AXIe: What is it?

• An open system modular instrumentation standard based on AdvancedTCA®
• that delivers high performance instrumentation
• for wireless comms, aerospace defense, high energy physics, semiconductor test, and other industries.

Multi-vendor AXIe systems

2-slot AXIe system

5-slot AXIe system

14-slot AXIe system
AXIe: Why, what are the advantages?

“Big brother to PXI.”

- Similar PCI Express data fabric, but twice as wide (x16 lanes to each slot)
- Larger and deeper modules (up to 200W per slot)
- Greater power and rack density (typically 2:1 to 3:1 over PXI)
- Scalability from 2-slot to 14-slot systems
- Horizontal configurations for minimal rack space, vertical for large systems
- Hosts the industry’s fastest modular digitizers, AWGs, and digital products
- High speed trigger, timing, and local bus
- Integrates easily with LXI, PXI, and VXI using IVI drivers

PXI (30 Watts)
AXIe (200 Watts)
High scalability of AXIe

2-slot AXIe system

5-slot AXIe system

14-slot AXIe system

Specialty instrument with AXIe module

PXI carrier module
Multi-vendor: Today, AXIe products may be mix-and-matched from 8 vendors:

Giga-tronics EW threat simulator

- Giga-tronics
- Elma Electronic
- Guzik
- Keysight

Informtest AXIe-0
Electronic Switching

Test Evolution AXIe-3.1
Semiconductor Test
(plus PXI)

Numerous AXIe-1 modules and systems from:

- Cobham
- Guzik
- Keysight
- Synopsis

2-slot AXIe system
5-slot AXIe system
14-slot AXIe system
AXIe can be easily integrated with other instruments in a test system

Open system formats

Instruments & Switching
- Bench and Modular Formats

Software
- All common apps and languages

Controllers
- Embedded or external
- Standard I/O

AXIe + PXI
Semiconductor Test System

LXI, PXI, and AXIe
Rack and Stack System
AXIe brings critical functionality to Mil/Aero systems in a dense and powerful form factor

Software
- Common software drives PXI and AXIe

Controllers
- Embedded or external
- PCIe is common interface for PXI and AXIe

Large selection of modules, with broad functionality in 4U chassis

Very high performance instrumentation expands performance envelope of modular platforms in 4U chassis
AXIe brings powerful and cost effective new technology to digital verification and test

AXIe delivers leading edge verification tools including:
- PCIe Gen 1,2,3 exerciser and analyzer
- Industry’s fastest logic analyzer
- DDR3/4 analysis

AXIe digitizers and AWGs deliver industry leading performance for mixed-signal test:
- Digitizers range from 1.6Gs/s @12 bits to 40Gs/s @ 8 bits
- AWGs deliver 8Gs/s @ 14 bits to 96Gs/s @ 8 bits
- 1, 2, 4 and even 32 channels
- Powerful and complex waveform creation and analysis

AXIe + PXI Semiconductor Test System offers cost effective alternative to “big iron” testers for small scale manufacturing and design verification
AXIe brings world-class measurements and density to Big Physics

AXIe is the next logical step in modular instrumentation for physics

AXIe digitizers and AWGs deliver industry leading performance:
- Digitizers range from 1.6Gs/s @ 12 bits to 40Gs/s @ 8 bits
- AWGs deliver 8Gs/s @ 14 bits to 96Gs/s @ 8 bits
- Powerful and complex waveform creation and analysis

AXIe brings unprecedented rack density to high speed digitizers – 64 channels, 104 possible!

4U Rack Height:
- 40 channels of 1.6Gs/s
- 20 channels of 10Gs/s

Waveform Capture and Generation
# AXIe Specification Structure

<table>
<thead>
<tr>
<th>AXIe-3.n</th>
<th>Other future Apps AXIe-3.n</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Semiconductor Test AXIe-3.1</strong></td>
<td>• Zone 3 signals:</td>
</tr>
<tr>
<td></td>
<td>• Trigger/Sync</td>
</tr>
<tr>
<td></td>
<td>• DUT I/O</td>
</tr>
<tr>
<td></td>
<td>• Other Zone 3 may be standardized in future</td>
</tr>
</tbody>
</table>

**AXIe-3**
- AXIe Zone 3 Mechanical
- By-slot customization of Zone 3 backplane

**AXIe-2**
- AXIe Software Specification
- Discovery, Configuration, and Control

**AXIe-1**
- AXIe Base Architecture
- ATCA + Triggers + Timing + Local Bus

**AXIe-0**
- Low Cost Architecture
- LAN-based, simplified system management

**ATCA**
- AdvancedTCA PICMG3.0, PICMG3.4
- LAN + PCIe + System management

- AXIe-3.n specifications define Zone 3 capabilities for specific markets
- A vendor may add a custom Zone 3 backplane that is not a AXIe-3.n specification
- AXIe-3 specifies mounting positions to add multiple Zone 3 backplanes
- AXIe-2 utilizes PXI for its module and chassis software requirements
- AXIe-1 is the core specification for AXIe, and dominates the market
- AXIe-0 is a low-cost subset of AXIe-1 specification for switches and low cost instruments
- ATCA is the underlying specification for all AXIe specifications
## AXIe Specification Structure

<table>
<thead>
<tr>
<th>AXIe-3.n</th>
<th>Semiconductor Test</th>
<th>AXIe-3.1</th>
<th>Other future Apps</th>
<th>AXIe-3.n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Zone 3 signals:</td>
<td></td>
<td>• Other Zone 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Trigger/Sync</td>
<td></td>
<td>may be</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DUT I/O</td>
<td></td>
<td>standardized in</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>future</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AXIe-3</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• AXIe Zone 3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mechanical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• By-slot</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>customization of</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Zone 3 backplane</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AXIe-2</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• AXIe Software</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Specification</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Discovery,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Configuration, and</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Control</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| AXIe-1   | • AXIe Base        |          |                  |          |
|----------| Base Architecture  |          |                  |          |
|          | • ATCA + Triggers  |          |                  |          |
|          | + Timing + Local   |          |                  |          |
|          | Bus                |          |                  |          |

| AXIe-0   | • Low Cost         |          |                  |          |
|----------| Architecture       |          |                  |          |
|          | • LAN-based,       |          |                  |          |
|          | simplified system  |          |                  |          |
|          | management         |          |                  |          |

| ATCA     | • AdvancedTCA      |          |                  |          |
|----------| PICMG3.0, PICMG3.4 |          |                  |          |
|          | • LAN + PCIe +     |          |                  |          |
|          | System management  |          |                  |          |

- **AXIe-3.n specifications define Zone 3 capabilities for specific markets**
- **A vendor may add a custom Zone 3 backplane that is not a AXIe-3.n specification**
- **AXIe-3 specifies mounting positions to add multiple Zone 3 backplanes**
- **AXIe-2 utilizes PXI for its module and chassis software requirements**
- **AXIe-1 is the core specification for AXIe, and dominates the market**
- **AXIe-0 is a low-cost subset of AXIe-1 specification for switches and low cost instruments**
- **ATCA is the underlying specification for all AXIe specifications**

**AXIe-1** is the core specification for AXIe, and dominates the market.
# AXIe Specification Structure

<table>
<thead>
<tr>
<th>AXIe-3.n</th>
<th>Semiconductor Test</th>
<th>AXIe-3.1</th>
<th>Other future Apps</th>
<th>AXIe-3.n</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Zone 3 signals:</td>
<td>• Trigger/Sync</td>
<td>• DUT I/O</td>
<td>• Other Zone 3 may be standardized in future</td>
<td>• AXIe-3.n specifications define Zone 3 capabilities for specific markets</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• A vendor may add a custom Zone 3 backplane that is not a AXIe-3.n specification</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• AXIe-3 specifies mounting positions to add multiple Zone 3 backplanes</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>• AXIe-2 utilizes PXI for its module and chassis software requirements</td>
</tr>
<tr>
<td>AXIe-3</td>
<td>AXIe Zone 3 Mechanical</td>
<td>By-slot customization of Zone 3 backplane</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AXIe-2</td>
<td>AXIe Software Specification</td>
<td>Discovery, Configuration, and Control</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AXIe-1</td>
<td>AXIe Base Architecture</td>
<td>ATCA + Triggers + Timing + Local Bus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>AXIe-0</td>
<td>Low Cost Architecture</td>
<td>LAN-based, simplified system management</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATCA</td>
<td>AdvancedTCA PICMG3.0, PICMG3.4</td>
<td>LAN + PCIe + System management</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ATCA is the underlying specification for all AXIe specifications</td>
<td></td>
</tr>
</tbody>
</table>
Why AdvancedTCA as a foundation?

The Advanced Telecom Computing Architecture (AdvancedTCA® or ATCA®) is a series of open standard computing platform specifications originally developed to meet the needs of communications equipment.

- Proven open system architecture
- Large board size, exceptional power management, robust cooling
- Rack space efficiency, horizontal and vertical configurations
- Scalability from 1 to 14 slots, 1 chassis to many

* PICMG is a registered trademark of the PCI Industrial Computer Manufacturers Group.
Advanced TCA Overview

- 2-14 Slots in 19” Rack
- Zone 1 power (-48V)
- Zone 2 data fabric
- User-defined Zone 3 Backplane
- Large format cards:
  - 280mm deep (11”)
  - 322.25mm wide (12.7”)
  - 30.48mm slot width (1.2”)
- LAN routed to every slot
- PICMG 3.4: PCI Express to every slot
- Flexible power and air cooled design
## AXIe Specification Structure

<table>
<thead>
<tr>
<th>AXIe-3.n</th>
<th>Semiconductor Test AXIe-3.1</th>
<th>Other future Apps AXIe-3.n</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Zone 3 signals:</td>
<td>Other Zone 3 may be standardized in future</td>
</tr>
<tr>
<td></td>
<td>• Trigger/Sync</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• DUT I/O</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AXIe-3</th>
<th>AXIe Zone 3 Mechanical</th>
<th>By-slot customization of Zone 3 backplane</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AXIe Software Specification</td>
<td>Discovery, Configuration, and Control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AXIe-2</th>
<th>AXIe Base Architecture</th>
<th>ATCA + Triggers + Timing + Local Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AXIe Software Specification</td>
<td>Discovery, Configuration, and Control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AXIe-1</th>
<th>AXIe Base Architecture</th>
<th>ATCA + Triggers + Timing + Local Bus</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>AXIe Software Specification</td>
<td>Discovery, Configuration, and Control</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AXIe-0</th>
<th>Low Cost Architecture</th>
<th>LAN-based, simplified system management</th>
</tr>
</thead>
</table>

| ATCA     | AdvancedTCA PICMG3.0, PICMG3.4 | LAN + PCIe + System management |

- AXIe-3.n specifications define Zone 3 capabilities for specific markets
- A vendor may add a custom Zone 3 backplane that is not a AXIe-3.n specification
- AXIe-3 specifies mounting positions to add multiple Zone 3 backplanes
- AXIe-2 utilizes PXI for its module and chassis software requirements
- AXIe-1 is the core specification for AXIe, and dominates the market
- AXIe-0 is a low-cost subset of AXIe-1 specification for switches and low cost instruments
- ATCA is the underlying specification for all AXIe specifications
AXle-1

• **Leveraged from ATCA:**
  - Same mechanical dimensions
  - Same connector zones
  - Power from Zone 1
  - PCI Express on Zone 2
  - No Zone 3

• **AXle-1 adds:**
  - Expanded data fabric (x16)
  - Triggers, synchronization
  - Local Bus
AXIe-1 Module Characteristics

Zone 1, Power and management

Zone 2 Connectors
- PCI Express x16
- Parallel Triggers
- Star Triggers & Sync
- Local Bus

Zone 3 (rear I/O)
- Eliminated for AXIe-1 products

Front (measurement signals)

Board

280mm (11.02 inches)
30.48mm slot pitch (1.2 inches)
Typically 200 Watts Power and Cooling

322.25mm (12.7 inches)
AXIe-1 allows the system module to be either be plugged in, or embedded into the chassis:

**Chassis with embedded system module (ports not shown, in rear)**

**Chassis with pluggable AXIe system module (plugged into center hub slot)**

**AXIe System Module delivers**

- PCI Express interface
- PCI Express switching
- LAN Interface
- Parallel and Star Triggers, Sync, and Clocks.

- Embedded system modules are the most common, but both varieties exist in AXIe.
Horizontal AXIe compared with PXI

The tale of two 4U chassis:

**AXIe**
- Total module volume: $4500 \times 3 = 13500 \text{ cm}^3$
- Total module power: $200W \times 5 = 1000 W$

**PXIe**
- Total module volume: $2720 \times 2 = 5440 \text{ cm}^3$
- Total module power: $17 \times 30 = 510 W$
AXIe-1 exploits unique bus topologies
AXIe-1 exploits unique bus topologies

x16 PCI Express, LAN
Star Triggers & Sync

12 Parallel Trigger Lines

Very high speed vendor defined Local Bus
AXIe-1 adds Timing and Triggering to ATCA

FCLK

CLK100

SYNC

TRIG[0:11]

STRIG

System Slot

Instrument Hub Slot

Instrument Slot

Instrument Slot

Instrument Slot

Instrument Slot

Instrument Slot

Instrument Slot

Instrument Hub Slot

Instrument Slot

Instrument Slot

Instrument Slot

Instrument Slot

Logical Slot

1

2

3

4

5

6

7

8

9

10

11

12

13

14

AXIe
AXIe-1 adds a High-Speed Local Bus to ATCA

Proven performance at 40GB/s using today’s technology
Local bus enables simultaneous high speed streaming between modules
Local bus enables very fast streaming between digitizers, DSP, and waveform generators

- 40GB/s today, more in future
- External RAID for nearly indefinite streaming
- Nearly endless number of configurations
A vendor may use the local bus for any purpose, and it may span as many contiguous slots as the vendor wishes.

Since local bus only communicates between adjacent modules, different vendors may use local bus differently, simultaneously.
**AXIe Speeds**

The chart above shows the maximum data rate of each architecture for a given transceiver speed. Bus speed is proportional to the number of lanes. Real world PCIe speeds are typically 20% lower than shown.

<table>
<thead>
<tr>
<th></th>
<th>Bus Speed (GB/sec)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCIe Gen2</td>
<td>4</td>
</tr>
<tr>
<td>PCIe Gen3</td>
<td>8</td>
</tr>
<tr>
<td>AXIe: (PCIe x16)</td>
<td>8</td>
</tr>
<tr>
<td>AXIe Local Bus</td>
<td>80 (demonstrated)</td>
</tr>
</tbody>
</table>

The AXIe Local Bus travels shorter distances, one slot pitch, and is not necessarily tied to PCIe or any other standard. Due to this, very high rates, up to 80 GBytes/sec, have been demonstrated.

http://axiestandard.org/files/AXIe_local_bus_speed_achieves_record_80_GB_.pdf
## AXIe Specification Structure

<table>
<thead>
<tr>
<th>AXIe-0</th>
<th>AXIe-1</th>
<th>AXIe-2</th>
<th>AXIe-3</th>
<th>AXIe-3.n</th>
</tr>
</thead>
<tbody>
<tr>
<td>• <strong>Low Cost Architecture</strong>&lt;br&gt;• LAN-based, simplified system management</td>
<td>• <strong>AXIe Base Architecture</strong>&lt;br&gt;• ATCA + Triggers + Timing + Local Bus</td>
<td>• <strong>AXIe Software Specification</strong>&lt;br&gt;• Discovery, Configuration, and Control</td>
<td>• <strong>AXIe Zone 3 Mechanical</strong>&lt;br&gt;• By-slot customization of Zone 3 backplane</td>
<td>• <strong>Zone 3 signals:</strong>&lt;br&gt;• Trigger/Sync&lt;br&gt;• DUT I/O</td>
</tr>
</tbody>
</table>
AXIe-0 LAN-only, same format

- 280mm (11.02 inches)
- 30.48mm slot pitch (1.2 inches)
- 322.25mm (12.7 inches)
- 50 Watts Power and Cooling
- 50-200 Watts with Management

- No Zone 3 connector
  Future efforts may define backplane or cable egress

- AXIe Trigger (12)

- LAN
  -48V Power
  Slot address

  \( \times = \) removed
AXIe-0 Applications

- Large switching systems and RF Interface Units
  - Mil/aero, electronic functional test
- Custom instrumentation from system integrators or users
  - Large board area and simple development
- VXI replacement in mil/aero
  - Replace large switching networks with AXIe-0
  - Incorporate management for modules >50 watts
  - Integrate PXI where needed using carriers
- General purpose and data acquisition
  - Architecture applicable to many instrument types
  - IEEE-1588 may be deployed when needed.
AXIe Specification Structure

<table>
<thead>
<tr>
<th>AXIe-3.n</th>
<th>Semiconductor Test AXIe-3.1</th>
<th>Other future Apps AXIe-3.n</th>
</tr>
</thead>
</table>
| • Zone 3 signals:  
  • Trigger/Sync  
  • DUT I/O | • Other Zone 3 may be standardized in future |

| AXIe-3 | AXIe Zone 3 Mechanical  
  By-slot customization of Zone 3 backplane |
|--------|----------------------------------|

| AXIe-2 | AXIe Software Specification  
  Discovery, Configuration, and Control |
|--------|----------------------------------|

| AXIe-1 | AXIe Base Architecture  
  ATCA + Triggers + Timing + Local Bus |
|--------|----------------------------------|

| AXIe-0 | Low Cost Architecture  
  LAN-based, simplified system management |
|--------|----------------------------------|

| ATCA | AdvancedTCA PICMG3.0, PICMG3.4  
  LAN + PCIe + System management |
|------|----------------------------------|

- AXIe-3.n specifications define Zone 3 capabilities for specific markets
- A vendor may add a custom Zone 3 backplane that is not a AXIe-3.n specification
- AXIe-3 specifies mounting positions to add multiple Zone 3 backplanes
- AXIe-2 utilizes PXI for its module and chassis software requirements
- AXIe-1 is the core specification for AXIe, and dominates the market
- AXIe-0 is a low-cost subset of AXIe-1 specification for switches and low cost instruments
- ATCA is the underlying specification for all AXIe specifications
AXIe-2: Base Software Specification

- Requires compliance with PXI-6
  - PXI Express Software Specification
- Almost no need for exceptions
  - AXIe always reports a single trigger bus
  - AXIe reports up to 4 links each with up to 16 lanes of PCIe Gen3
  - AXIe system driver generates Compact PCI EPROM data instead of reading from chassis
- Enables identical AXIe and PXI software
  - Same kernel driver and IO Library (VISA) naturally supports both PXI and AXIe
AXIe integration with Rack and Stack

GP-IB Instruments
LXI Box Instruments
AXIe (LAN and PCIe on backplane)
PXI

Software
- All common apps and languages

Controllers
- Embedded or external
- Standard I/O

Note: Graphic for example only, instruments do not need to be co-located in same rack unit.
## AXIe Specification Structure

### AXIe-3.n
- **Semiconductor Test AXIe-3.1**
  - Zone 3 signals:
    - Trigger/Sync
    - DUT I/O
- **Other future Apps AXIe-3.n**
  - Other Zone 3 may be standardized in future

### AXIe-3
- **AXIe Zone 3 Mechanical**
- By-slot customization of Zone 3 backplane

### AXIe-2
- **AXIe Software Specification**
  - Discovery, Configuration, and Control

### AXIe-1
- **AXIe Base Architecture**
  - ATCA + Triggers + Timing + Local Bus

### AXIe-0
- **Low Cost Architecture**
  - LAN-based, simplified system management

### ATCA
- **AdvancedTCA PICMG3.0, PICMG3.4**
- LAN + PCIe + System management

- AXIe-3.n specifications define Zone 3 capabilities for specific markets
- A vendor may add a custom Zone 3 backplane that is not an AXIe-3.n specification
- AXIe-3 specifies mounting positions to add multiple Zone 3 backplanes
- AXIe-2 utilizes PXI for its module and chassis software requirements
- AXIe-1 is the core specification for AXIe, and dominates the market
- AXIe-0 is a low-cost subset of AXIe-1 specification for switches and low cost instruments
- ATCA is the underlying specification for all AXIe specifications
AXIe-3 “Segmented Backplane”

- Enables multiple, different Zone 3 backplanes to be mounted into a chassis
  - Mechanical mounting specification
  - Custom or standardized Zone 3
  - Applications:
    - Signal ingress/egress
    - Precision timing
    - Analog bus
  - Chassis are allowed to ship with a Zone 3 backplane already installed.
# AXIe Specification Structure

<table>
<thead>
<tr>
<th>AXIe-3.n</th>
<th>Semiconductor Test AXIe-3.1</th>
<th>Other future Apps AXIe-3.n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zone 3 signals:</td>
<td>Trigger/Sync</td>
<td>Other Zone 3 may be standardized in future</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>AXIe-3</th>
<th>AXIe Zone 3 Mechanical</th>
<th>By-slot customization of Zone 3 backplane</th>
</tr>
</thead>
<tbody>
<tr>
<td>AXIe-2</td>
<td>AXIe Software Specification</td>
<td>Discovery, Configuration, and Control</td>
</tr>
<tr>
<td>AXIe-1</td>
<td>AXIe Base Architecture</td>
<td>ATCA + Triggers + Timing + Local Bus</td>
</tr>
<tr>
<td>AXIe-0</td>
<td>Low Cost Architecture</td>
<td>LAN-based, simplified system management</td>
</tr>
<tr>
<td>ATCA</td>
<td>Advanced TCA PICMG3.0, PICMG3.4</td>
<td>LAN + PCIe + System management</td>
</tr>
</tbody>
</table>

- AXIe-3.n specifications define Zone 3 capabilities for specific markets
- A vendor may add a custom Zone 3 backplane that is not a AXIe-3.n specification
- AXIe-3 specifies mounting positions to add multiple Zone 3 backplanes
- AXIe-2 utilizes PXI for its module and chassis software requirements
- AXIe-1 is the core specification for AXIe, and dominates the market
- AXIe-0 is a low-cost subset of AXIe-1 specification for switches and low cost instruments
- ATCA is the underlying specification for all AXIe specifications
AXIe-3.1 Overview

Zone 3 Semiconductor Test Extension

- Focused on semiconductor test
- Allows all signals to enter and exit through the rear via a single mass interconnect
- Provides for enhanced timing
- Provides for in situ diagnostics and calibration
AXIe-3.1 Extensions

- Timing and Triggering Extension
  - Quad Bi-Directional Star Trigger to Each Slot
  - Digital Channel Vendor-Defined Synchronization
- Test Fixture Support
  - Instrument I/O via Rear Transition Modules
- Field Calibration Path
  - External NIST traceable instruments
  - 4 Wire Kelvin Calibration Bus to each slot
  - 1 Amp, 300 Volt Max

Example Zone 3 backplanes
AXIe modules are upward compatible

- AXIe-0 modules work with AXIe-0, AXIe-1, and AXIe-3.1 chassis
- AXIe-1 modules work with AXIe-1 and AXIe-3.n chassis
- AXIe-3.n modules work only in AXIe 3.n chassis
## AXIe Specification Structure - Status

<table>
<thead>
<tr>
<th>AXIe-0</th>
<th>AXIe-1</th>
<th>AXIe-2</th>
<th>AXIe-3</th>
<th>AXIe-3.n</th>
</tr>
</thead>
<tbody>
<tr>
<td>Preliminary</td>
<td>Completed</td>
<td>Completed</td>
<td>In Process</td>
<td>Completed</td>
</tr>
<tr>
<td>Specification</td>
<td>AXIe Base</td>
<td>AXIe Software</td>
<td>AXIe Zone 3</td>
<td>AXIe-3.n</td>
</tr>
<tr>
<td></td>
<td>Architecture</td>
<td>Configuration</td>
<td>Mechanical</td>
<td>Specifications</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>By-slot</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>customization</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>of Zone 3</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>backplane</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>AXIe Base</td>
<td>AXIe Software</td>
<td>Other future</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Architecture</td>
<td>Configuration</td>
<td>AXIe-3.1</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>and Control</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Other future</td>
</tr>
<tr>
<td></td>
<td>AXIe Zone 3</td>
<td>AXIe Software</td>
<td>AXIe-3.1</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mechanical</td>
<td>Configuration</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### AXIe-0 Specifications
- Low Cost Architecture
- LAN-based, simplified system management

### AXIe-1 Specifications
- AXIe Base Architecture
- ATCA + Triggers + Timing + Local Bus

### AXIe-2 Specifications
- AXIe Software Architecture
- Discovery, Configuration, and Control

### AXIe-3 Specifications
- AXIe Zone 3 Mechanical
- By-slot customization of Zone 3 backplane

### AXIe-3.n Specifications
- AXIe-3.n specifications define Zone 3 capabilities for specific markets
- A vendor may add a custom Zone 3 backplane that is not a AXIe-3.n specification
- AXIe-3 specifies mounting positions to add multiple Zone 3 backplanes
- AXIe-2 utilizes PXI for its module and chassis software requirements
- AXIe-1 is the core specification for AXIe, and dominates the market
- AXIe-0 is a low-cost subset of AXIe-1 specification for switches and low cost instruments
- ATCA is the underlying specification for all AXIe specifications
## AXIe is the “Big Brother” of PXI

<table>
<thead>
<tr>
<th>Feature</th>
<th>AXIe</th>
<th>PXIe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chassis base</td>
<td>AdvancedTCA</td>
<td>cPCI/cPCIe</td>
</tr>
<tr>
<td>PCIe maximum data bandwidth (Maximum Gen 3.0):</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single peripheral slot to backplane</td>
<td>2-16* GB/s</td>
<td>4 GB/s</td>
</tr>
<tr>
<td>All peripheral slots to system slot</td>
<td>26-224* GB/s</td>
<td>8 GB/s</td>
</tr>
<tr>
<td>PCIe fabric</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>LAN backplane</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Local bus</td>
<td>62 differential pairs</td>
<td>1 line (13 PXI)</td>
</tr>
<tr>
<td>Triggers</td>
<td>Bidirectional Star Trigger 12 signal MLVDS bus</td>
<td>Star Trigger(1xTTL, 3x Diff per slot) 8 Signal TTL bus</td>
</tr>
<tr>
<td>Frequency Reference &amp; Sync</td>
<td>100MHz, yes</td>
<td>10MHz, 100MHz, yes</td>
</tr>
<tr>
<td>Power per slot</td>
<td>200 W</td>
<td>30 W</td>
</tr>
<tr>
<td>Board space per slot (higher density, flexibility)</td>
<td>900 cm²</td>
<td>160 cm²</td>
</tr>
<tr>
<td>Modules available</td>
<td>&gt;20</td>
<td>~1100</td>
</tr>
</tbody>
</table>

*Gen3 x16 15.74GB/s top theoretical*
Summary

AXIe is the “big brother to PXI”:

- An open system modular instrumentation standard based on AdvancedTCA®
- that delivers high performance instrumentation
- for wireless comms, aerospace defense, high energy physics, semiconductor test, and other industries.

AXIe delivers:

- Industry’s fastest modular digitizers, AWGs, and digital products
- Superior power, circuit, and rack density
- Compatibility with LXI, PXI, and VXI

Specifications may be downloaded from the AXIe Consortium website at www.axiestandard.org