

IEEE 802.1 MAC DATA Security

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AIM of this Contribution
Seeding Discussion

These slides aim to stimulate discussion.

Concepts and examples are illustrative and may contain technical simplifications or inaccuracies.

Technical correctness and feasibility require further validation.



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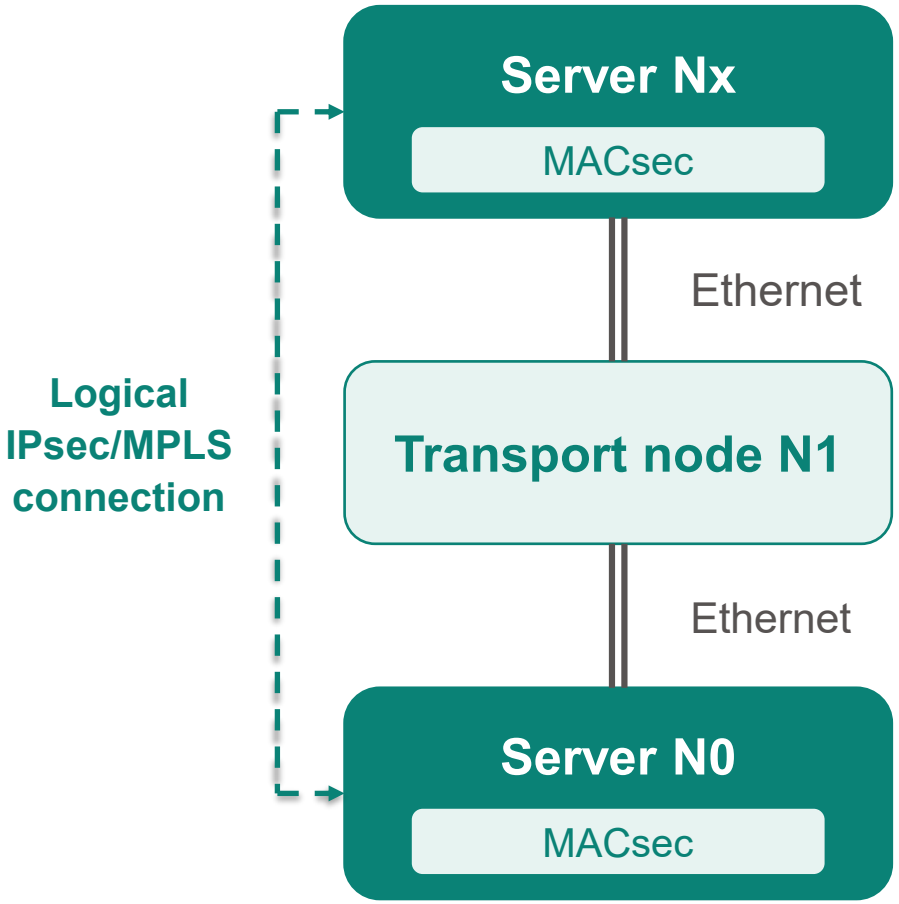
MAC DATA Security (MDsec)
Scenario Alpha: Data center



Data-center endpoints

Nx is a server in Austin, Texas.
N0 is a server in London, UK.

Current end-to-end protection

IPsec protects data between Nx and N0.

Reuse limitation

This scenario **cannot** reuse existing MACsec hardware and MKA software for end-to-end protection.

https://www.ieee802.org/1/files/public/docs2025/new-bidgoli-macsec-enhanced-1125-v01.pdf

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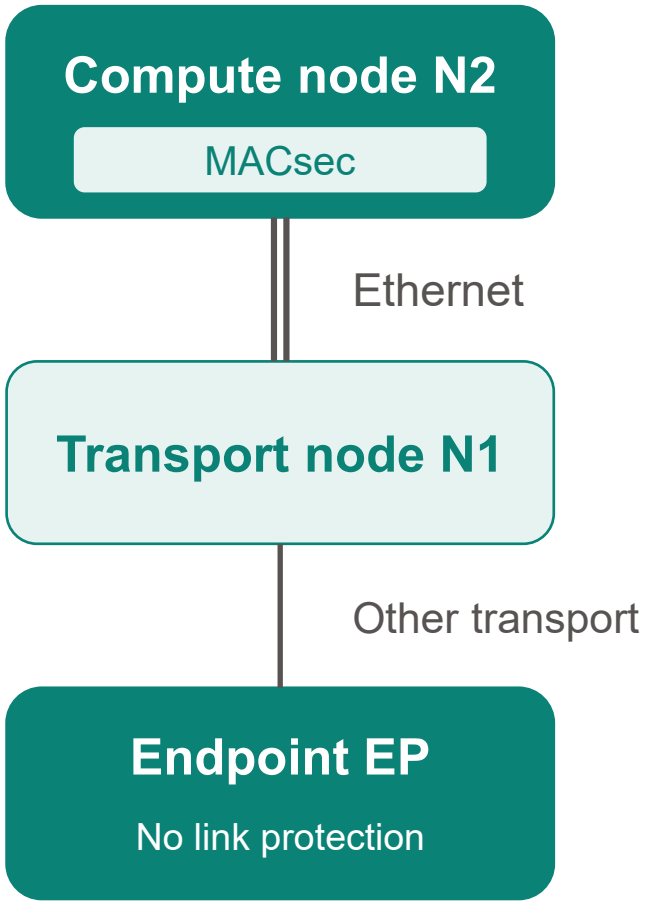
MAC DATA Security (MDsec)
Scenario Bravo: Unprotected endpoint



Endpoint-to-compute path

Endpoint EP connects to transport node N1 over another transport.

Current protection gap

The EP–N1 link **requires** com security.

Ethernet-side capabilities

N1 connects to N2 over Ethernet.

N2 has compute capacity, MACsec and MKA.

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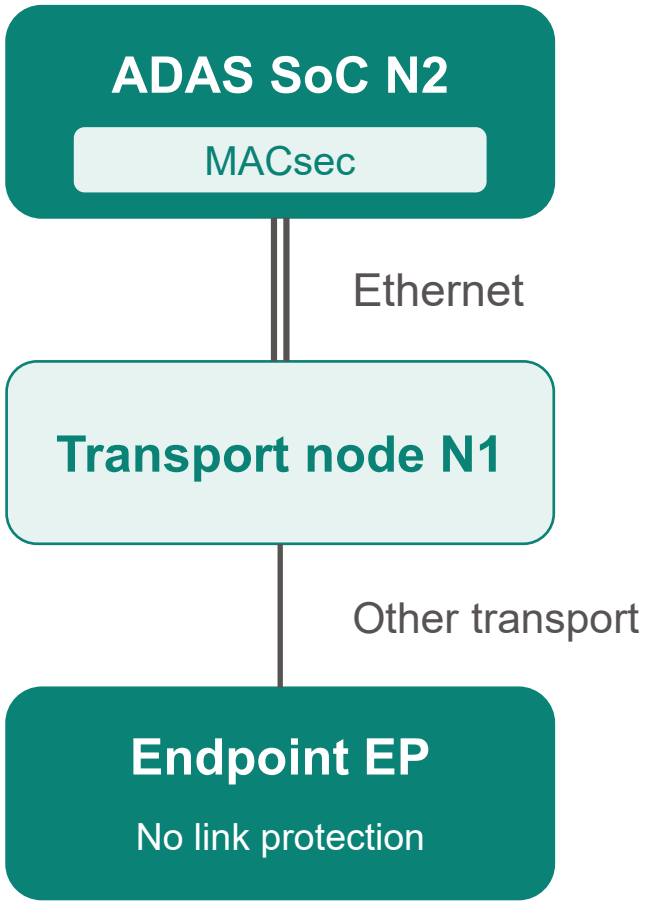
MAC DATA Security (MDsec)
Scenario Bravo: Automotive



Automotive endpoints

N2 is a central vehicle SoC.
EP connects through node N1.

Other transport examples

Flexray
SerDes
10BASE-T1S
MOST / CAN

Current protection gap

The EP–N1 link **requires** com security.

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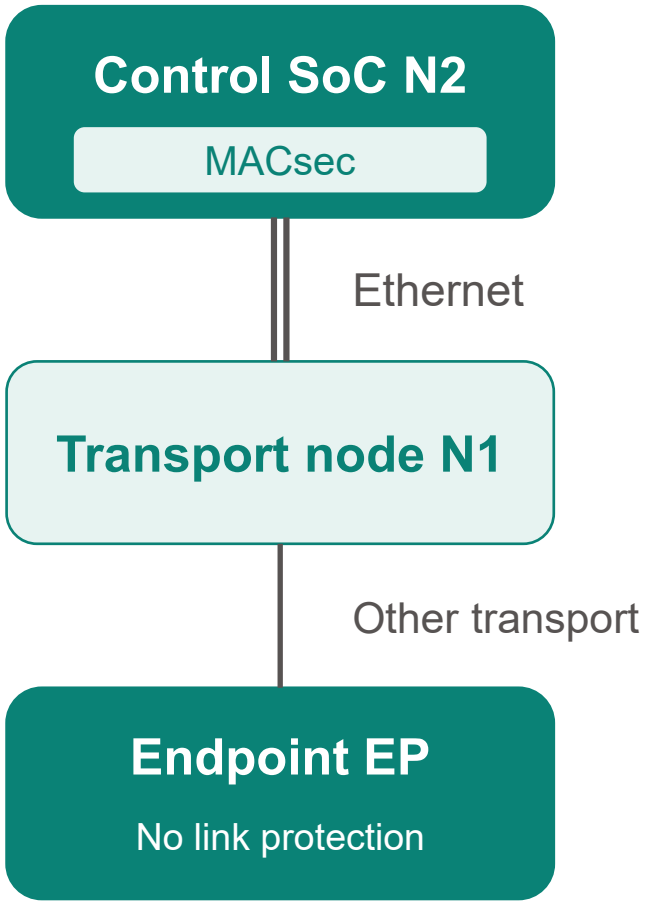
MAC DATA Security (MDsec)
Scenario Bravo: Robotics



Robotics endpoints

N2 is the central control node.
EP connects through N1.

Other transport examples

10BASE-T1S
EtherCAT ??
CAN FD / CAN XL

Current protection gap

The EP–N1 link **requires** com security.

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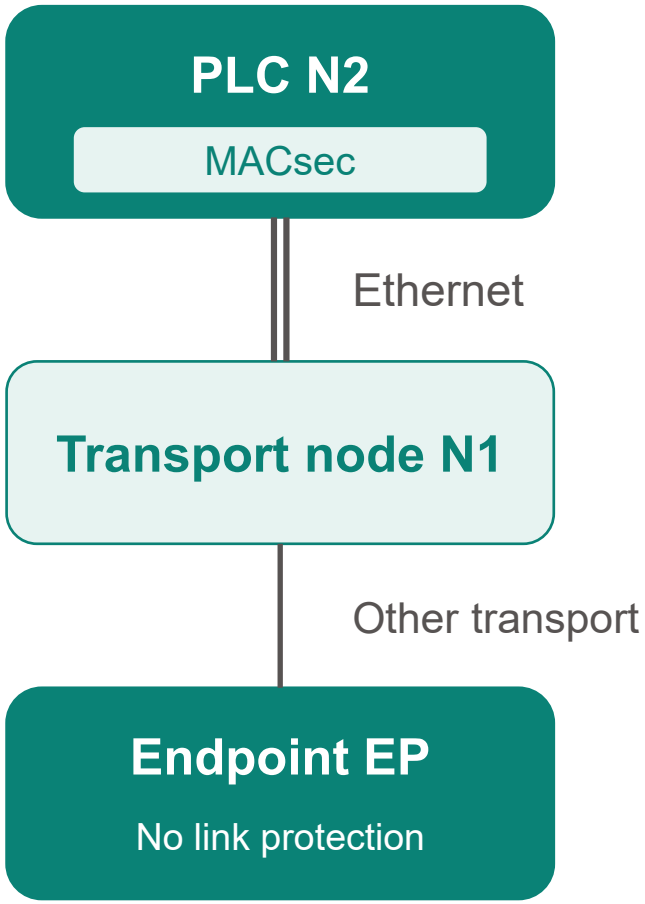
MAC DATA Security (MDsec)
Scenario Bravo: Industrial (OT)



Industrial endpoints

N2 is a programmable logic controller (PLC).
EP connects through N1.

Other transport examples

PROFINET / PROFIBUS
EtherCAT ??
Wireless (IEEE 802.11 / 802.15)

Current protection gap

The EP–N1 link **requires** com security.

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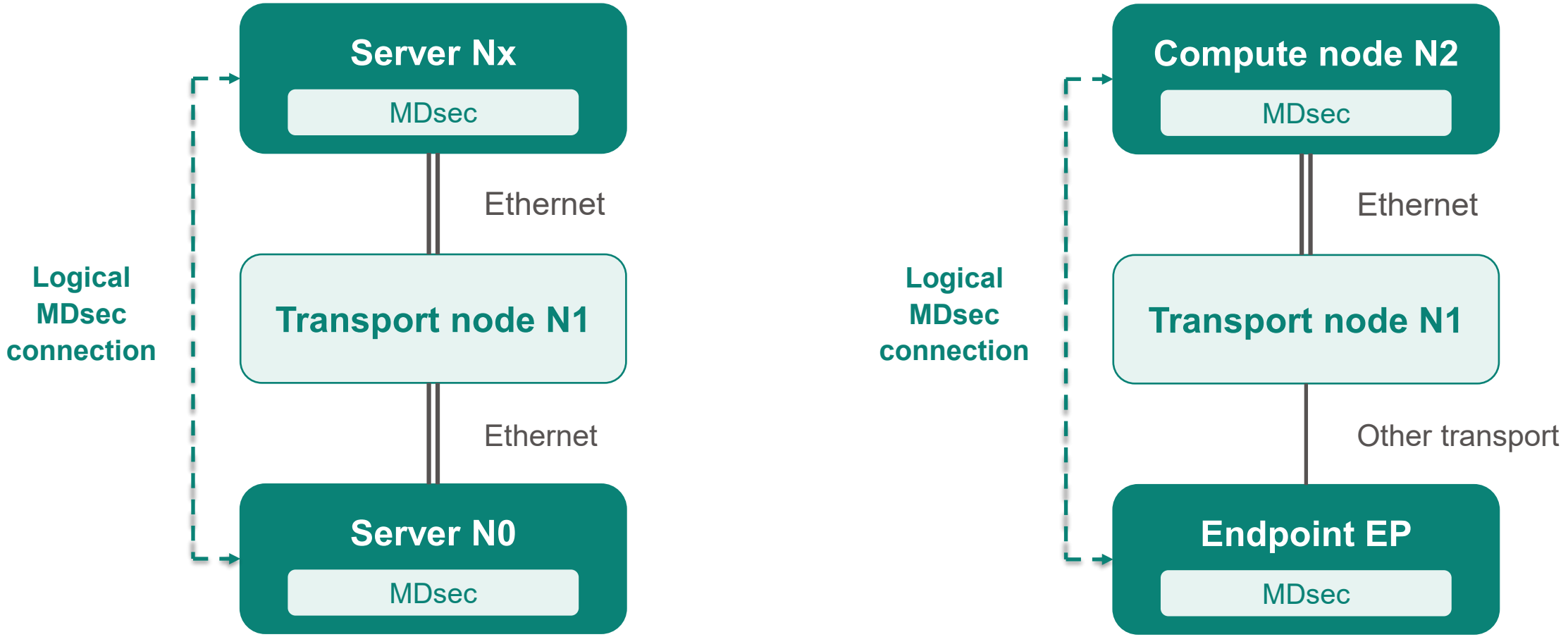
MAC DATA Security (MDsec)
Vision: MDsec for Scenario Alpha and Bravo



Common protection model: End-to-end data protection for both scenarios.

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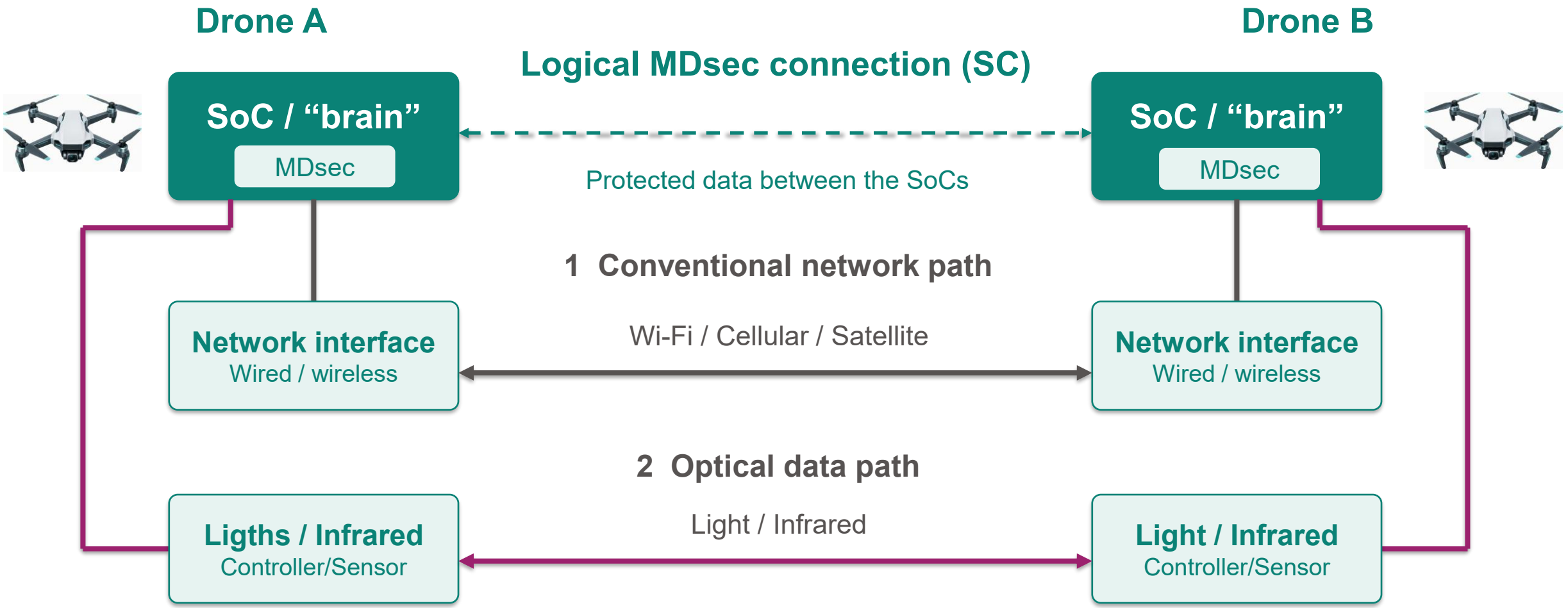
Applications: Drones



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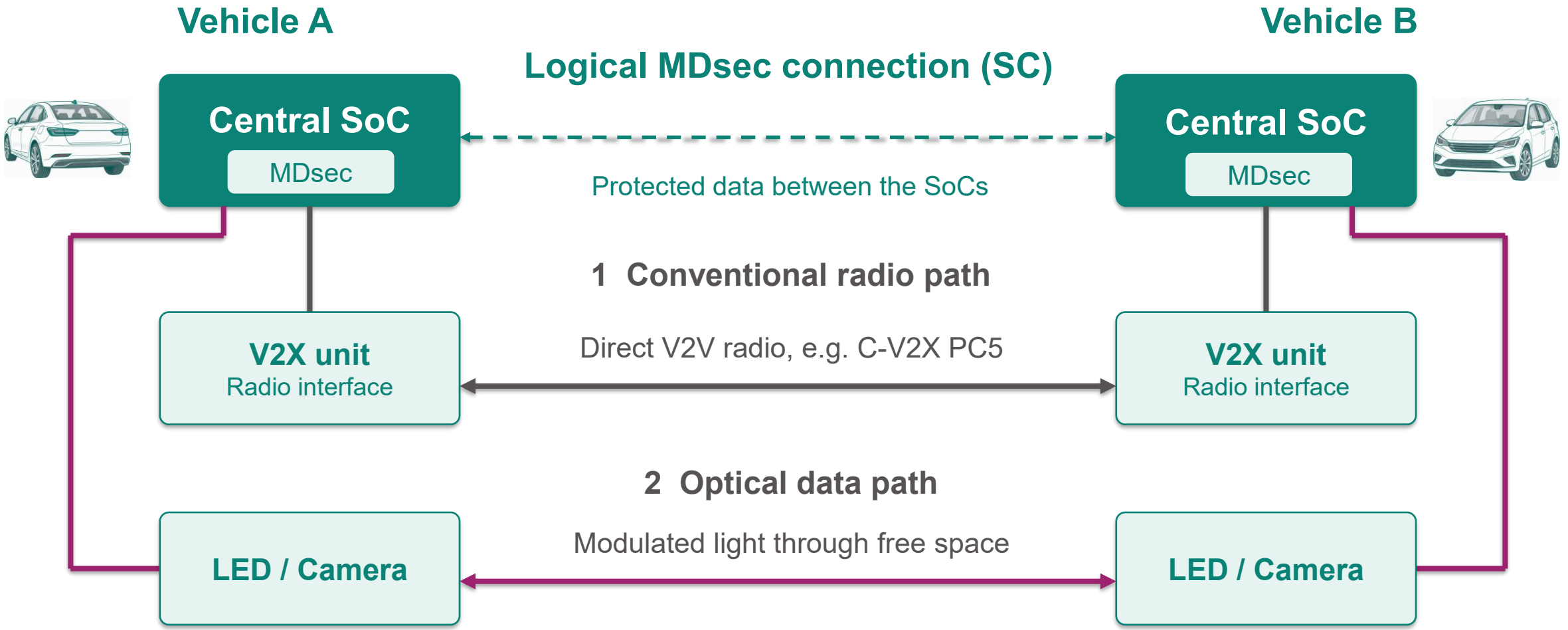
MAC DATA Security (MDsec)
Applications: Automotive



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MAC DATA Security (MDsec)
Applications: Robotics



Robot A

SoC / “brain”

MDsec

Logical MDsec connection

Protected data between the SoCs

Robot B

SoC / “brain”

MDsec



1 Conventional network path

Network interface
Wired / wireless

Ethernet / Wi-Fi / private 5G

Network interface
Wired / wireless

2 Motion and sensing path

Motors / Joints / Camera

Motion / gesture in the environment

Motors / Joints / Camera

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Infineon