TRANSATLANTIC SUBMARINE SYSTEM – THE PLANNING OF SYSTEM UPGRADES IN A COMPETITIVE AND EVOLVING ENVIRONMENT

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Abstract: In the transatlantic submarine system market, the current realities of the market place make the planning of any system a multi dimensional balancing act between current technology and prevailing market economics. Due to ongoing technological developments, the maximum capacity achievable on existing systems is increasing and the prospect of ever greater channel rates (i.e. 40Gbit/s, 100Git/s technology) could greatly increase potential capacity. While contemplating the further development and deployment of higher channel rate technology the system operators need to determine to what level these developments are of commercial interest.

1. INTRODUCTION

The purpose of this paper is to highlight the factors that are relevant during the planning and implementation of system upgrades. Apollo being a transatlantic cable system operates in both the largest and most competitive submarine capacity market globally. Due to a combination of market forces and corporate restructuring the most significant influence upon wholesale submarine capacity pricing in the region is the cost of upgrade.

The primary objective for system owners is to maximise the value of the system in both the short and long term. The relative high cost of optimising the ultimate capacity of the system when compared with the opportunity of using lower cost technology in order to achieve an immediate reduction in unit cost, places an owners' long and short term objectives in increasing conflict. In attempting to balance this calculation so as to enhance both long and short term results, it is inevitable that decisions made will have significant effects upon the supply of capacity to the market.

2. COMMERCIAL CONSIDERATIONS

There is a strong financial incentive for competitive submarine system owners to maintain a just in time upgrade plan, ensuring the ongoing support to customers without carrying a burdensome inventory. This can be reasoned as logical from both a technology and economic viewpoint.

The immediate technological horizon currently being considered by transatlantic system owners is the introduction of 40Gbit/s channels. While contemplating such further development and deployment the system owners need to determine to what level these advances are of commercial interest. Lessons must be learned from the terrestrial systems where 40Gbit/s technology is now widely deployed. Factors to consider include a

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higher ultimate capacity of the fibre, a lower unit cost for resultant capacity or a specific and firm customer demand for that technology. To date it is yet to be seen whether these criteria will be widely met in the short term although all are expected in the future. The timing of such adoption is therefore critical.

Higher channel rate technology promises the clear advantage of further exploiting existing fibres by offering a higher ultimate capacity. Taking into account the high cost of laying the new submarine cable this aspect will prolong the system life and delay the need for new cables on that route. In an environment such as the Atlantic where capacity has for some time been priced based upon terminal equipment costs only, the ability to increase the capacity available purely through terminal equipment upgrades has the potential to delay the need for further submarine build. When looking at the cost of submarine cable build the cost of terminal equipment is a relatively small part compared with the cost of submerged plant and marine installation. Depending on the day one equipped capacity for shorter repeated systems the terminal equipment may be as much as 20% of the whole system cost. For longer systems such as transatlantic systems in the range of 6000km, the cost of terminal equipment is closer to 10% of the new system cost. Submerged plant takes a significantly higher proportion of the system cost as the system increases in length. For that reason it is imperative that submerged plant is planned and designed well and long term taking account of fibre type, repeater bandwidth, repeater spacing etc. Systems planned along best practice principles will have a high chance of adopting new technology and extending their competitive commercial life.

Achieving maximum capacity of the fibre may not currently be the most important short term consideration for systems that have been deployed with a higher number of fibre pairs and still have plenty of capacity available. If for example enhancing ultimate capacity increased equipment cost then immediate sales would be jeopardised. For those owners it is more the lower cost of capacity that is of interest at the expense of ultimate capacity.

3. TECHNICAL CONSIDERATIONS

Ongoing technological developments including the introduction of higher channels rates is increasing the potential capacity of the majority of transatlantic systems compared to their original design capacity.

Over recent years there has been a tremendous amount of development work in upgrade technology. Telegeography have reported ultimate design capacity in the Atlantic has risen as follows: 25Tbit/s in 2007, 32.6Tbit/s in 2008, 38Tbit/s in 2009 and 53Tbit/s in 2010 [1], see Figure 1. Over the same period sold capacity in the Atlantic has risen from approximately 5 Tbit to 10 Tbit/s.

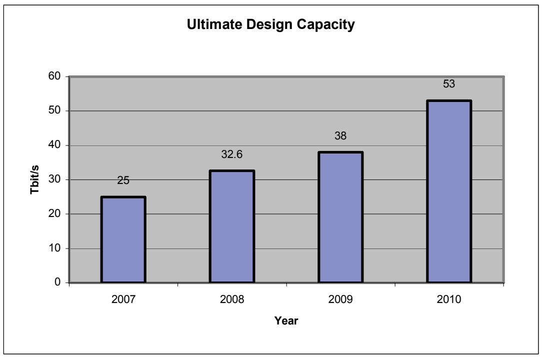

Figure 1. Transatlantic Ultimate Design capacity

Consideration needs to be given to when is it best to deploy the latest technology. There is a risk in being the first to try any new technology which can be manifested in delay in the upgrade Ready for Service (RFS) date due to either delay in technology development after contract signature or delay due to problems discovered during implementation. Focused project management and vendor management combined with a carefully negotiated upgrade contract that includes both incentives and penalties related to the RFS date can partially mitigate this risk.

Whenever higher channel rates are introduced questions are raised about the network reliability, as ever more capacity is transmitted over a single wavelength. The submarine 40G technology still has to prove itself in operation and this point will certainly be considered by the operators.

4. PLANNING

The managing of inventory and the planning of any transatlantic system upgrade is dependant on the following factors: existing equipage levels; design capacity; technical considerations (interface types etc); committed and predicted sales; equipment leadtimes and pricing. In the current transatlantic market where the market price of capacity is very low in comparison to the investment required, the submarine cable operators are not incentivised to keep a large inventory of available capacity for potential sales. With the costs of equipment trending downward and with an expected step reduction in cost due to the potential of new technology, finding the correct upgrade steps is a challenge. Too small an upgrade step and both the unit cost and supplier installation and commissioning will be proportionally higher. Too large a step and the inventory introduces increased risk of technological obsolescence and capital inefficiencies.

Performing system upgrades in small steps allows the owner to review technology developments and take advantage of those when suitable. The increase in the unit cost for small step upgrades must be balanced by the benefit brought through preserving cash and maintaining an acceptable return on investment timescale.

A further consideration of a system owner is to strive to provide a level of future proofing for their system wherever this is commercially possible. Aiming to maintain dark fibre pairs and equipping fibre pairs allowing for future adoption of finer channel spacing and higher line rates alongside existing equipment, allows an owner to adopt new technologies in a more efficient manner than if the adoption would require the replacement of existing equipment. System theoretical capacity often assumes equipping dark fibres with the latest available technology. This is however limited by the original deployment and sometimes requires the original equipment to be replaced. When any equipment replacement is required in order to adopt new technologies then the business drivers underwriting such adoption must consider and account for such replacement with possible consequences on the projected return on investment.

Today the lit capacity in the Atlantic represents <25% [2] of the potential capacity, in such circumstances replacement of equipment installed for earlier upgrades is not necessary as in general there is likely to be sufficient fibre or repeater bandwidth to allow new technology to be adopted. As this percentage increases however the ability to upgrade without the requirement for complex replacement and migration, which reduces an owners ability to upgrade in small increments, reduces. Without large scale upgrades the 'potential capacity' begins to reduce as previously installed equipment removes the ability for the adoption of denser waves with higher bit rates.

Over the coming years existing systems and their upgrade potential should support capacity growth. Upgrades planning is therefore key and balancing long term market interests and current market price will be the main challenge.

5. 40G - DRIVERS

There is currently a mixed response on the deployment of the higher rate technology in the near future on the transatlantic link. Some of the customers do not currently see a clear cost driver for moving to the 40G technology. Making comparisons with the terrestrial systems where 40G capacity is widely deployed, the lower cost of equivalent capacity is not yet obvious. The prices for 40G capacity are often similar to 4 x 10G capacity and from that aspect do not yet offer a direct advantage. This is a major hurdle to the widespread adoption of 40Gbit/s technology. The key advantages of deploying 40G technology are seen to be lower cost per unit of capacity. In time if cost advantages can be seen the adoption of 40G will bring additional benefits such as simplifying the backbone design and routing advantages for IP traffic.

Current demand is overwhelmingly for 10G interface, supported by 40G channel only in so far that the costs are reduced and capacity increased.

40G technology is seen largely as an interim solution, or a step to 100G which is better aligned with Ethernet standardisation. However, taking into account the time it took for 40G to start being considered as a serious alternative to 10G, 100G may not be as close for the long haul submarine systems as often implied.

As in the case with 40G it is the cost per 10G or 10G equivalent that will drive the development and adoption of 100G rather that the technical conformation with customer's terrestrial network standards. Considering the time required for this technology to get from research stage to the viable commercial proposition we may have to wait some time before we see 100G on long haul submarine networks.

6. REFERENCES

[1] Telegeography Traffic Trends Workshop Presentations, PTC Hawaii 2007, 2008, 2009, 2010.

[2] Telegeography Traffic Trends Workshop Presentations, PTC Hawaii 2010

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