

iCity – ITSoS: New Generation (NG) Smart City Apps Platform

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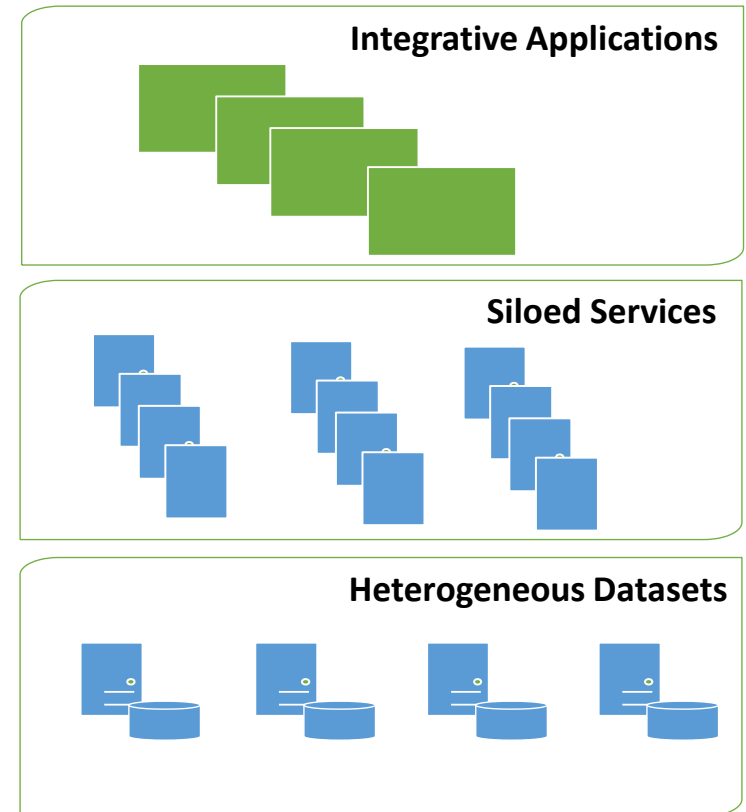
iCity Research Day 2020



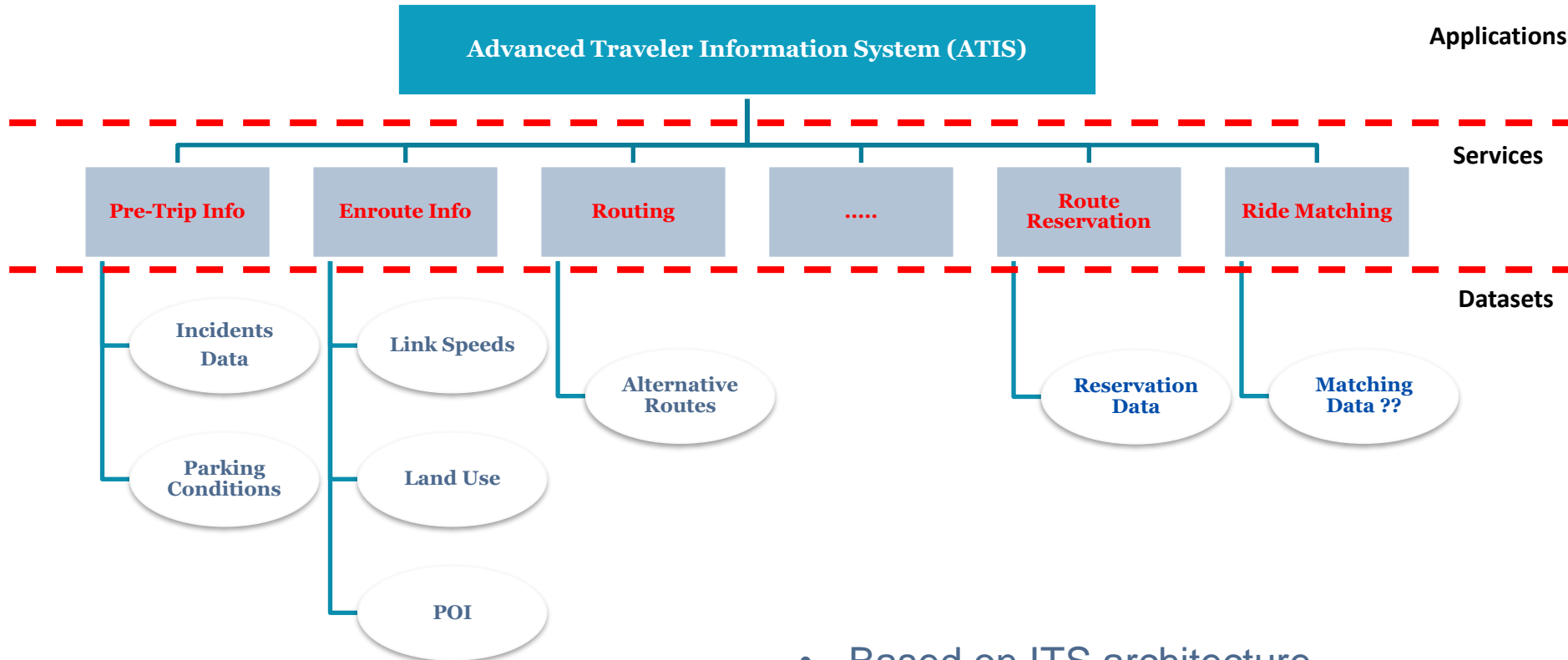
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Challenges

- **Smart City Apps are:**
 - Developed in-house / Siloed
 - Comprised of 1/ 2 services
 - Processes 1 / 2 datasets
- **New Generation (NG) Apps will:**
 - Be complex workflows of **services**.
 - A service process a multitude of **data**.
 - Different providers:
 - Siloed services
 - Heterogeneous datasets
 - Need to scale to **a Mega-city size**

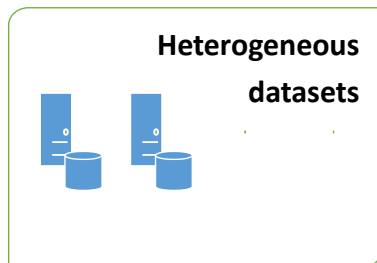


NG App Example

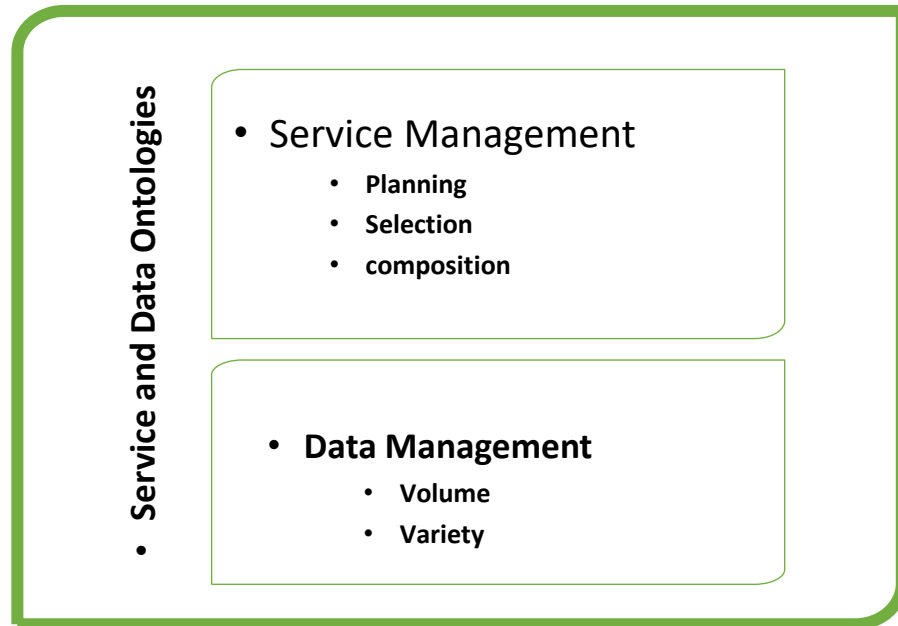


- Based on ITS architecture
- Compare to current ATIS offerings

Research Objective: Platform

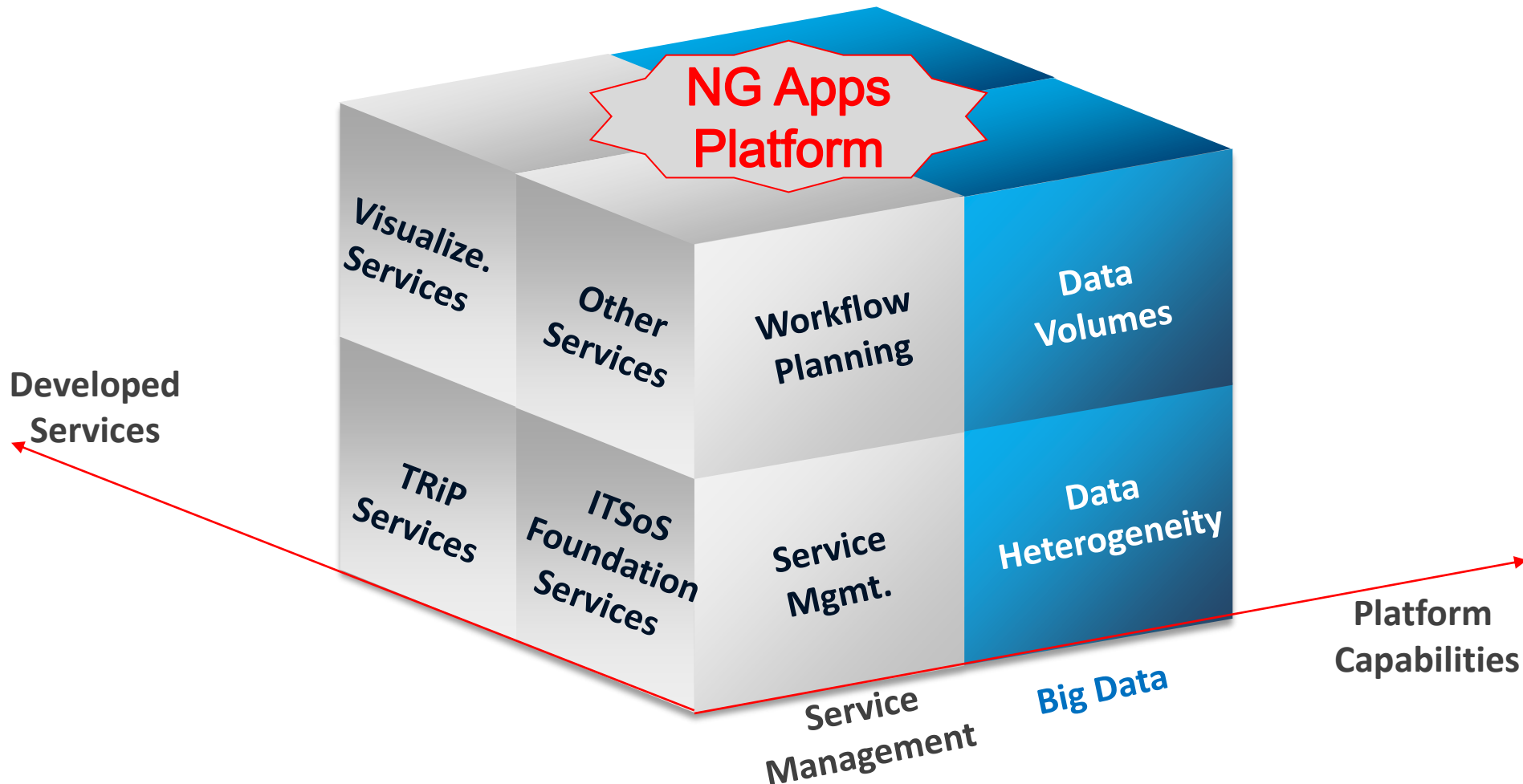


Application



Platform Capabilities

NG Smart City Apps Platform



ITSoS-iCity Services

GIS Visualization Services

- 1- Pedestrian Safety Index
- 2- GTA O-D Travel Time
- 3- Service: Traffic Bottleneck Visualization

TRiP Services

- 1- TRiP Routing
- 2- TRiP Link Level State Tracking
- 3- TRiP Trip Level Reservation
- 4- Performance Management

More Service

- OTP Transit Services
- OTP Ontology Data Integration
- Highway Traffic Macroscopic Characteristics Estimation using CNN

ITSoS Foundation Services

Traffic Data as a Service

TRiP Network Abstraction Services

GTFS Data as a Service





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ITSoS-iCity Services

TRiP Services

1- TRiP Routing

2- TRiP Link Level
State Tracking

3- TRiP Trip Level
Reservation

4- Performance
Management

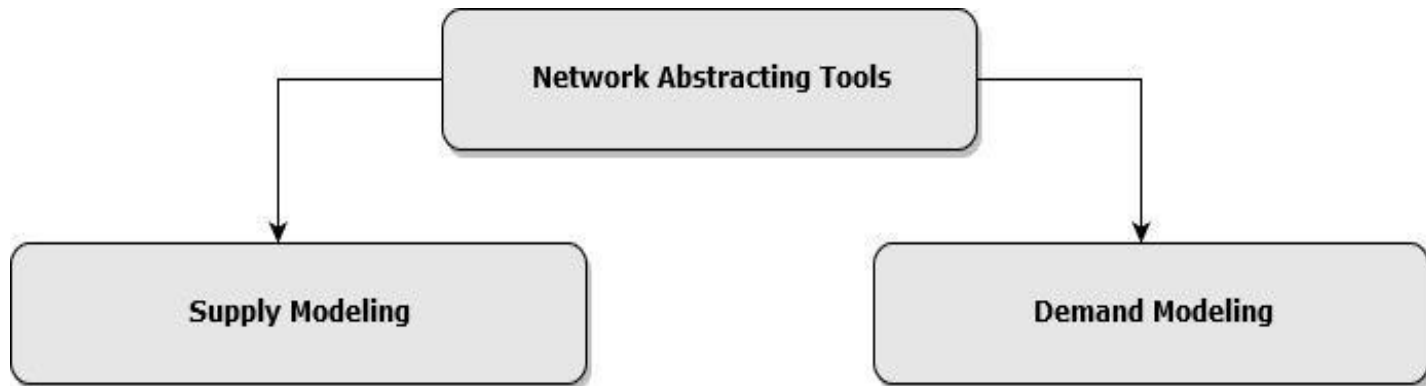
ITSoS Foundation Services

TRiP Network Abstraction Services



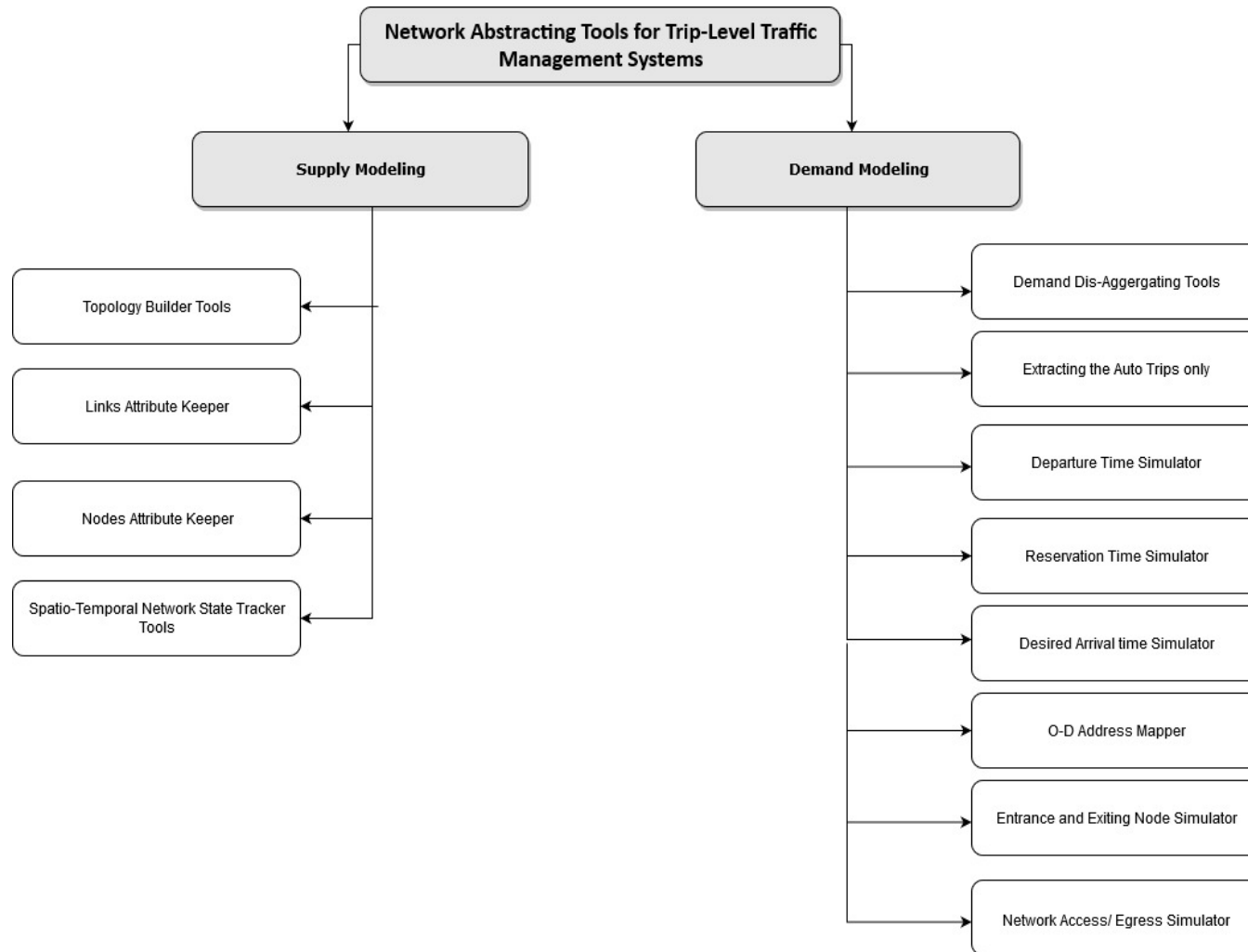
iCity- TRiP Network Abstraction Services

- A comprehensive Framework for trip level and link level network abstraction tools.
- In this presentation, I will present a brief about customizable software for supply and demand abstraction tools only.

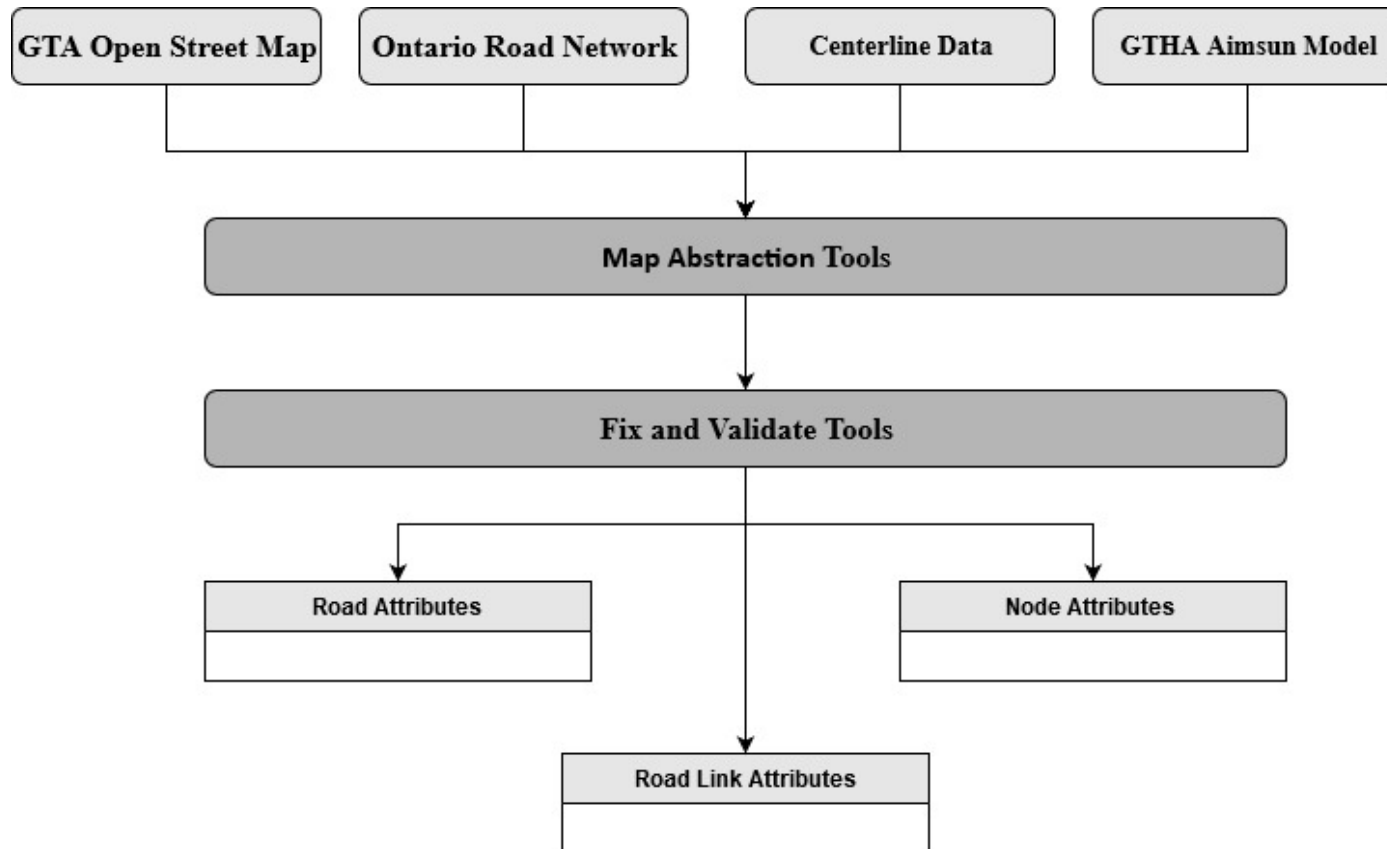


- This is ready-to-integrate tools with both trip level traffic management solutions and transportation simulation platforms.

ITSoS-iCity Network Abstraction Services(TRiP)



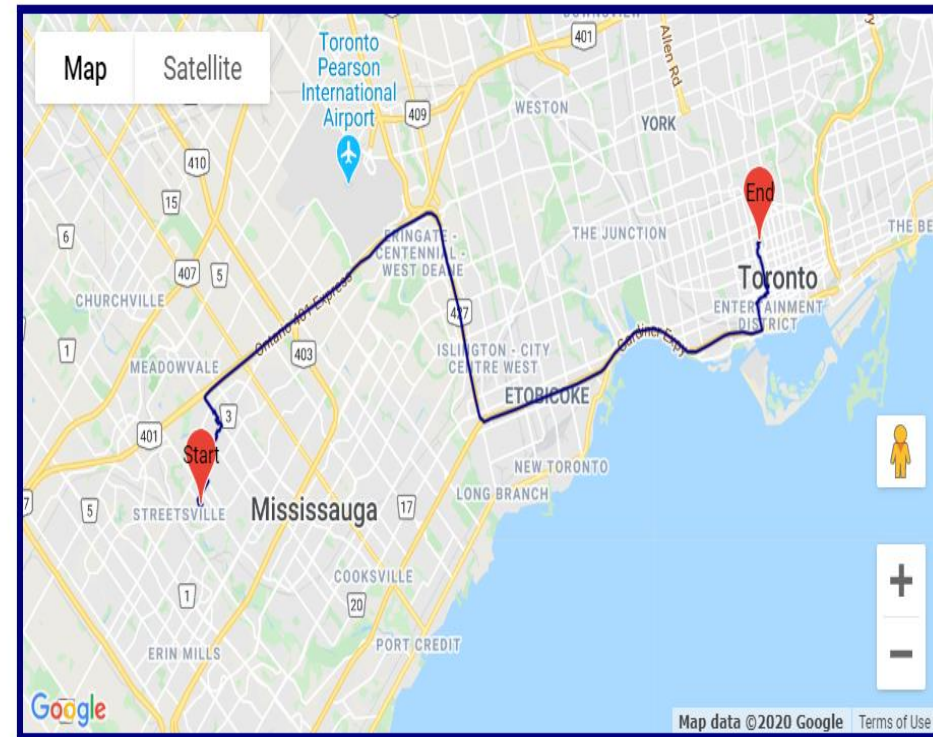
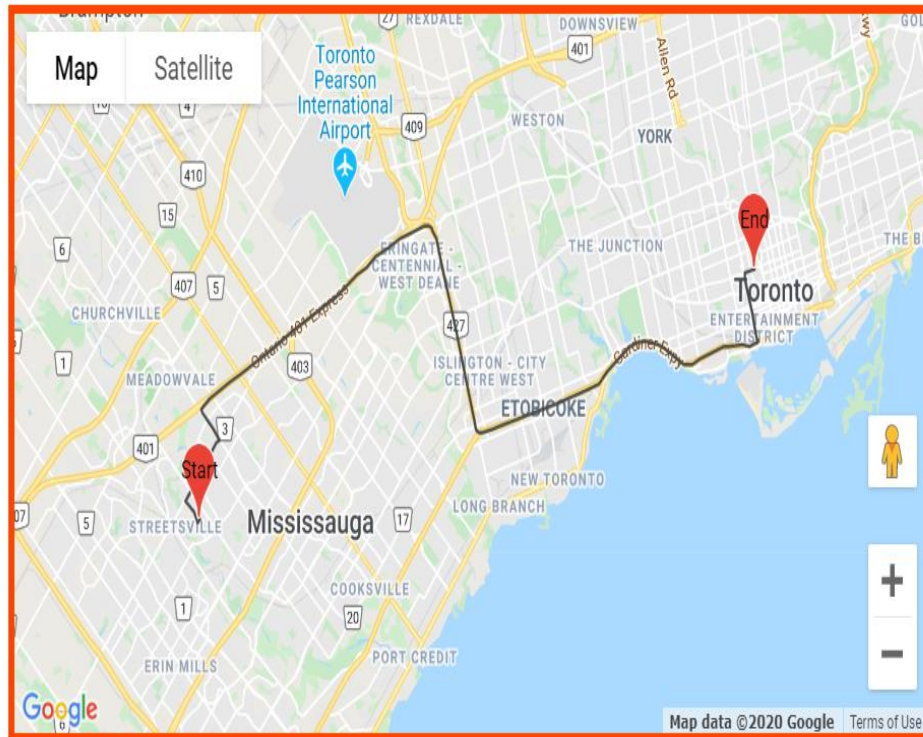
Example: Topology Building Tools



Application TRiP as an Advanced Traveller Information System

Google Maps

TRiP



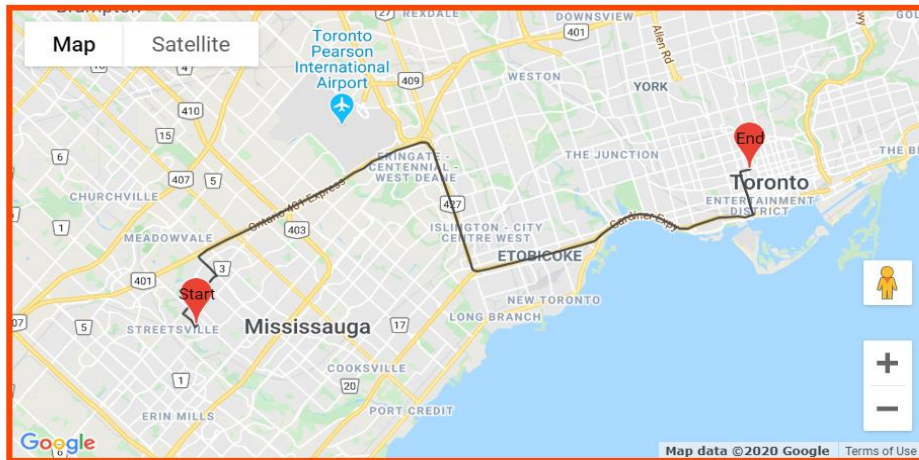
Application: Reservation-based Traffic Control System

- Link Level & Trip Level Control
- Can traffic be managed by a reservation system?

Advanced Travelers Information System

Re-planned your trip!

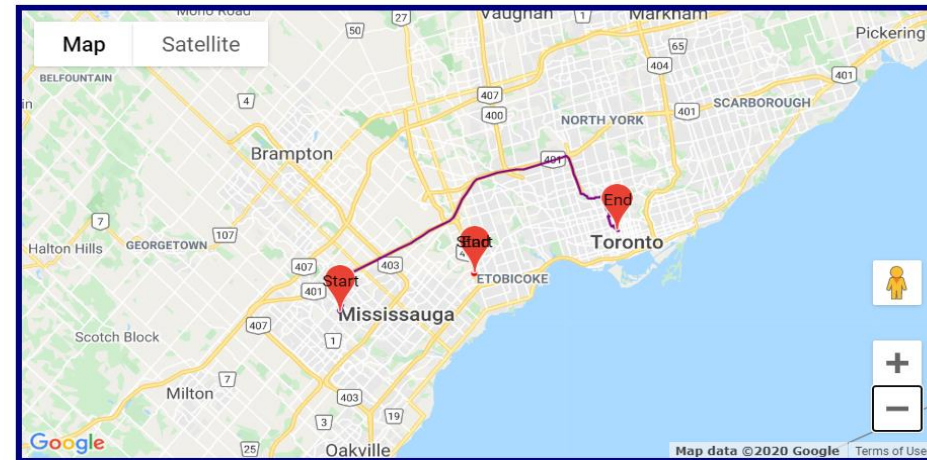
Google Maps



The total travel time is: 40.083 minutes.

The total distance is: 39.761 km.

TRiP



The total travel time is: 43.487 minutes.

The total distance is: 40.632 km.





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Application: OTP Transit (GTHA)

The screenshot displays the ilsos.ca OTP Instance web application. The main map shows a route from College St at McCaul St (837) to York Region Administrative Centre. The route is highlighted in green and red, indicating different transit modes. The application shows 3 itineraries returned, with the first one selected. The first itinerary details are as follows:

- Start:** 3:03pm, 05/02/2018
- Step 1:** BUS: TTC, (506) CARLTON S.C. to EAST - 506 CARLTON REPLACEMENT BUS TOWARDS MAIN STREET STATION
- Step 2:** WALK 59 m to COLLEGE STATION - NORTHBOUND PLATFORM
- Step 3:** SUBWAY: TTC, (1) LINE 1 (YONGE-UNIVERSITY) to LINE 1 (YONGE-UNIVERSITY) TOWARDS FINCH STATION
- Step 4:** WALK 198 m to FINCH GO BUS TERMINAL PLATFORM 2
- Step 5:** BUS: York Region Transit, (blue) VIVA BLUE to Newmarket Terminal - NB
- Step 6:** WALK 346 m to stop York Region Administrative Centre
- End:** 5:04pm, 05/02/2018

The Trip Options panel on the left shows the following settings:

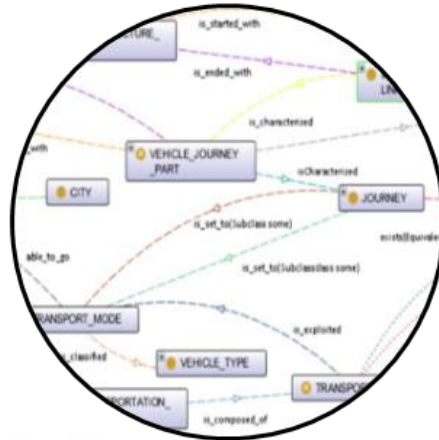
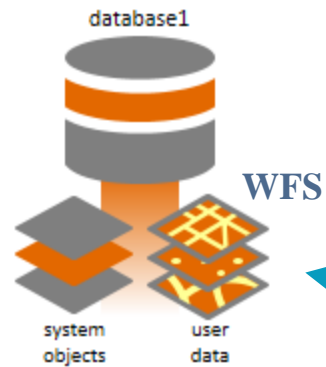
- Start:** stop COLLEGE ST AT MCCAUL ST (837)
- End:** stop York Region Administrative Centre
- Depart:** 3:00pm, 05/02/2018
- Travel by:** Transit
- Maximum walk:** 750.00 m
- Preferred Routes:** (None)
- Weight:** (slider)
- Banned routes:** (None)
- Wheelchair accessible trip:** (checkbox)
- Plan Your Trip** button

Semantic ATIS Architecture

SQL DB



Data



Ontology Engine

Use Interface



OTP Server

Data



Application (3): Advanced Traveler Information System

ITSos [← Back to ITS page](#)

Advanced Travelers Information System

Start: 7:02am, 05/04/2020

WALK 561 m to QUEEN'S PARK STATION - SOUTHBOUND PLATFORM

SUBWAY: TTC, (1) LINE 1 (YONGE-UNIVERSITY) to LINE 1 (YONGE-UNIVERSITY) towards FINCH STATION

2. 7:04am 7:20am

3. 7:04am 7:20am

First Previous Next Last

Trip Options

Start: (43.65989, -79.39035)

End: (43.64525, -79.38063)

Depart: 7:00am, 05/04/2020, Now

Travel by: Transit

Maximum walk: 1000 m, Presets

Preferred Routes: (None) Edit...

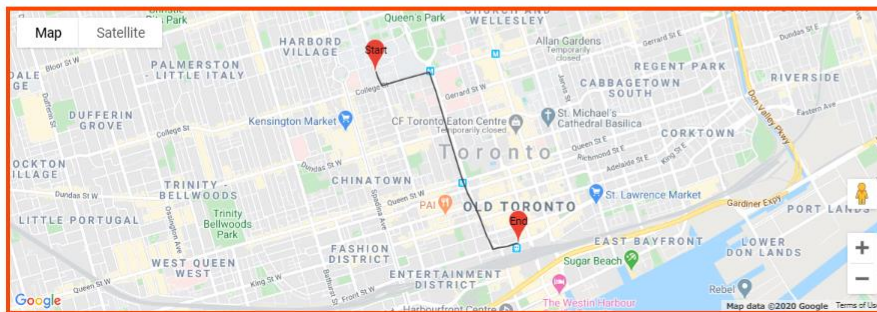
Weight: Edit...

Banned routes: (None) Edit...

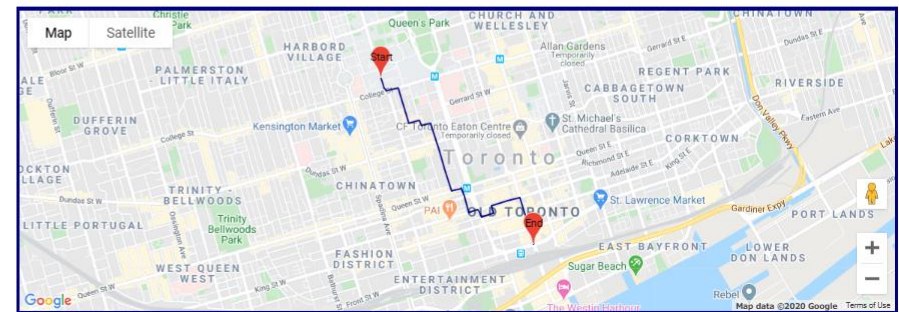
Wheelchair accessible trip:

Plan Your Trip

Google Maps



TRIP

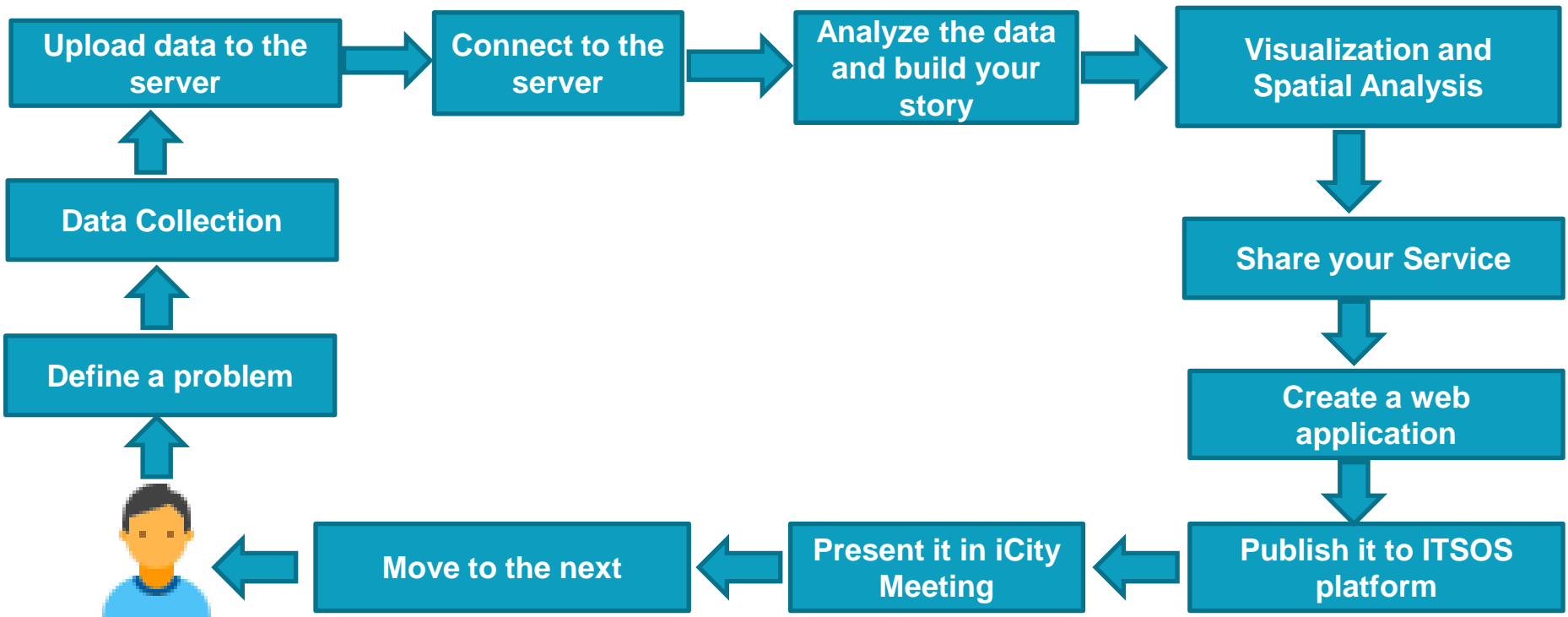


one-its-wbapp1.transport.utoronto.ca:12345/?module=planner&fromPlace=43.65989,-79.39635&toPlace=43.64525,-79.38063&date=05-04-2020&time=07:00:00&mode=TRANSIT&maxWalkDistance=1000&arriveBy=false&wheelchair=false&locale=en&itinIndex=0#



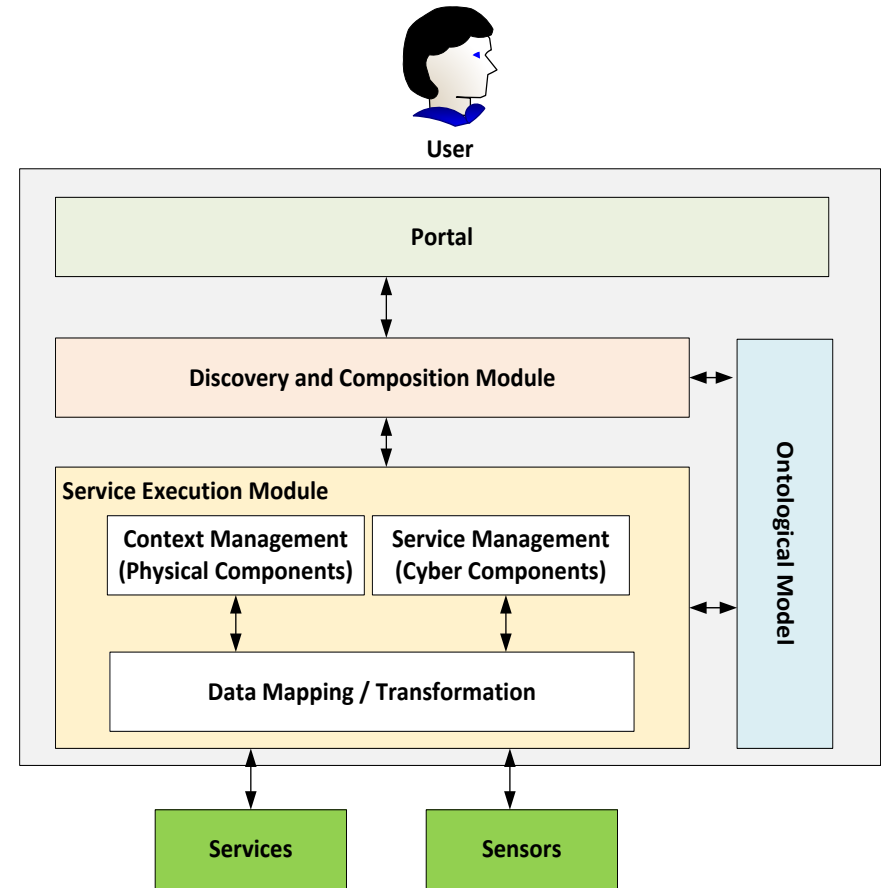
How to contribute to ITSoS?

- Explore transportation data and publish new services through ITSoS platform.
- Build the innovation hub and the collaborative ecosystem that will be used to build the new **generation (NG) of the Smart City Apps** through shared data and services

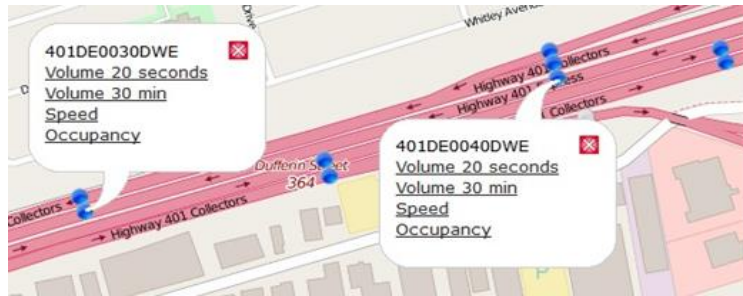


Challenge: Service Management

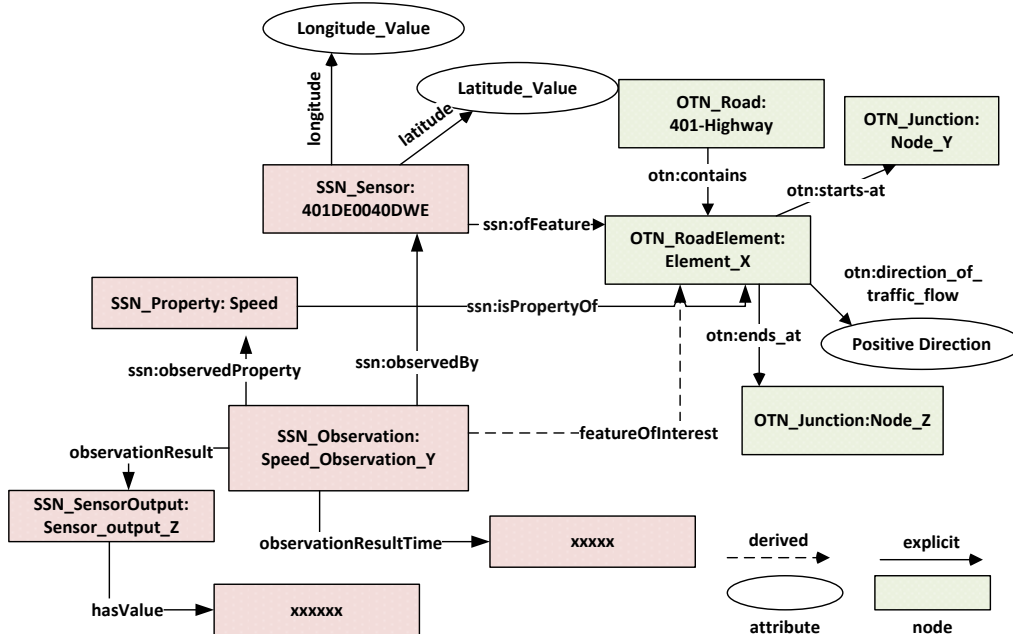
- **Ontological Models**
 - Service and Data
- **Service Management**
 - Planning
 - Discovery
 - Selection
 - Composition
- **Data Integration**
 - Mapping
- **Context management**



Challenge: Data Heterogeneity



- Designed data linking/ integrating ontologies
- In collaboration with iCity Project **



mXpress: Example

Home Maps About Us

mXpress

Search: CN Tower, ON

Destination: Toronto Pearson International Airport, ON

Gardiner Expressway, Highway 27

27.1 km, 25 min

- Head northeast on Bremner Boulevard 450 m
- Turn right onto York Street 150 m
- Take the ramp on the right towards Gardiner Expressway West 400 m
- Merge left onto Gardiner Expressway (Gardiner) 10 km
- Keep right onto Gardiner Expressway Collector (Gardiner) 2.5 km
- Take the ramp towards 427 600 m
- Keep right towards 427: Pearson Airport 900 m
- Continue onto Highway 427 Express (427) 3.5 km
- Take this ramp towards Highway 97 700 m

0:48 / 1:44

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Challenge 3: Scale to a Mega City

- **Scalable architecture**
 - Smaller Processing delays
 - in spite of increases in data volume.
- **Parallelization**
 - In-memory processing

NG Smart City Apps Platform

