

# Apex.AI<sup>®</sup>

The vehicle OS company.

## Eclipse iceoryx™ Speeds up your SDV

EclipseCon Community Day - Automotive@Eclipse  
24 October 2022

Simon Hoinkis



# Eclipse iceoryx Speeds up your SDV

## Agenda

1. Why does inter-process communication (IPC) matter?
2. From AUTOSAR Classic to AUTOSAR Adaptive
3. Why is iceoryx the perfect match for your SDV?
4. How to integrate iceoryx?
  - a. Generic template
  - b. AUTOSAR Adaptive ara::com
  - c. Rust binding
5. Summary and outlook

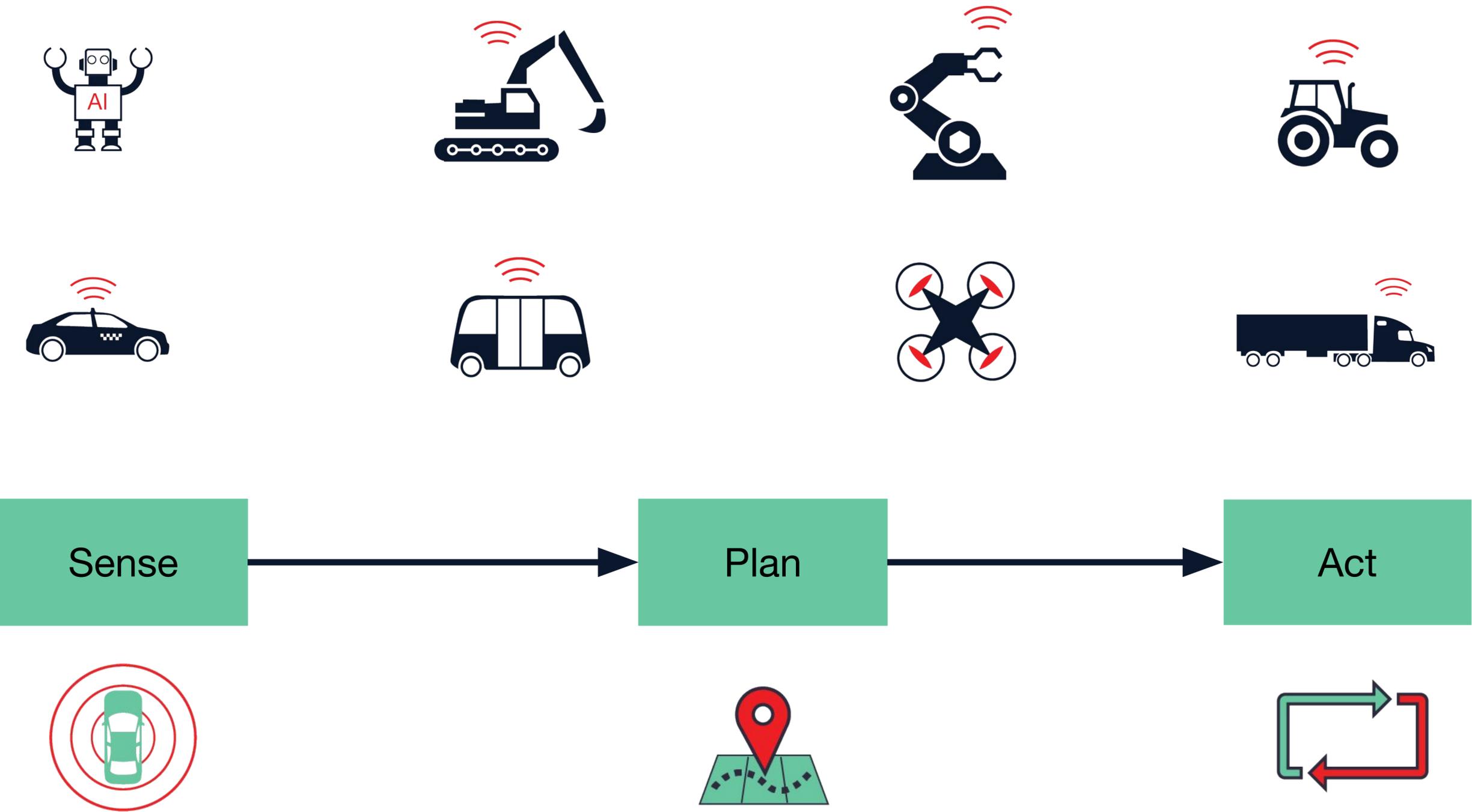
# Why does IPC matter?

# 1



# Eclipse iceoryx Speeds up your SDV

## Why does IPC matter?



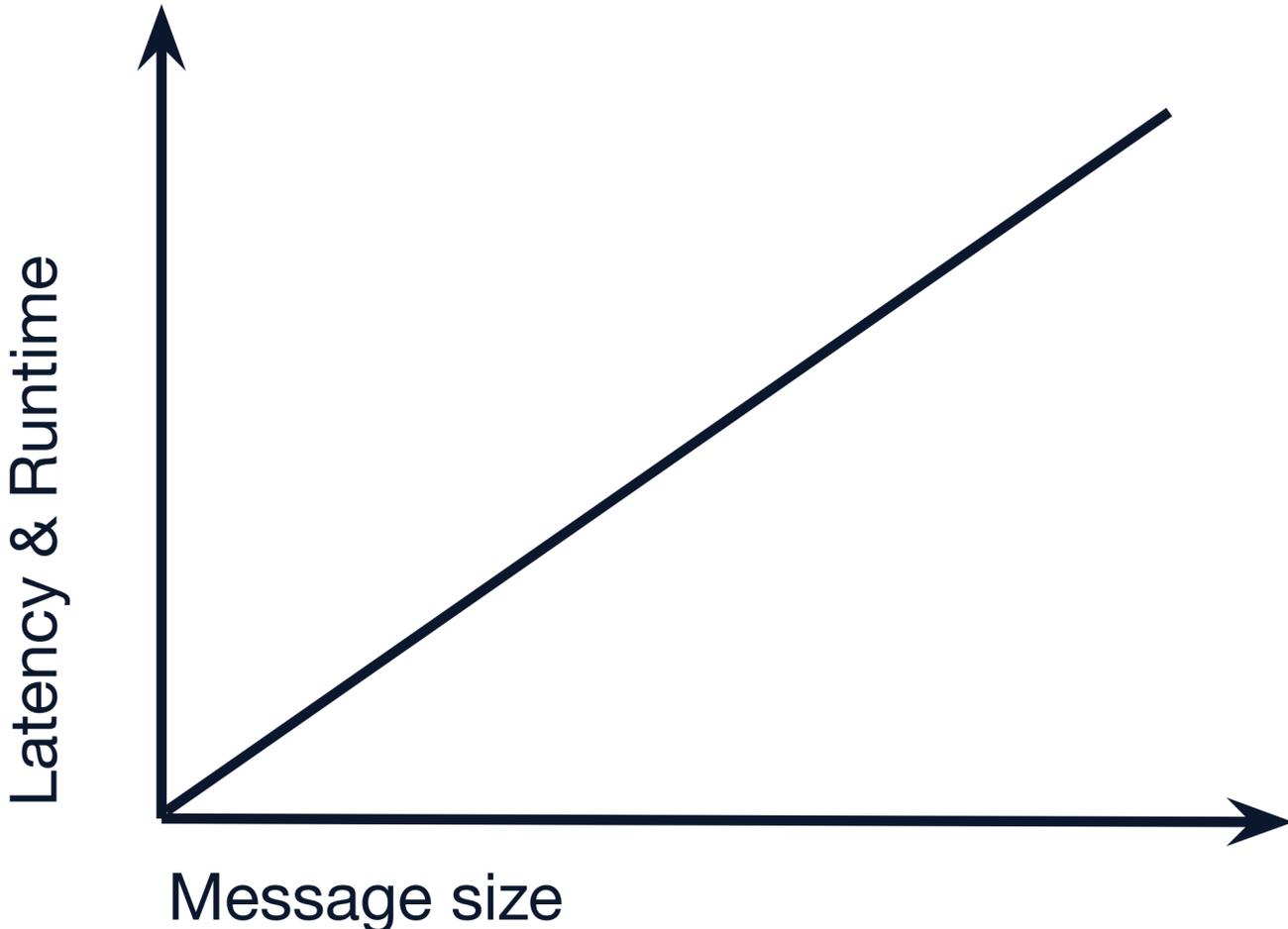
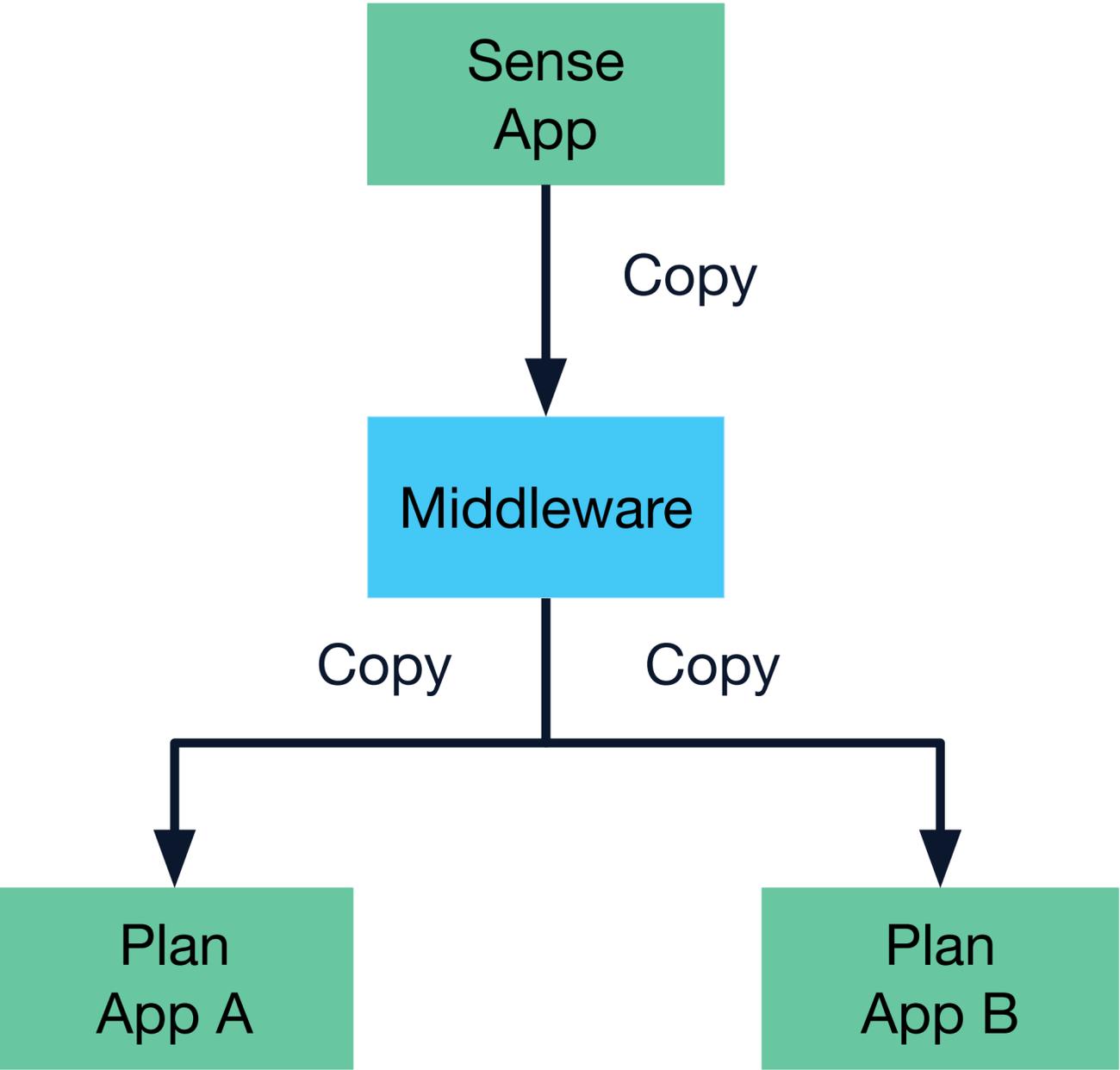
# From AUTOSAR Classic to AUTOSAR Adaptive

# 2



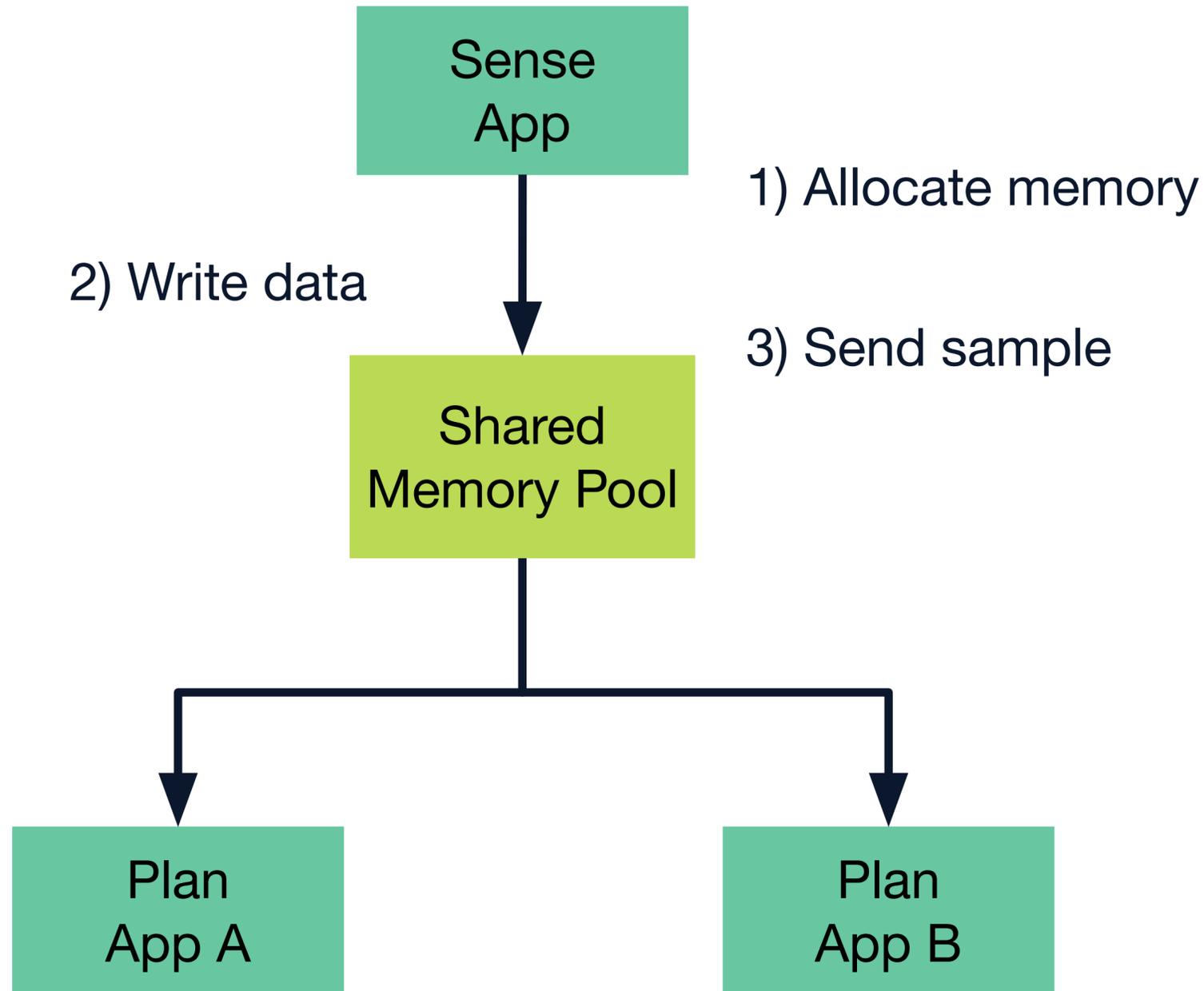
# Eclipse iceoryx Speeds up your SDV

Problem: AUTOSAR Classic copies data for every subscriber



# Eclipse iceoryx Speeds up your SDV

## Solution: zero-copy API



# Eclipse iceoryx Speeds up your SDV

## The history of Eclipse iceoryx

- 2009 - 2012
  - Robert Bosch GmbH creates zero-copy middleware *Driver Assistance Data DeliverY* (DADDY) for advanced driver assistance systems (ADAS)
  - Running today on millions of microcontroller-based ECUs
- 2016
  - Bosch contributes DADDY's zero-copy API to AUTOSAR Adaptive together with BMW (ara::com)
  - Bosch starts development of a POSIX middleware based on DADDY for ara::com
- 2019
  - Bosch open-sources the POSIX middleware as Eclipse iceoryx
    - First embedded ECU code on Eclipse
    - Most popular Eclipse Automotive project (951 ★)

The logo for DADDY, featuring the word "DADDY" in a bold, dark blue, sans-serif font. The letter "A" is replaced by a stylized black silhouette of a top hat and a mustache.The logo for AUTOSAR, featuring the word "AUTOSAR" in a bold, dark grey, sans-serif font. The letter "O" is replaced by a stylized grey and white circular graphic.The logo for iceoryx, featuring a stylized grey and black geometric shape above the word "iceoryx" in a lowercase, black, sans-serif font.

**Why is iceoryx  
the perfect match  
for your SDV?**

**3**



# Eclipse iceoryx Speeds up your SDV

## Why is iceoryx the perfect match for your SDV?

- Everyone needs fast IPC
  - Why reinvent the wheel?
  - Why waste money?
  - Use iceoryx 😊
- iceoryx is developed since 2019 as open-source with an automotive-centric community e.g.
  - ETAS GmbH
  - Robert Bosch GmbH
  - Apex.AI Inc.
  - Avin Systems
  - Continental AG
  - SAIC Motor Ltd.
  - NXP N.V.
  - Lear Corp.
  - Waabi
- Some of those companies build commercial products on top of Eclipse iceoryx
- iceoryx is integrated in Eclipse Cyclone DDS and used in ROS 2 as middleware by a huge community
- Open source is the right choice
  - Transparency builds trust with customers & partners
  - Better quality and less bugs
  - Faster development with the community
- ISO 26262 certification ongoing
  - All iceoryx maintainers have a safety background
  - The work in the open is conducted according to established guidelines and practises e.g.
    - Review checklists
    - Commit traceability
    - Usage of sanitizers
    - Static code analysis

# How to integrate iceoryx?

# 4



# Eclipse iceoryx Speeds up your SDV

## Integration with the generic CMake template

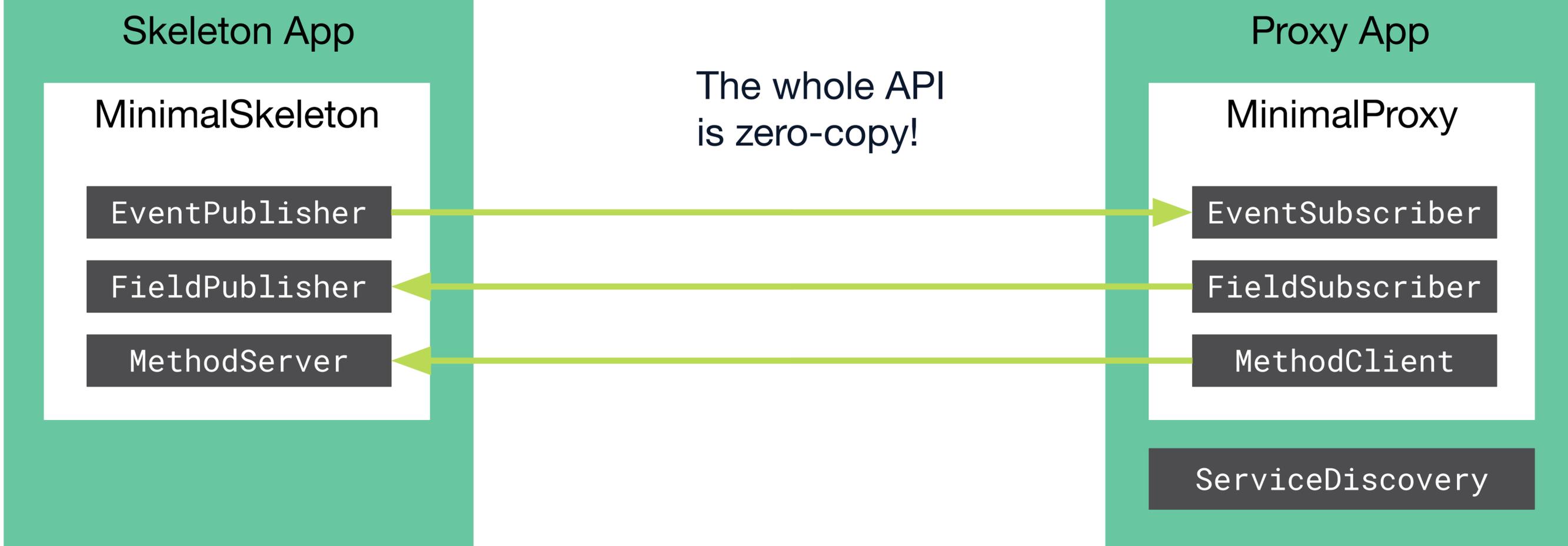
- Ready to use and easy to get started
- No need to fight with CMake
- Using `FetchContent` from CMake 3.11

```
# fetch iceoryx if not found
if(NOT iceoryx_hoofs_FOUND OR NOT iceoryx_posh_FOUND)
  # .. snip ..
  include(FetchContent)
  FetchContent_Declare(
    iceoryx
    GIT_REPOSITORY https://github.com/eclipse-iceoryx/iceoryx.git
    GIT_TAG v2.0.2
  )
```

<https://github.com/eclipse-iceoryx/iceoryx-project-template>

# Eclipse iceoryx Speeds up your SDV

## Integration in AUTOSAR Adaptive ara::com



<https://github.com/eclipse-iceoryx/iceoryx-automotive-soa>

<https://www.apex.ai/post/eclipse-iceoryx-blueberry-speeds-up-autosar-and-ros-2>

# Eclipse iceoryx Speeds up your SDV

## Integration into Rust projects

```
[dependencies]
iceoryx-rs = "0.1"
...
use iceoryx_rs::marker::ShmSend;

#[repr(C)]
#[derive(Default)]
pub struct Counter {
    pub counter: u32,
}

unsafe impl ShmSend for Counter {}
```

```
use iceoryx_rs::PublisherBuilder;
use iceoryx_rs::Runtime;

mod topic;
use topic::Counter;

fn main() -> Result<(), Box<dyn Error>>
{
    Runtime::init("publisher");
    let publisher =
    PublisherBuilder::<Counter>::new("Foo",
    "Bar", "Blubb").create()?;
    ...
}
```

<https://crates.io/crates/iceoryx-rs>

# Summary and outlook

# 5



# Eclipse iceoryx Speeds up your SDV

## Summary

- iceoryx has a long history and its predecessor is used in millions of cars
- Development of iceoryx heavily influenced AUTOSAR Adaptive and its zero-copy API became an industry standard
- The iceoryx community is looking forward to working with the SDV community and speed up their frameworks

## Outlook

- More ROS 2 support is coming
  - *rmw\_iceoryx* will be updated to Blueberry
    - [https://github.com/ros2/rmw\\_iceoryx](https://github.com/ros2/rmw_iceoryx)
- ISO 26262 certification efforts will continue
  - Expect many more patches going upstream



# Apex.AI<sup>®</sup>

The vehicle OS company.

Questions?



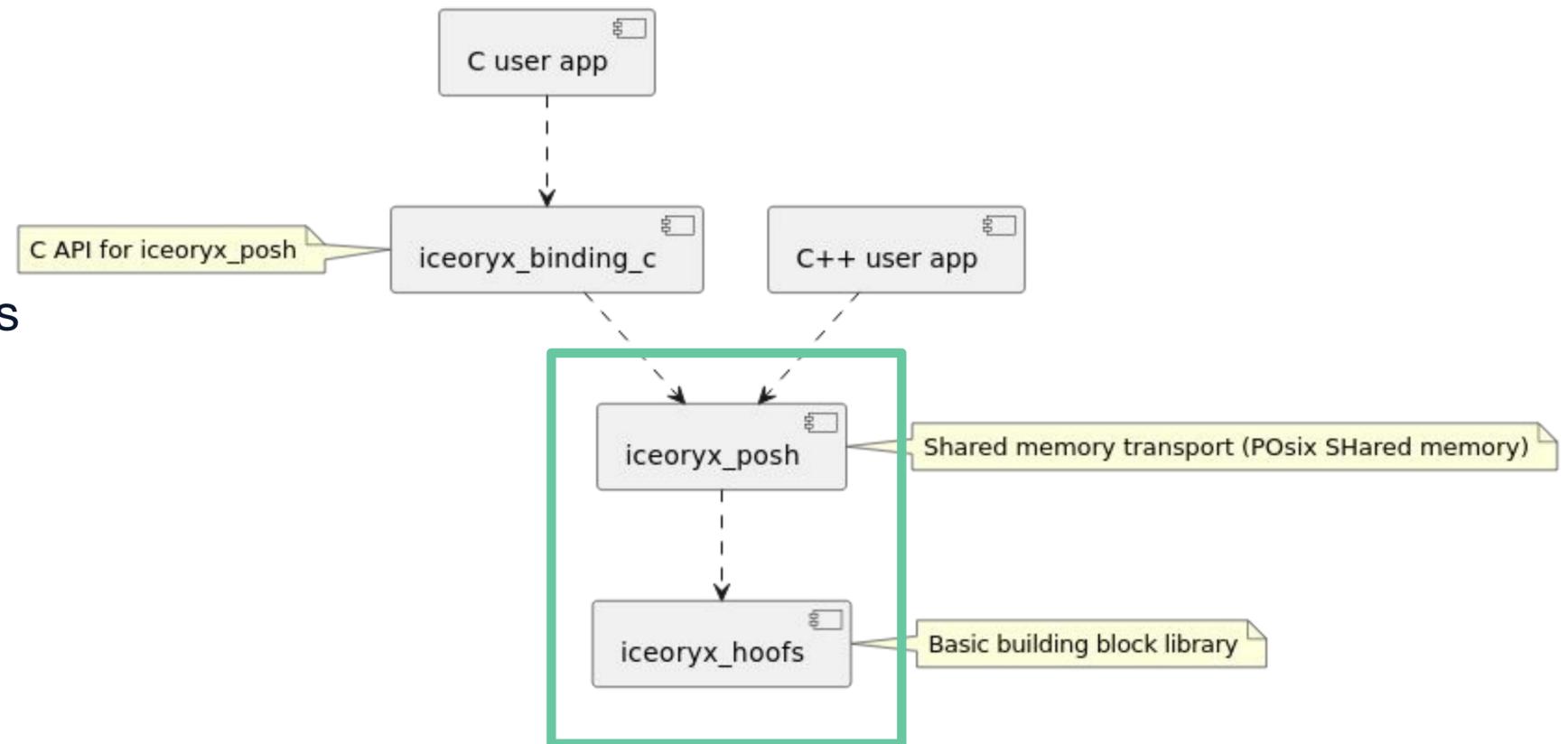
# Apex.AI<sup>®</sup>

The vehicle OS company.

# Eclipse iceoryx Speeds up your SDV

## Backup: State of the ISO 26262 certification

- iceoryx\_hoofs and iceoryx\_posh will get certified
  - hoofs: **H**andy **O**bjects **O**ptimised **F**or **S**afety
  - posh: **P**OSIX **S**Hared memory
- Started bottom-up with iceoryx\_hoofs
  - Addressing AUTOSAR C++14 ruleset violations with Axivion Suite in the upstream repository
  - Some work not happening in the upstream repository e.g.
    - Requirements elicitation
    - MC/DC tests



Overall certification progress

