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Integrating an actor based connected car platform with Adaptive AUTOSAR
Future mobility service systems

- Connected to swarms of smart things
- Integral part of system of systems
- Fully autonomous
- Shared ownership, zero-casualty safety, reliability, and ...?
Challenges for future mobility systems

- Integration of automotive with heterogeneous subsystems and complex societal dynamics
- Highly networked, time coordinated interactions with highest degrees of assurance and safety
- Increasing complexity of V2X systems demand distributed computing with massive data

Architectures that allow development, deployment and maintainability of services
- Open Interfaces
- Adaptive
- Real-time
- Dynamic

Source: US DOT
Need for a shift in computing paradigm

- Automotive and roadside gateways (Fog) can host and compose services
- A unifying platform is required to seamlessly interconnect in-vehicle servers with the fog, cloud, and IOT.
Accessor: An actor based paradigm

- Accessor provides access to device or service by exposing only the interface
- Service implementation is abstracted
- Sequence of requests for a service (a stream) triggers a sequence of responses
- Composable with other actors
- Application execution controlled by accessor model of computation

This is the essence of accessors, a design pattern that embraces concurrency, asynchrony, and atomicity.
A novel candidate: Accessor platform

- Directly connects to **heterogeneous** things and services **within** and outside the vehicle

- **Scalable** and **dynamic** services can be developed and deployed using flow based design.

- **Dynamic Composability** of accessors facilitate service adaptability based on context/environment

- Allows **distributed computing** with fog or cloud for time-critical, data and processor-intensive applications

**Collaborators**

Project URL: https://www.icyphy.org/accessors/
Model based design environment for service modeling

- Newer services can be built using the service components of the accessor library
- In built timing guarantees made possible from a few decades of work in Models of Computation (MoCs)
- Code generation for target hardware
- Accessors for different devices/service to be developed.
A Telematics application using Accessors

- Different services relying on OBD data utilize data pushed to the cloud.
- Services lie outside the scope of the vehicle.

- OBD accessor is used to create such services that rely on vehicular data
- Same application can run in a vehicle gateway or user`s mobile phone – interoperability!
A case for integrating Accessor with Adaptive AUTOSAR*

*This is an early stage R&D feasibility study only
A case for integrating Accessor with Adaptive AUTOSAR*

- Model based tools to design and rapidly develop diverse services with application level time guarantees
- Reuse IT standards as much as possible at the application level
- Development of ARA applications will become easier, apart from extending the scope beyond infotainment
- Adaptive AUTOSAR architecture allows us to interconnect both platforms
Current work

- Accessor platform (in both node.js and Java) can itself run as an adaptive application or as a stand alone non-AUTOSAR application

- Make sample ARA services available in the accessor library

- Accessor-level services utilize time and execution management APIs to achieve deterministic temporal semantics
Some more current work

- Developing SOME/IP accessor (subscriber and notifier) to interface accessor applications with adaptive autosar applications

- An accessor application to switch between and detect new cameras utilizes SOME/IP accessor

- Mechanisms to utilize ARA APIs should be developed by extending SOME/IP accessor interface design

Downloads specific camera service from Road side unit
Conclusion

- We share our early stage work on a new connected car platform that could supplement Adaptive AUTOSAR goals.

- Accessor platform
  - Uniform device/service interfaces with underlying module implementations for heterogeneous environments
  - Extends the scope of services residing within the vehicle to edge and cloud
  - Greatly reduced development time in a model based environment with code generation for target hardware
  - Dynamic and adaptive services that can run untrusted code from remote services (eg. City infrastructure)
Thank you for your attention!

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