# Major public transportation provider optimizes, migrates and upgrades its existing network to realize security improvements

Comprehensive analysis and optimization from Alcatel-Lucent reveals pain points and drives the migration of an existing network to support multicast IP-based audio/video

CASE STUDY   MARKET: **TRANSPORTATION**   REGION: **NORTH AMERICA**

Massachusetts Bay Transportation Authority
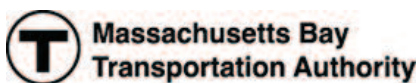
The Massachusetts Bay Transportation Authority (MBTA) is one of the largest transportation authorities in the world servicing over 1.3 million passengers each weekday. The Authority required an objective analysis of its multivendor network to determine whether it would support future demands including a network-wide deployment of IP audio/video. Alcatel-Lucent assessed the legacy network, identified problem areas, and made specific recommendations to quickly achieve network improvements and optimize to support multicast IP-audio/video to meet security and customer safety needs.

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CHALLENGES

- Complex multivendor network with various equipment and technologies at different stages of life and regulatory compliance requirements

- Growing bandwidth, OPEX and network management issues

- Uncertainty about the network's ability to support new applications including a network-wide rollout of IP audio/video needed to meet new security requirements

SOLUTIONS

- Assessed the current optical and data network to determine the ability to support additional IP audio/video traffic loads from a capacity, delay, latency, and resiliency perspective

- Recommended specific areas for improvements after collecting and analyzing the data network and optical network inventory

- Performed non-intrusive network discovery using AuditBox TM (proprietary Alcatel-Lucent data collection tool) to capture inventory and configurations of network equipment, Opnet's NetDoctor TM (enhanced with proprietary Bell Labs algorithms) to outline specific configuration and consistency issues

- Identified several major areas of network optimization regarding interior gateway protocol (IGP) routing, IP summarization, and optical redesign that would result in immediate network enhancements

- Created a new Network Migration Plan and migrated existing network to support multicast IP-based audio/video

- Deployed, tested and documented the network

BENEFITS

- Network Analysis resulted in significant network adjustments that improved the stability, reliability, and consistency of the network

- Network design is completely compliant for multicast applications requirements

The challenge

The MBTA is the oldest continuously operating subway system in the country. Opened in 1897, the T has remained a critical part of Boston serving 175 communities providing transit alternatives to a population of almost 4.7 million people over an area of 3,200 square miles.

The MBTA is currently the fifth largest mass transit system in the United States serving approximately 1.3 million customers. To provide service the Authority maintains over 182 bus routes, 4 rapid transit lines of heavy and light rail, 5 bus rapid transit lines, 4 trackless trolley lines, 14 commuter rail lines, 3 ferry routes, and a flexible para-transit service.

OPERATIONAL EXCELLENCE AND PUBLIC SAFETY ARE HIGH PRIORITIES

Critical to MBTA's operational excellence is a multi-vendor fiber optic and cable-based Wide Area Network (WAN). To improve the user experience and better meet public safety and Homeland Security initiatives MBTA has continuously invested in various network technologies, systems, and applications. These include enhanced safety applications such as public announcement systems, closed circuit television (CCTV) systems biochemical monitoring.

NEWER APPLICATIONS STRESS LEGACY NETWORK

MBTA has introduced an automated fare collection system that required a SONET network, supplied by Alcatel-Lucent, to connect subway stations and operations centers. Moving from tokens to an automated system was a "tremendous change" admits Gary Foster, Chief of Technology, MBTA. "That was a paradigm shift for the MBTA: making sure that we had a network that we could rely on for speed, for real-time transactions, particularly credit card purchases made at our vending machines, as well as returning signals from our camera system back to our control centers."

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The addition of these and other multitask applications placed mounting pressure on MBTA's packet/optical network infrastructure. Bandwidth management issues began to threaten the reliability, security and performance of existing and planned applications while driving up operational expenses. As well, some applications had unique network requirements that the legacy infrastructure could not support as configured. Required was an immediate and objective assessment of the global network infrastructure with two overriding goals:

- Determine whether the legacy network could support new feature rich applications, including next-generation, multicast IP audio/video services without degradation in network bandwidth or impacting other applications
- Identify strategies for optimizing the existing packet/optical network to resolve growing performance and bandwidth issues and reducing OPEX

Why Alcatel-Lucent?

Optimization of MBTA's existing network assets was the cornerstone of Alcatel-Lucent's approach. Rather than assuming or recommending new proprietary solutions, Alcatel-Lucent championed a vendor-neutral strategy focused on protecting and optimizing MBTA's legacy network assets. Optimization means reducing costs, improving Quality of Experience (QoE), increasing utilization and boosting performance while positioning an existing network for growth or evolution towards a High Leveraged Network (HLN) architecture. Effectively, optimization enables network operators to extend the life of their existing assets.

MULTIVENDOR NETWORKS ARE COMPLEX AND CHALLENGING

A complicating factor was the fact that the MBTA network was comprised of various technologies from a number of equipment vendors. Objectivity, in-depth knowledge of network technologies and equipment from various vendors, and the ability to adapt on-the-fly to challenges inherent in a complex multivendor environment were critical to the success of an initial assessment – and subsequent recommendations for optimization. Alcatel-Lucent is one of the few global solution providers with the depth-of- knowledge and specialized network transformation expertise and processes to ensure success.

PROVEN PROCESS AND OPTIMIZATION CAPABILITIES

Alcatel-Lucent has proven capabilities for leading assessment and optimization projects that solve the type of network performance issues experienced by MBTA and other transportation service providers. Alcatel-Lucent's optimization solution enables network owners and operators to exploit their existing network assets while delivering the performance required to meet quality and operational standards in access, switching, transport, wireless, LAN/WAN and data networks.

PRIOR EXPERIENCE WITH MBTA ESTABLISHED TRUST

In addition, MBTA had prior experience working with Alcatel-Lucent for the deployment of a fiber optic network to support the automated fare collection system. Gary Foster comments on the relationship and experience: "In Alcatel-Lucent, what we got was someone who handled presales, sales, and execution excellently, had a complete professional team — a partner that was willing to work within our framework and across functions at the MBTA. This can be difficult at times in the public sector: working with all the different teams and also providing the structure and the professionalism required to execute."

This prior experience with Alcatel-Lucent, in addition to a proven Network Transformation and Optimization process, gave MBTA confidence to proceed with Alcatel-Lucent's assessment and optimization services.

The solution

Alcatel-Lucent recommended and implemented a progressive, three-pronged strategy for tackling the assessment and optimization requirement. The first step was an assessment to establish a baseline network profile. This resulted in a high level 20-page report that summarized key infrastructure problems. This step led to an in-depth analysis of the physical and logical data network and optical network inventory. This was needed to determine the network's ability to support additional IP audio/video traffic loads from a capacity, delay, latency, and resiliency perspective. The second step involved a comprehensive analysis with specific recommendations for how to address performance issues and provided a plan for reconfiguring the network to support new IP deployments.

The in-depth analysis included:

- Review of all relevant network configurations and connections
- Non-intrusive network discovery using AuditBox TM (ALU proprietary) to capture inventory and configurations of network equipment, OpNet's NetDoctor TM (enhanced with proprietary Bell Labs algorithms) to outline specific configuration and consistency issues
- Identification of major areas of network optimization (IGP routing, IP summarization, and optical redesign) that would result in immediate network enhancements

Detailed Migration Plan:

The assessments revealed that the MBTA network was not configured to support SSM Multicast; that hardware updates and software configuration changes were needed to support new planned deployments. The comprehensive analysis and optimization report included a Network Migration Plan for minimizing network interruptions, out-of-hours support for hardware upgrades, network renumbering, and new installation cutover. The plan included:

- A multicast network design with models for unicast audio/video data flows, multicast data flows, and routing protocol design to support multicast
- Measurement of traffic characteristics on the network pre and post multicast
- Documented multi-vendor equipment configurations
- Layer 2 and Layer 3 network design and implementations
- Recommendations for changing control process implementation

DEPLOY, TEST, AND DOCUMENT THE NEW NETWORK

Alcatel-Lucent was engaged by MBTA to implement all optimization recommendations and to deploy, test, and document the new network. This required the migration of the flat Layer 2 network to a hierarchical-Layer 3 network to mitigate the impact of multicast traffic on the legacy MBTA SONET network.

Foster comments on the approach taken by Alcatel-Lucent to the overall optimization and network migration: "The team [Alcatel-Lucent] stuck to the original assessment and understood the application requirements we had in mind. So they really had a strong understanding of what we were doing here at the MBTA and trying to accomplish with the network. That was critical."

KEY BENEFITS REALIZED BY MBTA

Ultimately, Network Optimization is about increasing bandwidth on the existing infrastructure. Foster comments on this promise following the multicast migration phase of the project: "We found out with the bandwidth (the project) provided, with no additional cost, that we've been able to add a couple of smaller, less significant applications and eliminate some secondary wiring into our stations and really leverage the network with minimal additional investment, which is a great thing in the public sector." In addition, MBTA has benefited from the following:

This project was bid competitively.

- Network is now completely compliant for IP multicasting over SONET
- Identified and removed recursive network paths that wasted bandwidth
- Resolved numerous network performance issues that hampered applications/network growth for the Transit Customer network needs
- Reduced time-to-resolution for legacy network outages from days to minutes

Foster comments on the overall experience and implementation: "The thing that really impressed me about working with Alcatel-Lucent was every person I met was professional, courteous, thoughtful, and they really seemed to care about what we were doing here at the MBTA. I really felt there was a commitment to the project. In many cases you don't see that."

The Value Add

Alcatel-Lucent worked closely with the MBTA internal team onsite, attended meetings, and represented MBTA's interests to other vendors as needed. In so doing, Alcatel-Lucent became a trusted advisor and leader in a quest to cost effectively evolve the MBTA network infrastructure and drive a network migration to support IP multicast audio/video. "They really took the leadership position in terms of architecting the solution and helping the internal team understand what the implications were," says Foster. "And that led to a number of major upgrades in terms of network, resiliency, minimal disruption to the network, or if we lose a particular site, we can automatically reroute."

Exposure to industry best practices and project management expertise was also highly valued by MBTA. This resulted in knowledge sharing and learning opportunities for the internal MBTA team. "Project management was solid and based on industry best practices. They [Alcatel-Lucent] provided learning opportunities for my team," says Foster. "The [Alcatel-Lucent] team really brought their information in openly and shared it with anyone on our team. So there was a lot for my team and for other departments in the company who had a stake in the project. I really think that's unusual: you don't see that in general," he adds.

The Future

Alcatel-Lucent has given MBTA time to plan in a measured way for the future. By reconfiguring and stabilizing the existing network with as little downtime as possible, MBTA has a network that now supports newer technologies that make the system safer for the public, more resilient, with increased bandwidth for future growth.

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