INFORMING INVESTMENT DECISIONS WITH SUBMARINE BANDWIDTH PRICING ANALYSIS

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Abstract: Cloud-based network services with global reach rely on the undersea cable network. Knowledge of network metrics guides successful investments in undersea capacity. Along with supply, demand, and cost, bandwidth pricing is a critical industry metric to track. Relying on a data set of more than 200,000 records stretching back 14 years, this paper will examine the evolution of bandwidth pricing on primary submarine cable routes, and contrast those with prices for IP transit. Analysis will examine price trends over time, place, and capacity, and lend insights into future submarine cable investments.

This paper examines the evolution of both bandwidth prices and IP transit prices and contrasts the two. The research finds that local high-capacity IP transit prices are often higher than the combination of transport to the nearest primary global IP traffic hub plus IP transit purchase there. This shapes how Internet traffic is routed, and subsequently, demand for submarine cable capacity.

1. INTRODUCTION

Bandwidth prices vary widely by region but show nearly universal decline. Price erosion is a constant companion to supply and demand growth for submarine cable bandwidth. Prices routinely decline at a compounded annual rate of 25 percent per year, and short-term market disruptions produce even sharper price drops. Reckoning with these trends is critical for successful investment in submarine cable capacity.

Whether or not wholesale capacity sales are a primary strategy for a cable system owner, capacity pricing is a critical factor in submarine cable business plans. Linked with demand volume and capacity cost, price determines profit margin and return on investment. Prices for wholesale bandwidth transactions establish a revenue model for wholesale sales, as well as a proxy value of a system's unsold bandwidth, including bandwidth allocated to owners' internal use. Prices also determine the opportunity cost for build-vs.-buy decisions.

IP Transit Only a few of the world's largest Internet backbone providers claim transit-free status, exchanging all of their traffic with other backbone providers via peering. Downstream Internet service providers (ISPs), content companies, and other Internet operators must purchase at least some upstream "transit" in order to connect their internal networks to the Internet at large.

Purchasing an IP transit port affords access to the entire Internet via the provider's Internet backbone, peers, and other transit customers. Paid peering is similar to transit, but only grants the customer access to that provider's network, which includes the provider's transit customers, but not the provider's peers.

IP transit prices in this paper are based on confidential quarterly surveys of major IP transit providers for prices in major cities around the world. All transit pricing data shown exclude installation and local access costs and specify a baseline service level and purchase volume for a one-year term.

Bandwidth pricing Unlike IP transit pricing, bandwidth prices are for discrete circuits traversing routes between two points. Transactions come in the form of lease or IRU. Although layer 2 Ethernet transactions can resemble layer 3 transactions with a more port-based topology rather than discrete routing and may also include CDRs and different classes of service, this paper focuses on transactions at lower network layers, SDH and DWDM wavelengths. Bandwidth price data in this paper share the same methodology as IP transit, based on confidential quarterly surveys of major bandwidth providers for prices on primary global routes. All bandwidth pricing data shown exclude installation and local access costs and specify a baseline service level and purchase volume for a one-year term.

Contrasting transit and transport For ISPs whose main capacity requirement is connecting subscribers to other parts of the Internet, IP transit is the obvious alternative to wholesale bandwidth. Unlike bandwidth circuits, which are restricted to points on a fixed route, IP transit confers a guaranteed connection to an IP backbone to carry the client's traffic over diverse, unspecified paths to reach its intended recipient. Recipient locations are IP addresses, not physical places. The main advantage for the buyer is that it reduces the expenditure and complexity of network equipment and management. In many regions, increasing competition for IP transit services has driven down prices, making this an increasingly attractive proposition.

2. GLOBAL PRICE TRENDS

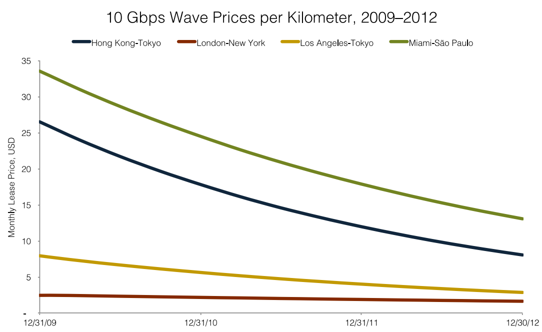

Figure 1 : Global Wavelength Price Trends

Prices for both transport bandwidth and IP transit are declining. Among primary global submarine cable routes, median monthly lease prices for 10 Gbps wavelengths have declined approximately 30 percent per year compounded annually from 2009 to 2012, with the exception of the trans-Atlantic route, which declined at a more modest rate of 13 percent (see Figure 1, Global Wavelength Price Trends). Despite the slower rate of decline, the trans-Atlantic route remains the lowest-priced among major undersea routes per unit distance.

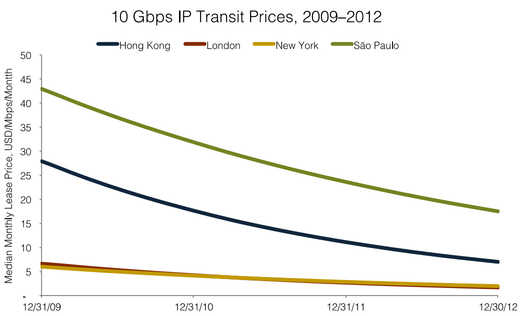

Figure 2 : Global IP Transit Price Trends

Prices for transit exhibit trends similar to transport. Prices for 10 GigE ports in London have declined 37 percent compounded annually from 2009 to 2012, surpassing New York as the lowest-priced IP transit location during the period. Prices in São Paulo declined more modestly at 26 percent, an otherwise brisk pace of decline (see Figure 2, Global IP Transit Price

Trends). Although IP transit prices have declined universally, differences in price by geography have remained pervasive over time. The ratio of highest to lowest price among this group of IP transit locations rose from approximately 6 to 9 over the period.

Transport and Transit Prices, 10 Gbps Connectivity	CAGR, 2009–2012
Transport	
Hong Kong-Tokyo	-33%
London-New York	-13%
Los Angeles-Tokyo	-29%
Miami-São Paulo	-27%
Transit	
Hong Kong	-37%
London	-37%
New York	-31%
São Paulo	-26%

Table 1 **: Transport and Transit Prices**

Summarizing rates of price decline for transport and transit, rates of decline are similar (see Table 1, Transport and Transit Price Trends). One route that stands out is London–New York, where the rate of price decline is much slower than other global routes and associated transit venues.

3. LOCAL VS. REMOTE TRANSIT

One of the primary applications for buying wavelengths is to link core routers in IP networks into a mesh network. A fundamental analysis for a buyer is whether to buy transit locally or seek lower prices elsewhere. If the net price of the remote transit plus the price of transport to reach the remote location remains lower than the local transit price, then the "pipe & port" proposition may be optimal.

The pipe & port price is the monthly recurring charge (MRC) of the remote transit, plus the MRC of the equivalent point-to-point capacity. For example, the median 10 Gbps IP transit price in Hong Kong was $7.00 per Mbps per month, or $70,000 per month, in 2012. The IP transit price in Los Angeles, the nearest top-tier, low-price IP transit venue, was approximately $19,300 MRC. The median MRC of a 10 Gbps wave linking Hong Kong with Los Angeles was approximately $43,800. So the pipe & port price is $19,300 plus $43,800, which equals $63,100, 10 percent less than the IP transit price in Hong Kong.

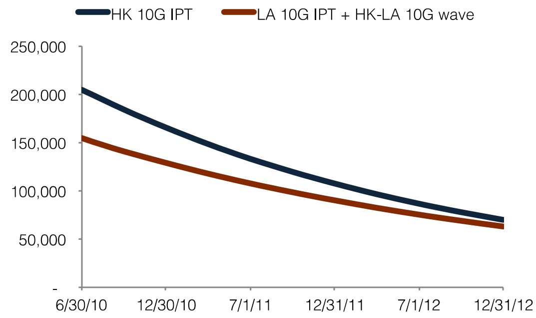

Figure 3 **: Hong Kong Transit Prices**

Prices for 10 Gbps transit in Hong Kong and Los Angeles, as well as 10 Gbps wavelength prices linking the two cities, have fallen over the past few years (see Figure 3, Hong Kong Transit Prices). Over that time, the price for transit in Hong Kong has converged with that of the pipe & port price to Los Angeles since Q2 2010, when 10 Gbps Hong Kong IP transit was priced 33 percent higher than pipe & port. This corresponds with the emergence of Hong Kong as a transit hub in its own right, rather than a conduit for transit sourced from the United States. For an Asian transit buyer with a PoP in Hong Kong, there is little price incentive to source 10 Gbps transit abroad.

This relationship of local vs. pipe & port pricing plays out differently for São Paulo and Miami, where the price for IP transit in São Paulo has remained approximately 1.5 times that of pipe & port between 2009 and 2012 (see Figure 4, São Paulo Transit Prices.

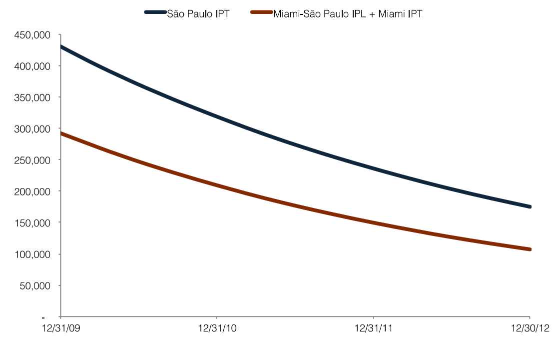

Figure 4 **: São Paulo Transit Prices**

The relationship between local transit price and pipe & port changes with lower capacity. For Hong Kong, the price of IP transit at the STM-4 port size has remained less expensive than STM-4 transport price to Los Angeles plus transit price there (see Figure 5, Hong Kong Transit Prices, STM-4). For an Asian transit buyer, if the price of transport to reach Hong Kong is less than this difference, then it makes sense to buy IP transit in Hong Kong. If the pipe & port cost is less from its location, then it makes sense to buy transit in Los Angeles. São Paulo and Miami demonstrate a similar scenario.

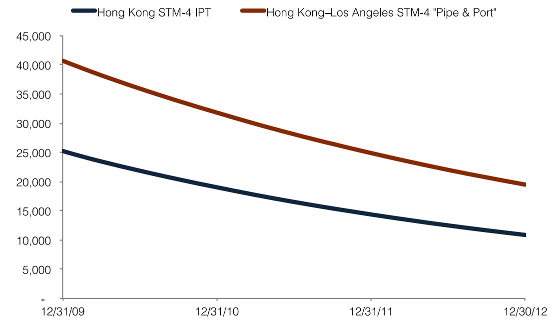

Figure 5 **: Hong Kong Transit Prices, STM-4**

One reason for the different relationship between local transit and pipe & port at different capacity is that lower capacity transport and transit purchases come at higher unit prices. This means a supplier can buy transport and transit at high capacity and make a gross margin selling lower capacity service.

Remote Transit Dependence The Middle East is highly dependent on the pipe & port model. Market forces in the Middle East dictate that nearly all traffic is exchanged outside of the region, primarily in Europe. Bandwidth and transit pricing impart some of those forces. A pipe & port scenario linking Fujairah landing station with IP transit in Europe at the 10 Gbps level was approximately $100,000 per month as of 2012. Transit may also be sourced from Hong Kong, but the price for Hong Kong transit is nearly as much as Europe pipe & port at $70,000 per month, while the Fujairah–Hong Kong transport price is even higher than Fujairah–Europe, rendering the eastward pipe & port scenario for the Gulf region nearly two thirds more than westward.

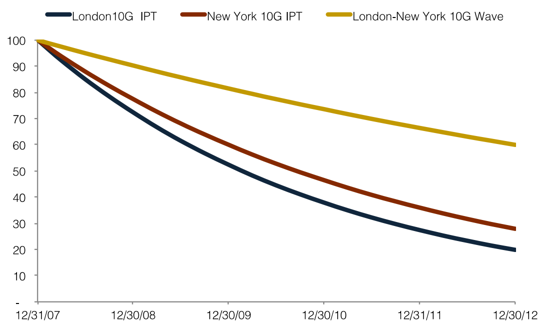

Figure 6 **: London and New York Prices**

Contrary to the scenarios in Asia and Latin America, where there is discernible demand for port & pipe capacity, the relationship between trans-Atlantic transport and transit in either the United States or Europe is less connected (see Figure 6, London and New York Prices). Europe is now a primary global traffic exchange host in its own right, not reliant on the United States for global traffic exchange. IP transit price declines in London and other European hubs have actually outstripped American counterparts as the lowest in the world. Monthly prices per Mbps are now measured in fractions of a Euro. Meanwhile, trans-Atlantic wave pricing has declined modestly relative to other primary submarine routes.

4. DEMAND ANALYSIS

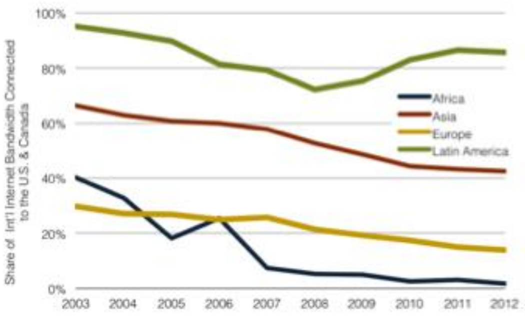

Figure 7 : Share of Bandwidth to United States and Canada

The price relationships between transit and transport in different locations help shape traffic flows. Africa, Asia, and Europe have become less reliant on the United States as a hub for traffic exchange, while Latin America has remained highly dependent (see Figure 7, Share of Bandwidth to United States and Canada). Pipe & port prices between Latin America and Miami that remain cheaper than local IP transit in Latin America corroborate that dependence. At the same time, Europe is growing in importance as a venue for traffic exchange for the Middle East and Africa (see Figure 8, Share of Bandwidth to Europe). Approximately 80 percent of the Middle East's international Internet bandwidth connects with Europe; the balance is split between Asia and the United States. Again, lowest-priced access to transit, pipe & port between the Middle East or Africa and Europe, corresponds with traffic flows between these regions.

Although IP transit pricing corresponds with global traffic flows, other factors beyond pricing contribute to traffic flows and network architecture, such as access to content, local business conditions, and a critical mass of global carriers exchanging traffic in a given location.

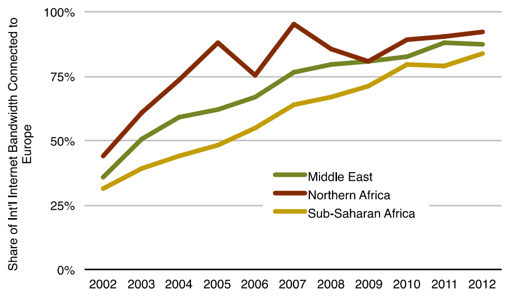

Figure 8 : Share of Bandwidth to Europe

5. CONCLUSION

Regional pricing disparities persist A primary application for international bandwidth is to provide a mesh network between major Internet hubs. Europe has emerged as the least expensive IP transit venue in the world, with median 10 Gbps prices of $1.69 per Mbps per month by Q4 2012, edging slightly past the United States at $1.96, providing transit that can be an order of magnitude cheaper than what is available locally in other parts of the world. Even in Hong Kong, a viable transit hub in its own right, transit prices are more than four times that of Europe.

Low IP transit prices in Europe continue to garner volume from abroad, driven by low prices and abundant opportunities for interconnection, even after overcoming transport prices to reach the destination. Closer proximity to emerging markets in the Middle East and Africa has helped Europe supplant the United States as a transit venue for these regions. New submarine cable capacity linking the regions has enabled this scenario.

Pipe & port often cheaper than local IPT Even though Asia has become less reliant on the United States as a venue for Internet traffic exchange, disparities persist between transit prices in Hong Kong and Los Angeles. While prices for small capacity increments are cost-effectively procured in Hong Kong, high-capacity ports can still be had cheaper in Los

Angeles, even after factoring in transport between Hong Kong and Los Angeles. This scenario plays out similarly for São Paulo and Miami, and between the Middle East and Europe and Africa and Europe.

Submarine cables carry the world's IP traffic whether the wholesale transactions are made as local transit purchases or in a pipe & port scenario. In the pipe & port scenario, submarine cable operators have direct transactions with regional ISPs in Africa, the Middle East, and Latin America, which buy both transport and transit. Even in the local transit transaction, a transit supplier ultimately aggregates traffic and uses the global submarine cable network to haul traffic back to the major exchanges in the United States and Europe for peering and additional transit connectivity. But in this scenario, submarine cable operators have less visibility into the transit customers ultimately consuming bandwidth provided by transit suppliers, since the local transit buyers are not sourcing submarine cable bandwidth, even though their transit suppliers are. The critical aspect for submarine cable planning is to ensure that new systems augment access to robust traffic exchange opportunities, exemplified by cheap IP transit. If local Internet exchanges develop and local IPT becomes cheaper, a region will become less dependent on other regions for Internet connectivity. International Internet traffic will increasingly become intra-regional, rather than inter-regional. This would slow the pace of growth for capacity on submarine cables.

The competitive price of pipe & port reinforces the backhaul of regional capacity to global hubs outside of the region. This makes economic sense, in that only a few locations in the world have the critical mass of transit and peering opportunities that afford global connectivity at low price in one spot. Notable examples are Latin America and the Middle East, which exchange most of their traffic remotely, in the United States and Europe, respectively. Corresponding traffic flows will continue to drive demand on global submarine cables. The trade-off for regions accessing global hubs can have an unfavorable effect on user experience, since the remote traffic exchange increases latency. To counteract this, ISPs seek to have content hosted locally and exchange traffic in intra-regional hubs. This will help make intra-regional traffic exchange more efficient, but content demands are often not intra-regional, and not all regions are ideal for global traffic exchange. Accordingly, the pipe & port model will likely persist, even after the development of more intra-regional traffic exchange, propelled by lower prices and more universal access to global content and traffic exchange.

6. REFERENCES

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