How Cities and States are Pioneering V2X
Pioneering V2X by combining disruptive changes
Disruptive changes due to ATMS / V2X, New Mobility Services and SDVs

Proprietary Past | Today | Digital Future

Hardware Focus | Software/Data Focus | Function/Operations Focus

Increased Connectivity

1. Traffic Management / V2X

2. Autonomous vehicles / Drones

3. New Mobility Services (MaaS)

Intelligent Traffic System Evolution over time

Vehicle Evolution over time


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Mark Rogers
Pioneering by combining technologies – build a mobility operating for smart cities based on data driven application from simulation to intervention.
Pioneering by merging Autonomous Technology with Connected Technology
Pioneering by following standards to eliminate barriers

V2x Communications

Wlan 802.11p features:

- Frequency: 5.9 GHz
- Direct device-to-device (ad-hoc) communication
- Protocol standards: ETSI ITS-G5 (EU), WAVE (USA)
- Low latency (<10ms) with up to 2400 messages/s
- Security: per message, certificate based (PKI)
Pioneering by Merging (Applications, Use Cases, and Locations)
Example: THEA Connected Vehicle Pilot
Solving Real World Problems
Our successful process with our customer and partners: from design to deployment

**Content**
- 44 RSUs
- 1600 equipped passenger vehicles
- 10 equipped transit buses
- 10 equipped street cars/trolleys
- 5 V2I apps
- 4 V2V apps
- 4 Mobility and Agency apps
- 500 Personal Safety Devices
- RSU Central Management System

**System approach**
- CMS to manage RSUs
- Overt-the-Air OBU updates
- Data logging
- Travel time/Speed measurements
- Communication between CMC and controllers over RSUs

**Learn**
- Do not rely on unpublished standards in progress
- If a USA standard does not exist, use international standard
- Continuous alignments between stakeholders
- Certification process lagged design process
- System and interoperability tests

Team Commitment
Traffic Management with Connected Vehicles
Cooperative ITS as complete system solution on central and field level.

An extensive system solution with local services by „Decentralized Environmental Awareness Messages“ (DENM).

Road Side Unit as Modern Traffic Detector

DENMs for Hazard Notifications

Better Handling by Specialized View Options

A Flexible and Customized System Solution

The RSU also aggregates Common Awareness Messages (CAM) and sends those to the CMS.

Aggregated CAMs have the same function as conventional loop detectors and provide traffic data:
- Type of vehicle
- Speed
- Traffic volume in vehicles/hour
DENMs are sent to the RSUs and from there on selectively transferred to the traffic participants with relevant information.

The CMS also generates DENMs itself (e.g., Fog Warning) and sends them via the RSU to surrounding vehicles.
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- RSU map view for device overview
- Status overview in RSU list view
- In-depth information in RSU detail view
- Managing new issues in RSU status view
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- As ADD-ON to an existing Scala/Concert System
- As stand-alone version without Concert functions

Traffic Management System – SCALA Concert

Devices and Intelligent Systems

- DSRC/WLAN 802.11p
- Car2X
- Car2Car
- Standardisation

Traffic Management System – SCALA Concert

- Strrafic Motion
- LSA Controller
- Parking mgmt.
- CMS

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- DSRC/WLAN 802.11p
- Car2X
- Car2Car Standardisation

Sitraffic ESCoS
CMS
Demonstration in Dubai

C2X roadwork warning demonstration in Dubai

Siemens ATMS
Warning trailer or sign
Roadside Unit (RSU)
On-board units with driver displays

Showcase the future of safety and efficiency.
Demonstration in Dubai

1 Roadwork information is sent to the traffic management center once the trailer is set up. Alternatively, the ATMS system can also declare information (speed limits, etc.) to be sent to the roadside through response plans.

2 The roadwork warning trailer communicates the hazard with the vehicles, along with additional information (e.g. speed limits, restrictions, etc.).

3 The driver receives warnings and additional information from the On-Board Unit or smart device.

Siemens ATMS

Ethernet or LTE

5.9 GHz 802.11p

Siemens Road Side Unit

C2X On-Board Unit

On-Board Display

CAN Bus
Technologies in combination with standardized protocols enable almost endless Car2x use cases:

**Traffic Management Layer**
- Concert

**Message Layer**
- **BSM Basic Safety Message**
  - Vehicle ID
  - Position
  - Speed
  - Heading
- **TIM: Traveler Information Message**
  - Incident messages (accident, glaze,…)
  - Location
  - Incident type
- **MAP: intersection topology**
  - Lanes
  - Driving directions
- **SPAT: Signal Phase and Timing**
  - Signal groups
  - Signal phase and remaining green/red times

**Communication**

**RSU Applications**
- Transit Signal Priority
- Road Works Warning
- Emergency Vehicle Warning
- Time-to-Green
- Variable Speed Limits
- Pedestrian / Bicycle Warning
- Emergency Vehicle Preemption
- Travel time (CAM Aggregation)
Advanced Traffic Management
Connectivity offers new possibilities for safety, mobility, and driving

1. Elementary school
   - Attention: School ends now
   - Children may cross road

2. Accident blocks road
   - Traffic jam
   - Take detour and turn around

3. Your vehicle uses electric drive
   - Free access to city center guaranteed

4. P+R and bus for only $2 instead of city center parking
   - 15 parking spaces available

**ATMS:**
- **Safety**
- **Traffic Flow**
- **Congestion charging**
- **Value-added travel information**
Contact

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