

UTMS System Architecture

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SUMMARY

"Traffic management" does possess one of the most important positions in "System Architecture for ITS in Japan" jointly developed by Japan's 5 relevant Agency and Ministries including National Police Agency (NPA). Traffic management is a duty of NPA for the purposes of preventing traffic accidents and traffic related pollution while promoting transportation efficiencies. In order to commit sophisticated and effective traffic management works, taking ITS technologies into account is mandatory. The UTMS21 is an ITS based comprehensive systems concept focused on the traffic management purposes being developed by the UTMS (society) of Japan which is an affiliated body of NPA. UTMS System Architecture therefore is to support and to logically explain the UTMS21 in conformance with System Architecture for ITS in Japan. In this paper, for a part of the products, we first express the concept of traffic management in the light of ITS technology then further display a list of UTMS services.

INTRODUCTION

In Japan, under the "Total Concept of Promoting Intelligent Transport Systems" agreed by 5 offices, each office is promoting its own ITS programs according to each administrative duty. The "Architecture for the ITS onboard system" developed by JSK, where a vehicle is the initial point of interest. is the one of such examples. The UTMS System Architecture focused on the traffic management should be the another example. The UTMS System Architecture is to (1) first discuss purposes and duties of the traffic management in the light of ITS technologies, (2)define and clarify user services included in the systems, (3) then highlight data communication factors between system functions and (4)finally contribute in developing future UTMS relevant systems through effective use of information resources.

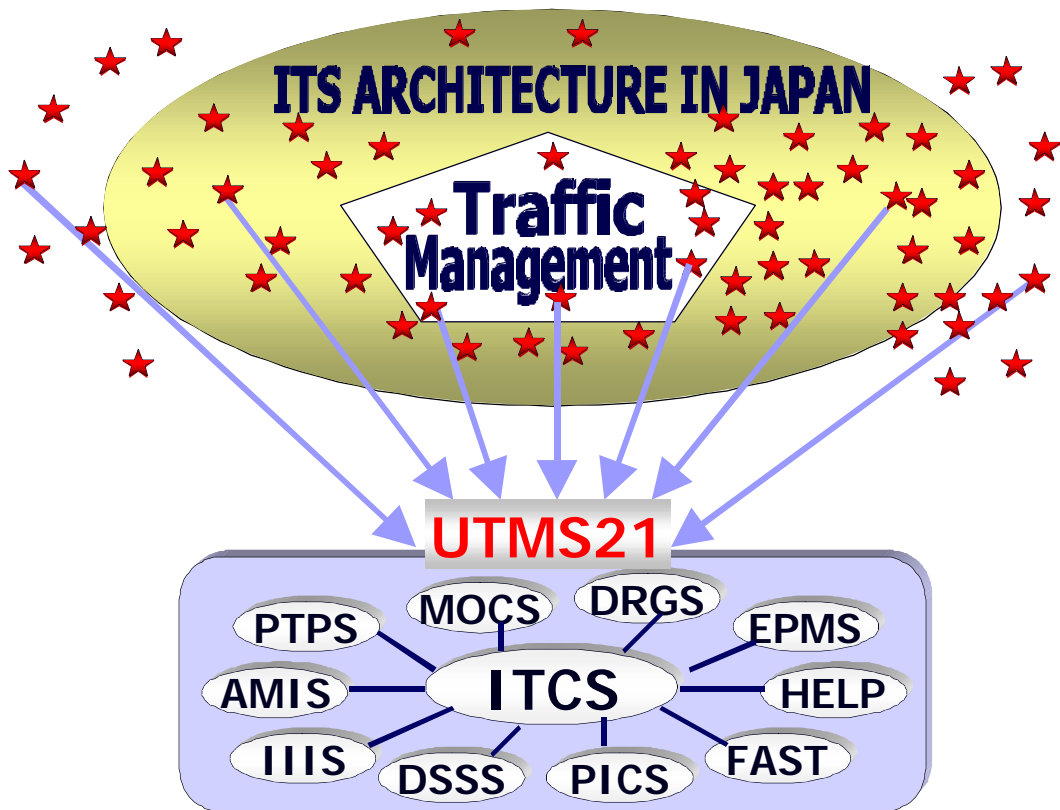


Fig.1 ITS System Architecture in Japan and UTMS21

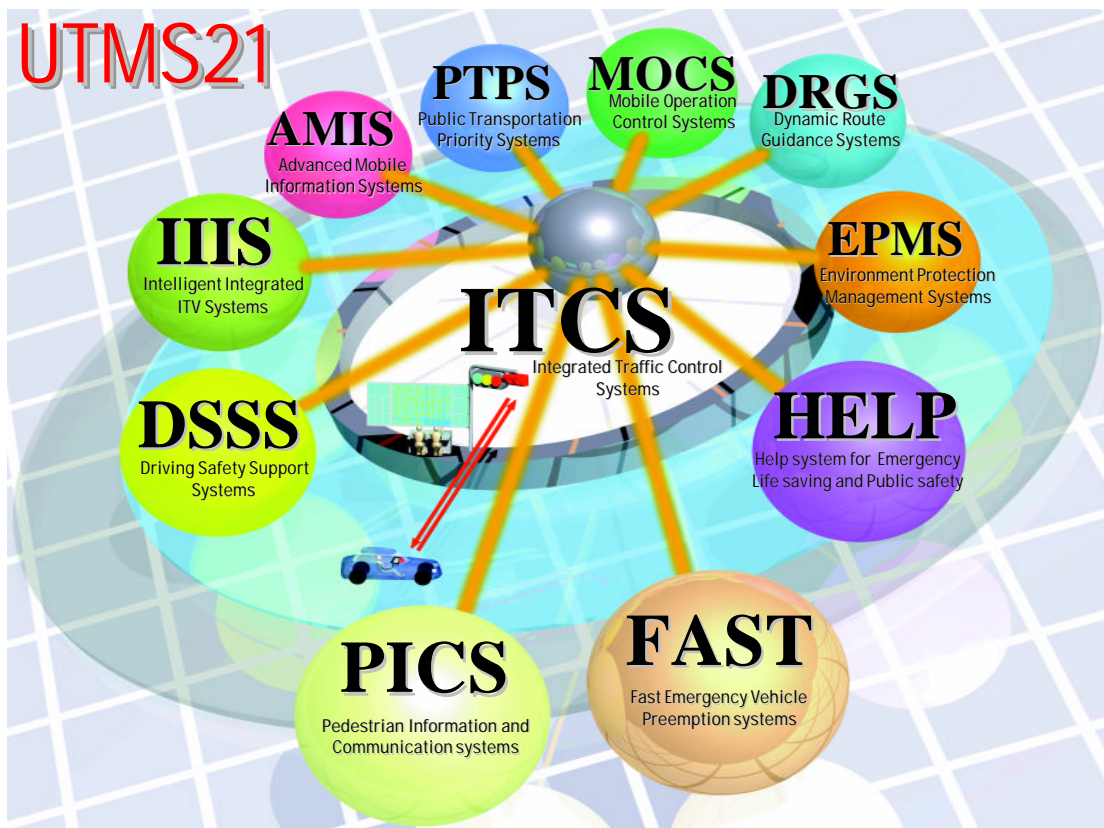


Fig.2 UTMS21 concept

WHAT IS TRAFFIC MANAGEMENT

Mobility is one of the fundamental human requirements hence free mobility is a part of human rights. However, to maintain public safety and order, at a necessary minimum rate, mobility may be managed. This total idea is said traffic management.

Conclusively, traffic management is a government activity to prevent traffic accidents and traffic related pollution while to promote efficiencies. The important factors of traffic management include,

- (1) Arrangement of rights of way in time division (e.g. traffic signaling)
- (2) Arrangement of rights of way in space division (e.g. route guidance or regulation)
- (3) Optimum allocation of traffic related resources (e.g. traffic demand management)
- (4) Protection of people (e.g. pedestrians, physically impaired and the aged)
- (5) Others

The scope of traffic management works includes traffic regulation, law enforcement, education and others. NPA therefore is in charge of traffic management with a quarter million of uniformed officers and 4,000 traffic and information relevant engineering staffs. Moreover, NPA possesses 160,000 signal controllers, 7.6 millions of traffic signs and 18,000 Infra-Red Beacons in field.

THE FUNDAMENT OF TRAFFIC MANAGEMENT

Traffic management originally is an action conducted between an individual and the other, interactively exchanging information at a traffic site. This may include hand signals or any other instruction given by a police officer. Likewise, simply by modernizing the original hand actions, ITS based traffic management systems or UTMS21 have been developed. The human to human information exchange at site is represented by an “eye contact” between a police officer and a traveler. In the traffic signal example, eyes of travelers are always turned upon signal lights and computers behind the lights are sending messages to drivers, that is to say traffic management people behind the computers are sending messages to travelers. Hence, a correct saying is not “the car violates a red light” but “the driver of the car violates a red light”. UTMS System Architecture, as such, is focusing on the human.

In modern UTMS21 concept, the sharply eyeing Infra-Red Beacons are introduced as a core technology of interactive information exchanges like eye contacts.

REQUIREMENT AND DUTIES OF UTMS SYSTEMS

Though to survey and analyze every requirements and demands from the fields or people is the starting point of any system architecture works, it is reasonable for the UTMS system architecture to follow the requirements from the traffic management people side. These requirements should have been summed up well reflecting the public needs. The major

requirements from the traffic management administration are concluded as follows.

- (1) Satisfactory traveling circumstances
- (2) Optimum distribution of resources
- (3) Public welfare

The detailed activities under the requirements said above are as follows

- (1) Law enforcement and education
- (2) Management of traffic accidents or emergency cases
- (3) Management of traffic in large scale disasters
- (4) Management of drivers or driving licenses
- (5) Management of on and off road parking
- (6) Permission procedure of road usage or irregular vehicles/freights
- (7) Support for non-traffic police activities

COMMUNICATION FACTOR IN UTMS SYSTEM ARCHITECTURE

Table 1 shows typical communication links between entities of UTMS system architecture. Because individual interactive communication between a traffic manager and a traveler is the fundamental traffic management concept for present and future, An Infra-Red Beacon is employed as one of the most suitable DSRC method. It has a lot of technical features including an extremely narrow communication service area without interference to realize lane by lane traffic control and information exchange. Moreover the Infra-Red media carries plenty of possibilities for future technical development.

Table 1 Typical Communication links in UTMS systems for present and future

Section	Communication media	Typical contents of communication
Walking people Roadside	Infra-red Beacons	Information required for or requested by pedestrians
Walking people Driving people	Infra-red DSRC	Mutual sensing & conveyance of warning information between pedestrians and drivers
People Outside of UTMS systems	DLRC	General information for traveling, public transport information
Driving people Roadside	Infra-red Beacons	Vehicle sensing, ETC, driving information, DRGS
Roadside Center	Wired	Center to Roadside communication

Note: Pedestrians includes manually or electrically driven wheelchairs

THE LIST OF UTMS SERVICES

A list of UTMS services is constructed reflecting traffic management needs, which are required to commit effective and efficient traffic management. In the process of building the list, we first surveyed the boundary or how far the scope of UTMS services spread, and displayed all of the required services. Then examined one by one to produce the final list. The list is in hierarchical structure including 41 items of UTMS services and 191 items of sub services. The sub services are packages for actual deployment. The list is the interim product at the time of this paper was written and the work is still going on.

[1st layer: Categories of traffic management items]

- (1) Common items for traffic management
- (2) General items for traffic management
- (3) Specific items for traffic management
- (4) Support items for traffic management
- (5) Surrounding items for traffic management

[2nd layer: Purposes of traffic management]

[3rd layer: List of the UTMS services]

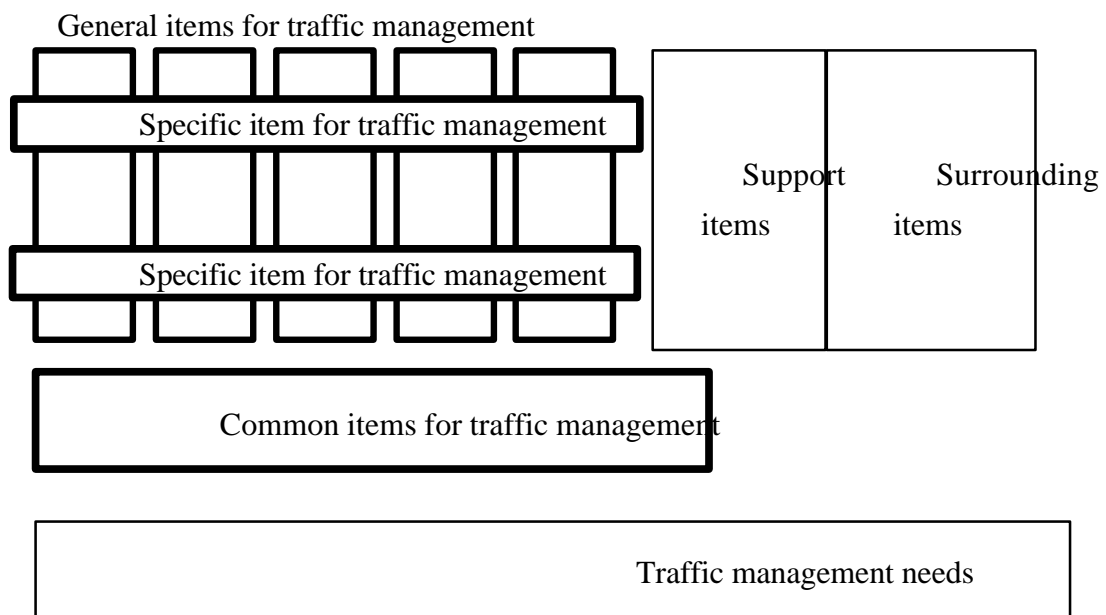


Fig.3 UTMS Services construction

Table 2 The list of UTMS services

Traffic management (TM) categories		Purposes	List of UTMS services	
UTMS services based on traffic management needs	Common items for TM	Information acquisition	Traffic information from vehicle detectors ITCS	
			Information on weather and the environment ITCS	
			Travel time ITCS/AMIS	
			Traffic information from video image IIS	
			Traffic information from still image IIS	
			Information through police communication ITCS	
		Processing	Information processing ITCS	
		TM Tactics	Control parameters ITCS	
		TM Strategy	Inter-region traffic management planing	
	Regional traffic management planing			
	General TM items	General Information dissemination	Traffic information to drivers AMIS	
			Traffic information to pre-trip drivers ITCS	
			Traveler information to all travelers ITCS	
			Public transport information to travelers	
		Warning information	Hazard warning at dangerous places DSSS	
			General warning information at roads DSSS	
			Driving information about neighboring vehicles DSSS	
			Driving information about high-speed traffic situation	
		Traffic control	Centrally determined route guidance DRGS	
			Arterial / wide-area traffic control MODERATO	
			Intersection traffic control ITCS	
			Lane oriented traffic control	
			Zone oriented traffic control	
		Specific TM items	Pedestrians including wheel chairs	Walking circumstances for pedestrians PICS
				Traffic control for pedestrians ITCS
	The environment		Traffic management to protect the environment EPMS	
	Public transport		Public transport priority PTPS	
			Public transport information MOCS	
			Taxi priority MOCS	
	Commercial vehicles		Commercial vehicles operation support MOCS	
	Emergency cases		Traffic management for emergency cases ITCS	
	Rescue activities		Emergency vehicle priority FAST	
			Rescue activities support HELP	
Grade crossing	Traffic management at grade crossings DSSS/ITCS			
Special vehicles	Traffic management for special vehicles			

(Table 2 continued)

	Support items for TM	Other organization	Information exchange between other organization ITCS/AMIS
		Efficiency	Efficiency of traffic management activities
		Enforcement	Law enforcement
		Drivers	Management of drivers and driving licenses
	Police activities	Support for non-traffic police activities	
Surrounding items of TM	Electronic payment	Electronic payment	

Note: A list of UTMS21 project currently underway or already deployed

AMIS: Advanced Mobile Information Systems

DRGS: Dynamic Route Guidance Systems

DSSS: Driving Safety Support Systems

EPMS: Environmental Protection Management Systems

HELP: Help Systems for Emergency Life Saving and Public Safety

IIIS: Intelligent Integrated ITV Systems

ITCS: Integrated Traffic Control Systems

MOCS: Mobile Operation Control Systems

MODERATO: Management by Origin-Destination Related Adaptation for Traffic Optimization

PTPS: Public Transportation Priority Systems

FUTURE WORKS

The UTMS (Society) is to continue the System Architecture works according to the second year programs in 1999. The works will include to define each services and sub-services in detail and to find common functions or common technical resources throughout the list of sub-services.

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