Networked Utilities for Reliable and Safe Transfers of Control Between Native Mission Software and Backseat MOOS-IvP Helm on an Autonomous Surface Craft

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What this talk will cover

1. Motivations
2. Solution: Safe Hand-over Utilities (SHU)
3. Hardware Elements and Hosted Software
4. Breakdown of SHU elements
5. Demonstrating three hand-over scenarios

SHU: Safe Hand-over Utilities

Distributed, networked utilities for safe and robust transfer of thruster control between Native and Payload mission controllers.

Motivations for SHU

Considerations and specifications critical to SCOAP's operation.

1. Safety to surroundings
2. Safety of the system

Motivations for SHU

Considerations and specifications critical to SCOAP's operation.

3. Thrusters continuously under command by either the Native Mission Controller or Payload Mission Controller
4. Flexible switching between the Native and Payload Mission Controllers
5. Robust high-level protection from hardware or software faults and failures
6. Collaboration between various fail-safe measures already in place
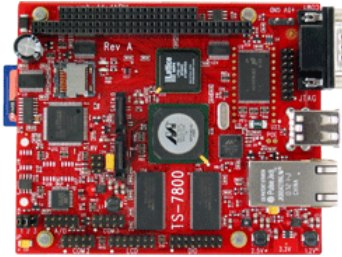7. Low bandwidth communication

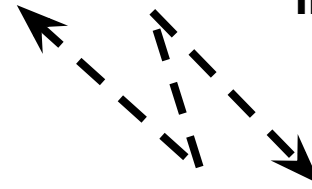# On Board USV

NATIVE CPU
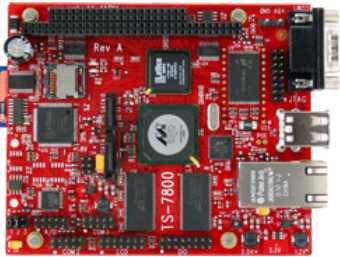
PAYLOAD CPU

THRUSTERS

2.4 GHz RF LoS/ Iridium

Off the USV

OPERATOR CPU

NATIVE CPU

USV Controller

192.168.0.50:8001

Native Mission Controller

OR

192.168.0.50:8003

Low Level Controller

192.168.0.50:8002

SHU_Native

PAYLOAD CPU

SHU_Payload

Payload Mission Controller: MOOS IvP Helm

OPERATOR CPU

SHU_Operator

THRUSTERS

NATIVE CPU

USV Controller

192.168.0.50:8001

192.168.0.50:8003

Native Mission Controller

Low Level Controller

192.168.0.50:8002

SHU_Native

PAYLOAD CPU

SHU_Payload

Payload Mission Controller:
MOOS IvP Helm

OPERATOR CPU

SHU_Operator
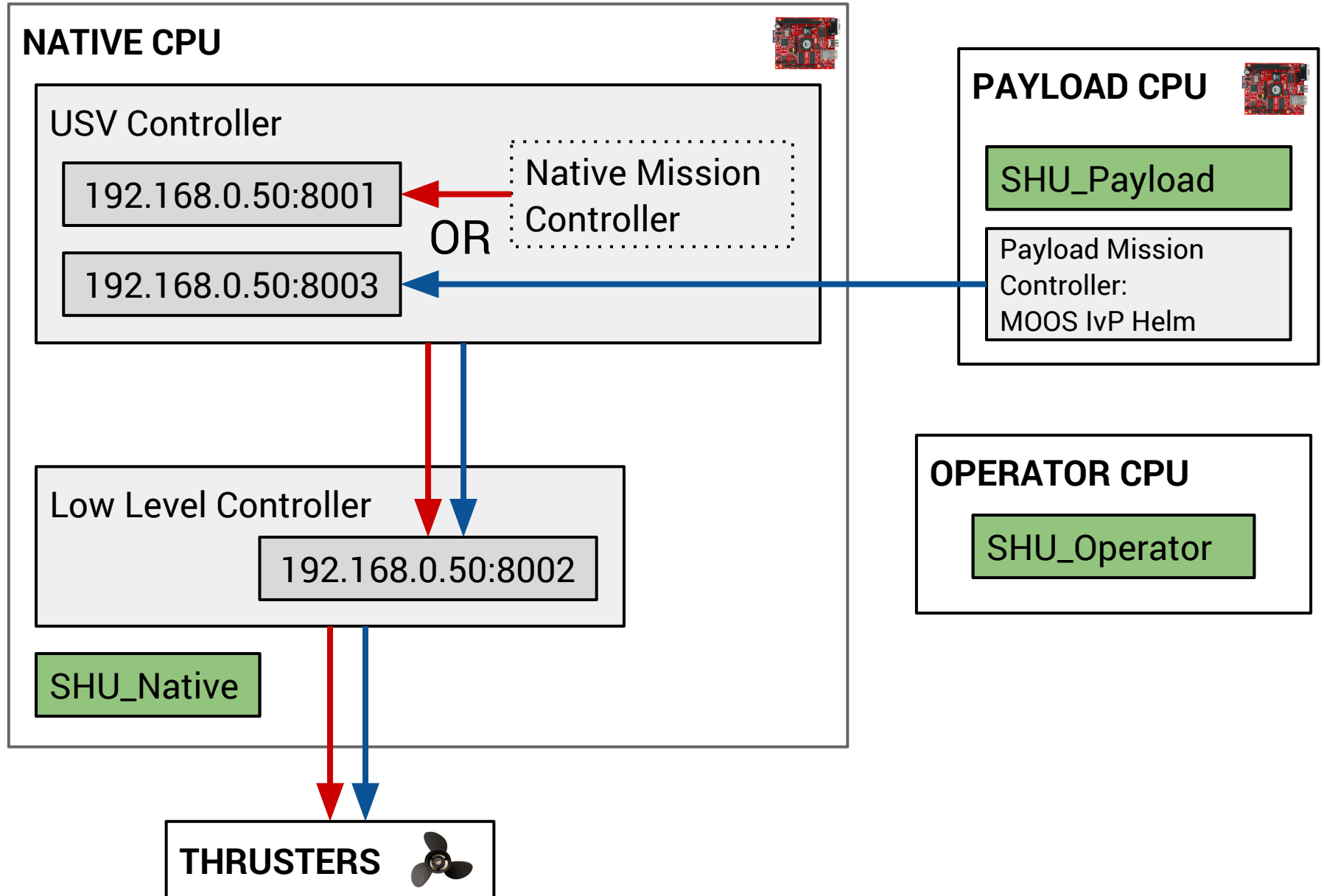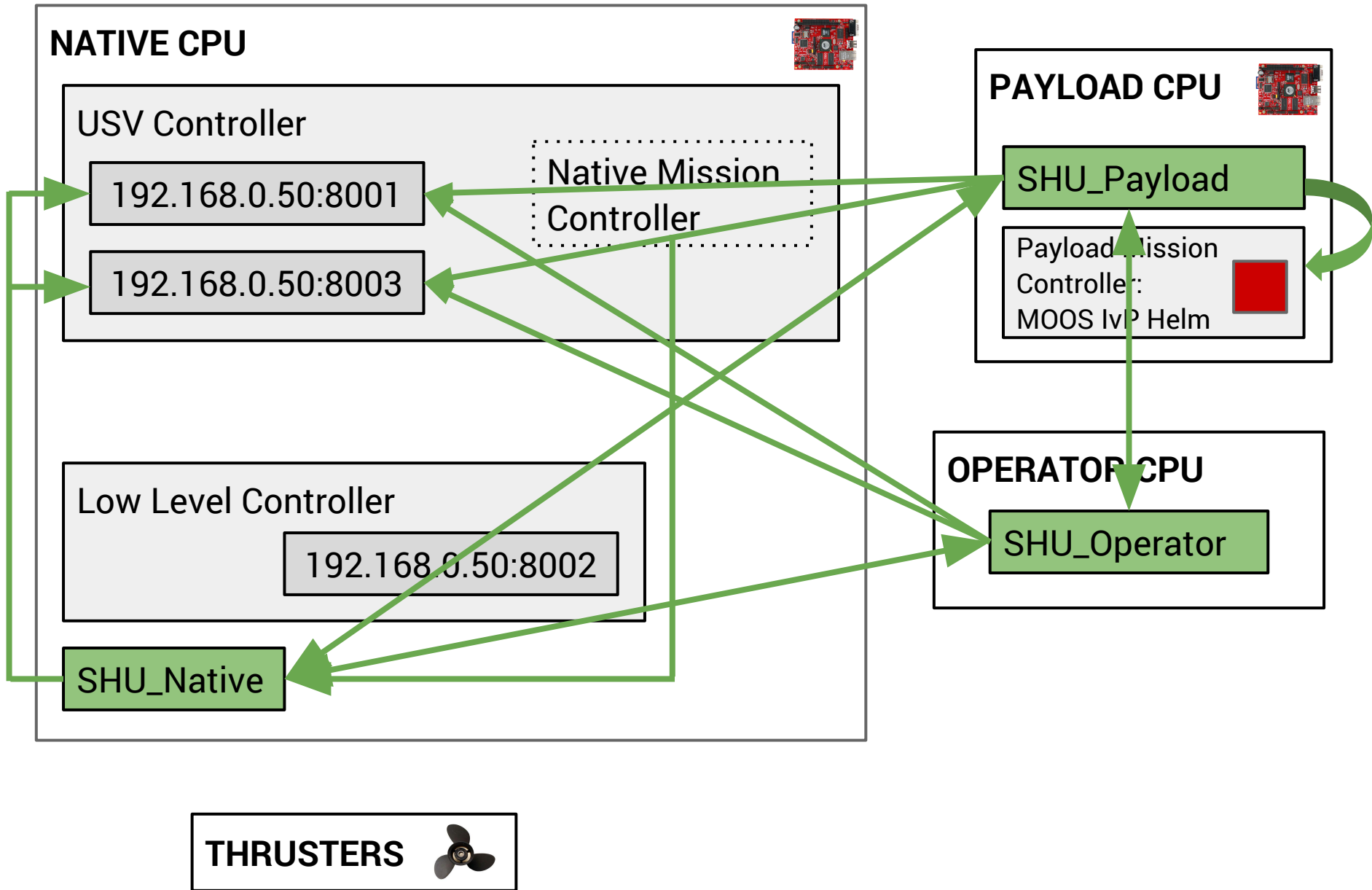
THRUSTERS

A few scenarios

1. User initiated Native to Payload
2. Fault initiated Payload to Native
3. User initiated Payload to Native

Scenario 1
User initiated Native to Payload

The USV is operating under LoS RC with thruster control NMEA messages originating from the Native Mission Controller to drive the USV.

We wish to hand-over control of the thrusters to our Payload Mission Controller: MOOS-IvP Helm.

NATIVE CPU

USV Controller

192.168.0.50:8001

Native Mission Controller

192.168.0.50:8003

Low Level Controller
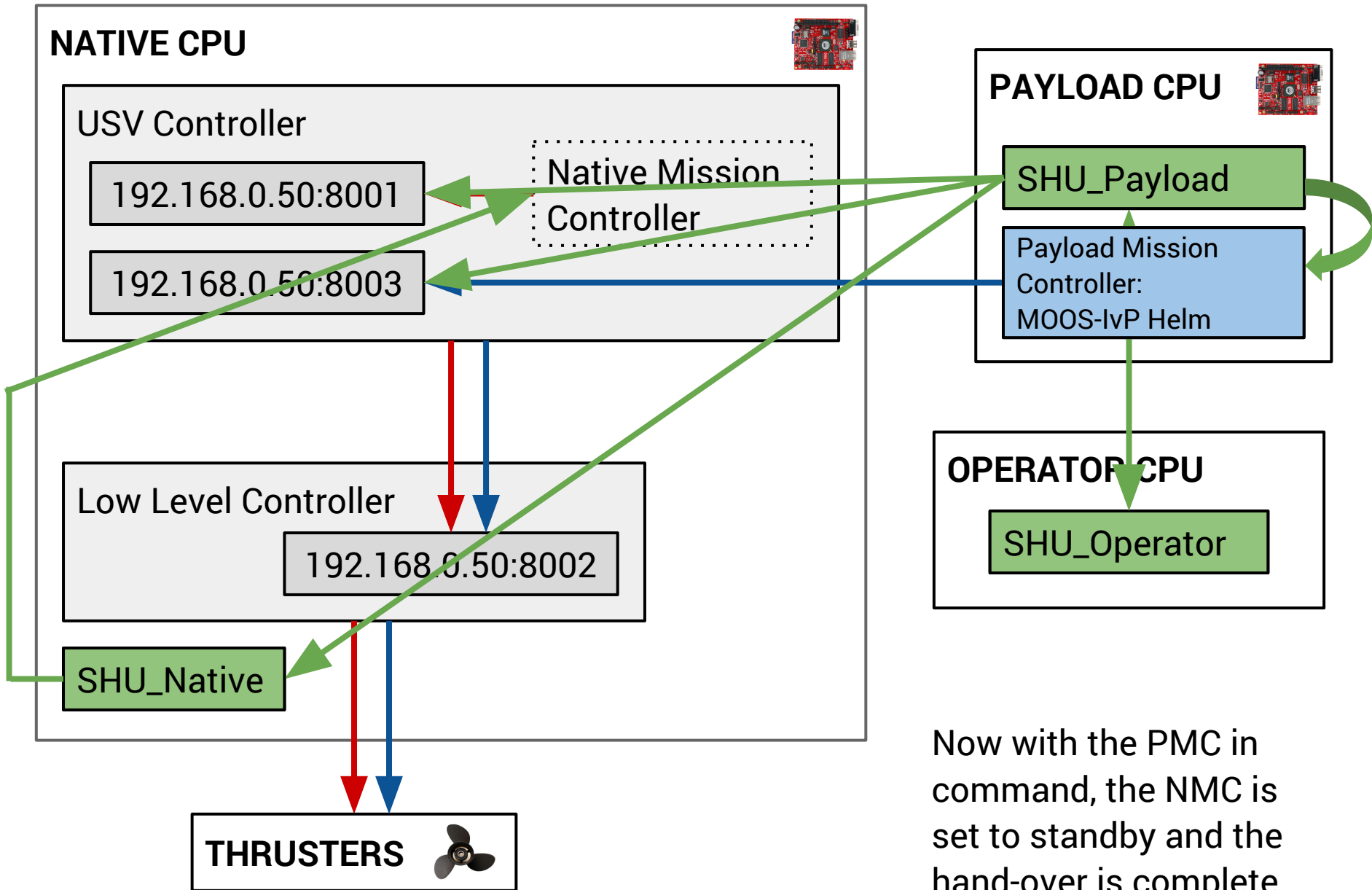
192.168.0.50:8002

SHU_Native

THRUSTERS

PAYLOAD CPU

SHU_Payload

Payload Mission Controller: MOOS-IvP Helm

OPERATOR CPU

SHU_Operator

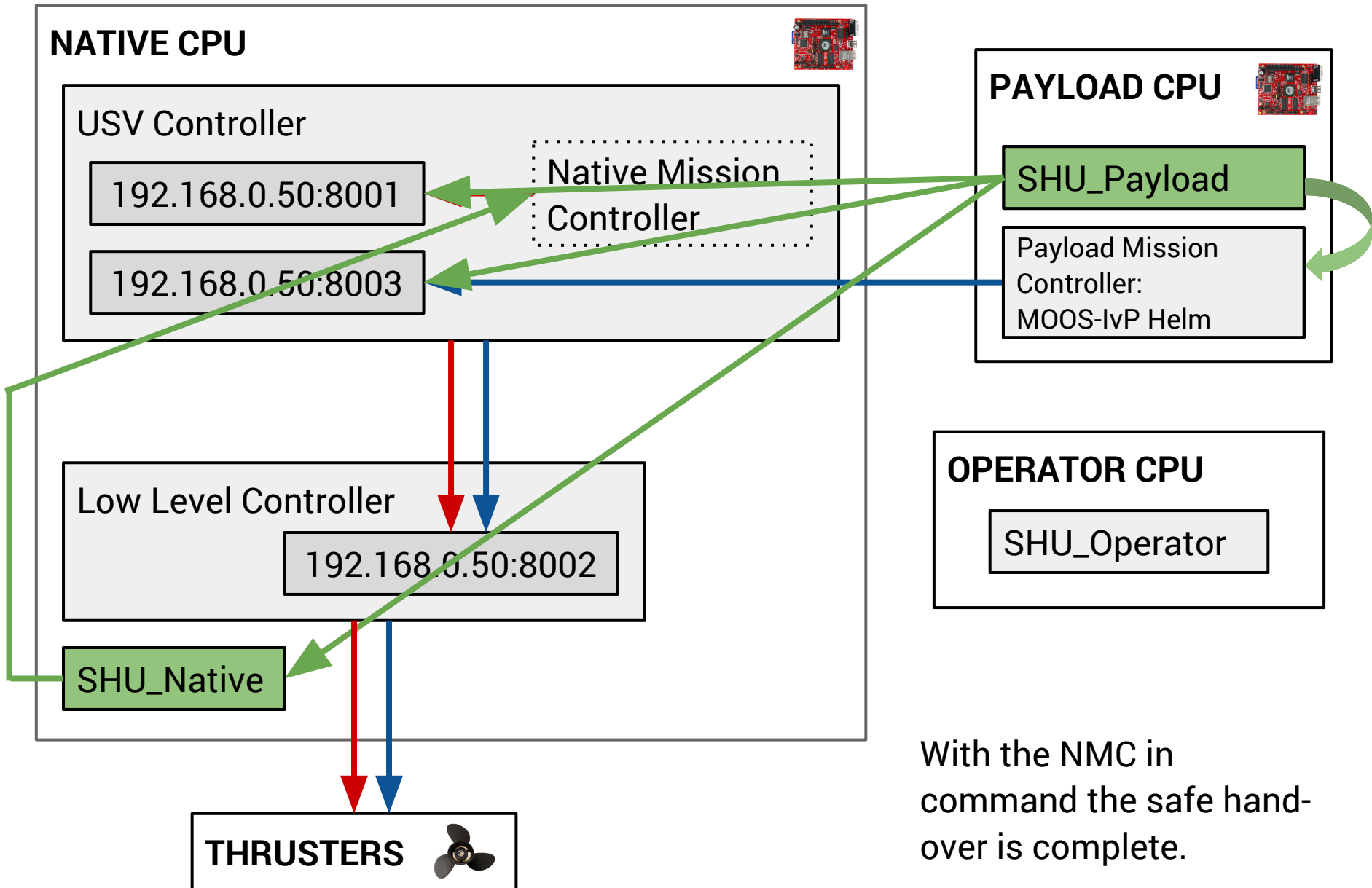Now with the PMC in command, the NMC is set to standby and the hand-over is complete.

Scenario 2
Fault initiated Payload to Native

The USV is operating under the Payload Mission Controller's direction with thruster control NMEA messages originating from MOOS-IvP Helm (MIH) to drive the USV.

Should any MIH related processes fail or resort to a "Standby Helm", SHU will work across the CPUs to safely return thruster control to the Native Mission Controller.

NATIVE CPU

USV Controller

192.168.0.50:8001

Native Mission Controller

192.168.0.50:8003

Low Level Controller

192.168.0.50:8002

SHU_Native

THRUSTERS

PAYLOAD CPU

SHU_Payload

Payload Mission Controller: MOOS-IvP Helm

OPERATOR CPU

SHU_Operator

With the NMC in command the safe hand-over is complete.

Scenario 3
User initiated Payload to Native

The USV is operating under the Payload Mission Controller's direction with thruster control NMEA messages originating from MOOS-IvP Helm (MIH) to drive the USV.

We wish to hand-over control of the thrusters to our Native Mission Controller.

Summary

1. SCOAP's size, speed and operating environment make safety a primary concern.
2. Hand-over of control of the thrusters needs to happen easily, but also safely and reliably.
3. SHU is a Native and Payload Mission Controller manager and monitor.