

ThunderSoft Automotive Business Introduction

Smart Vehicle Business Group

2022

ThunderSoft is World Leading OS Product and Technology Provider

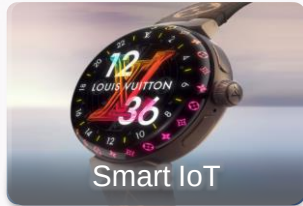


Main Business



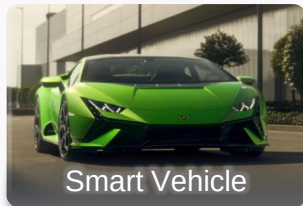
Smart Device

Empowering **900 million** smartphones, tablets and other devices worldwide



Smart IoT

Reaching **30 million** IoT computing devices worldwide



Smart Vehicle

Enabling **40 million** mass-produced vehicles worldwide



Smart Industry

Empowering **Smart Industries** Including Transportation, office parks, cities...

Core Technology

SOM

Smart Module
MEC
Devkits

OS

Linux
Android
IoT OS

Middleware

Smart vision HMI Engine
Security Multimedia
Smart Voice Connectivity

Cloud

Model Farm FOTA
Cloud Phone MDM
IoT Harbor Big Data

Ecosystem

Semiconductor



Cloud



OS



Global Presence

13 countries 40 cities 17 overseas cities
13,000+ employees 2,000+ Overseas employees



Smart Vehicle Business Group Development History

ThunderSoft's technology and products empower more than 40 million smart vehicles from more than 40 global automotive brands

Since **2014**

40+ Brands

Top global brands, such as Geely, Mercedes-Benz, Audi, GM, Toyota, Honda, etc.

40mil+ Vehicles

100+ mass production projects

63%+ Digital Cluster HMI market share

Top HMI design, 3D application, 3D engine and tool development team

ThunderSoft entered the automotive business

Start-up

Fast Growing

Continuously Expanding

2015



First MP, Mitsubishi Electric global platform, Honda China models

2016

Designated supplier for GAC G2 Platform



Acquired Rightware and Appsys

2017

MP of smartphone link products in global projects

Established Automotive Research Institute with Chongqing Government

2018

20+ Production projects



Acquired MMSolutions

2019



Audi e-tron CMS, a world's first

2020

50+ Production projects



World's first SA8155 MP on GWM SUV

ASPICE CL2

2021

Surround view products MP on several models

Committed to autonomous driving. Established ThunderX, and acquired Forvision.

2022

Established JV with JAC and Horizon Robotics

Intelligent Cockpit OS Technology won the prestigious 2021 Beijing Science and Technology Award



eCockpit 1.0 Launched, featuring Kanzi + Cluster + IVI



eCockpit 2.0 Hypervisor-based fusion digital cockpit

DMS & AVM Product launched

eCockpit 3.0 QNX Hypervisor + Qualcomm platform, world's first MP



AVP product launched

eCockpit 4.0 Support 4+ multi-screen interaction



Smart DVR & Carlog product launched



eCockpit 5.0 Integration of AI and self-parking

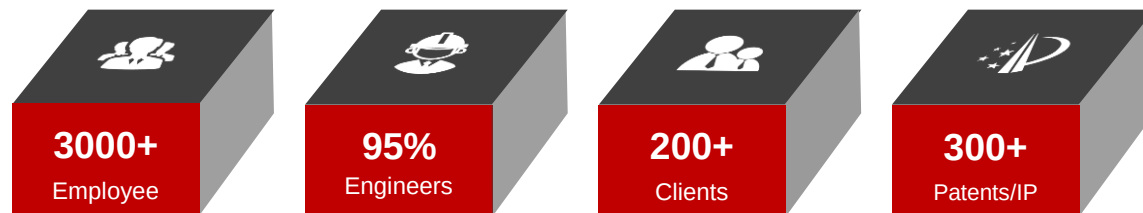


KanziOne launched



eCockpit 6.0 changeable screen + AI Assistant + smart scenario

Global Automotive Business and Service Network



Cities	Responsibilities
Beijing	HQ, Product Development, Advance Development, KDC (Kanzi Design Center), Qualcomm ODC, GM ODC
Shanghai	Product Development, Advance Development, Mass Production Development, KDC
Shenyang, Wuhan, Nanjing	MP Development, KDC
Dalian, Chengdu	MP Development
Tokyo	ThunderSoft Japan, FAE
Nagoya	NDC
Seoul	NDC
Helsinki	RIGHTWARE KDC HQ
Sofia	MM Solutions A ThunderSoft Company
Kiev	KDC, Europe R&D Center
Munich	Sales Offices
Detroit, Toronto, Silicon Valley	NDC

Deep Cooperation and Partnerships

Semiconductor Industry Cooperation



- Customer Support
- Engineering Services
- Chipset Solutions
- Camera software customization and ISP tuning



- Engineering Services
- Customer Support
- Cockpit Reference Design



- QNX Hypervisor adaptation for Android
- Android baseline maintenance
- Cockpit reference design
- Camera software customization and ISP tuning



- Connected DA Turnkey Solutions
- Customer Support



- MT2712 Android adaptation



- Camera software customization and ISP tuning



- NV chip ISP Tuning
- NV chip AVM Solution
- NV chip Camera Software



- Engineering Services
- Customer Support
- AVM Reference Design



- Engineering Services
- Joint Software Platform Development
- J-Series Chip Parking Solution



- Cockpit baseline maintenance
- Camera software customization and ISP tuning



- IVI/Radio/Gateway solutions based on NXP chips
- Camera software customization and ISP tuning



- Join SOAFEE SIG to jointly develop HPC software architecture

Technology Partnership



- IndiGO Platform Technology



- Basic software products and toolchain



- TAI ecosystem applications/services



- Azure and Technology
- TTS and AI Technology



- Virtualization Platform Technology
- Tanzu CI/CD Platform



- Cloud Native SDV Platform Technology
- HPC Technology Collaboration



- AutoSec Products and Technologies



- AutoSec Products and Technologies

Automotive Related Subsidiaries



World's Leading HMI Design & Development Technology



World's Leading Vision Technology



Self-Parking Technology



AD Domain Controller & HPC



Next Gen IOT & Vehicle OS



Advanced Qualcomm Hardware Reference Design & Qualcomm Cleanroom



AIoT Innovation & Startups Acceleration Platform (VC)

Customer Overview

ThunderSoft automotive customers include almost all domestic and global TOP OEMs and Tier-1s



SOP References (Most Recent)



Beijing Hyundai Mistra
IVI



Kia Carnial/K3
IVI



Enovate ME5
Cockpit



GAC Aion Series
Cockpit, AVM



GWM WEY Series
Cockpit



FAW HongQi Series
Cockpit, SmartDVR



HiPhi X
SOA, Cockpit



Weltmeister W6
Cockpit, AVM, DMS, SOA,
Scene Engine, SmartDVR



Geely Coolray/Emgrand
L/X7 Sport
Cockpit



XPeng P5
Cockpit



SAIC Rising Marvel R
Cockpit, SOA, QA PF



GM 20+ Global Models
ODC, IVI APP + FW



Nio All Models
AVM, SOA



SAIC IM L7/B
Carlog, CMS



Chery EXEED Series
Cockpit



Voyah Free
HMI



Toyota All Models
Kanzi



Lincoln Global Models
Kanzi



Ford Global Models
TSP, HMI



SGM Buick GL8
APP, HMI, Toolchain



GWM Haval H6/Cool Dog
Kanzi



JAC A432 Series
Cockpit, AVM, SmartDVR



FAW Bestune Series
Cockpit, SmartDVR



DF Kia Sportage Ace
Cockpit

Smart Vehicle Products and Services



Smart Cockpit



eCockpit Platform



Kanzi



Smart Assistant



FaceID/DMS



AudioCore



Mobile Link



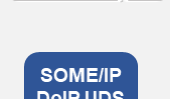
Cockpit Reference Hardware



Vehicle OS



Cube Framework



Cube OS



Cube AP



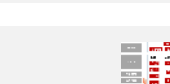
Cube Protocol Stack



Cube DeviceWare



Cube Service



Toolchain (w/MBD)



FOTA



Smart Driving



AVM



IMS



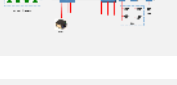
AVP/RPA/HPA



Smart DVR



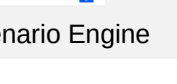
CMS



CarLog



XDC



ISP Tunning



Automated Testing



AutoCloud



AutoStudio



AutoBooster



AutoRobot



Cloud



TSP



Smart Scenario Engine



DevOps



Autonomous Driving Cloud

Core Technologies

Linux

Android

AutoSAR

Graphics

Camera

Network

Audio

Auto Test

ML

QNX

Hypervisor

Safety

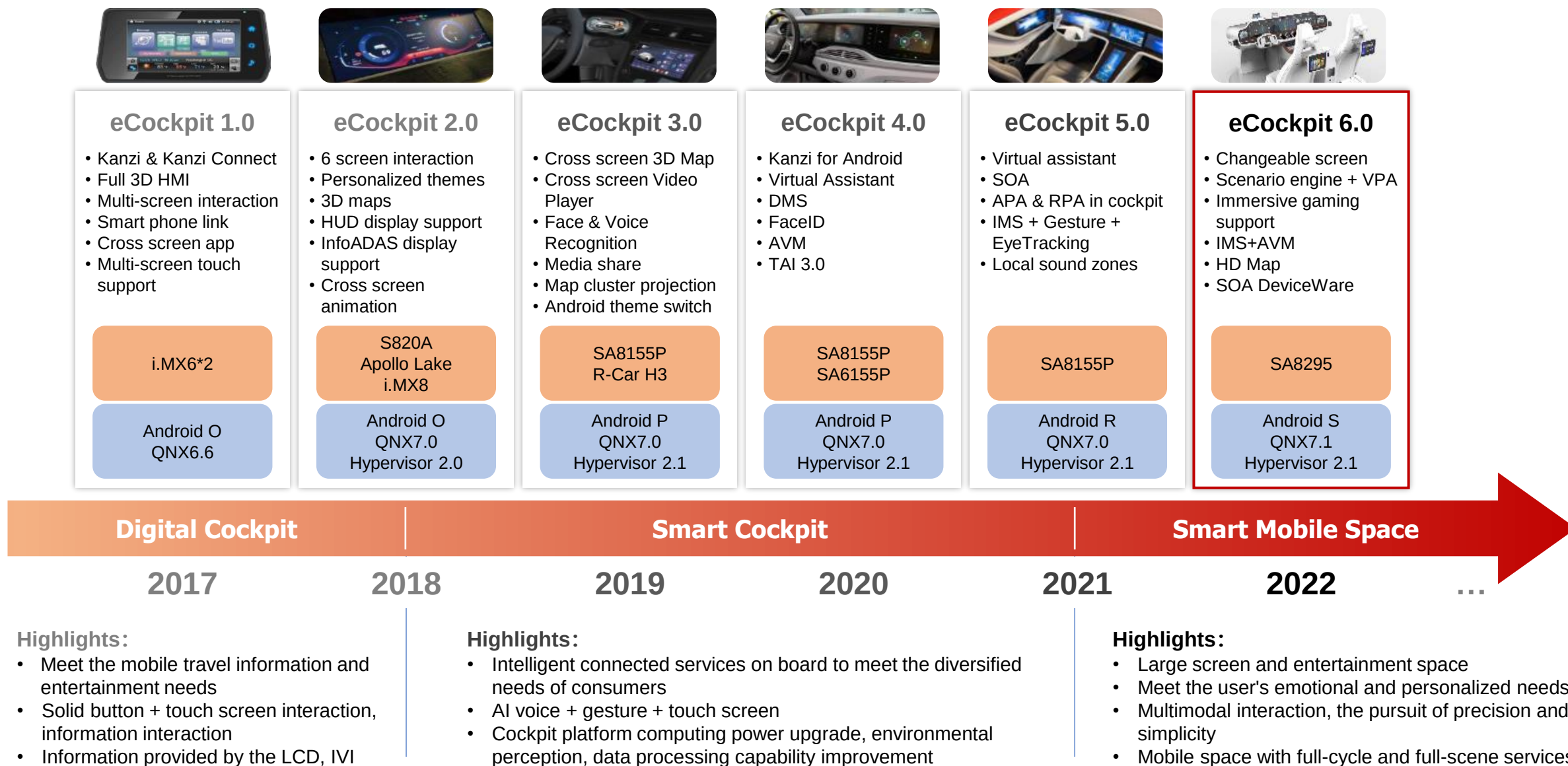
Security

MBSE

HMI

Connectivity

Smart Cockpit Product Development Roadmap



eCockpit 6.0: Next Gen Smart Cockpit Solution

Next Gen mobile space platform that provides users with an immersive entertainment space that meet users' needs for emotional, personalized and multimodal interactions.



- Qualcomm SA8295
- Interactive themes
- VPA Smart Assistant
- Smart Scenario Engine
- Immersive gaming experience
- QNX + Android in one screen
- Multi-screen fusion
- Immersive self-driving, self-parking and HD map navi
- 360 True surround view, DMS/FACEID, OMS
- SOA, cross-domain communication middleware
- Comprehensive link support for HiCar, CarPlay, Android Auto, etc.



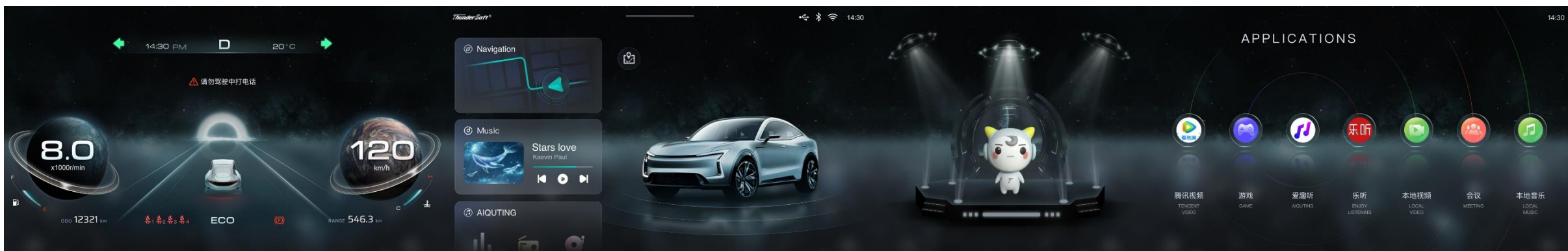
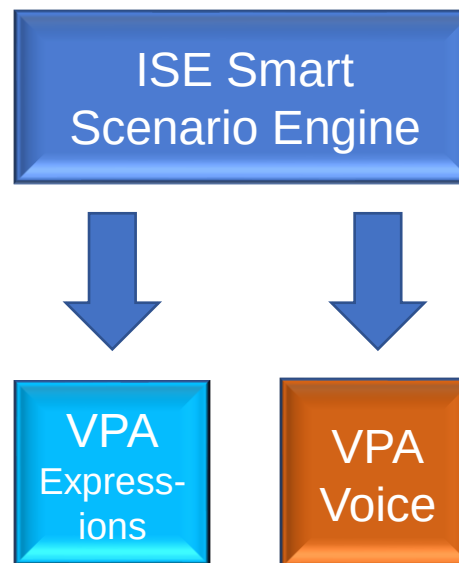


e-Cockpit Solution

ThunderSoft
e-Cockpit 5.0

VPA Smart Assistant

VPA's appearance and expressions are continuously updated via cloud, combined with the scenario engine to make the interaction more emotional



The World's First All-In-One development toolchain for Next Generation Cockpits,
Deep integration with Android makes multi-screen interaction across OS (QNX, Android, Linux) easy to develop



NEW RENDERING PIPELINE

Platform-independent graphics engine for best- in-class 3D rendering

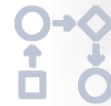
- Built-in physically based HDR rendering pipeline
- Support for glTF file format, to import thousands of high-quality 3D models



KANZI FOR ANDROID

Native Java support for deep Android integration

- Native Java and Kotlin support
- Kanzi Engine integrated into Android UI thread
- Free composition of Kanzi views within Android UI



NEW UI WORKFLOW

Optimized UI workflow for extreme efficiency

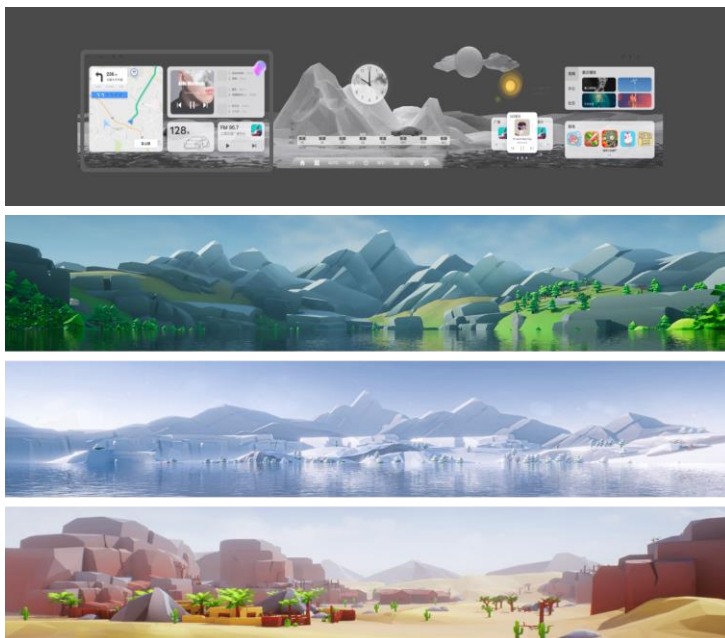
- Modular project management
- UI state monitoring in Kanzi Studio
- New UI workflow management



Kanzi One Cockpit Development Toolchain

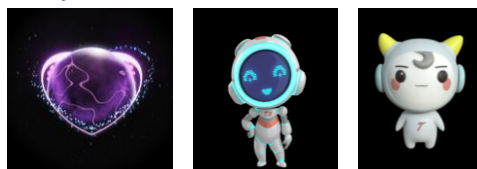
Kanzi For 3D Launcher

- Transition from 2D dimension to 3D dimension
- Advancing towards the concept of the metaverse



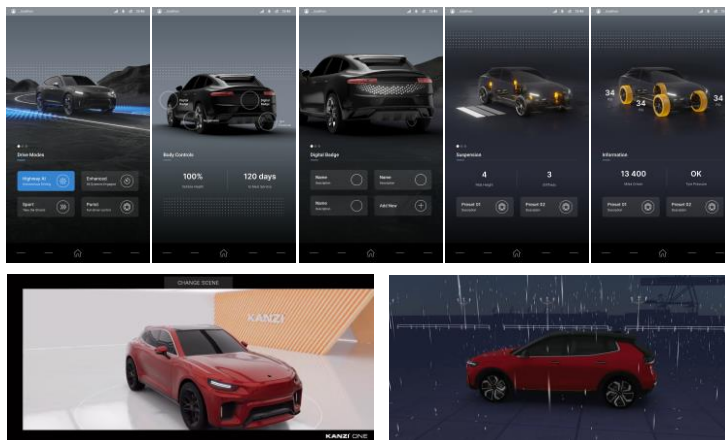
Kanzi For VR Assistant

- Real-time rendering 3D model,
- Easy to add decorations to VR assistant



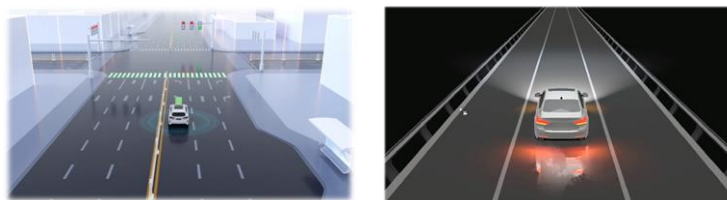
Kanzi For Car Setting

- Real-time rendering 3D car model
- Better visual performance and UI/UX



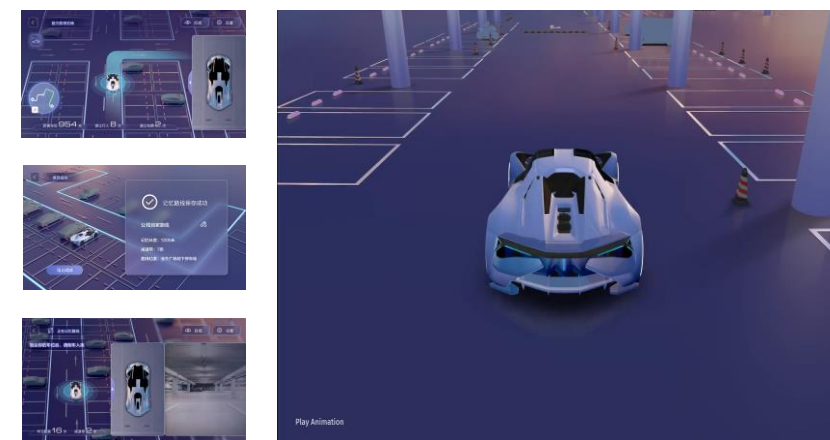
Kanzi For HD Self Driving

- Real-time reading data & real-time rendering
- Easy to create multiple UI themes
- Support HD Map, ADAS data



Kanzi For Auto Parking

- Real-time reading data and real-time rendering
- Supports AVM、APA、RPA、HPP、AVP

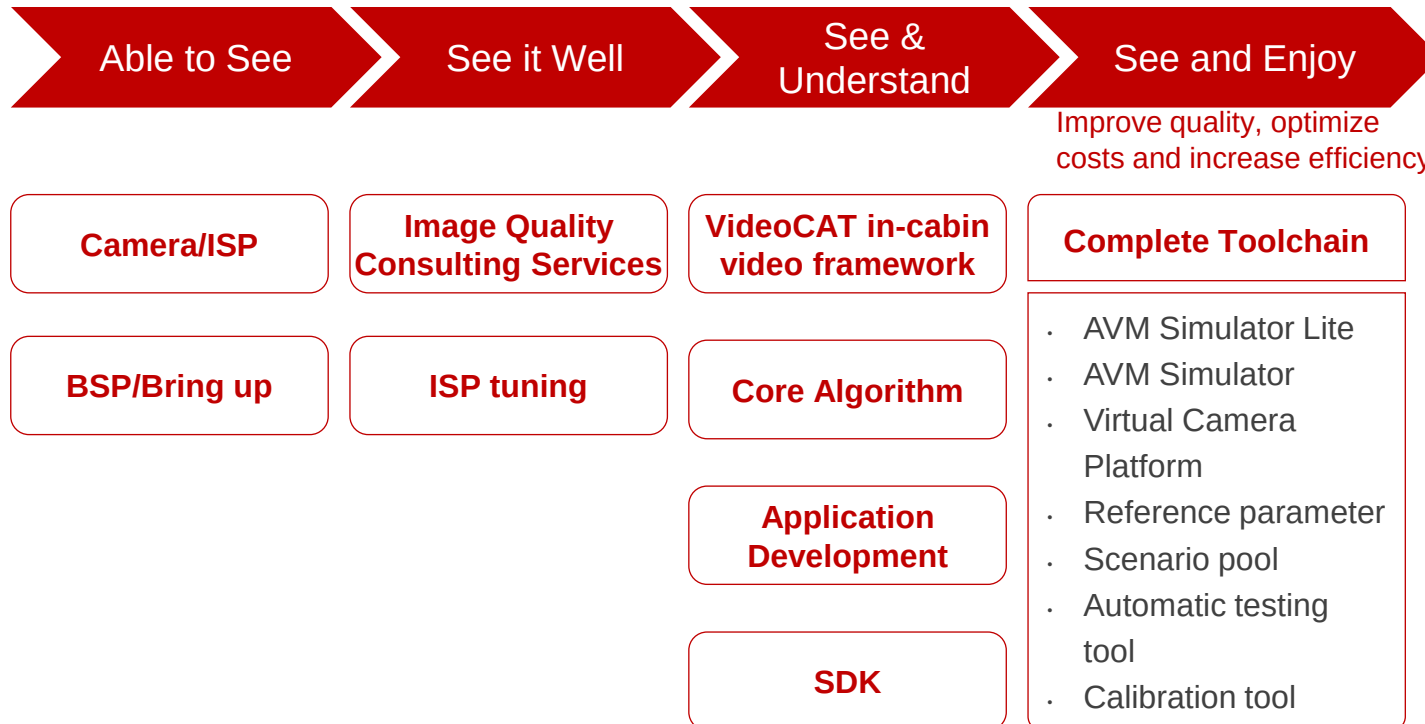


AVM Product & Solution

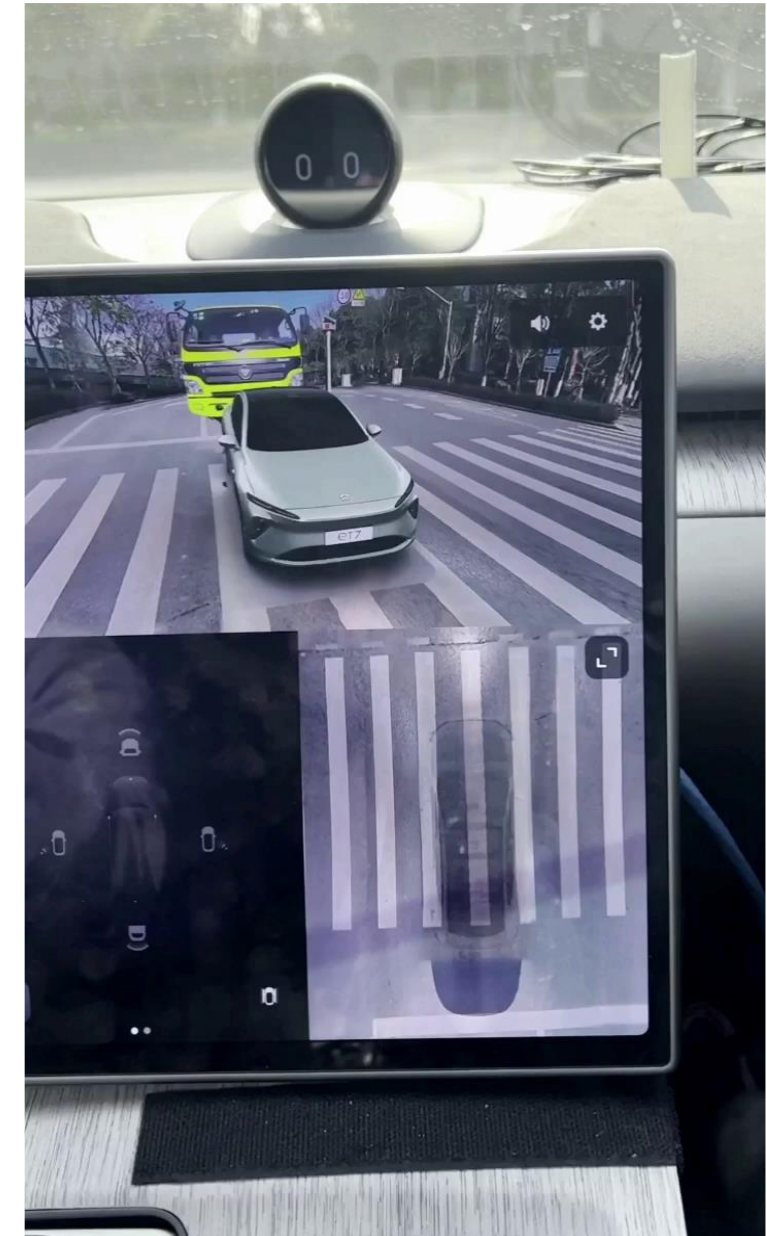
Industry leading domain controller level immersive AVM solution.
Full stack and high-quality algorithm and functions,
game like cool graphics and motion effects.

MP on domestic and global OEM models ,
including 4 flagship models, and 10+models in development

Full-stack AVM products and solutions



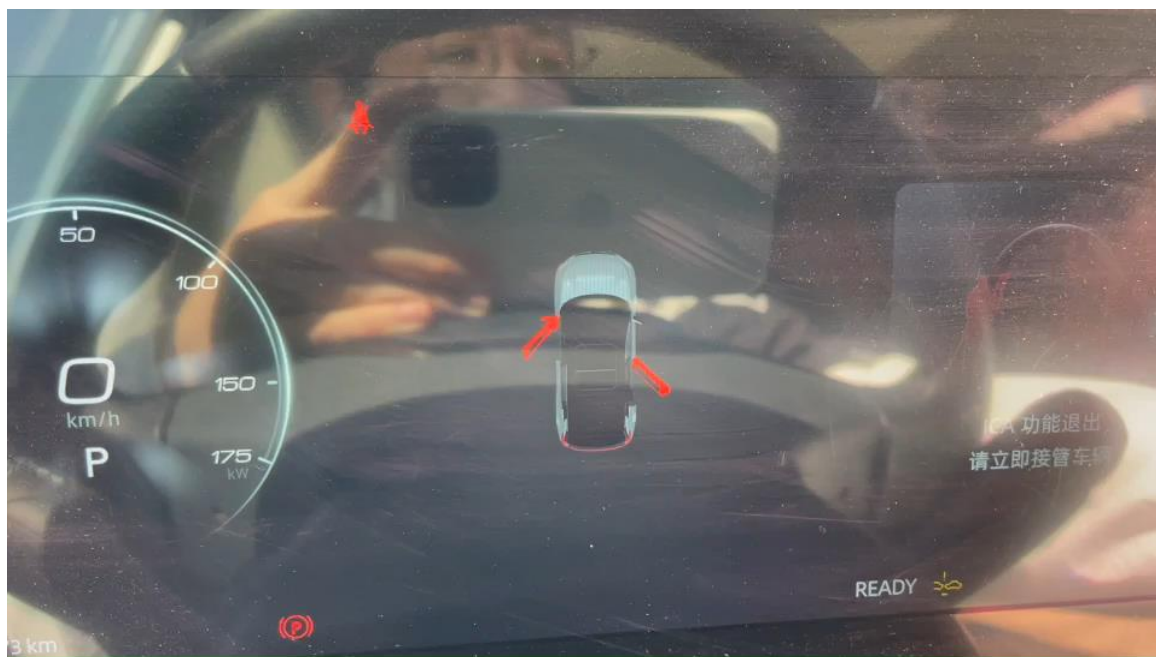
NIO ET7



IMS In-Cabin Vision Algorithm Solutions

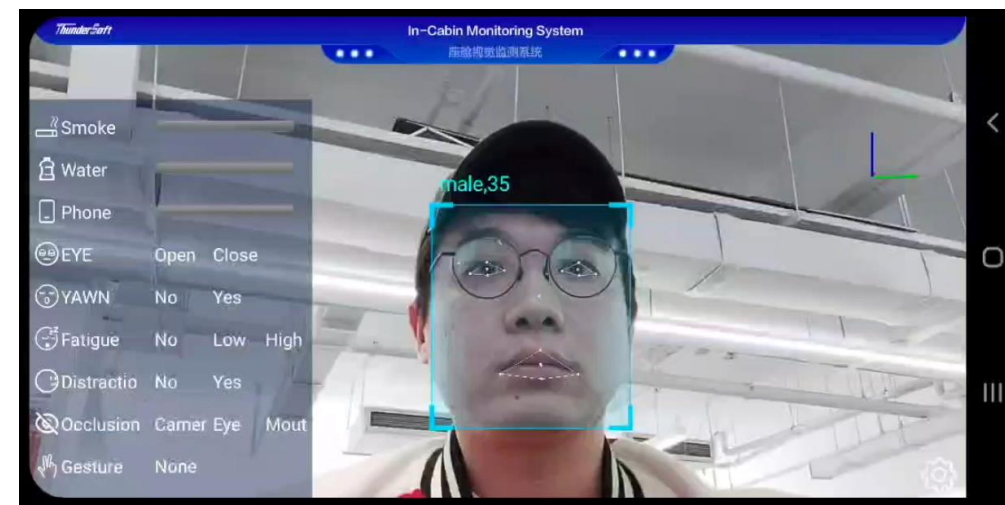
IMS algorithm and solution already integrated in various MP models from OEMs such as Weltmeister, FAW and GAC.

Weltmeister W6



FaceID on QNX,
Quick and seamless login to interact with driver personal comfort settings

DMS Algorithm Demo

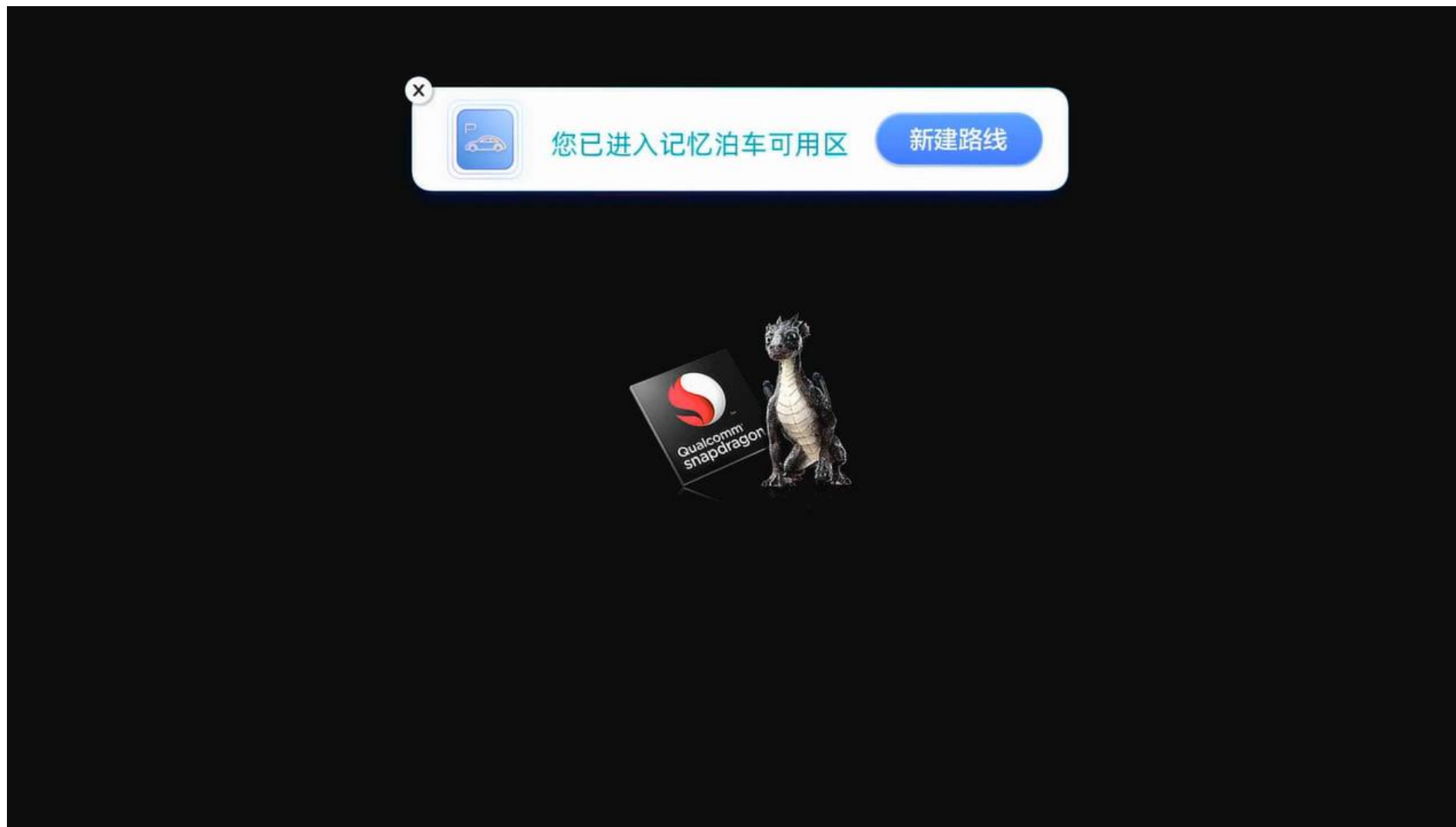


Multimodal Interaction with VPA, HMI, etc.



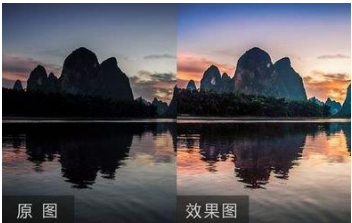
AVP Solution

Industry leading domain controller level immersive AVM solution. Full stack and high-quality algorithm and functions, game like cool graphics and motion effects.



Smart DVR seeks differentiation from traditional DVR solutions to meet the individual needs.
Integration of cutting-edge vision algorithms to achieve InfoADAS functionalities.

DVR Functions



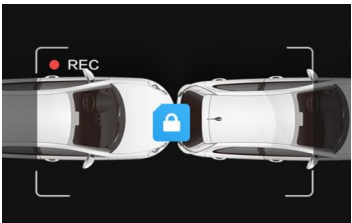
One-Click Filter



Mobile Sharing



One-Click Capture



Emergency Recording



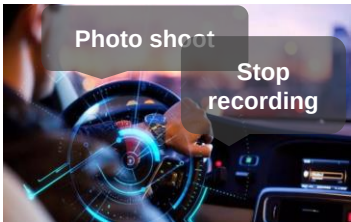
Tiktok Video Recording



Road Book



Live Streaming



AI Speech Control



Upload to Cloud

ADAS Functions



FCW
(GB/T 33577-2017)



BLW



HM



PCW

CMS Solution: Digital Rearview Mirror System

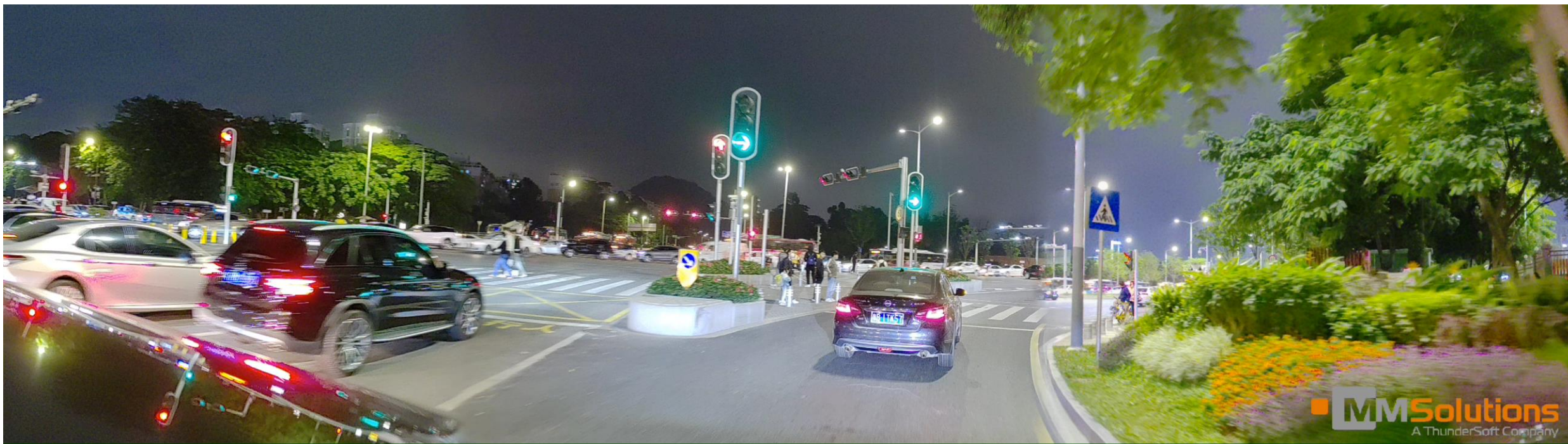
Audi e-tron is equipped with the World's First mass produced digital rearview mirror system based on Thundersoft's CMS solution with LED anti-flicker, HDR, low latency, etc.



CarLog: Ultra-Wide HD Smart Camera System

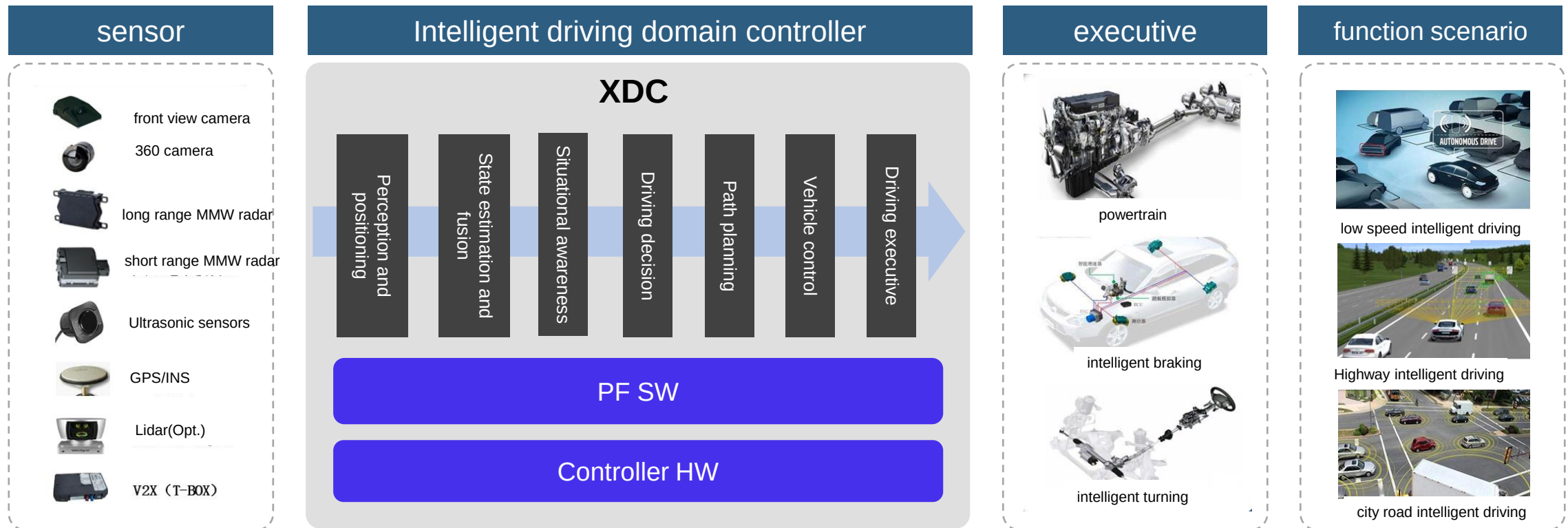
Users can record distortion-free 180° ultra-wide 4K video of cities, mountains, seas and stars while driving. Videos and pictures can be stored and edited locally, and owners can share these moments.

IM Motor L7



XDC L2+ Smart Driving System Solution

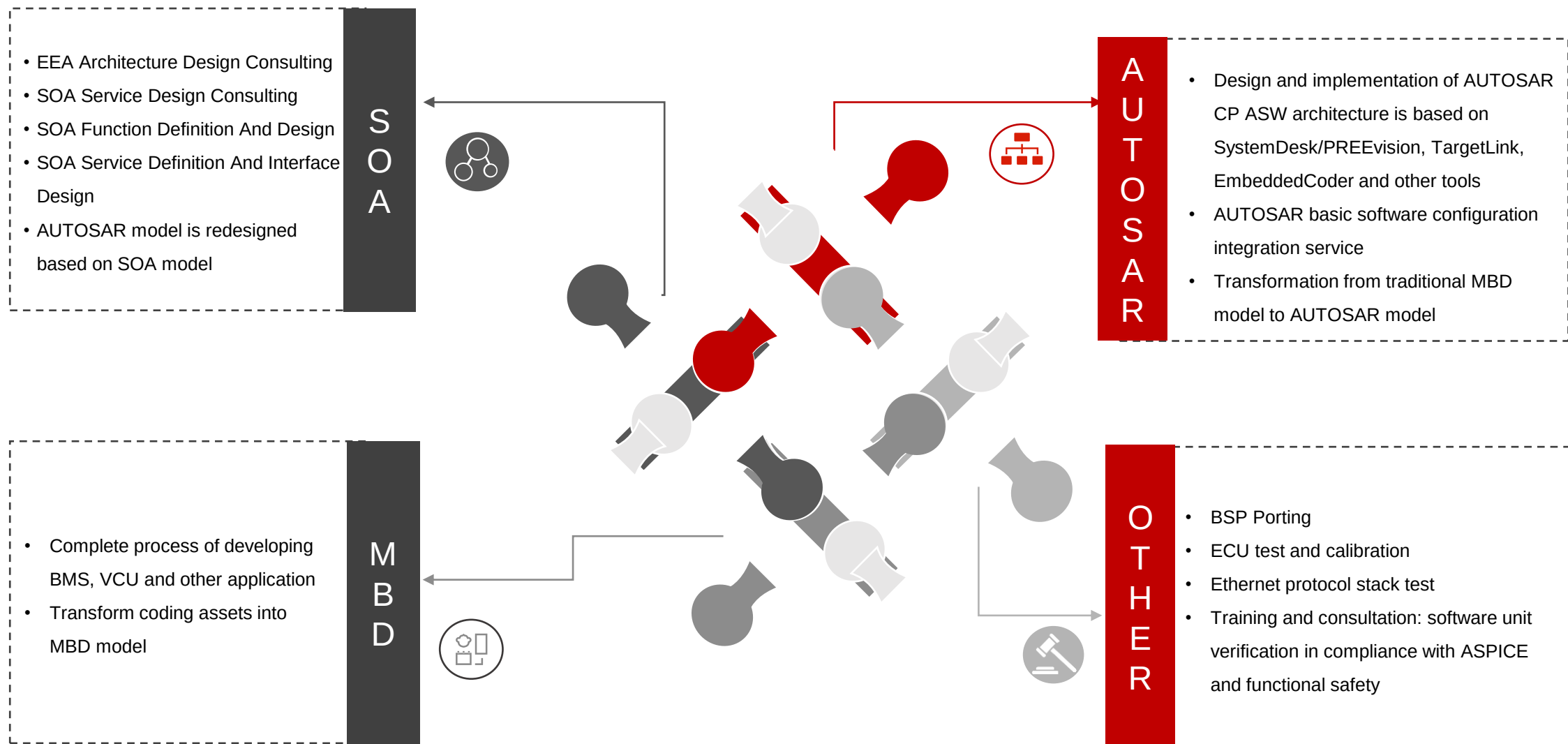
Intelligent driving domain controller (XDC) is the control center of intelligent driving system. Include controller hardware and software platform for L2+ autonomous driving development



Cube Product Overview



Cube Service



Zonal Gateway Communication Acceleration Solution

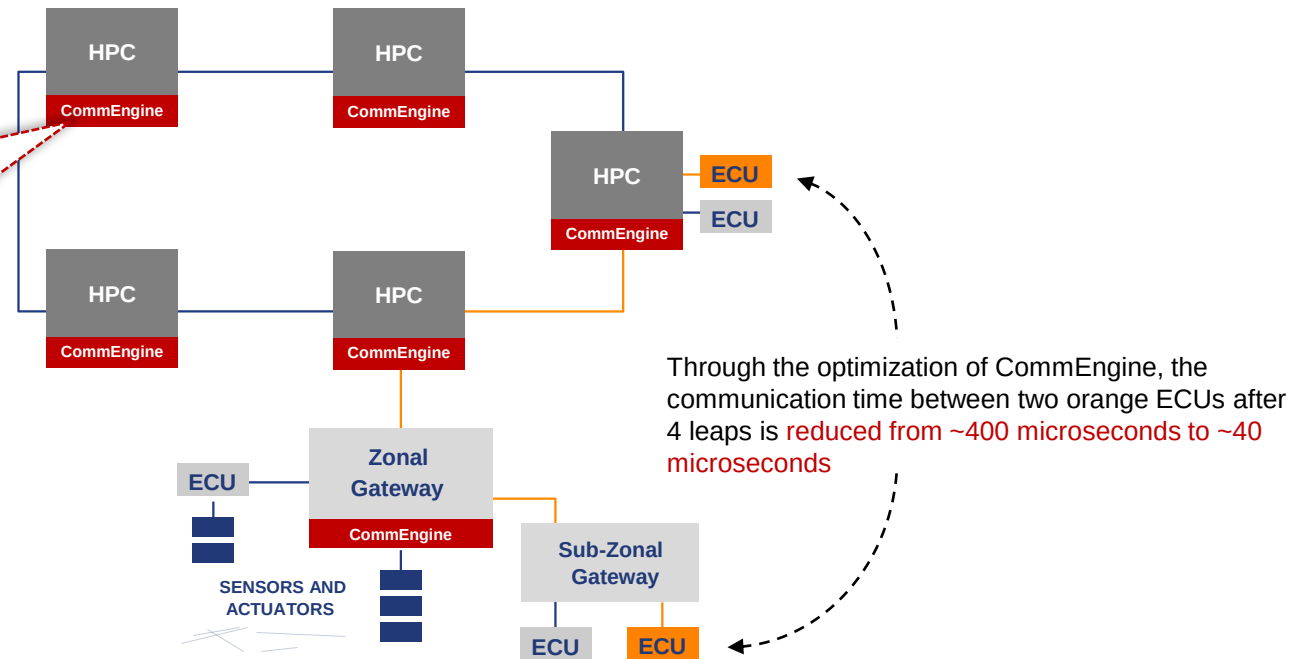
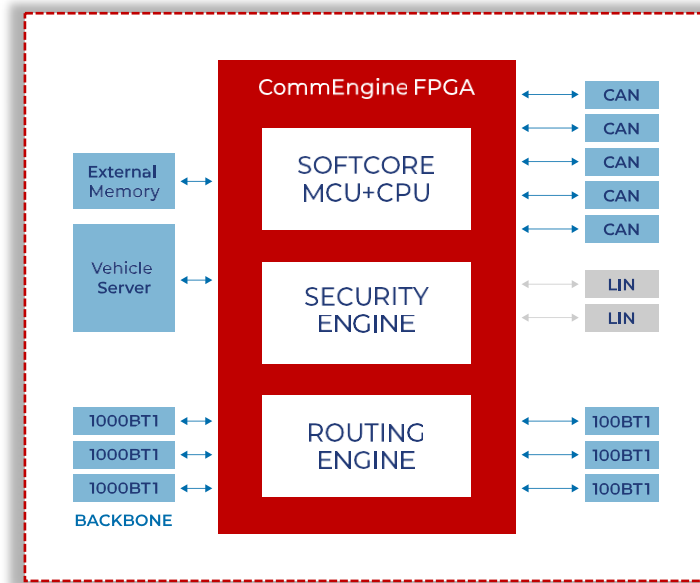
High-performance and cost-effective single-chip zonal gateway routing communication acceleration solution for ultra-low latency and gigabit+ bandwidth

Core Benefits

- Network and application acceleration
- Easy-to-integrate single-chip solutions
- Cost-reduce MCU+Switch solution
- Communication security and anti-tampering features
- Support for ETH, TSN, AUTOSAR PDU routing
- Reduced entire vehicle harness with Zonal EE
- Available in core IP, FPGA or ASIC

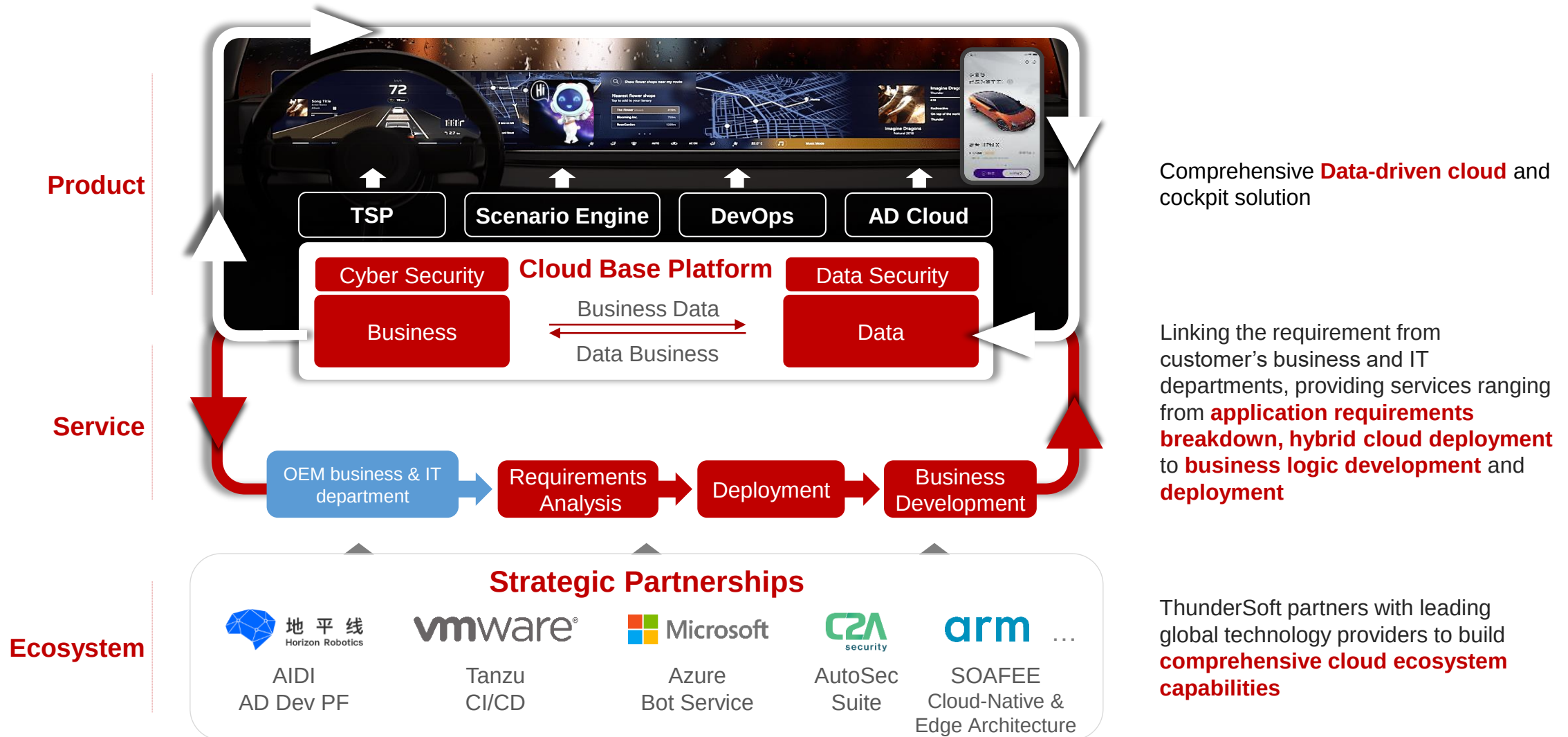
Usage Scenarios

- **Sub-Zonal gateway:** aggregates low bandwidth interfaces (CAN, LIN, sensors, I/O) into a single high bandwidth upstream interface (ETH), such as a zonal gate module.
- **Zonal gateways:** for routing, PDU construction and reconfiguration, streaming, security and gigabit+ switching between low and high-speed interfaces.
- **HPC:** for interconnecting high-bandwidth backbones with external sensors, ECUs and gateways.



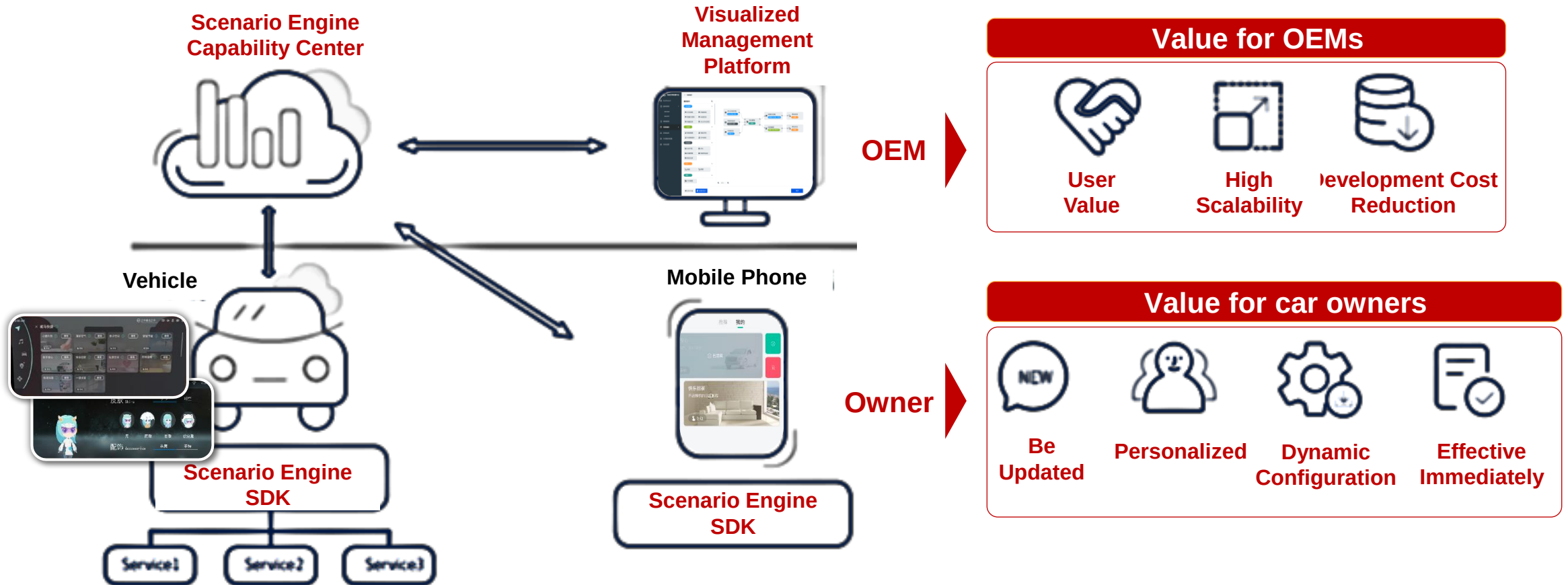
Cloud Products and Services: Data-driven Automotive Cloud Solutions *ThunderSoft*

Based on comprehensive technical support and ecological source integration capabilities, we provide complete automotive cloud product and full lifecycle service for OEMs



Smart Scenario Engine: SDV Development Mode

Owners may customize scenarios to meet personal needs with mobile APP and IVI.
For OEMs, operator or product manager, may develop complex scenarios and deploy them OTA-less with visualized simple click & drag operation



Thundersoft partners with Microsoft Azure Cognitive Service to bring human voice and emotions to ThunderSoft AI Assistant XiaoDa

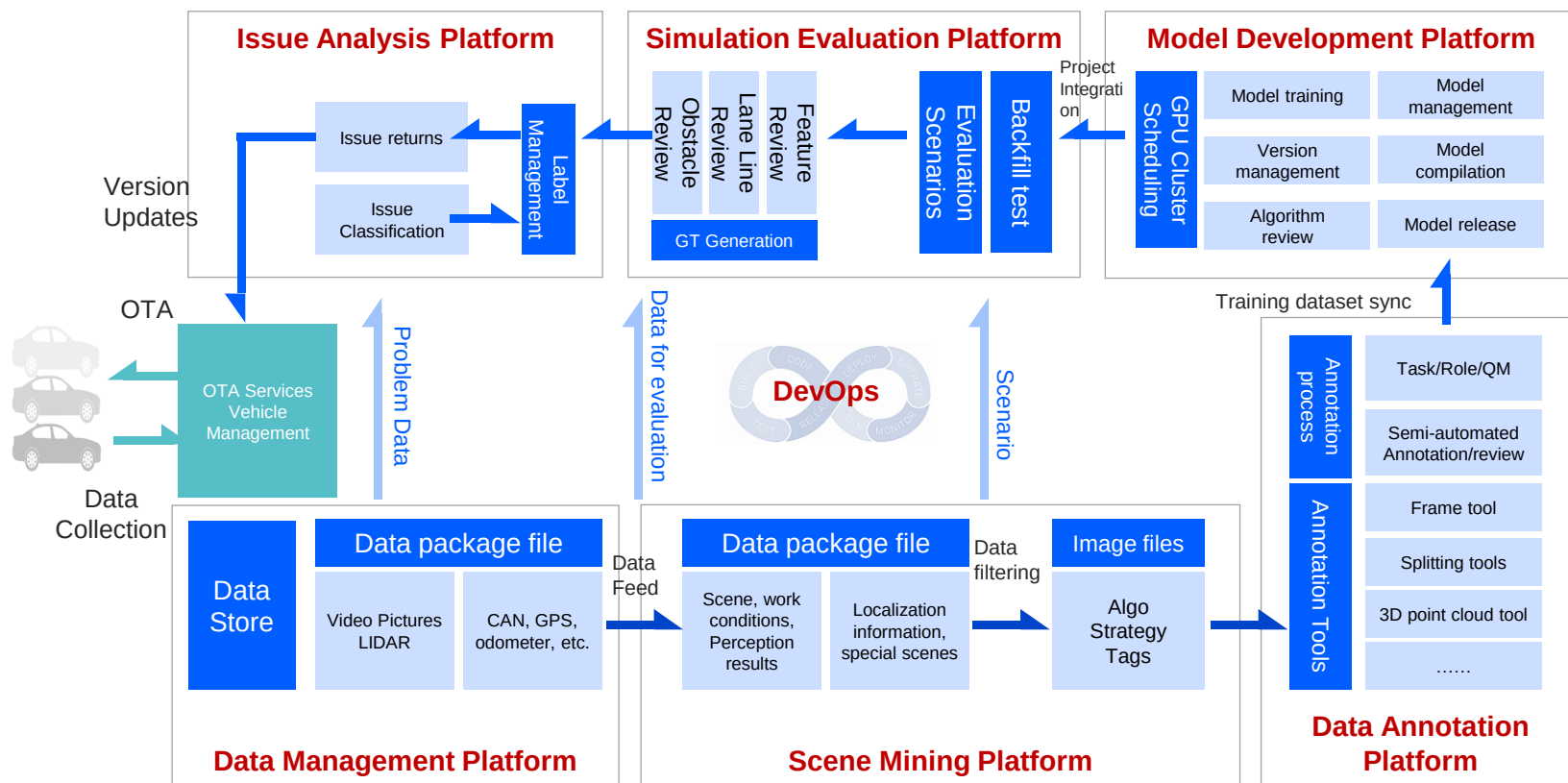
Smart Scenario Engine + Cube DeviceWare

Internally, DeviceWare connects the cockpit domain with the rest of the vehicle, externally, it acts as SOA gateway to link the cloud with the car and smart devices.



AD Cloud Solution

Leverage end-to-end data for significantly cost reduction and efficiency in L2+ autonomous driving R&D



Efficient corner case scenario mining loop

- 400+ scene tags, scene library construction
- Real-time synchronization of mining rules between car and cloud
- Difficult scenario attribution and update

Fully automated closed-loop data workflow

- Full automation: from data filtering, labeling, model training to version release
- 20x improvement in R&D efficiency

Mass production R&D experience

- Built-in, continuously updated MP datasets
- R&D evaluation paradigm for smart driving
- 4D annotation + automatic annotation



Thundersoft partners with Horizon collaborate to provide AD Cloud customize development, private deployment, operation and maintenance based on AIDI SaaS platform

Cyber Security and Compliance Solutions

Provide Comprehensive automotive cyber security solutions for OEMs, covering CSMS, embedded security, ISO21434 consulting and GDPR solutions



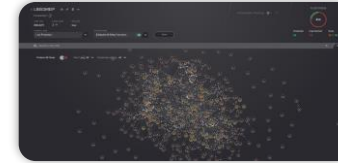
AutoSec Analysis

Easily meet the requirements of WP.29 and ISO 21434 to manage risk throughout your organization with scalable TARA.



AutoSec Network

Design, deploy, and maintain in-vehicle network protection with embedded Ethernet and CAN software IDPS solutions.



AutoSec Endpoint

Analyze vehicle SBOMs, protect against vulnerabilities, and enable real-time risk elimination at the ECU level with embedded operational protection solutions.



Audit Manager

Facilitate ongoing audits of data usage to simplify the assessment of risk and compliance with relevant regulations and compliance. Converts incoming audit evidence into auditor-friendly GDPR reports.

WP.29

Cybersecurity Management System (CSMS)

OEMs must demonstrate compliance with the information security management process as defined in the regulations at each of the following stages

1. Development phase
2. Production (implementation) phase
3. Post-production phase

Type Approval

The certification required for each vehicle off the line. Each vehicle's type certification requires a series of information security processes managed in the CSMS system.

ISO 21434

Organizational Project Management

- Organizational Cybersecurity Management
- Project Dependent Cybersecurity Management
- Distributed Cybersecurity Activities

Vulnerability Management

- Continual Cybersecurity Activities

Conceptual Phase

- Threat Analysis And Risk Assessment Methods (15.3 – 15.9)

Development Phase

- Product Development

Post Development Phase

- Cybersecurity Validation

GDPR

Encryption and masking of personal data

Ability to restore the availability and accessibility of personal data in a timely manner in the event of a physical or technical incident

Ensure the continued confidentiality, integrity, availability and resilience of processing systems and services

Regular testing and continuous evaluation of the effectiveness of technical and organizational measures (TOMS)

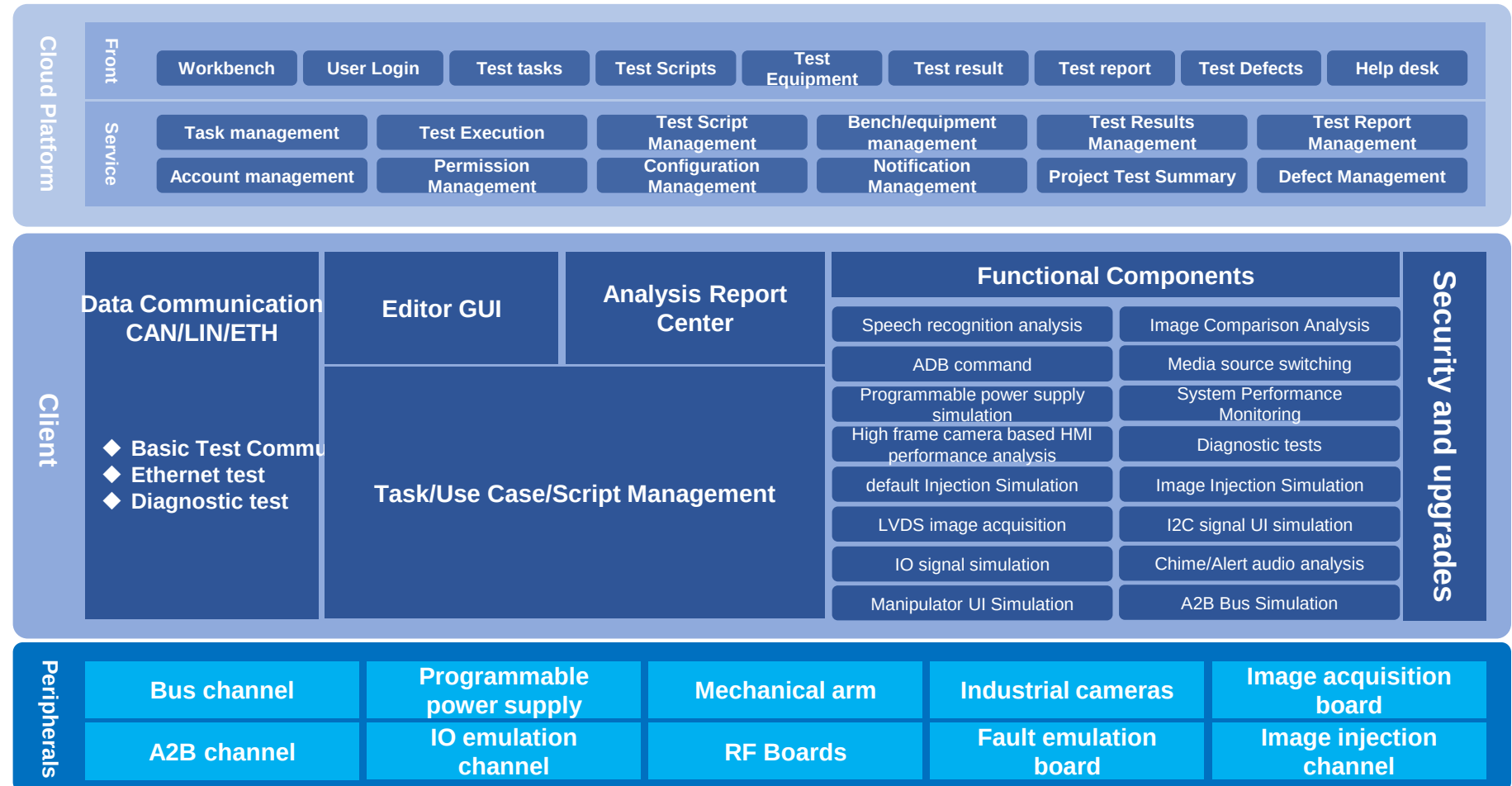


Thundersoft partners with C2A and AWS to provide customer with complete cyber security and compliance solutions

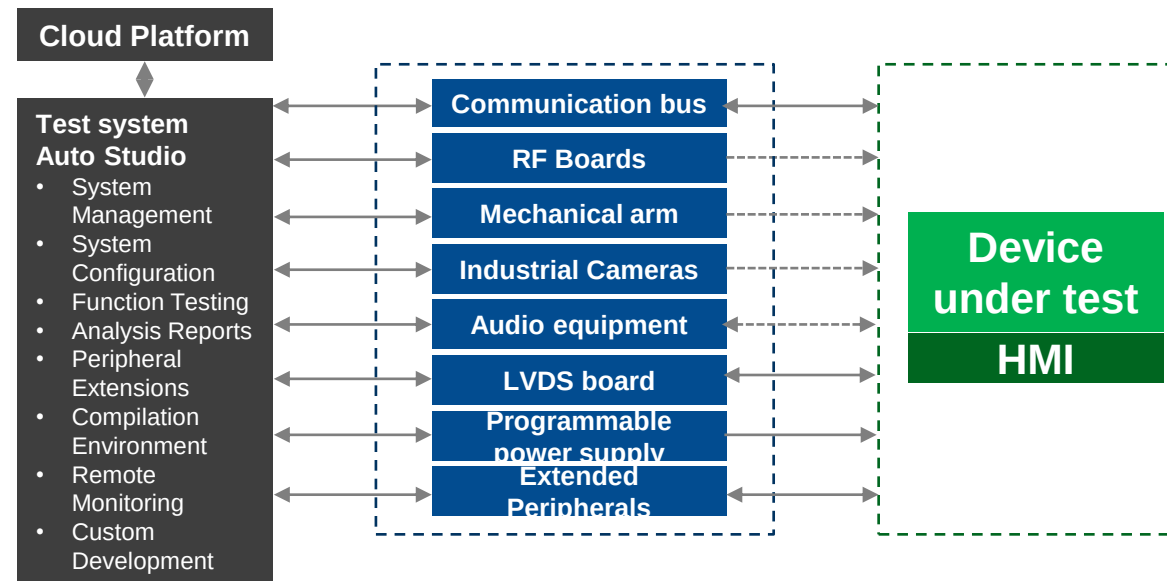
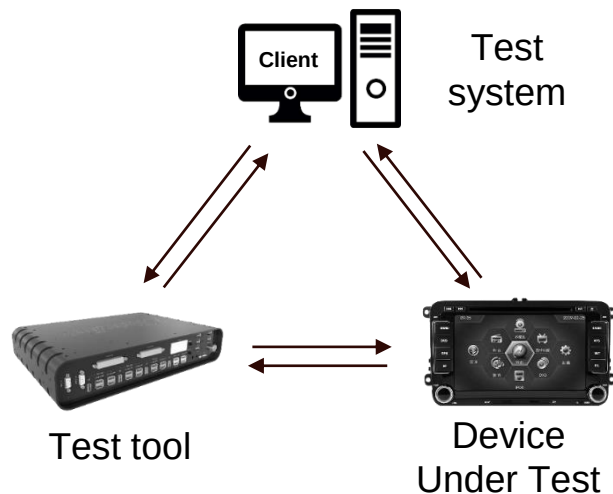
Automated Testing system

Thundersoft's testing systems and tools are used in cockpit, vehicle, autonomous driving, and network connectivity, saving a lot of time and cost for development and testing, shortening the development cycle and improving product reliability at the same time

- Development in Java, Python languages.
- Support for mainstream communication tools.
- Cloud-based BS architecture, client CS architecture.
- HTML reports.
- Support for multitenancy.
- Support for use case repository sharing.
- Integration of rich APIs;
- Local server deployment.
- Private cloud deployment.
- Public cloud deployment.



Automated Testing: Systems Blocks and Applications



Smoke test



Function test



Performance Test



Special test

Software Development

- ◆ Improve software development and testing efficiency
- ◆ Speed up software update iteration
- ◆ Reduce testing labor costs

Single Acceptance

- ◆ Improve product testing efficiency
- ◆ Improve test quality
- ◆ Improve test coverage

System Acceptance

- ◆ Improve the efficiency of cross product testing
- ◆ Reduce the pressure of smart cockpit testing

Road Test

- ◆ Advance development of scripted road test replay
- ◆ Improve test efficiency and quality
- ◆ NG item location, image playback
- ◆ NG item correction retesting

Automated Testing Cloud Platform

- Support for public and private cloud deployments.
- Multi-client, enabling use case resource sharing and unified management of use case assets.
- Remote control, timely processing of test tasks and viewing of test results.
- Collaborative management of test tasks and synchronization to improve project testing efficiency.
- Access to other management systems to realize the digitalization of enterprises.
- Full tracking of test tasks, automation coverage, test data, etc.



Test Task Management

- Kanban Management
- Test Task Status
- Test Execution
- Test Report Display



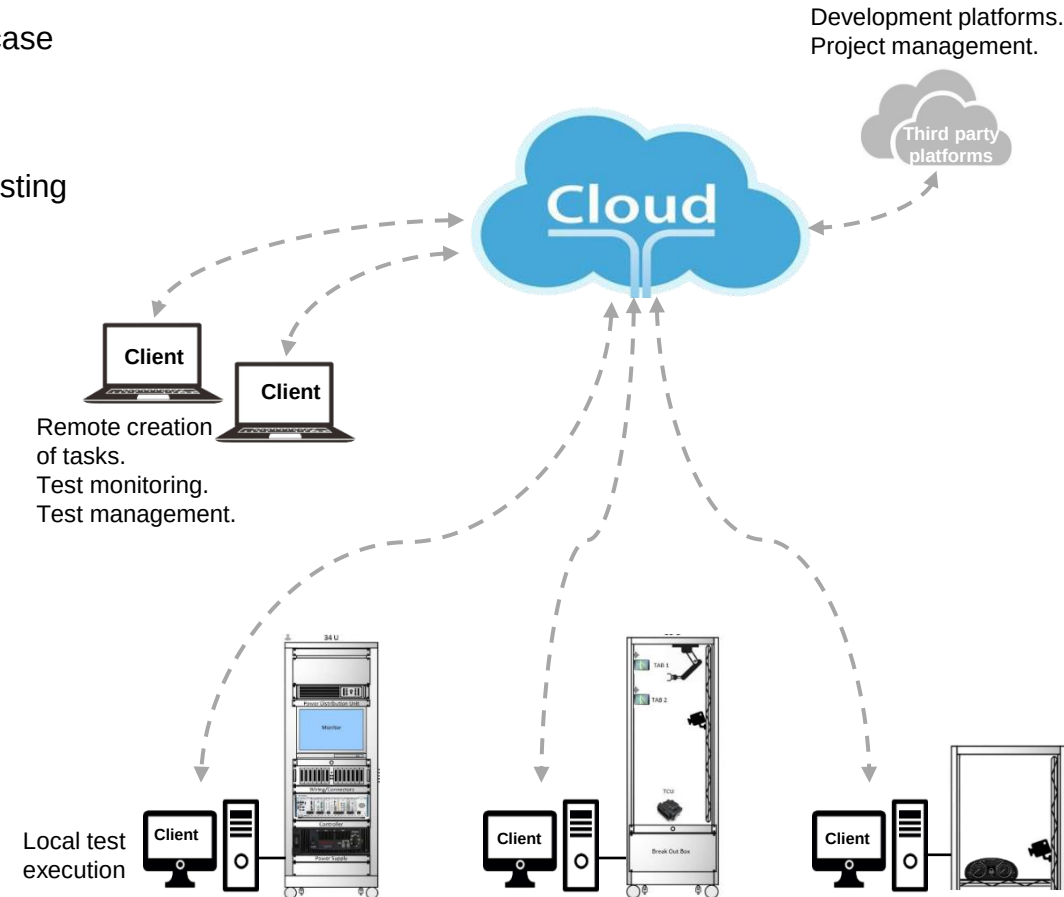
Project Cooperation

- Test Pipeline Management
- Open up the test information chain
- Test task issuance
- Agile development support



Building Special Test Lib

- | | |
|--------------------------------|----------------------------|
| • Instrumentation Special Test | • Multi-screen interaction |
| • Voice Special Test | • UI Touch |
| • Navigation Test | • Telematics |
| • AVM Special Test | • Voltage fluctuation |
| • DMS Special Test | • Diagnostic Test Library |
| • Screen smoothness | |
| • Start-up time | |



Engineering Services

Focus on smart connectivity and smart driving with OS as the core,
providing full lifecycle services for OEMs

On-Site & ODC

Resource Outsourcing

- On-Site
- ODC

Consulting service

Consulting

- Qualcomm Platform Technical Support
- Technical / Development Consulting
- QNX & QNX Hypervisor Consulting

Package (Software development service)

BSP development

- Chip: Qualcomm, NXP, Samsung, Renesas, Intel, TI, etc.
- OS: Android, Linux, QNX
- Hypervisor: QNX, Integrity

Kanzi service

- HMI Design
- Kanzi 3D HMI Development
- Training Services

MCU

- Chip: RH850, RL78, etc.
- Radio
- Audio
- CAN
- etc.

OS development

- Performance Tuning
- System Enhancements
- OS Customization

App development

- Application Customization
- HMI Development

Integration and Testing

- System Integration
- Third Party Software Integration
- FT, IT, ST, RC, etc.



ThunderSoft

The logo features the word "ThunderSoft" in a bold, italicized, red sans-serif font. The letters "T", "h", "u", "n", "d", "e", "r", "S", "o", "f", and "t" are all in red. The "S" is stylized with horizontal lines through it. The background consists of several light gray, slanted rectangular bars of varying lengths, creating a sense of motion or speed.