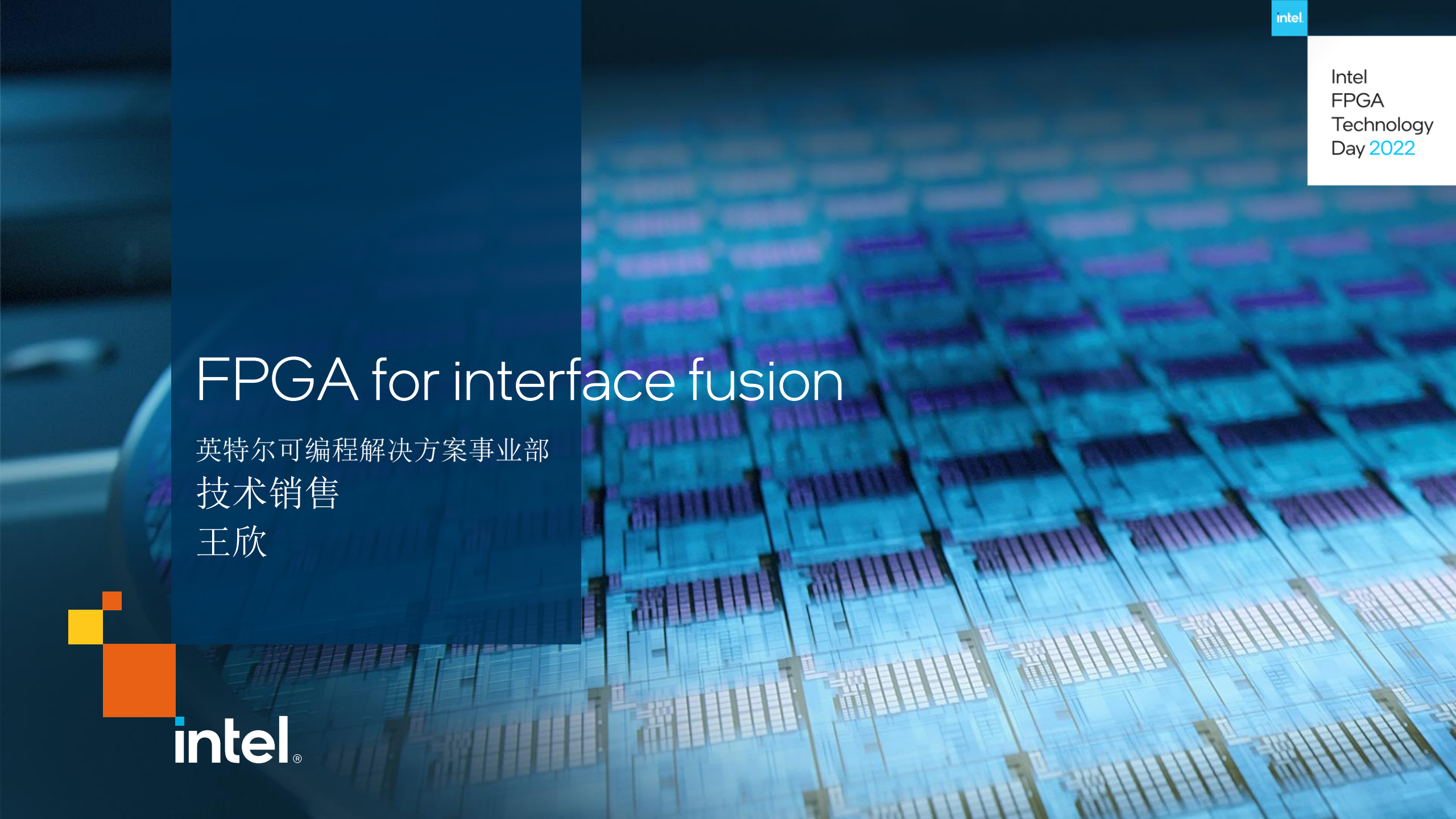


Intel FPGA Technology Day 2022

FPGA for interface fusion

英特尔可编程解决方案事业部
技术销售
王欣

Legal Notices

No license (express or implied, by estoppel or otherwise) to any intellectual property rights is granted by this document.

This document contains information on products, services and/or processes in development. All information provided here is subject to change without notice.

Contact your Intel representative to obtain the latest forecast, schedule, specifications and roadmaps.

You may not use or facilitate the use of this document in connection with any infringement or other legal analysis concerning Intel products described herein. You agree to grant Intel a non-exclusive, royalty-free license to any patent claim thereafter drafted which includes subject matter disclosed herein.

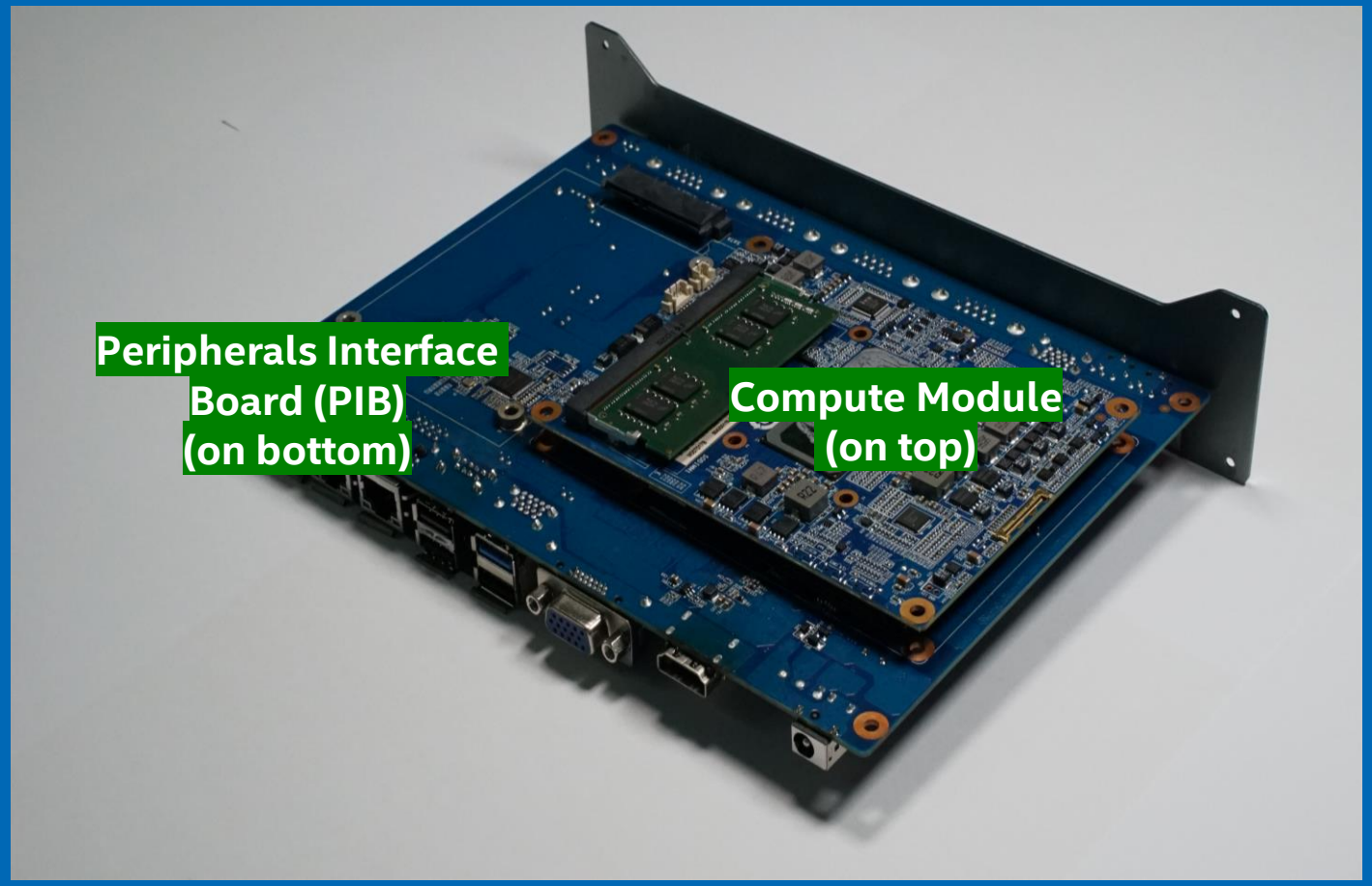
Intel, the Intel logo, are trademarks of Intel Corporation or its subsidiaries in the U.S. and/or other countries.

This presentation discusses proprietary information of Intel Corporation covered by respective participant CNDAs

Agenda

- Intel Industrial Edge Module
- Peripherals interface board with FPGA
- Autonomous Mobile Robot application
  - Time synchronization

Intel® Industrial Edge Module



Intel® Industrial Edge Module is a **modular Hardware** reference design based on Atom (Elkhart Lake) and Core (Whiskey Lake, Tiger Lake) platforms, optimized for **Industrial applications** such as control and vision.

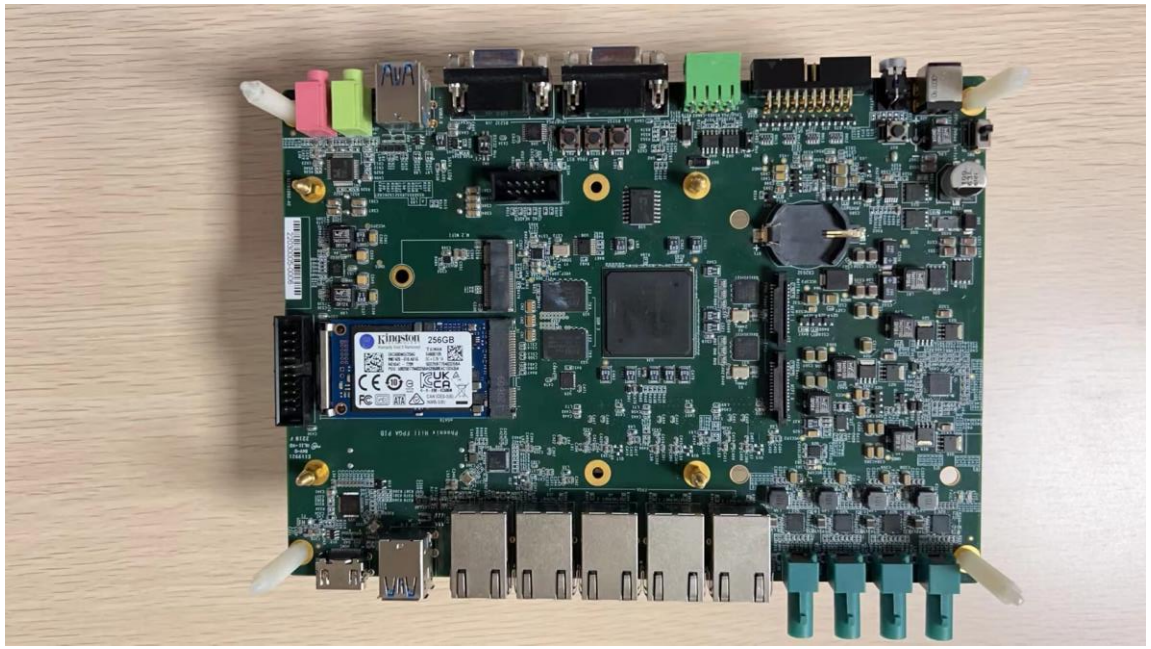
Benefits:

- **Modular Design**: Cost & time saving on I/O customization, high-mix & low-volume SKUs
- **Upgradable**: Superior experience of newer CPU on legacy I/O
- **Industrial Grade**: Industrial I/Os, Industrial connectors & fanless robust design

Intel FPGA Technology Day 2022

Peripherals Interface Board – Powered by FPGA

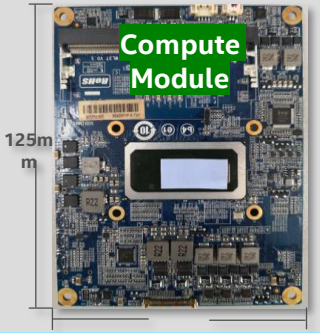
CycloneV GT on board



- Interface in Parallel
  - Senor Interfaces
  - Ethernet ports
  - Control Ports
- Deterministic Computation
  - PLC Control
  - Motion Control
- Workload offload
  - Imaging Signal Processing
  - AI inference

Intel FPGA Technology Day 2022

System Diagram



CPU ON PHOENIX HILL COMPUTE BOARD

Application | Application | Application

ROS2 | ECI

Intel X86 Driver

B2B CONNECT PLUG

PCIE Gen2x4 | PCIE Gen2x1 | eSPI

B2B CONNECT PLUG

PERIPHERAL INTERFACE BOARD

FPGA RTL

CPU Interfaces

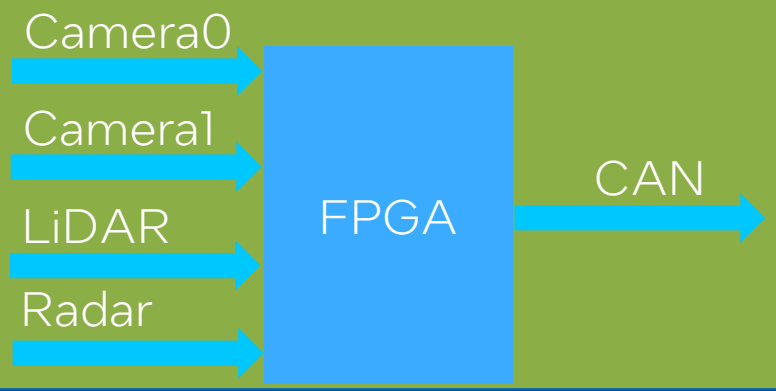
USB

MIPI x2 LVDS x4 | ETH X 4 | CAN | GPIO | PWM | UART | HDMI | Eth | M.2 | SATA

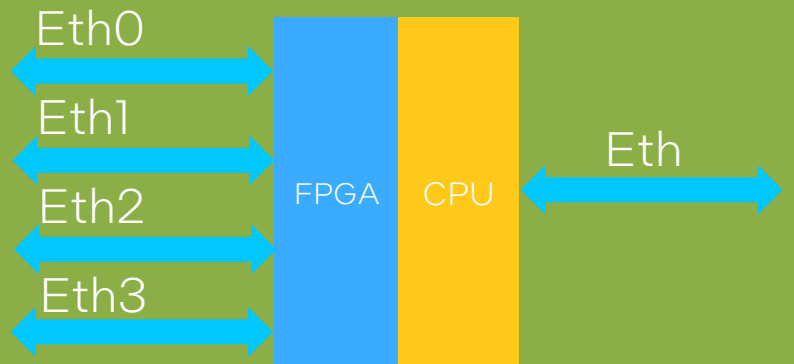
Intel FPGA Technology Day 2022

Target Area

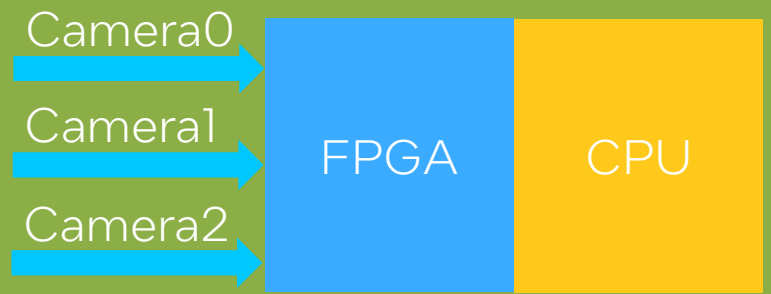
Autonomous Mobile Robot



Industry Internet



Machine Vision



Vision Control

Intel FPGA Technology Day 2022

Sensor Fusion in AMR

Increased Demands

Increased demands on AMR in various application scenarios

Complex Environment

Increased complexity on the Moving environment.

Multisensor Required

No single sensor could solve all the problems.

Requirement

Various sensor + **Time Synchronization**

- Need various sensors to assist on autonomous navigation accuracy and intelligent obstacle avoidance capability.
- Need time synchronization between sensor data to ensure the accuracy.

As-Is Solution

X86 CPU

- ✓ Connect to multi sensors and use soft time synchronization.
- ✗ Number of sensor connected is limited.
- ✗ Cannot sure accurate time synchronization.

MCU

- ✓ Connect to multi sensors
- ✗ Cannot sure accurate time synchronization

FPGA

——Our Proposed Solution

Extended Sensor Hub

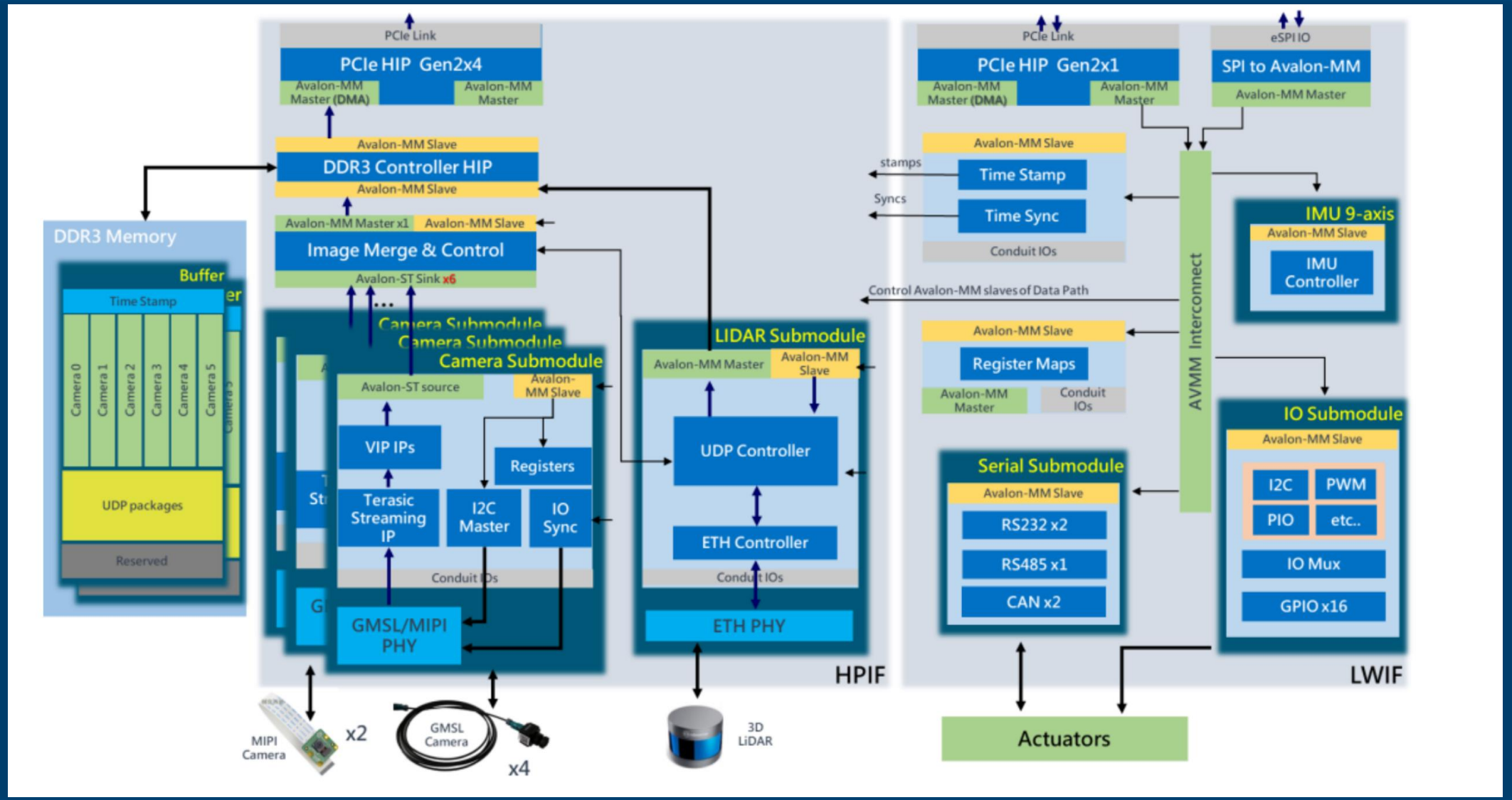
Time Synchronization

Trigger the sensor collection simultaneously to make sure the hard time synchronization between different sensors.

Image Preprocessing

Future use for image preprocessing, using ISP, before sending to CPU for further processing.

FPGA RTL Diagram



Intel FPGA Technology Day 2022

Software Diagram

Software Architecture

App

Latency Indicator | Camera data / stitched image | LiDar data / depth map

ROS

Modified Robot OS

Config: Lidar ROS Node; Camera ROS Node

Time Sync: IMU ROS Node

Data Capture: Odom ROS Node

Joystick ROS Node

Sensor Fusion Driver

Sensor Fusion Driver

V4L2 | CAN | UART | RS485 | Eth | GPIO

System Setting | Extract Timestamp | Data Depacking

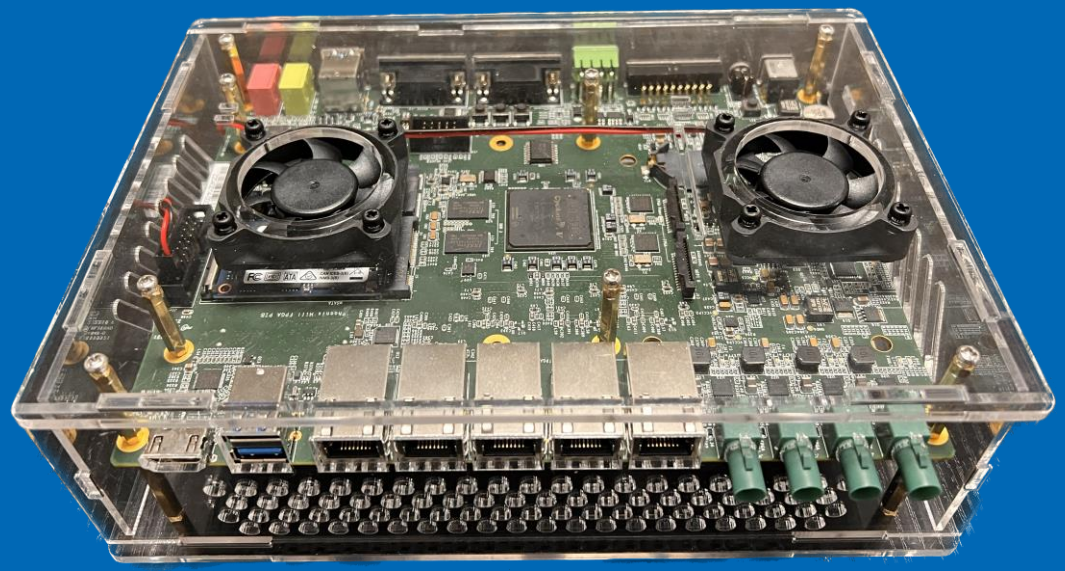
FPGA/ Kernel Driver

FPGA Kernel Driver

Interface → Sync Adjust → Data capture

Intel FPGA Technology Day 2022

More are coming ....



Intel FPGA Technology Day 2022

intel