PARADIGM SHIFT FOR SUBSEA CABLE UPGRADES & NEW BUILDS - *IMPACTS OF RECENT AND POTENTIAL FUTURE CHANGES IN THE SLTE SUPPLY MARKET ON SUPPLIERS AND OWNERS OF SUBSEA CABLES*

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Abstract: Traditionally, the subsea telecom cable industry has had a limited number of suppliers providing new turnkey systems or equipment upgrades to existing cables. However since the early 2000's a number of suppliers have entered the market for provision of terminal equipment ("SLTE") only. The first of these was Azea in 2002, (acquired by Xtera in 2007). Later, Mitsubishi Electric, Infinera, and Ciena joined, giving a choice of four SLTE-only suppliers in addition to the five turnkey cable suppliers, ASN, TE SubCom, NEC, Huawei and Fujitsu. By chance, the timing of the emergence of the SLTE-only suppliers has coincided with several disruptive technologies for optical transmission terminal equipment, which can significantly increase the ultimate capacity of existing subsea cables, and hence increased the economic life of those cables. This has had a positive impact for owners of existing cables, but has obviously affected turnkey suppliers as well as potential owners or promoters of new cables.

1 INTRODUCTION

To date the new SLTE-only 'upgrade suppliers' have competed with the legacy subsea cable suppliers only for upgrade of existing cables. However, as promoters of new cables take advantage of changes in technology, price and lead-time in the market, this increases the potential for third-party SLTE to be used both for the initial capacity as well as upgrades after RFS.

This shift in supply dynamics is set to change the way those contemplating new builds go to market. It also has ramifications for the industry as a whole.

2 DRIVERS FOR SUBSEA CABLE OWNERS

2.1 Upgrade of Existing Cables

The year 2000 technology crash led to write offs of assets and consequent unsustainable reductions in price of capacity in the early 2000's. The impacts of these events are still being felt in the subsea market, and operators need to extend the useful economic lifetime of their legacy cables' wet plant, until it is financially viable to construct new cables when the existing cables finally reach their ultimate capacity. Operators of existing cables seek to upgrade with terminal equipment enabling maximum ultimate capacity, lowest cost-per bit, and short delivery lead-times, without any compromise on the reliability of the network - all necessary to successfully compete in the market.

2.2 New Build Cables

The requirements of owners of new-build cable networks also include highest ultimate capacity, lowest cost-per bit, and short delivery lead-times, with high

reliability. However their highest priority is likely to be funding the new build - so initial cost as well as the future business plan are critical.

Legacy operators state that they cannot easily or accurately forecast their future capacity demand, and this is a strong driver for their need for short SLTE delivery times. Operators building new cables are even less sure about their capacity demand forecast, and so they also desire the ability to increase the equipped capacity a few months before RFS if demand changes after the cable is funded and under construction.

2.3 Economics of Upgrade of Existing/Legacy Cables

Although the technology of subsea telecom cables has changed dramatically over the years, SLTE has always been considered as part of the subsea end-to-end network. Until the advent of optical WDM technology in the late 1990's the SLTE was considered as a fixed capacity and there was no concept of 'upgrade' as we now know it. Even with the first WDM systems in the late 1990's (e.g.: 8 x 2.5 Gb/s) offered very little upgrade potential.

However technology changes mean that even pre-WDM cables deployed in the mid-1990's (e.g.: 1 x 5 Gb/s), can in some cases be upgraded to 2 or 4 x 100 Gb/s - giving an ultimate capacity around 40 ~ 80 times the design capacity at time of contract. Early WDM systems of 2000 period, with design capacity of 16 x 2.5 Gb/s or 16 x 10 Gb/s can now often be upgraded to 20 or 30 x 100 Gb/s - an ultimate capacity of 20 ~ 70 times that expected at time of contract. The achievable capacity still depends on the quality of the legacy cable - but the upgraded capacities achieved have in many cases been as surprising to suppliers as to operators and owners.

The wet plant of subsea systems has almost always been engineered for a 'design lifetime' of 25 years, however, in recent years operators of legacy cables can foresee that their wet plant may continue to be upgradable beyond the 25 year 'design life'.

2.4 Economics of New Cable Builds

Supplying and deploying a new system has historically been the bastion of the turnkey cable system providers, providing holistic solutions incorporating fibre, cable, repeaters, PFE, SLTE & often maintenance services for the life of the system. With alternate suppliers entering the market offering terminal equipment only or 'SLTE only' solutions, this position is being challenged.

It is not uncommon for a new build to go to market with separate requests for quotation, carving out the SLTE component. Typically the rationale for doing so is based on a desire to obtain the latest technology coupled with a competitive price point. Given the competitive nature of the 'SLTE only' supply market, there is an opportunity to make considerable savings.

To illustrate the advantages of separating out the wet plant from the SLTE, let's look at the following real-life scenario. Note that in this situation, the wet plant supplier agreed to honor the system guarantee, despite not supplying the SLTE in a turnkey environment;

The original model [1] for this new build assumed $15.7 million to light each incremental terabit of capacity based on a turnkey solution. Through negotiations with the wet plant vendor and a "SLTE only' supplier, this was subsequently reduced to $6.5 million per terabit. This represents an overall savings of $166 million on the total cost of capacity that was anticipated to be lit in the first 5 years of operation.

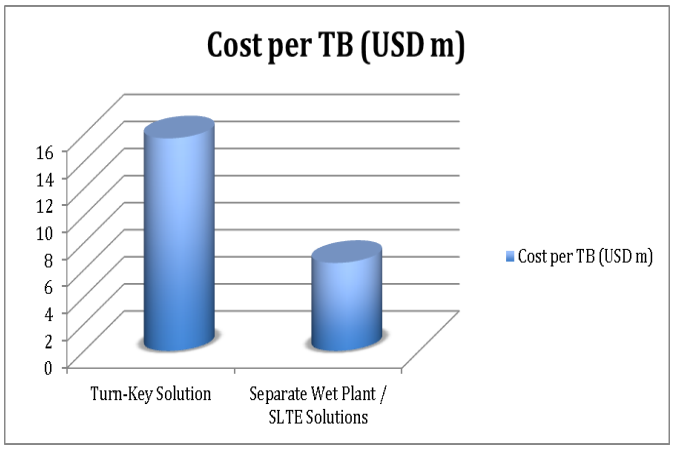

Figure 1: Turn-Key Vs. Separate Wet Plant combined with SLTE only solution

Using an 'SLTE only' supplier in this example, enables the system owner to offer competitive prices to the market whilst retaining a healthy margin against other cables that may potentially over-build whilst at the same time, insulating themselves against the risk of an upgrade occurring on existing systems on the same route and becoming uncompetitive. But the turnkey solution is still an option as having a single supplier end-to-end does provide significant advantages with no demarcation issues when it comes to technical / maintenance.

3 INDUSTRY & TECHNOLOGY CHANGES

By coincidence the increase in the number of third-party SLTE suppliers came just before a step-function in technologies for optical systems, and line rates of 40 Gb/s and 100 Gb/s, has enabled further increases in ultimate capacity and lower costs per bit.

3.1 Number of Suppliers

The number of full turnkey subsea cable suppliers has always been small (4 or 5), so in an industry with traditionally long delivery times, high development costs, high barriers to entry, and a somewhat unpredictable demand, there was little pressure on the turnkey suppliers to push operators towards new SLTE technology. For example upgrading a 10 Gb's cable with more 10 Gb/s waves seemed to be the easy solution and the one which recovered the most of the development costs that the supplier had already invested in 10 Gb/s SLTE technology.

The initial upgrades of legacy networks by Azea (subsequently Xtera) with N x 10 Gb/s technology at lower costs and shorter delivery lead-times was an annoying thorn in the side of the legacy turnkey suppliers, but overall was considered a small and manageable threat.

However the entry of Infinera, Ciena and Mitsubishi into the SLTE-only market in 2005~2010 changed the market dynamics, and now SLTE-only vendors are perceived as a critical threat to turnkey suppliers' SLTE business. Initially these new suppliers were providing N x 10 Gb/s solutions, but with lower costs and shorter lead-times. Ciena, Infinera, Xtera and Mitsubishi soon began supplying 40 Gb/s SLTE solutions, and the competition between these new suppliers, rather than simply with the legacy turnkey suppliers, further decreased market prices and lead-times. And some N x 100 Gb/s SLTE commercial solutions have already been supplied.

The turnkey suppliers have tried to fight back in industry publications and in presentations to customers, claiming that they can and will deliver technology surpassing the SLTE-only vendors' solutions - but to date this has not happened.

3.2 Owners of Existing Cables

The owners of legacy cables were initially very cautious about adopting a third-party supplier for upgrade. However, with new suppliers winning business, it soon became clear that there were big advantages, and selecting from the best of the new SLTE suppliers they have gained very significant cost reductions, increases in ultimate capacity, as well as very important extensions to the practical lifetime of their

wet plant.

3.3 Potential Owners of New Cables

By engaging with SLTE only suppliers, builders of new cables are not only able to reduce their initial costs, but far more importantly, they are able to significantly reduce the post-RFS costs of additional capacity, and are able to make changes to the equipped initial capacity up to a few months of actual RFS date. This strengthens their business-case and assists in funding the new cable, but also offers increased leverage over the wet plant suppliers, who are currently very desperate for business.

3.4 Turnkey Cable Suppliers

The entry of the new SLTE suppliers has impacted the legacy turnkey suppliers significantly. One impact is that the legacy suppliers lose upgrade revenue that they would otherwise have secured. However by far the most important impact has been the extension of practical lifetime of existing cables, and the consequent dampening of demand for new cables.

The demand for new cables has had peaks and troughs, and the extension in economic lifetime of existing cables, some now up to 15 years old, is lengthening what would already be a low period for the wet plant suppliers. It appears that four suppliers (ASN, TE SubCom, NEC and Huawei) is simply too many for the level of business in the market, and with the next peak in demand for new cables several years away if 1 or 2 suppliers exit the market, then one or two remaining may be too few when the next peak comes. Even if all four stay in the market, the retention of experienced staff, skills, manufacturing plant, ships, etc is going to be a major problem in the next few years.

3.5 SLTE Suppliers

The new SLTE suppliers fall into two categories: Ciena, Infinera are already significant terrestrial network suppliers, and are growing rapidly. For them, subsea SLTE is probably a relatively small percentage of their overall revenues, but a profitable business segment which is often and attractive way to penetrate into new accounts and to strengthen and broaden relationships with existing carriers who are cable owners. The development costs to adapt their existing products to subsea requirements are small compared to their overall development costs. Xtera is probably much more dependent upon its SLTE business, and Mitsubishi is not well known as a terrestrial transmission supplier outside of Japan. So for these two suppliers the total revenues are smaller, hence development costs are probably a larger percentage of their overall cost structure. The move to technologies such as 100 Gb/s, SuperChannels, 8QAM, Soft-Decision FEC, etc may be more difficult than for the larger terrestrial players.

4 THE VALUE OF CAPACITY

How do you value the capacity added to a network given the significantly lower cost to massively increase the available capacity to an existing system? In our industry, there is a high degree of transparency and most have an acute awareness of the cost to buy equipment to upgrade a system. Is it fair and reasonable to expect this ‘new’ capacity on an upgraded system to be made available to the market at a lower price point than the initial capacity? Buyers would argue so.

However, we operate in an industry that shows absolutely zero elasticity in demand. That is to say, carriers will not buy more than they need just because it is ‘on sale’ and will typically only purchase what they need, when they need it, and where they need it. Taking this fact into account, there is absolutely no need for a system owner to lower price points on any incremental gains they make via an upgrade, as it isn’t going to attract additional sales. Maintaining the ‘market rate’ for the route / market in which the system competes is the logical thing to do as carriers will buy as long as market rates are met. The only

potential exception may be if somebody wants to obtain a fibre pair.

Getting drawn into negotiations by a buyer of capacity over the underlying cost of a system with or without the additions of upgrade costs is a slippery slope to go down. When a cable owner starts negotiating on margin rather than a fair market value for the capacity, there is no turning back and long term, everyone loses as lower price points in the market deter others from building as protracted ROI's are obviously not desirable and incredibly hard to secure funding against.

5 IMPACT OF UPGRADES ON THE NEW CABLE MARKET

Beyond the issue of potentially diminished ROI's as mentioned above, there are a number of considerations that are taken into account when contemplating a new build. When looking at a new build, the key considerations historically have been demand, cost to build & finally, the ability to fund the build.

If we look at each of these elements, it is easy to see some of the impacts the upgrade market has on the new build market. Obviously, demand for a specific route and the cost to build on a specific route are quantifiable and obtainable with a minimum of fuss. Funding, however, has historically been the major hurdle and now so more than ever, with the capital markets being reluctant to absorb risk. The advent of an upgrade market adds an entirely new dimension of risk to what is already perceived to be a risky proposition.

Convincing a source of funding to step in and back a new system with the specter of an upgrade occurring on a competing system on a similar route would send chills up the spine of even the most liberal of bankers. So yes, the upgrade market has the potential to impact on the new build market. Defining what that impact is, however, varies by region and by what segment of the industry you are in.

In the emerging markets such as Latin America & Africa, there is little to no impact. The same can be said for intra-Asia as new builds continue to flourish based on sheer demand. But it is the key routes such as Trans-Atlantic and Trans-Pacific where the issue becomes more focused. There will always be demands from the market for lower latency routes and diverse routes, but will proposed builds get funded with the potential for upgrades to existing systems looming in the background?

The common view is yes, but new builds may be delayed rather than abandoned. The rationale behind this statement is based on the average age of systems on key routes. If we take the Trans-Atlantic market as point in case, there have been no new builds for over ten years, which is a very long time in this industry. Upgrading current systems on this route is a great way of extracting additional value out of aged assets, but at the end of the day, they are aged assets and the over-all economic life of these systems just doesn't support long term investment – in part, that is why this market is driven by leases rather than IRU's.

In APTelecom's experience, we have seen renewed demand for IRU's trans-Atlantic, on the basis of a new build. Yes, the cost to obtain capacity is market par, but it makes sense to step into a significant commitment on a new build when the economic life of the system is significant.

We have taken a look at the impact of new system builds vs. upgrades in the context of general market considerations, so now let's consider the impact on the vendor market. Historically, 'turnkey' solutions have been the norm. That has now shifted dramatically as we now see those looking to deploy new systems seeking hybrid solutions. Many tenders issued over the last 12 months or so have chosen to break down the supply into two distinct components with the SLTE being open to supply from the "SLTE only' sector. This

represents a significant reduction in deal value and potential margin that can be made by a traditional system supplier. This in itself has potential ramifications to the industry as a whole over time.

Arguably if the system suppliers aren't enjoying the margins they need to justify remaining in business, we may see a reduction in the number of maintenance vessels in the water, despite O&M charges.

6 COMPARISON OF TECHNOLOGY FOR UPGRADES VS NEW-BUILD CABLES

To date the application of SLTE from the new suppliers has been to existing cables. Providing SLTE for new cables is essentially no different. However one difference which is important between legacy cables and the next generation of wet plant to be deployed is the fibre type. Future cable will use only one fibre type, with positive dispersion and large effective area so it is easier to manufacture and maintain, compared to multiple fibre types. The current limitation for DSP cancellation of chromatic dispersion is around 50,000 ~ 100,000 ps/nm. So current 'terrestrial technology' SLTE technology is limited to approx 2,500 ~ 5,000 km with such new wet plant. New trans-Pacific cables with segment length of 10,000 km and this new wet plant, will require more than 200,000 ps/nm of chromatic dispersion correction. So to be an SLTE supplier for new cables as well as existing cables, new suppliers or legacy suppliers will need to invest some further R&D into the SLTE technology, to compensate for higher amounts of CD.

6.1 Shift in Thinking for New Cable Builds

For the reasons detailed above, builders of new cables benefit greatly from the changed market for subsea SLTE. While the wet plant suppliers are already in a demand trough, exacerbated by the extension in lifetime of existing cables, those who propose to build new cables are in a higher position of power over the wet plant suppliers than in the past. They can demand SLTE from a third party, and have separate bids for the wet plant and they dry plant. This situation will not go away - and the industry needs to be able cope with this new paradigm. There are two important aspects of this business model with separate wet plant supplier and SLTE supplier:

a) Both parties need to have input into the overall line design (repeater power, gain, bandwidth, etc., quantity of repeaters, and fibre specification. How will they work together for the best outcome for the end customer, and who will take the final decision for each aspect?

b) How will the end customer be guaranteed a working system. Who will provide overall responsibility for technical design?

One solution to both of the above aspects is for there to be an independent third party, employed by the end customer to mediate between the wet and SLTE suppliers. Such party may need to enter into a tripartite agreement with the two suppliers and the purchasers or funders of the system.

7 SUMMARY & CONCLUSIONS

Potential future purchasing behavior will enable spectrum sales to large capacity buyers, thus the importance of SLTE and wet system best of breed built networks. 'Future-proofing' is becoming a big topic for many buyers. In 3-4 years time many wholesale capacity buyers will want a hedged position on new submarine cable builds, in that as capacity is upgraded they reap the benefits of a lower per unit cost basis with the increase in technological benefits and the adoption of lower cost SLTE models.

The current state of the market is seeing a major paradigm shift in how new submarine cable systems will be built and deployed. Cost, credit, and equity raising in the global recessionary period have

forced many new entrepreneurial and consortia builders to look at reducing cost in order to get funding. In many respects the SLTE question is a shift that we saw emerge in the industry during the advent of DWDM technology being deployed over a decade ago. Only those operators, builders, vendors, and wholesale capacity buyers that strive to achieve the lowest price point per Tbps will succeed moving forward.

8 REFERENCES

[1] APTelecom, "result obtained for consulting client in 2012"

