Seamless traffic data dissemination across urban and inter-urban networks

SEAMLESS

27/09/2013

Vienna

Jörg Freudenstein

SEVENTH FRAMEWORK PROGRAMME

Partners

1. **AlbrechtConsult (consortium coordinator)**
2. **PTV**

3. **Mott MacDonald**
4. **TrafficMaster**

Partner AlbrechtConsult

- Specialised in all aspects of ITS architecture
- Distributed systems, interfaces and interoperability
- Urban and inter-urban domain
- Open Traffic Systems City Association (OCA)
- In SEAMLESS: migration path from current landscape of traffic management systems towards an open, distributed architecture
- Projects:
  - sim^{TD}: Support of the City of Frankfurt/Main in providing the Urban part of a large Field Operational Test
  - Mobility Data Marketplace: innovative concept for an electronic marketplace for traffic and transport data
  - DATEX II: leading the Expert and Study Group on data exchange in the EasyWay programme

Albrecht Consult

Aachen

Partner PTV

- Software solutions for traffic management
- Leading provider of products and solutions for travel, traffic and transportation planning
- Cutting-edge software technology and consulting to enable customers to meet their mobility needs
- Traveler and consumer information
  - manage traffic and transportation
  - traffic reports
  - optimizing long-term resource allocation
- Know-how:
  - data acquisition from different sources (stationary and floating car)
  - data fusion and data management
- In SEAMLESS: provide extensive knowledge of both the market and the research perspective of traffic management systems and cooperative systems

ptv traffic mobility logistics.

Karlsruhe

Partner Mott MacDonald

- Transport technology services:
  - traffic management systems
  - communications design
  - data management and analysis
  - travel information systems
- In SEAMLESS:
  - Experience on the full range of inter-urban and urban traffic systems interfaces and data distribution issues
  - deep technical experience on harmonisation of protocols
  - awareness of emerging research on in-vehicle traffic management
- Projects:
  - Leeds UTMC – delivery of traffic management systems integration platform; integration of ITS components including VMS and website
  - Halogen – provides information services from the national roads infrastructure
  - ITS Metadata Registry – repository and process for data exchange specifications; has contributed to harmonisation & improvement of data dissemination protocols including DATEX II.

Glasgow

Partner TrafficMaster

- Live traffic data, collection, processing and dissemination
- Most established private sector traffic data service provider
- Traffic data quality and dissemination expertise
- Over 4 million customers in the UK
  - radio broadcast (RDS-TMC and DAB-TPEG)
  - internet feeds
  - interactive phone services
  - mobile apps
  - web services

trafficmaster intelligent driving

Crainfield / Bedford

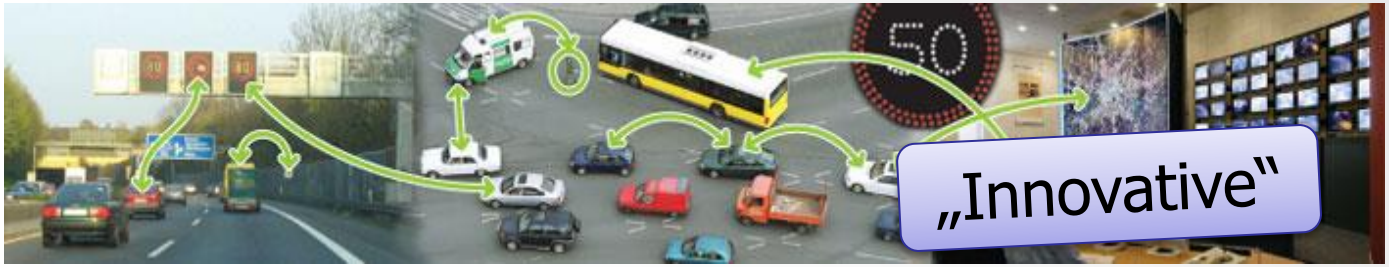
- Customers: car makers, mobile network operators, UK government, motoring organisations, mobile phone and portable navigation companies
- Participation in working groups for the UK's Digital Radio Action Plan and the EC's ITS Directive
- TMC/TPEG standards development work conducted through TISA

The Story

„Traditional“

Traffic Management

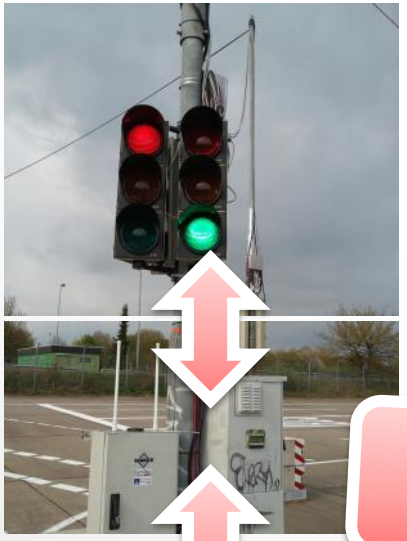
The Story

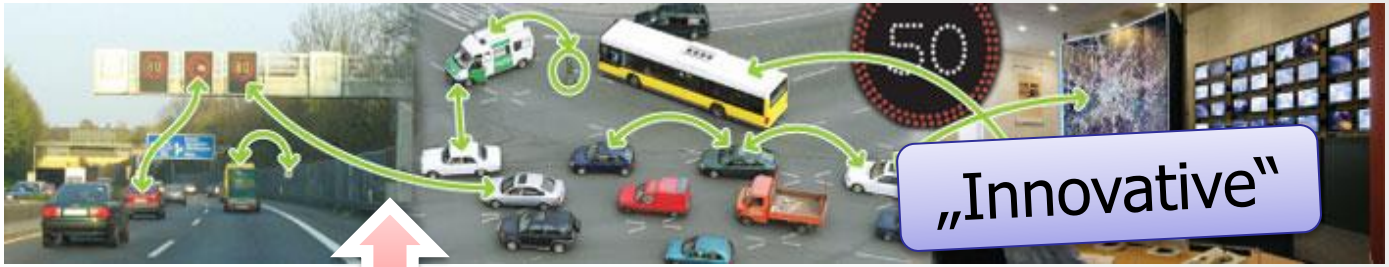


Cooperative Systems

Traffic Management

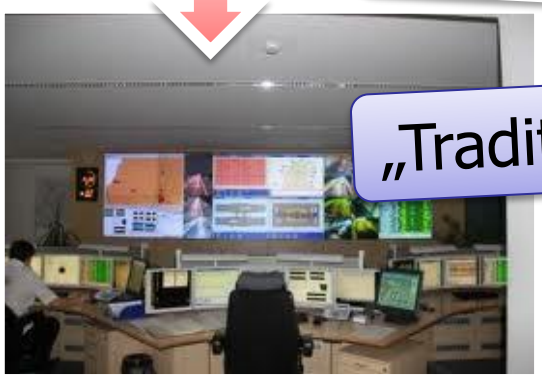
The Story





Cooperative Systems

The Challenge



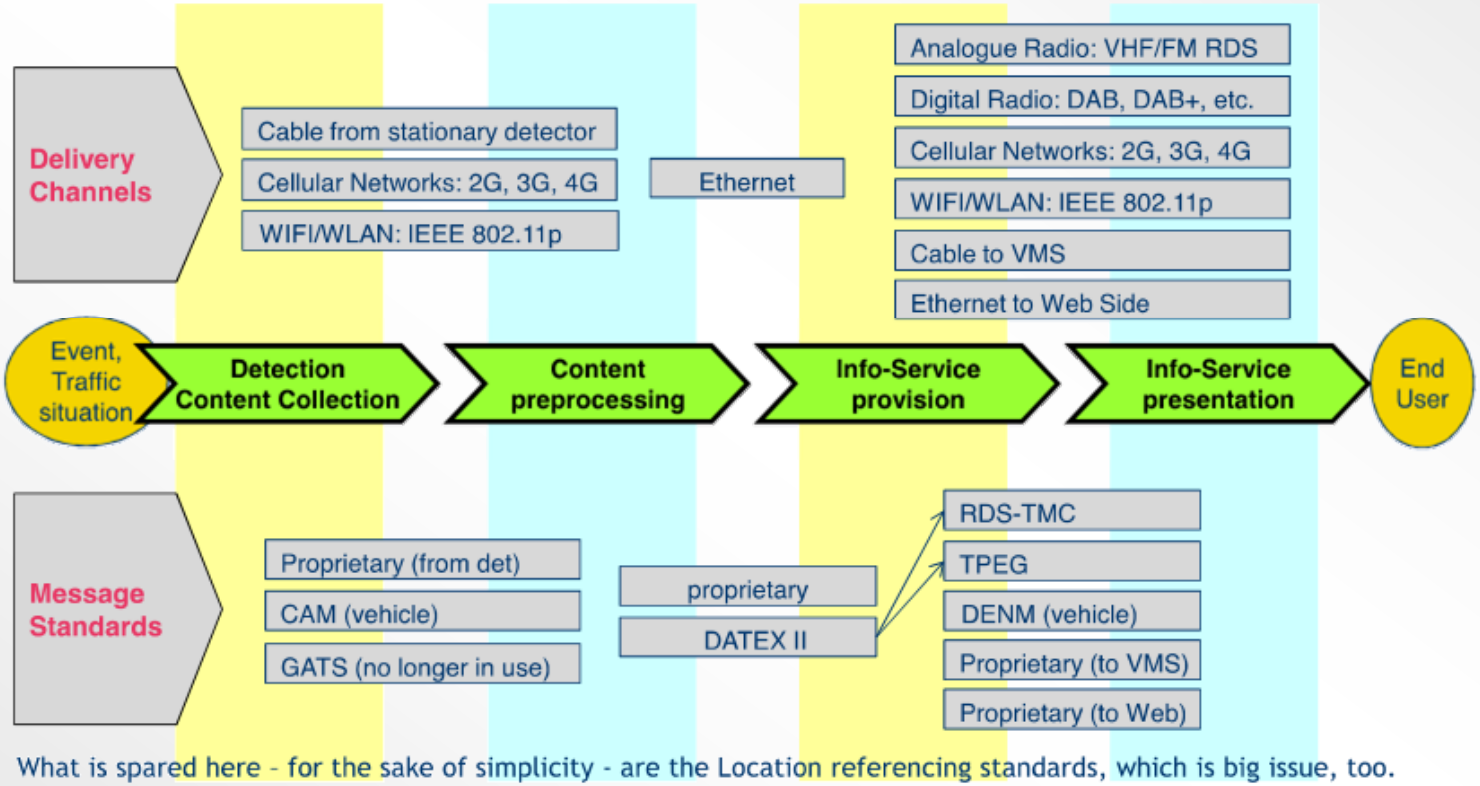
Traffic Management

The Story

- Wake up call for traditional Traffic Management: Cooperative Systems and Data Dissemination are coming!
  - new technologies
  - new infrastructure
  - new players
  - maybe even new mindset
- Two strong and proud communities –
  who takes care of connecting the two worlds?

The Story

Traditional Service Chain

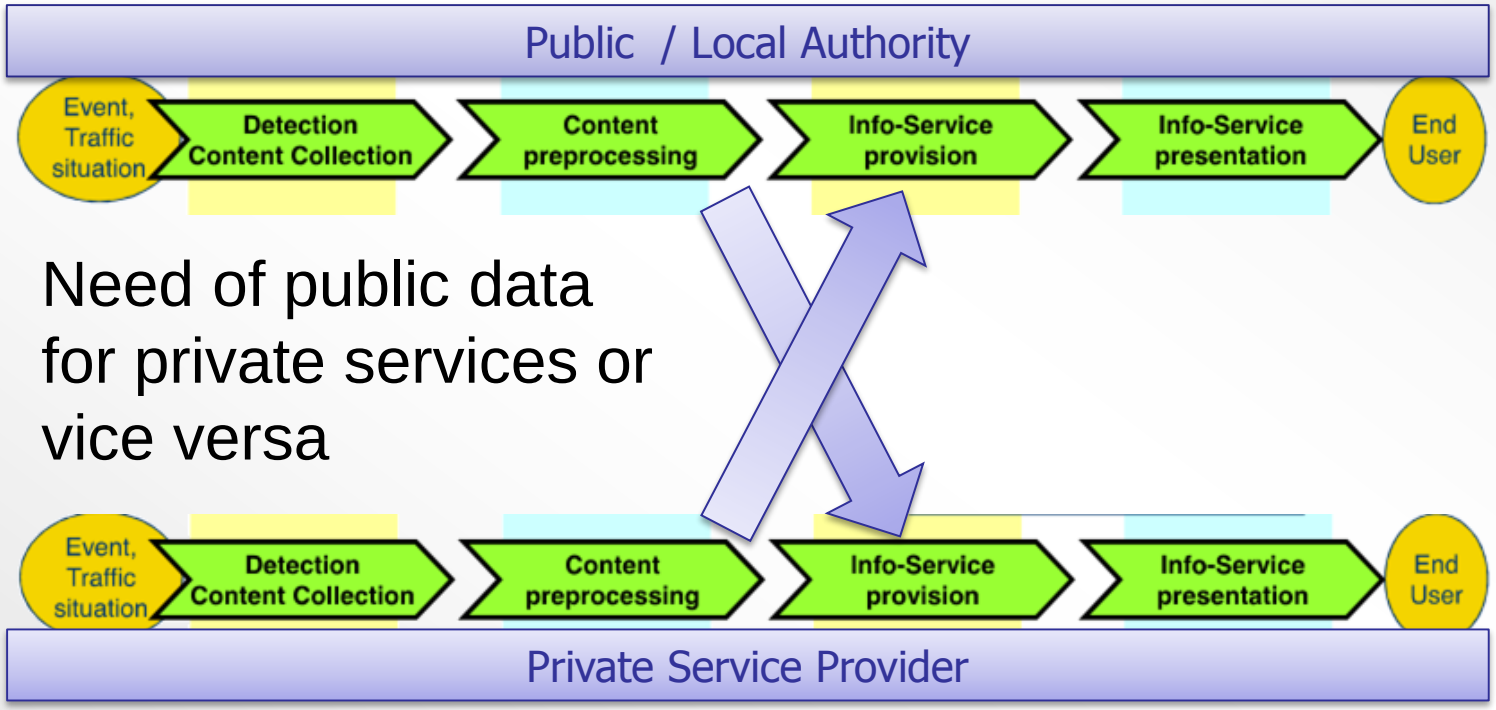


What is spared here - for the sake of simplicity - are the Location referencing standards, which is big issue, too.

TISA Traveller Information Services Association

The Story

Possible influence of Cooperative Systems and Data Dissemination



The Story

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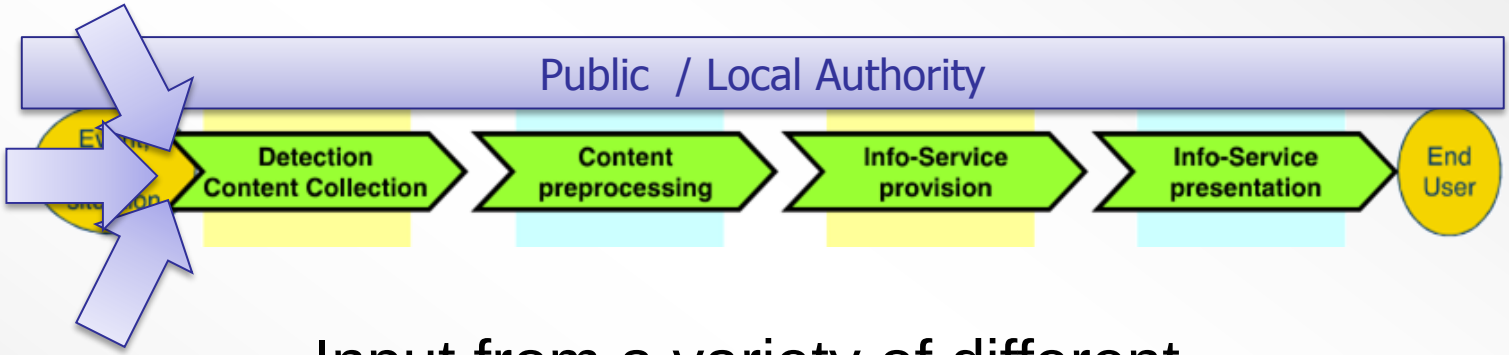
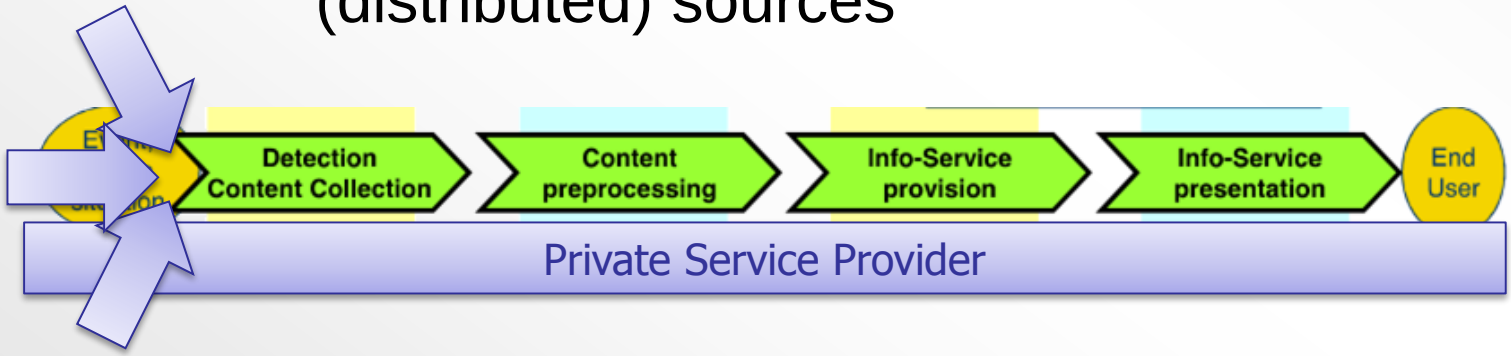


Input from a variety of different (distributed) sources



The Story

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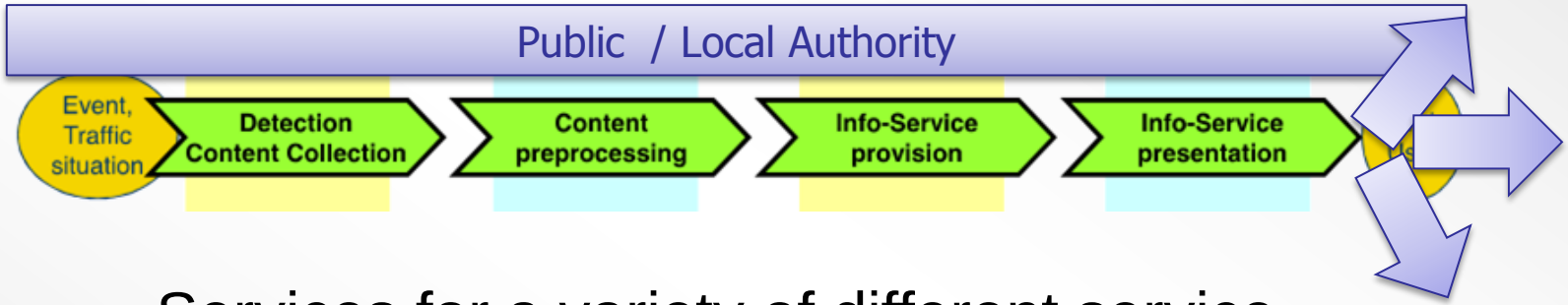
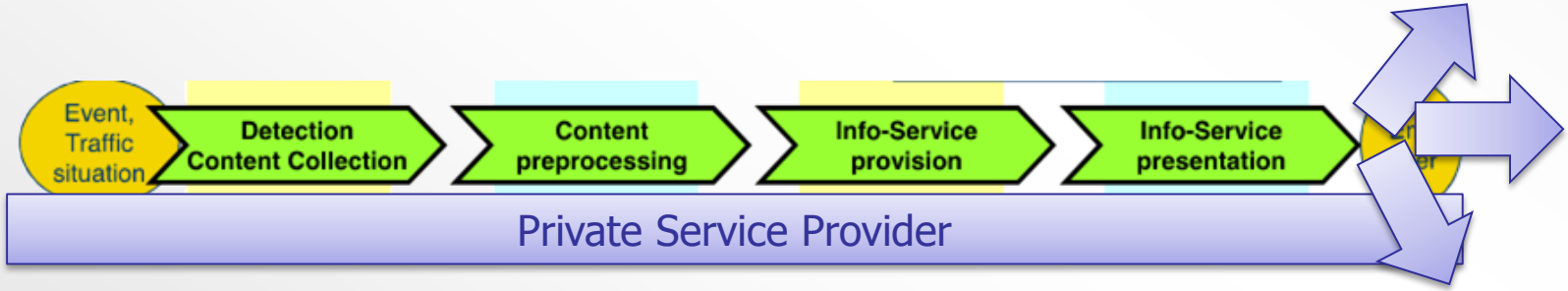


Services for a variety of different service providers and end-user channels



The Story

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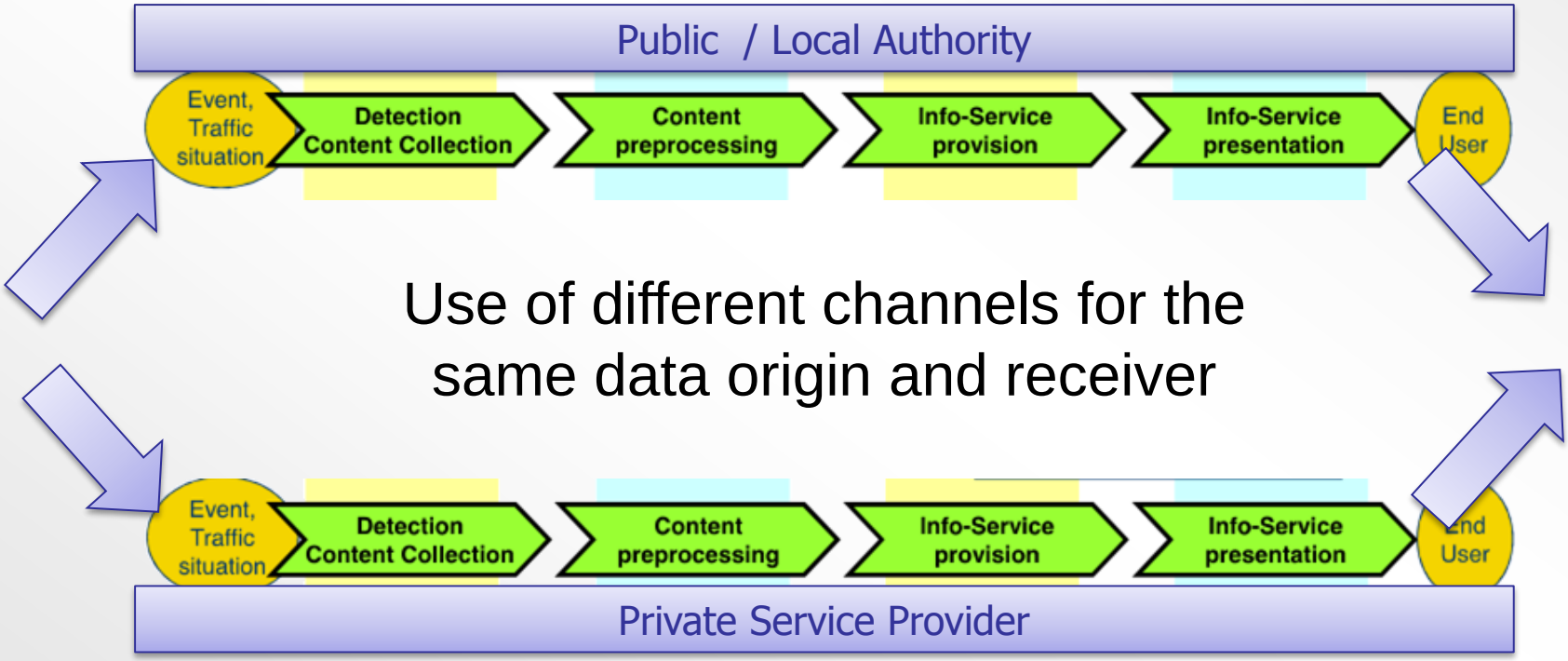
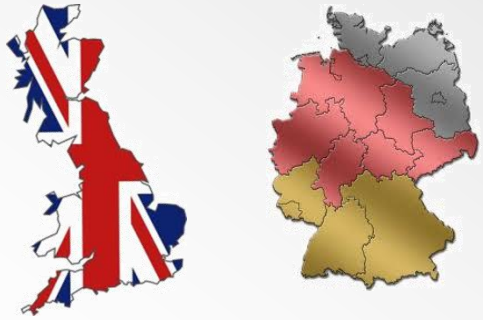


The Story

- A lot of Test Fields for Cooperative Systems
- And yes if you scratch the surface there are efforts to **connect legacy**
  (somewhere in the Annex …)

- Often bespoke/proprietary solutions
  which do not survive the end of the project
- Few (no?) use of standards
- **There is a gap!**

Project 'SEAMLESS'



- "Prepare traffic data dissemination that works seamlessly across urban and inter-urban networks"
- Main topics
  - Data dissemination to in-vehicle systems
  - Link to cooperative systems
  - Linking Legacy

The Challenge

so far

Road authorities must make best use of existing road capacity and keep track of

- Rising traffic demand
- Environmental challenges
- Economical feasibility

now

Road authorities have recognised the growing importance but also the huge potential of intelligent infrastructure

Challenges in distributing road authority data to travellers:

- Not all data available (with public funding?!) reaches travellers (e.g. due to administrative problems)
- Road authorities are seeking to reduce their dependency on bespoke roadside infrastructure for traffic management

The Challenge (cont.)

- Lots of money was invested

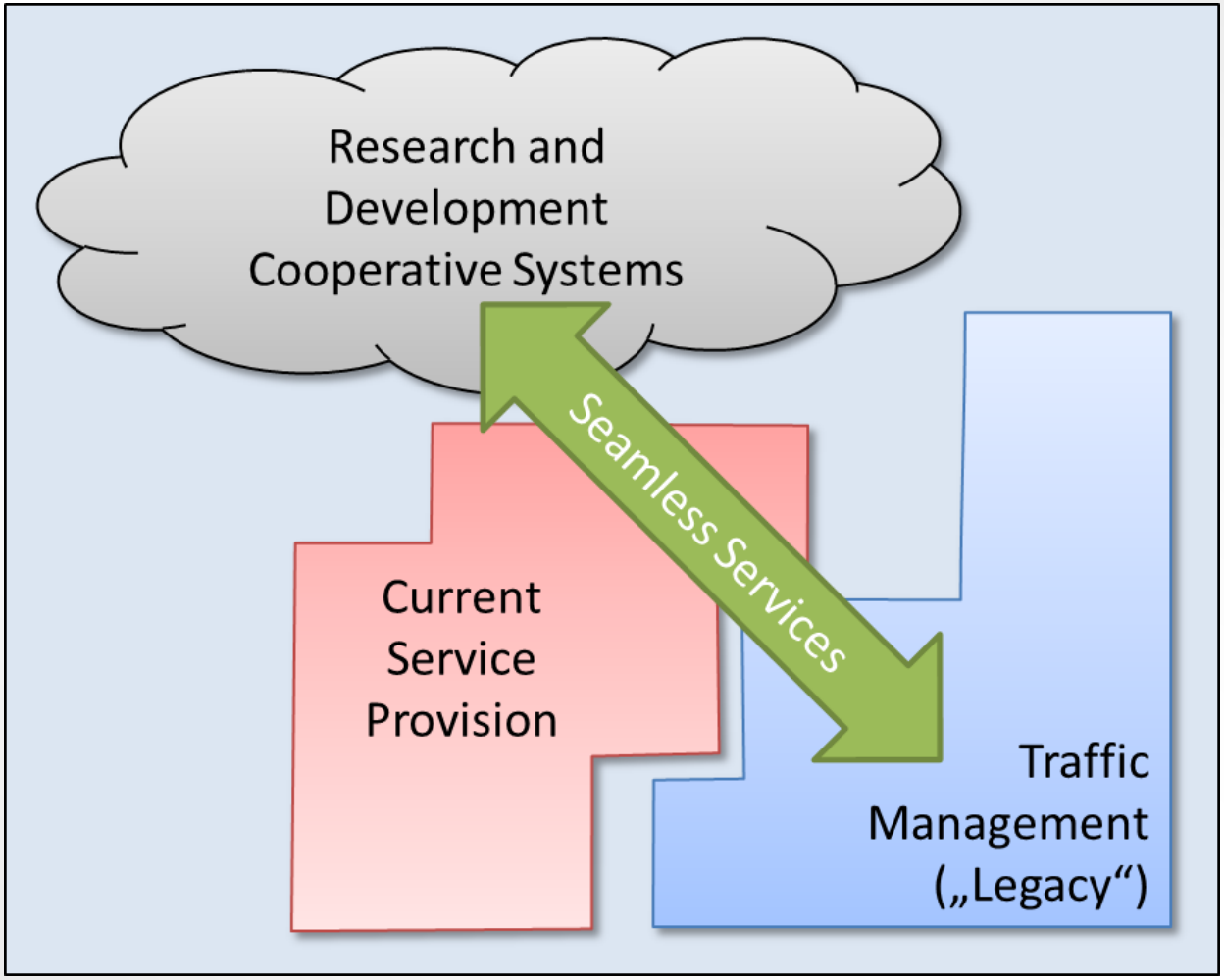
But results are poor

- New technology-channels are to come up

But even new channels have no content,
if back end data exchange does not work

Lack of seamless services

Seamless Services



Results of SEAMLESS

- Overview about existing research
- Analysis of business cases
- Developing a Generic architecture
- Multiple Mappings between standards (UTMC / OCIT to ETSI)
- Harmonisation of protocols and data profiles

Existing research

- "Analysis of existing research on road data dissemination to in-vehicle devices"
- Analysis of existing research
  - Summarized 42 projects in total with respect to Cooperative Systems
  - Description of standards
  - Stakeholder and their objectives
  - Description of Use Cases

Existing research

- Huge number of standardisation and business development activities
- Work of TISA as well as of ETSI/CEN will influence the future market
- Innovation-oriented activities are mainly based on
  - COMeSAFTEY
    (consolidation the outcomes of the research projects)
  - CVIS/SafeSpot/Coopers
    (basic technology oriented results)
  - Sim^{TD} and Drive C2X
    (most relevant field operation tests (FOT))
- Introduction of new services must be based on sound migration strategy

Furthermore:

- EU-wide know-how and orientations have been incorporated into SEAMLESS by the Deployment Guidelines (in form of knowledge from more than 140 road operators)

Existing research

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    (basic tech
  - Sim[TI]
    (mos
- Introduc
  strategy

Was shown in previous meetings and is published in Deliverable 1

Furthermore:

- EU-wide know-how and orientations have been incorporated into SEAMLESS by the Deployment Guidelines (in form of knowledge from more than 140 road operators)

Business Case Considerations

- Advantages of new data-exchange cooperations

  Road Operators:
  - Direct communicate with the driver
  - Better acceptance of the measures

  Car Manufactures:
  - improvement of vehicle safety systems
  - driver information and efficient engine control

  Service Providers:
  - commercial distribution of data and information

- Exchange of data
- Free Delivery
- Payment Model

- Appropriate organizational arrangements needed for cooperation – for example Mobility Data Market Place
- Focus on long period operation without losing quality
- Business structures must be in line with all technical and organizational aspects

⇨ Cost savings, quality improvement of information

Business Case Considerations

- Private information providers and the automotive sector have realised the need for improved cooperation between (urban) public authorities and industry
- BUT: 'Unlocking' public data is cost intensive!
  - legacy systems (different level of implementation, different hardware structure, different data structures, …)
  - often small coverage of multiple authorities
  - not always free of charge
  - data existence not even always known
- As a result, only the most valuable sources are used
- Suggestions:
  - Data is released to the commercial providers 'free of charge' using a simple model
  - contract with few if any restrictions on data re-use
  - Data should be available from all sources in one (or a minimum set of) agreed common formats (for example consolidated DATEX II profiles)

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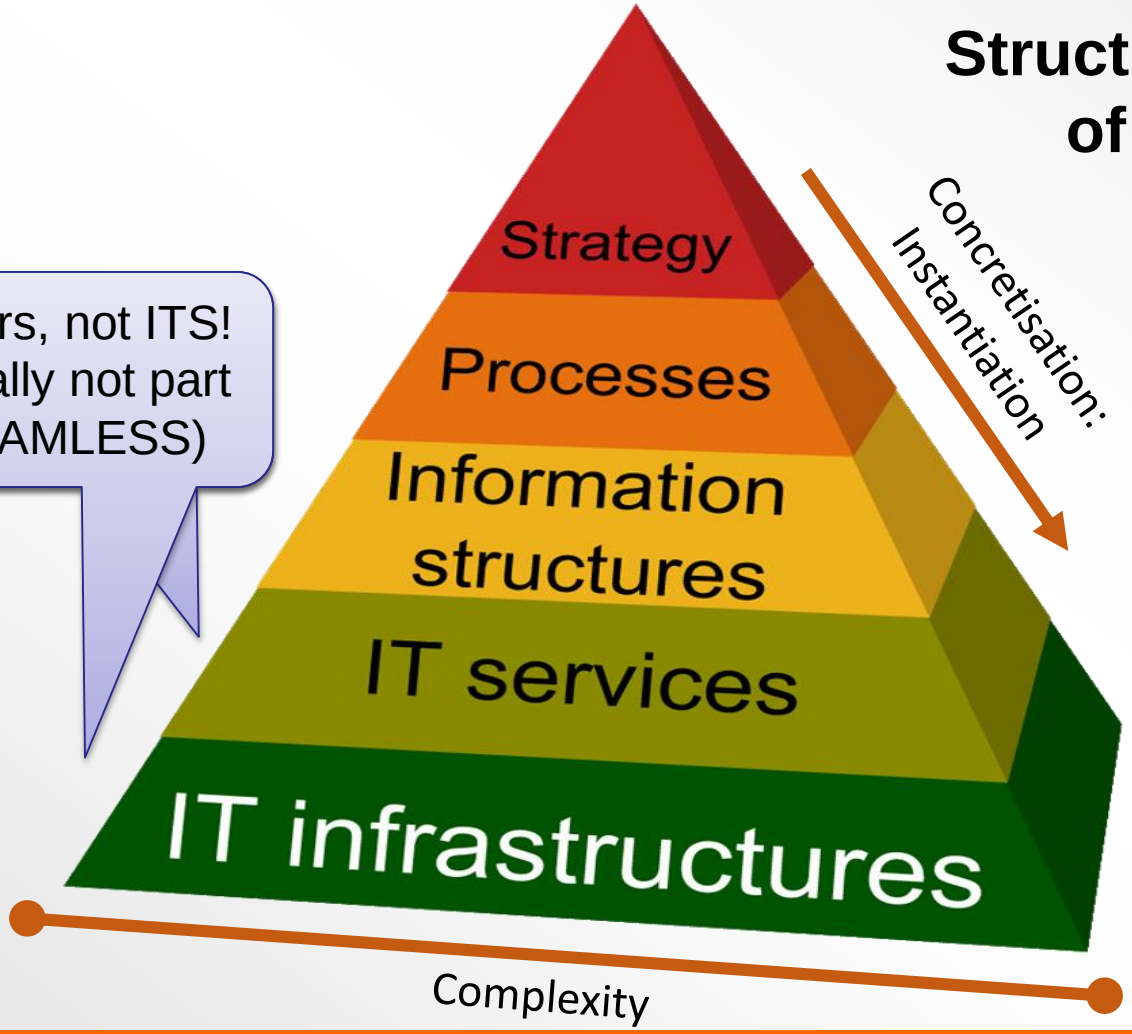
See Deliverable 2

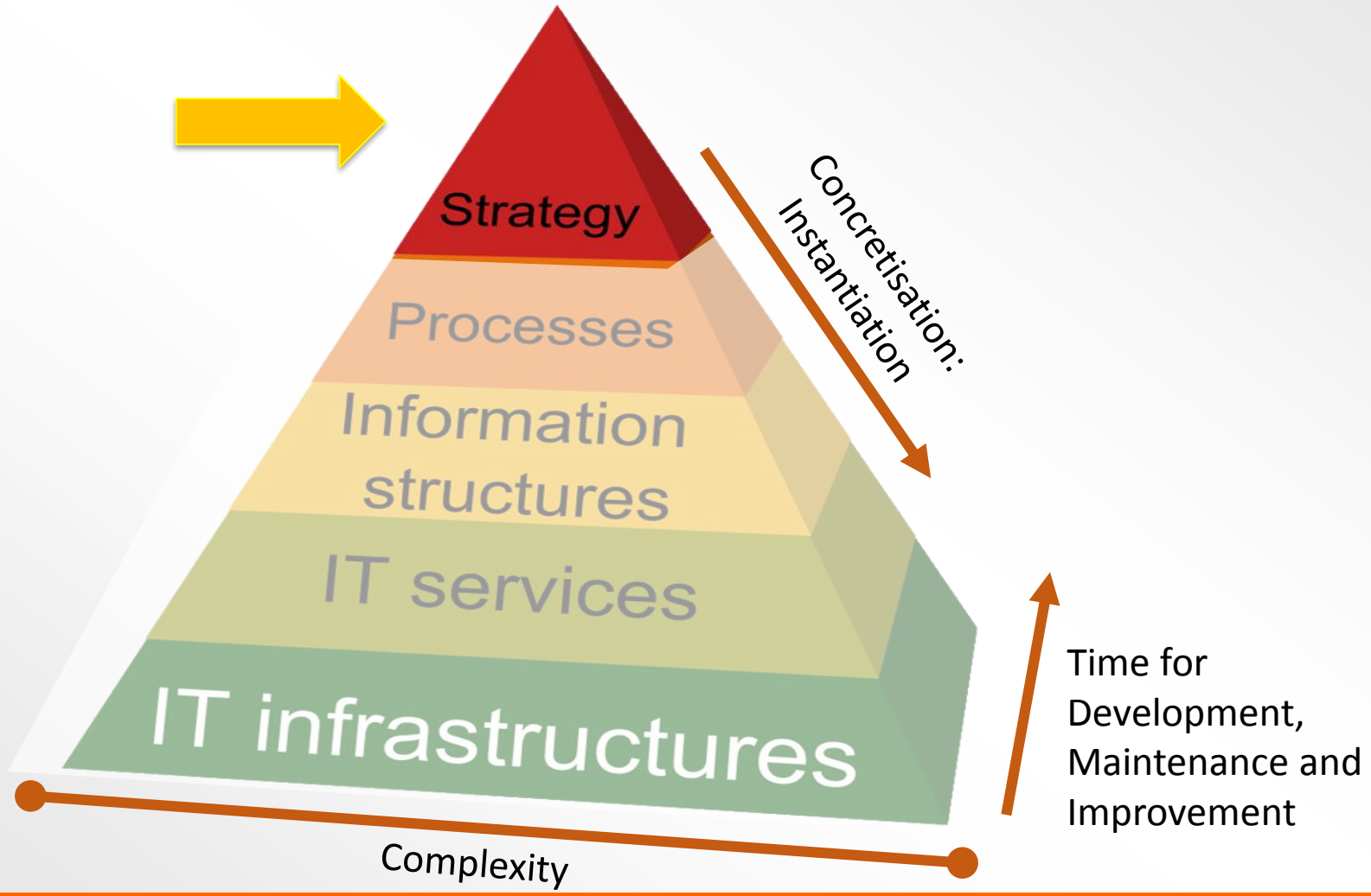
ITS Services

Structural composition of ITS Services



IT layers, not ITS! (basically not part of SEAMLESS)

Generic Architecture



Generic Architecture

- Architecture model for C-ITS
  - Generic nature
  - Adapting existing architectures (ETSI, CVIS, ..)
  - Focus on linking legacy systems
  - Base for modeling tailored reference architectures for different use cases (e.g. traffic light phase assistant, journey times, …)

Service Providers

Road Operators

Central Layer

Field Layer

Mobile Layer

Service Providers

Road Operators

Central ITS-station

Central ITS-station

Roadside ITS-station

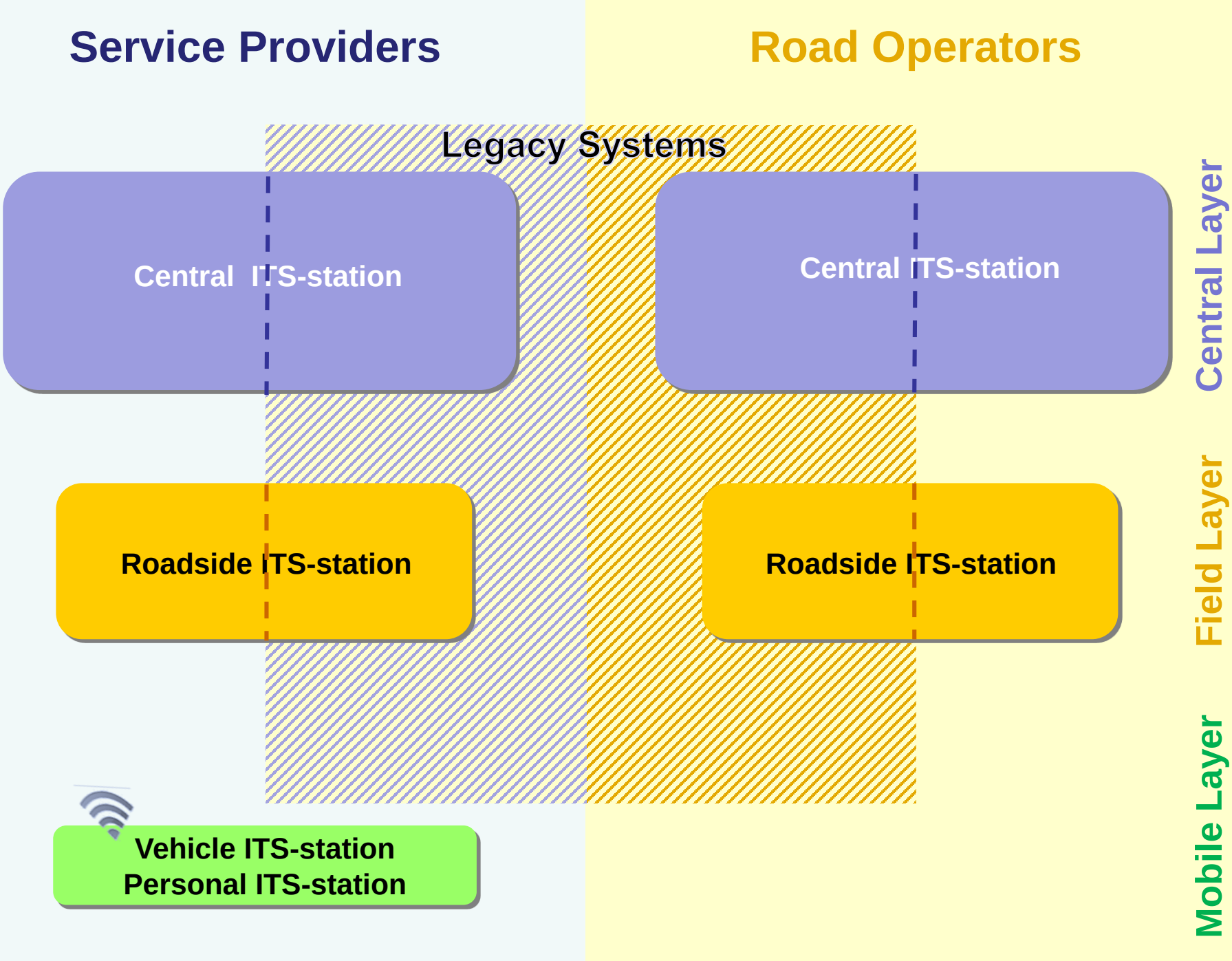
Roadside ITS-station

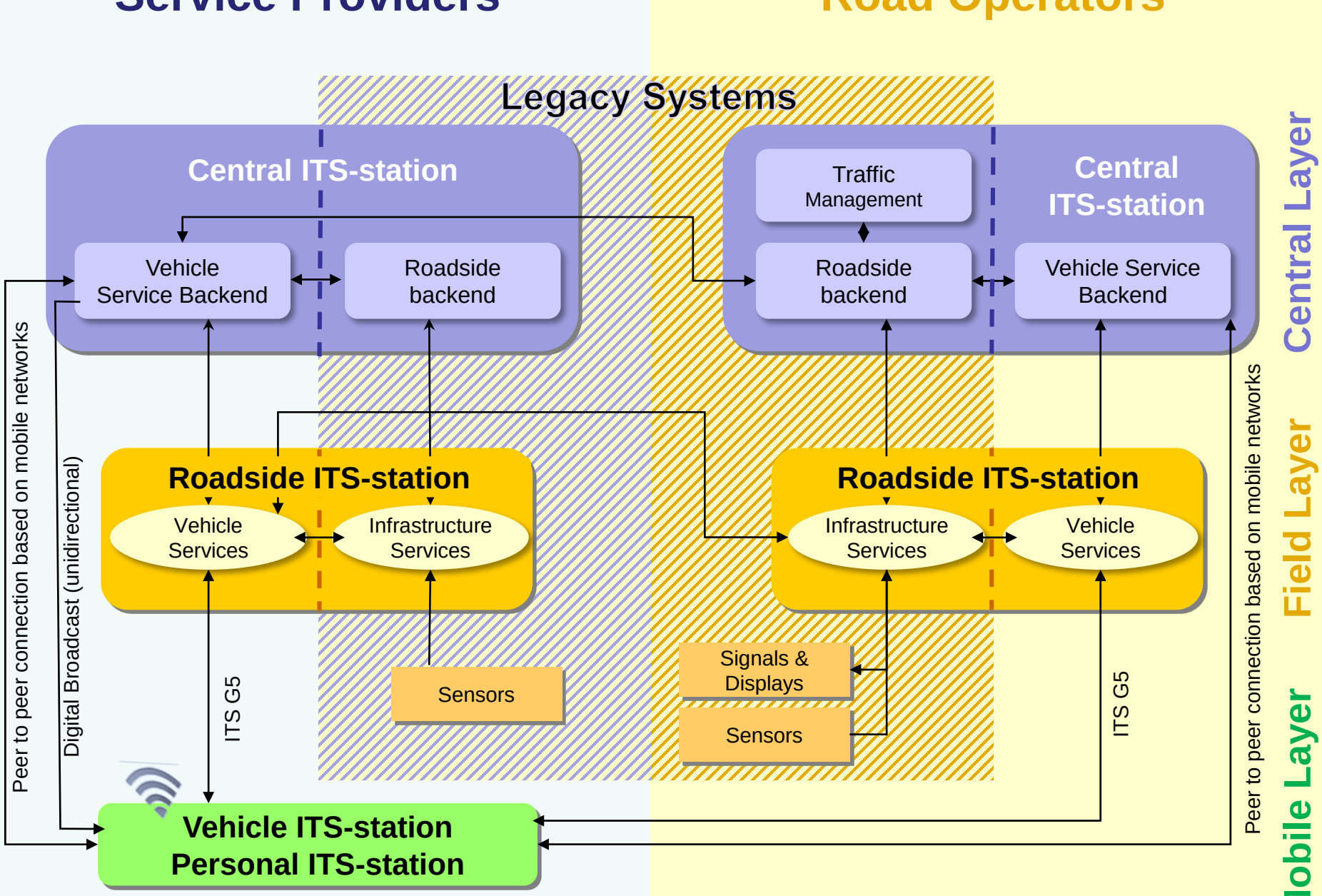
Vehicle ITS-station
Personal ITS-station

Central Layer

Field Layer

Mobile Layer

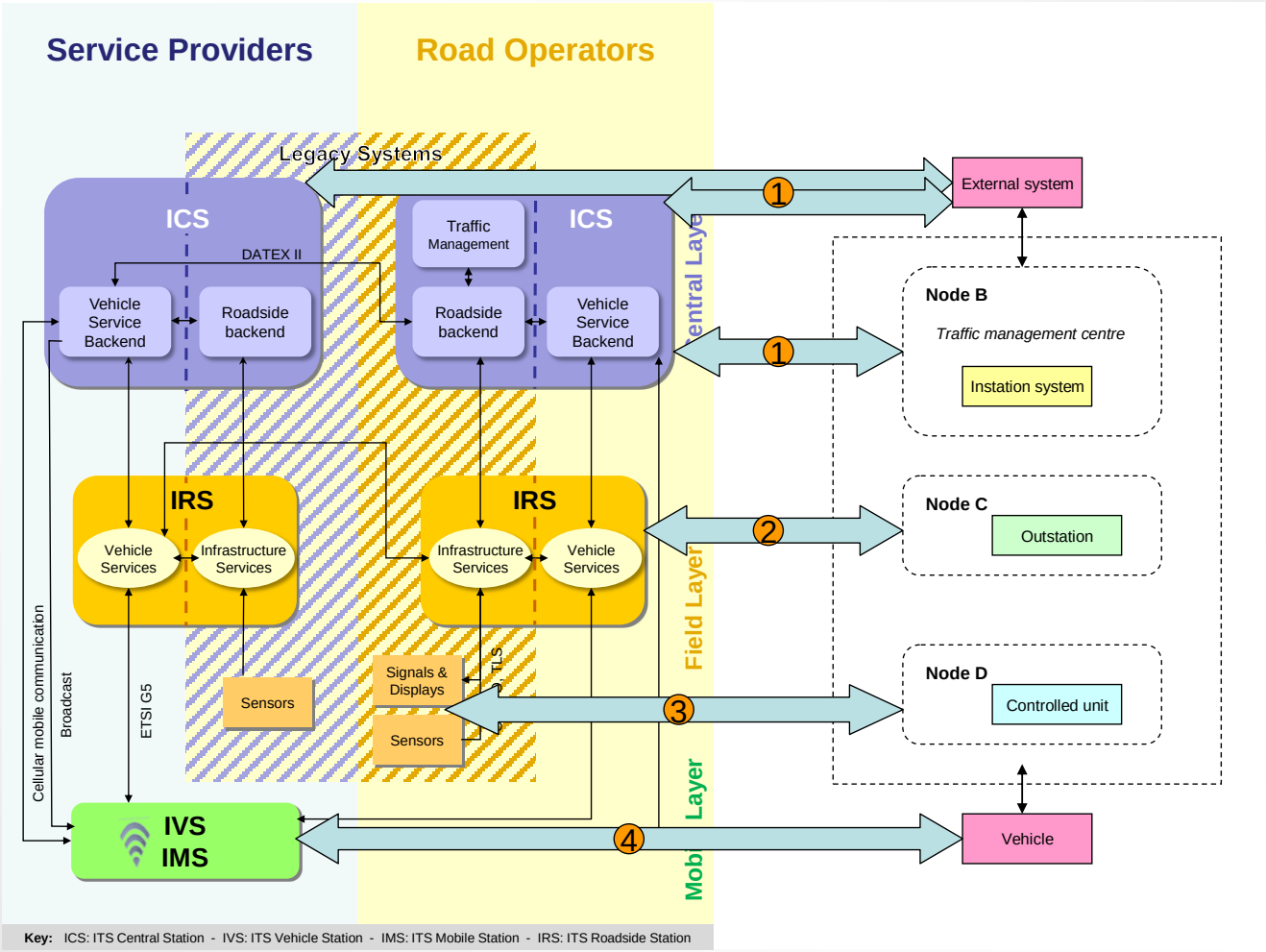

Service Providers
Road Operators
Legacy Systems
Central ITS-station
Central ITS-station
Roadside ITS-station
Roadside ITS-station
Vehicle ITS-station
Personal ITS-station
Central Layer
Field Layer
Mobile Layer


Service Providers
Road Operators
Legacy Systems
Central ITS-station
Vehicle Service Backend
Roadside backend
Traffic Management
Central ITS-station
Roadside backend
Vehicle Service Backend
Roadside ITS-station
Vehicle Services
Infrastructure Services
Roadside ITS-station
Infrastructure Services
Vehicle Services
Sensors
Signals & Displays
Sensors
Peer to peer connection based on mobile networks
Digital Broadcast (unidirectional)
ITS G5
ITS G5
Peer to peer connection based on mobile networks
Vehicle ITS-station
Personal ITS-station
Central Layer
Field Layer
Mobile Layer

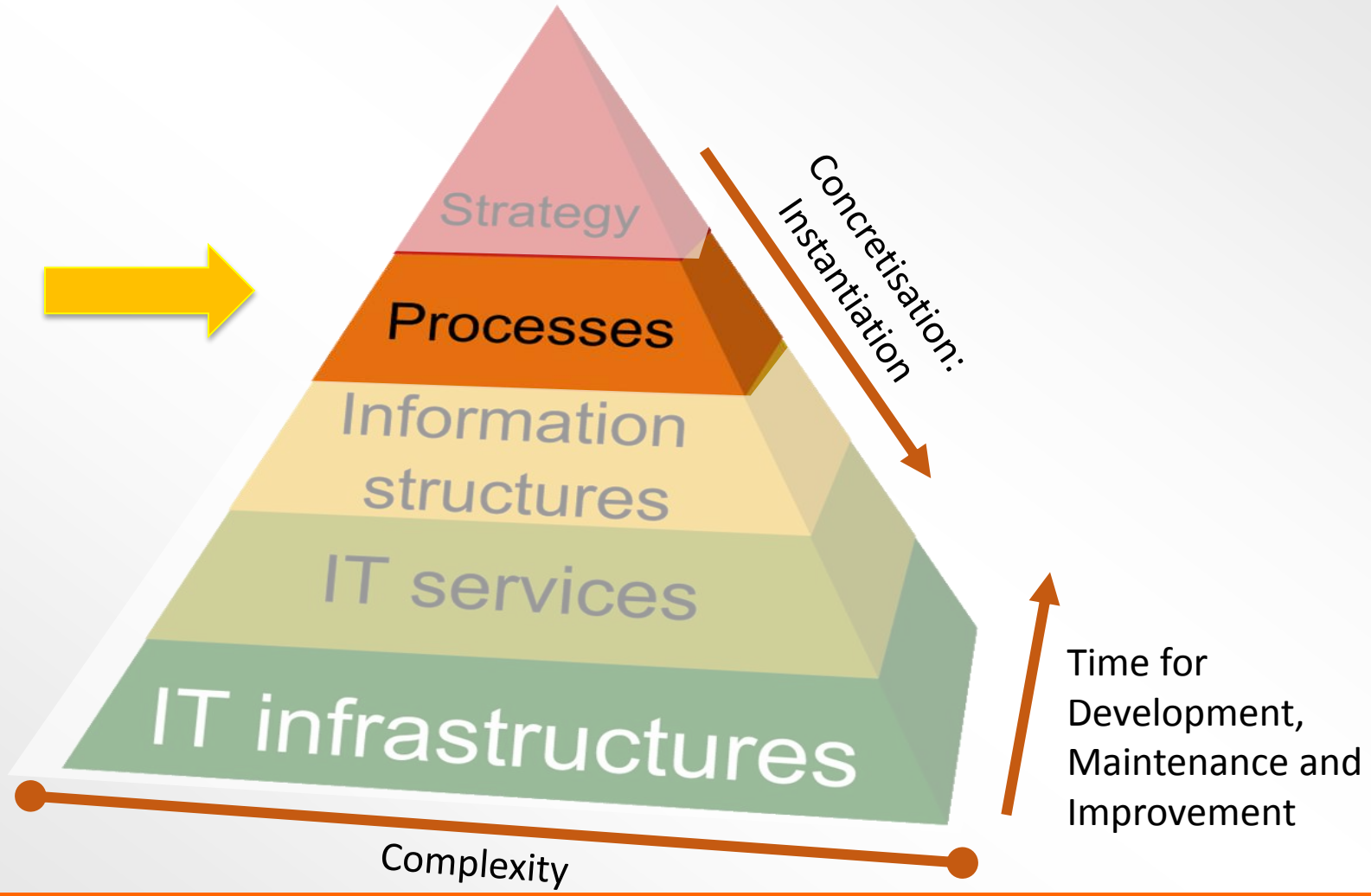
Hybrid communication

- Service Providers
  - want to deliver their information through a dedicated channel
  - want to set their services apart from other service providers
  - do not feel unhappy when controlling both ends of the channel (e.g. bespoke solution on customer side)
- Road Operators
  - are interested in complete and coincident information on customer side and
  - consistent data deliveries
  - like to use more than one channel to get a wider information spread and to compensate channel constraints

Example Mapping to UTMC

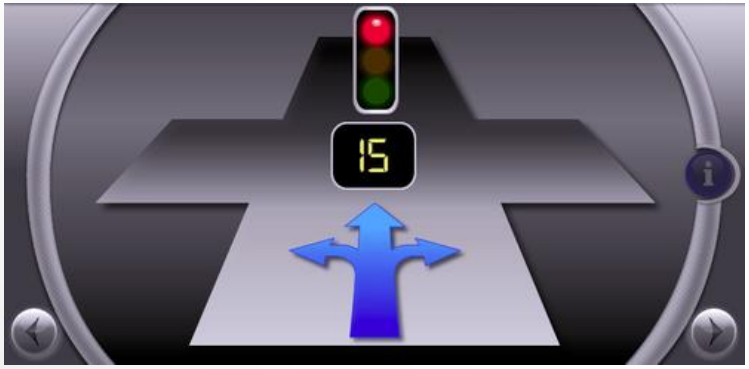


Use Cases


Strategy
Processes
Information structures
IT services
IT infrastructures
Concretisation: Instantiation
Complexity
Time for Development, Maintenance and Improvement

Use Case

Example Traffic Light Phase Assistant



Traffic Light Phase Asst.

- Different architectures possible

(direct communication via Field Layer, Central routing, …)

- Different communication channels

(digital or local broadcast, peer to peer, …)

- Different Data Models

(type and amount of data to transfer differs a lot)

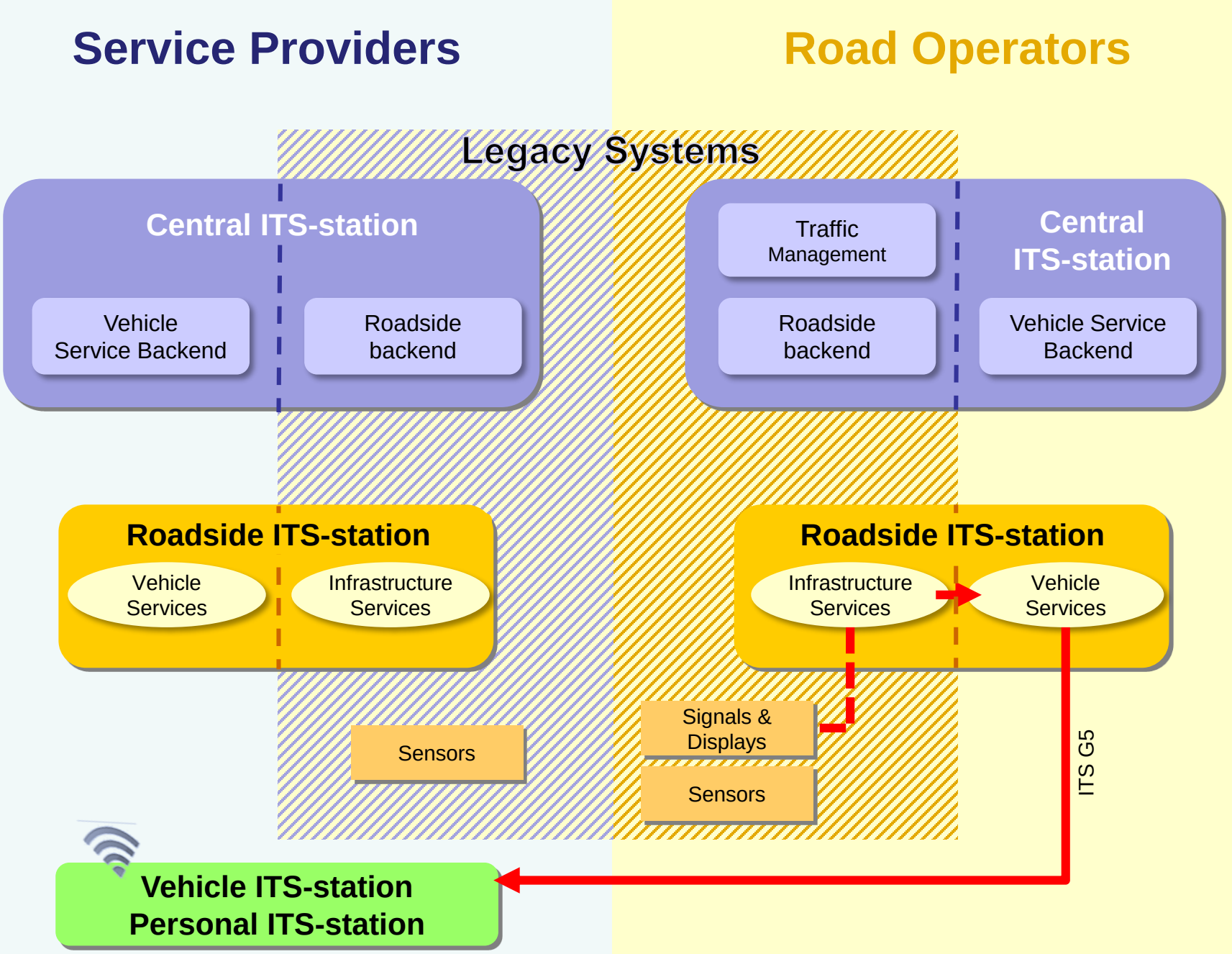
- Different channel characteristics

(Latency, Bandwidth)

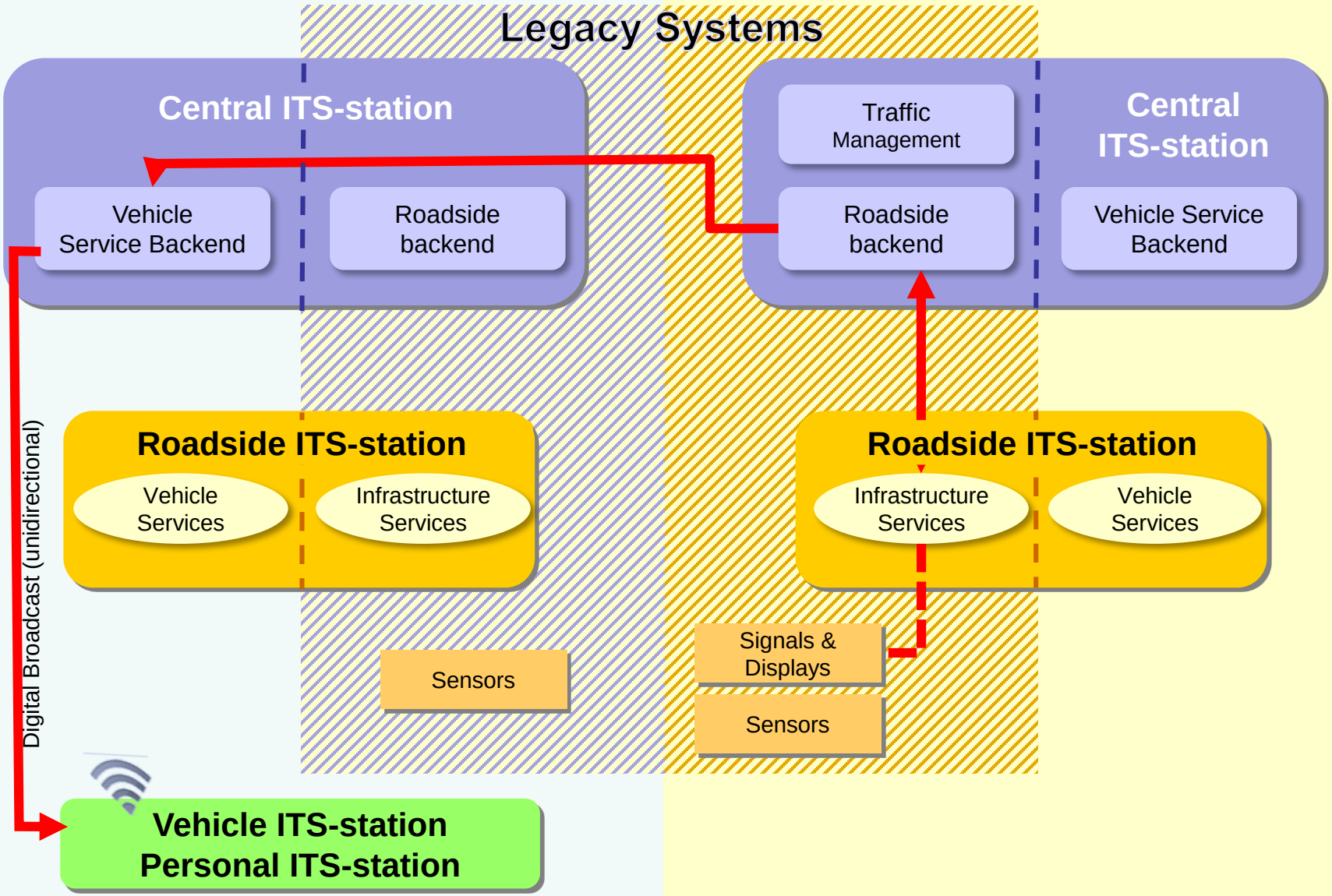
- Different applications

(Real time prognosis, routing, eco-driving, …)

All of these Points influence each other!



Example communication via Field Layer



Example communication via Service Provider

Traffic Light Phase Asst.

- Roadside ITS station is raising questions
  - Where is it placed physically?
  - Multifunctional approach
    (like sim^{TD}, with framework and applications)
    sim^{TD}, CVIS paradigm: adding elements at runtime

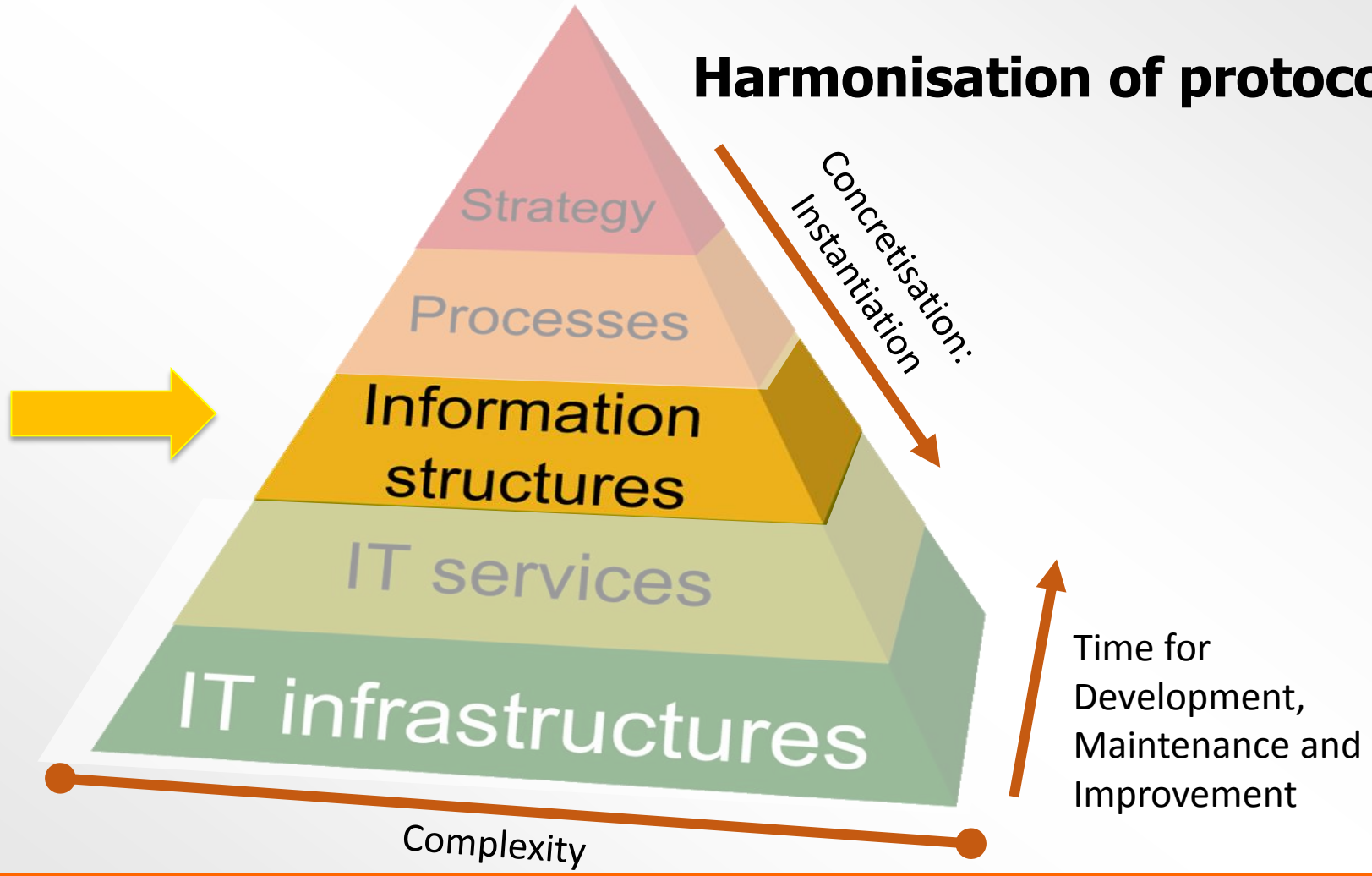
  or "Plug-in" for Traffic light controller
    (intended by manufactures of traffic light controllers
    → more complex data handling inside the controller necessary)
- And even more
  - Own radio module for every application?
  - Will OCIT-O need to transport FCD data? (in fact, this is planned)
  - New controlling methods/software necessary?!
    (also think of budget approaches regarding Public Transport)

Lots of unregulated activities

Questions are the same as for inter-urban systems!

DATEX II profiles and mappings

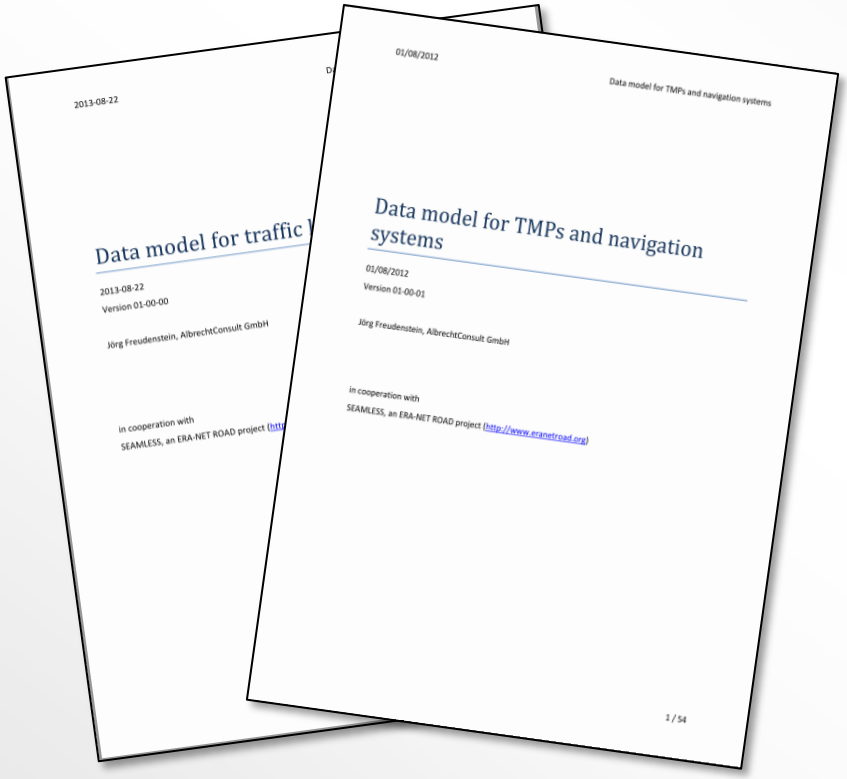
Harmonisation of protocols

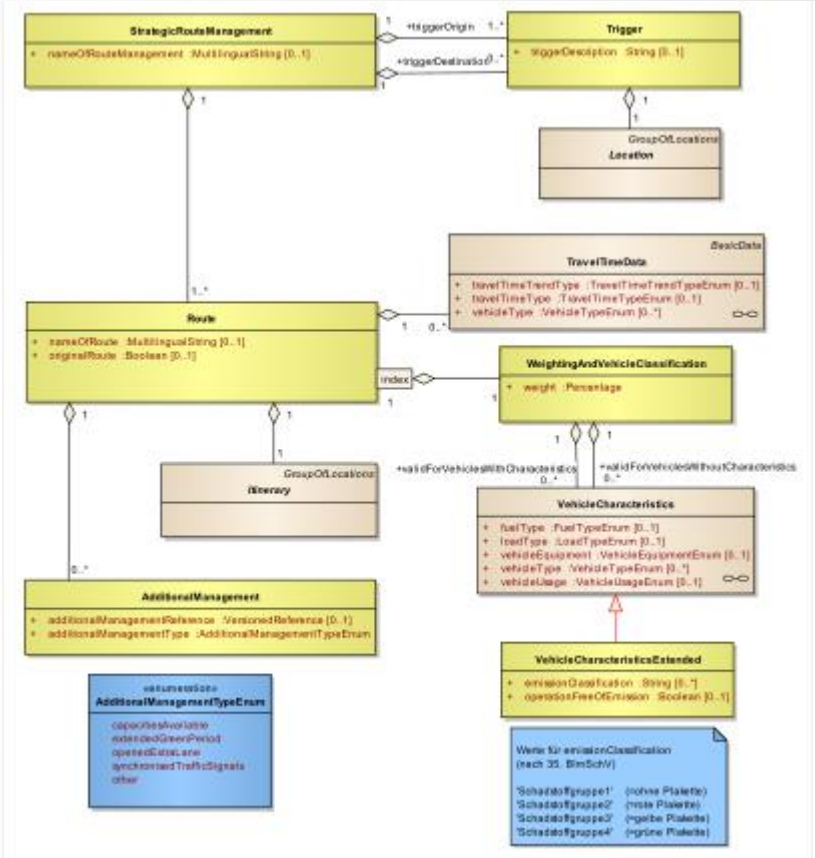


Harmonisation of protocols

- SEAMLESS results on the **traffic light** use case
  - DATEX II model and profile for traffic light information
  - DATEX II model and profile for traffic management plans

DATEX II profiles





DATEX II profiles (cont.)

- UML Profile, tailored to the use case in question
- Selecting appropriate attributes and literals from DATEX II „Level A“
- Adding custom extensions („Level B“)
- XSD schema
- Documentation
- Example files (XML)

Harmonisation of protocols

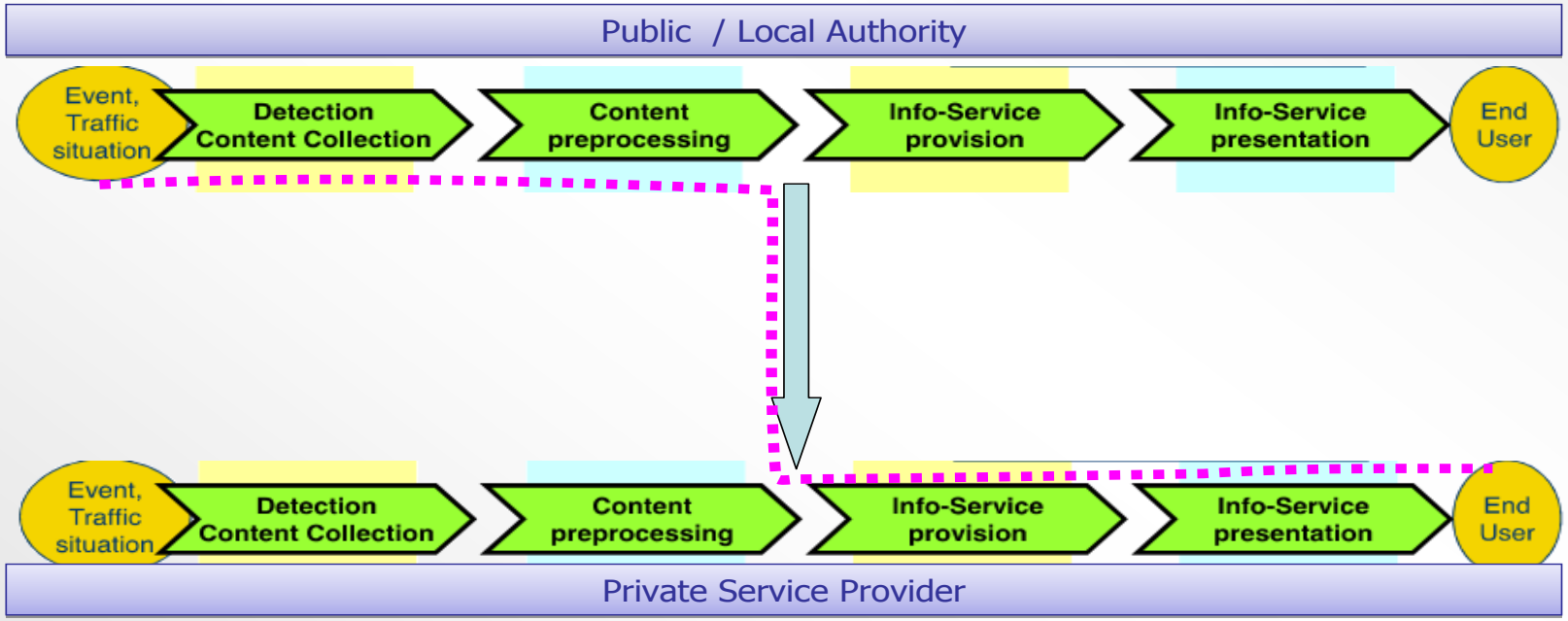
- SEAMLESS results on **traffic information** use case
  - Improved travel time & traffic condition profile
  - XML Schema defining travel time & traffic condition profile (like seen before on Traffic Light Use Case)
  - Comment on CEN 16157-5 (Variable Message Signs)
  - Improvement issues with DATEX II
  - Comment on TPEG TFP
  - UTMC Guidance – Publishing traffic information
  - Guidance on translation of DATEX II travel times and traffic events to TPEG.

Now showing

Example DATEX II to TPEG

Here: Travel times and traffic status (translation to TPEG TFP)

Same exists for traffic events (translation to TPEG TEC)



Example DATEX II to TPEG

Comparison:

EasyWay Deployment Guideline TIS-DG03-05 vs. DATEX II (no distinction in TPEG TFP)

EasyWay travel time types	DATEX II enumeration literals
• *Instantaneous Travel Time (ITT)* • *Output Rebuilt Travel Time (ORTT)* • *Estimated Travel Time (ETT)* • *Mixed Travel Time (MTT)* • *Forecast Travel Time (FTT)*	• *best* • *estimated* • *instantaneous* • *reconstituted*

SEAMLESS

Example DATEX II to TPEG

TPEG TFP concept	DATEX II-TPEG translation notes
freeflowTravelTime	from freeflowTravelTime
delay	difference between travelTime and freeflowTravelTime
averageSpeed	Represented by TrafficSpeed::averageVehicleSpeed, but this is not in the DATEX II travel times profile.
LOS (level of service)	from combination of trafficStatusValue and trafficTrendType (if published, else the translation will need to look at the previous value to determine the trend)

status

freeflow -> free traffic

heavy -> heavy traffic

congested -> queuing traffic

impossible -> no traffic flow

unknown -> unknown

trend

trafficBuildingUp -> "increasing" i.e. codes 17-20

trafficEasing -> "decreasing" i.e. codes 26-30

trafficStable -> "constant" i.e. codes 9-14

unknown -> "Tendency: unknown" i.e. codes 0-6

Example DATEX II to TPEG

- SEAMLESS showed how to translate urban traffic management system information (DATEX II) for subsequent presentation to motorists (TPEG) for traffic status and traffic events
- Based on UTMC urban traffic systems
  (i.e. not all parts of DATEX II or TPEG are covered)
- UDG (UTMC Development Group) can be asked to add extensions to UTMC to cover all mandatory TPEG elements
- DATEX II is capable to cover the bridge between UTMC and TPEG without lack of information

SEAMLESS in Summary

- Amount of data is increasing, its audience as well
- Data today is still not always accessible in a satisfying way

⇨ Danger of reducing interest in new technologies

⇨ New Opportunities go along with new risks of wrong handling

- SEAMLESS showed how to merge architectures from R&D and FOT on existing urban systems
- SEAMLESS showed that OTS and UTMC can be mapped to C-ITS architectures
- SEAMLESS showed variants for the open question of best allocation for R-ITSS (same problem for urban than for inter urban)

Thank you for your attention

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On behalf of the SEAMLESS partners:
Mott MacDonald, UK
PTV, Germany
TrafficMaster, UK
AlbrechtConsult, Germany

Collection of Links

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- www.ots2.org
- www.utmc.uk.com
- www.simtd.de
- www.cvisproject.org