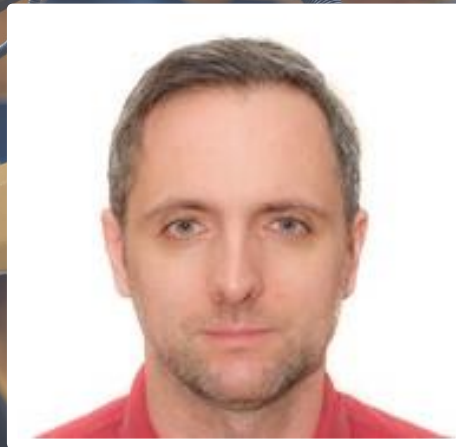


Functional Safety
Control Platform
for AMRs
(FuSA for AMRs)

nexCOBOT
Open Robots & Machines



Matteo Salardi
Functional Safety Specialist
Intel

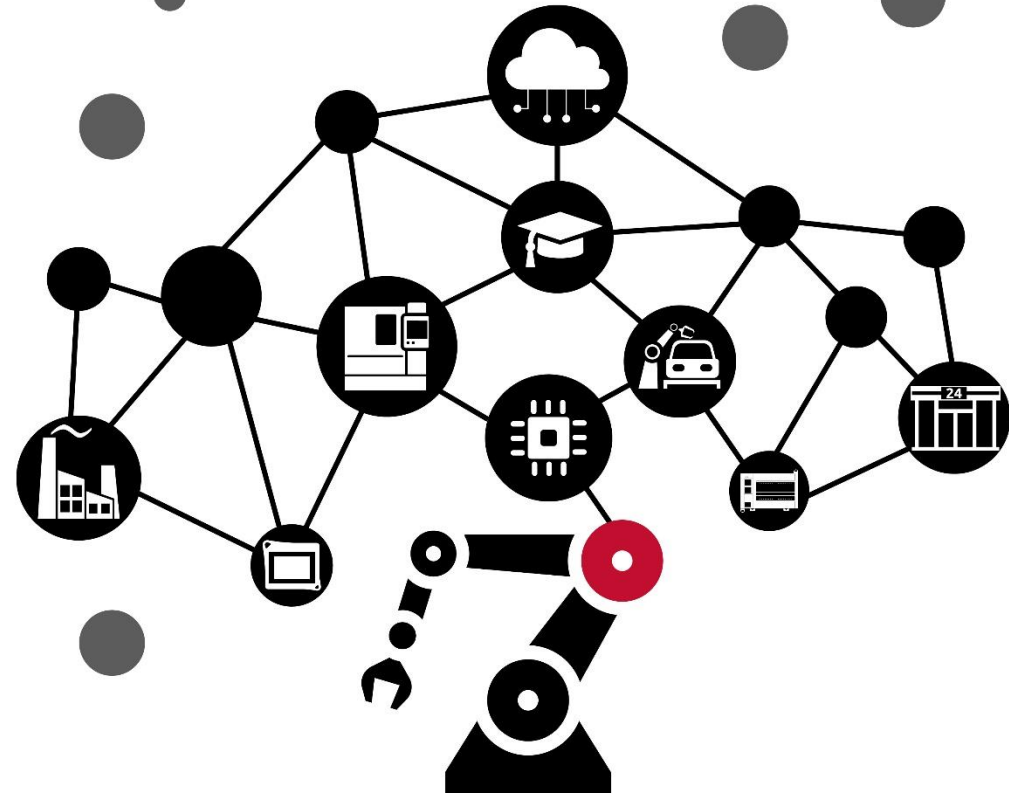


Jenny Shern
General Manager
NexCOBOT

Functional Safety Control Platform for Autonomous Mobile Robots

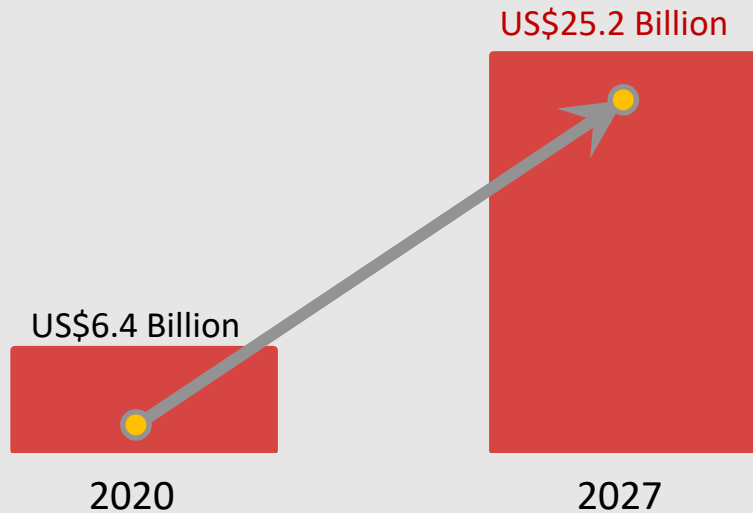
Jenny Shern

December 20, 2022



Autonomous Mobile Robots(AMRs) Market

CAGR:21.6%



*Data from Global Industry Analysts



Realize the Importance of AMR Safety

1 • Keep workers safe

2 • Avoid collision accidents

Safety Functions of AMRs

SCB100 Safety Controller Platform



Raise platform

Locating shaft

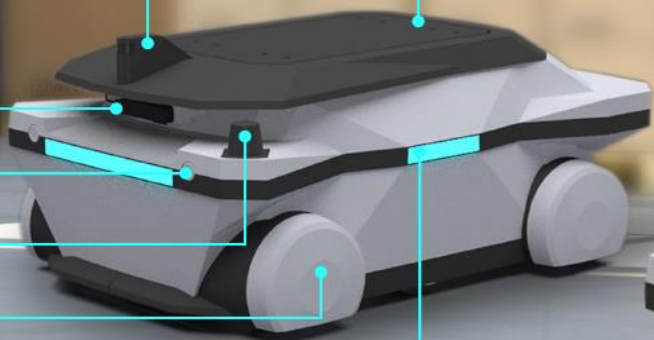
Camera

Ultrasonic sensor

LiDAR

Motor driver

Side light



Safety laser scanner & Safety camera



Servo drive & encoder



E-Stop Device

Velocity Limiting

Braking System

Presence-sensing devices

AMR Safety Standards

- ▶ The market for AMRs is growing so fast that safety standards are required to ensure that manufacturers develop safe machines to keep workers safe.

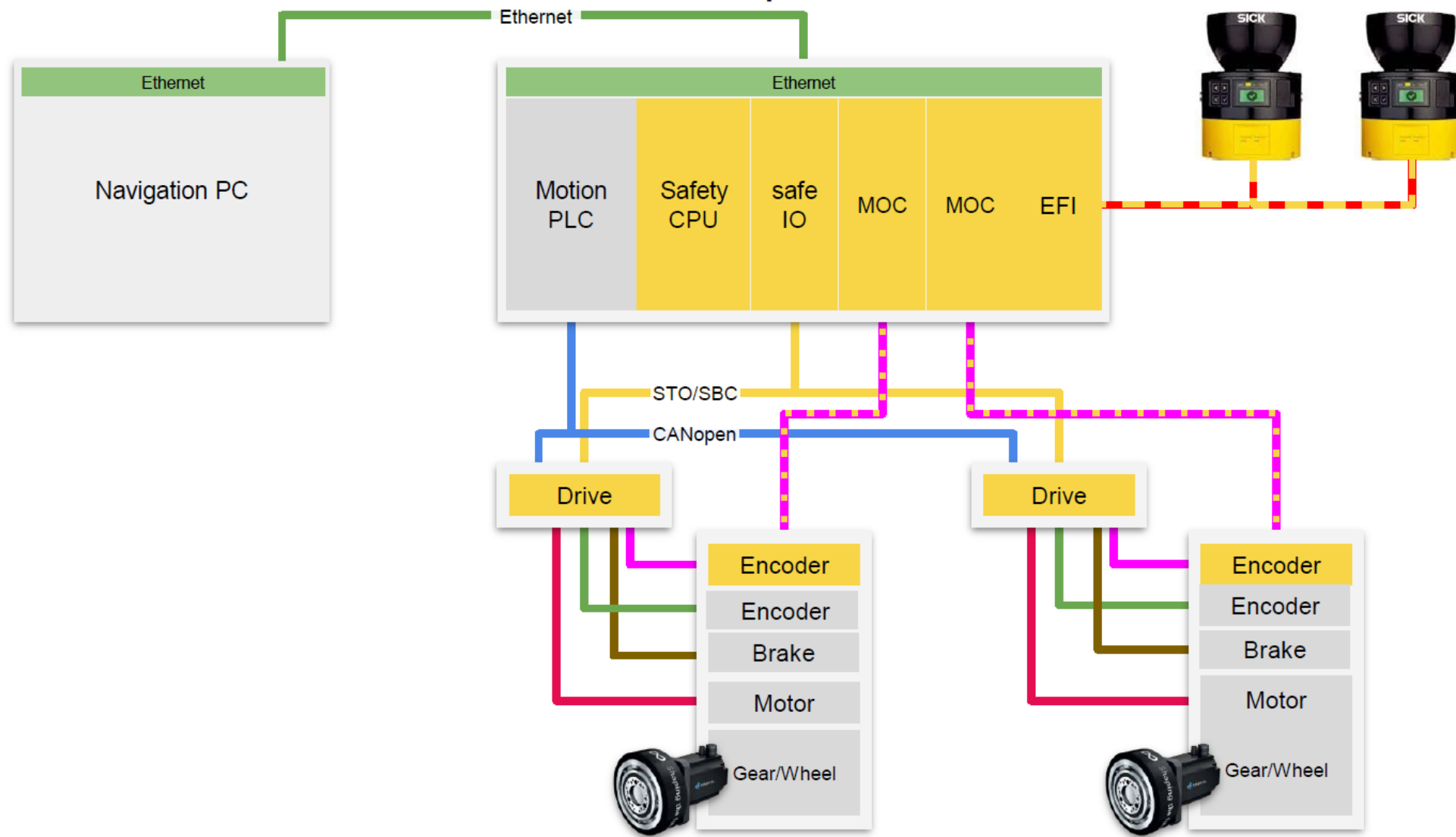
EU Standard	American Standard
ISO 3691-4:2020	RIA R15.08-1-2020
For Industrial Trucks - Safety Requirements And Verification - Part 4: Driverless Industrial Trucks And Their Systems	For Industrial Mobile Robots - Safety Requirements - Part 1: Requirements For The Industrial Mobile Robot



International
Organization for
Standardization



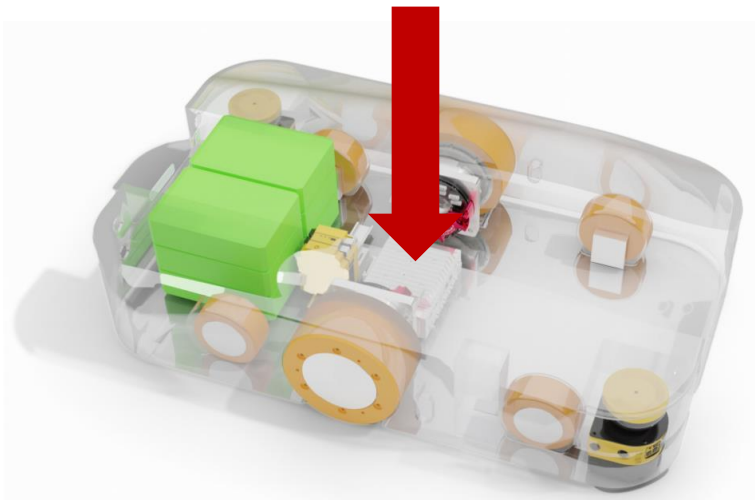
Traditional AMR Safety Protection Architecture - CANOpen



SCB100 - Robot Safety Controller Board



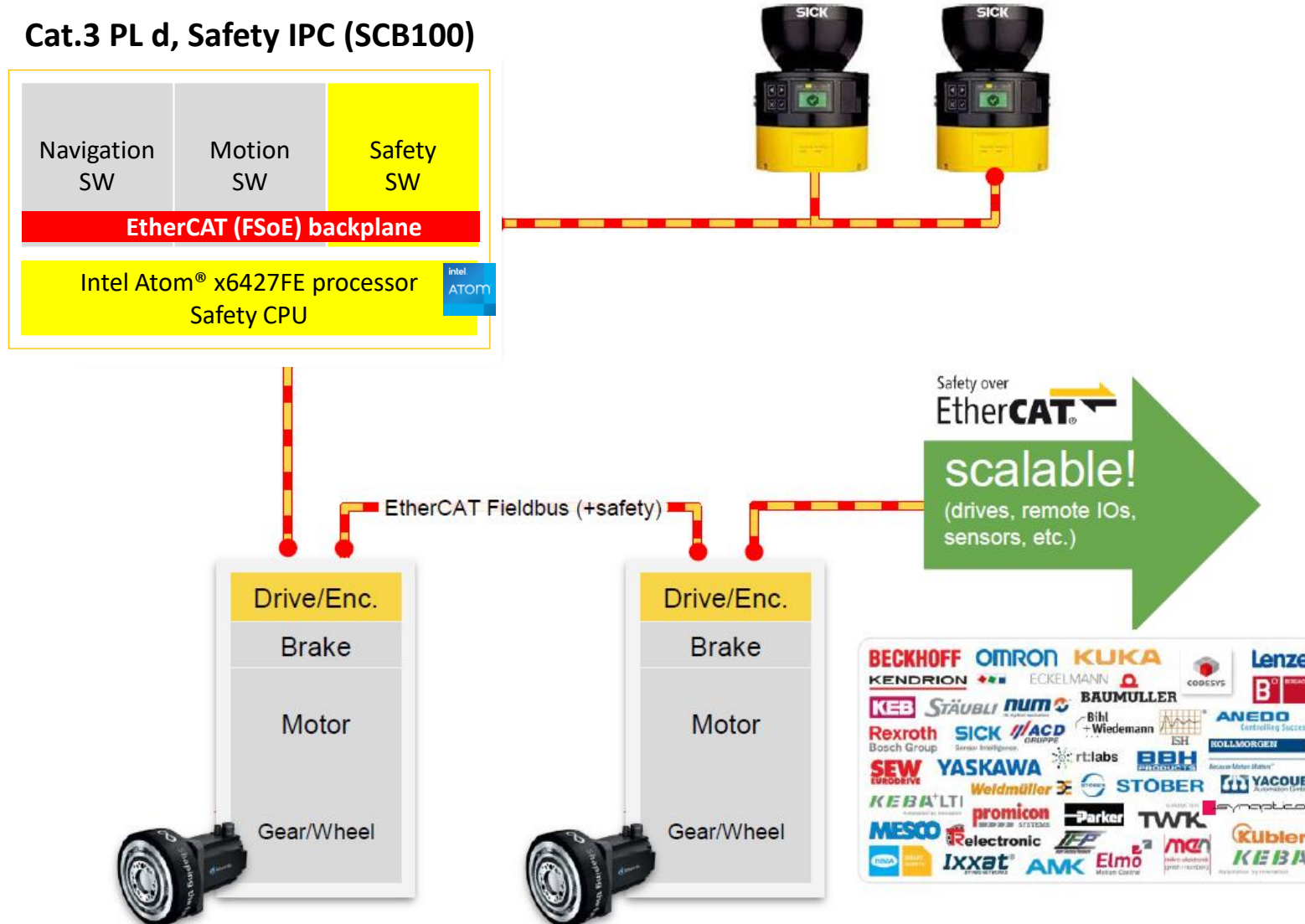
Combine navigation controller and safety controller into one controller



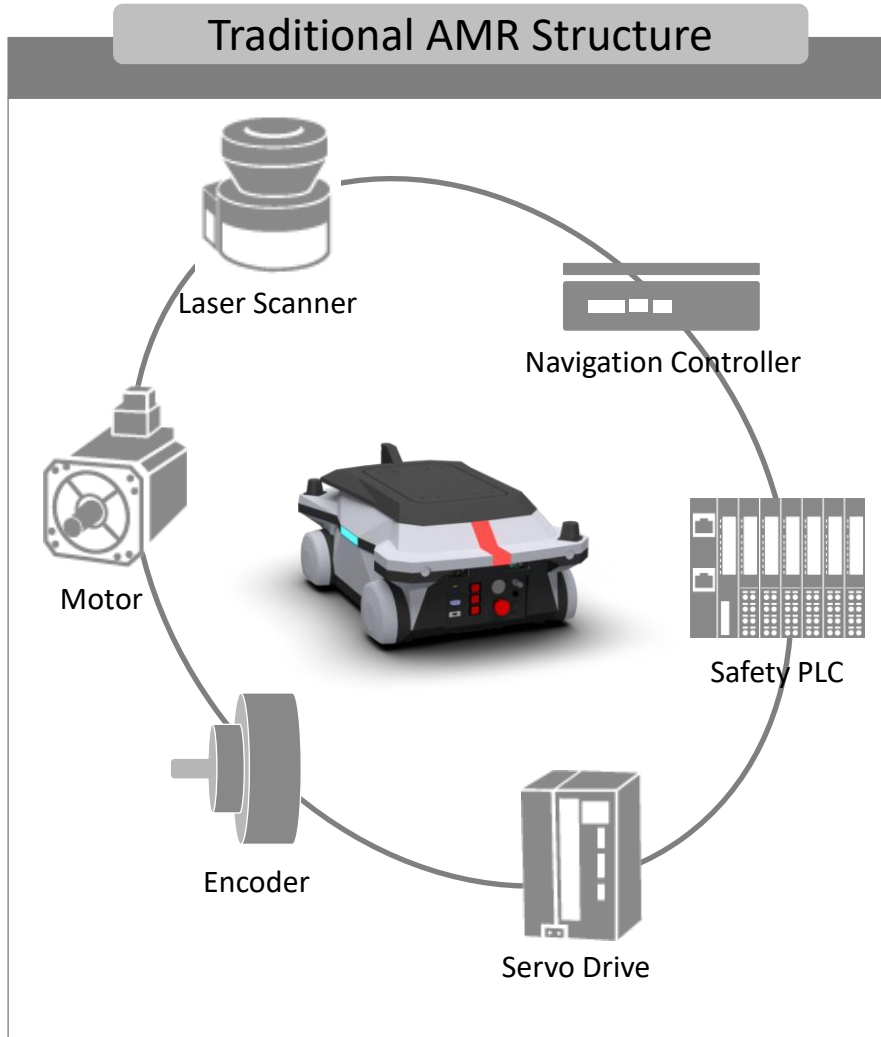
- ▶ Board-level SIL2, Cat.3 PLd safety capability enabled by the Intel Atom® x6427FE processor
- ▶ Accelerated development with a safety-related software stack
- ▶ Save time (12-18 months) and effort for IEC 61508 certification
- ▶ Compatible with Safety RTOS and Safety Hypervisor



NexCOBOT & Synapticon Solution – EtherCAT FSoE



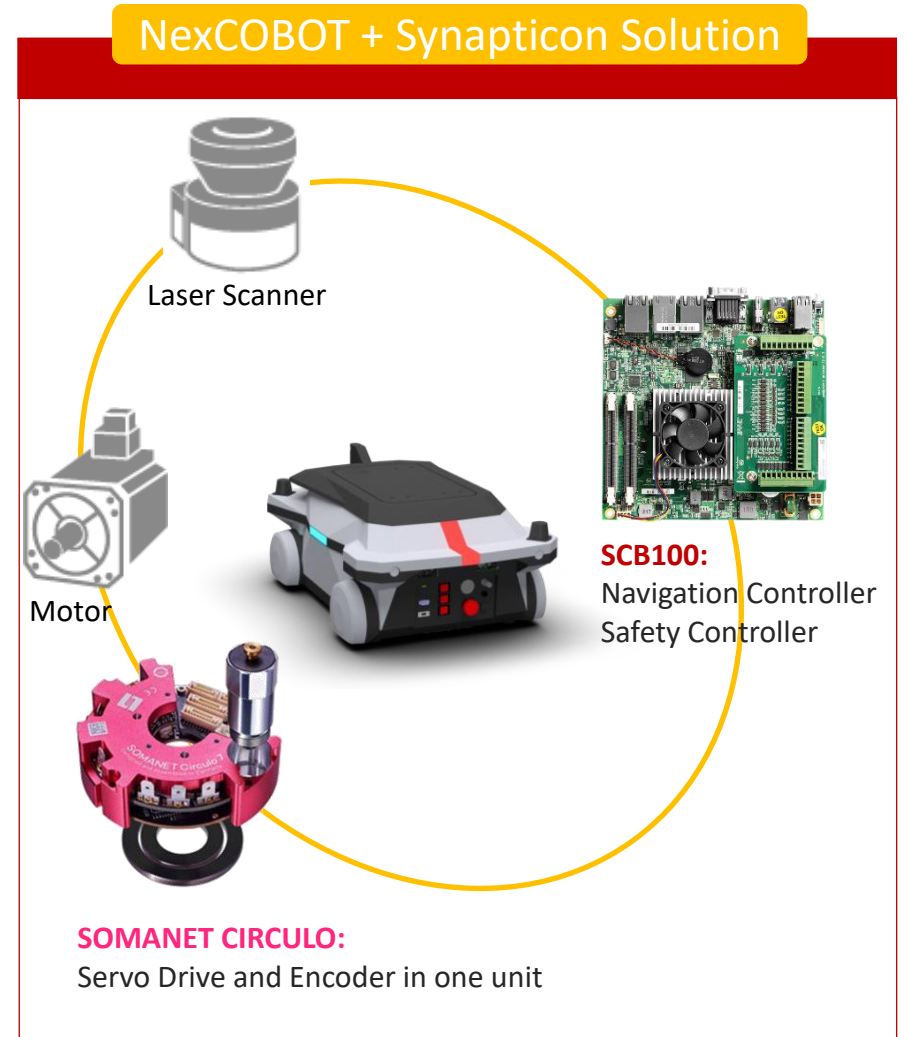
AMR Architecture



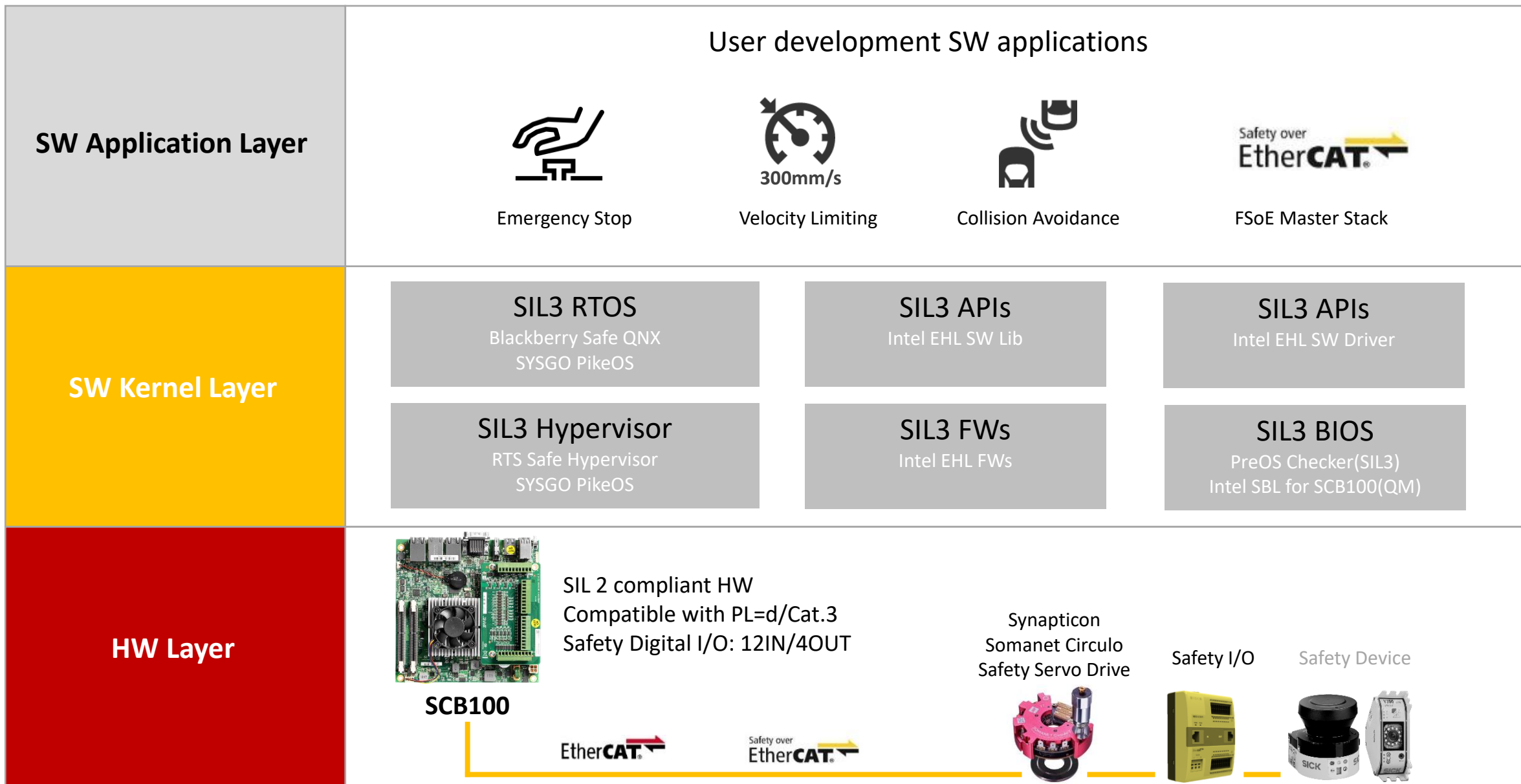
Less components
Less complexity

→

Reduce system cost
Shorten development time



Software Building Blocks for SCB100



SCB100 Functional Safety Features



intel
ATOM

Board-level SIL2 safety capability enabled by the Enhanced for IoT Intel Atom® x6427FE processor

Delivers performance and power efficiency, is enhanced for IoT, and supports key FuSa-capable features



In-Band Error Correcting Code (ECC)

- This feature corrects single-bit memory errors in standard, non-ECC memory.

Intel® Safety Island (Intel® SI)

- During operation, Intel® SI checks the processor to help ensure that the architecture is functioning as expected.

Intel® Slim Bootloader

- Lightweight bootloader and supports verified boot, measured boot, and secured firmware updates.

Pre-OS Checker

- SIL3-capable software component that verifies the integrity of the boot process.

Safety Application Scenario of SCB100

When the AMR is moving in the work field, we need to make sure the moving speed is under the limit of ISO 3691-4 or RIA 15.08-1.

Velocity Limiting

- Users could implement a velocity limiting safety function with SCB100, by receiving the safety encoder data from safety inputs, and calculating the velocity of AMR. If the velocity is over limit, the SCB100 could trigger safety stop functions of safety servo drive by FSoE.
If AMR detects any pedestrian is inside the danger zone of AMR, AMR should stop in order to prevent the collision.

Collision Avoidance

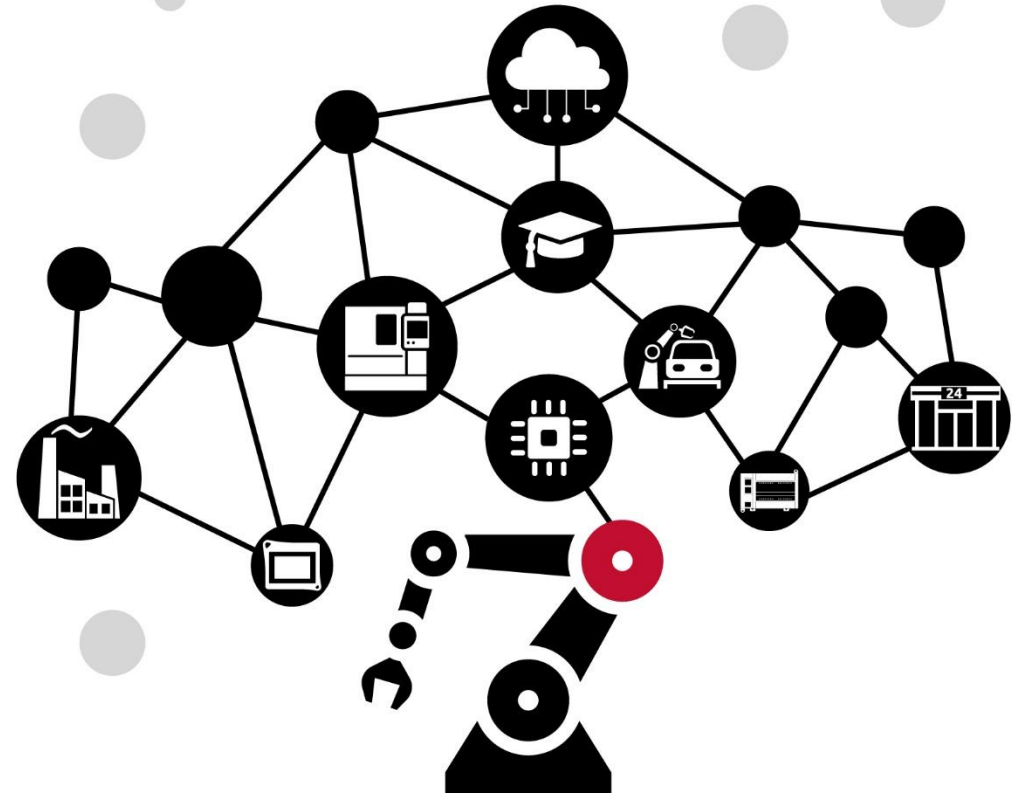
- Users could implement a collision avoidance safety function with SCB100, by receiving the safety data from presence-sensing device and calculating the danger zone of AMR. If it detects any pedestrian inside the danger zone, the SCB100 could trigger safety stop functions of safety servo drive by FSoE.

Thank You

FOR MORE INFORMATION

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contact@nexcobot.com



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