Projeto

INTERSCITY

Ciência e Computação a serviço das cidades

Prof. Fabio Kon
Department of Computer Science
IME-USP
Our view

**Smart City** =
"a city in which its social, business, and technological aspects are supported by ICT to improve the quality of life of its citizens in an integrated, affordable, and sustainable way."

we’re interested in developing a
Open Source
**Software Platform for Smart Cities**
Our view on Smart Cities

Although we don’t ignore high-tech solutions for the elite, we prefer to focus on:

• people (technology is a means not an end)
• low-income populations
• developing countries
• underprivileged neighborhoods
Collaborations

• 35 CS professors +
  • Architects, Urban Planners, Economists, Health Professionals, Transportation Engineers

• USP, Unicamp, UFABC, UFG, UFMA, UFMS, PUC-Rio, UFRJ, Scipopolis

• São Paulo City Secretariats:
  • Health
  • People with Disabilities
The InterSCity Project

- 3 lines of research
- 3 levels
A generic Software Platform for Smart Cities

Traditional Solutions and Vertical Silos

- Bus Position Systems
- Subway Systems
- Traffic Management Systems
- Pollution Management Systems

Horizontal Solutions

- Transportation Systems
- Health Care Systems
- Traffic Management Systems
- City Management Systems

Smart City Platform
Survey and proposed reference architecture for Smart City Software Platforms

Software Platforms for Smart Cities: Concepts, Requirements, Challenges, and a Unified Reference Architecture

Eduardo Felipe Zambom Santana, University of Sao Paulo
Ana Paula Chaves, Federal Technological University of Parana
Marco Aurelio Gerosa, University of Sao Paulo
Fabio Kon, University of Sao Paulo
Dejan S. Milojicic, Hewlett Packard Labs Palo Alto

Making cities smarter help improve city services and increase citizens' quality of life. Information and communication technologies (ICT) are fundamental for progressing towards smarter city environments. However, the ICT community must overcome current significant technical and scientific challenges before these platforms can be widely used. This paper surveys the state-of-the-art in software for smart cities. We analyzed 28 projects with respect to the most used enabling technologies and identified significant trends, challenges, and research needs.
InterSCity Platform

Smart City Platform by the Software Systems Research Group - IM
http://intersciry.org/

Projects
Subgroups

- docs
  Smart City Software Platform documentation
- dev-env
- kong-api-gateway

InterSCity: A Scalable Microservice-based Open Source Platform for Smart Cities

Arthur de M. Del Esposte¹, Fabio Kon¹, Fabio M. Costa¹ and Nelson Lago²

¹Department of Computer Science, University of São Paulo, P. de Moda, 05008-900, São Paulo, São Paulo, Brazil
²Institute of Informatics, Federal University of Goiás, Avenida D. Cipriano, Goiânia, 74000-900, Goiás, Goiás, Brazil
[esposte, kon, lago]@me.ufrg.br, fcon@ufmg.br

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Abstract: Smart City technologies emerge as a potential solution to tackle common problems in large urban centers by using city resources efficiently and providing quality services for citizens. Despite the various advances in middleware technologies to support these smart cities, there are no universally accepted platforms yet. Most of the existing solutions do not provide the required flexibility to be shared across cities. Moreover, the extensive yet and development of non-open source software leads to interoperability issues and limits the collaborations among R&D groups. In this paper, we explore the use of a microservices architecture to address key practical challenges in smart city platforms. We present InterSCity, a microservices-based open source smart city platform that aims at supporting collaborative, novel smart city research, development, and deployment initiatives. We discuss how the microservice approach enables a flexible, extendable, and loosely coupled architecture and present experimental results demonstrating the scalability of the proposed platform.

INTRODUCTION

The rapid growth of cities around the world has created large, densely populated urban centers characterized by complex interconnections, social, and economic organizations. This urbanization phenomenon, along with the increasing reliance on information and communication technologies (ICT), has led to the development of smart cities. The Internet of Things (IoT), Big Data, Cloud Computing, and Edge Computing are key enablers for smart cities that offer a wide range of opportunities and challenges, both in the academy and industry. To fully exploit the potential of these enablers, future smart cities will demand a unified ICT infrastructure that can seamlessly connect various components, ensuring effective and efficient services.
Metodologia para busca de escalabilidade
Busca por escalabilidad
Ongoing work on the platform

- Support for Big Data Processing
- More sample applications
- Initial experiments with real sensors (e.g., measuring health of urban trees)

InterSCity’s Kappa Architecture for Big Data Processing
InterSCSimulator

- Erlang-based large-scale simulator for Smart Cities
- Simulations with 10+ million agents in super-real-time
- Multimodal transportation
  - cars, pedestrians, buses, subway, (bicycles).
- Impact analysis of changes in the transportation infrastructure and associated costs.
- Population from Paraisópolis favela (slum) in SP.
Ongoing Work: Integration of Simulator with the Platform

- Enables:
  - Realistic Workloads to test and experiment with the platform
  - Inject real platform data into the simulation
Carga Antes das otimizações

Após Otimizações
Preliminary Analysis
Collaboration with city governments

• SP Secretariat of Health

• SP Secretariat of People with Disabilities

• **Sharing of Data, Problems, and Challenges**
Exemplo 1: Mobilidade + Saúde
Exemplo 2: Esporte + Saúde
Exemplo 3: interscity.org/apps/acessibilidade
Entrepreneurship and Innovation

• Organizing Hackathons:
  • Smart Cities, Research Tools, Smart Cities (again)
  • Next: AI and Machine Learning

• Discussion panels on Ethical issues

• Fostering Startups
  • Example: Scipopolis
Scipopulis’ COLETIVO APP
(for citizens)
Already in use by 300 city servants in São Paulo
in test at: Rio de Janeiro, Curitiba, Santiago (Chile), and Brasilia.
MOBILITY PANEL
(CONSOLIDATED BUS SPEEDS for citizens)
Historical data

Comparing bus x auto

TEMPO DE VIAGEM
ZONA SUL

CORREDOR - Santo Amaro/9 Julio
- Bairro-Centro: 44 min, Centro-Bairro: 34 min
- Car: 40 min, Auto: 24 min

CORREDOR Parelheiros - parte rio bonito
- Car: 21 min, Auto: 15 min
- Car: 19 min, Auto: 12 min

CORREDOR Ibirapuera
- Car: 20 min, Auto: 27 min
- Car: 17 min, Auto: 24 min

TIETE LOCAL

45.9

TEMPO REAL
Trecho: PTEDOLIMA_PTEFRANC...
Sentido: AYRTONSENNA
2Km em 2 minutos
Políticas Públicas baseadas em Evidências

1) Crie e colete evidências científicas rigorosas sobre o que funciona, incluindo custos e benefícios.
2) Monitore a execução de programas e use análise científica de impacto do programa para medir sua eficácia.
3) Use as evidências científicas para melhorar os programas, aumentar a escala do que funciona, retirar recursos dos programas que não funcionam.
4) Incentive a inovação e teste novas abordagens
Next Steps and opportunities for Graduate Students and Post-Docs

• Advanced collaborative research among InterSCity partners
  • Middleware implementation: scalability, performance, usability by developers
  • Big Data processing, analysis, and visualization
  • Machine Learning to improve city services
• Data Science to: (Collaboration with MIT)
  • understand mobility patterns and
  • suggest improvements
• Establish and strengthen international collaborations
Parceria:
MIT Senseable City Lab

Urban imagination and social innovation through design & science

The real-time city is real! As layers of networks and digital information blanket urban space, new approaches to the study of the built environment are emerging. The way we describe and understand cities is being radically transformed—as are the tools we use to design them. The mission of the Senseable City Laboratory—a research initiative at the Massachusetts Institute of Technology—is to anticipate these changes and study them from a critical point of view.

Not bound by the methodologies of a single field, the Lab is characterized by an omni-disciplinary approach: it speaks the language of designers, planners, engineers, physicists, biologists and social scientists. Senseable is as fluent with industry partners as it is with metropolitan governments, individual citizens and disadvantaged communities. Through design and science, the Lab develops and deploys tools to learn about cities—so that cities can learn about us.
Further Information

interscity@ime.usp.br

Papers, documentation, and full source code available at interscity.org