

### Driving to the Edge



How Open APIs and Open RAN will Transform Ordinary Parking Lots into Dynamic Data Centers

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### **The Next 30 Minutes**

#### Auto Industry Evolution Connected & Autonomous Vehicles

Increasing Role of Mobile Networks in Realizing the Vision

#### **Challenges: What it takes**

# Auto Industry On the Brink of a Revolution?

### Radisys

#### **Connected Car:**

Most visible example of IoT in the industry

### \$273 Billion

Potential application revenue of connected vehicles by 2026

Innovation: Sensors to artificial intelligence to big-data analytics

Smart Everything Everywhere Road signs to wrist watches

### Innovation Is a Constant, but Pace is Changing, Radisys Moves are Bolder



#### **250 million** Vehicles Will be Connected Globally by 2020

Source: Gartner

### Radisys

new Auto Mobile

## Auto

Autonomous Vehicles

# Mobile

Connected and Controlled with Highly Efficient Mobile Networks

### Driving New Efficiencies and Economies Radisys

Self-Driving

Potential application revenue of connected vehicles by 2026

\$273 Billion

A 🖞 🏠 / Source 🌀 SMA, Machine Research

Cloud Services

### Self-Parking 62% reduction

in space needed if the garage was reserved

exclusively for self-parking cars. 26% when co-exists with human-based parking *Source: PCMag* 

### **\$\$\$\$\$\$\$\$**

Trillions forecasted in overall economic value driven by self-driving cars – fuel savings, accident avoidance, traffic efficiencies, personal productivity, etc.

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### Comes With the Tsunami of Mobile Data Radisys



**Estimated** amount of data that an autonomous car will generate in about an hour and a half of driving



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#### Demanding Unforeseen Requirements of Low Network Latencies

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### Evolving Role of Mobile Networks

### New Mobile Standards to Accelerate Innovation & Adoption

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#### ✓ Part of 3GPP Release 14

- Builds upon existing LTE connectivity developments for automotive applications
- Leverages existing LTE networks for V2N communications
- ✓ 5G compliant
- ✓ Strong ecosystem support

#### Win-Win for Automakers, Infrastructure Operators, Mobile Operators, Consumers

### Autonomous Driving Needs Autonomous Networks

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Next

Generation

Open RAN

Traditional RAN

Proprietary Vendor lock-ins, slow time to market and high innovation cost	Platform	Software-Defined Open white box hardware and software (NFV, SDN) efficiencies
Embedded Integrated control and data, proprietary interfaces	Software Modularity	Unbundled Disaggregated control / data, Open APIs
Fixed Pre-programmed control logic and fixed network resources	Application and Network Adaptability	Programmable based on real world network conditions
Integrated Integrated RRU & BBU with high cost last mile transport	Deployability and Manageability	Flexible Deployment architecture and front haul agnostics

Roadside Comm.TelematicsSafety DrivingComfort DrivingWired/ Wireless2G/3G/4GV2X (802.11P 4.5G)5G

### MEC Paving the Path based on Open Principles Radisys



- High Bandwidth Data Analytics & Overlay at the Edge – AR/ VR, HD Maps
- Local Breakout of Data to Local Service Providers -Telematics
- Ultra-Low Latency V2I and V2N IoT Communication
  Autonomous Navigation
- Real-time RAN Aware Data Treatment FOTA, SOTA, Emergency Response
- Location Aware Service Insertion Based on Crowdsourced Data



#### Use Case: Transforming Ordinary Parking Lots into Dynamic Data Centers



- ✓ Parking spots subscribe and notify their status to the cloud parking MEC application
- ✓ Parking event requested by car via connected mobile network
- ✓ MEC host receives the parking request and location information from eNodeB
- ✓ Parking MEC application authenticates the car, triangulates available parking spots in the area and automatically assigns a parking to the car based on its location
- $\checkmark$  The car can be configured to accept the assigned parking automatically or manually
- $\checkmark$  Location and HD map of the parking spot is sent to the car
- $\checkmark$  The car's GPS system navigates the car to the assigned parking spot
- Once the car is parked, it tracks parked duration and automatically charges subscribers credit card

#### Use Case: RAN Aware Over The Air (OTA) Upgrade of Vehicle Firmware Radisys





CSPs can save on firmware transport costs



Higher reliability and policy enforcement to prevent upgrade failures

- **Augments scalability** by adding new features and infrastructure to products after they are released.
- **Continuous Improvement:** Bugs and product behavior can be continuously improved even after the device is in the hands of consumers.
- **Agility:** Companies can test new features by sending updates to one or multiple devices.
- **Time to Market:** Developers can deploy frequently and reliably, knowing that products will stay functional as updates are released.

### Pulling Together the Solutions

#### What Does it Take to Pull Together a Mobile Edge Solution?

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- ETSI MEC Architecture is used as an example, but it's use is <u>not</u> mandatory
- Each domain represents a specific aspect of the solution with a number of potential choices
- Each choice introduces tradeoffs that affect the overall solution architecture
- We've not explored all domains (OSS, UE apps etc. are left out)



3 major problems to be solved

#### Radisys Edge Computing Platform Software





#### **Smart Parking - Implementation Architecture**



### Summary

- The automobile industry is on the verge of disruption, creating new ecosystems with auto manufactures, software and content providers as well as network operators
- Market movement is dependent on innovations in the mobile space.
- "Open networks" will not be good to have but a requirement
- Open RAN will bring in new advancements in innovation, but will require strong understanding of "how" to put these solutions together – hardware, software, open, proprietary, edge, centralized.

