Infinera Case Study: Migration of a Pan-European Optical Network

Migrating or "rolling over" live traffic to a new optical network can be one of the most difficult and nerve-wracking challenges for a service provider with a busy network. This Case Study looks at how the unique capabilities of the Infinera Digital ROADM, backed up with the skill and experience of the Infinera Customer Support team, enabled one large European service provider to simplify the process, completing a migration in record time with minimal cost and interruption -- and without the financial penalty of leasing additional international fiber pairs.

The Network and Migration Challenge

This Pan-European service provider operates an optical network linking major European cities. For confidentiality, we will use four major European capitals, London, Berlin, Rome, and Madrid, as proxies for the actual cities that form the major hubs of the network. See Figure 1.

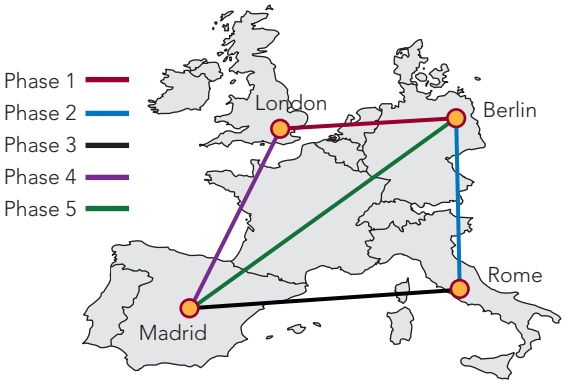

Figure 1

The service provider owns a single pair of fibers carrying all the existing service demands. These fibers were connected into traditional long-haul DWDM equipment deployed as a result of a procurement exercise several years ago.

In 2008 the service provider decided to replace this network with a modern, high-performance Infinera DTN Digital ROADM solution. Several migration scenarios were considered. Leasing additional fiber pairs for the migration period was possible, but would have introduced an expensive additional cost. Alternatively, a "big bang" cutover within the allocated maintenance windows could have been attempted, but with a high level of risk. The Infinera DTN, with its unique digital architecture and integrated bandwidth management, offered a new, innovative approach to the migration challenge. The Infinera strategy did not require the service provider to lease additional fiber pairs during the migration phase and offered a continuous set of fallback options at each stage to reduce risk.

The Infinera DTN Switching Capability

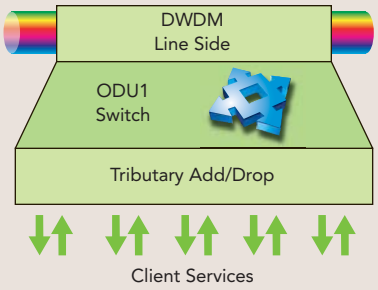

Figure 2 shows a schematic of the Infinera DTN. There is a clear electronic delineation in this system between tributary add/drop interfaces and the long-haul (line-side) part of the sytem. The DTN includes an ODU1 switching capability between the tributary and the line sides of the sytem, which is fully controlled by a GMPLS control plane running on each DTN.

In contrast, in a conventional ROADM sytem, each add/drop interface is physically connected to a specific line-side wavelength on a transponder card. There is no digital switch function integrated into the ROADM. Conventional ROADMs can only switch between different directions on the line side. In addition to the migration capability, the fully integrated GMPLS-powered switching capability in the Infinera Digital ROADM offers other significant advantages in terms of architecture, flexibility, and scalability.

Migration in Three Steps

The migration was carried out throughout the network. As an illustration, we examine here the procedures for the migration on the London-Rome route.

Step 1: Equipment Installation

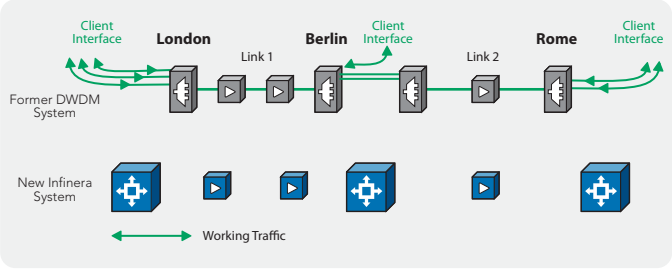

Figure 3: Services re-routed through Infinera DTNs

The DTN equipment was installed in the PoPs at each end of the link, from London through Berlin to Rome (Figure 3). At this stage all the client services are still running on the old DWDM equipment, and the new Infinera DTNs (with their associated line amplifiers) have been installed and tested.

Step 2: Services re-routed through the DTNs

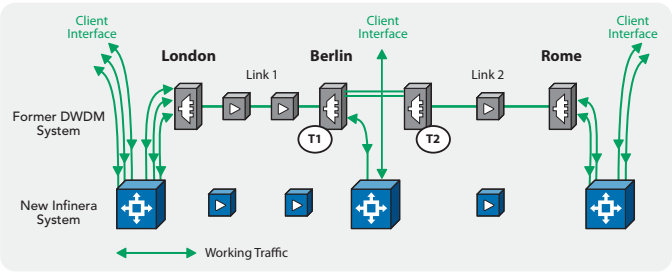

Figure 4: Services re-routed through Infinera DTNs

There are two kinds of service at each PoP location: add/drop services that terminate in this location, and express services that transit this location. In Step 2 we route both of these service types through the new DTNs using the integrated switching capability.

Examples of the fiber connections are shown in Figure 4. In the London PoP, only express services are shown. Each service enters the London DTN, and is switched through this node and back out to the old DWDM terminal.

In Berlin, express services have not yet been migrated through the local DTN – they are passed directly between the two DWDM terminals marked as T1 and T2. However, there is an add/drop service in this location, which is dropped from T1, taken into the Berlin DTN, routed through the integrated switching capability, and passed out to the client connection.

Each cross-connection is pre-configured within the DTN, but the removal and re-routing of fibers is a service-impacting event. For each location, all the add/drop and express service connections had to be re-connected within the four-hour maintenance window. In practice, each customer would have experienced a short outage typically lasting less than a few minutes -- well within the designated four-hour maintenance window.

Step 3: Line side transmission moved to the DTN

The final stage of the migration involves a switch from the old line-side terminal path, and activation of the new DTN line-side (Figure 5). The gray line indicates the old client service paths, now defunct and no longer carrying traffic.

This stage of the migration involves disconnecting the line-side fibers in the old DWDM terminals and the intermediate amplifier sites. The fibers are then connected into the line-side of the Infinera DTN and all the wavelengths on that link are brought up. Infinera equipment includes an automated amplifier power balancing system that allows this process to take place very rapidly, and typically with no user intervention.

When the line-side link has stabilized, a set of TL1 scripts are run to re-route the client connections from the "loop through" configuration that was established in Step 2. During the Step 3 migration customers typically lost their connection for about one hour, again well within the planned four-hour maintenance window. The old DWDM equipment in London, Berlin and Rome can now be removed.

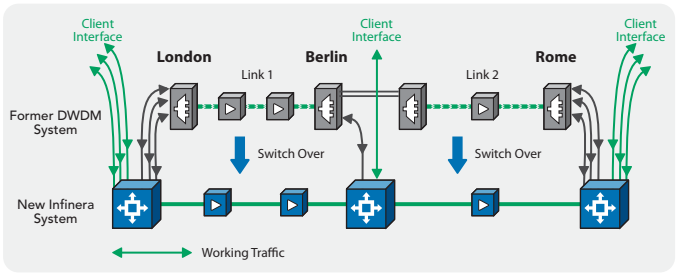

Figure 5: Line side transmission moved to Infinera DTNs

Conclusion: A Complete Pan-European Network Migration in Just 45 Days

The service provider budgeted 54 days for the migration of 120 individual client services in 15 planned maintenance windows. The actual migration was completed in just 45 days. This was achieved because Infinera's digital architecture has the versatility to function as a digital cross-connect as well as an optical transport system; and because the Infinera system with its IQ™ operating system automates, the process of bringing up 10 Gb/s wavelengths. In this installation, 120 circuits were migrated from the old system to the Infinera platform and every one of the circuits was down for less than 15 minutes each. Finally, the migration was enabled by Infinera's world-class customer service and support team, working closely with the service provider team on planning, preparation, and execution of the migration.

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