# PICMG 2021

Jess Isquith

PICMG, President

Embedded Tech Trends

# PICMG Overview

COM-HPC®

MicroSAM™

CompactPCI® Serial

COM Express®

μTCA®

AdvancedTCA®

CompactPCI®

SHB Express™

Modular

Scalable

Interoperable

Founded 1994 as a non-profit consortium

Deep engineering expertise in member companies

Rigorous Intellectual Property policies

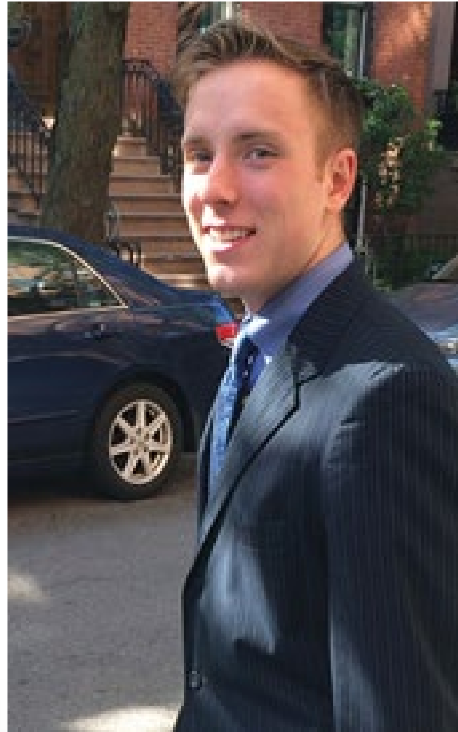
Over 50 standards released to date

Membership comprised of ~140 companies from 20 countries

# PICMG Leadership

PICMG

**Doug Sandy**
CTO



**Dylan Lang**
Treasurer

**Valerie Andrew**
Marketing Officer

Executive membership act as Board of Directors

PICMG is Member Driven!

# 2021 Initiatives

PICMG®

## COM-HPC®

Acromag
ADLINK
Advantech
AMI
Amphenol
congatec
Elma Electronic
Emerson Machine
Ept
Fastwel
GE Automation
HEITEC
Intel
Kontron
MEN
Avnet
N.A.T
nVent
Samtec
Seco
Supermicro
TE Connectivity
Trenz Electronic
University Bielefeld
VersaLogic Corp.

## CompactPCI® Serial

Acromag, Inc.
ADLINK
Airbus Defence & Space
Amphenol
EKF
Elma Electronic
Embeck
European Space Agency
FASTWEL
Hartmann Electronic
HEITEC
Lodz University
MEN Mikro
National Instruments
nVent
Paul Sherrer Institut
Samtec
TE Connectivity

## μTCA®

Amphenol
Atom Computing
BAE
Comtel
DESY
Embeck
ept
ESS
MicroLab
N.A.T.
nVent
Pixus Technologies
Positronics
Samtec
University of Lodz
VadaTech
W-IE-NE-R Power

## MicroSAM™

IIoT Initiatives

ADLINK
AMI
Arroyo Technology
Avnet
Elma Electronic Inc.
ept GmbH
Intel Corporation
Lodz University
MEN Mikro
nVent
Samtec
TE Connectivity
Trenz Electronic GmbH
Triple Ring Technologies

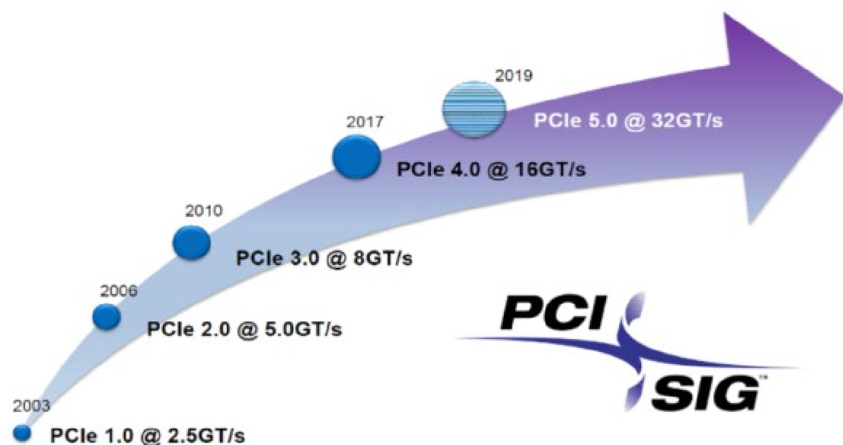
# Driving Forces and Key Considerations

## Technology Evolution

- PCIe Gen 4 (16 GT/s) and  Gen 5 (32 GT/s)
- 100 Gigabit Ethernet
- USB4
- Manageability down to embedded units

## Critical considerations

- Platform Management
- Backward compatibility
- Cooling
- Interoperability

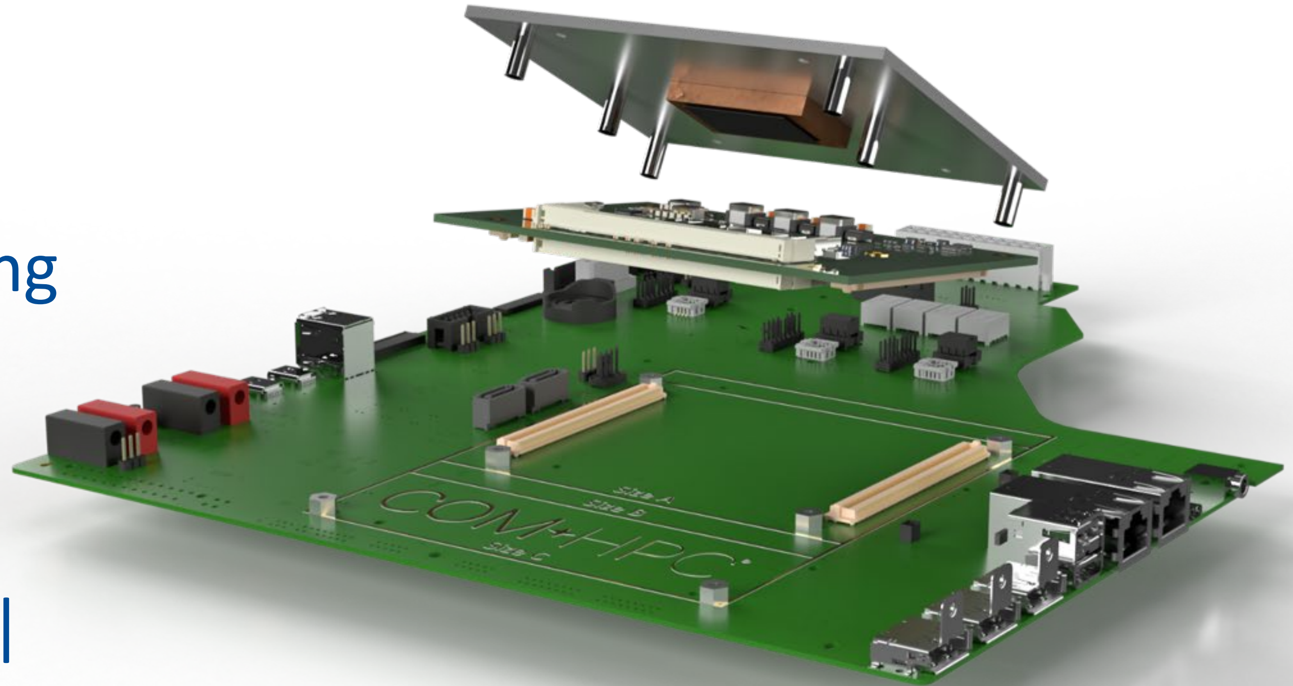



## Market Trends

- Digital transformation
- 5G and AI with tremendous data growth and processing requirements
- Autonomous vehicles, factory floor & HPC workloads with server-class processors
- IoT devices, sensors and actuators producing enormous amounts of data – preprocessing of data “at the edge”
- Greater adoption of open standards

# COM+HPC®

5G Networks | Autonomous Driving | AI | Autonomous Vehicles | Robotics | Casino Gaming | Healthcare | Instrumentation Industrial Automation | Defense| Transportation | Avionics and more …



PICMG

# Benefits of COMs

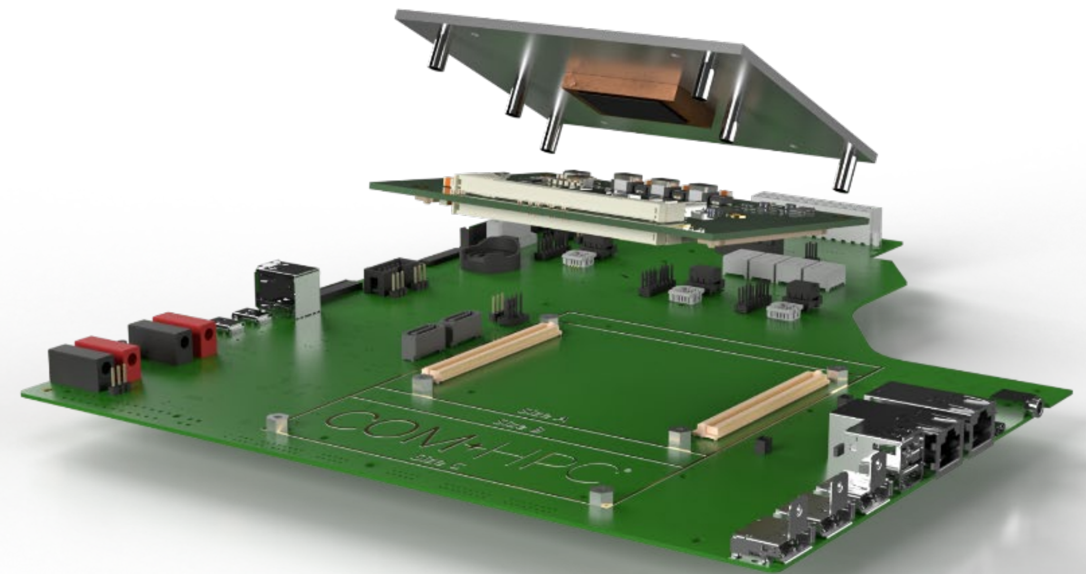
COM+HPC®

Computer-On-Module Concept

- CPU module with standard compute core functions
- Carrier board with customer specific functions & size

Computer-On-Module Benefits

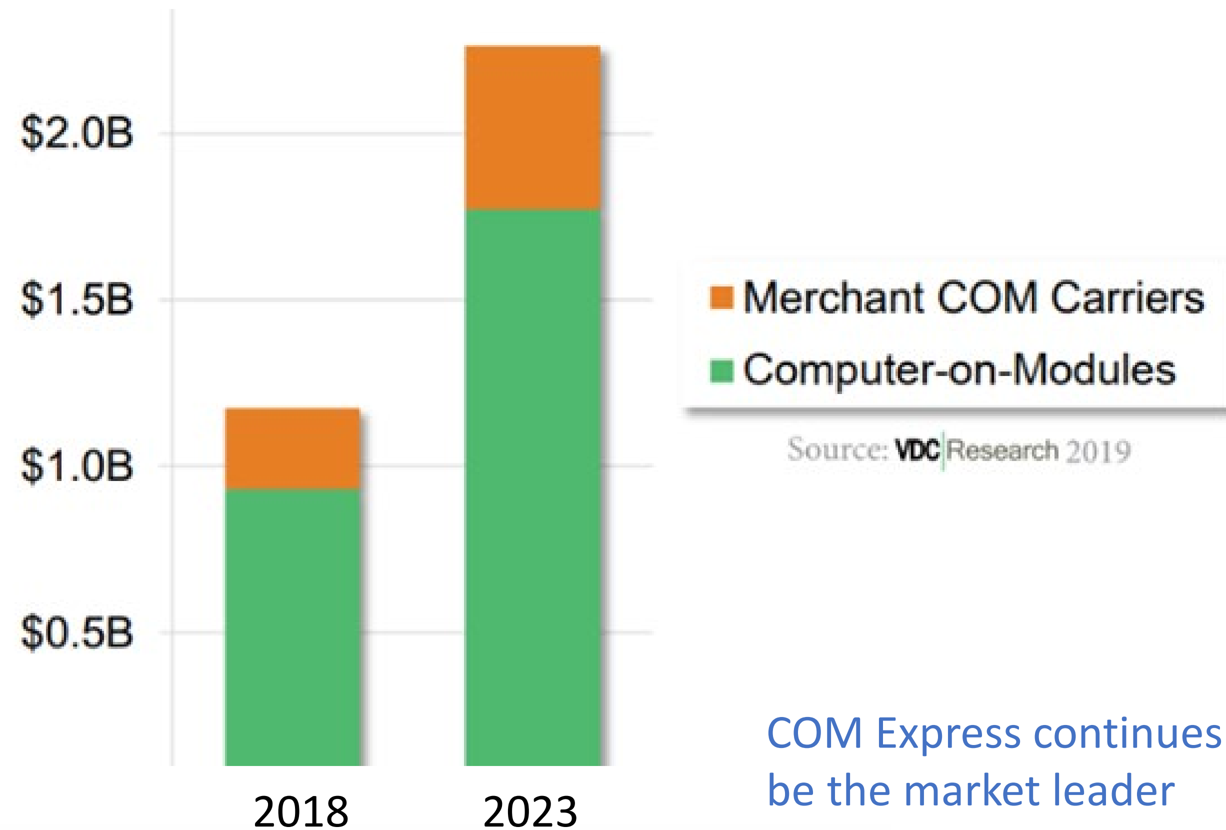
- Faster time to market
- Reduced development costs
- Scalable product range
- Allows customer focus on system features
- Faster reaction to market trends
- Second source philosophy
- Minimize inventory cost



PICMG®

## Reports Insights

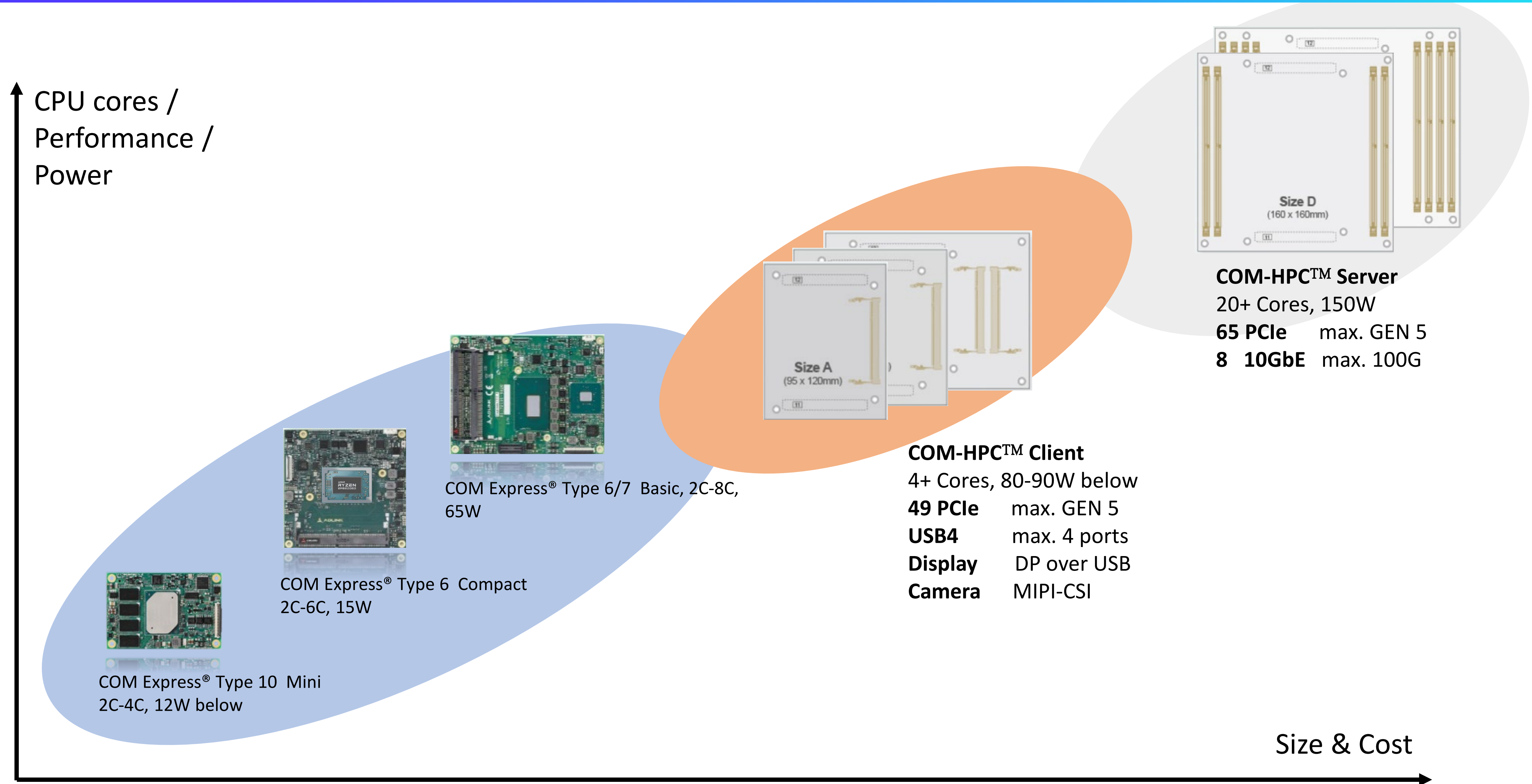
In 2020, the market size of Computer on Module is **1.4 Billion USD**, and it will reach **3.510 Billion USD** in 2025, growing at a CAGR of **12.4%** from 2020




COM Express continues to be the market leader

These reports do not include the high-performance markets addressed by COM-HPC

# PICMG COM Evolution




COM-HPC is not a replacement for COM Express



Graphics courtesy of ADLINK

# Computer on Module for High Performance Computing (COM-HPC)

## *New Open Standard for High-Performance Compute Modules*

Server and Client Modules

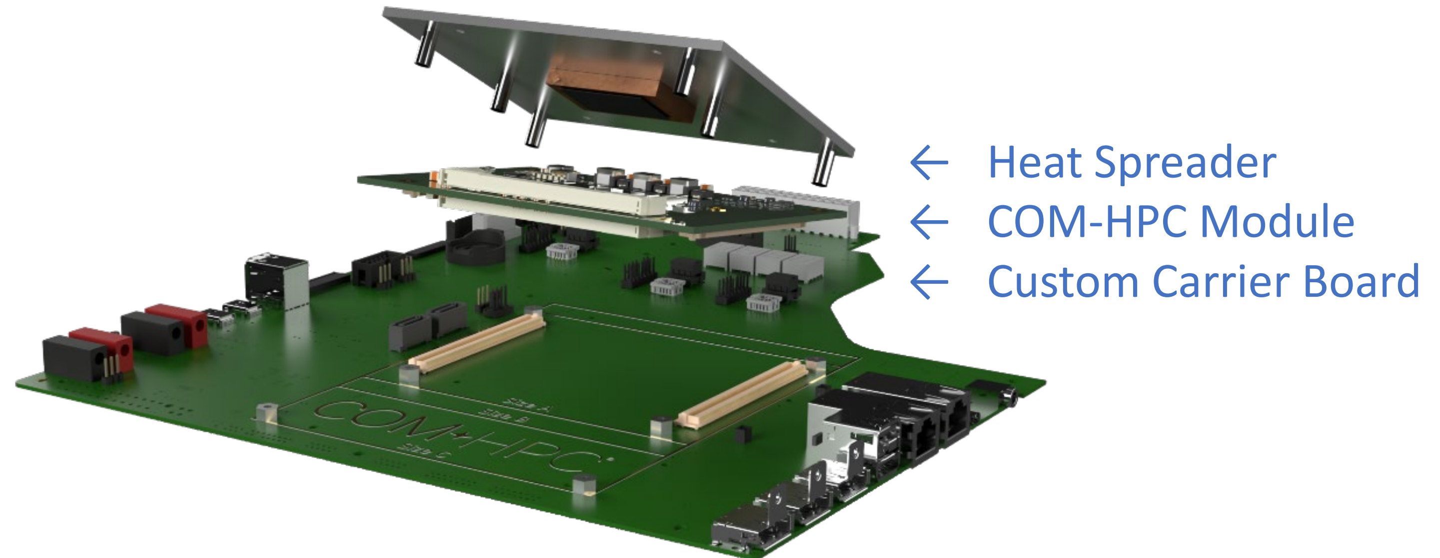
Two 400 pin high performance connectors

System Management Interface

Not limited to x86 processors

- Provides for the use of RISC processors, FPGAs and GPGPUs

COM-HPC serves many of the same applications and markets as COM Express, but with potentially higher end CPUs, more memory, more and faster I/O options




← Heat Spreader
← COM-HPC Module
← Custom Carrier Board

Image courtesy of congatec

COM-HPC is not a replacement for COM Express

# COM-HPC Team

## Milestones and Targets

- PICMG workgroup officially started Oct 23, 2018
- Pinout pre-release 10/2019
- Base Specification final Q1 2021
- Platform Management Specification final Q1/2021
- Initial Design Guide final Q1 2021

## Sponsors

- ADLINK, Kontron, congatec

## Officers

- Chairperson: Christian Eder, congatec
- Editor: Stefan Milnor, Kontron
- Secretary: Dylan Lang, Samtec
- 26 companies are participating

## Subcommittee Leads

- Signal Integrity: Burrell Best, Samtec
- System management: Jens Hagemeyer, University Bielefeld

> 3000 person hours meeting time
> 3000 person hours of work
450 document pages

**4 person years of investment from the workgroup**

# COM-HPC Modules & Connector

## *New Open Standard for High-Performance Compute Modules*

Client:

Size A 95mm x 120mm

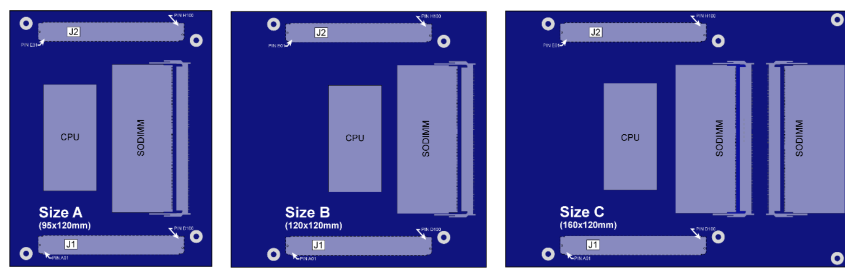
Size B 120mm x 120mm

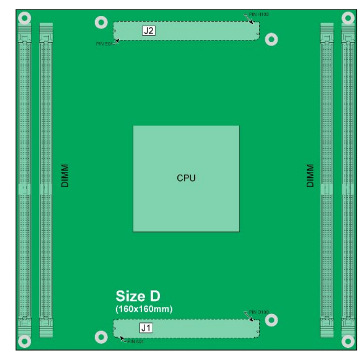
Size C 160mm x 120mm

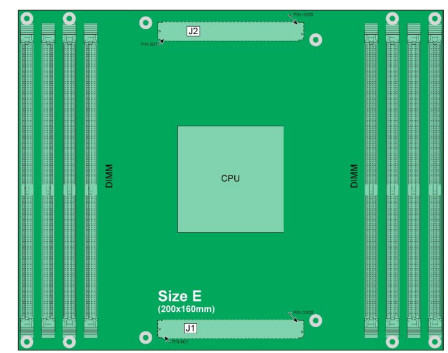
Server:

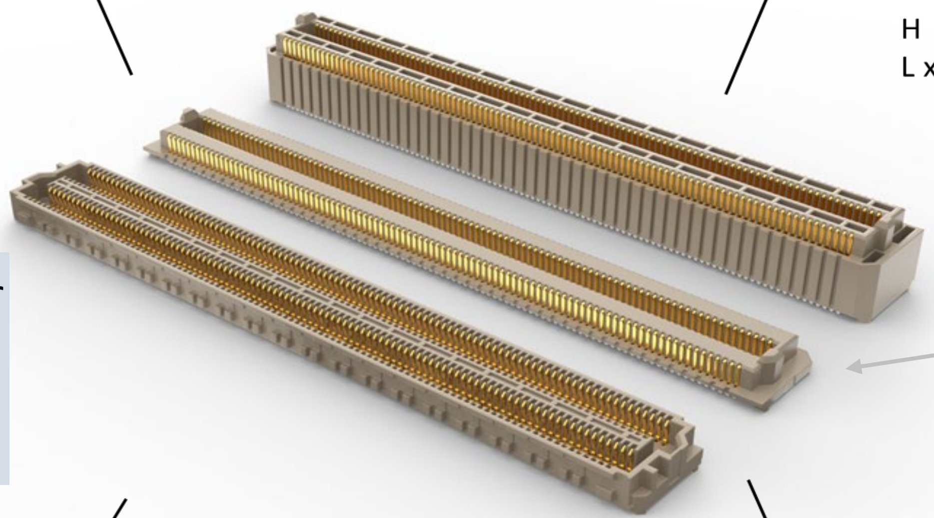
Size D 160mm x 160mm

Size E 200mm x 160mm



**High density**
**400 pins**

**Dimension**
H 10mm, 5mm
L x W 68.62mm x 9mm

Total of 800-pins per module for both Client and Server types

10 mm stack height or 5 mm stack height connector on carrier.

Max component height of 5 mm on carrier.

**Fast speed**
32G (up to **PCIe Gen5**)

**Location**
max. two on module
**J1 (lower side), J2 (upper side)**

Picture: courtesy of Samtec

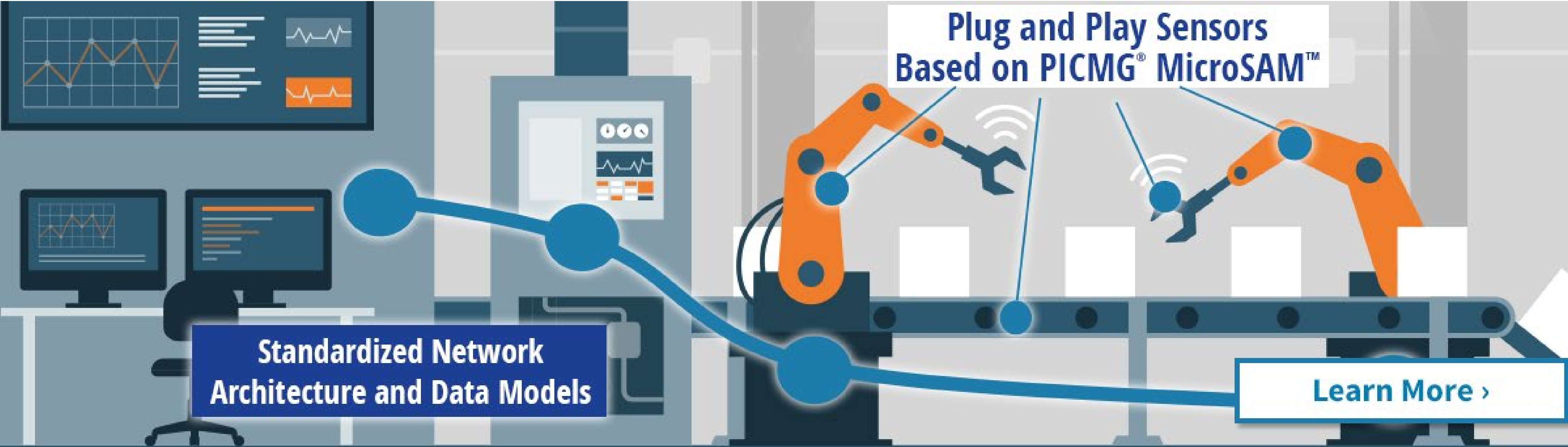
PICMG

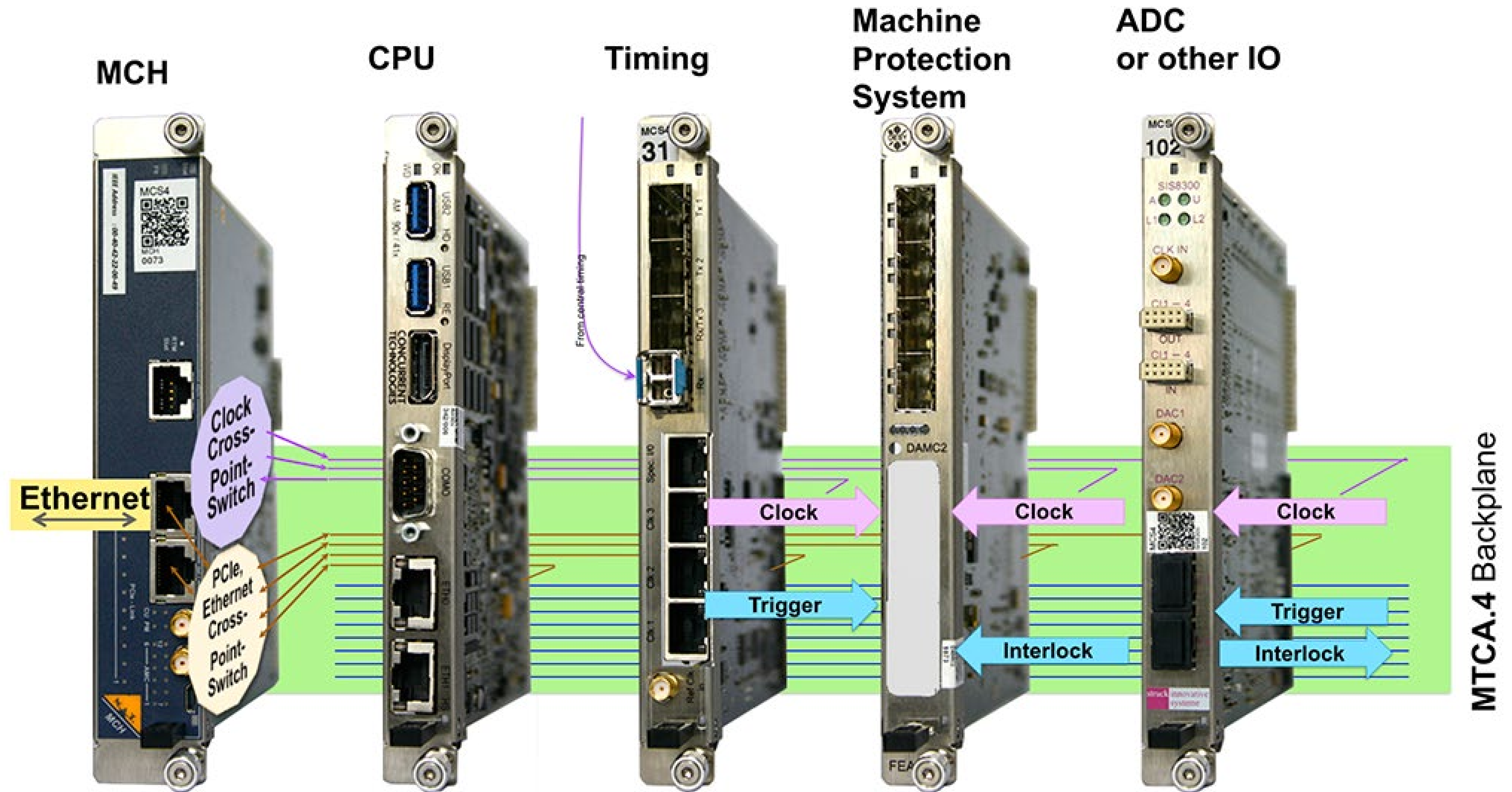
## *New Open Standard for High-Performance Compute Modules*

www.embedded-computing.com/com-hpc

| Topic / Title | Presenter | Company / University |
|---|---|---|
| **Introduction to COM-HPC** | Christian Eder | congatec |
| **Heterogeneous Computing on COM-HPC**<br>**Platform Management for COM-HPC** | Martin Kaiser<br>Jens Hagemeyer | University of Bielefeld |
| **Investment Protection and Scalability with COM-HPC** | Pawitter Bhatia<br>Joel Finkel | Intel |
| **Specification Development Processes – COM-HPC and Others** | Stefan Milnor | Kontron |
| **COM-HPC Server Modules** | Henk van Bremen | ADLINK |
| **The Journey to COM-HPC Client** | Max Chi | Advantech |
| **COM-HPC Carrier Design Considerations** | Christian Engels | Avnet Integrated |
| **Delivering Bleeding Edge Power and Performance** | Burrell Best | Samtec |

# IIoT Initiatives presented by Doug Sandy




μTCA®
MCH
CPU
Timing
Machine Protection System
ADC or other IO
Clock Cross-Point-Switch
Ethernet
PCIe, Ethernet Cross-Point-Switch
Clock
Clock
Clock
Trigger
Trigger
Interlock
Interlock
MTCA.4 Backplane

# MicroTCA Next Generation

PICMG®

Picture: courtesy of nVent

µTCA®

AdvancedMC™

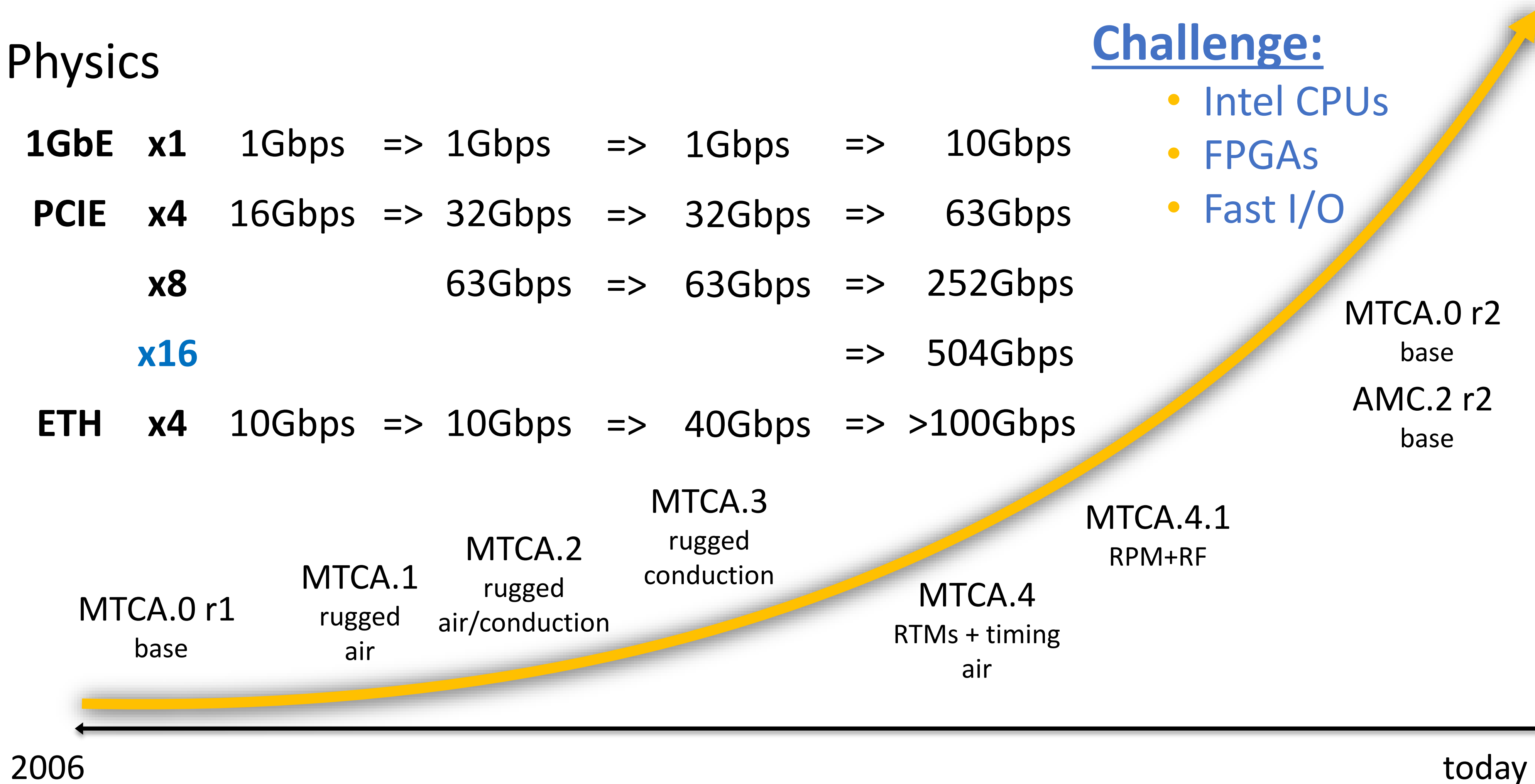
Leadership

- Chair – Kay Rehlich, DESY, kay.rehlich@desy.de
- Editor – Heiko Körte, N.A.T, heikort@nateurope.com
- Secretary - Thomas Holzapfel, powerBridge

Goals

- Members represent
    - Users, Component, and System Manufacturers
- Goal
    - Improve MicroTCA so that it can meet the requirements for the **next 10-15 years**
    - Keep next generation of MicroTCA backward compatible
- Key Features
    - 100 GB Ethernet
    - 2 kW per crate
    - 200 W max. per AMC slot
    - 32 GT/s PCIe gen 5
    - > USB 3.2
    - Enhanced management features

# MicroTCA Next Generation: goals and status

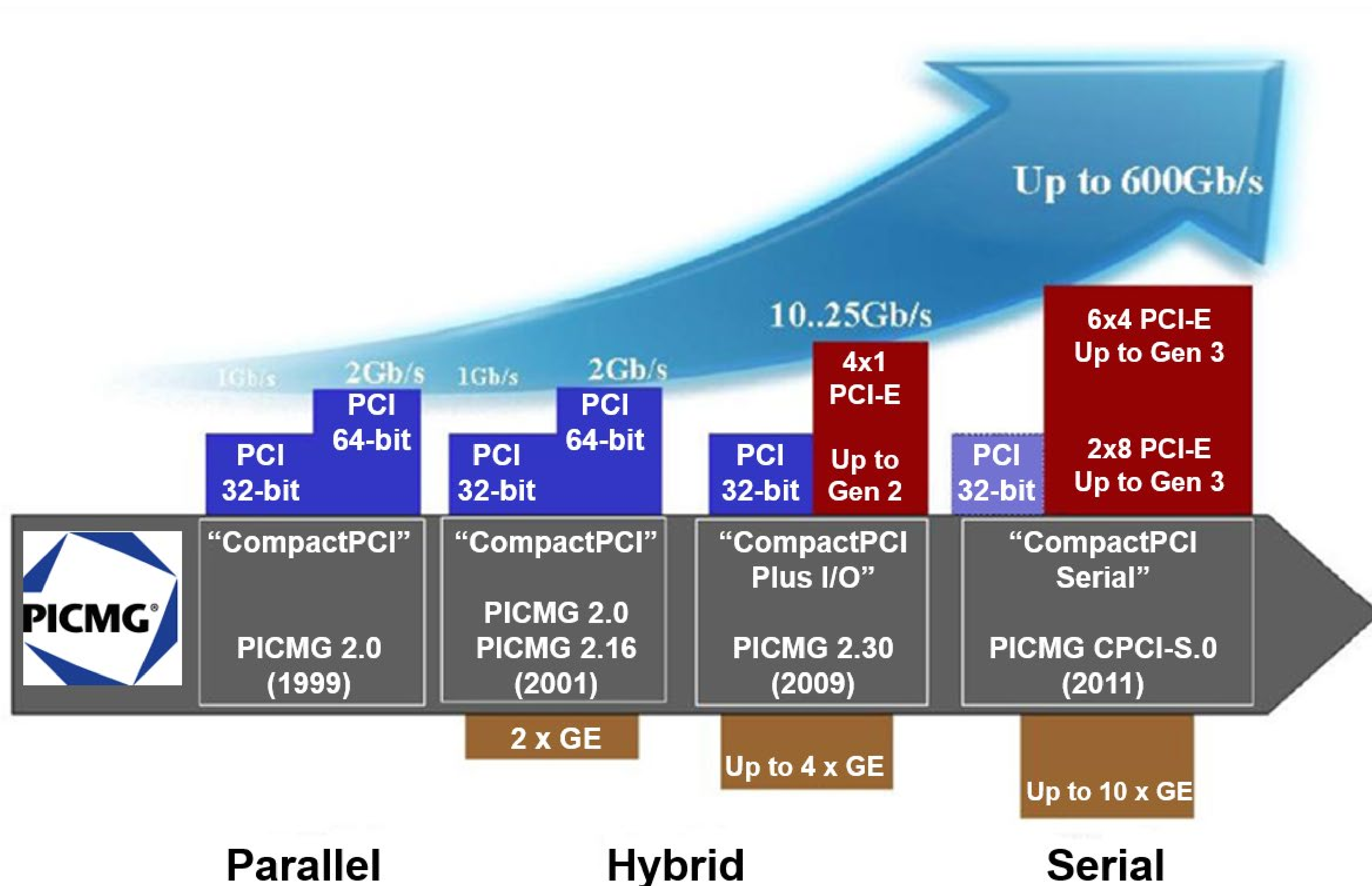



Slide courtesy of N.A.T.

# MicroTCA Global Adoption – Physics Community

MicroTCA is increasingly being used in particle accelerators, plasma fusion, photon science for data acquisition and fast feedback:
LNLS (BR), CERN (CH), IHEP (CN), SINAP (CN), GSI/FAIR (DE), IPP (DE), ITER (FR), Soleil (FR), KEK (JAP), ESS (SWE), TARLA (TR), Diamond (UK), APS-U (USA), FRIB (USA), ORNL (USA), ...

# CompactPCI® Serial



# CompactPCI Serial

Leadership

- Chair – Manfred Schmitz
- Editor – Christian Ganninger Christian.Ganninger@nvent.com
- Secretary - Gerald Nimmrich gn@ekf.de

Goals

- Support for PCIe GEN 4 and GEN 5
- Beside 1000BaseT and 10GBaseT, Ethernet KR4 shall also be supported
- Support for USB 3.2 + (USB 4 now feasible!)
- In case of compatibility issues an extreme simple $I^2C$ based backplane identification shall be defined
- SPI signals shall be usable as differential lines alternatively
- Extension to support a redundant system slot like in CompactPCI Serial for Space
- Backward compatibility

*In 2020: The Space Avionics Open Interface Architecture (SAVOIR) working group at European Space Agency (ESA) selected cPCI Serial Space for multiple data handling systems.*

# Cross Consortia Collaboration and Compatibility

PICMG and VITA
- HPM / IPMI
- COM Express on VME and VPX
- FMC on MicroTCA

PICMG and DMTF
PICMG and OCP
PICMG and SGET
- Complementary COMs
- Complementary IIoT Initiatives

Collaboration is critical to PICMG

More to come!!

**Open Standards encourage innovation and differentiation amongst multiple vendors – interoperability is key**

# Upcoming Milestones and Resources

## Upcoming Announcements

- Q1
  - COM-HPC Release
  - New PICMG website
- Q2
  - MicroSAM Firmware Release
- Q3
  - Full COM-HPC Design Guide
  - IIoT Data Models
- Q4
  - CompactPCI Serial Extensions Release
  - IIoT Data Models

**Resources**

- COM-HPC Academy
  - www.embedded-computing.com/com-hpc
- MicroTCA Workshop
  - https://indico.desy.de/event/27340/contributions/
- MicroTCA Technology Lab
  - https://techlab.desy.de/
- ESA Study
  - https://indico.esa.int/event/335/attachments/3807/5348/MOSAIC.pdf
- New Space System Engineering
  - Ignacio Chechile, ReOrbit

www.picmg.org

Thank you

jess@picmg.org

LinkedIn: @picmg