SERVICE SYSTEMS, SYSTEM OF SYSTEMS, CYBER PHYSICAL SYSTEMS: LESSONS LEARNED FROM ELECTRIC VEHICLES TO ACHIEVE NEW MOBILITY CHALLENGES

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AGENDA

- Introduction about new mobility

- Lessons learned from Electric Vehicles about:
  - Service Systems
  - System of Systems
  - Cyber Physical Systems

- Focus on autonomous driving

- Synthesis of new automotive challenges

- Illustration of one step in our learning process
NEW MOBILITY : THE BIKE STORY

Service with connected bikes
free-floating

Service with connected bikes
with stands

constituent of an
integrated mobility service

mechanical product
mecatronic system
system of systems
socio-cyber-physical SoS

IEEE SOSE 2018 PARIS
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JUNE 2018
PROPERTY OF GROUPE RENAULT

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BATTERY AS A SERVICE: A SERVICE SYSTEM BASED ON A CONNECTED PRODUCT

Ownership kept by OEM
Guaranty for performance
Replacement if >25% capacity lost
Pricing personalization / usage

EV business since 2012

Automotive business as usual

For sale

Customer

For sale

Battery to rent as a service

Batteries data lake

Usage

Engineering

Manufacturing

Marketing

Invoicing

Dealers

Customer

Customer
EV AND CHARGE INFRASTRUCTURE: A LARGE SCALE SYSTEM OF SYSTEMS

EV business since 2012

- Standards to be applied, revised or initiated (IEC, SAE, GB/T, DIN, EN)
- Standards for EVSE: 9
- Standards for plugs: 7
- Cable standards: 6 (communication) 3 (electric)
- Consortiums, certification labels
- National legacy, regulation and incentives
- Many decisions at local level in the end

No question mark about fuel distribution infrastructure availability and interoperability.

Public charging spots available in France (Gireve data)
MICROGRID AND VIRTUAL POWER PLANT: A SOCIO-CYBER-PHYSICAL SOS

business as usual

EV integration perspective on behalf of energy transition

Distributed Energy Resources

self-consumption

Virtual Power Plant

“a cloud-based control center that aggregates the capacity of heterogeneous Distributed Energy Resources” (Wikipedia)

markets

flexibility valorization

aggregation

(MDPI)
AUTONOMOUS DRIVING ON BEHALF OF REGIONAL PLANNING

- Economic activities location
- Economic & environmental performance
- Attractivity
- Social inclusion
- Transit
- Homes location

Regional planning

- Mobility authority
- Public transport operator
- Private service providers
- ADcar manufacturers
- Drivers
- Passengers
- Mobility platforms

Ecosystems

- Public transport infrastructure
- Road infrastructure
- Domestic infrastructure
- Private vehicles
- Service vehicles
- Private vehicle operators
- Public transport infrastructure owners
- Road infrastructure owners
- Domestic infrastructure owners

Systems in the field

- Economic activities
- Housing location
- Economic & environmental performance
- Attractivity
- Social inclusion
- Transit

Autonomous Driving
SYNTHESIS OF NEW AUTOMOTIVE CHALLENGES

System of Product and Service (PSS)

Service provided by other economical entity

Service

car manufacturer

car users

Value proposition

Configuration management

Value sharing business model

Co-creation (incl users)

Collaborative engineering

Lifecycles offsets and interlacing

Cultural shift

Governance

Safety

Cybersecurity

non exhaustive list of challenges:

System of Product and Service (PSS)
FIELD OPERATIONAL TEST ON PUBLIC ROADS

“Rouen Normandy Autonomous Lab”, Europe’s first on-demand mobility experimental service using autonomous electric vehicles on public roads (10 km).

2 years of public experimentation from mid 2018