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OCP
SUMMIT



OCP NIC 3.0 Collaboration

- An Open Hardware development Story

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Facebook, Inc

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Agenda

- Overview of project in the past one year
- OCP NIC 3.0 Mechanicals
- OCP NIC 3.0 Thermal

Background

OCP Mezzanine Cards

All accepted by the IC

Specification	Version	Submit Date	Contributor	License	Notes
OCP Mezzanine card v2.0 OCP_Mezz_2.0_rev1.00_20151215b_pub_release.pdf(2.2MB) OCP_Mezz_2.0_rev1.00_20151215b_pub_release_3D_package.zip (88MB) Mechanical 20151023_P1-P9_K1-K5 zip file (57MB)	V2.0-1.0	Dec 15, 2015	Facebook	OWFa 1.0	Added support for x16 (quad x4), NCSI, dual QSFP+, & Quad SDP+ Accepted by OCP IC 2/24/2016
OCP Mezzanine card v0.5, original standard Mezzanine Card (rev 0.5)	V0.5	Oct 8, 2012	Facebook	OWFa 1.0	Defacto standard for the original network mezzanine with a x8 PCIe Gen3 interface

OCP Mezz v0.5

- Defined ~2012
- 10G Ethernet
- 2x SFP
- X8 PCIe Gen3
- I2C sideband

OCP Mezz v2.0

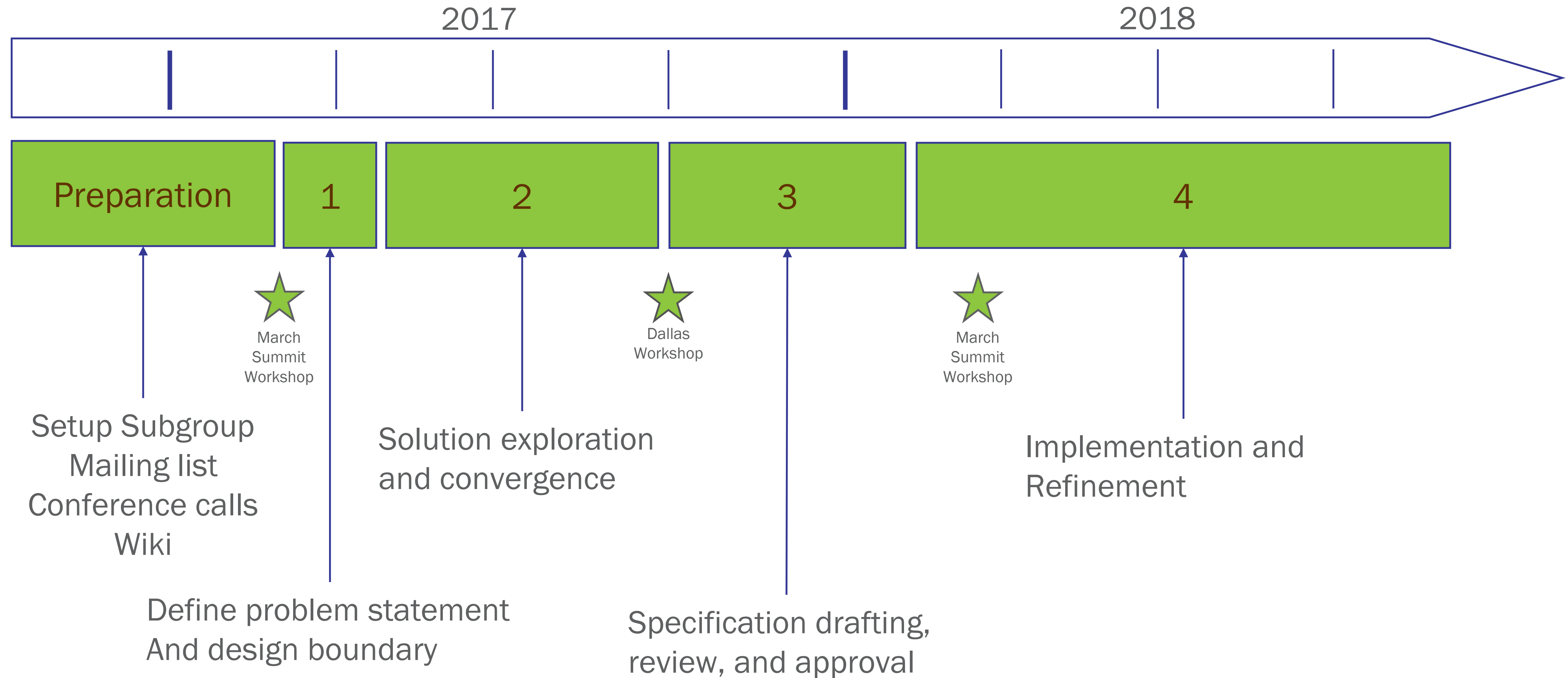
- Defined ~2015
- 10/25/40/50/100G Ethernet
- Up to 4x SFP28, 2x QSFP28, 4x RJ45
- X16 PCIe Gen3
- NCSI sideband

OCP NIC 2.0 Limitation



- Gates emerging use cases & blocks broader adoption
 - Board space
 - Mechanical and thermal profile
 - Connector placement
 - Specification quality

OCP NIC 3.0 Milestones



Define Problem Statement

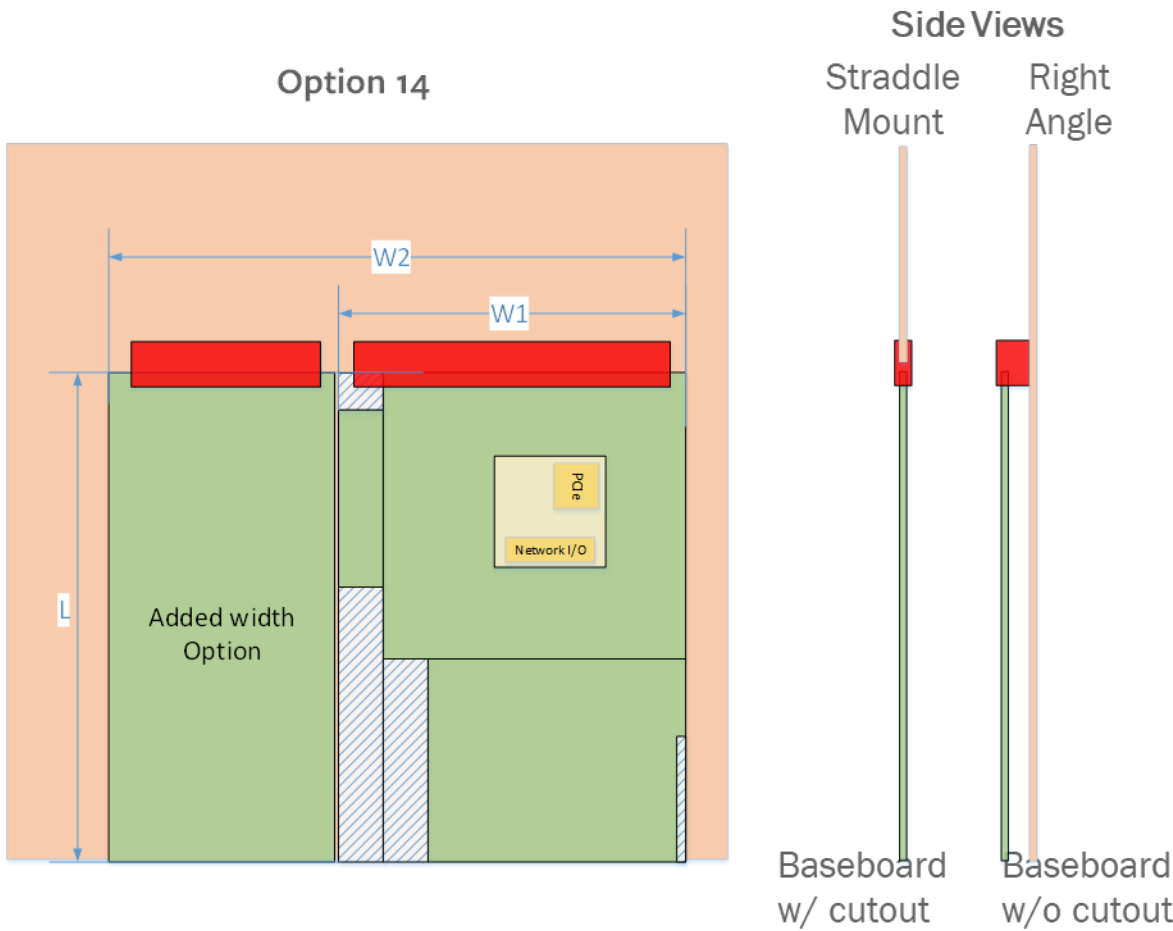
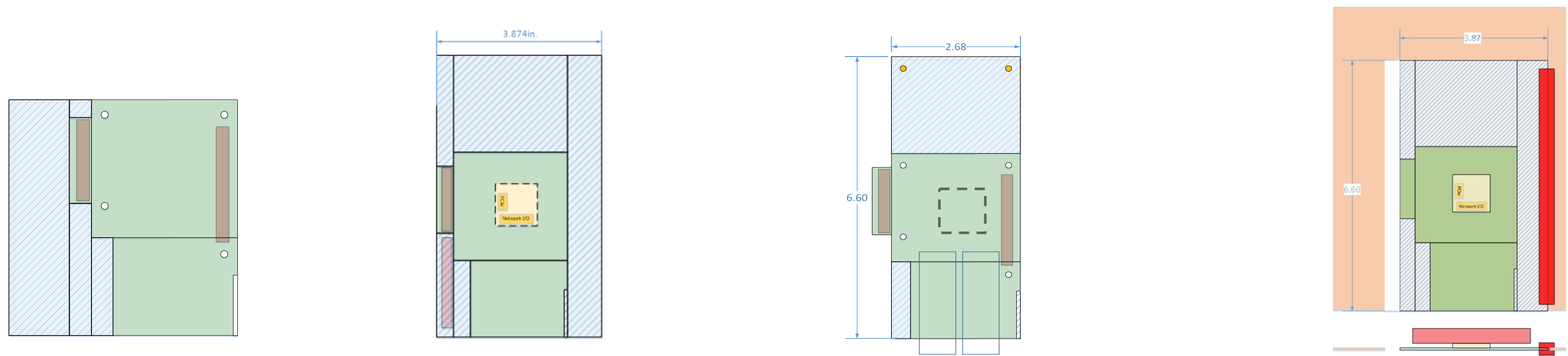
March to Mid-April '17

OCP Partner	A		B	
	90/10	50/50 confidences	90/10	50/50 confidences
	Very typical and Important use cases	Stretch goals and use cases	Very typical and Important use cases	Stretch goals and use cases
# and Type of I/O Ports	2, (2xSFP/SFP28, 2xQSFP/QSFP28)	2, (2xSFP/SFP28, 2xQSFP/QSFP28)	1-4 ports SFP+ or Base-T, or 1-2 QSFP	1-4 ports SFP+ or Base-T, or 1-2 QSFP
# of major IC (ASIC, FPGA, or other)	1	1	1 or 2 (ASIC, ASIC+PHY)	2 or 3 (ASIC + FPGA/SoC + PHY)
# of DRAM	6 x16	12 x16	10	20
Power envelope of IC#1 (Max power at Tj max)	15	20	20	50
Max T_case of IC#1	95	95	105	110
IC#1 mechanical dimension (WxLxH)	33x33x2.5	45x45x3.7	25x25x 3.7	45x45x3.7
If Applicable:	N/A	N/A	Phy	Phy
Power envelope of IC#2 (Max power at Tj max)	N/A	N/A	3W per port	3W per port, total <50W
Max T_case of IC#2	N/A	N/A	105	110
IC#2 mechanical dimension (WxLxH)	N/A	N/A	19x19x~2.5 mm	19x19~2.5 mm
If Applicable:	N/A	N/A	N/A	FPGA/SoC
Power envelope of IC#2 (Max power at Tj max)	N/A	N/A	N/A	TBD, total < 50W
Max T_case of IC#2	N/A	N/A	N/A	105
IC#2 mechanical dimension (WxLxH)	N/A	N/A	N/A	25x25x3.7
If Applicable:				
DRAM Power (each component at Tj max)	0.33	0.5	0.4	0.4
Max T_case of DRAM	95	95	95	95
If Applicable:				
# of Optical modules	0	2	1-4 SFP+, or 1-2 QSFP	1-4 SFP+, or 1-2 QSFP
Optical Module power (each)	0	1.5	1.5 watts (SFP+), 3.5 watts (QSFP)	1.5 watts (SFP+), 3.5 watts (QSFP)
Optical Module Max Tcase	0	70	70 deg C	85 deg C
System air flow direction	Inlet	Inlet	Both	Both

- Survey's sent to OCP community partners to understand future use cases
- Data compiled to determine require electrical, mechanical, and thermal envelopes

Solution Exploration and Convergence

Mid-April to end-of-September'17



Dallas Workshop

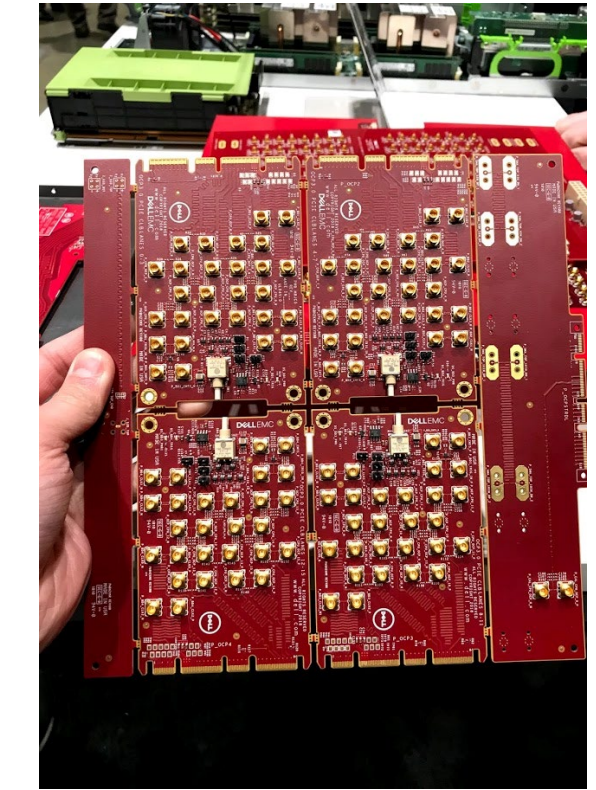
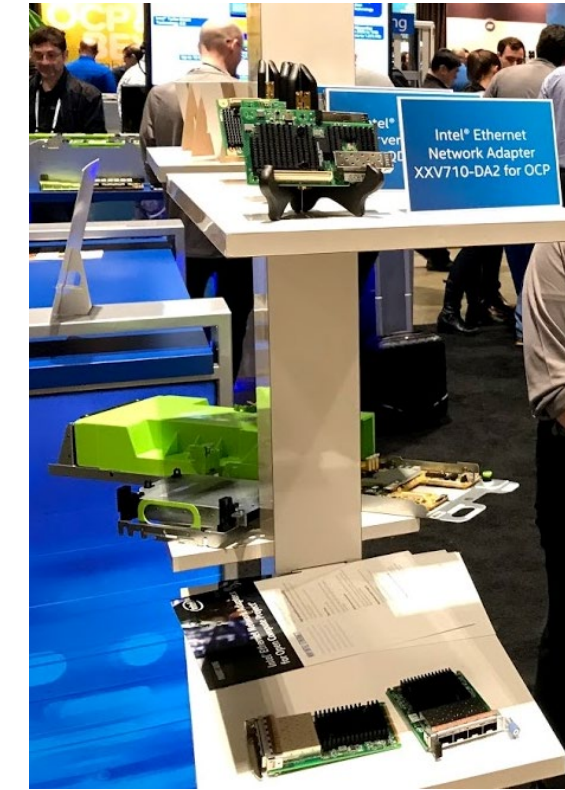
Sep 25th, 2017



- First F2F workshop
 - Met each other in person
 - Had an open discussion
 - Accelerated the collaboration

2018 US Summit Workshop

March 21st, 2018

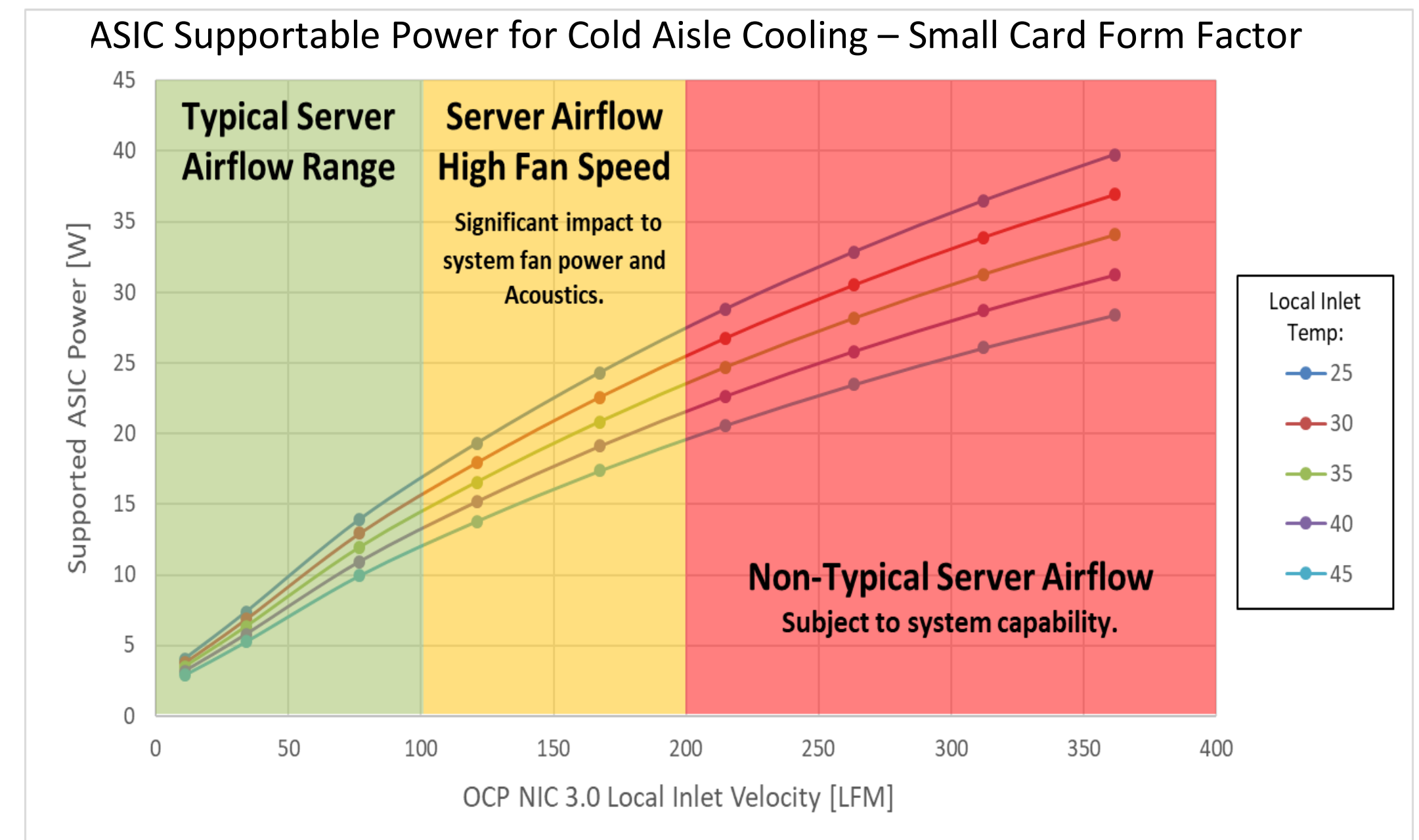
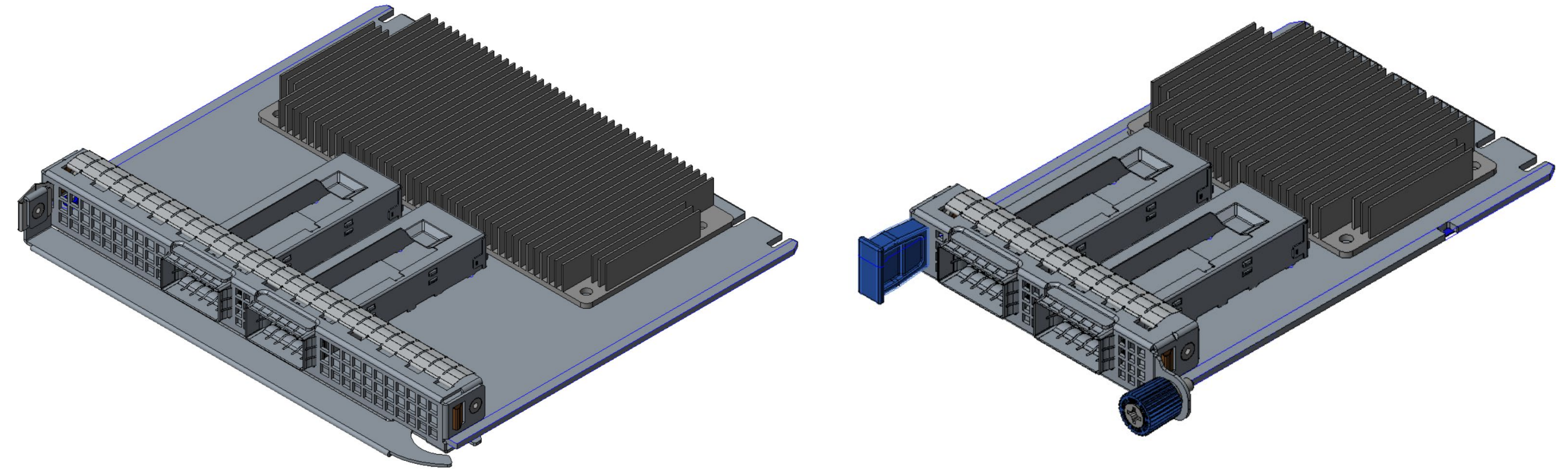


* Photographs Courtesy Of Thomas Ng

- Annual summit workshop
 - Share the works done in this area and calls for action
 - Outreach to broader community
- OCP NIC related hardware exhibited by:
 - ASRock / Cavium / Dell-EMC / Facebook / HPE
 - Inspur / Intel / OpenCAPI / OpenPower
 - Penguin Computing / Quanta / Samsung
 - SolarFlare / TE / Wiwynn

Solution Overview

- 2x Form factors (SFF and LFF)
- SFF-TA-1002 connector
- 32 lanes of PCIe Gen4
 - 4x of OCP NIC 2.0
- EMI containment
- Front service
- 80W/150W power delivery
- Larger thermal potential in similar profile
- NIC management features



Latest specification : <http://www.opencompute.org/wiki/Server/Mezz>

Draft – Review – Approve – Improve

Oct'17 to June'18

Contributors / Community partners

22x General specification working sessions

20x Mechanical specific working sessions

10x Thermal specific working sessions

1 Specification

Mechanical 3D models

Mechanical 2D models

Thermal simulation models

Thermal test fixture model

http://www.opencompute.org/wiki/Server/Mezz#Updated_Specification_Docs



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Compute Project

OCP NIC 3.0 Design Specification

Version 0.70

Author: OCP Server Workgroup, OCP NIC subgroup

Amphenol Corporation

Broadcom Limited

Cavium

Dell, Inc.

Facebook, Inc.

Hewlett Packard Enterprise Company

Intel Corporation

Keysight

Lenovo Group Ltd

Mellanox Technologies, Ltd

Netronome Systems, Inc.

Quanta Computer Inc.

TE Connectivity Corporation

University of New Hampshire

And many more!

Implementation and Refinement

0v70 – Initial release
Jan 25th, 2018

0v80 – Hot fixes
June 4th 2018

0v90 – Add Signal Integrity Guideline and Conformance
Sept 2018

1v00 – Add Implementation Learning
Q4'18

Subgroup Wiki with latest specification : <http://www.opencompute.org/wiki/Server/Mezz>

Mailing list: <http://lists.opencompute.org/mailman/listinfo/opencompute-mezz-card>

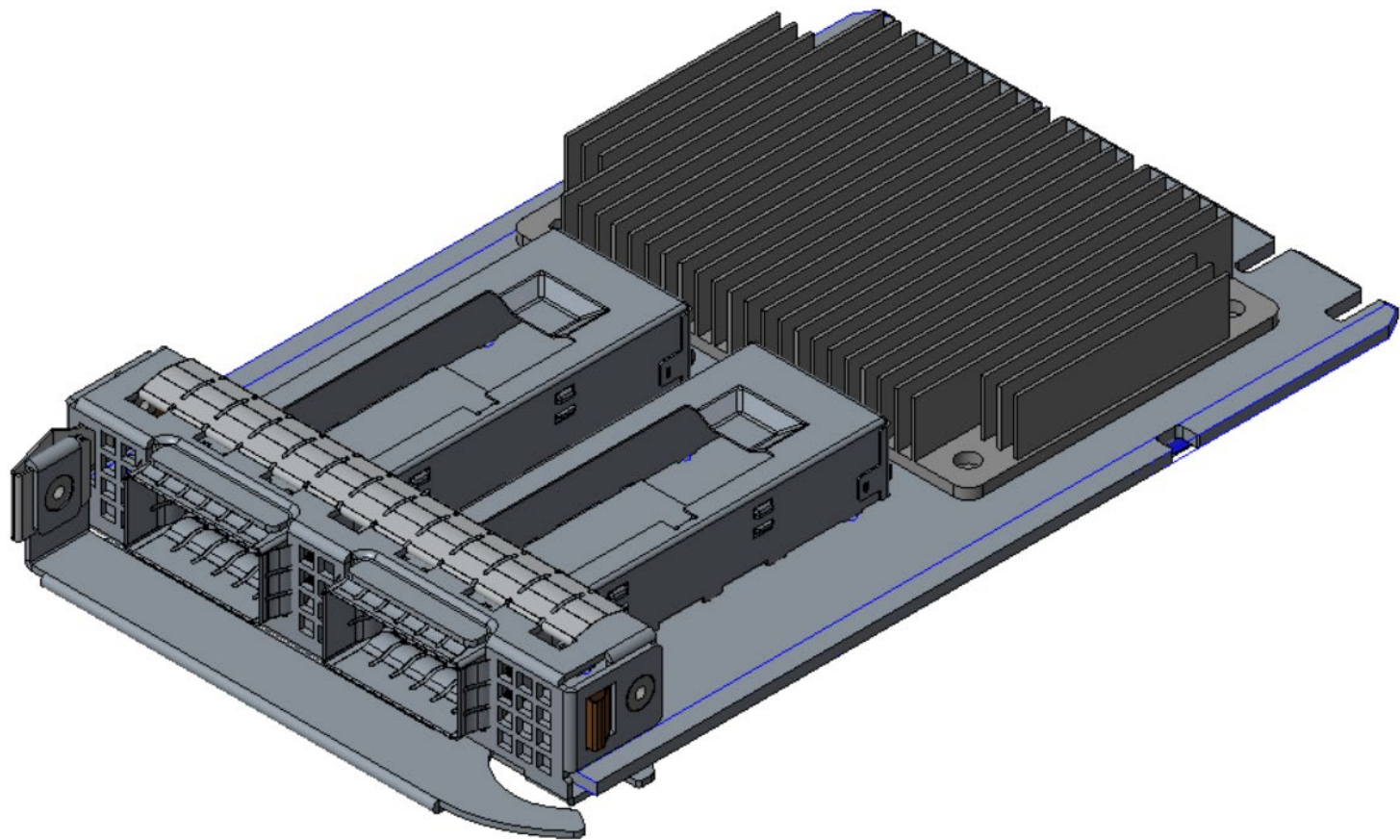
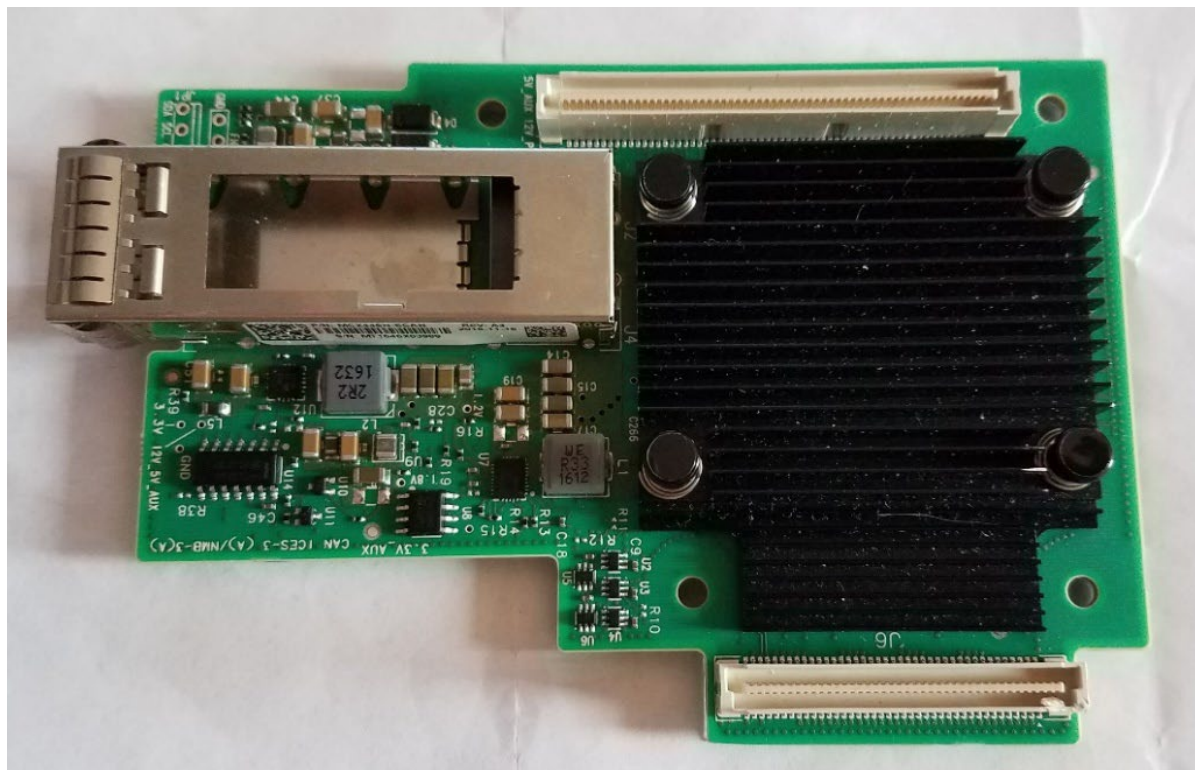


OCP NIC 3.0 Mechanicals

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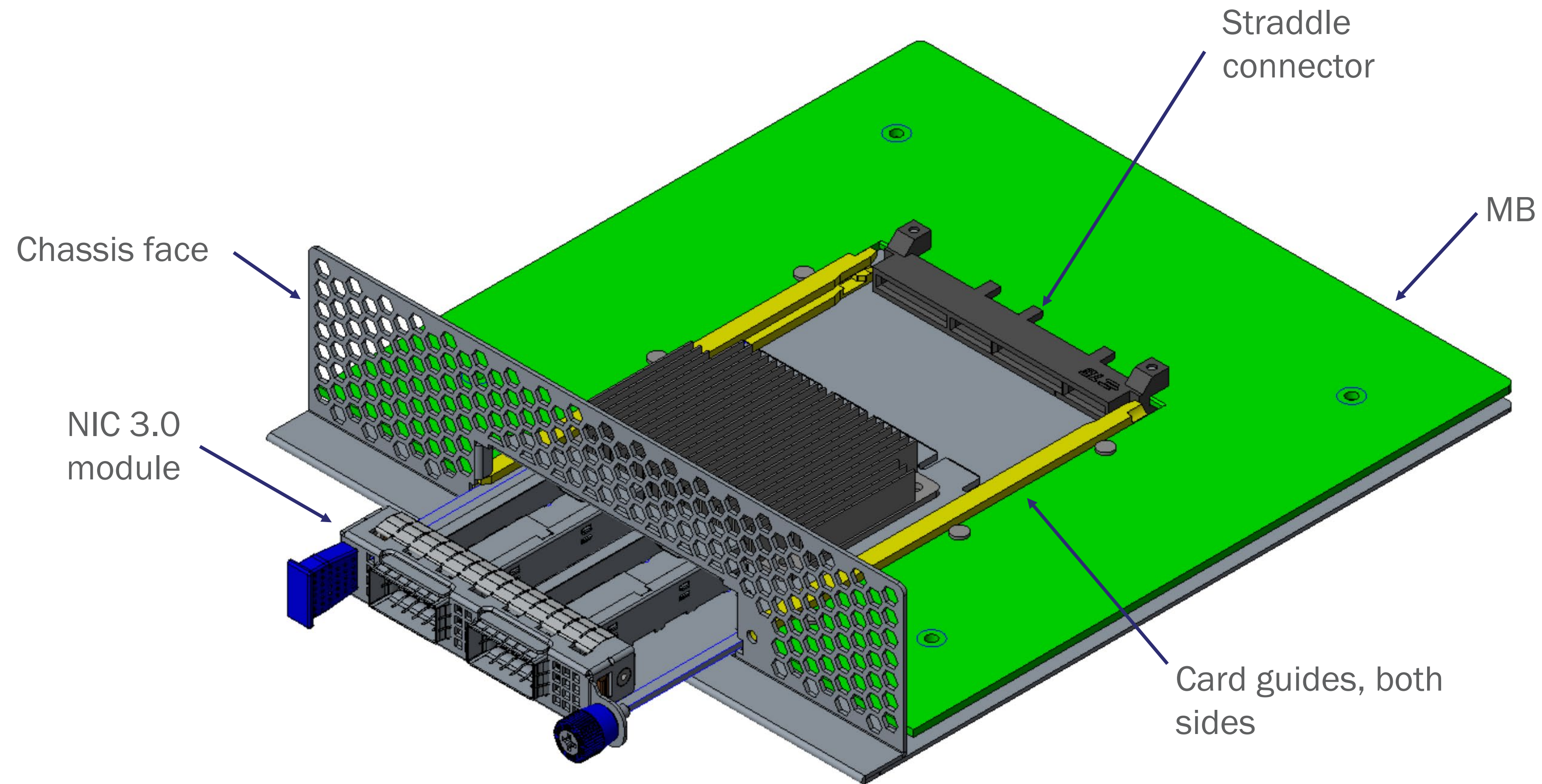


OCP Mezz 2.0 vs OCP NIC 3.0



	Mezz 2.0	NIC 3.0
Small Size	Non-Rectangle	76x115
Small Area	8000 mm ²	8740 mm ²
Large Size	NA	139x115
Large Area	NA	15985 mm ²
Expansion Direction	NA	Side
Connector style	Mezz	Edge (.6mm pitch)
PCB Orientations	Parallel	Parallel
Installation	In Chassis	Front/Rear Panel
Installation Action	Parallel to Front/Rear Panel	Perpendicular to Front/Rear Panel
Hot Swap	No	Yes
EMI Containment for Serviceability	High Difficulty	Low Difficulty

NIC 3.0 Configuration



NIC 3.0 Mechanical Goal:

Develop universal form factors which shall include mechanicals and EMI containment.

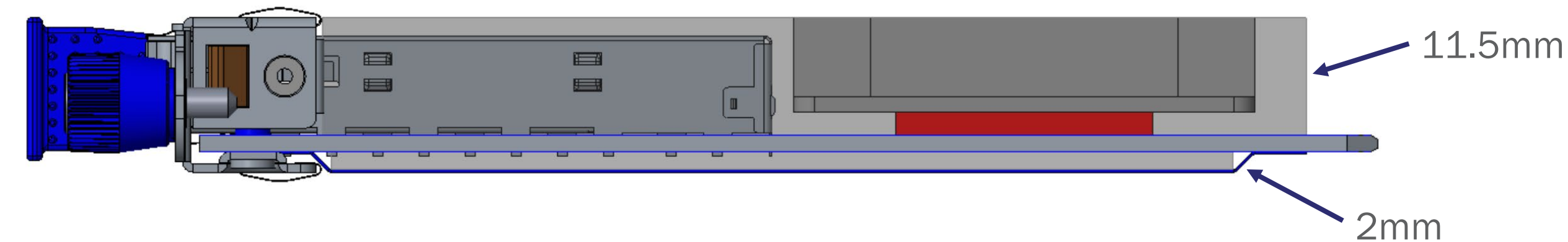
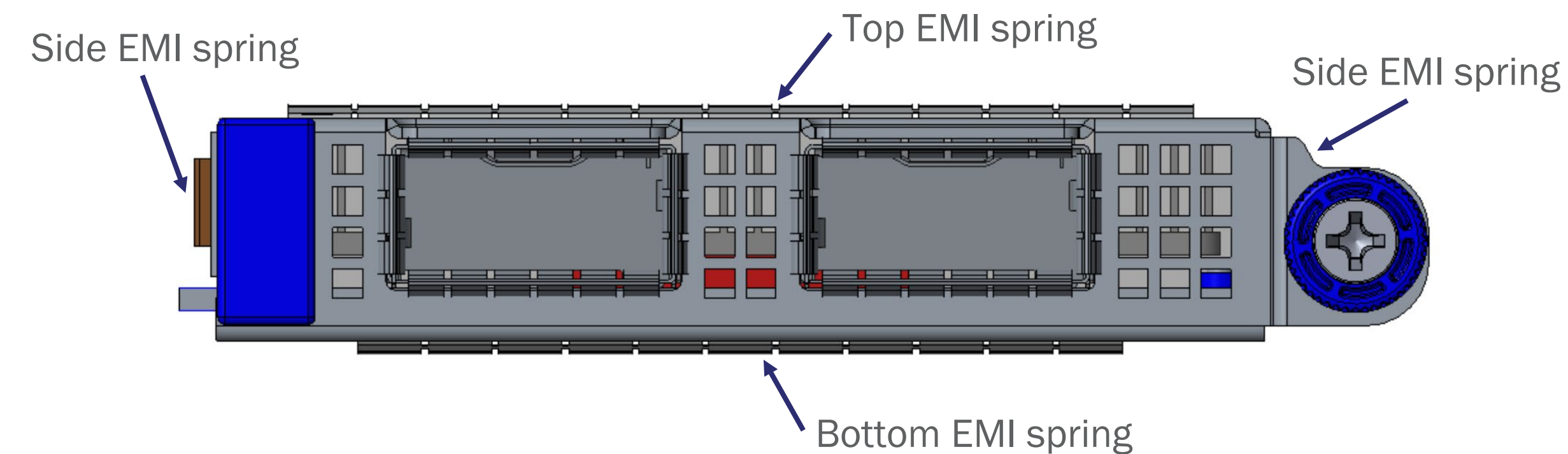
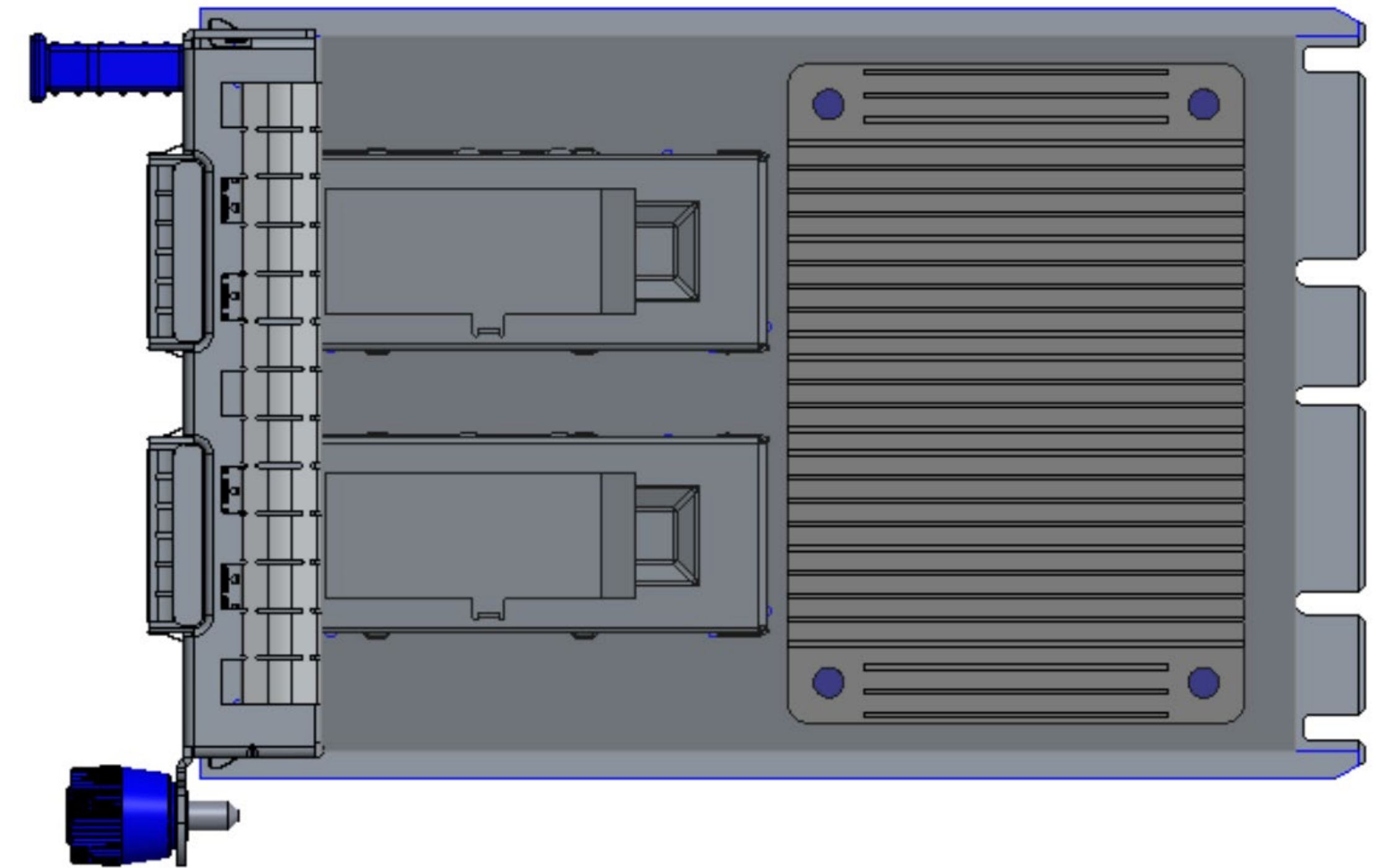
Requirements:

- The same NIC design must work in both straddle and right angle configurations
- NICs might be oriented horizontally or vertically
- Retention and guidance must work with specified NIC v3.0 MB thicknesses
- Common mechanical features used across small and large form factors
- Some form of mechanism is required for seating large form factors due to mating forces
- Design of PCB should be flexible enough to support many component and connector configurations without need of mechanical changes
- Recommended mechanical designs will be included in the specification to simplify and reduce barriers to adoption

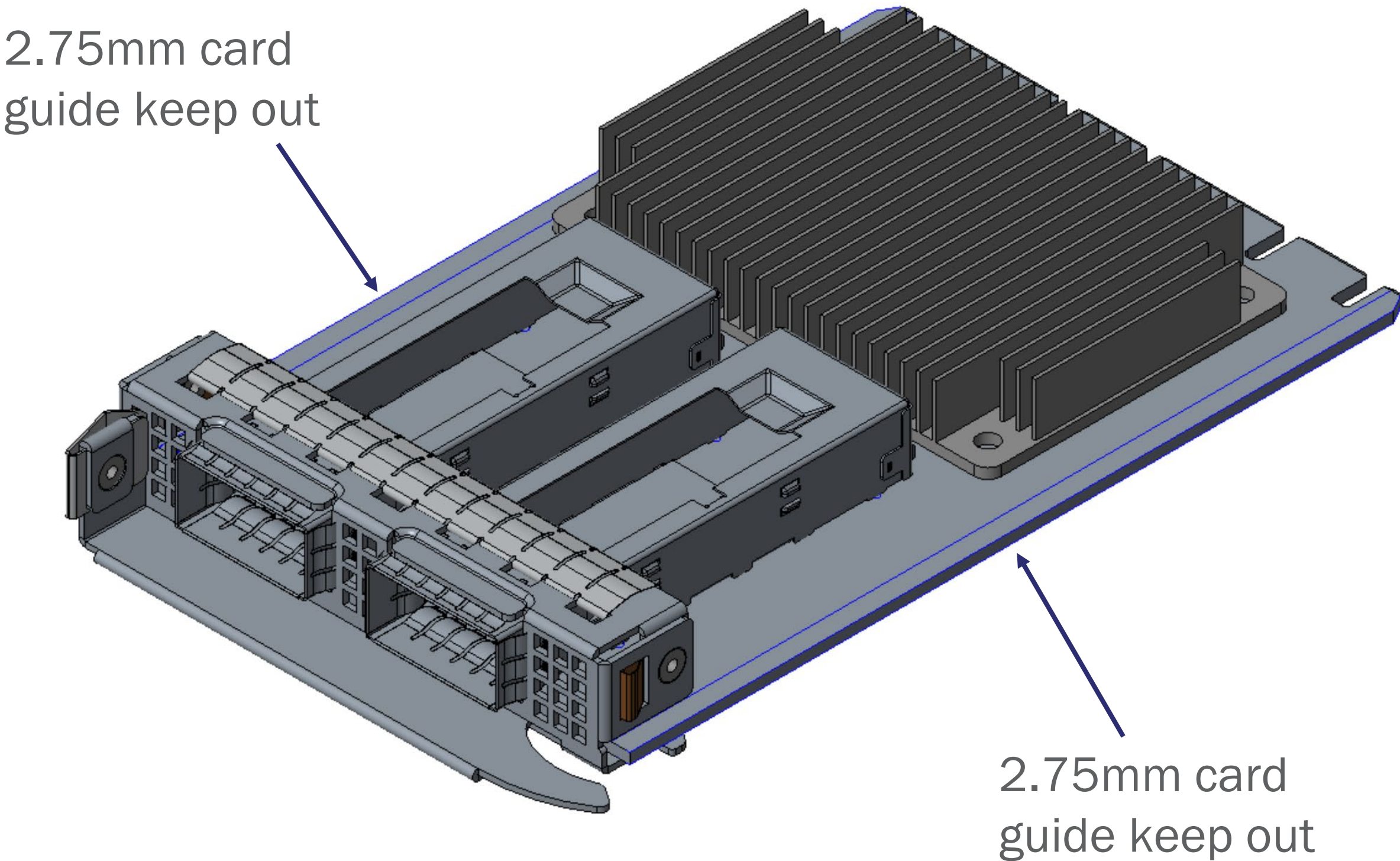
NIC 3.0 Module Configuration

Features:

- Increased total PCB space
- Simplified component keep-in areas
- Scalable design to support large form factor
- Built in EMI containment
- Available in thumb screw or tool-less configurations with no PCB changes



NIC 3.0 Module Sizes



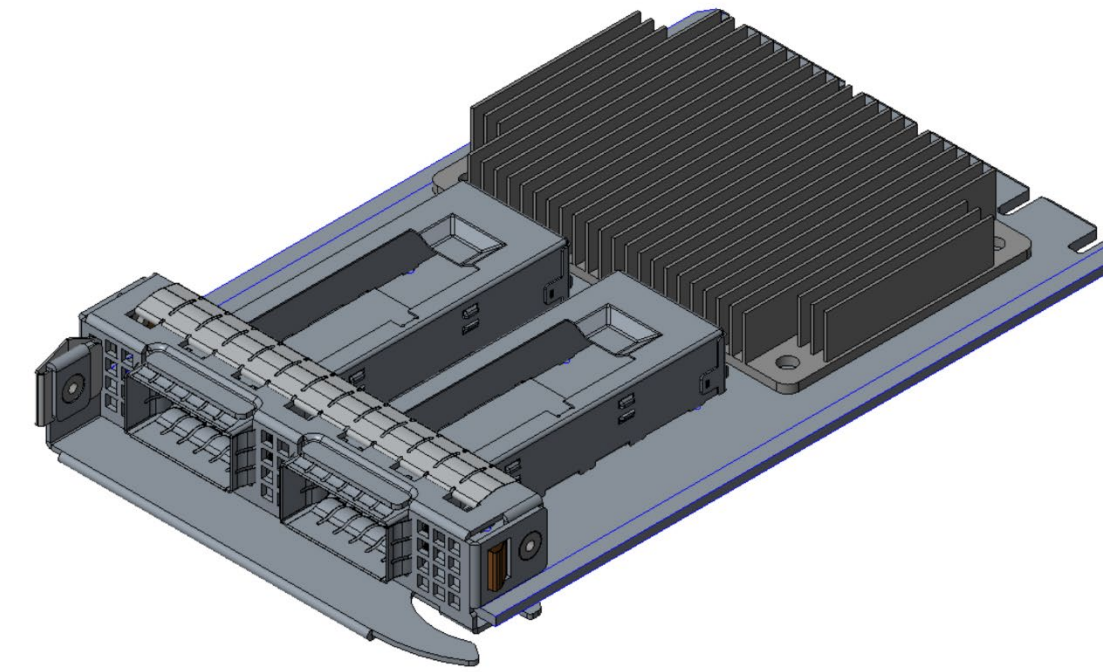
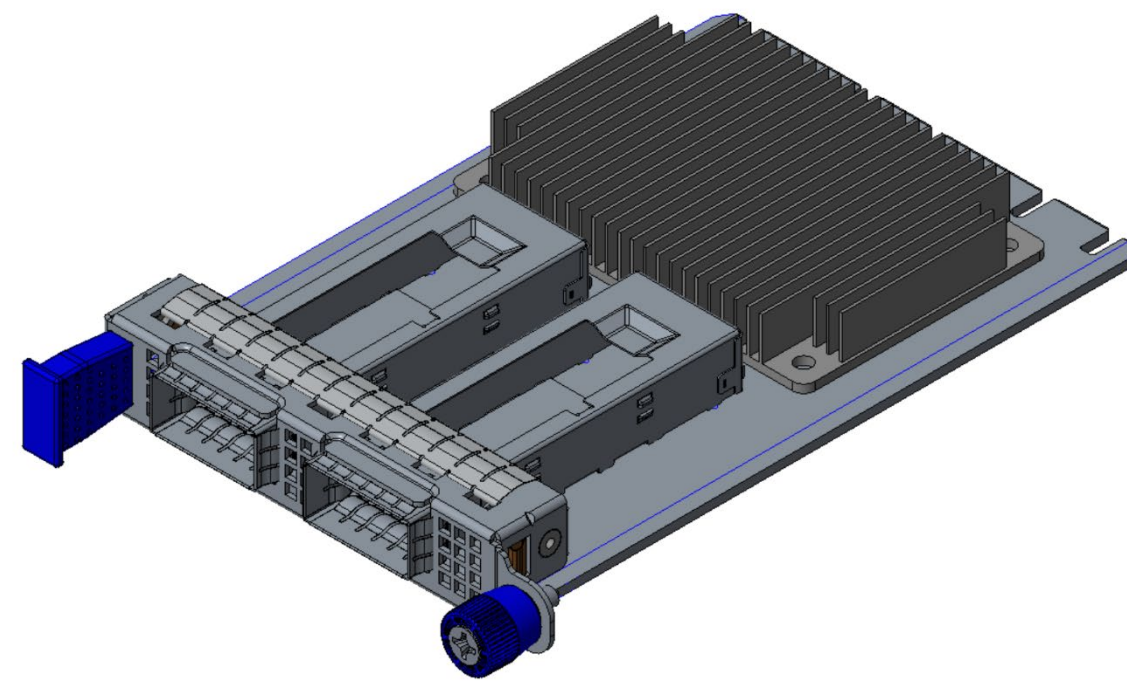
		Available Space	
	PCB Size	Top/Bottom Component Placement	Routing Inner Layers
Small Size (SFF)	76x115	70.5x109	76x115
Large Size (LFF)	139x115	133.5x109	139x115

subtract 5.5mm from width (card guide)
subtract 6mm from length (edge connector)

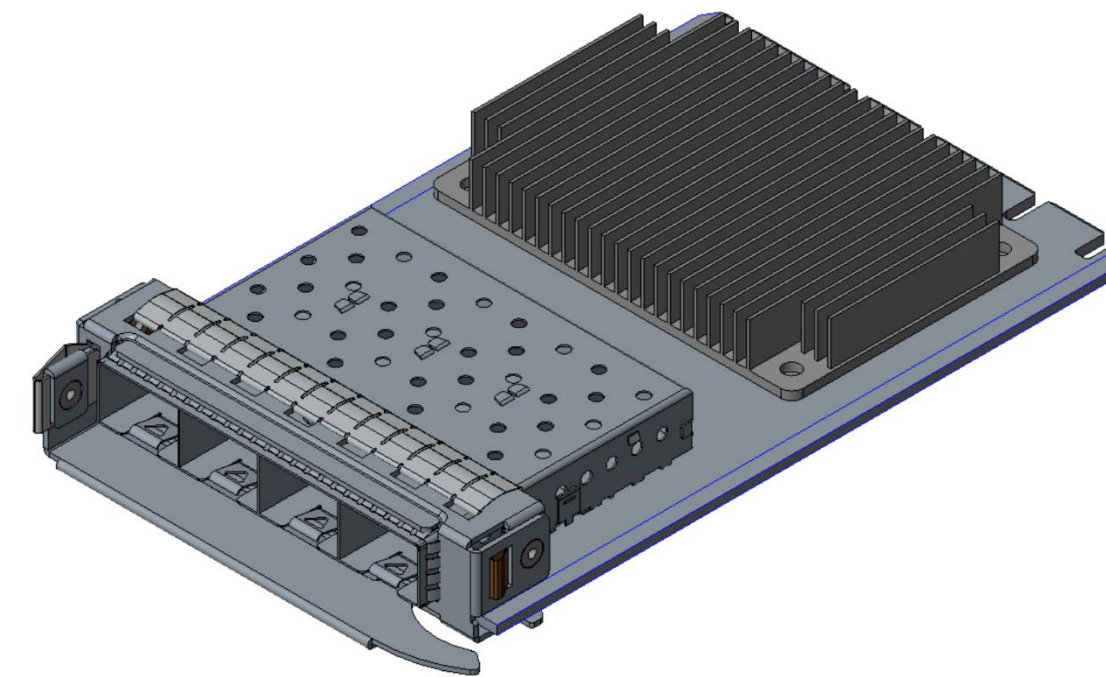
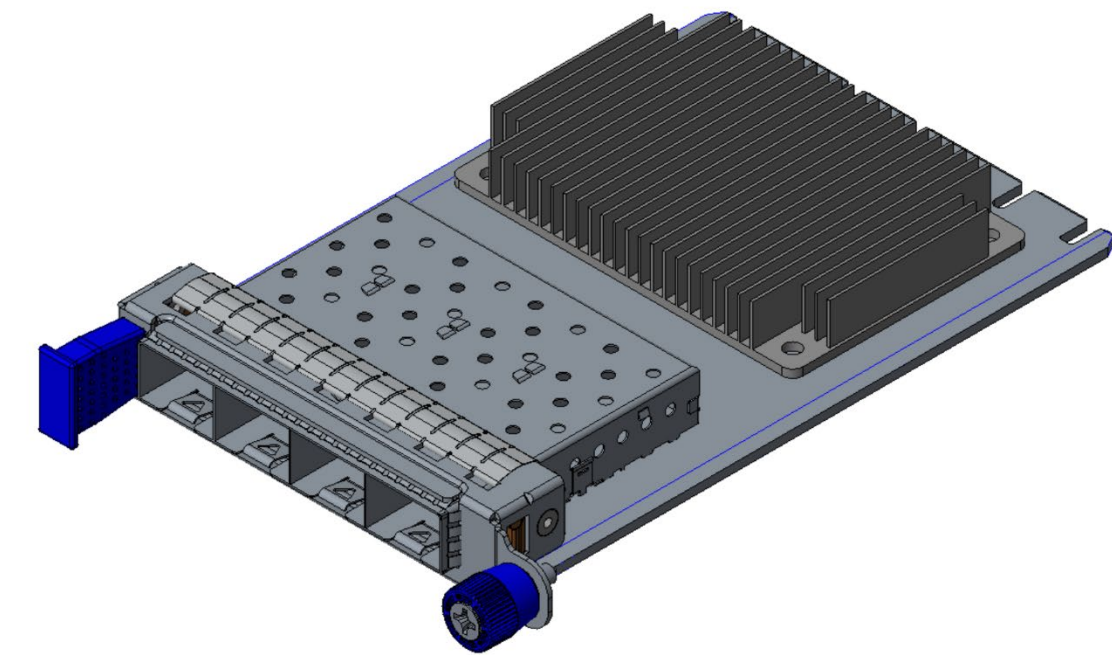
NIC 3.0 SFF Module Versions

Complete 3D CAD available at:
<http://www.opencompute.org/wiki/Server/Mezz>

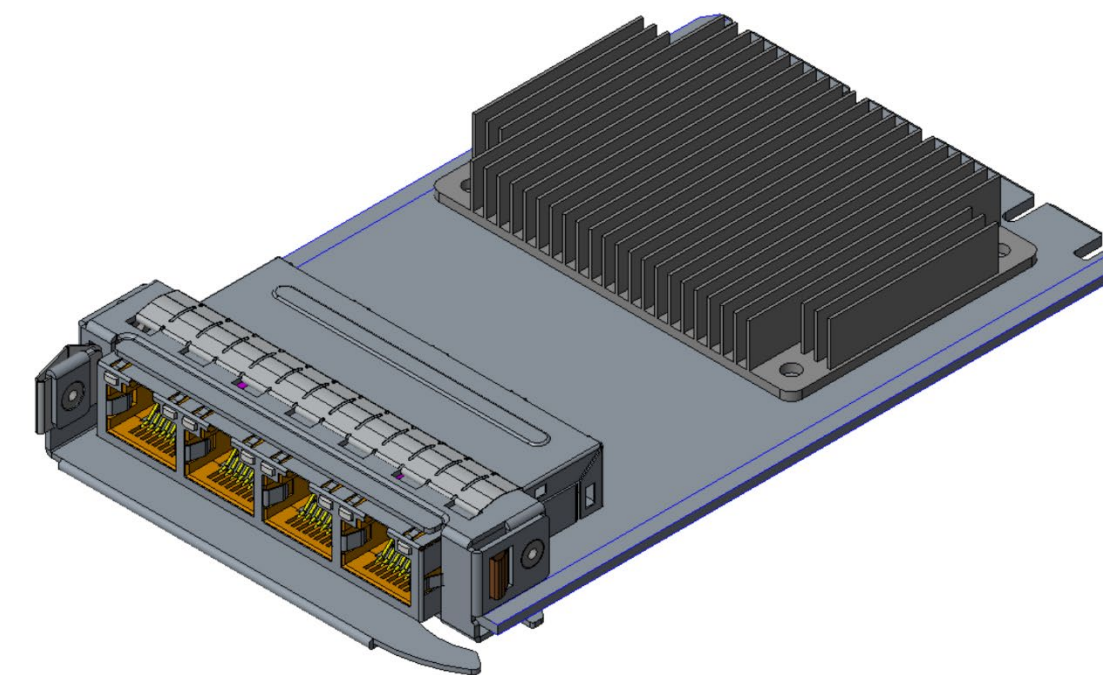
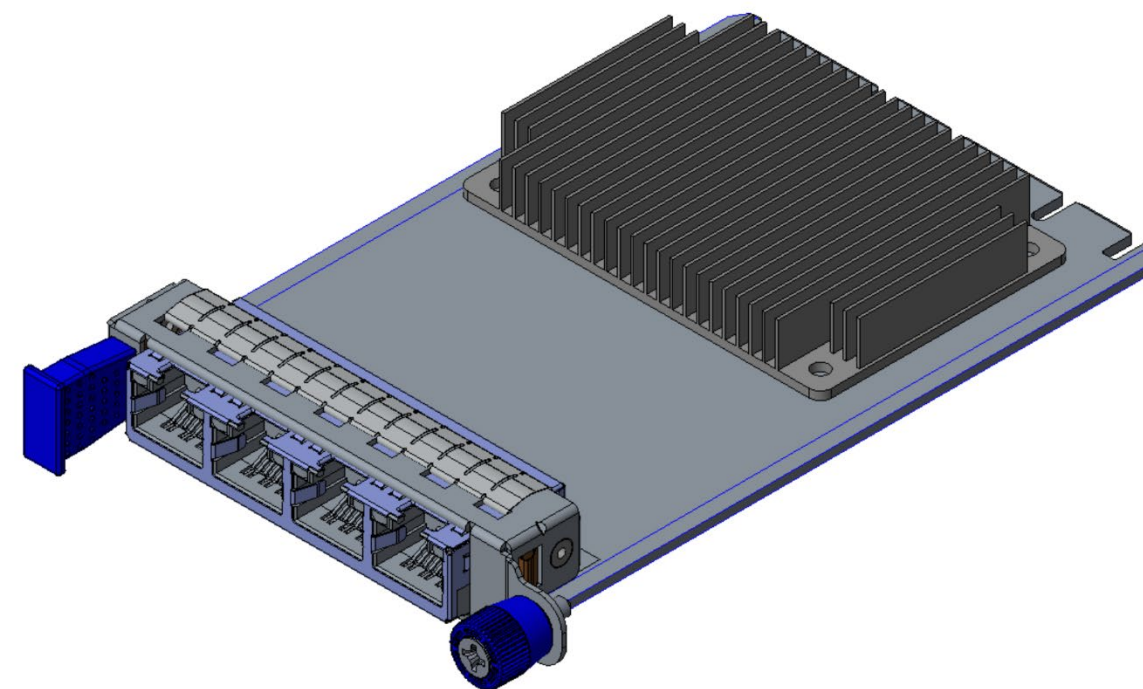
2x QSFP



4x SFP



4x RJ45



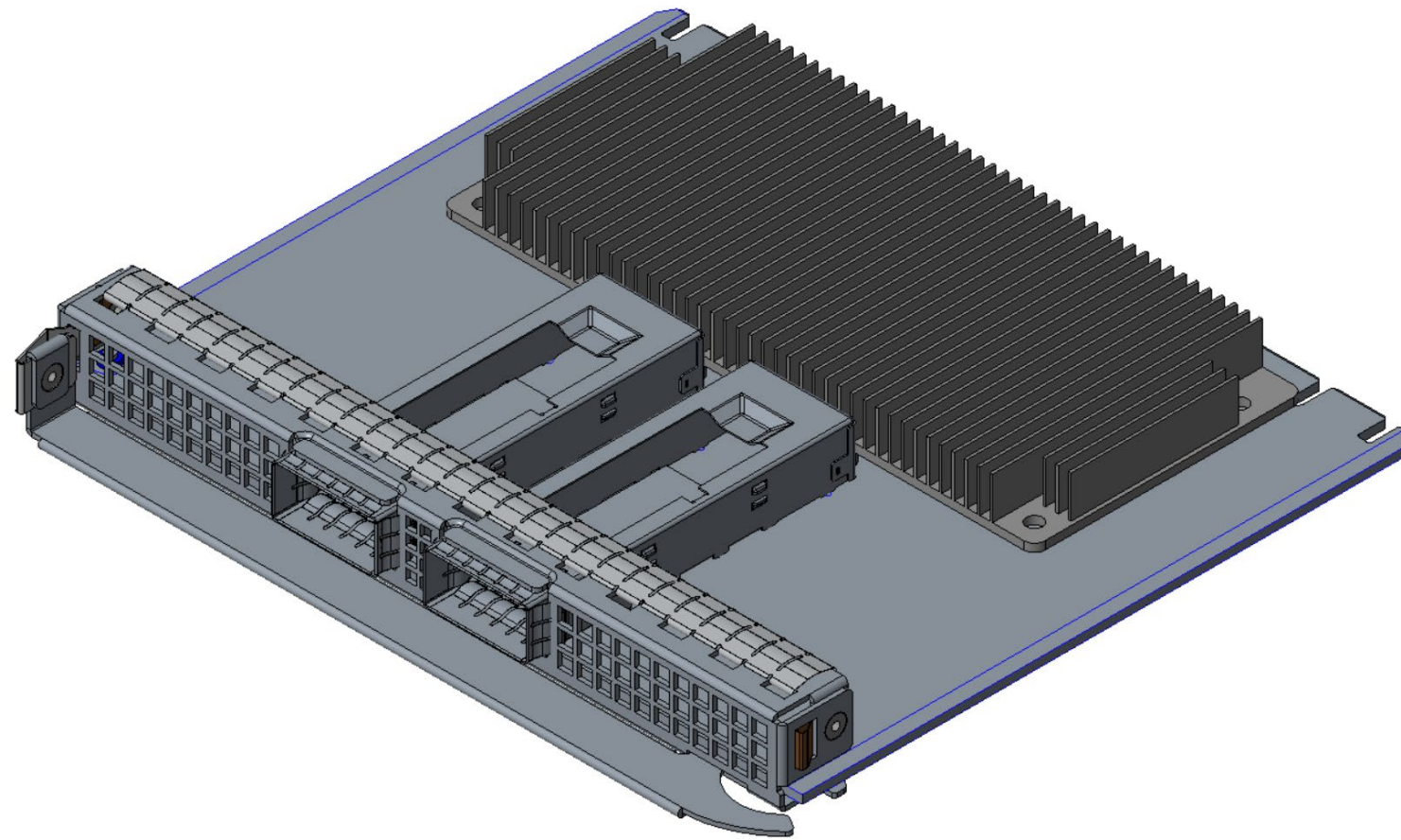
Single thumb screw version

Tool-less version

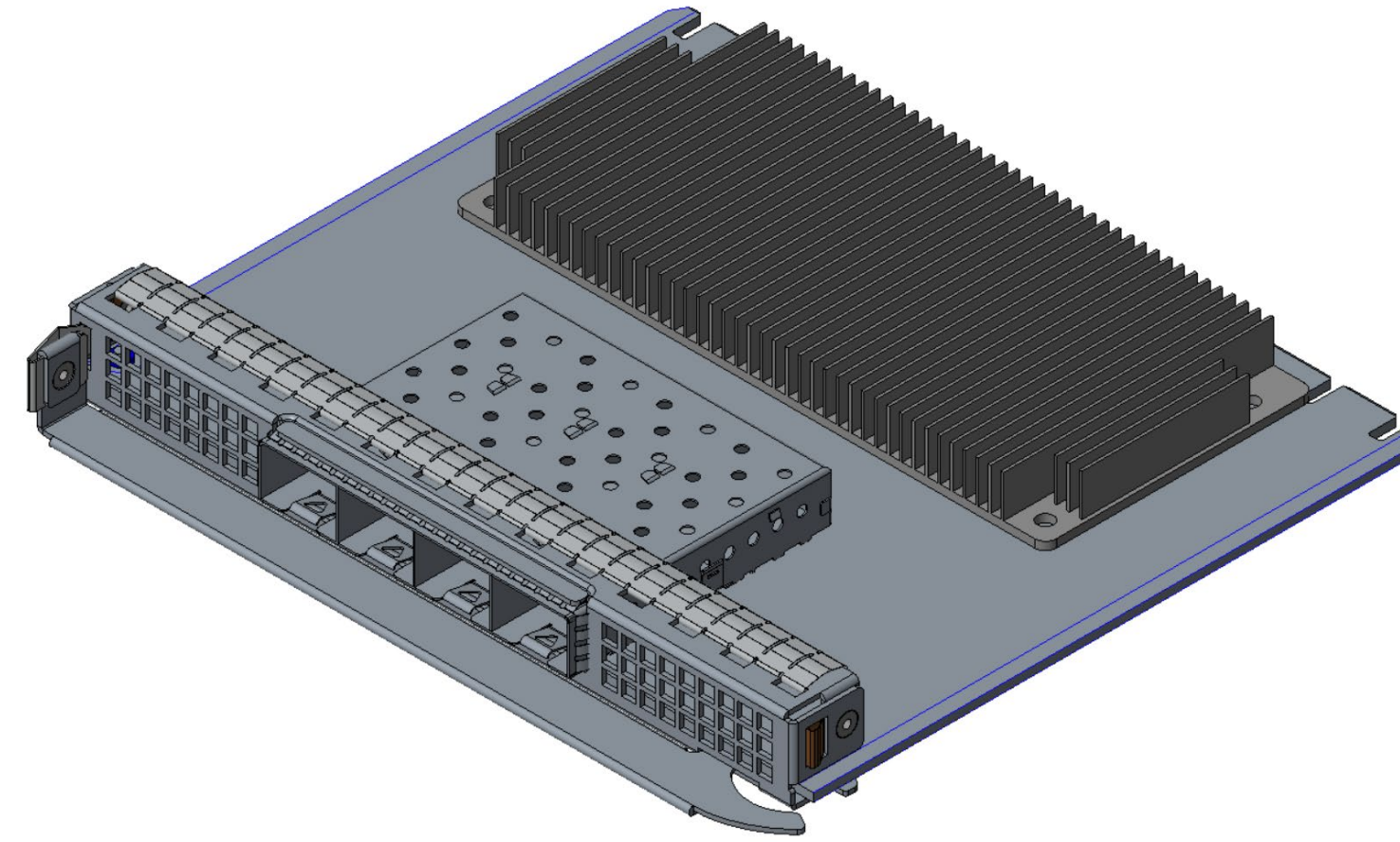
NIC 3.0 LFF Module Versions

Complete 3D CAD available at:
<http://www.opencompute.org/wiki/Server/Mezz>

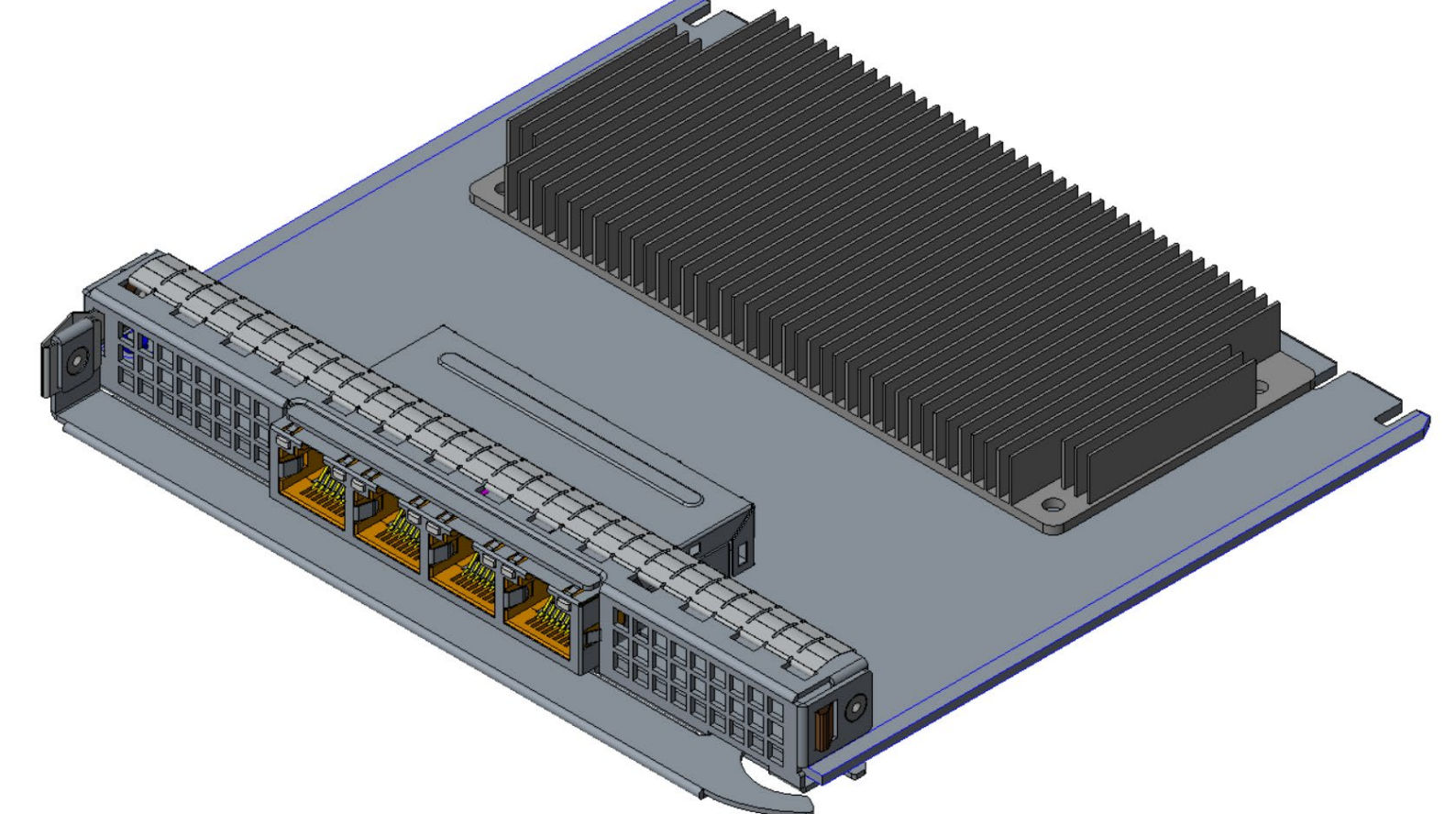
2x QSFP



4x SFP



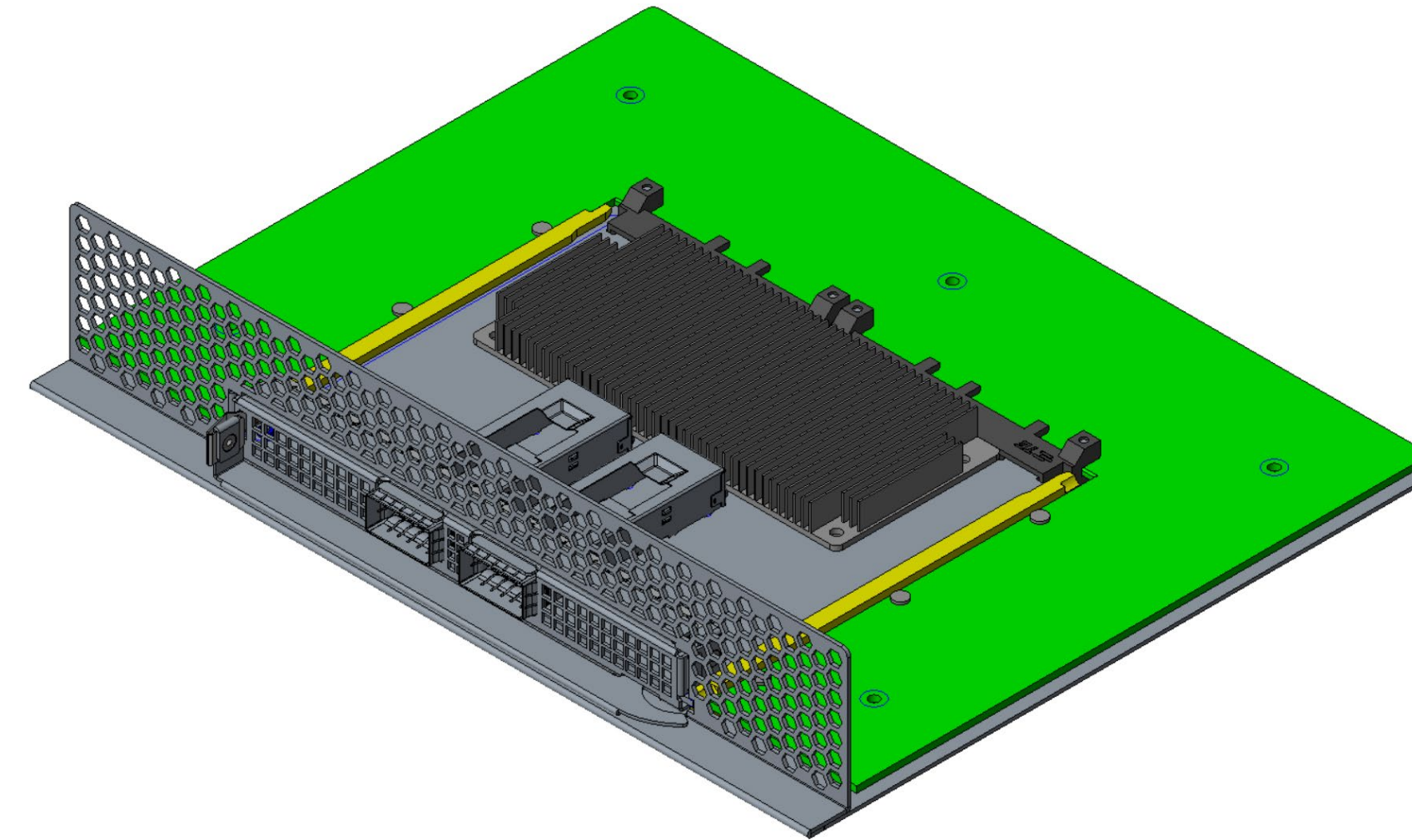
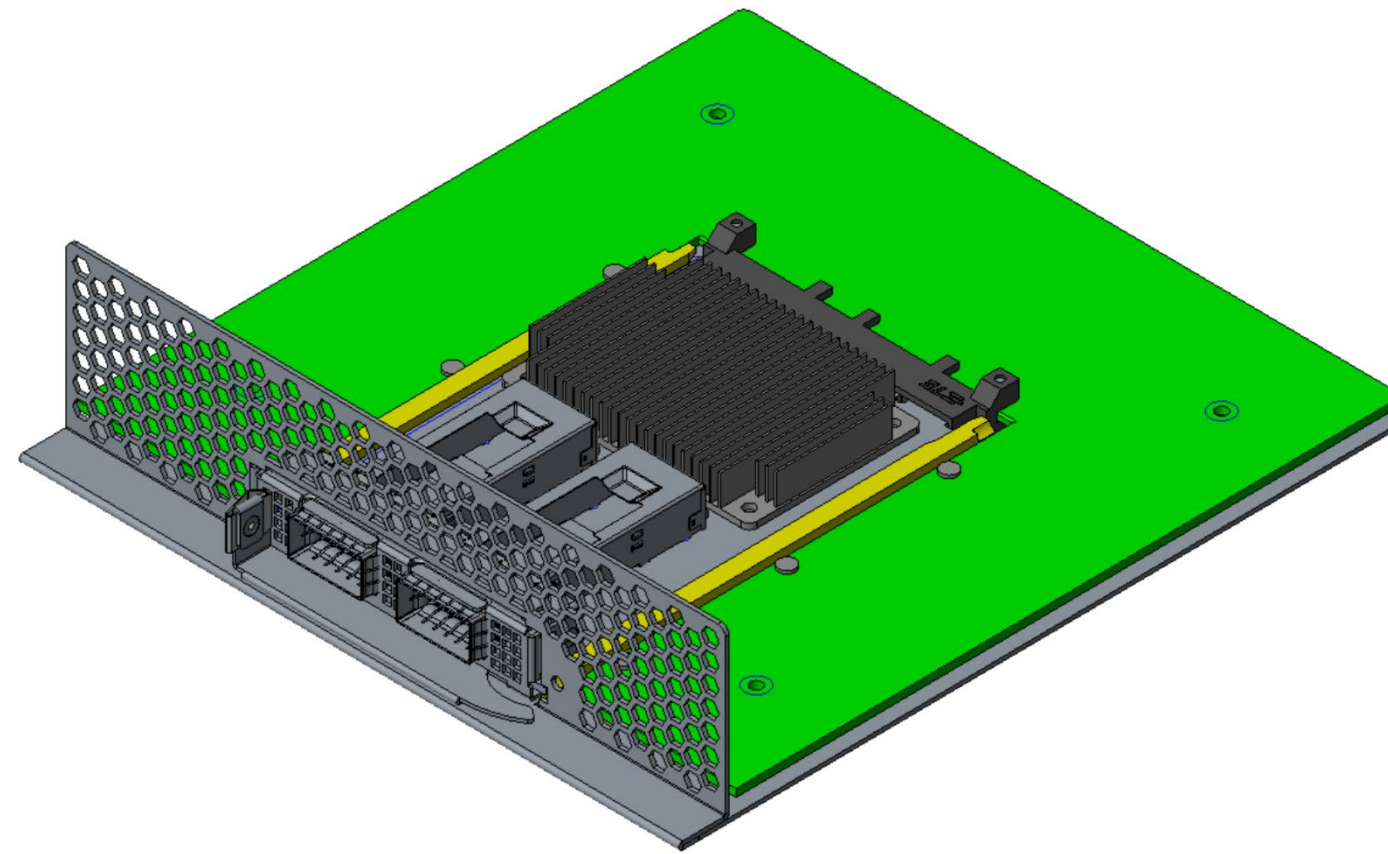
4x RJ45



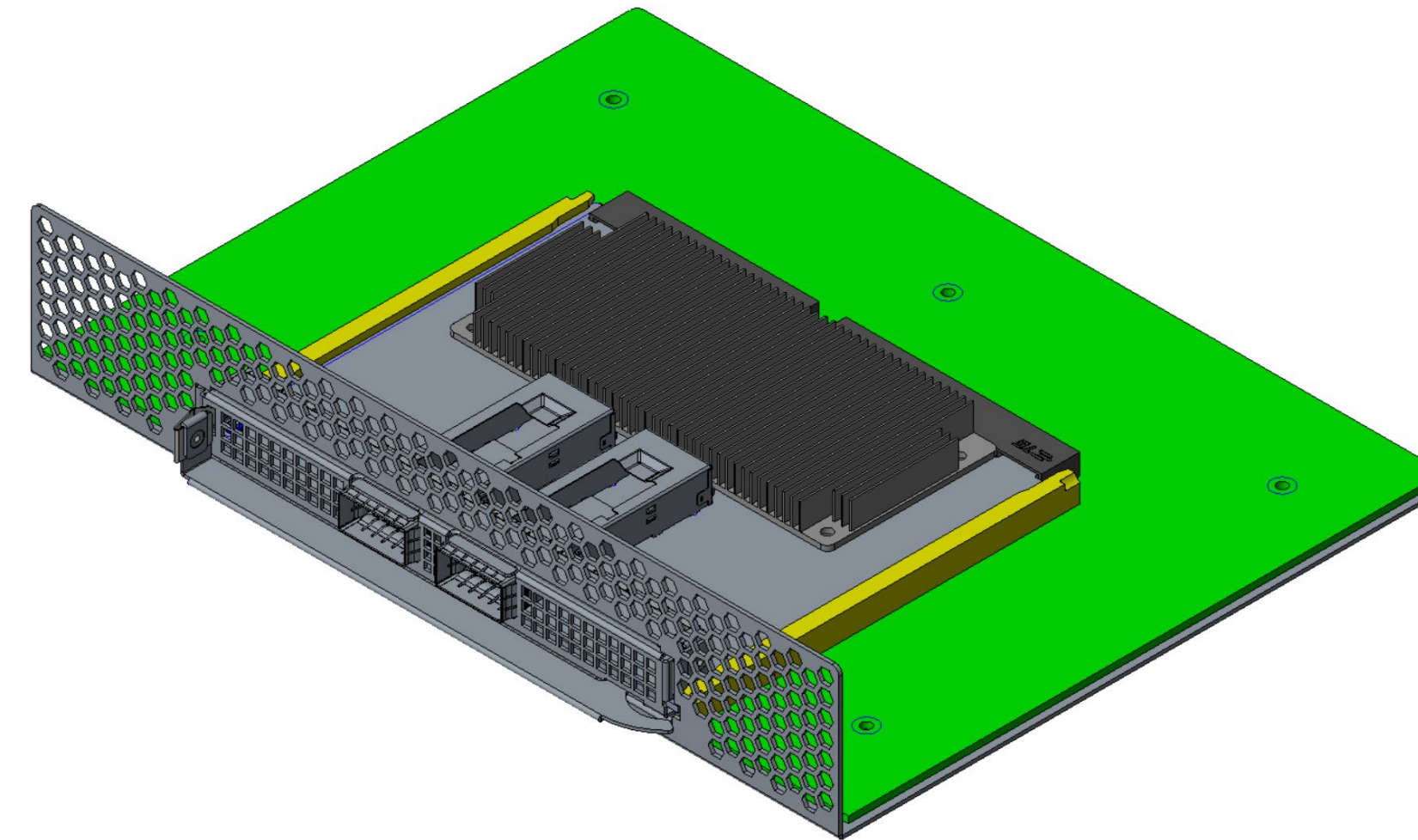
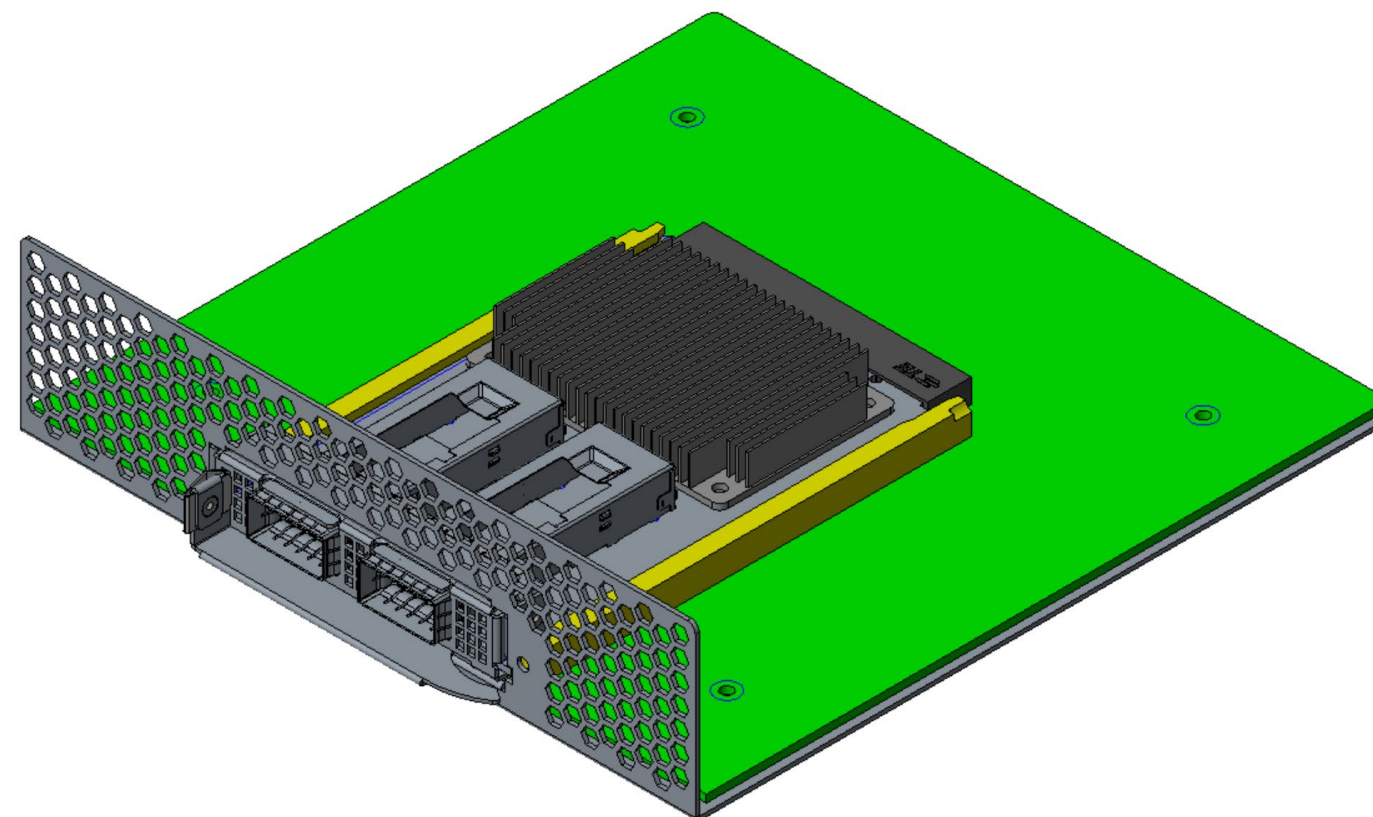
NIC 3.0 Chassis Examples

Complete 3D CAD available at:
<http://www.opencompute.org/wiki/Server/Mezz>

Straddle
Mount



Right Angle
Mount





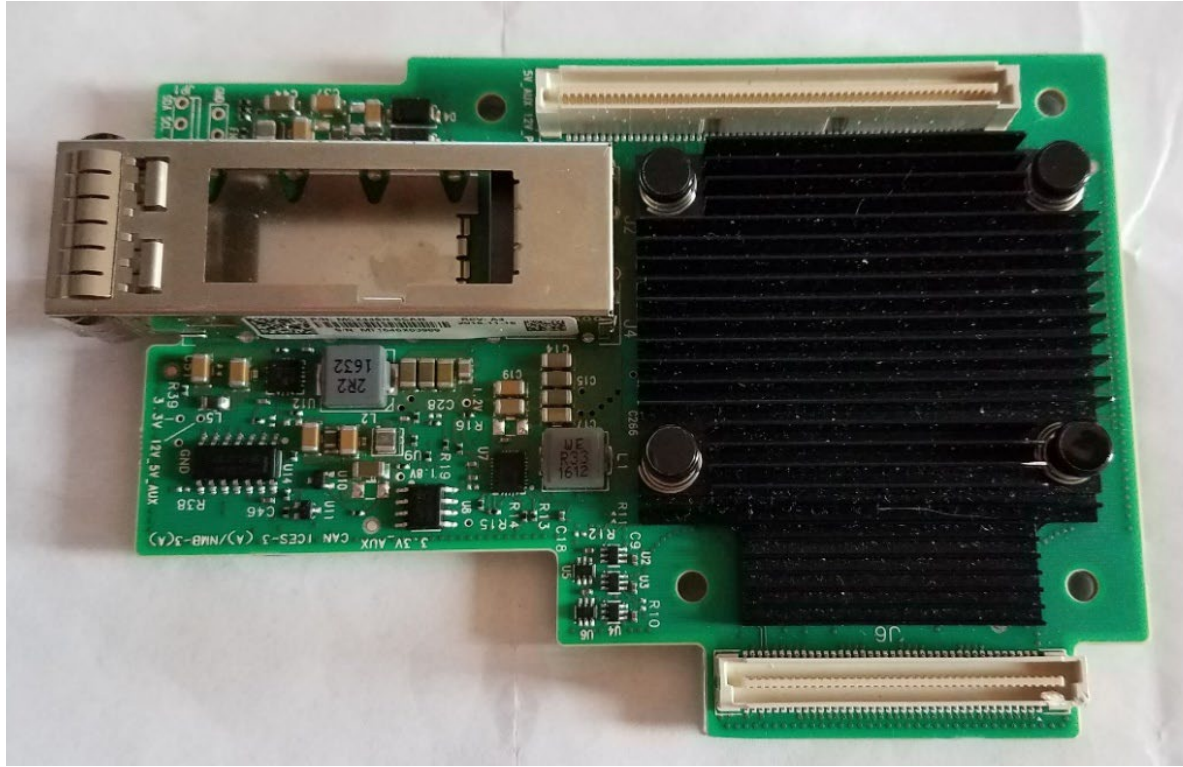
OCP NIC 3.0 Thermal

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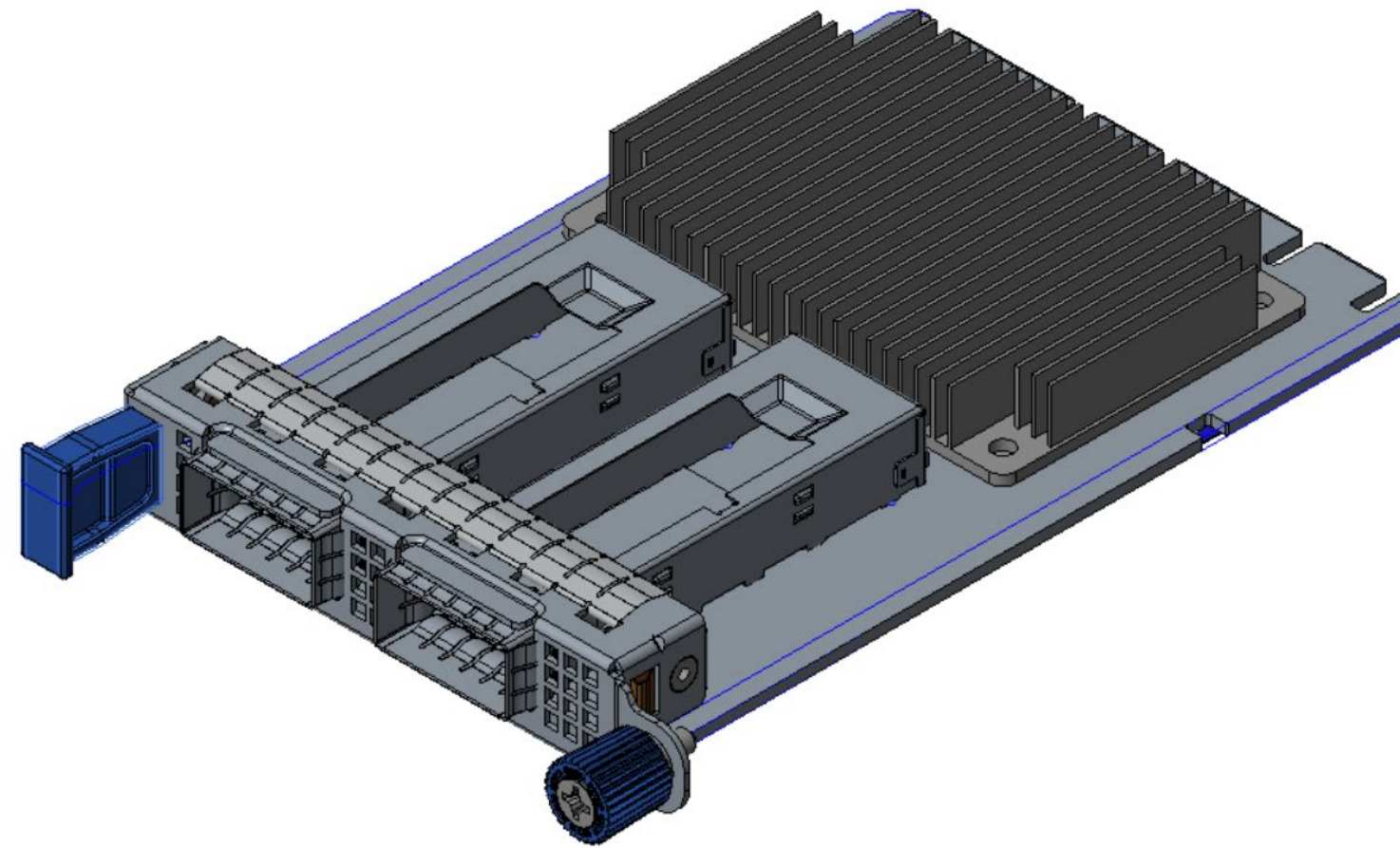


Thermal Benefits for NIC 3.0

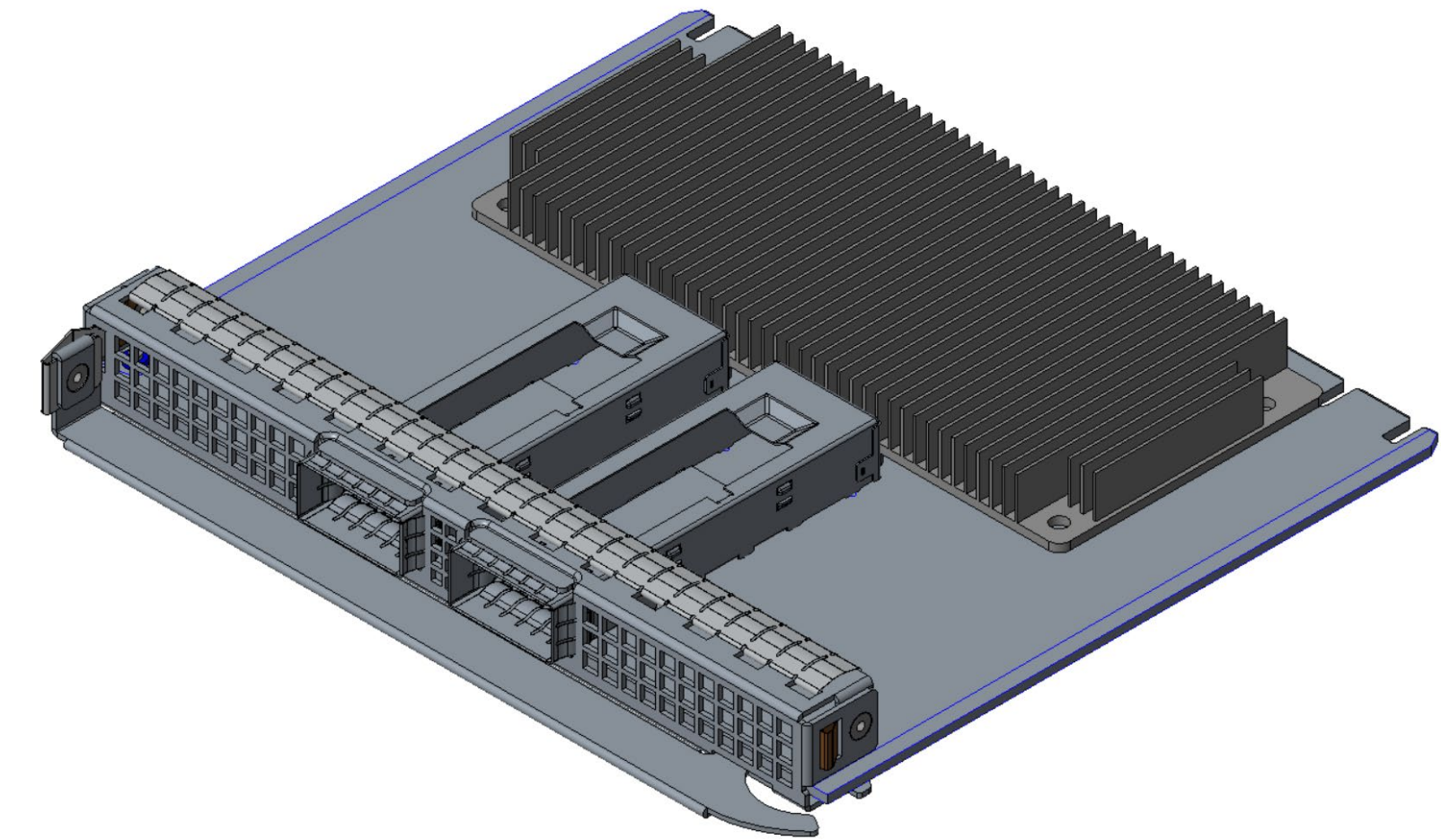
Mezz 2.0



NIC 3.0 SFF

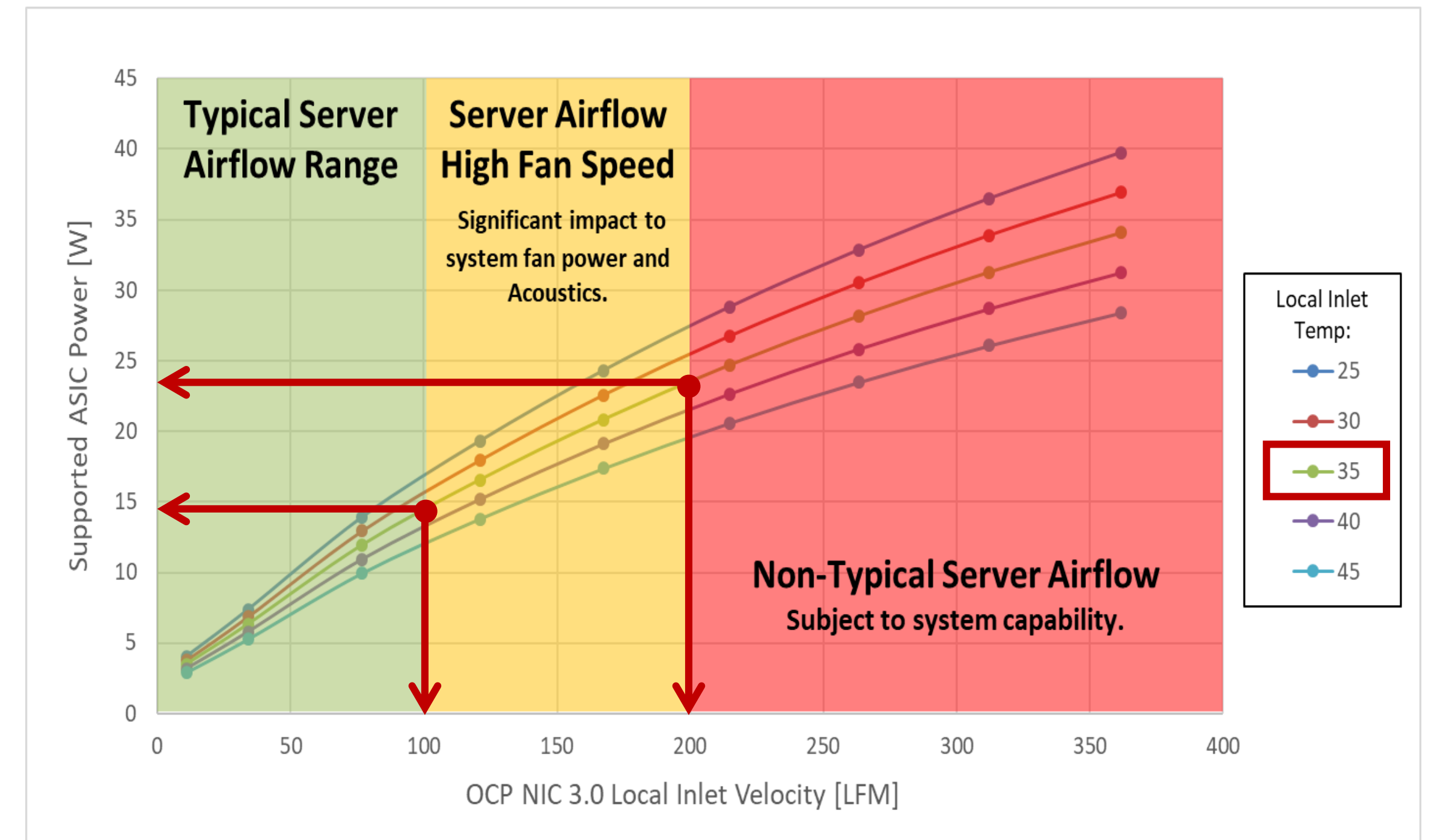
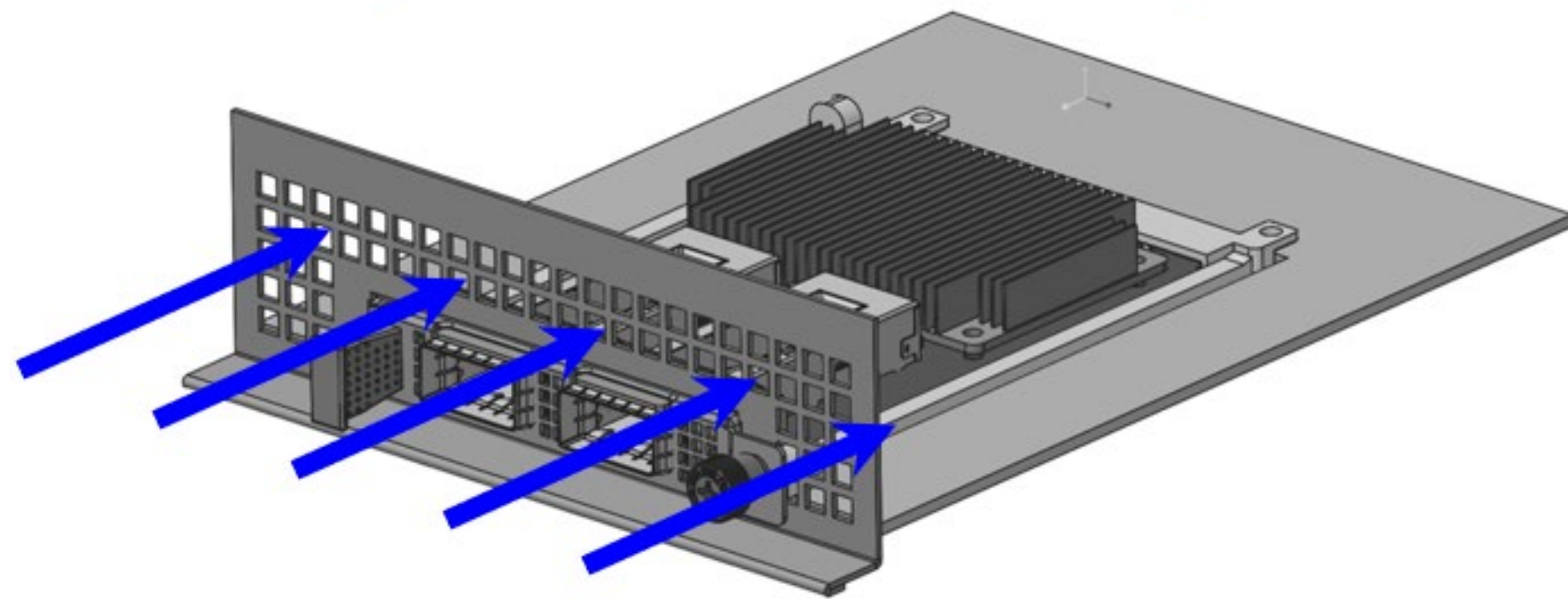


NIC 3.0 LFF



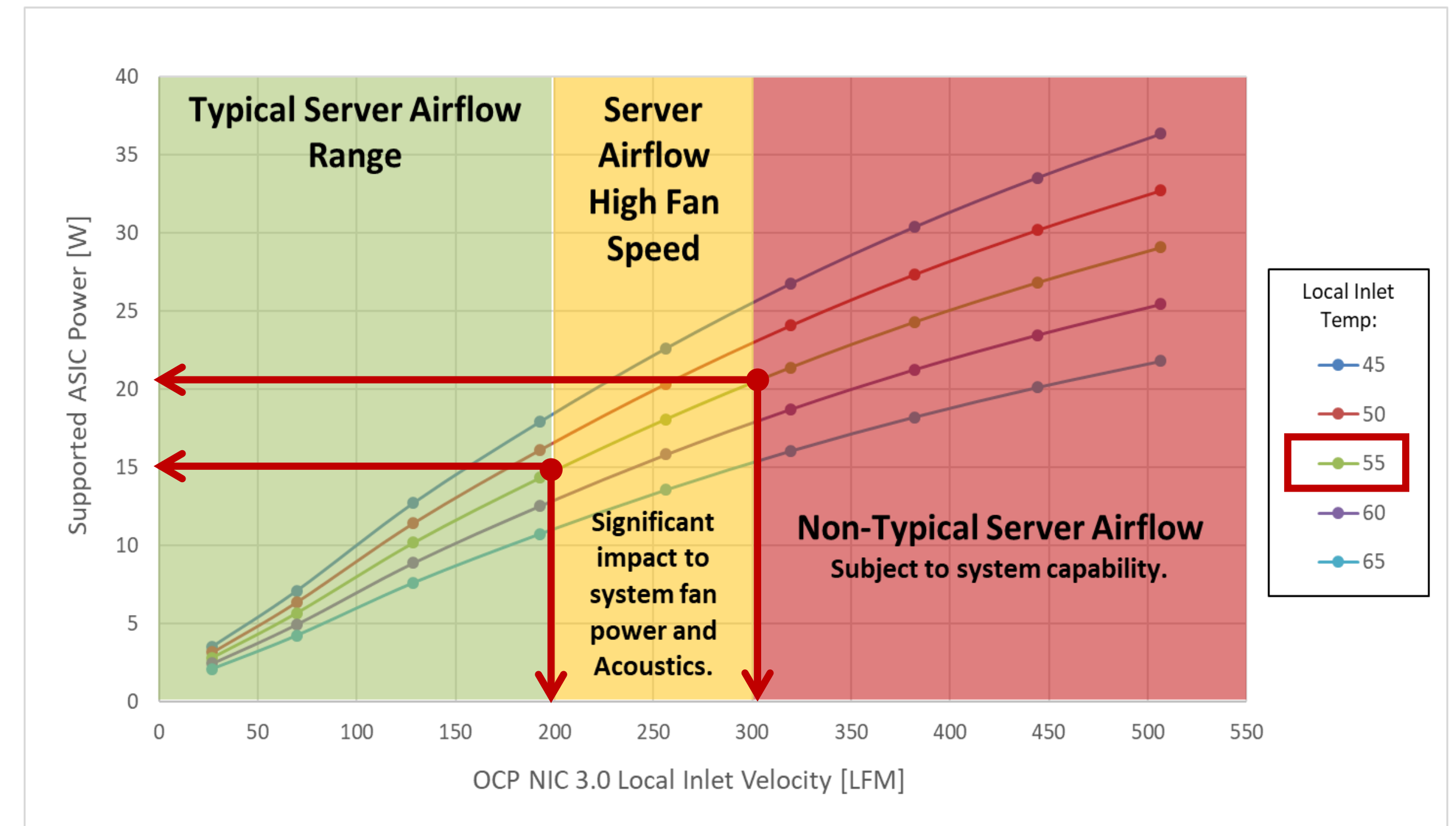
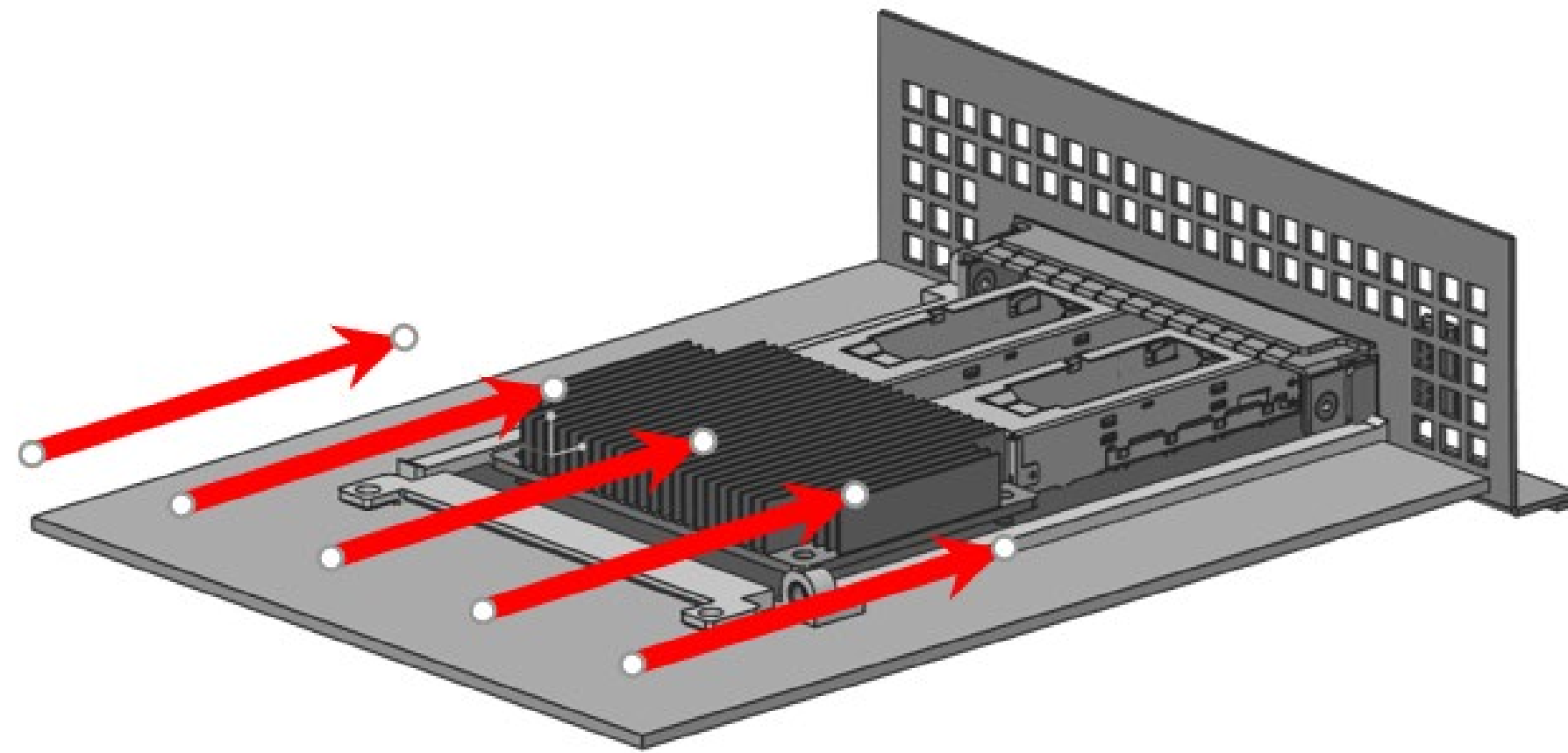
- More space for heatsink with no bergstak connector on the side
- Up-facing heatsink permits flexibility on heatsink height
- LFF allows thermal potential for high-power ASIC cooling

Thermal Design Guidance – Cold Aisle



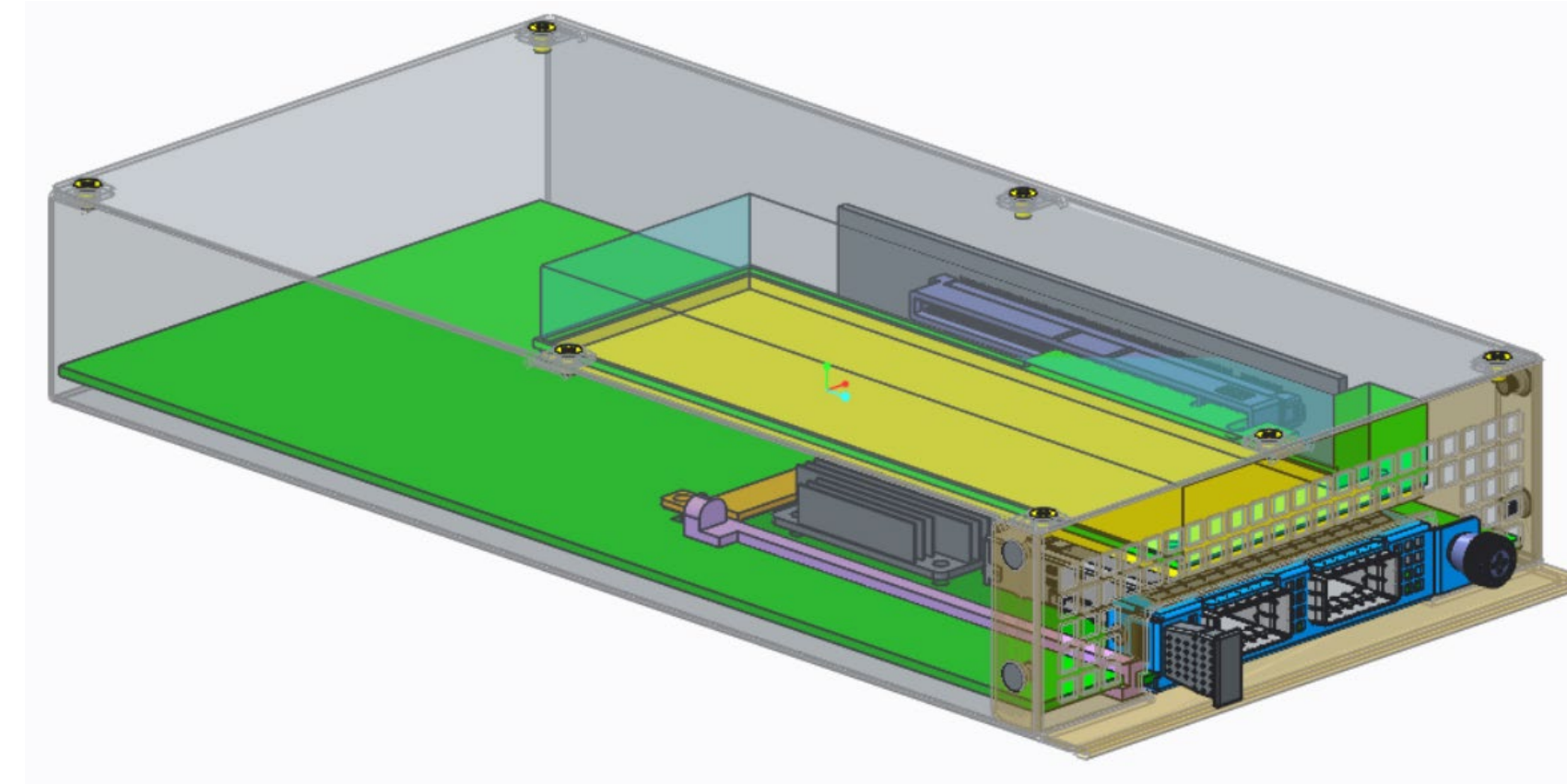
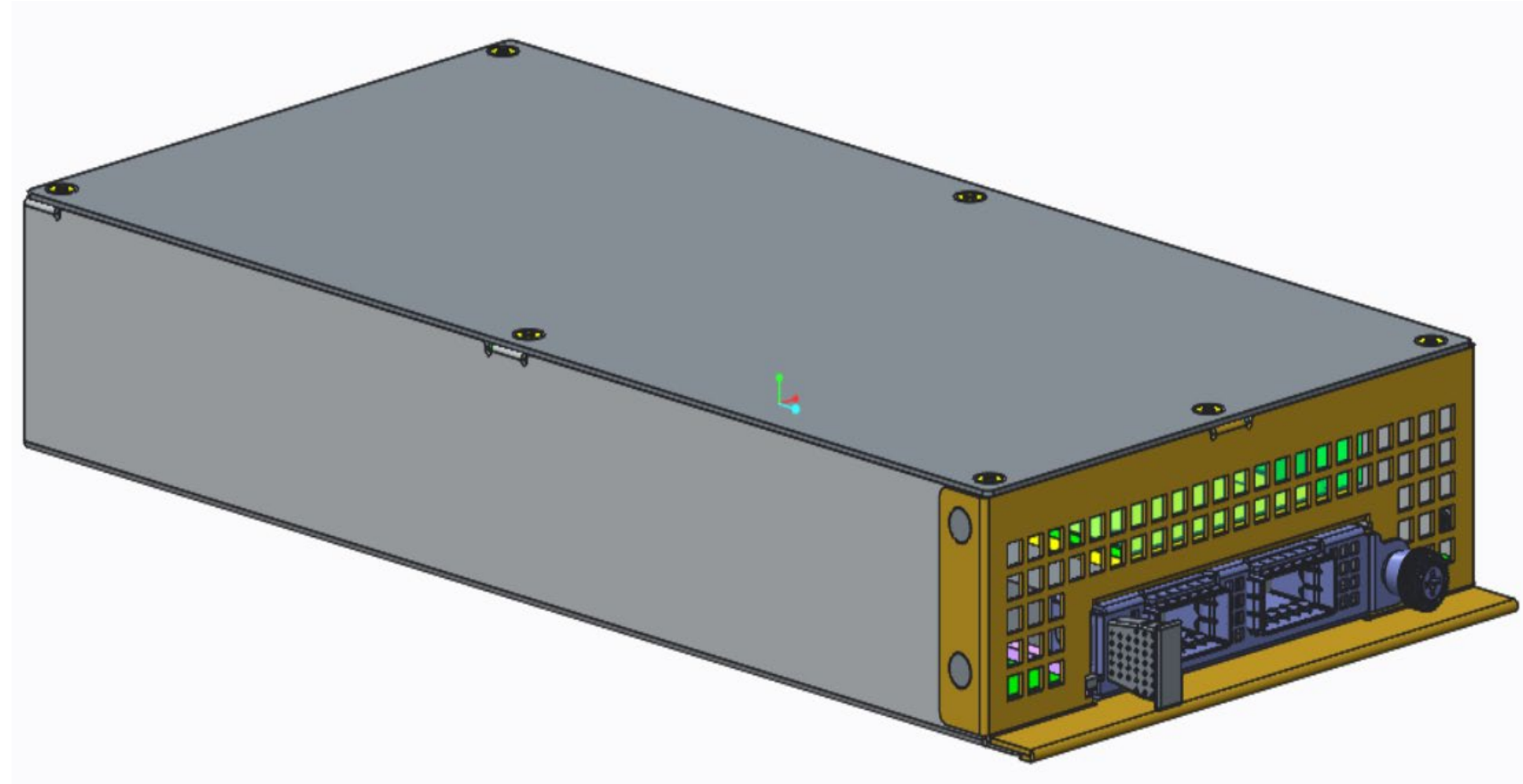
- For typical inlet temperature 35 °C, SFF:
 - Support 15W ASICs under 100 LFM (Typical)
 - Support 23W ASICs under 200 LFM (High)

Thermal Design Guidance – Hot Aisle



- Hot-aisle cooling is more challenging due to higher supply air temperature
- For typical inlet temperature 55°C, SFF:
 - Support 15W ASICs under 200 LFM (Typical)
 - Support 20W ASICs under 300 LFM (High)

Thermal Test Fixture



- **Purpose:**
 - Provide standardized test data across different NIC and system vendors
- **Features:**
 - Simple and easy adoption by both NIC and system vendors
 - Representative thermal data to define cooling tiers across different use cases
 - Functional test board for power delivery and reporting interface

Implementation and Refinement

0v70 – Initial release
Jan 25th, 2018

0v80 – Hot fixes
June 4th 2018

0v90 – Add Signal Integrity Guideline and Conformance
Sept 2018

1v00 – Add Implementation Learning
Q4'18

Subgroup Wiki with latest specification : <http://www.opencompute.org/wiki/Server/Mezz>

Mailing list: <http://lists.opencompute.org/mailman/listinfo/opencompute-mezz-card>





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