

Projeto



INCT
InterSCity
Future Internet for Smart Cities

Ciência e Computação a serviço das cidades



Prof. Fabio Kon
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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

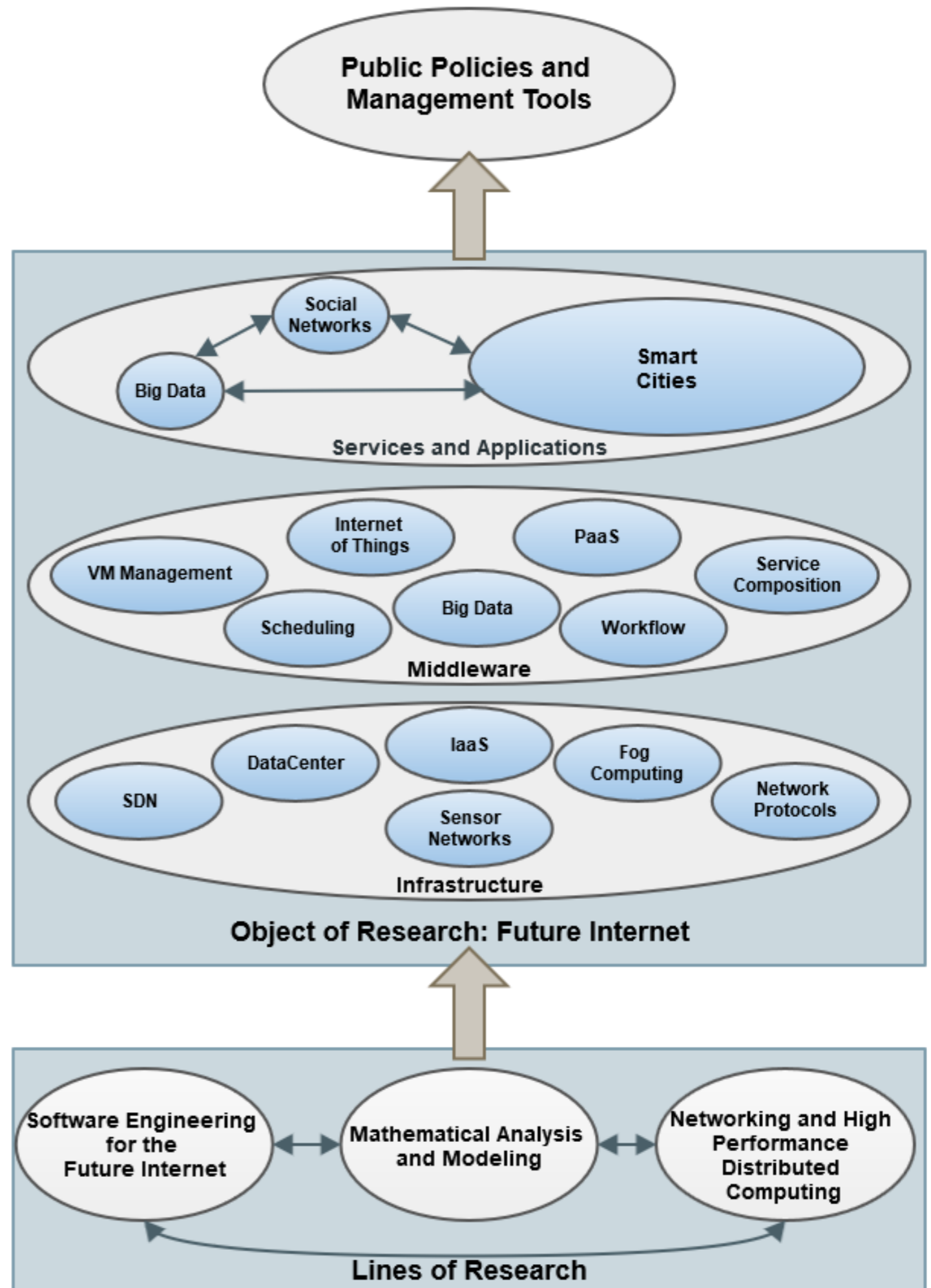


Collaborations

- 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

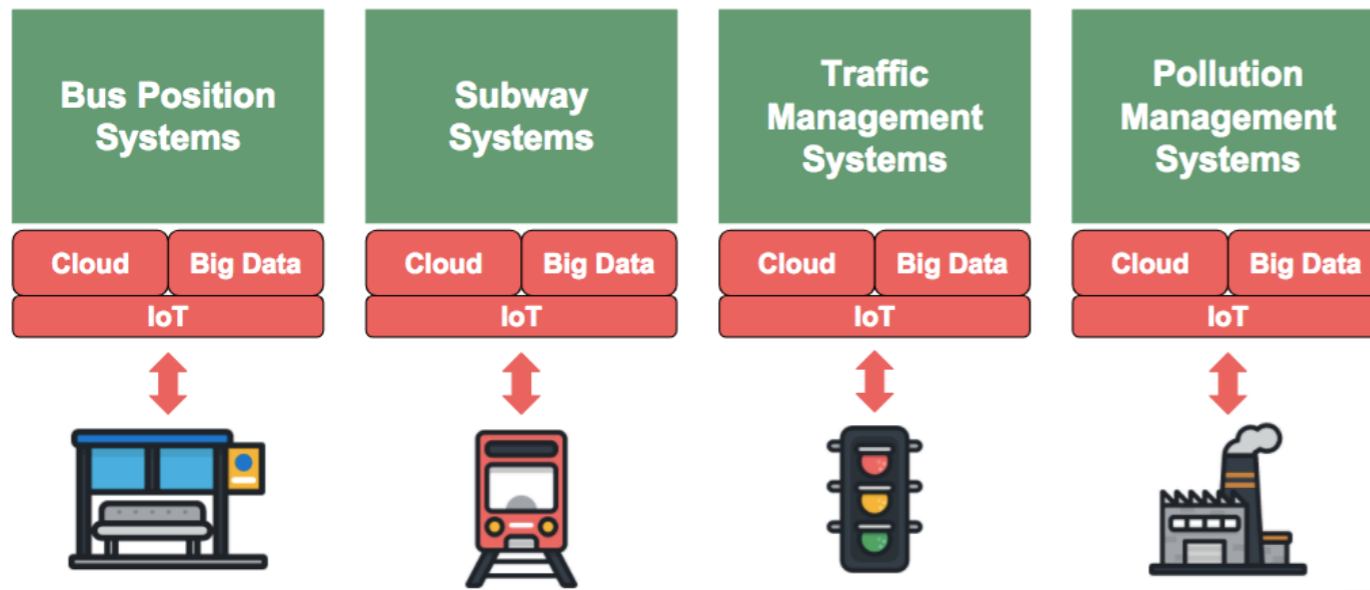
The InterSCity Project

- 3 lines of research
- 3 levels

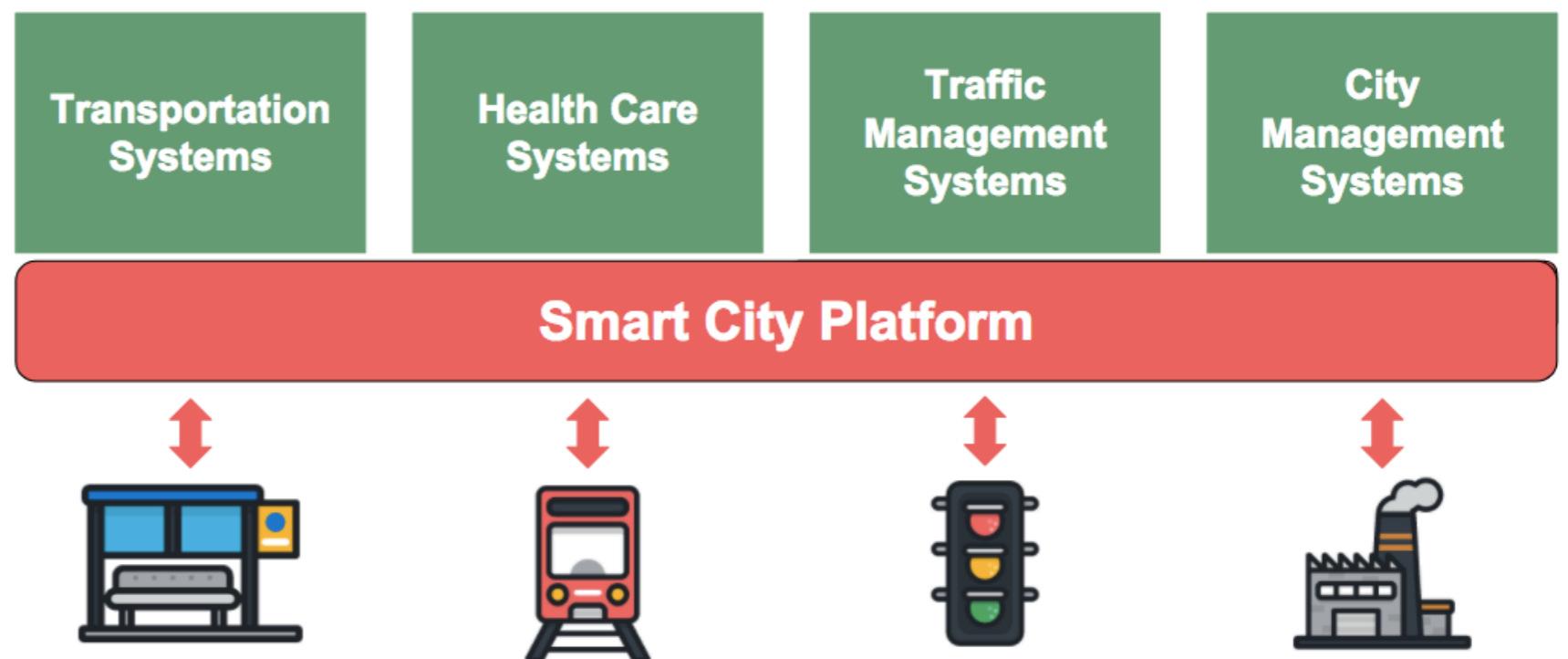


A generic Software Platform for Smart Cities

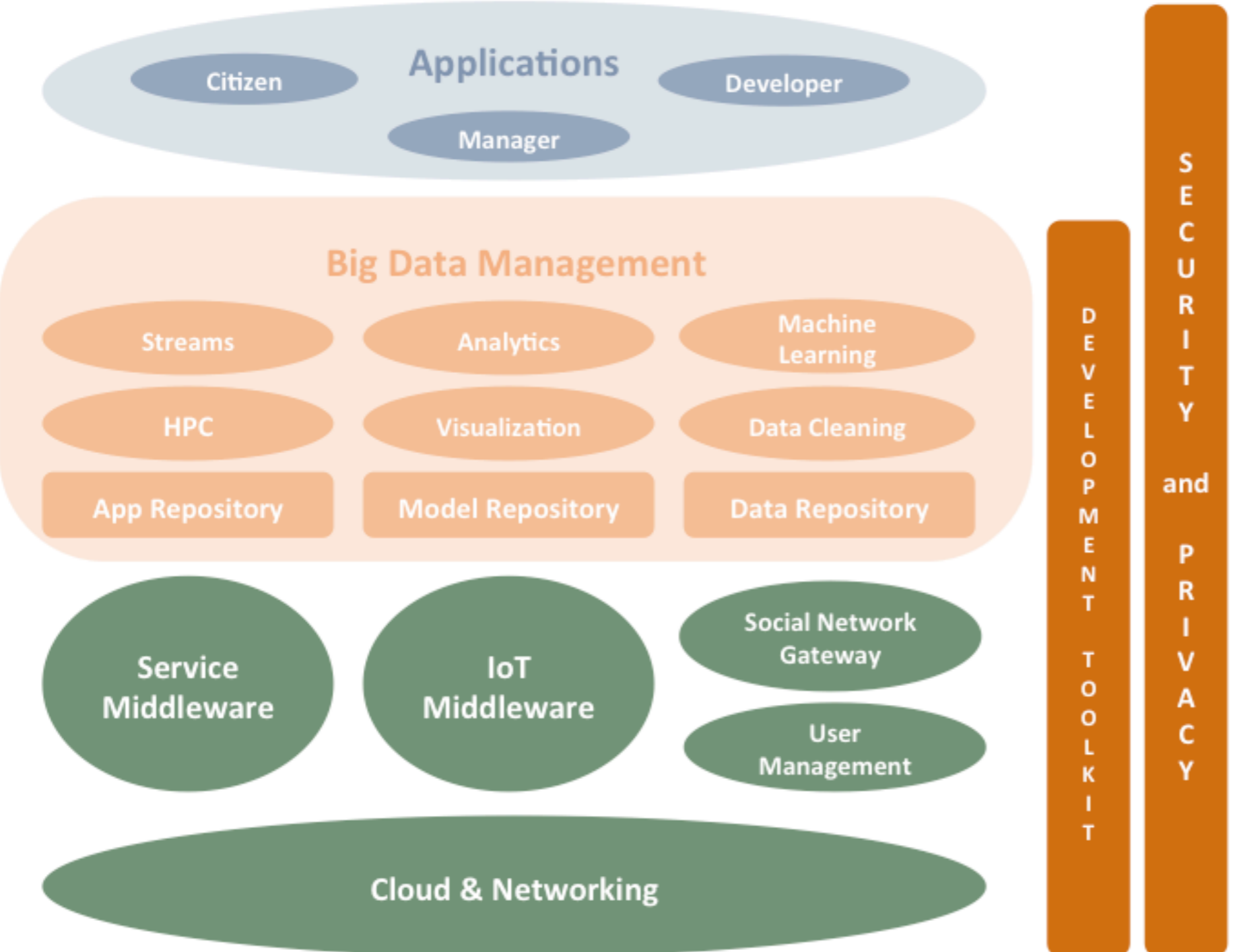
Traditional Solutions and Vertical Silos



Horizontal Solutions



Survey and proposed reference architecture for Smart City Software Platforms



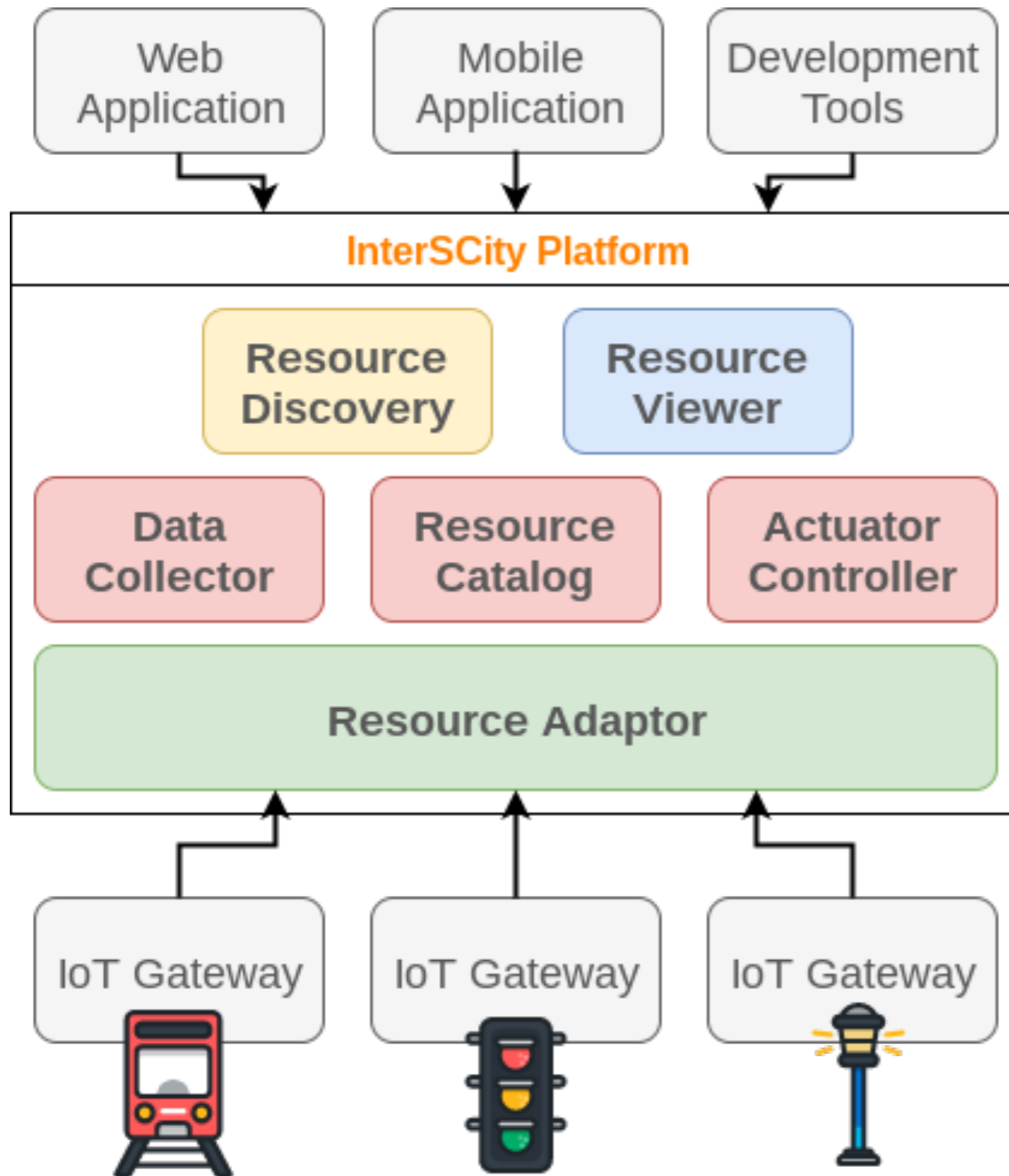
ACM Computing Surveys

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

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

Making cities smarter help improve city services and increase citizens' quality of life. Information communication technologies (ICT) are fundamental for progressing towards smarter city environments. Smart City software platforms potentially support the development and integration of Smart City applications. However, the ICT community must overcome current significant technological and scientific challenges before these platforms can be widely used. This paper surveys the state-of-the-art in software platforms for Smart Cities. We analyzed 23 projects with respect to the most used enabling technologies, functional and non-functional requirements, classifying them into four categories: Cyber-Physical Systems, Internet of Things, Big Data, and Cloud Computing. Based on these results, we derived a reference architecture.





GitLab Projects Groups Snippets Help

InterSCity Platform
Smart City Platform by the Software Systems Research Group - IMI
<http://interscity.org/>

Projects Subgroups Filter by name

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

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

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Keywords: Smart Cities, Software Platform, Microservices, Scalability, Open Source Software

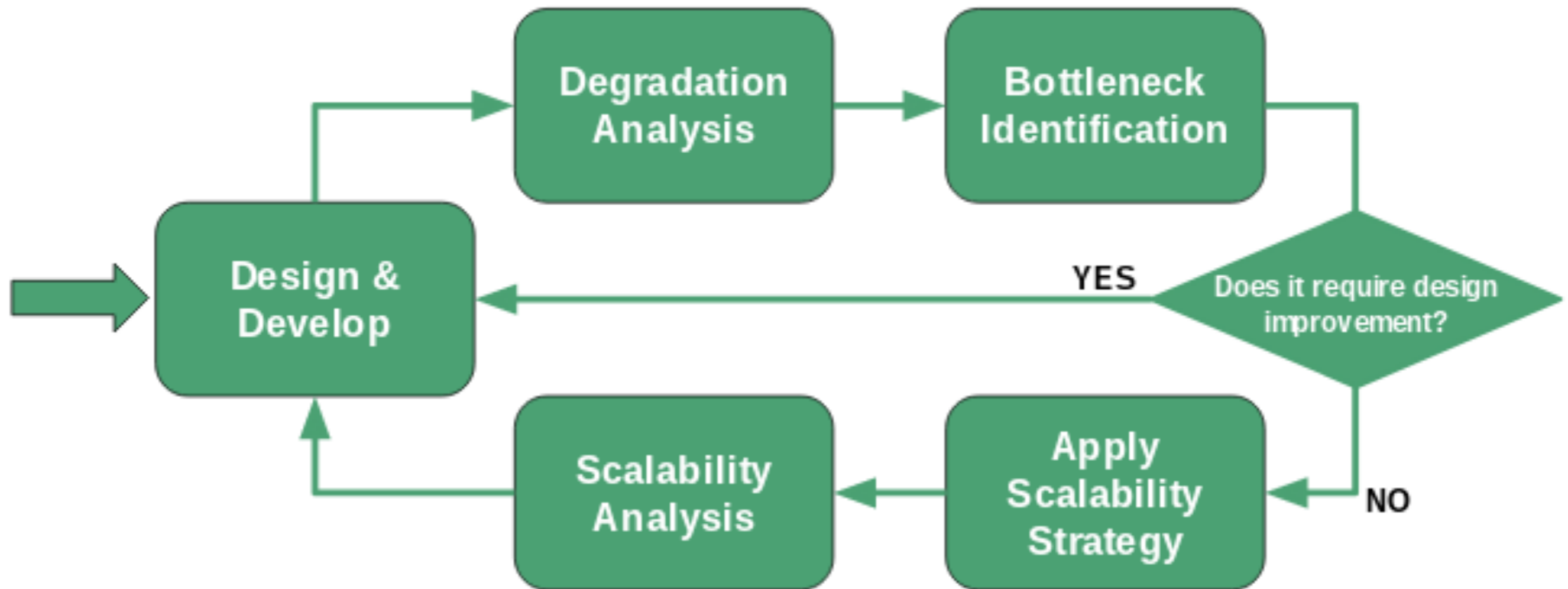
Abstract: Smart City technologies emerge as a potential solution to tackle common problems in large urban centers by using city resources efficiently and providing quality services for citizens. Despite the various advances in middleware technologies to support future smart cities, there are no universally accepted platforms yet. Most of the existing solutions do not provide the required flexibility to be shared across cities. Moreover, the extensive use and development of non-open-source software leads to interoperability issues and limits the collaboration 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 microservice-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, extensible, and loosely coupled architecture and present experimental results demonstrating the scalability of the proposed platform.

INTRODUCTION

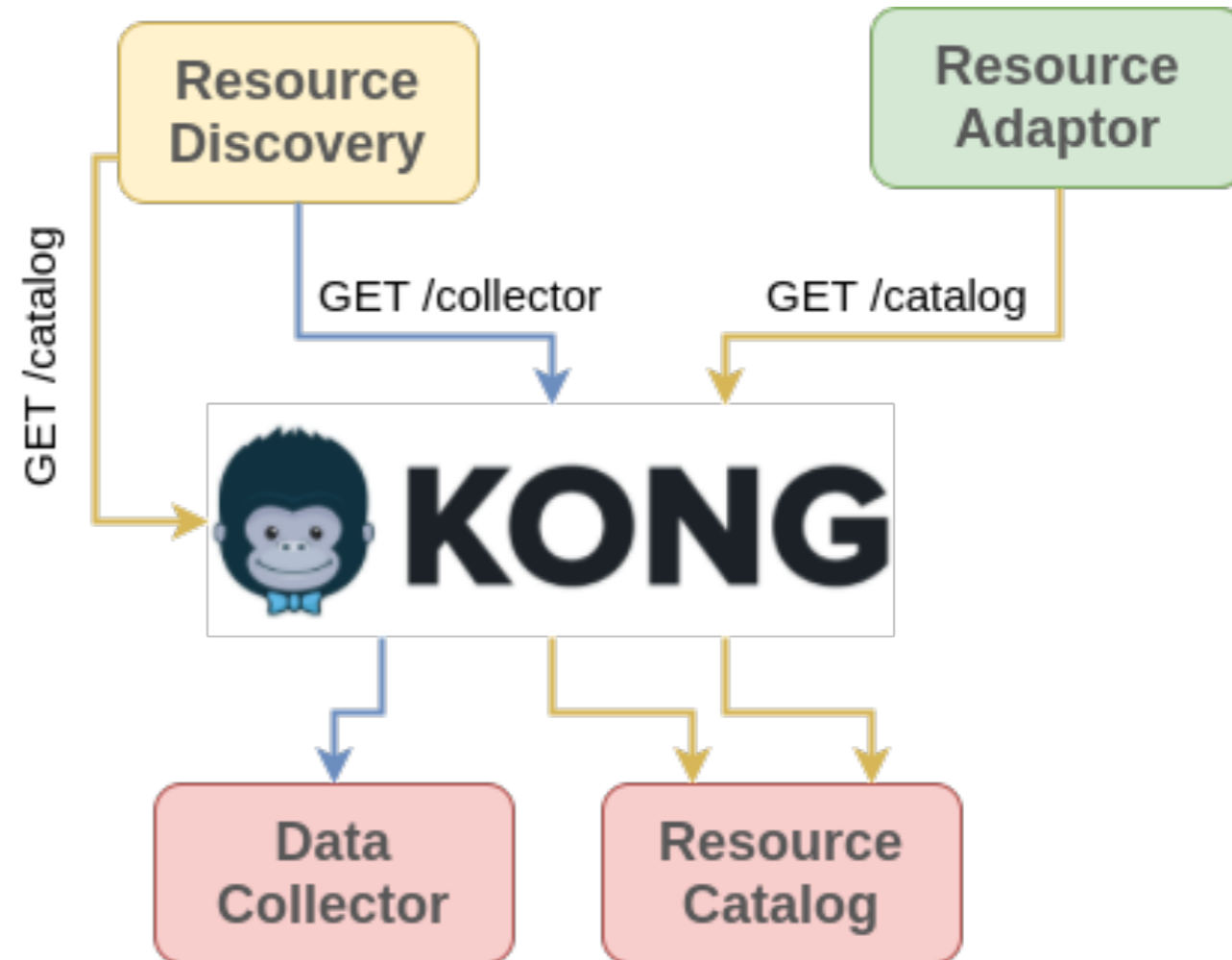
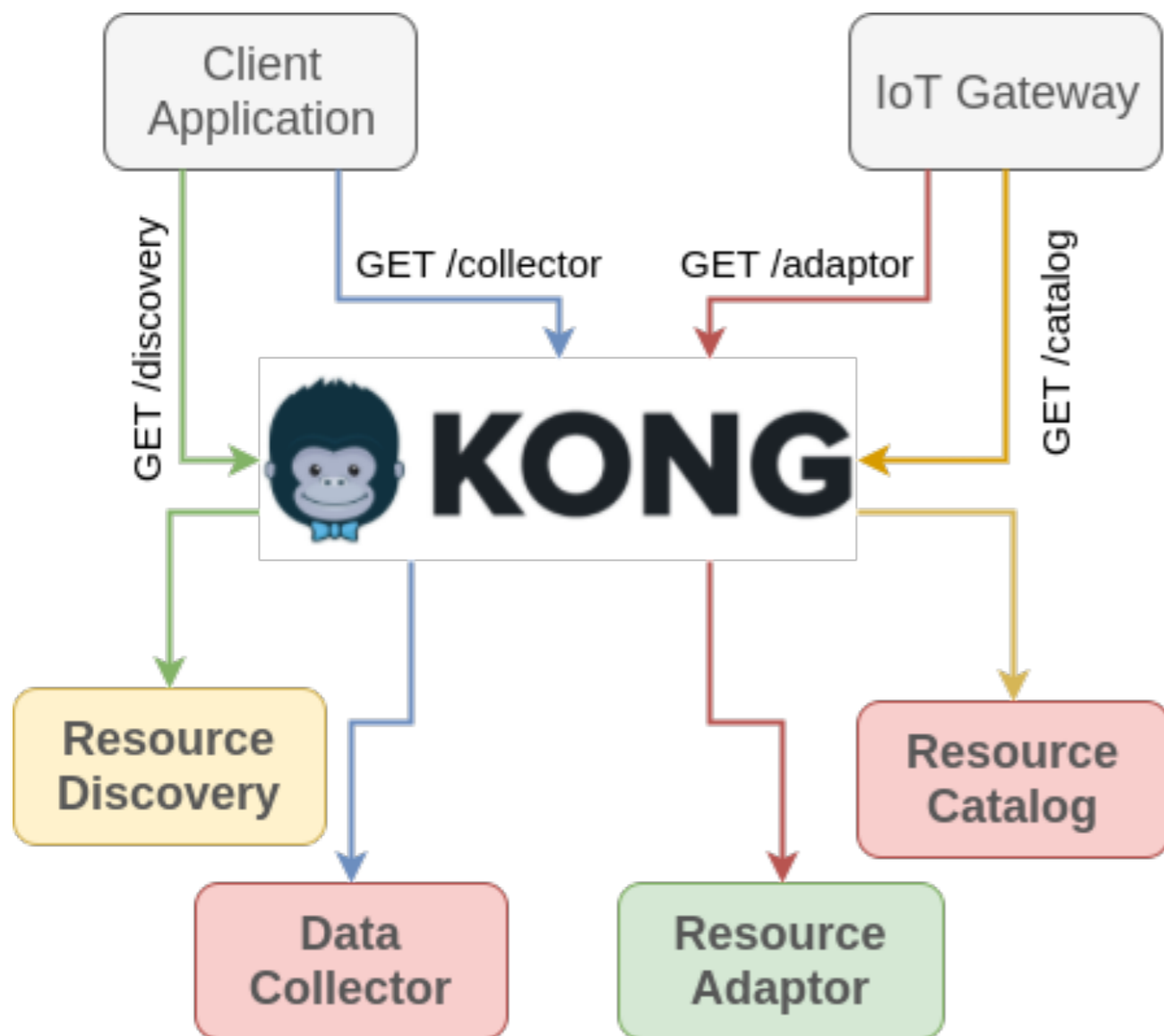
The rapid growth of cities around the world has created large, densely populated urban centers characterized by complex interconnected structural, social and economic organizations. This urbanization phenomenon has led to several challenges for smart cities

et al., 2014). The Internet of Things (IoT), Big Data, and Cloud Computing are key enabling technologies of 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 to properly share their resources rather than relying

Metodologia para busca de escalabilidade

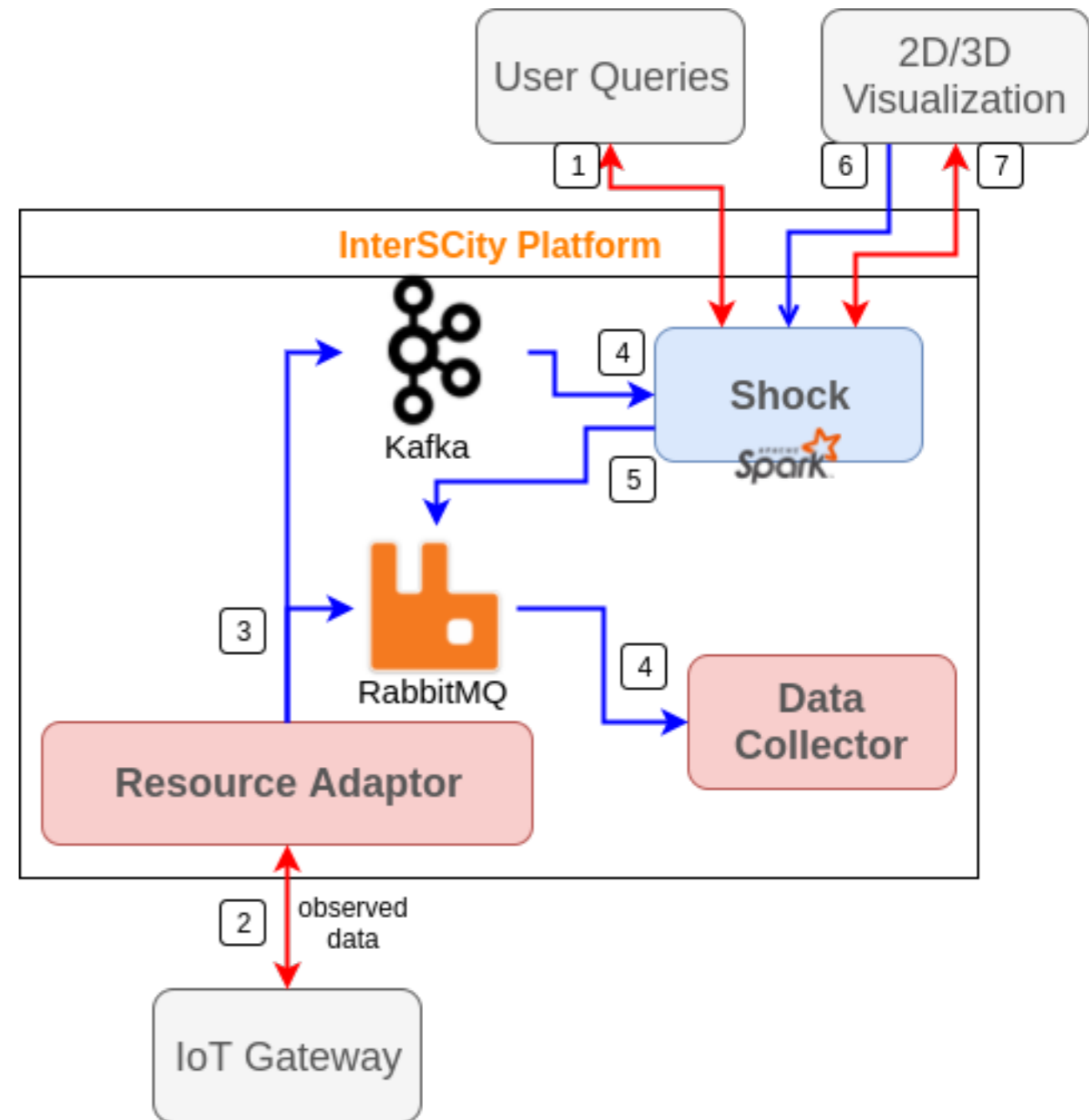


Busca por escalabilidade



Ongoing work on the platform

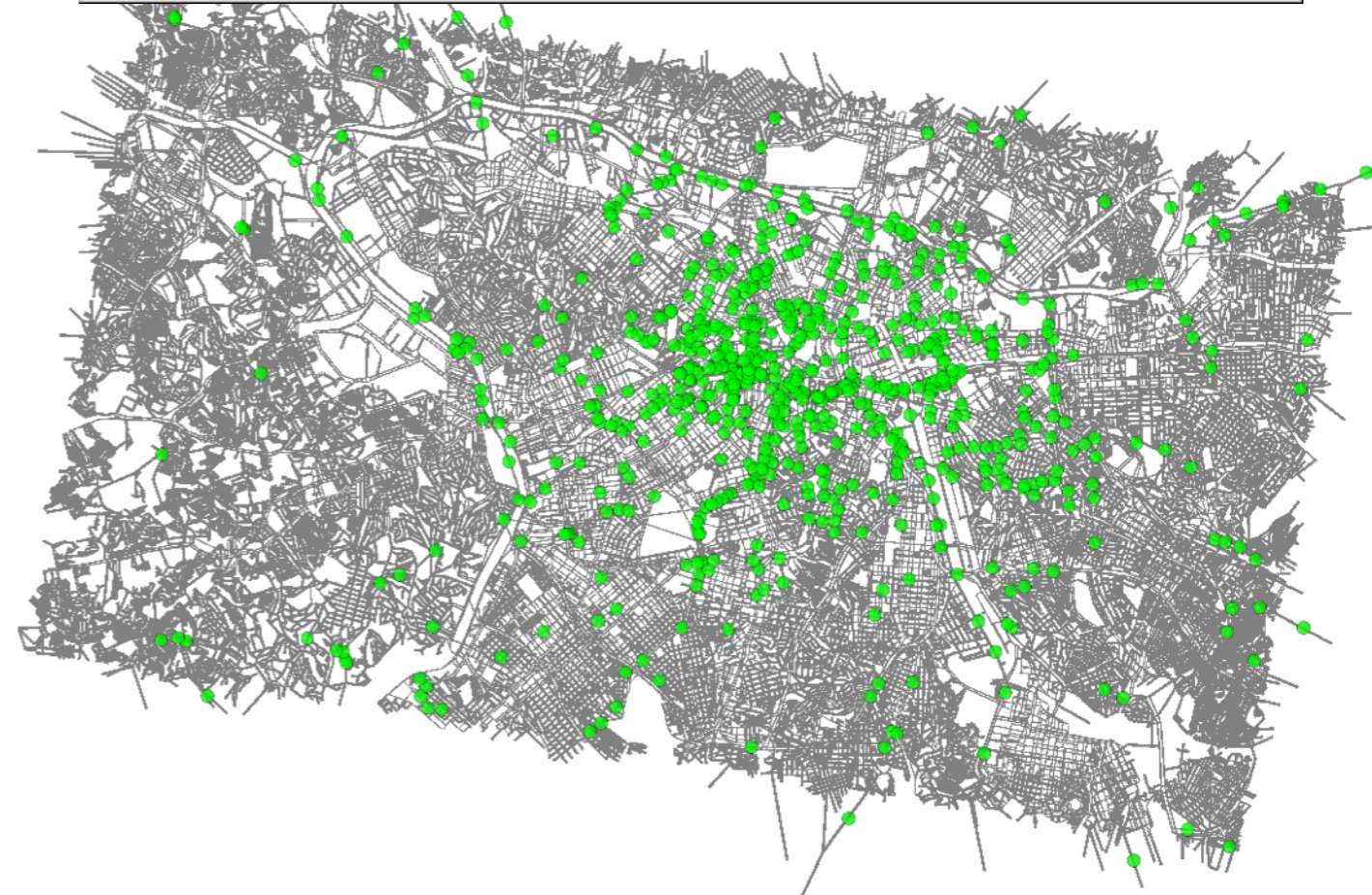
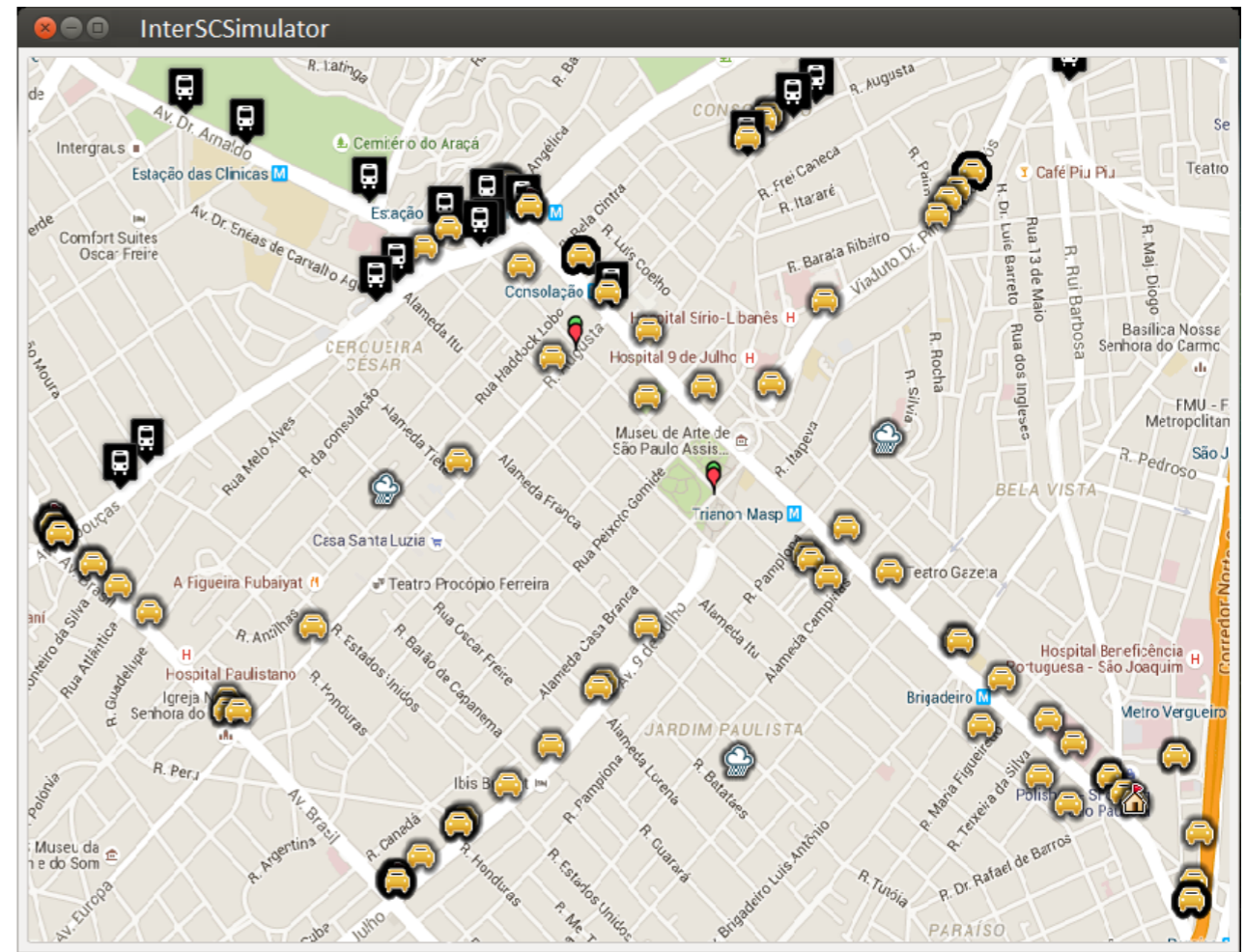
- Support for Big Data Processing
- More sample applications
- Initial experiments with real sensors (e.g., measuring health of urban trees)



InterSCity's Kappa Architecture for Big Data Processing

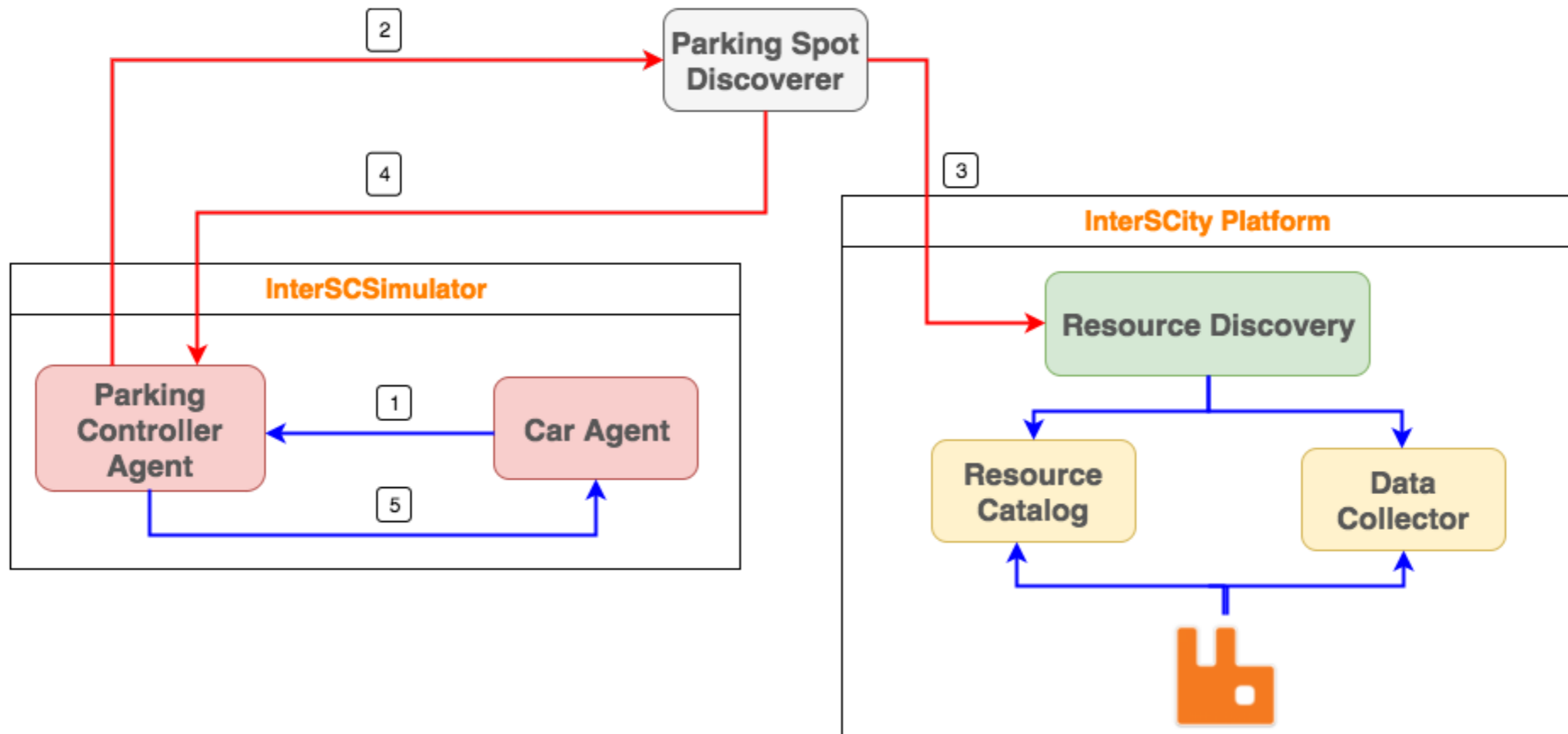
InterSCimulator

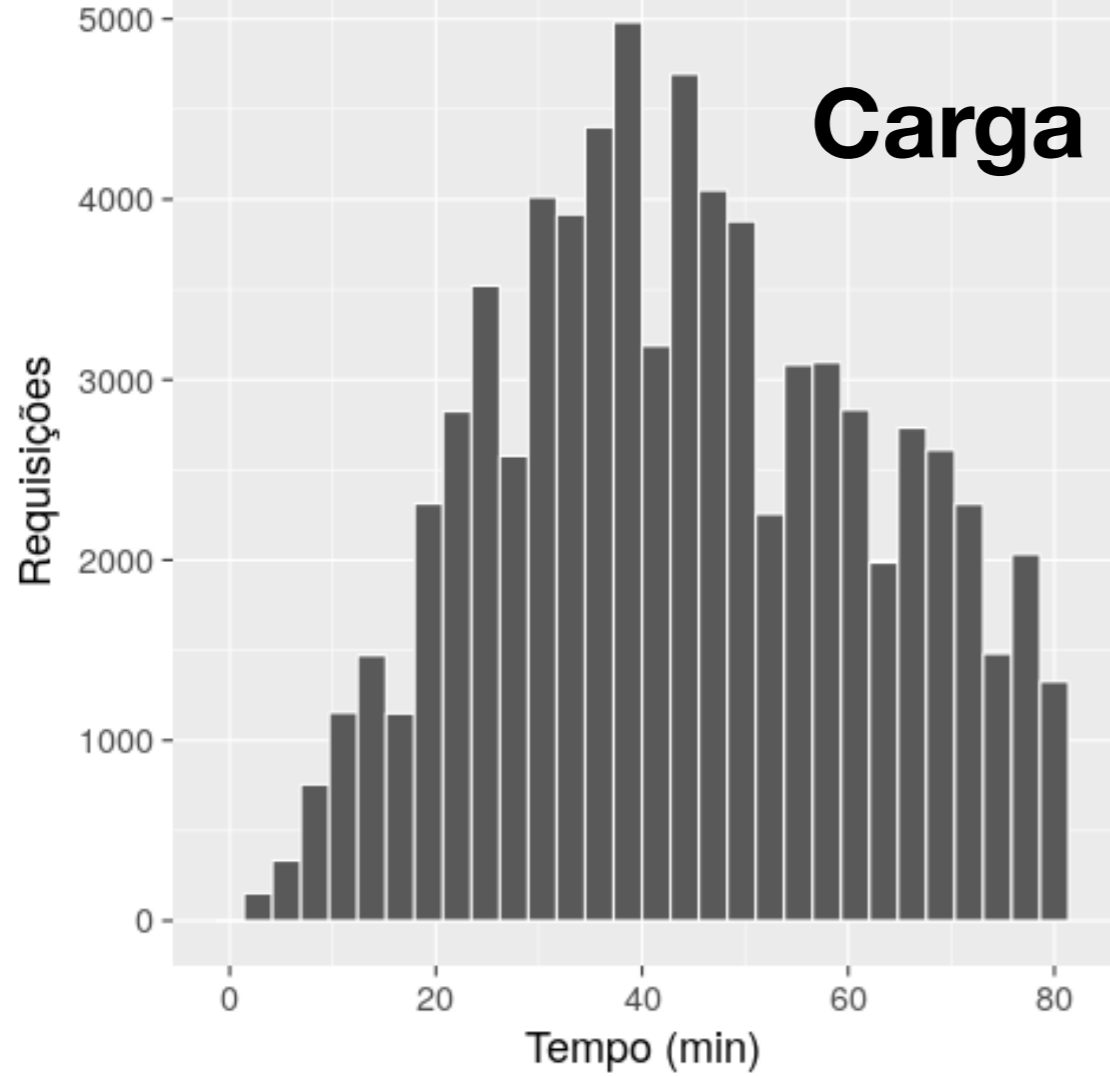
- Erlang-based large-scale simulator for Smart Cities
- Simulations with 10+ million agents in super-real-time
- Multimodal transportation
 - cars, pedestrians, buses, subway, (bicycles).
 - Impact analysis of changes in the transportation infrastructure and associated costs.
 - Population from Paraisópolis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



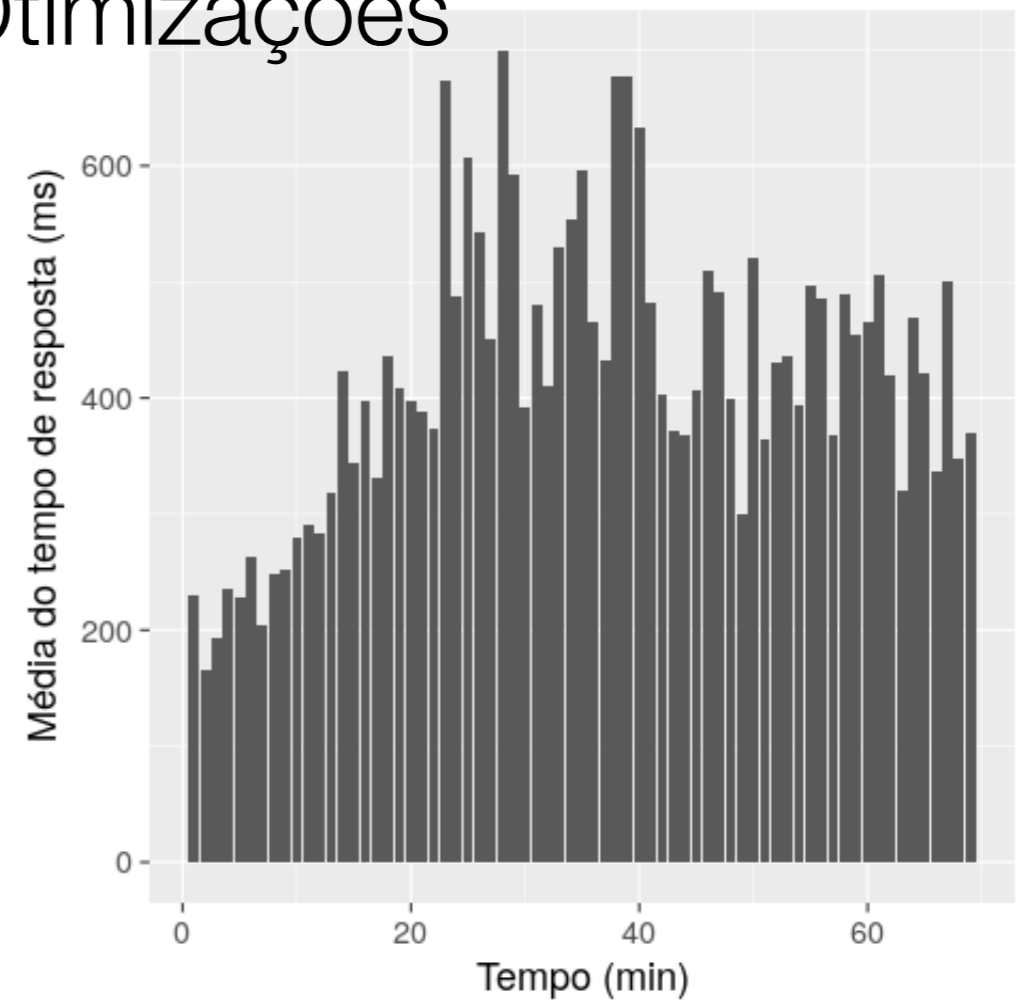
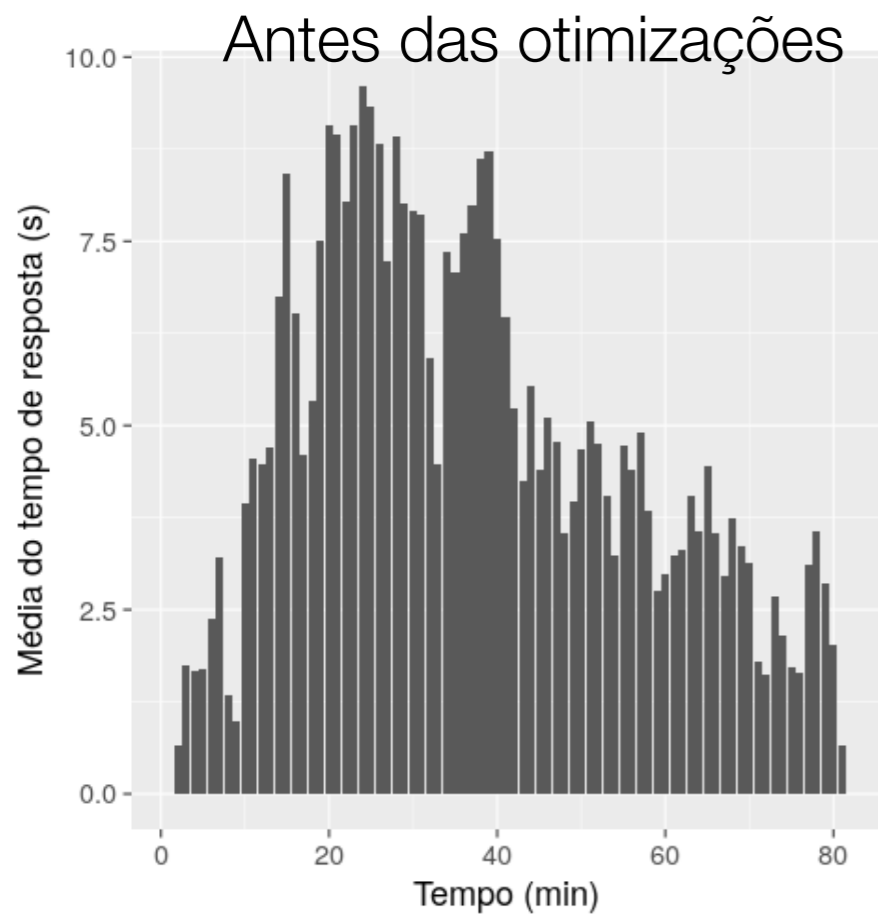
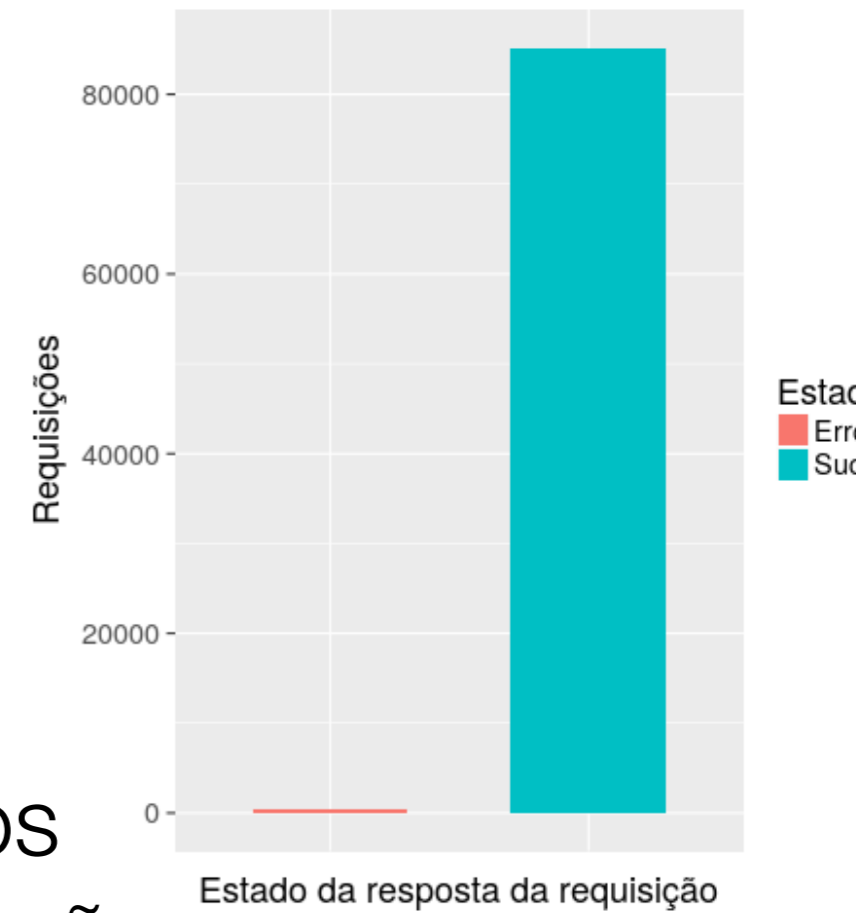
Ongoing Work: Integration of Simulator with the Platform

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

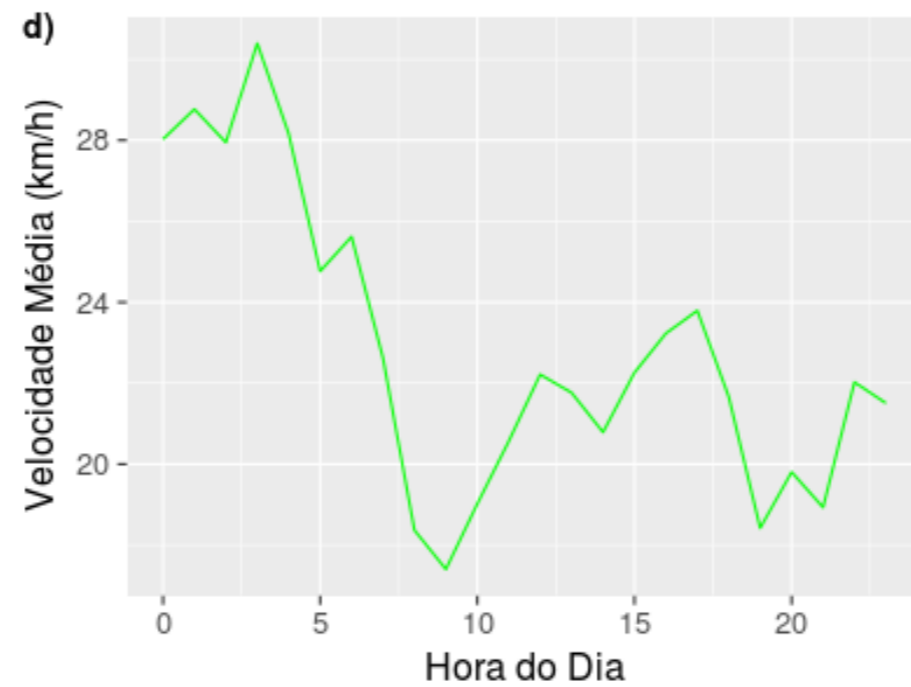
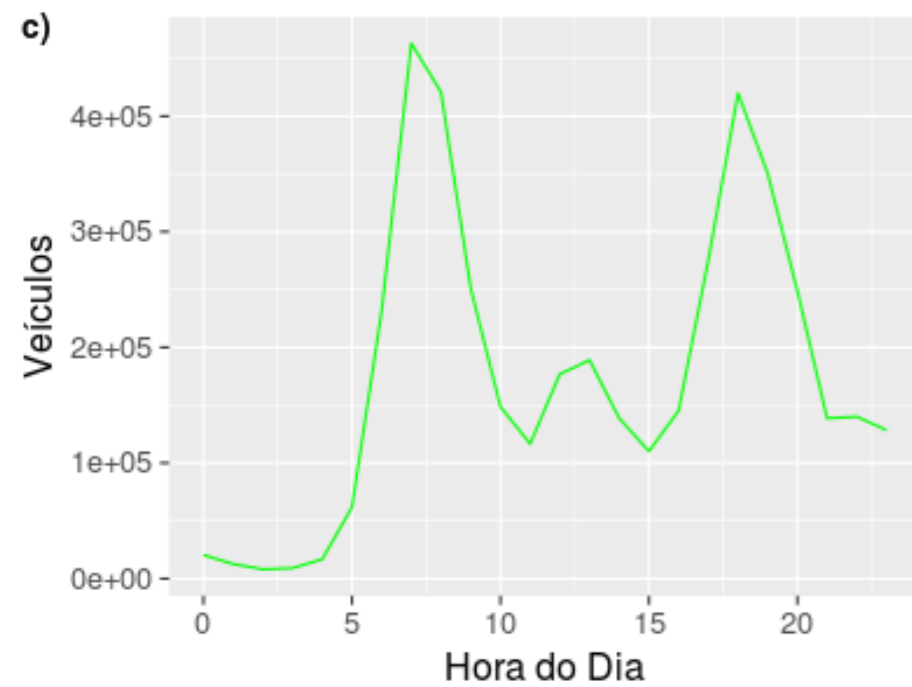
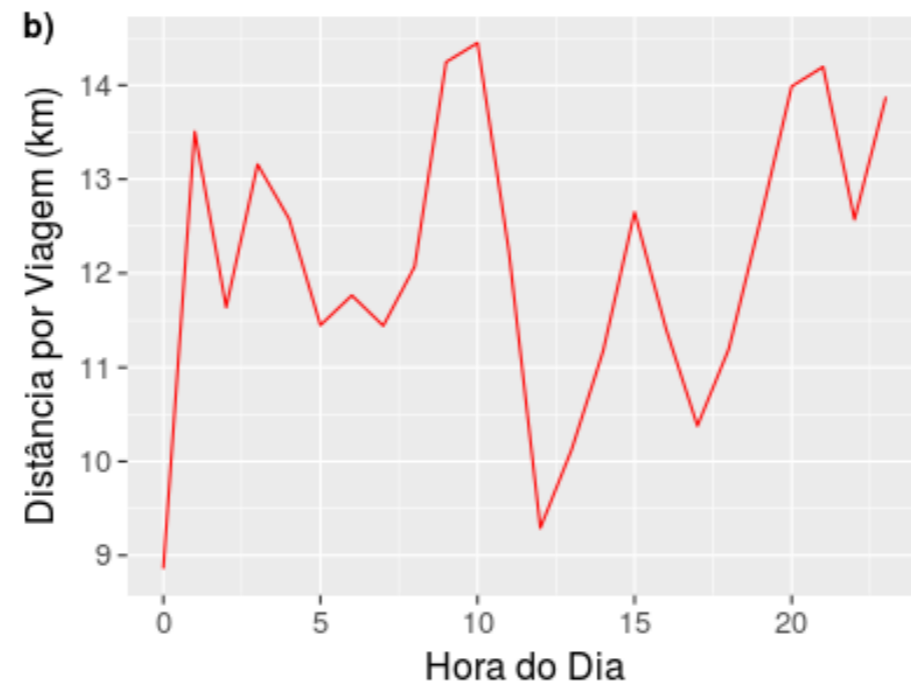
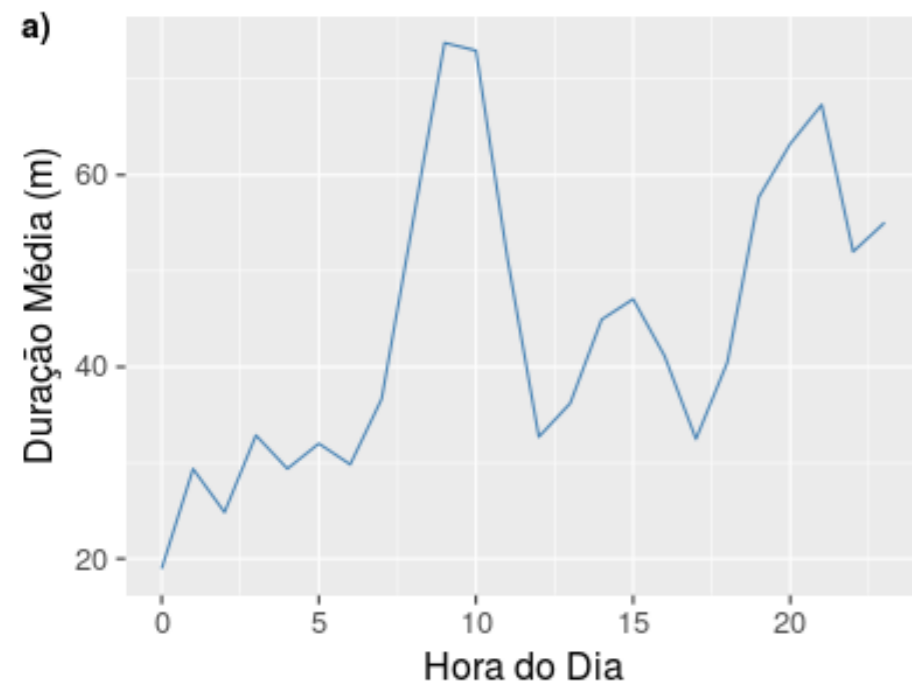




Após
Otimizações



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

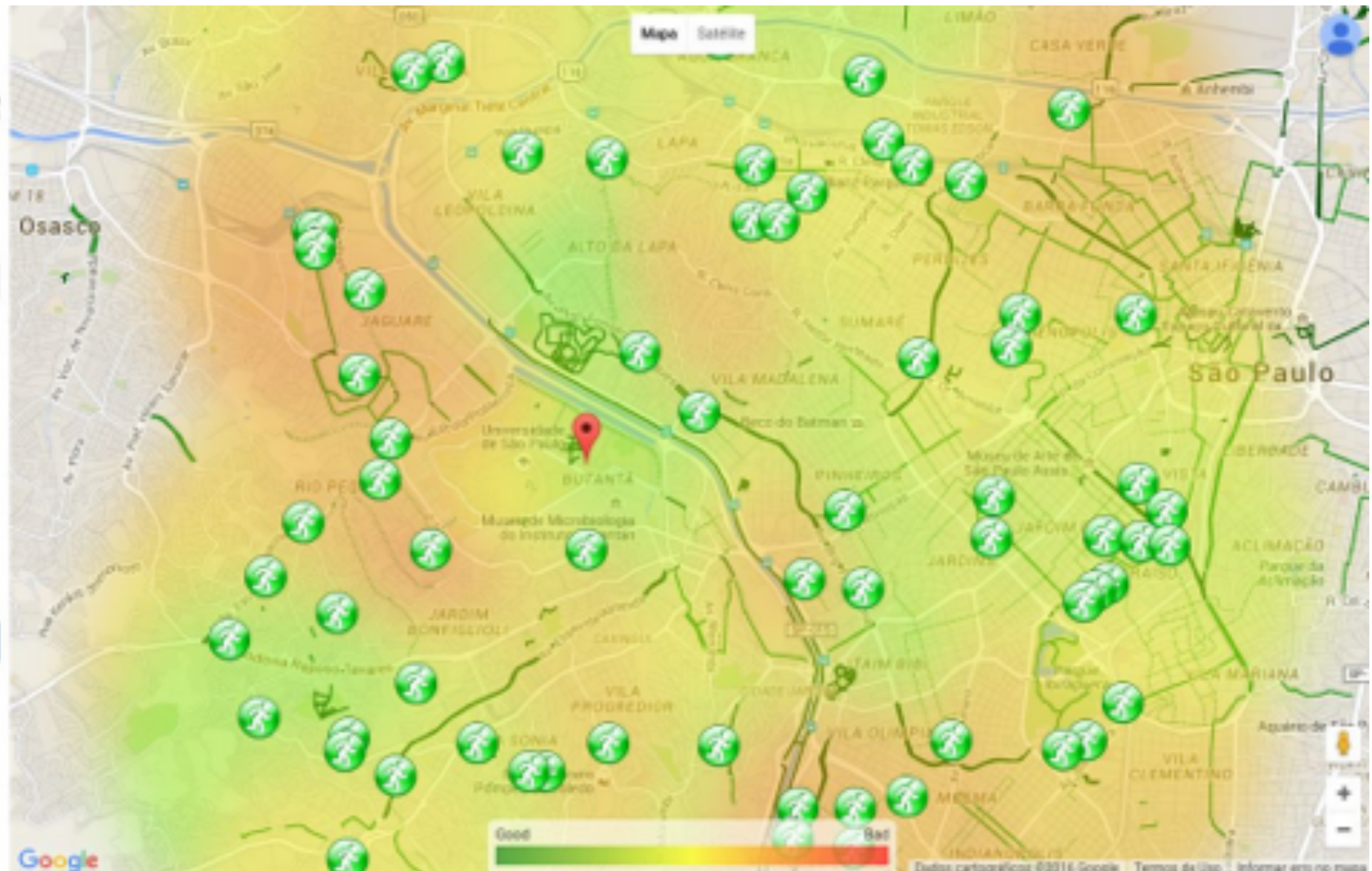


R. da Biblioteca - Butantã, SP

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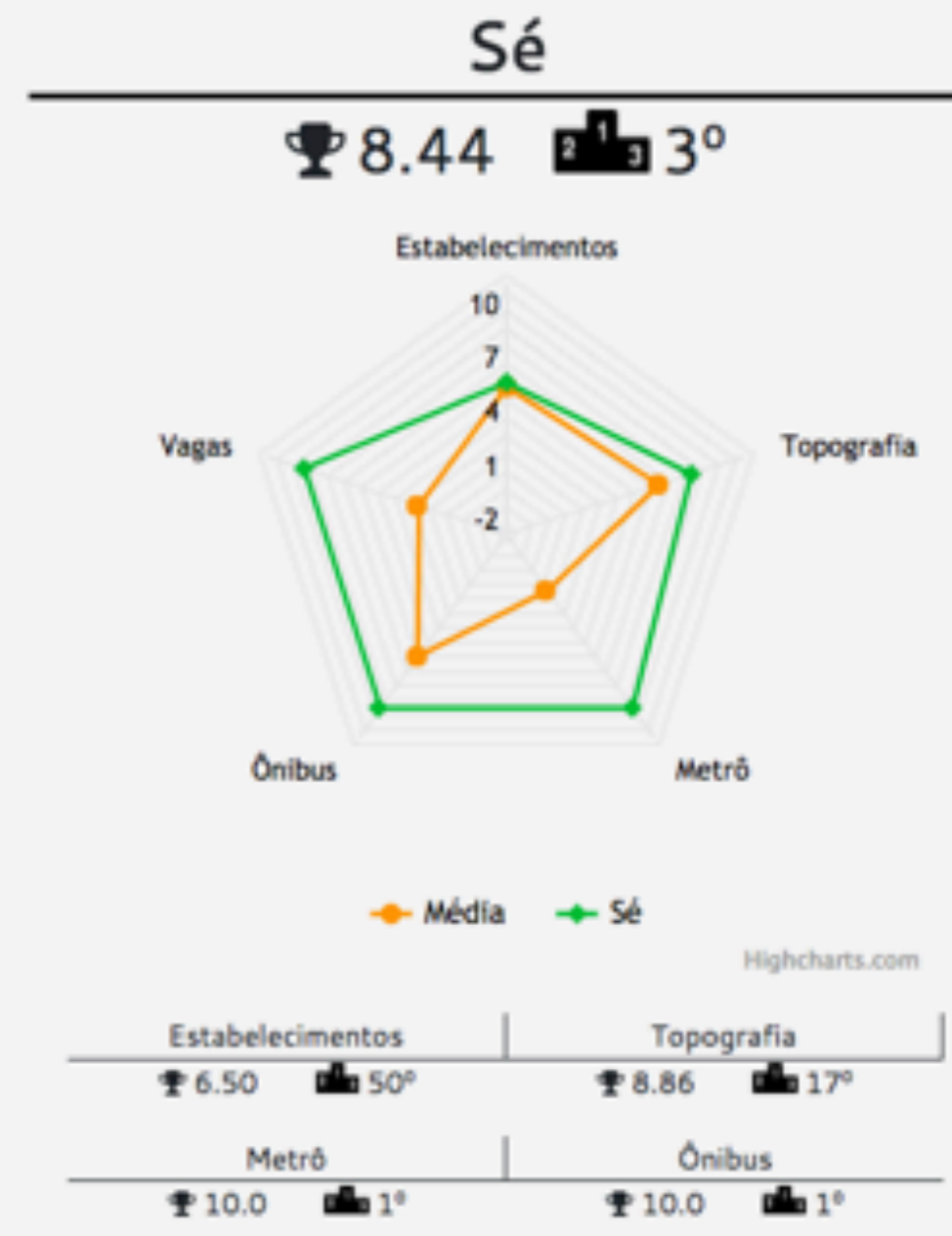
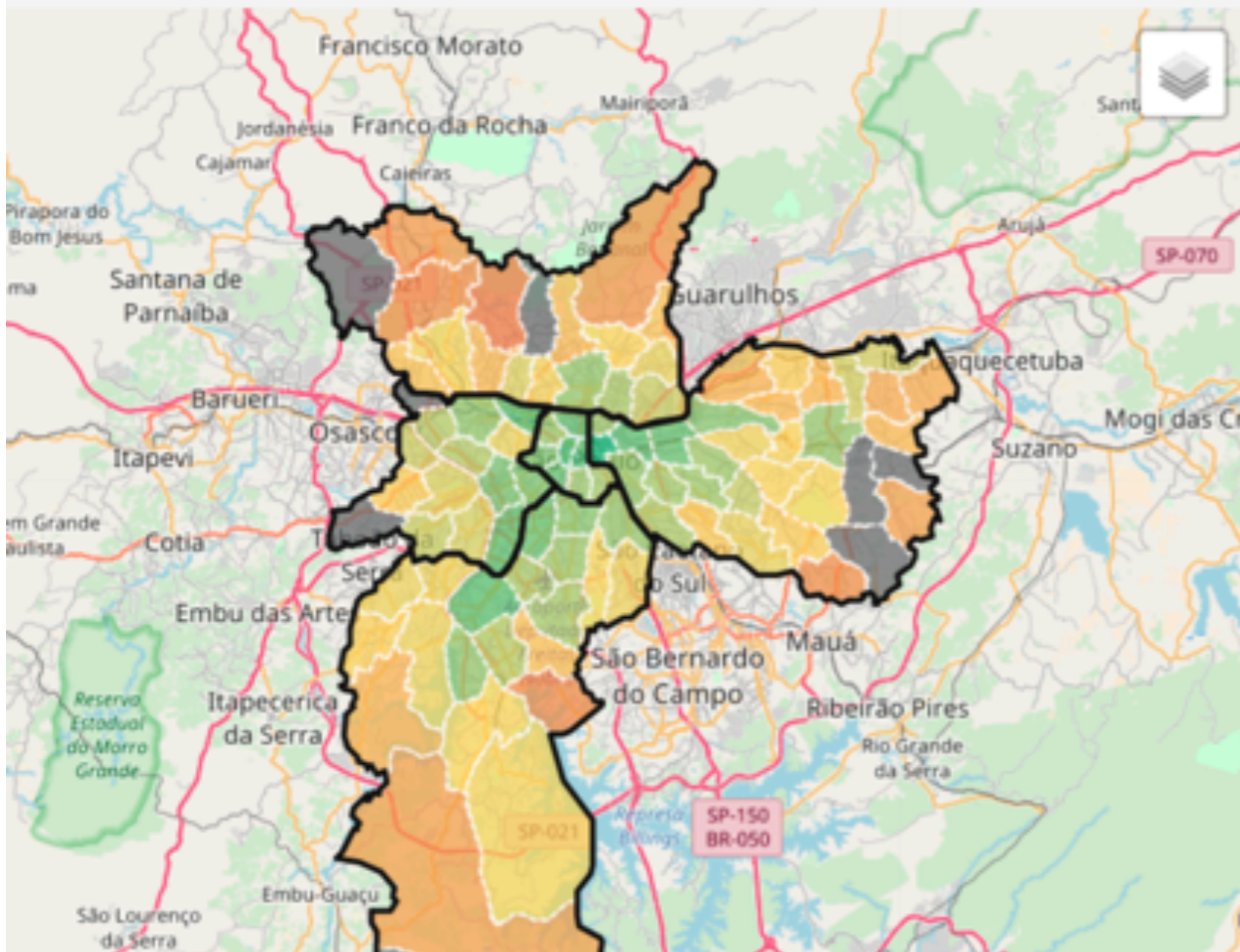
Data to be considered:

- Air pollution
- Humidity
- Temperature
- UV Index (ultraviolet)
- Green areas
- Bike paths



Exemplo 3: intercity.org/apps/acessibilidade

Explore os dados escolhendo uma região no mapa 📍



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)

ESPERÔMETRO
TEMPO DE ESPERA SEMANAL

30 min MÉDIA | 1h30m TOTAL | **30** min ATUAL

638H | 0,05 | 24\$ | **45** min

3x mais que o normal

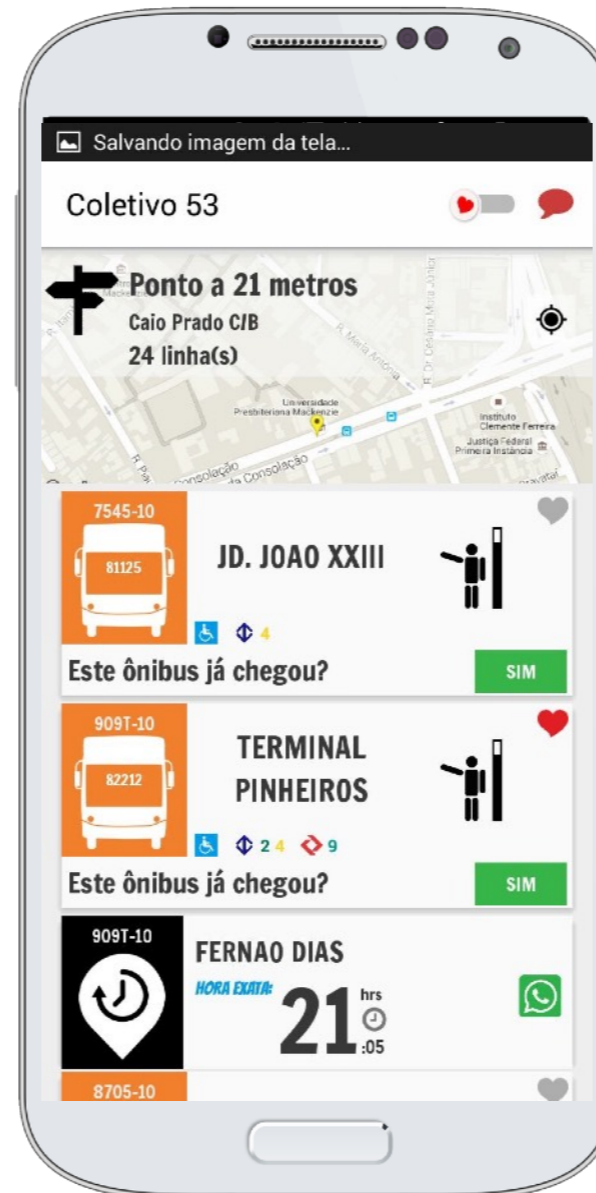
JD. Maria Luiza | 2 Amigos

753H | Como é que está esse ônibus?

#euvoucommoto | #daparasetar | #lataardinha

Acidente na Rubem Berta, 978. | **35** min

Val de Metro que ônibus não dá!



SCIPOPULIS São Paulo
Dia de referência 12/05/2017

RELATÓRIO DIÁRIO

RANKING DAS LINHAS MAIS LENTAS

Pico da manhã

1º	6008-21-0Term. Sto. Amaro	9.9 km/h
2º	5100-10-1Term. Pinheiros	10.4 km/h
3º	6805-10-0Term. João Dias	15.5 km/h

Pico da tarde

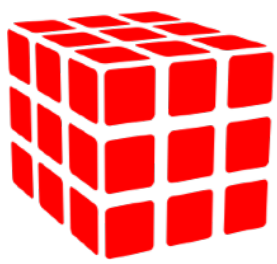
1º	5100-10-0Term. Pq. Dom Pedro II	8.4 km/h
2º	930P-10-0Term. Pinheiros	8.6 km/h
3º	6805-10-1Term. Capelinha	8.9 km/h

VELOCIDADE DOS ÔNIBUS NO DIA

CIRCULAÇÃO DE ÔNIBUS

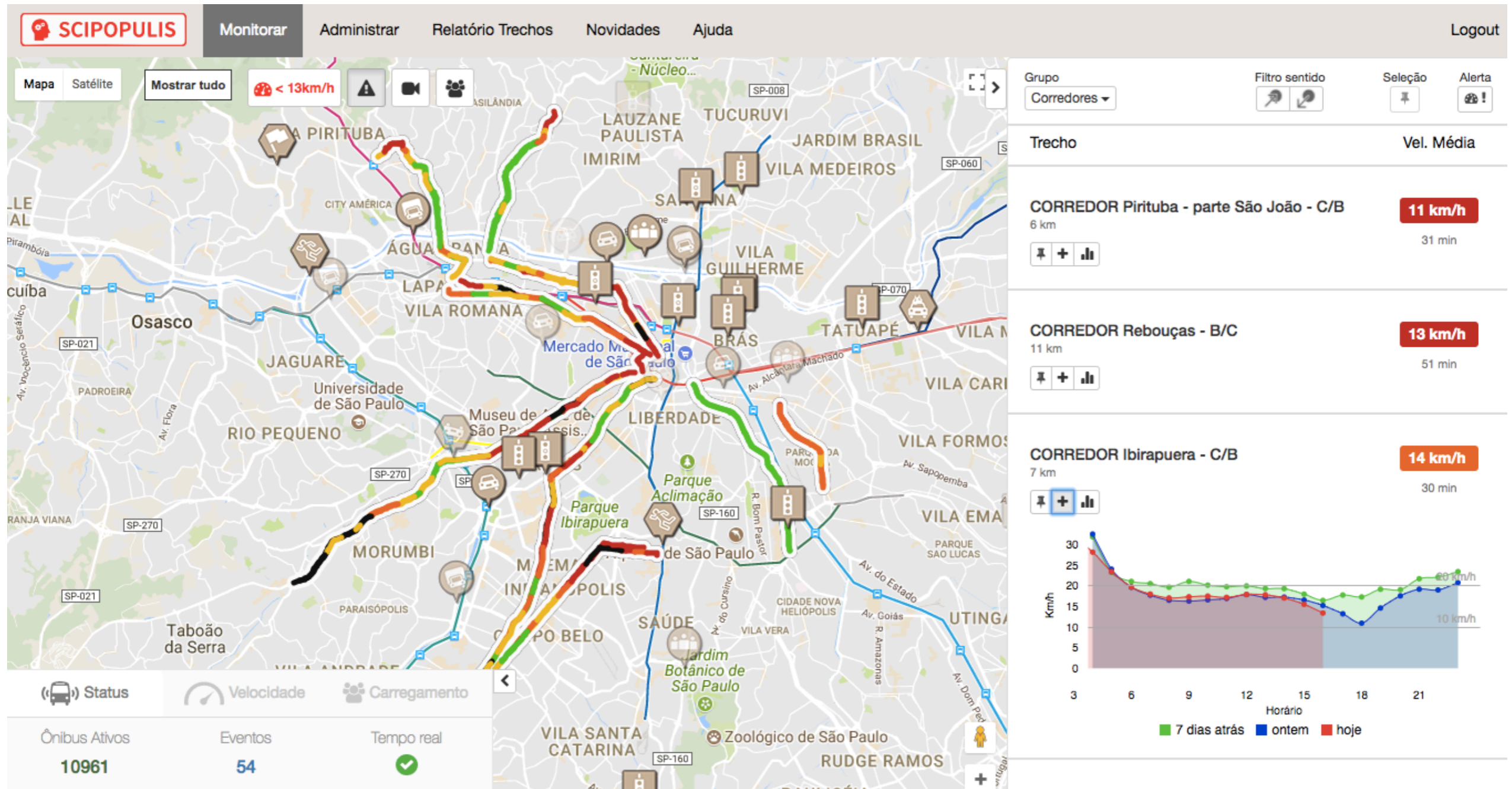
fale@scipopulis.com



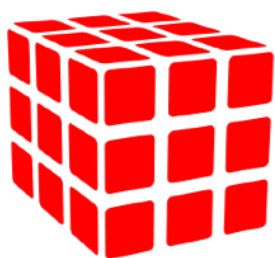


REAL TIME DASHBOARD

(for system operators)



- Already in use by 300 city servants in São Paulo
- in test at: Rio de Janeiro, Curitiba, Santiago (Chile), and Brasilia.



MOBILITY PANEL

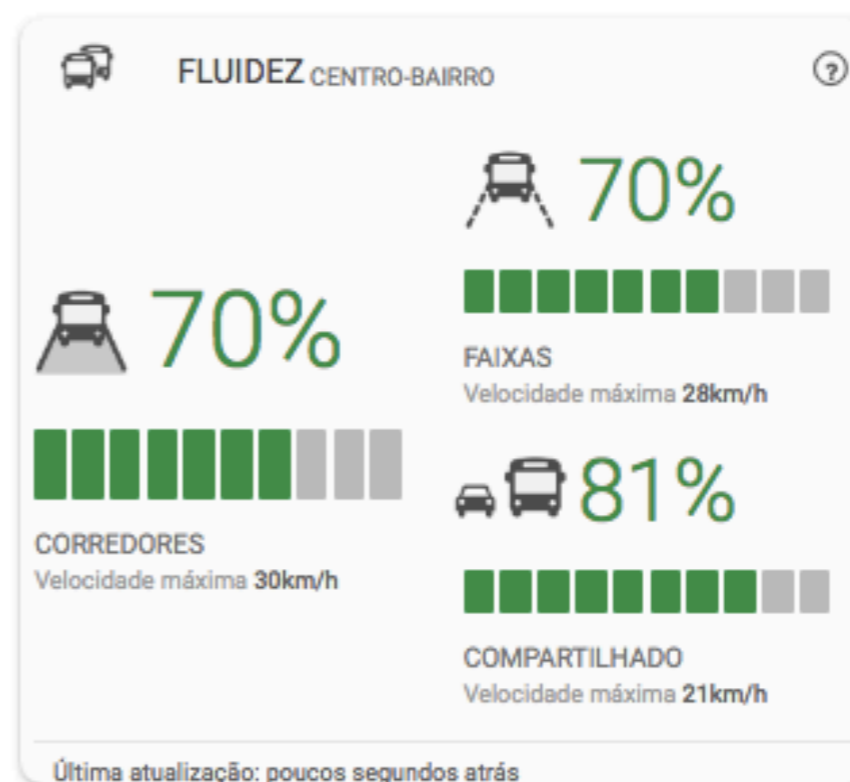
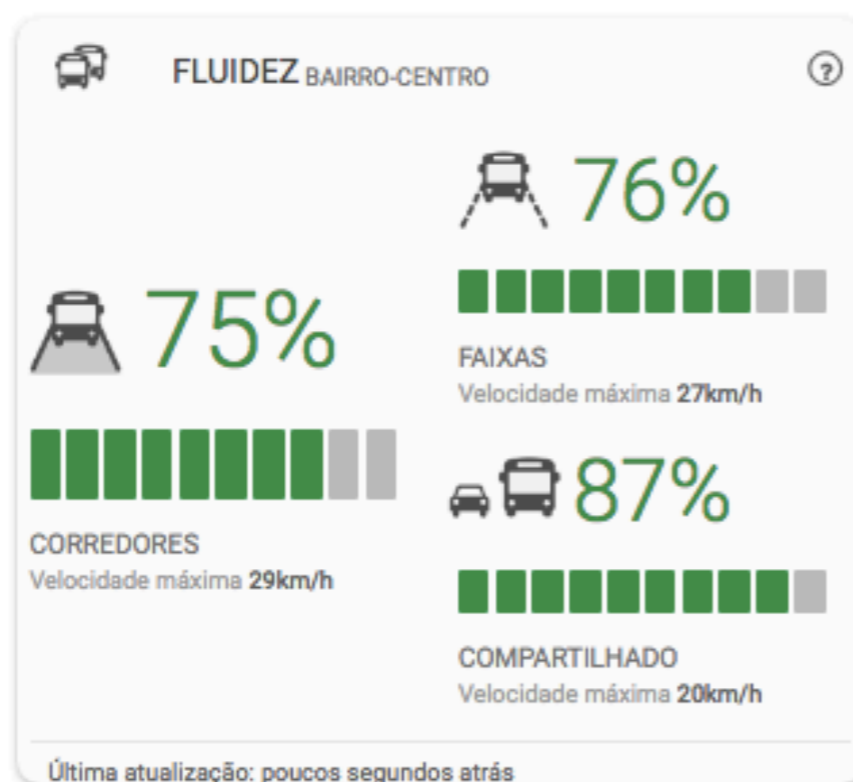
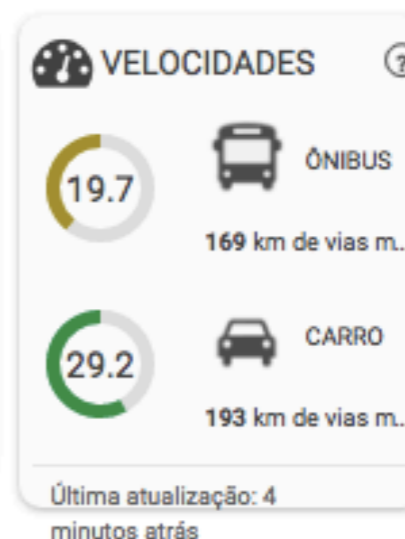
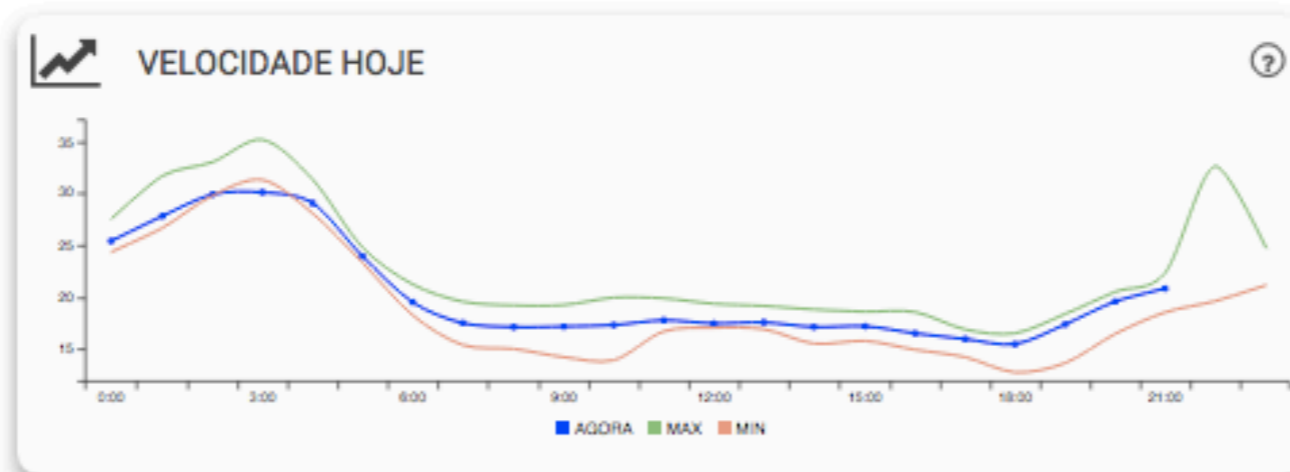
(CONSOLIDATED BUS SPEEDS for citizens)

PAINEL DA MOBILIDADE

FLUIDEZ

VELOCIDADES

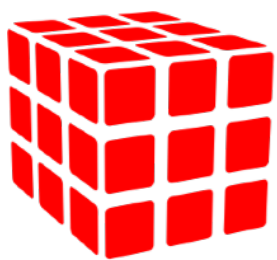
TEMPO



Semáforos em funcionamento 6246 (99.24%)

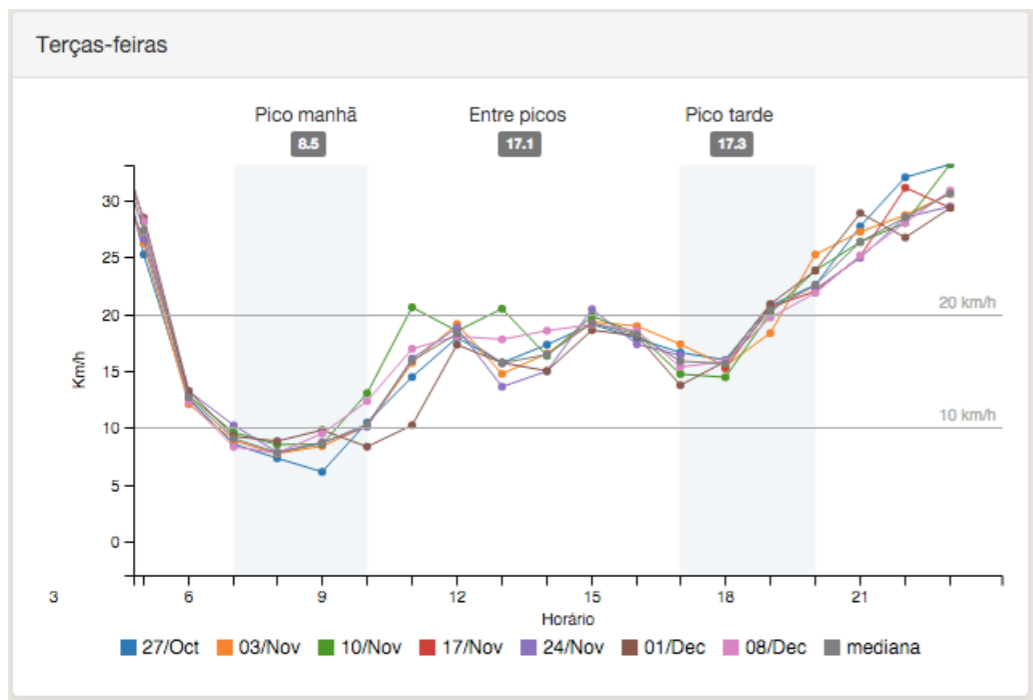
Total de ocorrências de trânsito hoje 214 / Média de ocorrências 130



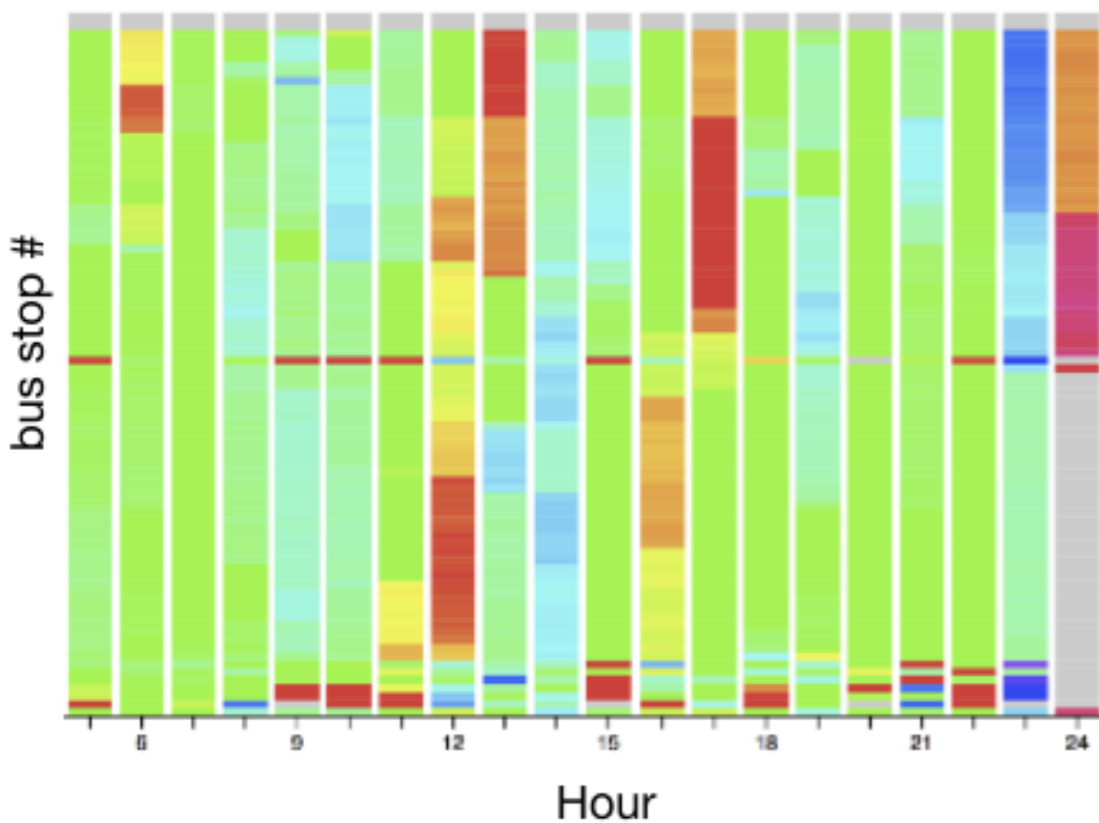


DATA ANALYSIS and visualization

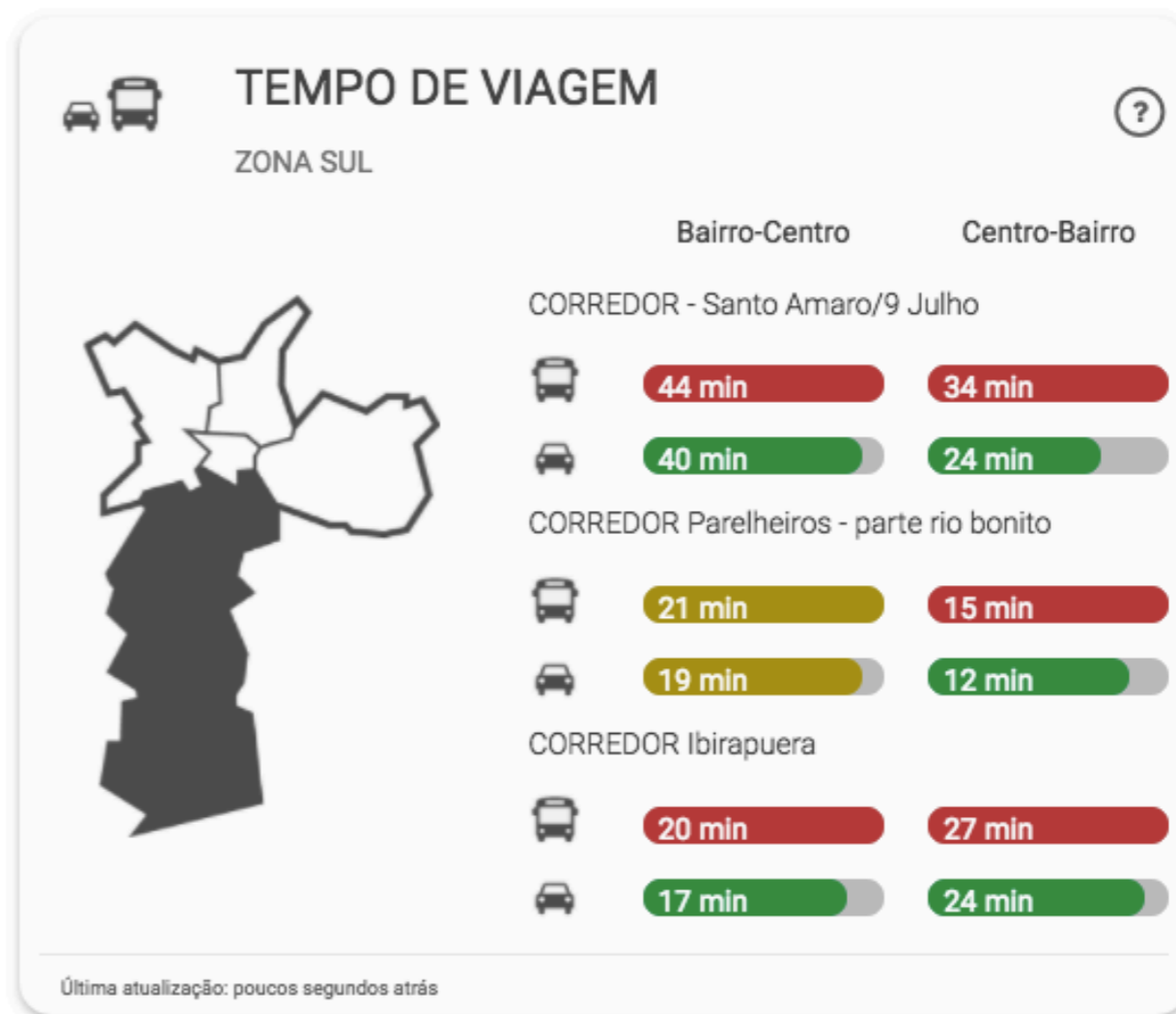
Historical data



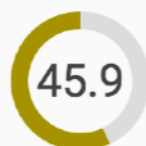
Headway discrepancy per bus stop



Comparing bus x auto



TIETE LOCAL

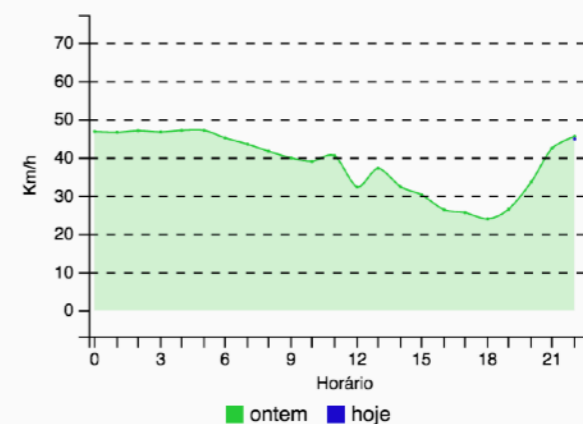


TEMPO REAL

Trecho: PTEDOLIMAO_PTEFRANC...

Sentido: AYRTONSENNA

2Km em 2 minutos



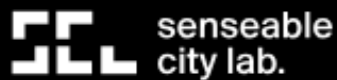
Políticas Públicas baseadas em Evidências

- 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*

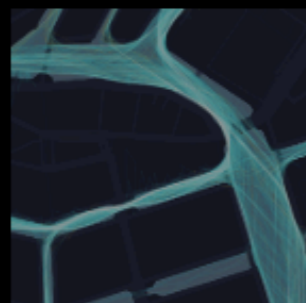
The real-time city is real! As layers of networks and digital information blanket urban space, new approaches to the study of the built environment are emerging. The way we describe and understand cities is being radically transformed—as are the tools we use to design them. The mission of the Senseable 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.

Projects



Minimum Fleet
2018



Summer Day in Amsterd...
2018



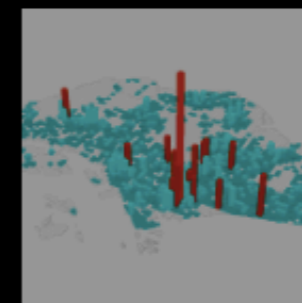
City Nature Challenge 20...
2018



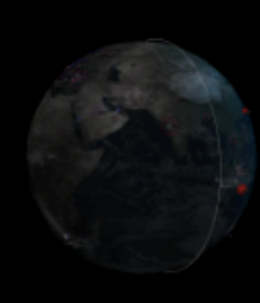
Clean Air Nairobi
2018



City Scanner
2018



Friendly Cities
2018



Global Mobility Index
2018



2017 For
Future
City Pre
the 4th
Revolu

A panoramic view of a city skyline at sunset, with various buildings and a prominent tower on the right.

Further Information

intercity@ime.usp.br

Papers, documentation,
and full source code available at

intercity.org