CONCEIVING, SPECIFYING AND DELIVERING THE ADVANCED ARCHITECTURES OF THE FUTURE

COMMERCIALIZATION
CONCEIVING, SPECIFYING AND DELIVERING THE ADVANCED ARCHITECTURES OF THE FUTURE

PORTFOLIO
CAPABILITIES WITH BOTH THE BRAIN AND NERVOUS SYSTEM OF THE VEHICLE

SVA™ LOWERS TOTAL COST OF OWNERSHIP AND ENABLES THE SOFTWARE-DEFINED VEHICLE
VEHICLE FATALITIES COMING DOWN GLOBALLY, BUT PASSIVE SAFETY AT ITS LIMIT, ADVANCED SAFETY SOLUTIONS CRITICAL IN REDUCING VEHICLE FATALITIES

94% of all accidents are caused by human error

1.35M road traffic deaths annually

EMISSIONS REGULATIONS BECOMING INCREASINGLY STRINGENT GLOBALLY TO HELP IMPROVE AIR QUALITY AND REDUCE TRANSPORTATIONS ENVIRONMENTAL IMPACT

#1 air pollution is the number one environmental cause of death in the European Union

4.6 metric tons of CO₂ per year emitted from a typical passenger vehicle

URBANIZATION AND CONSUMER EXPECTATIONS: DRIVING DEMAND FOR MORE INTELLIGENT, INTEGRATED AND PRODUCTIVE SOLUTIONS

6B smartphones globally by 2025, replacing the PC as consumers key connected device

25B IoT connected devices globally

Air pollution is the number one environmental cause of death in the European Union.
**SAFE**

APTIV MISSION
A SOCIETY THAT SEES ZERO FATALITIES, ZERO INJURIES AND ZERO ACCIDENTS

APTIV TECHNOLOGIES
• Perception systems and sensor fusion
• Active Safety software and multidomain controllers
• High fidelity / reliability interconnects and signal distribution
• Gesture and voice recognition for hands free control

**GREEN**

APTIV MISSION
ZERO EMISSIONS: MINIMIZE THE VEHICLE’S TOTAL LIFECYCLE ENVIRONMENTAL IMPACT

APTIV TECHNOLOGIES
• High Voltage wiring and electrical centers
• High Voltage connectors, plug-in chargers and cord sets
• Aluminum wire harnesses for light-weighting
• Architecture optimization for mass and weight reduction

**CONNECTED**

APTIV MISSION
SEAMLESS INTEGRATION BETWEEN THE CAR, ITS PASSENGERS, AND THE WORLD AROUND IT

APTIV TECHNOLOGIES
• Secure connected gateways (Cellular, Satellite, DSRC, GPS)
• Wireless (Wifi, BT), Media Modules and Consumer Ports
• Over-The-Air (OTA) for Software and Firmware
• Edge Processing, cloud analytics and cybersecurity
ARCHITECTURE COMPLEXITY

POWER CONSUMPTION

SIGNAL DISTRIBUTION

CONNECTOR COUNT

1995

2005

2020

2050

ARCHITECTURE COMPLEXITY

POWER CONSUMPTION

SIGNAL DISTRIBUTION

CONNECTOR COUNT

1100 W

200 Mb/s

300

340

500 Mb/s

40 kW

KEY CHALLENGES

MINIATURIZATION
Component miniaturization and increased wire density

QUALITY
Automation required for AV content specifications

LABOR
Global labor cost increases and lack of labor availability

Architecture Requirements Expanding...
CREATING NEW OPPORTUNITIES FOR APTIV
... Demanding New Compute Solutions

Platform strategy enables Aptiv to efficiently deliver these advanced solutions.

**Development**
- Increasing complexity and interdependencies extending timelines

**Manufacturing**
- Vehicle physically out of space, and difficult to assemble

**Post-Production**
- Heavy function split resulting in engineering, with no ability to enhance functionality

**Architectural Complexity**

**Domain Expansion**
- Leveraging compute platform knowledge to deliver incremental features and functions

**UP Integration Beginning**
- High performance compute platforms serve as natural function consolidators

**Past and Future**
- 1990: Engine Controllers, Active Safety, Body & Security
- 2000: Engine Controllers, Active Safety, Body & Security
- 2010: Engine Controllers, Active Safety, Body & Security
- 2020: Engine Controllers, Active Safety, Body & Security

**Engine Controllers**
- Infotainment
- Active Safety
- Passive Safety
- Body & Security

**Body & Security**
- Instrumentation
- User Experience

**Infotainment & User Experience**
- Connectivity

**Active Safety**
- ADAS

**Passive Safety**
- Body & Security

**Connectivity**
- High performance compute platforms serve as natural function consolidators

**Domain Expansion**

**Leveraging Compute Platform Knowledge to Deliver Incremental Features and Functions**

**Up Integration Beginning**

**High Performance Compute Platforms Serve as Natural Function Consolidators**

**Platform Strategy Enables Aptiv to Efficiently Deliver These Advanced Solutions**
Perfectly Positioned to Win

BRAIN AND NERVOUS SYSTEM CAPABILITIES ENABLING FULL SYSTEM SOLUTIONS

CURRENT PLATFORMS

ADVANCED SOFTWARE

1. CLOUD
2. APPLICATION LAYER
3. MIDDLEWARE
4. OPERATING SYSTEM
5. HARDWARE ABSTRACTION

ADVANCED ARCHITECTURES

1. COMPUTE
2. DATA & POWER DISTRIBUTION
3. SENSORS, PERIPHERALS & ACTUATORS

FUTURE PLATFORMS

SVA™

FUTURE PLATFORMS

APRIL 2019
100+ Controllers

200 Million lines of code

1000+ Functions dependent upon multiple controllers

“The complexity is paralyzing us”
– OEM customer
TODAY
CHALLENGES IN ALL THREE PHASES OF VEHICLE LIFECYCLE

Development
Manufacturing
Post-Production

Development
Manufacturing
Post-Production
SVA™ A FLEXIBLE AND SCALABLE PLATFORM DESIGNED TO

SIMPLIFY
Vehicle System and Function Complexity and Interdependence

UNITE
Diverse Applications Across the Full Vehicle Lifecycle

EMPOWER
OEMs to Fully Control the User Experience of Their Vehicles
FUNDAMENTAL PRINCIPLES DIFFERENTIATE SVA™

ABSTRACT
Software From Hardware

SEPARATE
Input / Output From Compute

ENABLE
“Serverization” of Compute
THIS SLIDE HAS BEEN REDACTED
LOWER TOTAL COST OF OWNERSHIP

- **75%** Lower System Integration and Testing Cost
- **25%** Reduction in Weight and Packaging Space for Compute
- **50%** Labor Savings to Install Electrical Distribution
- **75%** Software Warranty Cost Reduction
- **20%** SKU Reduction
- **20%** Reduction in Wire Harness Weight
- **20%** Factory Floor Space Reduction for Electrical Architecture Installation
- **100%** Elimination of Model Year Updates
PARALLEL DEVELOPMENTS ACCELERATE TIME TO MARKET

TODAY
Concept definition → Hardware Design → Software Design → System Validation

SVA™
Concept definition → Hardware Design → Hardware Validation → Software Features → Validation → System Validation

- Lower System Integration and Testing Cost: 75%
- Software Warranty Cost Reduction: 75%

LOWER SYSTEM INTEGRATION AND TESTING COST
SOFTWARE WARRANTY COST REDUCTION
Labor Savings to Install Electrical Distribution
50%

Factory Floor Space Reduction for Electrical Architecture Installation
20%

Reduction in Wire Harness Weight
20%

SKU Reduction
20%

Simplify and Automate Assembly

Reduction In Weight and Packaging Space for Compute
25%

Reduction in Wire Harness Weight
20%

SKU Reduction
20%

Labor Savings to Install Electrical Distribution
50%
Certified Software

New Certified Software Functionality Updates

Elimination of Model Year Updates

100%

STREAMLINE LIFECYCLE MANAGEMENT

VEHICLE MANUFACTURER SOFTWARE LIBRARY

Updates

VEHICLE SPECIFIC SOFTWARE BUILD

New Certified Software Functionality

Certified Software Functionality

Updates

Certified Hardware

100% Elimination of Model Year Updates

AP T I V
DOMA IN AND ZONE CONTROL REPRESENT BUILDING BLOCKS TOWARDS SVA™

Reducing complexity through intelligent zone control and management

Supporting incremental functionality through domain centralization

Enabling software to define new features independent of underlying hardware

Historically

Initial Introductions Into Production

50 – 100 Distributed ECUs per Vehicle

Today

Supporting incremental functionality through domain centralization

Reducing complexity through intelligent zone control and management

2025 and beyond

Enabling software to define new features independent of underlying hardware

A P T I V
**APPLICATIONS**

- Software as a Services (SaaS)
- Software as a Platform (SaaP)

**SVA™ PLATFORM & SYSTEMS INTEGRATION**

- Platform as a Service (PaaS)
- Software Development Kit (SDK)
- Technology Licensing
- Cloud Based Lifecycle Management
  - Digital Twin
  - OTA (SOTA / FOTA)

**VEHICLE MANUFACTURERS**

- EV Range Performance Update
- Occupant Authentication
- Audio Enhancements
- Point / Gesture To Search
- Home Automation

**3RD PARTIES**

- Digital Assistants

**VEHICLE INTEGRATION AND VALIDATION**

**SOFTWARE SERVICES LAYER & FRAMEWORK**

**MIXED CRITICALITY MIDDLEWARE**

**INTEGRATED OPERATING SYSTEM**

**PLATFORM INTEGRATION AND TOOLING**

**UNLOCK NEW INNOVATION AND EMPOWER OEMS TO DEFINE THE USER EXPERIENCE**

**Examples**

- Mixed Criticality Middleware
- Software Services Layer & Framework
- Integrated Operating System
- Vehicle Integration and Validation
- Platform Integration and Tooling

**VEHICLE MANUFACTURERS**

- APTIV
- 3rd Parties

**3RD PARTIES**

- Digital Assistants

**APPLICATIONS**

- Software as a Services (SaaS)
- Software as a Platform (SaaP)

**SVA™ PLATFORM & SYSTEMS INTEGRATION**

- Platform as a Service (PaaS)
- Software Development Kit (SDK)
- Technology Licensing
- Cloud Based Lifecycle Management
  - Digital Twin
  - OTA (SOTA / FOTA)
SVA™ A SUSTAINABLE ARCHITECTURE