# UIC CODE 917-1

4th edition, July 2007

*Original*

**RI**

## Technical provisions for the international interconnected Railway data transmission networks

*Dispositions techniques pour l'interconnexion des réseaux internationaux de transmission de données ferroviaires*
*Technische Vorschriften für den Verbund der internationalen Eisenbahn-Datenübertragungsnetze*

UNION INTERNATIONALE DES CHEMINS DE FER
INTERNATIONALER EISENBAHNVERBAND
INTERNATIONAL UNION OF RAILWAYS

## Leaflet to be classified in Volume:

IX - Information Technology - Miscellaneous

## Application:

With effect from 1 July 2007
All members of the International Union of Railways

## Record of updates

| | |
|---|---|
| **1st edition, January 1972** | First issue and 1 amendment. |
| **2nd edition, July 1997** | |
| **3rd edition, August 2003** | Retyped in FrameMaker.<br>Important: the articles (points) in this leaflet have been renumbered in the new edition. The first digit of each point has been increased by one (i.e. 0 becomes 1, 1 becomes 2, and so on). Please take account of this when using cross-references from other leaflets. |
| **4th edition, July 2007** | Changes due to new technology. New point 5, 6, 7 have been inserted. |

*The person responsible for this leaflet is named in the UIC Code*

# Contents

# Summary

The *UIC Leaflet 917-1* sets out the technical characteristics of an international interconnected data transmission network together with the procedures governing integration of the various national networks in this international interconnected network.

There are several solutions used by the Railways:

1. One solution is based on the *ITU-T X.75 Recommendation*. The set of X.75 configuration values that must be respected in order to achieve international connectivity among data transmission networks is defined. The Leaflet specifies the addressing scheme based on Data Network Identification Codes (DNIC).

2. Another solution is based on Internet Protocol (IP), where MPLS technology is applied. The procedure how the basic MPLS structure and configuration shall be achieved is defined in the Leaflet.

# 1 - Preliminary remarks

**1.1 -** This Leaflet sets out the technical characteristics of international interconnected data transmission networks together with the procedures governing integration of the various national networks in the international interconnected networks.

**1.2 -** The general principles governing the structure and operation of each national railway data transmission network and its general technical characteristics should be harmonised insofar as this harmonisation is essential to its integration in the international system.

**1.3 -** While respecting the independent configuration of national networks, international network links must be developed in accordance with the common rules set out in this leaflet with mandatory or recommendatory status.

**1.4 -** Where there is a reference in this leaflet to a certain standard, this is mandatory only for those networks, where this standard technology is adopted by the railway authorities.

# 2 - Configuration of the networks belonging to the international interconnected X.75 network

**2.1 -** The national nodes connected to the international interconnected railway data transmission network shall use packet switching and shall as a rule be a part of the highest level of the national network. Nodes shall be interconnected in an international interconnected network using *ITU-T X.75 protocol* (see Bibliography - page 13). The parameters of this protocol which apply to the international interconnected railway data transmission network are specified in Appendix A - page 9.

**2.2 -** The nodes in the network shall be capable of guaranteeing at least 99% uninterrupted service - including during maintenance periods - throughout the year on a round-the-clock basis.

**2.3 -** The national nodes shall be identified within the international interconnected network by the Data Network Identification Code (DNIC) (see List of abbreviations - page 12). Appendix B - page 11 lists the DNIC currently assigned to participating railways.

**2.4 -** The nodes and transmission circuits in the international interconnected data transmission network must be capable of transmitting the data flows to and from national subscribers or in transit the data flows to neighbouring national networks. This transmission must function equally well under normal circumstances and when another participating network is downgraded.

# 3 - Configuration of the international interconnected X.75 network

**3.1 -** The routes used normally and alternate routes shall be defined according to the number of nodes, their location and the availability of transmission circuits.

**3.2 -** A map of the international interconnected networks shall be drawn up according to these criteria in agreement with all the railways concerned.

**3.3 -** The number of circuits provided between two nodes shall depend on line speed (throughput) and the volume of data to be handled at peak hours. Operators of participating networks shall be responsible for ensuring that an adequate number of circuits and adequate line speed (throughput) are provided so that information in the international interconnected network will be transmitted smoothly and without disruptions.

**3.4 -** 99% of the time, the transit time through a participant's network for a standard X.25 (see Bibliography - page 13) packet shall not exceed 2 seconds. This time shall be measured between the end of error-free reception of the data packet at the first node of the national network on the transit route and the start of transmission of the same data packet by the last node on the route.

# 4 - X.75 network management

**4.1 -** The network shall be managed by controlling all functions essential to data transit through the network. The SNMP procedure (see List of abbreviations - page 12) can be used for message interchange.

**4.2 -** Each participating railway shall be able to receive SNMP messages.

**4.3 -** Provision has not been made for a participating railway to intervene actively in another railway for control purposes; each railway shall be responsible for ensuring that its operations have a minimum error rate.

**4.4 -** Network servicing and maintenance as well as detection and elimination of interference on international links shall be performed in accordance with the provisions of *UIC Leaflet 917-2* (see Bibliography - page 13) or other agreed regulations. Any interference detected shall be eliminated as quickly as possible, latest till the end of the next working day. The coordination shall be the responsibility of the railway whose network is identified by the lower DNIC. The higher reliability is reached by doubling the nodes, redundancy in transmission link network, etc.

# 5 - Organisation of the international MPLS network

**5.1 -** For operation of the international MPLS (Multi Protocol Label Switching) network an "operating entity" is necessary to fulfil central network operation tasks. This operating entity is also responsible for international MPLS network structure and configuration.

**5.2 -** The local tasks concerning the equipment of the international MPLS network are fulfilled by the "local participant". Between the operating entity and the local participant a contractual relationship has to be established on the basis of this Leaflet.

**5.3 -** The MPLS network services are offered for all Railway related applications. For each application a "virtual private network" (VPN) (see List of abbreviations - page 12) shall be set up.

**5.4 -** The obligations of the operating entity concerning the international MPLS network are:

- Network Operation,
- conducting maintenance of hardware and software,
- conducting trouble shooting,
- periodical reporting.

**5.5 -** The obligations of the local participant concerning the international MPLS network are:

- fulfil the specifications of environment according the prescriptions of the manufacturer,
- uninterrupted power supply (UPS - see List of abbreviations - page 12),
- local helpdesk,
- first level support (knowledge of basic skills).

# 6 - Structure of the international MPLS network

**6.1 -** The Network Management Centre (NMC) (see List of abbreviations - page 12) is situated in a location of the operating entity, the routers and related equipment are situated in locations of the local participants.

**6.2 -** The links of the international MPLS network shall be agreed among the participants under consideration of the reports of the NMC concerning the respective workload of the links.

**6.3 -** The configuration parameters to be defined by the operating entity are:

- possible types of routers including memory capacities and software version,
- possible types of interfaces including MTU (Maximum Transmission Unit - see List of abbreviations - page 12).

**6.4 -** The "basic configuration file" is provided by the operating entity and sent to the local participants.

**6.5 -** The operating entity and local participant shall agree about IP address scheme (see List of abbreviations - page 12) for VPN .

# 7 - MPLS network management

**7.1 -** The network shall be managed by the NMC controlling all functions essential to data transit through the network. Any interference detected shall be eliminated as quickly as possible according to the application needs and the concluded contracts.

**7.2 -** Installation of routers, links, VPNs etc is conducted by the NMC.

**7.3 -** Necessary intervention of a local participant within the frame of first level support will be indicated by the NMC.

**7.4 -** The local participants can have access to the respective data of the NMC concerning a passive overview of their topological area and/or the VPNs in which they are included.

# Appendix A - Definition of X.75 interconnection parameters

### Link parameters (X.75, level 2)

| | |
|---|---|
| Level 2 node address (STE-A [03], STE-B [01]) | to be agreed bilaterally[a] |
| Frame retransmission timer T1 (in sec) | 3 |
| Packet sequence numbering | mod. 8 |
| Window size | 7 |
| Max. number of transmission attempts of a frame N2 | 3 |

a. for new links:
- STE-A.... lower DNIC
- STE-B.... higher DNIC

### Access parameters (X.75, level 3)

| | |
|---|---|
| Level 3 access addresses | DNIC + subscriber address |
| Window size | 2 |
| Packet sequence numbering | mod. 8 |
| Number of logical channels (SVC, bidirectional) | $n_{svc} \geq 10$ |
| Use of logical channel 0 | no |
| Logical channels search direction | STE-A: 1 → / STE-B: ← $n_{svc}$ |
| Default packet size (octet) | 128 |
| Maximum packet size (octet) | ≥ 256 |
| Throughput class | ≥ 9 600 |
| Number of repetitions for: Clear, Restart, Reset | 1 |

**Facilities**

*yes = absolutely required*
*opt = optional*
*no = not required*

| | |
|---|---|
| Fast select | yes |
| D-bit modification | yes |
| Interrupt packet | yes |
| Window size negotiation | yes |
| Packet size negotiation | yes |
| International Closed User Group (CUG) | yes |
| Transit network identification | yes |
| Display clearing network | yes |
| Clearing network identification code | yes |
| Throughput class negotiation | opt |
| Call identification (identifier) | opt |
| Called line address modified notification | opt |
| Selection of transit delay | no |
| Display of transit delay | no |
| Charging information | no |

# Appendix B - Addressing for X.75 network

### Data Network Identification Code (DNIC)

| Railway | DNIC | According to *UIT-T X.121* (see Bibliography - page 13) |
|---|---|---|
| CD | 2307 | yes |
| DB/AG | 2653 | yes |
| FS | 1999 | no |
| MAV | 2167 | yes |
| NS | 2951 | no |
| ÖBB | 1006 | no |
| PKP | 2606 | yes |
| SBB | 2286 | yes |
| SNCB | 2075 | yes |
| ZSR | 2317 | yes |

# List of abbreviations

| | |
|---|---|
| **DNIC** | Data network identification codes |
| **IP** | Internet protocol |
| **MPLS** | Multi protocol label switching |
| **MTU** | Maximum Transmission unit |
| **NMC** | Network management centre |
| **SNMP** | Simple Network Management Protocol |
| **UPS** | Uninterrupted power supply |
| **VPN** | Virtual private network |

# Bibliography

## 1. UIC leaflets

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*UIC Leaflet 917-2: Maintenance of the international railway data transmission network for use by the railways,* 3rd edition, May 2004

## 2. International standards

**International Telecommunication Union (ITU)**
*ITU-T recommendation X.25: Interface between Data Terminal Equipment (DTE) and Data Circuit-terminating Equipment (DCE) for terminals operating in the packet mode and connected to public data networks by dedicated circuit,* October 96

*ITU-T recommendation X.75: Packet-switched signalling system between public networks providing data transmission services,* October 96

*ITU-T recommendation X.121: International numbering plan for public data networks,* October 2000

## Warning



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