The Art of Peering: The Peering Playbook

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DrPeering.net Peering Resources

- Internet Service Providers and Peering
- A Business Case for Peering
- About the White Paper Process
- The Art of Peering - The Peering Playbook
- The Art of Peering - The IX Playbook
- Chief Technical Liaison
- Ecosystems: 95th Percentile Measurement for Internet Transit
- Asia Pacific Peering Guidebook
- Evolution of the U.S. Peering
- Emerging Video Internet Ecosystems
- European vs US Internet Exchange Points
- Internet DataCenter Build vs Buy Decision
- Internet Service Providers and Peering
- Internet Transit Pricing Historical and Projections
- Modeling the value of an Internet Exchange Point
- NANOG History
- Peering: Motivations to Peer
- A Study of 28 Peering Policies
- Peering Simulation Game
- Peering: Top 10 Ways to Contact Peering Coordinators
- Peering: Top 10 Reasons NOT to peer
- Public vs Private Peering - the Great Debate
- The Folly of Peering Ratios
- Top 9 IX Selection Criteria
- Video Internet - The Next Wave of Massive Disruption to the U.S. Peering Ecosystem

All freely available
## Some differences between European and U.S. Model Internet Exchange

<table>
<thead>
<tr>
<th>European IXes</th>
<th>U.S. IXes</th>
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<tbody>
<tr>
<td>1. Are Non-Profit Associations</td>
<td>1. Are Commercial Corporations</td>
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<tr>
<td>2. Have “Members”</td>
<td>2. Have “Customers”</td>
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<td>4. Are Colo-Neutral: Some University Grade Colo</td>
<td>4. Own Financial/Commercial Grade Colo infrastructure</td>
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<tr>
<td>5. Member Meetings and Voting on changes to policies and fees</td>
<td>5. Follow interests of Customers, Stockholders, Employees</td>
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<td>6. Fixed contracts and fees</td>
<td>6. Negotiable Contracts and fees</td>
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<tr>
<td>7. Modest Capital and Operating Budget</td>
<td>7. Large Capital and Operating Budget</td>
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<tr>
<td>8. Low Price</td>
<td>8. High(er) Price</td>
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<tr>
<td>9. 24/7 on-call support</td>
<td>9. 24/7 on-site support w/backup processes</td>
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</tbody>
</table>
U.S. Internet Exchange Point Model

U.S. Colocation Operator operates both colo and peering fabric (one contract)

Colocation space is more valuable with well-populated IX access there (e.g., EQIX Ashburn, PAIX Palo Alto).

U.S. IX/Colo Operator typically for profit.

Strategic differential pricing: Prices set strategically. At steady state they approximate what the market will pay.

Multi-Tenant Building (e.g., InfoMart in Dallas)

U.S. IX may be spread across multiple colocation facilities interconnected with fiber, but typically this is limited to their own colo facilities within a single metro area.

Colocation Provider/IX Operator pays for IX switch(es), fiber between and within their own facilities, then resells fiber capacity to customers in their buildings for private peering.

IXes across U.S. primarily compete, cooperate only when customers push for it (e.g., GFF replaced IX mtgs)

Small amounts of public peering traffic (10s of Gbps publicly peered at the larger IXes)

Much more private peering.

Traffic stats typically private

When multiple U.S. colo operators cohabitate in a multi-tenant building, there are sometimes conflicts getting inter-colo interconnections, since both competing colo operators have to agree to their respective customers interconnecting.

Physical cross connects comparably expensive ($250/mo) within U.S. Colocation centers.

Only colocation operators can run cross connects.

The costs of private peering between two IX buildings (owned by the same IX Operator) are borne by the ISP. This makes the more densely populated colo more valuable and sought after since in-building cross connects are generally less expensive than inter-building circuits.

Exceptions: The Seattle Internet Exchange (SIIX) is perhaps the largest IX that more closely resembles the European model. It is housed in the Westin building in Seattle, and is run on a shoe string budget by and for its membership. It is the chief competitor with PAIX Seattle. There are a few other smallish non-commercial IXes in the U.S. and Canada.
European Internet Exchange Point Model

**European IX Colocation Neutrality**
- IX customers can choose colocation facility that meets their facilities needs.

**European IX Operated by formal Association**
- Typically founded by a set of ISPs.
- Prices approximate cost.
- Everyone pays the same published fees.

**European IX Operator is typically a not-for-profit organization.**

**Colo1**
- IX Switch
- IX Cust

**Colo2**
- IX Cust
- IX Switch

**Colo3**
- IX Cust
- IX Switch

**Colo4**
- IX Cust
- IX Switch

**European IXes spread across multiple colocation facilities interconnected with fiber**
- In the “classic LINX model”, the Colocation Provider may subsidize or pay for elements of having the IX within their facilities (e.g. space, power, fiber, equipment costs, etc.)

**Q:** Why does colo operator pay for IX to be in building?
- A: Colocation space more valuable with IX access there.

See “Value of an Internet Exchange” article for discussion of IX value.

**Colo1**
- Massive amounts of public peering traffic (the largest have several 100s of Gbps of publicly peered traffic)
- Traffic stats are public at Euro-IX

**Colo4**
- Physical cross connects relatively inexpensive (maybe $1000 non-recurring install fee) within building.
- In some cases, ISPs can run their own wires depending on Colocation Operator rules

**Colo2**
- IX Cust
- IX Switch
Research “The Art of Peering”

- Follow up to the first three white papers.

Q: When e-mail to peering@<ispdomain>.net generates no response, what do Seasoned Peering Coordinators do?

- Smartest Peering Coordinator: “Tricks of the Trade”
- 20 Tactics successfully used to obtain Peering where you otherwise might not be able to.

Disclaimer: These are NOT recommended tactics…I am simply documenting what has been successfully used in the field to obtain peering.
Graphical Notation of Tactics

To Portray Peering Plays Pictorially…

P?=Peering Request w/ Peering Coordinator

Peering Negotiation

T?=Transit Request To Sales Person

Transit Negotiations

Larger Circle=More Customer Prefixes
Thicker Lines=More Traffic
Transit and Peering Sessions

T=Established Transit Session
(Selling Access to entire Internet)
Size indicates effective size of transport
Supporting the session

P=Established Peering Session
(Reciprocal Access to each others customers)
Size indicates effective size of transport
Supporting the session

Graphical Display of Routing Announcements

Represents “the rest of the Internet”
Traffic over Transit and Peering Sessions

Traffic showed as directed lines

Thickness of line indicates amount of Traffic in relevant direction

Other Variations

P->T = Transition of Relationship

P | T = Either Peering or Transit apply

= Traffic destined anywhere

= Fictitious Traffic

= Packet Loss ridden Traffic

= Traffic destined to green network

= Traffic destined to brown network
The

20 TRICKS OF THE TRADE
Tactic #1) The **Direct Approach** uses peering@<ispdomain>.net, phone calls, face to face meetings, or otherwise direct interactions with Peering Coordinators to establish peering.

P?=Peering Request
To Peering Coordinator(s)

Peering Negotiation

Leading to

Peering Session

{null}

-or-

{“No”,null}
Top 10 ways seasoned Peering Coordinators Contact Target ISP

1. face-to-face at informal meeting in an Internet Operations forum like NANOG, IETF, RIPE, GPF, APNIC, AFNOG, etc.,

2. face-to-face at Commercial Peering Forums like Global Peering Forum (you must be a customer of one of the sponsoring IXes)

3. face-to-face at IX Member Meetings like DECIX, LINX, or AMS-IX member meetings

4. introductions through an IX Chief Technical Liaison or a peer that knows the right contacts via electronic mail,

5. using the pseudo standard peering@ispdomain.net or a personal contact,

6. from contacts listed on an exchange point participant list, or peeringdb registrations,

7. with tech-c or admin-c from DNS or ASN registries,

8. Google for peering contact AS peering,

9. from the target ISP sales force, at trade show or as part of sales process,

10. from the target ISP NOC.
**Tactic #2)**  The *Transit with Peering Migration* tactic leverages an internal advocate to buy transit with a contractual migration to peering at a later time.

Transit Negotiations with Sales leads to Peering

(…if peering prerequisites be met…)
Tactic #3 - The **End Run Tactic** minimizes the need for transit by enticing a direct relationship with the target ISP’s largest traffic volume customers.
Tactic #4  In Europe, the **Dual Transit/Peering** separates the peering traffic from the transit traffic using separate interface cards and/or routers.
Tactic #5  **Purchase Transit *Only* from jerk Tier 1 or Large Tier 2 ISPs** to reduce the risk of being a customer of a potential peer.

Reducing “I already hear your routes for free from a peer”

(One less barrier to overcome during peering negotiations.)
6) **Paid Peering** as a maneuver is positioned by some as a stepping stone to peering for those who don’t immediately meet the peering prerequisites.
Tactic #7 - In the **Partial Transit** tactic, the routes learned at an exchange point are exchanged with the peer for a price slightly higher than transport costs.

Geographically Remote Router

Routing Announcements
Forwarding all customer & Peering Pt Routes (almost peering – maybe costs less)
8) The **Chicken** tactic involves de-peering in order to make the other peer adjust the relationship.

Who will blink first?

A<->B Traffic has to go somewhere
On Wed, Sep 14, 2005 at 01:41:32PM -0400, Joseph Nuara wrote:

> Does anyone know what the story is with Cogent and L3? I noticed that my
> Cogent site (IN NY) is using a path to one of my providers (IN NJ) via
> asia as opposed to the local and preferred L3 peer. After several days I
> was finally told that L3 and Cogent are working through some peering
> negotiations and cogent is moving traffic off their L3 peer in
> anticipation of a depeering (I guess they are trying to avoid the whole
> France Telecom thing that happend last time). Does anyone have a better
> clue as to what is going on and where the negotiations stand?

Unofficial sources say that Level 3 sent a depeering notice to Cogent a
month ago, for a disconnection on either the 15th or the 16th of
September. Based on the fact that Cogent is offering 0 commit ports to any
Level 3 customers they can find (at 50% of their L3 pricing), it looks
like they're preparing to shift as much traffic off as possible, and put
the rest on transit. With any luck (if you're a Cogent or L3 customer at
any rate) they won't be blackholing each other. Guess we'll find out this
week. :)

As for the path through Asia, sounds broken, send the traceroute to
customer support and tell them to get it fixed.
Example in 2005

Cogent Network Status/DNS Server Status Description:
Date: 10/05/2005

Level 3 has partitioned its part of the Internet from Cogent's part of the Internet by denying Level 3's customers access to Cogent's customers and denying Cogent's customers access to Level 3 customers. Level 3 terminated its peering with Cogent without cause (as permitted under its peering agreement with Cogent) even though both Cogent and Level 3 remained in full compliance with the previously existing interconnection agreement.
even though both Cogent and Level 3 remained in full compliance with the previously existing interconnection agreement.

Many Level 3 customers can still exchange traffic with Cogent customers because the Level 3 customer is multi-homed, i.e. it also has a connection to Cogent or to one of the many other networks with which Cogent has a peering relationship. As described below Cogent is offering a solution to Level 3 customers that are not multi-homed.

Cogent will offer any Level 3 customer, who is single homed to the Level 3 network as of October 5, 2005, one year of full Internet transit free of charge at the same bandwidth currently being supplied by Level 3. Cogent will provide this connectivity in over 1,000 locations throughout North America and Europe.

Cogent is committed to an open Internet. The existing interconnection facilities between Level 3 and Cogent remain intact. Cogent hopes that Level 3 will reactivate these connections, restoring a full level of service to their customers.

For more information on Cogent's offer of free Internet transit, please call:
NORTH AMERICA: 1-877-875-4432
EUROPE: +33 (0)1 49 03 19 30
## Internet Health Report

**Generated from 10/5/2005 2:53:21 PM**

**From:** AT&T  |  **To:** AT&T  |  **Metric:** Latency (ms)  |  **Period:** Last 1 Hour

### Destination - Latency (ms) - Last 1 Hour

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<th>Internap</th>
<th>Level3</th>
<th>Qwest</th>
<th>Savvis</th>
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</table>

Re: AW: Cogent/Level 3 depeering

- From: Patrick W. Gilmore
- Date: Wed Oct 05 16:18:50 2005

On Oct 5, 2005, at 12:49 PM, John van Oppen wrote:

I think in all the recent cases, cogent ended up buying transit from verio.

That was the case for access to AOL and Sprint when I turned off my cogent feed a week ago. I think that is also what they did with france telecom but I am not sure on that one as I never checked (I had other transit).

When AOL de-peered Cogent, they got to AOL via Above.Net. But that was a long time ago.

When Teleglobe de-peered Cogent, Teleglobe turned the peering back on. I guess Cogent's attitude of "this hurts you more than me" worked.

When FT de-peered Cogent, Cogent bought (more) transit from Verio.

--
TTFN,
patrick
Tactic 9 & The Nature of Web Traffic

- Asymmetric Traffic

Client (Browser, Peer2peer client) → Small Requests → Service (Web Server, Peer2peer client)

Generate Large Responses
Tactic #9  In the **Traffic Manipulation** tactic, ISPs or content players force traffic along the network path that makes peering appear most cost effective.

CH ISP
i.e. Yahoo!

B hears A’s route ‘for free’ through Peer L

A forces traffic Over B’s transit

1 MONTH LATER
Contact PC-We should Peer!
9b) For Access Heavy Guys… In the **Traffic Manipulation** tactic, Access ISP
a) stop announcing routes, or
b) insert Target AS# into announcement to trigger BGP Loop Suppression to force traffic along the network path that makes peering appear most cost effective.

---

B hears A’s route ‘for free’ through Peer L
A forces traffic Over B’s transit
1 MONTH LATER
Contact PC-We should Peer!
Tactic #10 The **Bluff** maneuver is simply overstating future traffic volumes or performance issues to make peering appear more attractive.

Overstating Traffic Futures “You better peer with me now cause… Lots of transit fees coming otherwise!”

Fictitious Performance Problems
Tactic #11 The **Wide Scale Open Peering Policy** as a tactic signals to the Peering Coordinator Community the willingness to peer and therefore increases the likelihood of being contacted for peering by other ISPs.

From the highest mountain

“We will Peer with Anyone!”

To anyone who will listen!
Tactic #12 The **Massive Colo Build tactic** seeks to meet the collocation prerequisites of as many ISPs as possible by building POPs into as many exchange points as possible.

```
Pacific ——— M ——— C ——— Eastern
TimeZone
```

"Meet us in 3 Time Zones"
Tactic #13 The **Aggressive Traffic Buildup** tactic increases the traffic volume by large scale market and therefore traffic capture to make peering more attractive.

Cheap Transit for sale
“${\text{belowCost}}$/Mbps!”
Tactic #14 **Friendship-based Peering** leverages contacts in the industry to speed along and obtain peering where the process may not be in place for a peering.

Forums to meet Peering Coordinators
GPF
NANOG
APRICOT
RIPE
IETF
Tactic #15 The **Spam Peering Requests** tactic is a specific case of the **Wide Scale Open Peering** tactic using the exchange point contact lists to initiate peering.
Tactic 16 - The Honey Approach

• “Easier to lure flies with honey…than with Vinegar”
• Publicly promote the attractiveness of Peering with the candidate.
• Example: Yahoo!
  – Policy=“Yes”, millions of streaming hours
• Example: Rogers
  – 650K Internet subs, 2.3M cable subs
  – Largest Cable company in Canada
Tactic 17 Purchasing Legacy Peering provides an immediate set of peering partners.
18) The **Bait and Switch** tactic leverages a large corporate identity to obtain peering even though ultimately only a small subset or unrelated set of routes are actually announced.

```
  A -- P? -- B
  
  A --- P? --- B
  
  A --- P --- B
```

New Startup Subsidiary
19) The **False Peering Outage** tactic involves deceiving an ill-equipped NOC into believing a non-existing peering session is down.

\[ A_{NOC}: \text{Hey – Emergency!} \]
\[ A_{NOC}: \text{Our Peering Session with you Went Down!} \]
\[ B_{NOC}: \text{Strange. <looks on router> I don’t see it configured.} \]
\[ A_{NOC}: \text{It was. Don’t make me escalate to <famous person>} \]
\[ B_{NOC}: \text{Ah – I bet is was that last config run that trashed it.} \]
\[ B_{NOC}: \text{Give me a few minutes to fix it on both ends.} \]
20) The **Leverage Broader Business Arrangement** takes advantage of other aspects of the relationship between two companies to obtain peering in exchange for something else.
Summary

• These are the “Tricks of the Trade”

• Copies of the “Art of Peering: The Peering Playbook” are freely available
  – Send e-mail to wbn@drpeering.net or
  Or <google for “William B. Norton”>

100+ pages of Internet Peering research freely available at http://DrPeering.net