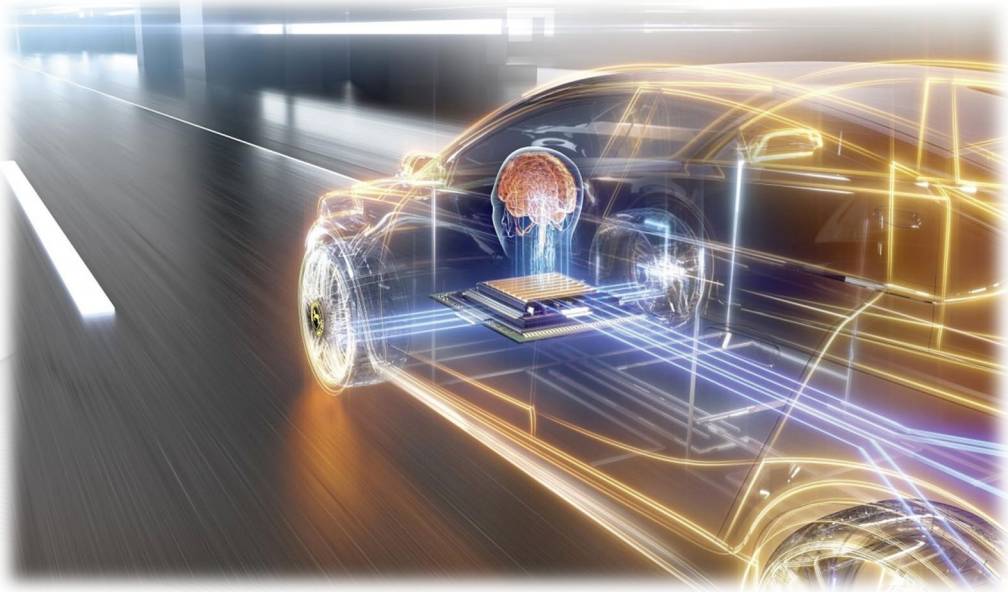
KATECH 한국자동차연구원

Electronic Architecture Design to realize SDV

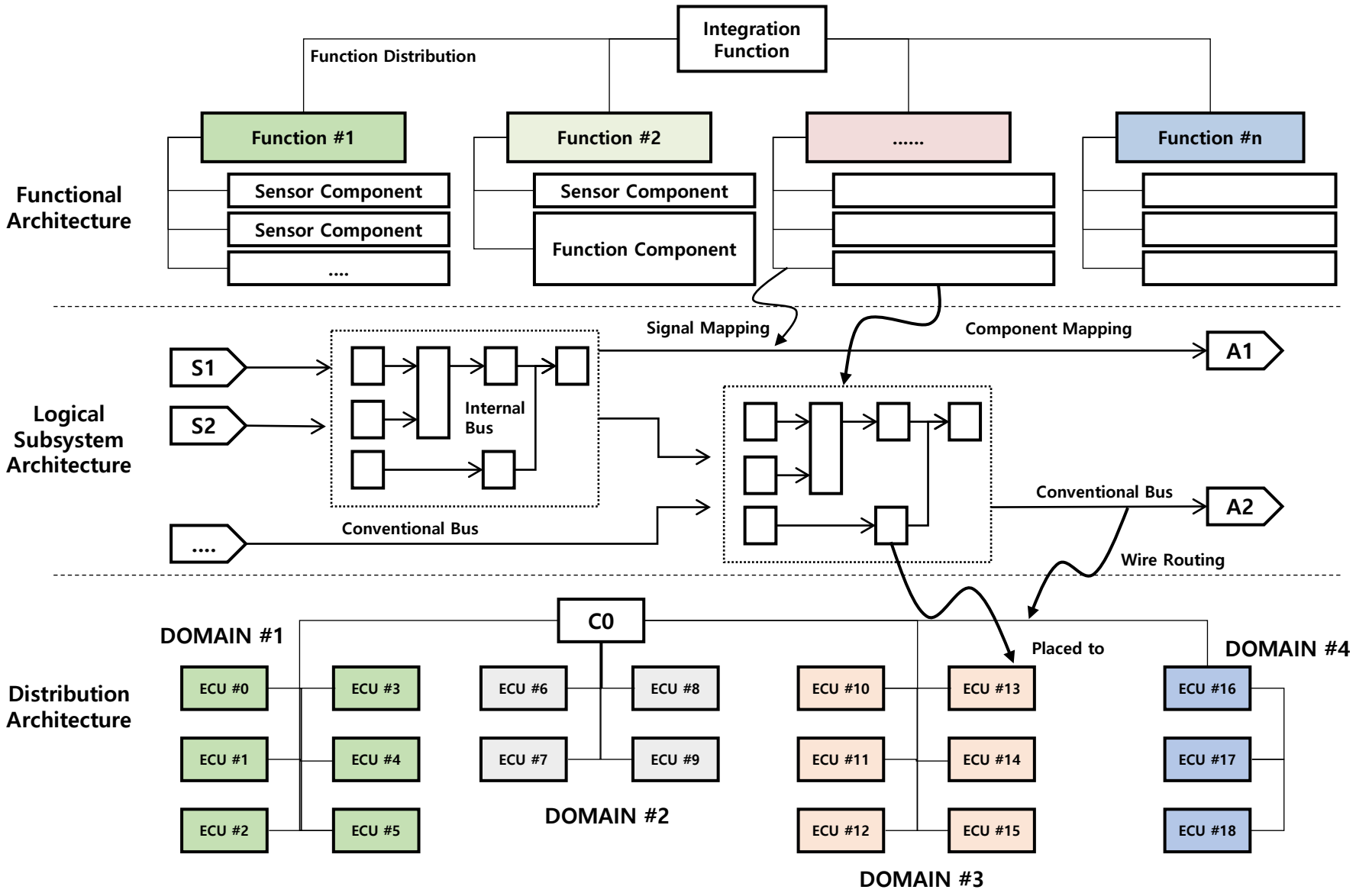
KATECH (Korea Automotive Technology Institute)

Bigdata · SW platform R&D division

Park Jeehun (parkjh@katech.re.kr)



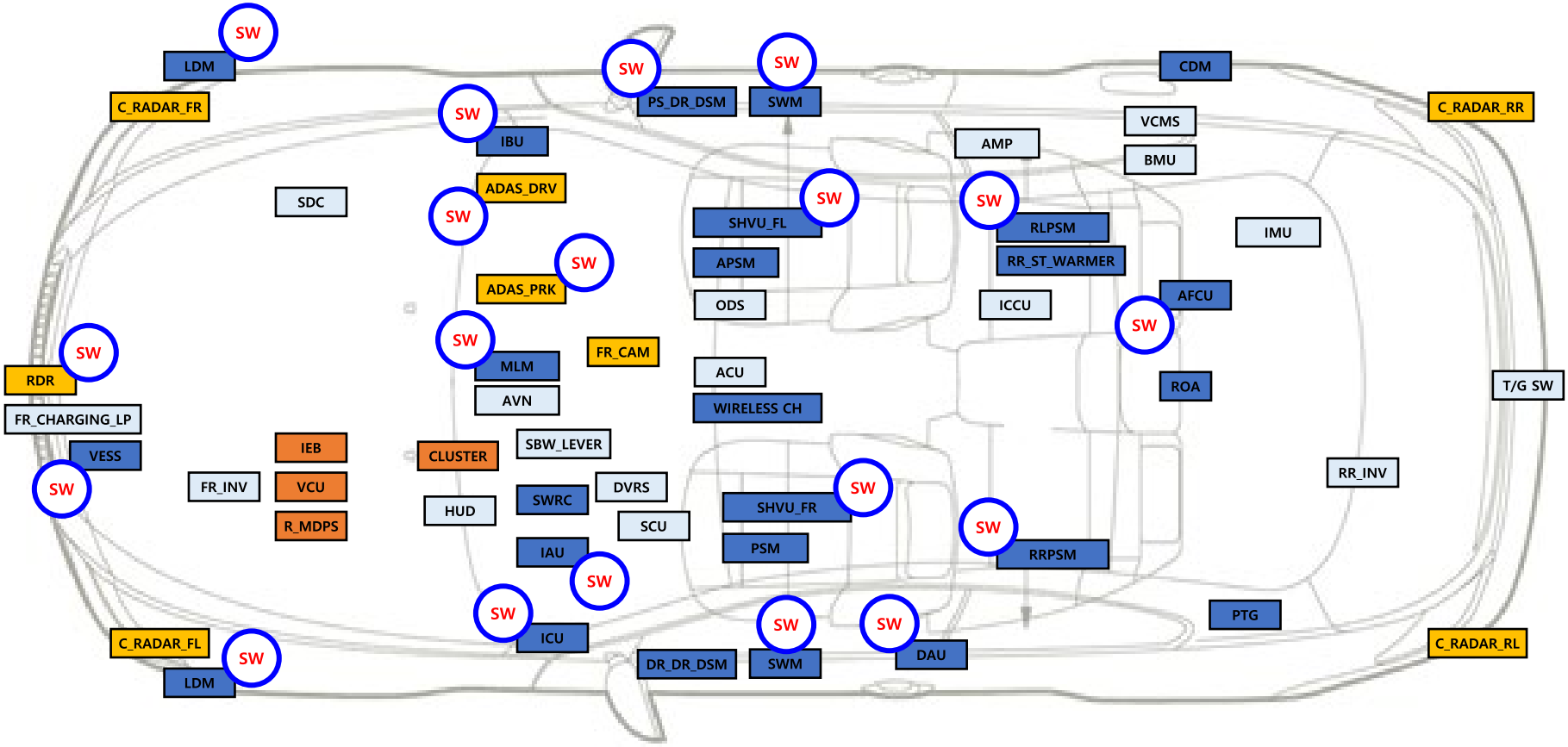
Analysis | Traditional Methodology



※ S : Sensor, A : Actuator, C : Controller

Bench-marking

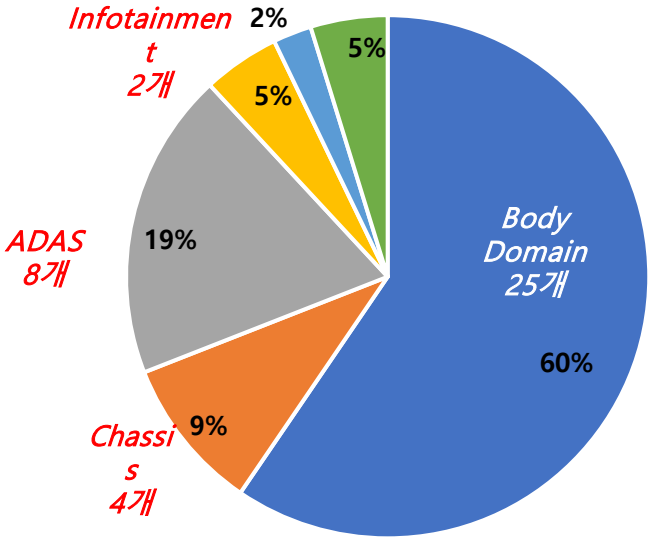
ECU Function Distribution

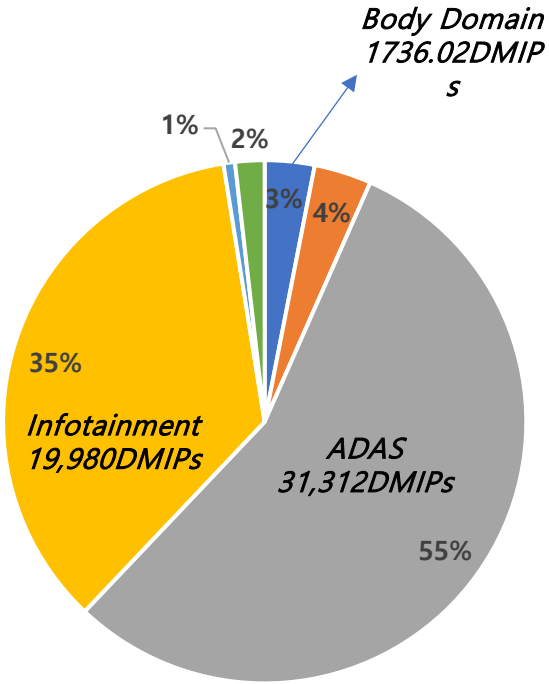


RDR ADAS　　LDM BODY　　R_MDPS CHASSIS

Bench-marking

ECU Function Distribution





Body Domain | Chassis Domain | ADAS | Infotainment | PowerTrain | Battery

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Goal

Software shift

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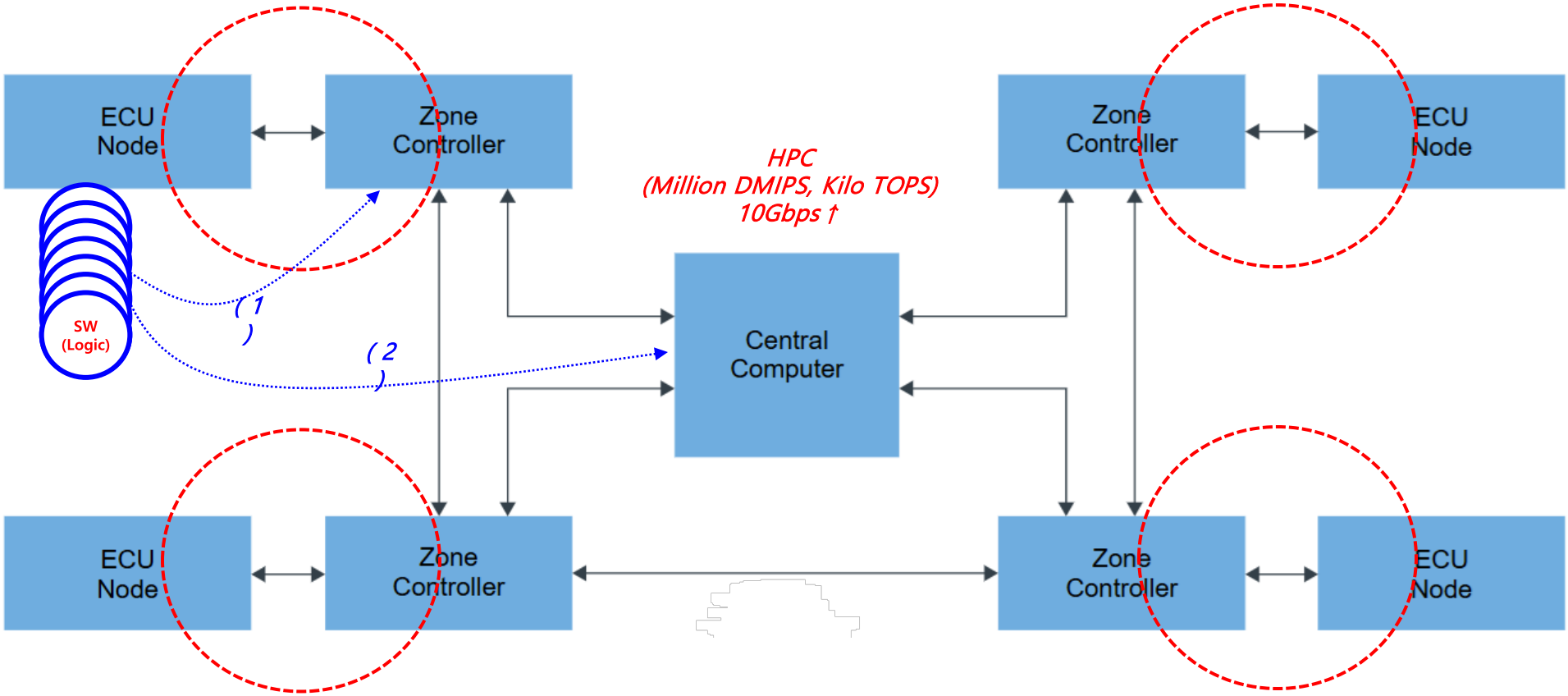
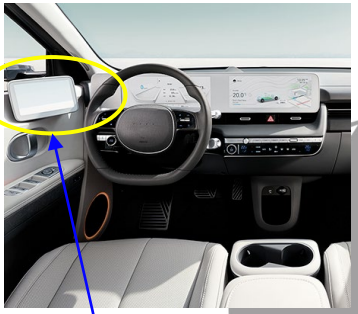
Realization

Zonal Architecture



ECU | Body System

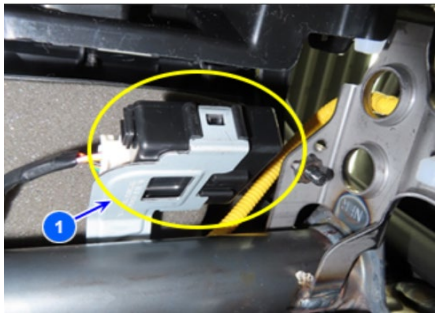
DAU



DSM

ICU (Integrated Control Unit)

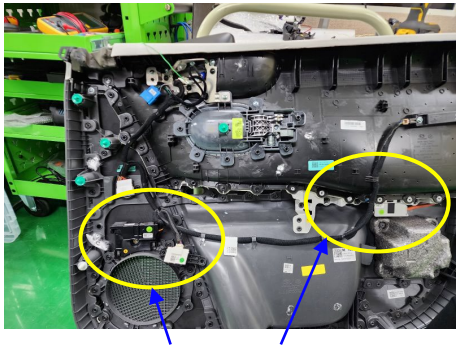
IBU (Integrated Body Unit)



Mood_LP

Mood LP

IAU
(Identity Authentication Unit)



DD_SP / DD_AR

DSM(Digital Side Mirror)

Mirror Actuator

DAU(Door Area Unit)

Mood Lamp(1)

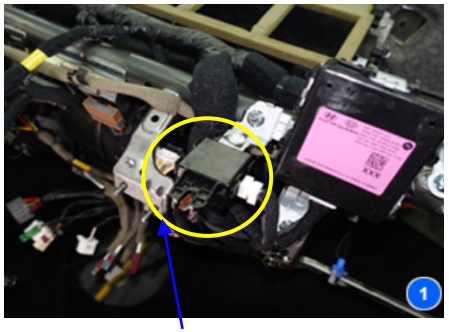
Mood Lamp(2)

Door Lock Actuator

Window Motor

NFC ANT

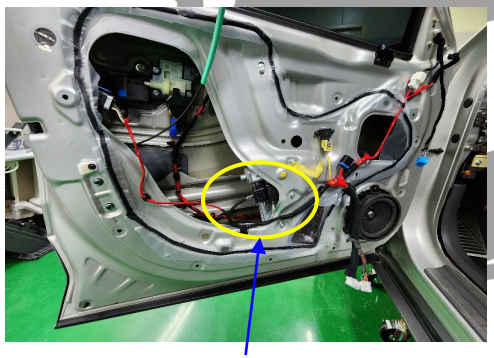
SWM
(Safety Window Module)



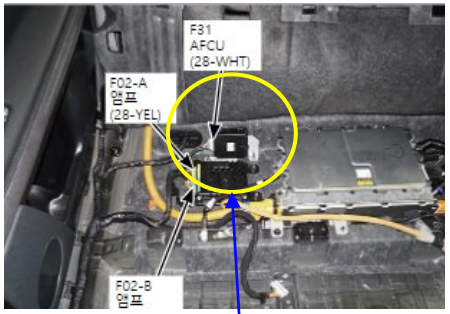
IAU

AFCU
(Auto Flush Control Unit)

NFC ANT



SWM



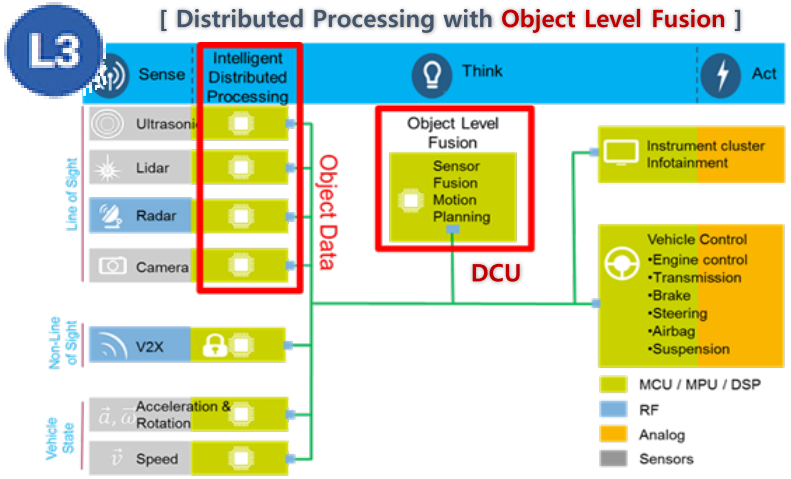
AFCU

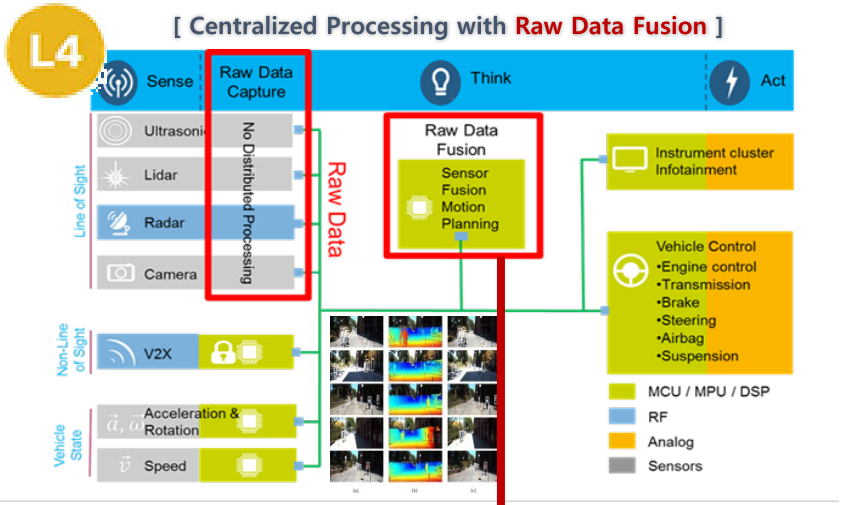
ECU (including SW)

Actuator

Sensor

ECU | Automated System





레벨 1

센서 레벨 1	#
초음파 센서	4
장거리 레이더	1
단거리 레이더	2
카메라/ 단거리 전용 라이다	1
총합	~6-8

측면 또는 세로방향 지원

레벨 2

센서 레벨 2	#
초음파 센서	8
장거리 레이더	1
단거리 레이더	2-4
카메라	2-4
총합	~17

주위 환경 관찰

레벨 3

센서 레벨 3	#
초음파 센서	8
장거리 레이더	2
단거리 레이더	4
카메라(좌우)	2
카메라(외관)	4
카메라(스테레오)	1
μbolo	1
라이다	1
추측위치	1
총합	~24-26

의식 공유

레벨 4

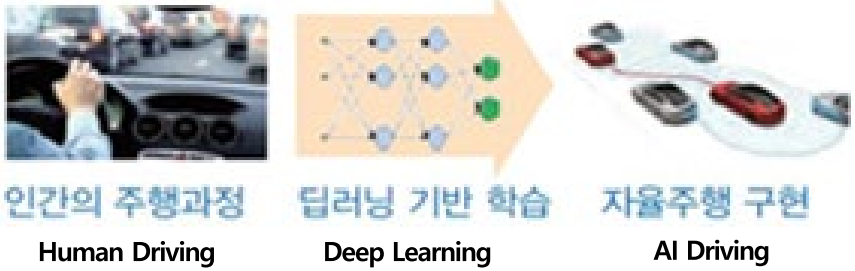
센서 레벨 4	#
초음파 센서	8
장거리 레이더	2
단거리 레이더	4
카메라 (스테레오/3초점)	2/3
카메라(외관)	4
카메라(스테레오)	1
μbolo	1
라이다	2/4
추측위치	1
총합	~24-28

운전자 조작 없음

레벨 5

센서 레벨 5	#
초음파 센서	8-10
장거리 레이더	2
단거리 레이더	4
카메라(좌우)	2/3
카메라(외관)	4
카메라 (스테레오)	2
μbolo	1/2
라이다	4
추측위치	1
총합	~28-32

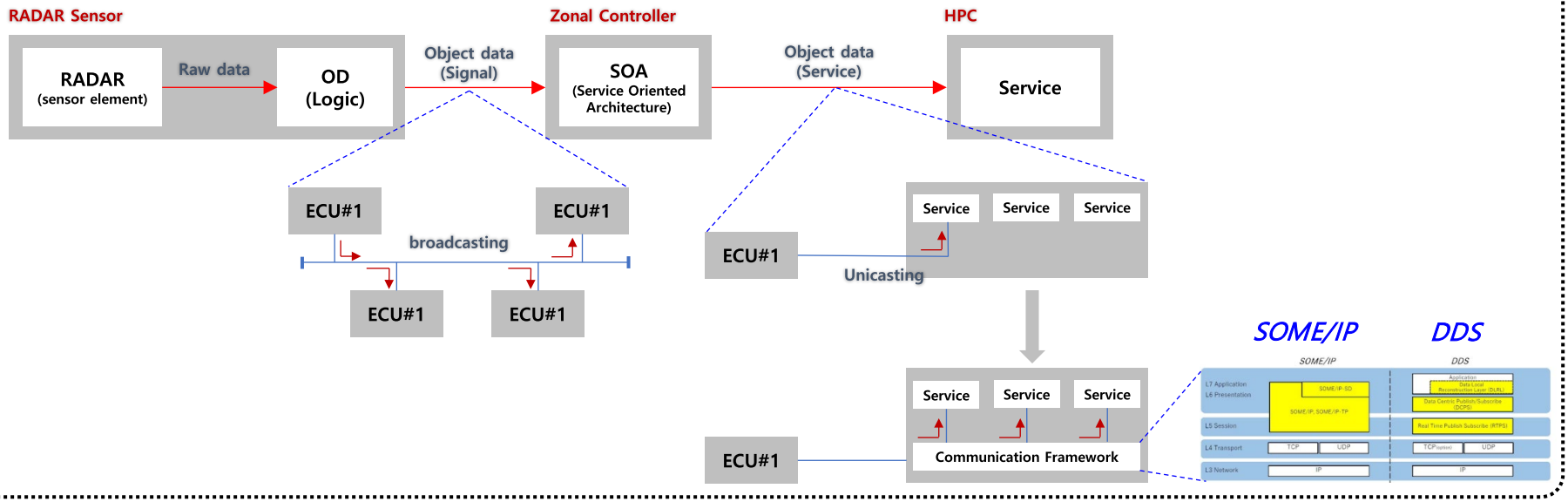
운전자 없음

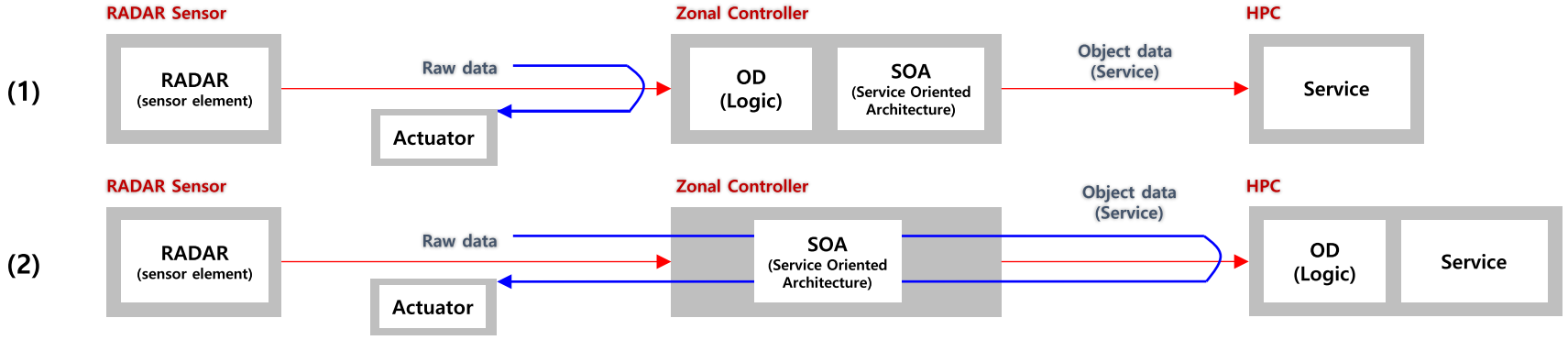


[Average sensor count in respective autonomous driving levels (출처: Frost&Sullivan)]

Methodo-logy

SW migration based on real-time requirements



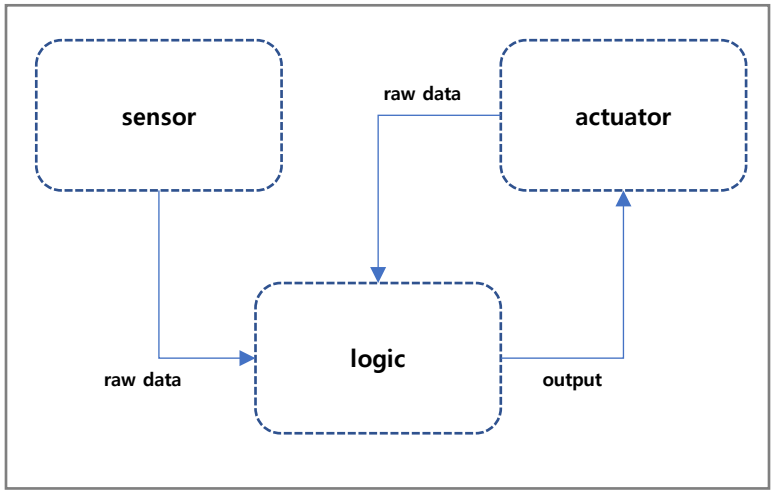


Hardware abstraction

NCS

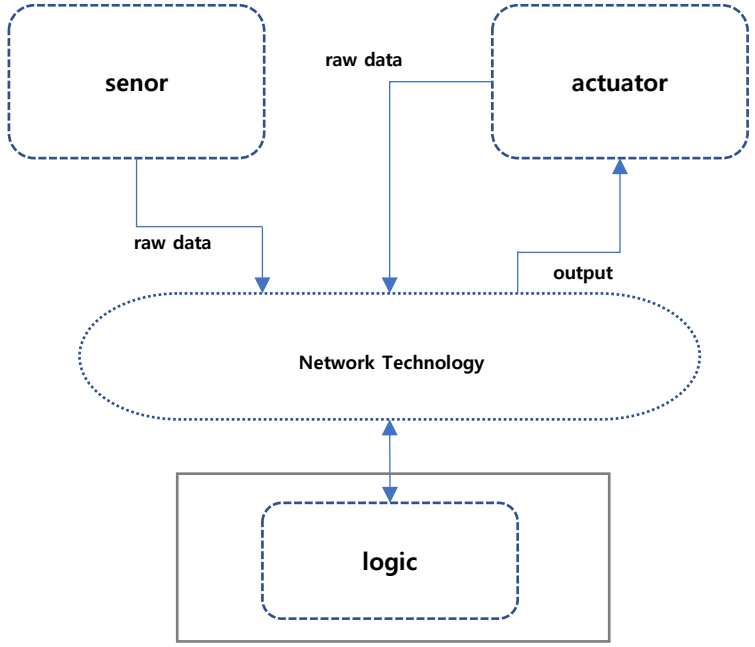
Data processing for SW migration

- To migrate software for HPCs in vehicles, the raw data needs to be transferred firstly.
  - (AS-IS) Sensors and actuators are directly connected to software(logic)
  - (TO-BE) Sensors and actuators are connected to software(logic) through a network technology



ECU

[Traditional vehicle ECU system]



HPC

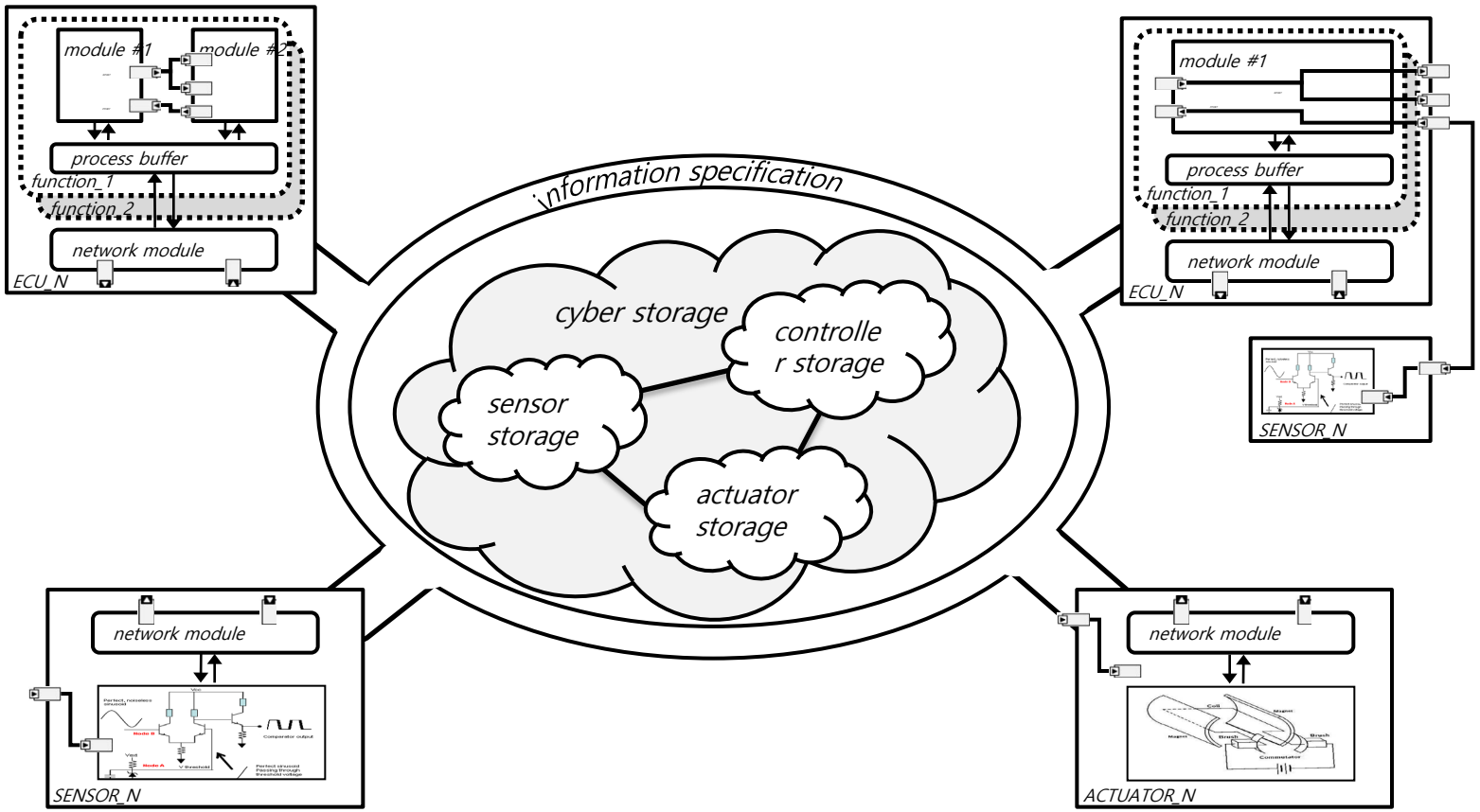
[HPC-based ECU system]

Concept to realize SDV

CPS

Cyber Physical System

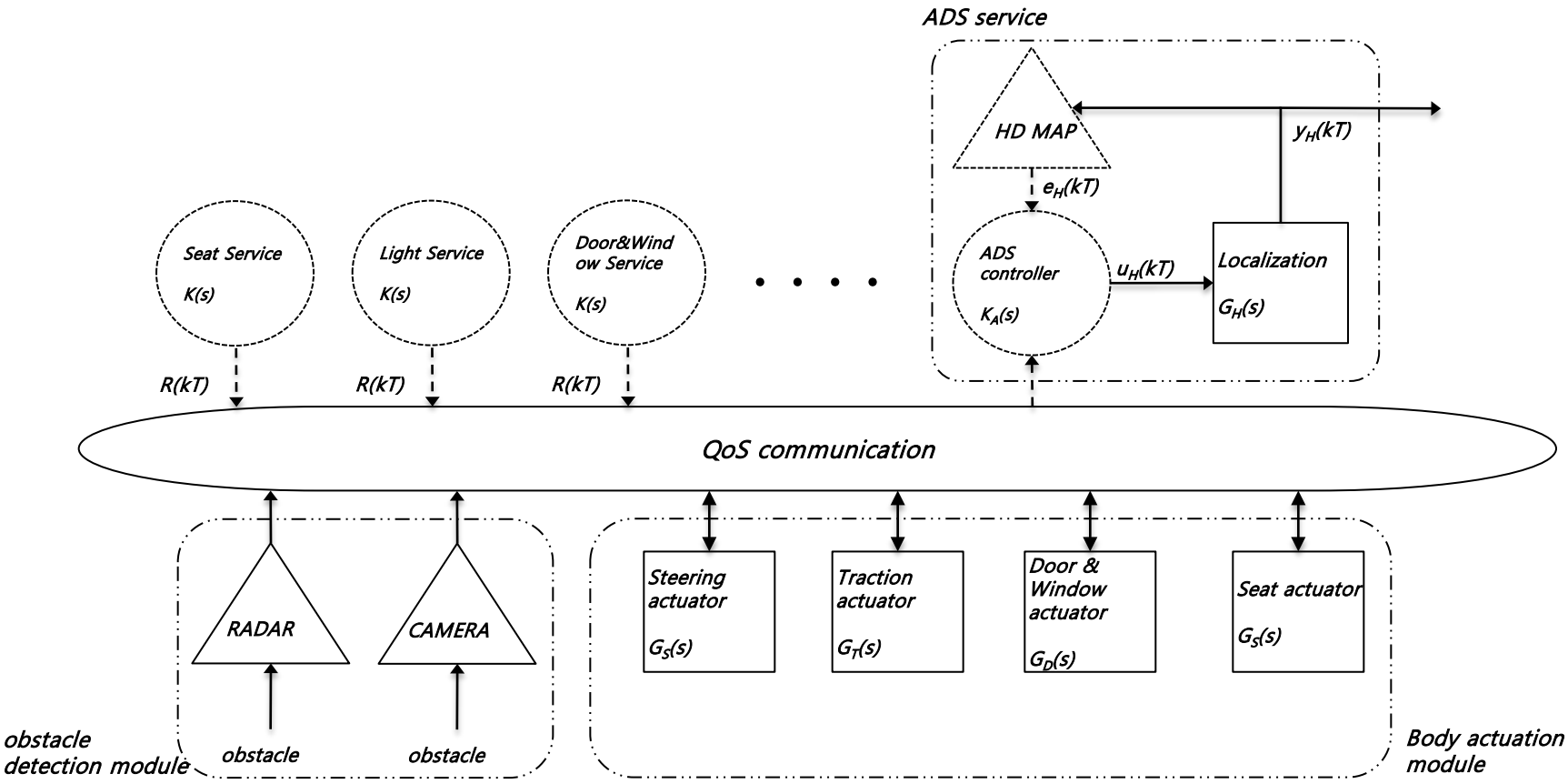
- **Definition of control loop and network information specification**
- **Design of virtual storage (eg, sensor storage, actuator storage, controller storage)**



Design to realize SDV

CPS

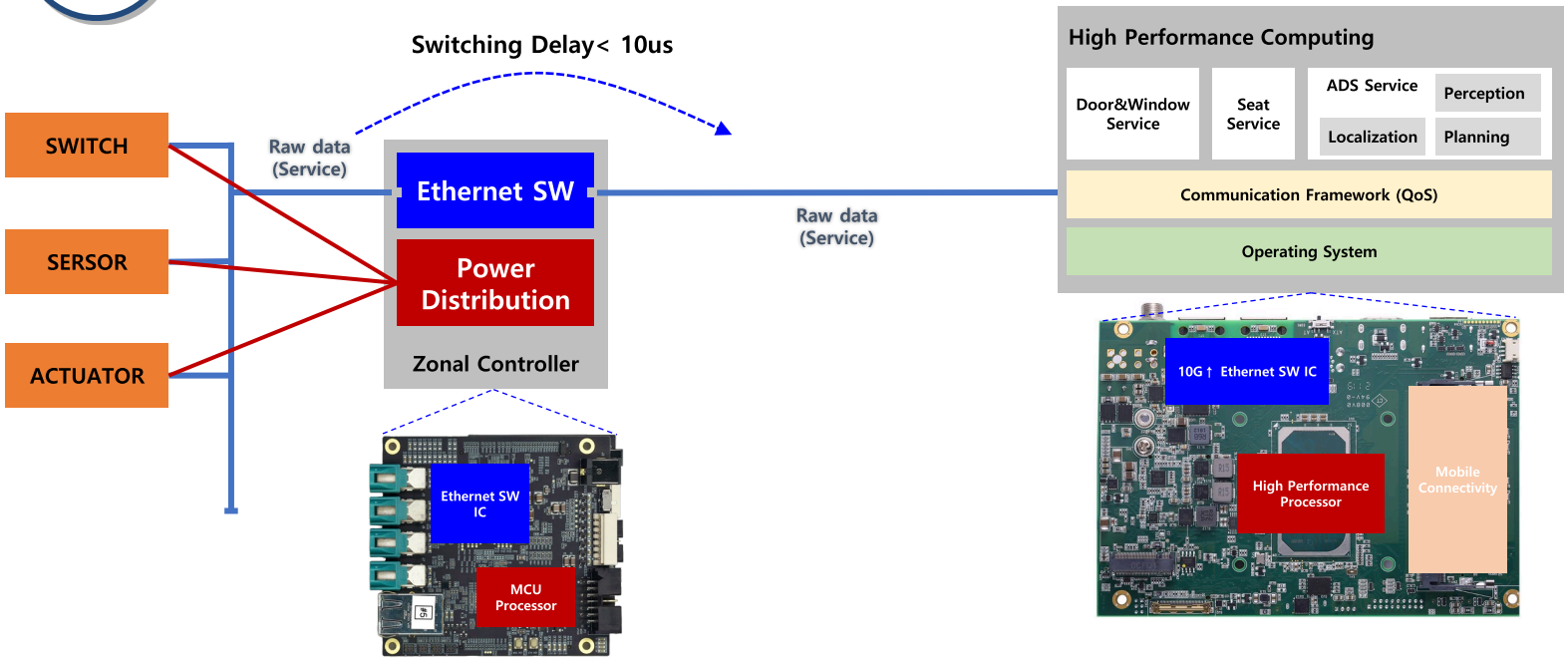
SDV based on Cyber Physical System (example)



Implementation to realize SDV

CPS

SDV based on Cyber Physical System (example)



Conclusion

Vehicle brain – centralized architecture

- Zonal architecture is an temporary state to accommodate the constraints of the current vehicle architecture
- Considering software orchestration, network jitter, processing power, etc., the final form of SDV technically ends up being a centralized architecture with a vehicle brain
- Zonal controller has functions such as wiring harness reduction, power supply, etc.