



# Smarter Cities Skills and Academic Research

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Prof. Valentin Cristea  
University Politehnica of Bucharest



# Agenda

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- Motivation
- About Smarter Cities
- Smarter Cities technology support
- Services for urban traffic management
- Contributions
- Further approach
- Expected results

# Motivation

By 2050,



70 percent of people  
will be living in cities.

There will be at least 27 "megacities" of  
10 million people, compared to 19 today.

- Many challenges due to the scale
- Research projects aiming to solve them
- ICT Companies will offer Smarter Services

# Smaller size cities have problems as well !



"Smart" drivers trying to cross an intersection in Bucharest

# What Smarter Cities mean?

- Smarter
  - environment
  - people
  - economy
  - mobility
  - governance
  - living



<http://www.smart-cities.eu/>

# Smarter Environment & People

## ○ Environment

- Attractivity of natural conditions
- Pollution
- Environmental protection
- Sustainable resource management

## ○ People

- Level of qualification
- Affinity to life long learning
- Social and ethnic plurality
- Flexibility
- Creativity
- Cosmopolitanism/Open-mindedness
- Participation in public life



<http://www.smart-cities.eu/>



# Smarter Economy & Mobility

## ○ Economy

- Innovative spirit
- Entrepreneurship
- Economic image & trademarks
- Productivity
- Flexibility of labour market
- International embeddedness
- Ability to transform

## ○ Mobility

- Local accessibility
- (Inter-)national accessibility
- Availability of ICT-infrastructure
- Sustainable, innovative and safe transport systems



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# Smarter Governance & Living

- Governance
  - Participation in decision-making
  - Public and social services
  - Transparent governance
  - Political strategies & perspectives
- Living
  - Cultural facilities
  - Health conditions
  - Individual safety
  - Housing quality
  - Education facilities
  - Touristic attractiveness
  - Social cohesion



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# ICT support for Smarter Cities

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- **Information and Communication Technologies are the main support for smarter cities**
- Together with knowledge and social infrastructures they
  - Support decision making through the use of knowledge distributed across the city
  - Give proactive responses to Smarter Cities challenges
  - Achieve better outcomes for all citizens by coordinating resources of the city systems
  - Improve sustainable growth through successful competition for municipal funds, talent, and business resources

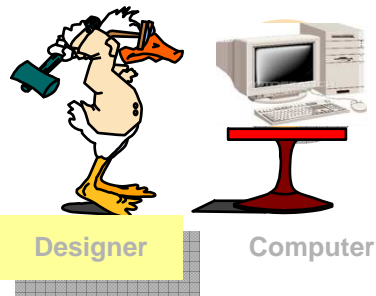
**Smarter Cities on a Smarter Planet.** *Driving sustainable growth and prosperity through the strategic use of technology.* <ftp://public.dhe.ibm.com/common/ssi/ecm/en/bfb14005usen/BFB14005USEN.PDF>

# One challenge and one Answer

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## ○ Challenge

- let people interact with computers while maintaining their normal flow of work in the real world
- this asks for a change in ICT



- from the computer context (files, spreadsheets, documents, etc.)
- to user's context (e.g. human exploration in extreme environments, urban traffic, house, city tour, etc.)

## ○ Our claim: a possible solution is

- Intelligent Event-Based SOA



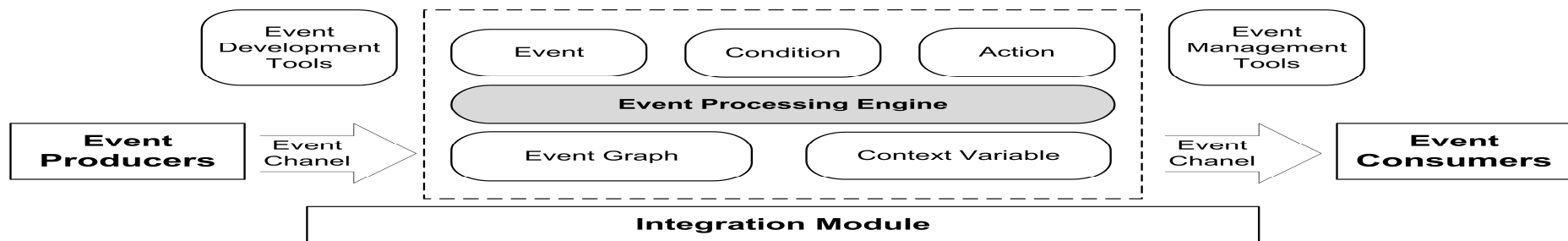
# Motivation: SOA responds to customer needs

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- SOA systems are collections of distributed services that encapsulate specific functionalities
  - Services do not know each other explicitly
  - They are offered via **published interfaces** and **retrieved** by the interested customers
- The **publish / subscribe** model supports services that **respond to customer needs**
  - Customers manifest their interest for a specific service type
  - When such a service is published, the subscriber is notified, finds its public interface and starts using the service

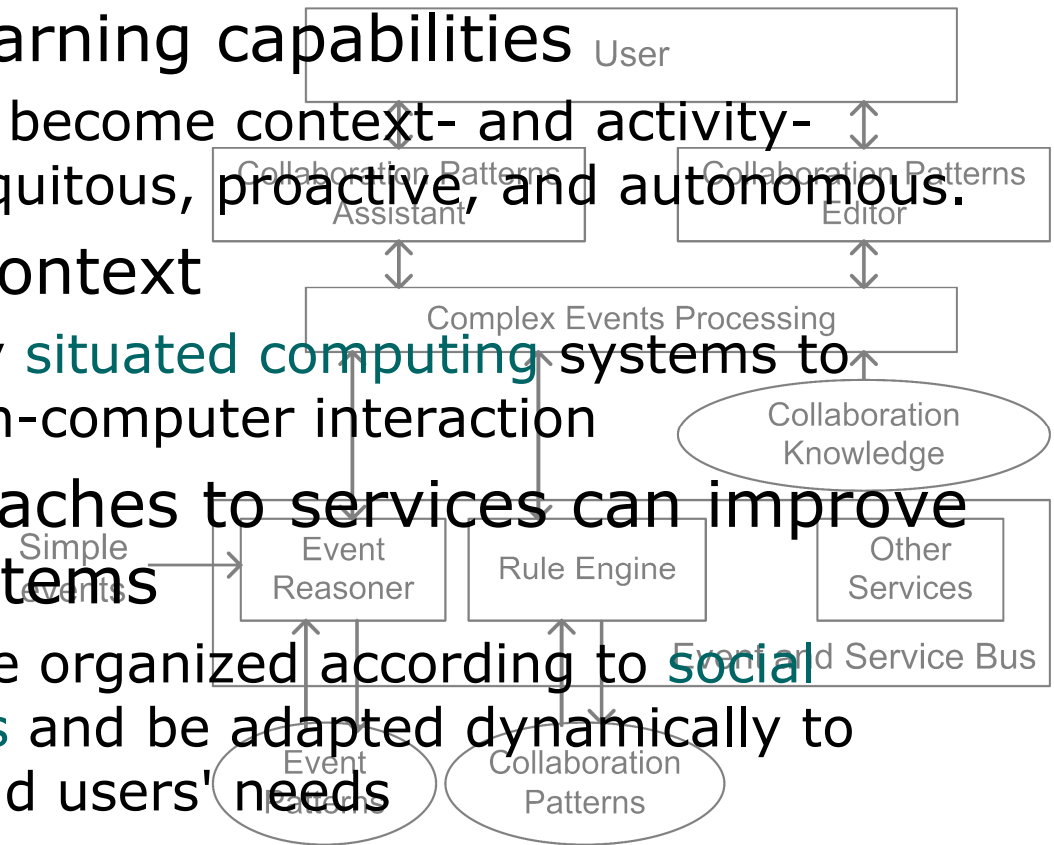
## Motivation-2: Event-Based SOA adds timeliness

- EB-SOA couples the SOA model with the **event** paradigm in a natural way
  - Delivers Service **when events occur**
  - Supports **context aware** and **adaptive** applications
    - Responds to requirements of highly dynamic and distributed environments
    - Simplifies application development



# Motivation-3: Intelligent Event-Based SOA

- Enrich the urban environment with **situational information** and learning capabilities
  - Intelligent services become **context- and activity-aware, mobile, ubiquitous, proactive, and autonomous.**
- Use the human's context
  - can be exploited by **situated computing systems** to enhance the human-computer interaction
- **User-centric** approaches to services can improve the core urban systems
  - the activities can be organized according to **social interaction patterns** and be adapted dynamically to context changes and users' needs



# Services for urban traffic management

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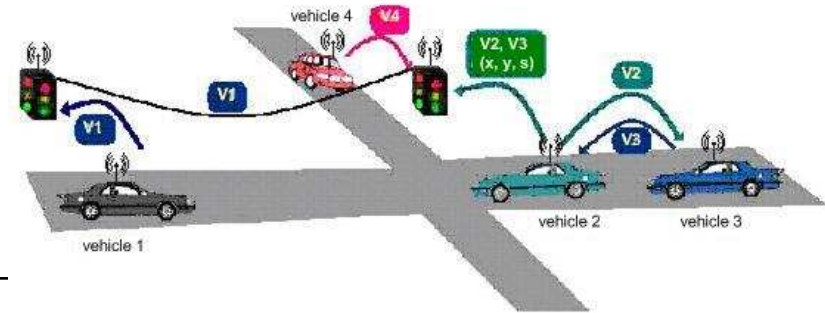
- Very actual and important topic.
  - "the daily commute in some of the world's most economically important international cities is longer and more grueling than before imagined, reflecting the failure of transportation infrastructure to keep pace with economic activity" (recent study of IBM\*)



\* <http://www-03.ibm.com/press/us/en/pressrelease/32017.wss>



# Contributions (1)

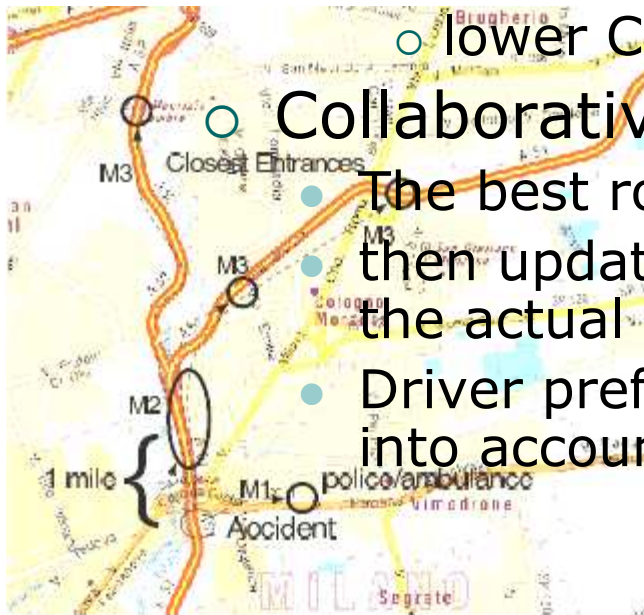


- Adaptive traffic light system

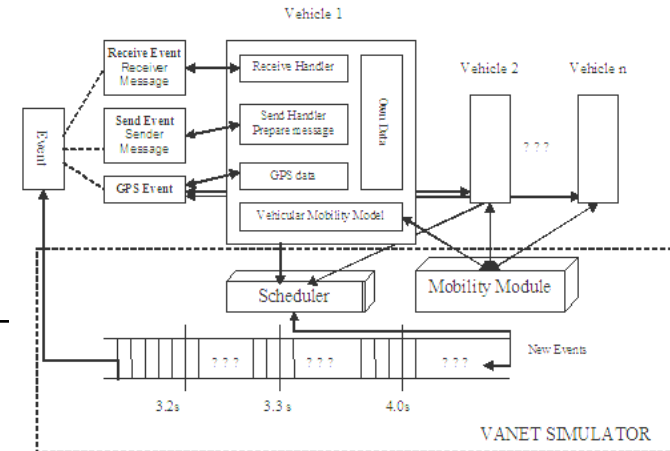
- Based on wireless communication between vehicles and fixed controller nodes deployed in intersections
- The results show
  - significant improves of traffic fluency in intersections,
  - reduction of fuel consumption, and
  - lower CO2 emissions by vehicles.

- Collaborative route planning

- The best route to destination is initially computed then updated periodically along the way, depending on the actual traffic conditions.
- Driver preferences, abilities and needs are also taken into account.



## Contributions (2)

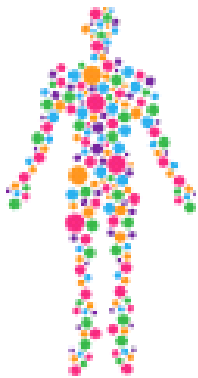


- An Integrated Vehicular and Network Simulator for Vehicular Ad-hoc Networks
  - Developed to evaluate different solutions and assess the results
  - It has a **network component**, capable of simulating the behavior of a wireless network,
  - and a **vehicular traffic component**, able to provide an accurate mobility model for vehicular networks.

# Further approach - use of the situated computing metaphor

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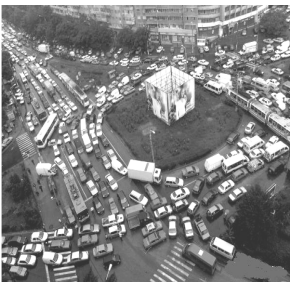
- Context: location, time, identity
- Human capabilities
  - ability to exchange oral messages (speech) or to give tactile feedback
    - people interact in a natural way with other people, services, and devices while maintaining their normal flow of activities in the real world
    - e.g. use oral messages while driving a vehicle
  - specific personal information about users
    - what they like or dislike, what do they know or not know, what they did in the past (the history)
    - e.g. when calculating the way to office, take into account driver's habitual way
  - user's emotional state, and focus of attention
    - e.g. automatic actions for traffic safety



## Further approach (2)

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- Social context: identities of people around the user
  - activities should be organized according to social interaction patterns and be adapted dynamically to context changes
    - e.g. interaction in the community of taxi drivers
    - customer looking for a taxi in her proximity
- Augmented reality: adds knowledge to what user perceives directly
  - e.g. an image of the actual traffic in a city area
  - oral and visual information about a restaurant in proximity





# Expected results

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# Traffic information anywhere, anytime, ...





# Fuel saving



# Improved car security



# Load management for high capacity cars



# Free of charge car parking lots





# Better coordination of police patrols



# High quality break-down self-service





# Orchestrated Cars Collision Center



3/22/2011

IBM Academic Days for Universities in Romania, 17-18 March 2011

27



Thank you !

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