



ICT services & solutions

Essential communications for London Underground

The London Underground network has 275 stations and runs over 243 miles of track split across 12 lines, with 3-4 million passengers using the Underground each day to travel around Greater London.

Tube Lines is a consortium responsible for the Jubilee, Northern and Piccadilly lines, providing maintenance and upgrades for the infrastructure on all three, as part of a 30-year public private partnership (PPP) contract with London Underground.

As part of a £4.5 billion investment programme, Tube Lines provides maintenance of existing systems, and plans and executes works to upgrade the track, signals, trains and stations. This is a massive task, with Tube Lines responsible for some of the oldest infrastructure on the network. With such an extensive remit, Tube Lines faces many challenges in successfully keeping this infrastructure operating every day, and therefore works closely with carefully selected external organisations to help maintain and develop the many different and diverse systems that are needed. One vital aspect of Tube Lines' responsibility is the station communications systems and their maintenance. These systems provide essential passenger information, security monitoring and supervisory control and data acquisition (SCADA) services.

Our role

As part of a 13-year upgrade and maintenance contract awarded in January 2005, **telent** provides an integrated whole-life communications and maintenance solution for Tube Lines through Enhance Communications, a joint venture with Amey. Our integrated station management software solution provides monitoring and control of public address, security monitoring, passenger help points and visual information display subsystems, all interconnected by the station LAN infrastructure which also allows the SCADA subsystem to monitor other station assets such as lifts and escalators. The contract builds on **telent's** existing relationship with Tube Lines and consists of two elements: a six-year upgrade programme covering 76 stations; and a maintenance contract supporting all of Tube Lines' 100 stations. As part of the contract, **telent** also provides ongoing site commissioning and conducts regular system performance reviews to ensure that communications systems are delivering optimum efficiencies.

How we perform

telent has developed a maintenance management system which is used to provide 24/7/365 maintenance support services for Tube Lines. Operational performance is a key driver for Tube Lines and, as such, **telent** is incentivised through its contracting arrangements to reduce fault levels and fix times on an ongoing basis. Tube Lines use a service points system (derived from numbers of faults and fix times) to measure performance, and **telent** receives financial bonuses if its performance exceeds the targets set on a monthly basis.

On the Jubilee Line **telent** has managed to consistently improve performance year-on-year and has driven the fault levels to 50 per cent of the permitted contract targets. Like Tube Lines, **telent** continually looks to innovate and introduce new practices in order to further improve operational performance. This is achieved by considerable investment in training, constant monitoring of key performance indicators, developing the systems that support the workforce and targeted planned maintenance to eliminate poor performing assets.

LAN backbone

All the various communications systems must be kept functioning correctly at all times in order for a station to be kept open. Failures can necessitate evacuation and closing a station with consequent disruption and delays for passengers and contractual penalties for **telent**. The station LAN provides the backbone on which all the communications subsystems rely, and as such must be of the highest quality.

Industrial grade switches and routers are configured in a ring architecture to provide network resilience, with redundant power supplies at key nodes. Fibre is used to optimise performance in the high bandwidth segments, particularly between the main communications equipment room and the manned control room.

Hirschmann MICE switches support HIPER-Ring redundant Ethernet network protocol to provide very high degrees of availability in every area of the network. Extensive modeling was carried out to ensure that the LAN had sufficient capacity, both during normal operation and when operating in a degraded mode during an incident.



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WAN infrastructure

In an extension to the original station upgrade contract, **telent** is also providing an inter-station WAN which will link all the stations on a given line (i.e. Jubilee, Northern and Piccadilly) to their appropriate line control centres. The WAN will also connect to Tube Lines' headquarters at Westferry Circus in Canary Wharf and has links to key maintenance organisations such as **telent**.

London Underground's existing CONNECT contract has necessitated the use of an Ethernet over SDH solution with 2 Mbit/s E1 bearers between stations. The limited number of these E1 links has further constrained the WAN design into a series of rings, each encompassing up to eight stations and the appropriate line control centre (LCC).

telent is providing duplicated E1 to Ethernet converters and a router at each station. These connect the existing station LAN to the WAN and provide a resilient ring architecture to ensure a reliable connection to the LCC. **telent** took full responsibility for the LAN / WAN integration.

An overall network management system (NMS), based on HP Openview, is provided at Westferry Circus. This enables close supervision and management of the WAN. Faults can be quickly identified and the underlying causes determined. The appropriate maintenance teams can then be identified and mobilised.

The NMS system also allows detailed management of the limited bandwidth that is available. Users and potential users are allocated bandwidth and even the time of day when it is available. This is then monitored to ensure that business or operationally critical applications are prioritised.

CCTV and other systems

The largest single data requirement comes from the security monitoring system. **telent** is installing a total of over 5,000 CCTV cameras, the output of which is being recorded on to DVRs continuously as part of general surveillance. In all, over 200 terabytes of storage are required for this system.

Real-time recordings can be initiated by the station staff or may be triggered automatically as a result of incidents, such as an emergency call from a help point. Suitably authorised staff or British Transport Police officers can review and copy the recordings using a PC connected via the station LAN.

The other systems make lesser demands on bandwidth but are equally demanding in terms of reliability and resilience. The PA is probably the single most important tool to enable station staff to ensure passenger safety on the station. Visual information displays on platforms and in ticket halls are synchronised to the timetable and signalling system in order to provide passengers with reliable and regularly updated information on train arrivals and departures. They are also used to provide safety information and ad-hoc and routine messages.

Key facilities such as escalators and lifts are monitored via the SCADA system so failures are detected promptly and appropriate measures can be taken to mitigate the consequences by, for example, directing passengers to alternative exits.

Integrated management solution

telent has developed an integrated management solution which supports a multi-tier, client/server architecture that scales in terms of size, complexity and resilience, whilst ensuring that the performance of the overall system is not adversely affected. It provides a single and intuitive unified interface to operators, in order to control and monitor the disparate systems so as to minimise their workload. On smaller stations, a single operator seated at a workstation in the control room, controls all the above communications systems. During busy periods on larger stations, several operators at multiple workstations can share the workload.

The multi-tier architecture allows both local and remote (network wide) access to the station systems for fault management and diagnostics.



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