



23rd Meeting of the COMCEC TCWG

**Developing Intelligent Transportation Systems
in OIC Member Countries**

**ANALYSIS OF CURRENT CASE IN OIC MEMBER
COUNTRIES**

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UTRLAB

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ANALYSIS OF CURRENT CASE IN OIC MEMBER COUNTRIES



01 Introduction

Introduction

According to 2010/40/EU Directive, Intelligent Transportation Systems are; advanced applications which without embodying intelligence as such aim to provide innovative services relating to different modes of transport and traffic management and enable various users to be better informed and make safer, more coordinated and ‘smarter’ use of transport networks.”

- ITS are encapsulation of:

- **monitoring,**
- **measurement,**
- **analysis,**
- **control systems,**

which depend on **multi-directional** data exchange in the frame of **user-vehicle-infrastructure-center**.

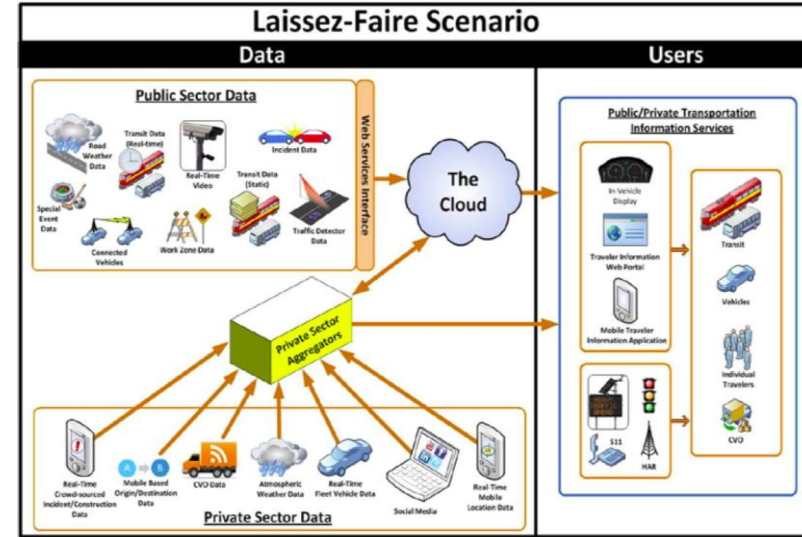


ITS :

- Reducing travel time
- Increasing traffic safety
- Optimum use of existing road capacities
- Increasing mobility
- Contributing to the economy by ensuring the energy efficiency and reducing the environmental impacts of transportation sector.

Categorization of ITS in this study

- The most fundamental categorization of ITS are made in level of urban traffic and intercity traffic.
- ITS can be categorized in 4 subsections when perspective of transportation management is taken into consideration. These subsections are:
 - ATIS: Advanced Traveller Information Systems
 - ATMS: Advanced Traffic Management Systems
 - APTS: Advanced Public Transportation Systems
 - EMS: Emergency Management Systems



Iqbal (2018)



02 Literature Review

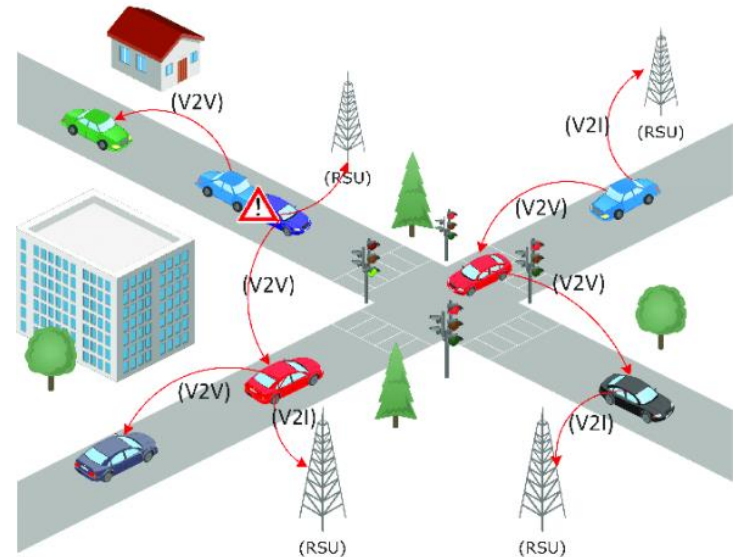
Literature Review

In early 2000s, Vehicular Ad-hoc Network (VANET) have been introduced to provide mobile communication via creating a wireless network in the base of vehicles.

- Vehicle-to-vehicle (V2V),
- Vehicle-to-infrastructure (V2I),
- Vehicle-to-everything (V2X) and

In today's World;

- ✓ Internet of Things (IoT),
- ✓ Sensor technologies,
- ✓ Autonomous vehicles,
- ✓ Cloud technology,
- ✓ Big data,
- ✓ Artificial intelligence,
- ✓ Blockchain technology
- ✓ Vehicle-to-pedestrian (V2P)

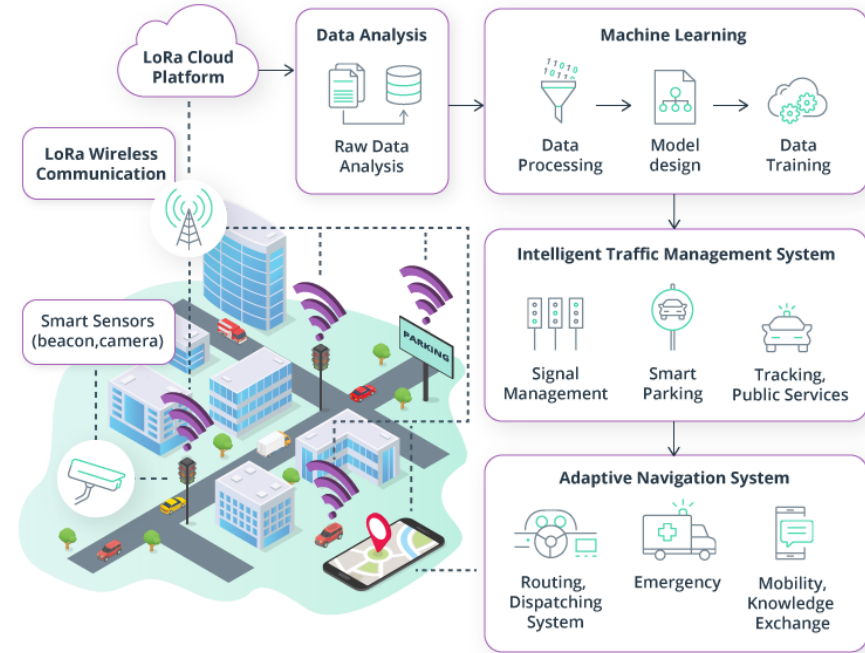


VANET Communications (Ehtisham et al., 2024)



Advanced Traffic Management Systems (ATMS)

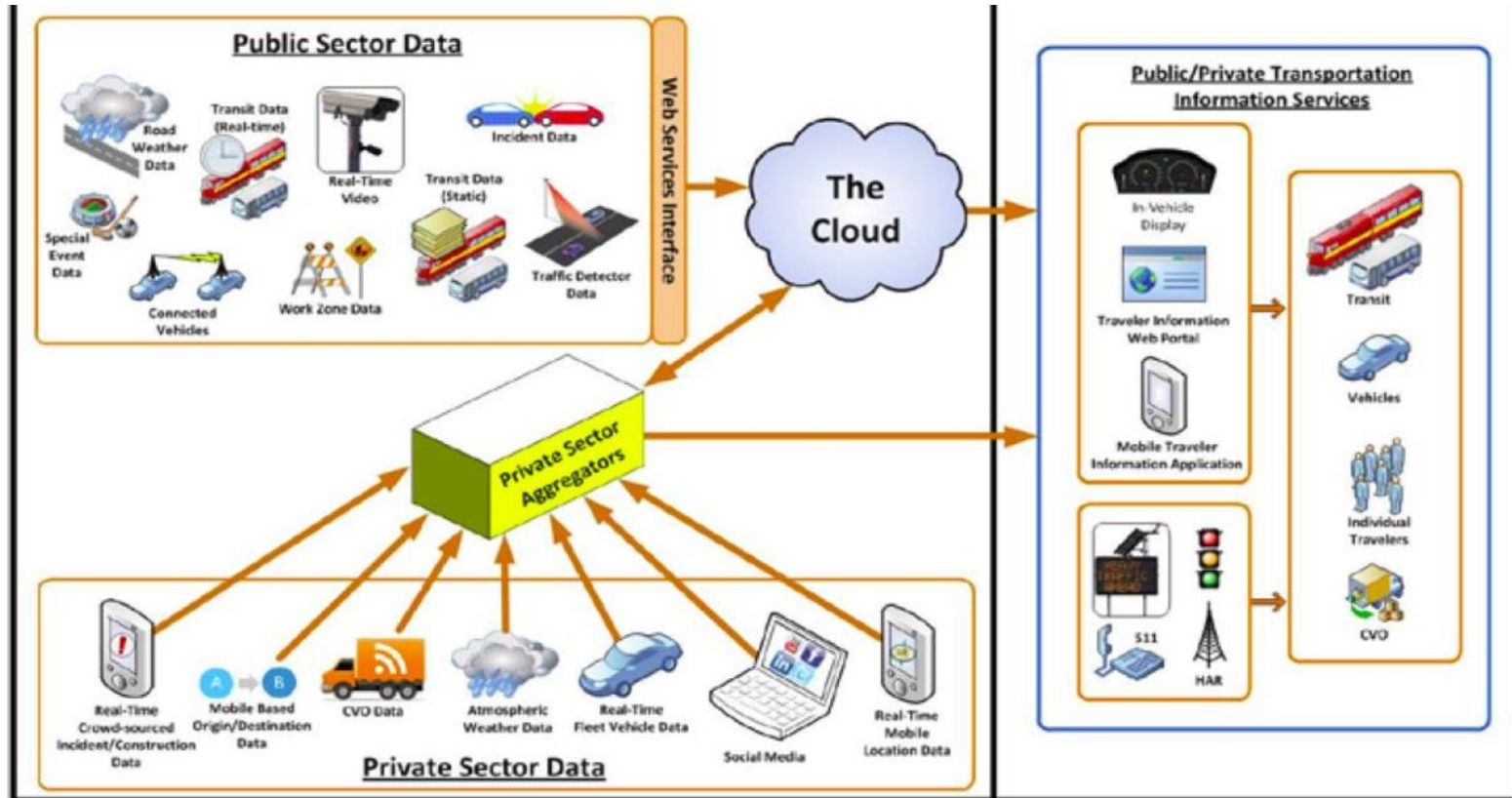
- ATMS, have various functions such as;
 - Controlling of traffic management,
 - Congestion avoidance,
 - Travel time prediction and
 - Traffic data collection (Ravish & Swamy, 2021).



Advanced Traffic Management Systems Functions
(Source : Intellias)



Advanced Traveler Information Systems (ATIS)

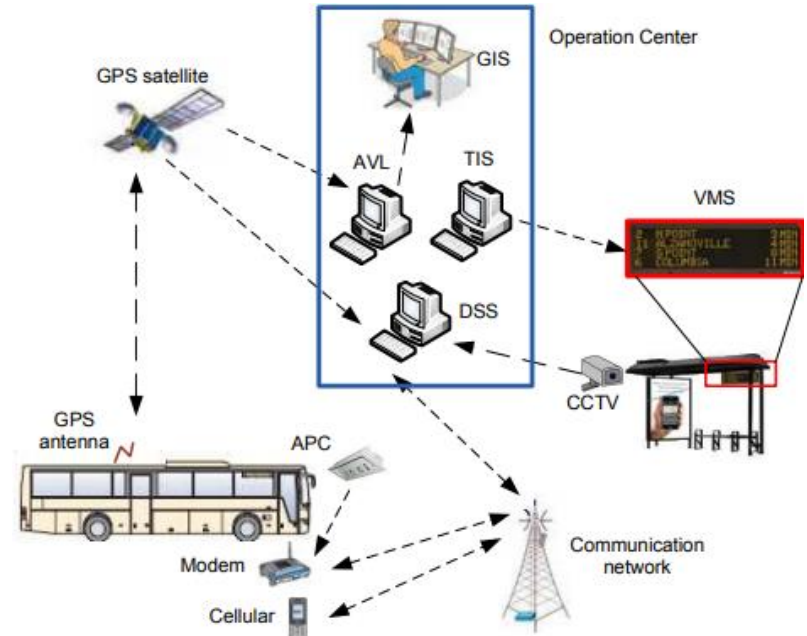


ATIS Applications and Data Dissemination (Iqbal, 2017)



Advanced Public Transportation Systems (APTS)

- There are a variety of technologies that are involved in APTS.
 - Automatic Vehicle Location Systems (AVLS),
 - Traveler Information Systems (TIS),
 - Automatic Passenger Counters (APC),
 - Geographic Information Systems (GIS),
 - Decision Support Systems (DSS),

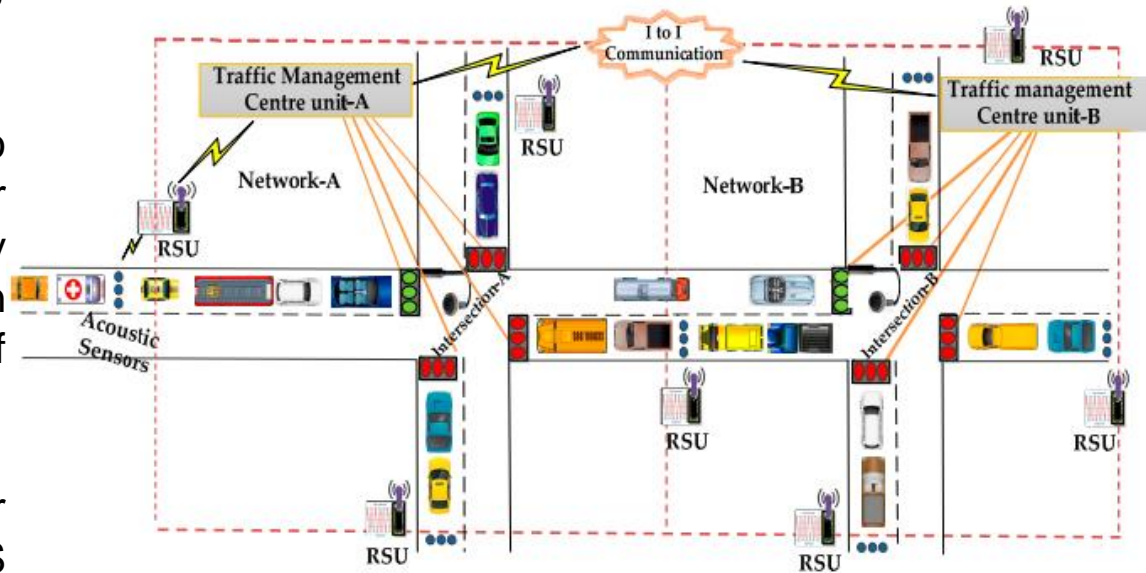


**Advanced Public Transportation Systems
(Elkosantini and Darmoul, 2013)**



Emergency Management Systems (EMS)

- Emergency Vehicle Priority (EVP) is an EMS technology, which is integrated with ATMS.
- EVP provides the priority to emergency vehicles in their route to the incident zone by adjusting the traffic signals in the route to the advantage of emergency vehicles.
- The system utilizes Computer Aided Dispatch (CAD), GPS and traffic information (Queensland Government Department of Transport and Main Roads.)



Emergency Vehicle Priority Function Scheme

(Nellore and Hancke, 2016)





03 Analysis of Current Case in OIC Member Countries

Analysis Of Current Case In OIC Member Countries

- Desk-based research: Türkiye and Iraq.
- Best practice country: The United States of America
- Field visited countries: Malaysia and The Gambia



Iraq

- Iraq is the sixth largest oil exporting country,
- Iraq's crude oil export value exceeded \$99 Billion in 2023 (World's Top Exports).
- Despite the worldwide influence of Iraq's oil export, the investment and regulation efforts related to transportation policies and infrastructure development have been very scarce nationwide.
- Arterial roads in the major cities in Iraq and intercity roads suffer from severe traffic congestion and traffic safety vulnerabilities (Al Jameel & Abdabas, 2017; Jumaah et al., 2019).
- Despite the lack of initiatives in Iraq, the academic literature presents several applications of ITS to improve the efficiency and sustainability of transportation systems.



Iraq

- Although there is lack of planned regulation in policy making related to ITS, there has been several applications of ITS in the major cities of Iraq.
- In 2022, the Traffic Signals in Baghdad have been reactivated following 19-year suspension with the initiative of the government.
- Traffic enforcement officers and army personnel have been appointed to intersections where traffic signals don't operate.



Traffic Signal in Baghdad (Source: Anadolu Agency)



Iraq

- In 2023, CCTV cameras and speed radars were deployed in Baghdad.
- With installed traffic monitoring system speed, seatbelt and red-light violations have been aimed to detect (Iraqi News).
- In 12 March 2024, General Traffic Directorate (GTD) started to enforce fine applications through surveillance systems (Shafaq News).



**Installation of Monitoring Equipment in Baghdad
(Source: Iraqi News)**



Iraq – Recommendations From Academic Literature As An Example

- Abdulwahab et al. (2018) presented an institutional framework recommendation for the development of ITS in Iraq in their study and recommended 8 key elements for institutional framework.



Institutional Framework Recommendation for Iraq (Abdulwahab et. al. 2018)



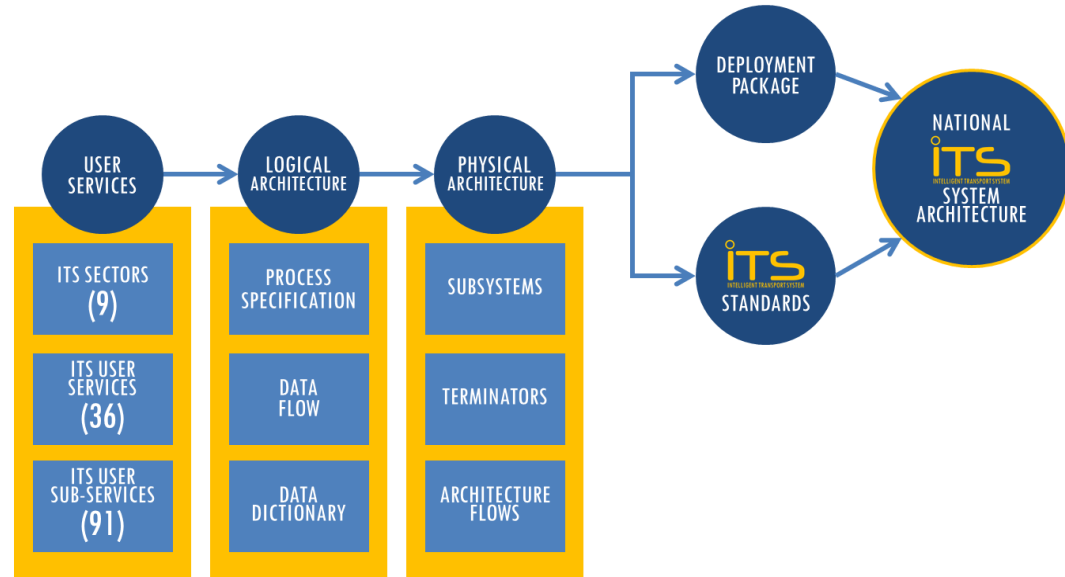
Malaysia

- Malaysia is a middle-income country and have a continuing development path in all aspects of industry.
- Malaysia developed its National **ITS System Architecture** in 2007.
- there are 11 published ITS standards in the name of Malaysian Standards (MS), where ITS standards are mostly adopted from ISO/TC 204.
- There are several documents and strategic plans that have been released over the years, which are;
 - ITS Strategic Plan in 1999,
 - ITS Master Plan in 2004,
 - ITS System Architecture in 2007 and
 - 2019-2023 Malaysian ITS Blueprint in 2019.



Malaysia

- In ITS Master Plan, it has been stated that the aim of the ITS architecture is to;
- Promote the interoperability,
- Identify the standards and
- Promote the compatibility of systems

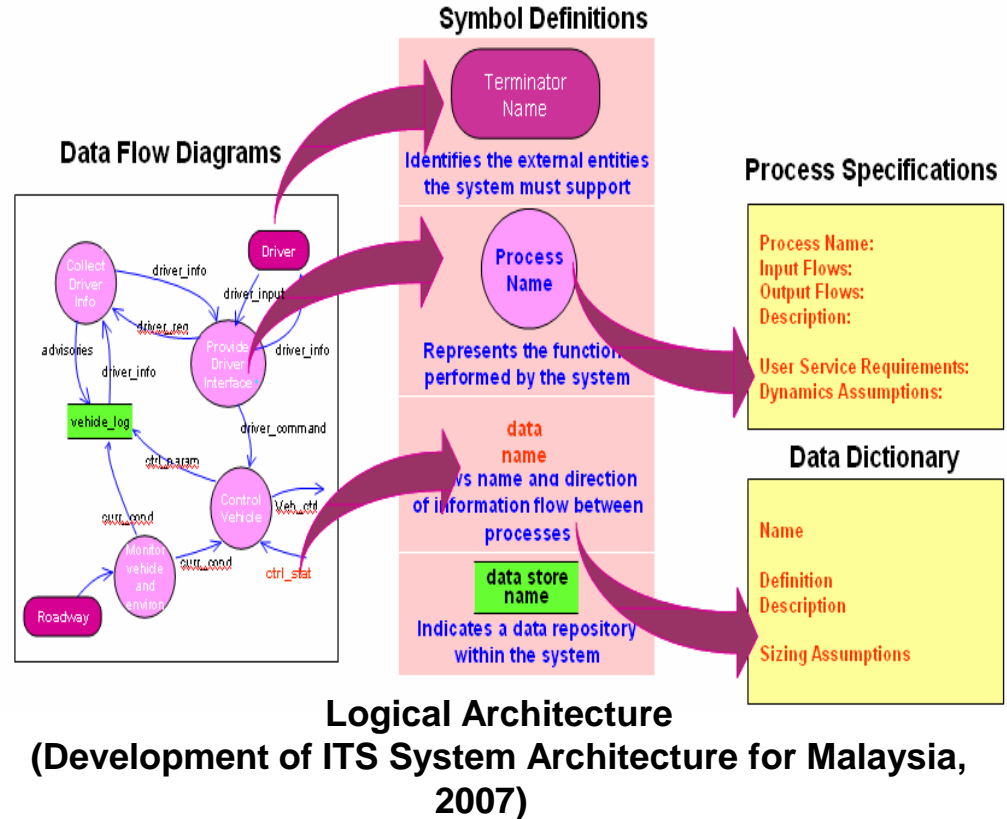


**ITS System Architecture of Malaysia
(Malaysian ITS Blueprint (2019-2023))**



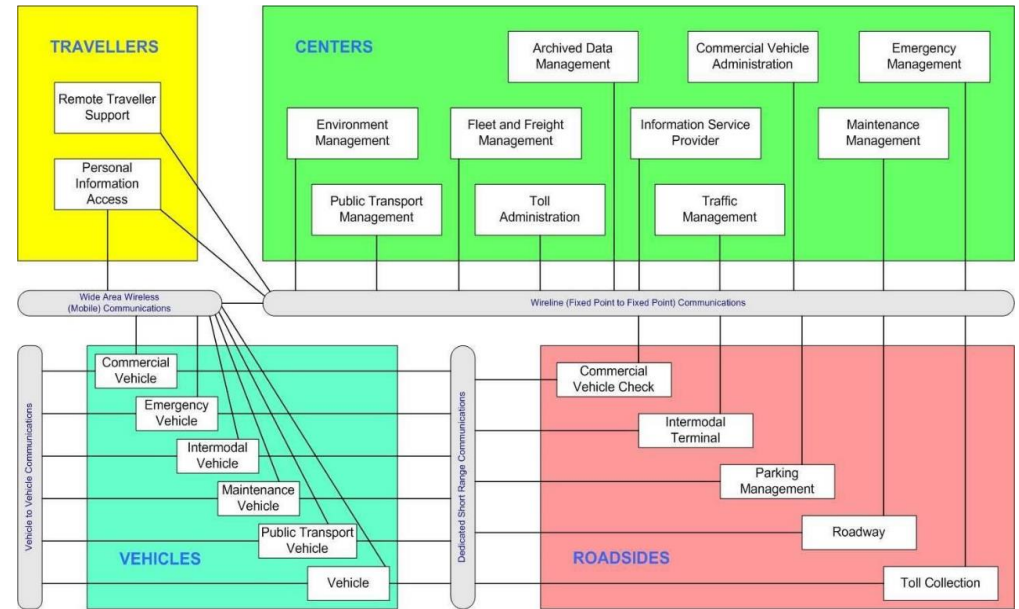
MALAYSIA

- Malaysia **ITS System Architecture** consists of two sub-architectural layers which are Logical Architecture and Physical Architecture.
- Logical architecture represents the complete set of;
 - Process specifications,
 - Data flow diagrams,
 - Data dictionary entries and
 - Is the embodiment of functional layer of the user services.



Malaysia

- **Physical Architecture** represents the physical entities and subsystems, which the processes defined in Logical Architecture.
- The communication channels are included to Physical Architecture.
- The Physical Architecture comprises of four components,
 - Subsystems,
 - Terminators,
 - Physical architecture flows and
 - Physical architecture interconnection.

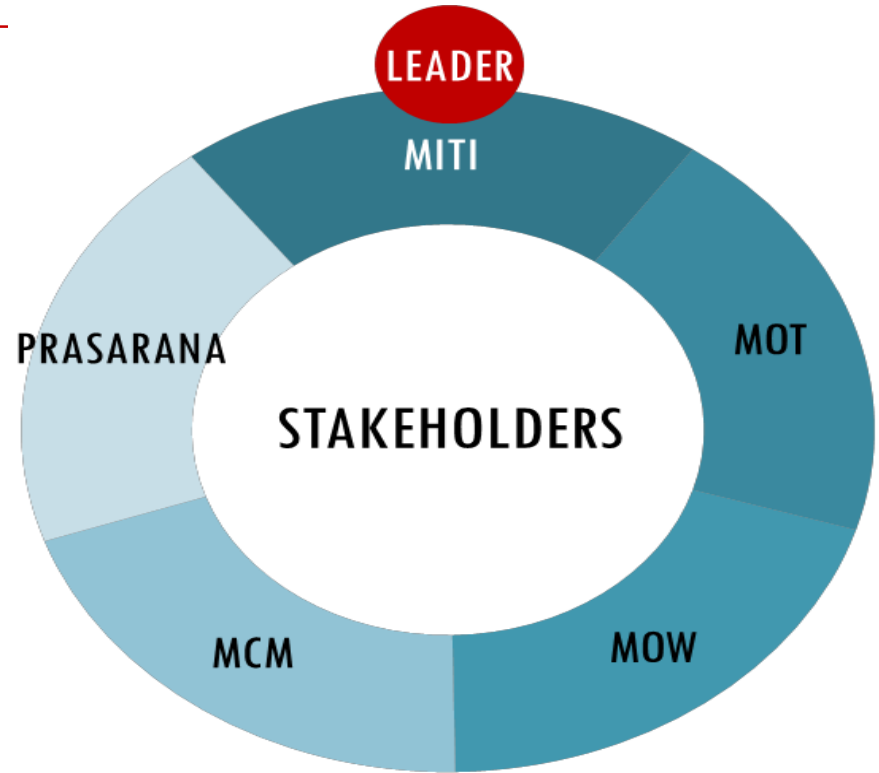


Physical Architecture
(Development of ITS System Architecture for Malaysia, 2007)



Malaysia

- **Deployment Packages** are the real-world solutions according to the needs of the users, operators, engineers and overall the stakeholders of the system.
- To exemplify, in Malaysia, the Disaster Management Deployment package includes;
 - Emergency Response Management,
 - Emergency Vehicle Routing,
 - Personal Security and Mayday Support,
 - Disaster Command and Control,
 - Disaster Information Dissemination (Malaysian ITS Blueprint (2019-2023), 2019).

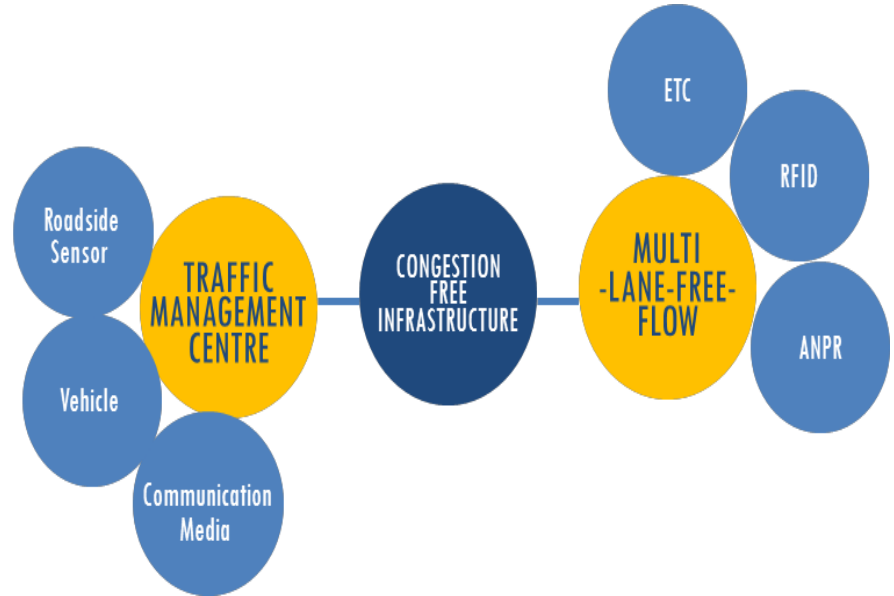


**Stakeholders of Standard Development Process
(Malaysian ITS Blueprint (2019-2023), 2019)**



Advanced Traffic Management Systems (ATMS)

- According to ITS Blueprint of Malaysia, one of the strategic pillars have been stated as “Congestion-Free Infrastructure”.
- With the purpose of ensuring a congestion-free infrastructure, two main focuses are determined as;
 - Establishment of Traffic Management Centres (TMC) and
 - Ensuring Multi-Lane-Fast-Flow (MLFF) in road networks.



**Congestion Free Infrastructure
(Malaysian ITS Blueprint (2019-2023), 2019)**



Advanced Traffic Management Systems (ATMS)

- National Intelligent Transportation Management Centre (NITMC),
- Integrated Traffic Information System (ITIS),
- Beginning operation in 2005 in Klang Valley, comprises of two components, which are;
 - Advanced Traffic Management System (ATMS) and
 - Advanced Traveler Information System (ATIS).



Advanced Traffic Management Systems (ATMS)

- ATMS utilize CCTVs, Automatic Detection System (AID) and Automatic Vehicle Location System (AVL) for transferring the data to Traffic Management Centre (TMC). TMC serves for managing the transportation operations.
- Kuala Lumpur Control and Command Centre (KLCCC) oversees the traffic control and management through 5000 installed CCTVs.



**AID Application in Malaysia
(UniMAP Library Digital Repository)**



EXAMPLES OF ATMS IN MALAYSIA



**Traffic Management Centre of Kuala Lumpur City Hall
(Source: ITS Asia – Pacific)**



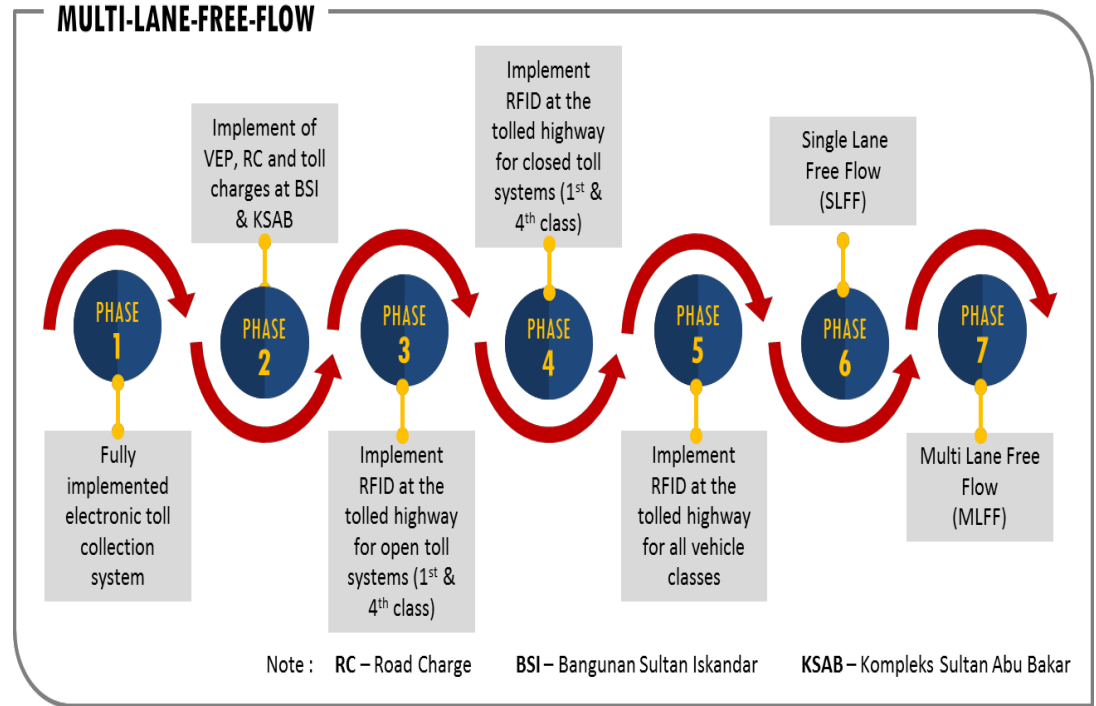
**Malaysian Highway Authority National Traffic Management Centre
(Source: ITS Asia-Pacific)**



ELECTRONIC PAYMENT SYSTEMS, ETC

The ETC systems in Malaysia are implemented nationwide in the road networks.

- The transitional passage to RFID and ANPR technologies in all highways and all vehicle classes and establishing the Multi Lane Free Flow – MLFF is aimed to be completed by 2025 .



MLFF Transition Phases (Malaysian ITS Blueprint (2019-2023), 2019)



Advanced Traveler Information Systems (ATIS)

Traveler Information systems;

- Variable Message Signs (VMS).
- PLUS Mobile Application is developed by PLUS highway which provide information about Toll Fare,
- Traffic update via CCTV,
- Travel Time Advisory (TTA) and nearby R&R Facilities.



**VMS Application in Malaysia, Speed Violation Enforcement Warning
(Source: Intertraffic)**



Malaysia

- Malaysia have;
- Traveler information system for public transportation
- Safety Systems comprise of 3 components;
 - Automated Enforcement Systems,
 - Weigh in Motion Systems and
 - Emergency Management Systems.



Tunnel Traffic Management Systems (TTMS) And Bridge Traffic Management Systems (BTMS)

- Tunnel traffic is managed by highway operations TMCs in Malaysia.
- In Menora Tunnel, Oversized Vehicle Detection System (OVDS) is used to detect the height and weight violations of vehicles.
- SMART Tunnel application applied in highway tunnels of Malaysia is equipped with 212 units of CCTVs. It includes Automatic Detection systems and SMART helpline which helps motorists in emergency cases.
- Examples to BTMS in Malaysia can be given as CCTV deployment in Penang Bridge and the second Penang Bridge.



WEATHER INFORMATION SYSTEMS (WIS)

- Weather information provided by Malaysian Meteorological Department (MetMalaysia) is integrated with the National Disaster Command Centre (NDCC), which governs the disaster management in Malaysia.
- Additionally, weather related disaster early warning systems gather information from:
 - Bilik Gerakan Bencana (BigBen) or Disaster War Room under Public Work Department for landslide risks;
 - Department of Irrigation and Drainage for flood risks; and
 - MetMalaysia for tsunami risks.



The Gambia

- The Gambia is classified as a Least Developed Country (LDC) with a Gross National Income per Capita of \$750 (United Nations Department of Economic and Social Affairs).
- The Gambia's national transportation system comprises of three modes which are road, air and maritime andriver transport.
- The country's road network is estimated as 3,920 kms long. 818.5 kms of this network is classified as primary roads, inter-urban trunk roads.
- Secondary roads make up of 359 kms while urban roads, mainly within the capital region Greater Banjul Area (GBA), make up of 187 kms of the road network.
- 2,556 kms of the road network are rural feeder and gravel/earth surface (The Gambia National Transport Policy 2018-2027).



ITS Applications In The Gambia

- In The Gambia, the applications of ITS are limited and does not exceed few applications such as amounts of traffic signalization and traffic cameras.



Traffic Signalization in The Gambia



The Gambia

- Although the current applications are inadequate, there are attempts to develop strategies for implementation of ITS.
- “Improving Human and Institutional Capacity for the Development of an Institutional Framework for Intelligent Transportation System (ITS) in The Gambia” Project executed by The Gambia-Ministry of Transport, Works and Infrastructure is in motion.
- The project includes a field visit to Qatar in order to benefit from Qatar's better practices in ITS activities and benefit from one-on-one experience sharing.
- In order to achieve the funding for development of the infrastructure, grants, credits with low interest rates can be implemented.



Best Practice Country-USA

- The United States of America (the US) having started their nationwide initiatives in early 1900s, are one of the pioneers in the matter of ITS in the world.
- The US is one of the prominent countries especially because of the strength of the country in terms of legislative and political background, investment in research and development, ITS architecture and standards.



History Of ITS In The USA

1910-1960

- 3 color traffic signalization application in 1914
- Transportation Research Board founded in 1920

1960s

- ERGS Project
- US Department of Transportation founded in 1966

1970s

- Traffic signalization control systems and map matching algorithms developed.
- National Highway Traffic Safety Administration – NHTSA founded in 1970
- Automatic Route Control Systems – ARCS have been developed and loop detectors have emerged in 1971

1980s

- Microprocessors, computers, sensors and GPS
- Intelligent Vehicle Highway System (IVHS)
- Fuel-Efficient Traffic Signal Management (FETSIM) program in 1983
- Automated Traffic Surveillance and Control System in 1984

1990s

- World Wide Web established
- ITS Architecture of United States developed in 1993
- USDOT ITS JPO have established in 1994

2000s

- Growth of communication technologies
- Cellular subscribers and Wi-Fi usage have increased
- Cloud Technology

2010s

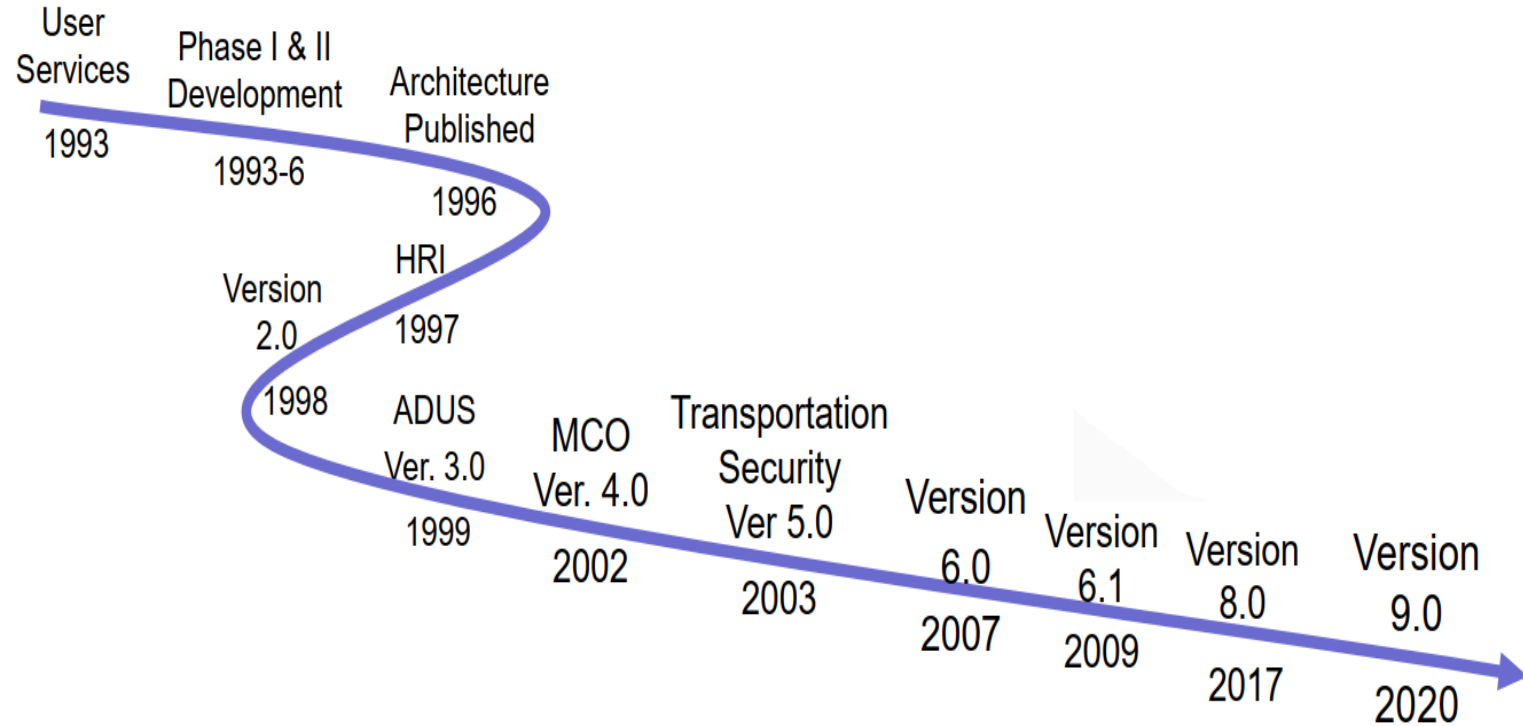
- Probe vehicles equipped with geographic location and mapping systems
- Vehicle to vehicle (V2V)
- Vehicle to infrastructure (V2I)
- Vehicle to other modes (V2X) technologies
- 2010-2011 ITS America Annual Report
- MAP-21 signed into law in 2012
- 2015-2019, 2017-2021 Strategic Action Plans

2020s

- 2020-2025 Strategic Action Plan
- In 2022, V2X Wireless Communications Summit held in 2022



ITS Architecture Of The USA – ARC-IT

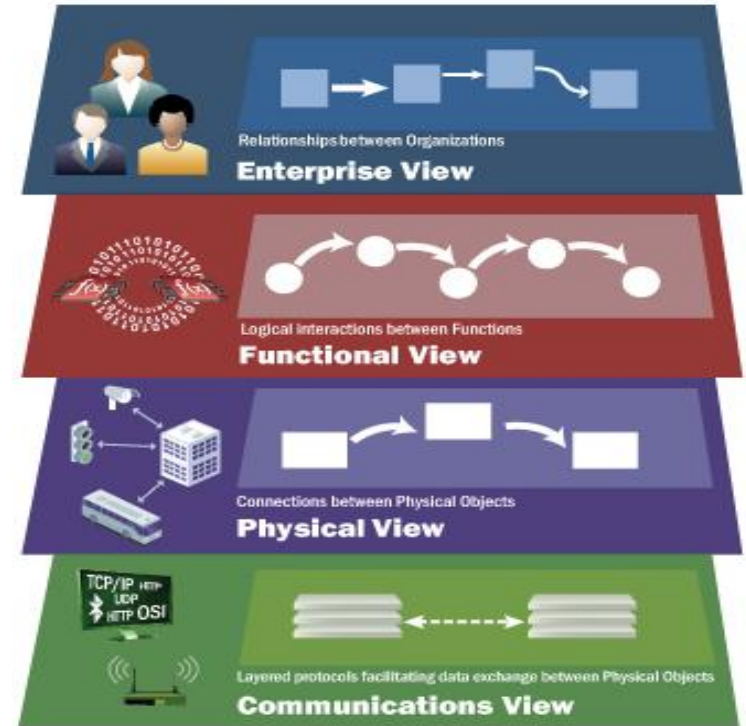


Continuous Development of ITS Architecture in USA (Office of the Assistant Secretary for Research and Technology, 2017)



ITS Architecture Of The USA – ARC-IT

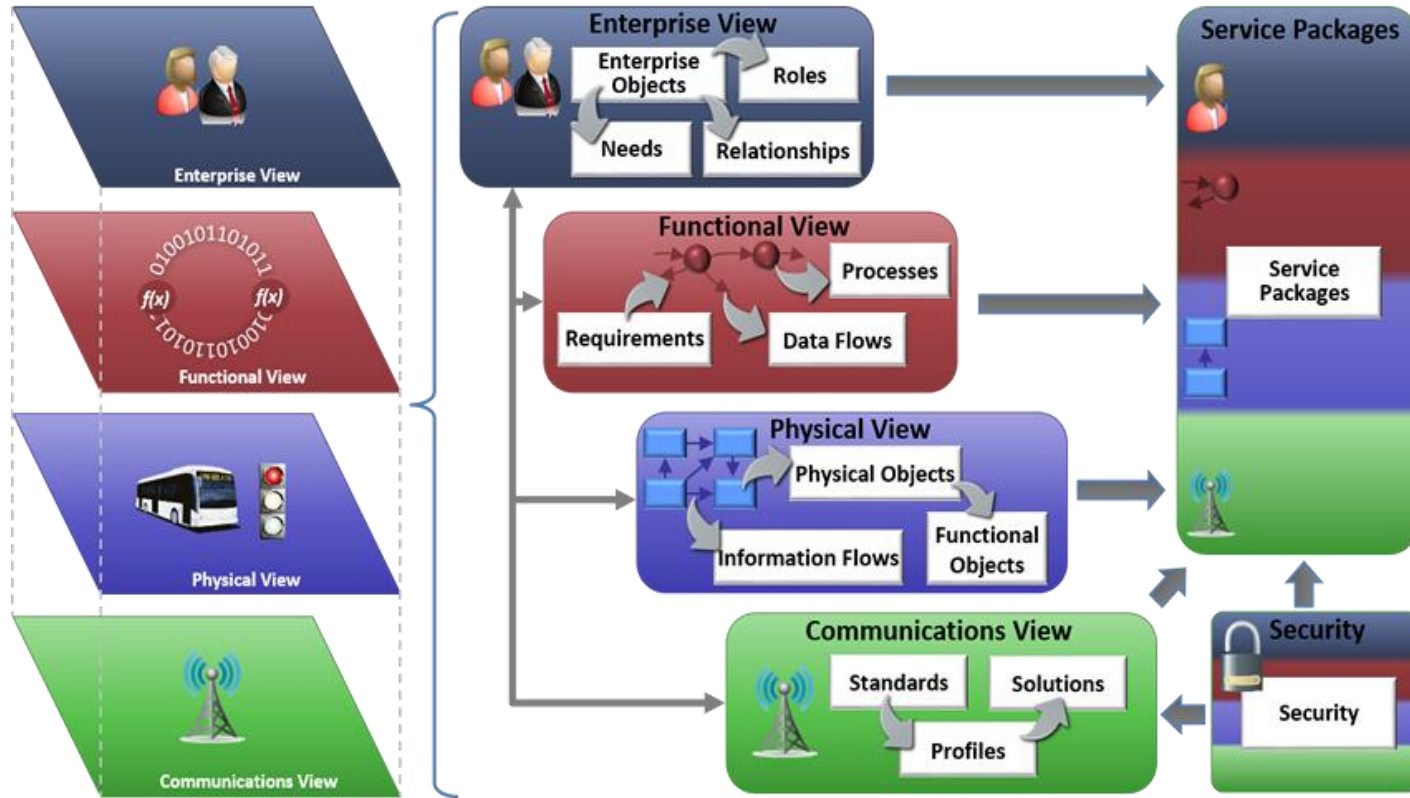
- ITS architecture of the US comprises of four layers which are;
 - Enterprise view,
 - Functional view,
 - Physical view and
 - Communications view (ARC-IT).



Views of ITS Architecture of USA
(Source: ARC-IT)



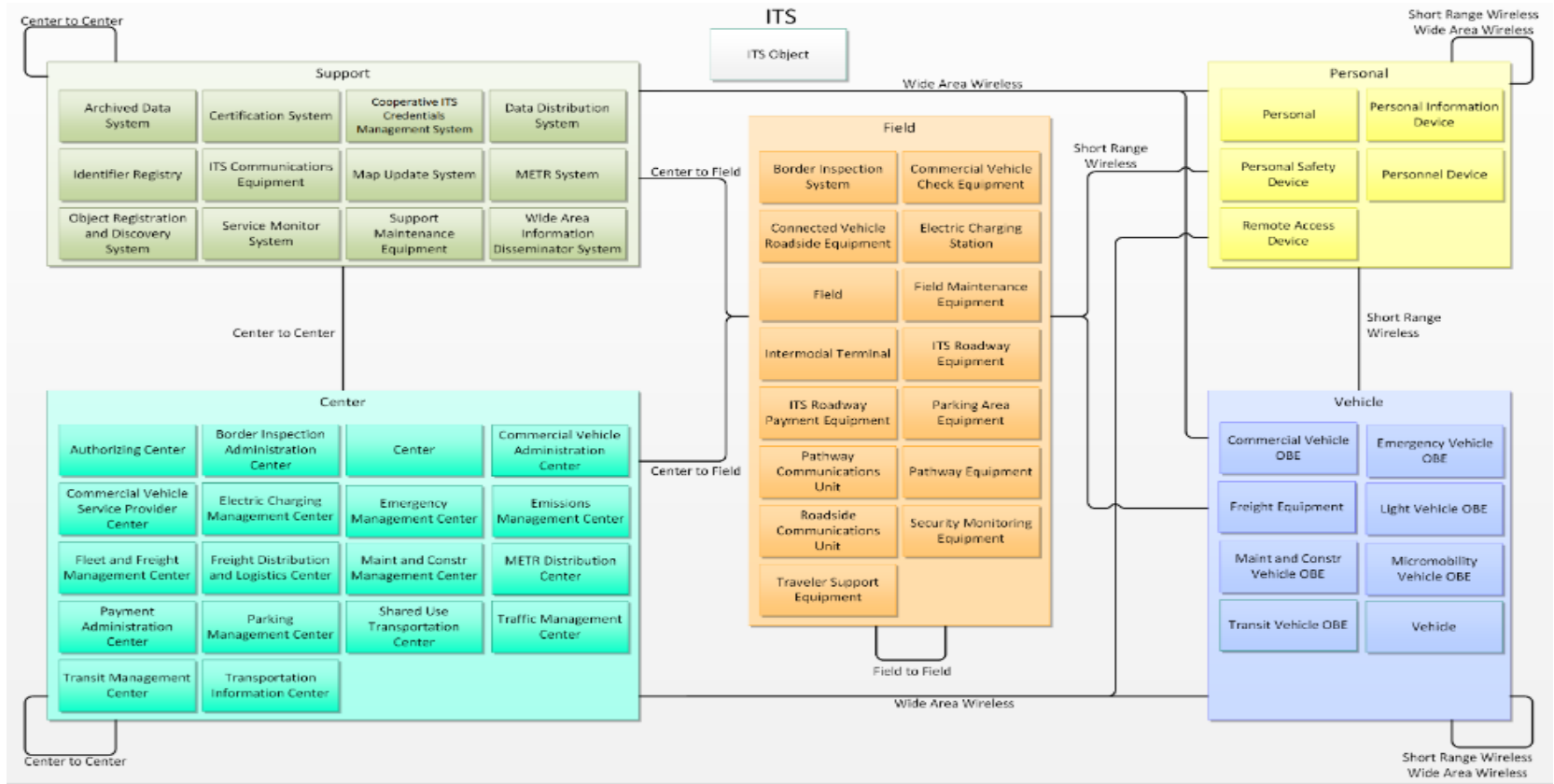
ITS Architecture Of The USA – ARC-IT



Cooperative Working Discipline of ARC-IT Views (Source: ARC - IT)



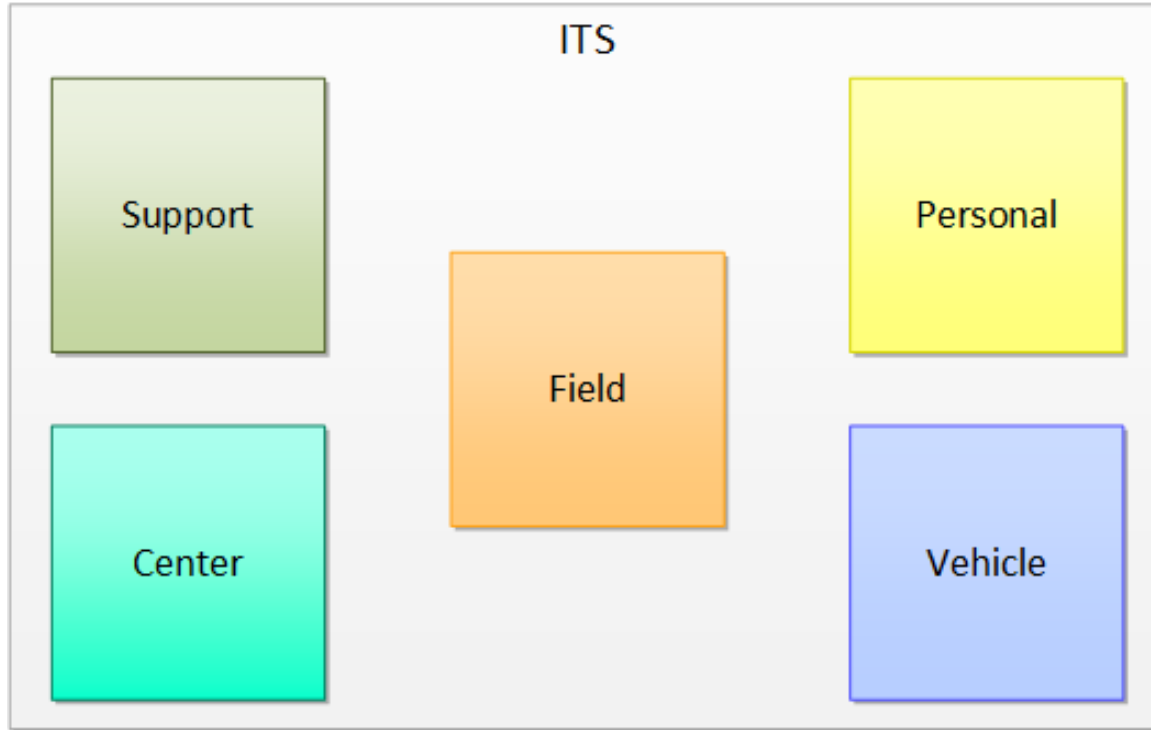
ITS Architecture Of The USA – ARC-IT



Functional View of ITS Architecture (Yokota & Weiland, 2004)



ITS Architecture Of The USA – ARC-IT



Classes of Physical View (Source: ARC-IT)



Comparison Of The Case Studies - Türkiye

- Türkiye has already prepared 2020-2023 Intelligent Transportation Systems Strategic Action Plans and determined its national goals for reaching quality standards and ensuring the prevalence of ITS applications.
- With the Action Plan, ITS vision of the country has been created, and five strategic objectives have been determined within the scope of the mission. In line with these strategic objectives, it was aimed to carry out thirty-one actions. For each action, responsible organization has been also determined.
- Systematic monitoring of implementation and effectiveness of strategies stated in Action Plan, SEPSIS (Strategy and Action Plan Monitoring and Evaluation System) System will be used (Republic of Turkey Ministry of Transport and Infrastructure, 2020).



Comparison Of The Case Studies - Malaysia

- Malaysia have shown promising improvement in ITS area especially in the last 25 years after the release of ITS Strategic Plan in 1999.
- The ITS Master Plan was released in 2004
- In 2007, as a continuation of the ITS Master Plan, the Ministry of Works released the ITS Architecture.
- The System Architecture offered a comprehensive account of the interactions between roadside devices, control centres, vehicles, and travelers, thereby creating a unified framework for the coordinated implementation of ITS in Malaysia.
- Lastly, The Malaysian ITS Blueprint (2019-2023) was published in which the way forward for collaboration and integration is explained in the development of ITS in Malaysia.



Comparison Of The Case Studies - Malaysia

- Key challenges, issues and needs about the development of ITS in Malaysia,
 - The ITS deployments mainly are concentrated around Klang Valley in Malaysia, the deployment and applications of such systems must be made prevalent throughout the country.
 - The inter-operability and coordination of the systems must be developed



Comparison Of The Case Studies - Iraq

- Iraq's major cities suffer from traffic congestion, pollution and traffic safety vulnerabilities
- Inadequacy of transportation infrastructure,
- There have not been major infrastructure improvements over the years,
- Scarcity of ITS applications in the road network of the country.
- Increasing private vehicle ownership
- There have been various applications such as reactivating the traffic signals in Baghdad and deployment of radars and CCTV cameras;
- However, such applications need to be extended and supported also with infrastructure development to provide a sustainable transportation in Iraq's major cities.



Comparison Of The Case Studies– The Gambia

- The Gambia, has very primary needs and necessities to improve urban and intercity transportation systems.
- The road network needs to be expanded, capacities should be increased and maintenance work in the transportation infrastructures need to be promoted.
- The implementation of ITS in-road networks of The Gambia are very limited and does not exceed few applications of traffic signals and traffic cameras.
- There are attempts to improve the current situation by initiatives such as «Improving Human and Institutional Capacity for the Development of an Institutional Framework for Intelligent Transportation System (ITS) in The Gambia» project. Similar projects must be supported



Comparison Of The Case Studies

- When the situation is evaluated, it becomes clear that countries should have forward-looking plans and road maps in parallel with technological developments.
- Therefore, the case studies are evaluated in guiding principles of;
 - Planning and Development Activities,
 - Implementation and Operationalization Activities,
 - Monitoring and Evaluation Activities.



Comparison Of The Case Studies

	USA	Türkiye	Iraq	Malaysia	The Gambia
Planning and Development					
Operational plan for ITS integration	X	X	N/A	X	N/A
Stakeholder engagement	X	X	N/A	X	N/A
ITS architecture	X	N/A	N/A	X	N/A
Enterprise view	X	N/A	N/A	X	N/A
Budgetary plans for ITS development	X	N/A	N/A	X	N/A
Human resource capabilities	X	N/A	N/A	N/A	N/A
Aligning ITS initiatives with global standards and frameworks	X	N/A	N/A	N/A	N/A
Implementation and Operationalization					
ITS implementation activities (Deployment Strategies)	X	X	N/A	X	N/A
Policy advocacy ITS Development	X	X	N/A	X	N/A
Monitoring and Evaluation					
Governance structure for ITS	X	X	N/A	X	N/A
Establishing criteria and metrics for evaluating ITS impact	X	X	N/A	X	N/A
Monitoring ITS operational performance	X	N/A	N/A	N/A	N/A
Updates of ITS strategies	X	N/A	N/A	N/A	N/A
Developing a framework for continuous improvement	X	X	N/A	X	N/A

NOTE: All selected case studies among OIC member countries should develop end finish ITS architecture, apart from Malaysia, in order to get benefits from ITS





THANKS