Bluetooth traffic monitoring

Vehicular traffic estimation through bluetooth detection

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TiS innovation park

The 3-steps idea

1. **Discover Bluetooth devices**
2. **Couple each response with the current timestamp**
3. **Analyse the data gathered**

What is the talk about? 1/3

Bluetooth devices can be set as:

- Visible
- Limited
- Invisible

What is the talk about? 2/3

Inquiring *visible* in-car bluetooth devices:

- Headsets

- Navigations

- Entertainment system

What is the talk about? 3/3

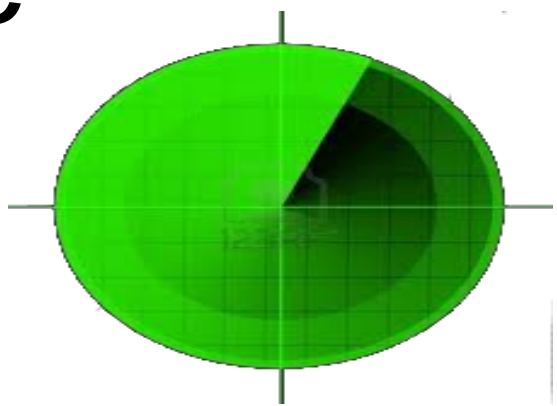
Bl devices can be set as:

- Vis
- Limited
- Invisible

Most of them are VISIBLE by default

What is the talk about? 3/3

- Make an active query nearby a vehicle lane
- Get a response



Is it worth?

Empirical results proof we get at least the 25% of the total vehicle flow

Agenda

1. *Why is it needed?*
2. *Which technologies have I used?*
3. *How does it work?*
4. *What kind of results have we got?*

1. Why is it needed?

The INTEGREEN project

INTEGRATION OF TRAFFIC AND ENVIRONMENTAL DATA
FOR IMPROVING GREEN POLICIES IN THE CITY OF BOLZANO

EU project funded by the LIFE+ program

Comune di Bolzano
Stadtgemeinde Bozen

TiS innovation park

AIT AUSTRIAN INSTITUTE OF TECHNOLOGY
TOMORROW TODAY

Life

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Bluetooth traffic monitoring

We need data!

Data about:

- Traffic
- Meteo
- Pollution
- Parking
- Bus timetable
- ..

Vehicular traffic data

- Count cars passing by a monitored area:
  - → trends at single stations
- Elapsed time to pass through two monitored areas:
  - → Origin destination (O/D) matrix

O/D: cameras

- Expensive
- Difficult deployment
- They need electricity
- High bandwidth

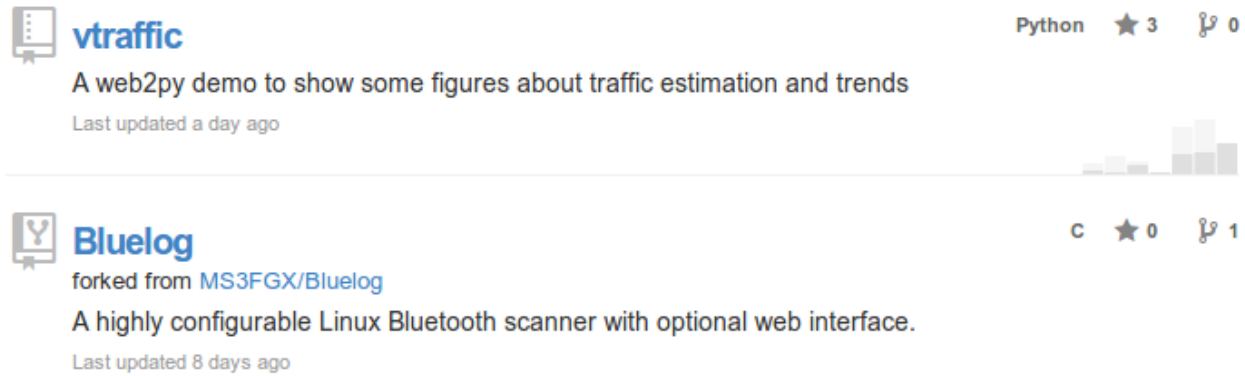
2. Which technology have I used?

Hardware

Raspberry-pi

- Arm full-pc 700Mhz
- 512Mb
- 2USB
- credit-card-sized
- 35$
- Model A consumes 120mA/h

Software


vtraffic
Python
3
0
A web2py demo to show some figures about traffic estimation and trends
Last updated a day ago
Bluelog
C
0
1
forked from MS3FGX/Bluelog
A highly configurable Linux Bluetooth scanner with optional web interface.
Last updated 8 days ago

Software: bluelog

https://github.com/ilvalle/Bluelog

- Initially developed by Tom Nardi and licensed as GPLv2
- It inquiries seamless for discovering new bluetooth
- Rely on a sqlite DB as local storage for cache purpose

Software: vtraffic

https://github.com/ilvalle/vtraffic

- Web2py app for analysing all data gathered
- AGPL Licence
- Written in python
- Owns an internal scheduler to run periodic tasks
- http://traffic.integreen-life.bz.it

The white boxes

Fixed

Mobile

The white boxes

Fixed

- Raspberry-pi / Bluetooth device
- 3g connection
  - Vpn
  - Live update
  - Monitoring (Ganglia)
  - (real) time data delivery

Mobile

- Raspberry-pi / Bluetooth device
- Battery powered
- Local data stored
- (no-real) time data delivery

Real deployments

Fixed

- 12 fixed stations deployed

Vittorio veneto	2013-03-21 18:00:34
Tis*	2013-07-10 08:59:19
Castel Firmiano	2013-10-23 13:06:12
Viale Druso Poste	2014-04-09 10:33:08
Via Rosmini	2014-02-06 10:16:07

Mobile

- Mercatino di Natale 2013
- Laives
- Test Viale Druso
- Test Castel Firmiano
- Several minor tests (es, tis)

Real deployments = Read data (1)

Vittorio veneto	2013-03-21 18:00:34	914851	2617	2 lanes
Tis*	2013-07-10 08:59:19	2062804	3712	2 lanes(one way)
Castel Firmiano	2013-10-23 13:06:12	914851	2655	2 lanes
Viale Druso Poste	2014-04-09 10:33:08	1102408	4458	4 lanes
Via Rosmini	2014-02-06 10:16:07	527789	2600	1 lane
All mobiles stations	2012-11-29 12:20:43	350831	...	...

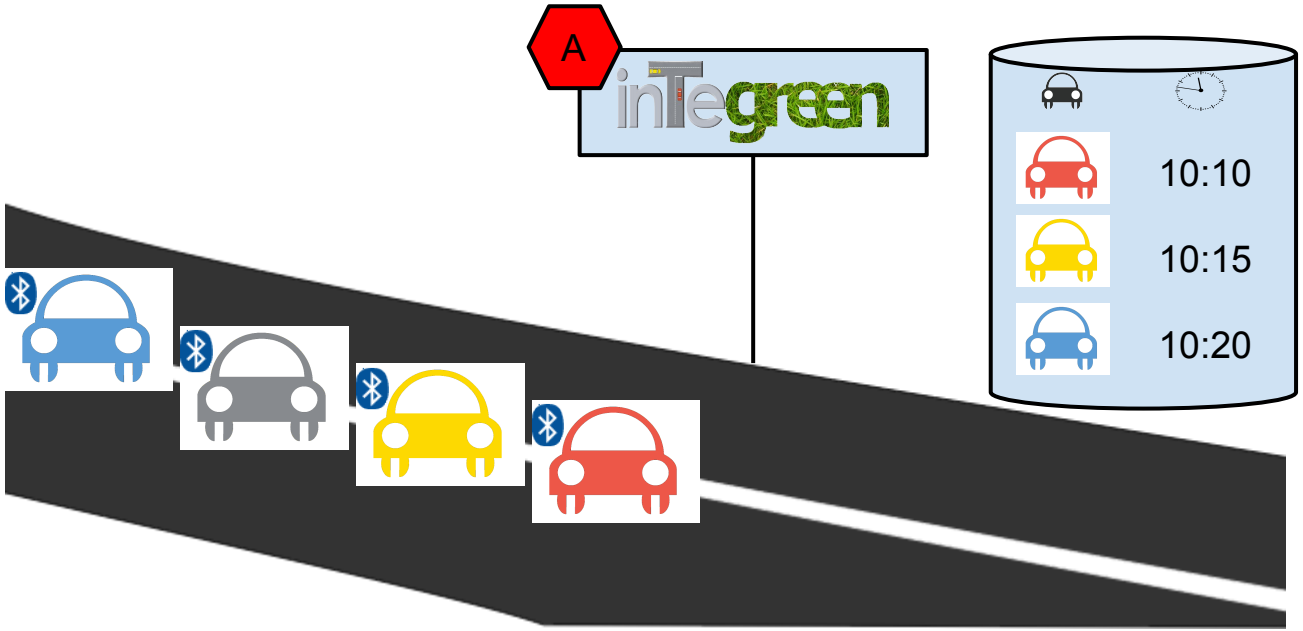
Real deployments = Read data (2)

2 years more than 11 millions detections and counting...

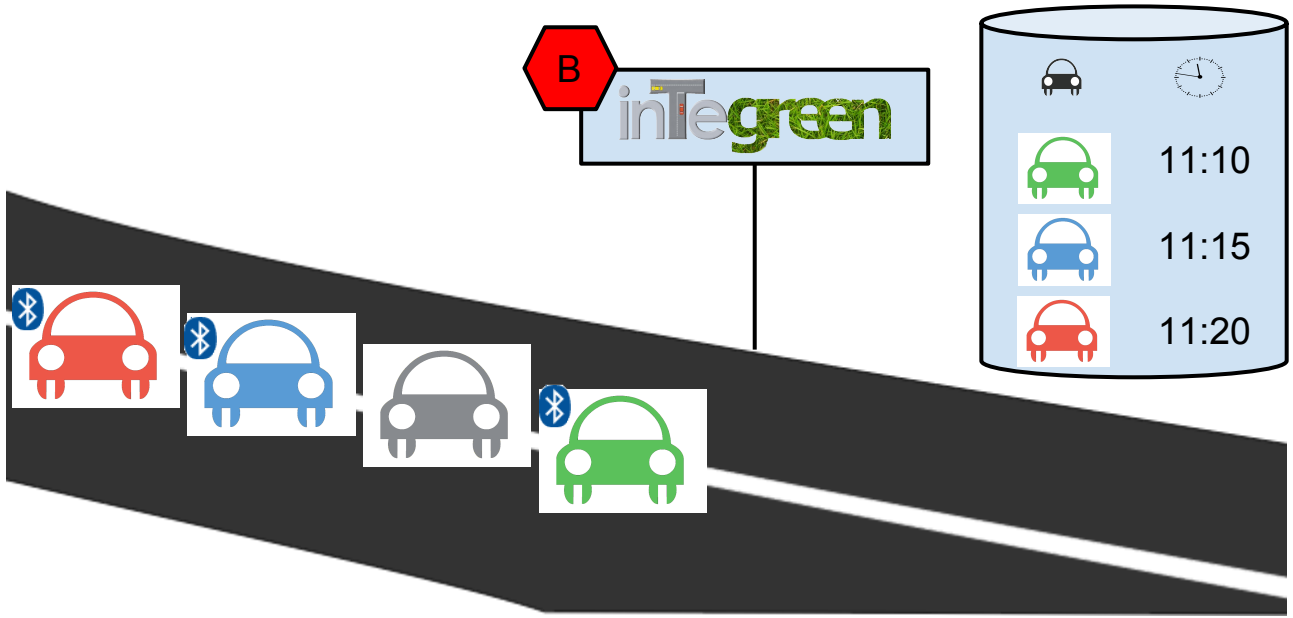
The 12 fixed stations gather together almost 40000 detections per day

3. How does it work?

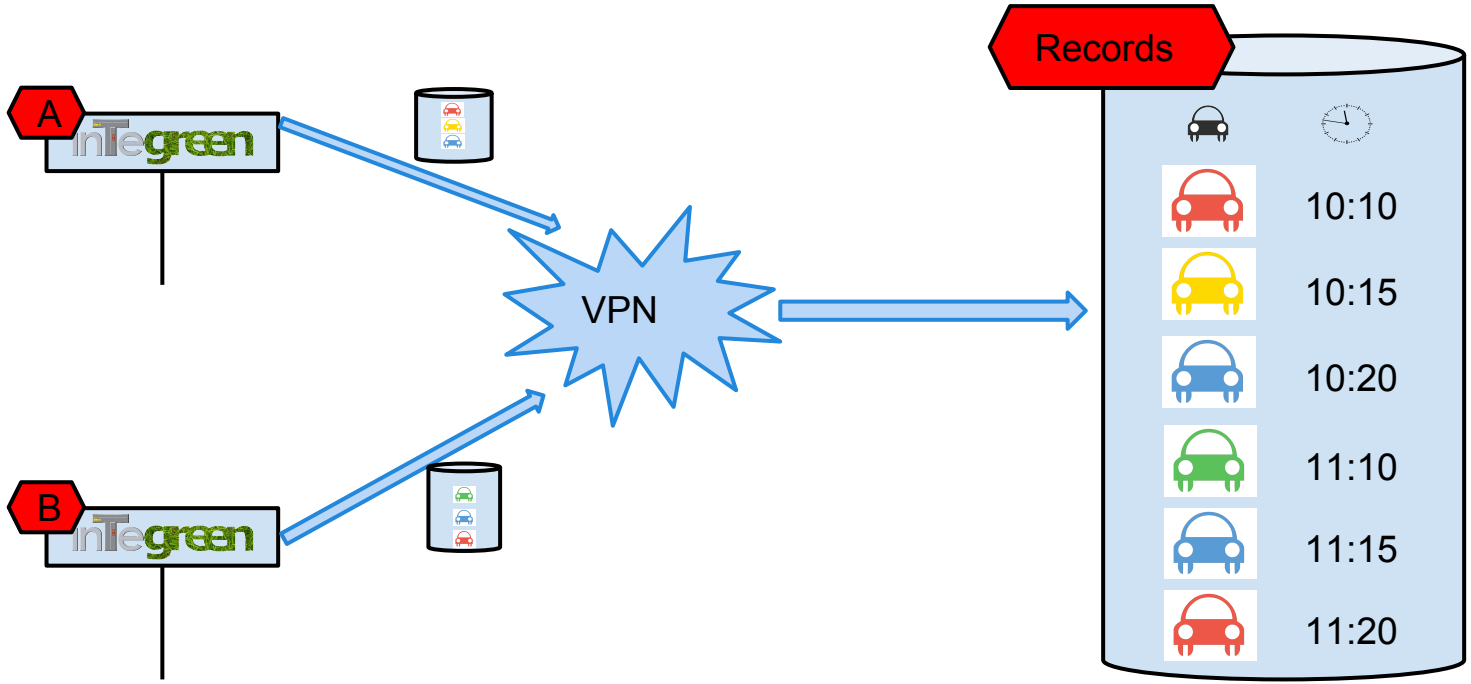
Monitoring vehicles (station A)



Monitoring vehicles (station B)

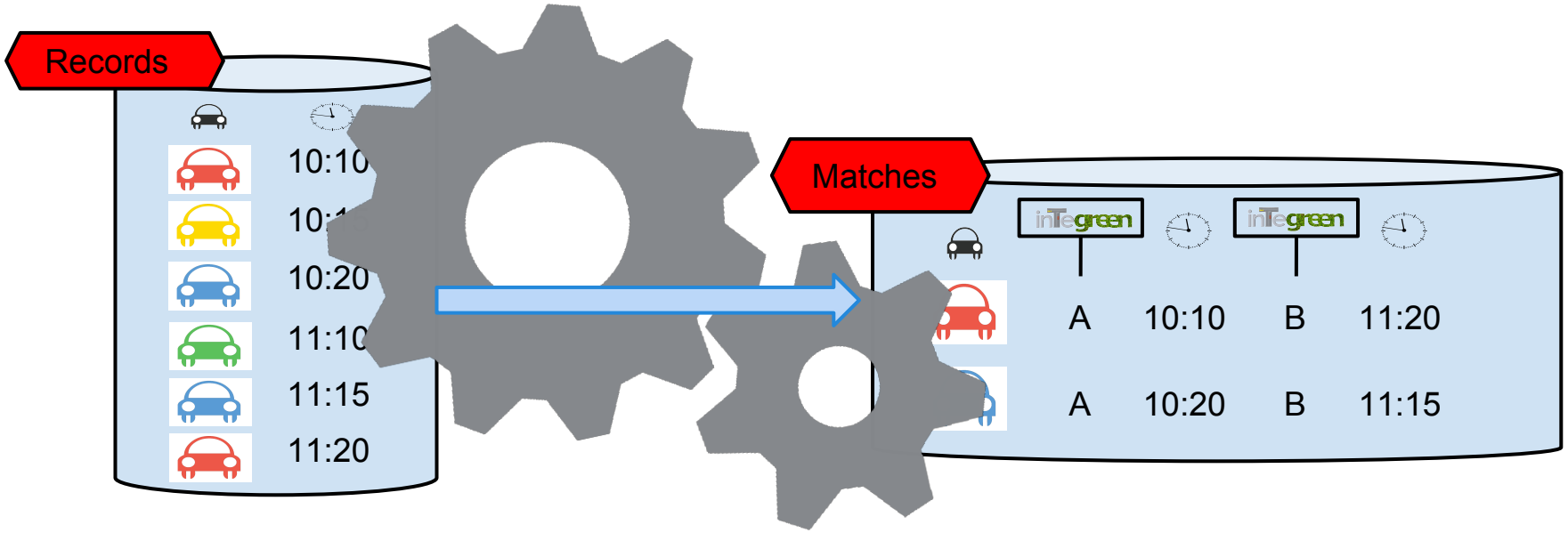


Supervisor centre



Pairing matches

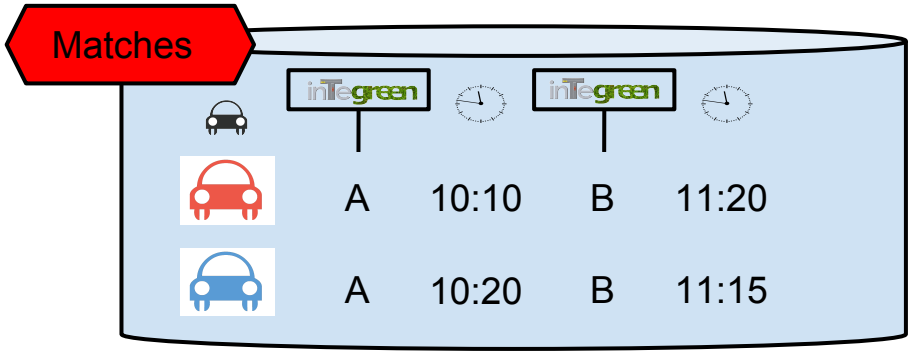
Periodically (ex: every 5m) records are elaborated



Given several matches from A to B we can

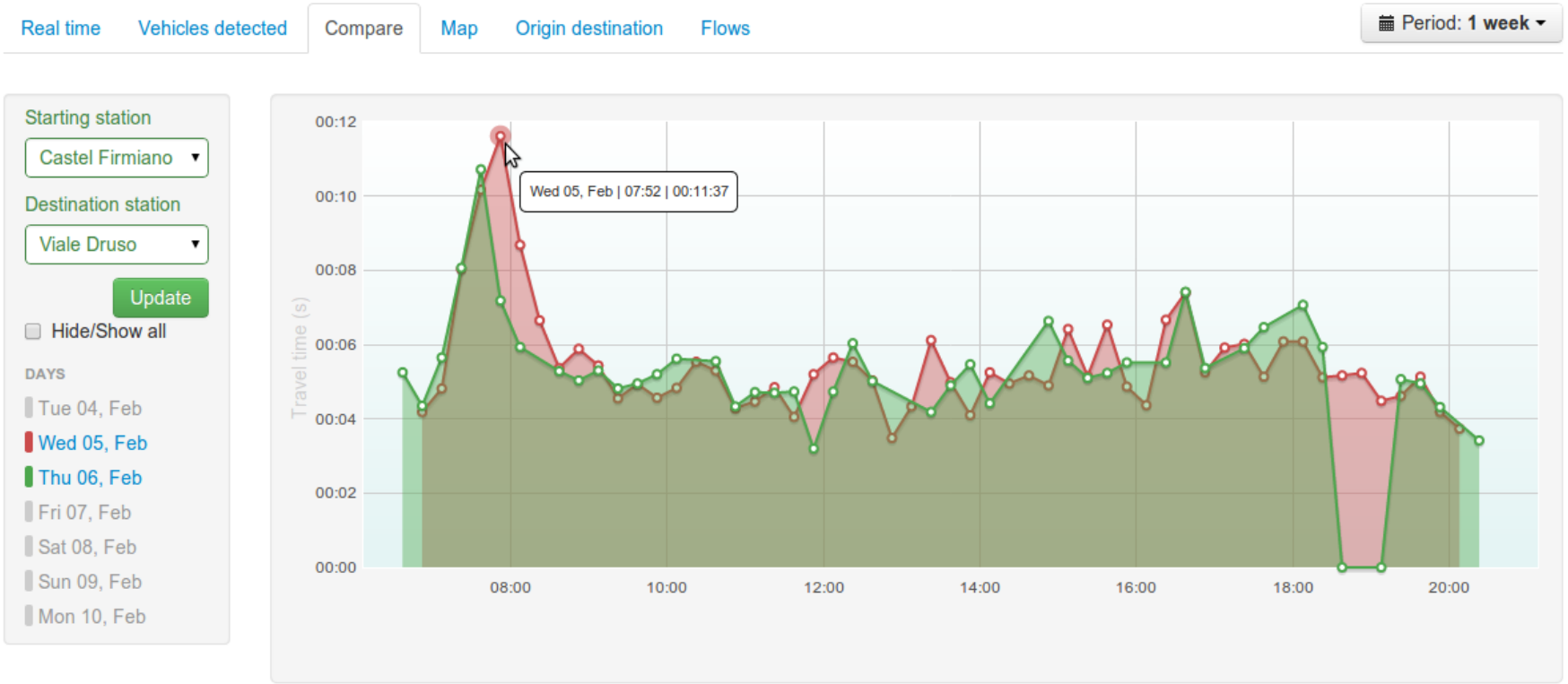
1. Plot the mean elapsed travel aggregated for specific time windows (ex: 15m)

2. Study flow behaviors

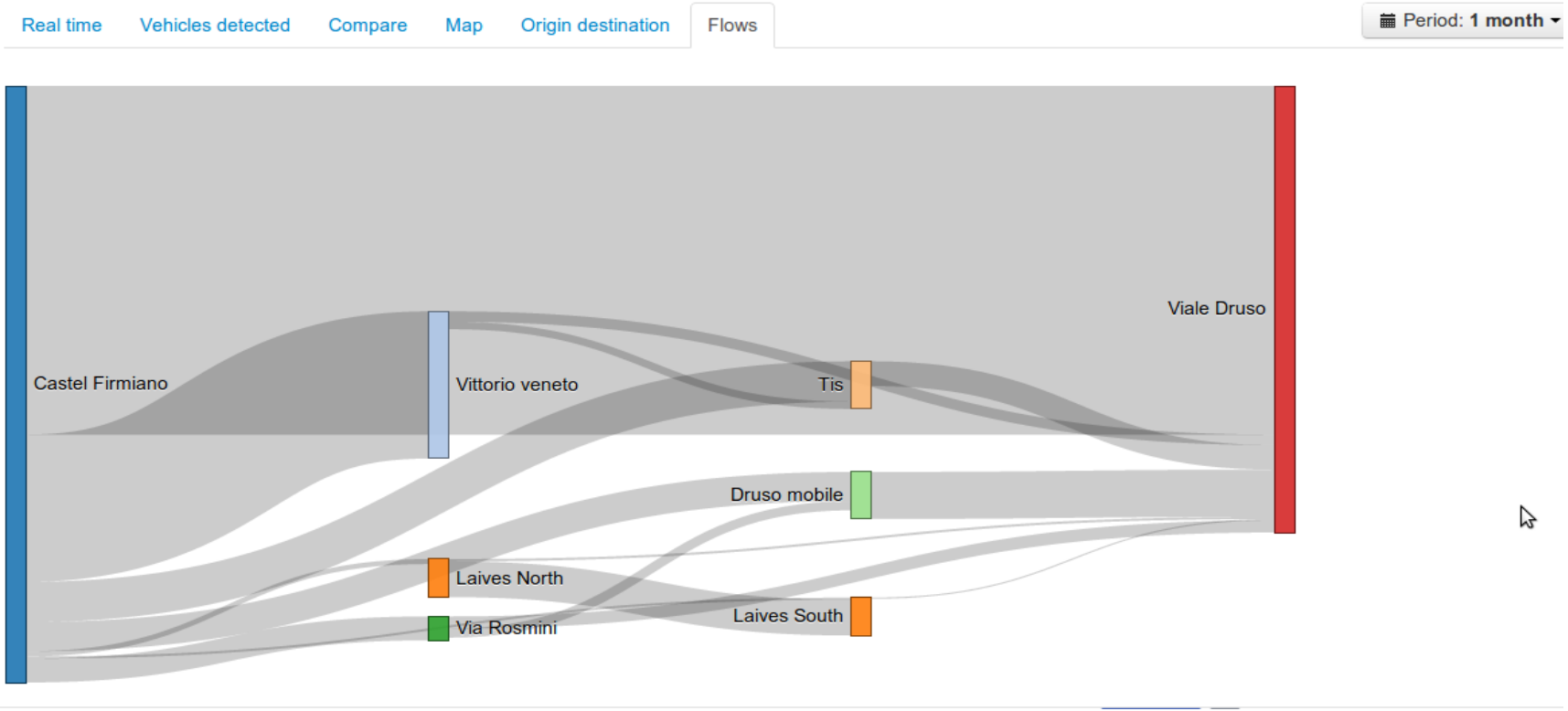


3. Provide information in (about)-real-time

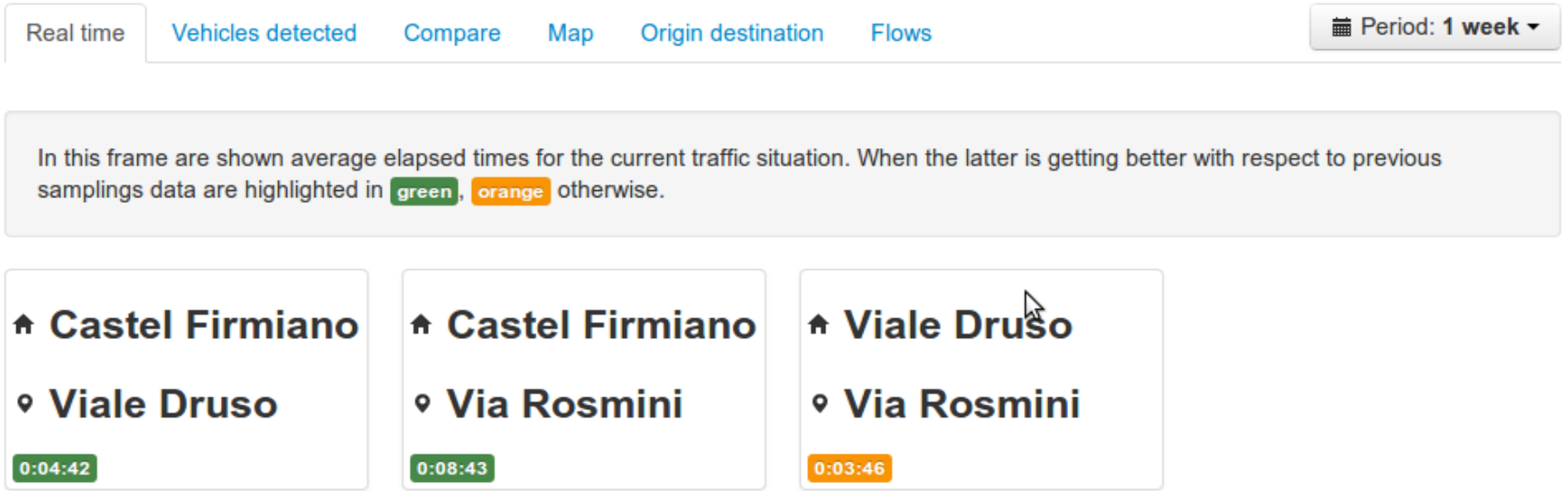
1. Plot the mean elapsed travel time



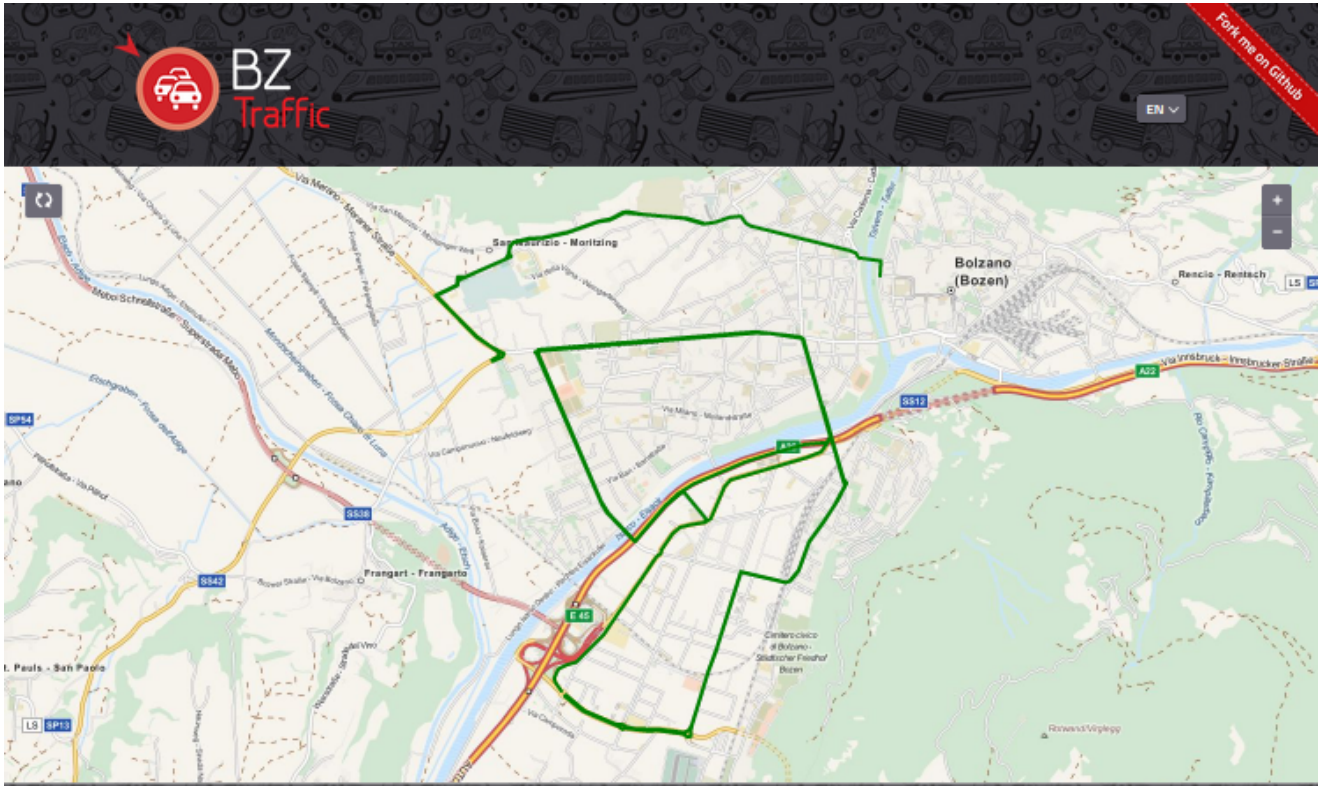
2. Study flow behaviors



3. Provide information in (almost)-real-time (1)

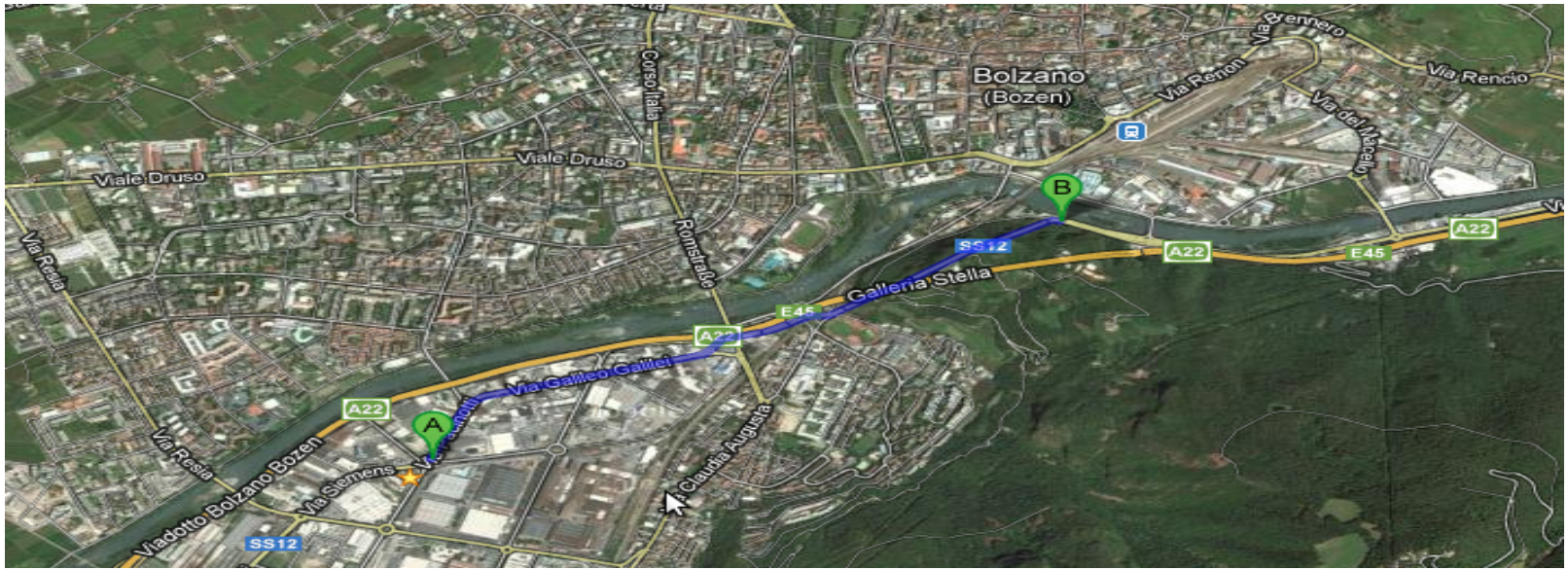


3. Provide information in (almost)-real-time (2)



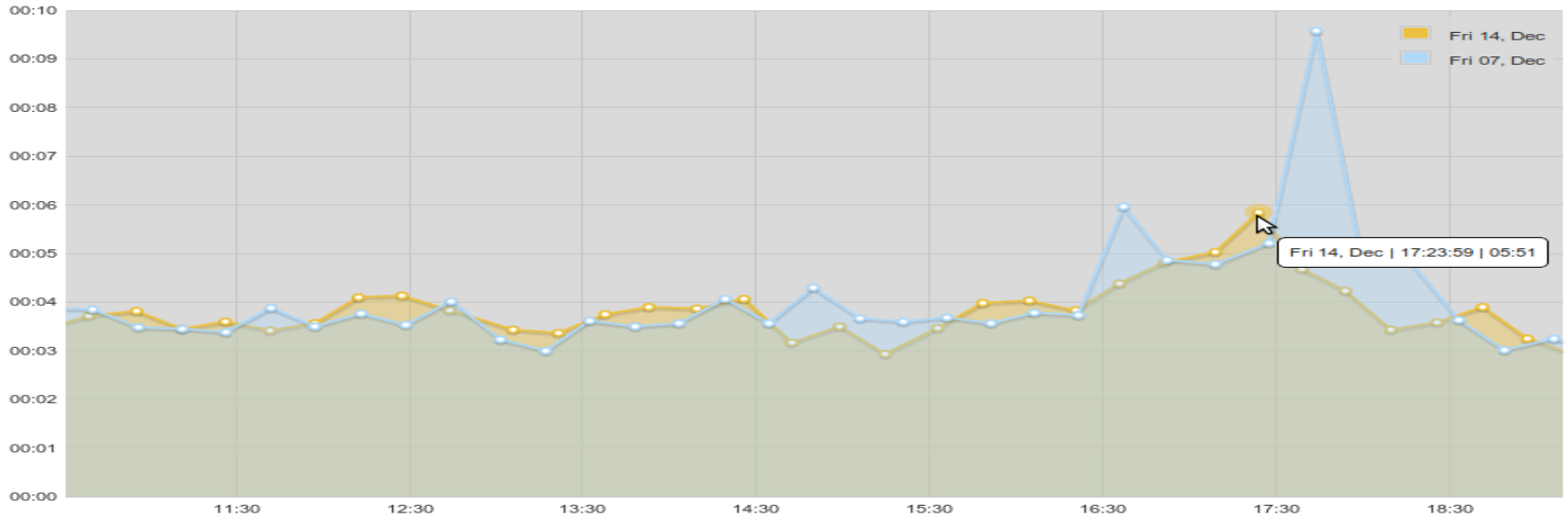
4. What kind of results have we got?

1’ Experiment



Shortest path 3Km passing through 4 traffic lights (all on-demand)

1’ Experiment

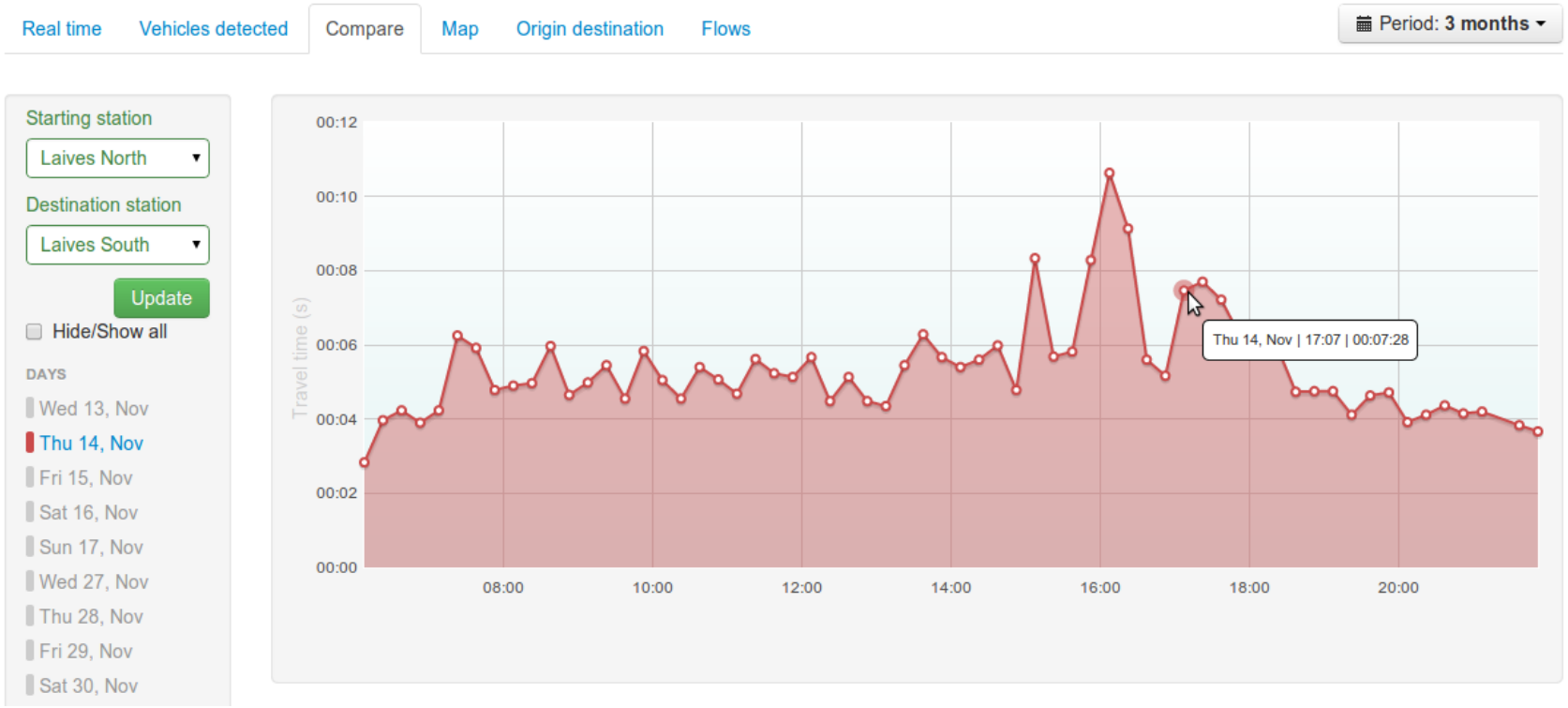


Median values: yellow peak --> 5:56 blue peak --> 10:12

2’ Experiment: Laives

For years several cars passed through Laives to reach/leave Bolzano (commuters)

2’ Experiment: Laives



2’ Experiment: Laives

Since January 2014 a new tunnel allows people to reach/leave Bolzano without passing through the city of Laives.

Results?

2’ Experiment: Laives

Early monitoring sessions claim that the elapsed travel time increased.

By monitoring cars entering and leaving the city we monitored those that have a stop.

People still pass through the city for needs, which demand a few stops.

Next steps

- ✓ Power supply: solar-panel
- ✓ vtraffic: improve graph/map/console etc

Conclusions

- I presented an alternative approach to monitor vehicular traffic

- Easy-to-deploy and cheap prototype powered by FOSS

Thank you for your attention

TIS innovation park
Free Software & Open Technology

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