



The foundation for Internet Exchange
Points 

The Taxonomy of Internet Data Centers

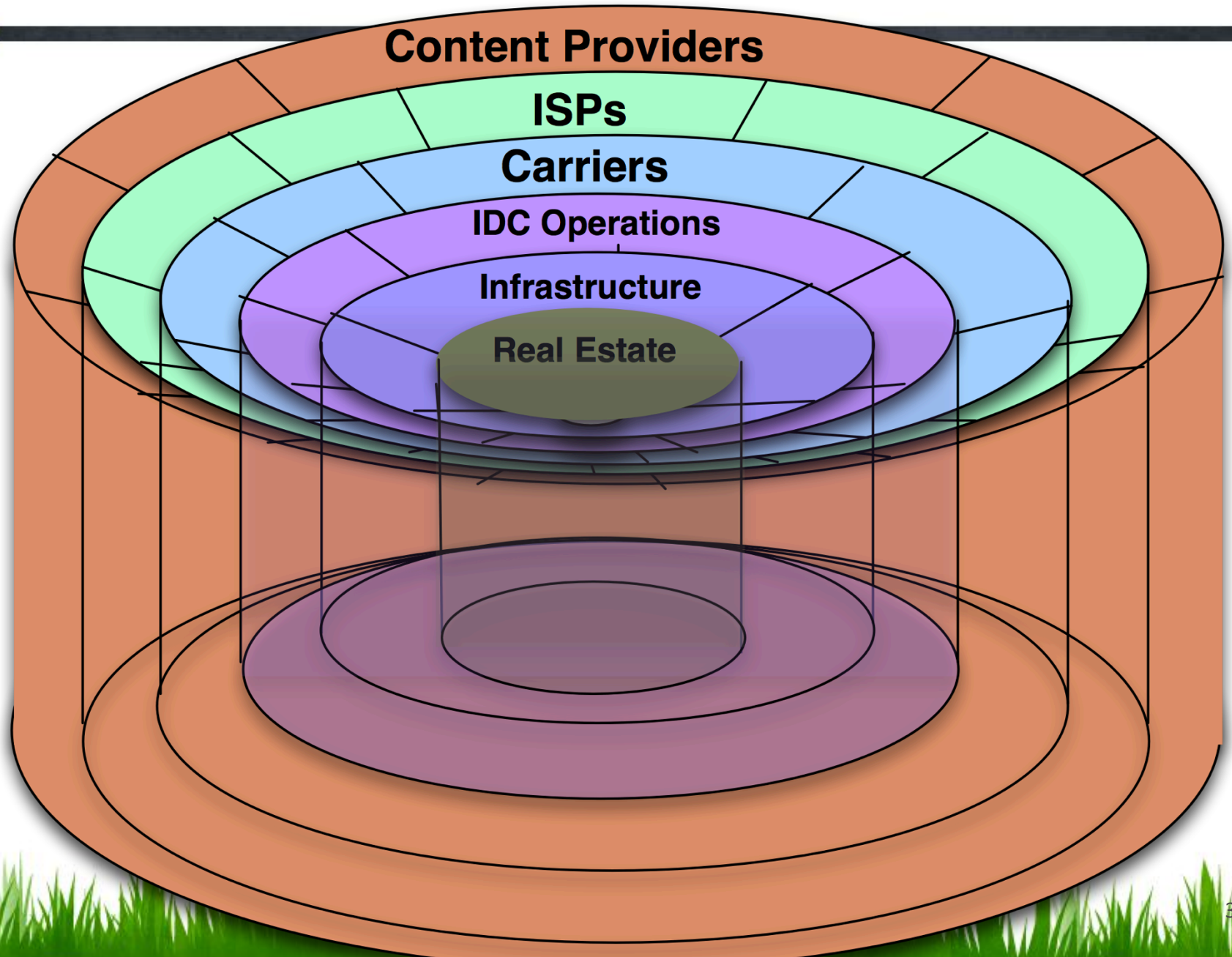


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This framework will describe any IDC

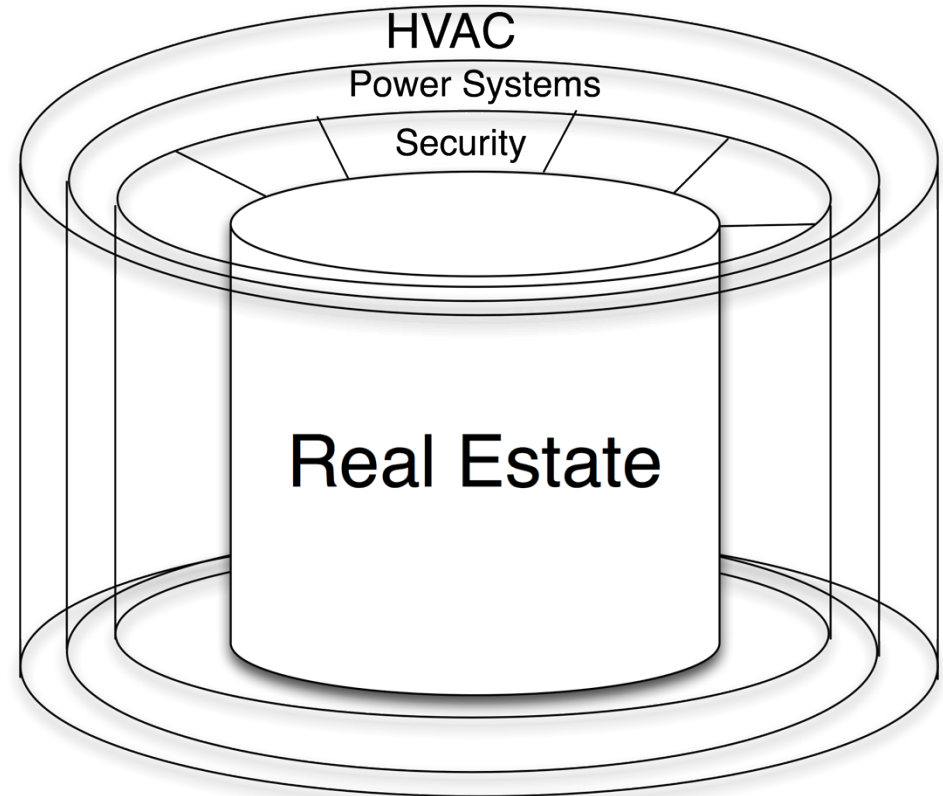
- Cluttered marketplace for Internet Data Centers (IDC)
- How do you compare colo company X with IDC Y?
- Model for categorizing any IDC
- Very helpful abstraction

The Model



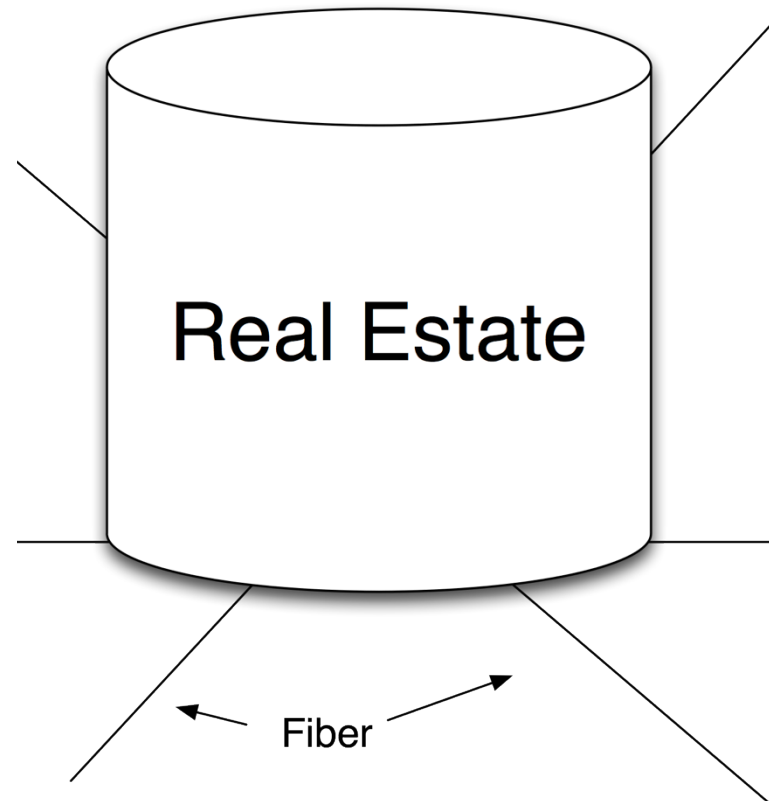
Data Center Operations

- Start with the basic data center



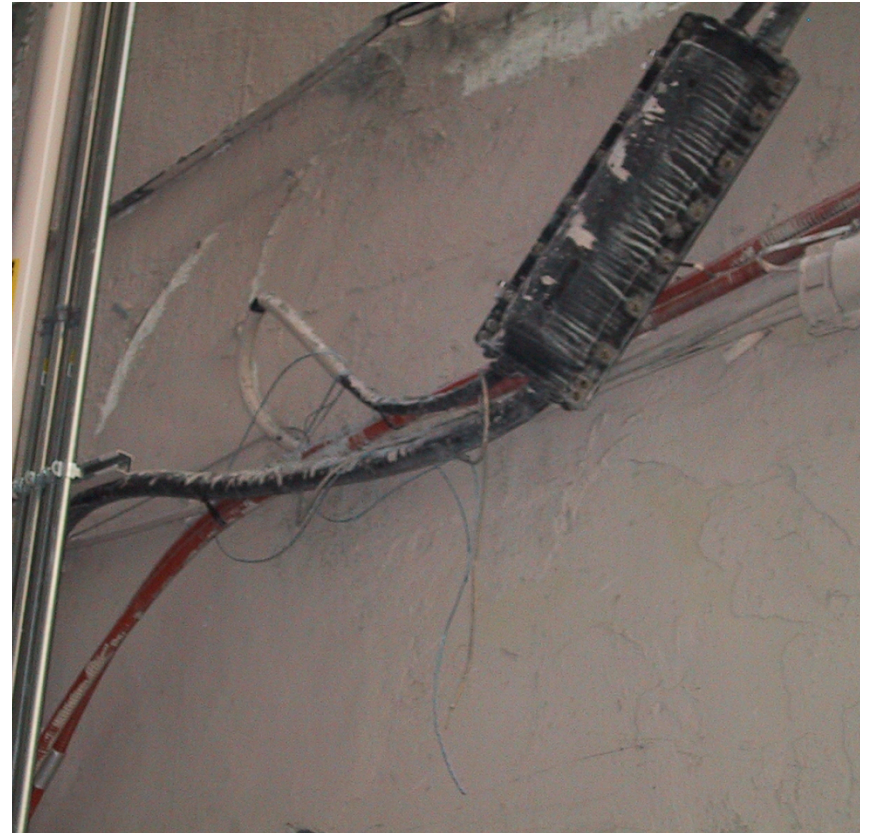
Real Estate

- Physical space and fire suppression systems
- Desirability of real estate-NJ?
- Travel incognito story
 - Rights of way - railroad
- Cost per sq meter
- Ease of access
- Price of power in area
- Proximity to fiber
- Floor loading
- Local gov't support
- ..hundreds of selection criteria



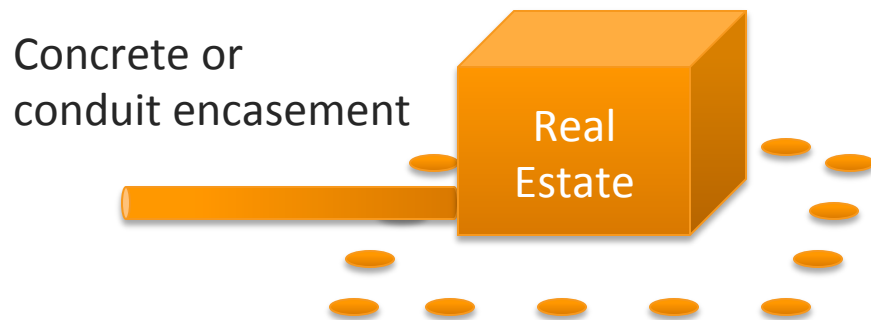
Fiber Entrance

- Fiber entrance facilities vary in quality



Secured Fiber Entrance

- Conduits
- concrete



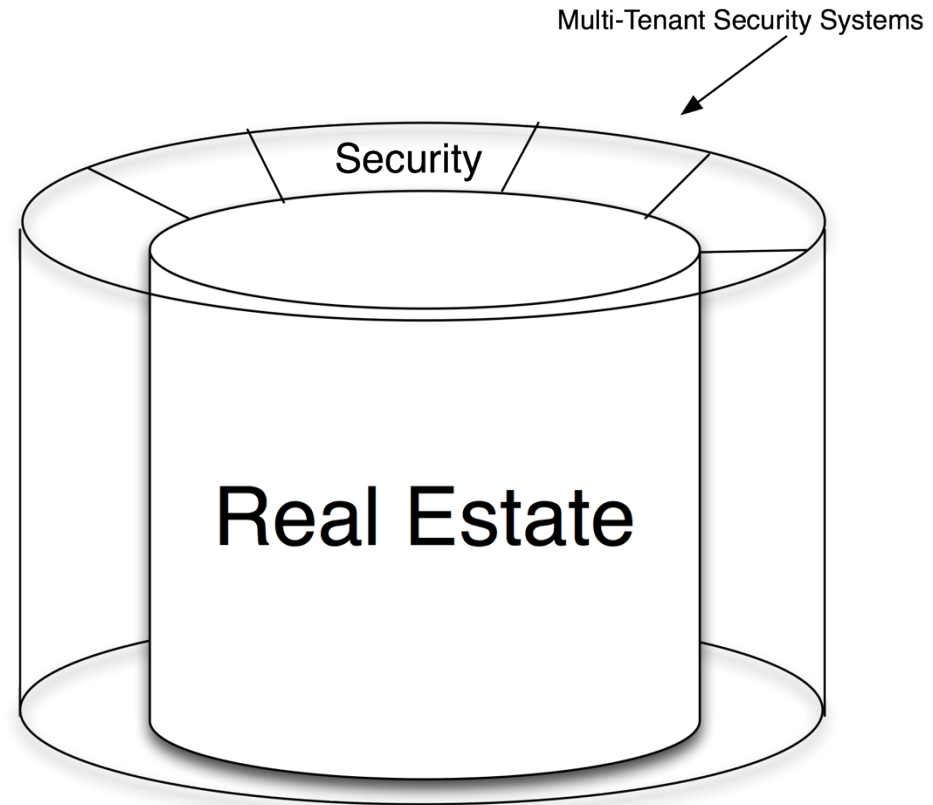
Man holes

Real Estate and Fiber Entrance

- Inter-floor ducts



Security



Multi-tenant vs. single tenant shown in ring

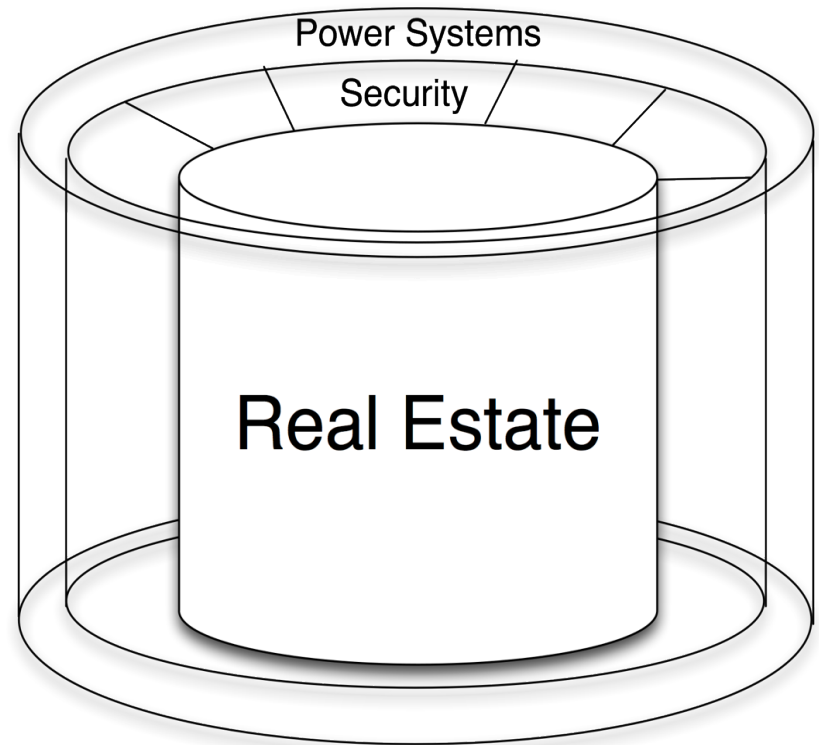
Security

- Guard gates
- Mote
- Man Traps
- Bullet proof glass
- Authentication system
 - Multi-tenant challenges
- Underground bunker
- Surveillance cameras
- Cage access logs



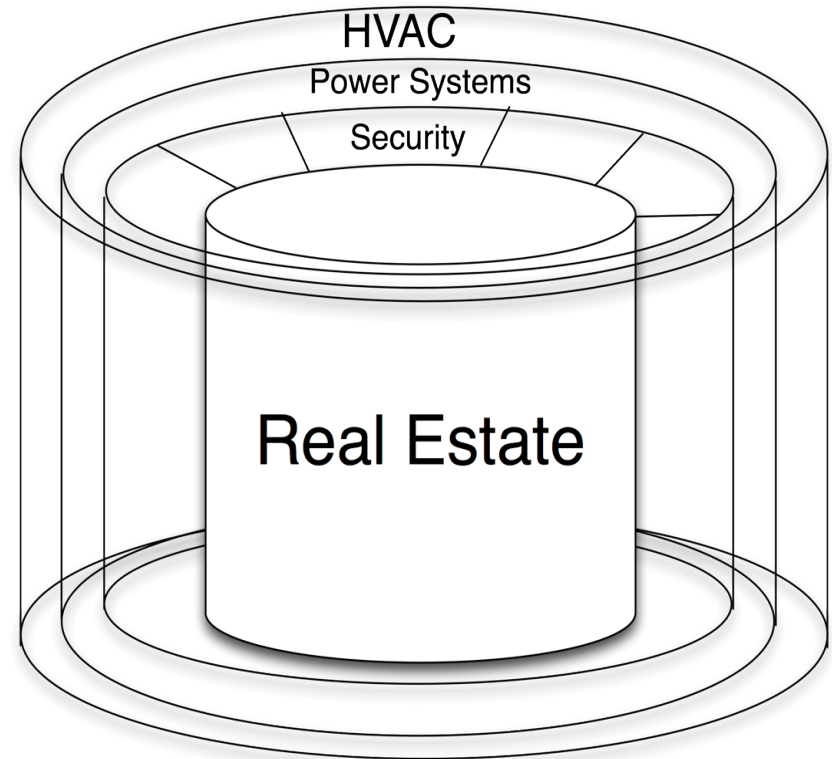
Power systems

- Conditioned Power
 - Reliable Power
 - Brownouts, cutovers
- Generators vs. Flywheel
- UPS
- Power Distribution
- Tradeoffs / religion here
- Availability and price are key



HVAC

- Heating, Venting, Air Conditioning (HVAC)
- Humidity controlled
- Ambient Temperature
- Stable environment for equipment (65°-85°F)
45% relative humidity
Source: IBM
- Economies of scale



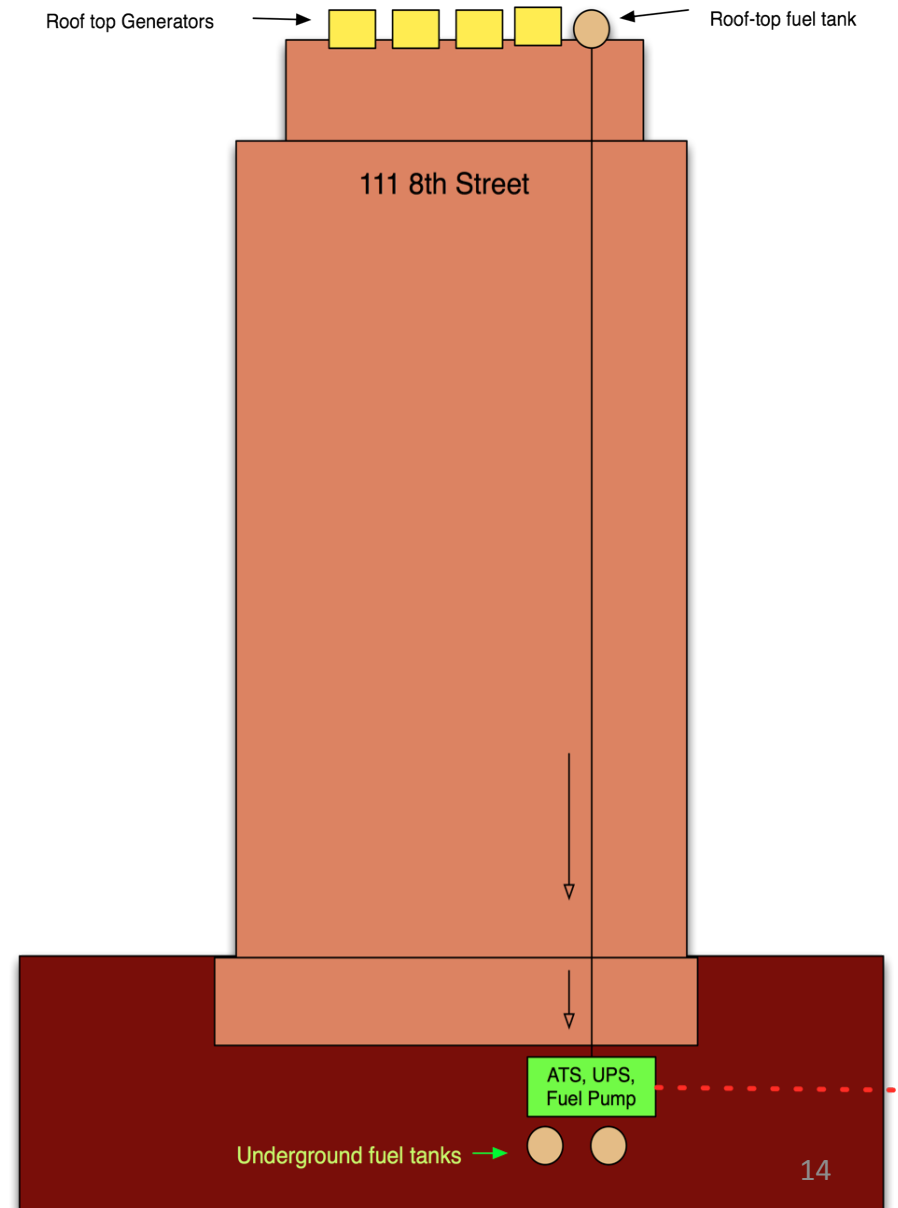
We expect the lights will stay on

- Notification
- Data Center Operations
- Processes and people

- 111 8th street story illustrates this

The 111 8th street story

- New York City
- Major Carrier Hotel
- Power outage
- Genset failures
- What happened?



The 111 8th street story

- What happened?

Pressure increasing

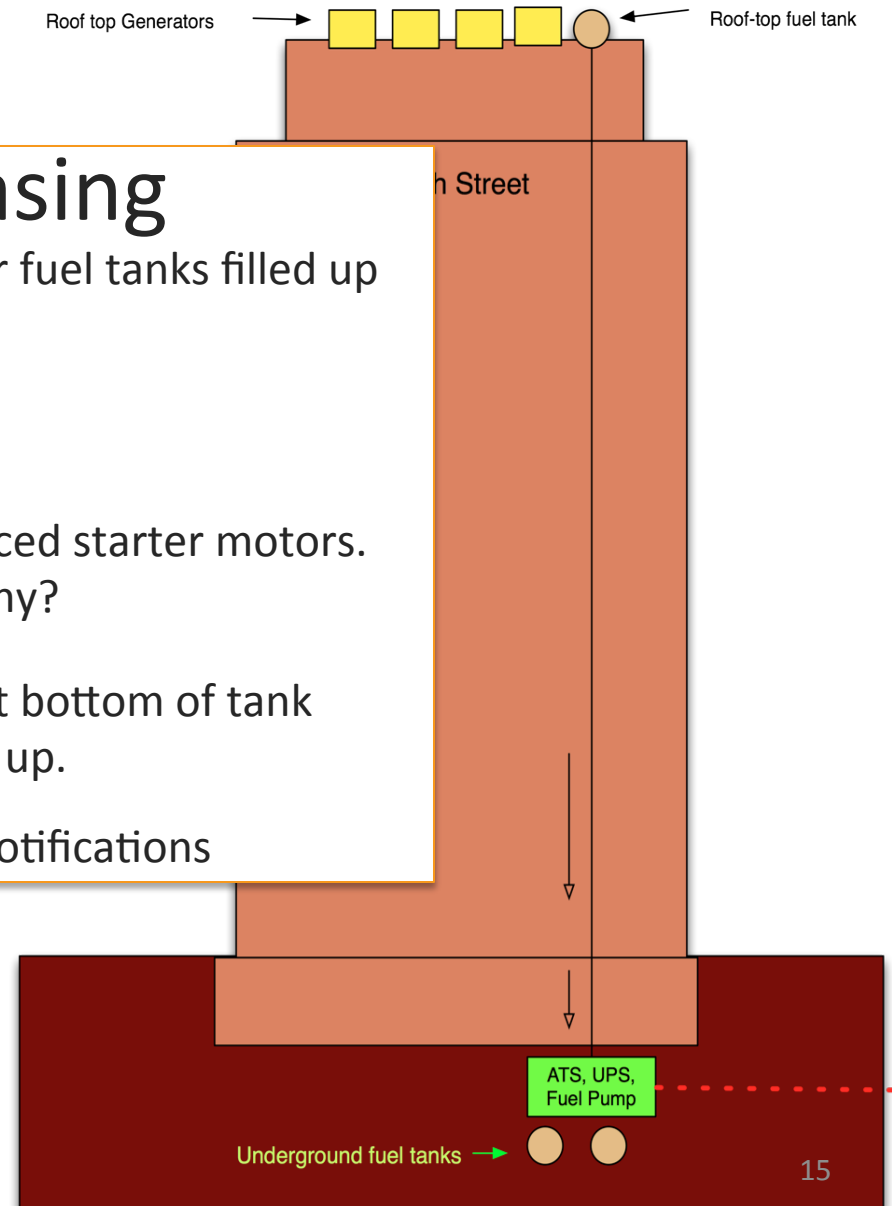
Fuel tank was empty – fixed polarity and upper fuel tanks filled up
Up on roof – generators not running – why?

Starter motors burned out.

Went across town to supply store. Replaced starter motors.
Up on roof – generators not starting – why?

Fuel filters clogged from sludge at bottom of tank
Replaced fuel filters – generators up.

24 hours + without notifications



What we should learn from this outage

#1 Things break

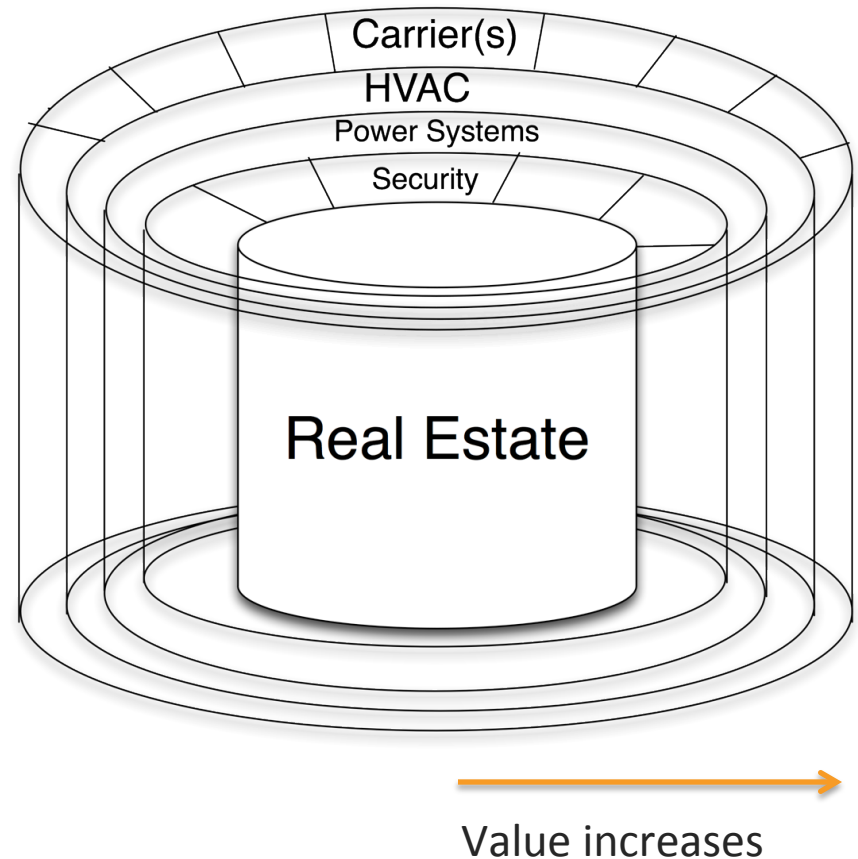
#2 Everyone recognizes #1

#3 How the IDC keeps participants informed is more important than the outage

Data Center + Carrier -> Not an Island

Data Center Island

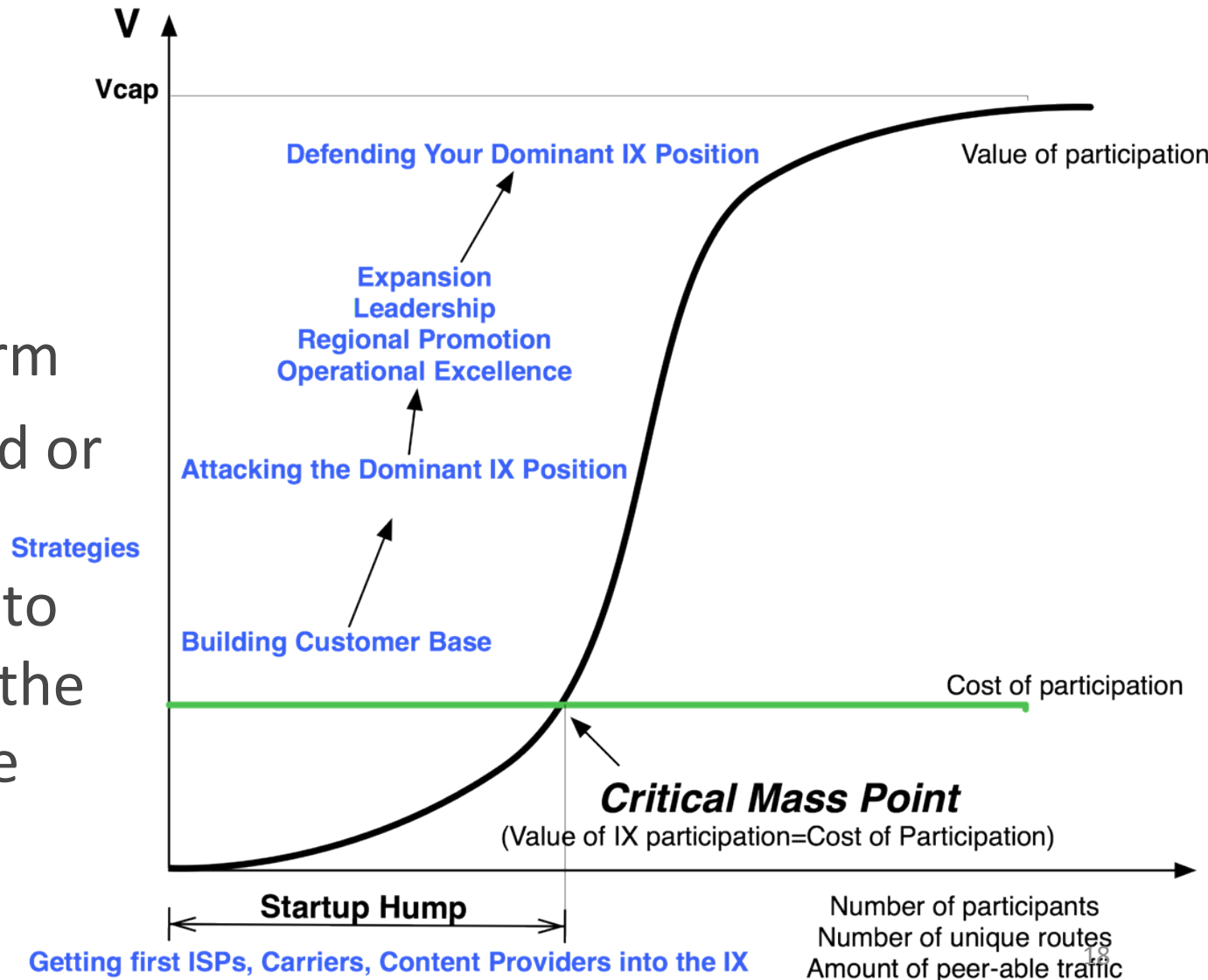
- Add carrier(s)
 - “Lit building”
- Carrier-owned
 - 1 carrier: Carrier POP
 - 1 carrier + hosting: Carrier Hosting Facility
- Carrier-Neutral
 - Which carriers are there
 - Key Selection criteria
 - Multiple carriers: carrier neutral colocation



The Value of an Internet Exchange

Value of the Internet Exchange Point

- Network Externality
- Economists term value of a good or service proportionate to who else uses the good or service

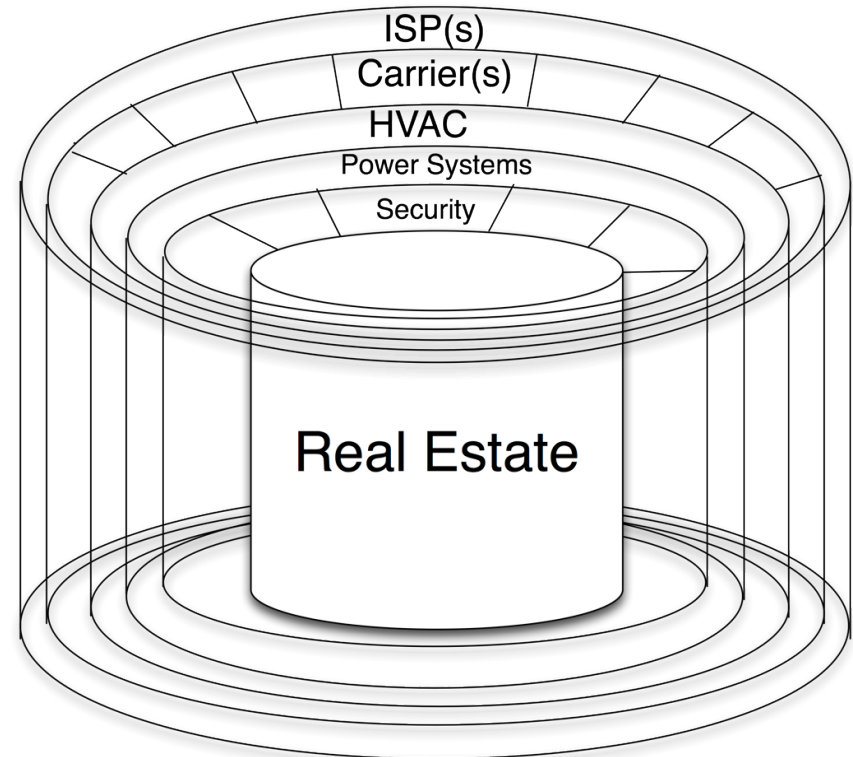


Neutrality

- Qwest won't POP Level 3 Gateways
- Level 3 won't be allowed into Qwest Cyber Centers
- Some customers won't POP a building without multiple carriers
- Some customers won't POP a building without a specific carrier being present
- Terremark acquired by Carrier – is it still carrier neutral?

Connected DC + ISP = Internet Data Center

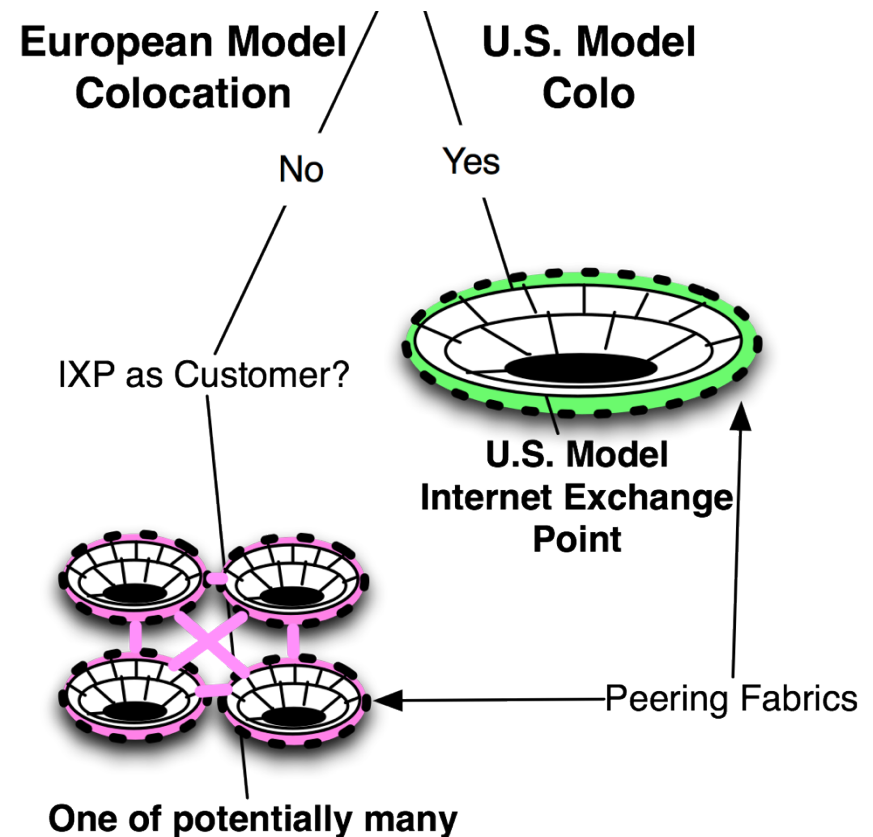
- ISP-owned Data Center
 - ISP POP if for self
 - ISP Hosting Facility if it hosts others
- Carrier and ISP-Neutral Data Center
 - Neutral Colocation Center
 - “carrier-neutral”
- Why is neutrality important?
 - Turkey story.



Wholesale data center space – sell for resale
“Telco Hotel”

Internet Exchange Points

- 2 Models
 - European Model
 - US Model
- Challenge:
 - After I explain the difference, tell me the benefits and drawbacks of each



European IXP Model

European Internet Exchange Point Model

European IXP Colocation Company Neutrality

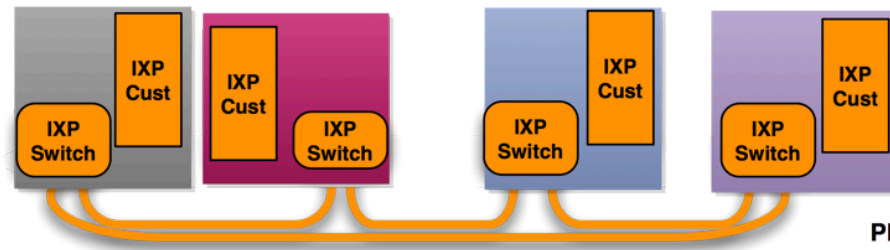
IXP Customers can choose colocation facility that meets their facilities needs.

Separate contracts with colocation and IXP Operator

European IXP Operated by formal association typically founded by a set of ISPs

European IXP Operator is typically a not-for-profit organization

Prices approximate cost. Everyone pays the same published fees.



European IXPs spread across multiple colocation facilities interconnected with fiber.

In the "classic LINX model", the colocation provider may subsidize or pay for the elements of having the IXP within the facility (space, power, fiber, equipment costs, etc.).

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

See "Value of an Internet Exchange" article for discussion of IXP value

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

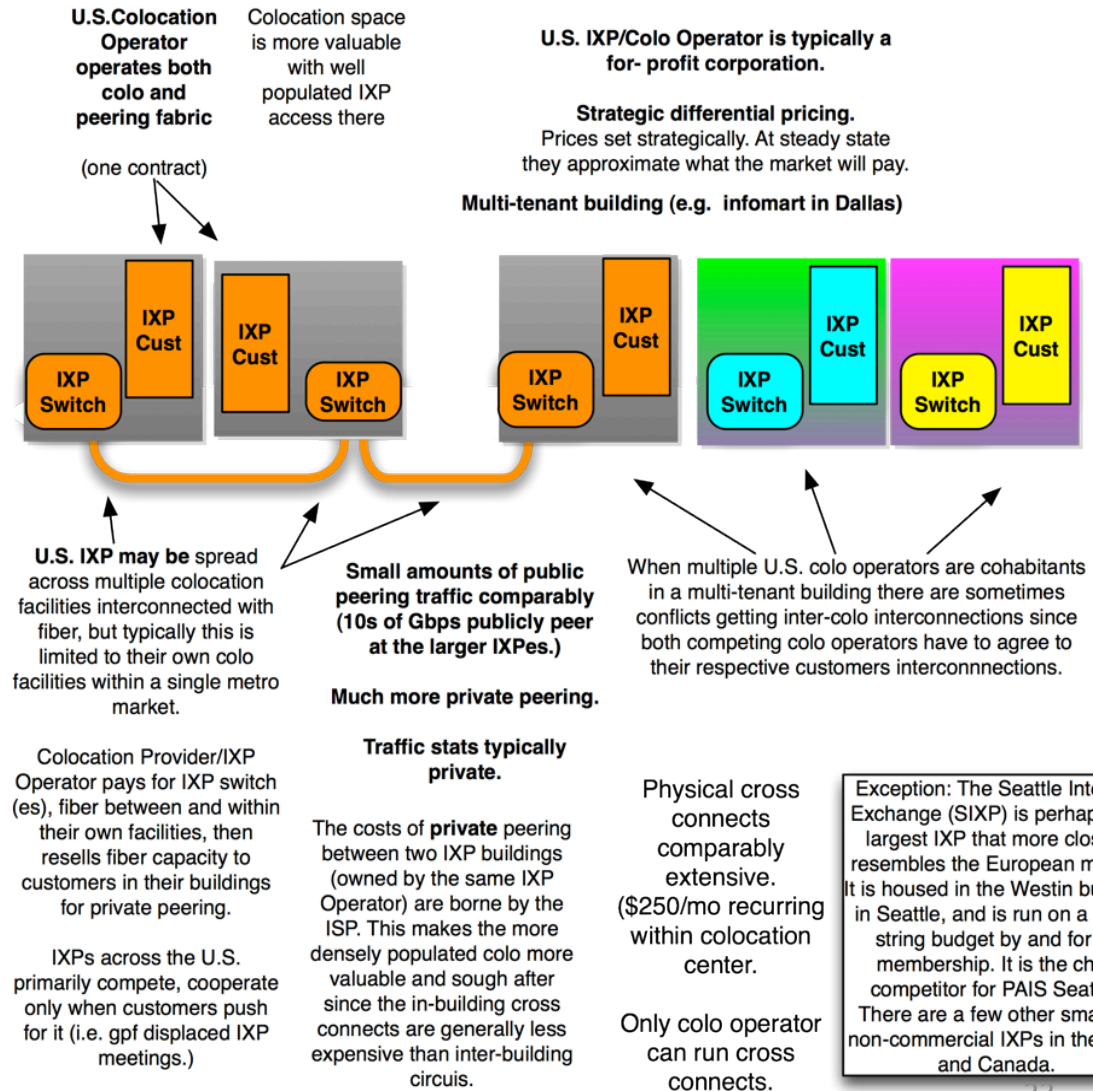
IXPs across Europe tend to cooperate more with each other and share information. (Competition creeping in now for largest European IXP)

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

U.S. Model Internet Exchange Point

U.S. Internet Exchange Point Model



Challenge

- What are some of the pro's and con's of the U.S. and European Internet Exchange Point models?
- Why are these differences important?

Challenges

- Zaid Telekom, a large telco, opens a data center for its customers. They claim they will sell to anyone. They encourage their competitors to come and be customers there.
- This data center is best described as a
 - A) carrier-neutral IXP?
 - B) U.S.-model IXP?
 - C) telco hotel?
 - D) carrier hosting facility

Challenges

- Zig Real Estate Holdings converts a very large building into a multi-floor data center. They do not operate a network of any kind. They sell only floors and suites.
- This data center is best described as a
 - A) U.S.-model IXP
 - B) ISP POP
 - C) telco hotel
 - D) European-model IXP

Challenges

- IXion builds data centers across Africa and does not own a carrier or ISP network. They encourage carriers and ISPs to build in, but IXion does not buy any services from them.
- This data center is best described as a
 - A) European-model IXP?
 - B) carrier-neutral colocation center?
 - C) U.S.-model IXP?
 - D) ISP data center

Challenges

- Central Internet Facilities builds data centers around the world and purchases bulk Internet Transit for resale inside its data center to its tenants.
- This data center is best described as a
 - A) hosting company?
 - B) carrier-neutral colocation center?
 - C) U.S.-model IXP?
 - D) carrier POP

Challenges

- NIX Centre builds a colocation data center complete with a peering fabric in Nigeria. It sells rack space to anyone but markets itself to the ISP community as a peering point. It does not operate a network and does not buy or resell any network.
- This data center is best described as a
 - A) European model IXP?
 - B) carrier-neutral colocation center?
 - C) U.S.-model IXP?
 - D) carrier POP

Challenges

- Ninter operates a shared peering fabric across multiple colocation buildings. Other than this LAN, it does not operate a network.
- This data center is best described as a
 - A) European-model IXP?
 - B) carrier-neutral colocation center?
 - C) U.S.-model IXP?
 - D) ISP data center