Dynamic Carpooling Mobility Services based on Secure Multi-Agent Platform

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Existing ride sharing systems

- social websites, static;
- trips planed long in advance;
- itinerary choice left to the user;
- lack of real agreement policy (and authentication system).

Related research

- some research using a Multi-Agent approach;
- strong emphasis on the problem of **optimization**:
  - vehicles and ressources management [MHST11, KHSH11];
  - itinerary optimization [ABP+10].
- problem of **unforessen events** during the trip rarelly addressed ([SANG06] MAS with *fixed* access points);
- security in the sense of **safety** (to be assured of the identity of the passenger or driver).

Our solution provides

- a Service Oriented Platform (openness);
- a distributed platform (reliability);
- a route planning algorithm improved with external sources (context awareness);
- a management of unforeseen events in the planning (dynamic);
- a secured end-to-end communication channel (security).

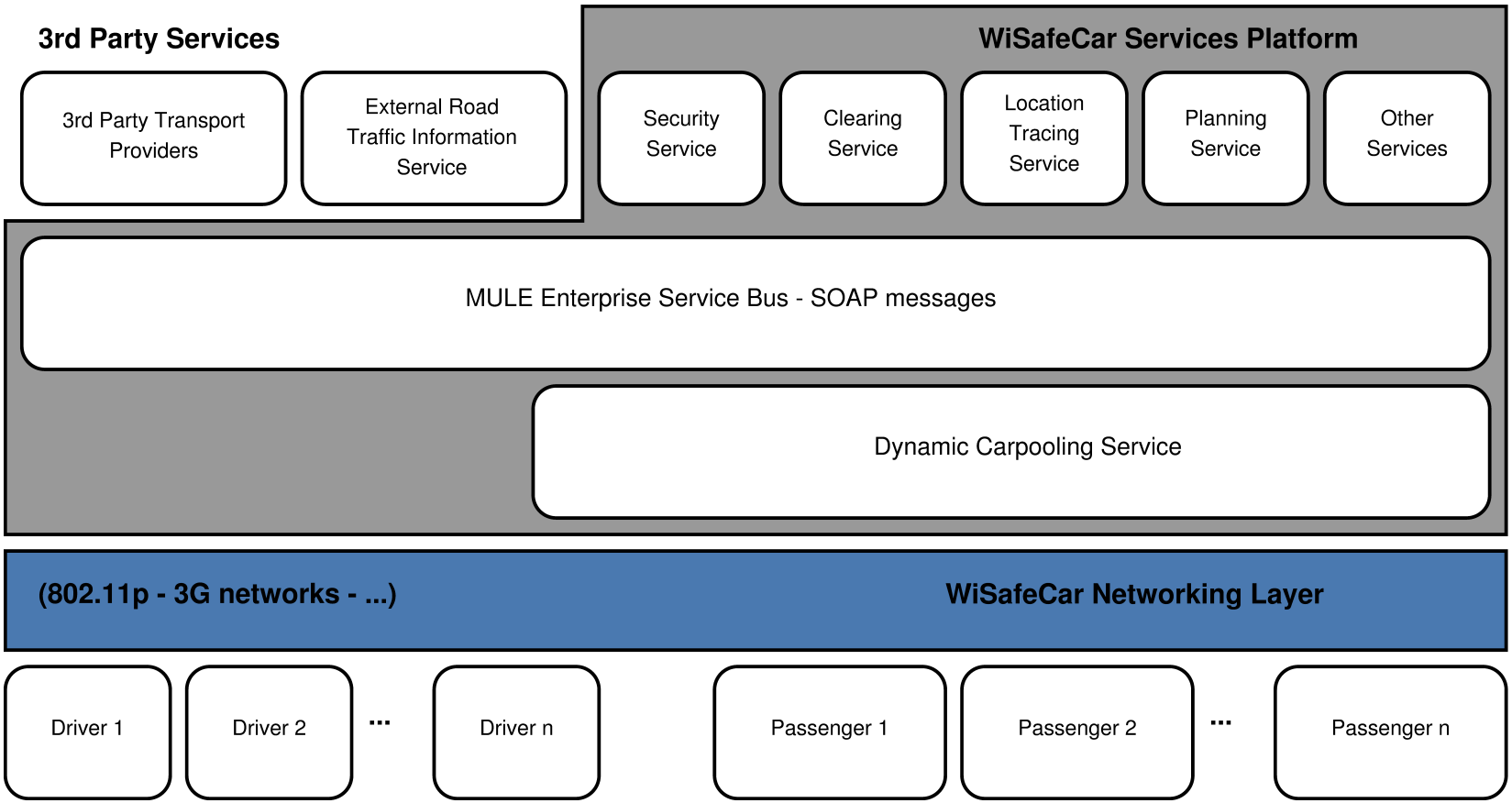
Service Oriented Architecture

Good guarantees of flexibility for future applications.

Contents

WiSafeCar Service Platform

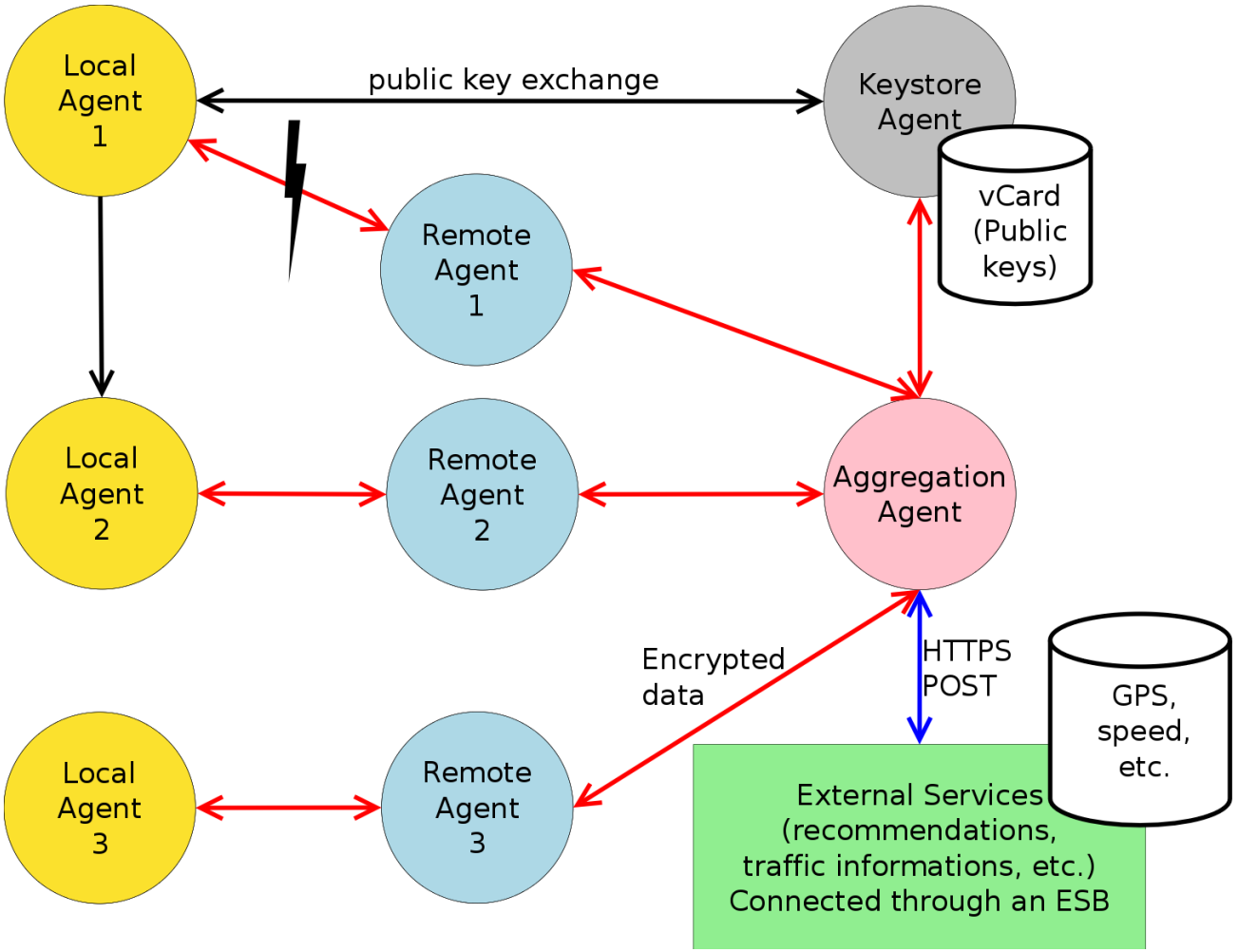
- Service Oriented Platform:
  - services (external sources) are connected to an Enterprise Service Bus (ESB);
  - only authorized services can access to data through the ESB;
  - gives flexibility for future applications.
- location tracing service (very sensitive data to secure);
- traffic information (congestion, accidents, meteorological information);
- information exchange between services: most of the time using the Datex II format [dat].


3rd Party Services
WiSafeCar Services Platform
3rd Party Transport Providers
External Road Traffic Information Service
Security Service
Clearing Service
Location Tracing Service
Planning Service
Other Services
MULE Enterprise Service Bus - SOAP messages
Dynamic Carpooling Service
(802.11p - 3G networks - ...)
WiSafeCar Networking Layer
Driver 1
Driver 2
...
Driver n
Passenger 1
Passenger 2
...
Passenger n

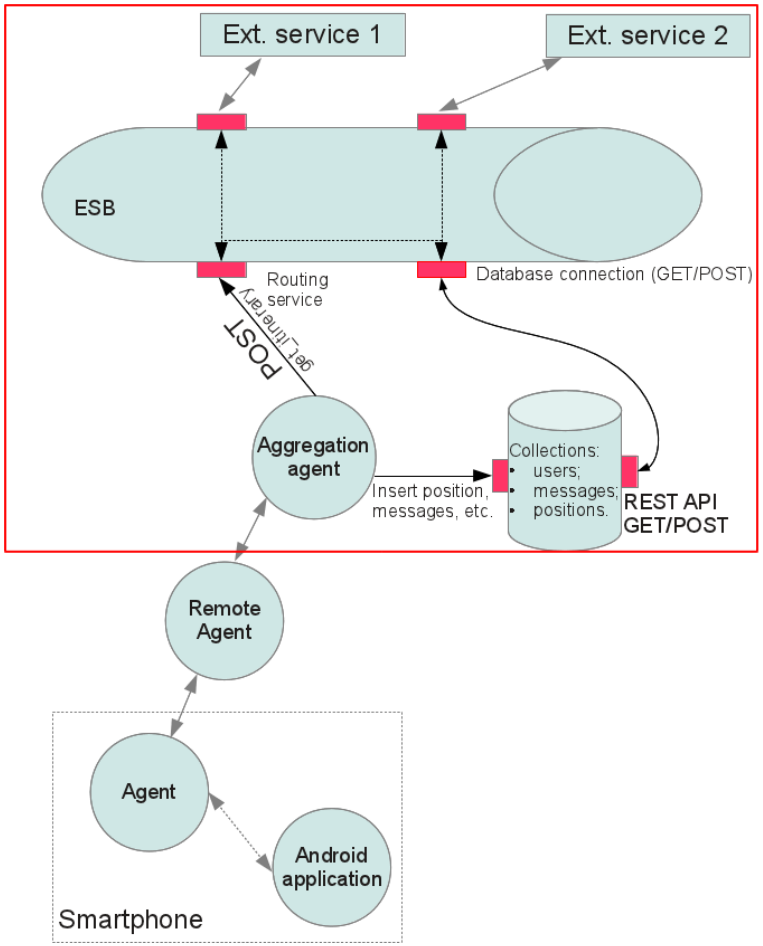
A Multi-Agent Based architecture

- Distributed;
- Multi-Agent System (SPADE [EPA06]) based on XMPP;
- Two kind of agents:
  - local, hosted on client's smartphones (connected to the open source Navit application [nav]);
  - remote, on the WiSafeCar platform.
- authentication and encryption system.

Technical view

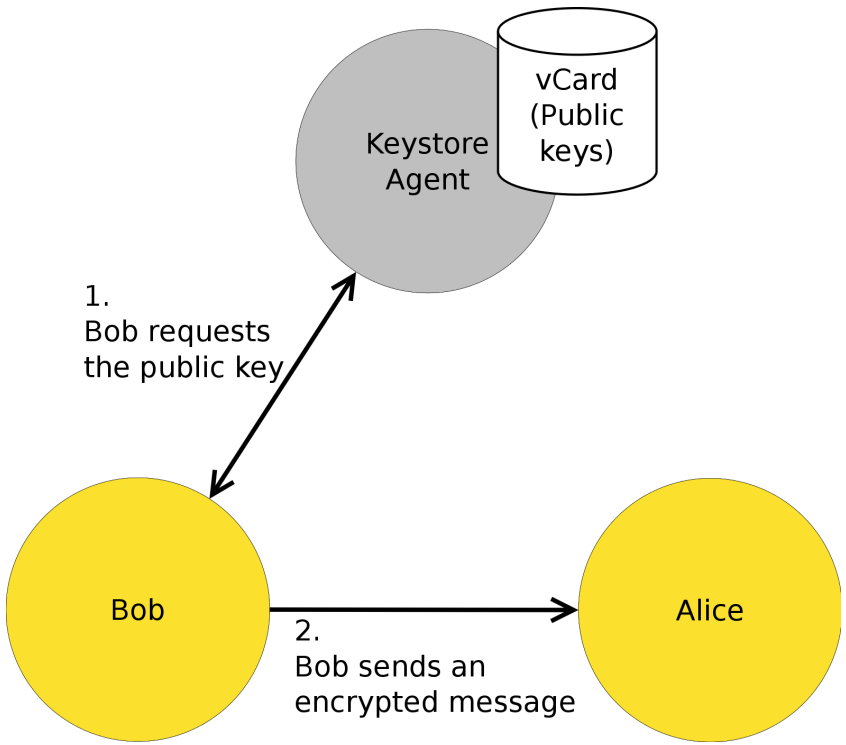


Service View



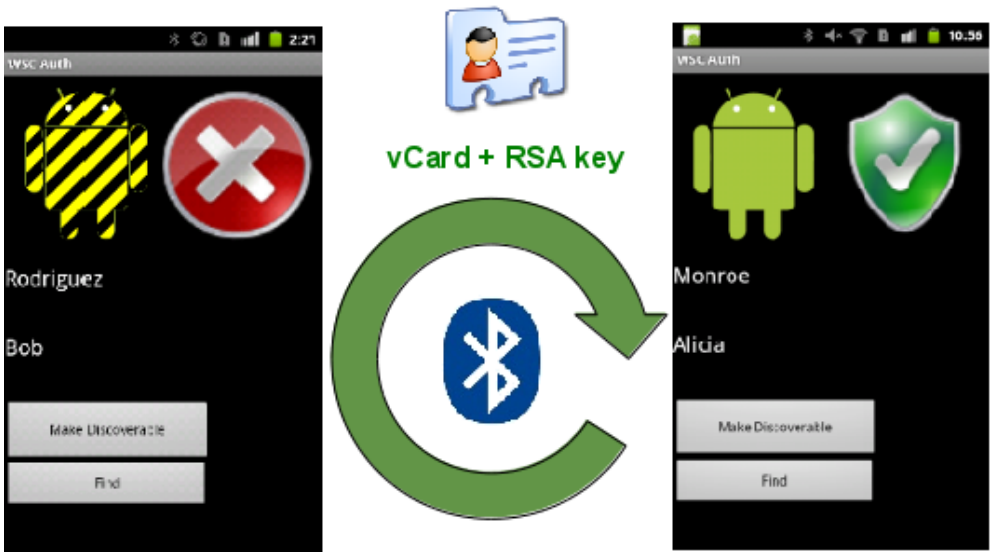
Contents

A repository of identity certificates



- key component of secured communications;
- responsible of vCards of registered users;
- each vCard contains the public key (and a photo) of the owner;
- preliminary registration step is mandatory.

A disconnected challenge-response based authentication



- triggered automatically near a pickup point;
- use the vCards previously retrieved;
- implemented with Bluetooth but not limited to.

Conclusion and future works

Conclusion

- Service Oriented Platform;
- dynamic and distributed;
- real-time reaction;
- secure communication.

Future works

- multi-modal trip planning;
- automate the registration procedure (vCards and keys generation).

End of the presentation

Q and A

- Thanks for listening.
- Any questions?

Bibliography I


M. Armendáriz, JC Burguillo, A. Peleteiro, G. Arnould, and D. Khadraoui.
Carpooling: A multi-agent simulation in netlogo.
Proc. ECMS, 2010.


Datex 2.
http://www.datex2.eu/.


M. Escriva Gregori, J. Palanca Camara, and G. Aranda Bada.
A jabber-based multi-agent system platform.
AAMAS HAKODATE, 2006.

Bibliography II


Jeribi Karama, Zgaya Hayfa, Hammadi Slim, and Mejri Hinda.
Vehicle Sharing Services Optimization Based on Multi-Agent Approach.
In *18th World Congress of the International Federation of Automatic Control (IFAC 2011)*, pages 13040–13045, Milan, Italie, August 2011.


Sghaier Manel, Zgaya Hayfa, Hammadi Slim, and Christian Tahon.
A Distributed Optimized Approach based on the Multi Agent Concept for the Implementation of a Real Time Carpooling Service with an Optimization Aspect on Siblings.
International Journal of Engineering, 5(2):217–241, June 2011.

Bibliography III


Navit car navigation system.
http://www.navit-project.org/.


F. Sottini, S. Abdel-Naby, and P. Giorgini.
Andiamo: A multiagent system to provide a mobile-based rideshare service.
2006.