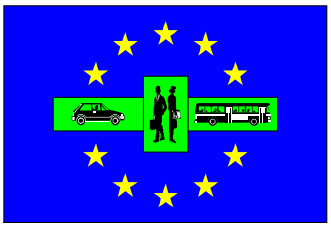

European ITS Framework Architecture

-

Communication Architecture

Annex 1 - Supporting information for Communications Analysis

Annex 1 of D3.3 - Issue 1

August 2000

This public report has been produced by the KAREN (Keystone Architecture Required for European Networks) project, as part of the 4th Framework Programme - Telematics Application Programme – road sector.

KAREN partners contributing to this report are:

AEROSPATIALE MATRA
ALCATEL AUSTRIA
ERTICO
EXPERTEL – GROUP FRANCE TELECOM
MANNESMANN PASSO
SIEMENS TRAFFIC CONTROLS LIMITED
ISIS

Document control sheet

Activity name: KAREN

Work area: Framework Architecture Development - WP3

Document title: Communication Architecture

Document number: D3.3 - Annex 1

Electronic reference:

Editor: R.A.P. Bossom (STCL)

Main author(s): M. Büter (Mannesmann Passo), G. Fraigneau (FT Expertel), J-F Gaillet (ERTICO), T. Peson (Aerospatiale Matra), M. Szvetits (Alcatel Austria)

Dissemination level[1]: Public usage

Version history:

Version number	Date	Editor	Summary of changes
Issue 1	August 2000	R.A.P. Bossom	Final Public Issue

Approval:

	Name	Date
Prepared	*Richard Bossom*	*August 2000*
Reviewed	*Gino Franco*	*August 2000*
Authorised	*Jan Willem Tierolf*	*August 2000*

Circulation:

Recipient	Date of submission
CEC	August 2000

[1] This is either: Restricted (to the programme, to the activity partners) or for Public usage

Table of Contents

Tables

Executive Summary

This Document contains the first Annex to the Main part of European ITS Framework Architecture Deliverable Document D 3.3, which provides a description of the European ITS Communication Architecture. It provides additional and supporting information to the Main Document. This information comprises a list of European ITS User Needs that are concerned with communications, and tables of data that were used to produce some of the results in the Main Document.

1 Introduction

1.1 Purpose

This Document provides the first Annex to the main part of European ITS Communications Architecture Deliverable Document D 3.3, which provides a description of the European ITS Communication Architecture. This Annex Document includes additional and supporting information to the Main Document. It contains a list of User Needs that are concerned with communications, and tables of data that were used to produce some of the results in the Main Document.

1.2 Where the document fits in the Architecture Documentation

The document is one of a set of two Annexes to the main European ITS Framework Architecture Communications Architecture Deliverable Document (D 3.3). The other Annex in the set is:

D3.3, Annex 2 - Communications Architecture - Details of ITS related Communications Technologies

1.3 Document Structure

This Annex Document has been divided into three Chapters, that follow this one. They provide information and data supporting the analysis of "example Systems" in the Main Document.

The following Chapter (2) provides a description of the KAREN User Needs that are relevant to Communications, and is followed by a Chapter (3) containing tables of physical data flow characteristics. The data in this second Chapter has been used to produce the analysis of the "example Systems" shown in Chapter 6 of the Main Document.

1.4 Abbreviations

The following abbreviations have been used in this Document and their meanings may not be included in the adjacent text.

MFO	Multi-Function Outstation
RDS-TMC	Radio Data System – Traffic Message Channel

Many abbreviations have been used in the tables that are provided in section 3.2. They show the data that has been used as the input for the analysis of the communications requirements for several of the "example Systems" in the KAREN Physical Architecture – see references in Chapter 8. Any abbreviations in these tables that are not included above are defined in the table contained in section 3.1.

2 Specific User Needs Regarding Communication

The following table presents an extract of the KAREN User Needs. They are taken from Appendix E in the KAREN User Needs Deliverable Document (D3.1). It shows the User Needs identified by KAREN that concern communications.

Table 1 Specific User Needs Regarding Communication

Allocation within KAREN User Needs				
Group		Category		Reference Number
Number	Name	Number	Name	
2	Management Activities	2.1.1	Information Management	2.1.1.2
		2.2	Infrastructure Maintenance Management	2.2.0.5
		2.2.3	Maintenance Units	2.2.3.1
3	Policing/Enforcing	3.1	Policing/Enforcing Traffic Regulations	3.1.0.5
4	Financial Transactions	4.1.3	Transaction	4.1.3.1
5	Emergency Services	5.1	Emergency Notification and Personal Security	5.1.0.6
6	Travel Information	6.1.3	Traveller Interaction	6.1.3.9
		6.2.3	Traveller Interaction	6.2.3.4
		6.4.2	Traveller Interaction	6.4.2.3
7	Traffic Management	7.1	Traffic Control	7.1.0.7
		7.1.3	Traffic Control Centres	7.1.3.1
		7.1.8	Roadside-Vehicle Communications	7.1.8.1
		7.2	Incident Management	7.2.0.5
		7.2.1	Emergency Services	7.2.1.3
8	In-Vehicle Systems	8.2.4	Short Range Communications	8.2.4.1
		8.2.5	Speed Control	8.2.5.2
9	Freight and Fleet Operation	9.1	Commercial Vehicle Pre-Clearance	9.1.0.3
		9.2	Commercial Vehicle Administrative Processes	9.2.0.2
		9.3	Automated Roadside Safety Inspection	9.3.0.1
		9.4	Commercial Vehicle On-Board Safety Monitoring	9.4.0.3

Allocation within KAREN User Needs				
Group		Category		Reference Number
Number	Name	Number	Name	
				9.4.0.4
		9.5.1	Road Freight Management	9.5.1.1
				9.5.1.2
				9.5.1.4
				9.5.1.5
				9.5.1.6
				9.5.1.7
				9.5.1.8
		9.5.2	Road Freight Fleet Management	9.5.2.7
				9.5.2.11
				9.5.2.13
				9.5.2.14
		9.5.3	Road Vehicle, Driver, Equipment and Cargo Management	9.5.3.3
				9.5.3.4
				9.5.3.5
				9.5.3.6
				9.5.3.7
				9.5.3.11
				9.5.3.14
				9.5.3.17
				9.5.3.20
				9.5.3.19
10	Public Transport	10.1.5	Communications	10.1.5.1
		10.2.2	Communications	10.2.2.1
				10.2.2.2
		10.5	Public Travel Security	10.5.0.2

3 Data used in the analysis of "example Systems"

3.1 Introduction

The table below provides a description of the characteristics and requirements for communication links. The contents of this table have been used to examine the physical flows in those "example Systems" in the KAREN Physical Architecture that have been analysed in the Communications Architecture – see Main Document (D 3.3). Full details of each "example System" will be found in the European ITS Physical Architecture Deliverable Document (D 3.2) – see reference 4(c). The characteristics and requirements of each link are analysed and described in Chapter 6 of the Main Document (D 3.3).

Table 2 Identities of Terms used in Communications Link Analysis

Item	Sub-Item	Values	Description
Link Number		I.x; T.x	x is used to number flows from 1 to … in sequence. I and T sand for Internal and Terminator.
Example System	Number	Pn	Same numbering as used for the physical architecture.
	Name		Name of the System (same as that used in the physical architecture).
Physical Data Flow Name			Either the name of the main data flow (sub-system level) or the name of the sub data flows (module level), as in the physical architecture.
Source	Location (Loc)	R, V, C, T, K	R, V, C and T stand for R(oadside), V(ehicle), C(entral), T(raveller), K(iosk) These are locations defined in the physical architecture.
	Potential Number	1, 2, 5, 10, 100, 1000, 10000, etc.	Order of magnitude of the total potential number of communicating parties which may require to be connected to the network.
Sink	Location (Loc)	R, V, C, T, K	R, V, C and T stand for R(oadside), V(ehicle), C(entral), T(raveller), K(iosk) These are locations defined in the physical architecture.
	Number per session (NpS)	1, 2, 5, 10, 100, 1000, 10000, etc.	Order of magnitude of the number of sinks which receive the same message on a broadcast or multi-point session. NB. If several sources sending messages to the same user or group of user, there is one session for each source.

Item	Sub-Item	Values	Description
	Potential Number (PN)	1, 2, 5, 10, 100, 1000, 10000, etc.	Order of magnitude of the total potential number of communicating parties which may require to be connected to the network.
Configuration	Type (Tp)	*x-y*	*x* and *y* are chosen among p, m, and b. p = point; m = multipoint; b = broadcast. Hence p-m = point to multipoint configuration. This means that during a session the *same message* is received simultaneously from one point to several point.
	Connectivity (Con)	Wl, Wd, E	Wl = wireless link required; wd = wired link required; e = either.
	Range (Ra)	Site, Loc, Met, Long	(On-)Site: sink and source are on the same physical sites Loc(al): sink and source are at close range (e.g. same road) (Met)ropolitan: sink and source are in the same agglomeration, or same region. Long: sink and source are connected over a long distance (e.g. national, international).
Quantification	Frequency (Freq)	ms, cs, ds, min, h, d, w, mth, y	Typical frequency of sessions per single links (order of magnitude, e.g. s = several times per second). (ms = millisecond, cs = centisecond, ds = decisecond, s = second, min = minute, h = hour, d = day, w = week, mth = month, y = year)
	Number of Sessions (NS)	1, 2, 5, 10, 100, 1000, 10000, etc. Or Z – Y	Order of magnitude of the number of simultaneous sessions. Z - Y : in case several sources and several sinks are communicating simultaneously, the Z – Y notation is used where Z is the total number of sources and Y the total number of sinks.
	Duration (Dur)	ms, cs, ds, min, h, d, w, mth, y	For a data transfer: maximum acceptable duration. For an interactive exchange: typical duration of the exchange. (ms = millisecond, cs = centisecond, ds = decisecond, s = second, min = minute, h = hour, d = day, w = week, mth = month, y = year)
	Latency (Lat)	ms, cs, ds, s, min, h, d, w, mth, y	The order of magnitude of the acceptable latency of the communication (ms = millisecond, cs = centisecond, ds = decisecond, s = second, min = minute, h = hour, d = day, w = week, mth = month, y = year).
	Volume (Vol)	B, KB, MB, GB, TB	Order of magnitude for typical sessions. Bytes, KiloBytes, MegaBytes, GigaBytes, TeraBytes

Item	Sub-Item	Values	Description
Security		*l*A(*x*), *l*I, *l*C	A(x) = Authentication required where x is/are the party which authenticates its identity (possible values for x: Sr; Sk; Sr,Sk). E.g. A(Sr,Sk), source and sink needs to authenticate their identity before transmission. I = Data integrity. The integrity of data cannot be altered (by chance or on purpose) without the system noticing it. 'I' indicate that special algorithms such as signed message digests must be available. C = Confidentiality. Prevents a third party to overhear the communication. Encryption means must be available to protect data against disclosure. *l* = Level of strength needed (H = High, M = Medium, L = Low). Symbols may be combined. E.g. HA(A)/LC: low confidentiality must be insured and end 'A' authenticated with strong mechanisms. Robustness was not considered. Flows supporting emergency and safety matters automatically call for robustness, this will be added in comments. Other cases of robustness requirements are based on an economical choice depending on the level of service which the provider wants to achieve. This is not part of this analysis.
Data	Type	Text, Audio, Video, Photo, Graphic, Animation, Multimedia, Raw data	Text: simple formatted text; Audio: simple audio record; Video: video record – no sound; Graphic: image which can be reconstructed out of a couple of data. Photo: still image; Animation: the image is not completely still some parts may be animated (moving icon for instance). Multimedia: the choice of the actual type is up to the application design. Raw data : formatted messages, queries, security data, etc. For physical transfer, a 'p' is put in front of the type (e.g. pText: physical transfer of Text). A combination of several type is possible (e.g. Audio/Video).
Comments			Definition of the session when needed, Comparable physical data flows, remarks on the way values were chosen, hypothesis, reason for not giving a value, etc.

3.2 Analysis tables for “example Systems”

The following pages show the tables of data that have been created for some of the “example Systems” in the KAREN Physical Architecture. This data has been used as input to the analysis of the characteristics of the major physical links in each “example System”. The results of the analysis on each “example System” will be found in the main part of this Document (D 3.3).

Tables of data have been prepared for analysis of the major links in the following “example Systems”:

- P1 Integrated Urban Traffic and Public Transport Management
- P2 - RDS-TMC Italian System
- P3 - Urban Traffic Control and Public Transport Priority System
- P10 - Electronic Cash Transaction
- P30 - Urban Traffic Management System
- P31 – Inter-urban Traffic Management System

Definitions of the symbols that have been used in the table headings and some of the entries are given in the table on the previous pages.

Table 3 P1 - Integrated Urban Traffic and Public Transport Management

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
Internal Flows																	
	iopttis_ additional_ traffic_data	C	1	C	1	1	p-p	Wd	Long	1	h	s	s	kB		Raw Data and Text	
	iopttis_ collected_ nat_ internat_ traffic_data	C	1	C	1	1	p-p	Wd	Long	1	min	s	s	kB		Raw Data and Text	
	iopttis_ additional_ local_traffic_data	C	1	C	1	1	p-p	Wd	Met	1	min	s	s	kB		Raw Data and Text	Considering a network linking 10 metropolitan areas, each including 10 cities each having its local sub-system
	iopttis_ collected_ local_traffic_ data	C	1	C	1	1	p-p	Wd	Met	1	min	s	s	kB		Raw Data and Text	

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	iopttis_ service_ request	C	1	C	1	1	p-p	Wd	Met	1	min	s	s	B		Raw Data	Several operators can be imagined for one city, but one operator could serve several cities Several thousands connections could be performed in one day.
	iopttis_ service_ required	C	1	C	1	1	p-p	Wd	Met	1	min	s	s	kB		Raw Data and text	Several operators can be imagined for one city. Several thousands connections could be performed in one day.
	iopttis_ traffic_ services_ to_be_ transmitted	C	1	C	1	1	p-p	E	Met	1	min	s	s	kB		Raw Data and text	Several thousands connections could be performed in one day. Here we presume that P1.1 and the communications management in P1.5 are located in near places.

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	iopttis_ request_ for_info	C	1	C	1	1	p-p	E	Met	1	min	s	s	B		Raw Data and text	Several thousands connections could be performed in one day. Here we presume that P1.1 and the communications management in P1.5 are located in near places.
	iopttis_ traffic_data	C	1	C	1	1	p-p	Wd	Long	1	min	s	s	kB		Raw Data	Considering a network linking 100 cities
	iopttis_ collected_ traffic_data	C	1	C	1	1	p-p	Wd	Met	1	min	s	s	kB		Raw Data	
	iopttis_info_ to_traveller	C	1	K	10	1	p-pm	E	Met	1	min	s	s	kB		Raw Data and Text	For one user terminal : one communication every minute or so.
	iopttis_ traveller_ request	K	10	C	1	1	p-p	E	Met.	1	min	s	s	B		Raw Data	For one user terminal : one communication every minute or so.

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
Terminator Flows																	
	trrs_ service_ request	C	1	C	10	1	p-p	Wd	Long	1	min	s	s	kB		Raw Data and Text	
	frrs_ service_ required	C	10	C	1	1	p-p	Wd	Long	1	min	s	s	kB		Raw Data and Text	
	frrs_ collected_ nat_ internat_ traffic_data	C	10	C	1	1	p-p	Wd	Long	1	min	s	s	kB		Raw Data and Text	
	trrs_ collected_ local_ traffic_data	C	1	C	10	1	p-p	Wd	Long	1	min	s	s	kB		Raw Data and Text	Each city system communicates with adjacent cities
	frrs_ collected_ local_ traffic_data	C	10	C	1	1	p-p	Wd	Long	1	min	s	s	kB		Raw Data and Text	Each city system communicates with adjacent cities

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	fo.tio_ service_ configuration	C	10	C	1	1	p-p	MMI	Site	1	min	s	s	B		Raw Data and Text	MMI
	frrs_basic_ traffic_data	C	10	C	1	1	p-p	Wd	Long	1	min	s	s	kB		Raw Data	Each city system communicates with adjacent cities : the potential numbers correspond to the number of interfaced systems for one city.
	tt_traffic_ info_ services	R	10	T	10^6	10^6	p-mbp	MMI	Met	1	min	s	s	kB		Raw Data and Text	MMI
	ft_traffic_ info_ services_ request	T	10^6	R	10	1	p-p	MMI	Met	1	min	s	s	kB		Raw Data and Text	MMI
	tt_traffic_ services	K	10	T	10^6	1	p-p	MMI	Site	1	min	s	s	kB		Raw Data and Text	MMI

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	ft_request_ for_services	T	10^6	K	10	1	p-p	MMI	Site	1	min	s	s	kB		Raw Data and Text	MMI

Table 4 P2 - RDS-TMC Italian System

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
Internal Flows																	
	rdstmci_ traffic_data	C	1	C	1	1	p-p	Wd	Site	1	NA	cs	micros	B		Raw Data	
	rdstmci_ collected_ data	C	1	C	1	1	p-p	Wd	Site	1	NA	cs	micros	B		Raw Data	
	rdstmci_ validated_ data	C	1	C	1	1	p-p	Wd	Site	1	NA	cs	micros	B		Raw Data	
	rdstmci_ broadcasted_ data	C	1	C	1	1	p-p	Wd	Site	1	s	cs	micros	B		Raw Data	Supposing that only part of the information is provided to the service provider.
Terminator Flows																	
	frrs_ns_ traffic_data	C	10	C	1	1	p-p	Wd	Long	1	NA	s	s	B		Raw Data and text	Size could be some tens of kB.
	frrs_s_ traffic_data	C	10	C	1	1	p-p	Wd	Long	1	min	s	s	B		Raw Data	Size could be some tens of kB.

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	tesp_traffic_data	C	1	C	10	1	p-p	Wd	Long	1	min	s	s	B		Raw Data	
	flds_db_info	C	1	C	1	1	p-p	Wd	Site	1	y	d	NA	MB		Raw Data and graphics	Assuming the maps are changed only on a weekly basis.
	to.rno_monitored_data	C	1	C	1	1	p-p	MMI	Site	1	s	s	s	B		Graphics	MMI
	fo.rno_validation_criteria	C	1	C	1	1	p-p	MMI	Site	1	s	s	s	B		Raw Data	MMI
	tesp_traffic_info	C	1	C	1	1	p-p	E	Long	1	s	s	s	B		Raw Data	Assuming only part of traffic information is provided to the external service provider.

Table 5 P3 - Urban Traffic Control and Public Transport Priority System

Link Num.	Physical Data Flow																Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
Internal Flows																	
	utcptp_ local_ traffic_data	R	100	C	1	1	p-p	Wd	Met	1	min	s	s	B	MDI	Raw Data	We suppose here that the traffic information update rate is around 1minute, and consider 100 intersections linked directly with the central system (and a total of 1000 equipped intersections). For one intersection, 1 message generated every minute or so, so for one linked intersection : 1 every few seconds.
	utcptp_ control_ criteria	C	1	R	100	1	p-p	Wd	Met	1	min	s	s	B	MDI	Raw Data	Supposed to be updated at a slower rate than traffic information
	utcptp_ other_app_ data	R	100	C	1	1	p-p	Wd	Met	1	min	s	s	B	MDI	Raw Data	

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	utcptp_pt_priority_request	C	1	R	100	1	p-p	Wd	Met	1	s	s	s	B	A(So)/MDI	Raw Data	Supposing that the message is only sent to the crossroads were the PT vehicle is to pass. Considers multiple PT vehicles going at the same time.
	utcptp_local_fault_diagnosis	R	100	C	1	1	p-p	Wd	Met	1	s	s	s	B	MDI	Raw Data	Assuming this message is sent only in case of problem.
	utcptp_local_app_data	C	1	R	100	1	p-p	Wd	Met	1	s	s	s	B	MDI	Raw Data	Could be sent simultaneously to several MFOs.
	utcptp_other_application_data	R	1	R	10	1	p-p	Wd	Loc	1	s	s	s	B	MDI	Raw Data	Message size could be much smaller. Number of simultaneous messages relates to the total number for the system. For one MFO, could be several messages at the same time if more than one application installed, but not all intersections equipped.

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	utcptp_loc_other_app_data	R	10	R	1	1	p-p	Wd	Loc	1	min	s	s	B	MDI	Raw Data	Message size could be much smaller. Number of simultaneous messages relates to the total number for the system. For one MFO, could be several messages at the same time if more than one application installed, but not all intersections equipped.
	utcptp_loc_faulty_component	R	10	R	1	1	p-p	Wd	Loc	1	s	s	s	B	MDI	Raw Data	Sent only in case of problem
	utcptp_actuation_commands	R	1	R	10	1	p-p	Wd	Loc	1	s	ds	ds	B	MDI	Raw Data	
	utcptp_special_local_pri_req	R	10	R	1	1	p-p	Wd	Loc	1	s	ds	ds	B	HDI	Raw Data	Number of simultaneous messages is for the whole system. For one intersection, less than 5.

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	utcptp_ roadside_ traffic_data	R	10	R	1	1	p-p	Wd	Loc	1	s	ds	ds	B		Raw Data	Number of simultaneous messages is for the whole system.
	utcptp_pt_ pri_req	R	1	R	10	1	p-p	Wd	Loc	1	s	s	s	B	MDI	Raw Data	Supposing a mean of 10 intersections linked to each node.
	utcptp_ control_ plans	R	1	R	10	1	p-p	Wd	Loc	1	min	s	s	B	MDI	Raw Data	Supposing an update rate of a few seconds for the strategy.
	utcptp_ other_local_ traffic_data	R	10	R	1	1	p-p	Wd	Loc	1	s	s	s	B		Raw Data	
	utcptp_ other_local_ fault_ diagnosis	R	10	R	1	1	p-p	Wd	Loc	1	s	s	s	B	MDI	Raw Data	Frequency for one given source MFO
	utcptp_ local_faults	C	1	C	1	1	p-p	Wd	Site	0	min	s	s	kB	MDI	Raw Data	Not found
	utcptp_ archived_ traffic_data	C	1	C	1	1	p-p	Wd	Site	0	min	s	s	kB	MDI	Raw Data	Not found

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	utcptp_ parameters	C	1	C	1	1	p-p	Wd	Site	0	min	s	s	kB	MDI	Raw Data	Not found
	utcptp_ faults_ sensors	R	10	R	1	1	p-p	Wd	Loc	1	s	ds	ds	B	MDI	Raw Data	Frequency for one MFO
	utcptp_ faults_ other_app	R	10	R	1	1	p-p	Wd	Loc	1	s	ds	ds	B	MDI	Raw Data	Frequency for one MFO
	utcptp_ faults_ traffic_lights	R	10	R	1	1	p-p	Wd	Loc	1	s	ds	ds	B	MDI	Raw Data	Frequency for one MFO
Terminator Flows																	
	trrs_other_ app_data	C	1	C	10	1	p-m	Wd	Met	1	min	s	s	kB	MDI	Raw Data	
	frrs_ control_ strategy	C	1	C	1	1	p-p	Wd	Met	1	min	s	s	kB	MDI	Raw Data	Size could be much reduced if messages consisting only of the identifier of the strategy to implement
	frrs_pt_ priority_ request	C	5	C	1	1	p-p	Wd	Met	1	s	s	s	B	A(So)	Raw Data	

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	frrs_other_app_data	C	10	C	1	1	m-p	Wd	Met	1	s	s	s	B	MDI	Raw Data	
	trrs_road_network_status	C	1	C	1	1	p-p	Wd	Met	1	min	s	s	kB		Raw Data	
	trrs_other_faults_is	C	1	C	10	1	p-m	Wd	Met	1	min	s	s	kB	MDI	Raw Data	
	fo_parameters	C	1	C	1	1	p-p	MMI	Site	1	NA	s	s	B	A(So)/MDI	Raw Data	MMI : data entered manually by the operator. Update rate : about 5 minutes
	to_equipment_diagnosis	C	1	C	1	1	p-p	MMI	Site	0	min	s	s	kB	MDI	Raw Data or Text and Graphics	MMI
	to_road_network_status	C	1	C	1	1	p-p	MMI	Site	0	min	s	s	kB	MDI	Raw Data and Graphics	MMI
	td_traffic_signal_outputs	R	100	T	10^6	10	p-b	phys.	Loc	100	s	ds	ds	B		Physical	Represents the traffic lights colour

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	tt_signal_ outputs	R	100	T	10^6	10	p-b	phys.	Loc	100	s	ds	ds			Physical	Represents the traffic lights colour
	tt_traffic_ info	R	100	T	10^6	10	p-b	MMI	Loc	100	s	ds	ds	B		Text	Represents a text displayed to the traveller
	ft_special_ pri_req	T	10	R	1	1	p-p	MMI	Loc	1	min	ds	ds	B		Raw Data	Represents the action made by the traveller to ask for priority. Number of simultaneous sessions corresponds to the whole system. A few messages could be transmitted at the same time for a given intersection.
	ftrfc_traffic_ data	T	100	R	1	1	p-p	phys.	Loc	1	ms	ms	ms	B		Raw Data	Represents the detection of passing cars by the sensors, achievable via different means (induction loops, radar, weight sensors, …).

Table 6 P10 - Electronic Cash Transaction

Link Num.	Physical Data Flow																Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
Internal Flows																	
	efc_pass_ input_1	K	10^3	T	10^6	1	p-p	?	Loc	10^3	min	s	s	kB	A(Sr,Sk) / HDI / HC	Raw Data and Text	Connection could be physical (magnetic card), via a connecting device (plug), or a remote link. Frequency relates to one kiosk. For one user : one per month.
	efc_pass_ output_1	T	10^6	K	10^3	1	p-p	?	Loc	10^3	min	s	s	kB	A(Sr,Sk) / HDI / HC	Raw Data and Text	Connection could be physical (magnetic card), via a connecting device (plug), or a remote link. Frequency relates to one kiosk. For one user : one per month.
	efc_pass_ output_2	T	10^6	K	10^3	1	p-p	?	Loc/ Long	10^3	min	s	s	B	A(Sr,Sk) / HDI/HC	Raw Data	Sink could be central, roadside or kiosk. Connection depends on this. Long distance is possible in case of central system reached via a network. Frequency relates to the provide service sub-system

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	efc_pass_ input_2	K	10^3	T	10^6	1	p-p	?	Loc/ Long	10^3	min	s	s	B	A(Sr,Sk) / HDI/HC	Raw Data	Source could be central, roadside or kiosk. Connection depends on this. Long distance is possible in case of central system reached via a network. Frequency relates to the Provide service sub-system
	efc_ transaction_ information	K	10^3	C	1	1	p-p	?	Loc/ Long	1	s	min	min	B	A(Sr,Sk) / HDI/HC	A(Sr,Sk) / HDI/HC	Source could be central, roadside or kiosk. Connection depends on this.
Terminator Flows																	
	tfc_financial_ request	K	10^3	C	10	1	p-p	E	Long	10^3	min	s	s	kB	A(Sr,Sk)/ HDI/HC	Raw Data	
	ffc_financial_ status	C	10	K	10^3	1	p-p	E	Long	10^3	min	s	s	B	A(Sr,Sk)/ HDI/HC	Raw Data	

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	tt_contract_details	K	10^3	T	10^6	1	p-p	MMI	Loc/ Long	10^3	min	s	s	kB		Text	Several messages of similar sizes sent in a short period (session). The frequency relates to the time between two sessions from one kiosk. The number of simultaneous sessions to the total number of sessions for all the kiosks at the same time. System could be central, in this case connection via PC.
	ft_contract_requests	T	10^6	K	10^3	1	p-p	MMI	Loc/ Long	10^3	min	s	s	B		Raw Data	Several messages of similar sizes sent in a short period (session). The frequency relates to the time between two sessions from one kiosk. The number of simultaneous sessions to the total number of sessions for all the kiosks at the same time. System could be central, in this case connection via PC

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	tt_guide_ transaction	K	10^3	T	10^3	1	p-p	MMI ?	Site/ Long	10^3	min	s	s	kB		Text	Sub-system location could be K, R or C. Several messages of similar sizes sent in a short period (session). The frequency relates to the time between two sessions from one sub-system. The number of simultaneous sessions to the total number of sessions for all the sub-systems at the same time. System could be central, in this case connection via PC

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	ft_specify_ transaction	T	10^3	K	10^3	1	p-p	MMI ?	Site/ Long	10^3	min	s	s	B	A(Sr,Sk)/ HDI/HC	Raw Data	Sub-system location could be K, R or C. Several messages of similar sizes sent in a short period (session). The frequency relates to the time between two sessions from one sub-system. The number of simultaneous sessions to the total number of sessions for all the sub-systems at the same time. System could be central, in this case connection via PC
	fo_ charging_ data	C	10	K	10^3	10^3	p-m	E	Long	1	w	min	min	MB	A(Sr,Sk)/ HDI/HC	Raw Data and Text	Supposing this corresponds to the updating of the whole data-base. Could be much reduced if only updates of some fields.
	fv_detect	V	10^6	R	10^3	1	b	phys ical	Loc	1	s	s	s	B		Raw Data	Physical interface : vehicle detected by "signature" (weight, radar, infra-red, induction loop …)

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	td_guide_ transaction	K	10^3	V	10^6	1	p-p	MMI ?	Site/ Long	10^3	min	s	s	kB		Text	Sub-system location could be K, R or C. Several messages of similar sizes sent in a short period (session). The frequency relates to the time between two sessions from one sub-system. The number of simultaneous sessions to the total number of sessions for all the sub-systems at the same time. System could be central, in this case connection via PC

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	fd_specify_ transaction	V	10^3	K	10^3	1	p-p	MMI ?	Site/ Long	10^3	min	s	s	B	A(Sr,Sk)/ HDI/HC	Raw Data	Sub-system location could be K, R or C. Several messages of similar sizes sent in a short period (session). The frequency relates to the time between two sessions from one sub-system. The number of simultaneous sessions to the total number of sessions for all the sub-systems at the same time. System could be central, in this case connection via PC
	fesp_ charging_ data	C	10	K	10^3	10^3	p-m	E	Long	1	w	min	min	MB	A(Sr,Sk)/ HDI/HC	Raw Data and Text	Supposing this corresponds to the updating of the whole data-base. Could be much reduced if only updates of some fields.
	tesp_ statistics	C	1	C	10	1	p-p	E	Long	1	w	min	min	kB	A(Sr,Sk)/ HDI/HC	Raw Data and Graphics	

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
	fesp_ request_ information	C	10	C	1	1	p-p	E	Long	1	w	s	s	B	A(Sr,Sk)	Raw Data	
	to_statistics	C	1	C	10	1	p-p	E	Long	1	w	min	min	kB	A(Sr,Sk)/ HDI/HC	Raw Data and Graphics	
	fo_request_ information	C	10	C	1	1	p-p	E	Long	1	w	s	s	B	A(Sr,Sk)	Raw Data	
	tfc_request_ financial_ transfer	C	1	C	10	1	p-p	E	Long	10	min	s	s	kB	A(Sr,Sk)/ HDI/HC	Raw Data	

Table 7 P30 - Urban Traffic Management System

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
Internal Flows																	
I.30.1	utm_ central_ data	C	1	R	300	1	p-p	E	Met	300	s	s	s	B	MI	Raw Data	Authentication of source could be required to prevent an attacker to take control of the system. This would be too much expensive compared to the prize and would need to much knowledge about the system. The risk is very low. The risk that data does not arrive at the appropriate point must absolutely be avoided.
I.30.1.1	utm_traffic_ management _data	C	1	R	300	1	p-p	E	Met	300	s	s	s	B	MI	Raw Data	Same as above

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
I.30.2	utm_ roadside_ data	R	400	C	400	1	p-p	E	Met	400	s	s	s	KB or MB	HA(Sr) / HDI/lC	Raw Data + Video Images	Very heterogeneous because of law enforcement data (e.g. security requirements only due to them)
I.30.2.1	utm_traffic_ flow_data	R	300	C	1	1	p-p	E	Met	300	s	s	s	B	LI	Raw Data	-
I.30.2.2	utm_ equipment_ monitor_ data	R	300	C	1	1	p-p	E	Met	300	s	s	s	B	LI	Raw Data	
I.30.2.3	utm_ equipment_ fault_data	R	300	C	1	1	p-p	E	Met	300	s	s	min	B	LI	Raw Data	

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
I.30.2.4	utm_law_ enforcement _data	R	100	C	1	1	p-p	E	Met	100	min	min	min	MB	HA(Sr)/ HI/LC	Video /photo /raw data	Session: send data about one vehicle Frequency: users require that law enforcement can be achieved in a very short time frame. Volume: photo of the vehicle, even video can be used. Depends on violation Raw data: road status, measures (speed, weight).
I.30.3	utm_local_ vehicle_ priority	V	10	R	1	1	p-b	Wl	Loc	1	s	ds	ds	B	HA(Sr)	Raw Data	Not more than 10 vehicles are suppose to communicate at the same time. The vehicle generates the data using a pre-programmed device which has anti-tamper features.
Terminator flows																	

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
T.30.esp.1	To External Service Provider	C	1	C	1~10	1	p-p	Wd	All	1	min	s	min	KB	HA(Sr)/ MI/MC	Raw Data	Depends highly on the contract with the provider
T.30.lea.1	To Law Enforcement Agency	C	1	C	1	1	p-p	Wd	All	1	min	s	min	KB	HA(Sr)/ HI/HC	Raw Data +photo +Video	
T.30.lea.2	From Law Enforcement Agency	C	1	C	1	1	p-p	Wd	All	1	min	s	min	MB?	HA(Sr)/ HI/HC	Raw Data	Tolerance values must not be disclosed.
T.30.mms.1	To Multi-Modal System	C	1	C/R	10	1	p-p	Wd	All	10	min	min	min	B	MA(Sr)/ HI	Raw Data	
T.30.mms.1.1	tmms-priority_hold	C	1	**C/R**	10	1	p-p	Wd	All	10	min	min	min	B	MA(Sr)/ HI	Raw Data	-
T.30.mms.2	From Multi-Modal System																
T.30.mms.2.1	fmms.mmc-crossing_ priority_ request	C	10	C/R	1	1	p-p	Wd	All	10	min	s	s	B	MA(Sr)/ HI	Raw Data	

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
T.30.mo.1	To Maintenance Organisation	C	1	C	1	1	p-p	Wd	All	1	min	min	s	KB	MA(Sr)/ MD/MC	Raw Data	
T.30.mo.2	From Maintenance Organisation	C	1	C	1	1	p-p	Wd	All	1	h	min	s	KB	MA(Sr)/ MD/MC	Raw Data	
T.30.rrs.1	To Related Road Systems	C	1	C	10	1	p-p	Wd	All	4	min	s	s	KB	MA(Sr)/ MD/MC	Raw Data	
T.30.rrs.2	From Related Road Systems	C	10	C	1	1	p-p	Wd	All	4	min	s	s	KB	MA(Sr)/ MD/MC	Raw Data	
T.30.v.ptv.1	From Vehicle																-
T.30.v.ptv.1.1	fv.ptv-direct_ priority_ request	V	100	R	100	1	p-p	Wl	Loc	100	s	s	s	B	HA(Sr)/ HI/HC	-	The potential number of sinks depends on the number of roadside locations from which priority can be requested.

Link Num.	Physical Data Flow																Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
T.30.ws	From Weather Systems	C	5	C	1	1	p-p	Wd	All	1	h or d	m	m	KB	LA(Sr)/LI	-	-

Table 8 P31 – Inter-urban Traffic Management System

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
Internal Flows																	
I.31.1	iutm_central_data	C	1	R	300	20	p-m	E	Long	20	min	s	s	B	HA(Sr)/ HI/LC		
I.31.1.1	iutm_traffic_management_data	C	1	R	300	20	p-m	E	Long	20	min	s	s	B	HA(Sr)/ HI/LC	Control Data	
I.31.2	iutm_ roadside_ data	R	500	C	1	500	p-p	E	Long	500	min	s	s	B	HA(Sr)/ HI/LC	Raw Data	
I.31.2.1	iutm_law_ enforcement_data	R	100	C	1	1	p-p	E	Long	100	min	min	min	MB	HA(Sr)/ HI/LC	Video/ photo/ raw data	
I.31.2.2	iutm_ equipment_ fault_data	R	400	C	1	1	p-p	E	Long	400	y	s	min	B	HA(Sr)/ HI/LC	Raw Data	

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
I.31.2.3	iutm_ equipment_ monitor_data	R	400	C	1	1	p-p	E	Long	400	s	s	s	B	HA(Sr)/ HI/LC	Raw Data	
I.31.2.4	iutm_traffic_ flow_data	R	400	C	1	1	p-p	E	Long	400	min	s	s	B	HA(Sr)/ HI/LC	Raw Data	
I.31.1	iutm_bridge _and_tunnel _ commands	C	1	R	20	10	p-p	Wd	Long	10	min	s	s	B	HA(Sr)/ HI/LC	Control Data	
I.31.2	iutm_ commands_ for_bridges_ and_tunnels	C	1	C	2	1	p-p	Wd	Long	1	s	s	s	B	HA(Sr)/ HI/LC	Control Data	
Terminator flows																	
T.31.esp.1	To External Service Provider	C	1	C	1~10	1	p-p	Wd	All	1	min	s	min	KB	HA(Sr)/ MI/MC	Raw Data	
T.31.lea.1	From Law Enforcement Agency	C	1	C	1	1	p-p	Wd	All	1	min	s	min	KB	HA(Sr)/ HI/HC	Raw Data	Tolerance values must not be disclosed.

Link Num.	Physical Data Flow															Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
T.31.lea.2	To Law Enforcement Agency	C	1	C	1	1	p-p	Wd	All	1	min	s	min	KB	HA(Sr)/ HI/HC	Raw Data + Video Images	
T.31.mms.1	From Multi-Modal System																
T.31.mms.1.1	fmms.mmc-crossing_ priority_ request	C	10	C/R	1	1	p-p	Wd	All	10	min	s	s	B	HA(Sr)/ HI/LC	Raw Data	
T.31.mms.2	To Multi-Modal System	C	1	C/R	10	1	p-p	Wd	All	10	min	s	s	B	HA(Sr)/ HI	Raw Data	
T.31.mms.2.2	tmms-priority_hold	C	1	C/R	10	1	p-p	Wd	All	10	min	s	s	B	HA(Sr)/ HI	Raw Data	
T.31.mo.1	From Maintenance Organisation	C	4	C	1	1	p-p	Wd	All	1	h	min	s	KB	HA(Sr)/ MD/MC	Raw Data	
T.31.mo.2	To Maintenance Organisation	C	1	C	4	1	p-p	Wd	All	1	min	min	s	KB	HA(Sr)/ MD/MC	Raw Data	

Link Num.	Physical Data Flow																Comments
	Name	Source		Sink			Configuration			Quantification					Security	Data Type	
		Loc	PN	Loc	PN	NpS	Tp	Con	Ra	NS	Freq	Dur	Lat	Vol			
T.31.rrs.1	From Related Road Systems	C	20	C	1	1	p-p	Wd	All	1	min	s	s	KB	HA(Sr)/ HD/HC	Raw Data	
T.31.rrs.2	To Related Road Systems	C	1	C	20	1	p-p	Wd	All	1	min	s	s	KB	HA(Sr)/ HD/HC	Raw Data	
T.31.ws.1	From Weather Systems	C	1	C	1	1	p-p	Wd	All	1	h	min	s	KB	HA(Sr)/ MD/MC	Raw Data	

4 References

(a) European ITS User Needs Deliverable Document, Issue 1, May 2000.

(b) European ITS Framework Architecture Functional Architecture Deliverable Document (D 3.1), Issue 1, August 2000.

(c) European ITS Framework Architecture Physical Architecture Deliverable Document (D 3.2), Issue 1, August 2000.

A copy of any of the above Documents can be found on the European ITS Framework Architecture CD-ROM, or at "http://www.trentel.org/transport/frame1.htm" by selecting "Deployment Information" and then "System Architecture".