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**Electronic railway equipment – On-board multimedia and telematic subsystems for railways –
Part 1: General architecture**

**Matériel électronique ferroviaire – Sous-systèmes ferroviaires multimédias et télématiques embarqués –
Partie 1: Architecture générale**



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INTERNATIONAL STANDARD

NORME INTERNATIONALE



**Electronic railway equipment – On-board multimedia and telematic subsystems
for railways –
Part 1: General architecture**

**Matériel électronique ferroviaire – Sous-systèmes ferroviaires multimédias et
télématiques embarqués –
Partie 1: Architecture générale**

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INTERNATIONAL ELECTROTECHNICAL COMMISSION

**ELECTRONIC RAILWAY EQUIPMENT –
ON-BOARD MULTIMEDIA AND TELEMATIC
SUBSYSTEMS FOR RAILWAYS –**

Part 1: General architecture

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The text of this standard is based on the following documents:

FDIS	Report on voting
9/1990/FDIS	9/2005/RVD

This publication has been drafted in accordance with the ISO/IEC Directives, Part 2.

A list of all parts of IEC 62580 series, under the general title *Electronic railway equipment – On-board multimedia and telematic subsystems for railways*, can be found on the IEC website.

The committee has decided that the contents of this publication will remain unchanged until the stability date indicated on the IEC web site under "<http://webstore.iec.ch>" in the data related to the specific publication. At this date, the publication will be

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INTRODUCTION

IEC 62580-1 defines the general architecture of the On-board Multimedia and Telematic Subsystems (OMTS), so as to achieve compatibility between subsystems in the same vehicle and between subsystems on-board of different vehicles in the same train.

NOTE 1 The acronym OMTS replaces the previous OMMS (On-board MultiMedia Subsystem) definition, due to a change in the title of this standard.

The multimedia and telematic system is composed of but not limited to:

- A Video surveillance/CCTV
- B Driver and crew orientated services
- C Passenger orientated services
- D Train operator and maintainer orientated services

OMTSs installed in the same vehicle (consist) communicate by means of the consist network.

OMTSs, installed in different vehicle (consist) in the same train, communicate by means of the train network.

It is likely that each OMTS exchanges information with applications installed on-ground by means of a wireless communication gateway.

The on-board communication and the on-board to ground communication are specified by the IEC 61375 series.

NOTE 2 Board-to-ground communication is intended as a generic link, with no assumption on the underlying technology (radio, satellite or other).

As illustrated in Figure 1, the IEC 62580 series is structured as follows:

IEC 62580-1: General architecture

IEC 62580-2: Video surveillance/CCTV services

Driver and crew orientated services, passenger orientated services and train operator/maintainer orientated services are matters of standardisation which can be addressed in the future.

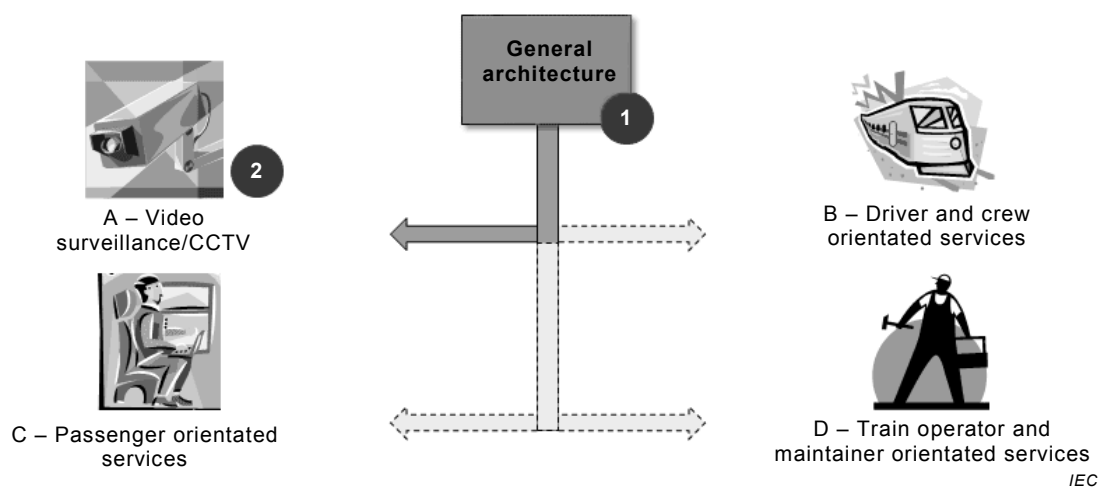


Figure 1 – OMTS categories and structure of the IEC 62580 series

ELECTRONIC RAILWAY EQUIPMENT – ON-BOARD MULTIMEDIA AND TELEMATIC SUBSYSTEMS FOR RAILWAYS –

Part 1: General architecture

1 Scope

This part of IEC 62580 specifies the general architecture of the On-board Multimedia and Telematic Subsystem, which includes four categories of multimedia and telematic subsystems identified as:

- A Video surveillance/CCTV
- B Driver and crew orientated services
- C Passenger orientated services
- D Train operator and maintainer orientated services

This part establishes:

- the boundary between the OMTS and the on-board communication system, as described by the IEC 61375 series
- the methodology to describe an OMTS in terms of abstract model
- the general principles and the basic requirements to specify the services provided/needed by each category
- the approach to ensure interoperability between services

This part gives guidelines for:

- OMTS classification
- functional breakdown structuring
- system breakdown structuring
- formal specification of an OMTS

This part is applicable to any type of train, e.g. open trains, multiple unit trains and closed trains.

NOTE The general architecture provides a common basis for the application categories defined in part 2 and possible future parts of this series of standards. Consequently, the approach is homogeneous for all multimedia and telematic subsystems addressed by this series of standards.

2 Normative references

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 61375 (all parts), *Electronic railway equipment – Train communication network (TCN)*

IEC 61375-2-3, *Electronic railway equipment – Train communication network (TCN) – Part 2-3: TCN communication profile*

IEC 61375-2-4, *Electronic railway equipment – Train communication network (TCN) – Part 2-4: TCN application profile*¹

IEC 61375-2-6, *Electronic railway equipment – Train communication network – Part 2-6: On-board to ground communication*

IEC 62280, *Railway applications – Communication, signalling and processing systems – Safety related communication in transmission systems*

ISO/IEC 8824 (all parts), *Information technology – Abstract Syntax Notation One (ASN.1)*

ISO/IEC 8825, *Information technology – ASN.1 encoding rules: Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER) and Distinguished Encoding Rules (DER)*

ISO/IEC 9646 (all parts), *Information technology – Open Systems Interconnection – Conformance testing methodology and framework*

ISO/IEC 42010:2011, *Systems and software engineering – Architecture description*

EN15380-4, *Railway applications – Classification system for railway vehicles – Part 4: Function groups*

3 Terms, definitions, abbreviations, acronyms, and conventions

3.1 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1.1 communication

capability to transfer information between different parts of a system or subsystem

Note 1 to entry: Communication may refer to on-board, train-ground, train-train or ground-ground transmission.

3.1.2 entity

any concrete or abstract thing of interest

Note 1 to entry: While in general the word entity can be used to refer to anything, in the context of modelling it is reserved to refer to things in the universe of discourse being modelled (ISO/IEC 10746-2).

3.1.3 function

specific purpose or objective to be accomplished, which can be specified or described without reference to the physical means of achieving it

Note 1 to entry: A function transfers (considered as a black box) input parameters (material, energy, information) into aim related output parameters (material, energy, information).

3.1.4 Functional Breakdown Structure FBS

hierarchical structure summarizing a set of functions leading to the same general focus or service, organized in function levels

¹ To be published.

3.1.5

function carriers

physical unit of observation to fulfil or partly fulfil one or more required functions

Note 1 to entry: Function carriers are considered as black box while describing the function.

3.1.6

function follower

application process which exchanges messages with the outside world only by means of a function leader

3.1.7

function leader

application process which manages exchanged messages with the outside world, routing them appropriately to and from the function follower(s) in a coordinated way

3.1.8

function level

hierarchy level to group functions of equal purpose. The first three levels are defined herein under:

1st level function

functional domain that encompasses a set of functions related to a same general focus or service for the considered (rolling stock) system

Note 1 to entry: Example for a 1st level function is:

- Provide appropriate conditions to passengers, train crew and payload.

2nd level function

related to a specific set of activities which contributes to the completion of the functional domain defined at the first level

Note 1 to entry: Examples for a 2nd level function are:

- Provide proper climate.
- Provide passenger information and entertainment.

Note 2 to entry: At this level, it is not said how a 2nd level function is to be implemented.

Note 3 to entry: A specific 2nd level function often is related to an engineering discipline and might be supported by one or a minimum number of subsystems.

Note 4 to entry: Each function at level 2 or level 3 has one or several transverse functions as sub-functions.

3rd level function

related to a specific activity within the related set of interconnected activities, it encompasses a set of tasks

Note 1 to entry: A function at least at level 3 should be supported as much as possible by one single subsystem.

Note 2 to entry: An example for 3rd level function is:

- Provide and support multimedia for passenger entertainment.

Note 3 to entry: Each function at level 2 or 3 has one or several transverse functions as sub-functions.

3.1.9

model

abstraction or representation of some aspect of a system.

3.1.10 multimedia

electronic production, coding/decoding, processing, delivery and consuming of information using a combination of one or more media including video, still images, audio, text in such a way that can be dynamically updated and/or interactively accessed

3.1.11 ontology

structure of concepts or entities within a domain, organized by relationships; a system model

Note 1 to entry: An ontology is a methodology which allows to specify knowledge within a specific domain in terms of concepts and the relationships which occur between them, so as to unambiguously define the meaning of each concept within a certain context. An ontology can be implemented using a semantic formal language which is machine-interpretable, building a model of the knowledge domain which can be automatically processed by computers.

3.1.12 operation

all functions which deal with the safety and regular exploitation of the transportation service

Note 1 to entry: Operational services are related to traction, braking and door management.

3.1.13 requirement

necessary condition or ability to constrain the solutions of a task or an aim

Note 1 to entry: A requirement describes for example, performance characteristics, operational conditions and quality attributes, expressed as measurable and testable technical parameters or indicators.

Note 2 to entry: Requirements are usually summarized in a specification.

Note 3 to entry: Beside requirements allocated to functions there are additional requirements allocated to other features (e.g. design, manufacturing).

The requirements are classified, but not only, into the following categories:

functional requirement

expresses the requirements on a certain functionality

Note 1 to entry: Functional requirements and use cases come from passenger/pay load and operator request rather than from integrator and supplier. They express the requirements on a certain functionality given in the FBS regarding interoperability (with other functions), operation, function/ behaviour, or functional architecture/design constraints.

The functional designation usually is additionally stated more precisely by detail properties, that provide more information referring to reliability, availability, performance, quality, documentation, input, output, real-time.

These higher-level functional goals pointed out for ambient conditions, design features and selected target groups/target objects are "requirements to a function".

system requirement

requirement on a subsystem or device

Note 1 to entry: Requirement on a subsystem or device regarding the requested technical compatibility, reliability, availability, maintainability, environmental impact/conditions (recyclables, emissions, EMC, climate, vibration), LCC, performance, quality, documentation, real-time behaviour, physical limits (dimension, weight), electrical interface (plugs, voltage, physical layer), or mechanical interface (fixing points, fixing method).

3.1.14 service

railways perform (transportation) services which are implemented by means of systems and subsystems

Note 1 to entry: In ICT, a service is a set of one or more functions provided by an application to another one.

Note 2 to entry: A service has some type of underlying computer system that supports the connection offered.

Note 3 to entry: A service provision is based on one or several functions each supported by a system (or subsystem). A service can also reuse other services. A service provider is able to perform a useful task for a service consumer, on request of the latter.

Note 4 to entry: The difference between service and function is blurry: in order to have the correct understanding, the following views are considered: behavioural, structural, external, internal. See Figure 7 for details.

3.1.15

service follower

application process which exchanges messages in a coordinated way with another application process in a SOA environment

3.1.16

service leader

application process in a SOA environment which manages exchanged messages in a coordinated way with other service follower(s)

3.1.17

Service Oriented Architecture

SOA

essentially a collection of services. These services communicate with each other. The communication can involve either simple data passing or it could involve two or more services coordinating some activity. Some means of connecting services to each other is needed

3.1.18

system

set of components organized to accomplish a specific function or set of functions

3.1.19

System Breakdown Structure

SBS

hierarchy of elements which can represent the structure of a system at different levels of detail. Structure here means the organisation of relations among the system constituents

3.1.20

subsystem

part of a larger system and set of elements, a coherent and somewhat independent component of a larger system

Note 1 to entry: A subsystem is a system itself. Therefore, a subsystem can be divided into further subsystems.

Note 2 to entry: A subsystem can be described in terms of functional blocks and interfaces. In a simple case, the functional blocks only exchange data. Often they need a more complex interaction in terms of services.

Note 3 to entry: A (sub)system is generally defined with a view to achieve a given objective.

3.1.21

telematic

applications which allow to seamlessly use remote objects, information or services, accessing them by means of a suitable communication system

Note 1 to entry: Telematics is the science of sending, receiving and storing information via telecommunication devices.

3.1.22

transverse function

function destined for the use together with several level 2 and level 3 functions of the Functional Breakdown Structure (FBS) at the same time

Note 1 to entry: The transverse functions are not part of the FBS but are implicit, for example "provide diagnosis" or "communicate with train bus".

3.1.23**Web Services**

the most likely connection technology of service-oriented architectures, they essentially use XML to create a robust connection

3.2 Abbreviations and acronyms

3G	Third Generation
ASN.1	Abstract Syntax Notation One
ATP	Automatic Train Protection
BD	Blue-ray Disk
CCTV	Closed Circuit Television
CMD	China locomotive remote Monitoring and Diagnosis system
CN	Consist Network
CRH	China Railway High-speed
DOO	Driver Only Operation
DPWS	Device Profile for Web Services
DVD	Digital Versatile Disk
ECN	Ethernet Consist Network
ETB	Ethernet Train Backbone
ETBN	Ethernet Train Backbone Node
FBS	Functional Breakdown Structure
GCG	Ground Communication Gateway
GMTS	Ground Multimedia and Telematic Subsystem
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HMI	Human Machine Interface
ICT	Information and Communication Technology
IEF	Information Exchange Format
IT	Information Technology
LCD	Liquid Cristal Display
LDP	Locomotive on-board general Data monitoring
MCG	Mobile Communication Gateway
MP3	Moving Picture Expert Group-1/2 Audio Layer 3
NOC	Network Operation Centre
OASIS	Organization for the Advancement of Structured Information Standards
OMMS	On board MultiMedia Subsystem
OMTS	On board Multimedia and Telematic Subsystem
OWL	Ontology Web Language
PA	Public Address
PDA	Personal Digital Assistant
PIS	Passenger Information System
RDF	Resource Description Framework
RM	Reference Model
SBS	System Breakdown Structure