Internet Video: The Next Wave of Massive Disruption to the U.S. Peering Ecosystem

IVTNWOMDTTUSPE

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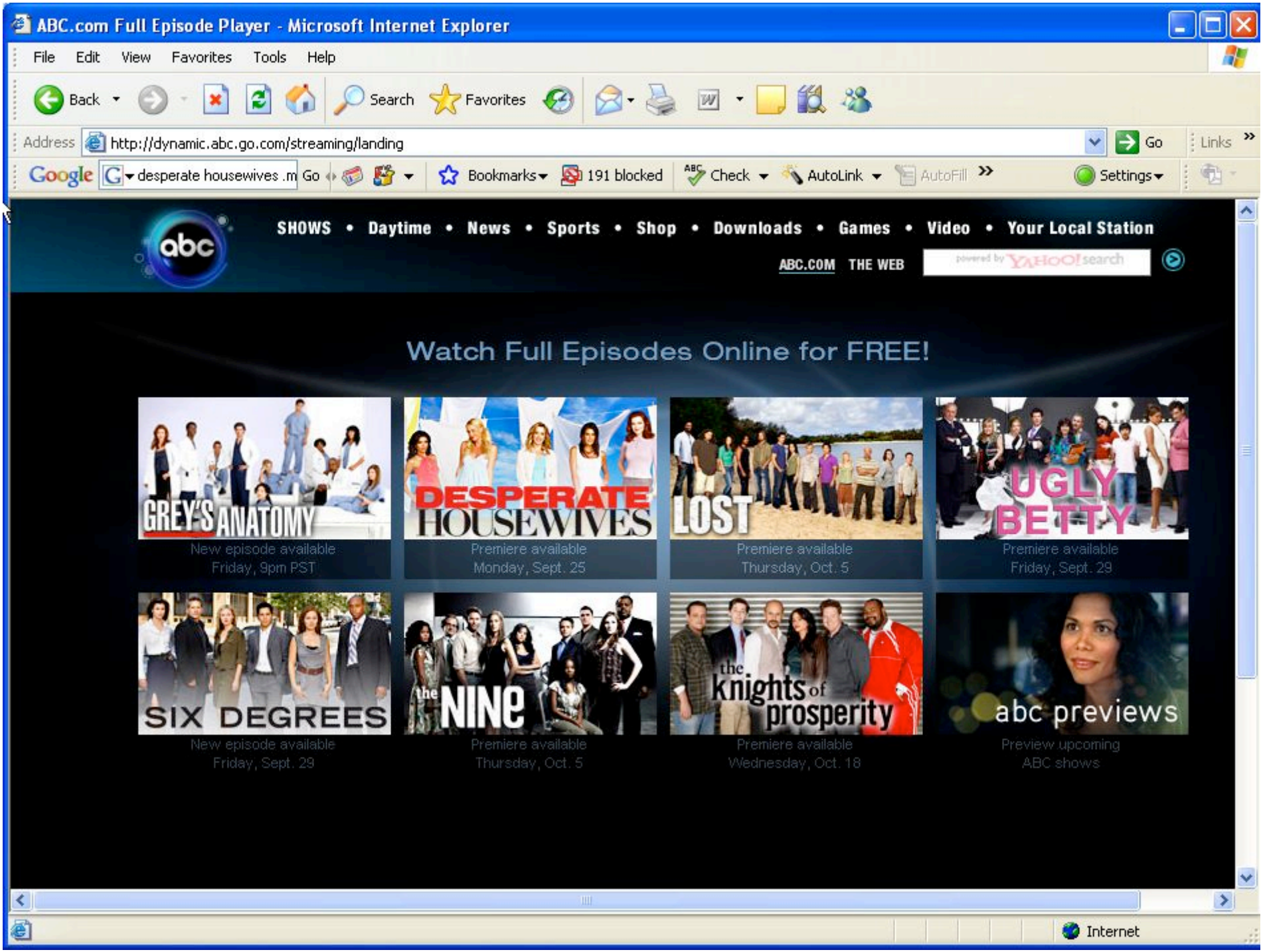
Equinix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GREY'S ANATOMY
New episode available
Friday, 9pm PST
DESPERATE HOUSEWIVES
Premiere available
Monday, Sept. 25
LOST
Premiere available
Thursday, Oct. 5
UGLY BETTY
Premiere available
Friday, Sept. 29
SIX DEGREES
New episode available
Friday, Sept. 29
the NINE
Premiere available
Thursday, Oct. 5
the knights of prosperity
Premiere available
Wednesday, Oct. 18
abc previews
Preview upcoming
ABC shows
Internet

Massive Disruption in U.S. Peering Ecosystem → Full Episodes

- "Desperate Housewives" – 210MB/hour
  - For 320x240 H.264 Video iTunes image
- 10,000,000 households
- 2,100,000,000 MB = 2.1 peta-Bytes
- How long will that take to download?
  3 days @ 64Gbps non-stop !
  Just one show
  Try 250M*180 Channels*HDTV

Historical Perspective…review 5yr disruptions…

Source: http://www.pbs.org/cringely/pulpit/pulpit20060302.html

The Research Question

- What are the costs per video of distributing movies across the Internet?

Modeling

	Load		
	Small	Medium	Large
Transit			
CDN			
Transit/Peering			
P2P			

Modeling the Video Service Provider Distribution Networks

Four Models

1. Commodity Transit
2. CDN
3. Transit/Peering/DIY CDN
4. Peer2Peer

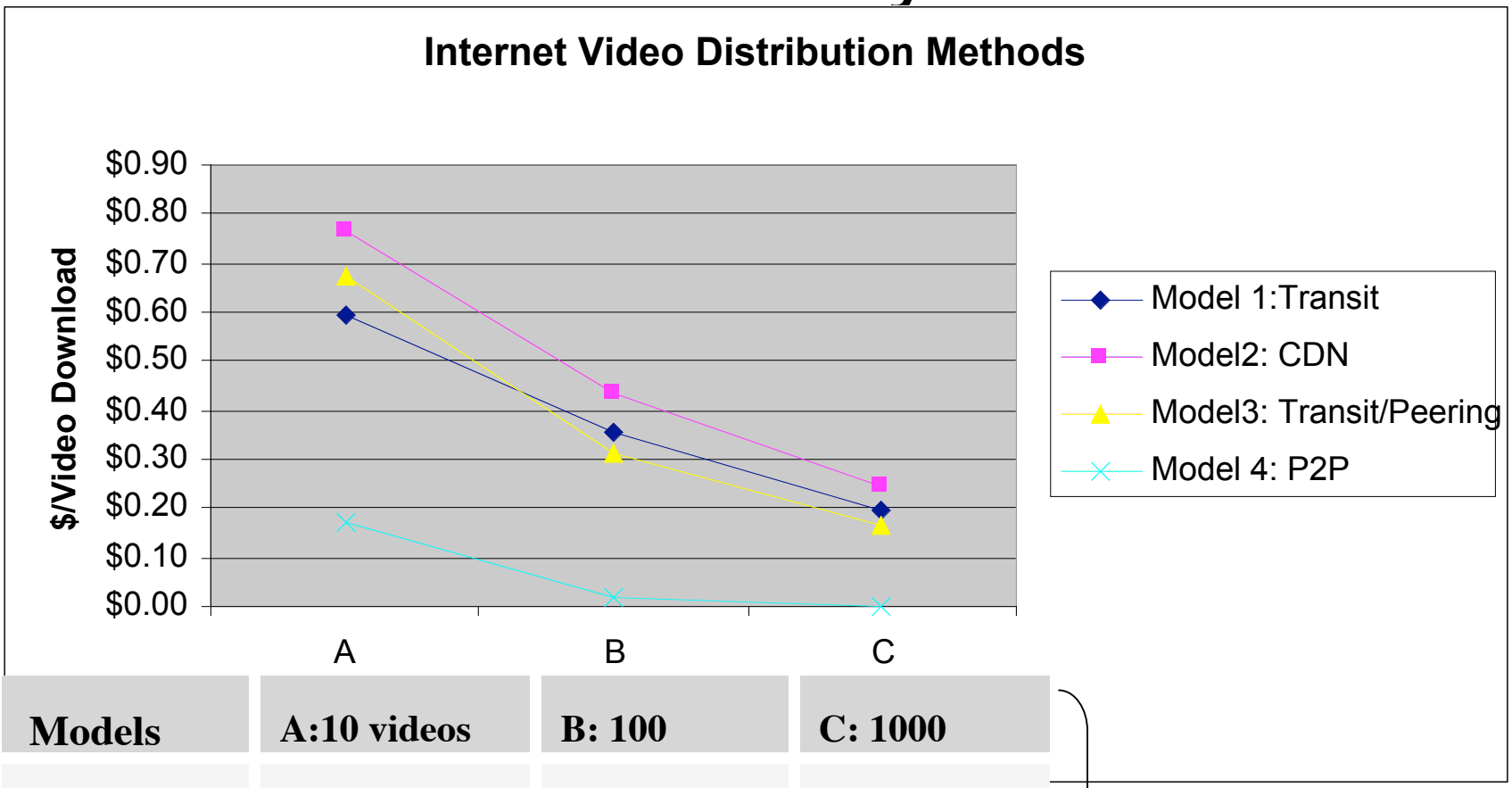
Four Load Models

A: Small Load
B: Medium Load
C: Large Load

Models	A:10 video s	B: 100	C: 1000
1: Transit	Model 1A	Model 1B	Model 1C
2: CDN	Model 2A	Model 2B	Model 2C
3: Hybrid	Model 3A	Model 3B	Model 3C
4: P2P	Model 4A	Model 4B	Model 4C

Goal : estimate cost : $/video downloaded

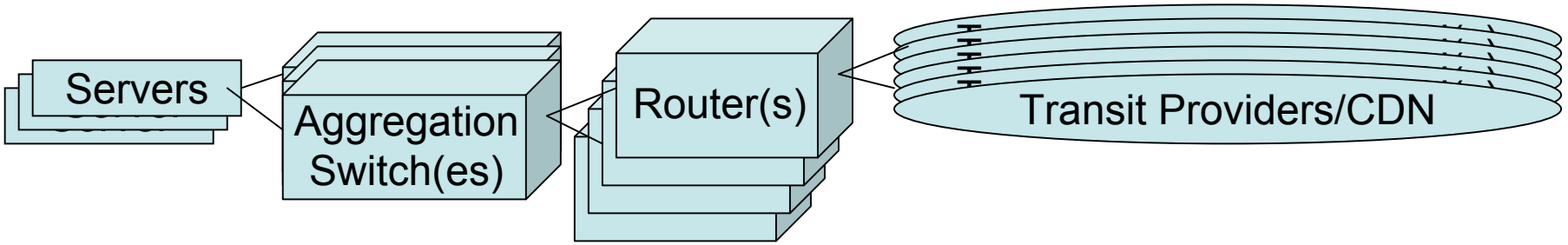
Summary

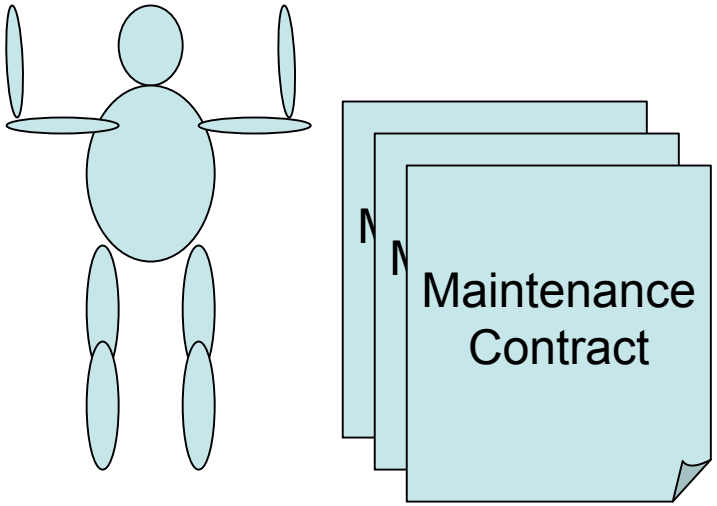


Models	A:10 videos	B: 100	C: 1000
1: Transit	1A: $0.60	1B: $0.36	1C: $0.20
2: CDN	2A: $0.77	2B: $0.44	2C: $0.24
3: Hybrid	3A: $0.69	3B: $0.31	3C: $0.17
4: P2P	4A:$0.18	4B: $0.0177	4C: $0.0018

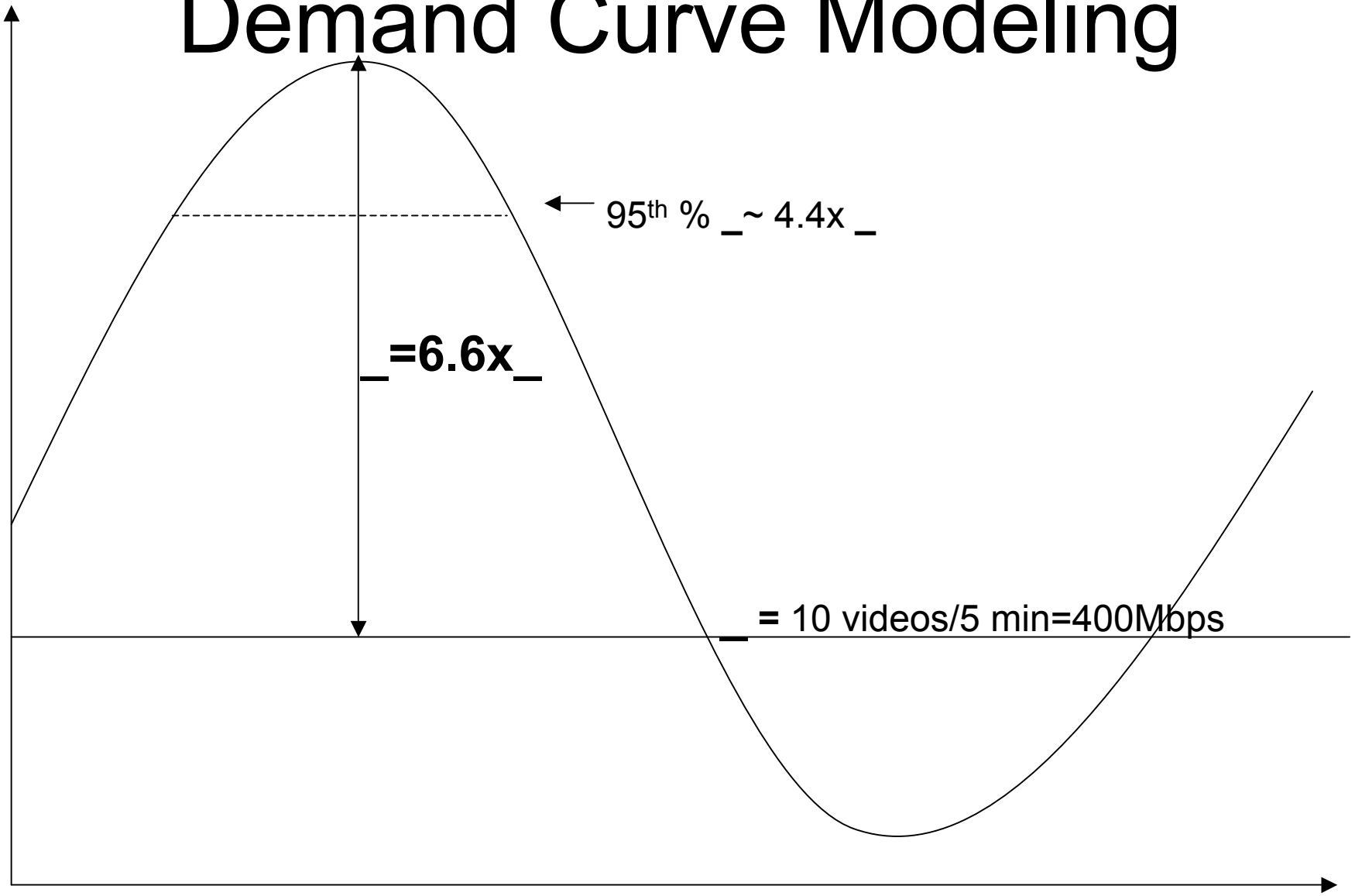
Per Video Cost Of delivery

Generalized Model

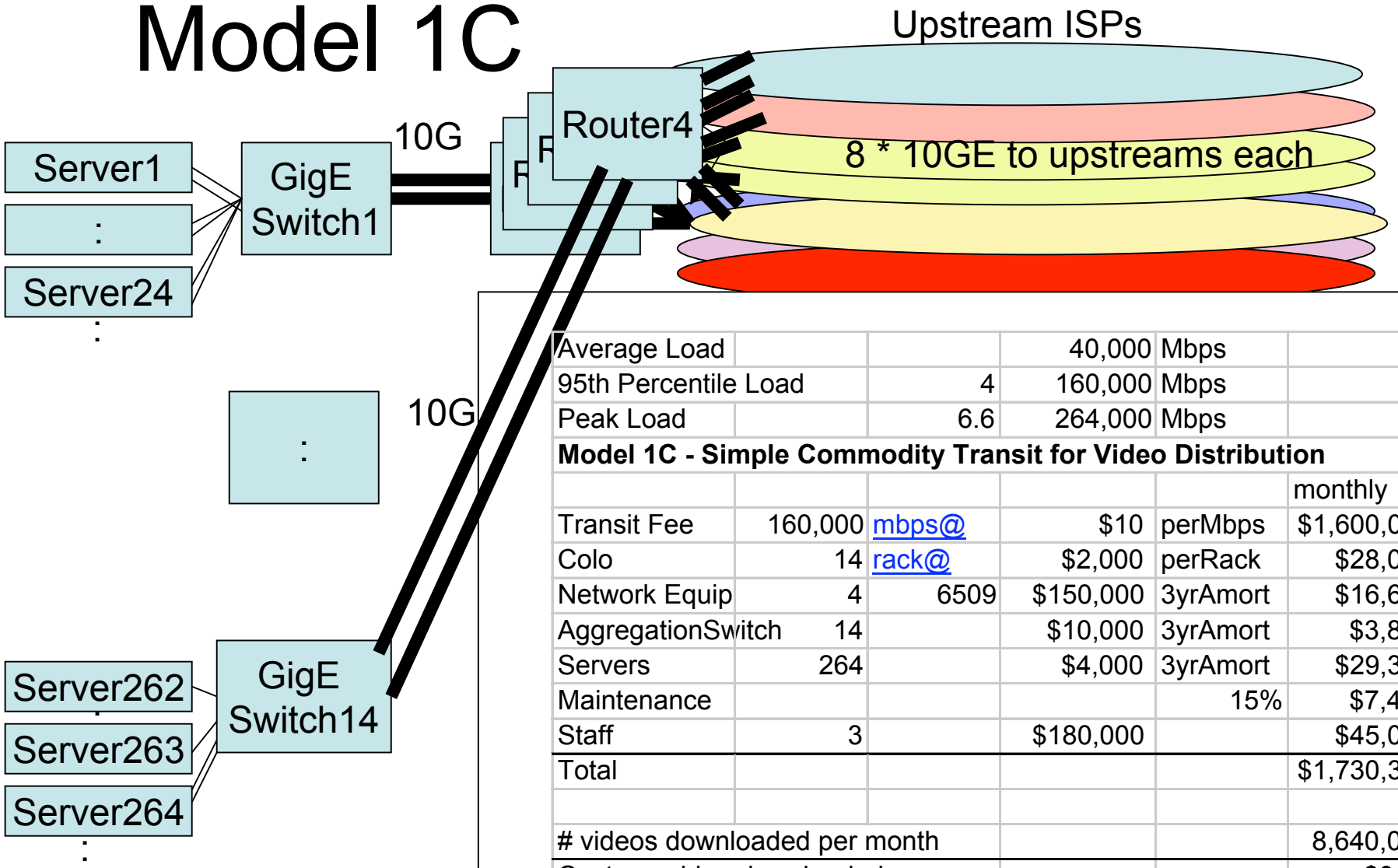




Demand Curve Modeling



Model 1C



Average Load			40,000	Mbps	
95th Percentile Load		4	160,000	Mbps	
Peak Load		6.6	264,000	Mbps	
Model 1C - Simple Commodity Transit for Video Distribution					
					monthly
Transit Fee	160,000	mbps@	$10	perMbps	$1,600,000
Colo	14	rack@	$2,000	perRack	$28,000
Network Equip	4	6509	$150,000	3yrAmort	$16,667
AggregationSwitch	14		$10,000	3yrAmort	$3,889
Servers	264		$4,000	3yrAmort	$29,333
Maintenance				15%	$7,483
Staff	3		$180,000		$45,000
Total					$1,730,372
# videos downloaded per month					8,640,000
Cost per video downloaded					$0.20

Distribution GigE Switch
48 port GigE for servers
2 10GE for upstream
$10,000
Add another every 24 servers

Routers
Cisco 6509Sup720-3bxl
w/4*4-port 10GE, $150,000
80Gbps from switches, 80Gbps to upstreams

Model 2C: CDN Large Load

Average Load			40,000	Mbps	
95th Percentile Load		4	160,000	Mbps	
Peak Load		6.6	264,000	Mbps	
Model 2C - Content Delivery Network for Video Distribution					
					monthly
Transit Fee	160,000	mbps@	$13	perMbps	$2,080,000
Colo	1	rack@	$1,500	perRack	$1,500
Network Equip	1	6503	$30,000	3yrAmort	$833
Servers	1		$4,000	3yrAmort	$111
Maintenance				15%	$367
Staff	0.5		$180,000		$7,500
Total					$2,090,311
# videos downloaded per month					8,640,000
Cost per video downloaded					$0.24

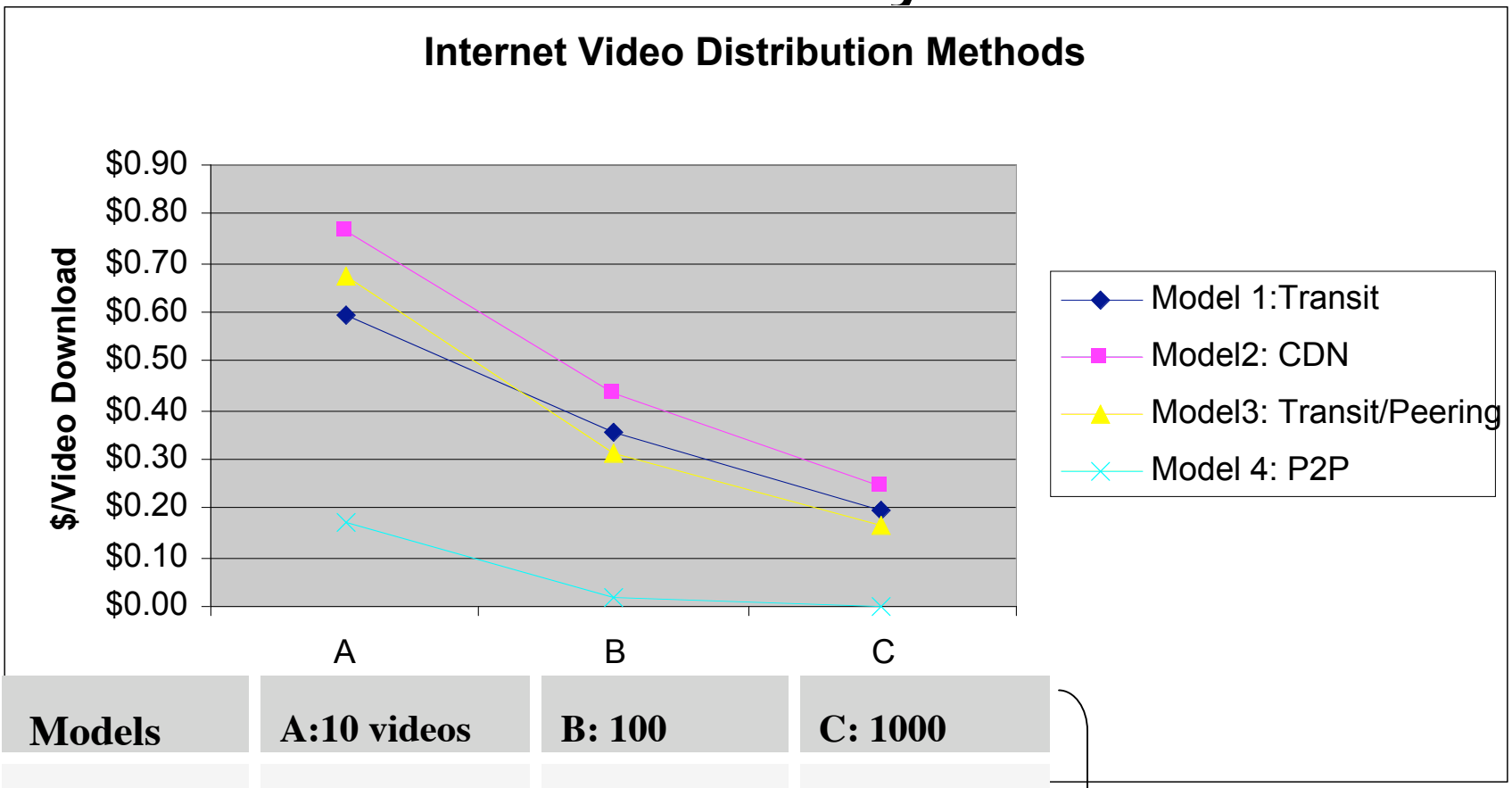
Model 3C: Transit/Peering Heavy Load

Average Load			40,000	Mbps	
95th Percentile Load		4	160,000	Mbps	
Peak Load		6.6	264,000	Mbps	
Model 3C - Blended Transit and Peering for Video distribution					
3 site	25%	peering			monthly
Transit Fee	120,000	mbps@	$10	perMbps	$1,200,000
Colo	42	rack@	$2,000	rack+port	$84,000
Network Equip	12	6509	$150,000	3yrAmort	$50,000
AggregationSwitch	42		$10,000	3yrAmort	$3,889
Servers	792		$4,000	3yrAmort	$88,000
Maintenance				15%	$21,283
Staff	3		$180,000		$45,000
Total					$1,492,172
# videos downloaded per month					8,640,000
Cost per video downloaded					$0.17

Model 4C: P2P Large Load

Average Load		Mbps		Mbps	
95th Percentile Load		4	160,000	Mbps	
Peak Load		6.6	264,000	Mbps	
Model 4C - Peer-to-Peer Network for Video Distribution					
single-site stormcasting					monthly
Transit Fee	100	mbps@	$50	perMbps	$5,000
Colo	1	rack@	$1,500	perRack	$1,500
Network Equip	1	6503	$30,000	3yrAmort	$833
Servers	1		$4,000	3yrAmort	$111
Maintenance				15%	$367
Staff	0.5		$180,000		$7,500
Total					$15,311
# videos downloaded per month					8,640,000
Cost per video downloaded					$0.0018

Summary



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Per Video Cost Of delivery

Observation/Implications

- Internet Transit Supply _
- Internet Transit Price _
- Internet Transit Model → src/dst specific
- Bottleneck**s**
  - IX Power, Router Capacity, Peer's Capacity,
  - Last Mile bottleneck
  - Do I need to upgrade $$$$ gear to support my competitor (peer)?
- Geoff Huston: "P2P has won. Telco/Cable co trying to keep its 1998 biz plan relevant."

I look forward to discussing this over the next few days.