Levels of Automated Driving

- **Level 0**: Driver Only
  - Driver continuously performs the longitudinal and lateral dynamic driving task
  - The other driving task is performed by the system
  - No intervening vehicle system active

- **Level 1**: Assisted
  - Driver continuously performs the longitudinal or lateral dynamic driving task
  - Driver must monitor the dynamic driving task and the driving environment at all times

- **Level 2**: Partial Automation
  - Driver does not need to monitor the dynamic driving task nor the driving environment at all times; must always be in a position to resume control
  - System performs longitudinal and lateral driving task in a defined use case

- **Level 3**: Conditional Automation
  - Driver is not required during defined use case
  - System performs the lateral and longitudinal dynamic driving task in all situations in a defined use case

- **Level 4**: High Automation
  - System performs the lateral and longitudinal dynamic driving task in all situations encountered during the entire journey
  - No driver required

- **Level 5**: Full Automation
  - System performs the lateral and longitudinal dynamic driving task in all situations in a defined use case
Progressive implementation of Autonomous Driving

5 levels of automation, not all authorized by current regulation

Change in regulation needed: Vienna Convention, Countries regulation, ECE vehicle regulation

- **ASSISTED DRIVING** Level 1
  - DRIVER ASSISTANCE
    - « HANDS ON »
    - CRUISE CONTROL LANE KEEPING

- **AUTOMATED DRIVING** Level 2
  - WITH DRIVER SUPERVISION
    - « HANDS OFF »
    - PARTIAL AUTOMATED DRIVING

- **AUTONOMOUS VEHICLE** Level 3
  - WITHOUT SUPERVISION (TEMPORARILY)
    - « EYES OFF »
    - TRAFFIC JAM CHAUFFEUR HIGHWAY CHAUFFEUR

- **AUTONOMOUS VEHICLE** Level 4
  - WITHOUT SUPERVISION
    - ON ENTIRE USE CASE
    - « MIND OFF »
    - TRAFFIC JAM PILOT HIGHWAY PILOT

- **AUTONOMOUS VEHICLE** Level 5
  - DRIVERLESS
    - VALET PARKING ROBOT TAXI

5 levels of automation, not all authorized by current regulation.
**PSA developments in line with product plan**

**PSA is on track to meet regulations and technical challenges**

**ADAS Step 1:** Autonomous Braking, Driving Assistance  
2015-2016

**ADAS Step 2:** Full Automatic City Park, Full Driving Assistance  
2017-2018

**ADAS Step 3:** Remote Parking Maneuvers, Autonomous vehicle  
2020

Level 1 to 2

Level 2 to 3

Regulation to change
Challenges of Driving Automation (Regulation and legal aspects)

- Current Regulations doesn’t allow autonomous vehicles
  - Evolution of Vienna convention, Vehicle regulations (eg ECE 79), and Countries traffic rules

  Article 8 Drivers
  5. Every driver shall at all times be able to control his vehicle or to guide his animals.

- Legal Aspects
  - Liability issues: for defective products, for road traffic accidents, Criminal Law
  - How to share the responsibility between the driver and the OEM ?
  - Others : Private Data protection, Cyber security, Insurances policy evolutions...

- PSA participates to serveral WG
  - ONU WG for ECE regulation evolution (ECE 79...)
  - Just obtained 4 specific authorizations for real road tests
  - PFA WG for regulation and legal aspect : CSTA14
Autonomous driving

Response to an actual customer demand

Will shortly be a « must have »

Could represent a basic safety service

Strong legal and liability issues for Automobile eco-system

- Oems
- Insurance companies
- Courts

Développement and déploiement could be challenged by Media and Ethic issues

Acceptability concerns
An Artificial Intelligence to develop: **Perceive – Decide - Act**

**Perception**
- Environment Sensors: Cameras, Radars...
- Geolocalization: GPS, MAP
- Vehicle sensors
- Driver Monitoring

**Strategy**
- Data fusion
- Artificial Intelligence Module
- Trajectory targets

**Action**
- Powertrain: Engine
- Braking: Brake System
- Electric Power Steering: Steering System

**Sensors design by suppliers**
**Integration by OEM**

**Designed by OEM**

**Actuators integrated by OEM**
**Low level control software defined by suppliers**
Autonomous vehicles

Will also be connected
Driving Automation and Connectivity

**ADAS and driving automation**

- **ADAS** Levels 1 & 2
- **AUTONOMOUS VEHICLE** Level 3
  
  WITHOUT SUPERVISION
  
  (TEMPORARLY)

- **AUTONOMOUS VEHICLE** Level 4
  
  WITHOUT SUPERVISION
  
  ON A DEFINED USE CASE

- **AUTONOMOUS VEHICLE** Level 5
  
  DRIVERLESS

**Connectivity**

- HD & Standard Maps
- HD MAP
- CONNECTED NAVIGATION
- PRECISE LOCALIZATION
- **V2X COMMUNICATION (CAR2X)**
  
  VEHICLE TO VEHICLE (V2V)
  
  VEHICLE TO INFRASTRUCTURE (V2I)
  
  INFRASTRUCTURE TO VEHICLE (I2V)
Connected car: What is it about?

- Connecting the vehicle to its environment
- Giving real time information to the customer
- Providing driving enjoyable on board experience
- Providing information for autonomous driving
An extended vehicle is understood as a physical road vehicle with external software and hardware extensions for some of its features. These extensions are developed, implemented and managed by the vehicle manufacturer.

The vehicle manufacturer is fully responsible for the communication among the various parts of the extended vehicle, especially between the internal and external software and hardware components.

The extended vehicle offers open access interfaces for the provision of services by vehicle manufacturers or third parties. The interfaces need to be designed and implemented in such a way that access to the extended vehicle does not jeopardize security safety, product integrity, data (against hacking,...),
The uses cases of connected vehicles

Product improvement:
- Better knowing vehicle real use
- High quality Input for engineering

Repair and Maintenance:
- Physical and technical vehicle data...

Driving experience:
- Ex: Dynamics info traffic, floating car data, geolocalization, pollution...

Using costs

Road safety:
- Driving Assistance
- eCall
- Autonomous vehicle

Knowing the Customer:
- CRM,
- Fleet management
- Pay as you drive

Mobility services / Intermodality
- Car sharing, ride sharing, ...

Associated services:
- Webradio,
- Webmusic,
- Apps, address list, destinations

Each interface being Extended vehicle interfaces
Connected vehicle Challenges

Cybersecurity, hacking
- we do our utmost in terms of architecture (our servers, our own data channels (eg BTA), to protect us and the vehicles from potential attacks
- Extended vehicle helps …

Privacy
- PSA is extremely conscious and careful to respect its customers privacy. We inform and communicate to the customer in a very transparent way.
- Data are never sold to a third party (except in the case of B2B, eg fleet Management)
- Finally only data for which the customer has clearly and expressly given his consent (eg appointments, embedded technical information or geolocalization with eCall)
Cybersecurity: which protection?

**Offboard level**
- The extended vehicle concept provides a secured link, while complying with current emission and maintenance regulations

**Organic**
- Embedded equipments tests
- Robust telematics design
- Cybersecurity high level request along développements

**Architecture level**
- Network physical and logical separation
- Firewall
- Continuous intrusion monitoring