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Ensuring Success of the shift to Software-Defined Vehicles

Taiwan-US TTIC Framework Cooperation on EV Industry Symposium

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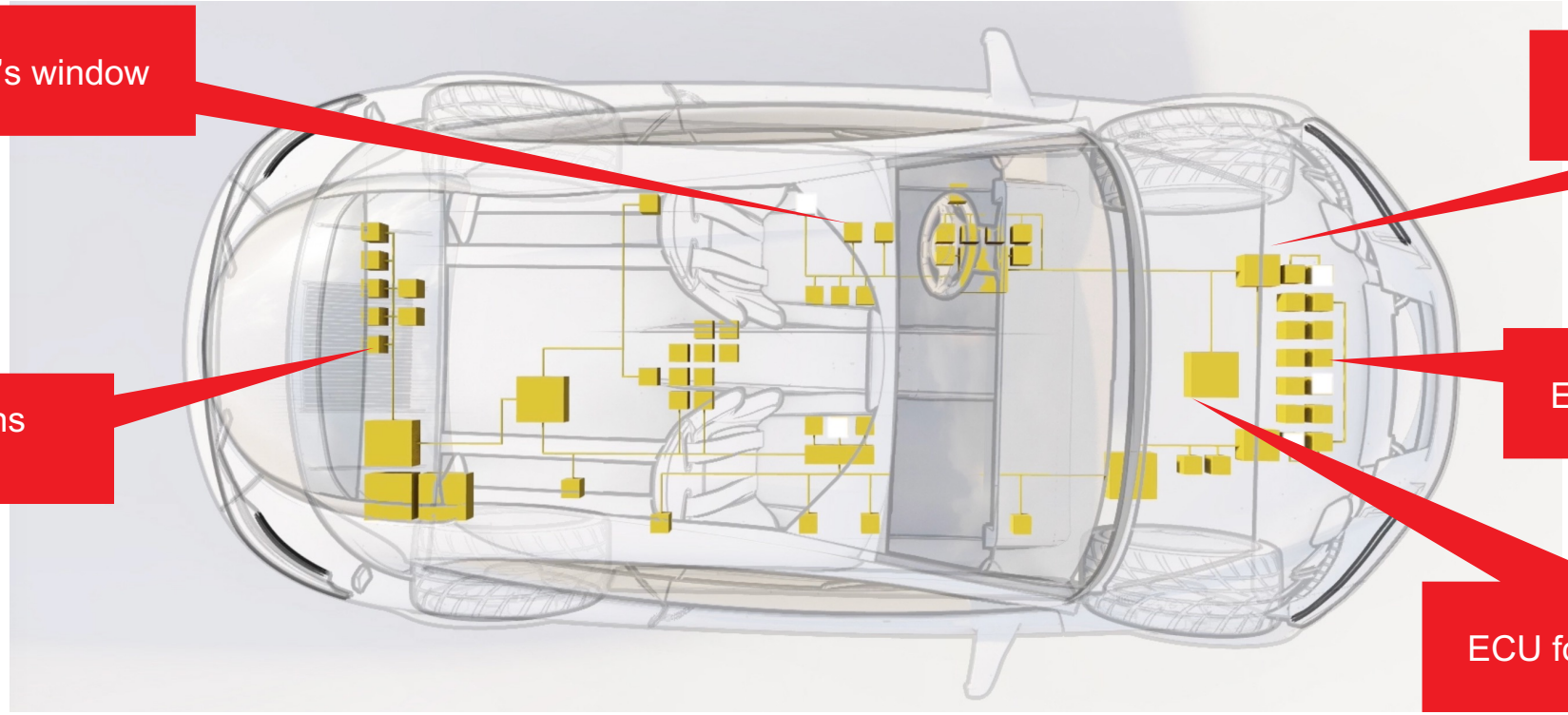
The Promise of Software-Defined Vehicles

Vehicles that can be continuously updated and enhanced through software

What is a Hardware Defined Vehicle?

Collection of single-function Electronic Control Units (ECU's)

- Most of the vehicles on the road today!



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Examples for illustrative purposes

Analogy: Hardware-defined personal devices

- These are hardware-defined:

- Each of these contains *some* software, but mostly has one job for all time
  - Generally not upgradable, or difficult to upgrade
  - Single function
  - Dedicated path of connectivity for each device

What is a Software-Defined Vehicle?

Consolidated hardware and software coexistence

- ECU's generally do multiple tasks
- Software is isolated from each other

Flexible and Upgradable

- Based on modern networking
- Extensible to add capabilities after shipment

Data-Driven

- Digital ECU's produce valuable data
- Data is used to improve vehicle capabilities

Connected

- Vehicles are connected to the cloud
- Supports new features and upgrades

Sonatus | Proven Automotive Software Supplier

End-to-end provider of in-vehicle and cloud software for accelerating vehicle software innovation

Announced OEMs in Production

HYUNDAI KIA GENESIS

In production since 2020. Dozens of models and millions of vehicles on the road by 2024

Tier 1 and Tier 2 Partners

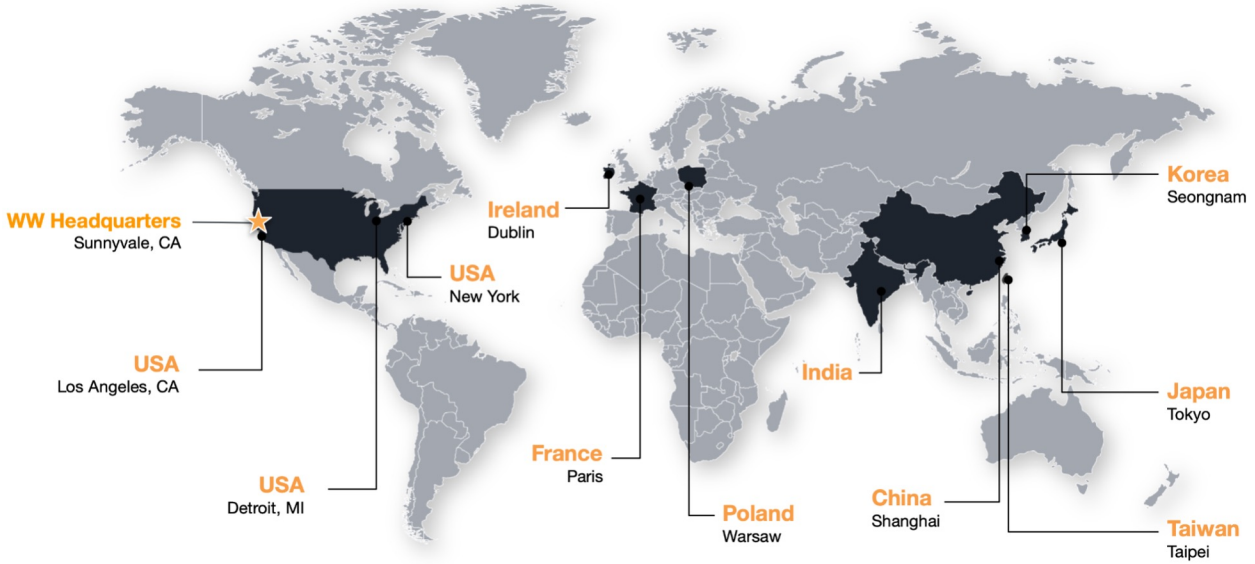
BROADCOM HL Klemove HYUNDAI AutoEver

LG MARVELL Micron HYUNDAI MOBIS

NXP REALTEK ST

Google Cloud Azure aws

Global Presence



Awards and Recognitions

AUTOTECH BREAKTHROUGH AWARD 2022 — OVERALL CONNECTED SOLUTION OF THE YEAR

INFORMATECH AUTOMOTIVE AWARDS WINNER! Software Supplier of the Year — SONATUS

Automotive News PACE AWARD

CES INNOVATION AWARDS 2022 HONOREE

Forbes 2023 AMERICA'S BEST STARTUP EMPLOYERS

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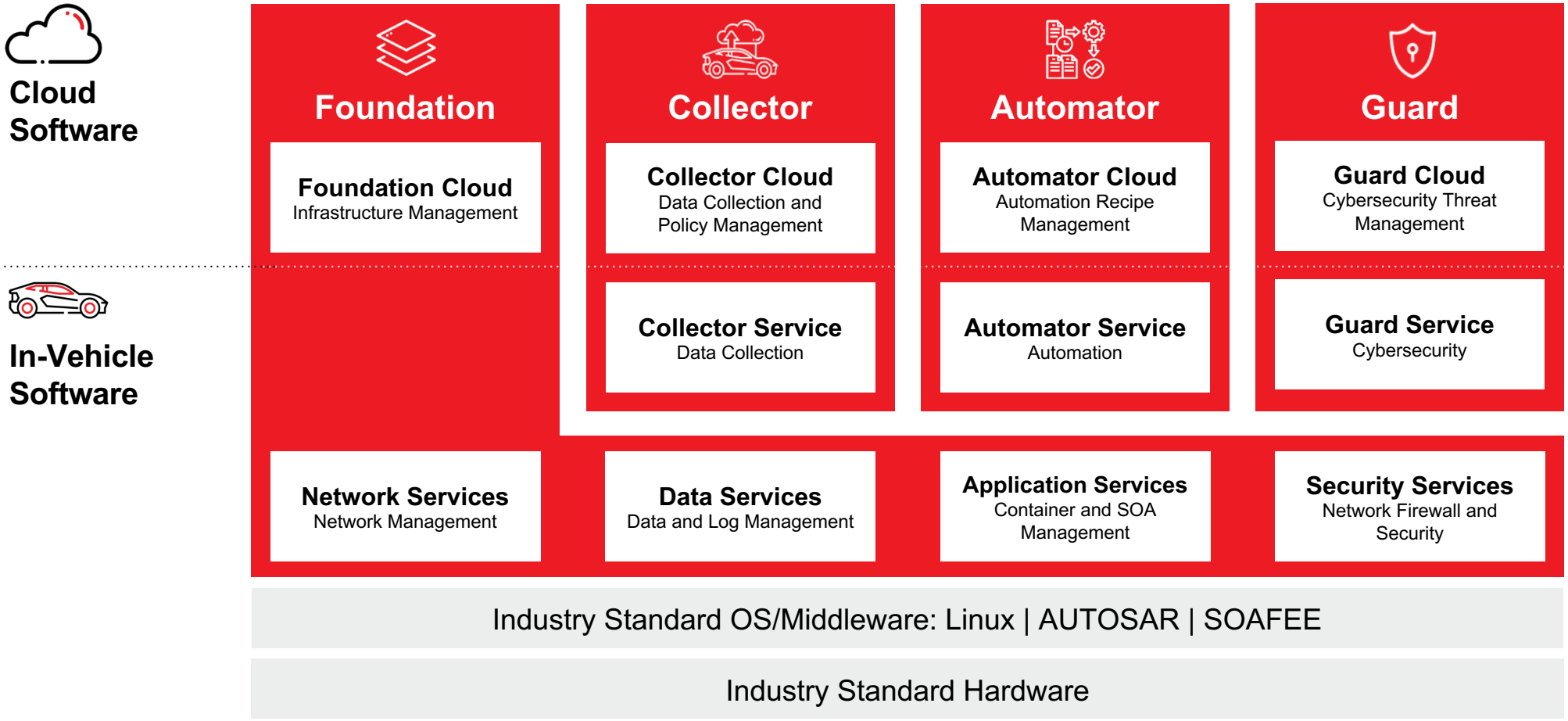
Sonatus Vehicle Platform and Products



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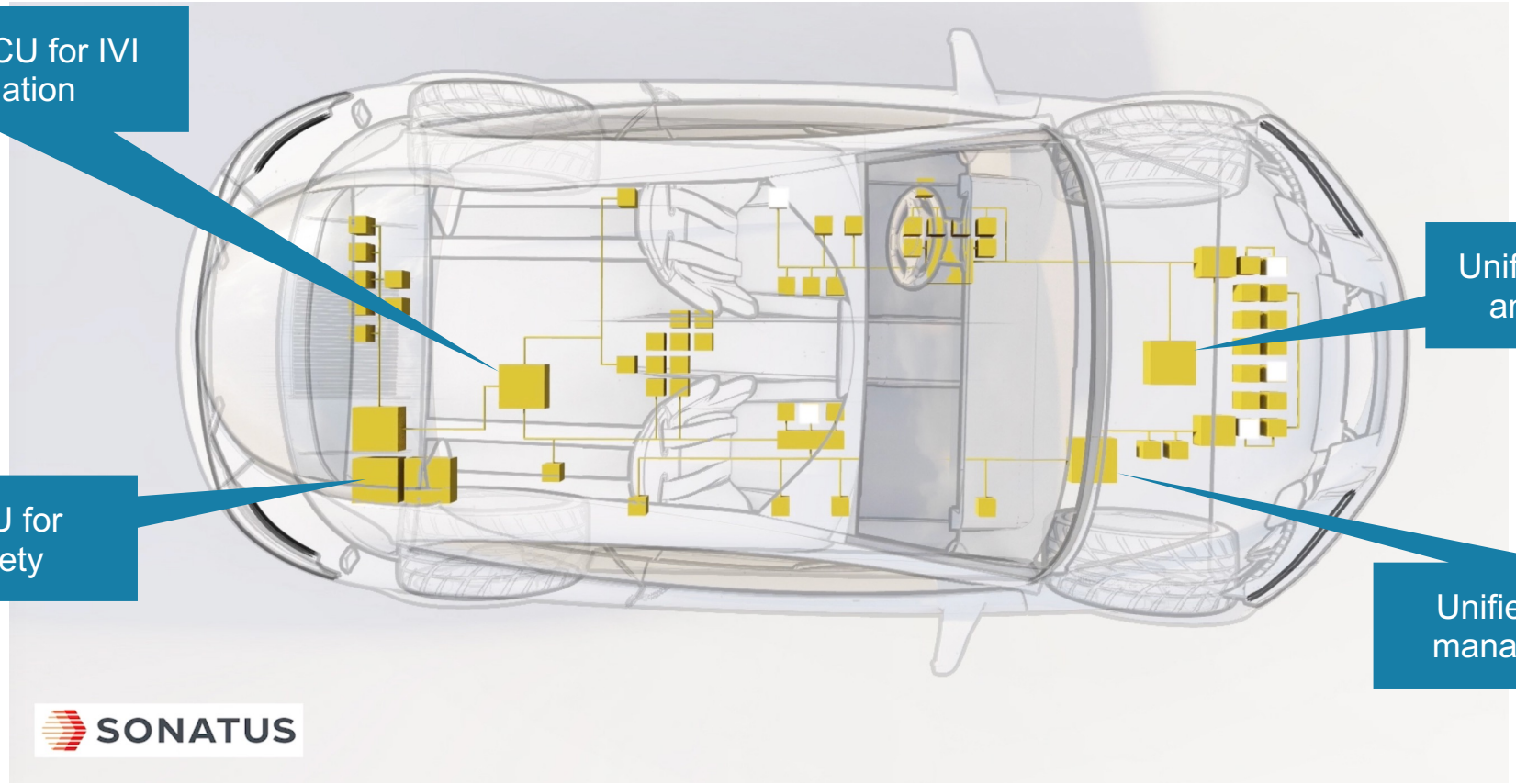
The first step to SDV: Consolidate similar functions

"Domain controllers" merge major functions into more advanced and extensible solutions



Examples for illustrative purposes

How do we achieve consolidation?

1. **Modern hardware & processors** that allow workload isolation
2. **Silicon solutions** implemented for automotive environment
3. **Standards** for mixed-criticality workloads
4. **Software solutions** that use these features and standards

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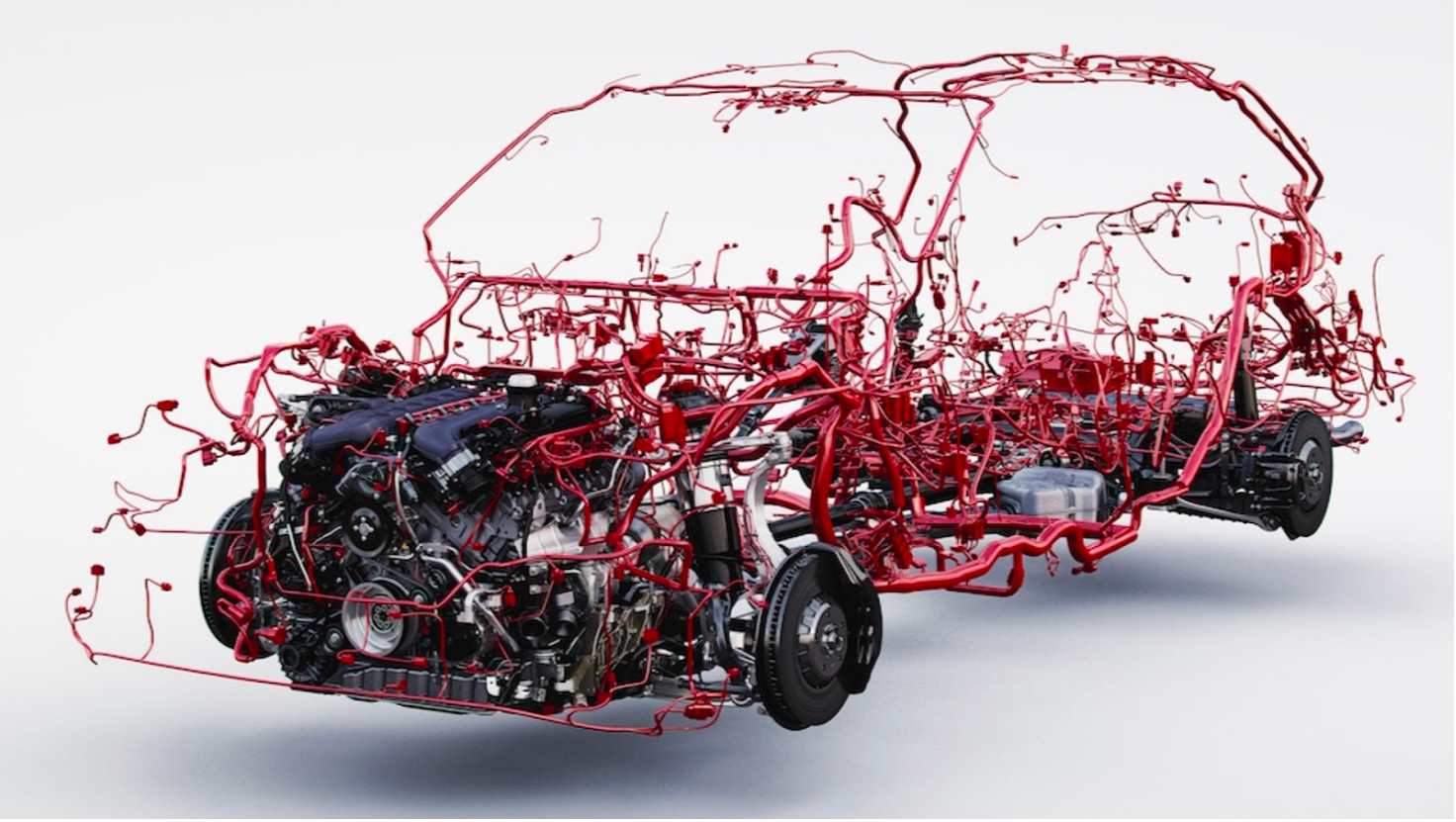
Vehicles have complex networks



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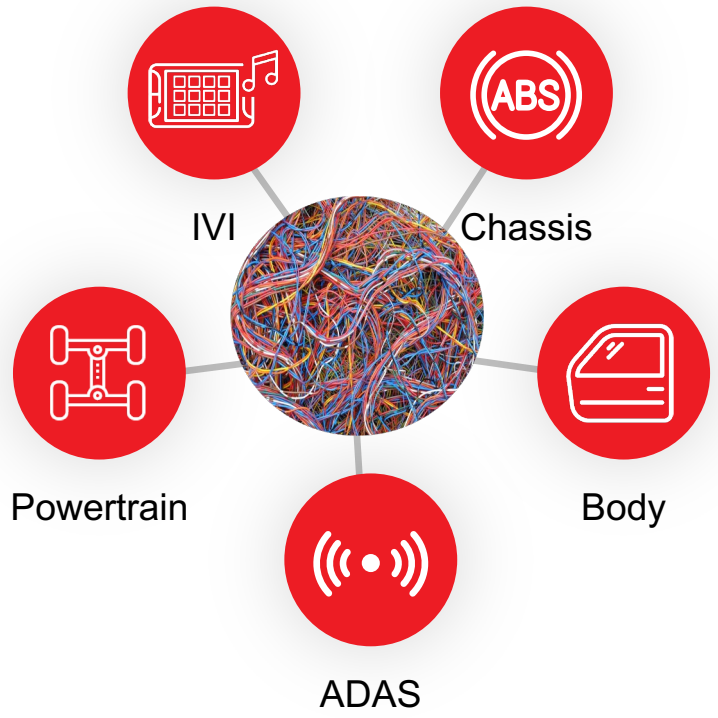
Why are complex networks a problem?



- Challenge to integrate new features
- Isolation inhibits multi-domain applications
- Difficult to debug or repair
- Fundamentally wasteful and complicated
- Expensive and difficult to physically install

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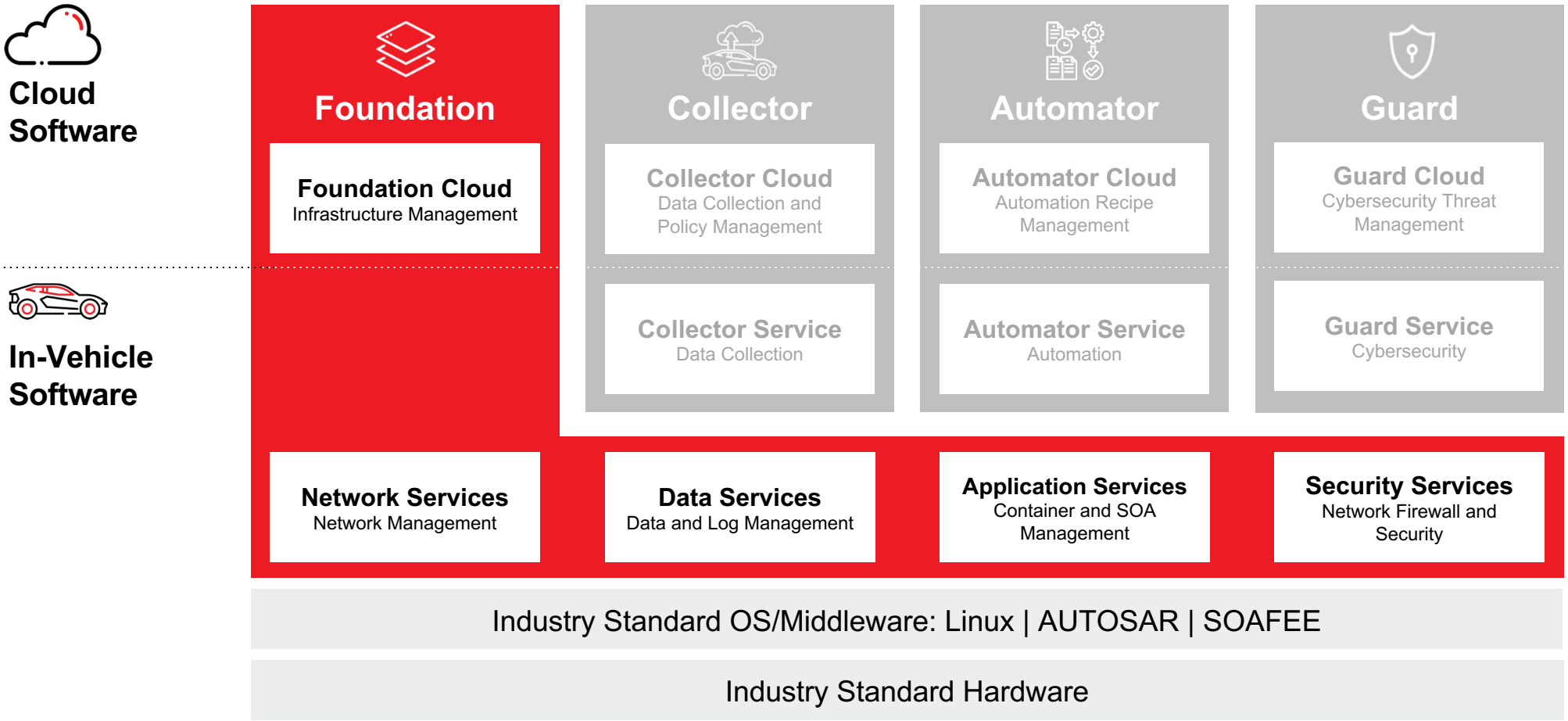
Sonatus Foundation: Critical infrastructure for SDVs



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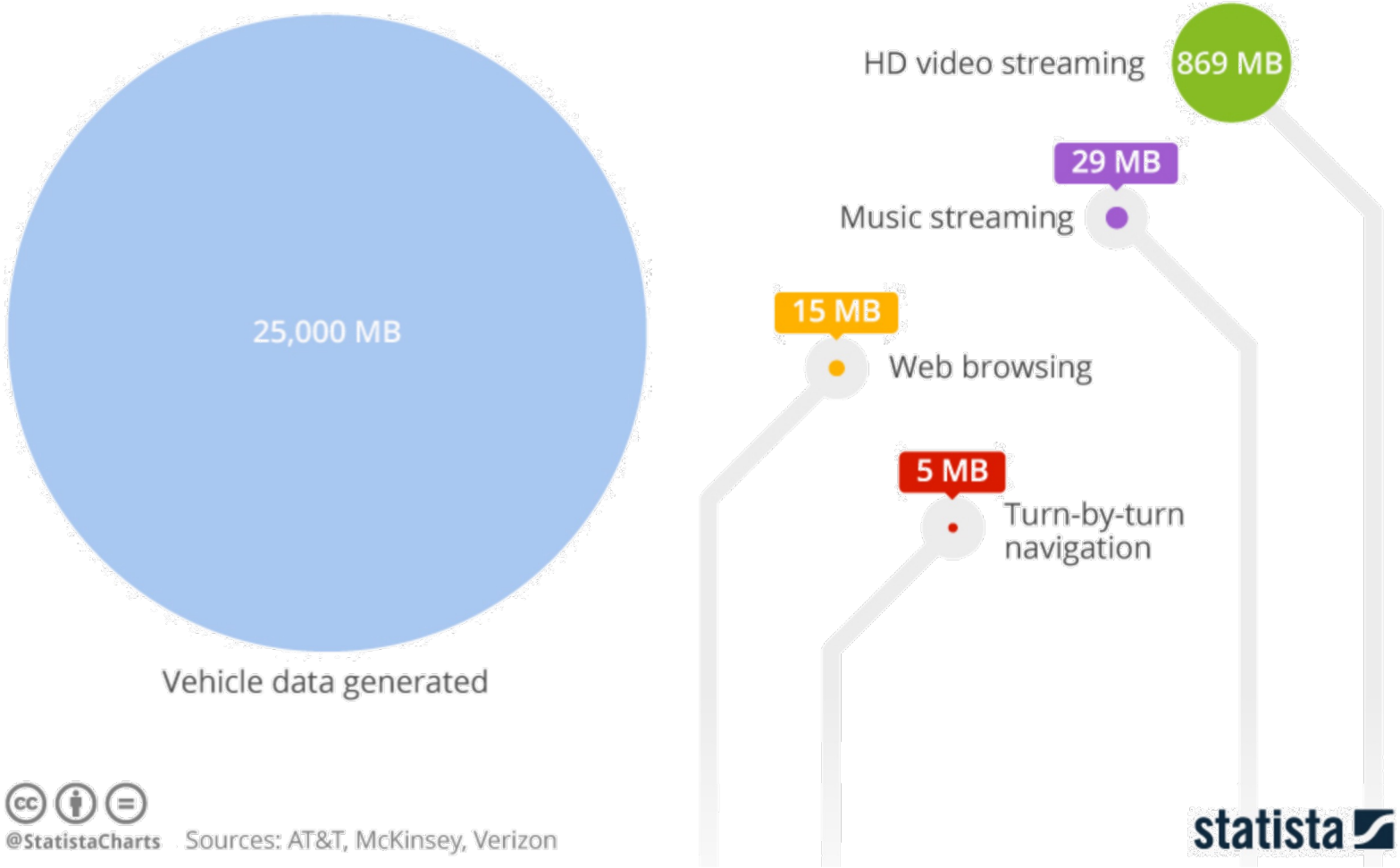
Data in vehicles is significant and growing

Data consumed or generated **per hour:**



Connected vehicles: Opportunity and Challenge

Opportunity

- Improvements in quality
- Valuable services to the driver
- Centralized/fleet management
- Recall avoidance
- Future V2V and V2X capability

Challenge

- Significant data to manage and store
- Prohibitive LTE upload costs
- Cloud storage and management
- Sharing among value chain
- Privacy concerns

Data is useful…but valuable needles in a huge haystack

- Thousands of data signals
- Hundreds of ECUs
- Communication between ECUs
- Changing external environment
- Evolving software

Even if you identify the right set of data to study…

- The data changes
- Your needs evolve
- New problems demand analysis

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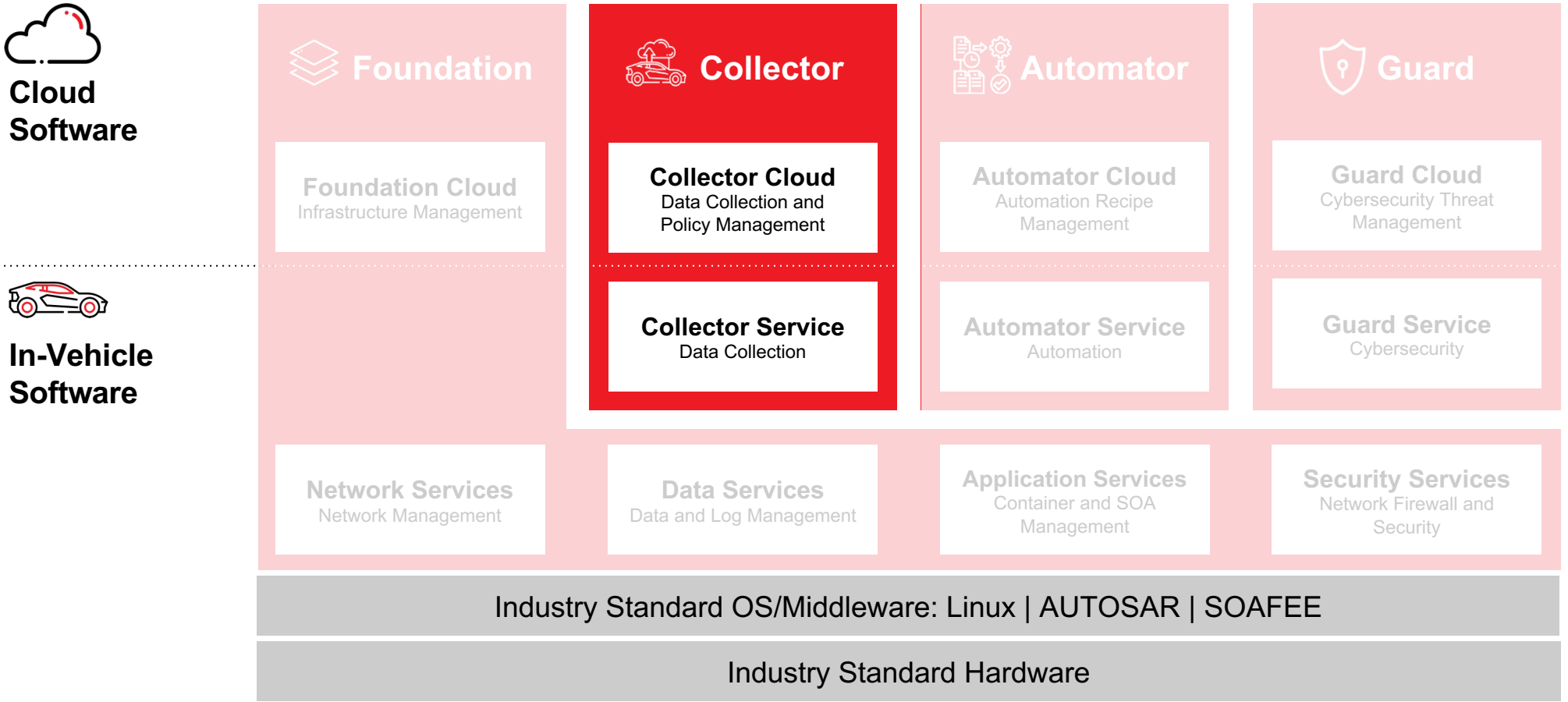
Sonatus Collector: Dynamic, Precision Data Collection



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Summary: What is a Software-Defined Vehicle?

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Sonatus helps OEMS achieve the promise of SDV's

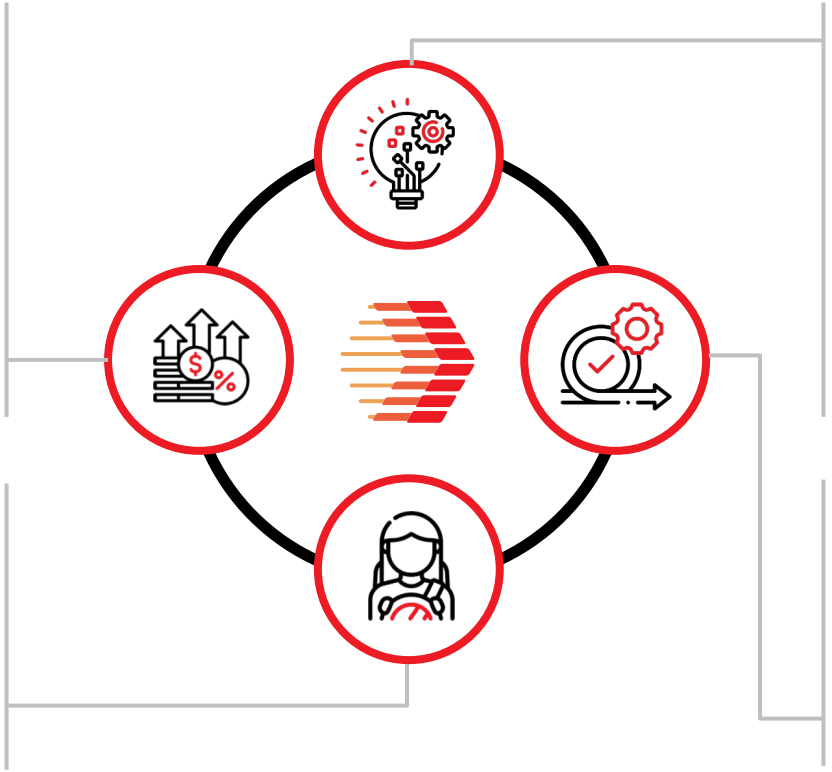
Value-added Services

Cloud-enabled integration:

- Fleet Applications
- Usage Based Insurance
- Smart Cities, Infrastructure
- Smart Home Integration

Post-sales

- Deploy new, personalized features
- Conduct extensive remote diagnostics
- Automatically calibrate ECUs remotely



Design and Engineering

- Enable cloud-native development
- Collect data dynamically to drive innovation
- Provide faster feature prototyping
- Support E/E architecture evolution

Production

- Remote automated end-of-line testing
- Automate tuning of ECUs

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Thank You

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ACCELERATING VEHICLE SOFTWARE INNOVATION

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