LECTURE

4 ITS ARCHITECTURE, ITS ORGANIZATIONS ITS STANDARDIZATION

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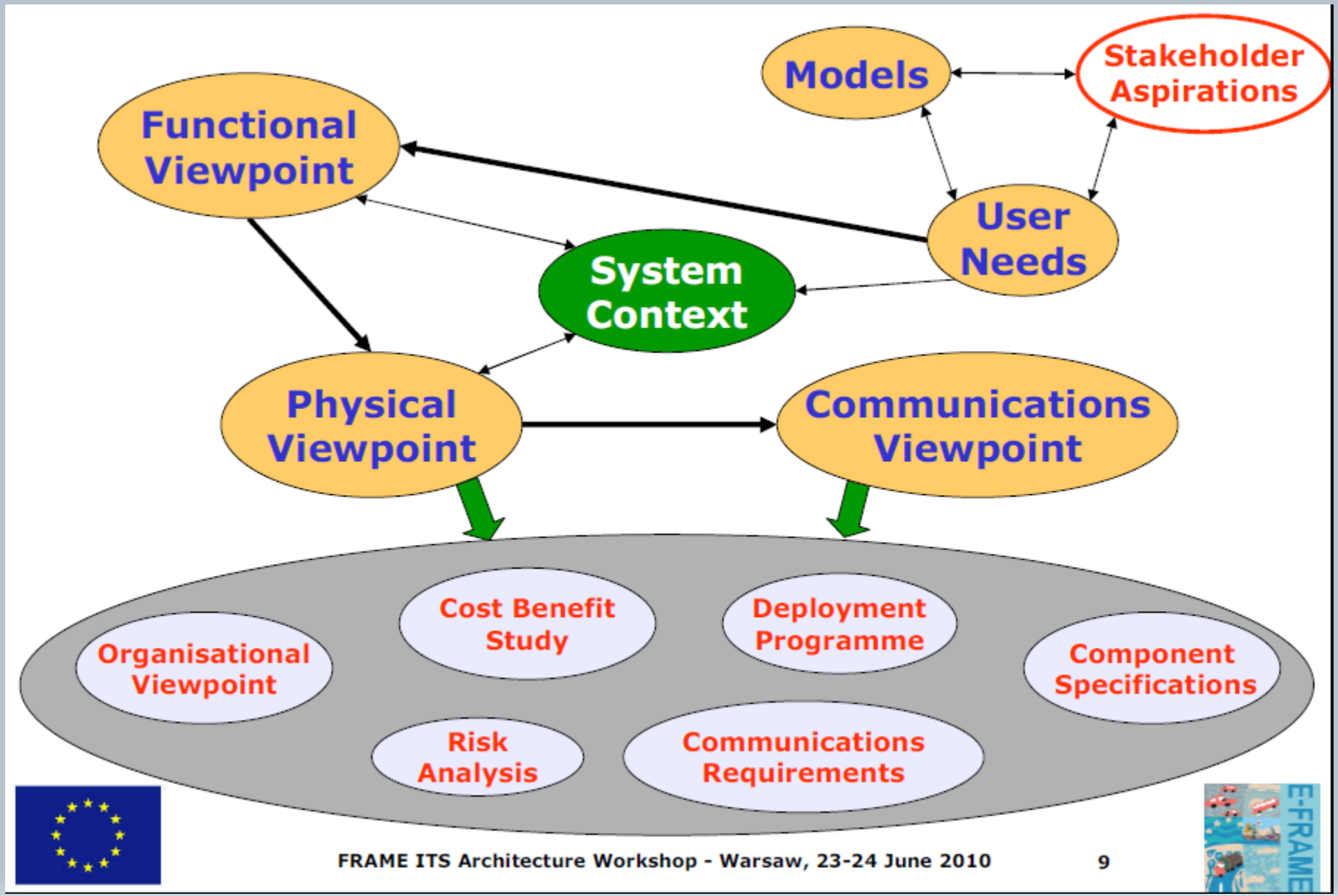
Lecture 4 – Overview

- ITS architecture – usage
- ITS architecture in the USA
- ITS associations
- Standardization in the ITS area

ITS Architecture - structure



ITS architecture usage

Cost/benefit analysis

Cost/benefit analysis in ITS - Costs

- Cover Capital and Revenue Costs of the ITS deployment
- Capital Costs
  - Acquisition and deployment of
    - Components
    - Communications Infrastructure
  - May include research and development
  - Some may be replaced by leasing
- Revenue Costs
  - Operation of Components
  - Use of Communications Infrastructure
  - Staff Costs
  - Leasing costs
  - Other consumables, e.g. publicity

Cost/benefit analysis in ITS - Benefits

- Can be defined in monetary terms as
  - Reduction in travel costs due to reduced delays
  - Reduced energy consumption
  - More productivity due to short, and more predictable, journey times for goods
- Other (non-financial) Benefits
  - Improved environment
    - Less noise – fewer stops/starts
    - Less pollution
  - Less stress – easier more comfortable journeys
- Organisational Benefits
  - Increased employment in
    - Public Transport
    - Service Providers

ITS architecture usage

Risk analysis

Risk analysis

- Identifies potential Risks to deployment
- Most severe Risks provided with a mitigation strategy
- Each strategy is given an Owner who is responsible for its implementation
- Analysis is divided into five steps
- Result should be a list of Risks, with their Mitigation Strategies and Owners

Risk definiton

- Risks may occur in one of five areas:
  - Financial: no budget for capital/revenue costs
  - Technical: functionality cannot be provided
  - Organisational: inability to cope with ITS
  - Institutional: conflicts and/or bad relationships
  - Requirement: Aspirations wrong or no longer valid
- Example:

  Travellers have concerns about the misuse of information collected by ITS services such as origin-destination matrixes, travel speeds, vehicle ocupancy, ..

Consequence and probability

- Consequence – what happens if and when the Risk occurs:
- Example:

  Travellers will be reluctant to use certain ITS services because they believe that their privacy will be compromised.
- What is the probability that a cause of the risk will occur:
  - Low: Risk is not likely to occur
  - Medium: Risk is likely to occur
  - High: Risk is (almost) certain to occur
- Example cause:

  The pressure of the "civil liberties" activists demand anonymity during normal personal transport.

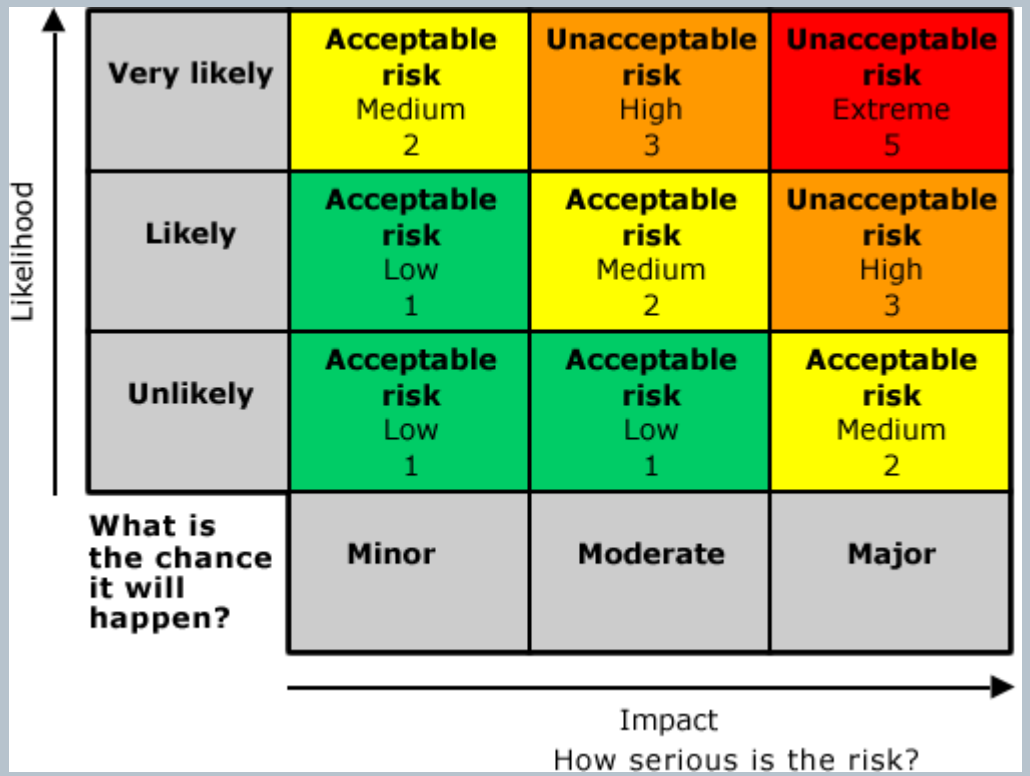
Impact

- There are three levels of impact:
  - Low: Insignificant or negligible impact
  - Medium: Will result in “significant” disruption of systems based on the Architecture or to system implementation, increase of costs, degradation of performance or a delay of implementation
  - High: Will make the implementation of the systems based on the Architecture impossible
- Example:

  ITS services that use systems which collect data about travellers' movements may not be implemented by certain authorities.

Risk matrix

- **Based on probability of occurrence and level of impact:**



- **Risk allocation will depend on circumstances**

Mitigation strategy

- Define the Risk mitigation strategy and the owner(s) responsible:
  - Start with highest “Red” risks and (possibly) “Orange” risks
  - Lower levels of risk can often be ignored
- Strategy describes what action to be taken

  e.g. Service providers and road operators must create their own monitoring and policing functions to ensure that data containing information about travellers' movements is not passed on to other agencies.
- Owner(s) must be one (or more) Stakeholders

US ITS Architecture

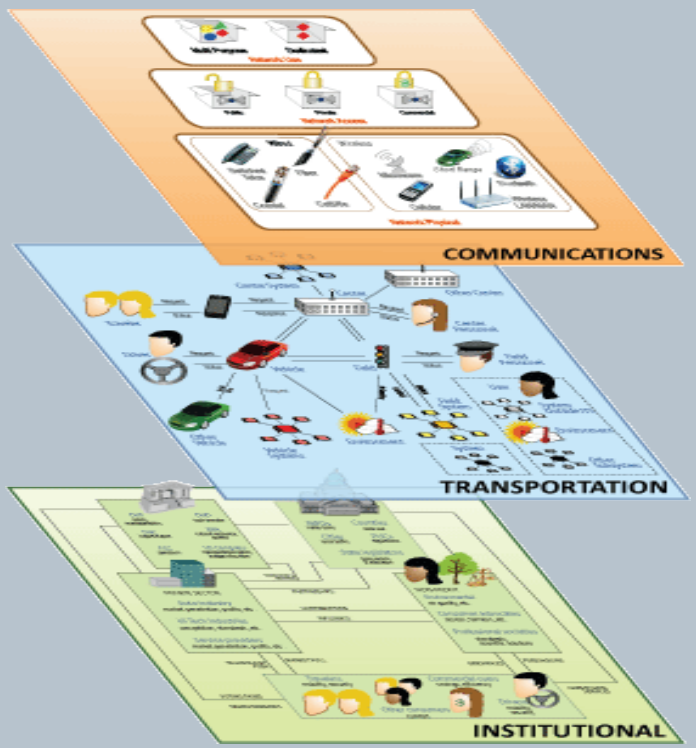
US Archtiecture

- Basic principle:

  Pre-defined market and service packages

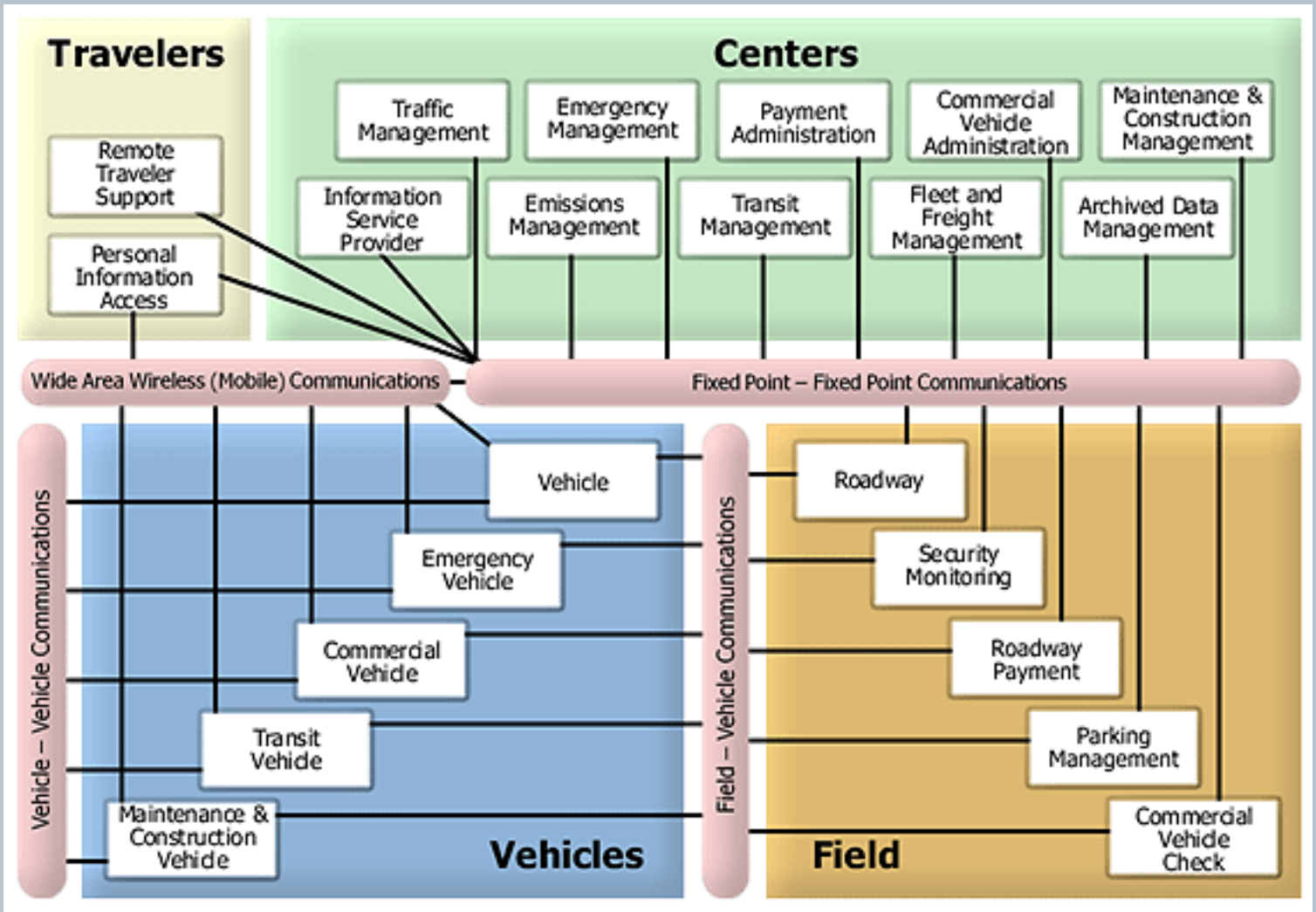
- US Architecture layers:

  – 2 Technical layers
    - Communication layer
    - Transportation layer
  – Institutional layer



Source: http://www.iteris.com/itsarch/

High level architecture diagram



Source: http://www.its.dot.gov/arch/arch_longdesc.htm

User Services Bundles

- Travel and Traffic Management
- Public Transportation Management
- Electronic Payment
- Commercial Vehicle Operations
- Emergency Management
- Advanced Vehicle Safety Systems
- Information Management
- Maintenance and Construction Management

User Services examples

- Travel and Traffic Management
  - Pre-Trip Travel Information
  - En-Route Driver Information
  - Route Guidance
  - Ride Matching and Reservation
  - Traveler Services Information
  - Traffic Control
  - Incident Management
  - Travel Demand Management
  - Emissions Testing and Mitigation
  - Highway-Rail Intersection

User service requirements example – Traffic Control

- **1.6.0** ITS shall include a Traffic Control (TC) function. Traffic Control provides the capability to efficiently manage the movement of traffic on streets and highways. Four functions are provided which are (1) Traffic Flow Optimization, (2) Traffic Surveillance, (3) Control, and (4) Provide Information. This will also include control of network signal systems with eventual integration of freeway control.
- **1.6.1** TC shall include a Traffic Flow Optimization function to provide the capability to optimize traffic flow.
- **1.6.1.1** Traffic Flow Optimization shall employ control strategies that seek to maximize traffic-movement efficiency.
- **1.6.1.2** Traffic Flow Optimization shall include a wide area optimization capability, to include several jurisdictions.
- **1.6.1.2.1** Wide area optimization shall integrate the control of network signal systems with the control of freeways.
- **1.6.1.2.2** Wide area optimization shall include features that provide preferential treatment for transit vehicles.
- **1.6.2** TC shall include a Traffic Surveillance function.

Service Packages

- represent slices of the Physical Architecture that address specific services
- service package collects together several different subsystems, equipment packages, terminators, and architecture flows
- Service areas: Archived data management, Public transportation, Traveler information, Traffic Management, Vehicle Safety, Commertial vehicle operations, Emergency management, Maintenance and Construction management

Source: http://www.iteris.com/itsarch/

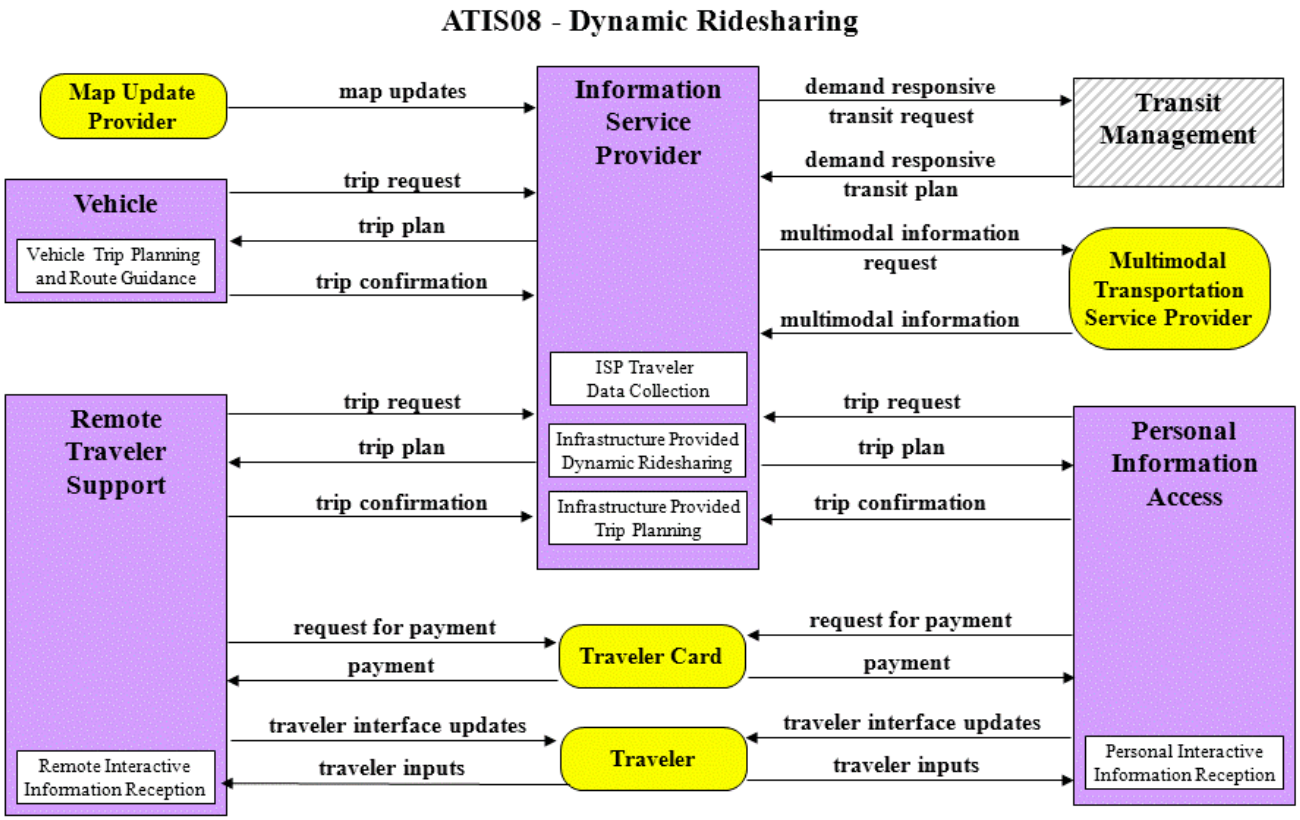
Service packages

- Service packages e.g. for the Traveller information service area:
  - ATIS01 Broadcast Traveler Information
  - ATIS02 Interactive Traveler Information
  - ATIS03 Autonomous Route Guidance
  - ATIS04 Dynamic Route Guidance
  - ATIS05 ISP Based Trip Planning and Route Guidance
  - ATIS06 Transportation Operations Data Sharing
  - ATIS07 Travel Services Information and Reservation
  - ATIS08 Dynamic Ridesharing
  - ATIS09 In Vehicle Signing
  - ATIS10 Short Range Communications Traveler Information

Source: http://www.iteris.com/itsarch/

E.g. service package Dynamic Ridesharing

- Graphic representation



Source: http://www.iteris.com/itsarch/html/mp/mpatis08.htm#tab-1

E.g. service package Dynamic Ridesharing

- Equipment packages - examples

Equipment Package	Subsystem
Infrastructure Provided Dynamic Ridesharing	Information Service Provider
Infrastructure Provided Trip Planning	Information Service Provider
ISP Traveler Data Collection	Information Service Provider
Personal Interactive Information Reception	Personal Information Access
Remote Interactive Information Reception	Remote Traveler Support
Vehicle Trip Planning and Route Guidance	Vehicle

Source: http://www.iteris.com/itsarch/html/mp/mpatis08.htm#tab-1

E.g. service package Dynamic Ridesharing

- Flows, e.g.

Source	Architecture Flow	Destination	In Graphic
Driver	driver inputs	Vehicle	No
Financial Institution	transaction status	Information Service Provider	No
Information Service Provider	payment request	Financial Institution	No
Information Service Provider	ISP operations information presentation	ISP Operator	No
Information Service Provider	map update request	Map Update Provider	No
Information Service Provider	multimodal information request	Multimodal Transportation Service Provider	Yes
Information Service Provider	trip plan	Personal Information Access	Yes
Information Service Provider	trip plan	Remote Traveler Support	Yes

Source: http://www.iteris.com/itsarch/html/mp/mpatis08.htm#tab-1

E.g. service package Dynamic Ridesharing

- Goals and objectives:
  - Objective categories:
    - Special Event Management: Mode Shift from SOV
    - System Efficiency: Cost of Congestion
    - System Efficiency: Delay
    - System Efficiency: Duration of Congestion
    - System Efficiency: Energy Consumption
    - System Efficiency: Extent of Congestion
    - System Efficiency: Intensity of Congestion (Travel Time Index)
    - System Efficiency: Travel Time
    - System Efficiency: Vehicle Miles Traveled
    - System Options: Mode Share
    - Travel Demand Management: Carpool/Vanpool

Source: http://www.iteris.com/itsarch/html/mp/mpatis08.htm#tab-1

E.g. service package Dynamic Ridesharing

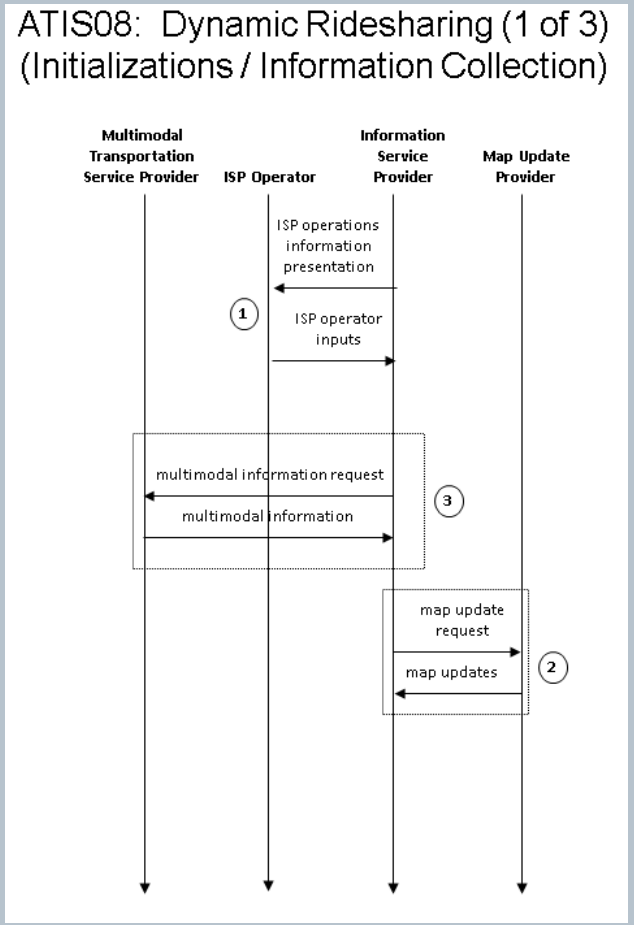
Goals and objectives:

- Objective e.g. Achieve X percent alternative (non-SOV) mode share in transit station communities (or other destinations) by year Y.
- Performace measure e.g. Percent of all trips made using alternative modes in transit station communities.
- Objective e.g. Annual rate of change in regional average commute travel time will not exceed regional rate of population growth through the year Y.
- Performace measure e.g. Average commute trip travel time (minutes).

Source: http://www.iteris.com/itsarch/html/mp/mpatis08.htm#tab-1

E.g. service package Dynamic Ridesharing

- User services
  - 1.4 Ride Matching And Reservation
  - 1.8 Travel Demand Management
  - 2.3 Personalized Public Transit
- Transaction set



Source: http://www.iteris.com/itsarch/html/mp/mpatis08.htm#tab-7

Architecture assessment
- US architecture recommendation

US architecture assessment

US Architecture provides checklist for the assessment:

- Contains 12 assessment areas:
  1. Architecture Scope and Region Description
  2. Stakeholders
  3. System Inventory
  4. Needs and Services
  5. Operational Concept
  6. Functional Requirements
  7. Interfaces/ Information Flows
  8. Project Sequencing
  9. Agreements
  10. Standards Identification
  11. Using the Regional ITS Architecture
  12. Maintenance Plan

US architecture assessment

Assessment checklist contains:

- Basic architecture data
  - Location
  - type
  - development date
  - last update date
  - Etc.
- Questions (basically yes/no questions)
- Place to comment each question

US architecture assessment

E.g. Needs and Services assessment

- a. Are transportation needs for the region defined and described? If so, are the documented needs consistent with the current needs of the region?
- b. Are transportation services, derived from the needs, defined and described? If so, do the documented services still cover the region's needs?
- c. Are the services adequately represented in the regional architecture? (e.g., Are services linked to inventory elements?)

US architecture assessment

E.g Operational concept assessment

- a. Has an architecture operational concept been described in sufficient detail to understand the roles and responsibilities of the primary stakeholders in the region in the delivery of ITS services?
- b. Are the documented roles and responsibilities consistent with current operations strategies of stakeholders in the region?
- c. Are the roles and responsibilities of the operational concept appropriately reflected in the architecture?

International ITS organizations

International ITS organizations

ITS America

- Founded in 1991
- includes more than 450 public agencies, private sector companies, and academic and research institutions.
- Through State Chapters includes more then 1200 member organisations
- works to amplify the advancements in transportation technologies
- provides technical services to further the research, development, and innovation

International ITS organizations

ERTICO (ITS Europe)

- network of Intelligent Transport Systems and Services stakeholders in Europe
- Members are
  - Mobile Network Operators
  - Public Authorities
  - Research institutes
  - Service Providers
  - Suppliers
  - Traffic and Transport Industry
- Active in many projects, currently e.g. from areas
  - Smart mobility
  - Clean mobility

International ITS organizations

PIARC - World road association

- established in 1909
- creates and coordinates Technical Committees,
- organizes a quadrennial World Road Congress
- has members in 142 countries
- Typical members in the Association: Governments, Regional Authorities, Collective Members and Individual Members
- Has a work group specialized in ITS (under Road Network Operation)

International ITS organizations

ITS nationals

- Network of national ITS associations
- Established in 2004
- Providing support and encouragement of national (as well as regional and local) consensus and cooperation related to ITS development and applications.
- Assisting in the creation of a ITS national strategy which can form the groundwork of future applications.
- Sponsoring or providing ITS training programmes, exchange of information and dissemination of R&D results.
- Building international contacts for the exchange of ITS experiences with other European and non-European organisations.

National ITS organization

- In Czech and Slovak Republic „Intelligent transport systems & services“ association
- member of ITS nationals
- ITS&S activities
  - organizing educational activities
  - cooperation with public administration authorities
  - supporting business activities of its member in forign countries
  - cooperation with national representatives in the technical committees CEN278 and ISO204
  - and many others
  - ITS conference (formerly every 2 yeard, now irregulary)
    - ITS Prague, ITS Bratislava,NavAge

International Standardization Bodies in the ITS area

ITS standards

- **The role of ITS standards could be summarized:**
  - instrument for time, parameter and protocol synchronization
  - added value for ITS architecture and ITS data registry
- **ITS standards (CEN, ISO) could be linked with**
  - ITS architecture: functions, interfaces, physical subsystems, communication links
  - ITS data registry: data model, transmission messages

ITS ISO standardization

- On the worldwide level Intelligent transport systems are solved in the Technical Committe **TC 204 Intelligent transport systems**
- Some ISO Workgroups have their equivalents in the CEN workgroups, there are also such workgroups, that do not have theirs counterparts in Europe, but their activity is being monitored closely
- Work groupes:
  - *WG 1 Architecture*
  - *WG 3 TICS database technology*
  - *WG 4 Automatic vehicle and equipment identification*
  - *WG 5 Fee and toll collection*
  - *WG 7 General fleet management and commercial/freight*
  - *WG 8 Public transport/emergency*
  - *WG 9 Integrated transport information, management and control*
  - *WG 10 Traveller information systems*
  - *WG 11 Route guidance and navigation systems*
  - *WG 14 Vehicle/roadway warning and control systems*
  - *WG 15 Dedicated short range communications for TICS applications*
  - *WG 16 Wide area communications/protocols and interfaces*
  - *WG 17 Nomadic Devices in ITS Systems*

ITS CEN standardization

- CEN Technical Committee 278 Road Transport and Traffic Telematics
- Committee by the Netherlandish Standardization Institute
- This committee was an inspiration for Czech TNK 136 committee with corresponding workgroups
  - WG 1 Electronic fee collection and access control (EFC)
  - WG 2 Freight and Fleet Management systems (FFMS)
  - WG 3 Public transport (PT)
  - WG 4 Traffic and traveller information (TTI)
  - WG 7 Geographic road data (GRD)
  - WG 8 Road traffic data (RTD)
  - WG 9 Dedicated Short Range Communication (DSRC)
  - WG 10 Man-machine interfaces (MMI)
  - WG 12 Automatic Vehicle Identification and Automatic Equipment Identification (AVI/AEI)
  - WG 13 Architecture and terminology
  - WG 14 After theft systems for the recovery of stolen vehicles
  - WG 15 eSafety
  - WG 16 Co-operative systems

ETSI

- European Telecommunications Standards Institute (ETSI)
- standards for Information and Communications Technologies (ICT), including fixed, mobile, radio, converged, broadcast and internet technologies.
- establishment of Technical Committee ITS (TC ITS) in 2008
- Unlike others, standards are freely available (due to membership fees.

Working Groups within the ETSI TC ITS	
Working Group	Title
WG1	Application Requirements and Services
WG2	Architecture and Cross-layer coordination
WG3	Transport and Network
WG4	Media and Medium Related
WG5	Security

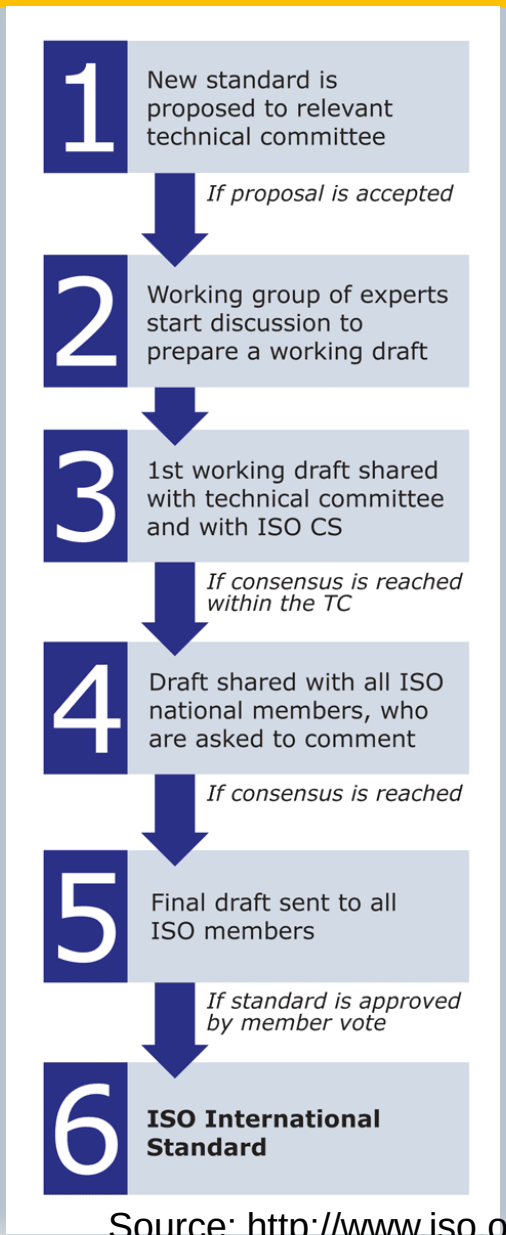
Other standardization bodies

- CENELEC
  - European Committee for Electrotechnical Standardization
- IEEE Institute of Electrical and Electronics Engineers (Standards Association)
- SAE (Society of Automotive Engineers)
  - committees grouped under the headings of Aerospace, Automotive and Commercial Vehicle
- IEC (International Electro technical Commission)
- Etc.

Important EU document for telematics standardization

- EC Standardisation Mandate M/453
  - Issued by the European Commission in late 2009 to the three main European SDO's, CEN, CENELEC and ETSI
  - To produce plan to cooperate in the development of a set of standards regarding V2X communication
  - ETSI and CEN produced „Response to Mandate M/453“, CENELEC is not taking part
  - This response contains aspects to be standardized

Standardization process – ISO example



- Standards should respond to a need in a market
- standards are based on global expert opinion
- standards are developed through a multi-stakeholder process
- standards are based on a consensus

- The process takes up to 4 years!!!

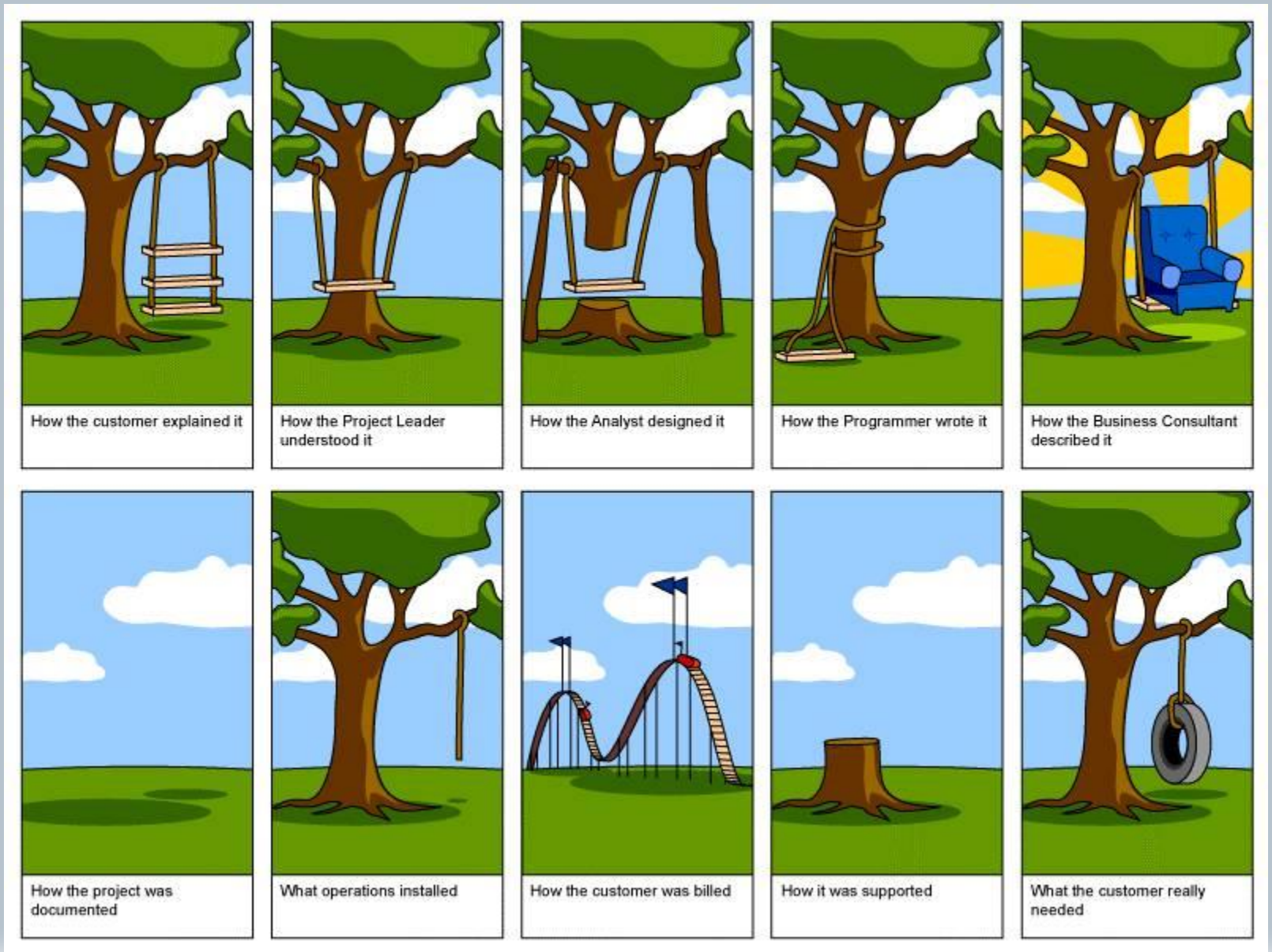
Source: http://www.iso.org/iso/home/standards_development.htm

Important EU document for telematics

- ITS Directive
  - DIRECTIVE 2010/40/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 7 July 2010
  - on the framework for the deployment of Intelligent Transport Systems in the field of road transport and for interfaces with other modes of transport

- ITS Action plan
  - COMMUNICATION FROM THE COMMISSION - Action Plan for the Deployment of Intelligent Transport Systems in Europe

Thank you for your attention



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