


The Internet Peering Playbook 

Introducing

Internet Transit



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Tabla Rosa





Internet Transit

Connecting to the Edge of the Internet

Overview of this Internet Transit section

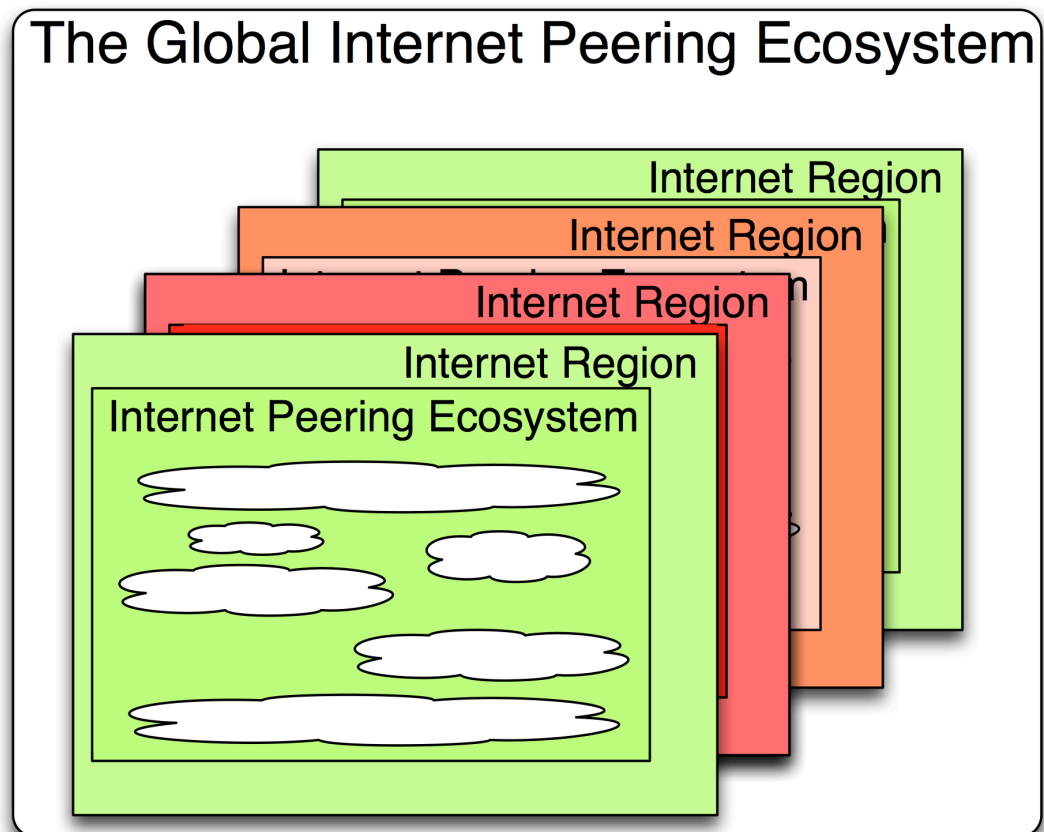
- Start assuming no knowledge
- Assume the Internet exists
- To get connected, connect to someone who is already connected
- Internet Transit service
 - Measurement and pricing models
- Exercise these definitions with
 - The Internet Transit Playbook

The Internet

- Network of Networks
- Organic from ARPANET, NSFNET
- Commercialization 1994
 - From “Planned economy Internet”
- Corporate interests 1997 onward
 - Limited information sharing
- Evolution: “Global Internet Peering Ecosystem”

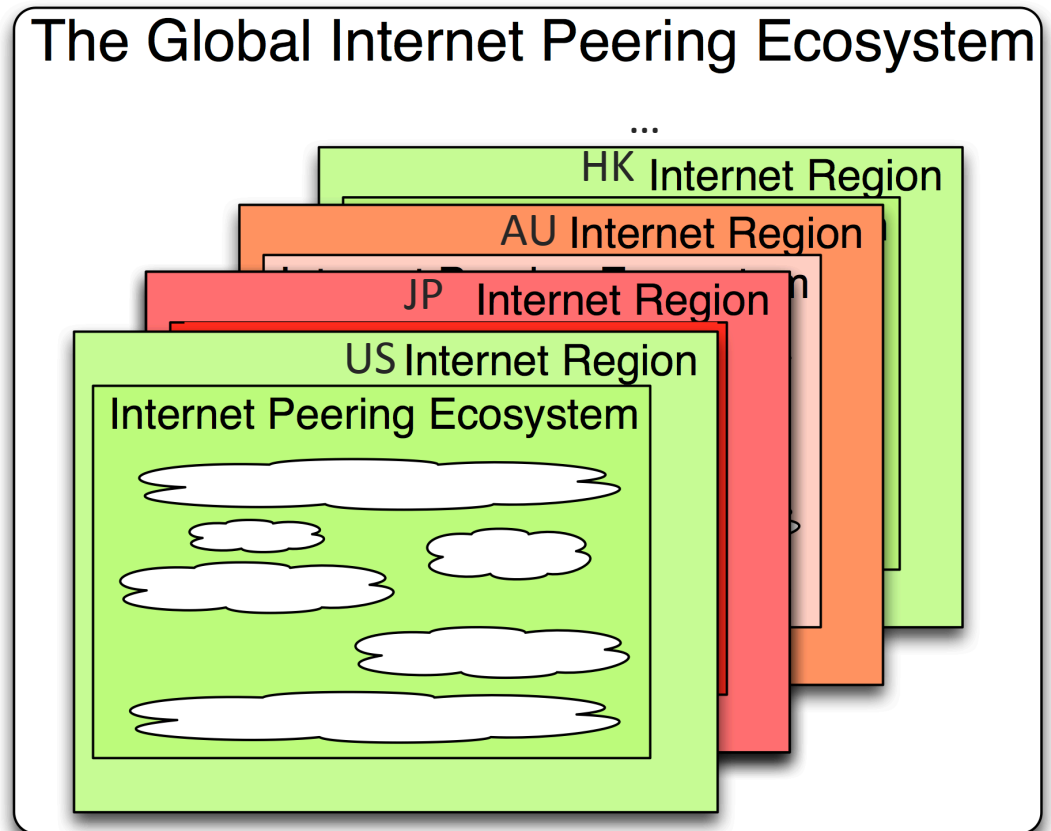
The Global Internet Peering Ecosystem

- **Definition:** The **Global Internet Peering Ecosystem** models the internal structure of the Internet as a set of Internet Regions (typically bound by country borders), each with its own Internet Peering Ecosystem.



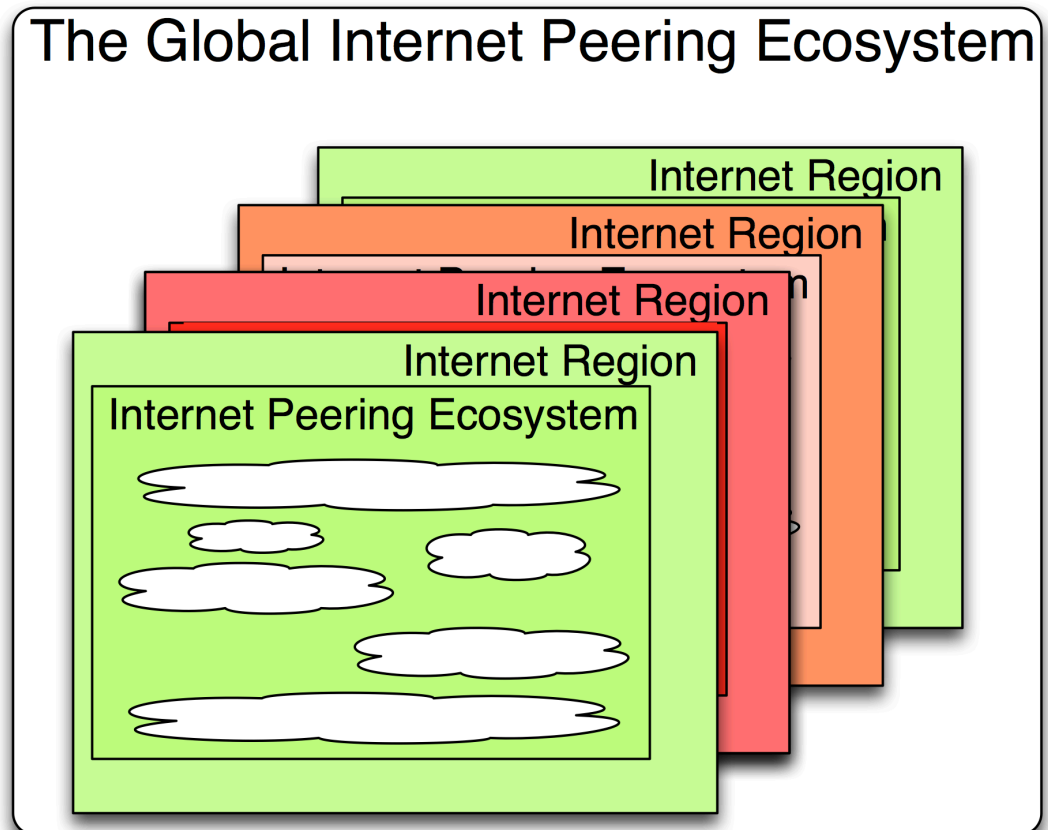
The Global Internet Peering Ecosystem

- **Definition:** An **Internet Region** is a portion of the Internet, usually defined by geographical boundaries (country or continent borders), in which an Internet Peering ecosystem is contained.



The Global Internet Peering Ecosystem

- **Definition:** The **Internet Peering Ecosystem** is a community of network service providers that interconnect their networks in various business relationships within an Internet Region.



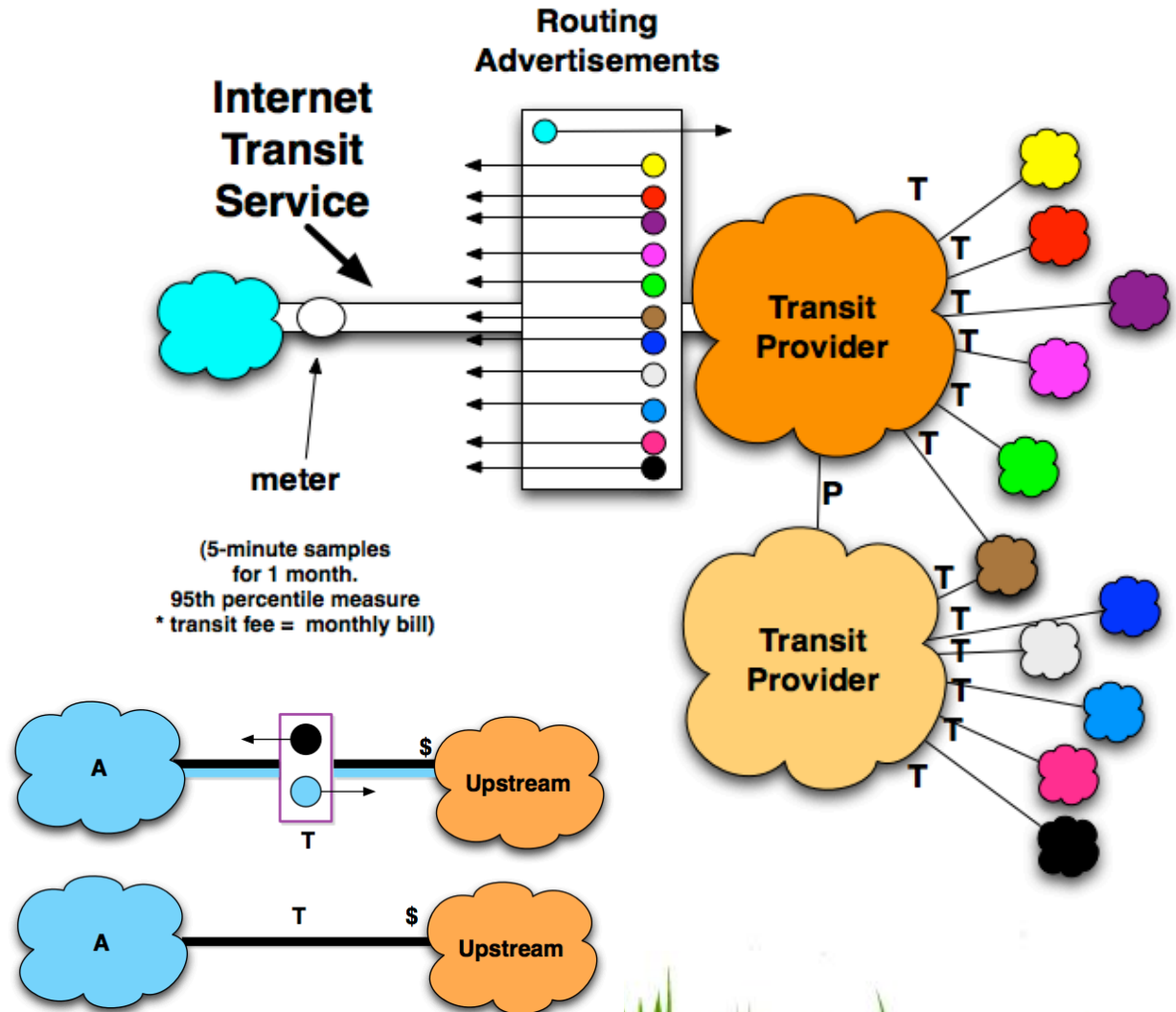
- **Definition: Internet Transit** is the business relationship whereby an entity provides (usually sells) access to the Internet.

"Internet → this way"

- **Definition: An Internet Service Providers (ISP)**, also called a “Transit Provider”, is an entity that sells access to the Internet.

Internet Transit Service

- Announce Reachability
- Metered Service
- Simple
- “Internet → This Way”
- Equivalent Notations



Internet Transit Pricing Model

- **Typically metered**
- **\$/Mbps**
- **Volume 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.

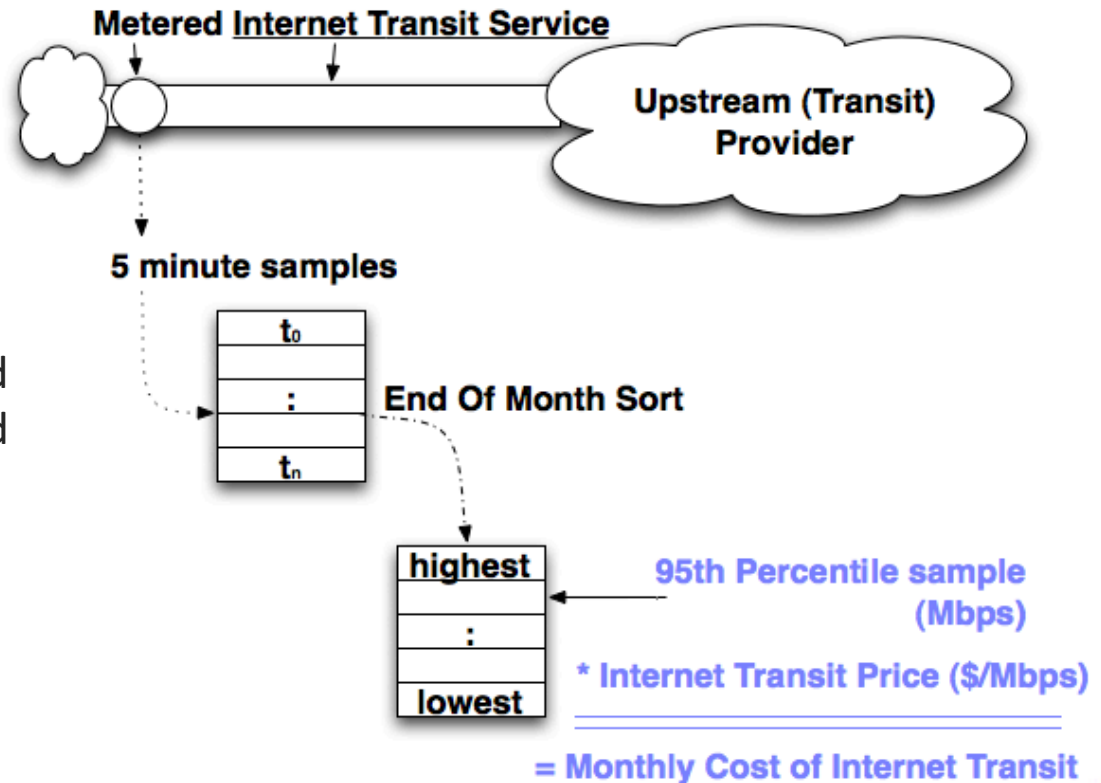
95th Percentile Billing Calculation

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

Question: at 95th I send 500Mbps and receive 800Mbps. My transit is priced at \$10/Mbps. What is my monthly Internet transit bill?

- a) \$5,000
- b) \$8,000
- c) \$13,000
- d) None of the above

Internet Transit Billing Calculation (95th Percentile Measurement)



Origin of the 95th Percentile

- Charged based on pipe capacity
- T1 Internet Service pricey
- Paid as if you filled it up 24/7
- Peak usage – bursty penalties
- 95th allows for 5% bursts
- Market adopted it

Transit Pricing with Commits

- Volume discounts
- Contracts with terms and duration

| Commit | Unit Price | MinSpend |
|---------------|-------------------|-----------------|
| 10 Mbps | \$12 per Mbps | \$120 /month |
| 100 Mbps | \$5 per Mbps | \$500 /month |
| 1 Gbps | \$3.50 per Mbps | \$3,500 /month |
| 10 Gbps | \$1.20 per Mbps | \$12,000 /month |
| 100 Gbps | \$0.70 per Mbps | \$70,000 /month |

$$\text{monthlyBill} = \max(T_v * P_c, C * P_c)$$

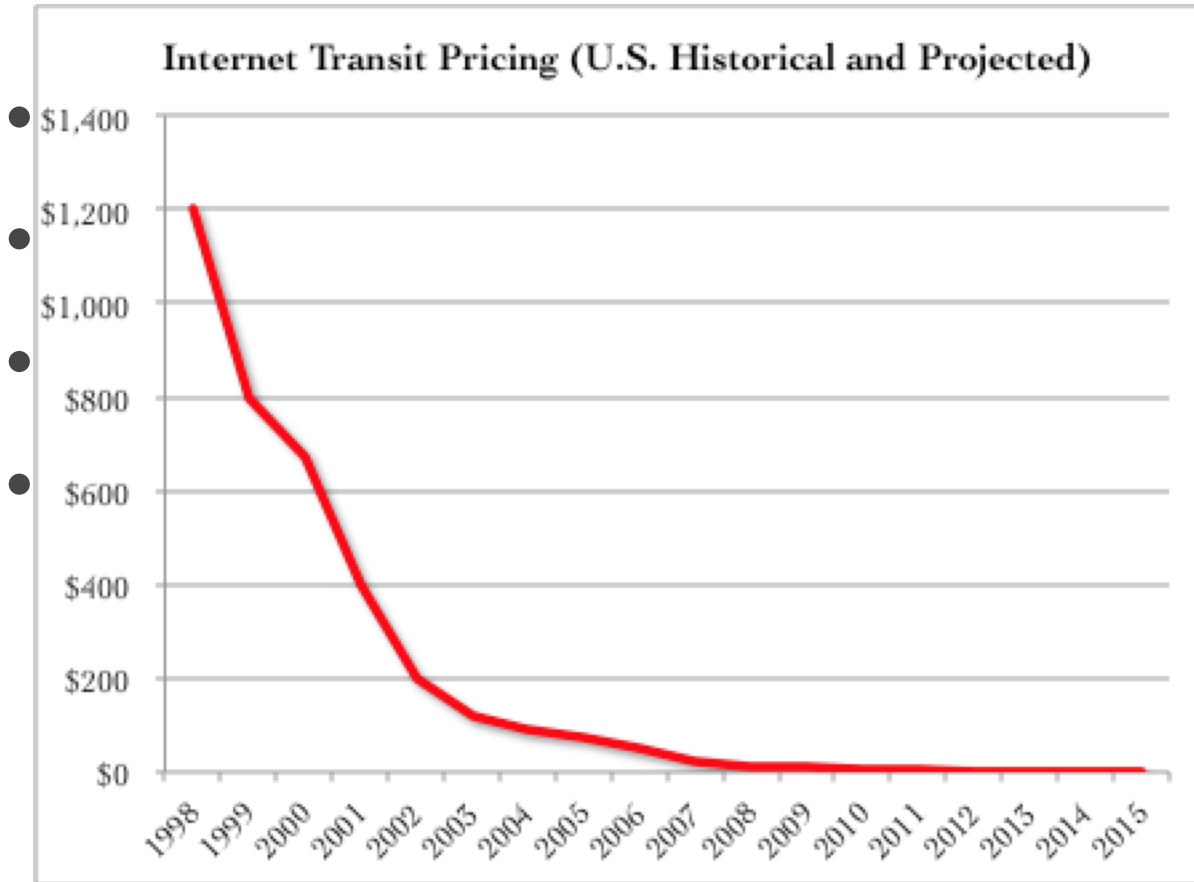
where

T_v = transitVolume_in_Mbps

C = commitLevel_in_Mbps

P_c = unitPrice_at_commitLevel_in_\$_per_Mbps

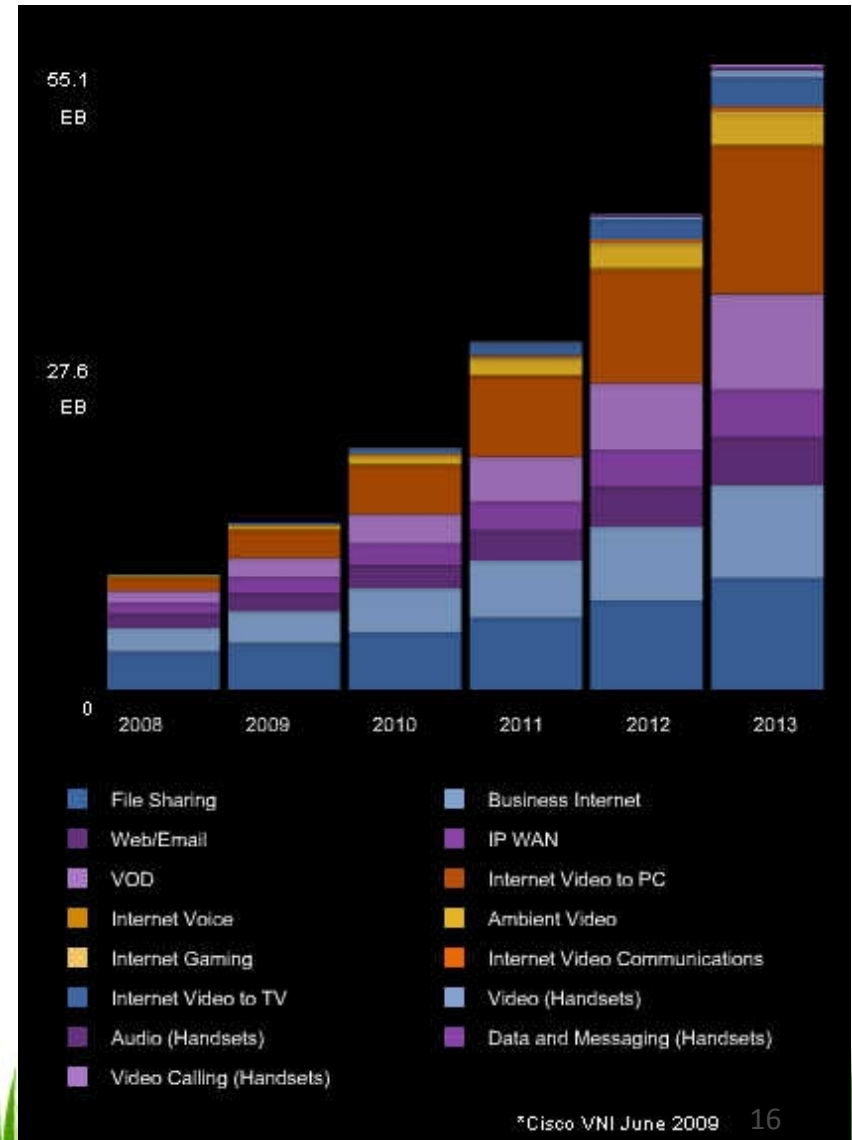
Internet Price Declines (U.S.)



| Price (in minimum) | | % Decline |
|--------------------|-----------------|-----------|
| \$1,200 | per Mbps | |
| \$800 | per Mbps | 33% |
| \$675 | per Mbps | 16% |
| \$400 | per Mbps | 40% |
| \$200 | per Mbps | 50% |
| \$120 | per Mbps | 40% |
| \$90 | per Mbps | 25% |
| \$75 | per Mbps | 17% |
| \$50 | per Mbps | 33% |
| \$25 | per Mbps | 50% |
| \$12 | per Mbps | 52% |
| \$9.00 | per Mbps | 25% |
| \$5.00 | per Mbps | 44% |
| \$3.25 | per Mbps | 35% |
| 2012 | \$2.34 per Mbps | 28% |
| 2013 | \$1.57 per Mbps | 33% |
| 2014 | \$0.94 per Mbps | 40% |
| 2015 | \$0.63 per Mbps | 33% |

Internet Transit Growth

- Massive growth in Video
- Price Decline at 30%
- Volume grows at 60%



Implementation of Internet Transit

Architecture evaluates technology and designs a solution
Product Mgmt and capacity planning involved

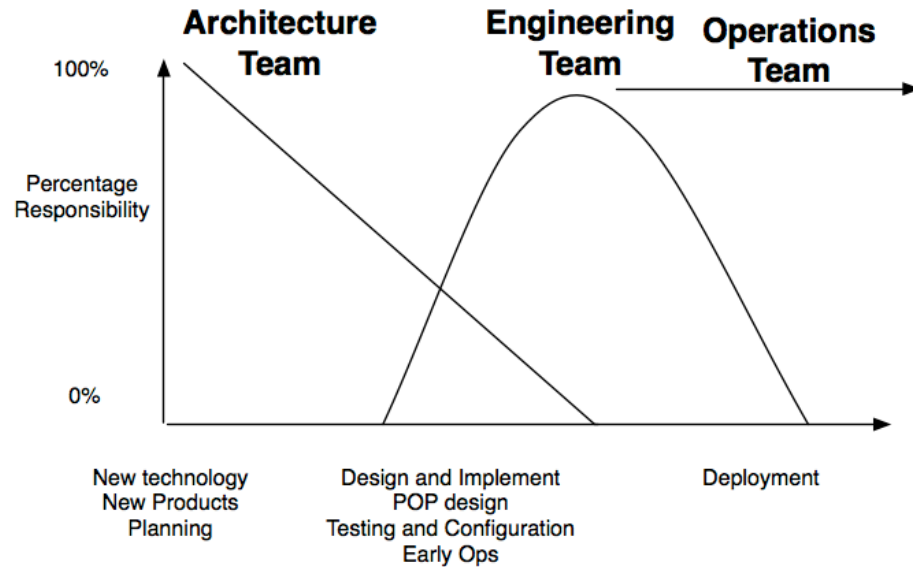
Engineering takes over implementation and early ops

Operations phases transition

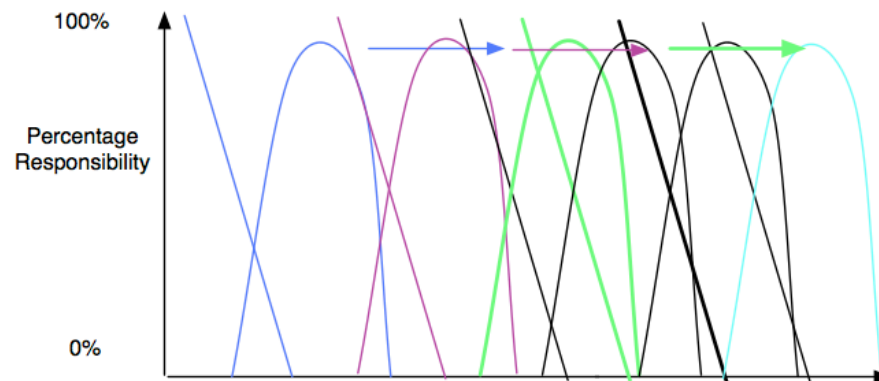
Feedback throughout

Always a new wave

Wave of Technology



Waves of Technology



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)

Problem Sets

1. I am purchasing Internet Transit from ISP A for \$5 per Mbps with no commits. At the end of the month I send 500 Mbps and receive 800Mbps at the 95th percentile. What is my monthly bill for Internet Transit?

A) \$5/month B) \$2500/month C) \$4000/month d) \$6500/month

(C) $\text{Max}(500\text{Mbps}, 800\text{Mbps}) * \$5/\text{Mbps} = \$4000/\text{month}$

2. I am purchasing Internet Transit from ISP B for \$5 per Mbps but I am considering buying their 1G commit transit product at a price of \$3/Mbps. I still expect to send 500 Mbps and receive 800Mbps at the 95th percentile. Should I commit to 1G?

YES – Commit early

$\text{Max}(500\text{Mbps}, 800\text{Mbps}) * \$5/\text{Mbps} = \$4000/\text{month}$

Vs.

$1000\text{Mbps} * \$3/\text{Mbps} = \$3000/\text{month}$

Next up...

- Exercise your understanding of Internet Transit
- Exercise the definitions
- Think about motivations