ACTIVITY REPORT 2021

ITXPT

Standard-based Mobility IT

The non-profit association ITxPT enables an open architecture, data accessibility, and interoperability between IT systems. The members of ITxPT develop the IT architecture for public transport and other mobility services together, based on standards and best practices. The specification is publicly available on the ITxPT website.

Photo: Transport for London

THE YEAR IN BREIF

2021 in numbers

ITxPT added another 17 members to the collaborative community in 2021. Together we are working to facilitate standardized data and develop innovative open IT solutions.

MEMBER OF ITXPT

Members from the whole world

In 2021 ITxPT counted 159 members and partner associations from 28 countries in Europe 19, Asia 6, North America 2, and Oceania 1. ITxPT is an essential factor in Mobility IT standardization.

Organization type	Counts
Partner association	6
PTA	15
PTO	18
Vehicle manufacturer	10
IT supplier LE	33
IT supplier SME	77
Grand total	**159**

Members

159

Countries

28

Meetings and activities

With over 150 official meetings and activities in 2021, the ITxPT collaborative community was highly active in developing new specifications in areas like Login service, Passenger Information, On-demand Transport, MQTT, JSON, Data Dictionary, Maintenance, FMStoIP, Passenger Counting, and Electric Vehicles.

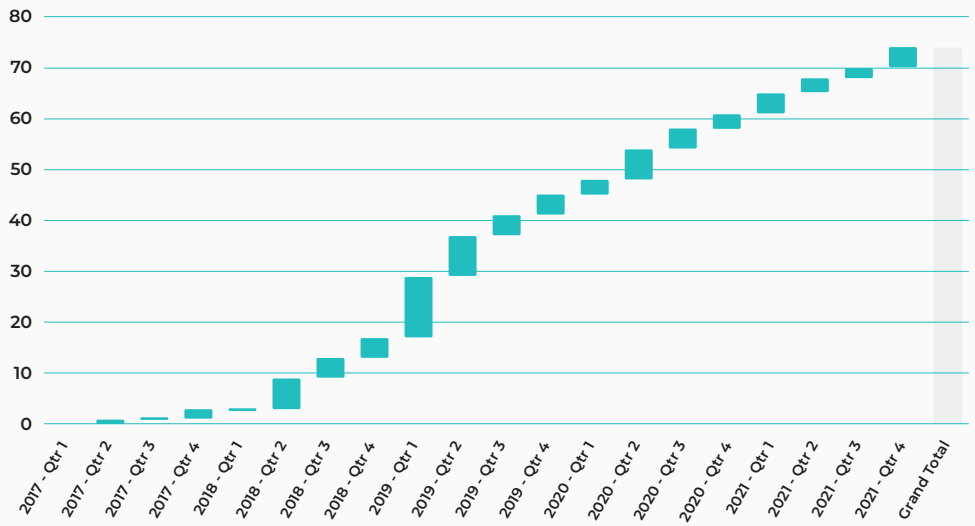
ITxPT activities	Counts
Members Meetings	4
Executive Board meetings	5
Implementation workshops/Consultant workshops	3
Requirements Committee (RC) meetings	17
Technical Committee (TC) meetings	19
RC and TC joint meetings	6
Requirements Working Group meetings	27
Technical Working Group meetings	71
Total	**151**

2021 Label deliveries

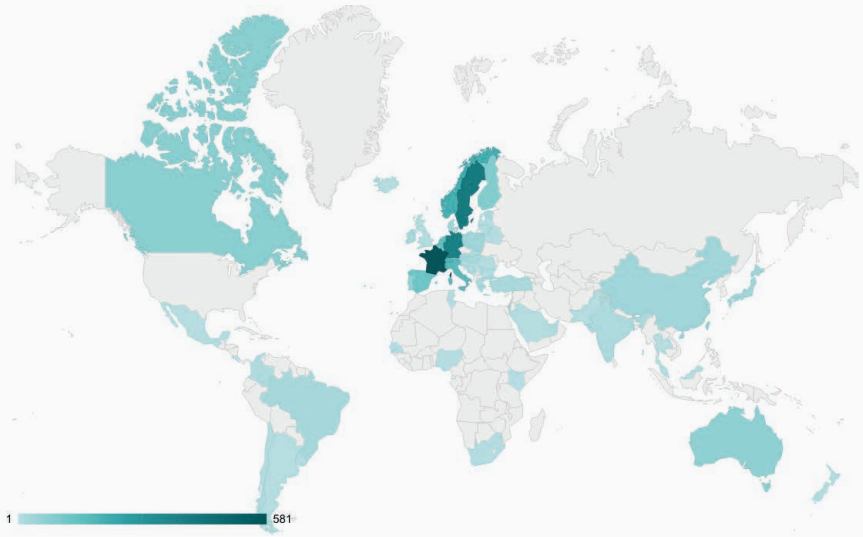
The ITxPT label proves that a product is tested by ITxPT and fully compliant with the specifications, and it streamlines the process in a tender for both buyer and seller.

Label delivery increase in 2021 +21%

ITxPT Label delivery						
Label type	**2017**	**2018**	**2019**	**2020**	**2021**	**Grand total**
Vehicle	2(4)	2(4)	3(8)	2(2)		9(18)
Module	3	10	24	12	13	62
Backoffice interface			2	1		3
Grand total	**5**	**12**	**29**	**15**	**13**	**74**



Quarterly label applications 2017–2021



ITxPT Wiki users worldwide

ITxPT knowledge center - Wiki

Wiki registrations in 2021:

775

Wiki registration growth in 2021:

+26%

2021 monthly login:

525

Anyone can register an account in the ITxPT documentation center and find Technical Specifications, the labeling process, and other information. The wiki users are spread worldwide and represent authorities, operators, vehicle manufacturers, IT suppliers, academics, and more.

Closing a successful year, we are looking forward to an exciting 2022.

Anders Selling
ITxPT Secretary General

A word from the Secretary General

2021 was a successful year for ITxPT, and the growth from previous years continued in 2021, with new members, labels, implementations, and expansion into new countries. We have also refined our remote work processes and extended the collaborative community beyond the ITxPT members.

It is essential to find mutual grounds with organizations outside of ITxPT for successful collaboration and knowledge sharing to avoid reinventing the wheel. Our exchange with the Smart Ticketing Alliance, the MaaS Alliance, and national transport organizations like VDV in Germany and APTA in North America, etc. accelerates the development and implementation of IT standardization.

We also help the EU Member States implement common standards for mobility data through the EU project Data4PT. As the technical leader of the project and provider of the data harmonization platform, ITxPT is highly contributing to future multimodal cross-border travel.

The goal of all ITxPT work is that the specifications are implemented and used to benefit travelers. Therefore, the collaborative community needs to facilitate implementation. With two new activities – the implementation workshops and the consultant workshops – we took further steps towards improving access to knowledge and support for implementing ITxPT.

We also have exciting news coming up regarding the ITxPT labs. TPG, the public transport authority Geneva, and the French national railways, SNCF are committed to building local ITxPT labs to facilitate their own implementation and provide lab resources to others as part of the ITxPT collaborative community.

Primary objectives for 2022:

- Evolve the ITxPT specification with customer needs in focus
- Develop the community through ITxPT Committees and Working Groups and through collaboration with other associations
- Provide implementation support for PTA and PTO
- Develop labeling, technical support, and lab strategy with local labs
- Continue implementation of National Access Points as implementation body in the EU PSA Data4PT

ITxPT – **a strategic choice**

In a world with continually accelerating IT evolution, it is beneficial to become a strategic or principal member of ITxPT and join the world-leading mobility actors in developing the future of Mobility IT. In all areas of Mobility and smart city solutions, there is a need for sharing standardized data between systems and services, which the ITxPT specifications support.

Photos: SNCF - Jean-Jacques D'Angelo, Alstom - Christian Creutz

SNCF implements ITxPT on Heavy Rail

The French national railway company SNCF has recognized the strategic benefits of ITxPT for the heavy rail sector. Through their determined work within the ITxPT collaborative community and the EU project Connecta3, SNCF establishes the ITxPT specifications within heavy rail.

"Until recently, the railway embedded systems were based on a legacy of proprietary silo concepts that made them costly due to a redundancy of functions and complex interfaces. Silo systems also lead to obsolescence management issues and a lack of scalability and innovation possibilities.

For the benefit of authorities, operators, and the industry within public transport, the railway stakeholders need a standard-based open IT platform to achieve interoperability and multimodality.

Therefore, in 2020, SNCF took the initiative to launch and lead the ITxPT Heavy Rail working group. It has already developed concrete functional requirements and technical specifications with the active contribution of the leading railway players. We promote the ITxPT label throughout the heavy rail ecosystem, including international standardization bodies, making ITxPT a cornerstone of interoperability standards. We make it happen!"

Laurent Llerena

Senior Expert – System Engineering
SNCF Rolling Stock Engineering Center

Photos: SNCB, Skånetrafiken, Ruter Oslo - Peter Gløersen, Solaris, Västtrafik - Eddi Löthman

Access to data – a strategic necessity

Innovative PTAs have expressed that access to their data is a key to the value and competitive advantage of their operations. Interoperable systems with data in a standardized format enable direct access to all data – something proprietary solutions do not provide.

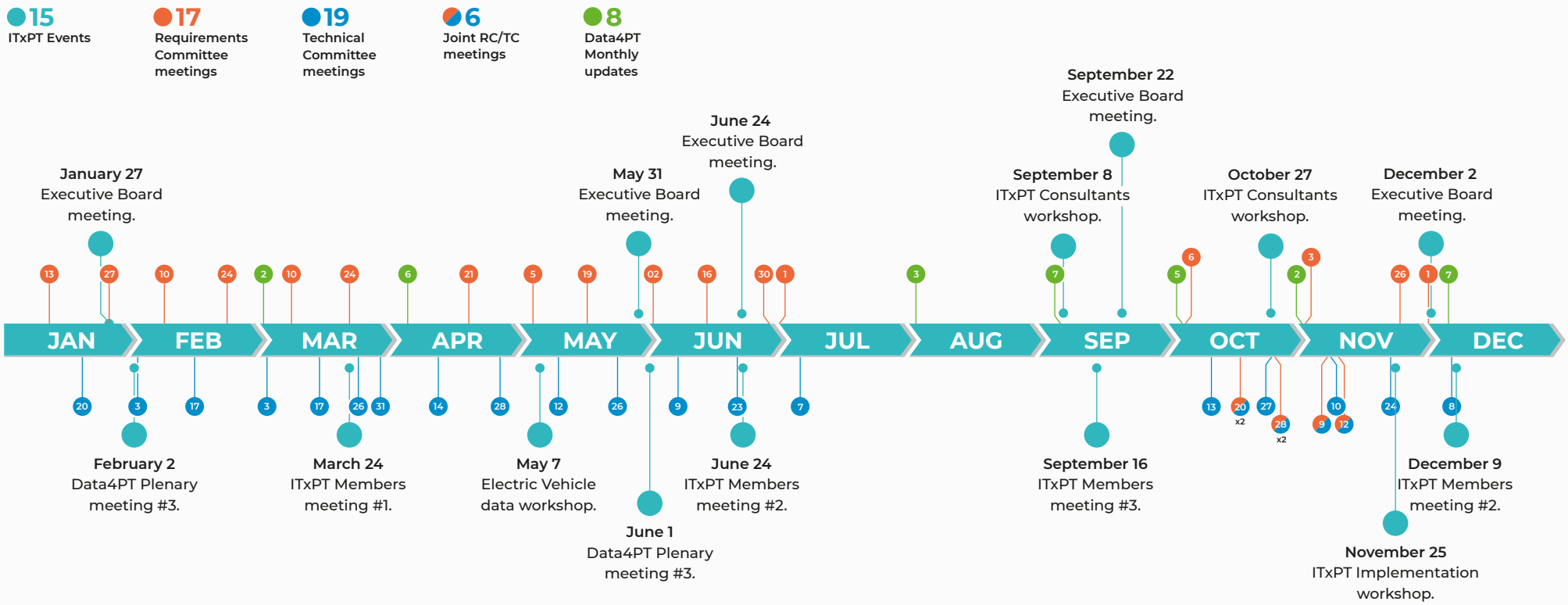
Tenders - streamlined procurement

The ITxPT Specification reduces the time and costs of specifying IT systems during tenders. With the standard-based ITxPT specifications as basic requirements for a tender, the buyer and the supplier can both focus on specific services and requirements without having to specify basic IT functionalities.

Strategic benefits of ITxPT:

- Ensures access to and ownership of data in standard formats
- Enables vendor independence that promotes competition and innovation
- Facilitates shared GPS and connectivity, hardware and software updates, and preinstalled wiring through standardized onboard networks
- Enables standardized hardware and software, with cost benefits compared to specialized solutions

2021 ITxPT Timeline



MEMBER OF ITXPT

The **Collaborative Community**

The collaboration between members is the heart of the ITxPT operation, with committees and working groups composed of members carrying out the work. The ITxPT Office supports and leads the processes extending beyond the members.

Collaboration beyond ITxPT members

In recent years the interest among external organizations has grown, and the collaborative community has expanded beyond the ITxPT members. Some examples are the German and North American associations of transport companies VDV and APTA, Mobility data (Google/GTFS) through the Data4PT project, EUSPA (Galileo/EGNSS), Smart Ticketing Alliance, and MaaS Alliance.

In ITxPT, we welcome these contacts and collaborations as an essential way to expand the Mobility IT standardization work.

Implementation workshops – sharing experience

In November 2021, ITxPT initiated a series of implementation workshops for authorities and operators to share experiences from implementing ITxPT among peers. The first session discussed De Lijn implementing ITxPT on 3700 buses and 400 trams in Belgium. The workshops will also provide insights into the need for ITxPT, consultants, and others.

Consultant workshops

In a series of workshops initiated in 2021, ITxPT and consultants seek to define the consultant role in the ITxPT ecosystem. How can they best help authorities and operators implement ITxPT, and how can ITxPT support the consultants?

Committees drive specification development

The ITxPT Collaborative Community drives the specification development through two committees.

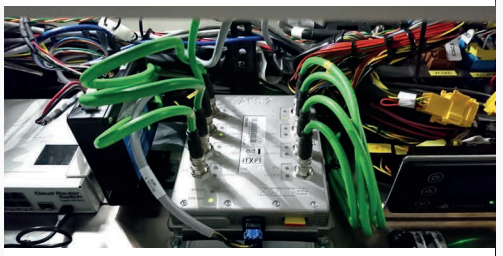
- **The Requirements Committee** collects and defines customer needs.
- **The Technical Committee** turns the requirements into specifications.

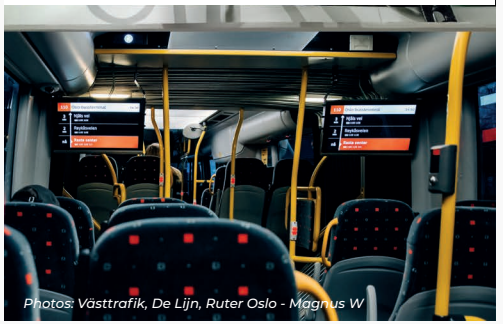
In 2021, the two committees further improved their collaboration through joint pre-studies of new topics and hand-over meetings. In the hand-over meetings, the Requirements Committee can explain the requirements to the Technical Committee.

Project participation supports standardization

As a highly active collaborative community, we are leaders, key contributors, and participants in several projects on the EU and national levels. We help to increase implementation of the ITxPT specification and support standardization:

- **Data4PT** - support for Siri/NeTEx, and implementation of National Access Points
- **Show** - defines interoperability aspects of autonomous vehicles
- **Nordic Way 3** - a Nordic communication and infrastructure project
- **RIVSILOn 2** - ITxPT reference installation in a fully electric vehicle
- **Shift2Rail and Connecta3** - compatibility between ITxPT and heavy rail





Photos: Västtrafik, De Lijn, Ruter Oslo - Magnus W

Implementation workshop

To enable public transport authorities and operators to share experiences from implementing ITxPT, and to exchange ideas, ITxPT initiated the implementation workshops in 2021. The first session discussed De Lijn's planned ITxPT implementation. De Lijn is the Flemish internal operator, in a region with 6,6 million habitants, and operates about 2500 buses and 400 trams.

Photos: De Lijn

Digitalizing the fleet

De Lijn is updating their fleet to electric vehicles, putting 3700 electric vehicles on the streets by 2035. In the next years, De Lijn bus fleet will be replaced at a steady pace. This creates an opportunity to implement a new mobility IT architecture.

"We didn't want to reinvent the wheel. So we asked ourselves: who has already figured out an IT architecture for vehicles, who has already solved the vehicle IT challenges we face? Very rapidly, we concluded that we need to take ITxPT as a basis for IT implementations on our vehicles.", says Rudi Willems, project Manager for the De Lijn ITxPT implementation project.

Customer service

De Lijn aims for improved customer service and satisfaction thanks to better control over data, better punctuality, connectivity, and traffic information. They also expect improved onboard security and comfort, thanks to enhanced use of cameras and passenger counting.

Data access and ownership

Access to data in standardized format will enable better collaboration with other organizations in areas like real time data, MaaS and Mobility on Demand. It also enables preventive and predictive maintenance, which requires continuously available real time information. De Lijn aims for a more efficient internal organization with analytics, machine learning, and automation that will support growth and innovation of new products and services.

Sustainability

A sustainable transport operation is a central objective, and a more comprehensive IT platform will enhance energy consumption monitoring and optimization, which is important when operating electric vehicles. Virtualization and a reduction of onboard hardware is another desirable outcome.

The situation today

A major goal of the ITxPT implementation is an integrated and cost-effective IT environment. With imperfect communication between the onboard systems, separate connectivity and GPS and deficiencies in interoperability the current solution demands heavy resources to keep it alive.

Backbone first implementation

De Lijn presented their plan of a gradual implementation, starting with a backbone of an onboard computer, interfaces and cabling for all equipment, connectivity, GPS, and a driver console. Later, modules will be added gradually to evolve into an integrated and manageable system.

Takeaways from the workshop

Labeled vehicles

De Lijn was recommended to require ITxPT labelled vehicles in the tender, where the IT infrastructure, with cabling, power connectors and antennas, is in place at delivery. Here, it is important to ask for the label, since labeled units have been tested by the ITxPT lab, which guarantees compliance.

Roadmap

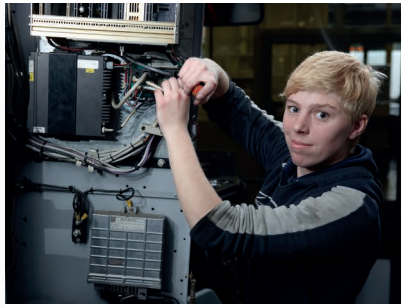
Another important aspect is to create a roadmap for the renewal of the system, which means the possibility to prepare the IT infrastructure for additional equipment down the road.

Challenges

- **Exchanging core components** in full operation with the risk of disturbing connected systems.
- **Legacy** – maintaining compatibility backwards, forwards and with custom-made solutions.
- **Multiple vehicle types** – doing multiple transitions on vehicles of different types and versions.
- **Integration** – with many different systems, including the vehicle itself.
- **Ownership** – multiple internal stakeholders bring multiple requirements. Therefore, it is important to work together and to get the vehicles to work as one system, realizing the customer value chains.

About De Lijn Internal bus and tram operator for the Belgian region Flanders, with its 6,6 million habitants.

2500 buses / **400** trams / **58** depots / **8000** employees



Photos: De Lijn

The **Technical Specifications**

The technical specifications are the core of ITxPT - a collection of specifications and best practices for mobility IT and open architecture. The specifications can also refer to complete or parts of official standards like CEN or ISO.

General content of the Specifications

The ITxPT specifications describe:

- physical requirements
- architecture
- generic mechanisms
- communication protocols
- data models for ITxPT compliance

Specifications updated in 2021

ITxPT released version 2.1.1 patch update of the specifications at the beginning of 2021. The update addressed sixty comments from users based on labeling experience and technical requests.

Known Issues document and Client development guideline

In addition to the 2.1.1 specifications, ITxPT released the following documents:

- Release notes – overview of changes in the release
- Change log – presents all changes in detail
- Known issues - describes issues that were not fixable as part of the 2.1.1 update
- Client development guidelines – list technical aspects when developing clients towards the ITxPT onboard services

ITxPT GitHub

The JSON and XML schemas, the Known Issues, and the Client Development Guidelines are all found on the ITxPT GitHub in the repository for each specification section: S01, S02, and S03. The 2.1.1 material is available in the 2.1.1 branch!

Rules for creating new specifications

The Technical Committee identified a need for standard design rules and best practices to make it easier to develop new specifications and align them with each other.

- ***General Design Rules*** - apply to all new ITxPT specifications and technical requirements on a conceptual level
- ***Conceptual Design Rules*** - describe Data Centric architecture principles and how to work with them
- ***Protocol Design Rules,*** for example, MQTT - requirements for creating technical specifications using different communication protocols
- ***Formatting Design Rules,*** for example, JSON

Data Dictionary – terms and definitions

The Data Dictionary describes terms and definitions to support the general design rules and anyone writing new ITxPT specifications. The Data Dictionary Technical subcommittee maintains the Data Dictionary.

Preview releases and public drafts

In 2021, ITxPT introduced two new document types to be able to inform earlier about upcoming specification updates.

The purpose of Preview Releases is to release a specification for implementation while still having the ability to fix critical issues without the problem of compatibility with the specification.

A Public Draft is a specification draft or other document that ITxPT wishes to release for broader circulation. Unlike Preview Release, which has several promises about its state, a public draft has none of that per default.

ITxPT **Laboratories and Services**

ITxPT operates two laboratories – one in Gothenburg and one in Paris. These laboratories form a strategic pillar in the organization's setup as they link the specifications with actual implementations during the labeling process. They also provide support regarding implementation and labeling, are feeding back valuable information from real-world applications, and are actively involved in research projects in PT.

Labeling, Support & Research

Thanks to our growth, ITxPT has seen in 2021 a constant increase in labeling requests. We had a backlog in the second half of 2021, with which the team just caught up in January 2022. ITxPT is together with partners preparing to extend the network of laboratories. The new laboratories will answer the organization's growth from a capacity perspective and make laboratories available more nationally. In 2022 a lot of effort - besides the daily labeling business – will go into pilot projects laying the foundation for shared quality standards and automation in the labeling process.

We are looking forward to working with the SNCF laboratory in Le Mans and TPG in Geneva.

We started the Cloud lab project early to provide tooling for developing compliant modules and support our members during the labeling process. The cloud lab is also meant to play a significant role in providing a test environment for proof of concept (PoC) development for new versions of the specifications as well as in the integration of tools provided by the DATA4PT project. We have completed the feasibility study around the cloud lab and continue working on its integration in the current growth strategy.

Hiring and expanding

To support the growth with internal resources, ITxPT's laboratories have open positions for test engineers and software/hardware development ideally experienced in the field of PT. Meanwhile, the Gothenburg lab works on adding another test bench. Further, the local labs keep focusing on automating the applied test procedures. Embedding these processes within the test management tool ReQtest is part of the ongoing quality assurance process even more critical in a network of laboratories.

Anders Selling and Sture Hedin speakers at Lindholmen Open Day.

Lab manager Anders Fromell and guests in the Gothenburg lab.

ITxPT members 2021

21ST CENTURY
4PT
ACCESS IS
ACKSYS
ACTIA PCS
ADIBUS
ADLINK TECHNOLOGY
AESYS
ALCOM ELECTRONICS
ALLIANCESWISSPASS
ALSTOM
ARCOBEL
ARRIVA
ARRIVA TRAINS
ASSTRA
ATB TRONDHEIM
ATRON
AXIS COMMUNICATIONS AB
BELDEN GROUP
BESTMILE
BLUEBUS
BUS EIREANN
BUS INFO
BUSTEC
BYD
CANGO
CARD4B
CIBEST
CLEVER DEVICES
CNH INDUSTRY
CONDUENT
CONSAT
CS GROUP
DATIK
DE LIJN
DIGIMOBEE
DILAX
DRESEARCH
DTI
EGIS
EQUANS
EUROTECH
EVOBUS
EXPLEO
FARA
FLOWBIRD
FOURC
GAIA
GIRO
GMV
GVB
HANOVER DISPLAYS
HELLA AGLAIA
HIKVISION
HITACHI ENERGY
HITACHI EUROPE LTD.
HIVEMQ
HOGIA
HOSTMOBILITY
HSL HELSINKI
ICOMERA
INDRA SISTEMAS
INFODEV
INIT
INTRAFFIC
ISR CORP
ITXPT
IVU
KENTKART
KEOLIS
KOLLEKTIVTRAFIKKFORENINGEN - PUBLIC TRANSPORT NORWAY
KONTRON
LANTECH
LECIP
LIT TRANSIT
LTA SINGAPORE
LTG
LUMIPLAN
MAESTRONIC
MAN TRUCK & BUS
MASTERCOM OY
METATRONIX
METRON
METROTEK
MLC ITS EUSKADI
MOVIA
MULTIQ
NAVOCAP
NBMS - SNCB
NEC
NETMODULE
NEWFLYER
NOBINA
NORDLAND CITY COUNCIL
NORGESBUSS
NORLED
OBSERVIT
OPENMATICS
ORING INDUSTRIAL NETWORKING CORP.
OWASYS
OXYFI
PILOTFISH
PLL FINNISH LOCAL TRANSPORT ASSOCIATION
PPTEXCELLENCE
PSI SOFTWARE
R2P
RATP
REGION STOCKHOLM
RIDANGO
RTM MARSEILLE
RUTER
SCANIA
SEE
SEIPRA
SESALY
SIGMAX
SKANETRAFIKEN
SKANTECH
SKYSS HORDALAND AUTHORITY
SNCF
SOLARIS BUS
SPEC
SQUARELL
ST ENGINEERING
STA - SÜDTIROLER TRANSPORTSTRUKTUREN
STIB
STRATIO
STREAMAX
SWARCO
SYNECTICS
TAIT RADIO
TELESTE
TELEXIS
TELIA
TENIX
TEQ
THALES
THOREB
TIDE
TIMESPACE TECHNOLOGY LTD.
TISSEO COLLECTIVITÉS
TP DE LA RÉGION LAUSANNOISE
TPG
TRANSDEV
TRANSPORT FOR LONDON
TRAPEZE
TRIONA
TRONTEQ
UITP
UNIBUSS
VASTTRAFIK
VDS RAIL
VIX TECHNOLOGY
VOLVO BUSES
VY BUSS
WAVECOM
WESTERMO
XEE
XIMEDES
XOVIS

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