

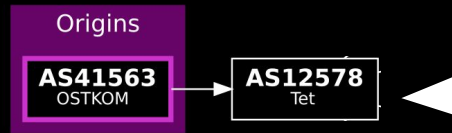
Transit Free, Tier ones, and the hopefuls

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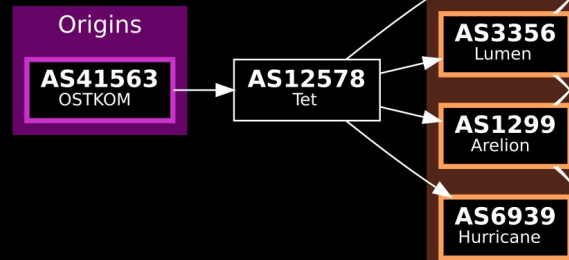
Let's say you
run a
company

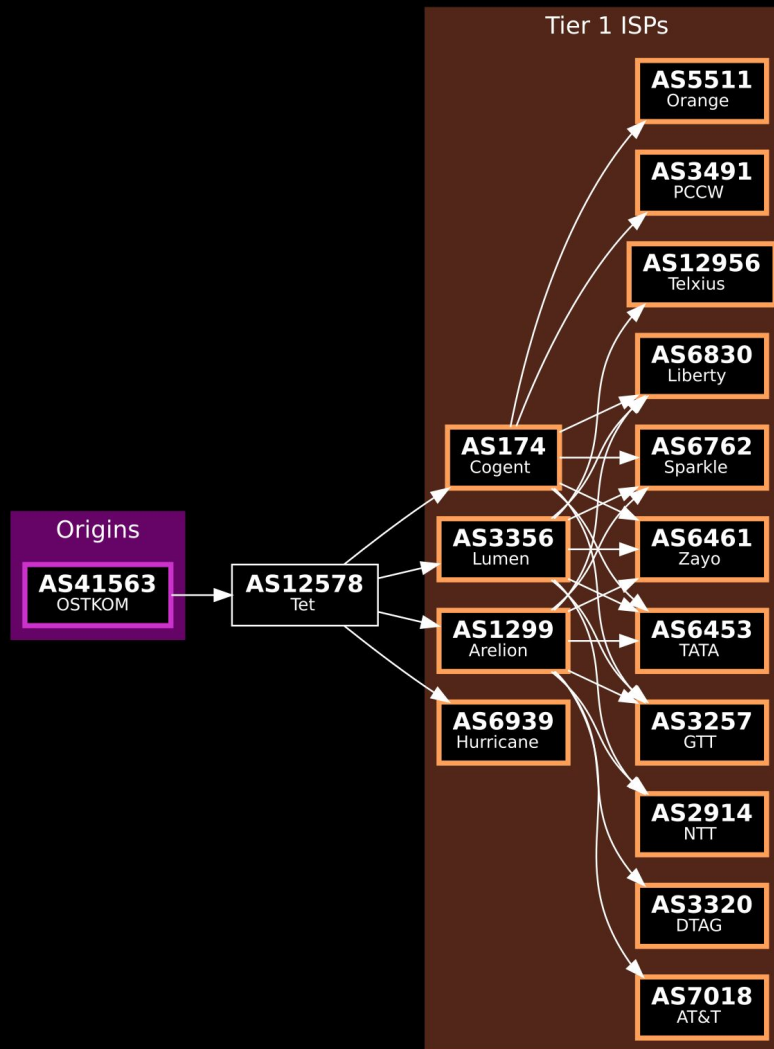


You buy
internet from
another
company



Who they buy
from a load of
other
companies

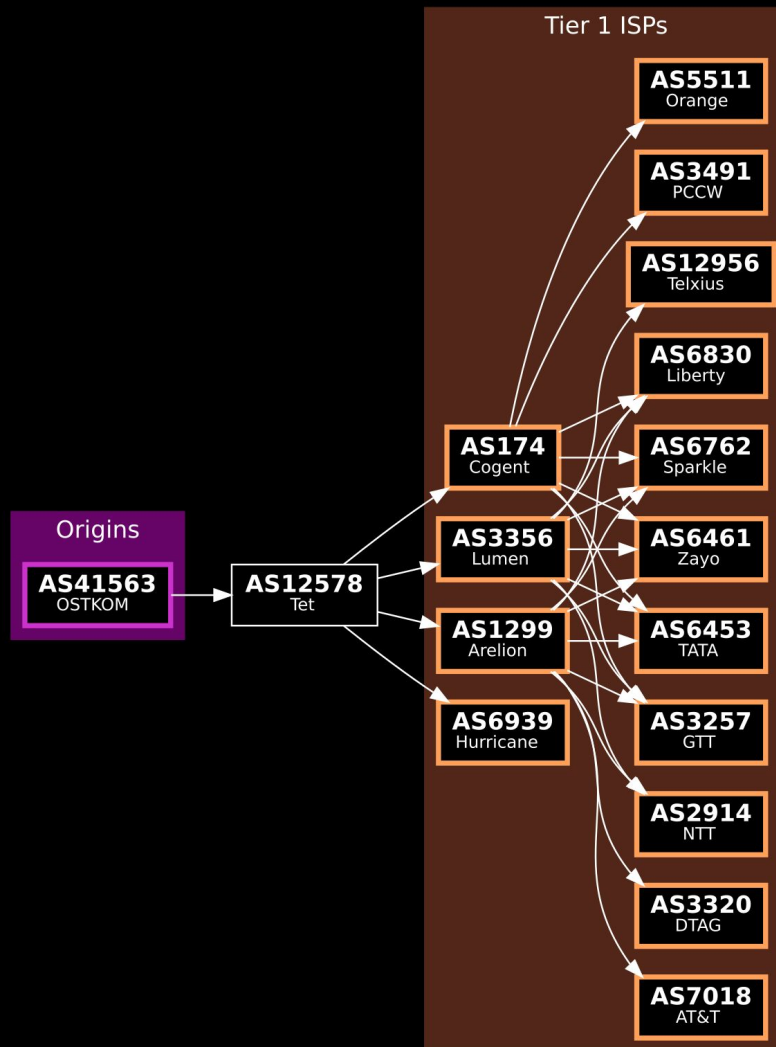




Who pass your
route to all of
their friends
and customers

There is obviously something interesting here

- Otherwise there would not be a highlight around these "Tier 1 ISPs" thing!
- Basically these are networks that have *special agreements* with each other than you and I don't have



General network policy rule of thumb

- If a customer gives you a route, you will always prefer it
 - This is because using a customer BGP route makes you money

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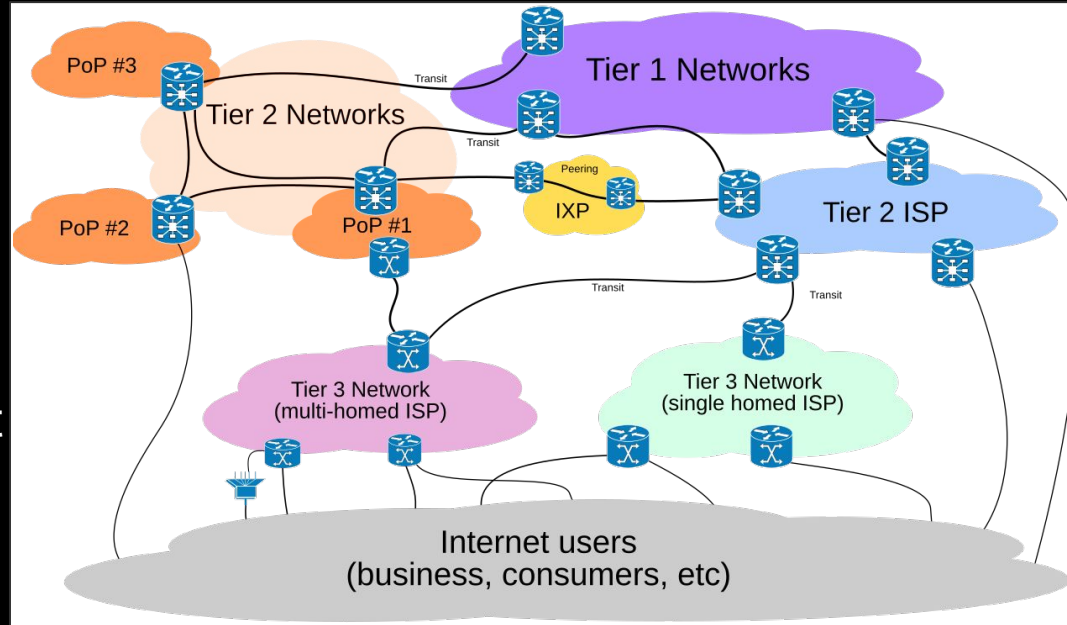
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What if you don't have transit though?

"Transit Free" vs Tier 1

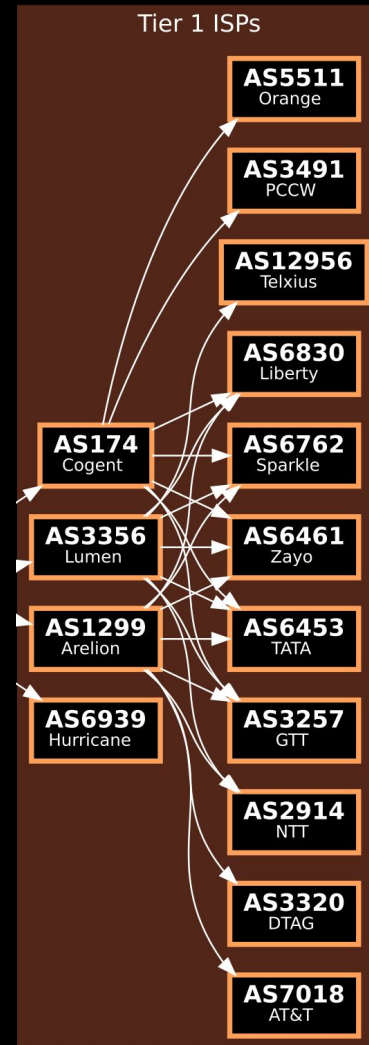
- BGP doesn't actually have any concept of tier, this is entirely a fictional concept that is better about explaining things than describing real world structures, for example this wikipedia diagram doesn't actually commonly exist in reality, at least in 2026
- "Transit Free" because it describes mostly what it really does, but the terms are practically interchangeable



"Transit Free"

- So if you "just" peer with all of these:
you will get all of their customers, and so
you should be able to get everywhere on
the internet.

That sounds great!



"Transit Free"

- Unfortunately this is not so easy
 - These networks have a business landscape to protect and are very careful about who they peer with, every potential peer *is also a* potential customer
 - Moderately large networks will commonly peer with at least a couple of transit free networks, where it makes sense for both parties
 - "Sense" could be political (both business or geopolitics)

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- Unfortunately this is not so easy
 - These networks have a business landscape to protect and are very careful about who they peer with, every potential peer **is also a** potential customer
 - Moderately large networks will commonly peer with at least a couple of transit free networks, where it makes sense for both parties
 - "Sense" could be political (both business or geopolitics)
- Peering with such networks typically comes extra requirements
 - Some kind of traffic ratio (transmit and receive rates **generally** must be roughly balanced)
 - Some kind of geographic footprint must be maintained
 - Nobody wants their expensive backbone paths to be "taken advantage" of

"Transit Free" kinda sucks!

- Pros:
 - You can get to everywhere without paying anyone
 - You get to brag about being in this state

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 - You can get to everywhere without paying anyone*
 - You get to brag about being in this state

"Transit Free" kinda sucks!

- Pros:
 - You can get to everywhere without paying anyone
 - You get to brag about being in this state
- Cons:
 - You have to haul it the peering point, this may be far away (and route miles are expensive)
 - You are vulnerable to being de-peered by one of the other transit-frees and you will then have "holes" in your routing table
 - Because there won't be any other way for you to get to someone else's customer cone, remember you are not paying anyone to carry you!

"Transit Free" sucks case study: NTT AS2914

- NTT is stuck in a peering dispute with both Arelion and Cogent
 - Because of this, NTT has no peering with Arelion and Cogent in Europe
 - This sucks very bad if you are a NTT customer in Europe, and NTT has no option but to haul/be hauled to America or Asia to exchange traffic
-
- Normal networks don't have to deal with these things, because a full de-peering is not fatal, you just lean on transit for a while (or forever)
 - But being de-peered would leave single homed NTT customers in the dirt
 - Instead, they are only slightly in the dirt right now, and only if they have traffic in Europe

So, who is who?

- With bgp.tools data feeds we know roughly where each feed is located
- We also know what CIDRs are announced where

So, who is who?

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- Lots of providers have informational BGP communities about if things are *peers* or *customers*

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```
unicast [AS36318 - zsnet-gw-tor02 0000-00-00] * (?/-) [AS206924]
```

```
Type: BGP
```

```
BGP.as_path: 36318 53356 33554 1299 206924 206924
```

```
BGP.community: (1299,430) [AS1299: AS1299 customer cone] [AS1299: EU Customers]
```

```
[AS1299: London/Slough (Customer)] [AS1299: Country United Kingdom] [AS1299: Region  
Europe] (1299,52600) (33554,100) (36318,20) (53356,20003)
```

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So, who is who?

- With bgp.tools data feeds we know roughly where each feed is located
- We also know what CIDRs are announced where
- Lots of providers have informational BGP communities about if things are ***peers*** or ***customers***
- bgp.tools has a lot of BGP feeds (4,200+) from many networks to support it's monitoring/looking glass mission
- ***Including now at INEX! You can help others (and yourself) debug the internet by feeding bgp.tools a full table over INEX LON1/LON2!***

So, who is who?

- With bgp.tools data feeds we know roughly where each feed is located
 - We also know what CIDRs are announced where
 - Lots of providers have informational BGP communities about if things are *peers* or *customers*
 - bgp.tools has a lot of BGP feeds (4,200+) from many networks to support it's monitoring/looking glass mission
-
- With all of these things combined we can create a matrix of who is peering with who!

Transit Free Peering Matrix

[illegible]

Transit Free Peering Matrix

	Sparkle	Telixus	NTT	Lumen	TATA	Verizon	Zayo	GTT	Arelion	PCCW	AT&T	DTAG	Orange	Liberty	HE	Cogent
Sparkle		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Telixus	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P
NTT	P	P		P	P	P	D	P	P	P	P	P	P	P	P	P
Lumen	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P
TATA	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P
Verizon	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P
Zayo	P	P	D	P	P	P		P	P	D	P	P	P	P	P	P
GTT	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P
Arelion	P	P	P	P	P	P	P	P		P	P	P	P	P	C	P
PCCW	P	P	P	P	P	P	D	P	P		P	P	P	P	P	P
AT&T	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P
DTAG	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P
Orange	P	P	P	P	P	P	P	P	P	P	P	P		P	P	P
Liberty	P	P	P	P	P	P	P	P	P	P	P	P	P		P	P
HE	P	P	P	P	P	P	P	P	C	P	P	P	P	P		X
Cogent	P	P	P	P	P	P	P	P	P	P	P	P	P	P	X	

Interesting things:

- Zayo<->NTT are not always peers
- Zayo<->PCCW are not always peers

North America

	Sparkle	Telixus	NTT	Lumen	TATA	Verizon	Zayo	GTT	Arelion	PCCW	AT&T	DTAG	Orange	Liberty	HE	Cogent
Sparkle		P	P	P	P	P	P	P	P	P	P	.	P	P	P	P
Telixus	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P
NTT	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P
Lumen	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P
TATA	P	P	P	P		P	P	P	P	P	P	P	P	.	P	P
Verizon	P	P	P	P	P		P	P	P	P	.	P	P	.	P	P
Zayo	P	P	P	P	P	P		P	P	P	P	.	P	.	P	P
GTT	P	P	P	P	P	P	P		P	P	P	.	P	P	P	P
Arelion	P	P	P	P	P	P	P	P		P	P	P	P	P	C	P
PCCW	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P
AT&T	P	P	P	P	P	.	P	P	P	P		P	P	.	P	P
DTAG	.	P	P	P	P	P	.	.	P	P	P		P	.	P	P
Orange	P	P	P	P	P	P	P	P	P	P	P	P		P	P	P
Liberty	P	P	P	P	.	.	.	P	P	P	.	.	P		P	P
HE	P	P	P	P	P	P	P	P	C	P	P	P	P	P		X
Cogent	P	P	P	P	P	P	P	P	P	P	P	P	P	P	X	

North America

	Sparkle	Telixus	NTT	Lumen	TATA	Verizon	Zayo	GTT	Arelion	PCCW	AT&T	DTAG	Orange	Liberty	HE	Cogent
Sparkle		P	P	P	P	P	P	P	P	P	P	.	P	P	P	P
Telixus	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P
NTT	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P
Lumen	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P
TATA	P	P	P	P		P	P	P	P	P	P	P	P	.	P	P
Verizon	P	P	P	P	P		P	P	P	P	.	P	P	.	P	P
Zayo	P	P	P	P	P	P		P	P	P	P	.	P	.	P	P
GTT	P	P	P	P	P	P	P		P	P	P	.	P	P	P	P
Arelion	P	P	P	P	P	P	P	P		P	P	P	P	P	C	P
PCCW	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P
AT&T	P	P	P	P	P	.	P	P	P	P		P	P	.	P	P
DTAG	.	P	P	P	P	P	.	.	P	P	P		P	.	P	P
Orange	P	P	P	P	P	P	P	P	P	P	P	P		P	P	P
Liberty	P	P	P	P	.	.	.	P	P	P	.	.	P		P	P
HE	P	P	P	P	P	P	P	P	C	P	P	P	P	P		X
Cogent	P	P	P	P	P	P	P	P	P	P	P	P	P	P	X	

Interesting things:

- Liberty Global and DTAG have many peering holes in the America it seems

Europe

	Sparkle	Telixus	NTT	Lumen	TATA	Verizon	Zayo	GTT	Arelion	PCCW	AT&T	DTAG	Orange	Liberty	HE	Cogent
Sparkle		P	P	P	P	.	P	P	P	P	.	P	P	P	P	P
Telixus	P		P	P	P	.	P	P	P	P	.	P	P	.	P	P
NTT	P	P		P	P	.	P	P	.	P	.	P	P	P	P	.
Lumen	P	P	P		P	.	P	P	P	P	.	P	P	P	P	P
TATA	P	P	P	P		.	P	P	P	P	.	P	P	P	P	P
Verizon	.	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Zayo	P	P	P	P	P	.		P	P	P	.	P	.	.	P	P
GTT	P	P	P	P	P	.	P		P	P	.	P	P	P	P	P
Arelion	P	P	.	P	P	.	P	P		P	.	P	P	P	C	P
PCCW	P	P	P	P	P	.	P	P	P		.	P	P	P	P	P
AT&T	.	.	.	.	.	.	.	.	.	.		.	.	.	.	.
DTAG	P	P	P	P	P	.	P	P	P	P	.		P	P	P	P
Orange	P	P	P	P	P	.	.	P	P	P	.	P		.	P	P
Liberty	P	.	P	P	P	.	.	P	P	P	.	P	.		P	P
HE	P	P	P	P	P	.	P	P	C	P	.	P	P	P		X
Cogent	P	P	.	P	P	.	P	P	P	P	.	P	P	P	X	

Europe

	Sparkle	Telixus	NTT	Lumen	TATA	Verizon	Zayo	GTT	Arelion	PCCW	AT&T	DTAG	Orange	Liberty	HE	Cogent
Sparkle		P	P	P	P	.	P	P	P	P	.	P	P	P	P	P
Telixus	P		P	P	P	.	P	P	P	P	.	P	P	.	P	P
NTT	P	P		P	P	.	P	P	.	P	.	P	P	P	P	.
Lumen	P	P	P		P	.	P	P	P	P	.	P	P	P	P	P
TATA	P	P	P	P		.	P	P	P	P	.	P	P	P	P	P
Verizon	.	.	.	.	.	Interesting things: You can see the NTT vs Arelion and Cogent dispute here!						.	.	.	.	.
Zayo	P	P	P	P	P							P	.	.	P	P
GTT	P	P	P	P	P							P	P	P	P	P
Arelion	P	P	.	P	P							P	P	P	C	P
PCCW	P	P	P	P	P							P	P	P	P	P
AT&T	.	.	.	.	.							.	.	.	.	.
DTAG	P	P	P	P	P	.	P	P	P	P	.		P	P	P	P
Orange	P	P	P	P	P	.	.	P	P	P	.	P		.	P	P
Liberty	P	.	P	P	P	.	.	P	P	P	.	P	.		P	P
HE	P	P	P	P	P	.	P	P	C	P	.	P	P	P		X
Cogent	P	P	.	P	P	.	P	P	P	P	.	P	P	P	X	

Asia-Pacific

	Sparkle	Telixus	NTT	Lumen	TATA	Verizon	Zayo	GTT	Arelion	PCCW	AT&T	DTAG	Orange	Liberty	HE	Cogent
Sparkle		P	P	P	.	P	.	P	P	P	P	P	P	P	P	P
Telixus	P		.	.	.	.	.	.	.	.	.	.	.	.	.	.
NTT	P	.		P	P	.	C	.	.	P	.	.	P	.	.	.
Lumen	P	.	P		P	.	.	P	P	P	.	.	.	.	P	P
TATA	.	.	P	P		.	.	P	P	P	.	P	.	.	P	P
Verizon	P	.	.	.	.		.	.	.	.	.	.	.	.	.	.
Zayo	.	.	C	.	.	.		.	.	C	.	.	.	.	.	P
GTT	P	.	.	P	P	.	.		P	P	.	.	.	.	.	P
Arelion	P	.	.	P	P	.	.	P		P	.	P	.	.	P	.
PCCW	P	.	P	P	P	.	C	P	P		.	.	.	.	P	P
AT&T	P	.	.	.	.	.	.	.	.	.		.	.	.	.	.
DTAG	P	.	.	.	P	.	.	.	P	.	.		.	.	P	P
Orange	P	.	P	.	.	.	.	.	.	.	.	.		.	.	.
Liberty	P	.	.	.	.	.	.	.	.	.	.	.	.		.	.
HE	P	.	.	P	P	.	.	.	P	P	.	P	.	.		X
Cogent	P	.	.	P	P	.	P	P	.	P	.	P	.	.	X	

Asia-Pacific

	Sparkle	Telixus	NTT	Lumen	TATA	Verizon	Zayo	GTT	Arelion	PCCW	AT&T	DTAG	Orange	Liberty	HE	Cogent
Sparkle		P	P	P	.	P	.	P	P	P	P	P	P	P	P	P
Telixus	P		.	.	.	.	.	.	.	.	.	.	.	.	.	.
NTT	P	.		P	P	.	C	.	.	.	.	.	.	.	.	.
Lumen	P	.	P		P	.	.	P	P	.	.	.	.	.	.	P
TATA	.	.	P	P		.	.	P	P	.	.	.	.	.	.	P
Verizon	P	.	.	.	.	.	.	.	.	.	.	.	.	.	.	.
Zayo	.	.	C	.	.	.	.	.	.	.	.	.	.	.	.	P
GTT	P	.	.	P	P	.	.		P	.	.	.	.	.	.	P
Arelion	P	.	.	P	P	.	.	P		P	.	P	.	.	P	.
PCCW	P	.	P	P	P	.	C	P	P		.	.	.	.	P	P
AT&T	P	.	.	.	.	.	.	.	.	.		.	.	.	.	.
DTAG	P	.	.	.	P	.	.	.	P	.	.		.	.	P	P
Orange	P	.	P	.	.	.	.	.	.	.	.	.		.	.	.
Liberty	P	.	.	.	.	.	.	.	.	.	.	.	.		.	.
HE	P	.	.	P	P	.	.	.	P	P	.	P	.	.		X
Cogent	P	.	.	P	P	.	P	P	.	P	.	P	.	.	X	

Interesting things:

- Zayo<-> NTT Customer relationship in APAC?
- Zayo<->PCCW Customer relationship in APAC?

In where Ben says:

A bunch of things he
can't write down

The hopefuls

- Networks very rarely publicly describe their intentions with regards to becoming transit free and so we're just going to look at a handy list on wikipedia that lists a bunch of networks that are almost Tier 1

The hop

- Network become wikipedia

Other major networks [\[edit \]](#)

This is a list of networks that are often considered close to the status of Tier 1, because they can reach the majority (50+%) of the internet via settlement-free peering with their global rings. However, routes to one or more Tier 1 are missing or paid. Therefore, they are technically [Tier 2](#), though practically something in between.

Name	Headquarters	AS Number	CAIDA AS Rank ^[16]	Reason
China Telecom	 China	4134/4809	125	Purchases transit from Lumen/AS3356 , Cogent/AS174 , Verizon/AS701 .
China Unicom	 China	4837	215	Purchases transit from Cogent/AS174 , Verizon/AS701 , Lumen/AS3356 , Orange/AS5511 .
Singtel ^[52]	 Singapore	7473	17	Purchases transit from Arelion/AS1299 , Zayo/AS6461 , Tata Communications/AS6453 .
Cogent Communications (formerly PSINet) ^[53]	 United States	174	3	No IPv6 routes to Hurricane Electric/AS6939 . ^{[54][55]}
Hurricane Electric ^[56]	 United States	6939	6	IPv4: Purchases transit from Arelion/AS1299 to reach GTT/AS3257 , NTT/AS2914 and Cogent/AS174 . IPv6: Lack of peering with Cogent/AS174 . ^{[54][55]}
RETN ^[57]	 United Kingdom	9002	10	Purchases transit from Lumen/AS3356 to reach Cogent/AS174 and NTT/AS2914 .
Vodafone Carrier Services (formerly Cable & Wireless) ^[58]	 United Kingdom	1273	13	Purchases transit from Arelion/AS1299 to reach AT&T/AS7018 and part of NTT/AS2914 . ^[59]
Telstra ^[60]	 Australia	4637	15	Purchases transit from Lumen/AS3356 , Arelion/AS1299 , Zayo/AS6461 .
Comcast ^[61]	 United States	7922	37	Purchases transit from Tata/AS6453

to on

Overall (either family, any region)

	Sparkle	Telixus	NTT	Lumen	TATA	Verizon	Zayo	GTT	Arelion	PCCW	AT&T	DTAG	Orange	Liberty	HE	Cogent	ChinaT	CN2	ChinaU	SingTel	RETN	Vodafofme	Telstra	Comcast
Sparkle		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	C	P	P	P
Telixus	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
NTT	P	P		P	P	P	D	P	P	P	P	P	P	P	P	P	P	C	P	P	C	P	P	P
Lumen	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	C	C	C	P	C	P	P	P
TATA	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	D	D	P	P	C
Verizon	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Zayo	P	P	D	P	P	P		P	P	D	P	P	P	P	P	P	P	P	P	C	P	P	C	P
GTT	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	C	P	P	P
Arelion	P	P	P	P	P	P	P	P		P	P	P	P	P	C	P	P	C	P	C	P	D	C	P
PCCW	P	P	P	P	P	P	D	P	P		P	P	P	P	P	P	P	C	P	P	C	P	P	P
AT&T	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P
DTAG	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	C	C	P	C	P	P	P
Orange	P	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P
Liberty	P	P	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P
HE	P	P	P	P	P	P	P	P	C	P	P	P	P	P		X	P	P	P	C	P	P	C	P
Cogent	P	P	P	P	P	P	P	P	P	P	P	P	P	P	X		C	P	C	P	P	P	P	P
ChinaT	P	P	P	C	P	P	P	P	P	P	P	P	P	P	P	C		P	P	P	P	P	P	P
CN2	P	P	C	C	P	P	P	P	C	C	P	C	P	P	P	P	P		P	P	P	P	P	P
ChinaU	P	P	P	C	P	P	P	P	P	P	P	C	P	P	P	C	P	P		P	P	P	P	P
SingTel	P	P	P	P	D	P	C	P	C	P	P	P	P	P	C	P	P	P	P		P	P	P	P
RETN	C	P	C	C	D	P	P	C	P	C	P	C	P	P	P	P	P	P	P	P		P	P	P
Vodafofme	P	P	P	P	P	P	P	P	D	P	P	P	P	P	P	P	P	P	P	P	P		P	P
Telstra	P	P	P	P	P	P	C	P	C	P	P	P	P	P	C	P	P	P	P	P	P	P		P
Comcast	P	P	P	P	C	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	

Overall (either family, any region)

	Sparkle	Telixus	NTT	Lumen	TATA	Verizon	Zayo	GTT	Arelion	PCCW	AT&T	DTAG	Orange	Liberty	HE	Cogent	ChinaT	CN2	ChinaU	SingTel	RETN	Vodafo	Telstra	Comcast
Sparkle		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	C	P	P	P
Telixus	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
NTT	P	P		P	P	P	D	P	P	P	P	P	P	P	P	P	P	C	P	P	C	P	P	P
Lumen	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	C	C	C	P	C	P	P	P
TATA	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	D	D	P	P	C
Verizon	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P
Zayo	P	P	D	P	P	P		P	P	D	P	P	P	P	P	P	P	P	P	C	P	P	C	P
GTT	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	C	P	P	P
Arelion	P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	C	P	C	P	D	C	P
PCCW	P	P	P	P	P	P	D	P	P		P	P	P	P	P	P	P	C	P	P	C	P	P	P
AT&T	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P	P	P
DTAG	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	C	C	P	C	P	P	P
Orange	P	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P	P
Liberty	P	P	P	P	P	P	P	P	P	P	P	P	P		P	P	P	P	P	P	P	P	P	P
HE	P	P	P	P	P	P	P	P	C	P	P	P	P	P		X	P	P	P	C	P	P	C	P
Cogent	P	P	P	P	P	P	P	P	P	P	P	P	P	P	X		C	P	C	P	P	P	P	P
ChinaT	P	P	P	C	P	P	P	P	P	P	P	P	P	P	P	C		P	P	P	P	P	P	P
CN2	P	P	C	C	P	P	P	P	C	C	P	C	P	P	P	P	P		P	P	P	P	P	P
ChinaU	P	P	P	C	P	P	P	P	P	P	P	C	P	P	P	C	P	P		P	P	P	P	P
SingTel	P	P	P	P	D	P	C	P	C	P	P	P	P	P	C	P	P	P	P		P	P	P	P
RETN	C	P	C	C	D	P	P	C	P	C	P	C	P	P	P	P	P	P	P	P		P	P	P
Vodafo	P	P	P	P	P	P	P	P	D	P	P	P	P	P	P	P	P	P	P	P	P		P	P
Telstra	P	P	P	P	P	P	C	P	C	P	P	P	P	P	C	P	P	P	P	P	P	P		P
Comcast	P	P	P	P	C	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	P	

Thanks!

Questions? Comments? Stories?

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