Integrated IP Based Passenger Information & CCTV for Rolling Stock Application

PT Communication Systems Private Limited
(A Joint Venture of PPS International & Televic Rail Belgium)
PT Communication Systems PVT LTD (PTCS) is a 50:50 Joint venture company between PPS international (Delhi) & Televic NV Belgium, setup in 2008.

The purpose of this JV is the design, development, manufacturing, sales and after sales service of Passenger Announcement (PA), Passenger Information (PIS), Passenger Infotainment (P Info), Passenger surveillance systems (CCTV), for rolling stock application under the transfer of technology from Televic Belgium under “MAKE IN INDIA” and to make European products on Indian prices.

Televic is more than 70 years old company, with its headquarter in Belgium and having manufacturing units in several countries including USA. Televic is a world leader and an obvious choice of most of the Rolling Stock manufacturing companies due to its innovation, reliability, sustainability, commitment and excellent quality products delivered to more than 25000 cars worldwide.

Over the past two decades, Televic has been continuously innovating its PIS solution to meet the customer’s demand to add more and more features & safety of passengers. Its latest generation of integrated solution of passenger information systems together with CCTV is now the Full IP Passenger Information System (FIP) which has now became the default option in our offering for most of our projects which is providing the greatest possible modularity and several other advantages towards equipping the metro and modern suburban vehicles.

PPS International, an ISO 9001 certified company established in 2003, is dedicated to work only in Railways/Metros in the niche market to deal only in Electrical department of Indian Railways. The objective of PPS is to search the best available technologies around the world in Railway field and to introduce the same in Indian market to bring value for money. Besides their own developed equipments, PPS is also an Indian representative of few world renowned European companies to represent them in India and to market their equipments in Indian Railways & Metros.

PTCS has obtained the complete technology from Televic being their JV partner for the local manufacturing of PIS & CCTV systems specifically for the Indian market keeping same configuration, manufacturing and quality standards and the same has been homologated to suit Indian conditions.

Most of the critical part are still being supplied by Televic to the JV(PTCS) to ensure the quality standards.
The system described in the catalogue is for the integrated solution for passenger information & surveillance system, however it can be adapted as per the customer’s requirement.

In a typical 6 car train, following equipment have been shown.

High speed ethernet back bone of 1 GHz through out the trains with full redundancy for the purpose of two coupled trains.

**PA System:**
- iCom Controller
- PIS HMI
- ACP
- CCU
- AAU
- PEAU
- Loud Speaker

**PIS System:**
- Front Display
- TFT Display
- Route Map Display
- Stretch Display (with or without video)

**CCTV**
- Recorder
- CCTV HMI
- Cameras
- Software

The proposed system comprises an integrated solution with following functionalities.

- A fully automated Passenger Information System, coupled to location and based on data prepared off-board (with LiveCom).
- A high performed network
- A full digital CCTV system integrated with the PIS part

**Overall supported functionalities**

- Public Address from Train Radio
- Public Address from Guard/Driver/Train Operator
- Driver to Guard (CAB to CAB) intercom
- Driver/Guard communication with Passenger via PEAU
- Broadcast of Journey Data to different system Components.
- Broadcast of infotainment data single channel.
- Interface with TCMS to share PIS diagnostic and Train Info (GPS data, speed, door status etc.).
- Interface with third party Train radio and Broadband radio system for audio and video broadcast.
- Recording of CCTV Video (Saloon, CAB, Platform area ...).
- Real time view of CCTV video in cab area on CCTV-HMI.
General Overview and System Layout

Example: 6 Car Layout

High Speed Ethernet Backbone

Audio System Layout

Visual System Layout

CCTV System Layout
Introduction

Controller is a heart of the whole system and is housed in 19\" 3U fully configurable rack with removable board from the front. In its full configuration, the iCom controller has following modules:

- Power supply
- Information Management Server (IMS) Module
- Digital Signage Server (DSS)
- iSync Server
- Mobile Access Router (MAR) including
  - signal splitters and filters
  - 3G module
  - WiFi module

Modules

The Information Management System (IMS) functions run in a real time eCos Operating System on an ARM architecture based processor. This processor platform can include a GPS module or can use localization information from another source, eg TCMS.

The IMS performs the complete route management, contains the route database, takes care of the automatic voice announcements, and the synchronized triggering of the different displays. The message database can be updated via a front-side Ethernet connection or via the iSync server.

Journey information and the synchronized triggers are also provided to the DSS.

The Digital Signage Server (DSS) module runs a web server and a streaming video server application. It adapts its information content dynamically on basis of information received by the IMS. It has a memory capacity of 64GB (this memory is divided in different section to allow pre-load of new information, effective space for content is defined on project level ) for the video, digital signage and (optional) advertisement files. The Digital Signage Server module manages the content of all TFT screens on the train.

It can stream up to 4 different videos simultaneously in broadcast mode, which means that each of these videos can be rendered on one or on multiple screens simultaneously.

This module can also be used to act as data gateway between different system, eg interface between passenger information system and TCMS.

The iSync application and Mobile Access Router (MAR) application run on one shared cPCI x86 architecture based processor.

Highlights

- No moving parts (fans, … ) whatsoever are used for this unit
- Configurable towards specific functional requirements
- EN50155 T3
- Up to 3 processor boards

Characteristics

**x86 based processor board**

- Intel Atom E680T, 1,60GHz
- cPCI serial platform
- 1GB RAM
- up to 64GB MLC
- up to 8GB SLC
- SLC and MLC are not exclusive
- Linux 3.2
- other configurations upon request

**ARM based processor board**

- ARM9 processor
- 16 MB RAM
- 16MB NOR Flash, 512MB NAND Flash
- CFlash interface up to 2GB
- eCos 3.0 RTOS
- other configurations upon request

**GPS receiver**

- 12-channel
- TSIP, DGPS & NMEA support
- integrated 3.3V 1W power supply for a LNA

**WiFi card**

- Standard: 802.11a/b/g/n
- Data rate up to 300Mbps
- Enhanced wireless security: 64/128-bits WEP, WPA, WPA2, 802.1x
- other configurations upon request
The iSync module manages the data transfer and transmission to and from the OCC. It enables a secure file transfer, optimized in cost, maintaining the data integrity, ... over a wireless link.

The MAR application handles the mobile link management (management of the lower layer GPRS and WiFi links).

Technology

**Standards:**
- IEEE 802.3i for 10baseT
- IEEE 802.3u for 100baseT(X)
- IEEE 802.11a/b/g/n
- IEEE 802.1x
- LTE, HSPA+, GSM, GPRS, EDGE
- WEP, WPA, WPA2

**Protocols:**
- TFTP, FTP

**Interfaces**

In its full configuration:
- **Backbone ports:** 2 M12 Ethernet ports
- **Diagnostic ports:** 1 diagnostic RJ45 Ethernet port

**Antenna connections:**
- 1 GPS connection with integrated DC blocking filter and 3.3V 1W LNA power supply
- 1 combined WiFi / 3G connection with internal signal splitter and filter
  - LOW port: 698 - 2200 MHz (LTE)
  - HIGH port: 2400 - 2690 MHz (WiFi)

Power requirements

**Input voltage:**
- 24V version: 24V DC (EN50155)
- 110V version: 110V DC (EN50155)

**Power consumption:**
- With IMS function only: 10W
- In its full configuration, at full load: approx. 70W

**Reverse polarity protection:** yes

Connection: CPC connector

Physical characteristics

**Housing:** Al
**Dimensions:** 436 X 209 X 132mm
**Weight:** between 7.0 and 11.0 kg depending on configuration

Environmental limits

**Operating temperature:** -40 to 75 °C (EN50155 T3)
**Storage temperature:** -40 to 85 °C
**Ingress protection:** IP40 front, IP20 overall

Certifications
EN50155
EN50121-3-2
EN45545
Touch Screen HMI
with embedded Linux client

Televic Rail’s touch screen HMI belongs to the Televic iCoM Passenger Information System’s family of devices for the on-board railway environment.

This HMI is a fanless Ethernet based device that comprises a XGA high brightness TFT panel with touchscreen, an Intel based processor with powerful video decoding capabilities and a wide input range EN50155 DC/DC convertor.

The device can be used as HMI for standard Passenger Information System functions, but also for video surveillance. It integrates seamlessly in Televic Rail’s on board Passenger Surveillance System.

Features
- XGA format
- LED backlight
- High brightness screen (700 cd/m2)
- Scratch resistant GFG resistive touch screen
- Ambient light sensor
- Linux kernel 3.2 operating system
- Low power Intel Bay Trail x86 processor with hardware accelerated video decoding
- Wide input range EN50155 DC/DC convertor
- Maintenance-free design

Optical characteristics

- **Diagonal:** 10.4 inch
- **Format:** 1024 X 768 pixels
- **Aspect ratio:** 4:3
- **Brightness:** Typical 700 cd/m²
- **Backlight technology:** LED
- **Colour depth:** 24 bit (16M colours)

Interfaces

- **Network port:** M12 D-coded 10/100 BaseT Ethernet port
- **Data / service ports:** 2 USB 2.0 service ports

Power characteristics

- **Input voltage:** Wide input voltage range: 24V to 110V DC (EN50155)
- **Power consumption:** Max 45W
- **Reverse polarity protection:** yes
- **Connection:** FCT 3W3

Processor platform characteristics

**Processor characteristics:**
- Low power Intel Bay Trail x86 processor
- 2GB RAM
- 4GB Flash Memory
- Linux 3.2

**Video decoding capabilities:**
- 4 FHD 30fps h264 MP streams from Ethernet (UDP, TCP)
- Other modes upon request

Physical characteristics

- **Housing:** Al
- **Dimensions:** 354 X 240 X 97mm
- **Weight:** 6.5 kg

Environmental limits

- **Full operating temperature:** -25 to +70 °C (natural convection)
- **Storage temperature:** -40 to +85 °C
- **Ingress protection:** IP65 (front), IP42 (back)
- **Impact protection:** IK 08

Standards and certifications

- EN50155
- EN50121-3-2
- EN45545-2
The ACP is a device mounted in front of the Asst driver with PA & intercom function, The ACP has the same integrated processor as the CCU and is directly connected with the same switch network, via a PoE port.

It will act as a redundant device towards the main CCU in a 3 car unit formation.

The ACP is based on a metal square panel having 5 pushbuttons (non-illuminated), such as:
- PA selection button
- PTT
- CAB-CAB mode
- spare

On the ACP panel a handheld microphone is mounted together with an integrated loudspeaker.
Central Control Unit (CCU)

The Central Control Unit is a unit which combines both interfaces with peripherals (desk buttons, microphones, handsets) and the central controller from Televic Rail's Full IP Voice Communication System (FIP) for rolling stock.

With its IP interface, it offers a high level of flexibility and diagnostics. While it is generally connected to the on-board Ethernet backbone, it also offers a second digital interface, that supports a fall back mode, towards other voice communication components such as amplifiers, handsets and microphones. As such it enables an unprecedented level of availability of the audio functions. As it is usually installed in each cab, it offers a redundant Master Unit function on unit and train level.

This CCU is developed for one large scale European project and will come in use on several others shortly.

### Highlights
- Low thermal footprint
- Full IP
- Optional digital fall back independent from Ethernet backbone

### Features
- Integrated cab loudspeaker class D amplifier
- The Master Unit function is redundantly powered via PoE

### Standards
- IEEE 802.3i for 10baseT
- IEEE 802.3u for 100BaseT(X)
- IEEE 802.3af for PoE

### Interfaces

**Front:**
- **Backbone ports:** female M12 D-coded Ethernet port
- **Fall back ports:** 3 male M12 D-coded Ethernet ports
- **Microphone / handset port:** SUB-D9
- **General purpose port:** DIN 41612 connector 48 pins male
  - 1 cab loudspeaker
  - 8 logical inputs for driver desk buttons
  - 6 voltage free logical outputs for driver desk indicators

**Rear:**
- **Power port:** 6 pins Souriau SMS connector

### Power requirements
- **Input voltage:** 110V DC (EN50155)
- **Power consumption:**
  - Stand-by: 7W
  - Maximum (full load): 40W
- **Reverse polarity protection:** yes

### Physical characteristics
- **Housing:** Al
- **Dimensions:** 260 X 192 X 47 mm excluding mounting flanges, studs and connectors (preliminary info)
- **Weight:** 3.5 kg

### Environmental limits
- **Operating temperature:** -40 to 75 °C (EN50155 T3)
- **Storage temperature:** -40 to 85 °C
- **Ingress protection:** IP40 overall

### Certifications
- EN50155
- EN50121-3-2
- EN45545
Audio Amplifier Unit (AAU)

The IP amplifier is the main audio amplifier unit (AAU) from Televic Rail’s Full IP Voice Communication System (FIP) for rolling stock.

It contains a double 2-channel highly efficient class D amplifiers that can drive 2 high voltage and 2 low voltage loudspeaker lines for Public Address functions.

With its IP interface, it offers a high level of flexibility and diagnostics. While it is generally connected to the on-board Ethernet backbone, it also offers a second digital interface, that supports a digital fall back mode. As such it enables an unprecedented level of availability of the public address function.

**Highlights**

- 4 Class D amplifiers for high efficiency (2 outputs are 100V-line outputs)
- 20W peak per output (with a max of 80 W including PSE)
- Low thermal footprint
- Double power supply
- Full IP
- Optional digital fall back independent from Ethernet backbone
- Automatic adaptation to ambient noise by measuring the ambient noise directly through the loudspeakers a few seconds preceding the actual announcement

**Features**

- Optional integrated proprietary PoE PSE (Power Sourcing Equipment) to support digital fall back for other Televic proprietary PoE PD devices

**Power requirements**

- **Input voltage:** 110V DC (EN50155)
- **Power consumption:**
  - Stand-by without PSE: 10W
  - Maximum (full load, including full load PSE): 80W
- **Reverse polarity protection:** yes

**Physical characteristics**

- **Housing:** Al
- **Dimensions:** 250 X 180 X 120mm excluding mounting flanges, studs and connectors
- **Weight:** 4.5 kg

**Environmental limits**

- **Operating temperature:** -40 to 75 °C (EN50155 T3)
- **Storage temperature:** -40 to 85 °C
- **Ingress protection:** IP40 overall

**Certifications**

- EN50155
- EN50121-3-2
- EN45545

**Interfaces**

- **Backbone ports:** female M12 D-coded Ethernet port
- **Fall back ports:** 2 male M12 D-coded Ethernet ports
- **Power port:** 6 pins Souriau SMS connector
  - 2 independent battery inputs
- **Service port:** 8 pins RJ45
- **Loudspeaker port:** 12 pins Souriau SMS connector
  - 4 independent loudspeaker branches
The Passenger emergency intercom communication unit facilitates intercom functionality between a passenger and crew, driver or dispatching.

For this device there are two main applications:
- Communication in case of an emergency – eventually coupled with activation of the emergency brakes.
- Communication in case of need for assistance – in particular the assistance for disabled persons.

Typical locations for the device are:
- Nearby the entrance doors of a coach
- In separated compartments
- At specific seat locations for disabled persons.

Highlights

- IP controlled devices
- PoE powered
- Modular electronics can be integrated in customized mechanical housing aligned with train interior design
- Available with or without integrated activation button.
- Possibility to activate the intercom function via an external switch contact, like emergency handle or call for aid button.
- Integrated LED indicators giving visual guidance through the functional scenario.
- Optional digital fall back mode independent from the train IP backbone. (augmented functional reliability)
- Input for connection in train security loop available. (augmented functional reliability signalization of activation)

Features

- Integrated LCD display to assist hearing impaired (optional)
- Stand by LED indicator

Standards and certifications

- EN 50155 (rolling stock electronic equipment)
- EN 50121-3-2 (emc)
- EN 61373 (vibration)
- EN 16334 (passenger emergency communication)
- EN 16683 (call for aid communication)
- Optional : interoperability constituent certificate according to TSI PRM 1300/2014

Models

Different mechanical designs are possible:
- Without integrated pushbutton
- With integrated pushbutton
- Adaptable front-plate in function aligned with train interior design.
Gooseneck microphone panel

Gooseneck microphone is used by driver/guard for manual announcement, cab to cab communication and passengers emergency talk back functions. It is either mounted on the driver desk or at any other appropriate location, which is convenient to Driver/Guard.

Technical Specification

- Electroacoustic principle: Electret
- Directional Characteristics: Cardioid
- Free-field nominal sensitivity: 25mV/Pa
- Acceptable terminal voltage: 1.5 V up to 10V
- Current drain: max. 0.5mA
- Optimal speaking distance: approx. 30 cm up to 1 m
Loudspeakers: Interior/Cab/Exterior Loudspeaker

These loudspeakers are specially designed to withstand harsh railway environments.

Technical data
- Full range speaker
- Rated power 20W
- Mean sound pressure level 89dB (1W/1m)

Interfaces
- Connector: WAGO

Environmental limits
- Operating temperature: -40 to 75 °C (EN50155 T3)
- Storage temperature: -40 to 85 °C
- Ingress protection: IP40 front, IP20 overall

Standards and certifications
- EN50155
- EN50121-3-2

Models
- Without front grille
- With front grille (option)
- 8Ω / 32Ω

Features
- 4 inch full range speaker
- High efficiency
- Balanced frequency response

Audio characteristics
- Directivity pattern:
- Frequency and impedance response:

External Loudspeaker

Cab Loudspeaker
The TFT display is full IP based high resolution display with IP54 rating for display route information, infotainment or any other media related messages inside the car.

Different sizes of industrial grade TFT screen are available as customer requirement having different aspects ratio and can be matched with the interior.

The TFT display is a fan-less Ethernet-based device that comprises a state-of-the-art TFT panel, a processing unit and an EN50155 power supply.

These TFT displays have an Ethernet daisy chain capability in order to facilitate cabling in the cars and minimize Eth ports on the switch device.

### Technical Specifications:

- **Ethernet Standards:** IEEE802.3i/IEEE802.3u, 10BASE-T/100BASE-TX
- **Ethernet Interface Connector:** M12 D-coded Ethernet Ports
- **Display Type:** 21.5” TFT display (can be customised)
- **Resolution:** 1920 x 1080 max
- **Viewing Angle:** 175 degree
- **Ingress level:** IP-54.
- **Input voltage:** 110V DC (EN50155)
- **Power consumption:** maximum 40W

### Physical Characteristic

- **Housing:** AL-unfinished - with front glass- to be mounted behind train cover
- **Weight:** Approx 6.2 kg
- **Mounting:** Flush Type or can be adapted as per project requirement.
Digital Route Maps (DRM)

Description:

This Digital route map (DRM) TFT display is full IP based high brightness TFT display with IP-54 rating for displaying Destination station, present station, approaching station, time for reaching next stations, real time clock and door indications.

The Route-map will show of all station of an route in different colors, point of inter-change or any other important information, flashing of emergency messages, important train messages, scrolling of routes etc. It has inbuilt ambient light sensor which control brightness of display with respect to the Intensity of light. Housing can be customised to match the interior of the car.

Technical Specifications:

Ethernet Standards: IEEE802.3i/IEEE802.3u, 10BASE-T/100BASE-TX
Ethernet Interface Connector: M12 D-coded Ethernet Ports
Display Type: 28” TFT display stretch type
Resolution: 1920 x 290
Viewing Angle: 120 degree
View Area: approx. 920 x 140 mm

Ingress level: IP-54.
Input voltage: 110V DC (EN50155)
Power consumption: maximum 40W

Physical characteristics

Housing: AL/SS
Weight: Approx 10 kg
Mounting: - Flush Type
The Front Destination Indicator (FDI) / Train Number Indicator (TDI) LED display is installed behind the wind screen, facing outside and in the driver cab.

- A typical Front Destination Indicator/Train Number Indicator LED display is capable of showing 2 lines of text however it can be customised:
  - Hindi in bigger font (90mm) at the top and
  - English in smaller font (45mm at the bottom).
- The Train Number Indicator LED display is capable of showing 2 lines of text:
  - 6 digit alpha-numeric train ID and 6-digit alphanumeric Rake ID in the top row and
  - Destination station in the bottom row
- A typical Side destination board is capable of showing the Train Route and is mounted behind the glass facing platform.
  - It can be customised for single line display in alternate languages.
    - Hindi in big font (90mm) at top
    - English in small font (45mm) at bottom
- Side destination board can be made in single line as well

These LED displays have an Ethernet daisy chain capability in order to facilitate cabling in the cars and minimize Eth ports on the switch device, but is not needed for the FDI/TNI display.

**Technical Specifications:**

- Ethernet Standards: IEEE802.3/IEEE802.3u, 10BASE-T/100BASE-TX
- Ethernet Interface Connector: M12 D-coded Ethernet Ports
- LED Matrix Size: 32 x 192, 24 x 192, 16x192, 16 x 128 (any other size can also be customized)
- Viewing Angle: 120 degree
- LED Pitch: As per project requirement
- LED Type: SMD- High Luminocity
- View Area: approx. 880 x 152mm (will vary as per LED matrix)
- Luminous Intensity: > 2000 mcd
- Ingress level: IP-54.
- Input voltage: 110V DC (EN50155)
- Power consumption: maximum 24W
LiveCom is a content creation tool that supports the management of station information, route information, journey information, triggers (GPS based, speed, temperature ...), text files, graphics and video files.

LiveCom provides the operator with the power to fully define and redefine the look and feel of their PIS themselves, whenever needed.

All content is created using LiveCom’s WYSIWYG Template Editor. LiveCom’s web-based end user interface offers profile-based access to all parties involved in the process of setting up information.

LiveCom interfaces seamlessly with Televic’s “Information and Communication Manager” (iCoM). The main features of LiveCom (non-exhaustive list):

- Efficient set-up and maintenance of all data and content needed to build and maintain a PIS system that stands out, with the possibility to show:
  - Passenger information (e.g. next stops, current station, current time...)
  - Digital signage and advertising, both semi-static (e.g. advertising, general info for passengers) but also dynamic (e.g. RSS data ... provided the data is made available on-board).

- LiveCom GUI for efficient/intuitive editing:
  - Multi-user, profile based access control
  - WYSIWYG interface
  - Emulate what screens will look like
**Information Management System (IMS)**

The Information Management System (located in the iCoM controller) manages and triggers all automatic passenger information functions in a synchronized way. In more detail, the IMS Module:

- Processes the inputs from the driver or TCMS
- Manages the vocal information: broadcasting of pre-recorded digital voice announcements.
- Manages the text information: controlling the functions of the LED displays connected to the system
- Provides route information to the Digital Signage Server (in the same iCoM controller)

Input has to come from the TCMS: time, GPS info, wheel pulses, door status etc. (mandatory for location tracking and time).

**Digital Signage Server (DSS)**

The Digital Signage Server (DSS) module (located in the iCoM) runs a web server and a streaming video server application. It has a memory capacity of about 28GB (total) for the video, digital signage and advertisement files.

The TFT LCD displays are addressed in a server-client system, where each TFT LCD display is a client. As such each TFT screen in the consist can be addressed individually by the Digital Signage Server, allowing for a very flexible system. Additionally, the DSS server addresses each TFT screen at the native resolution of the TFT screen. The DSS can stream up to 4 different videos simultaneously in broadcast mode, which means that each of these videos can be rendered on one or on multiple screens simultaneously.

The Digital Signage Server receives its inputs from the IMS; hence all audio announcements and text and graphic display messages are fully synchronized.

**Interface to the wayside - iSync**

The iSync software facilitates bidirectional data synchronization between wayside and on-board systems across an entire fleet. Upon data delivery, iSync activates the necessary software components at the destination to process the data in a correct way at the correct time. iSync also monitors the synchronization and activation status and reports this back to the end-user.

iSync will manage the data transfer for the Televic PIS system on the train and will be delivered with the following features:

- An overview of the whole fleet,
- Auto or manual deployment of software updated per data type
- Adaptive transfer properties
- Data exchange resumable
- Differential upload
- Activation date
- Priority management
Passenger trains are increasingly being equipped with on-board systems and services. These systems depend on, and are producing large amounts of data of various types. Keeping all data synchronised between train and wayside systems, and ensuring the overall health and status of all data-dependent systems becomes more and more challenging and expensive.

**iSync: synchronise | activate | manage**

iSync facilitates bidirectional data synchronisation between wayside and on-board systems across an entire fleet. Upon data delivery, iSync activates the necessary software components at the destination to process the data in such way that the corresponding on-board or wayside systems are correctly updated and configured. The entire synchronisation and provisioning process for all on-board systems in the entire fleet can be controlled and monitored by an operator from a single central iSync graphical user interface. As such, iSync enables effective management of all software and data used in the fleet.

**iSync is specifically designed for rail**

iSync is not just a generic IT tool for synchronisation: it is developed specifically for the rail business based on over 30 years of expertise in designing, manufacturing and maintaining passenger information and communication systems as well as mechatronics sensors for rail.

From its initial design, iSync has taken into account the specific characteristics of the rail business, including but not limited to:

- the heterogeneity of trains in terms of on-board systems (different vendors, different generations of equipment,...)
- heterogeneous and changing train configurations in the fleet
- heterogeneous requirements of on-board railway applications
- the importance of reliability and security
- the challenging conditions for cellular connectivity while on the move, resulting in frequent disconnections
- handling unpredictable events such as power outages, or defective on-board devices being swapped

The rail-oriented focus of iSync leads to a high-quality data synchronisation and management solution for rail, avoiding the risk of needing to go through lengthy, expensive, and hard to maintain customization cycles of generic tools for data synchronisation.

wayside control:
one single user interface
configure | activate | monitor

wayside applications supporting the on-board applications - any vendor

any data transfer (e.g. document, media, software update, ...)

any on-board peripheral – any vendor – any interface

your entire fleet
iSync connects to Televic’s and third parties’ applications, and manages the data traffic of all connected systems—before transferring them safely to/from the wayside over the most appropriate on-board wireless link. iSync respects any user/third party systems’ procedures and rules, whilst guaranteeing their integrity and ensuring reliable data exchange between control centres and running vehicles.

**iSync directly reduces operational costs** by drastically reducing the number of manual on-board interventions needed to keep the software and data of all on-board systems up-to-date and synchronised.

iSync manages data flows more efficiently, and keeps all systems up-to-date. By delivering crucial information to the right destination in the fastest way possible, Operations and Management are able to make better informed decisions. This way, **iSync allows saving costs on operations indirectly.**

### Without iSync: manual, per train and per application, tedious and error-prone updating actions needed

- **app1-w**
- **app2-w**

### With iSync: after a few clicks in a single central GUI for the entire fleet, full automated transfer, install and monitoring

- **app1-w**
- **app2-w**

**iSync main features**

**iSync responds to all common operational issues**

- **Optimized data transfers**: guaranteed data integrity, priority scheduling, using any wireless link (e.g. Wi-Fi, 4G, ...) avoids corrupted systems and optimizes the use of scarce bandwidth
- **Interoperable and future-proof**: modular design, specifically for rail, based on proven technologies and standards (e.g. OSGi, HTML5)
- **Efficient provisioning and updating**: dependency management in case of multiple updates, monitoring of updating status, trigger-based activations (e.g. on date/time, journey, network, ...), automated queuing
- **Efficient monitoring and management**: single user interface for all applications in the fleet, automation possibilities (if desired)
- **Secure**: end-to-end encryption of data transfer, credential-based access to user interface
All configuration and monitoring functionality is available from a single central iSync graphical user interface (GUI). The HTML5-based iSync GUI interfaces with the wayside iSync server and provides an overview of the data status of all connected systems across the entire fleet.

**iSync architecture overview**

The software core of iSync is built out of (i) an on-board part (installed on an on-board server), and (ii) a wayside part (typically installed in a datacenter) and relies on (iii) specific simple software adapter interfaces (custom-provided by Televic) to interoperate with existing Televic and third party applications. For supporting the necessary on-board hardware interfaces, Televic Rail provides the iCoM modular server for on-board information and entertainment. For the actual transmission of the data, Televic Rail offers its Mobile Access Router (MAR). The MAR makes Wi-Fi and 2/3/4G wireless connectivity available on-board the train. Alternatively, existing third party connectivity can be reused.

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**iSync streamlines operations**
A single solution for all data transfers

Different systems,
Different suppliers,
Different configuration needs and ways.

One common challenge: keeping on-board and wayside data synchronised, and all on-board systems up to date
Rail Network Video Recorder (NVR)
Full IP CCTV Recorder

Features
- modular HDD or SSD storage
- front removable caddy for ease of hardware archiving of footage
- records video of up to 20 cameras
- records up to 80Mbit / sec
- management of pre- and post-recording of events
- up to 16 programmable events
- high/low frame rate recordings based on events
- write protection of event-related recordings
- multi-level H264 recording
- health monitoring
- real-time clock
- power save management
- central management via Command for Rail
- Integrated heater with automatic temperature control

Interface

Network ports:
- M12 D-coded 10/100 BaseT Ethernet port (X 2) with link aggregation
- Option: M12 X-coded GigaBit Ethernet port (instead of the 10/100 BaseT Ethernet ports)

Storage Caddy
The recorder houses one removable caddy. The caddy comprises
- 2 slots of 2.5 inch, of which
  - Up to 2TB HDD per slot
  - Up to 1TB SSD per slot
- a key lock

Power characteristics

Input voltage:
- 24V DC (EN50155)
- option: 72V - 110V DC (EN50155) instead of 24V DC
- others upon request

Interruptions of voltage supply / supply change over:
- ENS0155 S2 (10ms)
- ENS0155 C1
- 10 seconds with optional capacitor power pack
- complete protection to any interruption with optional enhanced capacitor power pack

Power consumption:
- nominal: 18W
- maximum: 54W

Reverse polarity protection: yes
Connection: Souriau SMS

Physical characteristics

Housing: Al
Dimensions: 387 X 268 X 98mm (without mounting flanges)
Weight: 6.9 kg

Environmental limits

Full operating temperature:
- with SSD memory: -25 to +70 °C
- with 2 X 1TB HDD: -25 to +45 °C
Storage temperature:
- with SSD memory: -40 to +85 °C
- with 2 X 1TB HDD: -40 to +70 °C

Ingress protection: IP40

Standards and certifications
EN50155
EN50121-3-2
EN45545-2
Saloon Camera

Network Camera

Camera Coverage Area

Cab Camera

Televic camera is a compact, rugged and discreet full digital network camera and has IP67 or upper-rated protection against dust and water.

The camera is especially designed to withstand harsh conditions such as vibrations, shocks, bumps and temperature fluctuations especially designed for rolling stock application

Can be installed in the passenger areas or in the cab areas.

Basic features

- IP camera – 1024x768 (4:3)
- Interior camera: Lens: 2.8mm M12 mount, Fixed iris, Megapixel resolution, F2.0
  - Horizontal angle of view: > requested 80°
  - Vertical angle of view: > requested 60°
- Sensitivity: 0.2 (between full moon light and cloudy moon light)
- Support of H264 and MJpeg streaming
- MicroSD card support
- Up to 30 fps
- Fed by Power over Ethernet IEEE 802.3af Class 1, max. 3.2 W
- -30 °C to 60 °C (-13 °F to 122 °F) Humidity 10 - 95% RH (non-condensing)
- Tampering detection
- ......
Touch Screen HMI
with embedded Linux client

Televic Rail’s touch screen HMI belongs to the Televic iCoM Passenger Information System’s family of devices for the on-board railway environment. This HMI is a fanless Ethernet based device that comprises a XGA high brightness TFT panel with touch screen, an Intel based processor with powerful video decoding capabilities and a wide input range EN50155 DC/DC converter. The device can be used as HMI for standard Passenger Information System functions, but also for video surveillance. It integrates seamlessly in Televic Rail’s on board Passenger Surveillance System.

Features
- XGA format
- LED backlight
- High brightness screen (700 cd/m2)
- Scratch resistant GFG resistive touch screen
- Ambient light sensor
- Linux kernel 3.2 operating system
- Low power Intel Bay Trail x86 processor with hardware accelerated video decoding
- Wide input range EN50155 DC/DC converter
- Maintenance-free design

Optical characteristics
- **Diagonal:** 10.4 inch
- **Format:** 1024 X 768 pixels
- **Aspect ratio:** 4:3
- **Brightness:** Typical 700 cd/m²
- **Backlight technology:** LED
- **Colour depth:** 24 bit (16M colours)

Interfaces
- **Network port:** M12 D-coded 10/100 BaseT Ethernet port
- **Data/service ports:** 2 USB 2.0 service ports

Power characteristics
- **Input voltage:** Wide input voltage range: 24V to 110V DC (EN50155)
- **Power consumption:** Max 45W
- **Reverse polarity protection:** yes
- **Connection:** FCT 3W3

Processor platform characteristics

**Processor characteristics:**
- Low power Intel Bay Trail x86 processor
- 2GB RAM
- 4GB Flash Memory
- Linux 3.2

**Video decoding capabilities:**
- 4 FHD 30fps h264 MP streams from Ethernet (UDP, TCP)
- Other modes upon request

Physical characteristics
- **Housing:** Al
- **Dimensions:** 354 X 240 X 97mm
- **Weight:** 6,5 kg

Environmental limits
- **Full operating temperature:** -25 to +70 °C (natural convection)
- **Storage temperature:** -40 to +85 °C
- **Ingress protection:** IP65 (front), IP42 (back)
- **Impact protection:** IK 08

Standards and certifications
- EN50155
- EN50121-3-2
- EN45545-2
Off-board Investigation Software

Introduction
The off-board solution combines mobile surveillance with fixed facility management.

This enterprise software solution provides comprehensive transportation video management. Real-time, secure, web browser-based clients provide system status, alarms, and recorded video/data archives. This enables the ultimate flexibility and access to video and audio evidence, along with synchronized vehicle data, including interactive GPS maps.

The off-board tool allows users to:
- Extract video, GPS (if available), from mobile recorders, from a date and time that the user defines. GPS (if available) maps show the vehicle route and the user can click a point on the route to see the corresponding video and audio.
- Automatically download video, GPS, when certain alarms are triggered.
- Display live GPS maps (if available) with vehicle current location, route / speed / position, and associated video.
- Export video, GPS, and audio information to external files for evidence.
- Note that GPS features are only available when GPS is integrated onboard the vehicles.

After installing the software on a server and connecting the caddy a train caddy can be added to allow investigation of recorded files.

The software package allows that, via a wireless link recorded data and real-time views can be uploaded or monitored on the wayside. The performance of this real-time view and upload will depend on the available wireless bandwidth.

General overview of recorded files

![Command Navigation panel and Incident Archiver tabs](image)

Image: Command Dashboard (Health, Alarm, and Export Information)
Incident extraction screen

View with location of vehicle with GPS enabled viewer showing vehicle route

Location of the vehicle is available only when GPS is available in combination with open street map.

Media controls

Via an easy timeline interface time dependent views can be selected.
Also some control buttons are foreseen:
Forward - Backwards
Play fast forward - backwards
Pause
Go to start
Jump back 10 seconds
Sync view

When investigating an incident it can be very useful to play/view simultaneously all cameras of a car (from different viewing angles), this in combination with map view (location of the vehicle, only when GPS is available in combination with open street map).

Export function

By double clicking on a view-window, the system opens a new tab allowing export of the selected view.
The selected switch is specially for rail environment:

**Technical Specification:**

- Provides up to 30 watts per PoE port with a total power budget of 120 watts per switch
- IPv6 Ready logo awarded (IPv6 Logo Committee certified)
- Leading EN 50155-compliant PoE switches for rolling stock applications
- DHCP Option 82 for IP address assignment with different policies
- Turbo Ring and Turbo Chain (recovery time < 20 ms @ 250 switches), and STP/RSTP/MSTP for network redundancy
- IGMP snooping and GMRP for filtering multicast traffic
- EtherNet/IP and Modbus/TCP industrial Ethernet protocols supported
- Port-based VLAN, IEEE 802.1Q VLAN, and GVRP to ease network planning
- QoS (IEEE 802.1p/1Q and ToS/DiffServ) allows real-time traffic classification and prioritization
- IEEE 802.3ad, LACP for optimum bandwidth utilization
- SNMPv1/v2c/v3 for different levels of network management
- TACACS+, SNMPv3, IEEE 802.1X, HTTPS, and SSH to enhance network security
- RMON for efficient network monitoring and proactive capability
- Bandwidth management prevents unpredictable network status
- Lock port allows access by only authorized MAC addresses
- Port mirroring for online debugging
- Automatic warning by exception through email and relay output
- Line-swap fast recovery
- LLDP for automatic topology discovery in network management software
- Configurable by web browser, Telnet/serial console, CLI, and Windows utility
- Loop protection prevents network loops
- Panel mounting installation capability