PLANNING FOR 'JUST IN TIME' NETWORK UPGRADES

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Abstract: In increasingly complex macroeconomic times against a backdrop of rapidly evolving technology and customer demands, effectively managing your network capacity investment cycles has never been more important or challenging.

With technology advancements, improved network implementation times and information systems, the concept of 'Just in Time' upgrades is closer to reality for Submarine Telecommunication Operators. With 10G transmission technology now mature, 40G and 100G now at prime time and the next evolution just around the corner, the decision to augment existing technology or upgrade is not straightforward. To support these investment decisions business owners need to have a wide range of operational and technical information alongside business inputs readily available.

In this paper we examine how Southern Cross Cables Limited (SCCL) is realising the financial and operational benefits arising from its investments in business capabilities across Demand Modelling, Supplier Management, and Network Utilisation and Capacity Supply to improve the processes and information systems that support decision making for 'Just in Time' network upgrades - effectively tailoring its network to customer demands.

1. EVOLVING BUSINESS AND TECHNOLOGY LANDSCAPE

Submarine cable network upgrades today look very different to those of a decade or two ago. Traditionally they were large, capital intensive programmes of work which involved a single major build project, delivering maximum capacity for the technology of the day. Ensuring capacity availability for customer services through network capacity management was not such a critical activity as the network contained significant capacity headroom.
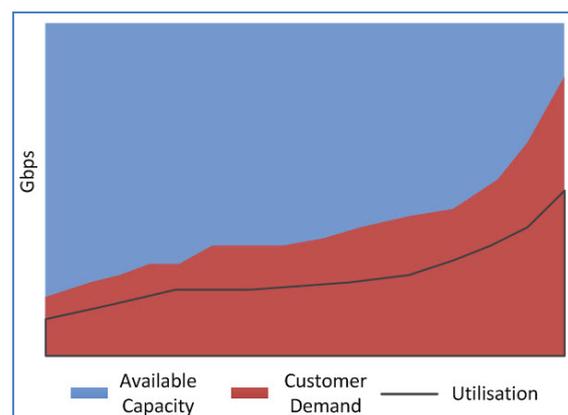

Figure 1: Major Upgrade Approach

The business and technology landscape is evolving for operators with a number of significant factors resulting in a review of the approach taken to plan and implement network upgrades:

- Recent global economic conditions have resulted in more stringent investment criteria for business stakeholders. The amended investment decision practices put in place are expected to remain the norm.
- Unprecedented customer demand for capacity remains challenging for operators to predict, coupled with an evolving telecommunications 'eco-system' with cloud services, data centres, caching, and content delivery networks altering the demand profiles for many operators.

In addition, network equipment supplier practices and technology are providing enablers for operators to reduce planning cycle time and to invest more frequently in targeted increments, while staying ahead of the demand curve for their networks:

- Technology evolution enables operators to extend the capabilities of subsea optical plant, delivering additional capacity and services through network equipment upgrades.
- Network technologies now offer much greater network and service design flexibility. Previously a network element managed a given capacity at a given rate with limited options with its interface. Now network equipment can handle a variety of cards providing different capacities, rates and interface options. This ability to mix and match allows operators to more closely manage the build of their networks to customer requirements.
- There has also been a significant reduction in network build costs relative to bandwidth supplied. For example, a recent upgrade project by SCCL was completed for 20% of the equivalent original build cost while delivering 10 times the capacity.

2. PLANNING FOR INCREMENTAL NETWORK UPGRADES

These factors are presenting operators with the opportunity to modify their network upgrade planning process towards 'Just in Time' – an incremental approach; smaller, more frequent, less capital intensive projects that implement capacity closer to when forecasted demand requires it.
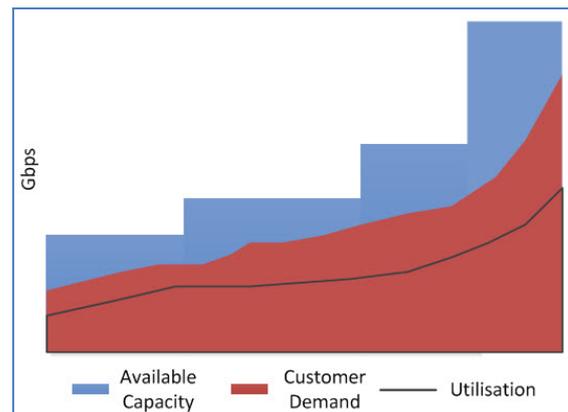

Figure 2: Incremental Upgrade Approach

The benefits exist for operators who choose to proceed with the adoption of a 'Just in Time' approach. Following initial investments in capability improvements across processes, analysis, and information systems, SCCL has managed to:

- Achieve a more predictable and improved ROI with less capital exposure, through a less intensive capital plan that is spread over time.
- Improve network utilisation rates and reduce the additional investments needed to manage inefficiencies (due to fragmentation) in network capacity allocation, ensuring revenues are maximised for its network assets.
- Reduce the overall time between the decision to upgrade and having the additional capacity available for use.
- Effectively balance its network technology investment strategy with current forecasted demand to determine the network design and build. This results in extending capacity on existing network technology to satisfy medium term

forecasted demand and de-risking investments in 'bleeding edge' technology.

- Bring new products to market more rapidly through targeted capacity and capability upgrades.

2.1 Investing in Core Capabilities

While the benefits are apparent and numerous, operators should recognise the challenges associated with adopting a 'Just in Time' approach, including the reduced time horizon available for network capacity upgrade planning and the increased rate of changes on the network:

- With the increased rate of change, focus is required on accelerating the business and operational readiness processes to make new capacity and capability available for use more rapidly following RFS.
- Operators must be able to respond more swiftly to deviations between demand projections and Fill Rates[1]. With available capacity being more closely aligned to forecasted demand, there is less contingency in the network to absorb planning errors. Network operational teams and planners need to more closely monitor and track key measures, in order to mitigate the risk of exhausting current capacity availability.
- With less capacity contingency in the network, the operator's business and operational planning processes also need to recognise the importance of network capacity management for the existing network by maintaining efficiencies in utilisation.

In SCCL, these challenges are being managed through capability development

in three important areas; Customer Demand Modelling, Supplier Relationship Management, and Network Utilisation and Capacity Supply. To ensure that investment decision cycles are in sync with network capacity supply, supplier performance, and forecasted demand, SCCL recognised the need to:

- Have better visibility of the actual capacity utilisation of the network.
- Elevate supplier engagement to promote transparent information exchange for technology plans and supply to support the planning process.

a. Customer Demand Modelling

Adopting a 'Just in Time' planning approach places significant reliance on effective demand modelling to quantify the scope and estimate the time to instigate each incremental upgrade. This demand modelling requires:

- Closer communications between sales and planning teams to ensure upgrade planning considers current customer purchased and committed capacity, along with sales forecasts for new and changing customer demands.
- Input from sales and product teams to ensure network upgrades meet any new product and service specifications.
- Improved understanding of the macro drivers of capacity demand to assist estimations, covering a myriad of inputs including broader market forecasts, data bandwidth consumption trends, and industry 'eco-system' developments such as caching, regional 'cloud' data centres.
- Incorporate marketing initiatives and their impacts on capacity demands.
- Clear insight into the grooming, utilisation and technology lifecycle requirements of the existing network.

SCCL has built models and processes to determine and track forecasted demands.

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[1] Fill Rates relate to the rate at which available network becomes committed through assignment and activations of customer services.

Demand modelling now incorporates both a top-down view that considers market analysis and stated customer needs, and a bottom-up view that takes in actual customer capacity utilisation profiles from the network. This helps form a holistic perspective and its feedback and verification loop ensures that forecasting and planning practices continue to improve and adapt.

b. Supplier Management

Planning for network upgrade projects requires a clear understanding of what can be achieved and how long it will take to realise it. Adopting an incremental approach to planning requires a strategically focused relationship with suppliers which emphasize alignment between requirements and technology, so both operators and suppliers can build supply considerations into their respective planning models and processes.

For SCCL, suppliers are engaged early on for technology evaluation and network design, and a close working relationship continues. It ensures any technology and availability constraints are well understood, and lead times and implementation times are properly factored in to any upgrade plans.

In addition, closer relationships with suppliers ensure that the operator has more certainty in planning through an improved appreciation for:
- Network technology supply economics and pricing which informs the decision to upgrade to new technologies or continuing to invest in the current technologies to meet forecasted demand.
- The capability provided with new network technology and its compatibility with the operator's existing products and services. This

provides input into the operator's product and customer migration roadmaps, in addition to the technology lifecycle plans for current network technologies.

c. Network Utilisation and Capacity Supply

Accurate and timely network utilisation and capacity information is a key component in providing network and financial planner's visibility of how and where network resources are deployed, the capacity used, allocated or committed, and how much capacity is available for use for new service provisioning.
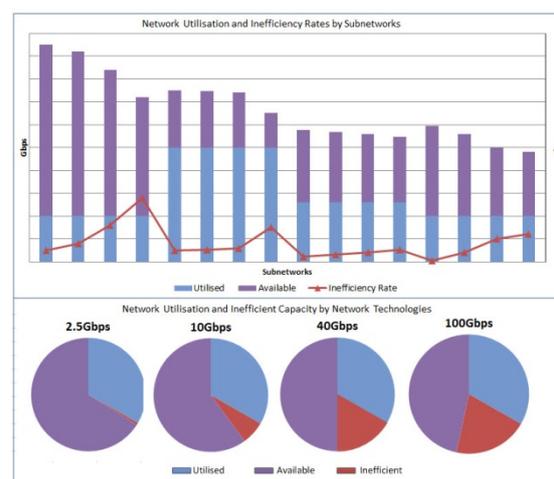

Figure 3: Managing Inefficient Capacity[2]

With the 'Just in Time' approach, access to accurate information on current network utilisation and performance is required to reduce the variability in estimation and contingency allowance typically required to cater for out of date network data.

Rather than relying on point audits and the associated time consuming data gathering and analysis, SCCL has made strategic investments in solutions from Boss Portal to ensure that reliable network information is readily available to inform network

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[2] Inefficient Capacity is capacity that is unusable due to fragmentation. Inefficiency Rate is Inefficient Capacity as a percentage of Total Capacity of the links.

capacity and upgrade planning and network grooming activities.

In addition, these network information systems play a key role in providing:

- Greater accuracy in existing network capacity management (covering all aspects of Allocated Capacity[3]) for improved network efficiency.
- An opportunity to deploy standard processes to reduce the elapsed time between RFS and business and operational readiness.
- Improved visibility of network performance and better understanding of the costs associated with delivering services (efficient circuit routing for existing services) across existing, sunset network technologies. This provides valuable insight into network technology lifecycle plans.
- Accurate contingency forecasting to cater for actual network grooming constraints at both overall capacity, and utilisation profile levels.
- Demonstrating to the operator's management and stakeholders the effects of improved planning cycles on costs and revenues.

With the capabilities now in place to support incremental upgrade planning processes, SCCL is further extending the information systems to provide monitoring of the key network metrics used to trigger upgrade planning cycles, and to provide a greater level of planning granularity to determine where in the network to most effectively target upgrade and augmentation investments.

3. BRINGING IT ALL TOGETHER

While investments in each of the capabilities above will prove valuable in their own right, it is these capabilities used in combination which allows operators to adjust their planning cycles, investment requirements, and upgrade frequency with success.

The case study below examines how SCCL has leveraged its investments in the capability areas discussed, to drive its incremental capacity planning and upgrade processes.

a. Establish Network Investment Trigger Points (Timing of Upgrades)

Firstly, to support the change towards a 'Just in Time' planning approach, new 'way points' need to be established that trigger a network investment planning cycle.

Using a Customer Demand Model, forecasted capacity demand over time is mapped against key network capacity metrics such as Authorised Utilisation[4] and Total Network Capacity. The intersect of Authorised Utilisation and forecasted demand represents the point at which new network capacity must be ready for service to ensure additional capacity is available when customers are expected to require it.

Taking into account lead times for equipment supply and network implementation, in combination with internal business approval, planning and management timelines, the point at which the network investment planning cycle must begin can be estimated.

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[3] Allocated Capacity refers to capacity assignment for the existing network, including capacity in use by customers, capacity not used but committed (allowance to meet product specifications such as diversity, etc), and capacity allowance for network grooming and fault restoration (see Authorised Utilisation).

[4] Authorised Utilisation is part of an operator's technology policy. This establishes the maximum assignable capacity level in the network making allowance for capacity headroom for fault restoration, test circuits, management traffic, inefficiency through fragmentation, and network grooming activities.
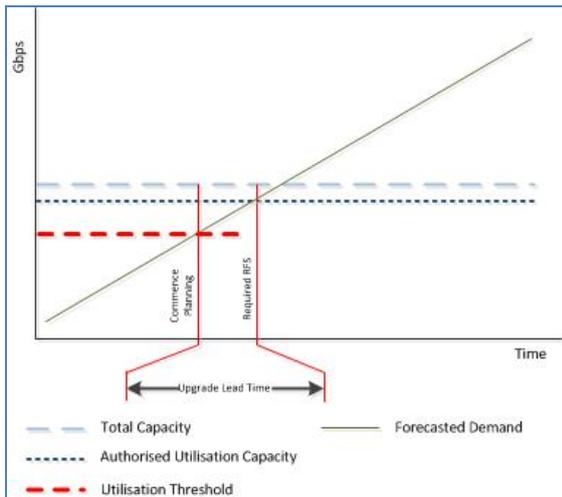
Figure 4: Network Investment Trigger Points

In turn, by mapping the estimated commencement time for the next network investment planning cycle onto the demand curve, a Utilisation Threshold can be established. This Utilisation Threshold provides a monitoring point which ensures that the network investment planning cycle is triggered in the event that the actual capacity utilisation rates deviate from forecasted demand.

b. Recalibrate Demand Modelling

One of the keys to a successful implementation of the 'Just in Time' approach is to ensure that the demand model tracks closely with actual demands. The model may need to be recalibrated from time to time to ensure its underlying assumptions continue to align with evolving market trends.
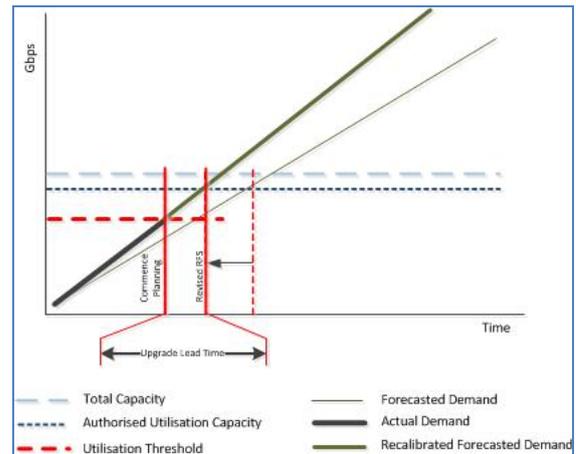

Figure 5: Recalibrate Demand Modelling

SCCL monitors its actual network utilisation and fill rates regularly to verify and refine its Customer Demand Model. If the estimated figures are within tolerance from the actuals, the model is valid and sufficiently tracks actual demands. If not, this information is used to recalibrate the customer demand profile in the model. The Utilisation Threshold may be revised to reduce any risk of encroaching on committed capacity allocations or Authorised Utilisation allowances.
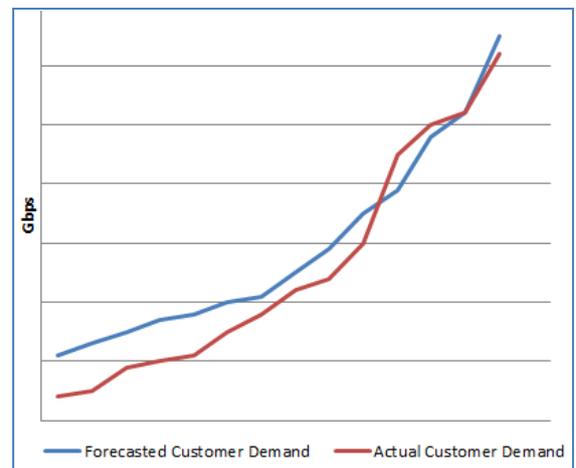

Figure 6: Verify Forecasted and Actual Demand

c. Determine Scope of Network Upgrade (Quantity)

Having reached the decision to initiate a network upgrade, the upgrade

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requirements and associated investments are determined.

To manage the changes arising from the network upgrade activity and the rate at which the business can absorb changes, a Capacity Supply Period[5] is established. This allows operational change impacts and expectations of new technology availability from supplier roadmaps to be considered when determining the level and frequency of the investment cycle.

The delta between the current network capacity and the target capacity determines the scope of the network upgrade required to meet the estimated customer demands for the given Capacity Supply Period.
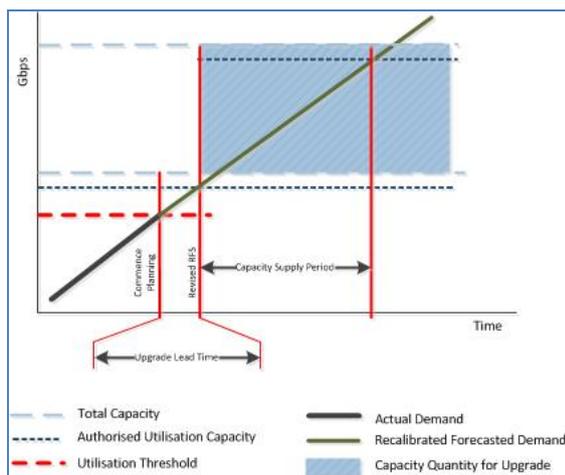

Figure 7: Determine Scope of Network Upgrade

Network equipment decommissioning and product development requirements (to meet both customers demand and/or product innovation for new service variants) are also part of the upgrade scope considerations.

Having determined the size and timing of investments, the planning and implementation projects are initiated to manage the commissioning of the new network upgrade and the next Utilisation Threshold can be established.

4. CONCLUSION

With technology evolution and increased pressure on investment decisions, the environmental conditions are pressing operators to take stock and reassess their traditional approaches to network upgrades and capacity expansion projects.

Significant benefits can be realised by operators who can effectively implement the practices and disciplines needed to manage the challenges associated with the increased pace of change resulting from an incremental planning approach.

The investments made in improved demand modelling, supplier management and information systems have built a key foundation for SCCL's new upgrade planning process.

With a focused investment cycle that efficiently uses capital and improves ROI from network upgrades, and with improved network efficiency, SCCL is now realising the financial and operational benefits associated with 'Just in Time' network upgrades.

5. REFERENCES

[1] Submarine Telecoms Forum, Inc "Submarine Cable Industry Report 2012", Issue 1, July 2012, Virginia, USA

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[5] The Capacity Supply Period is the period of time following RFS that the additional capacity from an upgrade is expected to be sufficient to satisfy demands based on the demand model.