UNIVERSITY OPTICAL DATA NETWORK UPGRADE

Passive network versus active systems for increasing campus network capacity

The Challenge

ABC University is faced with increased bandwidth demands that have far exceeded their expectations. Last year, a coarse wave division multiplexing (CWDM) passive network was installed to a portion of the data network to extend ring functionality to the entire network. It was anticipated that this CWDM addition would last the university for several years. Within the last year, however, inquiries for more bandwidth have risen greatly. Many of these inquiries are tied to research programs with available funding exceeding several million dollars. For the university to participate in these research programs, a certain level of bandwidth must be available between locations across the campus. It is calculated that the university will require 30 transmission channels within the next three years – nearly four times the capacity of the present network.

Due to high loss on the outside fiber, the need for more than eight working channels, and the fact that a shortage of fiber in certain areas of the network would not support multiple eight channel systems, Champion ONE looked at two possible solutions: an active DWDM system and a passive DWDM system.

A passive DWDM system has no electronics and does not require power for filters. In this setup, optical amplifiers are

required due to high fiber loss and the need for route protection. This type of solution requires less technician training and has an initial cost in the low six figures. After two years, the passive system will require hardware and software support for the optical amplifiers, resulting in an annual maintenance fee of several thousand dollars.

An active system involves electronics, will require additional technician training, and has an initial cost of almost twice that of the passive solution. This active system will have an annual maintenance fee for hardware and software support of almost six times that of the passive system after two years. It has been estimated that this system will save the university close to $3,000 per year with its alarm reporting and service provisioning features.

Recommendation

Based upon the initial cost of the two proposed systems, it is recommended that the University proceed with the implementation of the passive DWDM system. It will satisfy the bandwidth requirements for the entire study period (four years) and provide a lower cost solution that meets industry standards.

Business Opportunity

ABC University has a three-location fiber optic network today, as shown in Figure 1, which was rearranged to form a ring a year ago in order to provide a higher level of service continuity. The university owns all data transmission equipment at a local N Phone Company location in addition to its own two data centers, HS and Main. Internet access is provided through the local phone company site.

Despite measures to increase the existing fiber optic network's continuity, many data transmission demands were not forecasted during the last budget cycle. For instance, the university's medical and engineering colleges have an opportunity to participate in projects involving multiple universities on a state and national level which require high-speed transmission networks to be in place for data transfers. The data centers also require additional high-speed links for disaster recovery. Additionally, dormitory buildings need to have their connections to the data centers increased in bandwidth to relieve congestion. The culmination of all of these bandwidth requirements greatly exceeds the capabilities of the present network.

University directors feel that the research and development projects available to their various colleges pose a great opportunity that is not to be passed up. These programs have funding grants associated with them as well as the promise of national recognition for participating institutions. With regard to the other bandwidth demands faced by the university, increasing the links from dorms to data centers will increase student satisfaction with the university and will ensure that enrollment is high. While high enrollment and student satisfaction are priorities, the success of research projects is currently of greater importance to the university.

It has been estimated that these two deficiencies will have a negative impact on the university's revenues totaling over several million dollars for the next two years if the fiber optic transmission network is not replaced or rebuilt again. As a

result, the new network needs to be in place by the start of 2010.

Present Data Network

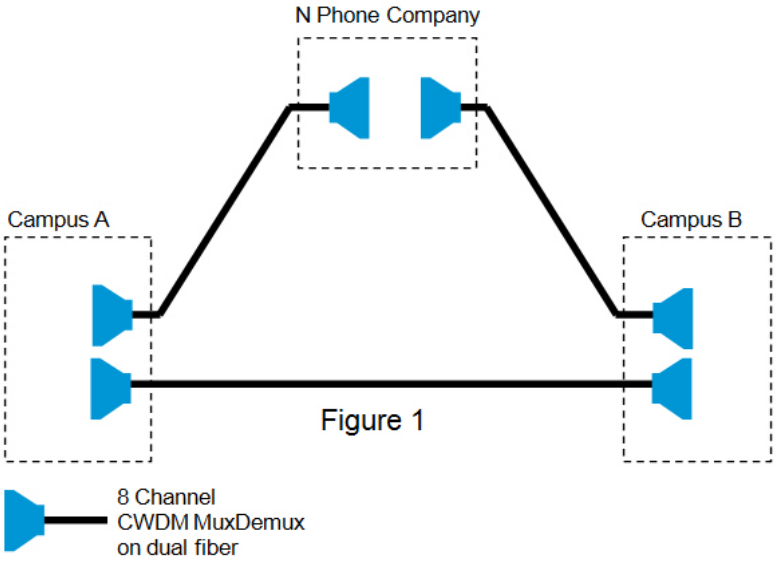

Figure 1

The distances between locations are approximately 10 km.

Project Schedule

Gather data requirements from each department	- complete by end of June, 2009
Design new data network with one of our partners	- complete by end of July, 2009
Receive approval to move forward with RFP	- complete by August 14, 2009
Issue RFP to vendors on record	- complete by September 18, 2009
Receive completed responses	- complete by October 9, 2009
Submit business case for approval	- complete by October 30, 2009
Select vendor and award contract	- complete by November 13, 2009
Place equipment purchase order with vendor	- complete by November 27, 2009
Take delivery of equipment	- complete by January 15, 2010
Equipment ready for new service	- complete by February 1, 2010

Alternatives

There were two viable solutions submitted during the RFP process, a passive solution and an active solution, that will support the University's need to upgrade the data network.

Alternative #1

Alternative #1 is a passive DWDM solution with optical amplifiers. This solution provides 40 channels between data centers and eight channels from each data center to the N Phone Company. DWDM transceivers will be placed in the data switches and routers and then connected to the corresponding ports on the DWDM MuxDemux and OADM units. The 40 channels will be muxed together and transported over two strands of fiber to a distant location where they will be de-muxed and connected to appropriate switches and routers. This technology only requires two strands of fiber between locations instead of the usual two strands per service. By using MuxDemux filters, the number of required fiber strands is reduced from 80 to only two. This fiber savings will often offset the cost of the filters.

Benefits

Lower Cost

The passive solution has an initial cost in the low six figures, almost half the cost of the active solution. The yearly maintenance fee on the optical amplifiers is several thousand dollars starting in the third year of the study period.

Ease of Operation

The passive filters do not require power and management to operate. The DWDM transceivers are plugged into the matching wavelength on MuxDemux and OADM units and the optical amplifiers provide for ring switch operation should there be a fiber cut along the routes.

The C1 filters have monitor ports that facilitate testing, turn-up and maintenance of the network.

Shorter Lead Time and Technician Training

The standard lead time for the passive network equipment is four to six weeks from receipt of purchase order. A minimal amount of technician training is required due to the similarity between this passive equipment and the existing passive equipment purchased last year.

Warranty

C1 provides a five year warranty for its MuxDemux, OADM and transceivers units.

Detriments

Non-manageable

The passive MuxDemux and OADM units are not manageable at Layer 1, the transport layer. On-site troubleshooting efforts or management at Layer 2 or higher is required to isolate a problem.

Longer Provisioning Time

Technicians must visit each site to provision a service over a channel.

Alternative #2

Alternative#2 is an active DWDM solution with AC powered shelves and micro-processors to control the operation. It provides 40 DWDM channels between data centers and eight channels from each data center to the N Phone Company. Transponders are used to convert the 850nm transceivers at switches and routers into DWDM wavelengths for connection to the corresponding ports on the MuxDemux units. The use of transponders provides an additional level of manageability over each channel and service. Like the passive solution, each DWDM route only requires two strands of fiber. The initial cost of the equipment is nearly double that of Alternative #1 and the yearly maintenance charges starting in the third year of operation is almost six times that of Alternative #1.

Benefits

Lower Operational Cost

Due to the system's Automatic Alarm Reporting capability, remote management of the equipment and Power Balancing features, technician troubleshooting costs are reduced by approximately $3,000 per year. Time required to provision new services is reduced by a remote login feature of the active equipment. The active solution uses transponders to convert the DWDM wavelengths to 1310nm signals and to provide a higher degree of manageability to the services that are carried over the transponders.

Detriments

Higher Initial Cost

The active system has a higher initial cost than the passive option due to the cost of the technology and features/options involved.

Longer Technician Training Time

Due to the many options and features of the active system equipment, more extensive training is required to bring technicians up to an appropriate level of understanding.

More Active Equipment Requiring a Maintenance Contract

The equipment maintenance charges that start after two years are nearly six times higher than those associated with Alternative #1.

Assumptions

There are two assumptions being made in this analysis. First, it is assumed that equipment pricing will hold steady for the next 12 months. Also, it is assumed that the bandwidth demand that is forecasted by each department will not fluctuate by more than 30% during the next 12 months. The discount rate is five percent.

Project Description

In the event that the business case is approved, the director of the IT department will generate a purchase order through the purchasing department. This department will proceed to submit the purchase order to Champion ONE for the passive network recommended as Alternative #1.

Champion ONE will ship the equipment to the University within the agreed upon interval and will assist with the staging and on-site installation/testing. The testing phase should take less than 16 hours, or two work days. During the testing interval, Champion ONE will provide training to the University's technicians who will be maintaining the passive network.

Support via e-mail and telephone will be made available to university technicians at no charge, should it be necessary. On-site support beyond the initial 16 hours can be arranged at the regular rate.

This passive network is designed to support up to 40 DWDM channels between data centers at the 1GigE and 10GigE rates. All 40 channels can be utilized when following the instructions provided by Champion ONE to the University's technicians.

Alarm reporting and troubleshooting of the passive network, not including the optical amplifiers, will be accomplished by use of Layer 2 and Layer 3 networks. University technicians will be monitoring the switch and router ports for these outside alarms.

The recommended passive network is illustrated in Figure 2 below.

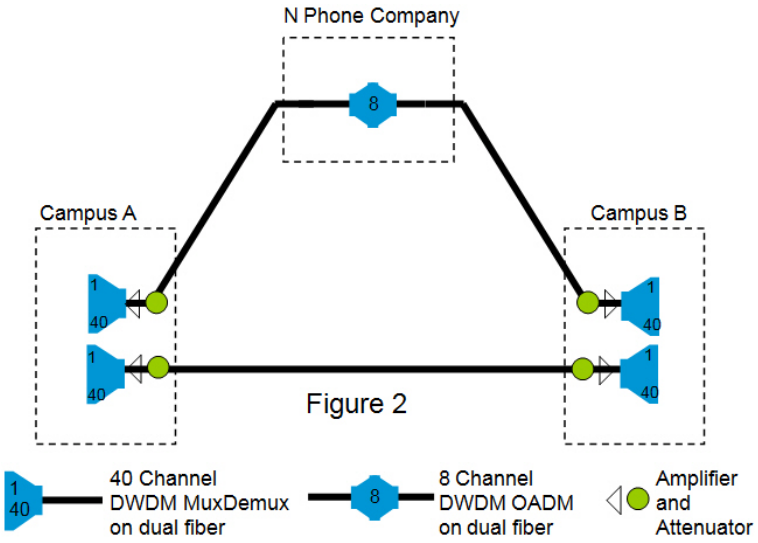

Figure 2

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