Autonomous Vehicle Overview, Intelligent Traffic Systems & Infrastructure Advisory

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Science Fiction to Science Fact: Autonomous Cars Shaped by Hollywood

**2015**
- Tesla cars will be 90% autonomous
- Audi to start selling low-speed autonomous cars

**2016**
- Mobileye bolt on hands-free kit on sale
- GM offering “super cruise” on Cadillacs

**2017**
- Google’s driverless car available to public
- Volvo to start selling driverless cars

**2018**
- Nissan to start selling driverless cars

**2019-2020**
- Tesla to offer “full autopilot” capability

**2020**
- GM, Mercedes-Benz, Audi, Nissan, BMW and Renault to release semi-autonomous vehicles
- Volvo will sell “crash-free” autonomous car

**2024**
- Jaguar to launch driverless car

**2025**
- Daimler, GM and Ford expect to release self-driving models

**2026-2035**
- When several sources predict autonomous cars will be standard issue

**2032**
- Auto-mode cars

**2035**
- Most cars will operate independent from human control

**2040**
- IEEE estimates that up to 75% of all vehicles will be autonomous

**2084**
- Drivers replaced with robots

**2263**
- Autonomous Flying Cars

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Sources: WSJ, Wikipedia
Basic Physical Ecosystem of an Autonomous Vehicle

“How does a self-driving car work?”

- Global Positioning System (GPS)
- Light Detection and Ranging (LIDAR)
- Cameras (Video)
- Ultrasonic Sensors
- Central Computer
- Radar Sensors
- Dedicated Short-Range Communications-Based Receiver (not pictured)
Autonomous Car Influencers & Champions

- Sergey Brin: Co-Founder of Google & Leader of Google X
- John Leonard: MIT Autonomous Expert & Prof. of Mechanical and Ocean Engineering
- Elon Musk: CEO of Tesla / Inventor & Investor in Disruptive Tech
- Mary Barra: CEO of General Motors
- Sebastian Thrun: CEO & Co-Founder of Udacity
- Peter Thiel: Co-Founder of PayPal & Palantir / Investor
Advances Across Industries Surpassing Autonomous Automobiles

Beam Telepresence Robots

Autonomous Liferaft

DARPA's Gladiator

Amazon Delivery Drones

Automated Robots Deliver Food to Hospital Patients

Volvo European Safe Road Trains for the Environment Project

Mobile Weather Data Collection Network

NOAA Solar Ocean Explorer

TELEPRESENCE

LIFERAFTS

UNMANNED TANKS

DRONES

HOSPITAL BOTS

iTRUCKING

TELEMATICS

SUBMARINES
Perceptions of distance will change as driverless vehicles will make travel more bearable, if not enjoyable. Many will view the ease of travel as an invitation to move out of urban centers. We can expect suburban areas to sprawl out from cities, and rural communities to thrive.
If getting to and from places is more seamless and enjoyable, then why fly or bother with trains? Mass transit will be threatened. In addition, people will take up weekend homes that are 3-6 hours outside of major urban areas and will sleep overnight in their vehicles. Night road traffic will increase.
Intelligent Traffic Systems (ITS) are one of the important aspects for success.

Traffic dictates flow, promotes commerce, drives safety, and environmental impact.

IoT enabled ITS provides better service by deploying traffic updates instantly.

In many cities across the US, to support “connected vehicles, low cost vehicle detecting sensors will be deployed on roads for every 1500 feet.”

There is no artificial substitute for reliable network infrastructure.
“Data is Becoming the New Oil”

• The on-board systems must be able to share information with a range of external systems for tasks such as emergency response, traffic management or fuel supply.

• Fast, reliable, Omnipresent Connectivity be the backbone of the future mobility ecosystem.”

• “A parallel digital infrastructure … that will be every bit as critical as roads and bridges.”

Ubiquitous Connectivity

- Monitoring & Maintenance
- Parking Info
- Content and Entertainment
- Traffic Management
- Other Vehicles
- Around Me
- Weather

Change in Communication Patterns
More Symmetrical

**PUSH Info**
Distribute a lot of information to the smart car and to a lot of devices and smart cars around it

**PULL Info**
Accumulate, gather information from the smart car and a lot of devices around it

This is true for all communication channels not only smart cars
Use of Smart Sensors and Monitoring applications

Collecting Essential Information from Multiple cameras and smart sensor for Monitoring, real time analytics is Essential
Required Infrastructure Features for Intelligent Traffic Management Systems

Reliability, Low latency and Jitter, Drop and Continue, Managed System & Ubiquitous Deployment

**With ITS**

- Dynamic Message Signs
- IP Traffic Cameras
- All Types of Sensors & Light Controls

**Fiber & Copper Connectivity**

Cost Effective, optimized performance drop and continue solution

**W/O ITS**

- Static signs
- Analog Camera
- Local Signal Sensors

**Twisted Copper pairs**

BACK TO Back configuration of old equipment
Low Performance
Enabling Higher Speed, Higher Security, Higher Reliability

Copper, Wireless, Fiber, LAN technologies have all gone through major evolutions.

No Need for Revolution Just Evolution

• Ubiquitous Communication requires a TOOL BOX of solutions for Cost Savings and Shorter Time to Deploy

• Take advantage of the existing infrastructure, already available across all transportation roads, highways... to deliver high speed reliable communication
  – Infrastructures: ITS as well as Telephony, Mobile
  – Offering: Fiber, Wireless, WiFi, Copper

• Take advantage of the existing COPPER infrastructure to deliver POWER.
  – Deliver remote power capabilities along with date over the same infrastructure
  – Deliver PoE and Line powering (Heavy Reading).
Features Required on Advanced ITS Devices For All Implemented Technologies

- Aggregator with Full Carrier Ethernet capabilities (CE 2.0 Layer 2)
- Optimized Performance, low latency and Jitter
- Powering, Line powering (only on copper)
- Compact and Ruggedized
- High Reliability and Availability
- Management
- Mix of Technologies - Copper and Fiber SFP; VDSL / G.fast / Fiber
- 10/100/1G/10G Ethernet
- POE, Terminal Adaptor, media converter “ALL In One”
Thank You!

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