Agile Development of Software Platform in Intelligent Driving Domain Controller based on AUTOSAR

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Agenda

- Development and Challenge in Intelligent Driving Domain Controller of Baidu Apollo
- MCU Platform Software of Intelligent Driving Domain Controller
- Agile Development of MCU Software in Intelligent Driving Domain Controller
- Summary

Strategy of Baidu Intelligent Driving Group

Apollo in intelligent vehicle、intelligent traffic、Robotaxi

builds core power for growth apart from mobile business

Navi Map

Robotaxi	**Apollo Go**	• Provides Robotaxi service for private customer
Private cars	**ASD** *Apollo Self-Driving*	• **Provides intelligent vehicle solutions for business customer**
City traffic	**ACE** *Apollo Connected Efficient Mobility*	• Provides intelligent traffic solution (V2X), already deployed in 51 cities

The 6th Gen. Robotaxi of Baidu-RT6

Robo Car JiDU ROBO 01

Improvement of traffic efficiency can increase 2.4%-4.8% GDP of China

Baidu ASD Products Matrix

Intelligent Cockpit

Duer OS

Duer SDK

Apollo Robo-Cabin Domain Controller+SDK

Intelligent Driving

AVP
Apollo Valet Parking

ANP2.0
Apollo Navigation Pilot (Highway)

ANP3.0
Apollo Navigation Pilot (Highway + Urban)

An important component of intelligent cockpit

Cooperate with intelligent driving HMI + HD Map

Intelligent Map

Navi Map

HMI-Map

HD-Map

Roadmap of Baidu intelligent driving products

integration of 3 scenes

城市道

高速道

停车场

纯泊车 AVP 1.0

第一代泊车产品 AVP 1.0

- 记忆泊车 HAVP(单层)
- 遥控泊车RPA
- 360°环视AVM
- 超声辅助UPA
- 融合式自动泊车 FAPA

芯片: Zu5 (1.2T) | 传感器: 5V12S

行泊一体 ANP 2.0

高速道行车

- 拨杆变道
- 自主变道
- 自动上下匝道
- 自动进出服务区
- 智能避让
- ADAS、AEB

第二代泊车产品 AVP 2.0

功能进化:

- AVP 1.0所有功能
- 机械车位、低速AEB

性能提升:

- 泊车耗时↓ 建图距离↑ 建图时间↓
- 泊车一体化HMI

芯片: TDA4-VM (8T) | 传感器: 5V12S

芯片: 2 x TDA4-VM (16T) / TDA4VH(32T)
传感器: 9V5R12S

三域融通 ANP 3.0

城市道行车

- 路口直行/右转
- 无保护左转
- 有保护左转
- 路口掉头
- 环岛通行
- 主辅路切换

高速道行车

- ANP2.0 所有功能
- 自动通过ETC

第三代泊车产品 AVP 3.0

功能进化:

- AVP 2.0所有功能
- HAVP(跨层)、过道闸、超长记忆路线……

性能提升:

- 泊车耗时↓ 建图距离↑ 巡航速度↑
- 实时建图

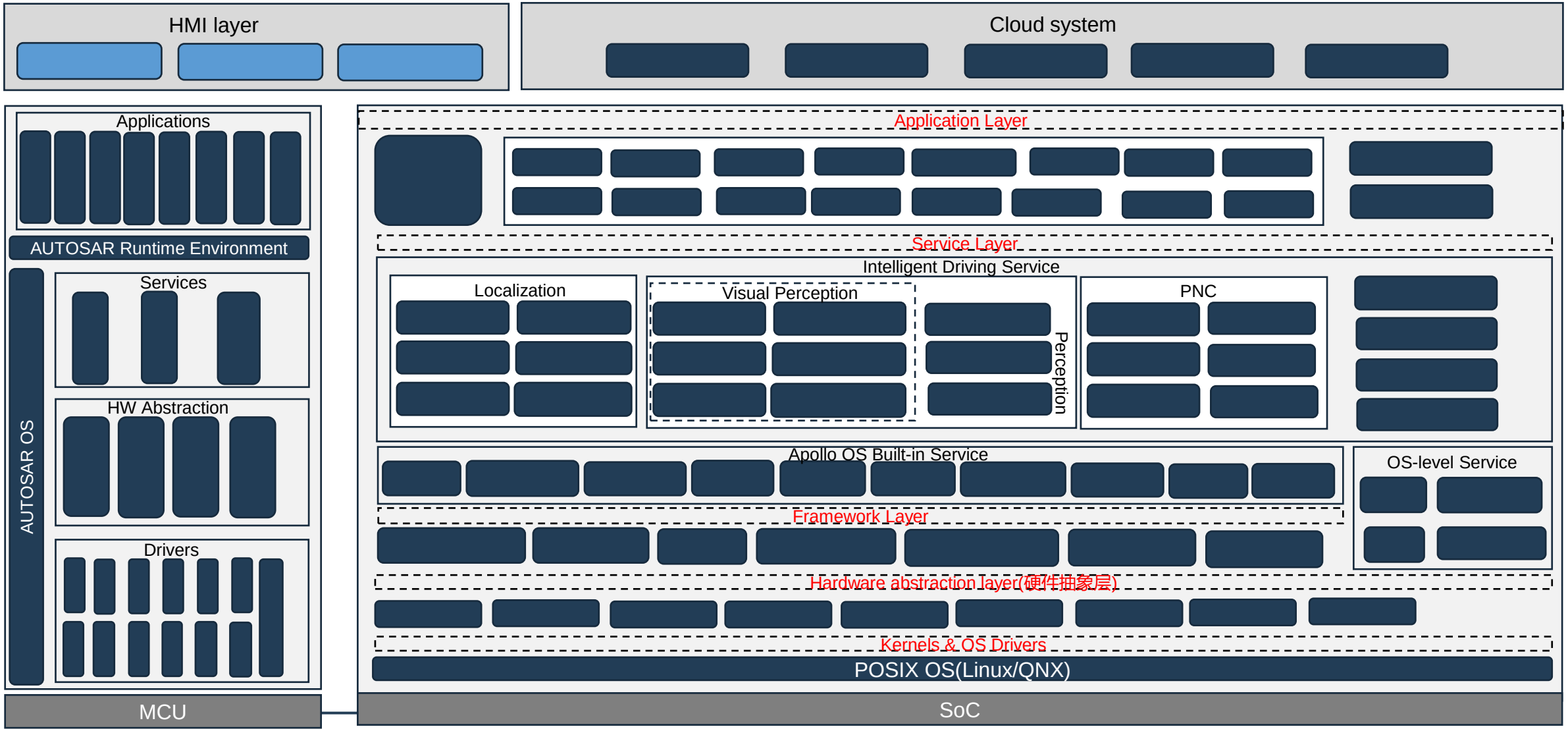
芯片: 2 x Orin-X (508T) | 传感器: 11V5R12S + 2L

低算力: 1.2 TOPS

中低算力: 8-32 TOPS

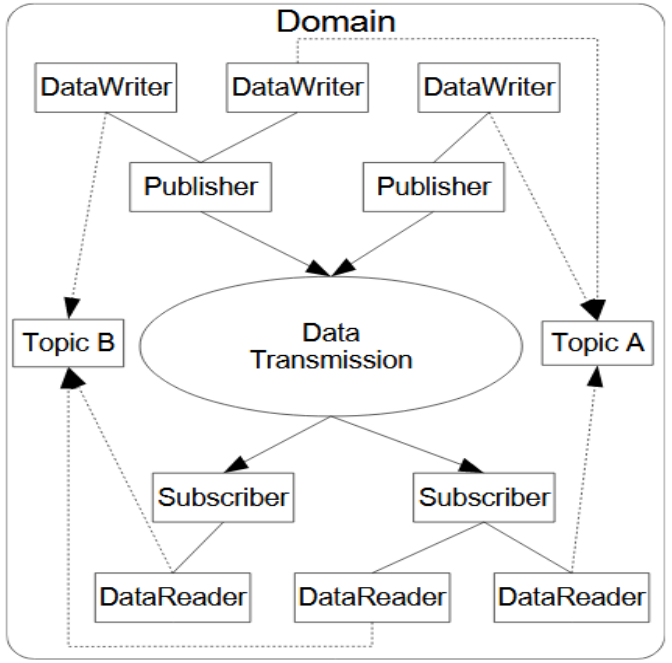
高算力: 508 TOPS

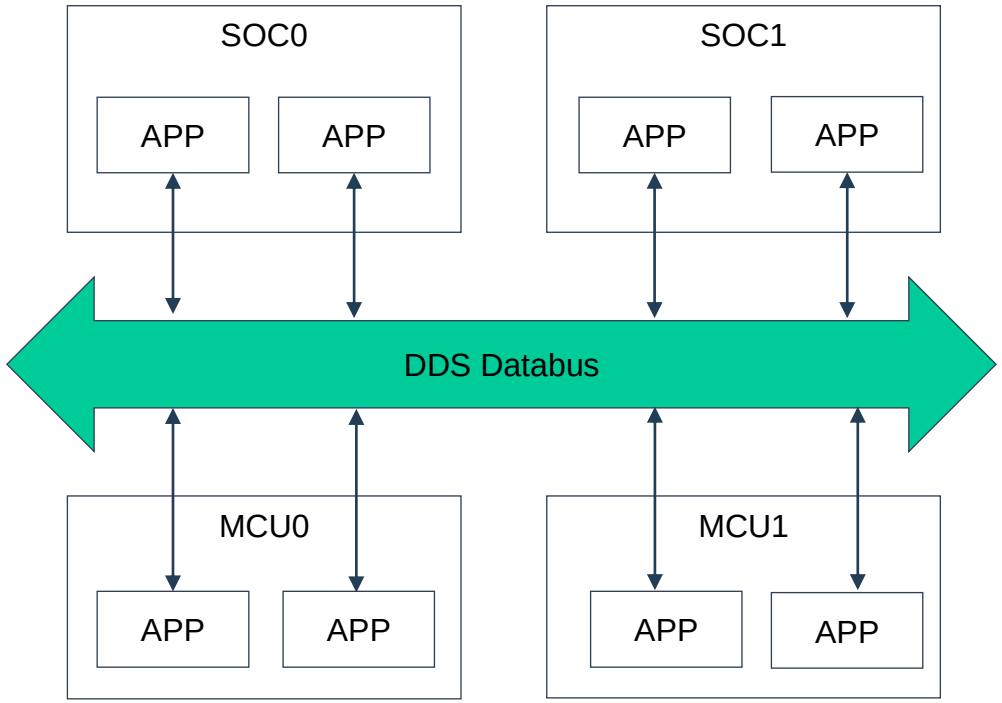
Software Architecture of Intelligent Driving Domain Controller

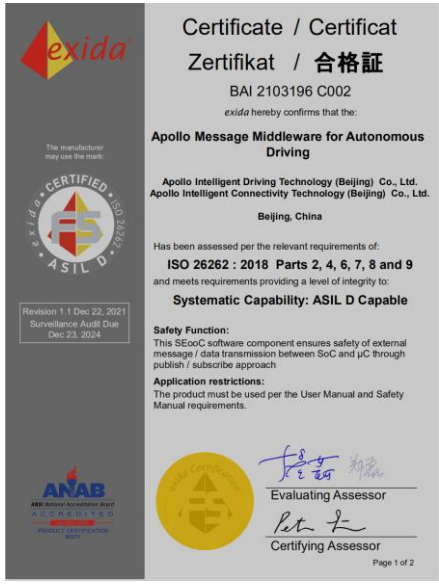


SOA architecture based on DDS within controller

- Dynamic publish and subscribe services base on data. Enables flexible deployment of applications
- Enhanced QoS services based on data fulfills requirements on real-time, reliability and data sequence.
- A DDS stack is integrated in MCU based on Eth stacks of AUTOSAR CP
- ASIL-D authenticated

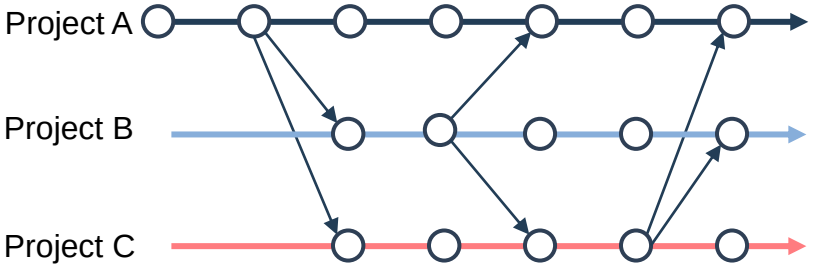




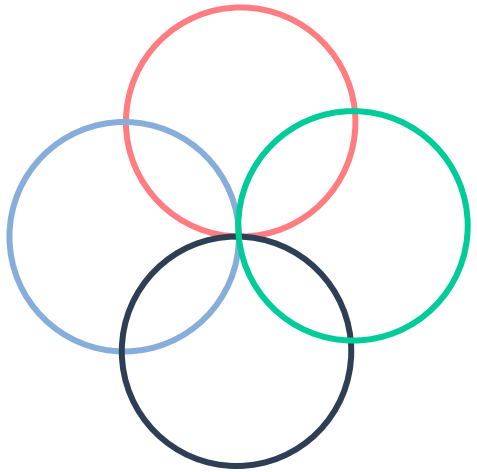


Challenged in MCU software development

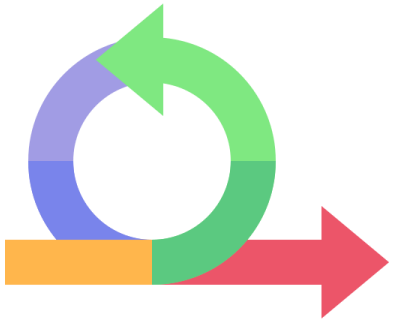
Simultaneous development of several projects on the same controller platform. Maintenance of several development branches



Tight coupling software components.



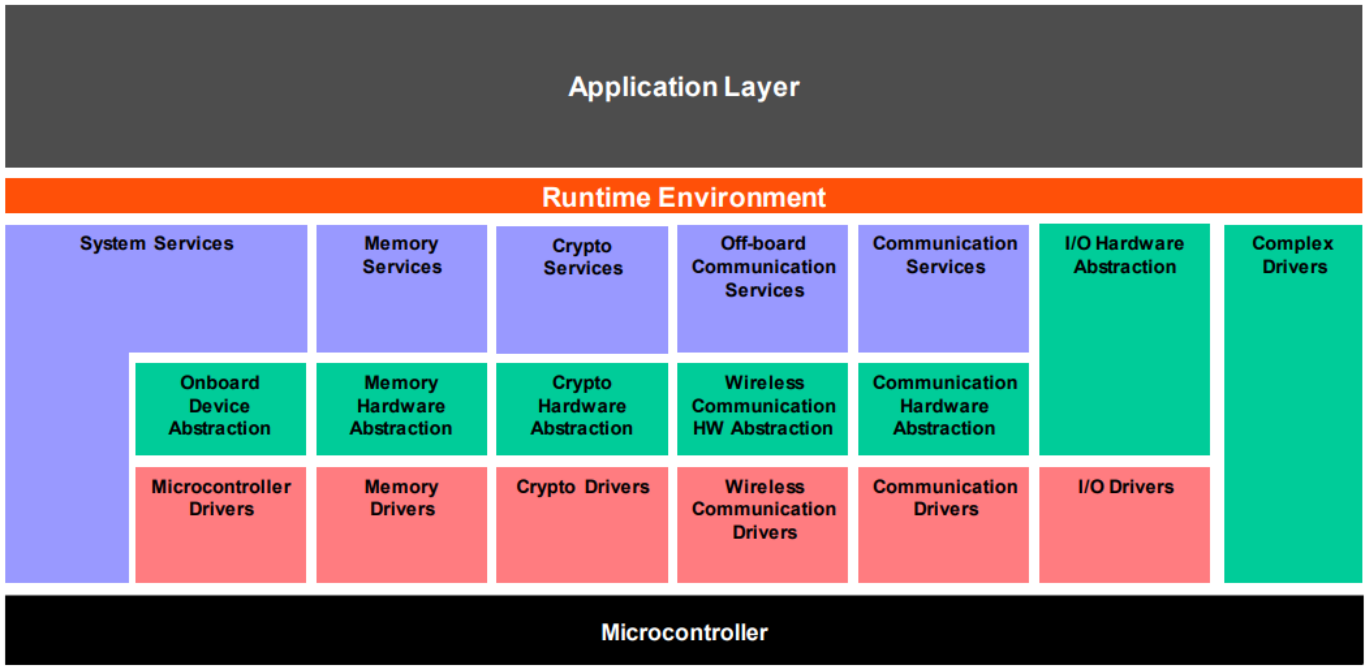
Requirements change frequently. Shorter development cycles



Inspiration from AUTOSAR

Core principles of AUTOSAR:

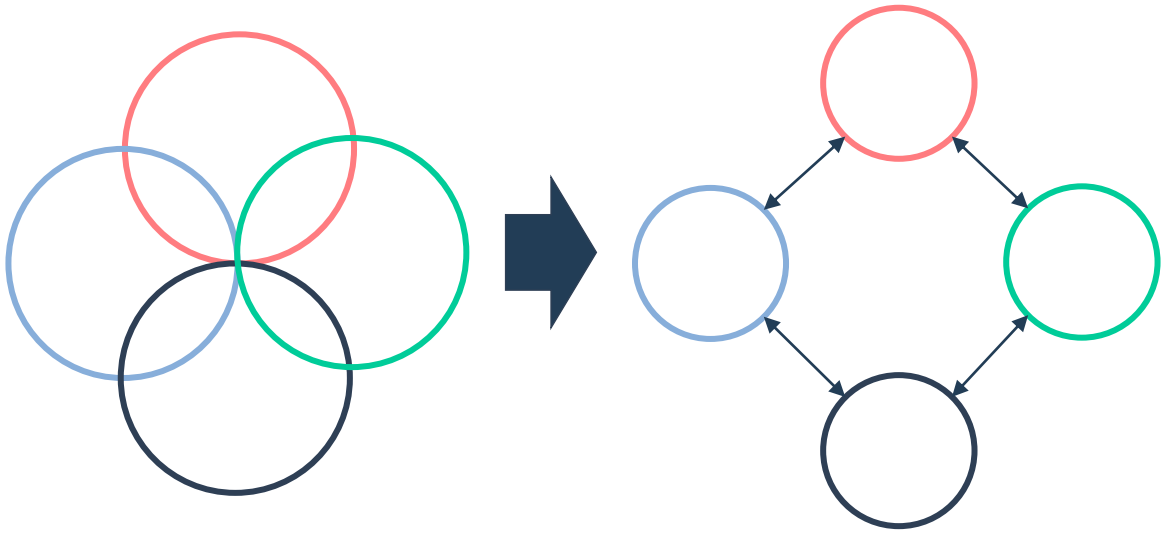
- Decoupling between SW and HW
- Modulation of SW
- Standardization of interfaces



Improvement of SW Architecture

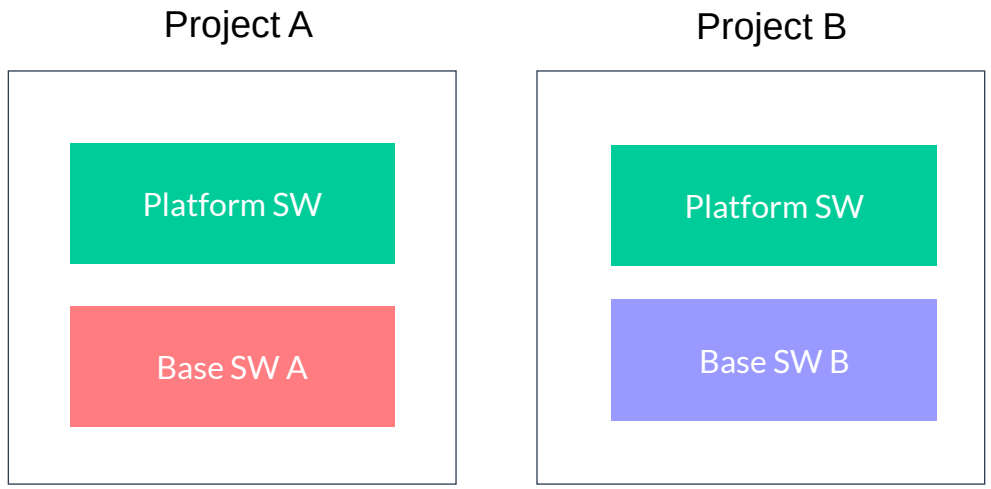
Loosely coupling:

- Modulation of SW. Define clear boundaries between components
- Define interfaces for data exchange between modules



Mainline SW architecture:

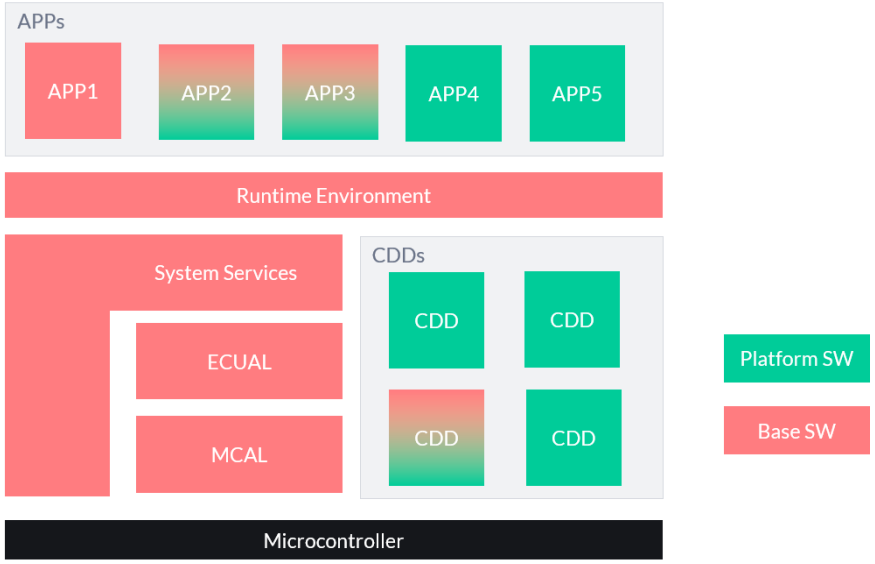
- Platform SW: core logics independent from projects specific requirements and external interfaces
- Base SW: project-specific and vehicle types relevant logics



Methodology of mainline SW architecture

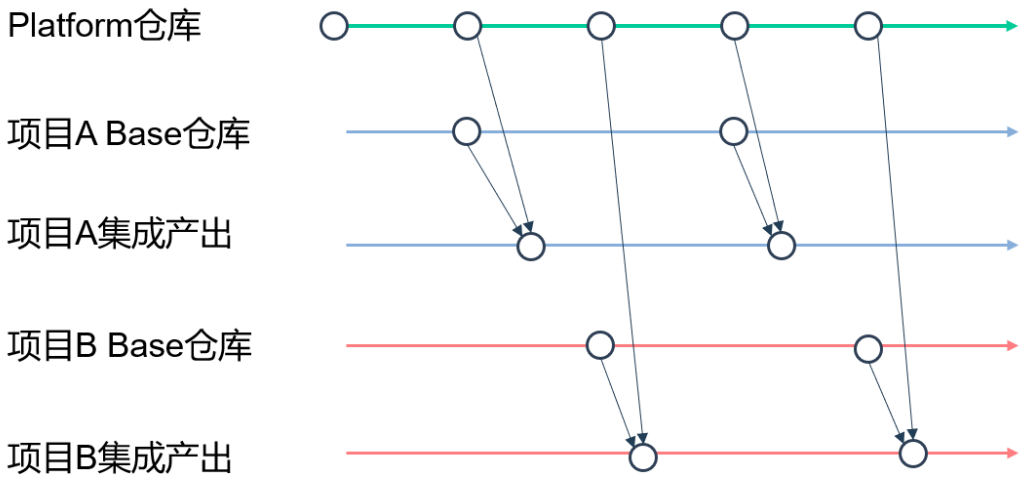
SW layers:

- AUTOSAR BSW belongs to Base SW
- Most CDDs are Platform SW
- Signal abstraction makes most APP independent from projects
- Define interfaces between Base SW and Platform SW



SW Management

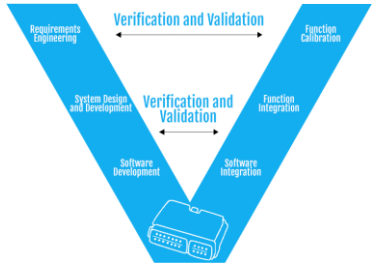
- One Platform repository and several projects Base repositories
- Platform SW + Project Base SW = Project Output
- Changes in Platform SW work on all projects
- Quality assurances with help of CICD



Agile development of MCU software in intelligent driving domain controller

Release delivery of domain controller

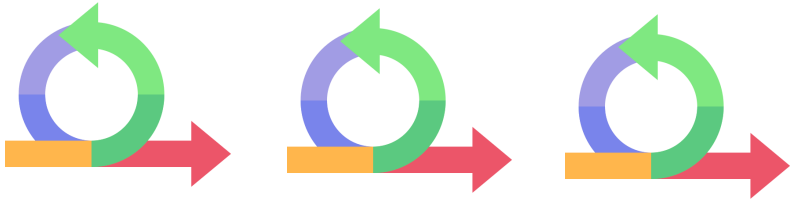
2~3 months



- SW requirements
- SW design
- SW development
- SW tests
- Verification and validation

MCU SW releases

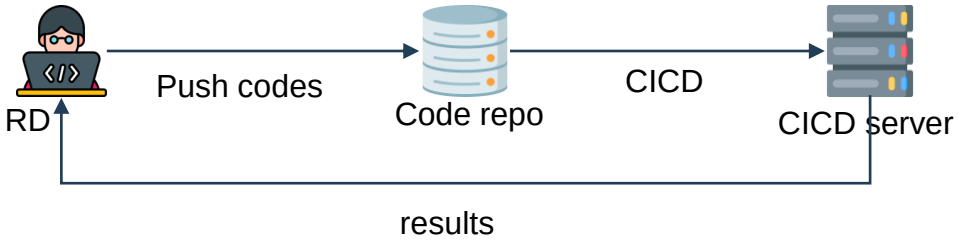
1 week



- Release plan
- SW development
- Module tests
- Integration tests
- Bug fix
- SW Release

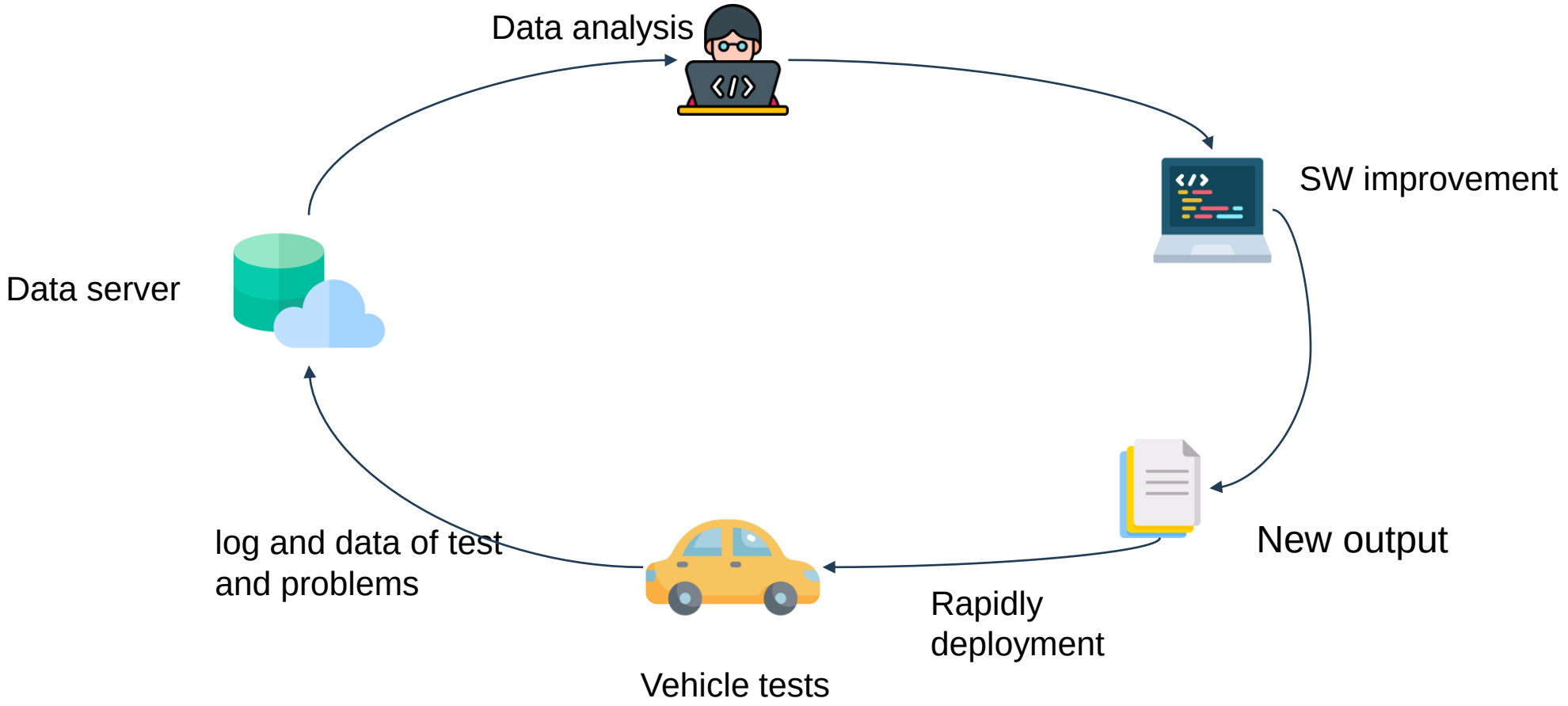
MCU SW development

1 day

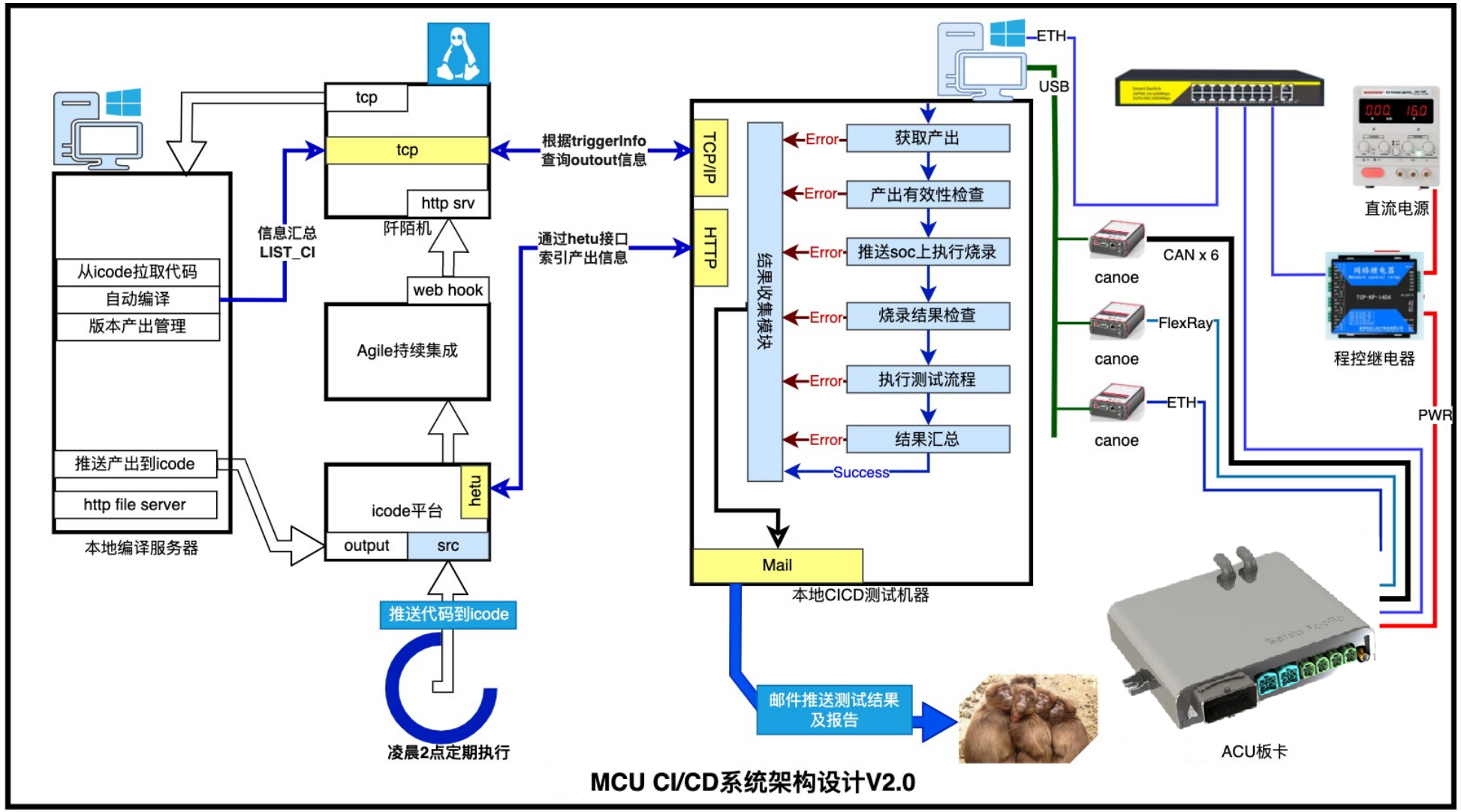


- Daily plan
- Coding
- Continuous integration
- Continuous deployment

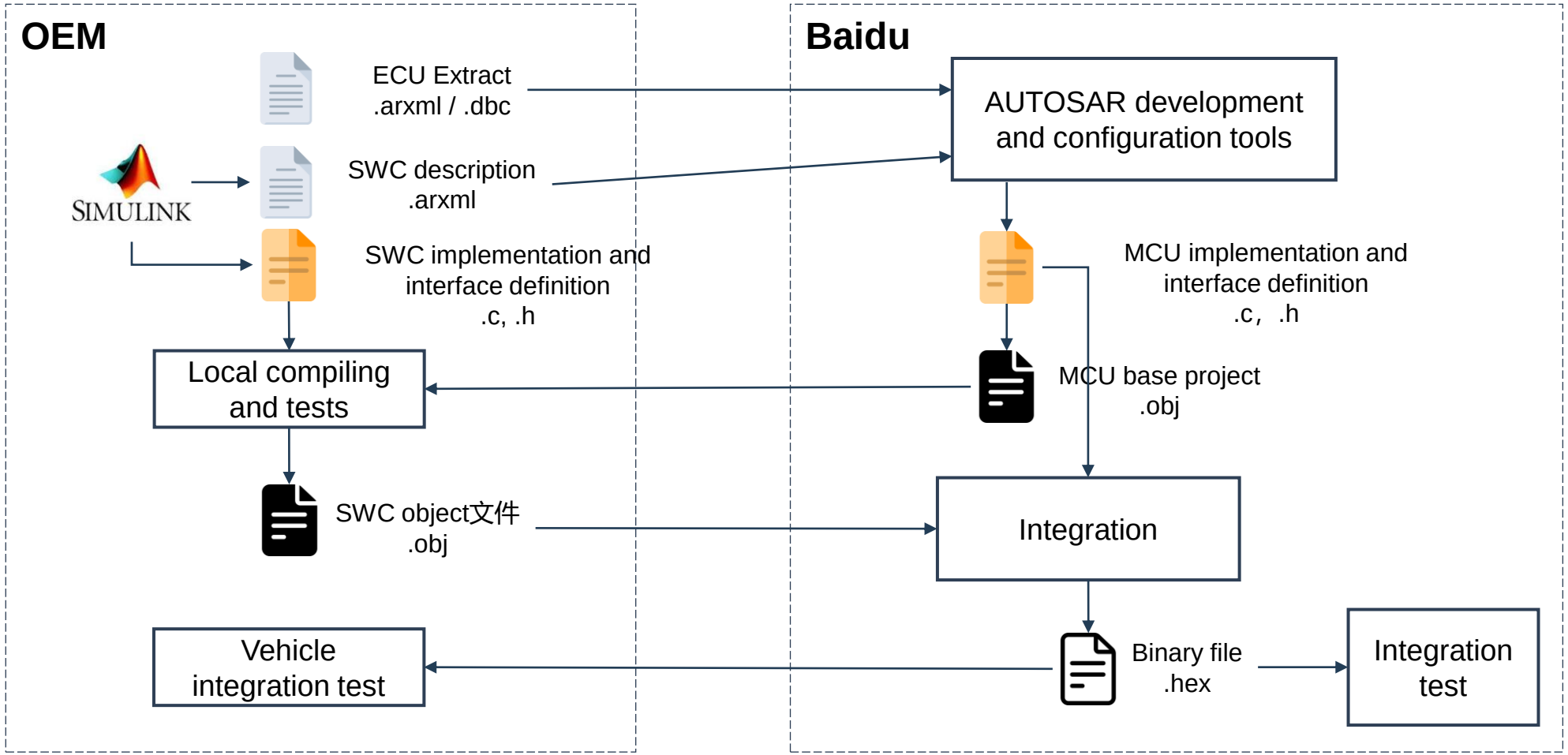
Close loop


Data analysis
SW improvement
New output
Rapidly
deployment
Vehicle tests
log and data of test
and problems
Data server

CICD Design


tcp
tcp
http srv
阡陌机
信息汇总
LIST_CI
从icode拉取代码
自动编译
版本产出管理
推送产出到icode
http file server
本地编译服务器
web hook
Agile持续集成
icode平台
hetu
output
src
推送代码到icode
凌晨2点定期执行
根据triggerInfo
查询outout信息
通过hetu接口
索引产出信息
TCP/IP
HTTP
结果收集模块
Error
获取产出
产出有效性检查
推送soc上执行烧录
烧录结果检查
执行测试流程
结果汇总
Success
Mail
本地CICD测试机器
ETH
USB
canoe
CAN x 6
FlexRay
ETH
直流电源
程控继电器
PWR
邮件推送测试结果
及报告
ACU板卡
MCU CI/CD系统架构设计V2.0

Joint-development in MCU based on AUTOSAR



Summary

- MCU modulation and mainline SW architecture makes simultaneous development of one platform for several different projects and vehicle types possible
- With the help of agile development and CICD, the rapidly changing requirements are fulfilled and the quality of deliveries is assured.

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