

# 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

## European IXes

1. Are Non-Profit Associations
2. Have “Members”
3. Run best quality Switches
4. Are Colo-Neutral: Some University Grade Colo
5. Member Meetings and Voting on changes to policies and fees
6. Fixed contracts and fees
7. Modest Capital and Operating Budget
8. Low Price
9. 24/7 on-call support

## U.S. IXes

1. Are Commercial Corporations
2. Have “Customers”
3. Run best quality Switches
4. Own Financial/Commercial Grade Colo infrastructure
5. Follow interests of Customers, Stockholders, Employees
6. Negotiable Contracts and fees
7. Large Capital and Operating Budget
8. High(er) Price
9. 24/7 on-site support w/backup processes

# U.S. Internet Exchange Point Model

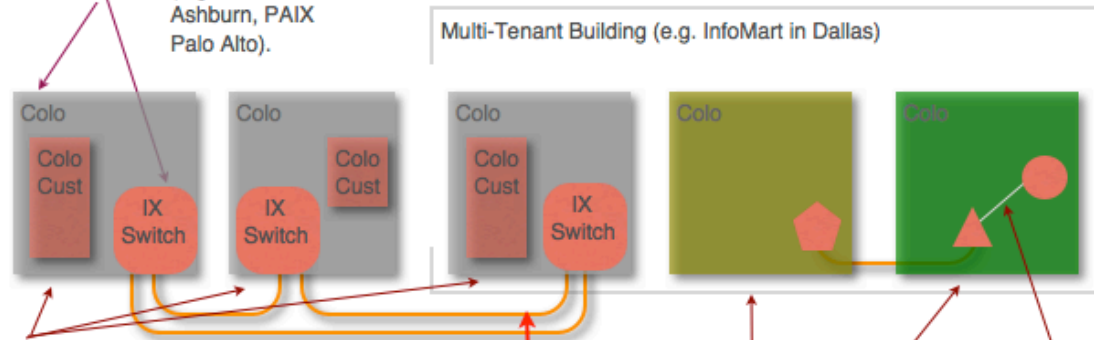
**U.S. Colocation Operator operates both colo and peering fabric**

(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.



**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., GPF replaced IX mtgs)

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

Much more private peering.

Traffic stats typically private

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

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.

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

Only colocation operators can run cross connects.

**Exceptions:** The Seattle Internet Exchange (SIX) 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.

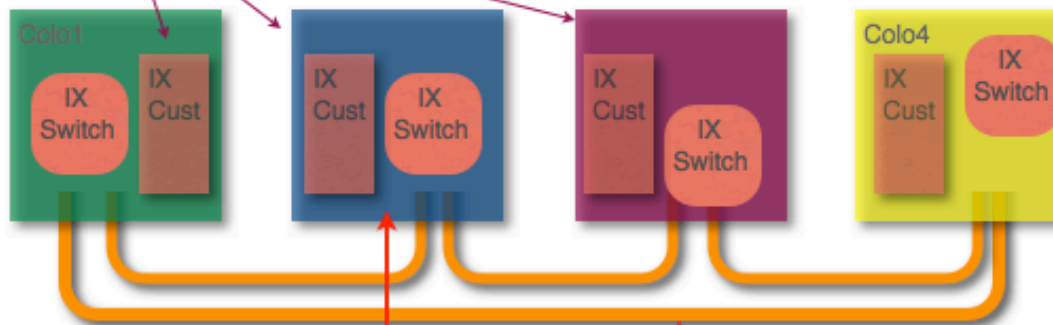
(Separate Contracts with colocation provider and IX Operator)

European IX Operated by formal **Association**, typically founded by a set of ISPs.

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

Prices approximate cost.

Everyone pays the same published fees.



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.

Massive amounts of public peering traffic (the largest have several 100s of Gbps of publicly peered traffic)

Traffic stats are **public** at Euro-IX

IXes across Europe tend to **cooperate** more with each other, and share info. Euro-IX facilitates this. (Competition creeping in now for largest/best European IX.)

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

# 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?

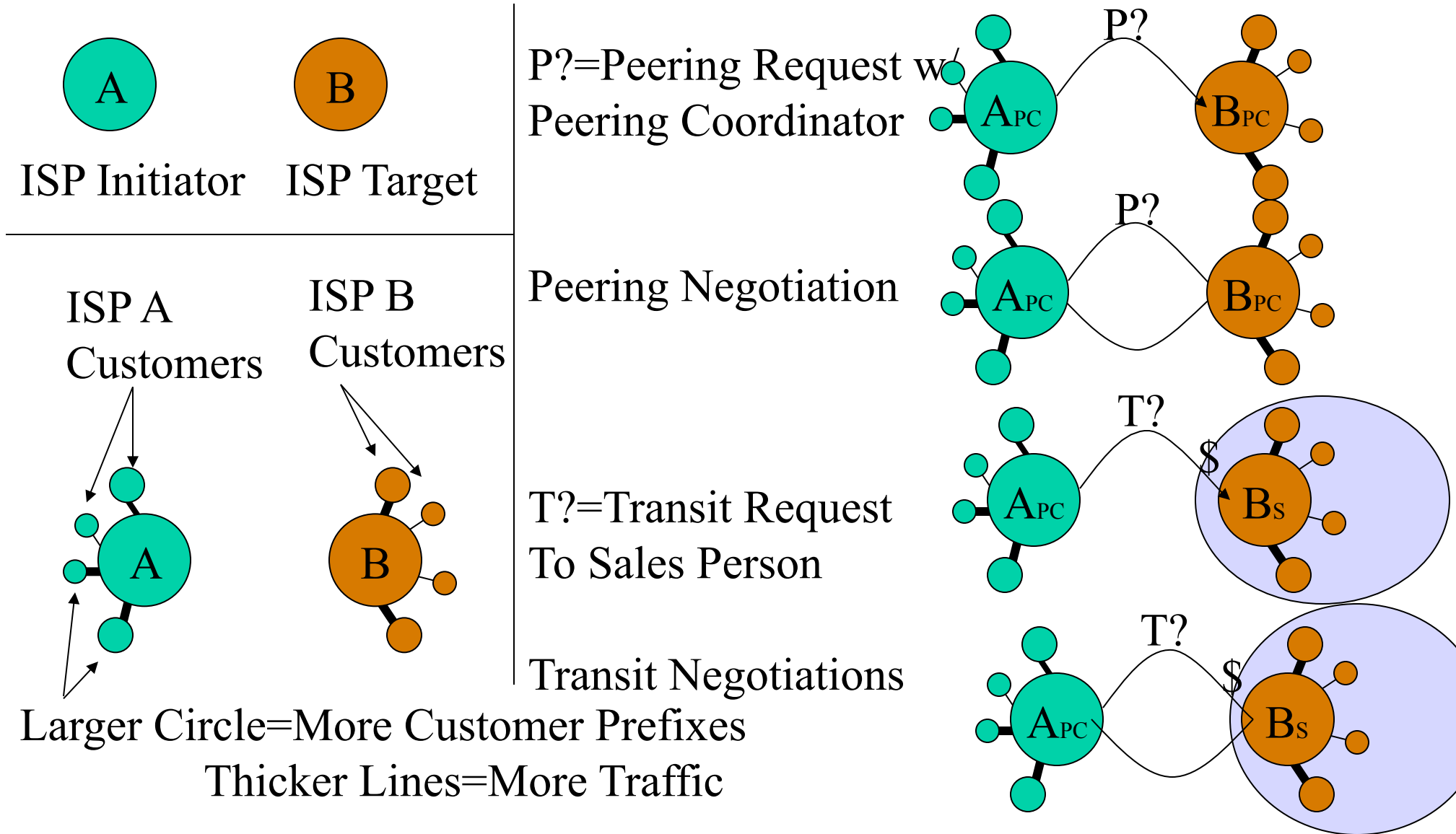
- Smartest Peering Coordinator: “Tricks of the Trade”
- 20 Tactics successfully used to obtain Peering where you otherwise might not be able to.

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

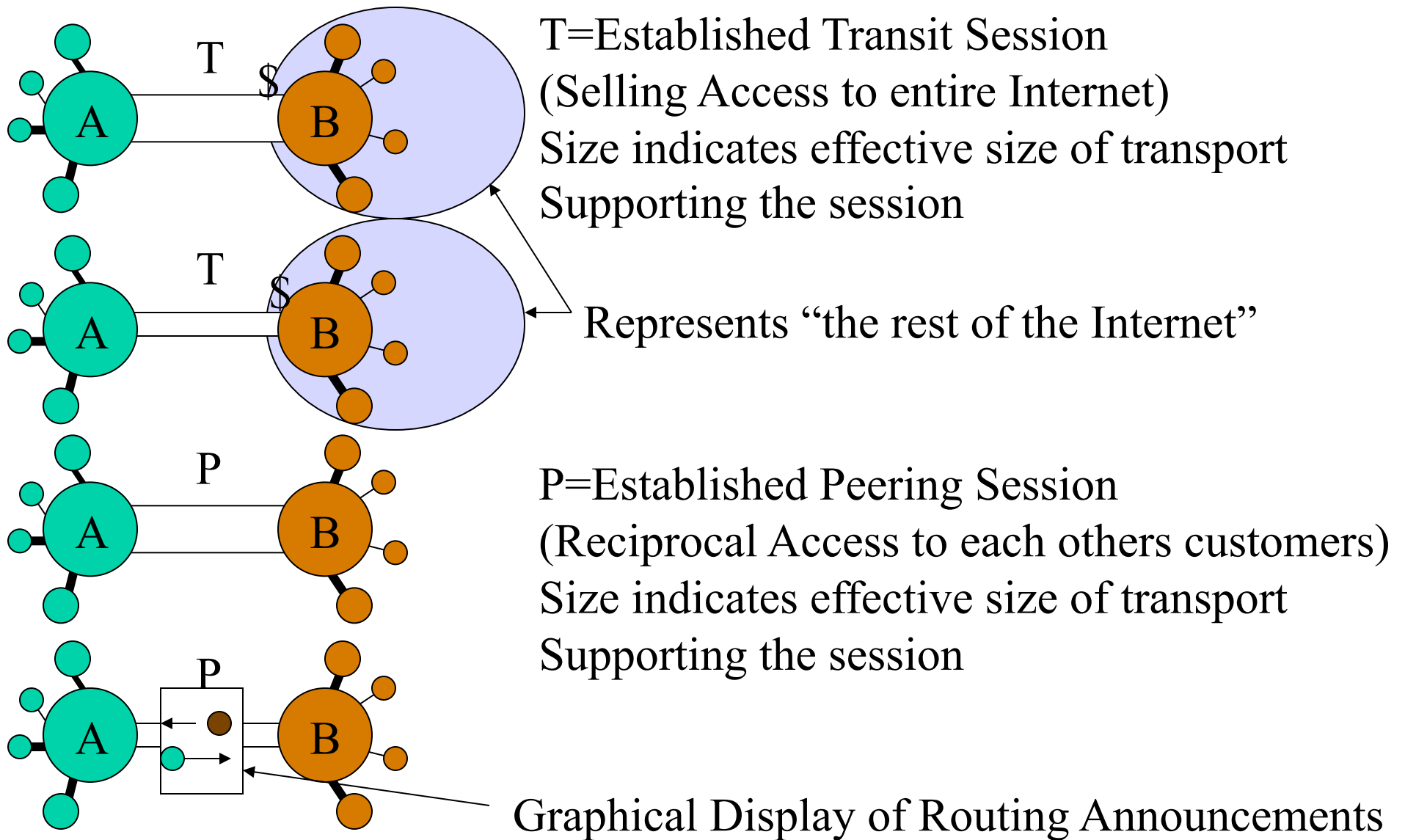
Language.Graphical notation to describe the tactics

# Graphical Notation of Tactics

To Portray Peering Plays Pictorially...



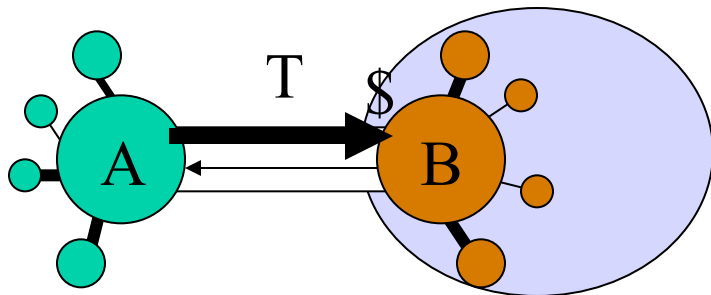
# Transit and Peering Sessions



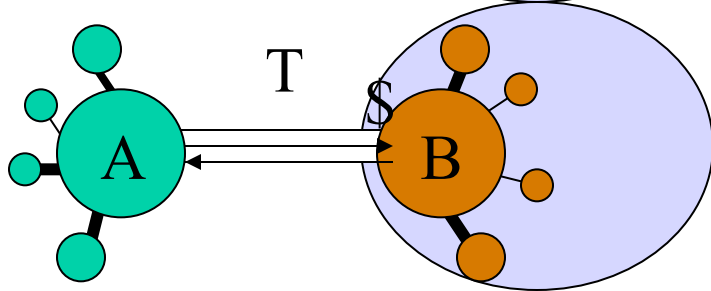


# Traffic over Transit and Peering Sessions

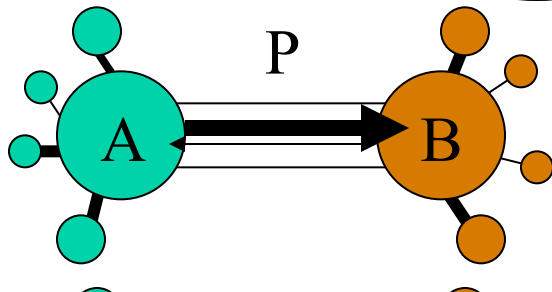
## Sessions



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

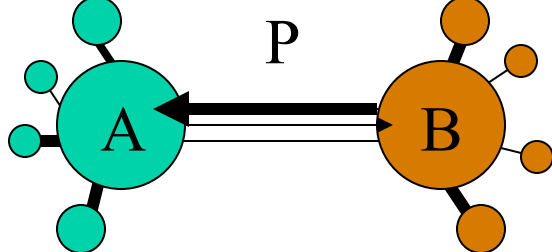
← = Traffic destined anywhere

.....▶ = Fictitious Traffic

- - - ▶ = Packet Loss ridden Traffic

→ = Traffic destined to green network

← = Traffic destined to brown network

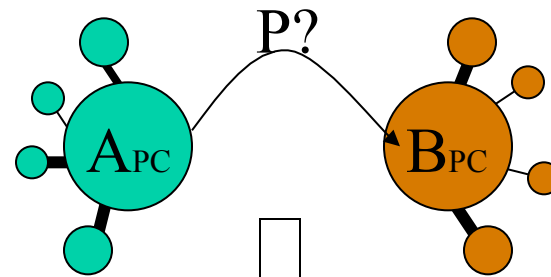


The

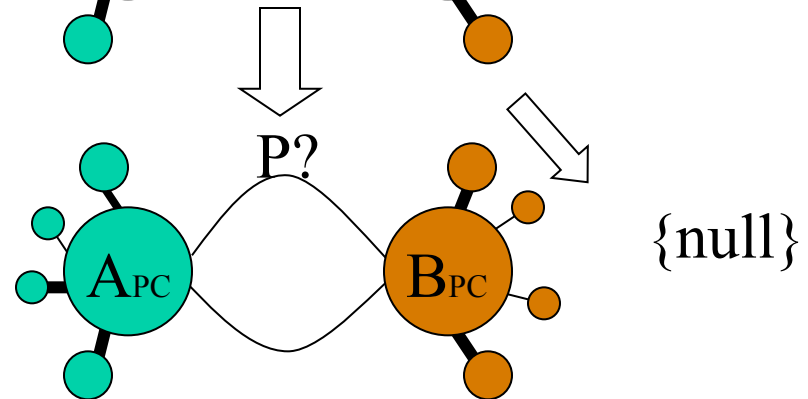
# **20 TRICKS OF THE TRADE**

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)

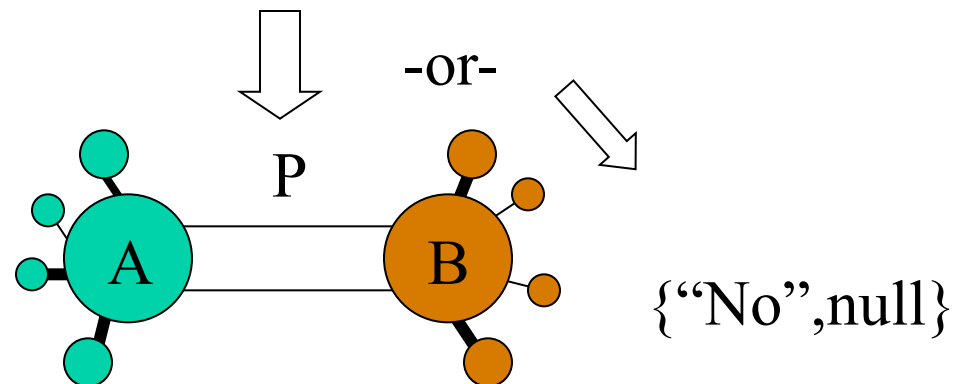


Peering Negotiation



Leading to

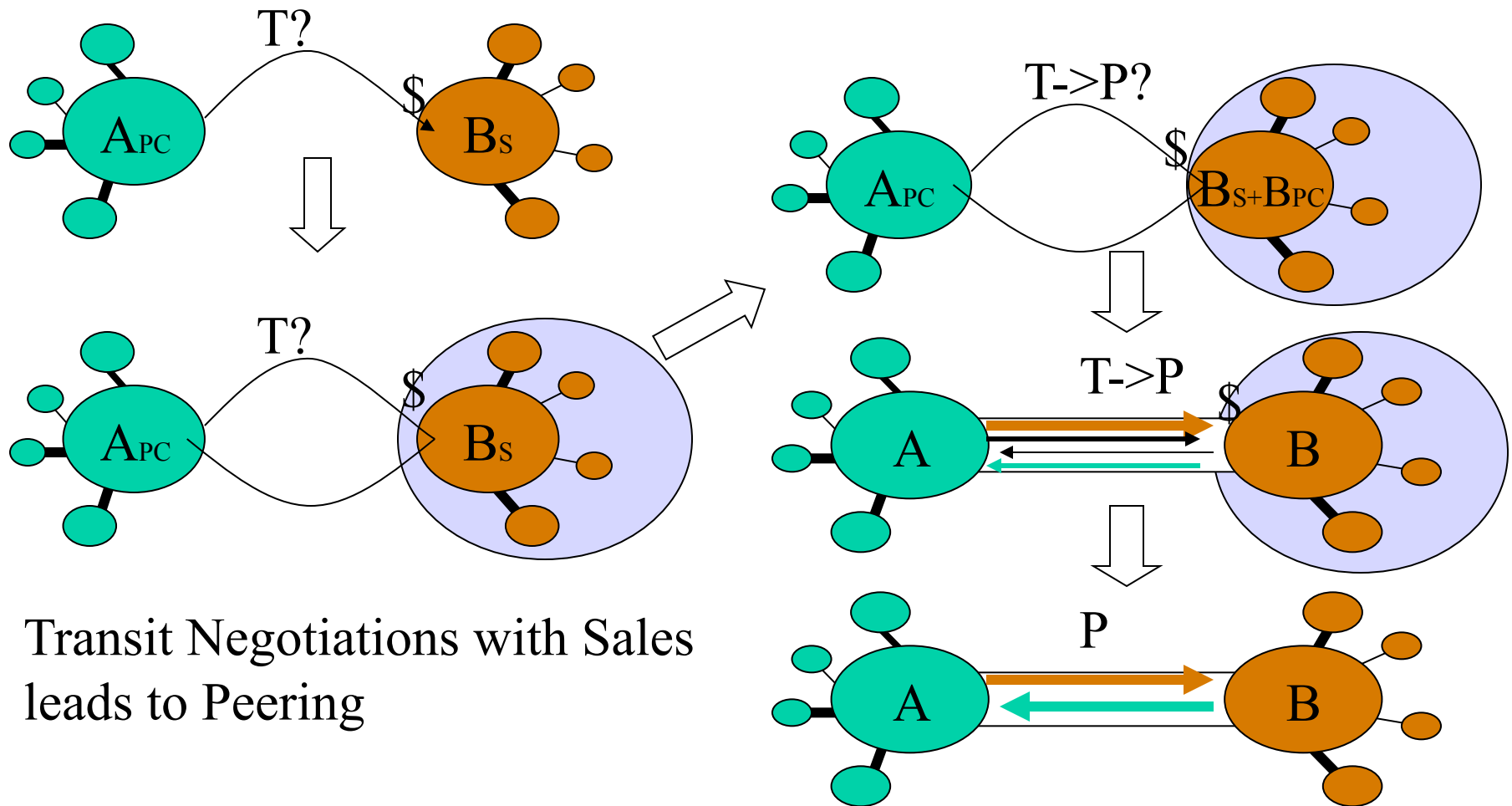
Peering Session



# 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.

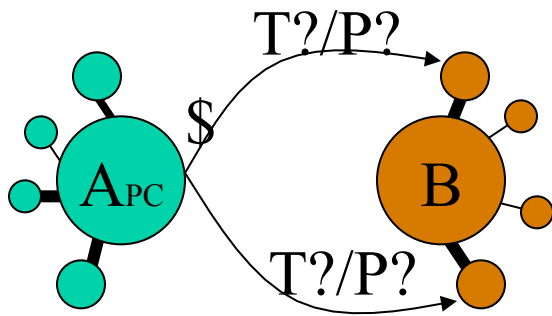
Tactic #2) The **Transit with Peering Migration** tactic leverages an internal advocate to buy transit with a contractual migration to peering at a later time.



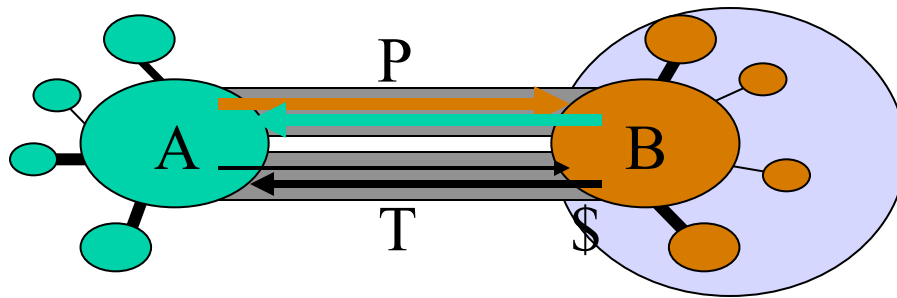
Transit Negotiations with Sales leads to Peering

(...if peering prerequisites be met...)

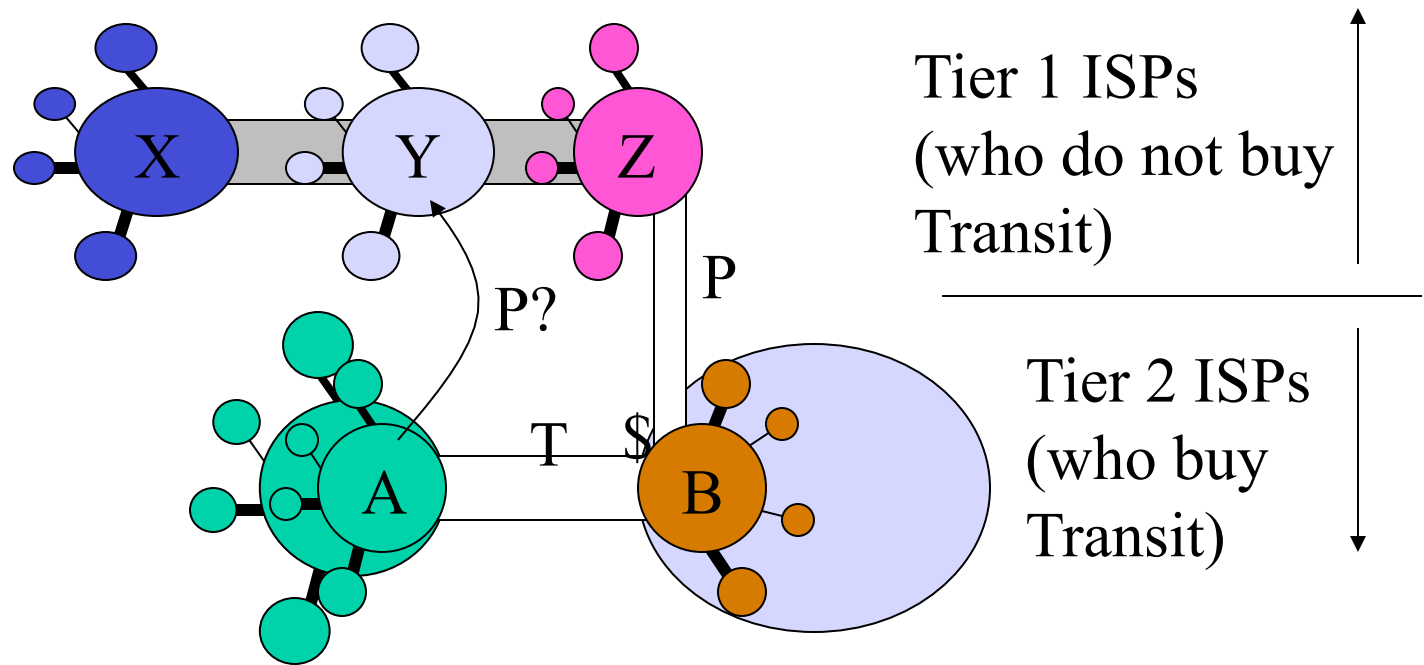
Tactic #3 - The **End Run Tactic** minimizes the need for transit by enticing a direct relationship with the target ISP's largest traffic volume customers.



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.**

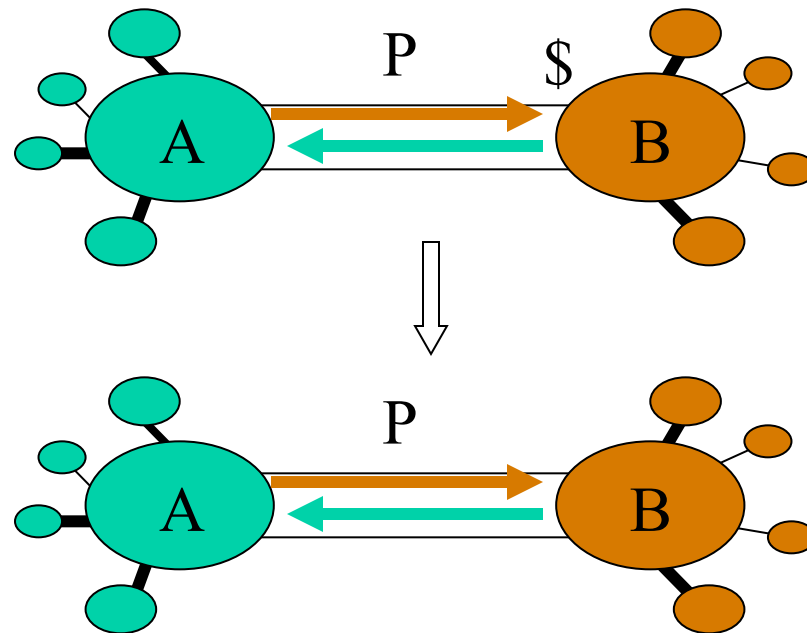


Reducing “I already hear your routes for free from a peer”

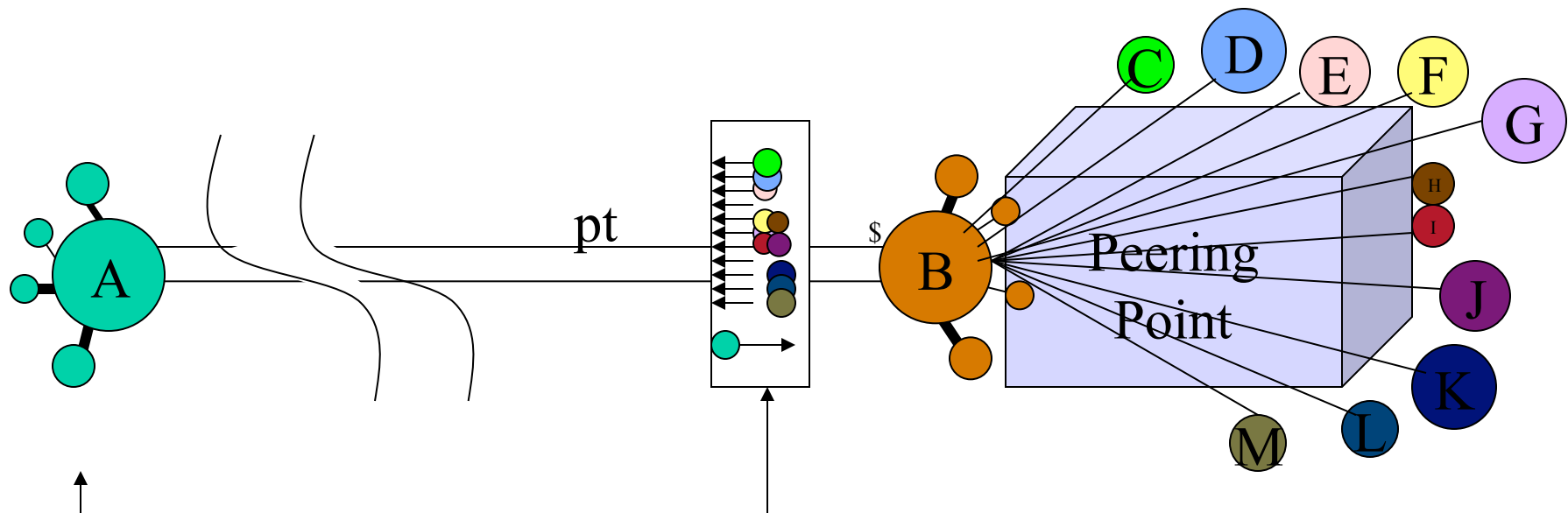
(One less barrier to overcome during peering negotiations.)



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.

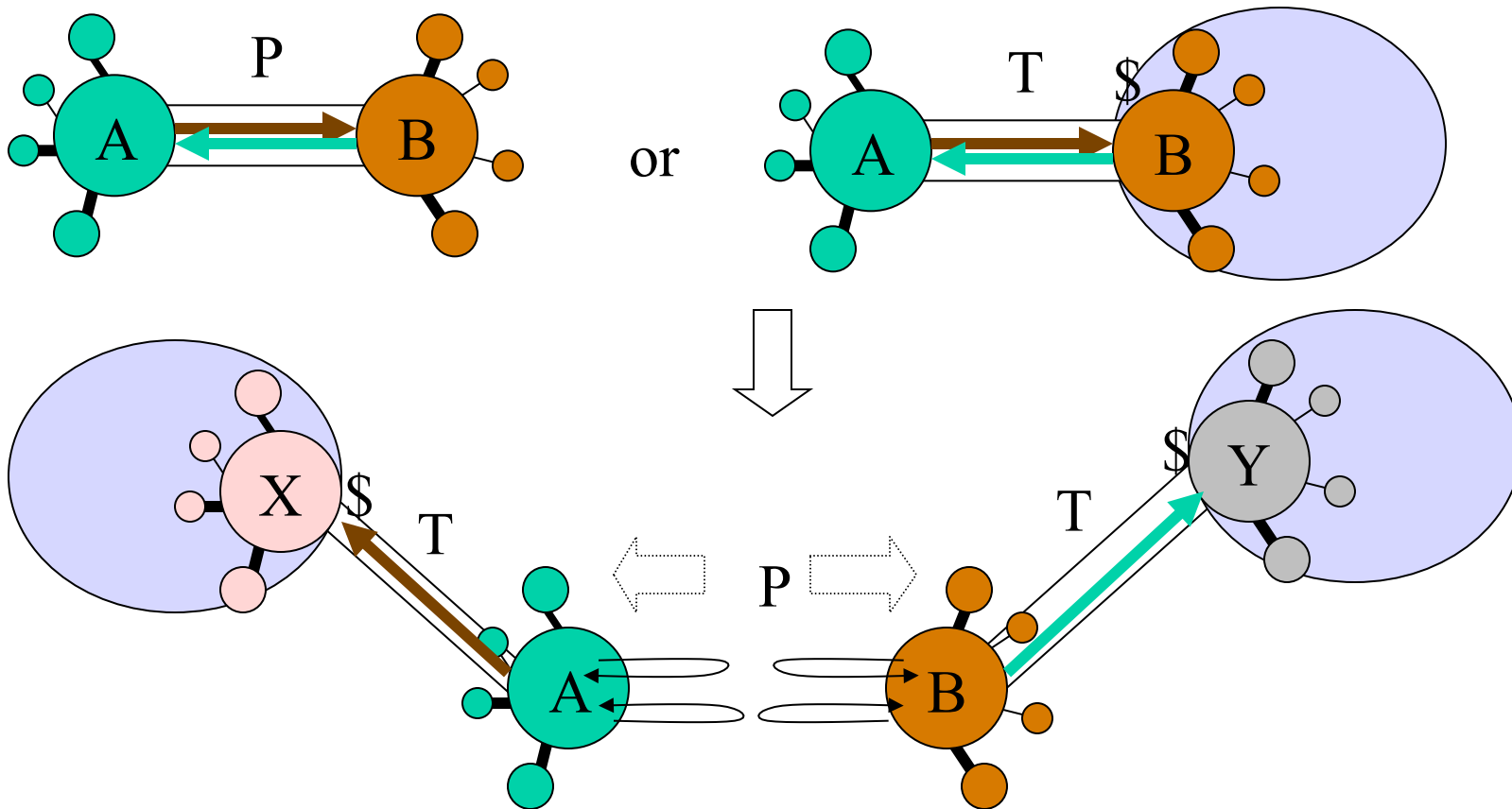


Geographically Remote Router

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 $\leftrightarrow$ 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  
COMMUNICATIONS

Optical Internet

## NETWORK STATUS

```
*****  
** Cogent Network Status Report Last Updated Wed Oct 5 12:45:00 2005 **  
*****
```

**Network Status:** Warning  
**DNS Servers Status:** Normal  
**Dialup/IPASS Status:** Normal  
**Mail Servers Status:** Normal  
**Webservers Status:** Normal

### **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.

### What tactic is this?

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

[up for email alerts](#) | [Monitor your performance](#)

From:  To:  Metric:  Period:

Destination by Origin

Metrics by Origin

Destination - Latency (ms) - Last 1 Hour

! abc	AT&T	Cogent	Internap	Level3	Qwest	Savvis	SBC	Sprint	UUNet	Verio	WilTel	XO
AT&T	35	66	40	41	40	38	42	40	40	35	36	38
Cogent	64	67	54	NA	57	28	37	57	57	103	40	51
Internap	39	60	65	40	48	37	40	35	47	55	43	46
Level3	41	NA	40	40	52	25	30	35	45	46	41	43
Qwest	40	54	48	52	48	38	39	40	46	47	42	48
Savvis	38	28	34	25	38	22	25	26	38	56	26	43
SBC	42	41	39	30	38	25	33	39	43	37	25	40
Sprint	41	51	36	35	40	27	38	35	38	50	33	46
UUNet	40	57	46	44	46	38	42	37	46	50	41	51
Verio	35	100	56	45	46	56	38	50	48	49	36	46
WilTel	35	40	41	41	43	26	25	35	41	38	39	39
XO	39	56	47	42	46	47	40	43	50	49	38	92

<http://scoreboard.keynote.com/scoreboard/Main.aspx?Destination=Level3>

[Date Prev](#) | [Date Next](#) | [Date Index](#) | [Thread Index](#) | [Author Index](#) | [Historical](#)

## Re: AW: Cogent/Level 3 depeering

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

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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.

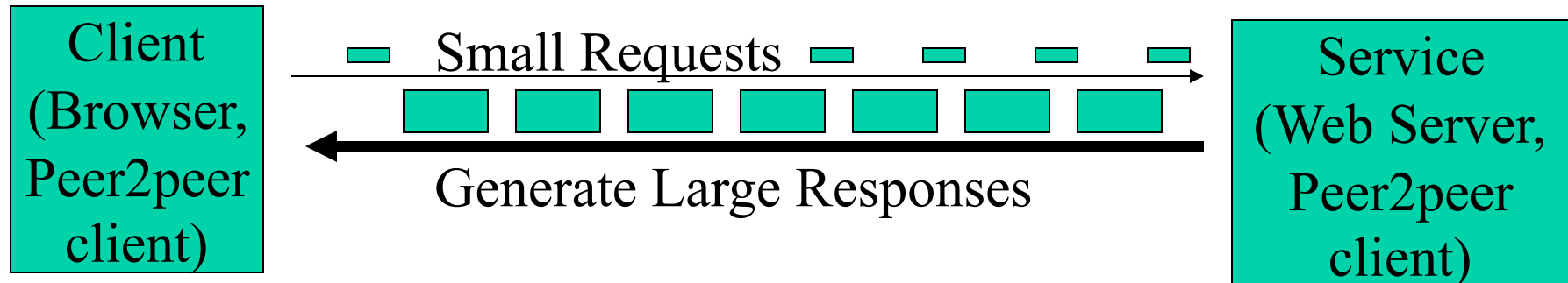
When FT de-peered Cogent, Cogent bought (more) transit from Verio.

--  
TTFN,  
patrick

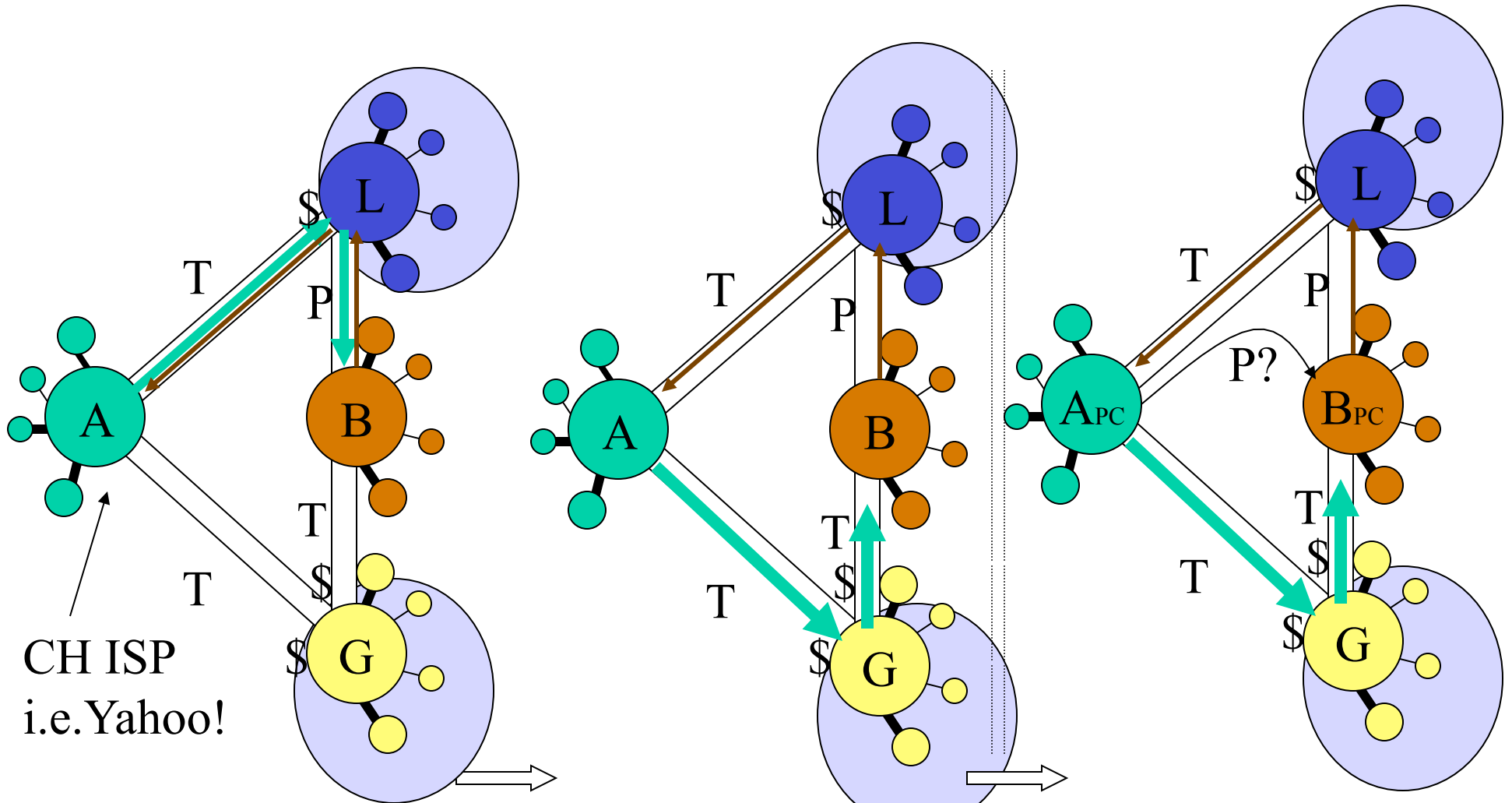


# Tactic 9 & The Nature of Web Traffic

- Asymmetric Traffic



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

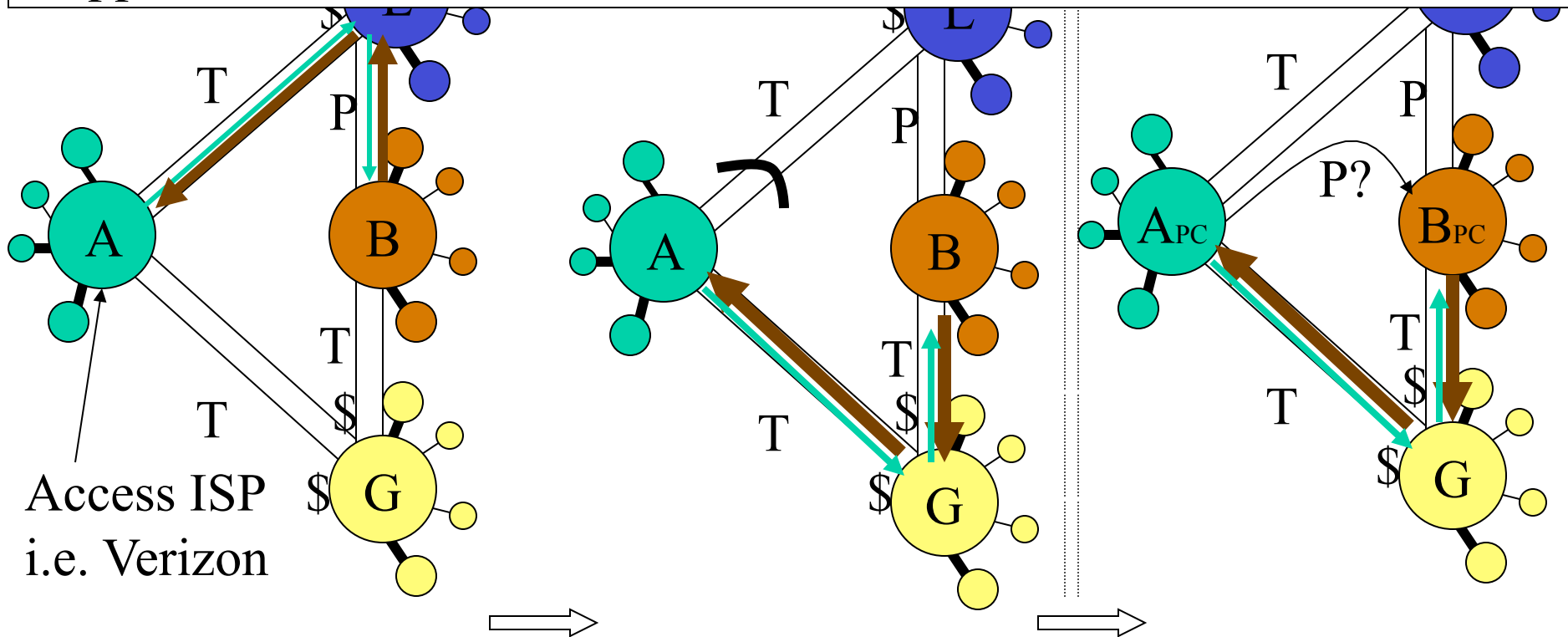
A forces traffic

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

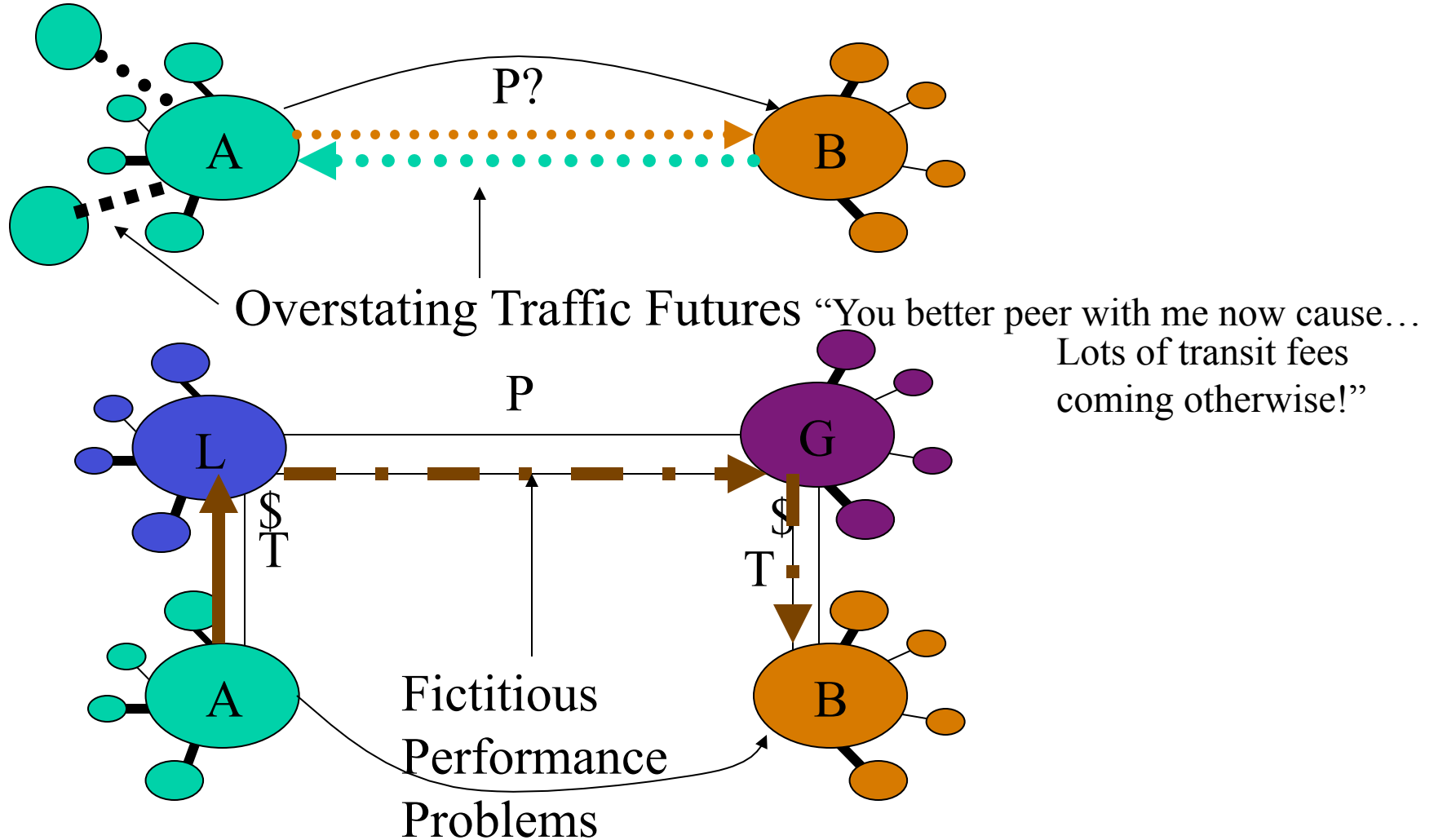
A forces traffic

Over B's transit

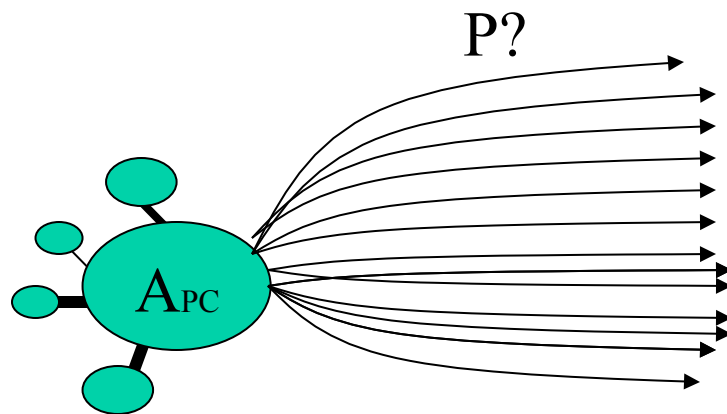
1 MONTH LATER

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.



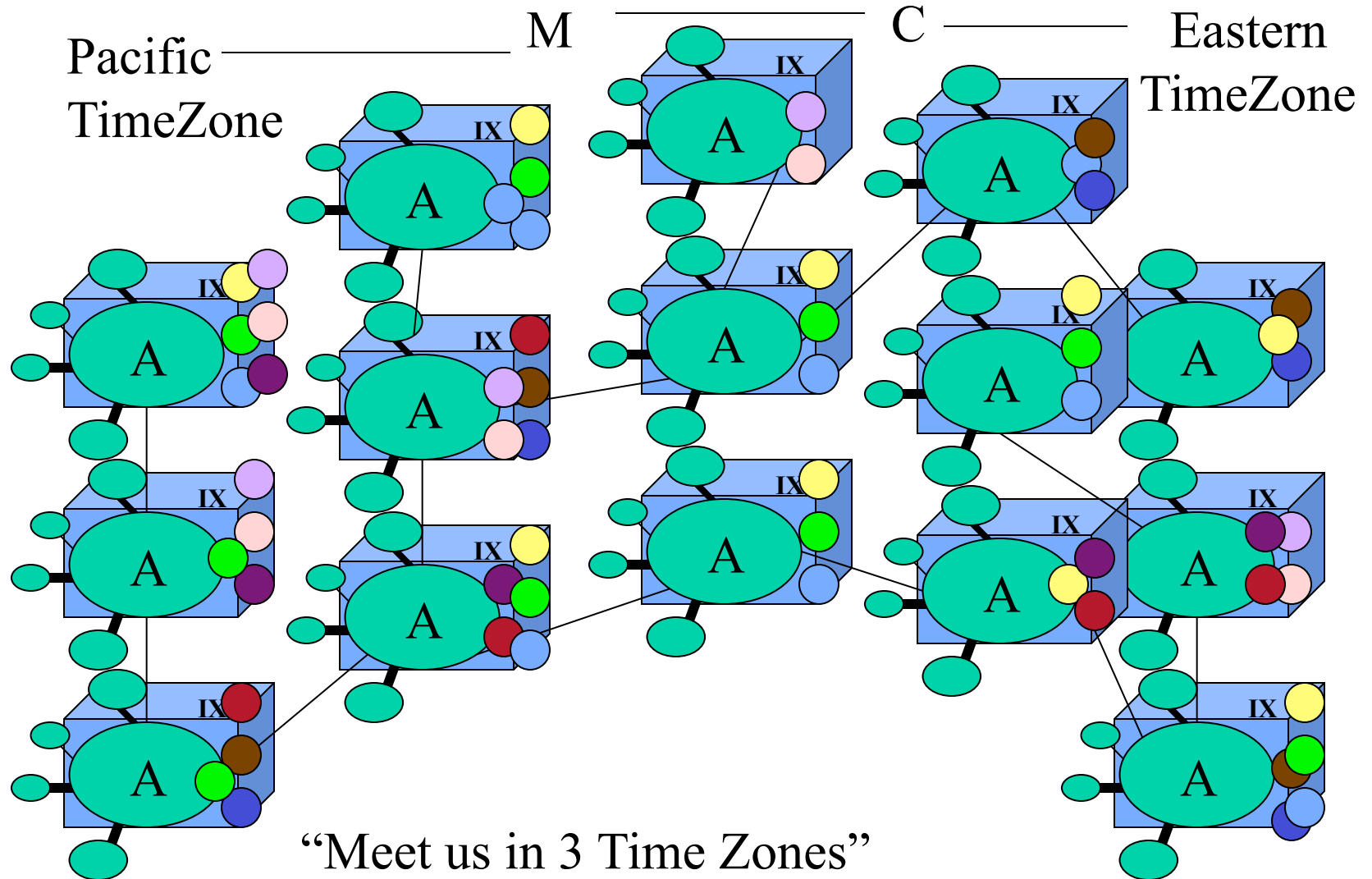
Tactic #11 The **Wide Scale Open Peering Policy** as a tactic signals to the Peering Coordinator Community the willingness to peer and therefore increases the likelihood of being contacted for peering by other ISPs.



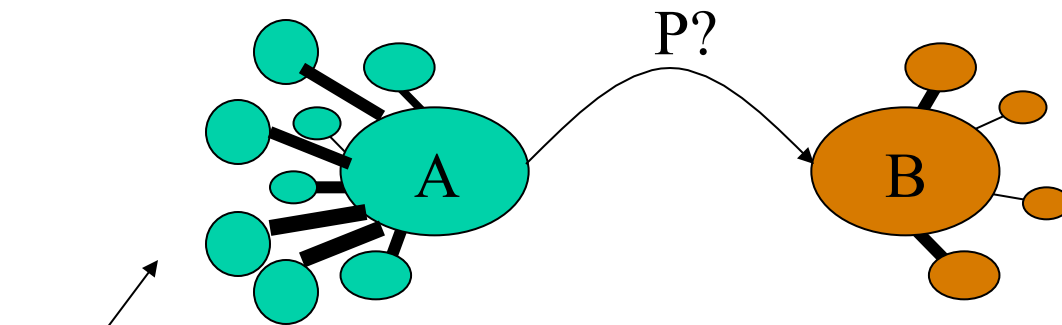
To anyone who will listen!

From the highest mountain  
“We will Peer with Anyone!”

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.

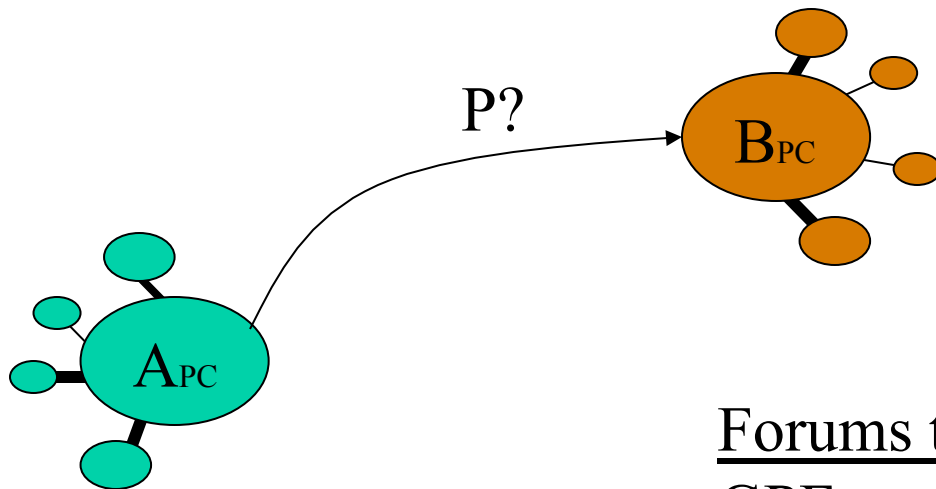


Tactic #13 The **Aggressive Traffic Buildup** tactic increases the traffic volume by large scale market and therefore traffic capture to make peering more attractive.



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

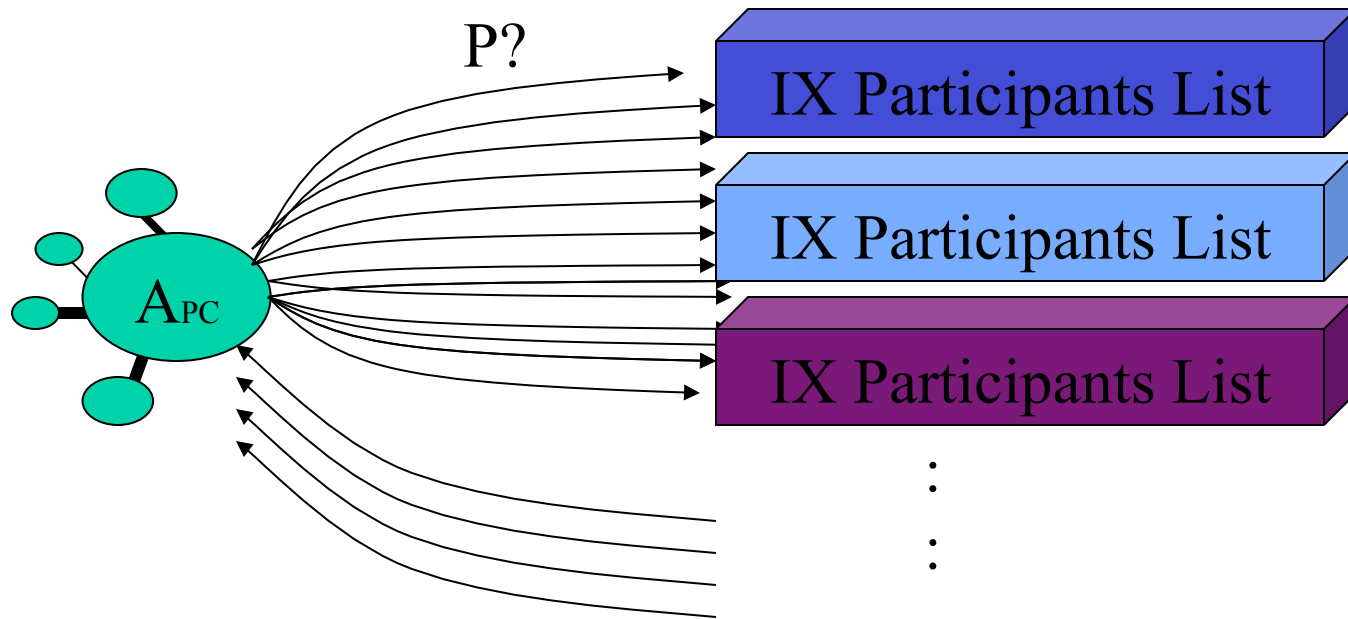
RIPE

IETF

:



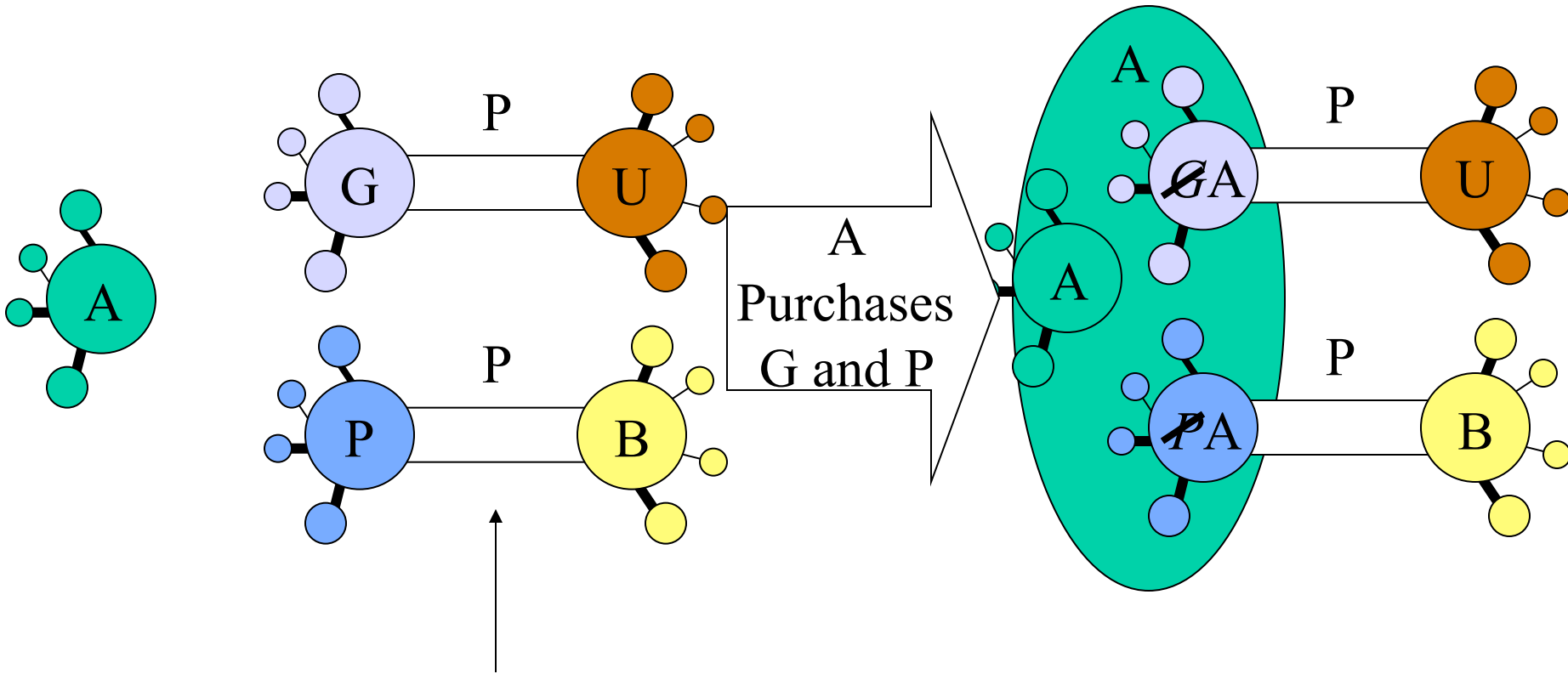
Tactic #15 The **Spam Peering Requests** tactic is a specific case of the **Wide Scale Open Peering** tactic using the exchange point contact lists to initiate peering.



# Tactic 16 - The Honey Approach

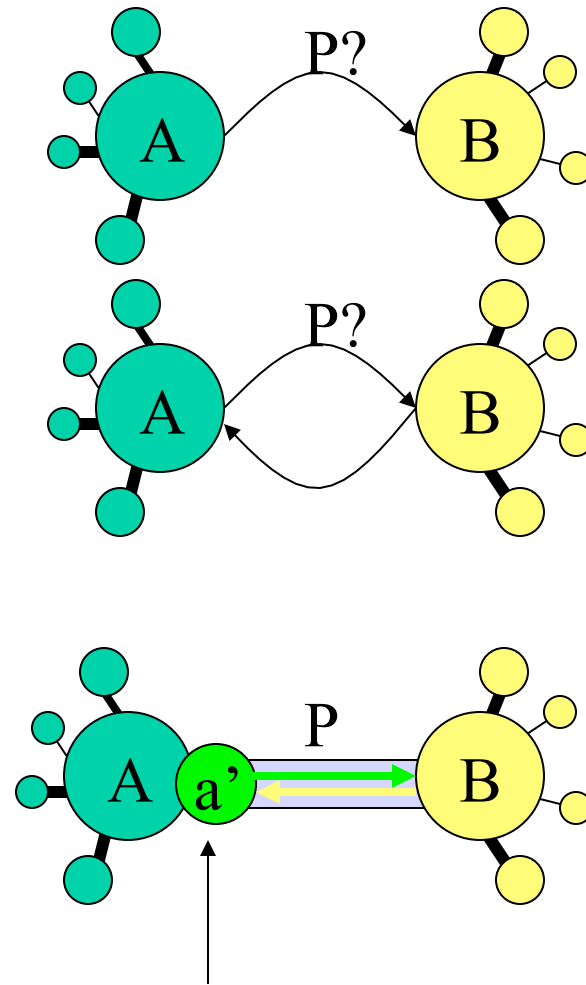
- “Easier to lure flies with honey...than with Vinegar”
- Publicly promote the attractiveness of Peering with the candidate.
- Example: Yahoo!
  - Policy=“Yes”, millions of streaming hours
- Example: Rogers
  - 650K Internet subs, 2.3M cable subs
  - Largest Cable company in Canada

Tactic 17 **Purchasing Legacy Peering** provides an immediate set of peering partners.



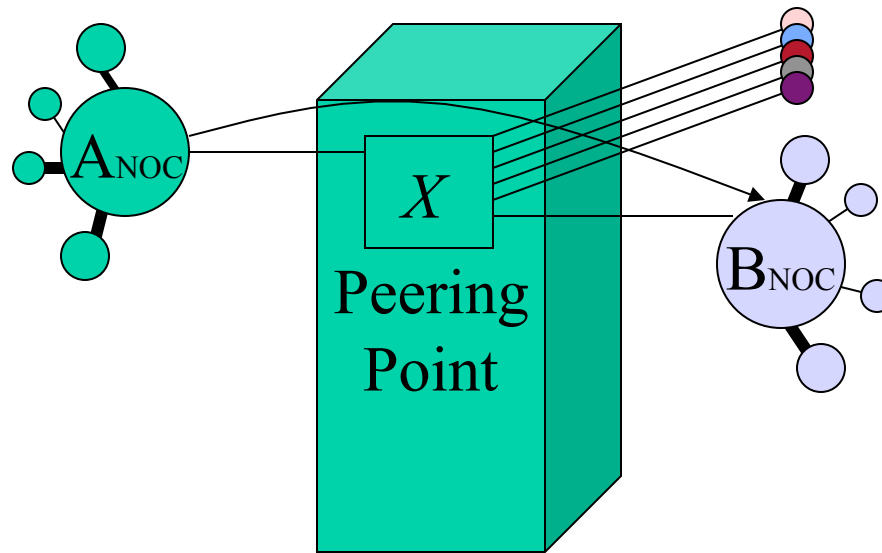
Legacy (early Internet day) Peering

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.



New Startup Subsidiary

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



$A_{\text{NOC}}$ : Hey – Emergency!

$A_{\text{NOC}}$ : Our Peering Session with you Went Down!

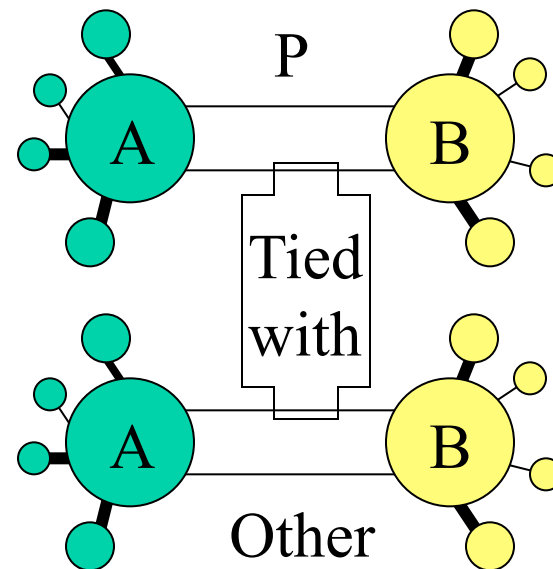
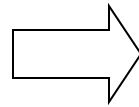
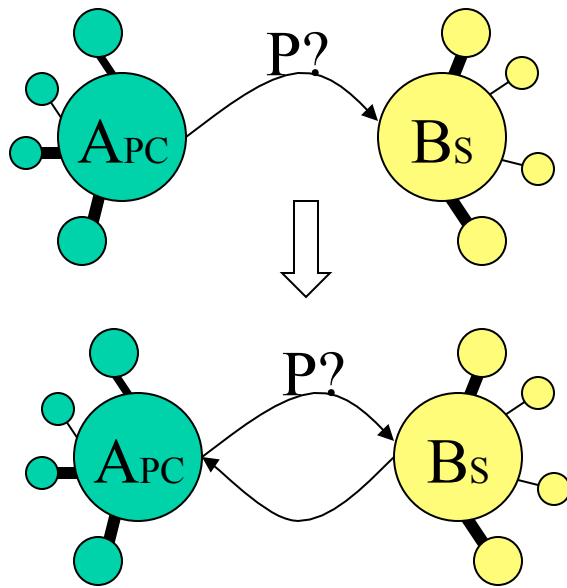
$B_{\text{NOC}}$ : Strange. <looks on router> I don't see it configured.

$A_{\text{NOC}}$ : It was. Don't make me escalate to <famous person>

$B_{\text{NOC}}$ : Ah – I bet it was that last config run that trashed it.

$B_{\text{NOC}}$ : 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.



Peering  
Tied with  
“Other”  
+Fiber deal  
+Dial-in deal  
+Racks  
+Transport  
+Strategic deal  
:

# 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](mailto:wbn@drpeering.net) or
  - Or <google for “William B. Norton”>

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