Exercise peering definitions

The

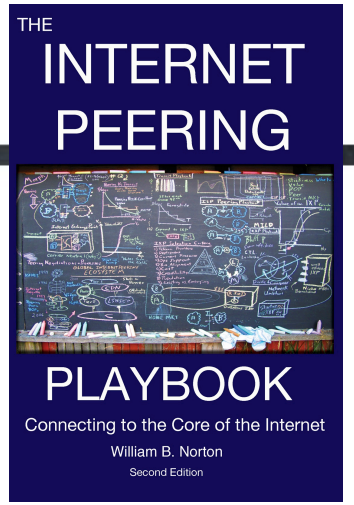
Peering Simulation Game

Meet the Presenter

William B. Norton

- Started working on Internet (NSFNET) in 1988
- 1st "Chairman" of North American Network Operator Group (NANOG) (1994-1998)
- 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

on Amazon.com
DropBox
iTunes

Freely available on
http://DrPeering.net

Agenda

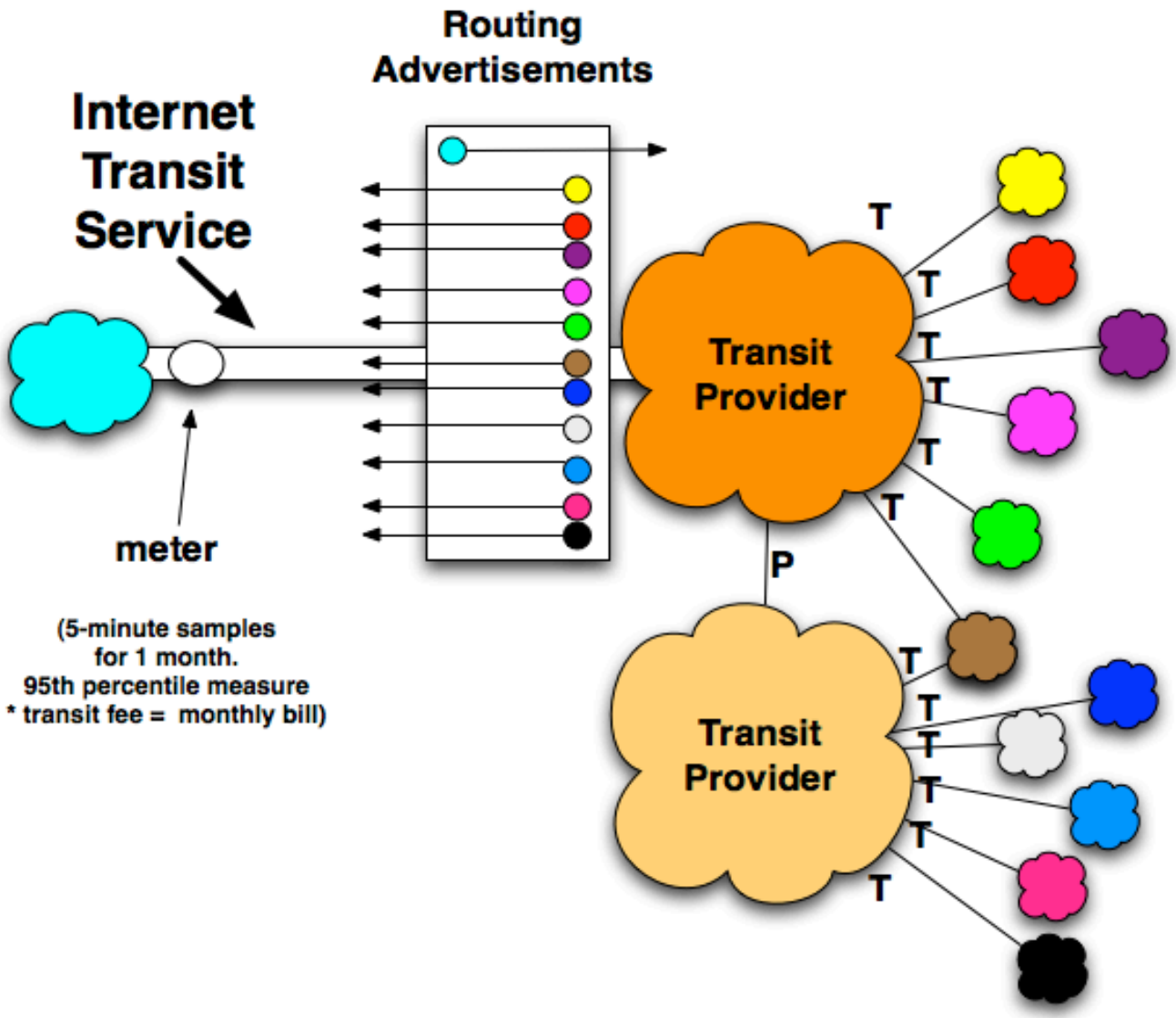
1. Introduce Internet Transit
2. Introduce Internet Peering
3. Peering Simulation Game

1) Internet Transit:

Connecting to the Edge of the Internet

Internet Transit Service

- Announce Reachability
- Metered Service
- Simple
- "Internet→ This Way"



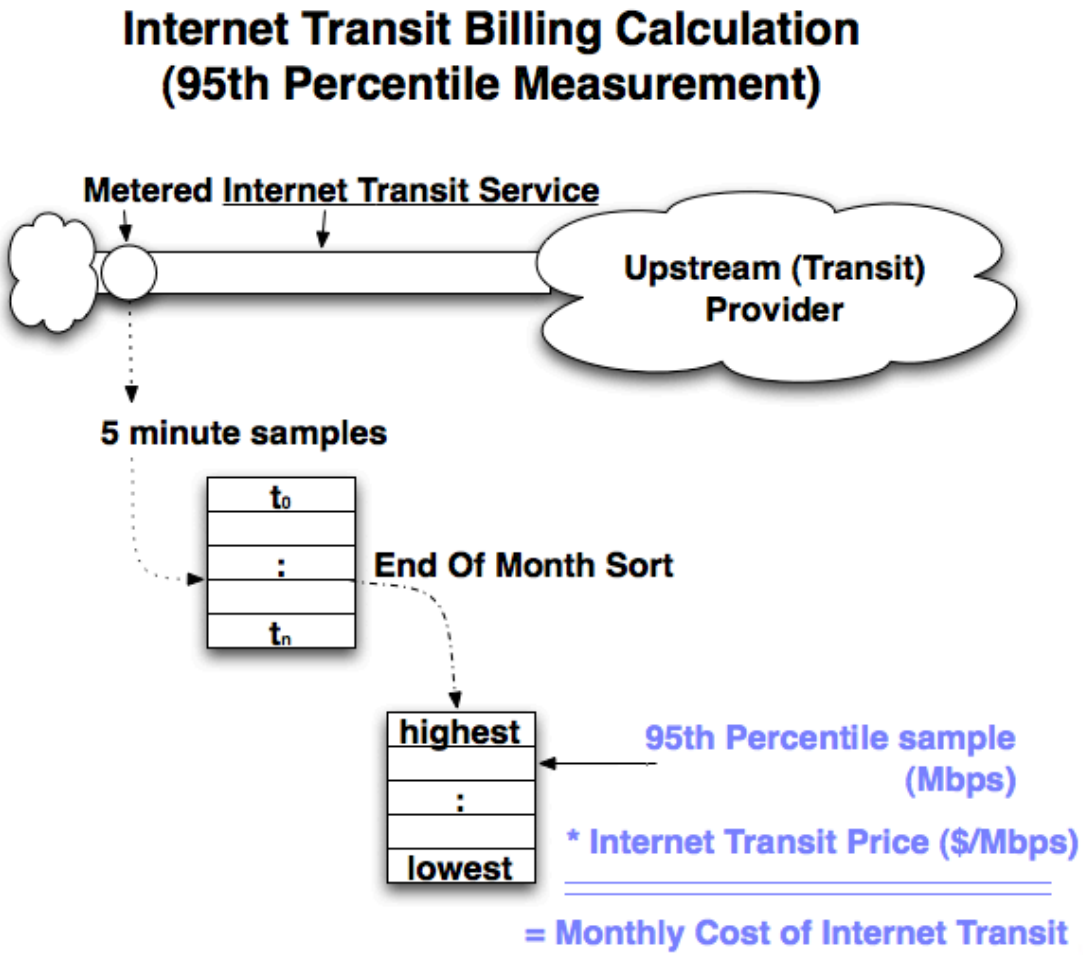
Internet Transit Pricing Model

- 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.

Let's walk through the 95th percentile measure

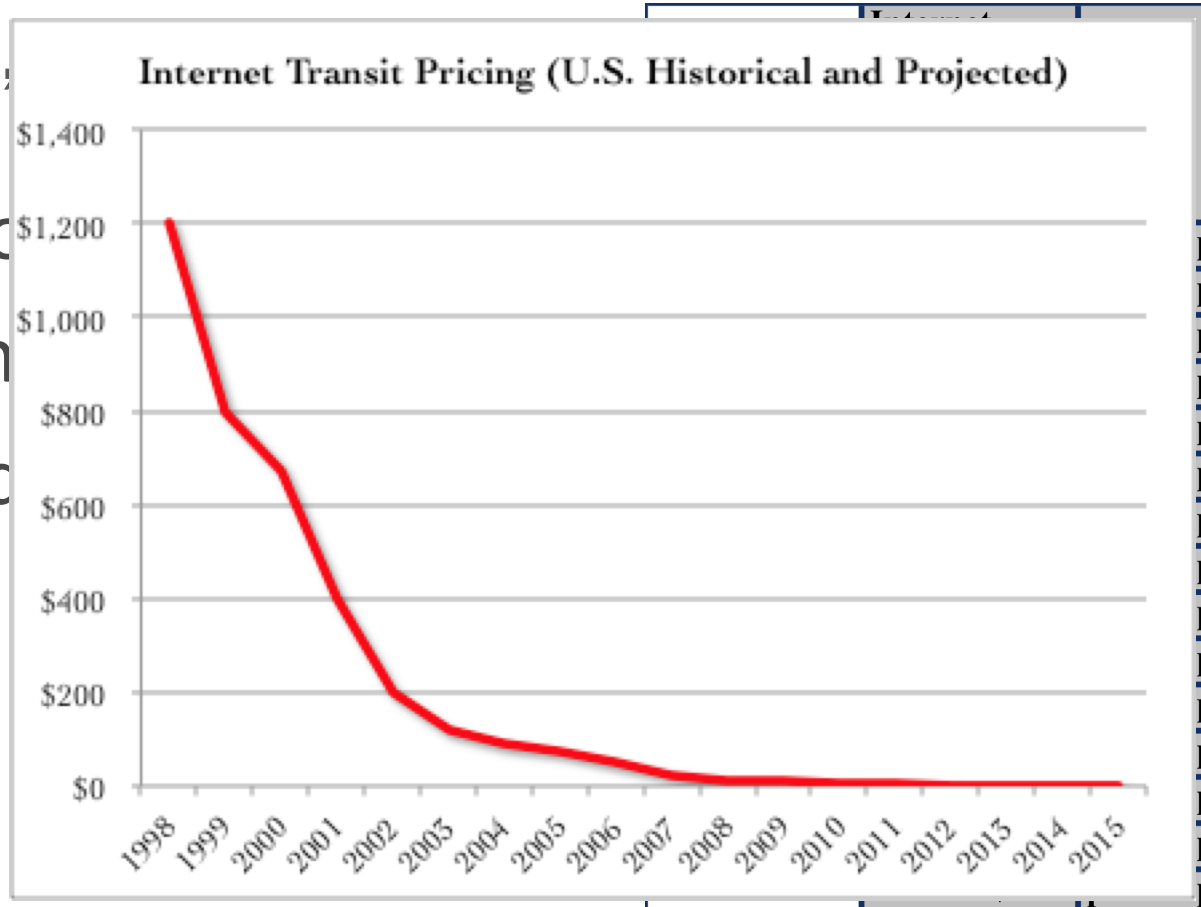
95th Percentile Billing Calculation

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



Internet Price Declines (U.S.)

- "Can
- "No c
- Pricin
- Trenc



			% Decline
		ps	
		ps	33%
		ps	16%
		ps	40%
		ps	50%
		ps	40%
		ps	25%
		ps	17%
		ps	33%
		ps	50%
		ps	52%
		ps	25%
		ps	44%
		ps	35%
		ps	28%
2013	$1.57	per Mbps	33%
2014	$0.94	per Mbps	40%
2015	$0.63	per Mbps	33%

7 Observations About Internet Transit

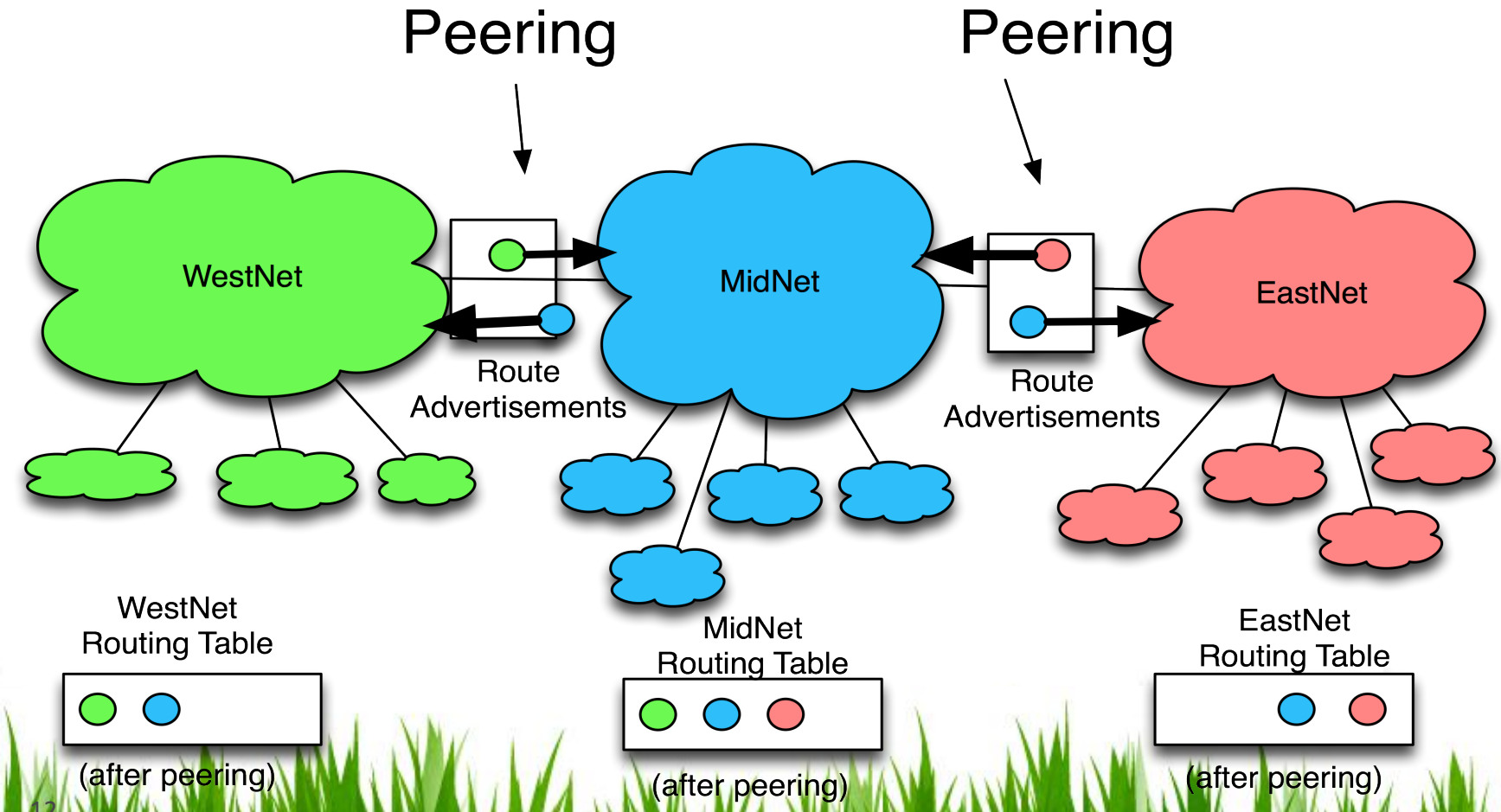
1. Simple Service
2. Metered Service
3. Transit Commits and Discounts
4. Contract Terms
5. Is a Commodity
6. Customer-Supplier Relationship
7. May have SLAs (joke)

2) Internet Peering:

Connecting to the Core of the Internet

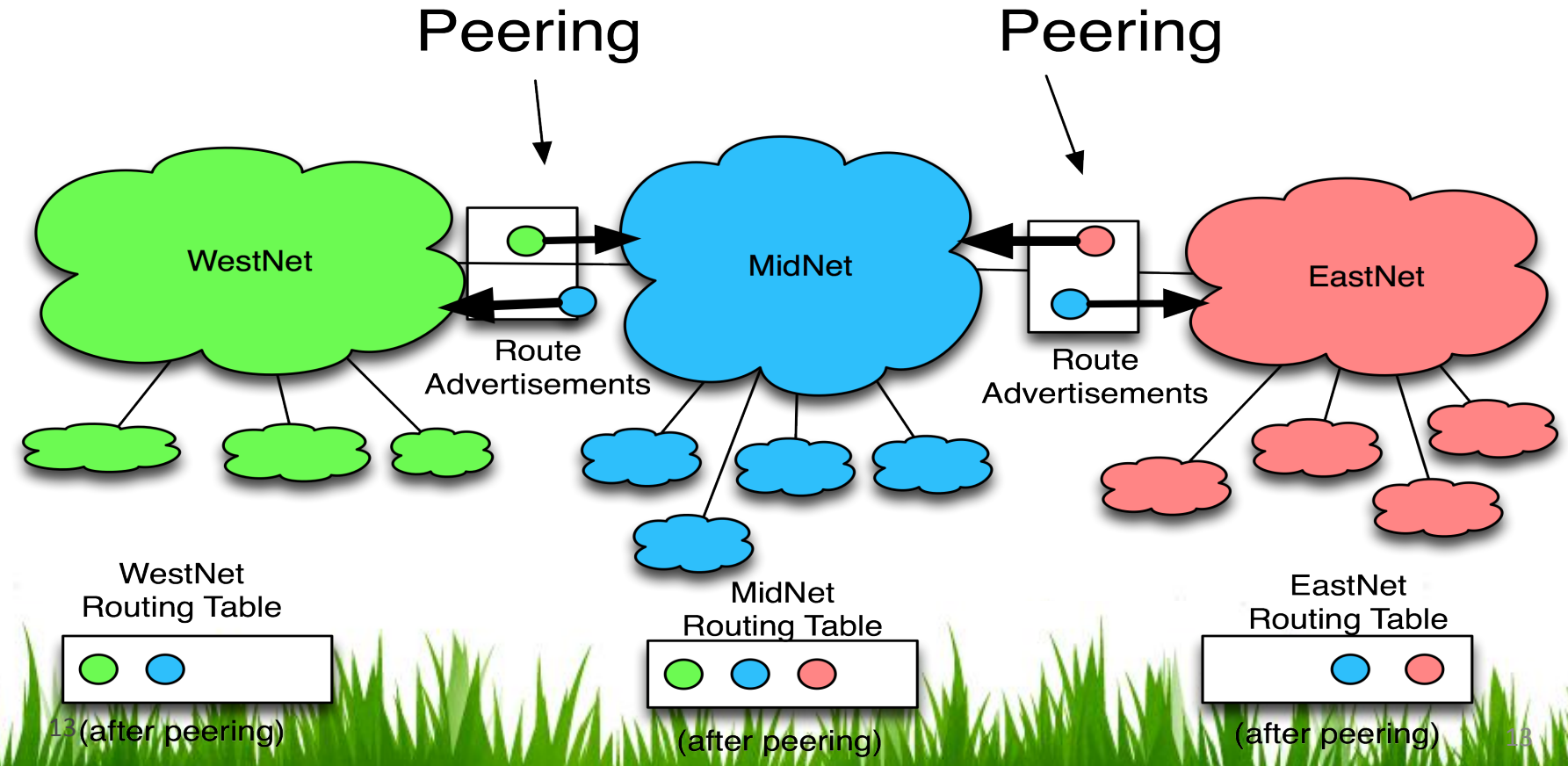
What is Internet Peering?

- 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

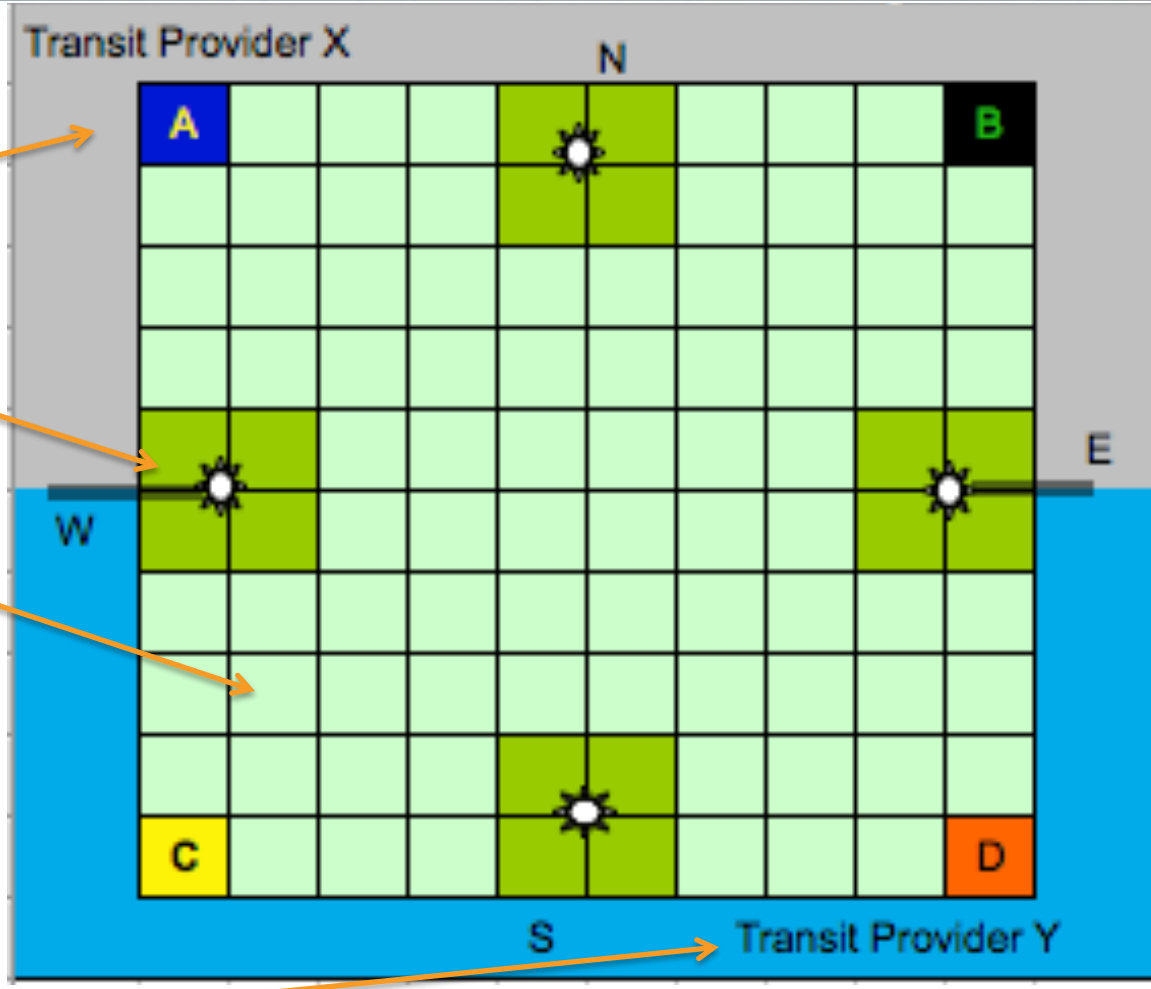
- Strategy Game
- Use the terminology correctly
- Negotiate Peering
- Successful in dozens of fora
- Engaging
- Fun!

The Game Board

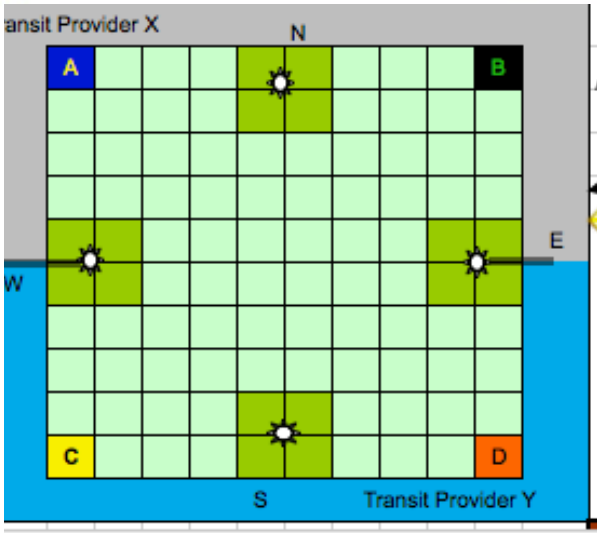
ISPs (A,B,C,D)
IXPs (E,W,N,S)

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

Pay Transit Fees
($1000/others' squares
/month)



The Scorecard



Internet Service Provider **Starting Point**

Get **$2000 revenue** for each square you own

Pay **$1000 transit fee** to your upstream for each square others own

Internet Exchange Point East

Reduce transit fee by peering with other ISPs at exchange point; **peering costs** $2000 per round and loss of 2 turns, split how ISPs see fit

Peering Array

ROUND	PLAYER	Roll	# Squares Owned	Revenue (Squares * $2000)	#OthersSquares	Transit Cost (*$1000)	Peering Costs	Net	Running Total	XpeerY	PLAYER	Pay for Transit to A?	Pay for Transit to B?	Pay for Transit to C?	Pay for Transit to D?
Jan	A	##	1	$2,000	3	($3,000)	$0	($1,000)	$23,000		A		1	1	
Jan	B	##	1	$2,000	3	($3,000)	$0	($1,000)	$23,000		B	1		1	
Jan	C	##	1	$2,000	3	($3,000)	$0	($1,000)	$23,000		C	1	1		
Jan	D	##	1	$2,000	3	($3,000)	$0	($1,000)	$23,000		D	1	1	1	
Feb	A	##	1	$2,000	3	($3,000)	$0	($1,000)	$22,000		A		1	1	
Feb	B	##	1	$2,000	3	($3,000)	$0	($1,000)	$22,000		B	1		1	
Feb	C	##	1	$2,000	3	($3,000)	$0	($1,000)	$22,000		C	1	1		
Feb	D	##	1	$2,000	3	($3,000)	$0	($1,000)	$22,000		D	1	1	1	
Mar	A	##	1	$2,000	3	($3,000)	$0	($1,000)	$21,000		A		1	1	
Mar	B	##	1	$2,000	3	($3,000)	$0	($1,000)	$21,000		B	1		1	
Mar	C	##	1	$2,000	3	($3,000)	$0	($1,000)	$21,000		C	1	1		
Mar	D	##	1	$2,000	3	($3,000)	$0	($1,000)	$21,000		D	1	1	1	

Notes:

Can only move adjacently and 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

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

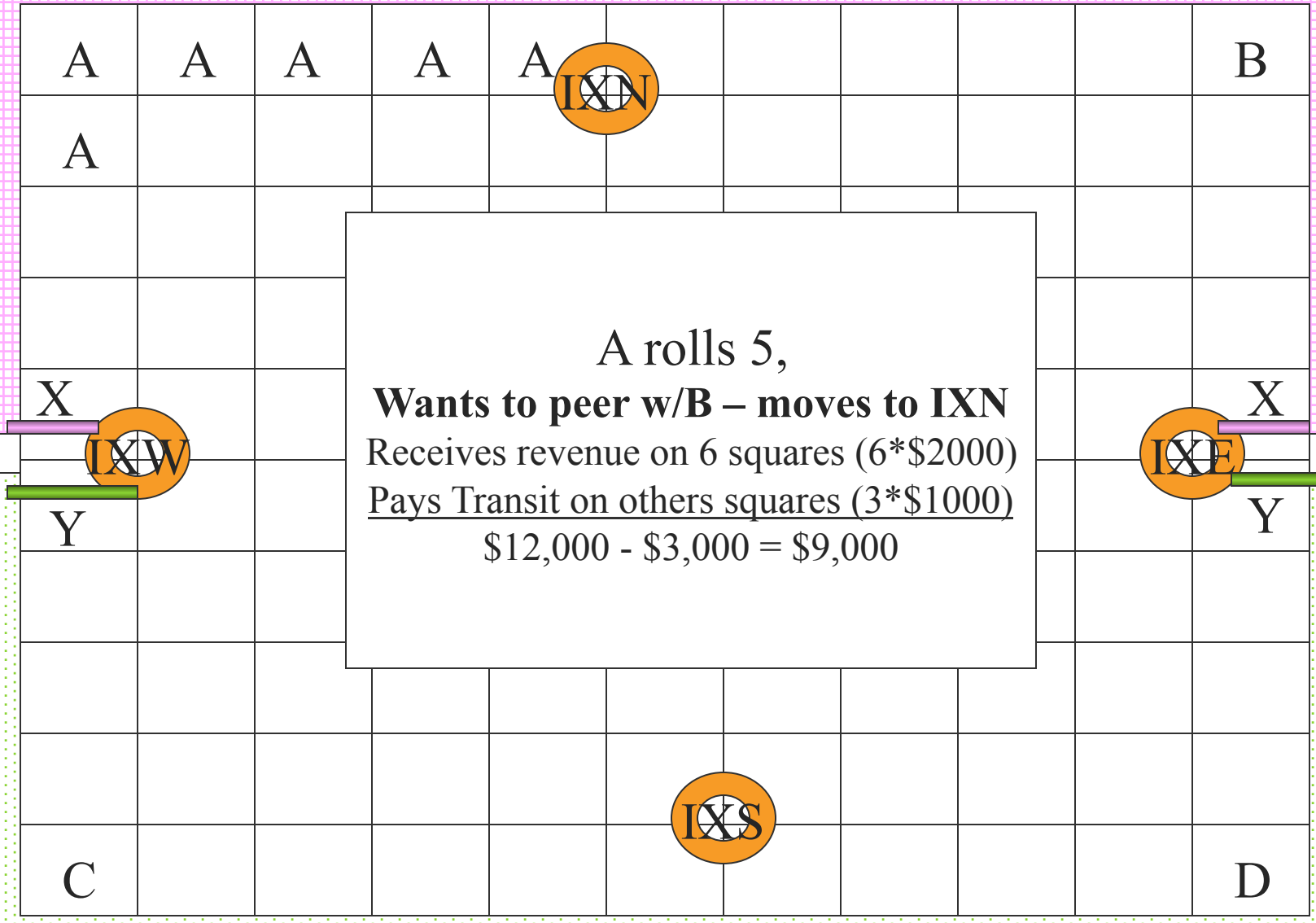
Gain transit revenue of $2000 for each customer square you own

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 negotiates who covers the costs of peering

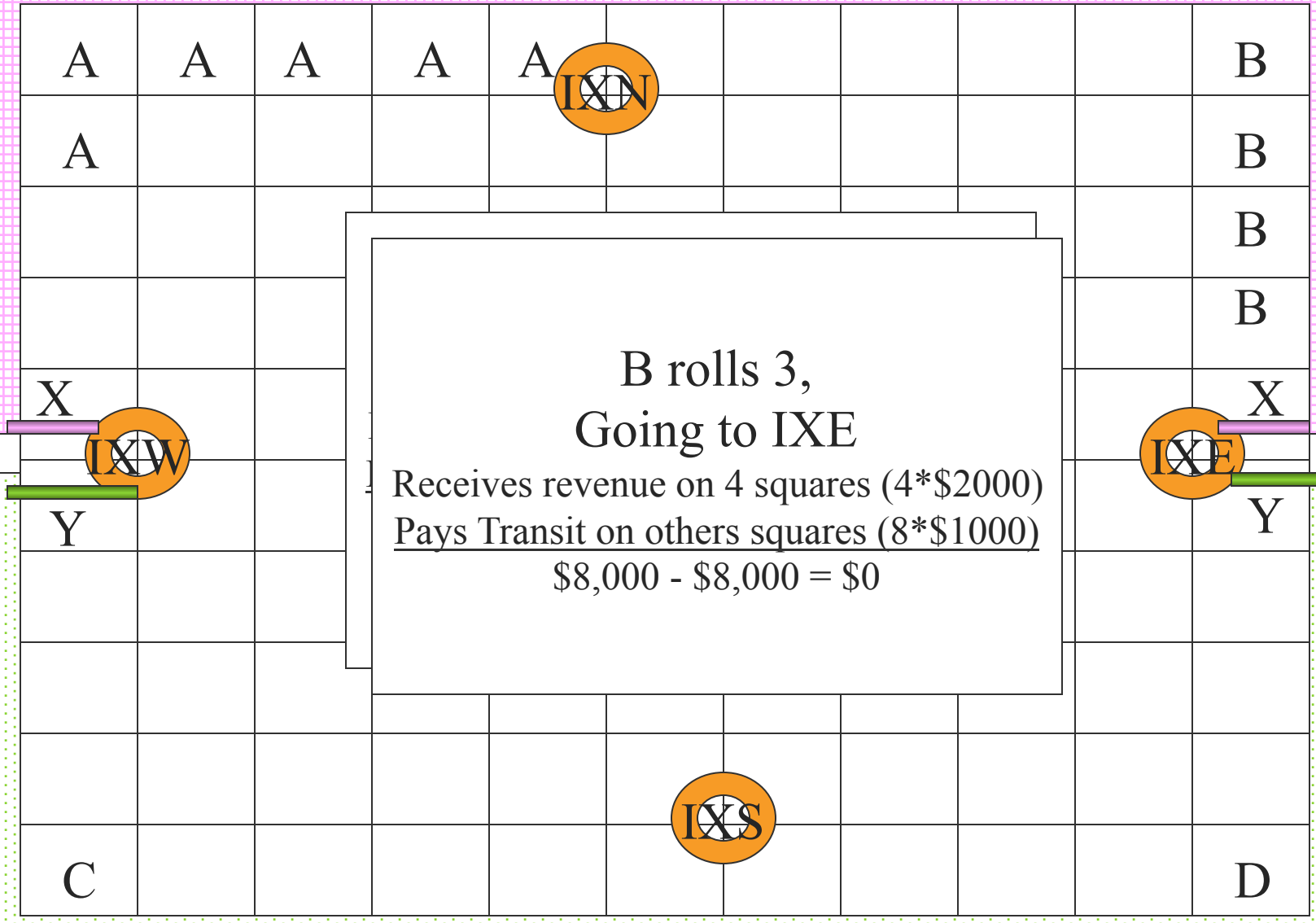
Quick round…

Transit Provider X



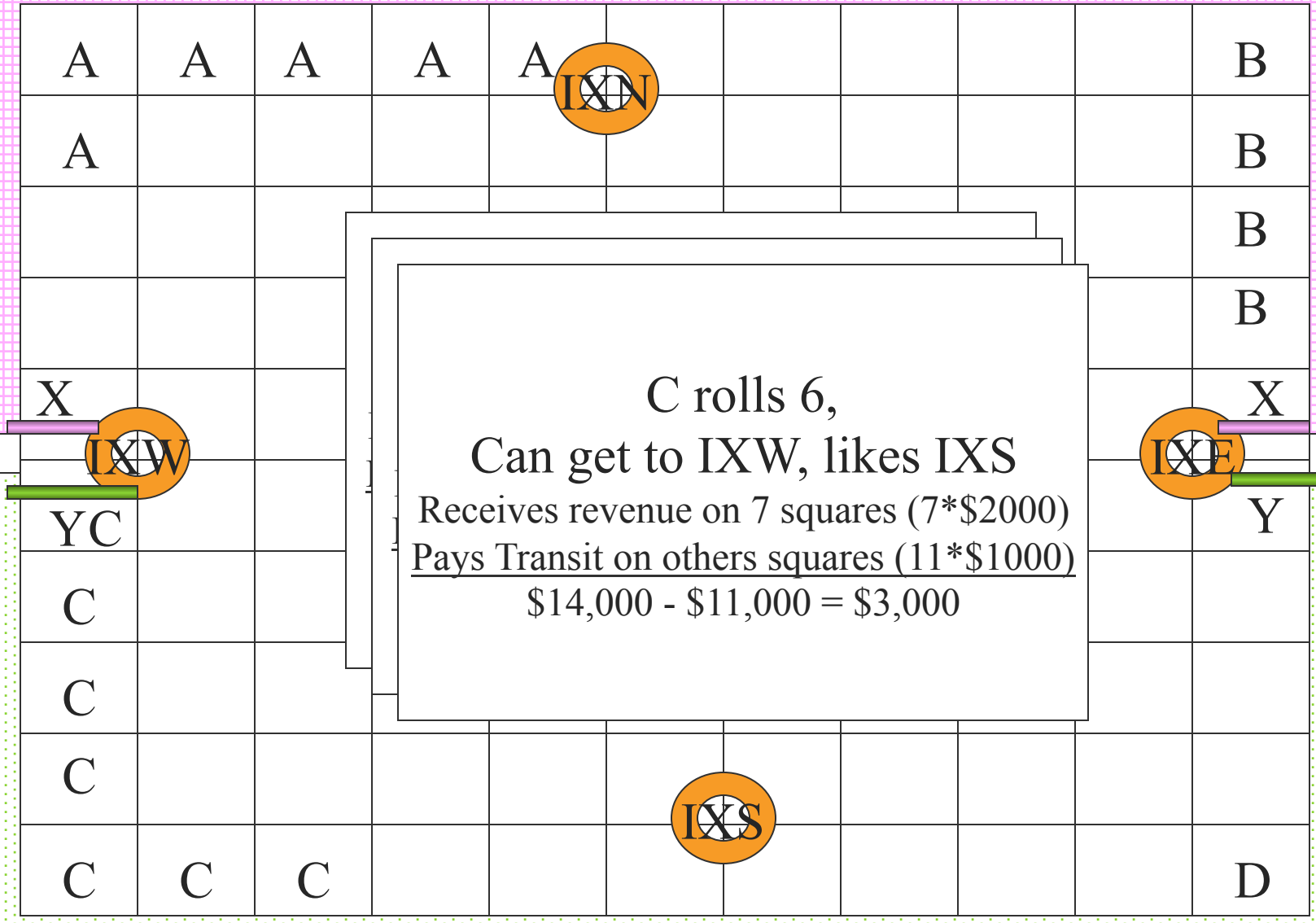
Transit Provider Y

Transit Provider X



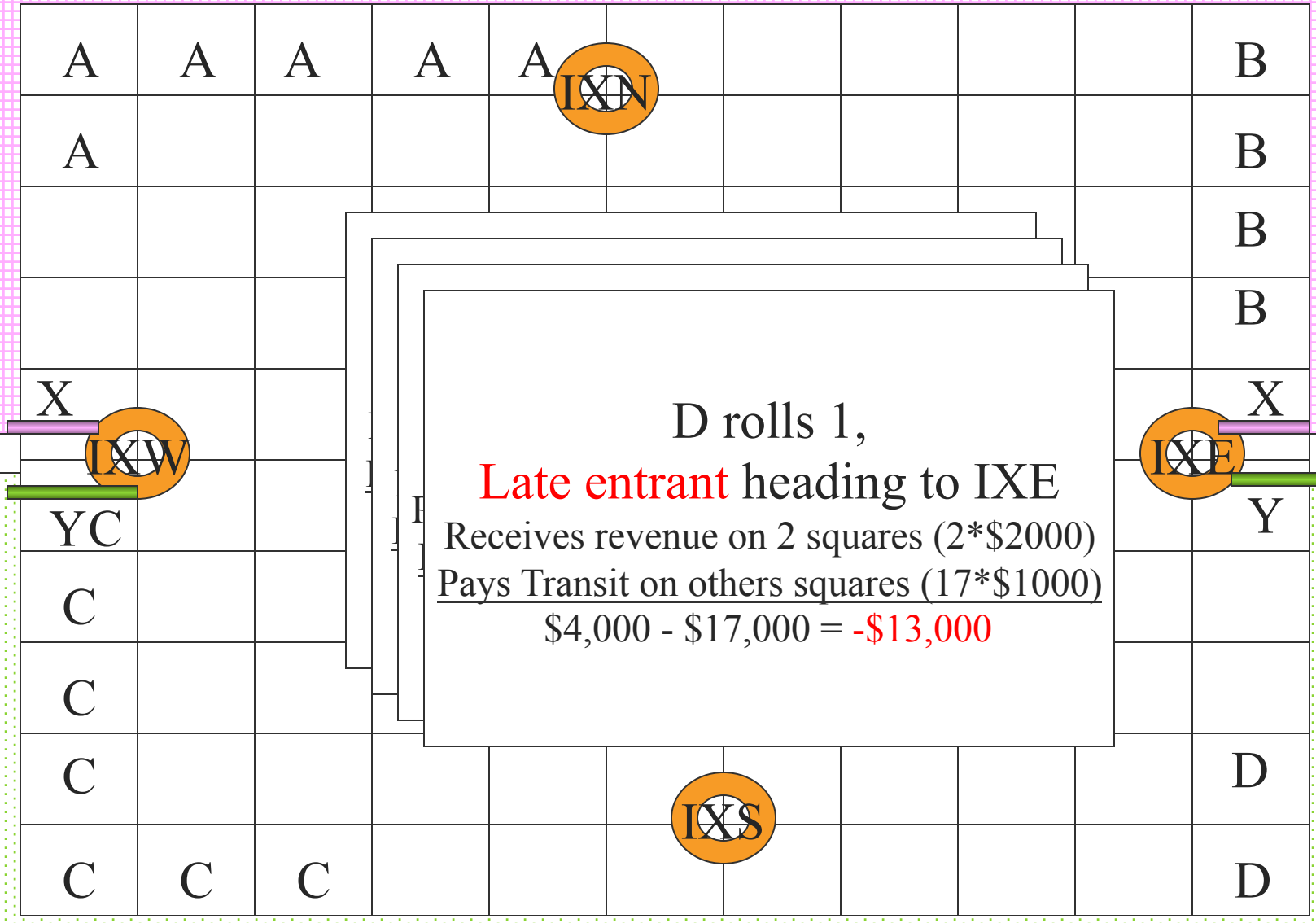
Transit Provider Y

Transit Provider X



Transit Provider Y

Transit Provider X

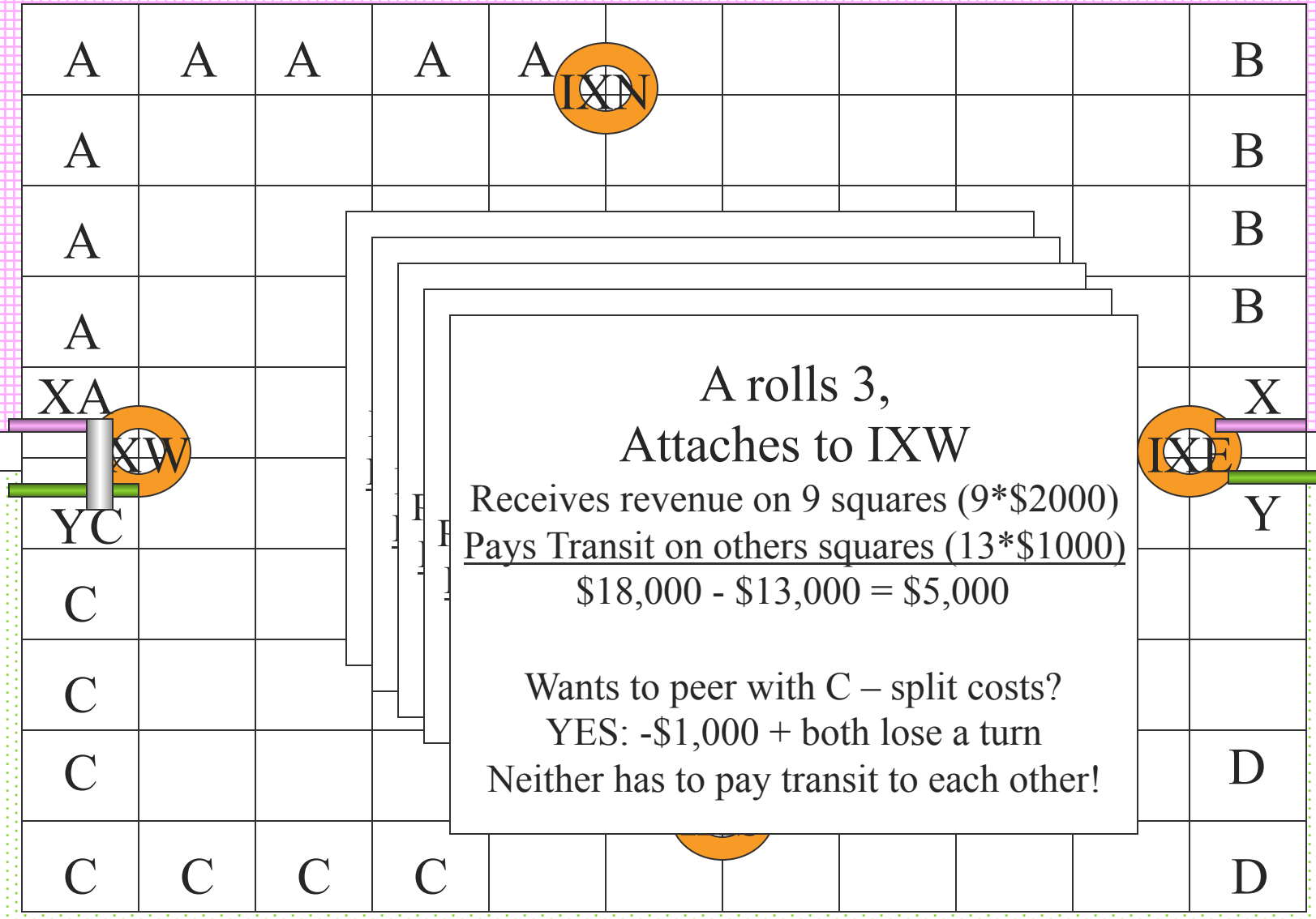


Transit Provider Y

Scoreboard after Round 1

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

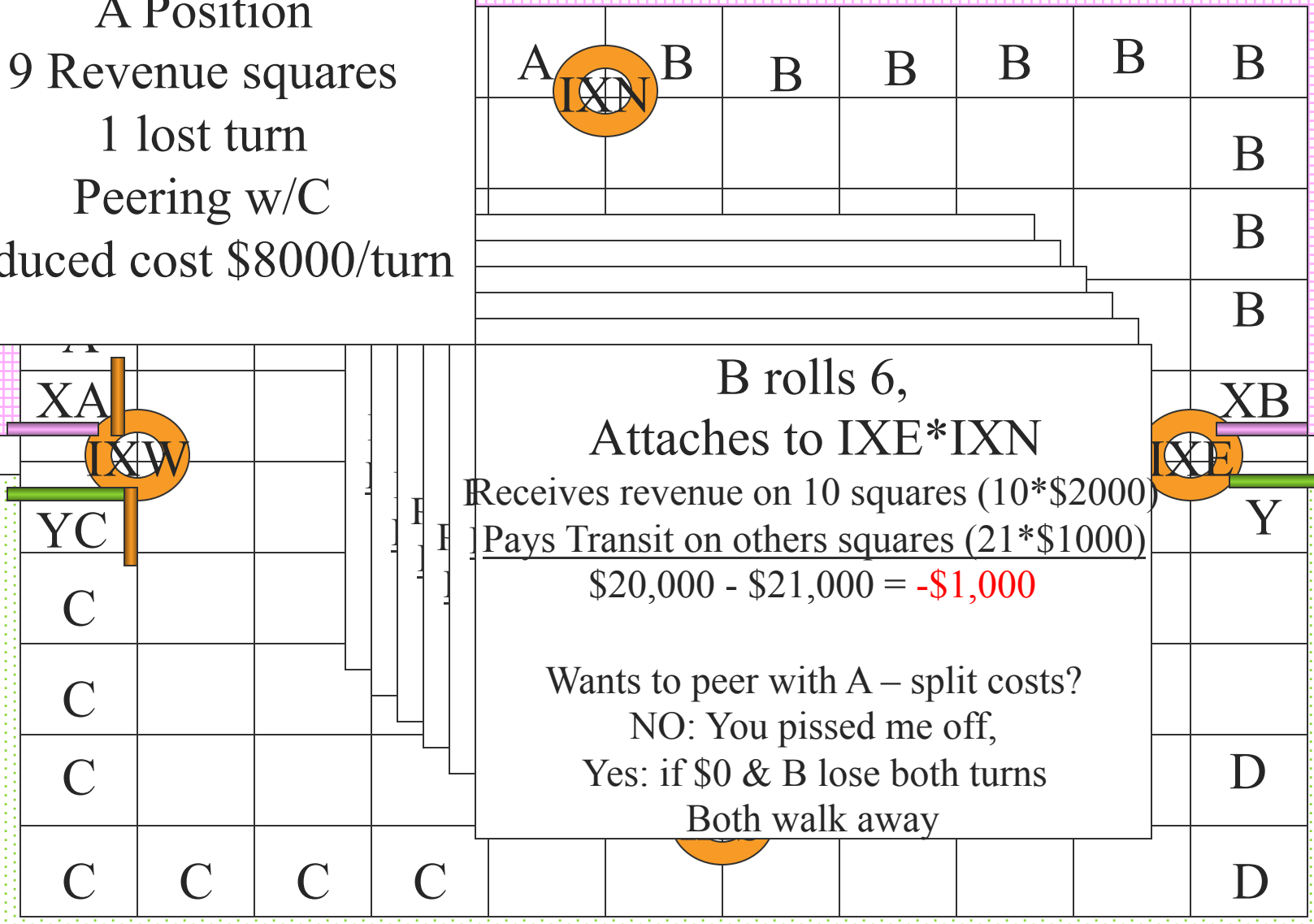
Transit Provider X



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

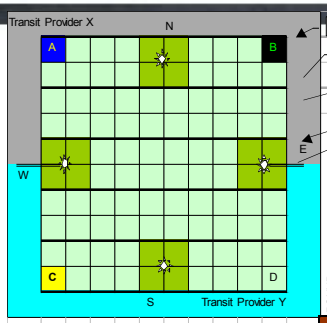
$35,000 VC Funding

~~$25,000 VC Funding~~ – HARD Economic Times

We want to hear your thought process and peering negotiations

Winner - prize

Play Game



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Peering Array

Calculate

Notes:

Can only move adjacently and 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

ROUND	PLAYER	Roll	Bonus Content Squares	# Squares Owned	Revenue (Squares * $2000)	#OthersSquares	Transit Cost (*$1000)	Peering Costs	Net	Running Total	XpeerY	PLAYER	Pay for Transit to A?	Pay for Transit to B?	Pay for Transit to C?	Pay for Transit to D?	Sum of Transit $$$$ paid to X	Sum of Transit $$$ Paid to Y	
0	A	##	1		$0	3	$0	$0	$0	$0		A		1	1	1	$ -		
0	B	##	1		$0	3	$0	$0	$0	$0		B	1		1	1	$ -		
0	C	##	1		$0	3	$0	$0	$0	$0		C	1	1		1		$ -	
0	D	##	1		$0	3	$0	$0	$0	$0		D	1	1	1			$ -	
copy	A	##	1		$2,000	3	($3,000)	$0	$25,000	$25,000		A		1	1	1	$ -		
copy	B	##	1		$2,000	3	($3,000)	$0	$25,000	$25,000		B	1		1	1	$ -		
copy	C	##	1		$2,000	3	($3,000)	$0	$25,000	$25,000		C	1	1		1		$ -	
copy	D	##	1		$2,000	3	($3,000)	$0	$25,000	$25,000		D	1	1	1			$ -	
Jan	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$24,000		A		1	1	1	$ 3,000		A
Jan	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$24,000		B	1		1	1	$ 6,000		B
Jan	C	##	1		$2,000	3	($3,000)	$0	($1,000)	$24,000		C	1	1		1		$ 3,000	C
Jan	D	##	1		$2,000	3	($3,000)	$0	($1,000)	$24,000		D	1	1	1			$ 6,000	D
Feb	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$23,000		A		1	1	1	$ 9,000		A
Feb	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$23,000		B	1		1	1	$ 12,000		B
Feb	C	##	1		$2,000	3	($3,000)	$0	($1,000)	$23,000		C	1	1		1		$ 9,000	C
Feb	D	##	1		$2,000	3	($3,000)	$0	($1,000)	$23,000		D	1	1	1			$ 12,000	D
Mar	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$22,000		A		1	1	1	$ 15,000		A
Mar	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$22,000		B	1		1	1	$ 18,000		B
Mar	C	##	1		$2,000	3	($3,000)	$0	($1,000)	$22,000		C	1	1		1		$ 15,000	C
Mar	D	##	1		$2,000	3	($3,000)	$0	($1,000)	$22,000		D	1	1	1			$ 18,000	D
Apr	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$21,000		A		1	1	1	$ 21,000		A
Apr	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$21,000		B	1		1	1	$ 24,000		B
Apr	C	##	1		$2,000	3	($3,000)	$0	($1,000)	$21,000		C	1	1		1		$ 21,000	C
Apr	D	##	1		$2,000	3	($3,000)	$0	($1,000)	$21,000		D	1	1	1			$ 24,000	D
May	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$20,000		A		1	1	1	$ 27,000		A
May	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$20,000		B	1		1	1	$ 30,000		B
May	C	##	1		$2,000	3	($3,000)	$0	($1,000)	$20,000		C	1	1		1		$ 27,000	C
Mayu	D	##	1		$2,000	3	($3,000)	$0	($1,000)	$20,000		D	1	1	1			$ 30,000	D
Jun	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$19,000		A		1	1	1	$ 33,000		A
Jun	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$19,000		B	1		1	1	$ 36,000		B
Jun	C	##	1		$2,000	3	($3,000)	$0	($1,000)	$19,000		C	1	1		1		$ 33,000	C
Jun	D	##	1		$2,000	3	($3,000)	$0	($1,000)	$19,000		D	1	1	1			$ 36,000	D
Jul	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$18,000		A		1	1	1	$ 39,000		A
Jul	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$18,000		B	1		1	1	$ 42,000		B
Jul	C	##	1		$2,000	3	($3,000)	$0	($1,000)	$18,000		C	1	1		1		$ 39,000	C
Jul	D	##	1		$2,000	3	($3,000)	$0	($1,000)	$18,000		D	1	1	1			$ 42,000	D
Aug	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$17,000		A		1	1	1	$ 45,000		A
Aug	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$17,000		B	1		1	1	$ 48,000		B
Aug	C	##	1		$2,000	3	($3,000)	$0	($1,000)	$17,000		C	1	1		1		$ 45,000	C
Aug	D	##	1		$2,000	3	($3,000)	$0	($1,000)	$17,000		D	1	1	1			$ 48,000	D
Sep	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$16,000		A		1	1	1	$ 51,000		A
Sep	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$16,000		B	1		1	1	$ 54,000		B
Sep	C	##	1		$2,000	3	($3,000)	$0	($1,000)	$16,000		C	1	1		1		$ 51,000	C
Sep	D	##	1		$2,000	3	($3,000)	$0	($1,000)	$16,000		D	1	1	1			$ 54,000	D
Oct	A	##	1		$2,000	3	($3,000)	$0	($1,000)	$15,000		A		1	1	1	$ 57,000		A
Oct	B	##	1		$2,000	3	($3,000)	$0	($1,000)	$15,000		B	1		1	1	$ 60,000		B