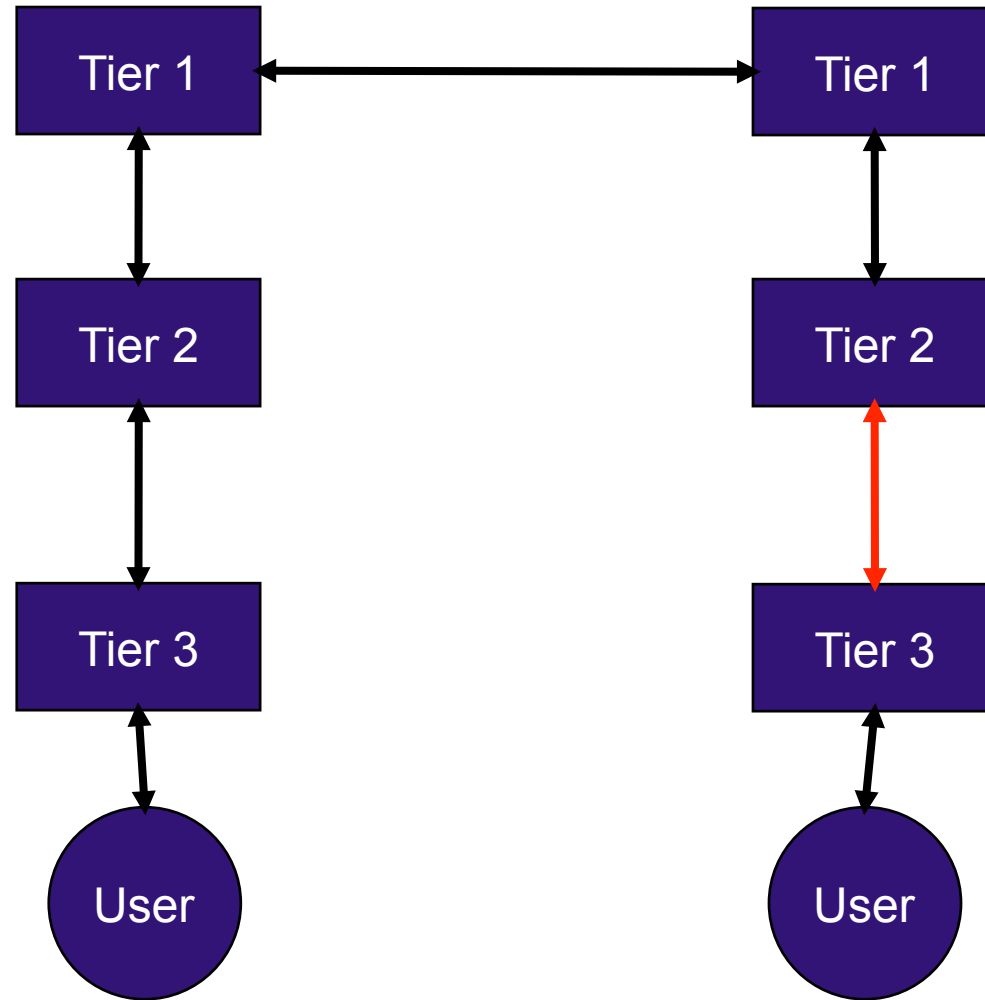
Peering – what is it?



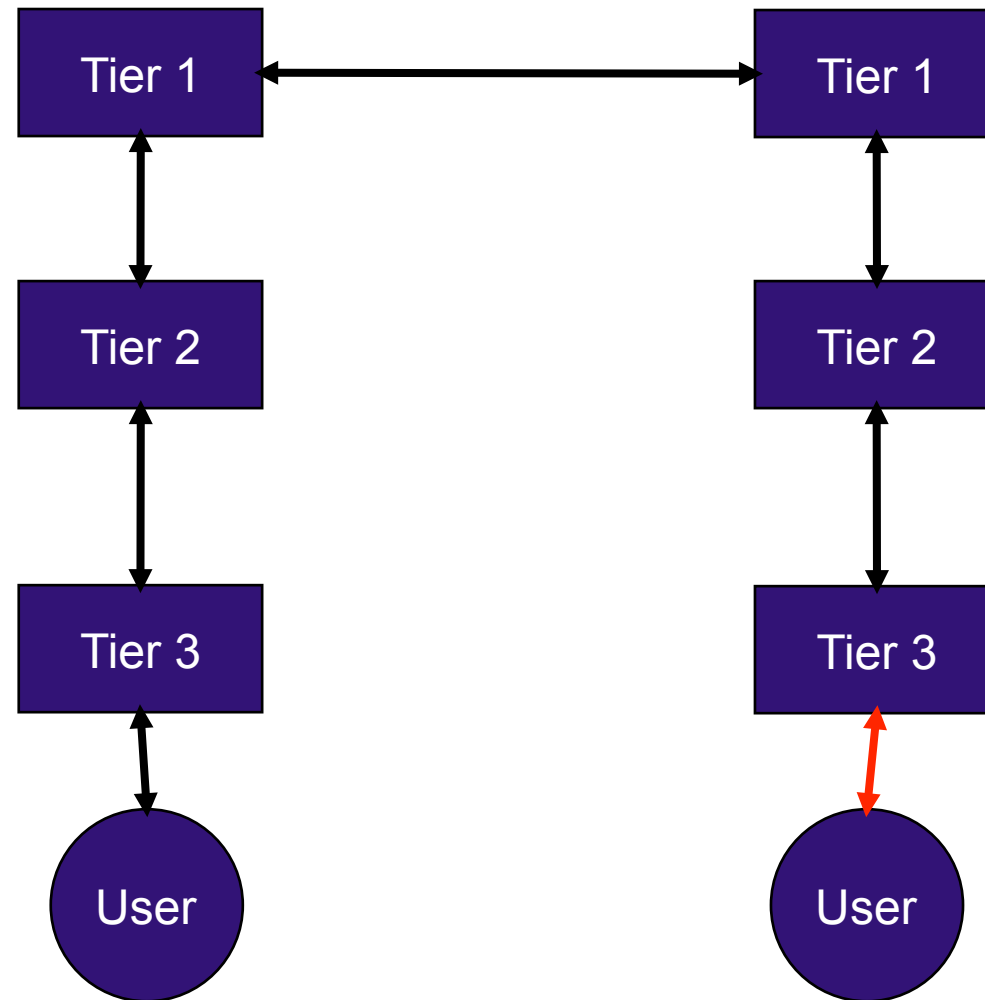
Peering – what is it?



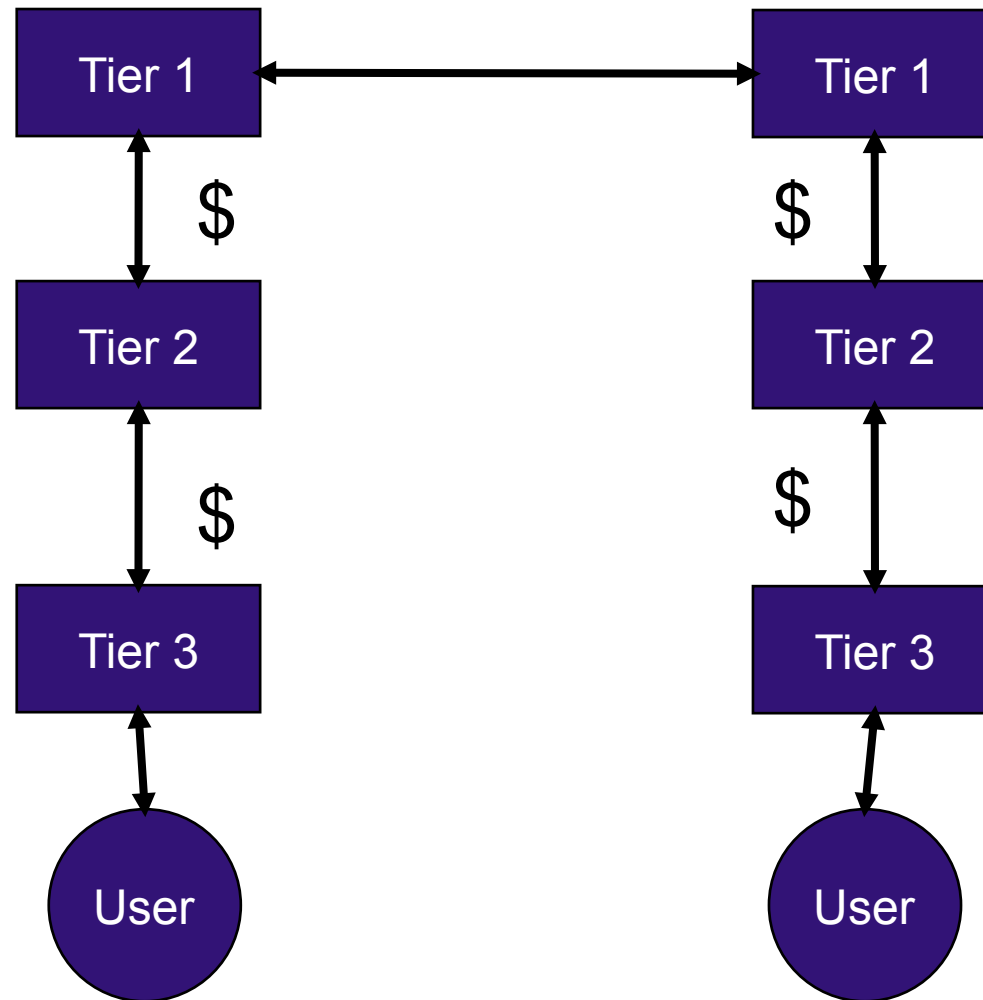
Peering – what is it?



Peering – what is it?



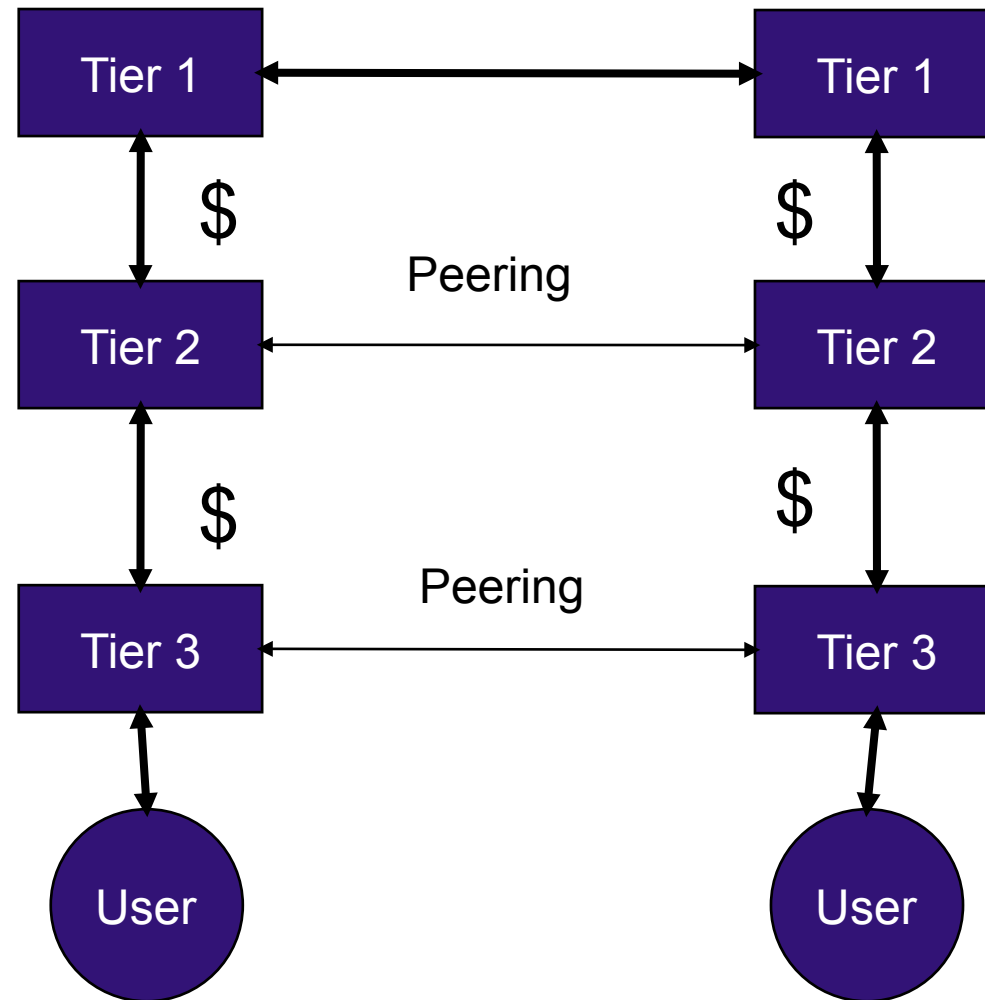
So what is the problem?



Other Problems

- Latency
 - Traffic may dog-leg via the US or Europe
 - Especially important for peer to peer traffic or gaming
- Congestion
 - Expensive international links
 - Makes everything unresponsive
- Jitter (or delay variance)
 - A combination of the above
 - Makes VOIP and video difficult to use or unusable

What do we do to fix it?



Advantages

- Tier 2 and 3 pay less transit charges (Hurrah!)
- Local traffic stays local
 - Lower latency
 - Less jitter
 - Less chance of congestion
 - Less dependency on external factors (like undersea cable breaks)
- Cooperation between ISPs
 - Overall better service
 - Possible moves towards a trade association

Disadvantages

- Tier 1 sees less revenue (but who cares)
- Tier 2 may see less revenue (but is paying less to Tier 1)
- Management may see peering as cooperation with potential competitors (but we all know how to manage our management don't we?)

Policies and Strategies

- Peering Strategy
 - How do I plan to achieve: reduced transit costs, increased profits, better customer experience, world domination etc
 - Private
- Peering Policy
 - What do I tell people who want to peer with me?
 - Should be publicly available (on your web site)
 - Includes contact info
 - Referred to on your PeeringDB page
 - If you are a large player or are very selective then should be objective in order to avoid problems with regulators

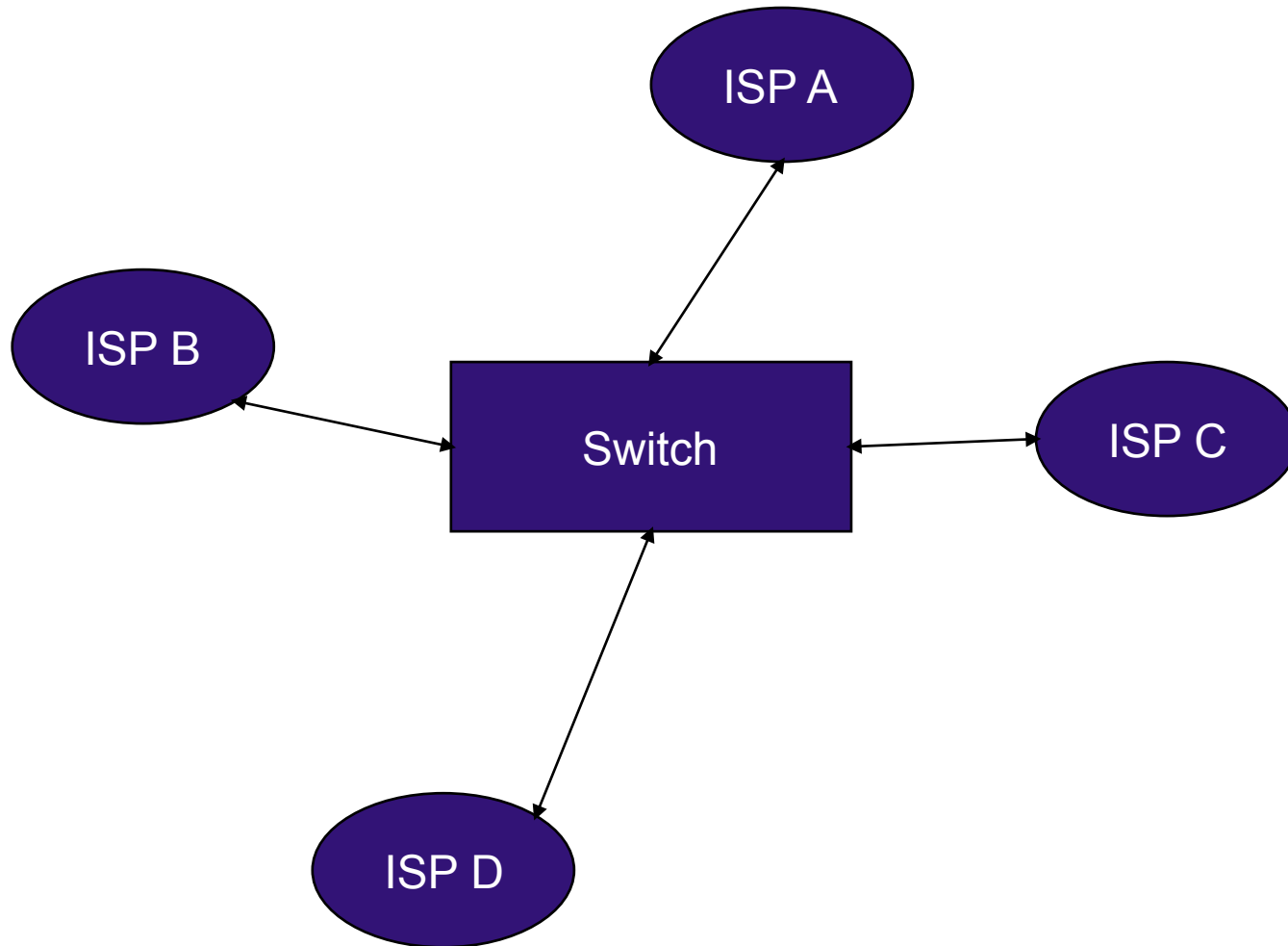
Types of Peering Policies

- Open (we peer with anyone)
- Selective (we are a bit fussy about who we peer with)
- Restrictive (we actively discourage people from peering with us)
- Closed (we won't peer with anyone)

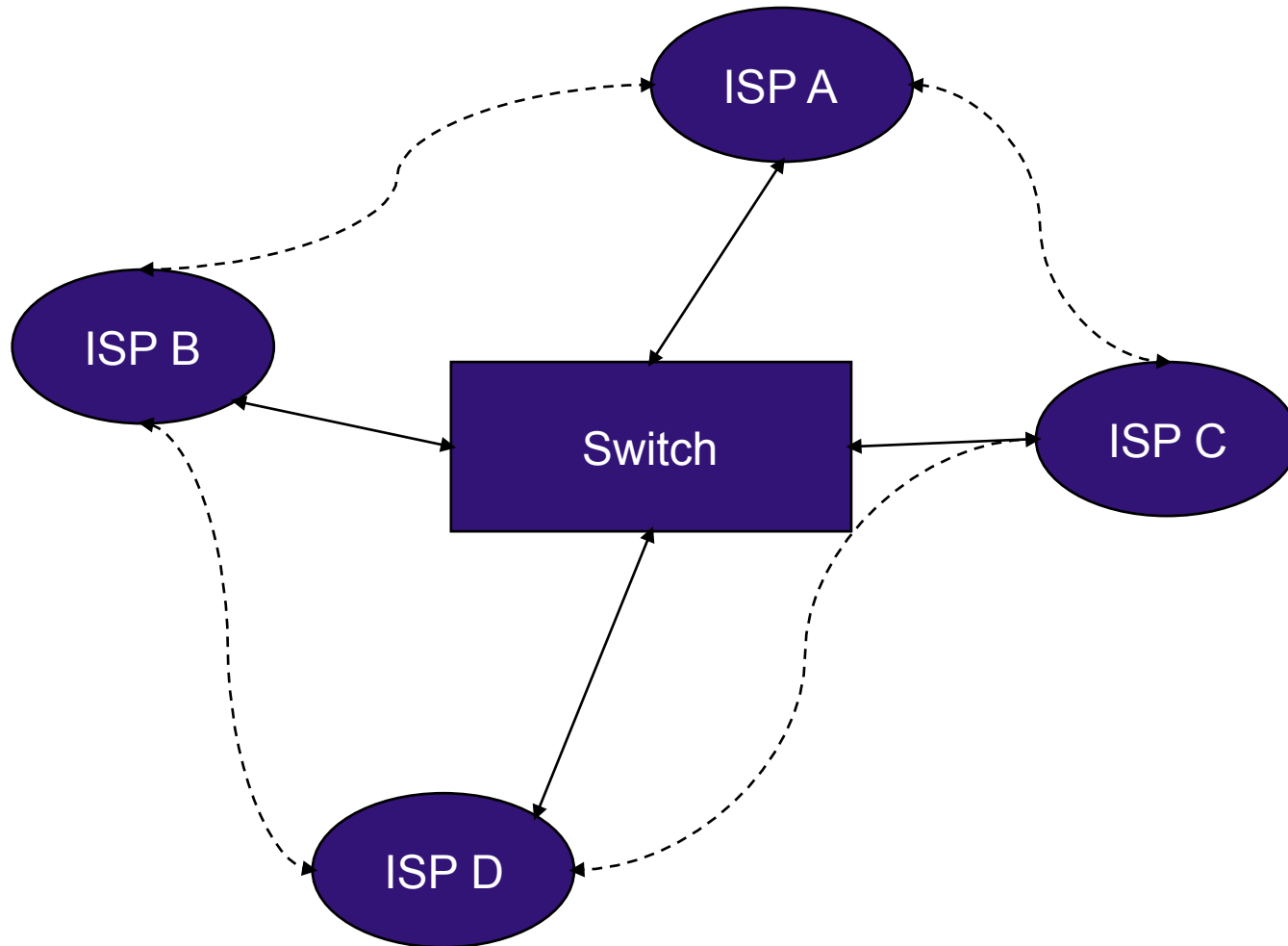
How do we do it?

- Via an Internet Exchange Point
 - A neutrally managed layer 2 switch
- Via direct peering
 - A direct connection between two ASes

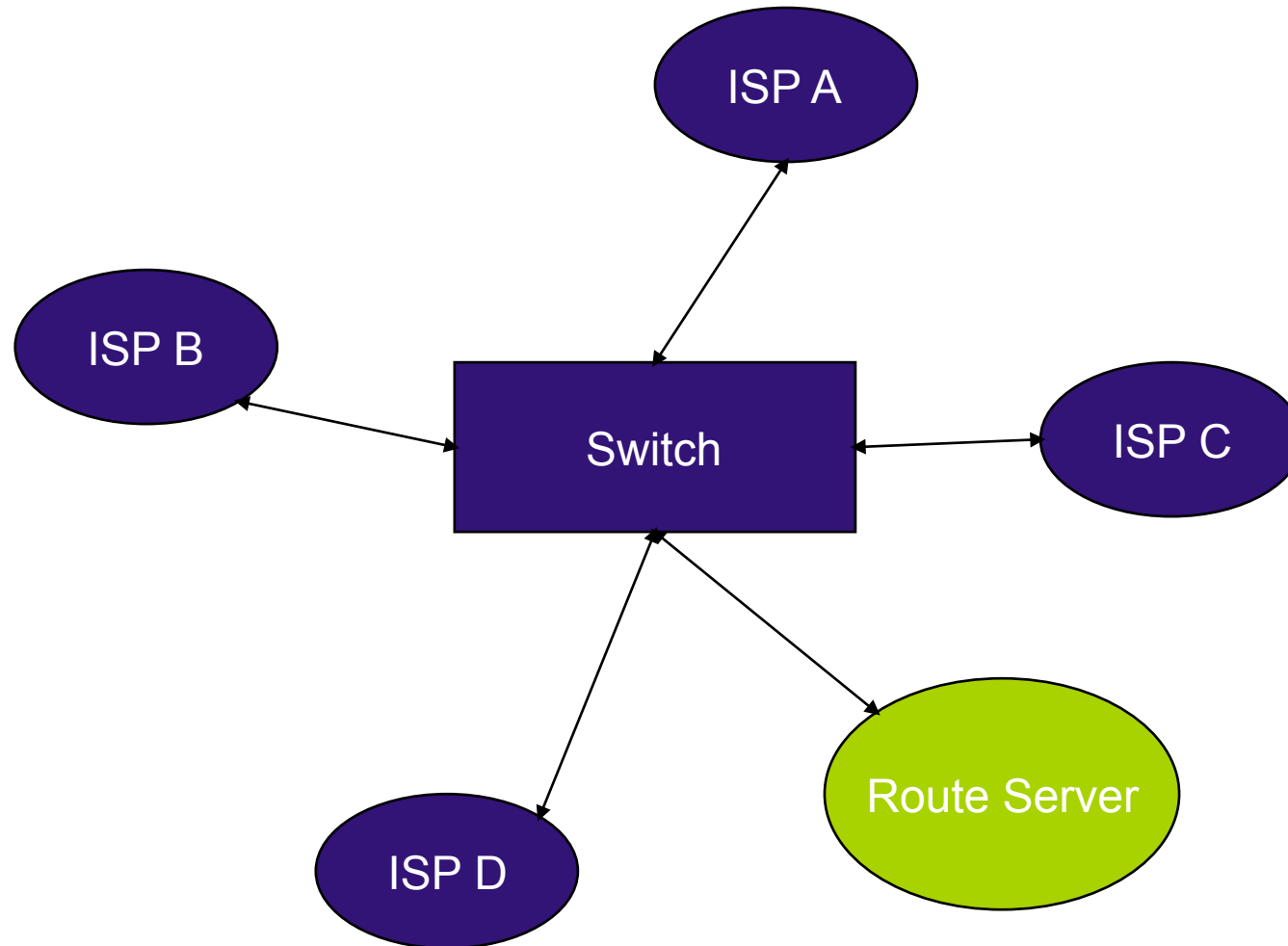
Typical IXP (Physical)



Typical IXP (Logical)



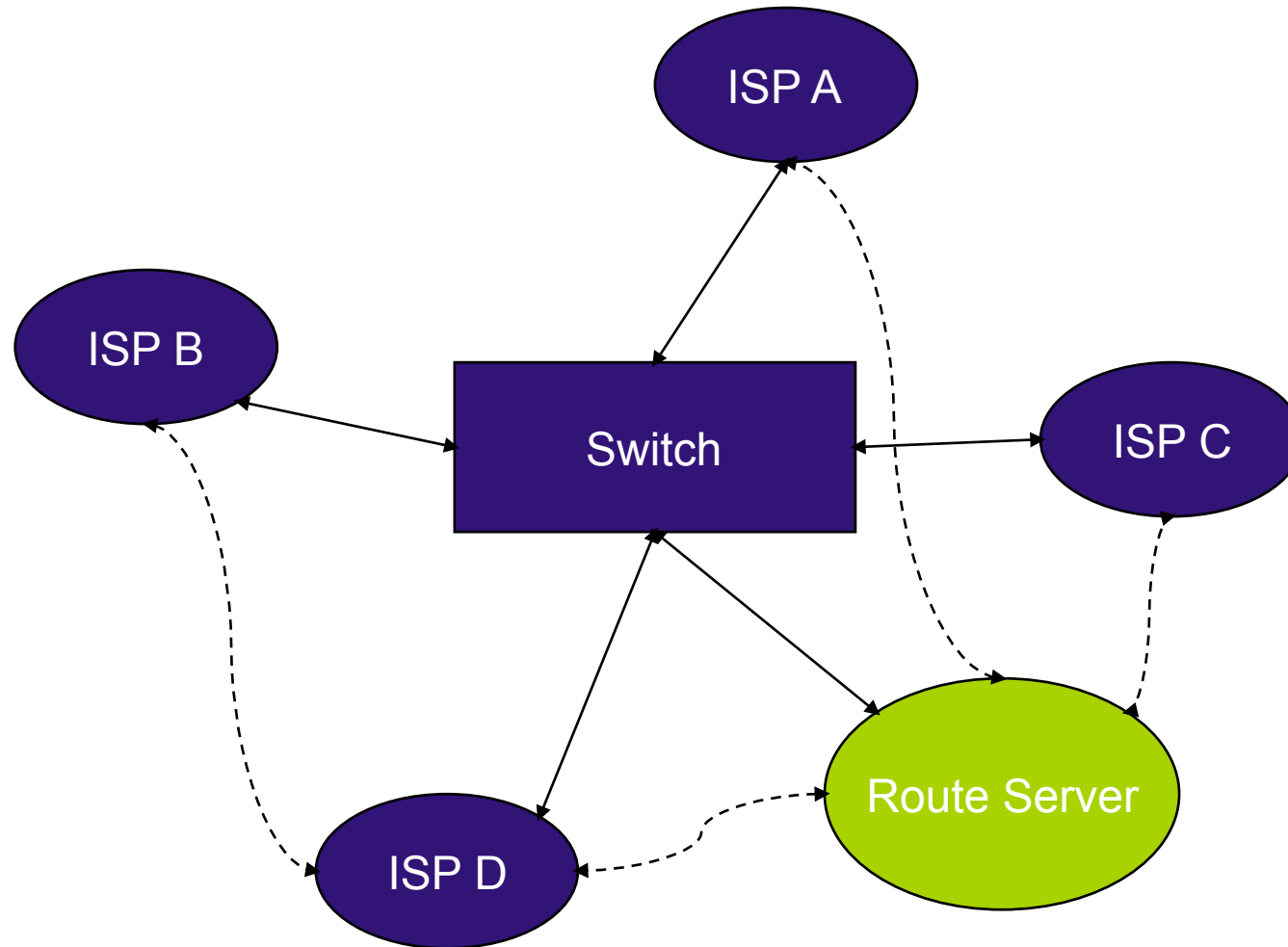
Typical IXP (Physical with route server)



Route Server

- Typically a PC running UNIX/Linux
- Zebra or Quagga
- Sets up BGP sessions with IXP members
- Distributes routes (not traffic)
- May be mandatory or optional

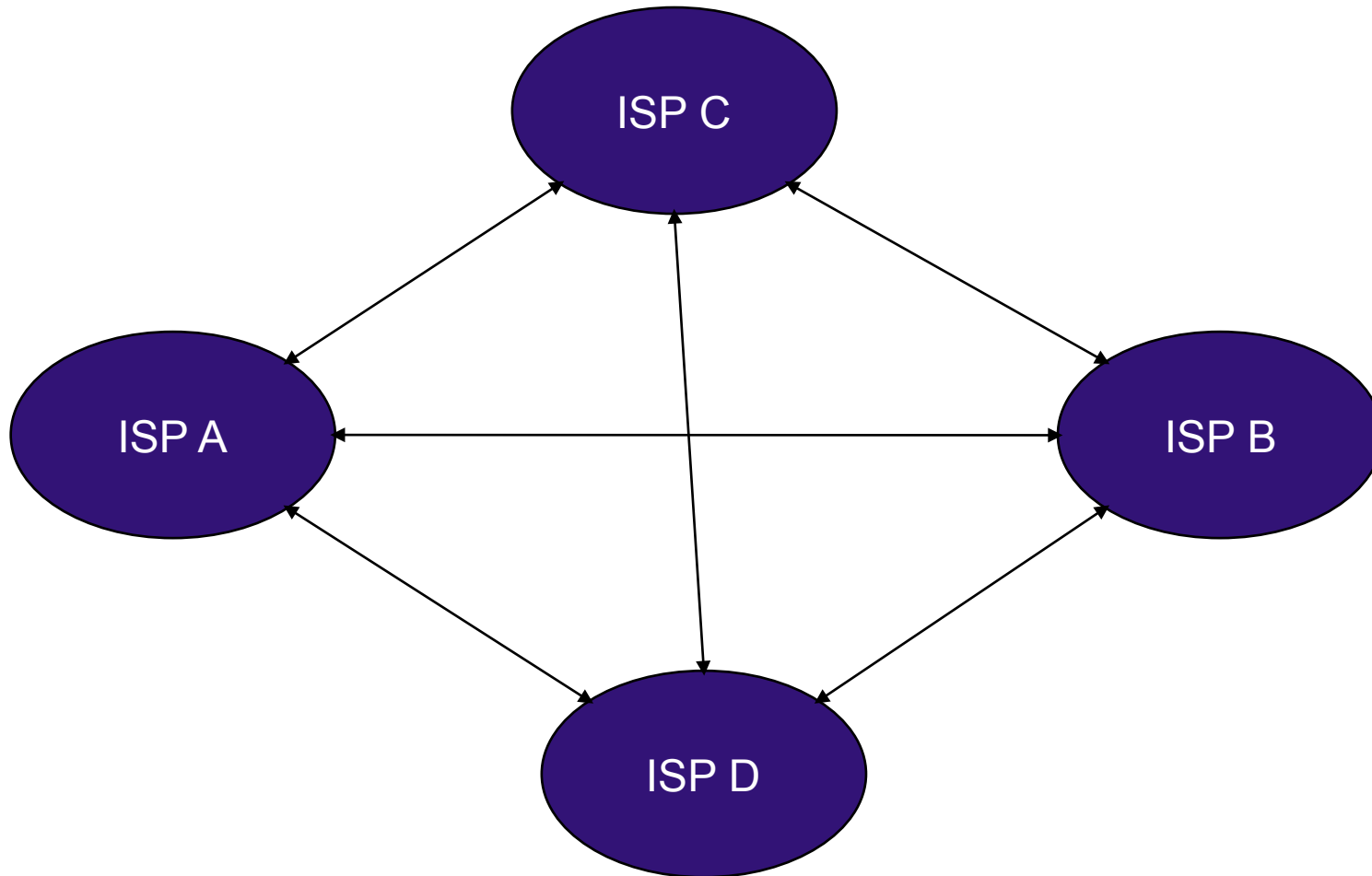
Typical IXP (Logical with route server)



IXP pros and cons

- Pros
 - Only one connection needed
 - Can be very cheap
 - All potential peers immediately available (especially with route server)
 - Can form the basis for cooperative ventures such as trade associations
- Cons
 - Infrastructure may congest (unlikely)
 - Single point of failure
 - Bad traffic (broadcast storms) may disrupt peering
 - Lack of flexibility (with route server)
 - May be difficult to measure traffic to individual peers
 - There may not be an IXP available (so create one, see PCH)

Direct Peering



Direct peering pros and cons

- Pros
 - Easy to see how much traffic is flowing to your peer
 - No single point of failure
 - No interference between peering session
- Cons
 - Port required for each peer (expensive)
 - Bringing up session needs physical installation (so tends to inhibit peering)
 - Cannot share bandwidth between several peers

Compromises

- Start peers on a shared infrastructure (IXP)
- Measure peering flows
- Migrate onto direct peerings when economical to do so
- Best of both worlds
- Assumes that you have the means to measure traffic flows

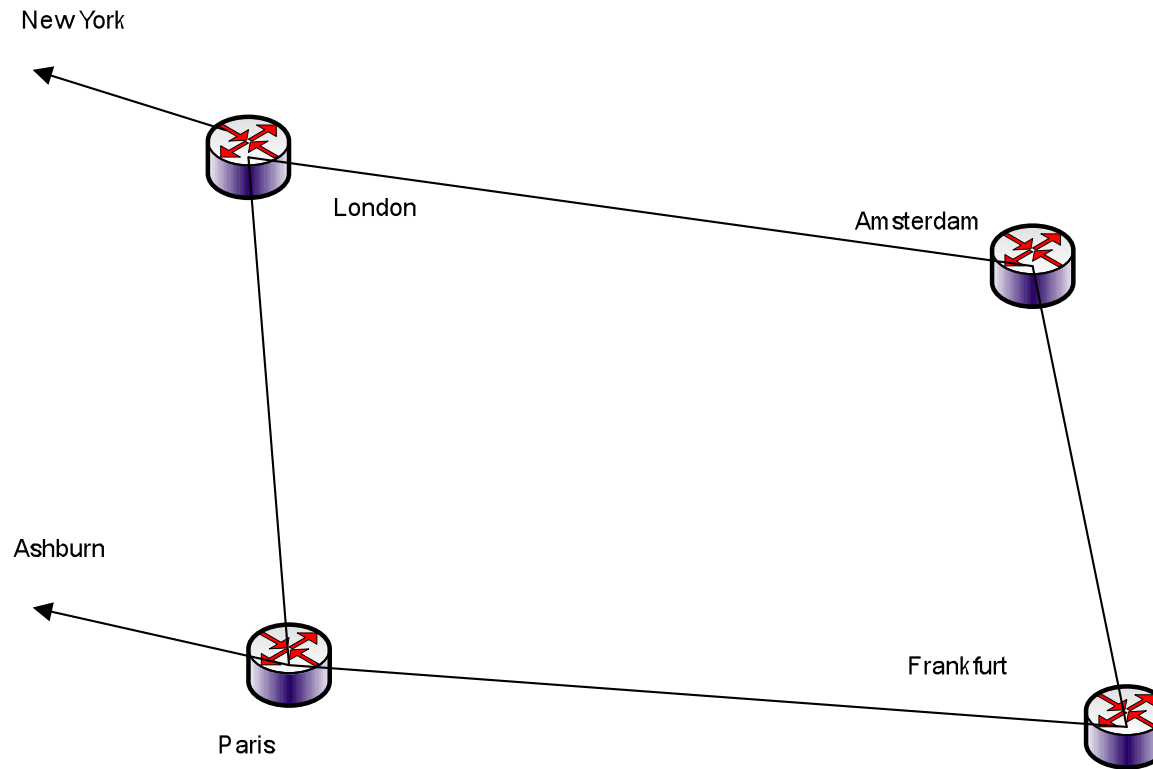
Why build a peering network?

- Cheaper than transit
- More control over traffic
- Traffic flows (especially if your traffic is asymmetrical)
- Ego factor
- Keep me in a job

Planning

- Estimates of amount of peering traffic
 - At least 20G
- Region
 - US
 - Europe
 - Split roughly 50/50
- Target likely peers
 - Content providers
 - Peer to peer (other eyeballs)
- Locations

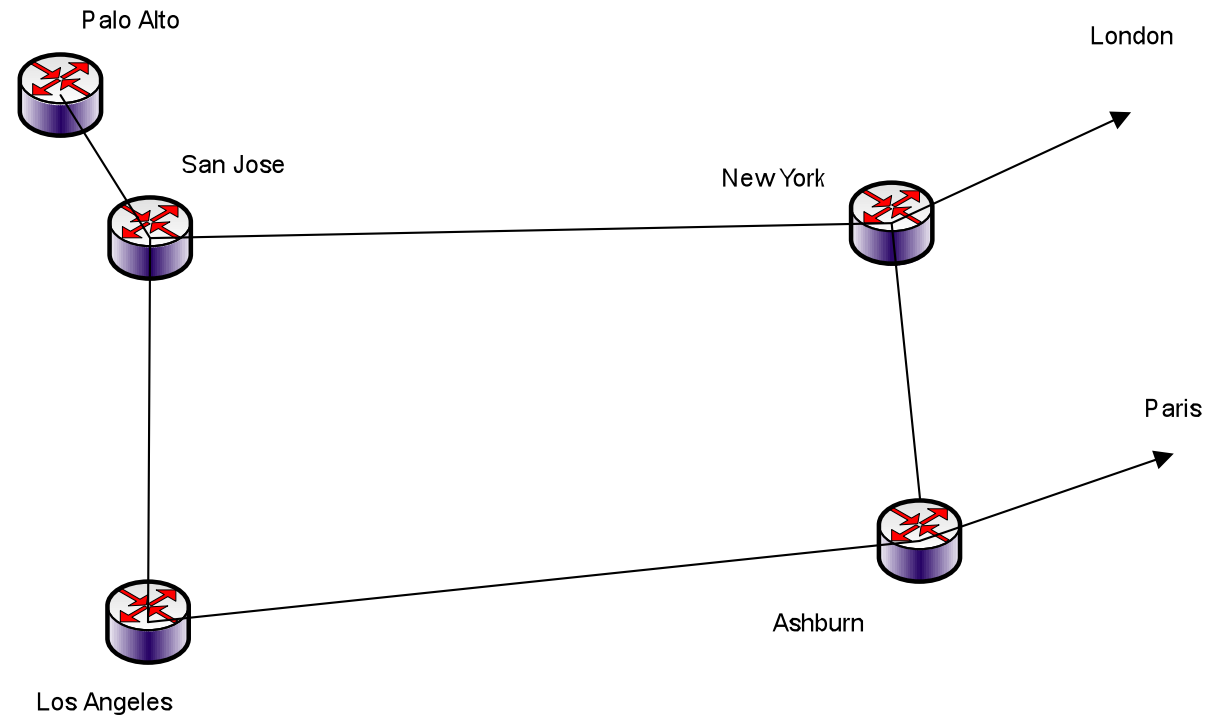
Network Diagram (Europe)



Locations (Europe)

- Fairly Easy as we already had a network in Europe
- Based around IXPs
 - Amsterdam (AMSIX)
 - Frankfurt (DECIX)
 - Paris (SFINX/PANAP/FreeIX)
- Initial Build
 - 10G ring London – Amsterdam – Paris – Frankfurt
 - Cisco CRSes (room to grow)
 - Optics as we need them

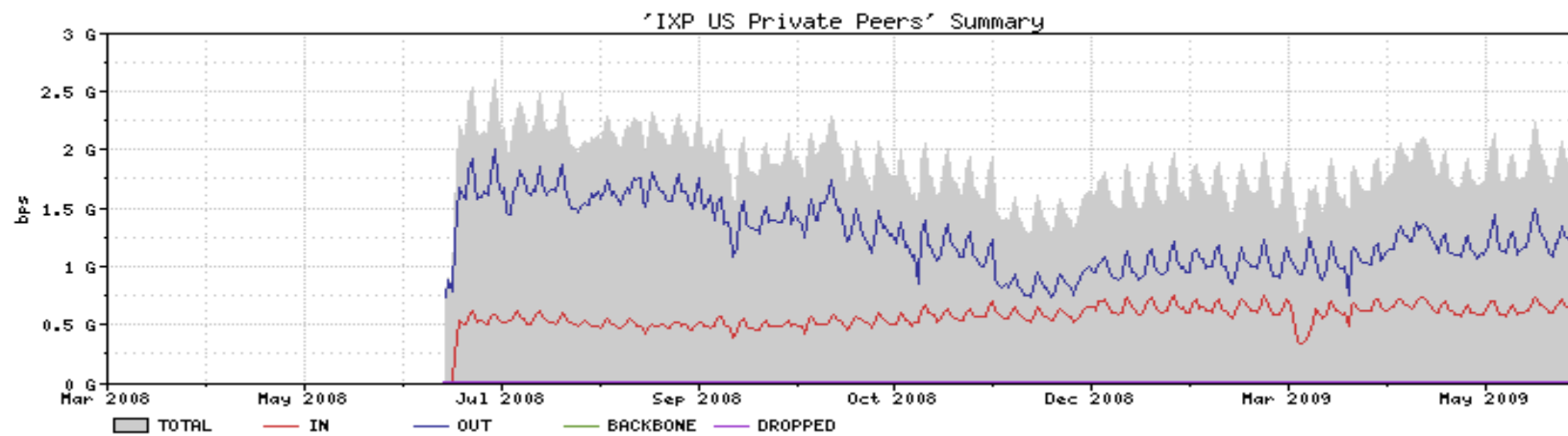
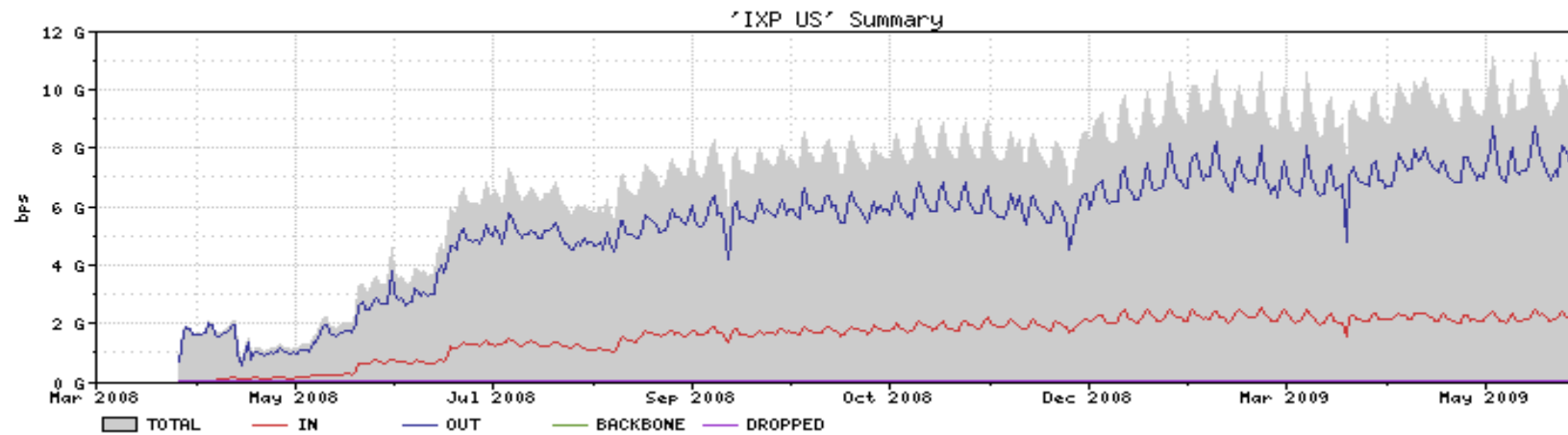
Network Diagram (US)



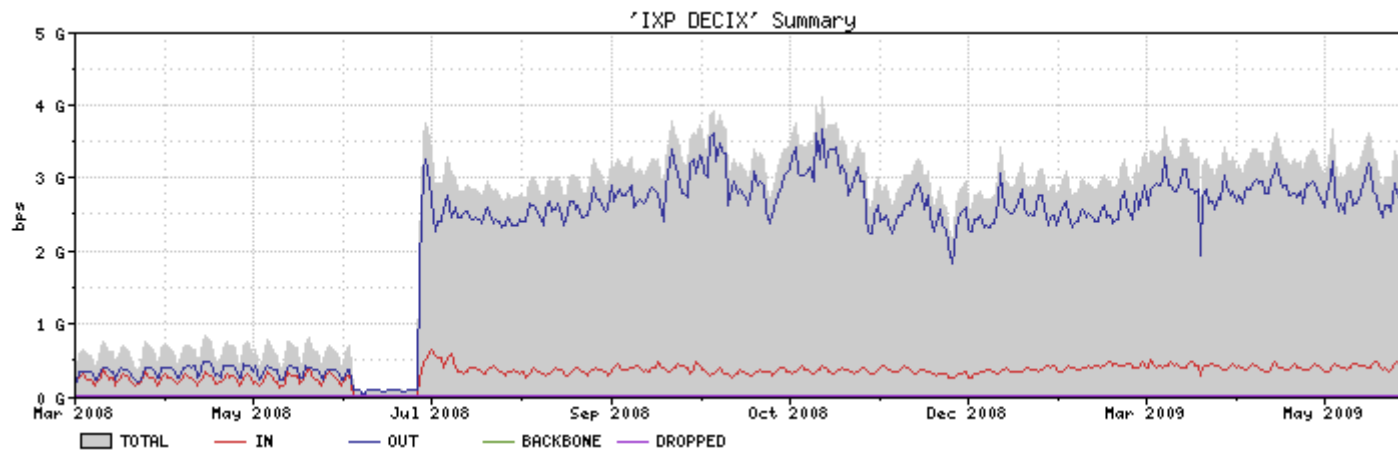
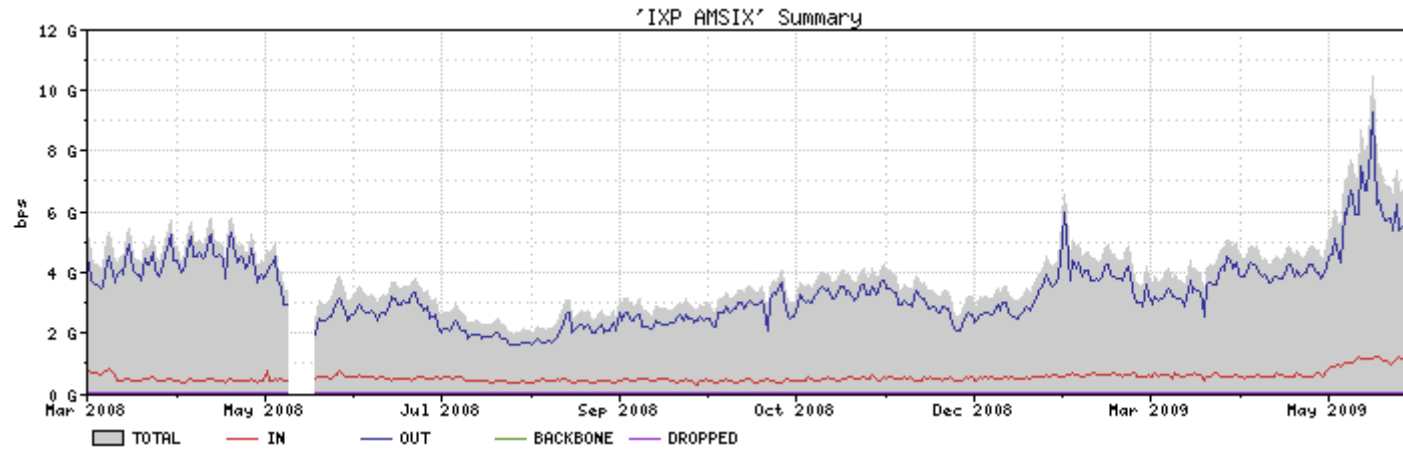
Locations (US)

- Brand New Network
- Based around IXPs
 - New York (NYIIX, PAIX)
 - Ashburn (Equinix)
 - Los Angeles (Any2, LAIIX)
 - Palo Alto (PAIX)
 - San Jose (Equinix)
- Initial Build
 - 10G ring New York – Ashburn – Los Angeles – San Jose
 - 10G spurs to Palo Alto
 - Cisco CRSes (room to grow)
 - Optics as we need them

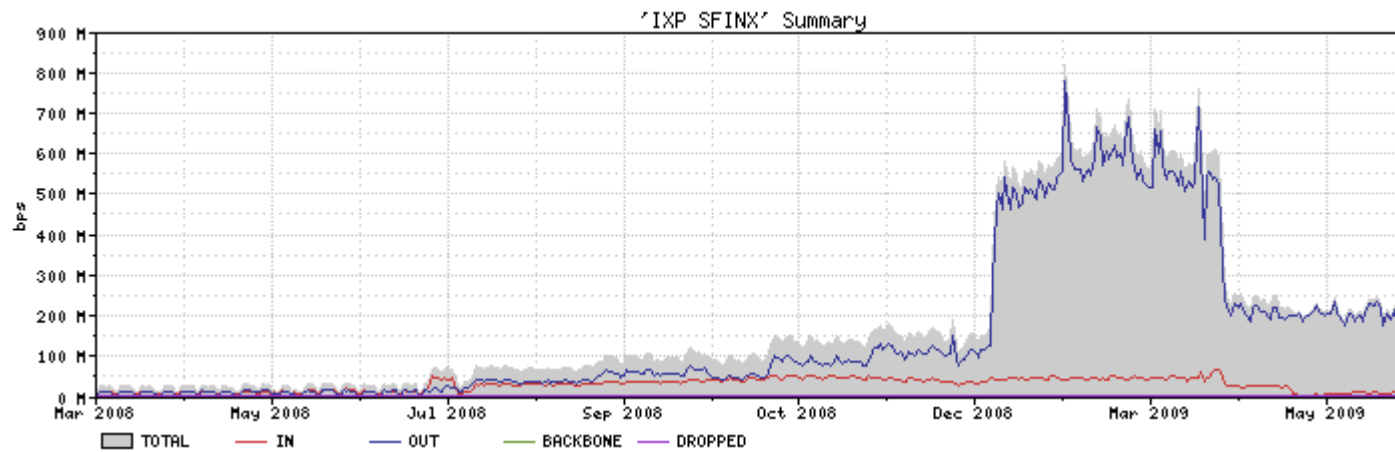
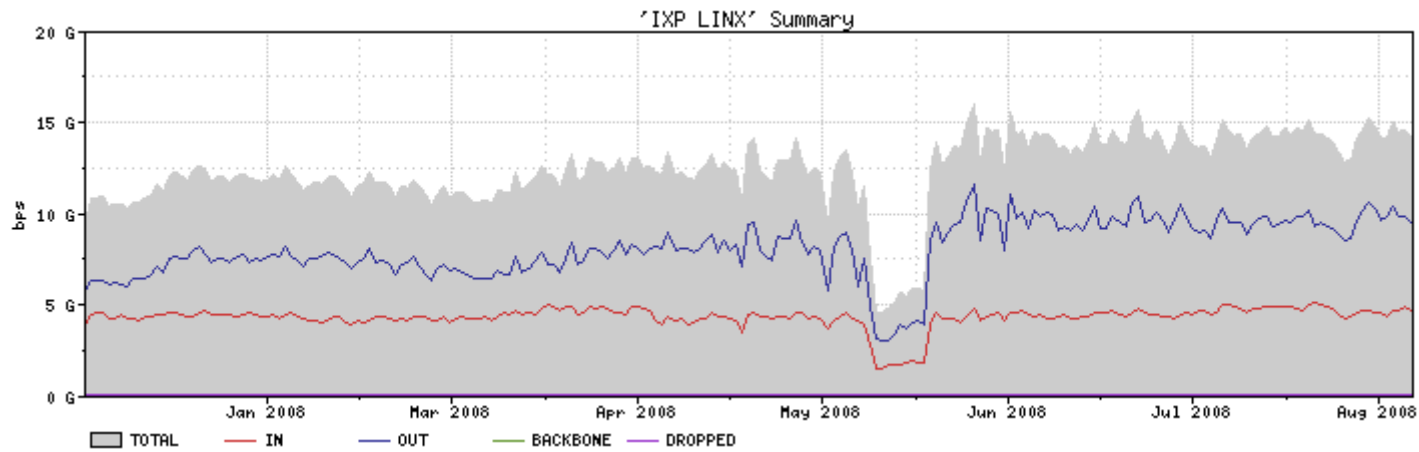
US traffic growth



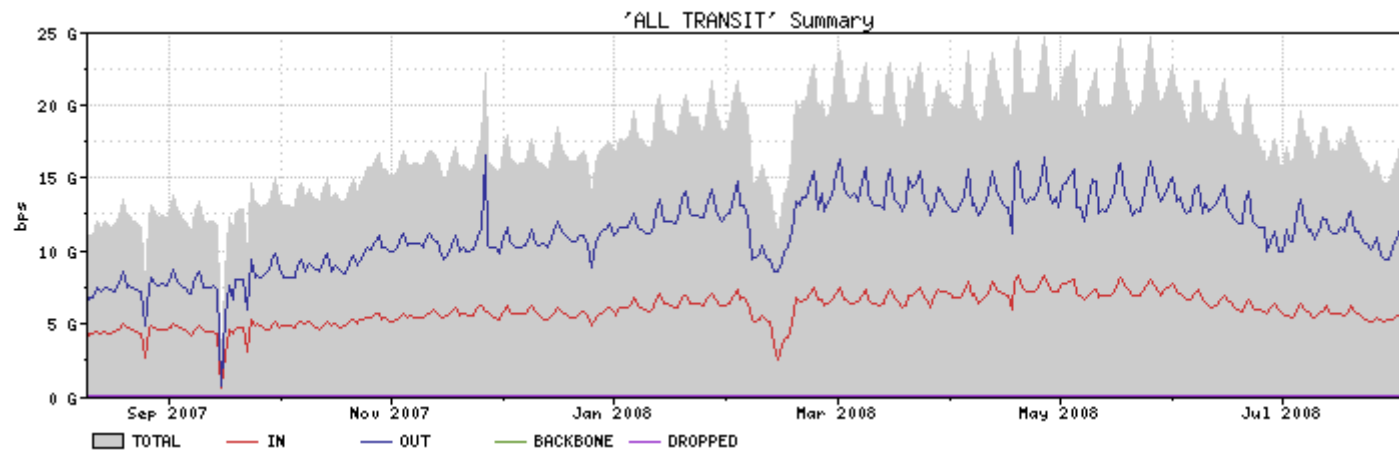
Europe Traffic growth



European Traffic growth (2)



Effect on transit



Savings

- Transit – Peering = 30 – 50%
- Total traffic = 140G approx
- Peering ratio approx 70%
- Latency/jitter improved
- Network available for reverse traffic FOC

How to use the New Network

- Analyse traffic (probably already done as part of your planning phase)
- Await requests to peer
- Stalk and hunt desired peers
- Bring up peerings

Tools of the Trade

- Good business card file
- PeeringDB
- Arbor (or similar)
- Renesys
- Local database
- Friendly and engaging smile

Business card file

- Contact details
- Phone number
- Email address
- Write things on the back (like AS number)
- May get extensive
- Review regularly (but don't throw away cards, peering coordinators move between companies but keep the same job)

PeeringDB

- Free!
- Incredibly useful resource
- <http://www.peeringdb.com>
- Guest access (guest/guest)
- Register your own account (<https://www.peeringdb.com/registration/register.php>)
- Enter your own network's details
- Easily search for details of potential peers

Peering DB

The screenshot shows the Peering DB website interface. The browser window title is "Home Page - Mozilla Firefox" and the address bar shows "https://www.peeringdb.com/private/index.php". The page is divided into several sections:

- Navigation:** Home Page, Logout
- Your Records:** Peering Record, User Account
- Search Records:** Networks, Exchange Points, Facilities, Common Points
- Suggestions:** Comments, New Exchange, New Facility
- Help:** FAQ, Statistics

Global System Statistics

Total Peering Networks	727
Total Public Exchange Points	163
Total Unique Public Exchange Presences	2599
Total Private Facilities	284
Total Unique Private Facility Presences	2024

Your User Account Status

Account Login	ntitley
Access Level	Level 2 (Normal User)
Peering Record	Easynet Group plc

Last 15 Updated Participants

Company Name	ASN	Date Last Updated
Quality Technology Services	4513	3/30/07, 04:17:32 PM GMT
Server Central Network (scnet)	23352	3/30/07, 04:01:06 PM GMT
AS35701	35701	3/30/07, 01:01:41 PM GMT
Sagashimbun Co., Ltd	18150	3/30/07, 05:46:53 AM GMT
Valueclick	25751	3/30/07, 02:38:42 AM GMT
Primus Telecommunications - US	11867	3/29/07, 08:16:58 PM GMT
Dailymotion	41690	3/29/07, 06:20:16 PM GMT
LeaseWeb	16265	3/29/07, 06:12:19 PM GMT
Eweka Internet Services	12989	3/29/07, 06:07:37 PM GMT
OCCAID	30071	3/29/07, 05:51:58 PM GMT
EWETel	9145	3/29/07, 05:16:31 AM GMT
Ipercast	25286	3/28/07, 10:48:48 PM GMT
Internap	22212	3/28/07, 10:29:13 PM GMT
Universal Telecom, Inc	16402	3/27/07, 10:58:29 PM GMT

PeeringDB (search)

Peering Networks Search/List - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Navigation

[Home Page](#)

[Logout](#)

Your Records

[Peering Record](#)

[User Account](#)

Search Records

[Networks](#)

[Exchange Points](#)

[Facilities](#)

[Common Points](#)

Suggestions

[Comments](#)

[New Exchange](#)

[New Facility](#)

Help

[FAQ](#)

[Statistics](#)

Search Peering Networks

Company Name	<input type="text" value="flag"/>	Primary ASN	<input type="text"/>
Network Type	<input type="text" value="Select Value"/>	IRR Macro	<input type="text"/>
Traffic Levels	<input type="text" value="Select Value"/>	General Peering Policy	<input type="text" value="Select Value"/>
Traffic Ratio	<input type="text" value="Select Value"/>	Geographic Scope	<input type="text" value="Select Value"/>

Peering Networks Search Results

Company Name	ASN	General Policy	Traffic Levels	Network Type	Network Scope	Public Count	Private Count
45RU HostAway	24541	Open	100-1000Mbps	Cable/DSL/ISP	Asia Pacific	1	0
4U Networks	25369	Open	100-1000Mbps	Content	Regional	5	2
AARNet	7575	Selective	1-5Gbps	Educational/Research	Asia Pacific	12	5
Abovenet Communications Inc.	6461	Selective	100+ Gbps	NSP	Global	0	0
Absolight	29608	Open	20-100Mbps	Content	Europe	4	1
Accelerated Connections Inc	21570	Selective	Not Disclosed	Cable/DSL/ISP	North America	1	0
ACOnet	1853	Open	5-10Gbps	Educational/Research	Regional	1	2
Adelphia Communications	19548	Restrictive	20-50 Gbps	Cable/DSL/ISP	North America	10	9
Advanced Knowledge Networks	14453	Open	0-20 Mbps	NSP	North America	1	1
Axiomus Ltd	6770	Open	100-1000Mbps	NSP	Europe	4	5
Affinity Internet, Inc.	3064	Open	1-5Gbps	Content	Global	1	0
Africa Online Operations (Mauritius) Ltd.	18922	Open	0-20 Mbps	Cable/DSL/ISP	Regional	1	0

1 2 3 4 5 6 7 8 9 10 of 55 [Next](#) [Last](#) >>

(c) 2004-2006 PeeringDB, All Rights Reserved. Please contact admin@peeringdb.com with questions/problems.

Done www.peeringdb.com

PeeringDB (search results)

Peering Networks Detailed View - Mozilla Firefox

File Edit View History Bookmarks Tools Help

Navigation	Company Information		Public Peering Exchange Points			
Home Page	Company Name	FLAG Telecom	Exchange Point Name	ASN	IP Address	Mbit/sec
Logout	Also Known As		AMS-IX	15412	195.69.144.72	2000
Your Records	Company Website	http://www.flagtelecom.com	Any2	15412	206.223.143.45	1000
Peering Record	Primary ASN	15412	DE-CIX	15412	80.81.192.64	2000
User Account	IRR Record	AS-FLAGP	Equinix Ashburn	15412	206.223.115.141	1000
Search Records	Network Type	NSP	HKIX	15412	202.40.161.196	2000
Networks	Approx Prefixes	6000	JPIX	15412	210.171.224.139	1000
Exchange Points	Traffic Levels	20-50 Gbps	JPNAP	15412	210.173.176.96	1000
Facilities	Traffic Ratios	Balanced	KINX	15412	192.145.251.42	1000
Common Points	Geographic Scope	Global	LAIX	15412	198.32.146.52	1000
Suggestions	Looking Glass URL		LINX	15412	195.66.226.146	2000
Comments	Route Server URL		LINX	15412	195.66.224.146	1000
New Exchange	Notes		NYIX	15412	198.32.160.88	1000
New Facility	Protocols Supported	Unicast IPv4 <input checked="" type="checkbox"/> Multicast <input checked="" type="checkbox"/> IPv6 <input checked="" type="checkbox"/>	1 2 of 2 Next > Last >>			
Help	Date Last Updated	2007-03-26 03:12:14 UTC	Private Peering Facilities			
FAQ	Peering Policy Information		Facility Name	ASN	City	Country
Statistics	Peering Policy URL		1 Wilshire	15412	Los Angeles	US
	General Policy	Selective	FiberNet Telecom Group - 60 Hudson St	15412	New York	US
	Multiple Locations	Not Required	FiberNet Telecom Group New York (111 Eighth Ave)	15412	New York	US
	Ratio Requirement	No	KINX IX Center	15412		KR
	Contract Requirement	Private Only	MEGA iAdvantage Hong Kong	15412	Hong Kong	HK
	Contact Information					
	Role	Contact Name	Telephone	E-Mail		
	Policy	Peering duty	+852 2848 0025	peering@flagtelecom.com		
	NOC	NOC	+44 (0) 20 8282 0068	noc@flagtelecom.com		
	Technical	NOC		noc@flagtelecom.com		

Done www.peeringdb.com

Arbor Peakflow (or similar)

- For each router in network
 - Takes netflow data
 - Takes an iBGP feed
 - Takes SNMP feed
- Used to determine traffic to and from a peer (or potential peer)
- For a potential peer will show the current path
- Also shows
 - Traffic breakdown (by destination port)
 - Traffic flowing from a peer to a peer (useful for detecting misconfigurations)
 - Peering adviser mode, shows peers to aim for
 - Traffic flows within network
 - Historical data
- Disadvantage
 - Cost (licensed per router)
 - May lie to you

Arbor Peakflow (example)

Peer 'AS15169: GOOGLE' Summary - Mozilla Firefox

File Edit View History Bookmarks Tools Help

peakflow™ # Logout Help

System > Alerts > Reports > Administration > Logged in as: nttiley 21:34:02 GMT | 04/01/2007

Peer 'AS15169: GOOGLE' Summary Download | Email | Edit

Peer AS15169: GOOGLE ▾

Units bps ▾

Period Today ▾

Update

'AS15169: GOOGLE' Traffic Summary

Legend: TOTAL (grey area), IN (red line), OUT (green line), BACKBONE (blue line), DROPPED (orange line)

Clear All Update

<input type="checkbox"/>	Class	Current	Average	Max
<input checked="" type="checkbox"/>	IN	198.00 Mbps	118.16 Mbps	244.00 Mbps
<input checked="" type="checkbox"/>	OUT	26.04 Mbps	14.76 Mbps	27.68 Mbps
<input checked="" type="checkbox"/>	DROPPED	0.00 bps	0.00 bps	0.00 bps
<input checked="" type="checkbox"/>	BACKBONE	0.00 bps	0.00 bps	0.00 bps
<input checked="" type="checkbox"/>	TOTAL	224.00 Mbps	132.93 Mbps	272.05 Mbps

Clear All Update

Page generation took 4.02 seconds. [Details](#)

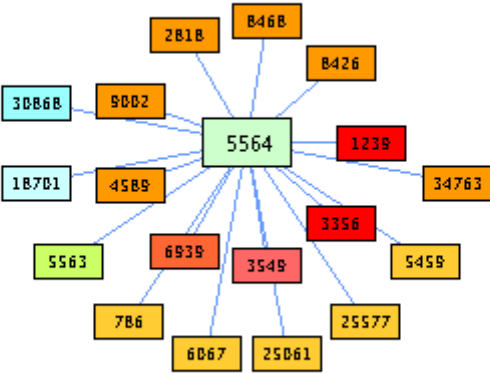
For assistance with this product, please contact ops@easynet.net. © 2007 Arbor Networks, Inc. All Rights Reserved.

Done fc0.blon.uk.easynet.net

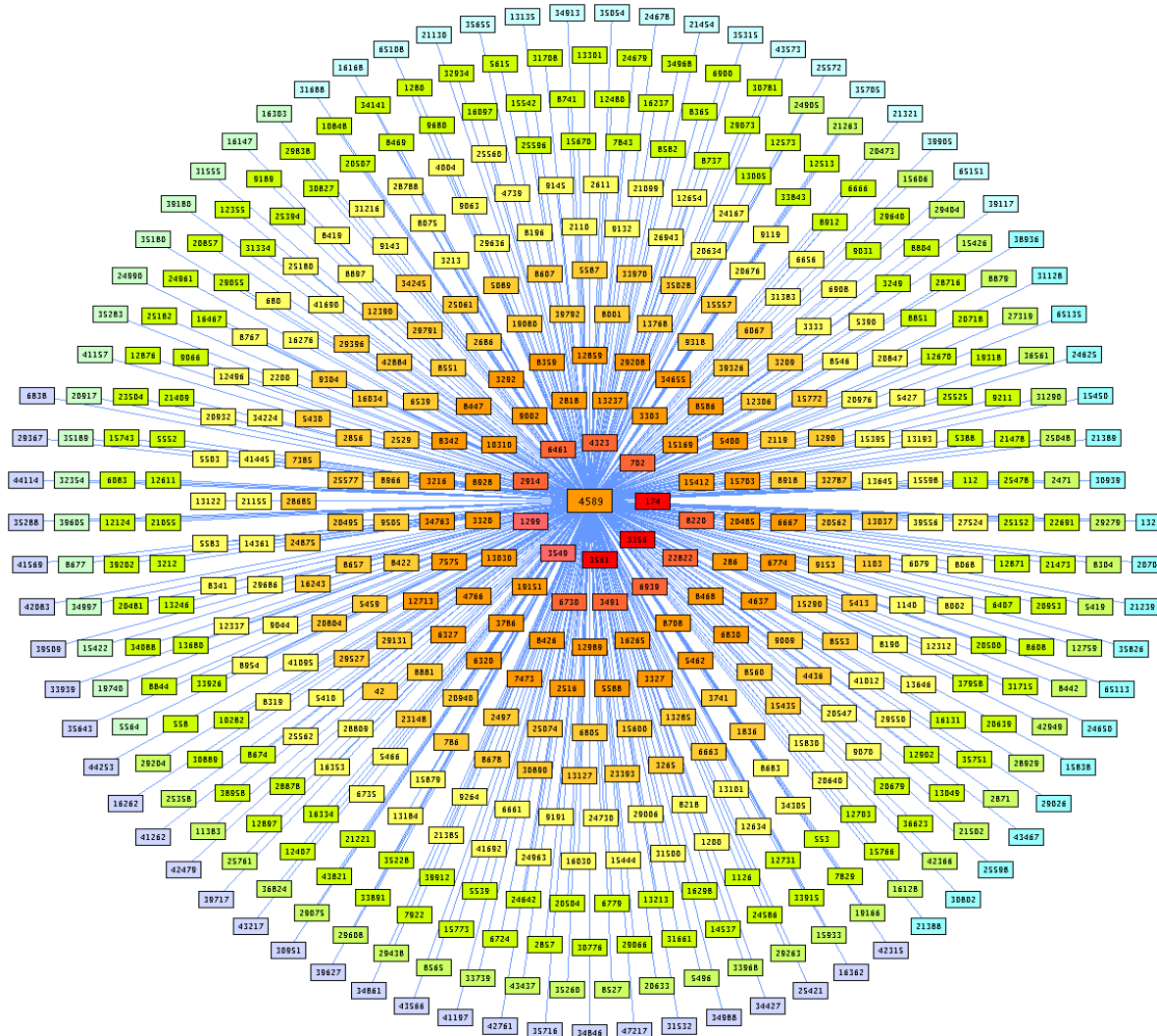
Renesys

- <http://www.renesys.com>
- Historical routing topology data
- Very useful
 - Debugging routing problems
 - Working out routing topologies
- Peering advisor tool
- Free
 - Give them a peering
 - Get access to basic tools
- Pay
 - Get automatic advisories of routing topology problems to feed to your NOC
 - Get access to complete history

AS5564 (Scotland Online)



AS4589 (Easynet)



Local Database

- Where do I peer
- Who do I peer with?
- How do I contact them?
- Who *don't* I peer with?
- Missing peering points
- Anything else you might want to record

IXP Overview

PeeringDB: Front page - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://peeringdb.easynet.net/peeringdb/

Most Visited Customize Links Free Hotmail Windows Marketplace Windows Media Windows Cartoons Easynet Ecommerce Snipe Tool! TinyURL!

NETCRAFT Services Risk Rating New Site Rank: 99641 Site Report [UK] Easynet Management Networks

HomeChip https://...:10000/ peakflow™ | SP - ... RIPE NCC Execu... Control Panel PeeringDB: Fr... peakflow™ | SP - ...

development site maybe prone to breakage and the production one will lag in features and fixes.

Global live BGP sessions: 1857 (IPv4: 1689 IPv6: 168 Down: 31)

Global ASNs peered with: 652

IXP	BGP	(down)	ASN	Graphs	IXP	BGP	(down)	ASN	Graphs	Country	BGP	(down)	ASN	Graphs
AMSIX	371	5	184	arbor	IPT US	1	0	1		BE	71	10	32	arbor
Any2	29	1	21	arbor	LAIIX	8	0	6	arbor	CH	80	0	57	arbor
Big Ape	5	0	5		LINX	291	4	164	arbor	DE	508	5	183	arbor
BNIX	70	10	31	arbor	MIX-IT	78	0	52	arbor	ES	79	5	41	arbor
CATNIX	21	4	19	arbor	NYIIX	47	0	39	arbor	FR	190	7	115	arbor
DECIX	478	5	167	arbor	PAIX NYC	14	0	12	arbor	IT	79	0	52	arbor
Equinix Ashburn	21	0	17	arbor	PAIX PAO	32	0	22	arbor	NL	372	5	184	arbor
Equinix San Jose	20	0	16	arbor	PANAP	78	3	77	arbor	UK	298	5	165	arbor
ESPANIX	57	1	28	arbor	Parix	22	0	21	arbor	US	180	1	68	arbor
FreeIX	54	2	53	arbor	PNI CH	1	0	1	arbor					
IPT BE	1	0	1		PNI DE	2	0	1	arbor					
IPT CH	1	0	1		PNI FR	1	0	1						
IPT DE	2	0	2		PNI UK	1	1	1	arbor					
IPT ES	1	0	1		PNI US	3	0	2	arbor					
IPT FR	2	0	2		SFINX	33	2	16	arbor					
IPT IT	1	0	1		SWISS-IX	40	0	37	arbor					
IPT NL	1	0	1		TIX	38	0	36	arbor					
IPT UK	6	0	3		WORK-IX	26	0	23						

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Done

Peer Search

The screenshot shows a Mozilla Firefox browser window displaying the PeeringDB website. The address bar shows the URL `http://peeringdb.easynet.net/peeringdb/view_peering.php?search`. The page title is "PeeringDB: Show Peering". The main content area is titled "PeeringDB: Show Peering" and includes the text "Advanced view: Search and show Peering information." and the Easynet logo.

The search interface is titled "Search for Peering data" and contains several sections:

- IXP:** A dropdown menu with options: * Any, AMSIX, Any2, Big Ape, BNIX, CATNIX, DECIX.
- Router:** A dropdown menu with options: * Any, br0.bnbru.be.easynet.net, br0.exmad.es.easynet.net, br0.isham.de.easynet.net, br0.ixbru.be.easynet.net, br0.ixfra.de.easynet.net, br0.thzrh.ch.easynet.net.
- Port:** A dropdown menu with options: * Any, br0.bnbru.be.easynet.net/ge-1/3/0.106, br0.exmad.es.easynet.net/ge-0/0/0.10, br0.exmad.es.easynet.net/ge-0/0/0.71, br0.isham.de.easynet.net/so-0/3/0.0, br0.ixbru.be.easynet.net/ge-0/2/0.309, br0.thzrh.ch.easynet.net/ge-1/3/0.60.
- Flexible search fields:** Three search fields, each with a dropdown menu (ASN), a comparison operator (==), and an input field. Each field has a "Stop here" dropdown menu.

At the bottom of the search interface are two buttons: "finish" and "update".

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Peer details

PeeringDB: Show Peering - Mozilla Firefox

File Edit View History Bookmarks Tools Help

http://peeringdb.easynet.net/peeringdb/view_peering.php?list

Most Visited Customize Links Free Hotmail Windows Marketplace Windows Media Windows Cartoons Easynet Ecommerce Snipe Tool! TinyURL!

Services Risk Rating New Site Rank: 99641 Site Report [UK] Easynet Management Networks

HomeChip https://...m:10000/ peakflow™ | SP ... RIPE NCC Execut... Control Panel PeeringDB:... peakflow™ | SP ... How do I dump a ...

Peering details for SpaceNet AG AS5539

Arbor: Peer AS
Arbor: AS

Range: 24h
Range: 48h
Range: 1w
Range: 1m
Range: 1y

Network details and notes for AS5539 (0 notes)

BGP sessions

Status	Peer ASN	Pfx Acpt	CC	IXP	Type	Peer address	Router	# Peer notes	BGP MD5
up	AS name	19	DE	DECIX	IXP	2001:7f8::15a3:0:1	er1.ixfra.de.easynet.net	0	[not set]
	AS-set					2001:7f8::11ed:0:2	GigabitEthernet2/1	0	[not set]
Notes show add	5539								
Static show edit	SpaceNet AG								
Cfg show	AS-SPACENET								

Friendly and Engaging Smile

- It helps to be friendly, but I seem to have managed to get away with it.
- Buy drinks
- Bring tee-shirts
- Go to meetings
 - RIPE
 - NANOG
 - APRICOT
 - SANOG
 - MENOG
 - UKNOF
- Sponsor SANOG meetings

Conclusions

- Pleasure
 - It can be a lot of fun being a peering coordinator
 - Cooperation
 - Meeting like minded people
 - Making the internet a better place (without peering there would be no internet)
- Profit
 - Peering is your markup
 - Difference between the price you pay for transit and the price you charge your customers
 - More peering generally means more profit and happier customers



Questions?

nigel.titley@uk.easynet.net