OPAL-RT Multi-System Expansion link

User Guide

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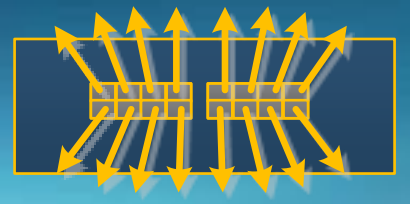
FROM IMAGINATION… TO REAL-TIME

What is the Multi-System Expansion Link ?



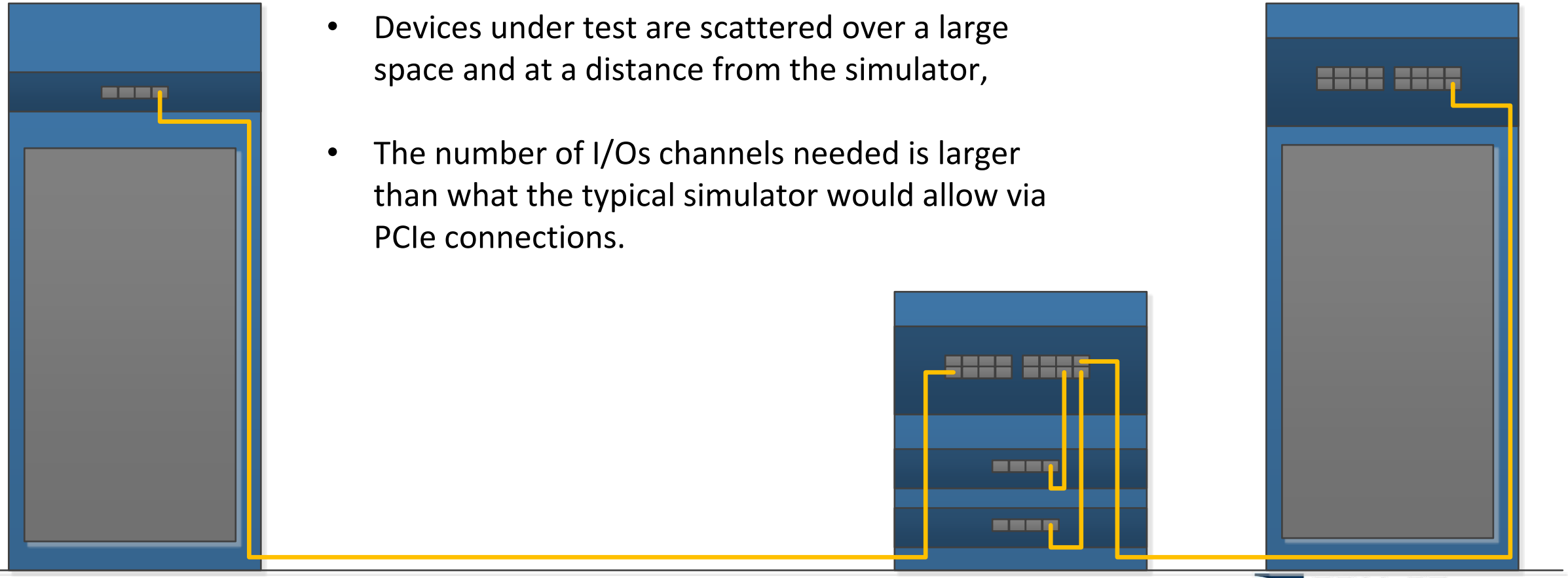
- OPAL-RT Multi-System Expansion link (MuSE)[1] is a fully integrated feature of OPAL-RT Software and FPGA solutions that facilitates management of a large number of I/O channels.
- The MuSE link expands the I/O capability of the real-time simulators by enabling connection of multiple FPGA-based I/O expansion boxes to the simulator.
- Based on standard multi-mode optical fibers and small form-factor pluggable (SFP) 5Gbps transceivers, this innovative feature allows you to manage up to 4096 I/O channels from your simulation model.

[1] *This link is also referred to as High Speed Link (HSL)*

Who should use the MUSE link ?

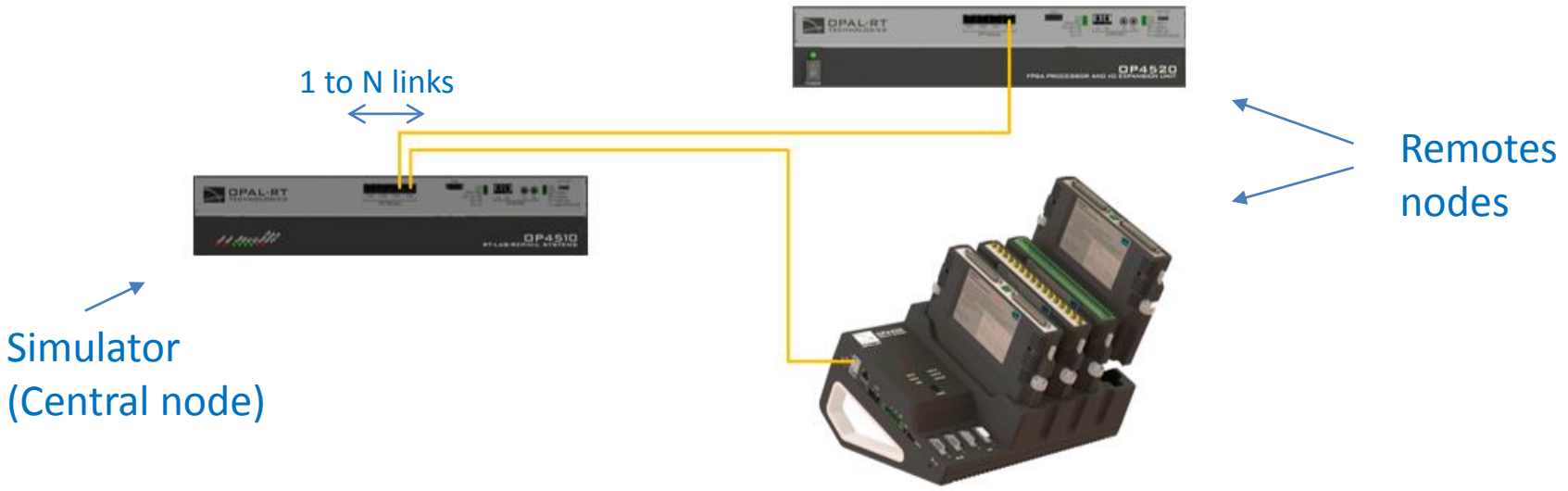
The MuSE link is the solution when:

- Devices under test are scattered over a large space and at a distance from the simulator,
- The number of I/Os channels needed is larger than what the typical simulator would allow via PCIe connections.



MuSE link architecture

- The typical topology is a star configuration with one simulator as the **central** node, connected to up to 16 **remote** boxes,
- The number of chassis is limited only by the number of available SFP sockets on the simulator



- The network of remote chassis is easily set up using the existing SFP sockets of the simulator, standard multi-mode optical fibers and small form-factor pluggable (SFP) transceivers, and does not require additional PCIe inter-connection hardware.

Hardware support

- The MuSE link is supported on most OPAL-RT platforms:

Central nodes

OP5707

OP4510

OP5607 and OP4520 can also be programmed as central nodes if connected to an OP5030 industrial target

Remote I/Os

OP4200

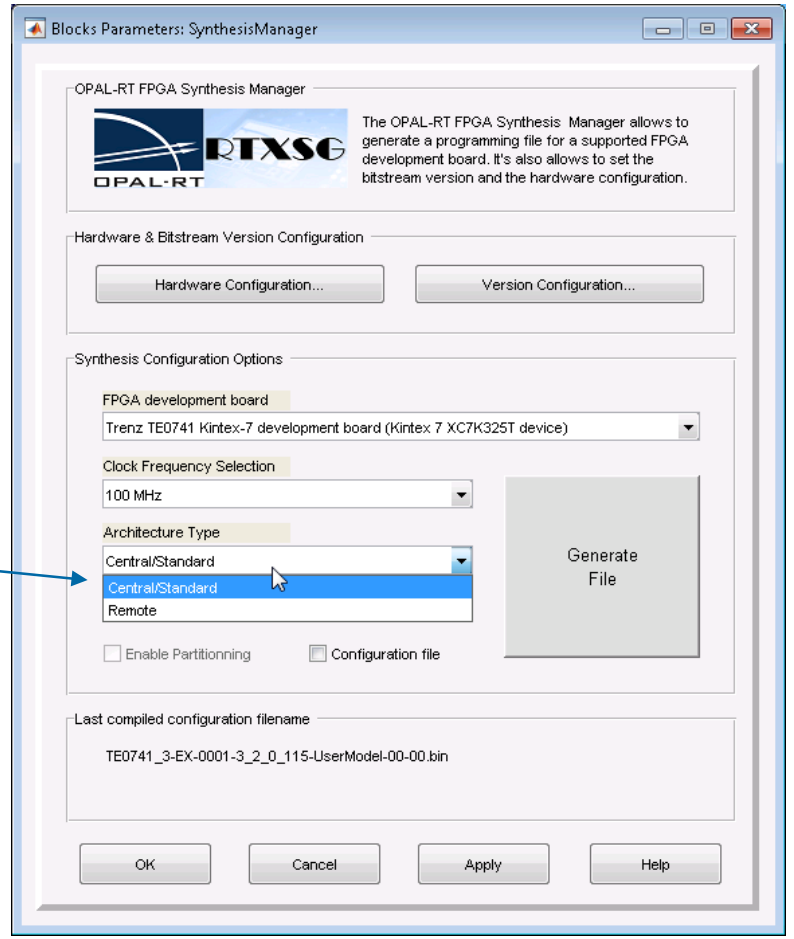
OP4520

OP5607

FPGA configuration

- The configuration of the FPGA for the MuSE link does not require advanced knowledge of high-speed communication programming :

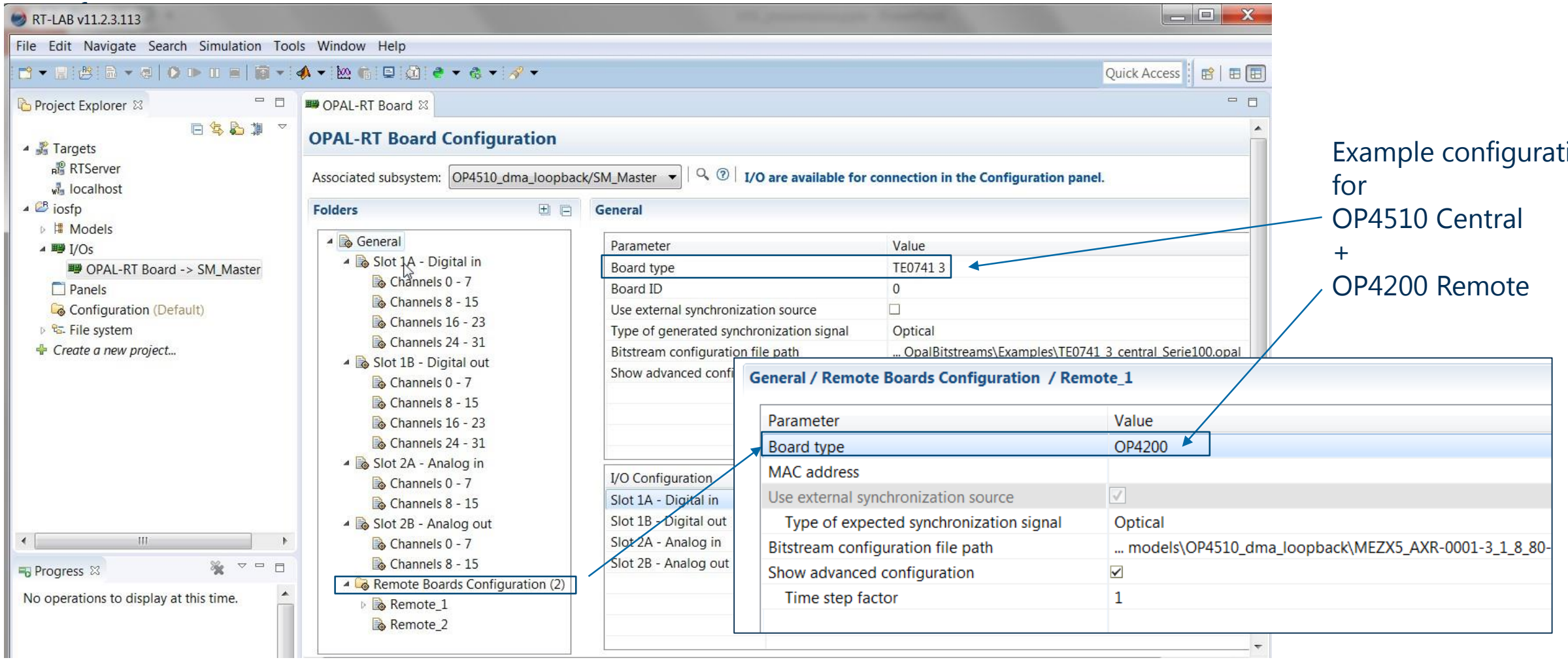
The MuSE link capability is automatically integrated into the FPGA programming file during its generation with OPAL-RT's RT-XSG tool after the User has selected the ***Architecture type*** (***Central*** or ***Remote***) option



- Existing chassis can be upgraded to support the new link simply by updating the FPGA programming file.

Software support

Configuration and management of remote I/Os is done via the RT-LAB or HYPERSIM User



Example configuration for
OP4510 Central
+
OP4200 Remote

Software features

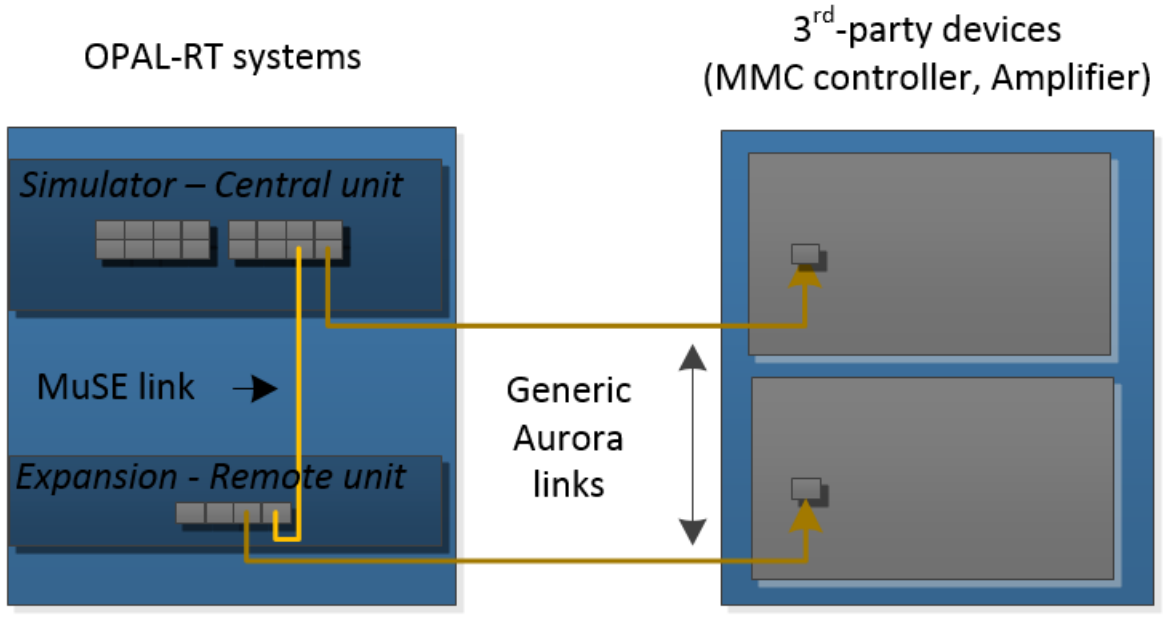
- Detection and initialization of the systems connected to the central unit are handled automatically at model load time
- Remote programming of the FPGA bitstreams of the remote units is supported [1]
- Central units programmed with a MuSE-link-compatible bitstream can run legacy models using Simulink I/O blocks when the remote units are not in use.
- The real-time synchronization signal is propagated to all units. [2]

[1] Early versions of the link require JTAG programming
[2] Early versions of the link require the legacy daisy-chain plastic optical fiber or copper cable

Applications

RT-XSG Legacy Generic Aurora blockset and the MuSE link can coexist in the same system

- Simulators can connect simultaneously to expansion chassis via MuSE link and to 3rd-party devices via the Generic Aurora link
- Expansions chassis can connect simultaneously to a simulator via MuSE link and to 3rd-party devices via the Generic Aurora link
- Upgrading existing systems to make them compatible with the MuSE link only requires regenerating the bitstream.



Specifications

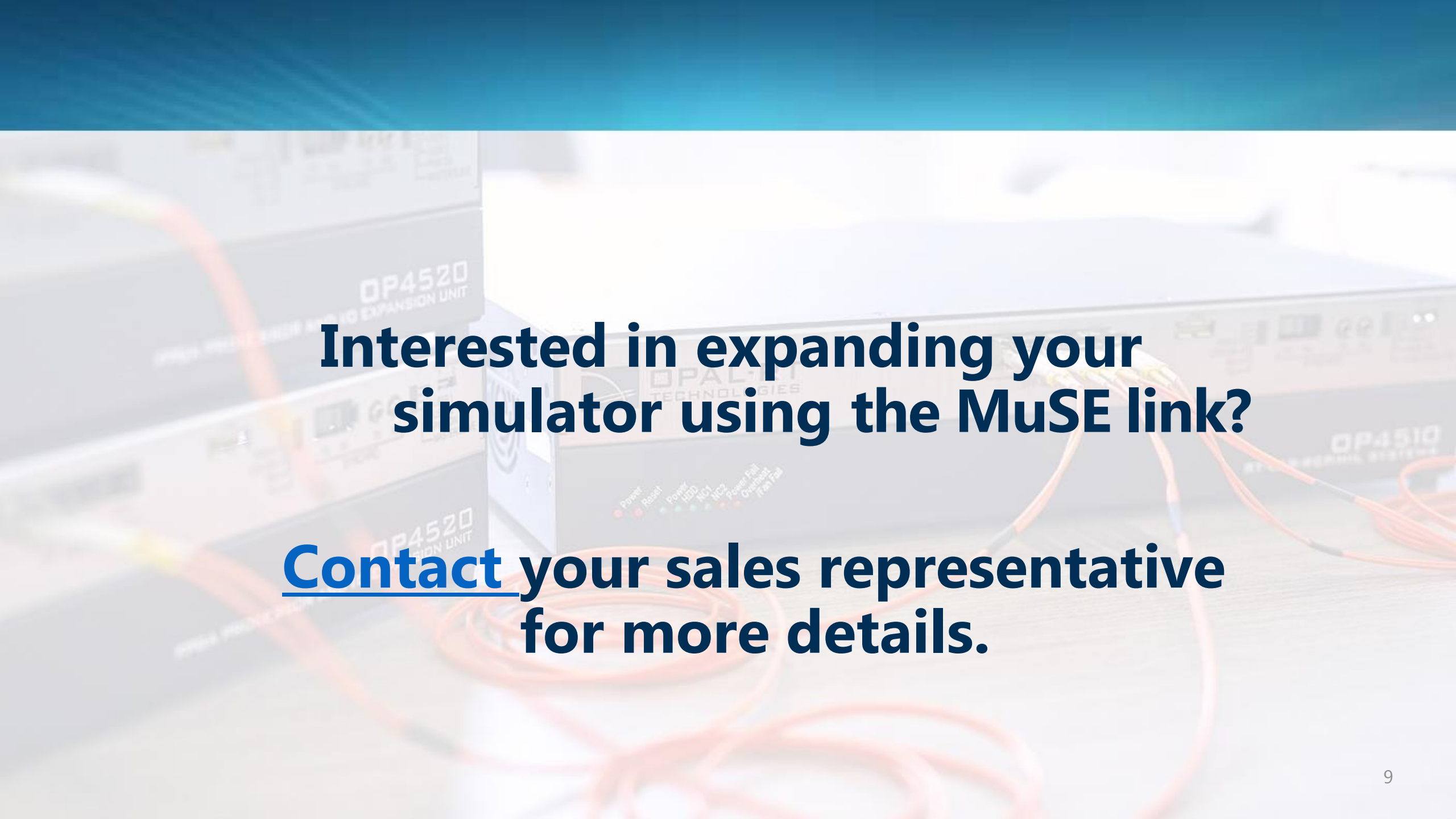
Platforms

Platform	OP4200	OP4510	OP4520	OP5607	OP5707
Physical links	2 (*)	4	4 (*)	16 (*)	16
Supported mode	Remote	Central	Remote (**)	Remote (**)	Central

(*) Only one link is used for the MuSE link in remote mode
(**) Central mode also supported if chassis is connected via PCIe to an OP5030 target

Link specifications

Communication protocol	Aurora 8b10b
Link Speed	5Gbps
SFP transceivers	Avago AFBR-57R5APZ 850nm
Optical fiber	Duplex Multi-Mode 50/125µm or 62/125µm, LC-LC
Cable length	Up to 150m, depending on fiber type



Interested in expanding your simulator using the MuSE link?

Contact your sales representative for more details.