

**A revolution in Smart Factory is coming...**

**Driven by Autonomous, SW-defined, Service-oriented, Fully Connected Cars.**

**Are you ready?**



Lawrence Vivolo  
Sr. Business Development Mgr.

**DELL**  
Technologies

# Smart Factory Initiatives

Key Messages: AI-enabled, [lots of] Data Driven



Reduced Downtime

48%

Unplanned downtime down from 11% to 5.8%



Reduction in Defects

49%

Defect rate down from 4.9% to 2.5%



New Product Introduction

23%

New product introduction cycle time reduced from 15 to 11 months



Process Improvement

16%

Average OEE improved from 74% to 86%



Improved Inventory

35%

Inventory turns increased from 14 to 19



Reduction in Energy Use

18%

Annual energy cost down from \$8.4M to \$6.9M

**What business benefits do you expect to derive from Digital Manufacturing?**

Source: SCM World “Smart Manufacturing and the Internet of Things” survey of 418 Manufacturing Business Line Executives and Plant Managers across 17 vertical industries.

# Why is Dell here Today?



~40 Automotive customers

100

Trust

Semiconductor companies rely on Dell Technologies to accelerate business outcomes

7 of 10

Installed at 7 of the 10 largest semiconductor companies by revenue<sup>1</sup>

50+

Used by 50+ organizations for semiconductor design, embedded software development, EDA application development, and silicon chip manufacturing workloads<sup>2</sup>

235+

Over 235 petabytes of Dell EMC PowerScale storage have been deployed at semiconductor companies worldwide<sup>3</sup>

Global team of Industry experts ready to help you succeed

The scale, performance and management to accelerate innovation

1. Based on EPS News report on semiconductor supplier ranking published in November 2019 and Dell Technologies internal analysis conducted in April 2020 [ ↑ ]

2,3. Based on Dell Technologies internal analysis conducted in April 2020



# Why is Dell here Today?

~40 Automotive customers  
1000+ PBs currently deployed  
Trusted by Top 5 Auto companies



**DELL**Technologies  
**Automotive**



Global team of Industry experts  
ready to help you succeed



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# ADAS/AD data management at scale

SAE level	0	1	2	3	4	5
Level of Automation	None	Function-specific	Multi-function automation	Limited Self-driving	High Automation	Full Automation
Examples	Lane-departure warning	Adaptive Cruise Control	Parking Assist, Platooning	Traffic Jam Chauffeur	Parking Garage Pilot	Robot Taxi



Real-world sensor data required (Kilometers)



1k-5k cores  
4-10 PB  
1-5 cars

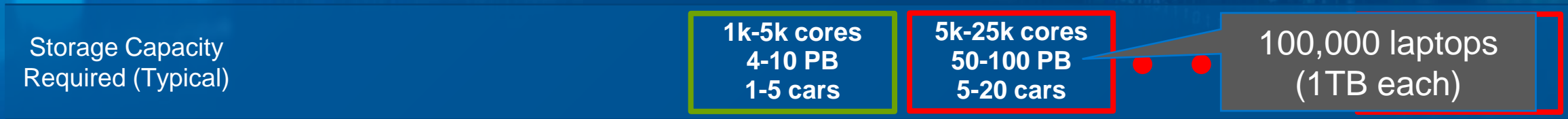
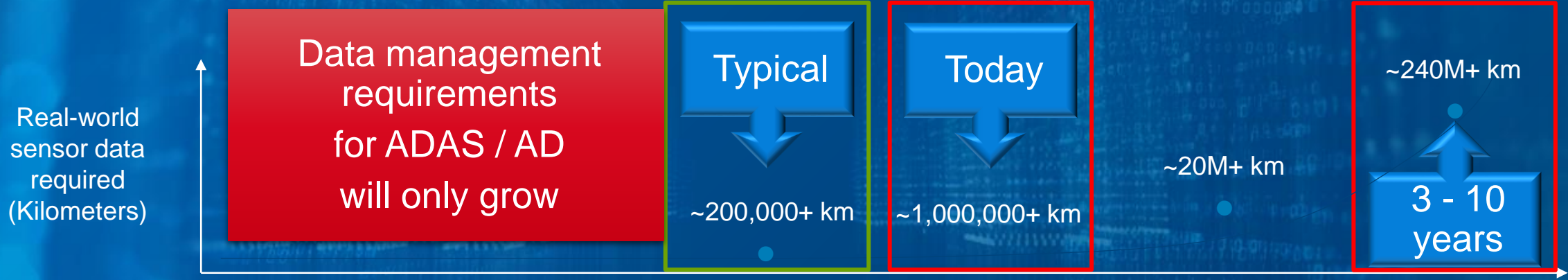
5k-25k cores  
50-100 PB  
5-20 cars

100,000 laptops (1TB each)

Storage Capacity Required (Typical)

# ADAS/AD data management at scale

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# Dell Sponsored Global Automotive Market Survey

## Where Automotive Systems Architectures Are Headed

>300 responses:

Targeted at technically literate job titles  
World-wide (66% North America)  
Small, medium, large companies

- 46% (145) OEM, tier 1 or tier 2 suppliers
- 22% (69): Manufacturing, operations, quality, supply chain or purchasing

- 20% Analyst/consultants
- Global automotive industry survey on future vehicle requirements
- Focus on vehicle evolution, and it's impact on back-end processes and infrastructures
- How to adjust and scale to the needs of the complex, broader ecosystem of the future



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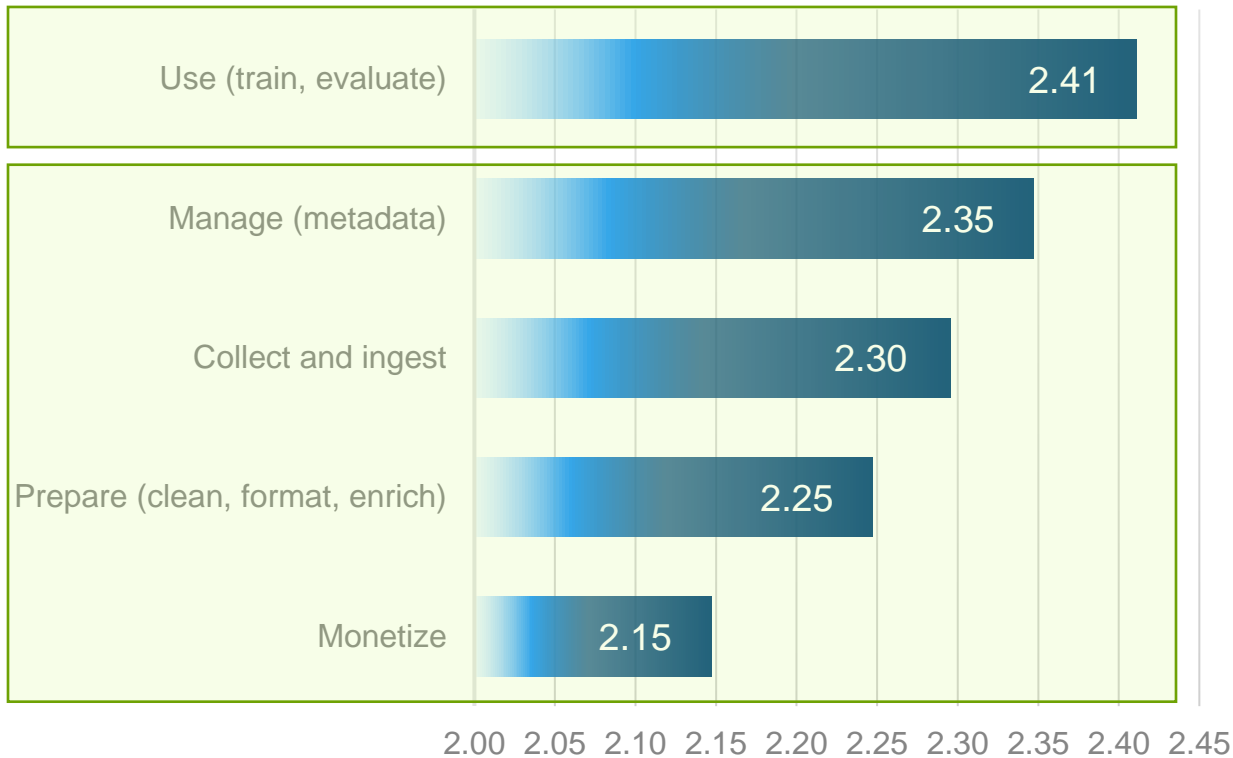
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- 20%: Analyst / consultants





# Strongest Impacts of AI / Data Scientist in the Data Continuum

Based on 1-3 scale, where 1 = Low impact, 2 = Medium Impact , 3 = High Impact



## Key insights:

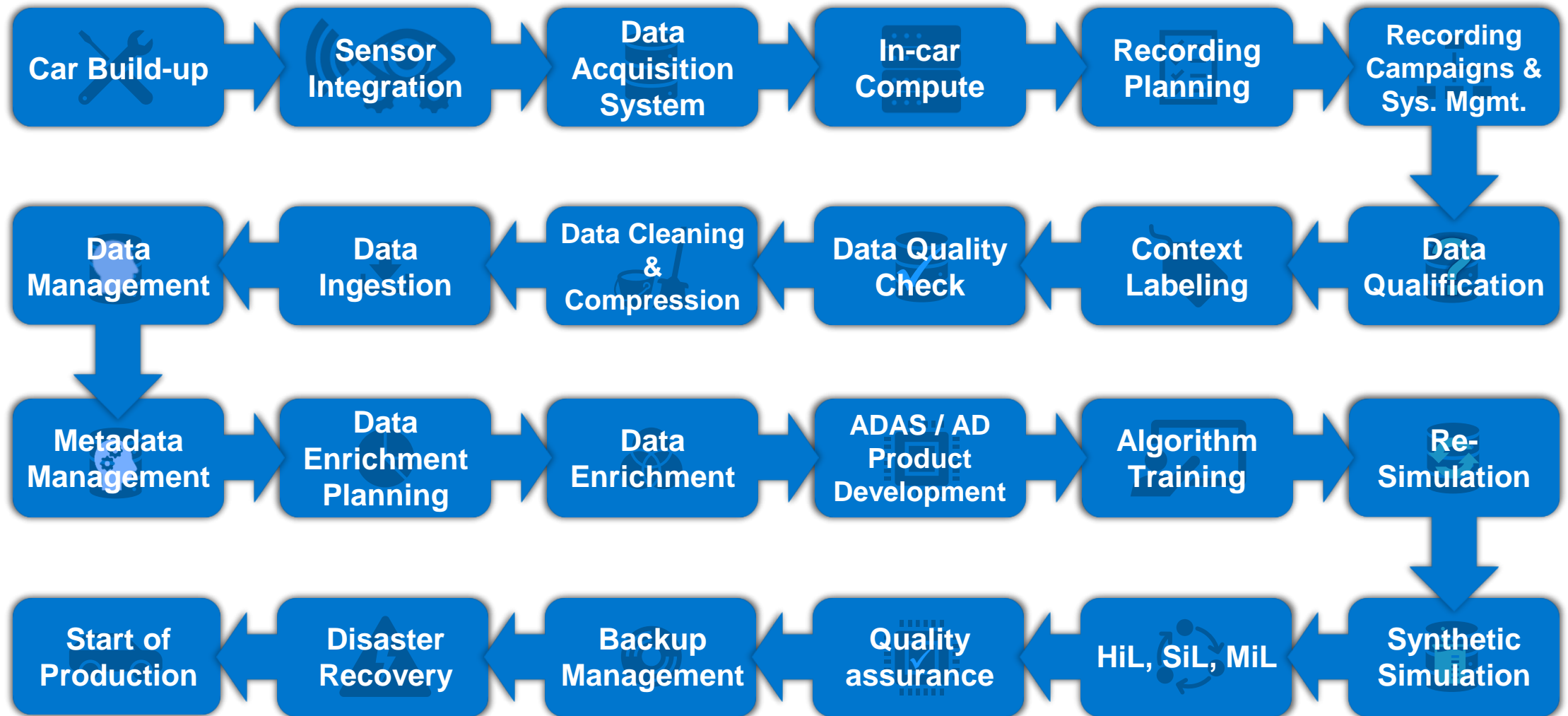
- Highest impact when implementing AI algorithms
- Data and Metadata Management
- Collecting and ingesting
- Data Preparation

## Takeaway

The application of AI on the data at various stages in the process currently has the highest impact at the use stage (training and evaluating algorithms). Overall AI has medium to high impact on all stages of the data continuum

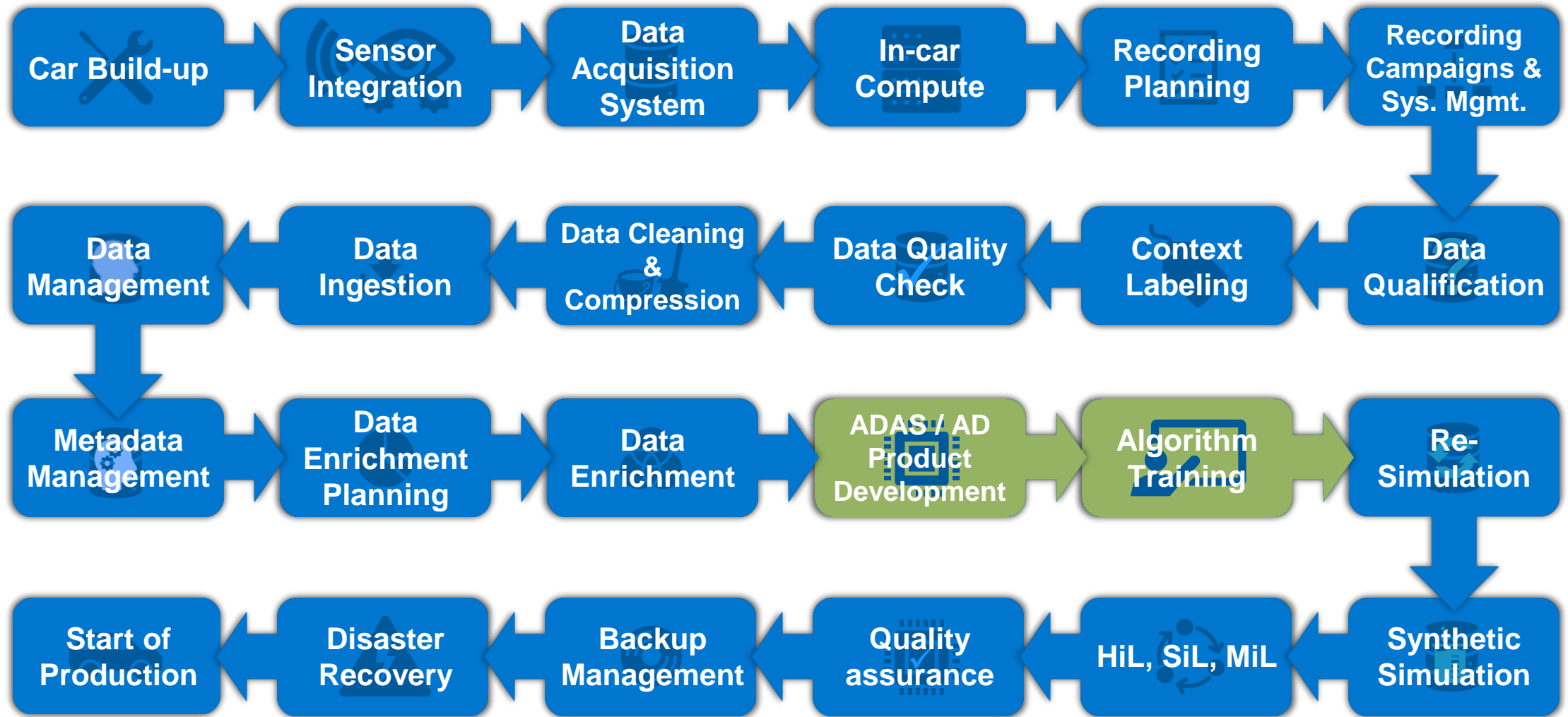
# ADAS Development Lifecycle & Tool Chain

A more detailed look reveals the complexity



# ADAS Development Lifecycle & Tool Chain

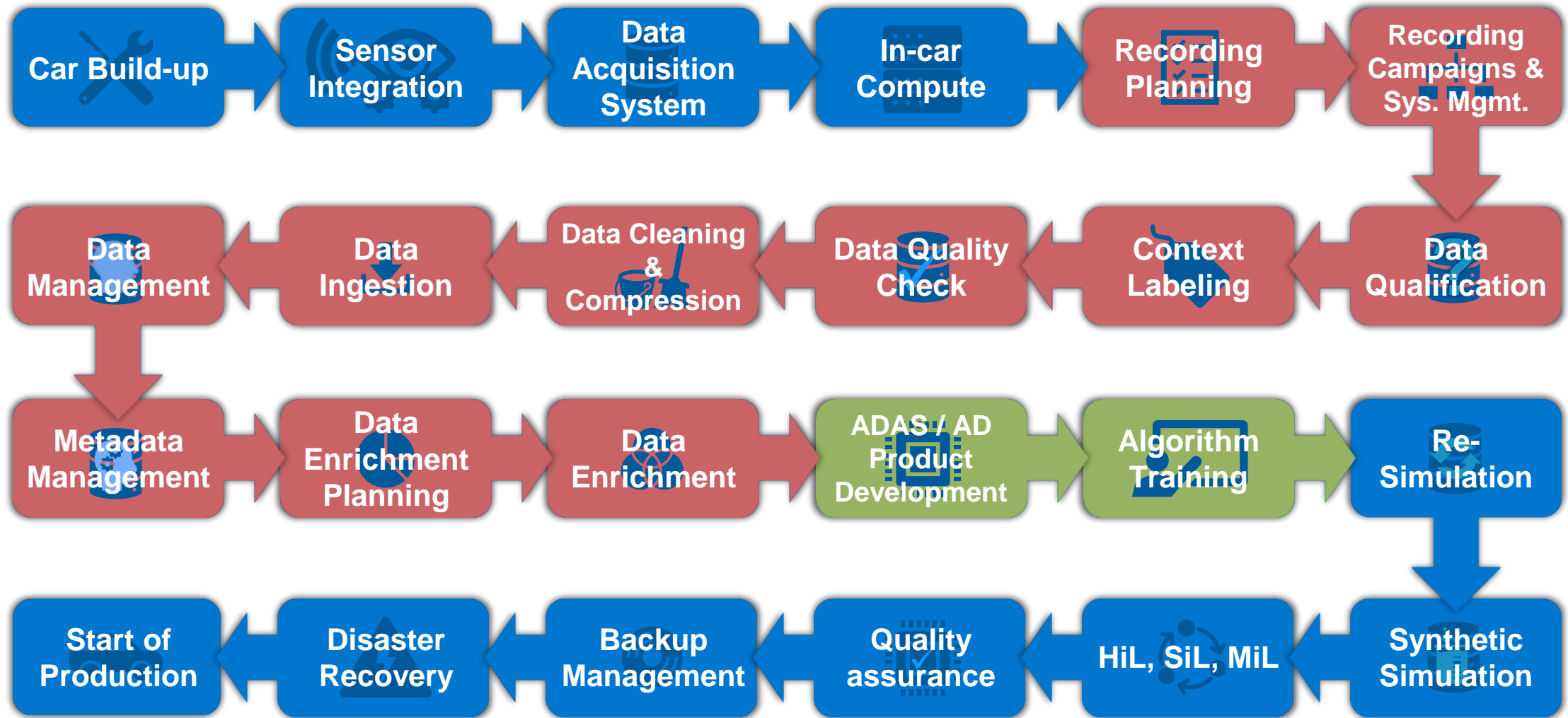
Data Scientist focus (**ideal**)





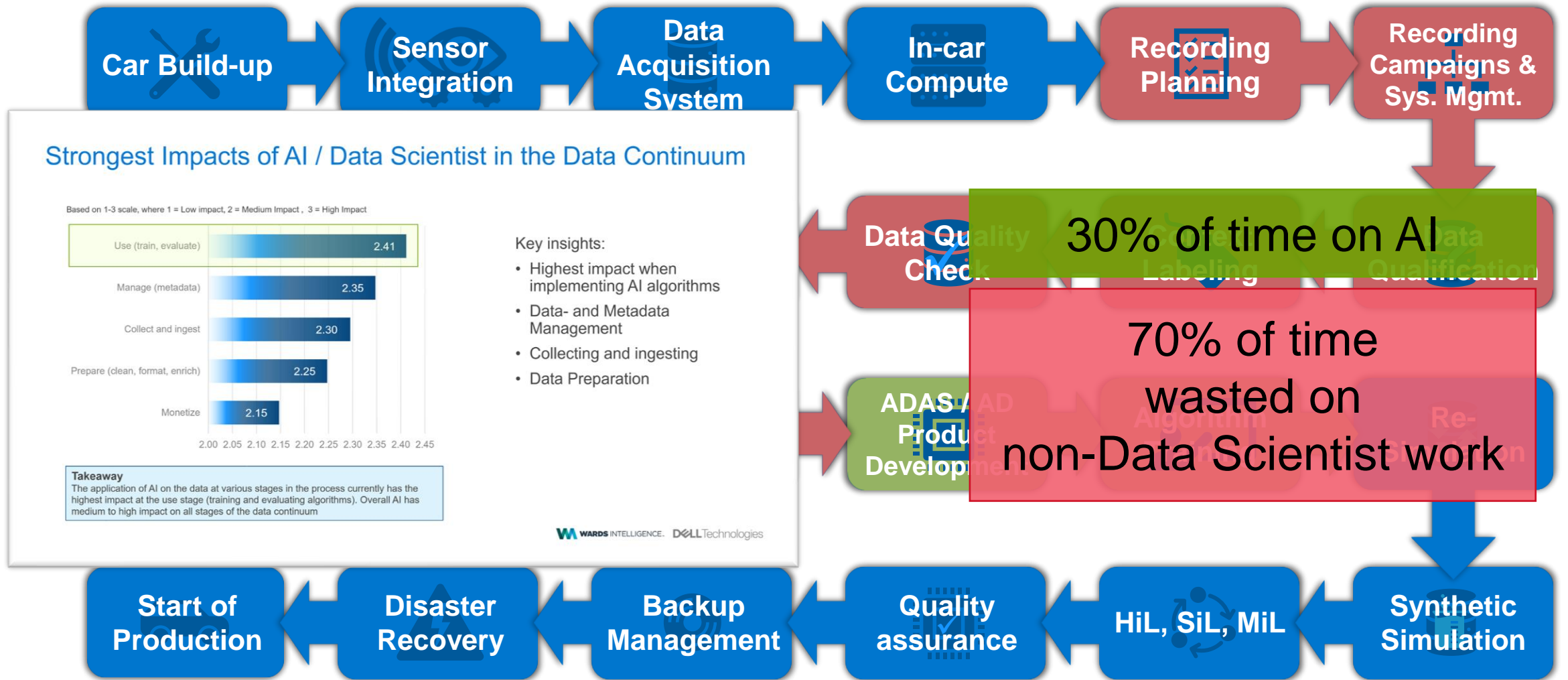
# ADAS Development Lifecycle & Tool Chain

Data Scientist focus (**reality**)

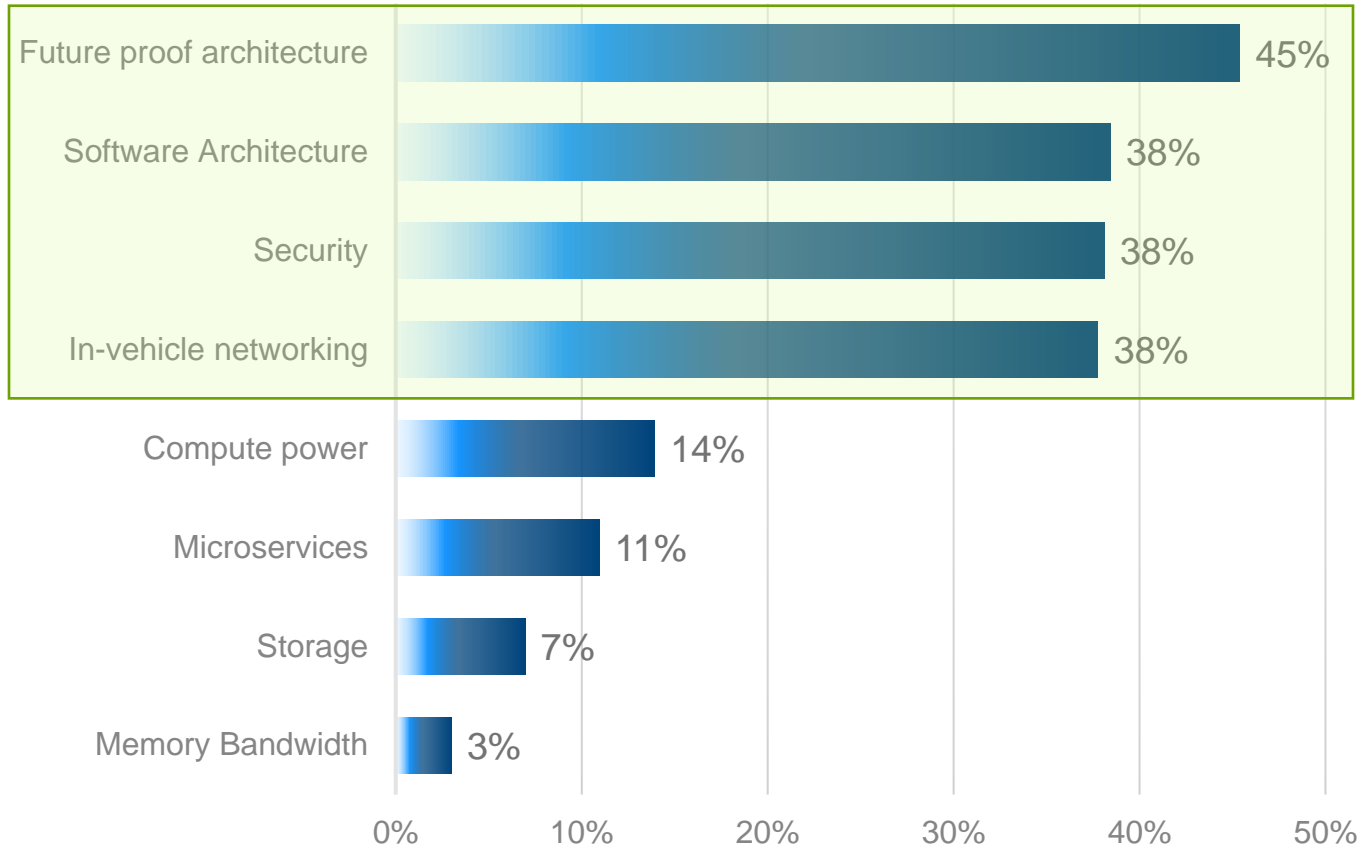


# ADAS Development Lifecycle & Tool Chain

Data Scientist utilization is major challenge



# Major Vehicle Electrical & Electronic System Challenges



## Takeaway

There are clear concerns about creating an architecture that has longevity. Main hurdles appear around the fundamental levels of software, security and networking. There is less concern with technical capabilities.

## Key insights:

- Future-proof architecture in-vehicle & in the Data Center
- Flexible E/E
- Enable OEMs OTA and new feature updates
- Functionalities-as-a-service
- Cope with fast changing technologies (e.g. AI)
- Transition to SoA and the vehicle as a platform
- Key enabling Technology: AI



# Why SOA? Today's Cars are Too Complex

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## Bosch: Did you know...

Facts and figures about electronics and software in vehicles

July 21, 2020

### The complexity of vehicle electronics is increasing.

- The complexity of vehicle electronics is increasing.
- Between 2006 and 2016, the average number of ECUs per vehicle across all vehicle classes increased from 28 to 38.<sup>7</sup>
- Up to 110 control units were installed in luxury vehicles in 2018; even in mass-market vehicles, the number is around 20.<sup>7</sup>
- The wiring harness of current mid-range vehicles is approx. eight kilometers long. Control units and wiring make a significant contribution to the weight of a vehicle. In a mid-range vehicle, 100 kilograms, control units and wiring make a significant contribution to the weight of a vehicle.
- Around ten different bus systems and transmission standards are used in a modern vehicle, including CAN, CAN-FD, MOST, LIN, Flexray, and Ethernet.

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## Bosch: Did you know...

Facts and figures about electronics and software in vehicles

July 21, 2020

### Software in the car is booming.

- Where a car included roughly 10 million lines of software code in 2010, the software of today's non-automated vehicles already runs to 100 million lines of code. By way of comparison, the Hubble space telescope has roughly 2 million lines of software code, and the latest PC operating systems have between 20 and 50 million.<sup>5, 6</sup>
- Tomorrow's automated vehicles will require between 300 and 500 million lines of code.<sup>6</sup>
- One million lines of code is equivalent to 18,000 A4 pages.<sup>5</sup>

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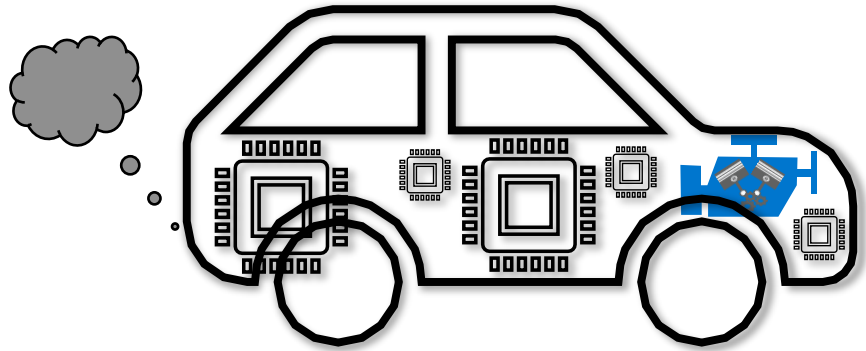
Source: <https://www.automotiveworld.com/news-releases/bosch-did-you-know/>

<sup>5</sup> Jeff Desjardins, [How Many Millions of Lines of Code Does It Take?](#)  
<sup>6</sup> Roland Berger, [Global Automotive Supplier Study 2018](#), p. 49  
<sup>7</sup> Roland Berger, [Consolidation in Vehicle Electronic Architectures](#), p. 6

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# The Transformation of Vehicles

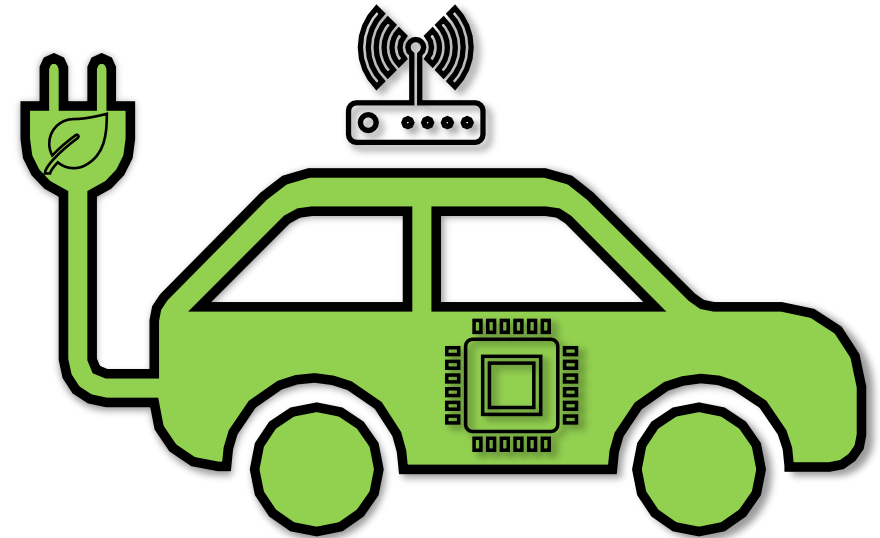
## Today



- Multiple decentralized ECUs
- Not connected
- Hardware-defined

Simplification  
Electrification

## Tomorrow



- Centralized domain architecture
- Simplified and open
- Connected to anything
- OTA updates + new functionalities
- Software-defined and aaS
- Secure

# What can tomorrow's vehicles do with an SOA?

Optimize the trip

Predictive maintenance & Predictive quality

Reduce CO2 / green wave

Find a parking slot

Drive me to the mountains (24 hrs) \$\$

Detect hazards / obstacles

Find a charging / gas station

Upgrade battery range (24 hrs) \$

Extend Smart Factory  
Go beyond the factory walls

New services / revenue  
(some yet to be defined)



Entertainment



Content/Maps



Concierge Services



Telematics



Sale of data



Fleet Management



Cost Avoidance



Over-the-Air



CRM

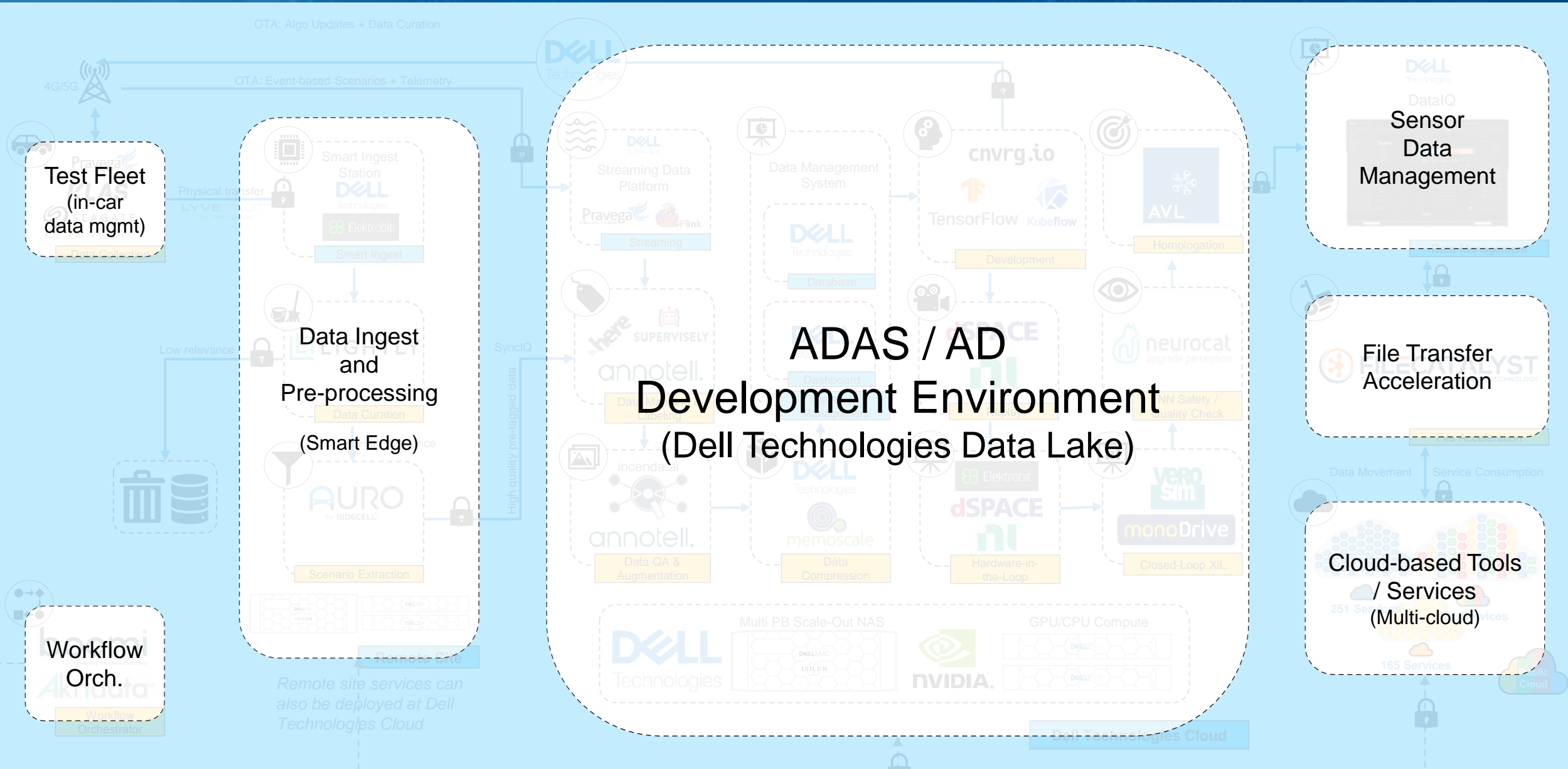


# Example: Dell Autonomous Drive Ecosystem

An End-to-End reference architecture for ADAS / AD

Dell Solution

ISV Solution



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Superna EyeGlass Ransomware Defender for Dell EMC PowerScale and ECS

# Example: Dell Autonomous Drive Ecosystem

A flexible, open data flow, with proven technology tools and services

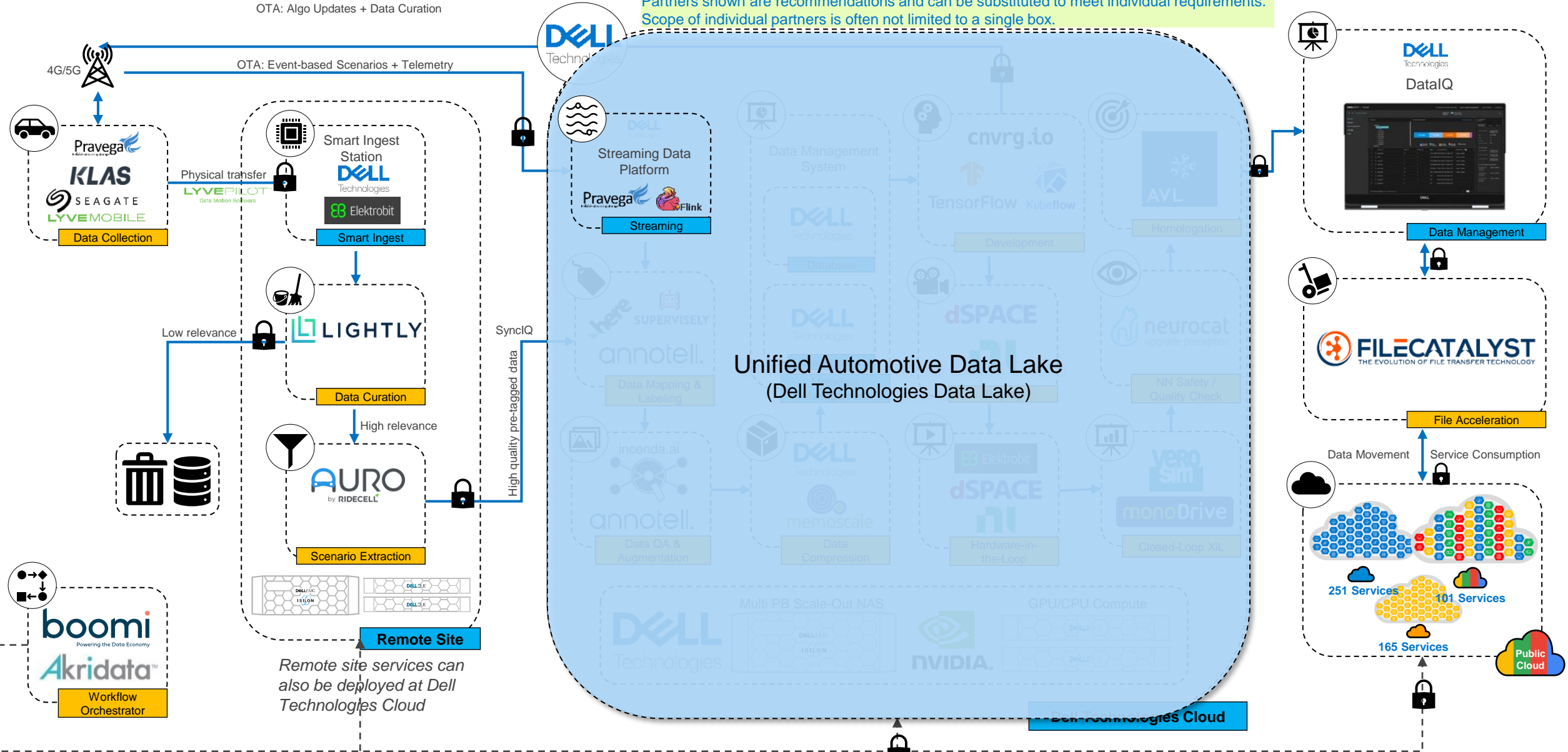
**Dell Solution**

**ISV Solution**

OTA: Algo Updates + Data Curation

OTA: Event-based Scenarios + Telemetry

Partners shown are recommendations and can be substituted to meet individual requirements. Scope of individual partners is often not limited to a single box.



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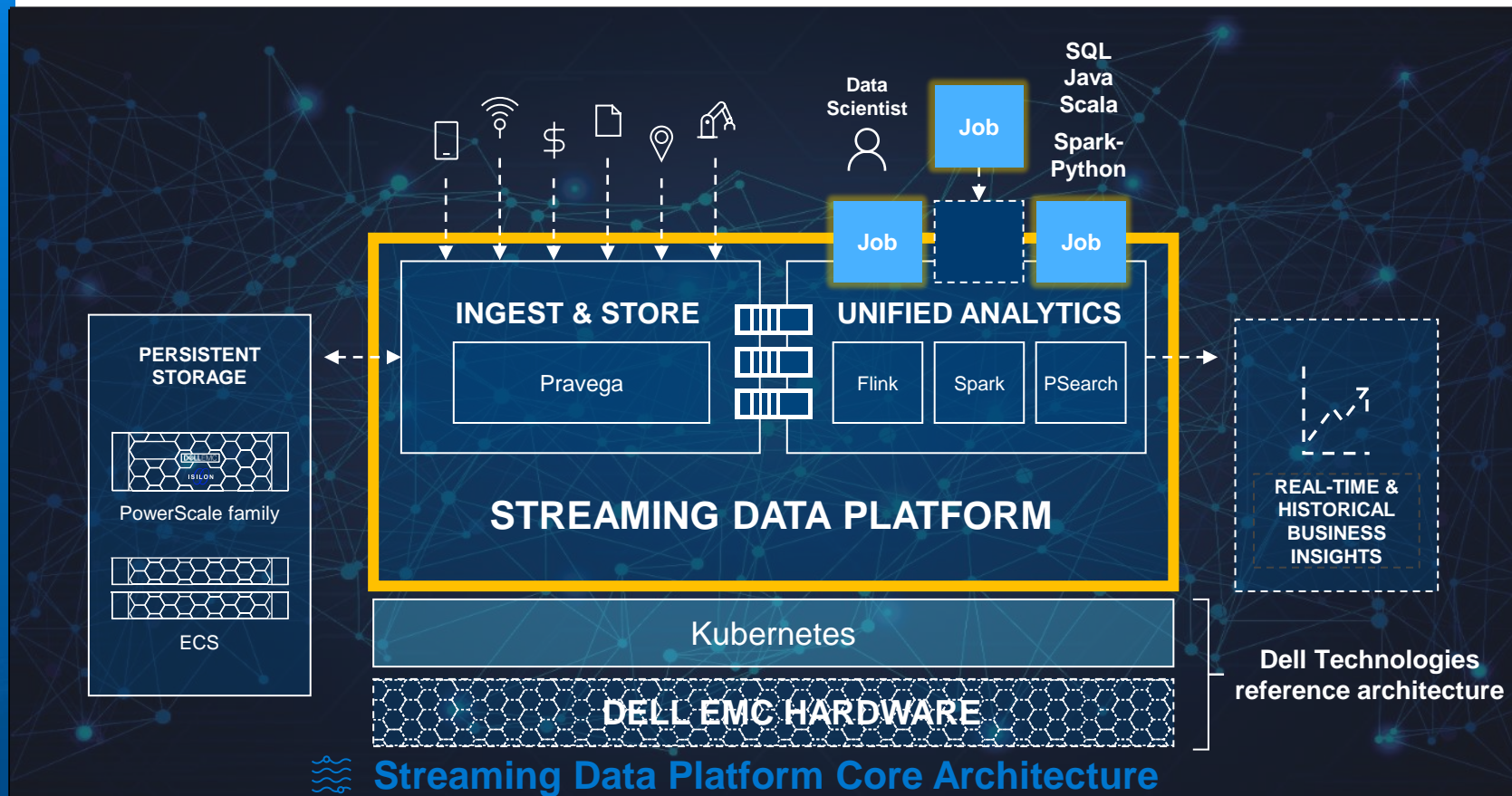
Superna Eyeglass Ransomware Defender for Dell EMC PowerScale and ECS

Dell EMC

# Streaming Data Platform

- Enterprise-grade platform built on open source
- Streamlines data ingestion and storage – regardless of source or type
- Frees Data Scientists to focus on application development
- Creates a foundation of unified historical and real-time data
- Enables innovation using a continually growing array of applications

Harness real-time and historical data in a single, future-proof, auto-scaling infrastructure and programming model

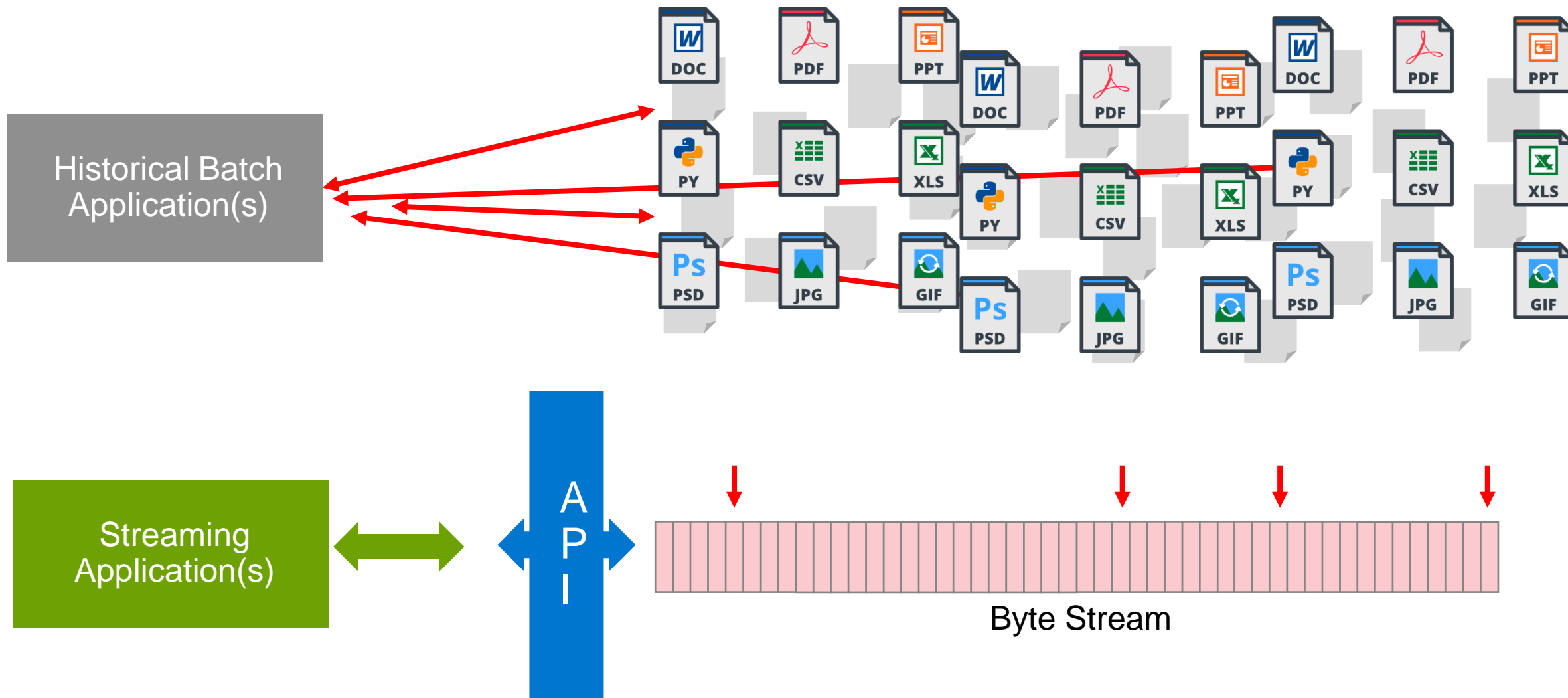


A scalable solution used to ingest, store, and analyze streaming data in real time



# Historical File/Object vs Stream Data Primitive

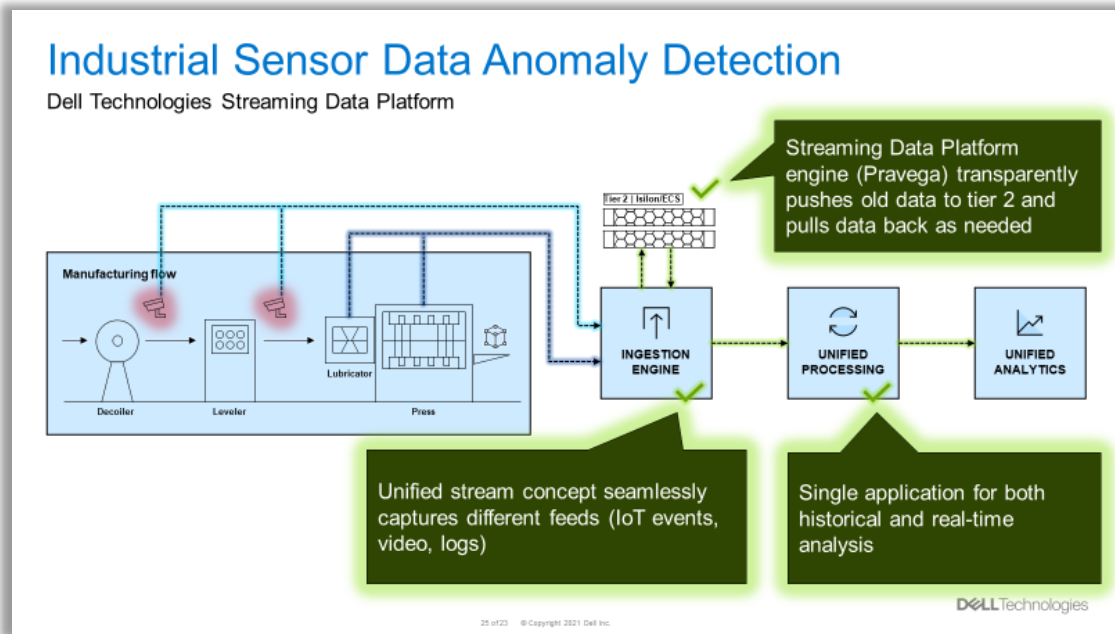
REAL-TIME and LONG-TERM ANALYSIS REQUIRES CHANGE



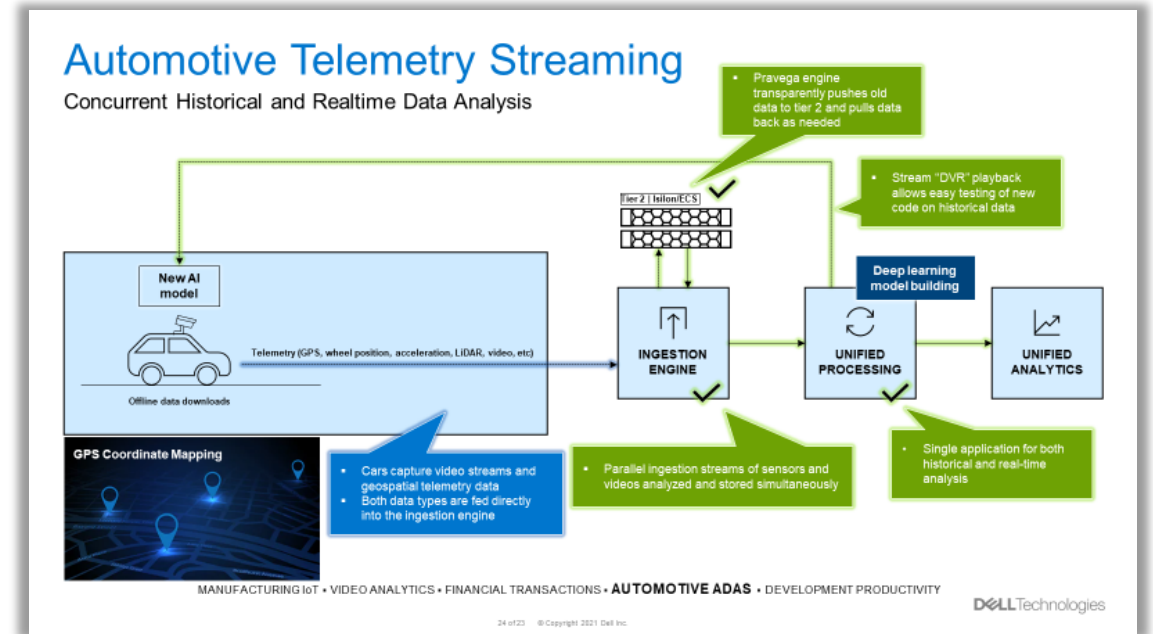


# Streaming Data Platform

Support across the entire Vehicle lifecycle



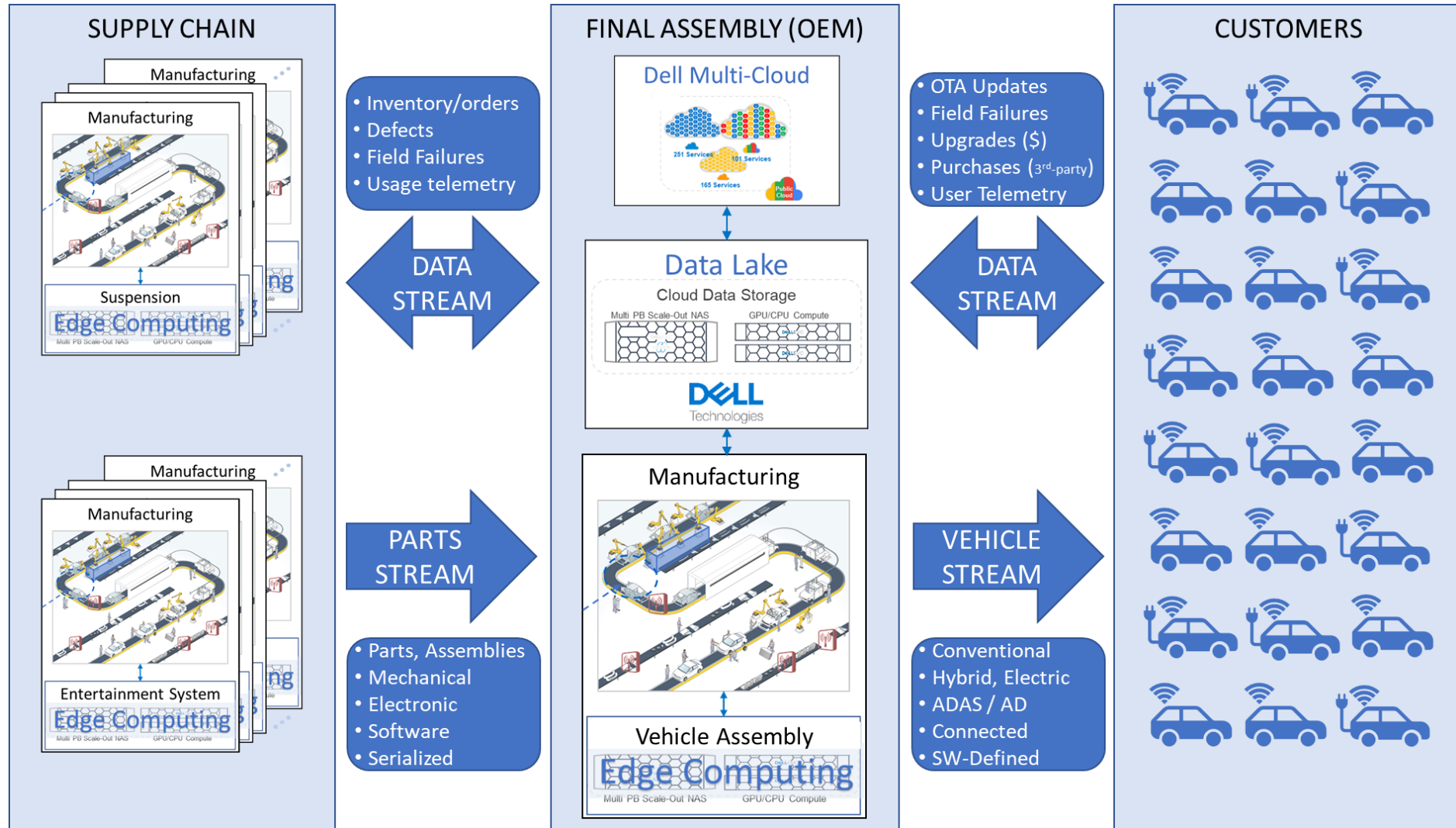
Manufacturing



Customer and Fleet Support

# Future-proof Factory Infrastructure must be AI-ready

AI spans the life-of-the-vehicle



# Summary:

Future-proof Smart Factory Infrastructure must be AI-ready



In-vehicle

 Software-defined | SoA

Data Driven

 Real-time | Long-term | Scalable

Cloud / IT

 Private | Multi | On-premise

Privacy / Security

 GDPR | UNECE WP.29 | Ransomware

Monetization

 New business models

New Technologies

 Edge | AI | 5G

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