Optical Illusions:

Content Providers and the Impending Transformation of International Transport

> Tim Stronge TeleGeography NANOG 71

Let's discover ...

- How dependent international transport is on content provider demand
- How content providers are changing international transport prices
- Magic



Growth depends on content.

Illusion #1

Sometimes, we require motion to comprehend an image







Recognizing the new gestalt



Recognizing the new gestalt



Switched Voice
Research-Educational
Enterprises and Others
Content Providers
Internet Backbone

Growth depends on content

Lit vs. Potential Capacity on All Trans-Atlantic Cables: Baseline View



Growth depends on content

Lit vs. Potential Capacity on All Trans-Atlantic Cables: Pessimistic View



Content providers are building cables . . . sort of.

Illusion #2

Sometimes, we perceive motion that does not exist



Source: http://www.ritsumei.ac.jp/%7Eakitaoka/index-e.html

Content provider cable investments

Provider	Cable	RFS
Google	Unity	2010
	Southeast Japan Cable (SJC)	2013
	FASTER	2016
	Monet	2017
	Tannat	2017
	Junior	2017
	Pacific Light Cable Network (PLCN)	2018
	INDIGO-West	2019
	INDIGO-Central	2019
Facebook	AEConnect	2016
	Asia Pacific Gateway (APG)	2016
	MAREA	2018
	Pacific Light Cable Network (PLCN)	2018
Microsoft	Hibernia Express	2015
	AEConnect	2016
	New Cross Pacific	2018
	MAREA	2018
Amazon	Hawaiki	2018

Note: Only publicly disclosed content provider investments shown.

Direct investment in new cables

Submarine Cable Build Cost Allocated to Content Providers



Note: Data exclude post-RFS fiber pair sales, spectrum, and managed bandwidth purchases.

Direct investment in new cables

Submarine Cable Build Cost Allocated to Content Providers



Direct investment in new cables

Submarine Cable Build Cost Allocated to All Owners



Content provider cables are not ubiquitous.

Illusion #3

Sometimes, we perceive colors that do not exist



Source: http://www.sciencedirect.com/science/article/pii/S0042698901001055

Content really big on some routes

International Capacity Usage by Network Type by Route



All submarine cables



Note: Includes both existing and planned systems.

Cables with content provider owners



Note: Includes both existing and planned systems.

Good ol' hub and spoke

Location of Content Provider Data Centers



Demand shapes prices . . . but not in the way you think.

Illusion #4

Sometimes, we disregard established patterns



Source: http://www.kyb.tuebingen.mpg.de/research/dep/bu/more-on-this-topic/optical-illusions.html



Source: http://www.michaelbach.de/ot/fcs-hollowFace/index.html

A discovery about bandwidth prices

- Faster demand growth -> faster price declines
- Wait, what?

The magic is in the unit costs

- Let's build a simple, hypothetical cost model:
- Each cable has \$6m annual opex
 - Wet and dry O&M, backhaul fees, power, SG&A
- Ignore initial capital payoff
- 100G wave upgrade costs fall 20% annually
- Each cable loaded with 6 Tbps in 2016 – Annual demand growth of 35% until fully loaded

Watch the denominator

Cost/Month

÷ 10G Waves Sold

= Cost per 10G Sold/Month

Capacity drives cable unit costs



Price finally approaches cost floor?



Content providers are a *solution* to cable funding dilemma ... but also a *problem*.

Illusion #5

Sometimes, the closer we are to an object the less we see





A basic cash flow model

- RFS = 2020
- Capacity sales
 - Addressable market = 400 Gbps, growing 20% p.a.
 - Price = \$25k per month for 100G annual lease, falling 20% p.a.
- Construction = \$150m
- 100G upgrades = \$200k now, falling 20% p.a.
- OPEX = lean wholesale operation

Hypothetical cable cash flow

Annual Cash Flow: 0 of 6 Fiber Pairs Sold



Share the load

Cumulative Cash Flow: 0 of 6 Fiber Pairs Offloaded



Share the load

Cumulative Cash Flow: 2 of 6 Fiber Pairs Offloaded



Share the load

Cumulative Cash Flow: 4 of 6 Fiber Pairs Offloaded



Content providers as buyers

- Good
 - Lots of unanticipated growth
 - Lower unit cost-> lower prices
 - Heavily underwrite some new cables

- Bad [?]
 - Not ubiquitous
 - Uncertain future demand
 - Market power shift to a few buyers
 - Content-only cables in our future?

Illusion #6

Sometimes, our desires create mirages



Thanks!



tstronge@telegeography.com



Carlsbad, CA I Washington, DC I Exeter, UK I Singapore I www.telegeography.com I info@telegeography.com