Trapeze™
Here for the journey

Intelligent Transport Systems
Case Studies

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Our ITS EXPERTISE

Trapeze has a suite of Intelligent Transport System (ITS) solutions that make managing tram, light rail, ferry, and bus transport networks more efficient and effective.

In this document and on our ITS webpage you will find a selection of our main customer case studies, press releases and more. We hope you enjoy reading them!

Discover more of our case studies by clicking here

Brighton & Hove – essential travel for our city
AVV Augsburger Verkehrs- und Tarifverbund
Transport for London
Land Transport Authority – We Keep Your World Moving
VAG
Royal Commission for Riyadh City
ZVV
yarra trams
sotra – Société des Transports Abidjanais
Stadt Ulm ulm
Tram Augsburg Streckennetz
DVB
hvv
Köln
MyCITI – Siyajikeleza. Laat Wiel. Going Places.
rnv – Mit gutem Gefühl unterwegs.
Saarbahn
ulm. neu-ulm touristik
Lucerne Transport
Freiburg im Breisgau
BERNMOBIL – Zusammen unterwegs
KVB
Rhaetian Railway
HOCHBAHN

Brighton & Hove Bus Company, UK
Cloud Migration Project

Industry
Bus

Challenge
Integrate metro and bus networks

Solution
Trapeze Intelligent Transport System (ITS)

Overview
800 buses

1,500 RTPI Displays

Results
- **Downtime minimised**
- **Recovery Time Objective (RTO) <15 mins**
- **263 buses and 285 signs migrated to the cloud**

Background

Brighton & Hove is renowned for its singular focus on ensuring every journey is an enjoyable one for the travelling public – as evidenced by the operator being recognised as 2017 Top City Operator at the UK Bus Awards and runner-up in 2020.

Objective

To stay at the cutting edge of what's possible in public transport, Brighton & Hove worked with Trapeze to migrate their ITS system to the cloud.

The benefits of transferring systems to the cloud are numerous, and include:
- Scalability and flexibility
- High availability
- Increased security
- Cost efficiency

Trapeze is committed to an innovative cloud-based solution. With this, we can deliver improved SLAs and KPIs and deliver a hosting service that is easy and convenient to run, as well as improved security and data replication.

Solution

With 263 buses and 285 signs to migrate to the cloud, it was important to Brighton & Hove that the migration was completed without impacting operations. Trapeze completed the shift to the cloud in just one day, with minimal downtime for Brighton & Hove, safeguarding their reputation and the passenger experience.

To ensure smooth migration with the possibility of switching back to on-premise hosting, Trapeze ran the services in mixed mode. Some vehicles and on-street digital displays were connected to the cloud environment and some were connected to the on-premises environment, then gradually moved from on-premises hosting to cloud hosting.

The migration of vehicles and on-street digital displays was transparent to service controllers as all vehicles, irrespective of being connected to on-premises or cloud, were monitored from the same Service Controller Application.

Results

The primary goal of Disaster Recovery (DR) is to minimize downtime and ensure the continuity of software services. By implementing DR plans, organizations can mitigate the impact of these events and maintain critical operations.

By tailoring the DR approach to the specific needs of Brighton & Hove buses, Trapeze created a robust and cost-effective strategy with an Recovery Time Objective (RTO) of less than 15 minutes and a Recovery Point Objective (RPO) of zero.

Trapeze did a lot of work with our IT department to make [the migration] possible. We were given access to the test environment, which was very reassuring. I feel we have certainly made the right choice by switching to the AWS cloud. I would like to thank Trapeze for not just their help but also their patience. They certainly went out of their way to make this successful.

Steve Lane - GPS Officer, Brighton & Hove Buses

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Cologne Transit Authority, Germany

Modernisation and Expansion of AVLC System

Industry

Bus, Light Rail

Objective

Modernise and Expand AVLC System

Solution

Trapeze Intelligent Transport System (ITS)

366 buses

381 trams

56 bus routes

11 tram routes

275 million passengers annually

Results

- Upgrade to digital radio system
- Expanded Automatic Vehicle Location and Control (AVLC)
- Passenger information

Kölner Verkehrs-Betriebe AG commissioned Trapeze to expand and upgrade their operations control system.

Background

Kölner Verkehrs-Betriebe AG (KVB) employs around 3,400 people and carries 275 million passengers a year. With around 750 vehicles, KVB services a total of over 2,000 stops on 11 light rail vehicle routes with a route length of 238.7 kilometres as well as 56 bus routes with a route length of 562 kilometres.

Solution

In 2009, KVB commissioned Trapeze with the expansion of its operations control system. In 2012, the control centre and the digital radio system were upgraded to current releases.

All KVB servers and workstations are implemented as virtual machines. There is a redundant control centre which is equipped for parallel operation. Data management in LIO-Data is used by KVB together with Stadtwerke Bonn. The two companies jointly operate tram routes 16 and 18.

In addition to real-time information, there are also powerful statistics functions available. If necessary, data is automatically forwarded through standard interfaces.

The functionalities:

- Automatic vehicle location and control system LIO
- TETRA radio system (Airbus)
- On-board computer generation IBISplus G1
- GPS-based location
- Transfer protection
- Passenger information (third-party DPI signs)
- Data supply with LIO-Data, data transfer from Microbus
- Traffic light pre-emption
- Extensive statistical data available in Business Intelligence and ISAS2
- Data exchange with ActiveForms+ for processing of information in the third-party system
- Completely virtualised HW platform

The system at a glance

Control centre

29 dispatcher workstations, 25 info stations, 10 data supply and/or statistics workstations

Radio system

Tetra digital radio: 17 base stations, 34 repeaters

Radio devices in vehicles plus 520 hand-held devices

Vehicles

366 buses in total (235 own buses, plus 131 fully integrated buses from third-party companies)

381 light rail vehicles

Dynamic passenger information

150 third-party DPI signs

Depots

5 in total, equipped with Wi-Fi (50 access points)

Third-party components

Passenger information, planning program, ticket vending machines, VoIP/TETRA voice system, incident management

Software interfaces

VDV452 planning program, VDV454 multi-agency, incident management, VDV453 data distributor

Results

- Upgraded digital radio system
- Expanded Automatic Vehicle Location and Control (AVLC) system
- Passenger information

"The AVLC is the most important dispatching instrument for our vehicles. Passenger information at the stops is guaranteed at all times thanks to the large number of DPI signs – especially when it comes to light rail vehicles. In the vehicles, passengers are promptly informed of special situations acoustically."

Dirk Scholz, RBL Project Manager, Kölner Verkehrs-Betriebe AG

Hamburg Transport Agency, Germany

Passenger information and management system improves public transport quality

Industry

Bus

Challenge

Upgrade passenger information and management system.

Solution

Trapeze Intelligent Transport System (ITS)

850 buses

4,400 employees

110 lines

1,303 stops

Snapshot

- ✓ Automatic Vehicle Location and Control (AVLC)
- ✓ Real Time Passenger Information signs (RTPI)
- ✓ Traffic Light Preemption
- ✓ Transfer protection

Background

As second largest local transport company in Germany, the company employs some 4,400 employees. It carries about 204 million passengers each year on more than 700 buses and 110 lines with 1,303 stops. A further 189 million passengers each year use its three underground routes.

Challenge

Hamburg city centre has for some time past seen the addition of new features to its landscape: The amber fluorescent letters of electronic displays which provide dynamic passenger information have joined the colourful lights of the metropolis. The displays form part of the passenger information and management system, which Hamburger Hochbahn AG ordered from Trapeze.

Solution

The Trapeze passenger information management system is a LIO automatic vehicle location and control system (AVLC). Among other things, LIO supports the modern vehicle equipment (IBISplus on-board computers) and is connected to a digital trunk radio system (TETRAPOL). The FIMS system was planned and delivered in three consecutive phases.

The functionalities

- LIO automatic vehicle location and control system
- TETRAPOL radio system
- Modern on-board computers IBISplus
- GPS-based location
- Transfer protection, including interfaces with the AVL systems of third parties
- Geographic information system (GIS)
- Passenger information system (SmartInfo)
- LIO-Data data supply
- Traffic light preemption
- Loading the vehicles with software and data using
- WLAN (wireless LAN)

The system at a glance

Control centre
1 server, 8 workstations, 2 info stations

Radio system
Digital radio (TETRAPOL)

Vehicles
Total of 850 (710 Hochbahn buses and
140 buses owned by the subsidiaries SBG and Jasper)

Depots
Total of 9

Dynamic Passenger Informatin
Around 200 SmartInfo displays

Third-party components
EADS radio system, INIT ticket printers

Software interfaces
HASTUS; online interface (OLIF) for the connection of third-party AVL systems - supports visualisation, dynamic passenger information, and transfer protection

Results:

- Automatic Vehicle Location and Control (AVLC)
- Real Time Passenger Information signs (RTPI)
- Traffic Light Preemption
- Transfer protection

“Hochbahn wishes to noticeably improve the quality of local public transport for customers by means of drastically improved passenger information and sustained transfer protection. The positive reactions of passengers show that we‘re on the right track with FIMS.”

Jens Müller, Project Manager, Hamburger Hochbahn

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Land Transport Authority, Singapore

Bus Intelligent Transport Systems and Multi-Operator Management

Industry

Bus

Objective

Improve bus services

Solution

Trapeze Intelligent Transport System (ITS)

Overview

- 6,000 buses
- 4 bus operators
- 12 depots
- 700 km² geographical area serviced
- 4 million daily ridership

Snapshot

- ✓ Increased service quality
- ✓ Bus operator incentives based on monitored KPIs
- ✓ More regular passenger wait times
- ✓ Cost control

The Singapore Land Transport Authority uses Trapeze's Intelligent Transport System solution to monitor and manage over 6,000 buses across multiple operators.

Background

The Land Transport Authority (LTA) manages various transport developments in Singapore, and are responsible for planning, designing, building, and maintaining Singapore's land transport infrastructure and systems. In 2016, LTA reorganised the way public bus service was funded and delivered throughout the country.

Previously, Singapore's bus services were divided into two 'concessions' that were managed and operated independently. Bus operators were remunerated from collected fares, using a revenue-based, service delivery model. As part of an initiative to increase bus service quality and reliability, LTA changed the concession arrangement to a bus contracting model. This meant that bus operators were contracted to the LTA to deliver services to a defined quality level, which included incentive-based Key Performance Indicators (KPIs).

This change known as the Bus Contracting Model (BCM), was fully implemented in 2016. The aim was to enhance connectivity and improve bus service standards for Singapore's 5.7 million residents and enable bus operators to respond to ridership and commuter needs more effectively.

Buses are the most used form of public transport in Singapore, with over four million passengers taking the bus daily - travelling across the island nation on more than 300 services, and over 6,000 buses.

Objective

Transport authorities face multiple challenges when managing increasingly complex networks and fleets to deliver more efficient and reliable, services. One challenge for bus transport is that it shares the road with other users, and it can be difficult for buses to arrive on time – especially during peak hours.

LTA's BCM aimed to increase bus service reliability and to ensure regular waiting times for commuters by including quality measurements (as part of the Bus Service Reliability Framework) into bus operator contracts, which are issued in packages.

This creates an incentive for operators to achieve the agreed service quality. The BCM also aims to encourage competition which keeps costs down, but also rewards good operators, and penalises the underperforming ones. LTA studied multiple models before the BCM was developed, which included London, and Perth in Western Australia.

Under the BCM, LTA owns all public buses, and leases them to bus operators for set terms. This prevents barriers for operators who are considering entering the market. LTA is also in charge of planning bus routes and providing fair conditions for operators to achieve LTA goals.

However, for the BCM to work effectively at the scale LTA needed, sophisticated technology and systems were required to accurately measure how well bus operators deliver their services. The technology had to provide LTA with a centralised monitoring and control platform that monitors, collects, and analyses large swathes of data from every single bus. The system also needed to provide each bus operator with the tools to manage their operation to meet service levels while, at the same time, collecting performance information.

LTA was focused on delivering better bus services, with a strong emphasis on service regularity. The system needed to enable operators, and the bus captains themselves to regulate the interval or headway, helping to provide a regularly spaced service.

LTA also wanted to keep passengers constantly informed with accurate, real-time data across multiple sources, such as bus stop information displays, websites, apps, and within buses. Having this information readily available would enable passengers to plan any journey in Singapore easily.

LTA decided to let bus companies operate the routes, as they have significant expertise in managing large bus fleets and attracting the right staff to operate and maintain them.

It is up to each bus operator in Singapore to deliver services that meet the LTA contract requirements, which are matched with passenger needs. This allows the LTA to manage the network with the passenger as the focus - providing better bus services and a better passenger experience.

Solution

Since 2014, Trapeze has provided LTA's technology to help manage bus services in Singapore. The Trapeze Intelligent Transport System (ITS), otherwise known as the Common Fleet Management System (CFMS), is at the heart of this - providing a common bus quality management and monitoring platform across all operators.

From this point, the LTA could monitor and measure the performance of individual buses, and the operation as a whole. LTA was also able to provide every bus operator with common tools to help actively manage their operations. This meant that operators did not have to acquire their own CFMS, as this was provided by LTA.

LTA's Common Fleet Management System

The Trapeze solution that LTA uses connects multiple bus operations with a central system, collecting and communicating key information in real-time. The CFMS is used by LTA to monitor the performance of planned bus services across the whole of Singapore, which involves multiple routes and four operators.

With the CFMS, LTA gains valuable insights into the bus services delivered, while operators ensure they can meet LTA's service quality benchmarks. The system monitors every bus service in Singapore, which include 'Trunk Bus Services' that run along longer routes between neighbourhoods, and 'Feeder Bus Services' which offer transfers from Mass Rapid Transit (MRT) stations and bus interchanges to surrounding areas.

The four bus operators in Singapore are SBS Transit, SMRT Buses, Go-Ahead Singapore, and Tower Transit. Buses are equipped with the Trapeze Intelligent Data Router (IDR) onboard computer with a touch display (or Driver Display Unit – DDU) for the driver.

The IDR informs the control room about all services, while the DDU informs the bus driver about their individual service. Each bus communicates with the control centre, using 3G/4G communications with support for VoIP calling.

The CFMS includes a range of advanced security facilities and audit trails and is monitored 24/7. There is also a dedicated user acceptance testing feature for assessing new software enhancements and updates.

Operator Contract Monitoring

The CFMS provides the mechanism for calculating and recognising the actual bus service quality and comparing this with the agreed contract requirements. Within operator contracts, there is a provision for recognising circumstances that are outside of their control.

Increased Efficiencies and Cost Control

Since the BCM was introduced, other benefits have included increased efficiencies due to centralised communications, asset management and investment. The BCM provides control over bus public transport costs by the regular, competitive tender process.

The introduction of foreign operators (Tower Transit and Go-Ahead Singapore) has brought in new practices to Singapore. In 2016, LTA established a centralised Bus Operations Centre to facilitate bus communication with bus operators. This enables bus operators to respond to incident management, service performance issues, and unplanned diversions quickly.

The CFMS supports BCM efficiencies and effectiveness by providing visibility and control over core business processes. CFMS data is continuously analysed across routes and services. The system is capable of monitoring thousands of vehicles and is also scalable, which can account for future growth. The CFMS can also be configured for changing needs and requirements.

The CFMS also helps manage communications. Servers and on-board computers exchange and share data on timetables, announcements, statistics, logs, and device messages. The CFMS also actively informs control centre dispatchers when incidents occur, and enables communication with vehicles, providing an overview of all operations.

Increased Service Quality

Since the BCM was introduced, LTA has a better understanding of how the bus fleet operates across all of Singapore. LTA has implemented many improvements over time that have led to increased customer satisfaction. Now that Singapore has fully transitioned to the BCM, there has been more regular wait times, more services deployed, and more staff employed by bus operators [1].

In 2016, when the BCM was first introduced, the average daily bus ridership figure was 3.9 million. In 2019, this reached 4.1 million average daily trips – an increase of over 5% [2].

Additional wait times have also decreased by 15% since 2016, when the BCM was fully implemented [3].

> *"The LTA is absolutely thrilled by the results of the Bus Contracting Model. Bus customer satisfaction ratings are through the roof and are well over 90%. We have never looked back and have never regretted it. Because we took the revenue and asset risks away from the operators, all they need to do is turn up and operate their services well. We are now in full control of service decisions and what is best for Singaporeans."*
>
> Jeremy Yap - Deputy Chief Executive of Public Transport, Policy and Planning, Singapore Land Transport Authority.

Singapore LTA – BCM and CFMS Success

- Increased bus service quality
- Increased bus ridership numbers - 3.9 million to 4.1 million average daily trips
- Increased bus services and operator employees
- Effective bus operator monitoring and KPI management
- More regular passenger wait times
- Cost control for bus services

References

1. Land Transport Authority, (2017). Bus Services Continue to Improve Since Transition to BCM

2. Land Transport Authority, (2020). Public Transport Ridership 2015-2019

3. Land Transport Authority, (2017). Bus Contracting Model Improves Bus Journeys for Commuters

4. Public Transport Council, (2020). Satisfaction With Public Transport Stays High In 2019

5. McKinsey and Company, (2018). Elements of success: Urban transportation systems of 24 global cities

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Riyadh Development Agency, Saudi Arabia
King Abdulaziz Transport Project for Riyadh

Industry
Bus

Challenge
Integrate metro and bus networks

Solution
Trapeze Intelligent Transport System (ITS)

Overview
- 800 buses
- 1,500 RTPI Displays
- Multi-Operator CPS Tool

Results
- ✓ Real-time passenger information
- ✓ Integrated bus information systems
- ✓ Integration with Riyadh metro using SIRI

Background

The Riyadh Development Agency (RDA) is investing billions in developing a state-of-the-art public transport system for the Saudi Arabian capital. From virtually no public transport, other than taxi services, the RDA will deliver an integrated metro and bus network for Riyadh's seven million residents.

The Riyadh Bus Project

The Riyadh Bus Project is a brand-new bus network which is being built from the ground up and includes bus feeder routes to metro stations and dedicated Bus Rapid Transit (BRT) lanes. Trapeze supported RDA to provide an Intelligent Transport Systems (ITS) solution to integrate Automatic Vehicle Location (AVL) and Real-Time Passenger Information (RTPI) for buses into the overall management system. Trapeze also delivered interfaces for multiple stakeholders to provide integrated data management and system control for Riyadh's expanding bus fleet.

After the project contract was awarded, Trapeze undertook a system testing phase before initial operational testing commenced in 2021. Operational testing involved a rollout of over 800 buses and 1,500 RTPI displays, with four depots constructed.

The RTPI displays feature full matrix, white LED screens as well as 32" and 55" TFT displays for BRT stations. The LED displays are optimised for use in the harsh Riyadh environment as they must withstand high temperatures and dust levels. The RTPI displays, as well as the SIRI connected system, are continuously updated using the Trapeze history-based prediction algorithm.

Bus priority at traffic lights is also provided via a network interface to a centralised traffic management system. The system will be supported 24/7 locally, and from the Trapeze International Monitoring Centre.

Solution

The Trapeze ITS solution, LIO, is at the heart of the bus operation, providing real-time management and passenger information solutions. LIO integrates the bus systems (CCTV, passenger counting, and infotainment solutions) with backend systems and collects operational statistics to enable detailed analysis and continuous improvement.

System Highlights

- High availability control centre with redundant DRC
- Multi-operator support for future expansion
- Control for over 1,500 real-time information displays - LEDs and TFTs
- Integration with Riyadh Metro using SIRI
- Over 100 workstations across the Operational Control Centre, training, and DR
- CCTV at stations, integrated into AVL workstation bullet points

Vehicle Highlights

- Intelligent Data Router (IDR) in all vehicles
- Driver's console with colour touch screen
- Integration with CCTV, AFC, APC, Infotainment
- Implementation of VDV 301 interface to APC
- Transparent routing for peripheral equipment
- VoIP for voice communications over 3G/4G

Results:

- Real-time passenger information
- Integrated bus information systems
- Integration with Riyadh metro using SIRI

"The Riyadh bus network is integrated with the Riyadh Metro to give the best public transport mode that covers the main streets, highways and sub-streets."

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Abidjan Selects Bus Intelligent Transport System in French-speaking African First

Trapeze Group technology to manage one of West Africa's largest bus networks.

JOHANNESBURG, SOUTH AFRICA, MARCH 22, 2022

Scania, in association with Société des Transports Abidjanais (SOTRA), has selected Trapeze Group to implement an Intelligent Transport System (ITS) to help manage 450 new buses, supplied by Scania, as part of Abidjan's first Bus Rapid Transit (BRT) system. The BRT system includes 9.8 kilometres of dedicated bus lanes and stations on the Boulevard Latrille, which runs from the north to the south of Abidjan, Côte d'Ivoire.

The project is due for completion in 2023 - with the ITS solution extended through the project to manage the entire 1,950 strong bus fleet, transporting over 800,000 people daily. The Trapeze ITS solution enables SOTRA to deliver more efficient and reliable bus services. The solution includes a control centre system for enhanced driver communications and service monitoring and a passenger information system on buses and at stations.

Meité Bouake, Managing Director at SOTRA, said, ***"Trapeze supports SOTRA in the digitalisation of its activities by implementing a complete ITS solution, including a passenger information system. This deployment will improve service quality by providing real-time passenger information to SOTRA commuters. In addition, as part of the overall Abidjan multimodal project, Trapeze prepares SOTRA for full integration within the overall transport ecosystem with the arrival of future projects like the Metro and the BRT. In summary, Trapeze will help SOTRA to greatly improve the Ivorian population's mobility."***

Johan Köhler, Managing Director Scania West Africa, said, ***"At Scania, we believe in providing solutions and not just products; in Abidjan, our partnership with Trapeze echoes our belief in partnering with experts to provide a complete package. With Trapeze, we are offering our customers the tools and products to improve public transportation in the city of Abidjan. This is a step in driving the shift to a sustainable future for all."***

The Trapeze ITS technology is already used by transport authorities worldwide, including Cape Town, Tshwane, London, Singapore, and Zurich. For SOTRA, Trapeze provides implementation support, consultation, training, and knowledge transfer. The system is scalable to include thousands of vehicles, has a high level of interoperability, and can also manage multimodal transport networks.

The Abidjan project continues Trapeze's commitment to supporting transport authorities and operators in West Africa.

Ms Maretha Britz, Trapeze South Africa Managing Director, said, ***"We're delighted to work with both SOTRA and Scania to deliver ITS technology to West Africa that transforms urban mobility in Abidjan. This allows us to further support the public transport industry in Africa, and we look forward to contributing to SOTRA's success."***

Transport for London, UK

Integrated operations control system for more than 9000 vehicles

Industry

Bus

Challenge

Provide bus operators with effective service control tools

Solution

AVLC Operations control system (ITS technology)

Overview

- 9,200 buses
- 700 routes
- 89 control centres
- 250 service controllers
- 40 control centres

Snapshot

- ✓ Performance measurement for fair service billing
- ✓ Real-time information for London's bus passengers
- ✓ Connected to the emergency control room

Background

London has more than 9000 buses operating on around 700 routes, taking more than six million passengers to their destinations everyday. Bus services are run by private operators with up to 250 service controllers managing the routes in 40 control centres. In 2005, London Buses and Trapeze embarked on a major programme to enhance the bus fleet management capabilities across London: the iBus project.

Objective

London Buses wanted to provide the bus operators with effective service control tools. All buses should be equipped with new technical systems. This needed a completely new solution, which was provided on the basis of Trapeze's AVLC operations control system. At this point in time, Trapeze's LIO system was already an established vehicle management solution that had proved its worth throughout Europe and was operating in many German cities. London Buses and the engineers were given a local demonstration of the system. The technical specifications for London were then produced. The solution includes dead reckoning in combination with map matching – an innovative approach to navigation that produces location data, even without satellite navigation signals. In the course of the project, iBus proved very convincing with comprehensive, reliable data provision so London Buses also decided to integrate an automated mechanism for monitoring and measuring the performance of the bus operator companies.

Solution

One central challenge of the iBus project was that the system should be able to respond flexibly to the constant growth of London with a corresponding need to expand the bus service to up to 10,000 buses. iBus meets this challenge with the possibility of a seamless extension of both buses and routes at any time. Absolutely reliable navigation for the vehicles was another equally important criterion for London Buses. Furthermore, crucial significance was given to the stability and availability of the new solution.

With the functional demonstration testing concept, London Buses and Trapeze were able to introduce the bus operators to the individual components and system functionalities with corresponding demonstrations as soon as these had completed the development phase. This gradual approach greatly enhanced the willingness of the service controllers to accept the new system. Moreover, the actual official acceptance of iBus was preceded by an introductory phase with verification tests, where London Buses was involved in every step of the proceedings. The final official tests were then no more than a formality.

Following a successful eight-week pilot on route 149, the 18 month roll-out of the iBus system to all vehicles commenced in 2007. During roll-out, the system was installed on 28 buses a day at two

installation sites in London, with the addition of a roving team installing buses on-site at garages. By 2009, all 8200 buses in London were fully equipped with the iBus system.

iBus is also now the data collection and calculation engine behind the payments to bus operators. In the past, London Buses used manual random sampling methods to evaluate the performance of individual bus operators. To automate this process, an additional system was developed to cover all trips and incidents. Processing of the local garage records permitted fair performance assessment of the operators. Incidents causing delays or breakdowns beyond the operator's control are entered at a user interface in order to calculate the performance that would have been achieved without these special circumstances.

Headways with appropriate waiting times have to be observed on the bus routes. If service is jeopardised by an accumulation of trips, then service controllers can intervene accordingly. Total performance measurability thus also helps to make the bus service more reliable.

All buses have been equipped with a precise tracking system, digital stop DPI signs and audio announcements. A prediction system uses the tracking information to compute the arrival times at every stop and permits dynamic, real-time, constantly up-to-date passenger information via countdown signs at over 2600 bus stops, digital signs at bus stations as well as through the internet and text messaging.

iBus is connected with CentreComm, London Buses' control centre for emergencies and escalation. The exact location of every bus can be displayed on monitors in the control room, thus shortening the response time in emergencies. Immediate intervention is also possible, even if a driver cannot set up a voice call.

The real-time information integrated in the AVLC system permits efficient dispatch of all vehicles together with dynamic timetable adjustment in any situation. The position of the buses is known at all times, thanks to a combination of GPS, dead reckoning, map technology and logical location. The current general overview also ensures that the right decisions can be taken swiftly at critical moments and in unscheduled operating conditions.

User-friendly Mobile Data Terminals (MDT) give the drivers all the relevant information about the schedule/headway situation at the touch of a button, as well as displaying messages issued by service controllers and enabling contact with the garage and CentreComm. Important tasks such as traffic light control or announcements at bus stops are triggered automatically by an on-board computer.

iBus currently handles communication between the buses and the garage/CentreComm with an analogue voice radio system that can also be used for GSM. When a priority call comes in, the analogue system automatically sends the GPS coordinates to the emergency control room. From mid-2018, a roll-out programme will commence which will see the analogue radio upgraded to a new digital radio system. This will provide sufficient scalable capacity and coverage to cover voice and data capability for buses over the next ten years.

Results

Punctual completion of the system roll-out was assisted by a solution strategy for problem buses. A contingent of additional buses was available besides the planned vehicles. If an operator was not able to make a certain bus available, the equipment was installed on a "replacement bus" instead. In addition, weekly schedules were drawn up at regular meetings to stipulate the sequence of bus garages and corresponding iBus installation. Effective solution methods were defined for current problems.

"The major iBus project by LBSL entails data and voice connections for the world's largest AVLC solution. Implementation of the project would not have been possible without the know-how,support and commitment of our main partner Trapeze"

Paul Fitzpatrick, Technical Services Group,
Transport for London

Melbourne's iconic tram network adopts Trapeze Group's AVLC technology

BRISBANE, AUSTRALIA. 24 AUGUST 2023.

One hundred trams running on Melbourne's historic tram network are set to be equipped with Trapeze Group's Automated Vehicle Location and Control (AVLC) technology. Trapeze Group and Yarra Trams have announced a multi-year agreement to deliver the AVM Sustainment Project. This project extends the life of the tram network's Automatic Vehicle Management (AVM) system, which has been used for more than 30 years, by interfacing it with the new AVLC system.

In-vehicle AVLC technology is due to be installed in 100 of Yarra Trams' E-class trams, with the replaced units retained as spare equipment for trams still using the older hardware. The Trapeze AVLC solution provides accurate vehicle tracking to generate a real-time operational view for effective fleet management and on-time performance.

Trapeze Rail Managing Director, Chris Gates, believes Trapeze Group and Yarra Trams are a natural fit, with more than 150 years of public transport experience between them. ***"We are delighted that Yarra Trams has identified Trapeze Group's AVLC technology as the best long-term solution for its operational strategy to improve customer satisfaction,"*** Mr Gates said.

"This decision sees Melbourne's tram operation join leading global cities including London, Zurich, Riyadh, and Singapore where public transport passengers experience the connected journey benefits delivered by Trapeze's intelligent transport solutions.

"Trapeze and Yarra Trams have worked collaboratively, particularly during the successful proof of concept. As Yarra Trams' current technology ages, Trapeze will support its critical functionality by sustaining the system while simultaneously creating a reliable platform for future proofing AVLC on the network."

Melbourne's tram network is the largest in the world. Every year the fleet of approximately 480 vehicles carries more than 200 million passengers on 27 routes along 250km of double track to nearly 1,700 stops. Yarra Trams has been operated by Keolis Downer, on behalf of the Victorian Department of Transport and Planning, since 2009. Keolis Downer is Australia's largest multi-modal transport operator. Trams are an iconic symbol of Melbourne, providing an essential service for residents and tourists in the world's most liveable city, according to Yarra Trams Chief Executive Officer, Carla Purcell.

"The Yarra Trams AVM Sustainment Project helps ensure our network remains an efficient, sustainable, and reliable way to experience Melbourne's inner suburbs," Ms Purcell said.

"As the operator of Melbourne's tram network, I am proud that Keolis Downer continues to demonstrate our commitment to the network's future through this project and I welcome Trapeze Group as one of our technology providers.

"By moving forward with the AVM Sustainment Project, we are establishing a strong foundation of proven, state of the art AVLC technology that will help achieve our goals for delivering both a reliable service and great customer experience outcomes for our passengers."

To learn more about Trapeze Group's suite of ITS technology solutions please visit our website here or contact our team here to get the conversation started.

Zurich Transport Authority, Switzerland

High service quality – thanks to the Trapeze control system

Industry

Bus, Tram, Cable Car

Challenge

Implement a single control system for multiple transport agencies

Solution

Trapeze Intelligent Transport System (ITS)

Overview

- 1100 vehicles
- 6 transport service providers
- 1839km² coverage area
- 14 dispatcher workstations
- 70 information workstations

Snapshot

- ✓ Single system for multi-agency control
- ✓ Multifunction on-board displays
- ✓ Transfer protections

Background

Zurich with its population of 400 000 people is the capital of the eponymous canton and the largest city in Switzerland. For decades, the city and canton of Zurich have focussed on providing public transport in the world's most modern multi-agency control system on behalf of the 1.3 million people in the agglomeration. The canton of Zurich and its surroundings covering around 1,839 km² form the multi-agency area of Zurich Transport Authority (ZVV) with more than 30 transport service providers. The ZVV consists of eight companies with market responsibility and numerous small and medium-sized transport contractors. Around 700 million passengers are carried every year by well over 1000 vehicles. Every day, more than half a million passengers cross Zurich's city border on public transport. ZVV is responsible for the strategic management, multi-agency wide marketing and funding of public transport. It also ensures that there is „one ticket for all" (tariff and multi-agency) in the living and economic area of Zurich.

Solution

ZVV's transport network operates a regular service on all routes. The commuter train routes passing through Zurich central station usually run every half hour. In more sparsely populated areas, trains and buses run an hourly service, while bus routes near to the cities run every fifteen minutes during the day. In the cities of Zurich and Winterthur, trams, trolleybuses and omnibuses run at far shorter intervals during the day.

The ZVV is served by buses and trams from six different operators with 1,100 vehicles running altogether. Each of these operators has its own LIO workstations, and four have their own control centre for controlling their vehicles. The individual operators all also use their own voice and data channels. But the multi-agency system is based on a shared data supply and a central control centre infrastructure at Verkehrsbetriebe Zurich (VBZ). The concept also envisages standardisation in the vehicles and with the equipment at the stops. The passengers thus benefit from uniform info systems, real-time information, transfer protection and naturally from central incident management.

As the largest operator in ZVV, VBZ assumes so-called lead-house functions. For example, at night the VBZ control centre takes over emergency calls for smaller operators. VBZ is also responsible for central tasks involved in data transfer and data distribution within the multi-agency. Furthermore, VBZ runs a technical centre for radio, vehicle equipment and stop equipment. It also chairs the Control Centre Commission with participation from all ZVV transport companies where joint forward-looking budget and strategy decisions are taken.

Thanks to the Trapeze AVLC, the ZVV transport companies are able to register and optimise their operational states and service quality. If incidents occur, the control system draws the attention of the dispatchers to possible problems at an early point in time. If necessary, they can then intervene in operations and initiate appropriate action. On a parallel basis, the control system helps them to provide their passengers swiftly with up-to-date information.

All operational data are recorded for subsequent analysis. The Business Intelligence solution LIO-BI is used to produce numerous statistics and evaluations. These important aids give the ZVV numerous possibilities for constant quality control and for optimising performance.

Altogether there are 37 depots in the ZVV where buses and trams are refuelled, cleaned and maintained. While vehicles are in the depot, new software and current data are transferred by Wi-Fi to their on-board computers.

Two different models of Trapeze on-board computers are installed in the ZVV vehicles: IBISplus G1 or the newer model IDR-f2. Drivers operate the on-board computer with a modern user terminal with touchscreen (MTT or IPT), which they also use to communicate with the control centre or with other vehicles. Furthermore, buses and trams are given priority at traffic lights to accelerate public transport. This is implemented by a local traffic light request; the vehicle or rather the on-board computer communicates via an analogue radio device with a junction controller at the respective traffic light system.

The control centre needs to know the exact locations of all vehicles at all times, with GPS location of the vehicles via the on-board computer. These location details also provide the basis for the departure times in the passenger information.

Incidents in the operational workflows often necessitate rapid changes or corrections in the control system. This puts the control centre staff under great time pressure, as ideally, the passengers notice the incidents as little as possible.

The targeted incident management system gives the dispatchers' valuable support, particularly in situations where every second counts. Besides actions or operational information, the system can also be used to send messages to all passenger information signs in the whole network. Furthermore, the system offers the dispatchers pre-defined actions which can be prepared during quieter periods. Dispatchers then revert to such actions when things get hectic and implement the defined workflow plan.

Results

Today's passengers expect constantly updated information about the status of their specific journey, so that the passenger information is therefore integrated as a central function in the LIO system. The ZVV uses Multifunctional Displays (MFD) in the vehicles and LED signs at the stops (SmartInfo G4 and SmartInfo G4i Large). They show the departure times in real-time, together with current information for the passengers when the need arises.

Every vehicle has at least one MFD to show the jumping dot display of the stops together with current messages. The displays in the vehicles also show transfers and journey continuation options. Transfer protection is an important part of the ZVV control system. In the event of an incident, e.g. route closure, all displays and DPI signs are automatically updated by the AVLC.

Verkehrsbetriebe Zurich have been a Trapeze customer for more than 50 years, with the two companies working together as partners on a good basis for decades. Trapeze supplied the world's first AVLC control system to VBZ in 1968.

VBZ has always had an interest in providing its passengers with the best, most advanced technical solutions. VBZ is a courageous pioneer and is not afraid to act as pilot customer to be the first company that implements new solutions offering a high customer benefit. Any „teething problems" that emerge with a newly developed product are tested first in a 'proof of concept". What matters to VBZ is to benefit as soon as possible from innovations and further developments made by Trapeze.

The system at a glance

Control centre

14 dispatcher workstations in 4 control centres, 70 information workstations, 9 IT workstations

Radio system

Hybrid radio system (analogue radio partly with quasi synchronous radio and GSM/GPRS); 19 voice channels, 24 data channels, 16 base stations, 133 data/ voice radio transmitters/receivers

Vehicles

More than 1,000 vehicles (buses, trams and cable cars)

Depots

37 depots, 1000+ vehicles (buses, trams and cable cars)

Dynamic Passenger Information

300 SmartInfo G4 via analogue radio or GSM/GPRS, 10 TFT display signs via GPRS, more than 1,600 multifunctional displays (MFD) in the vehicles

Third Party Components

Radio (Jöhl & Köferli as the radio system supplier or TAIT as the radio system manufacturer)

Software Interfaces

Interfaces to the radio system, to the planning program and for integrating DPI signs at individual stops

"The ZVV control system connects the transport agencies within the Zurich Transport Authority. The customer therefore benefits not only from one ticket for all, but also from transfer information that crosses the boundaries of the individual transport operators."

Mario Schmid, head of the control centre for Verkehrsbetriebe Zurich

TRAPEZE GROUP

Trapeze Group works with public transport agencies and their communities to develop and deliver smarter, more effective public transport solutions. For more than 25 years we have been Here for the Journey, evolving with our customers around the world to helping them move people from point A to Z, and everywhere in between.

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Trapeze Group provides technology solutions built specifically for public transport, with a 50-year history of working with public transport authorities and operators to deliver long-term value and results. Trapeze has a suite of Intelligent Transport System (ITS) solutions which make managing tram, light rail, ferry, and bus transport networks more effective and efficient. These ITS technologies enable authorities to effectively plan, schedule, operate, and analyse their multimodal networks, enhancing the passenger experience. Trapeze is part of the Modaxo Group, a global collective of technology companies passionate about changing the face of public transportation.

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