Exercise peering definitions

The

Peering Simulation Game

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Meet the Presenter

• Started working on Internet (NSFNET) in 1988
• 1998-2008 Co-Founder & Chief Technical Liaison, Equinix Inc. (NSDQ: EQIX)
• 2008-Present - DrPeering, Executive Director
  • Two-day On-Site Peering Workshops (EU/Africa)
• 2013 International Internet Exchange (IIX) CSO
White Paper Process

- Peering=under-documented Internet Operations Topic
- Interconnection Strategies for ISPs
  - “When does peering make sense?”
  - Lunches, document answers, create model, review, stepwise refinement
- Result: White Paper that reflects the community mindset
- 12 white papers --> Book

Freely available on http://DrPeering.net
Agenda

1. Introduce Internet Transit
2. Introduce Internet Peering
3. Peering Simulation Game
1) Internet Transit:  
Connecting to the Edge of the Internet
Internet Transit Service

- Announce Reachability
- Metered Service
- Simple
- “Internet → This Way”
Internet Transit Pricing Model

• Typically metered
  – Priced In $/Mbps (Mega-bit-per-second)

• Volume (Mbps) measured at 95th percentile

• Definition: The 95th Percentile Measurement Method (also called 95/5) uses a single measurement (the 95th percentile 5 minute sample for the month) to determine the transit service volume for monthly transit fee calculation.
95th Percentile Billing Calculation

- 5 minute samples
- Month of deltas
- 95th percentile
- Max(in,out)
- Origin of 95th?

Internet Transit Billing Calculation (95th Percentile Measurement)

Metered Internet Transit Service

Upstream (Transit) Provider

5 minute samples

\[ t_0 \]
\[ : \]
\[ t_n \]

End Of Month Sort

95th Percentile sample (Mbps)

\[ * \text{ Internet Transit Price ($/Mbps)} \]

\[ = \text{ Monthly Cost of Internet Transit} \]
Internet Price Declines (U.S.)

- “Can’t go lower”
- “No competition”
- Pricing varies widely
- Trend unmistakable

<table>
<thead>
<tr>
<th>Year</th>
<th>Price per Mbps</th>
<th>% Decline</th>
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<tbody>
<tr>
<td>2013</td>
<td>$1.57</td>
<td>33%</td>
</tr>
<tr>
<td>2014</td>
<td>$0.94</td>
<td>40%</td>
</tr>
<tr>
<td>2015</td>
<td>$0.63</td>
<td>33%</td>
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7 Observations About Internet Transit

1. Simple Service
2. Metered Service
3. Transit Commits and Discounts
4. Contract Terms
5. Is a Commodity
6. Customer-Supplier Relationship
7. May have SLAs (joke)
2) Internet Peering:
Connecting to the Core of the Internet
What is Internet Peering?

- Definition: Internet Peering is the business relationship whereby two companies reciprocally provide access to each others’ customers.
Internet Peering

3 Key Points

1. Peering is not a transitive relationship
2. Peering is not a perfect substitute
3. Peering is typically settlement free
3) Peering Simulation Game
Exercise the Peering Definitions
Apply the definitions

• Strategy Game
• Use the terminology correctly
• Negotiate Peering
• Successful in dozens of fora
• Engaging
• Fun!
The Game Board

ISPs (A,B,C,D)
IXPs (E,W,N,S)

Squares=Traffic
Traffic=Revenue ($2000/square/month)

Pay Transit Fees ($1000/others’ squares/month)
### The Scorecard

**Notes:**
- Can only move adjacent or diagonally
- Hint: Calculate cost of NOT peering vs. Cost of peering
- At end of game we assume all roll a 3 for remaining rolls
- Winner is the ISP will the largest bank account at the end

<table>
<thead>
<tr>
<th>ROUND</th>
<th>PLAYER</th>
<th>Roll</th>
<th># Squares Owned</th>
<th>Revenue (Squares • $2000)</th>
<th>Transit Cost ($1000)</th>
<th>Peering Costs</th>
<th>Net</th>
<th>Running Total</th>
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<td>1</td>
<td>$2,000</td>
<td>($3,000)</td>
<td>$0</td>
<td>($1,000)</td>
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<tr>
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<td>($3,000)</td>
<td>$0</td>
<td>($1,000)</td>
<td>$23,000</td>
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<td>($3,000)</td>
<td>$0</td>
<td>($1,000)</td>
<td>$21,000</td>
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</table>
3 Rules

1. **Goal:** Maximize bank holdings. Make money by acquiring customers and reduce transit costs by peering.

2. **Play:** Roll the dice and expand your network by selecting that many adjacent “squares” of customers.
   - Gain transit revenue of $2000 for each customer square you own.
   - Pay transit fees of $1000 for each square of traffic that **other** ISPs own.

3. If at Exchange Point, two ISPs can negotiate peering:
   - $2000 recurring cost and loss of 2 turns, ISPs negotiate who covers the costs of peering.
Transit Provider X

A rolls 5,
Wants to peer w/B – moves to IXN
Receives revenue on 6 squares (6*$2000)
Pays Transit on others squares (3*$1000)
$12,000 - $3,000 = $9,000

Transit Provider Y
Transit Provider X

A A A A A
A

IXN

B B B B
IXE

Transit Provider Y

X X
IXW

Y Y
IXS

A rolls 5,
Pays Transit on others squares (3*$1000)
Receives revenue on 6 squares (6*$2000)
$12,000 - $3,000 = $9,000

B rolls 3,
Going to IXE
Receives revenue on 4 squares (4*$2000)
Pays Transit on others squares (8*$1000)
$8,000 - $8,000 = $0
Transit Provider X

A  A  A  A  A  IXN  A
A  
A  
A  
X  
IXW  
YC  
C  
C  
C  
C  
C  
C  
D

Transit Provider Y

IXE  
IXF  
Y  
B  
B  
B  
B  
B  
B  
B

C rolls 6,
Can get to IXW, likes IXS
Receives revenue on 7 squares (7*$2000)
Pays Transit on others squares (11*$1000)
$14,000 - $11,000 = $3,000
D rolls 1,
Late entrant heading to IXE
Receives revenue on 2 squares (2*\$2000)
Pays Transit on others squares (17*\$1000)
\$4,000 - \$17,000 = -\$13,000
Scoreboard after Round 1

- ISP A: $9,000
- ISP B: $0
- ISPC: $3,000
- ISPD: -$13,000
Transit Provider X

A rolls 3,
Attaches to IXW

Receives revenue on 9 squares (9*$2000)
Pays Transit on others squares (13*$1000)
$18,000 - $13,000 = $5,000

Wants to peer with C – split costs?
YES: -$1,000 + both lose a turn
Neither has to pay transit to each other!

Transit Provider Y
Transit Provider X

A Position
9 Revenue squares
1 lost turn
Peering w/C
reduced cost $8000/turn

B rolls 6,
Attaches to IXE*IXN
Receives revenue on 10 squares (10*$2000)
Pays Transit on others squares (21*$1000)
$20,000 - $21,000 = -$1,000

Wants to peer with A – split costs?
NO: You pissed me off,
Yes: if $0 & B lose both turns
Both walk away

Transit Provider Y
Let’s play!

WELCOME TO BILLAND

4 ISPs that have never played before

Open Board
$35,000 VC Funding
$25,000 VC Funding – HARD Economic Times

We want to hear your thought process and peering negotiations
Winner - prize
# Play Game

## Game Rules

- **Objective:** Reach the destination square. Points are awarded as follows:
  - 25 points for reaching the destination square.
  - 10 points for each square crossed.
- **Movement:** Roll a 1-6 dice for movement. You can only move horizontally or diagonally.
- **Special Squares:**
  - Red squares: Move to the next square.
  - Blue squares: Move to the previous square.
  - Yellow squares: Match the number rolled.
  - Green squares: Advance three points.
  - Pink squares: Reverse the movement.
  - Purple squares: Stay in place.

## Game Setup

- **Grid:** 6x6 square grid.
- **Players:** Two players.
- **Tokens:** Two tokens for each player.

## Gameplay

1. **Roll the Dice:** Each turn, roll the dice to determine movement.
2. **Move Tokens:** Move tokens based on the dice roll and special squares.
3. **Score Points:** Record points for squares crossed.
4. **Winning Condition:** Reach the destination square first.

## Scoring

- **Points:** 25 points for the destination square, 10 points for each square crossed.

## Conclusion

The game concludes when one player reaches the destination square. The player with the highest score wins.

---

### Example Game

<table>
<thead>
<tr>
<th>Roll</th>
<th>Movement</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Forward</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>Right</td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td>Diagonal</td>
<td>15</td>
</tr>
</tbody>
</table>

---

**Example Score Sheet**

<table>
<thead>
<tr>
<th>Turn</th>
<th>Player</th>
<th>Movement</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td>25</td>
</tr>
<tr>
<td>2</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td>10</td>
</tr>
</tbody>
</table>

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**Final Score:**

- Player A: 85 points
- Player B: 75 points