Case Study: Cisco Systems Inc.

Cisco Advanced Services Rely on Cariden MATE Features to Migrate MPLS Core without Downtime or Packet Loss

Company:	Cisco Systems, Inc.
Industry:	Networking
Challenge:	Migrate 300 provider edge (PE) routers connected to Vodafone Germany's existing Cisco® GSR MPLS backbone to a new Cisco® CRS-1-based backbone without downtime or performance degradation • Needed to plan migration order • Wanted to provide customer with confidence that they would not impact service during migration • Wanted prediction of network link utilization at each step of migration
Solution:	Cariden MATE™ Design Software with Cisco Advanced Services expertise
Selection Criteria:	Accurate and easy traffic matrix deduction Accurate traffic simulations Functionality could be programmatically exercised, as well as through GUI
Results:	• Conducted a 10-week network migration with no downtime or packet loss • Cisco and Vodafone were able to handle migration with minimized operational resources since traffic changes were well understood and predictable • Risk of project was greatly reduced
Key Quote:	*The killer features were the ability to easily derive the traffic matrix through demand deduction and the ability to drive all functionality programmatically, meaning I could script repetitive tasks to test my alternatives instead of sitting in front of the tool all the time. Only the MATE product offers that functionality. — Oliver Boehmer, Solutions Architect, Cisco Systems Inc.*

Cisco Systems, Inc. recently demonstrated the value of advanced modeling and simulation software when it helped one of its large European service provider customers replace its core MPLS network routing platform with a higher-performance one.

The Challenge at Hand

Cisco Advanced Services was engaged to help mobile operator Vodafone Germany migrate from its existing Cisco 12000 Series GSR backbone to a network core based on the newer Cisco CRS-1 routers. The CRS-1 multi-terabit forwarding capacity was quickly becoming required by Vodafone Germany as unprecedented volumes of multimedia fixed and mobile traffic were traversing their core network links.

Cisco's assignment was to design, physically build the new network core, and create the overall migration strategy, including the order in which close to 300 PE routers would migrate to the new platform. At stake was the possibility of service degradation for the company's network users while edge devices still connected to the old core needed to communicate with devices already migrated to the new core over interconnections put in place for the duration of the migration. There were 12 points of presence (POPs), each with two redundant core GSRs to be upgraded to CRSs (see figure).

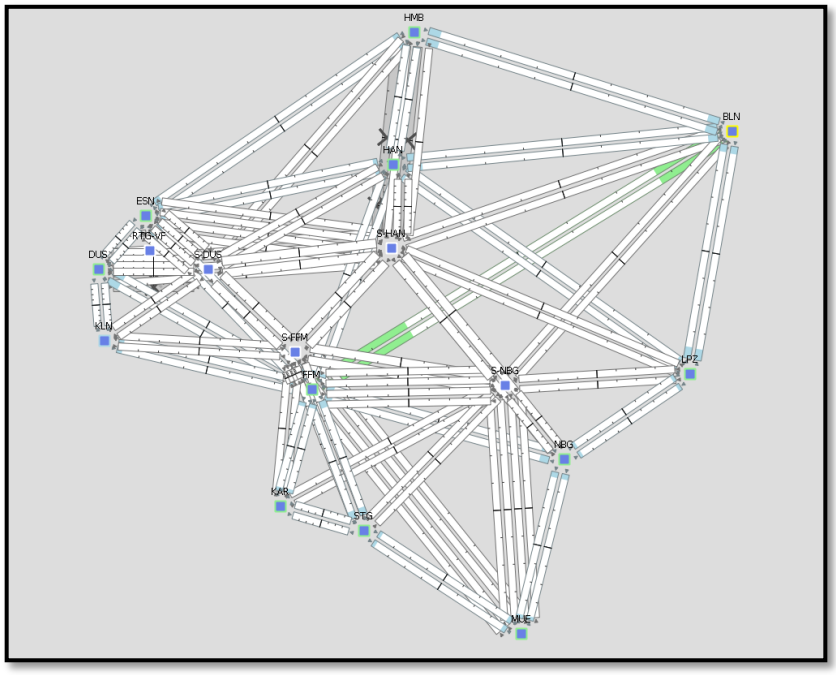

Figure 1: The new network was to be built alongside the old

Since there were so many edge devices to move and they were geographically dispersed across Germany, making an overnight switch was not an option. "The goal was to migrate in such a way that the multiple 10-Gbps interconnection links between the old core network and the new one didn't overrun capacity," explains Oliver Boehmer, Solutions Architect and Cisco lead for the migration project. Getting the migration wrong would cause the interconnections to become congested, drop packets, and impact service for large numbers of Vodafone's customers.

To build a plan, it was critical that Boehmer understood the traffic matrix: the complete listing of the end-to-end traffic flows on the network that would have to be carried. That would require some form of measurement on the existing GSR-based network before planning could begin.

Once an acceptable plan was developed, the physical migration would then become a joint effort between Cisco and its customer, Vodafone. Cisco had to develop a plan that could be handled by the small joint team of Cisco and Vodafone staff over a period of weeks.

The Solution

To build the plan his team required, the Cariden MATE software became Boehmer's right-hand assistant.

"The first 'killer feature' of the MATE software was the ability to derive a traffic matrix that we could use to understand the traffic flows the new network would have to handle," says Boehmer. "Only MATE offers the ability to do this from just link utilization alone; other tools require more complex measurements."

By gathering measured link-load data via interface statistics from the existing network and using network tomography to calculate the network path that data would take, the MATE tool produced a traffic matrix of all the flows in the network. This traffic matrix could then be used as the blueprint for the expected traffic during the simulation of the new network topologies while the migration project advanced.

Once he had the traffic matrix, Boehmer's next step was to create a topology model of the new network. Since the CRS-1 based network did not exist yet, using the discovery features available in the MATE software was not an option. The solution was going to be either using the GUI to create each network object, configure it correctly, and add it to the network model, or write a script to do the same thing programmatically. Boehmer chose the scripting option for two key reasons. First, it allowed him to quickly create the new network model in the tool by parsing information such as port numbers and IP addresses from a spreadsheet supplied by Vodafone. Second, because it allowed him to quickly adapt the topology to test the ordering of each migration step. This worked by running a simulation of the traffic flows created by each link being brought up to connect a PE to the new core or being taken down to remove it from the old one.

"For every move, we calculated the load of the new network," he explains. "The ability of the MATE software to be scripted is amazing," he adds. "It's very customizable. Its power is its versatility to integrate [the traffic demand] into the workflow in machine-readable form," which relieved Boehmer from having to perform a lengthy series of manual tasks to create the files and to retrieve the simulation results.

To migrate the 300 edge routers, Boehmer calculated 20 to 30 moves and was able to see how the load would be forwarded through the network and whether traffic would remain in balance. Vodafone's goal was to keep the interconnect link loads under 70% utilization.

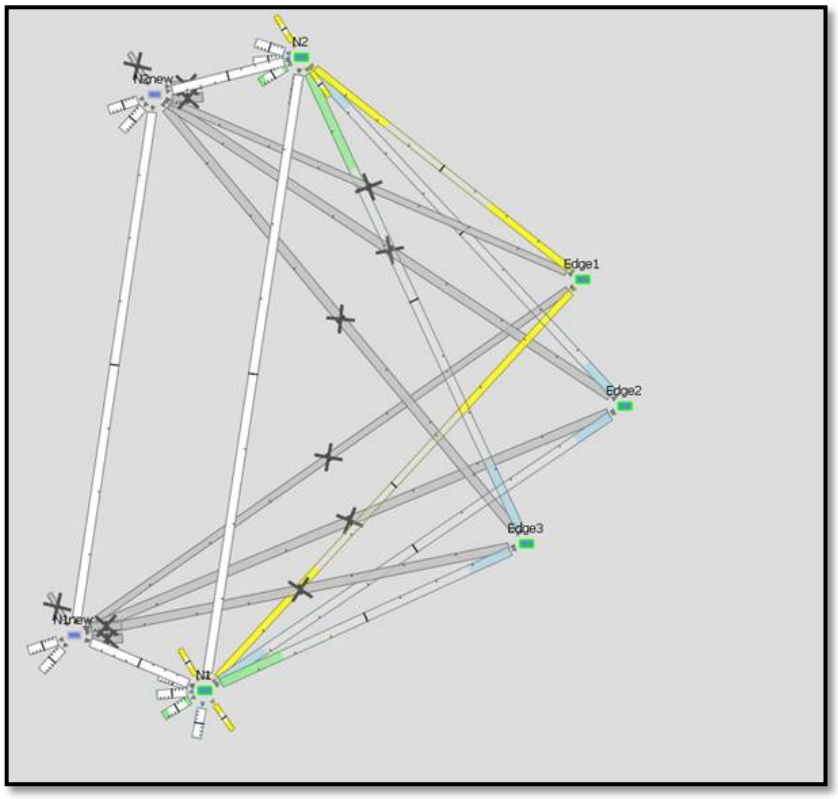

Figure 2: Boehmer simulated connecting each edge node to the new network and disconnecting it from the old

MATE simulations helped Cisco discover that "certain nodes couldn't move at the same time" without causing link utilization overruns or performance/quality-of-service (QoS) problems. "We tried about 10 different migration orders of equipment before finding the one that met all of the utilization and performance requirements during the transition," Boehmer says. "Without the functionality of the MATE tool, it would have been practically impossible to perform this level of modeling economically"

The Results

It is common for networking equipment vendors to handle core network forklift upgrades by building a parallel network and then switching the network over from old to new. However, customers always had to be willing to accept that network migrations could be risky and might impact service delivery during implementation. By using the MATE software, Cisco was able to provide its customer with more confidence that the migration would be trouble free.

"We did not suffer any downtime or packet drop during the migration process," says Boehmer. "We could reassure our customer, before the migration project began, that we understood and had managed the risks involved."

A typical approach is "to use common sense and accept a lot of risk, which would have involved much greater operational effort on the part of the customer [Vodafone]," Boehmer explains. Without having done the simulations and understanding what was going to happen to the traffic, Vodafone would have had operations staff watching traffic levels on all links in the network 24x7 during the

migration. Whenever traffic levels rose significantly on a particular link, staff would have had to have taken action to reroute flows to avoid the danger of congestion impacting services.

With the MATE solution, however, Boehmer had modeled the network and understood the impact of link utilization for each step of the migration. After the first couple of moves had confirmed that everything was working as expected, the team could monitor traffic flows with high confidence that service would be maintained.

"The planning for this migration project took two to three weeks," explains Boehmer. "Without the MATE software, it might have taken…well, we wouldn't have done it," he says, "We would have reverted instead to common sense and greater risk. With this unique approach, we were able to offer our customer more reassurance that the project would be completed without incident."

The tool was "extremely reliable and delivered what was expected," he adds. "The customer didn't have to expend resources on weekends and was highly satisfied, which is what we always strive for."

About Cariden

Cariden Technologies, Inc. is a software company serving telecommunications providers worldwide. Founded in 2001, the company has maintained steady growth and profitability with its industry-standard software for IP/MPLS capacity planning and traffic engineering. Networks serving 85% of the U.S. broadband customers have adopted Cariden software, as have 8 of the 11 global Tier 1 ISPs. Cariden's success is fueled by its technical innovations in delivering visibility, efficiency, and automation to networks.

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