# Flexible, Configurable, HW-Accelerated: how an optimized SW/HW architecture can overcome gateway limitations

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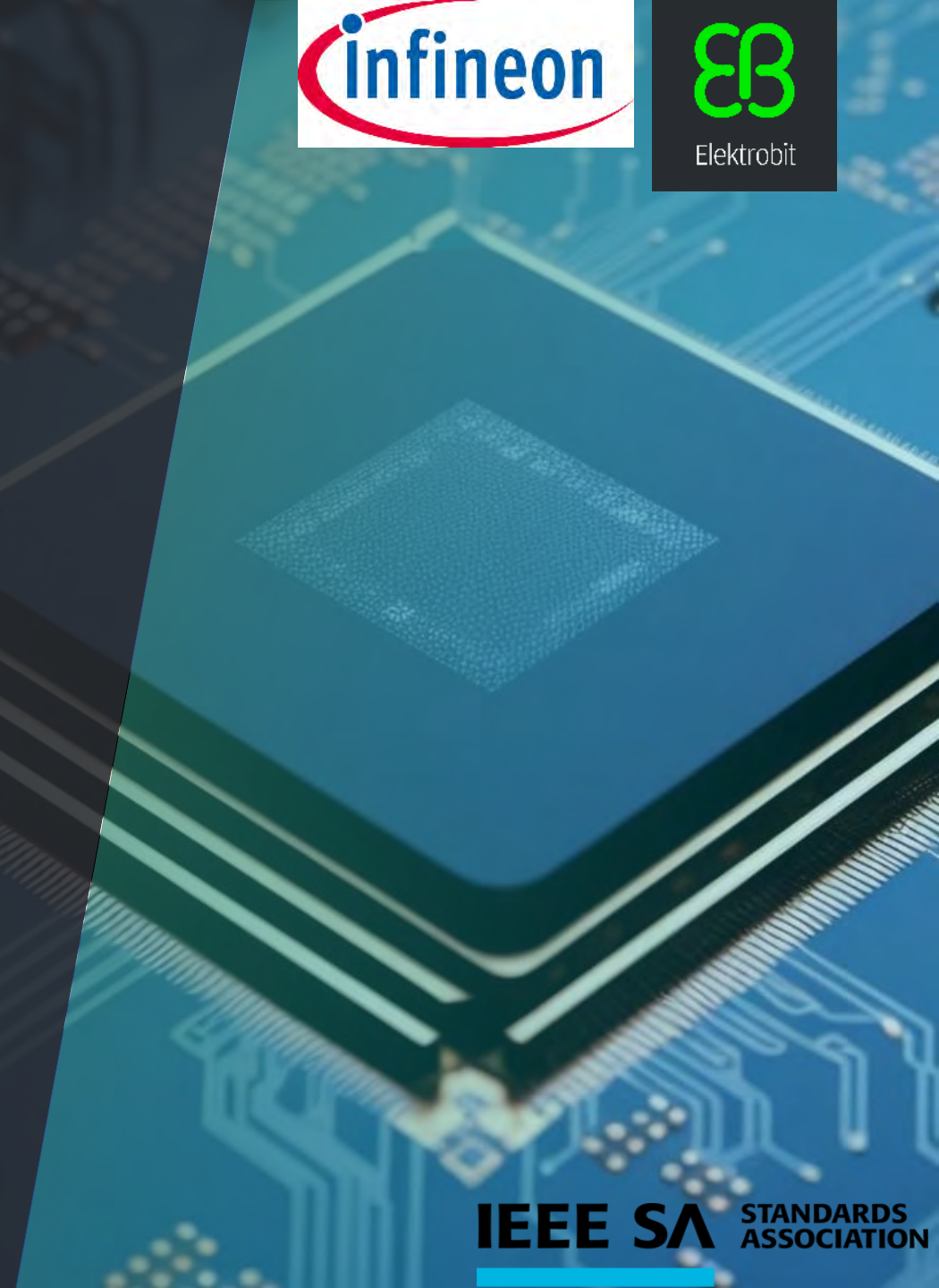
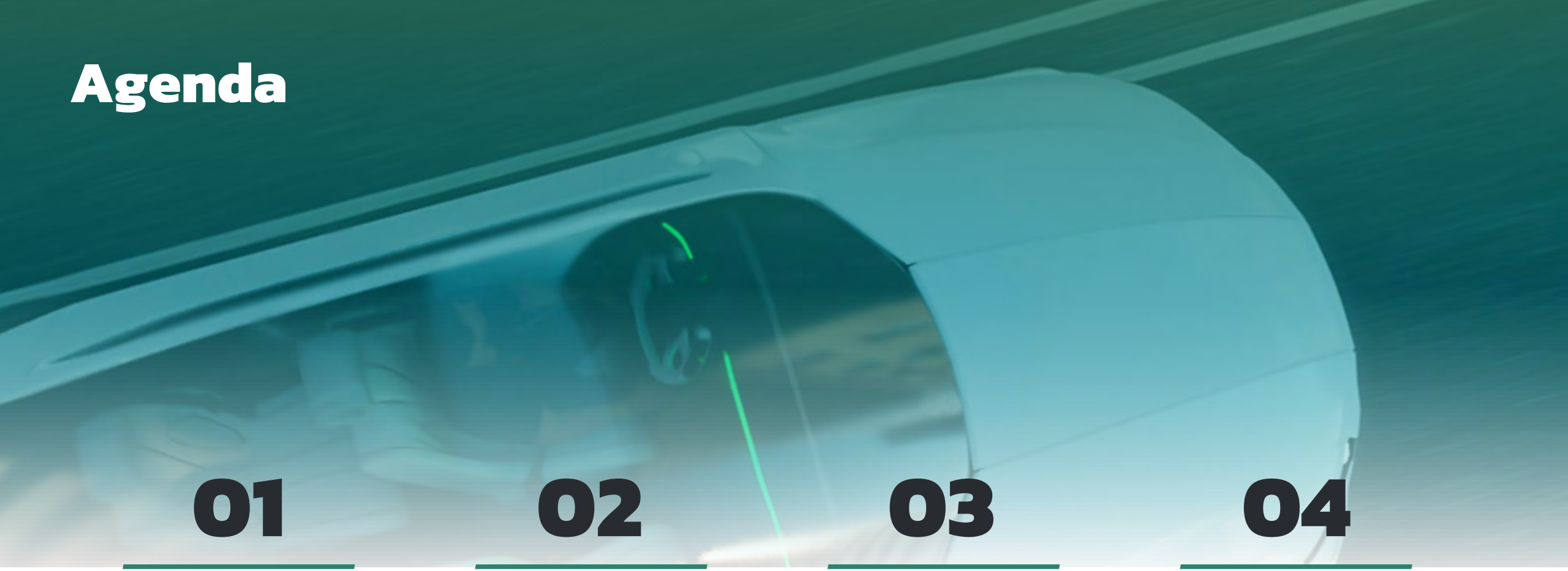
October 17th, 2024



# Agenda



**01**

Where is the challenge?

**02**

Where are we standing now?

**03**

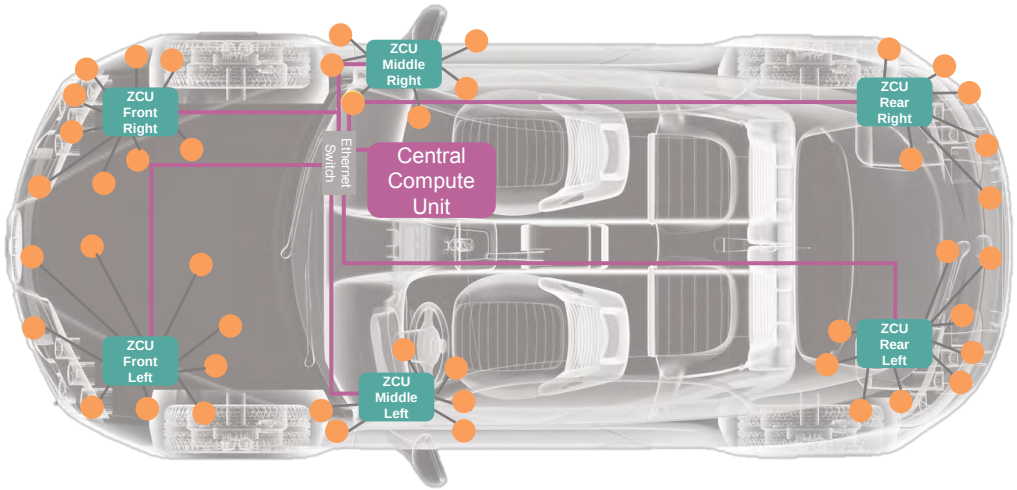
What can the future architecture look like?

**04**

Conclusion

# 01 Where is the challenge?

# Zonal Architecture increases the consolidation of features & ECUs




**New E/E architecture concepts consolidate features and reduce the number of ECUs**

**Challenge:**

Offer more features while reducing number of ECUs

# By reducing the number of ECUs, data routing is getting more important and at the same time more challenging

Clips from the movie "Modern Times" by Charlie Chaplin

## Domain Architecture

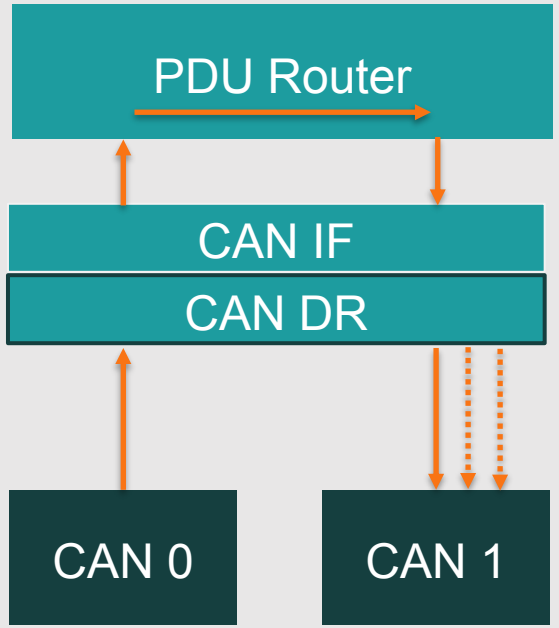
- Routing time: 1ms
- Traffic < 1000 fps
- PDU Routing (no HW acceleration)

## Zonal Architecture

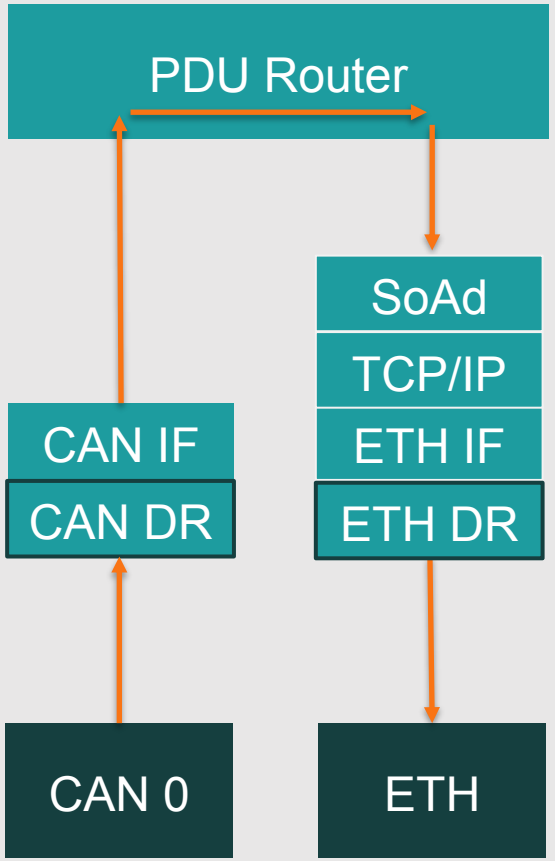
- Routing time: 1ms
- Traffic >> 1000 fps
- PDU Routing (no HW acceleration)

# Data Routing can be achieved in different ways

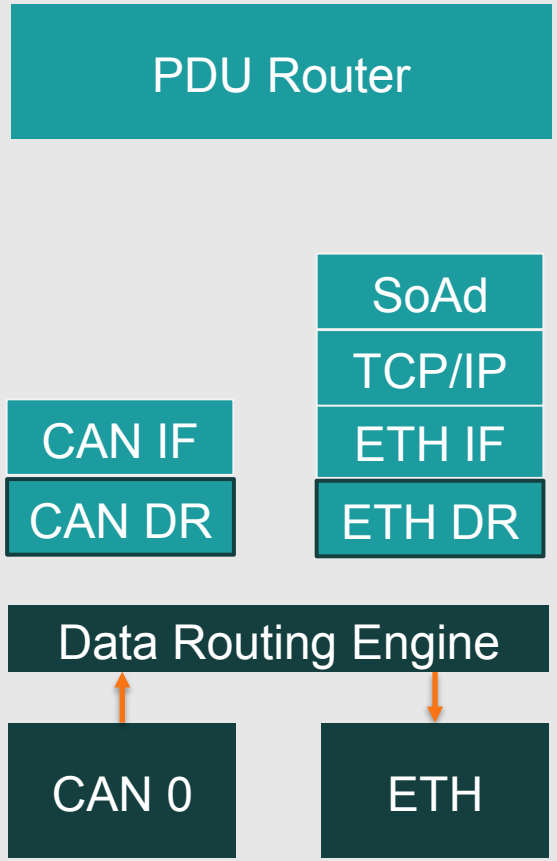
## CAN2CAN PDU Routing




## CAN2Ethernet PDU Routing



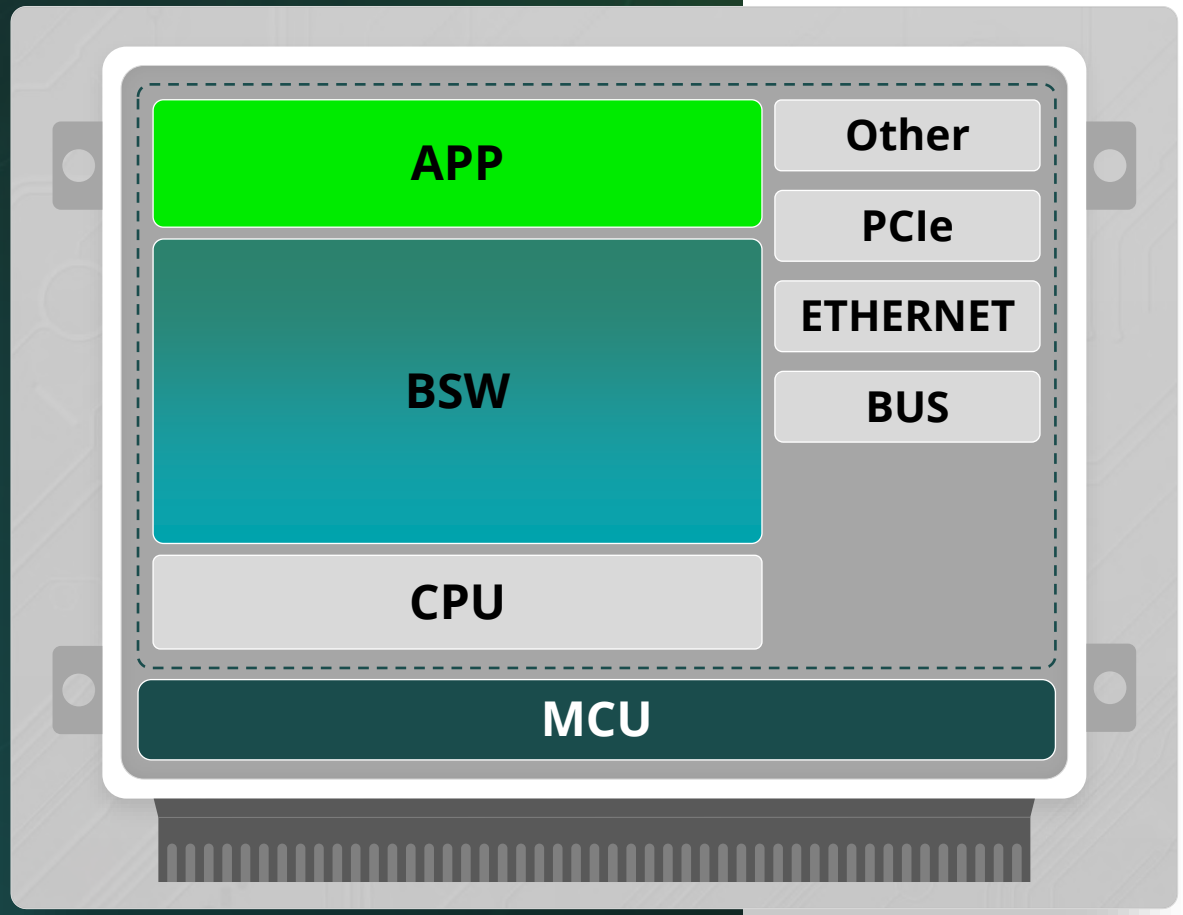

## HW Accelerated Routing



# 02 Where are we standing now?

# Performance

## Full SW approach



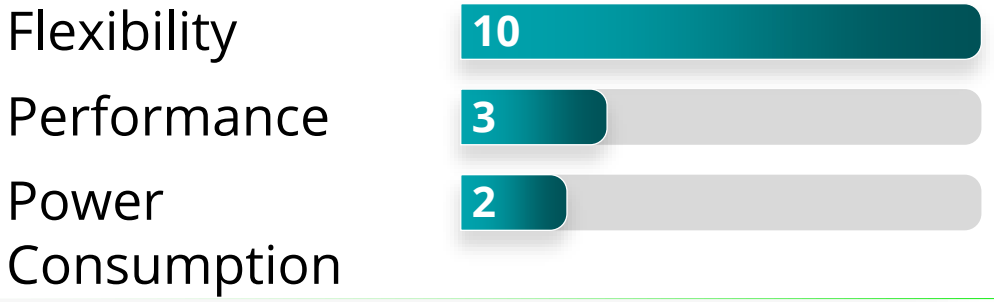

## Fully executed by CPU

**Pros:**

- Highest flexibility and reusability
- Easy to deploy new features

**Cons:**

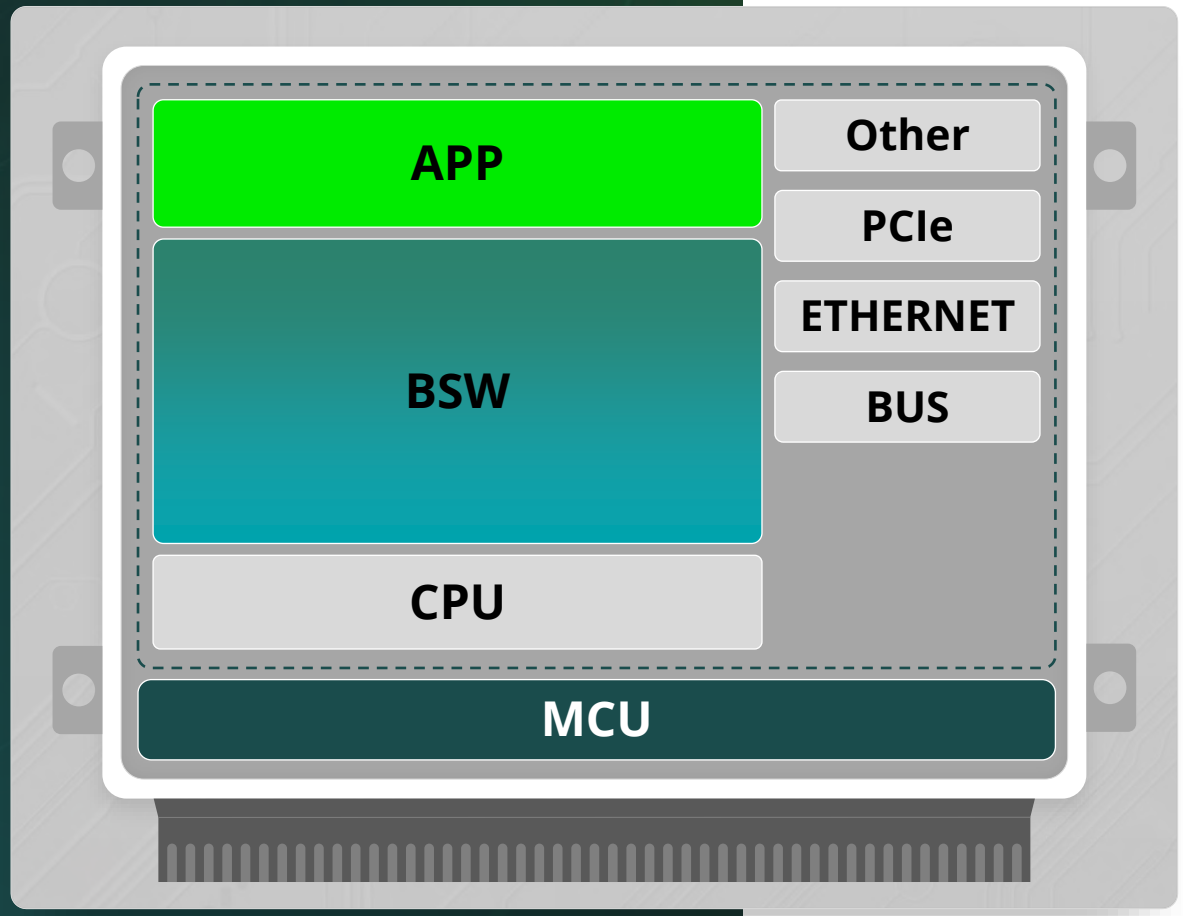
- Performance will not be sufficient
- Cost efficiency is questionable



# Comparing the performance of different routing options
# SW based (PDU) routing only

# Performance

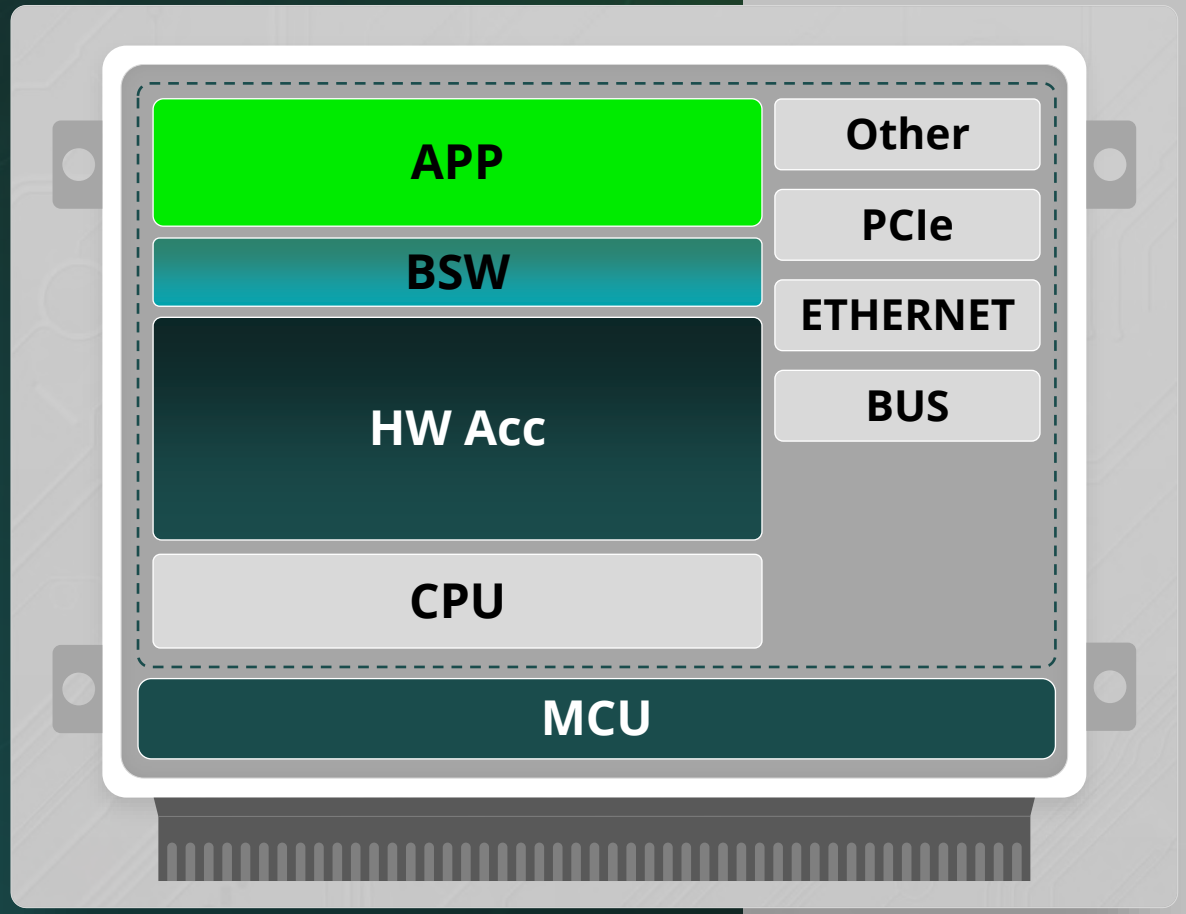
## Full SW approach




## Fully executed by CPU

# Performance

## Full HW approach




## Fully executed by HW Acc

**Pros:**

- Highest performance
- Lowest power consumption

**Cons:**

- Not possible to implement new features
- Limited configuration space or complex configuration process

| | |
|---|---|
| Flexibility | 1 |
| Performance | 10 |
| Power Consumption | 10 |

# Comparing the performance of different routing options
# SW based (PDU) routing vs HW accelerated routing

# Key takeaways of the different routing options

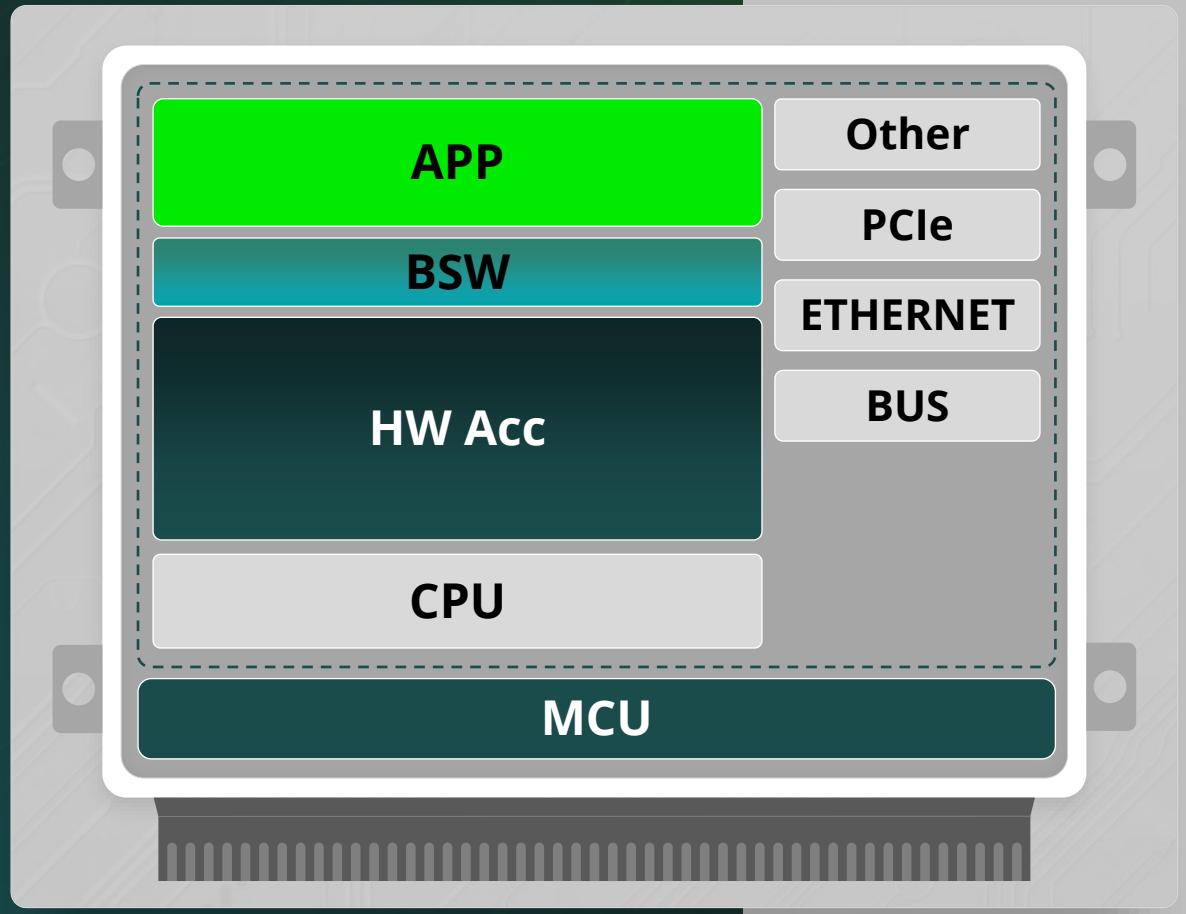
- PDU routing is fine as long as throughput is not too high
- HW acceleration guarantees low latency and reduces core load
- Pure HW accelerated solutions might not be flexible enough
- PDU based solutions consume compute power
- Does a combination of HW & SW offer the best fit?

# 03

# What can the future architecture look like?

# Outlook

## Full HW approach

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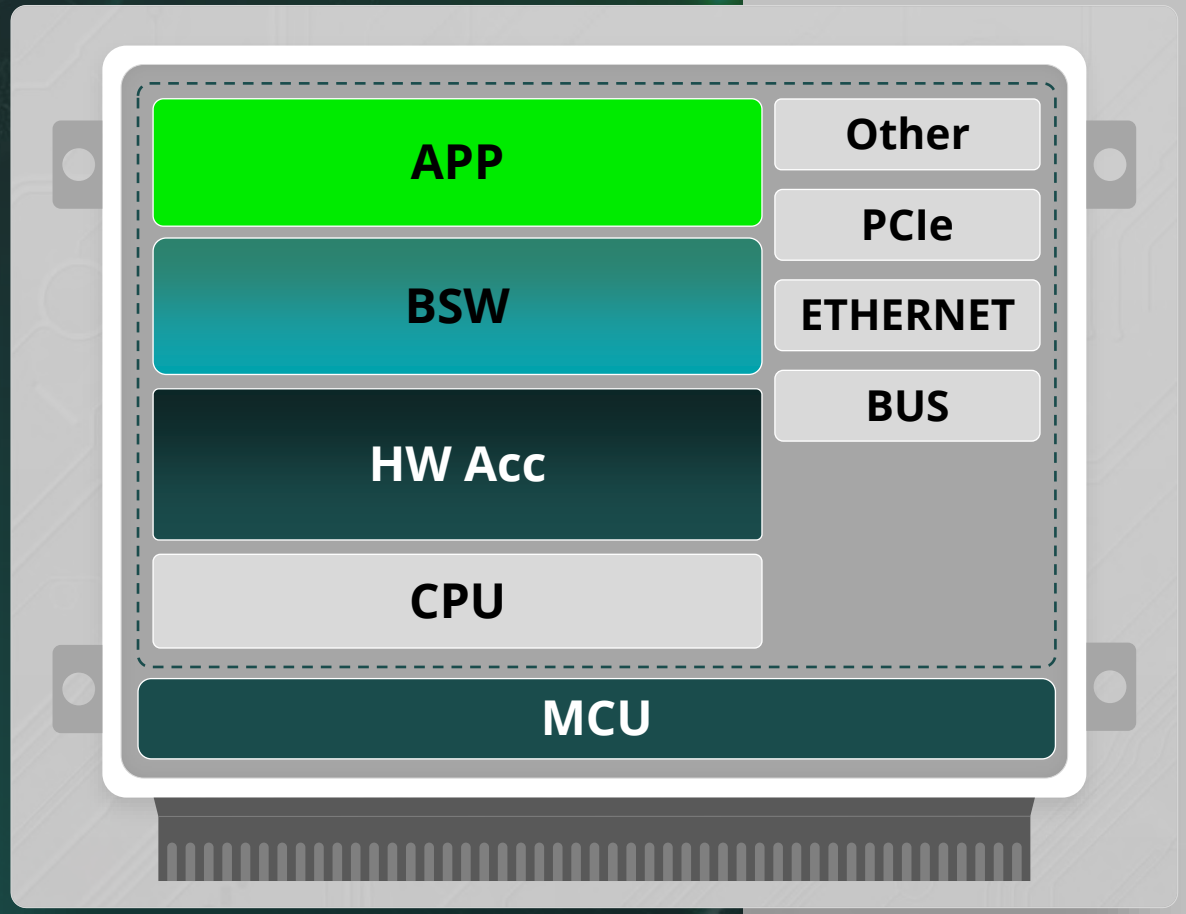
# Outlook

Combined approach



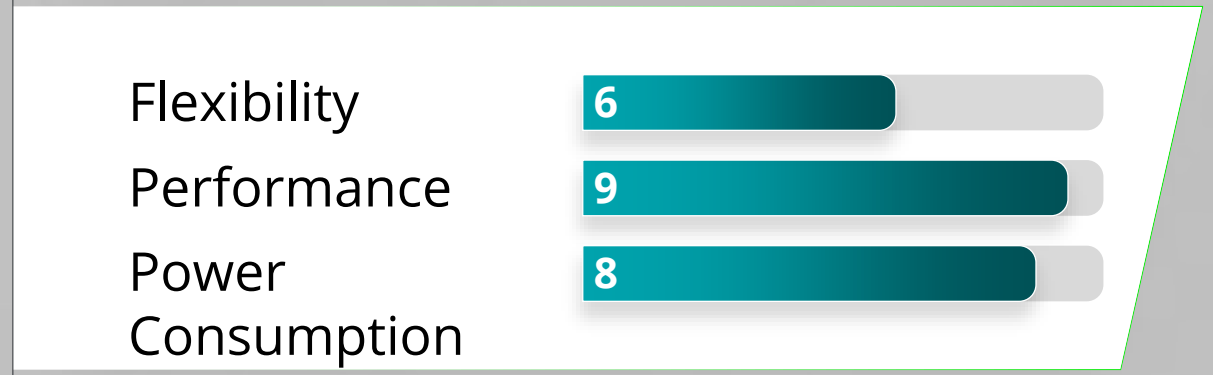

## Executed by combination

**Pros:**

- The most balanced approach
- Performance and flexibility is preserved

**Cons:**

- Currently many open points
- What to do with standardization?



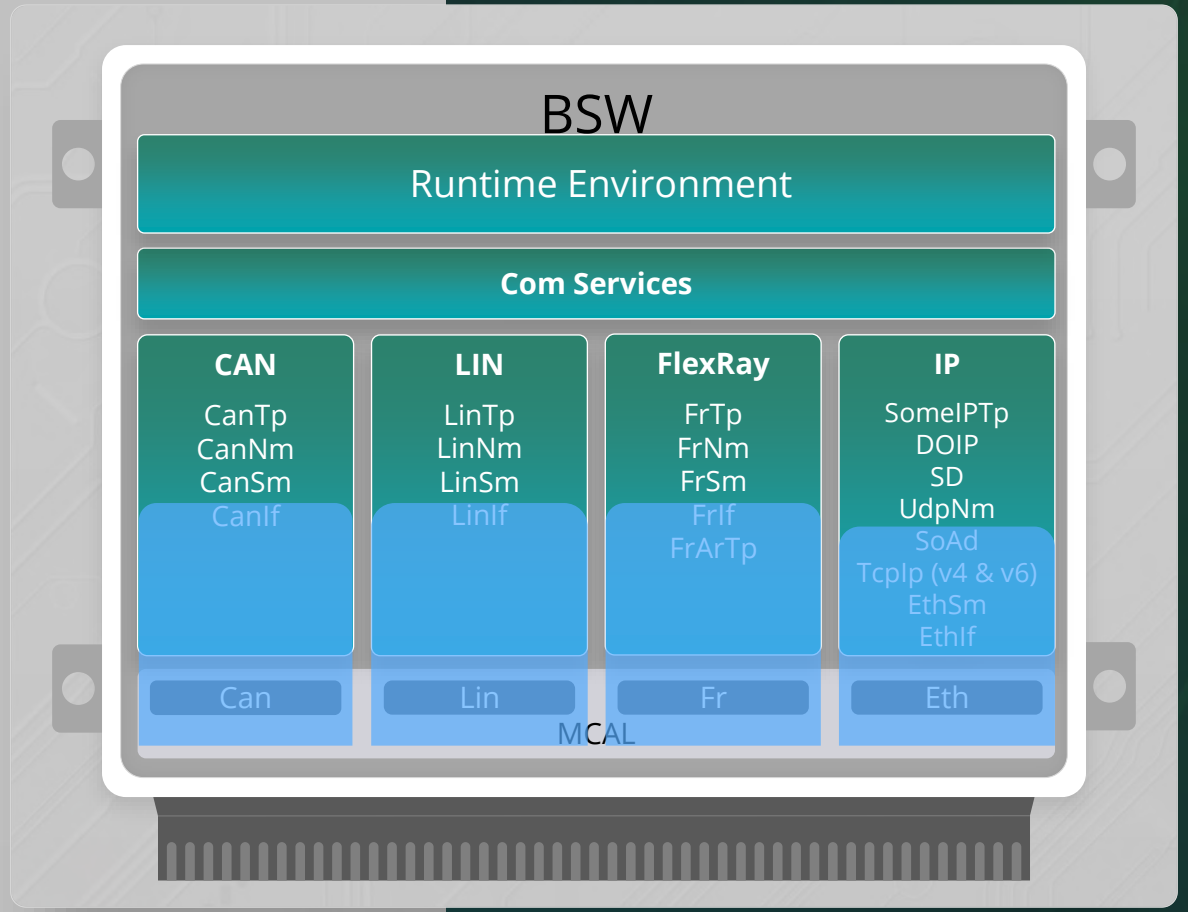
# Comparing the performance of different routing options
# SW based (PDU) routing vs HW accelerated routing vs. Combined

# Outlook

## Combined approach

### Open points with proposed architecture/solution

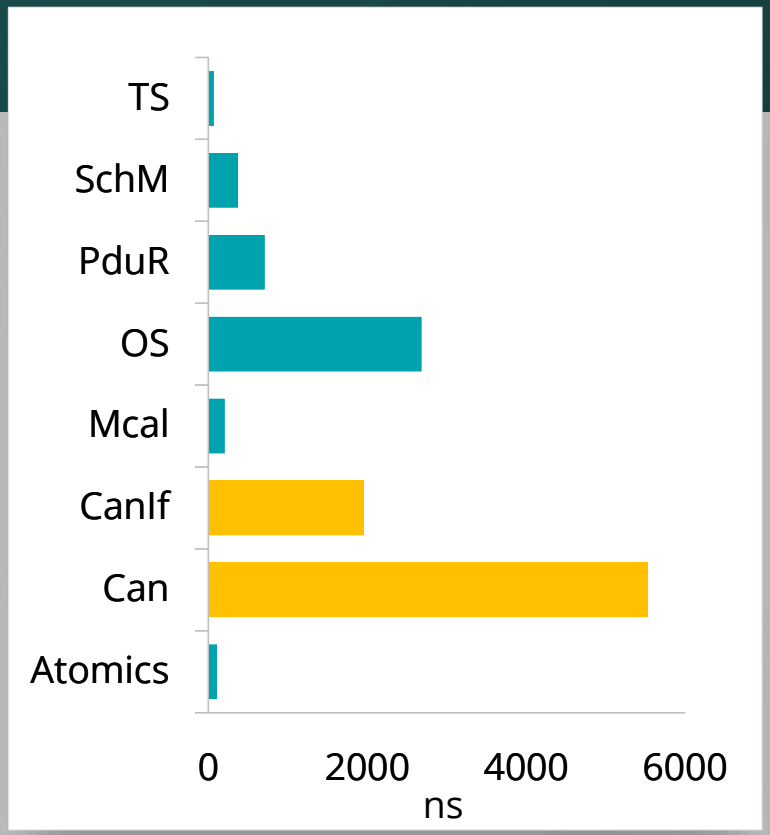
- Where is the boundary between Classic AUTOSAR and HW acceleration to be defined?
- Smooth integration of HW-related configuration parameters:
  - Special configuration model?
  - Common interfaces?
- How to support OEM-specific handling of information?



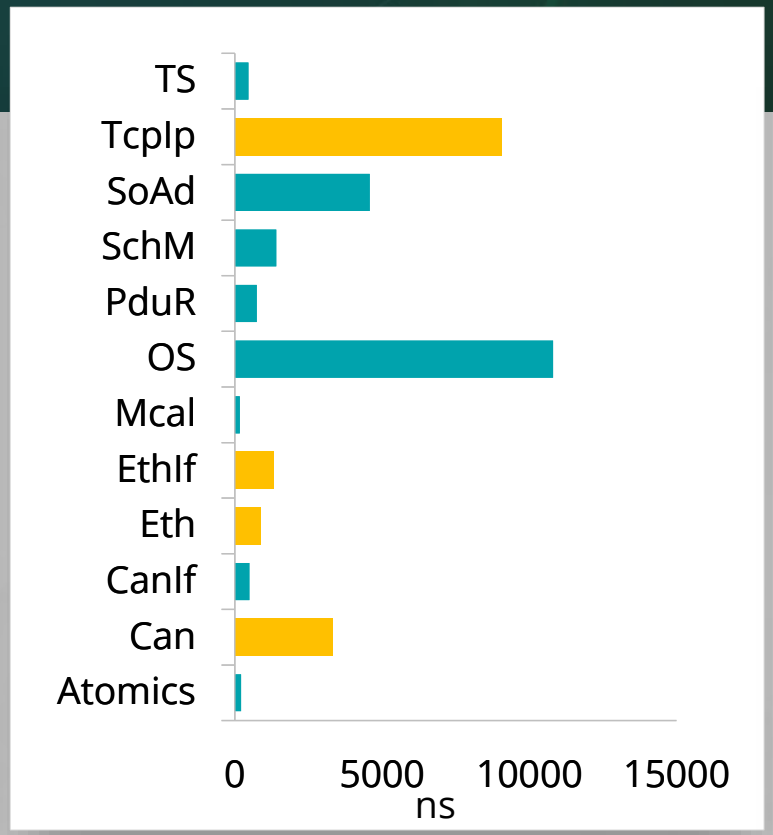
# Where is the border between HW and SW?

Let's have a look where are the bottlenecks in full SW approach

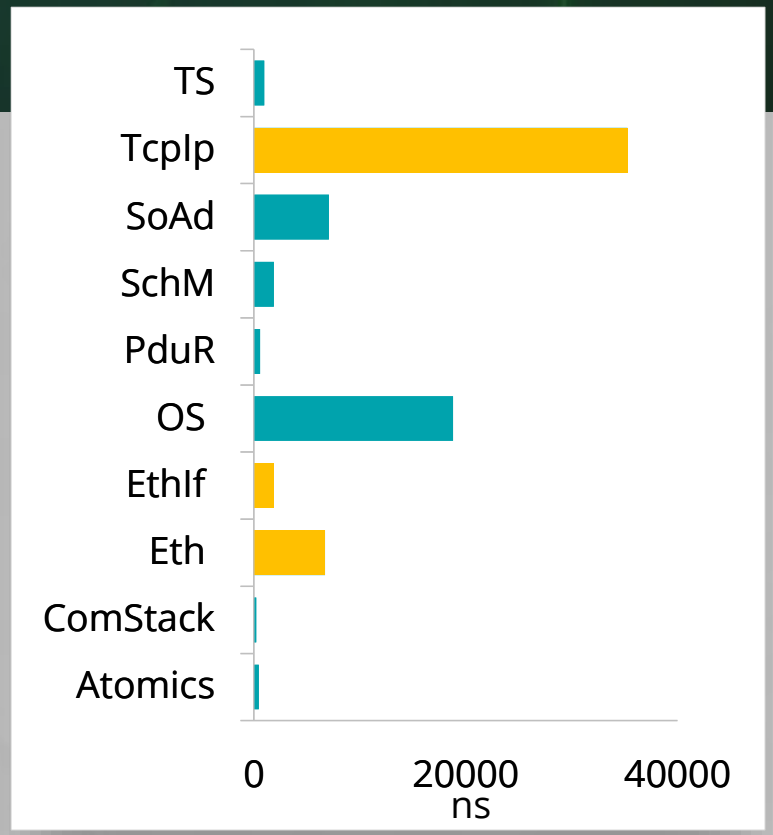
## CAN2CAN




## ETH2CAN




## ETH2ETH



# Outlook

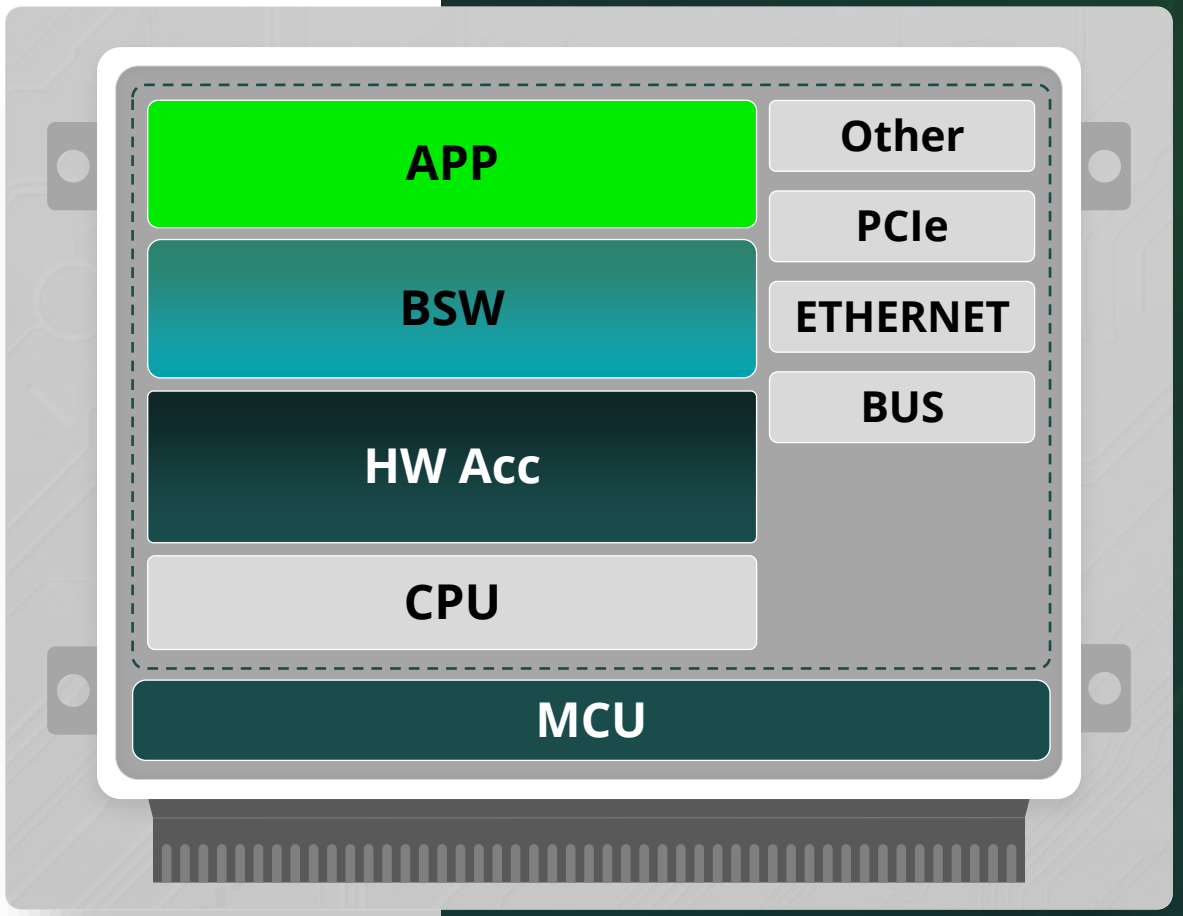
## Combined approach

Smooth handling of HW-related configuration parameters:

**Abstraction model to be considered in configuration**

How to support OEM-specific handling of information?

**Closer collaboration with OEMs and T1s is needed to solve common challenges**



# 04 Conclusion

# Conclusions

- Existing architectures can be served with the support of modern accelerator modules in MCUs and SoCs.
- However, future E/E architectures require even more advanced HW and SW solution.
- Investigation in new flexible and performant solutions has already started.
- Authors propose to have an early collaboration work with all stakeholders to find optimized solution.

# Contact us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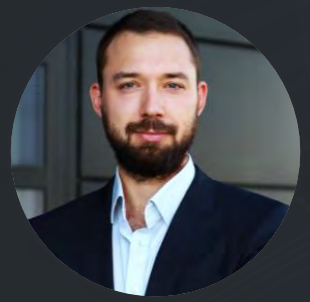


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