

NOKIA



Milan's Metro:
Intelligent rail solution
deployment to improve
public transport



Milan's metro operator Azienda Trasporti Milanesi (ATM) has enhanced passenger experience, improved operational efficiency and reduced costs by deploying the intelligent rail solution from Nokia to transform its communication network into a single, converged IP network.



Like many public transport operators, ATM has traditionally deployed TDM (Time Division Multiplexing) networks to run operational applications like video surveillance, voice services, public address and SCADA systems. With the need to enrich their networks with new applications and services, ATM decided to rationalize their communication networks into a converged packet-based network to reduce costs and increase the efficiency of their staff as well as improve the satisfaction and security of passengers.

“The necessity of an IP network transformation is due to the increasing need to host more services and its ability to converge these onto a single piece of infrastructure to provide a truly multi-service network.”

Challenges

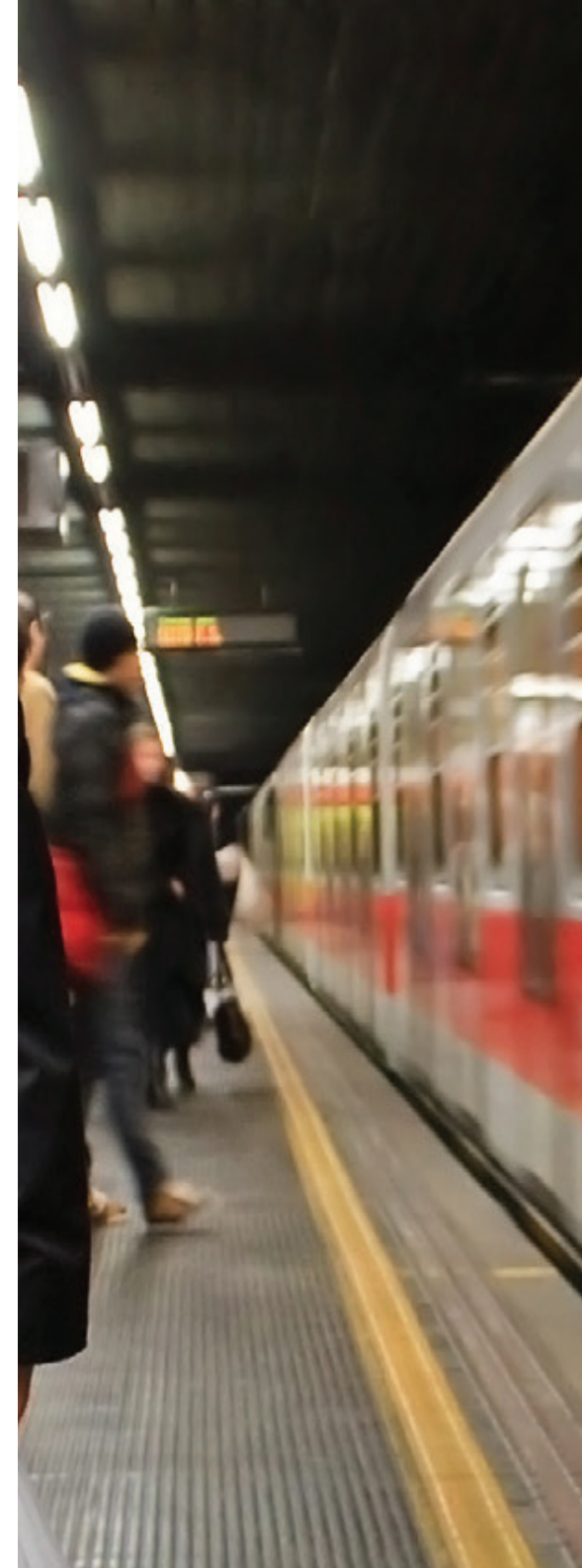
- Extending the rail network and its communication services to passengers and workers
- Providing the high-bandwidth capacity to support critical security and safety services
- Eliminating any disruptions
- Meeting passenger demand for access to new information services such as public Wi-Fi
- Ensuring a smooth migration from legacy to state-of-the-art network architecture

Solutions

- IP/MPLS Network infrastructure:
 - Access: OmniSwitch 6850 and Video surveillance system
 - Aggregation: Nokia 7450 Ethernet Service Switch
 - Core: Nokia 7750 Service Router
 - Network Management : 5620 Service Aware Manager

Benefits

- Hosting multiple applications on a single multiservice network infrastructure supporting any highbandwidth services, now and in the future
- Providing operational continuity during the migration
- Ensuring scalability of the solution that can easily be scaled up upon completion of metro extension projects and the installation of new surveillance or communications technologies
- Learning from experts during the maintenance and training phases
- Reducing operational costs
- Enhancing safety of passengers with video surveillance deployment





Since opening in 1964 Milan's metro network has continued to grow to keep up with demand from the expanding population of Italy's second largest city and its business hub. Now spanning 92 km across four lines, and expanding to 106 km when new lines and extensions open ahead of the 2015 World Expo, the network is the country's most extensive rapid transit system and carries over 320 million passengers every year.

The metro, like Milan, is not standing still. The city might be behind Rome in terms of metropolitan population, but it has by far the greatest suburban sprawl of any Italian metropolis. As a result, Milan is looking to extend its metro network further to serve developing population centres and ease congestion.

As the network has grown over the past 50 years, its telecommunications network has inevitably evolved with it.

When the 12 km Line 1 opened in 1964, copper cables distributed along its

tunnels carried data for operator Azienda Trasporti Milanesi (ATM) at a transmission speed of 300-1200 bits/s. These have progressively been replaced by an optical fiber network with digital transmission culminating in the installation of a Territory and Traffic Control system in the early 2000s.

This network, installed by Nokia, is primarily based on an optical fiber backbone and uses SDH equipment to carry data flows at speeds ranging from 9600 bits/s to 64 kbits/s and 2 megabits/s from various pieces of peripheral equipment. These include signalling light regulators, video surveillance systems, voice services, vehicle monitoring and asset management equipment, as well as access control systems to limited traffic areas. All of this equipment is linked to the correspondent control centre.

The Challenges

The gradual expansion of Milan's metro and changing passenger habits was placing significant demand on its network infrastructure. ATM wants to keep its passengers safe and secure, and has invested in surveillance systems to achieve this. Passengers are also increasingly demanding access to services like public WiFi. In order to keep up with this demand and to continue operating an effective service, ATM decided to explore the possibility of hosting more high-bandwidth services, mainly based on Ethernet interfaces, which required a further network evolution — this time to IP.

Stefano Pasetti, Director of Intelligent Transport Systems and Telecommunications Department of ATM, says: "The necessity of an IP network transformation is due to the increasing need to host more services and its ability to converge these onto a single piece of infrastructure to provide a truly multiservice network. The introduction of VoIP systems and the necessity to guarantee different 'Quality of Service' parameters led to a review of what we could do to improve the architecture and technology in use."

In 2010 ATM proceeded with a convergence to IP/MPLS with the intention of optimising resources dedicated to network management and maintenance.

The Solution

The main aim has been to realize a multiservice network, to optimize the resources dedicated to the management and the maintenance of the network and the use of locations and fiber optics, in relation to following technological development, still in progress:

- Revamping of teleoperation systems, both of remote control of signalling system and electrification plants (before based on point to point links and base band modem)
- Realization of a new radio system for train-to-wayside communications based on a digital standard (TETRA)
- The extension of video surveillance and video recording systems based on IP protocol (over 2.500 cameras transmitting IP video flows to Unified)
- The necessity of broadband links for Office Information and LAN Systems (of various locations and depots of the company) distributed over the territory
- The possibility to introduce additional services for Security and Operations (video surveillance on trains, infomobility, WiFi...)

Moreover, Nokia IP/MPLS network guarantees an adequate "technological continuity" with respect to the "old" SDH network, previously in use.

This communication network is designed to be resilient and to guarantee high reliability for critical services like the new SCADA (Supervisory Control and Data Acquisition) System of underground metro Line 3.

The network now supports voice services over intercoms installed at stations to the central operating site as well as public WiFi networks and an enhanced surveillance system. All of these services are singularly configured on specific Virtual Private Networks (VPN) which guarantees traffic segregation towards the respective central systems.

The surveillance system is now in operation on several lines and has enabled ATM to install more cameras at more locations, providing better coverage and improving passenger security. The network is also capable of being scaled up as the extension projects are completed as well as supporting the installation of digital signs and use of IP phones.



Migration with no service interruption

Even during a complex communication network refurbishment, halting public transport services is not an option. Nokia's solution, combined with deep expertise in project management, has facilitated a smooth migration from the old networks to the new IP/MPLS converged network without any service interruption.

An IP/MPLS network not only offers more features, higher security and more flexibility in deploying new services, it also reduces maintenance costs and simplifies operations.

Routine maintenance is carried out by a team of just nine ATM technicians. These are supported by a second specialist team of four technicians with network administration skills who are able to implement the second maintenance level. Nokia experts also provide an additional support service to solve more complex problems and minimise potential disruptions, reflecting the company's commitment to supporting the customer beyond the installation phase.

While the IP/MPLS network is enabling ATM to explore more advanced communications to improve the use of and security of its assets, the rollout has also optimised ATM's worker activity and resources.

This has contributed to a change in the way that ATM works and thinks about operating its metro network.

"The availability of a high-performance network infrastructure allows us to distribute software tools and applications across our organisation," Pasetti says. "This evolution also allows operations systems and personnel to benefit from centralised architecture and the advantages it provides in terms of increased security and availability as well as the simplification of the work station management process."

The Future

The new IP/MPLS network is now supporting enhanced video surveillance and Wi-Fi services in stations as well as depots. It has also enabled ATM to explore the possibility of introducing additional security and operations features. These could include video surveillance onboard trains, real-time passenger information updates and on board Wi-Fi services.

Indeed, IP-MPLS' capability to host multiple services on a single piece of architecture opens up a world of possibilities to ATM all at a fraction of the cost of installing these networks separately. With the process of migrating services to a single IP infrastructure continuing, the future of ATM's communications network could eventually encompass its own operations and communications networks as well as those of other organisations across the entire metropolitan area. It could then form the backbone of a future smart city that will be safe, and support on-time and connected commuters and citizens.

"This evolution also allows operations systems and personnel to benefit from centralised architecture and the advantages it provides in terms of increased security and availability as well as the simplification of the work station management process."



Nokia OYJ
Karakaari 7
02610 Espoo
Finland

Tel. +358 (0) 10 44 88 000

CID 170761

© 2023 Nokia

NOKIA

At Nokia, we create technology that helps the world act together.

As a B2B technology innovation leader, we are pioneering networks that sense, think and act by leveraging our work across mobile, fixed and cloud networks. In addition, we create value with intellectual property and long-term research, led by the award-winning Nokia Bell Labs.

Service providers, enterprises and partners worldwide trust Nokia to deliver secure, reliable and sustainable networks today – and work with us to create the digital services and applications of the future.