NexTech 2015, 19-23 July 2015, Nice, France

Panel on UBICOMM/EMERGING

Ubiquity, Internet of Things, and Accessibility: On Infrastructure Criticality and Resilience Needs

Moderator:
Hassan Khachfe, Lebanese International University, Lebanon

Panelists:
Dmitry Korzun, Petrozavodsk State University, Russian Federation: ***Smart spaces approach to creating ubiquitous IoT-based environments***

Nizar Al-Holou, University of Detroit Mercy, USA: ***Intelligent Transport Systems***

Andrzej Marczak, Gdansk University of Technology, Poland: ***Data security and data transmission in wireless network***


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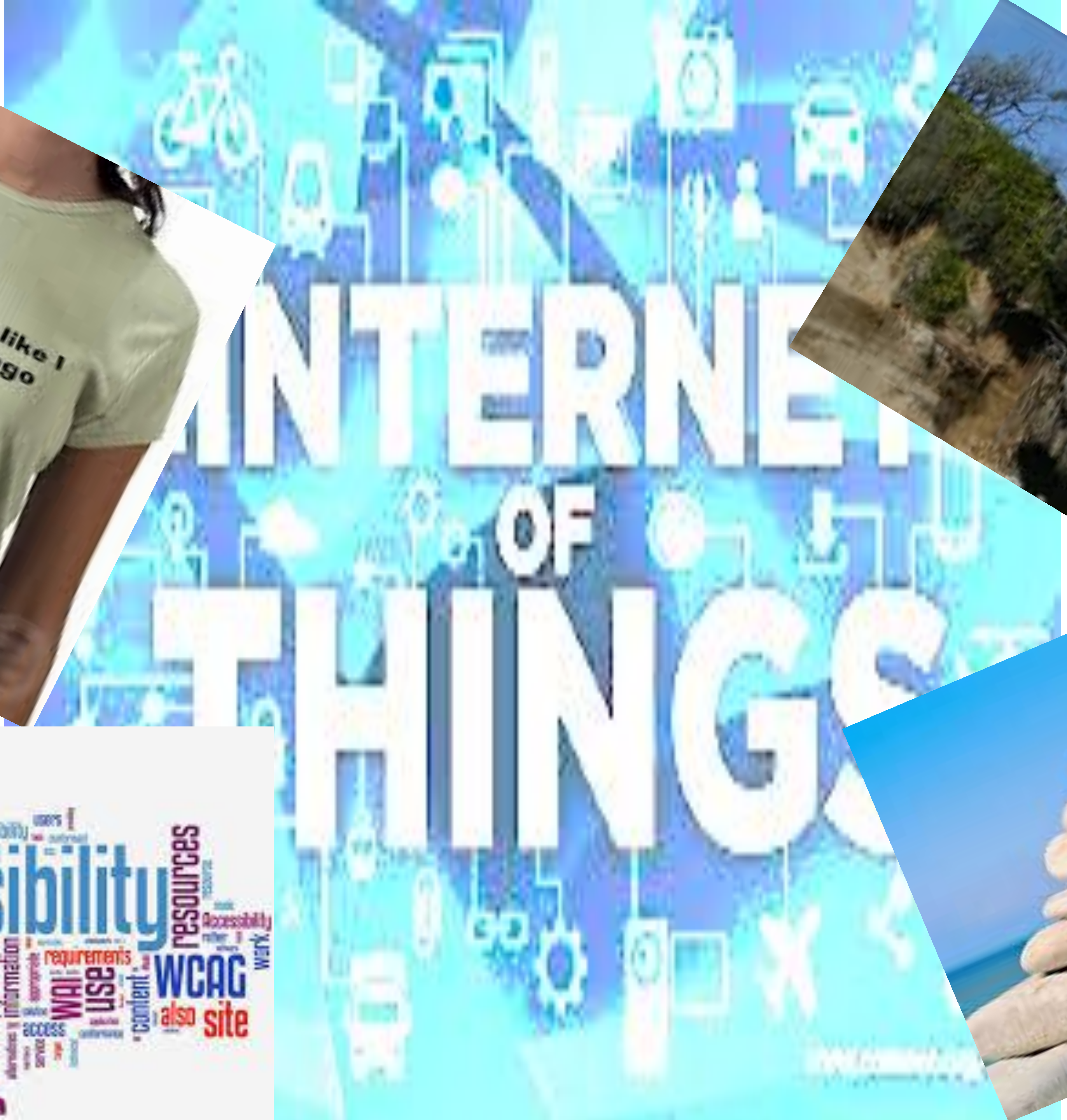
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Panel on UBICOMM/EMERGING
Ubiquity, Internet of Things, and Accessibility: On Infrastructure Criticality and Resilience Need

Dmitry Korzun

Department of Computer Science, Petrozavodsk State University, Russia

dkorzun@cs.karelia.ru

UBICOMM 2015
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The smart spaces approach to creating ubiquitous IoT-based environments

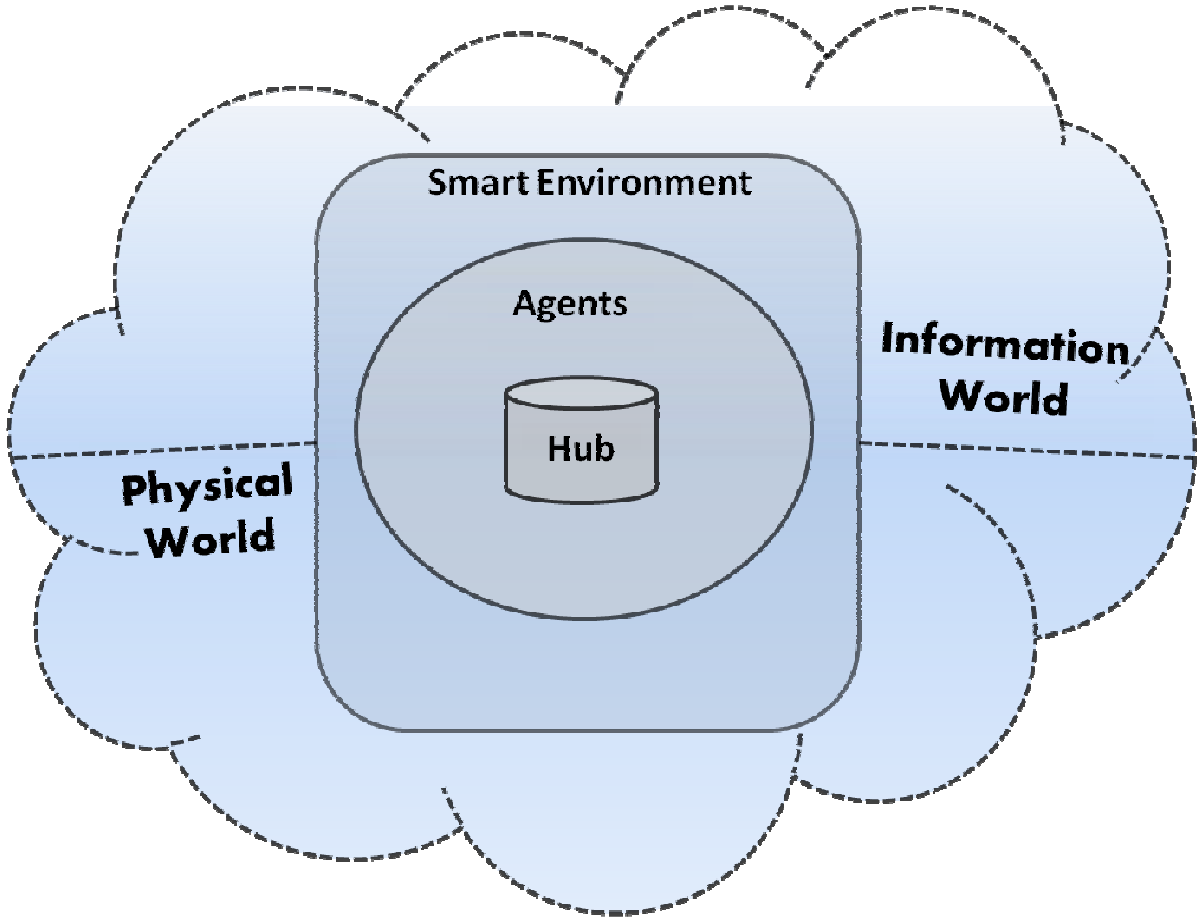
1. What the Internet of Things provides to smart spaces: ubiquitous connectivity and smart objects.
2. What infrastructural properties a smart space needs to construct and deliver services for surrounding users.
3. What mechanisms can support resilient accessibility of services in smart spaces.

Internet of Things (IoT) - Smart Spaces (SS)

- Smart Object (SO)
  - Everyday (physical) objects are augmented with sensing, processing, and network capabilities. They can understand and react to their environment.
- IoT: SO = smart device as a transformation result of a physical object
- SS: SO = software (programmable) agent running on a device

Smart Space

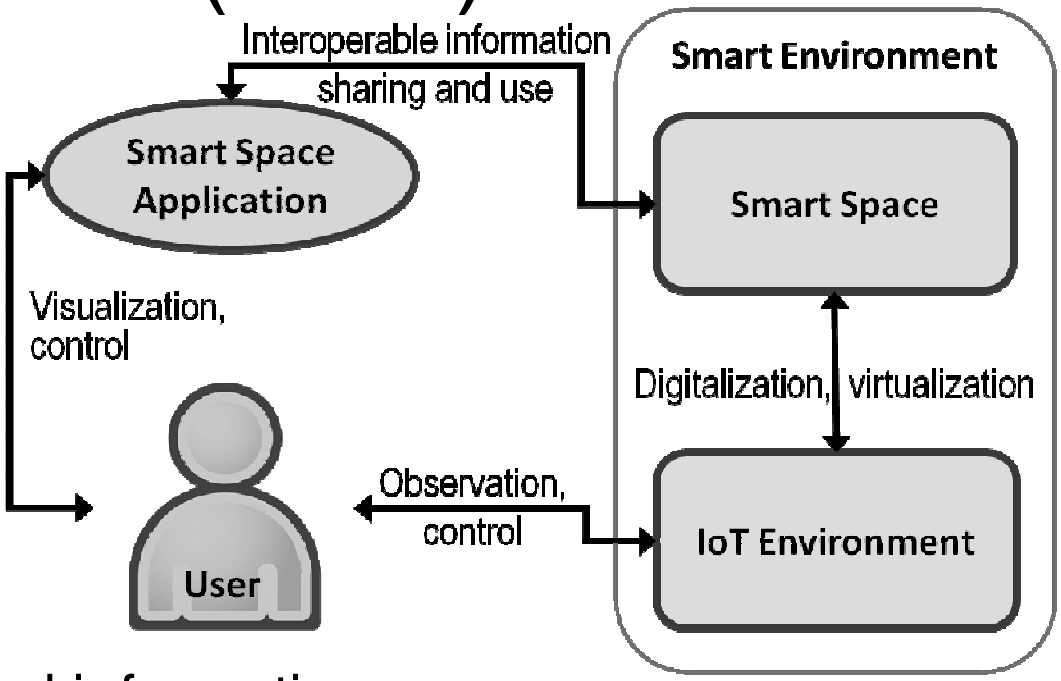
- Smart space:
  A localized IoT-aware service-oriented computing environment with a shared view on resources



Smart Space Application (SSA)

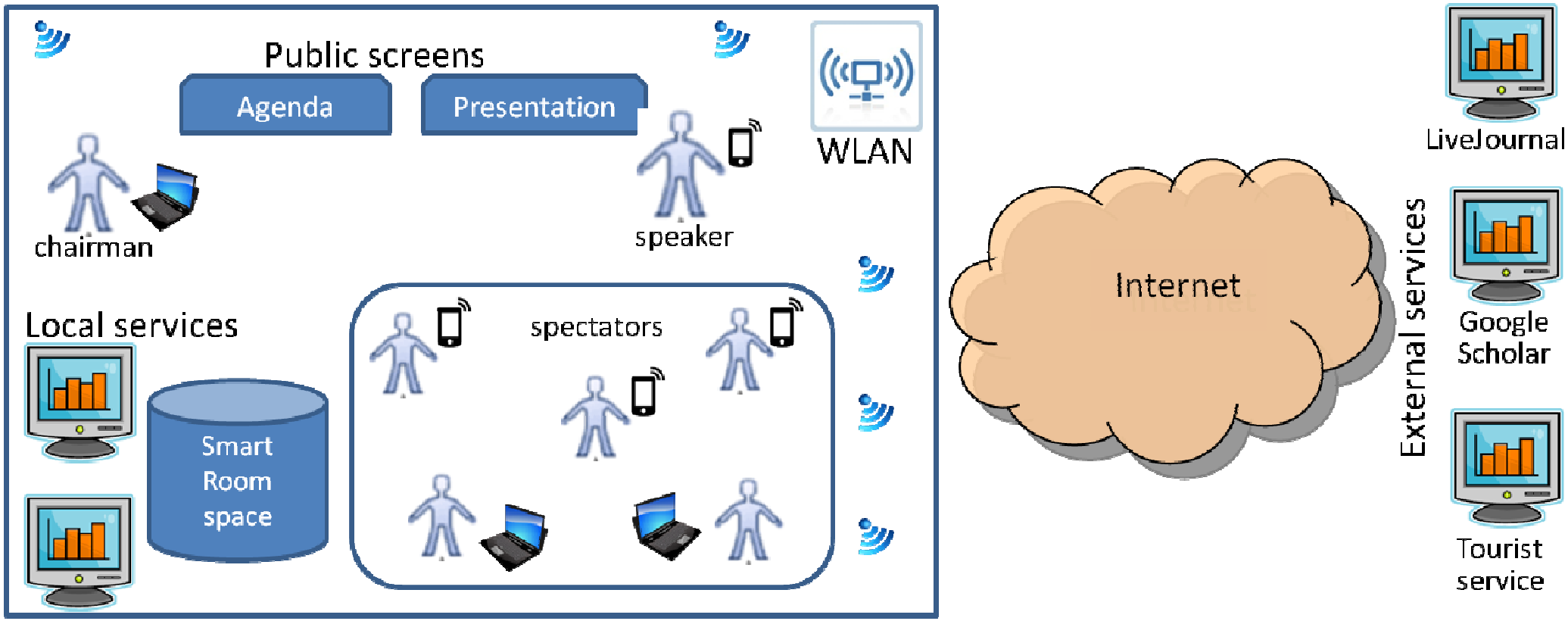
- Distributed system of agents hosted in IoT environment

- Smart properties of SSA:
  1. Understanding the situation where the application is used and by whom
  2. Interpreting the semantics of shared information
  3. Tolerating uncertainty at development and run time

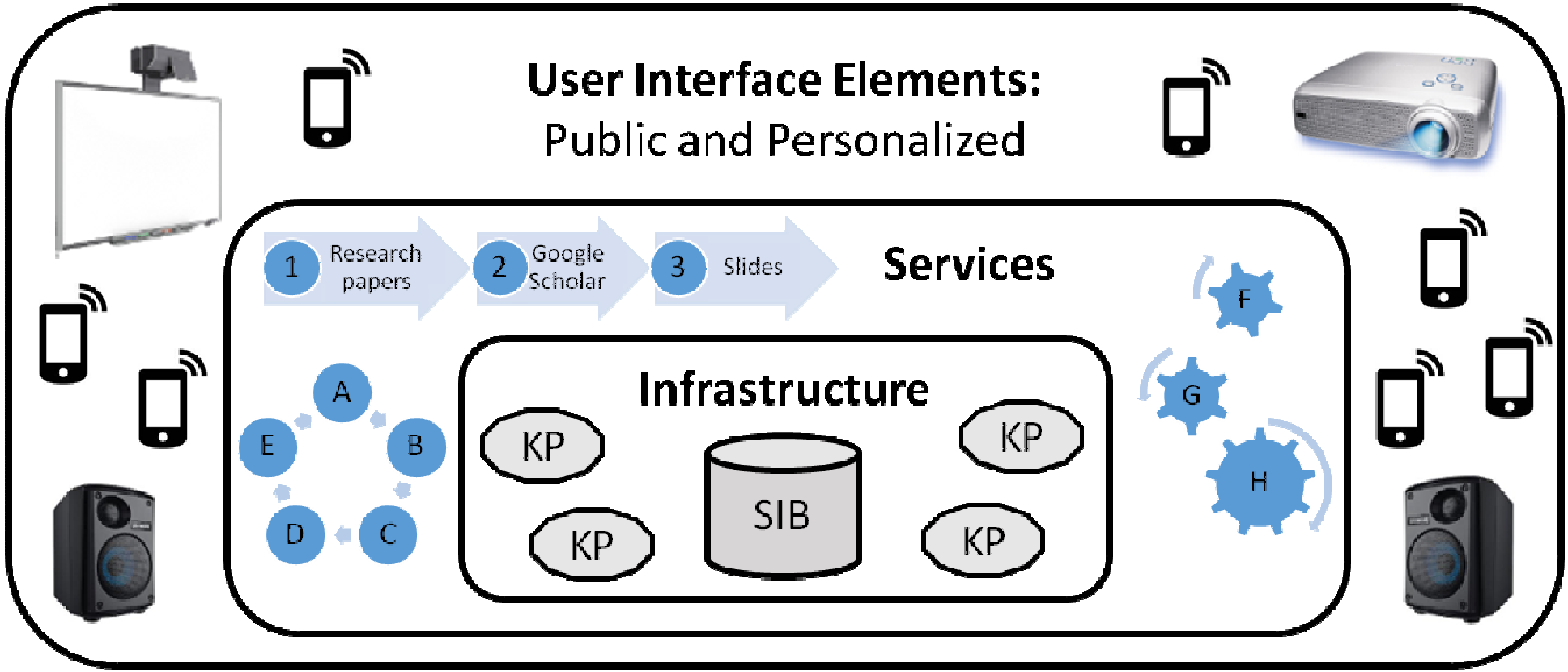


Focus is on software development, not on hardware and networking

Example: SmartRoom system



SmartRoom Infrastructure



Infrastructure Resilience

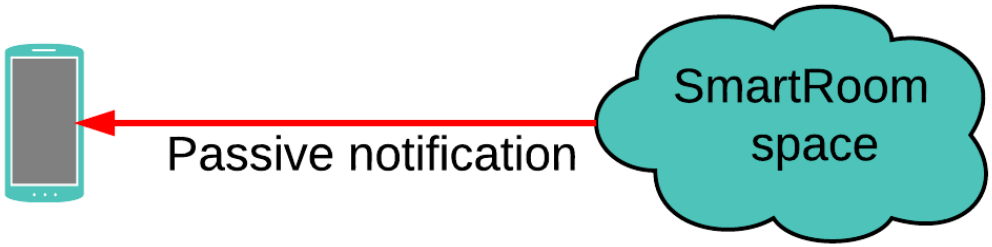
- Fault tolerance: an application is capable to deliver its services in the presence of faults
- Restarting and reconnecting mechanisms for infrastructure components (agents)
  - Restart: when the agent fails (software fault)
  - Reconnect: when the network connection fails (hardware or network fault)

Resilient Service Accessibility

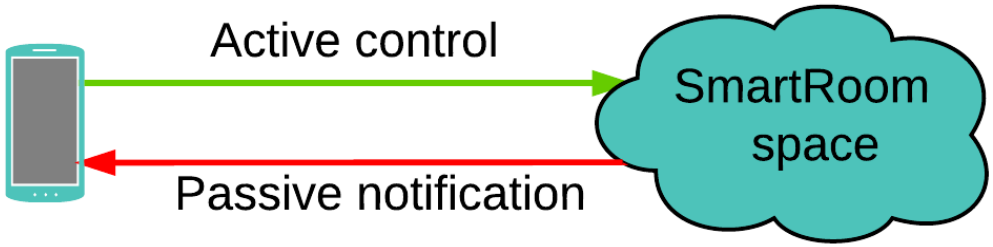
- Event-driven programming
- A lot of mobile clients accessing services in the smart space
- Subscription operation
  - persistent query for updates of specified content
  - Notifications are coming from the smart space to client
  - Some notifications are lost

Active control

- Server side (smart space) does not guarantee the delivery of notifications (best effort style)
- Client: can make additional checking



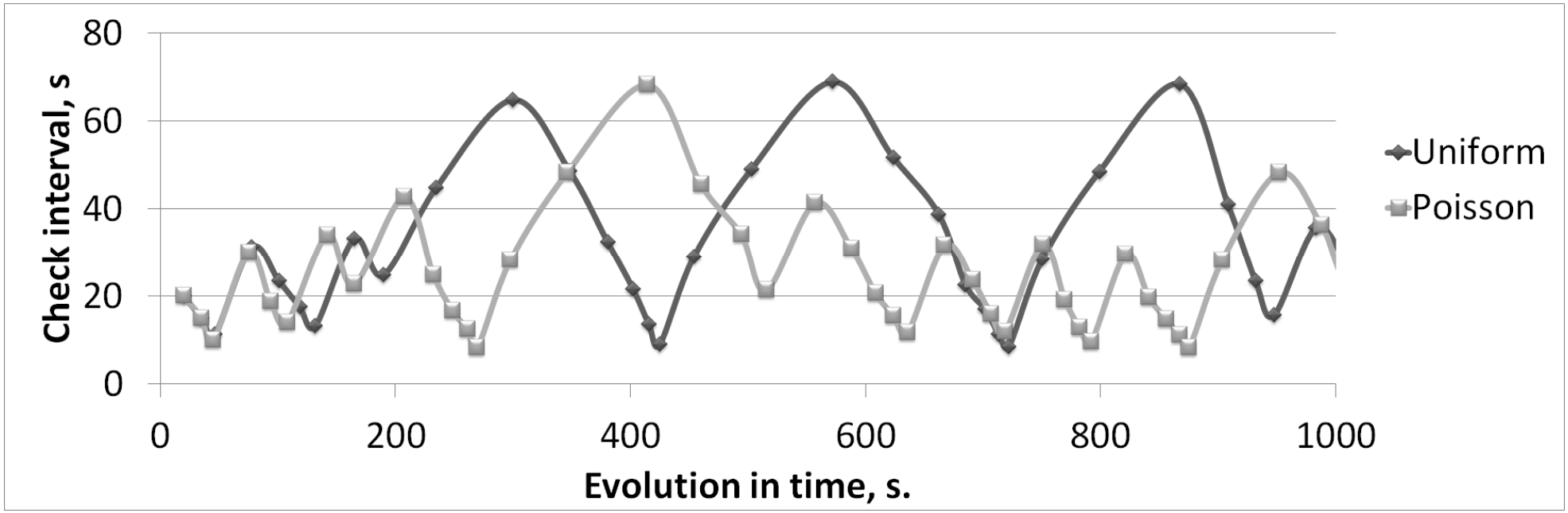
Current state



Proposed solution

Tradeoff

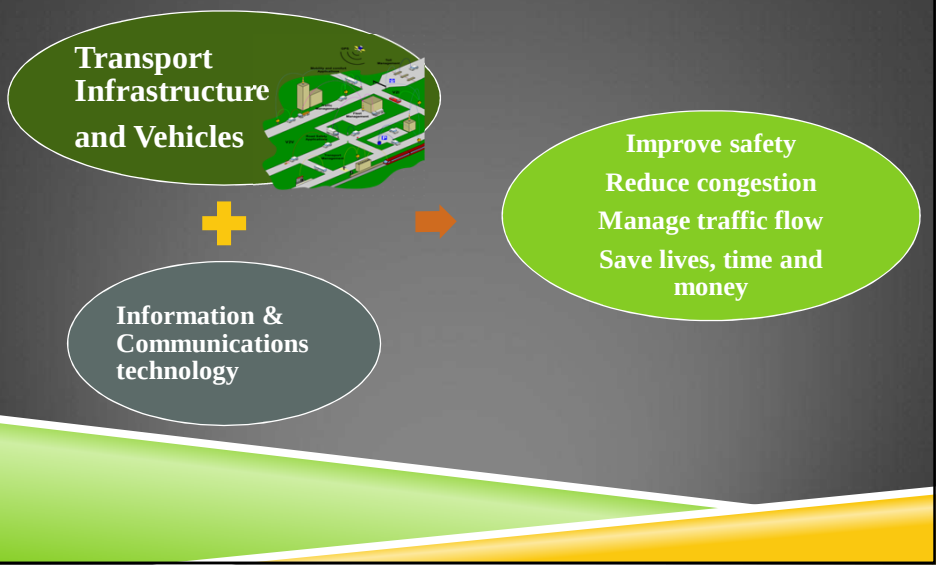
- More checks – more load (network, infrastructure)
- Less checks – more losses of notifications
- Balancing the check interval



INTELLIGENT TRANSPORTATION SYSTEMS (ITS)

Nizar Al-Holou, PhD
University of Detroit Mercy,
Detroit, MI, USA

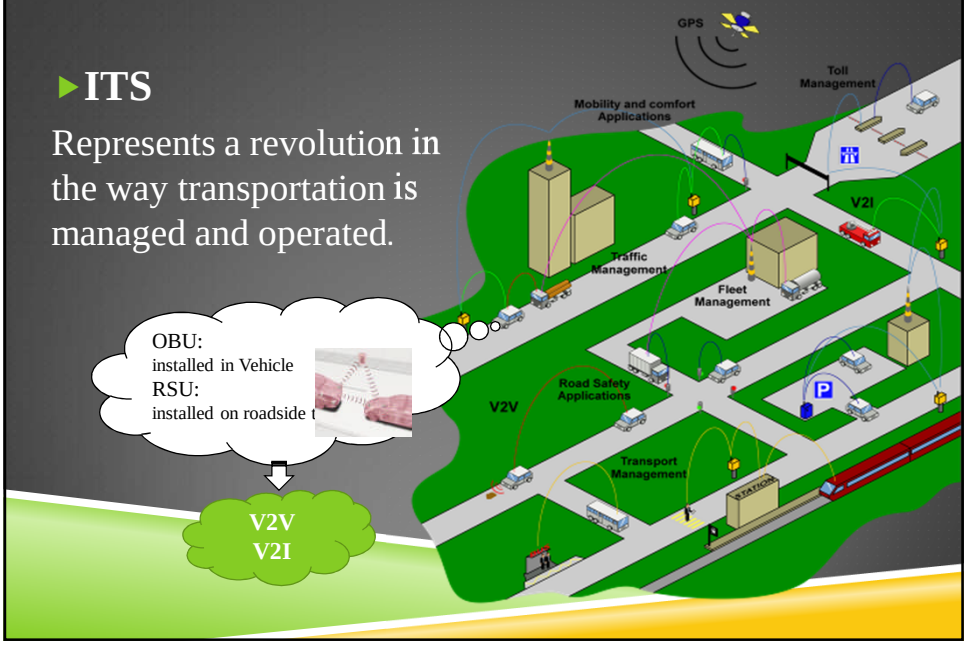
Intelligent Transportation Systems



Intelligent Transportation System

- **ITS**

Represents a revolution in the way transportation is managed and operated.



Vehicle Communication

- These communication schemes open the door for many applications in the vehicular environment, which can be broadly classified into :
  - **Safety applications**: (concerned with vehicles' and road safety)
    - Emergency break signaling.
    - Police warning system.
    - Road condition alarm system.
  - **Traffic Efficiency**: Path Planning and Traffic Management
  - **Energy consumption and Environment**
  - **Service applications**: (Luxury services to vehicles) .
    - ***Infotainment***:
    - Web on wheels

Vehicle Communication

- **Safety applications**: (concerned with vehicles' and road safety)
- **Traffic Efficiency**: Path planning and traffic management
- **Energy consumption and Environment**
  - **Service applications**: (Luxury services to vehicles): ***Infotainment***, Web on wheels
    - facilitated by a combination of V2V and V2I communications.

V2V and V2I

- **V2V systems** are completely infrastructure-free; only onboard units (OBUs) are needed:
  - Lane merging, automatic cruise control)
  - (e.g., traffic monitoring)
- **V2I systems** assume that all communications take place between roadside infrastructure (including roadside units [RSUs]) and OBUs.

Intelligent Transportation System ITS

- Communication Standards
- Wireless Access in Vehicular Environments (WAVE)
- Data Dissemination

ITS Communication Standards

- **Dedicated Short Range Communications (DSRC) communication has adopted:**
  - **IEEE 802.11p**
    - Physical and MAC layer of the communication stack.
    - Enables upper layers to:
      - Control the transmission power of transceiver.
      - Provide better immunity against delay and interference problem.
  - **IEEE 1609.x**
    - Multichannel access, security, and network management (operates on 7 different channels).

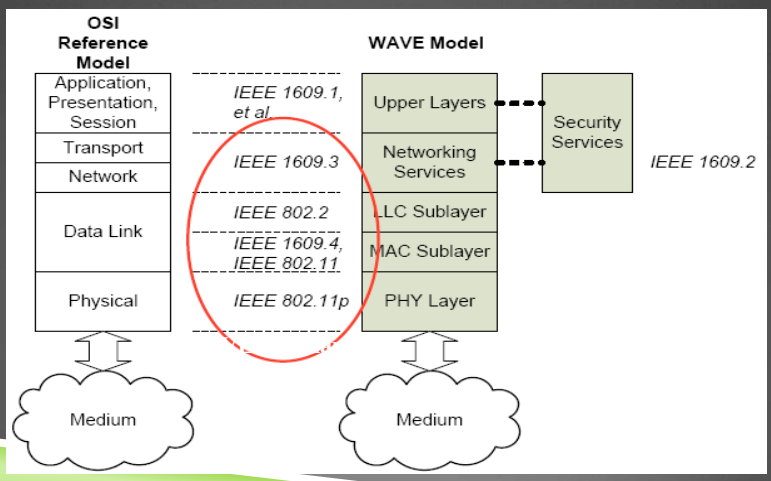
Wireless Access In Vehicular Environments (WAVE)

- What is WAVE?
  - IEEE 1609 - family of standards for wireless access in vehicular environments
  - Enable secure vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I)
  - Define an architecture and standardized set of services and interfaces

WAVE

- **IEEE P1609.1** – Resource/Application Manager
  - specifies the services and interfaces of the WAVE Resource Manager application
- **IEEE P1609.2** - Security Services for Applications and Management Messages: defines secure message formats and processing
- **IEEE P1609.3 - Networking Services**
  - defines network and transport layer services
  - defines Wave Short Messages
- **IEEE P1609.4** - : Medium Access Control-Multi-Channel Operations: provides enhancements to the IEEE 802.11 Media Access Control (MAC) to support WAVE operations

OSI Versus WAVE Model

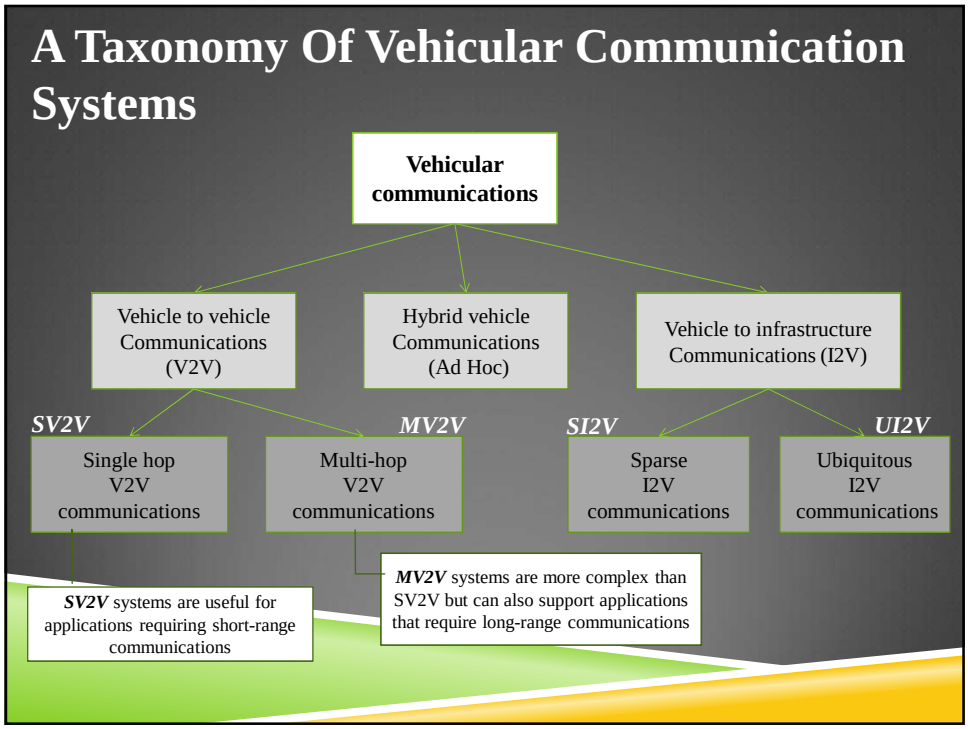


U.S.DOT - VEHICLE TO VEHICLE COMMUNICATION - YOUTUBE

- U.S.DOT - Vehicle To Vehicle Communication - YouTube :

  https://www.youtube.com/watch?v=POcQUTlOvZs
- Michigan Department of Transportation Safety Pilot

  https://www.youtube.com/watch?v=RXNbpLu_Y5g&list=PLjP1oRdEKVdRuN4Sk9blVyhdumTalvaQN


A Taxonomy Of Vehicular Communication Systems
Vehicular communications
Vehicle to vehicle Communications (V2V)
Hybrid vehicle Communications (Ad Hoc)
Vehicle to infrastructure Communications (I2V)
SV2V
MV2V
SI2V
UI2V
Single hop V2V communications
Multi-hop V2V communications
Sparse I2V communications
Ubiquitous I2V communications
SV2V systems are useful for applications requiring short-range communications
MV2V systems are more complex than SV2V but can also support applications that require long-range communications