PLANNING FOR OUT OF PLAN REQUIREMENTS

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Abstract: This paper reviews some of the considerations associated with implementing a submarine cable system upgrade comprising installing additional wavelength equipment and lower order interface requirements.

The strong take-up of broadband since about year 2004, in terms of subscribers and bit rate per subscriber, has resulted in a number of upgrades being planned and/or announced. Complementing the demand aspects, the capacity available for upgrading systems has been enhanced in terms of both transmission capabilities and Design Capacity. For example, the Design Capacity of the Australia-Japan Cable Network (AJC) Australian connectivity has gone from an initial 640Gbit/s to a potential of some 1,280Gbit/s.

If users are largely requiring capacity on a Just-In-Time or Out-Of-Plan basis, that is, not necessarily being able to provide longer term capacity requirements, then these limited longer term user forecasts can provide a dilemma for the Cable Operator planning an upgrade to meet requirements for several years.

This paper describes some of the challenges experienced by AJC when navigating the Upgrade route.

1 INTRODUCTION

The Australia-Japan Cable Network (AJC) consists of an optical fibre ring between Australia, Guam and Japan. The configuration of AJC is a collapsed ring where the fibre pairs share a common sheath on a historically safe route between branching units in 4000m water depth where separate landings are made in each of Australia, Guam and Japan. This configuration provides protection where it is needed while minimising overall construction and maintenance costs. Since commencing service in December 2001 AJC has not experienced any outages due to submarine events.

AJC is currently implementing an upgrade to its initially equipped capacity. This might be simplistically considered as adding additional capacity to meet demand at some time in the future. However the challenges of forecasting requirements in times of constraints with users providing forecasts, evolving demand applications and changing technology, let alone arranging the funding, should not be underestimated. The following sections of this paper outline some of the contrasts between the initial implementation of AJC and the implementation of the current upgrade of AJC.

2 INITIAL SYSTEM IMPLEMENTATION CONSIDERATIONS

In the case of AJC, the initial implementation during years 2000/2001 was to partially equip the then Design capacity of 32 x 10Gbit/s wavelengths per fibre pair potentially providing 320Gbit/s of Protected SDH capacity or 640Gbit/s of unprotected capacity. That is, the approach from the start was to plan for the unplanned by not fully equipping for reasons anticipated at that time, and confirmed since, as follow:

2.1 Initial Traffic Volume

During year 2000 the future volumes of traffic forecast, particularly by consultants, was significant to say the least. Notwithstanding the very strong forecasts, issues such as Traffic Types and ongoing Technical Developments, as elaborated below, suggested partially equipping the full Design Capacity initially was a prudent approach. That is, planning upgrades into the cable's life provides the opportunity to match capabilities to evolving requirements rather than fully equip initially and risk being superseded.

2.2 Initial Traffic Type

A standard offering circa year 2000 was Protected SDH optical rings. Interfaces preferred by Users on the AJC route at that time were STM-1 and STM-4.

The AJC expectation for Protected SDH capacity at that time was that both Pre-emptible and Non Pre-emptible Unprotected SDH capabilities, which had ITU-T recommendations, were likely future requirements. This view was based on indications that internet traffic would probably be supported on mesh networks comprising unprotected point to point links. Protection and diversity could be provided on these mesh networks by internet carriers configuring their own networks, with capacity acquired on different cable systems.

The AJC expectation for SDH interfaces was they would follow the trend of earlier cable systems, with minimum traffic units progressing from MAUO's (Minimum Assignable Unit Of Ownership of 64kbit/s) to MIU's (Minimum Investment Unit of 2Mbit/s). That is, the AJC expectation was that for Australian international connectivity the interface preference would progress from STM-1 and STM-4 to STM-16 and above. Accordingly, the use of STM-16 and above

was deferred from the initial AJC installation as these interfaces were not required by Users at that time and were considered best provided as part of an upgrade, closer to the time when those interfaces were required.

2.3 Initial Equipment

While the equipment offerings from vendors at that time were generally similar, the scope for improved technical performance, for example enhanced FEC, was apparent from both standards fora developments and activities in research and development laboratories. The ongoing development of relevant transmission standards for enhanced SDH or OTN capabilities also suggested some capabilities might best be addressed as a future Upgrade. Further, improvements in equipment density (less space) were also apparent.

Apart from the expectation of improved equipment capabilities within a few years of Ready For Service, the Design Capability of AJC at its Ready For Service was already well beyond the demand forecasts of the first several years. The Design Capacity of AJC at contract signing in mid year 2000 was 640Gbit/s connecting Australia to Japan via Guam.

For those not familiar with submarine cable costs, the unit cost of capacity is not Total Cost divided by Design Capacity (resulting in very low unit cost), but is based on Total Cost divided by planned Activated Capacity (resulting in not so low unit cost). While Australia has a healthy growth in international traffic, the communication user population is simply far less than Asia or North America or Europe. Accordingly, equipping to an expectation of Activated Capacity for a forecast timeframe has merit, compared with fully equipping to Design Capacity with terminal equipment that not only increases initial construction cost but may largely get superseded.

2.4 Initial Vendor Selection

AJC issued tenders for the initial system implementation at a time prior to which subsequent consolidation of prime contractors and subcontractors occurred. The responses to the initial AJC tender provided a competitive range of technical and commercial offerings.

2.5 Initial Funding

While not an insignificant issue, the options for obtaining debt funding about early year 2000 were not particularly limited. The initial success of some of the first private submarine cable financial models resulted in the availability of various forms of debt and/or vendor financing that differed from the consortia cable model previously generally used.

3 UPGRADE IMPLEMENTATION CONSIDERATIONS

As submarine industry survivors of the dot com crash / tech wreck would appreciate, the years around 2002 and 2003 were relatively tough, with Chapter 11's and refinancing not uncommon. New cable systems were rare, as were Upgrades. However, since about year 2004 the global take-up of Broadband has firmed, with the number of users, and bit rate per user, both growing strongly.

3.1 Upgrade Traffic Volume

From an Australian perspective, some 70% of internet traffic is international. Therefore the use of Australian international cables such as AJC has been directly impacted by the significant growth in Australian internet traffic growth of some 100% per annum. As the number of Australian Broadband Users and their bit rate continues to grow, the traffic carried by AJC tends to mirror this profile. However, due to commercial confidentialities, obtaining forecasts from users has challenges. For example, they may have capital expenditure constraints that limit longer term forecasts, even though the user might obtain subsequent approval to procure capacity on what some refer to as an "out of plan" basis.

Accordingly dimensioning an Upgrade to a limited period within the Design Life has merit to enable a subsequent future Upgrade to be applied closer to future requirements. That is, with a Design Life of twenty five years there may be merit in not one but several upgrades, with the intervals between Upgrades being long enough to take advantage of technical developments but short enough to avoid equipping beyond a period of firm confidence in the type of demand.

3.2 Upgrade Traffic Type

Since AJC Ready For Service in 2001 additional interfaces preferred by users include STM-16 up to 10G. While GbE interfaces are common in terrestrial interfaces, AJC has not had a strong expression of interest from Users. However AJC has factored GbE interfaces into its Upgrade plans. About the only certainty of the AJC Upgrade in terms of interfaces is that there will be no additional STM-1.

There has been a significant take-up of not only Protected SDH capacity on AJC but also Unprotected SDH capacity. The initial AJC equipment supports both Pre-emptible and Non Pre-emptible Unprotected traffic and Users have implemented combinations of Protected and Pre-Emptible Unprotected and separately, Non Pre-emptible Unprotected traffic plus Non Pre-emptible Unprotected traffic. On AJC, within its Upgrade timeframe, it is expected the existing combinations of Protected and Unprotected SDH will

continue to be required by some users while others will require Direct Wavelength Access.

This issue of whether AJC or the User provides the network intelligence for protection and management is a matter answered by the characteristics of the Australian market. The answer is essentially that the big capacity users may seek Direct Wavelength Access and provide their own traffic protection and management, whereas not so big capacity users may seek sub wavelength SDH with AJC providing traffic protection and management.

3.3 Upgrade Equipment

Transmission equipment offered in 2006 and 2007 includes enhanced SDH capabilities not available in year 2000 such as GFP, LCAS. Further, the equipment supports significantly more wavelengths per rack. This may present an opportunity for AJC to accommodate a coffee franchise at its two cable stations in each of Sydney, Guam and Japan, although passing foot traffic is not high. However it is certainly better to have a little too much cable station space than not enough.

However, a major technical aspect associated with enhanced FEC, coding and wavelength spacing is that a cable such as AJC has the potential for its original Design Capacity out of Australia to be significantly enhanced from 640Gbit/s to some 1,280Gbit/s.

3.4 Upgrade Vendor Selection

While the choice of vendors is reduced in year 2007 than it was in year 2000, a competitive choice of capable vendors is still available. Apart from cost and capability, associated considerations include whether the initial warranty still applies, can a vendor other than the original supplier implement and upgrade without interrupting traffic, and what ongoing support can be provided.

3.5 Upgrade Funding

Providers of debt funding during years before the refinancing of various communication companies tend to be somewhat less comfortable with communication businesses than they were. Accordingly, in AJC's experience, the lenders are certainly applying no less diligence than the original AJC financial approval received.

4 CONCLUSION

There are a number of not necessarily complementary considerations that apply to the initial equipping or upgrade of a submarine cable system such as AJC. Accordingly, incremental upgrades have merit to enable a subsequent upgrade to address the ongoing developments that occur in this ever changing industry. This provides an opportunity to plan for "out of plan" customer needs by reducing the time period during which changes will occur with traffic volume, traffic type, transmission capabilities and requirements.

Notwithstanding the considerations mentioned above, it is certainly better to have the challenge of an upgrade in a communications environment of strong growth in international capacity, rather than the tough times experienced by the communications industry immediately after the "tech wreck".