High-speed fabric backplanes burst on the scene in a data-hungry world

BY JOHN KELLER

The new generation of high-speed fabric backplanes represent a fundamental paradigm shift in technology that not only offers dramatic increases in data bandwidth, but also may be as significant as the shift from analog to digital signals.

These new backplanes that move data according to standards such as PICI Express, VITA 41, PICMG 2.16, and PICMG 3.0 offer to move data within systems and subsystems at gigabit speeds, rather than today's megabit bandwidths, and in the near future may open the way to widespread applications that move data between system components at terabit speeds.

Fast fabric backplanes are the next technological step beyond parallel data-bus approaches. Fabrics move data at blindingly fast speeds, yet move bits of data serially, rather than in parallel like legacy VME and PCI databases. The ability to move data within systems and subsystems at gigabit and terabit ranges offers to enable a broad new range of capabilities in data-intensive applications like radar signal processing, image processing and analysis, and battlefield situational awareness.

Some of the most promising high-speed fabric backplanes today offer fabrics such as Ethernet, VXS Switch Fabric, Advanced Telecom Computing Architecture (ATCA), StarFabric, PCI Express, and RapidIO.

On the horizon is one of the most anticipated new fabrics, the VPX fabric of the emerging VITA 46 databus standard.

These backplanes, which move data quickly among printed-circuit boards in a chassis, offer speed where designers need it most and will often help engineers accommodate new and legacy technologies in the same system.

Speeds of the new crop of fast fabric backplanes range from a few gigabits per second to as fast as 2.5 terabits per second, with faster speeds promised for the future, depending on system configurations, topologies, data lane widths, and other variables.

Not only is the ever-increasing need for data throughput speed driving applications of fabric backplanes, but perhaps more important, the need to fit massive amounts of processing power into tiny spaces is uncovering needs for fabric backplanes.

The booming industry in unmanned vehicles—particularly unmanned aerial vehicles (UAVs) is expected to be a major technology driver where high-speed fabric backplanes are concerned.

UAVs in the future will be expected to perform a broad range of sophisticated surveillance and reconnaissance tasks, as well as perform complex on-the-move communications switching and deliver precision weapons on target.

In all these applications, the ability to move data quickly will be paramount. Reconnaissance and surveillance will drive the need for processing data from radar, infrared, and visible-light cameras. Communications switching requires speed to keep messages moving. Likewise, precise targeting requires UAVs to be able to operate autonomously, choose weapons payloads, and discern real targets from decoys.

"There are growing requirements for applications where there is a lack of space," says Justin Moll, director of marketing for high-speed fabric specialist Elma Bustronic in Fremont, Calif.

"Space and weight are getting smaller, so there needs to be more functionality in less space," Moll says. "UAVs need to be lightweight and small, so a mesh VXS or VITA 46 backplanes are very good fits there. They will need a lot of processing power in a very small space."

Moll also points to the need to upgrade existing manned and unmanned systems with the latest processing power, and to add capabilities to existing platforms to keep them effective in the field for long periods.

Many choices in high-speed fabric backplanes are available today, with more companies and products joining the market all the time. Here are some of the most influential products and suppliers.

### HIGH-SPEED SERIAL FABRIC BACKPLANES

<table>
<thead>
<tr>
<th>Product name</th>
<th>System standard</th>
<th>Fabric</th>
<th>Backplane speed</th>
<th>Topology</th>
<th>Number of slots</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>APW LTD.; Waukesha, Wis.; 262-523-7600; <a href="http://www.apw.com">www.apw.com</a></td>
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<tr>
<td>EtherPlane</td>
<td>PICMG 2.16</td>
<td>Ethernet</td>
<td>40 gigabits per second</td>
<td>Single-star topology</td>
<td>15 to 21 slots</td>
<td>Supports full-duplex bit rates as fast as 2 gigabits per second per slot.</td>
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<tr>
<td>CARLO GAVAZZI COMPUTING SOLUTIONS; Brockton, Mass.; 508-588-6110; <a href="http://www.gavazzi-computing.com">www.gavazzi-computing.com</a></td>
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<tr>
<td>VITA 41</td>
<td>VITA 41</td>
<td>VXS Switch Fabric</td>
<td>NA</td>
<td>Dual star</td>
<td>12 slots</td>
<td>The subsets of VITA 41, including InfiniBand (VITA 41.1), RapidIO (VITA 41.2), Gigabit Ethernet (VITA 41.3), PCI Express (VITA 41.4), and StarFabric (VITA 41.5)</td>
</tr>
<tr>
<td>RM02</td>
<td>PICMG 3.0</td>
<td>Advanced Telecom Computing Architecture (ATCA)</td>
<td>90 to 600 gigabits per second</td>
<td>Full mesh</td>
<td>2 slots</td>
<td></td>
</tr>
<tr>
<td>RM06</td>
<td>PICMG 3.0</td>
<td>Advanced Telecom Computing Architecture (ATCA)</td>
<td>90 gigabits per second to 1.8 terabits per second</td>
<td>Full mesh</td>
<td>6 slots</td>
<td></td>
</tr>
<tr>
<td>DSA4</td>
<td>PICMG 3.0</td>
<td>Advanced Telecom Computing Architecture (ATCA)</td>
<td>28 to 560 gigabits per second</td>
<td>Dual star</td>
<td>14 slots</td>
<td></td>
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<tr>
<td>ELMA BUSTRONIC; Fremont, Calif.; 510-490-7388; <a href="http://www.bustronic.com">www.bustronic.com</a></td>
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<tr>
<td>CP 2SB (Compact Packet Switching) backplanes</td>
<td>PICMG 2.16</td>
<td>Switched Ethernet fabric</td>
<td>40 gigabits per second</td>
<td>Single- or dual-star</td>
<td>4, 6, or 8 slots standard</td>
<td>4-, 6-, and 8-slot backplane have one fabric slot and the rest as CompactPCI node slots. One 8-slot version has two fabric slots.</td>
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<tr>
<td>StarFabric backplanes</td>
<td>PICMG 2.17</td>
<td>StarFabric</td>
<td>100 gigabits per second</td>
<td>Single- or dual-star</td>
<td>4, 6, 8, or 17 slots standard</td>
<td>A distributed topology is available that gives each node slot a fabric chip.</td>
</tr>
<tr>
<td>ATCA backplanes</td>
<td>PICMG 3.0</td>
<td>Advanced Telecom Computing Architecture (ATCA)</td>
<td>1 to 2.5 terabits per second, depending on topology</td>
<td>Mesh, Dual Star (SU), and 7U Pluggable Dual Star</td>
<td>2 and 5 slots</td>
<td></td>
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<tr>
<td>EXP 0</td>
<td>CompactPCI Express</td>
<td>PCI Express</td>
<td>4 to 64 gigabits per second, depending on lane width</td>
<td>Single star</td>
<td>4 slots</td>
<td>The subsets of VITA 41, including InfiniBand (VITA 41.1), RapidIO (VITA 41.2), Gigabit Ethernet (VITA 41.3), PCI Express (VITA 41.4), and StarFabric (VITA 41.5)</td>
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<td>VXS backplanes</td>
<td>VITA 41</td>
<td>VXS Switch Fabric</td>
<td>As fast as 6 gigabits per second</td>
<td>Single-star, dual-star, or mesh</td>
<td>5, 8, 12, and 20 slots</td>
<td></td>
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<td>Product name</td>
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<td><strong>ELMA BUSTRONIC</strong>&lt;br&gt;continued</td>
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<tr>
<td>VITA 46 Concept Backplane</td>
<td>VITA 46</td>
<td>VPX</td>
<td>As fast as 6 gigabits per second</td>
<td>Point-to-point mesh</td>
<td>3 legacy VME 64X slots, and 9 VITA 46 slots</td>
<td>The subsets of VITA 41 included InfiniBand (VITA 41.1), RapidIO (VITA 41.2), Gigabit Ethernet (VITA 41.3), PCI Express (VITA 41.4), and StarFabric (VITA 41.5)</td>
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**VITA 46 Switch Fabric**
- **VPX**
- As fast as 6 gigabits per second
- Single-star, dual-star, dual-dual star, and replicated versions available
- 12 slots, other sizes available
- **Mesh, Dual Star (SU), and 7U Pluggable Dual Star**
- 2, 5, 14, and 16 slots

**VITA 46 Backplanes**
- **VITA 46 Concept**
- **VPX**
- As fast as 6 gigabits per second
- Single-star, dual-star, dual-dual star, and replicated versions available
- 12 slots, other sizes available
- **Mesh, Dual Star (SU), and 7U Pluggable Dual Star**
- 2, 5, 14, and 16 slots

**ATCA Backplanes**
- **PICMG 3.0**
- Advanced Telecom Computing Architecture (ATCA)
- As fast as 6.4 gigabits per second
- Single-star, dual-star, dual-dual star, and replicated versions available
- 12 slots, other sizes available
- **Mesh, Dual Star (SU), and 7U Pluggable Dual Star**
- 2, 5, 14, and 16 slots

**VITA 41 Switch Fabric**
- **VITA 41**
- **VXS**
- As fast as 6.4 gigabits per second
- Single-star, dual-star, dual-dual star, and replicated versions available
- 12 slots, other sizes available
- **Mesh, Dual Star (SU), and 7U Pluggable Dual Star**
- 2, 5, 14, and 16 slots

**VITA 41 Backplanes**
- **VITA 41**
- **VXS**
- As fast as 6.4 gigabits per second
- Single-star, dual-star, dual-dual star, and replicated versions available
- 12 slots, other sizes available
- **Mesh, Dual Star (SU), and 7U Pluggable Dual Star**
- 2, 5, 14, and 16 slots

**VITA 41.1 InfiniBand**
- **VITA 41.1**, RapidIO (VITA 41.2), Gigabit Ethernet (VITA 41.3), PCI Express (VITA 41.4), and StarFabric (VITA 41.5)

**ELMA BUSTRONIC**; Fremont, Calif.; 510-490-7388; www.bustronic.com

**VXS Backplanes**
- **VITA 41**
- **VXS Switch Fabric**
- As fast as 6.4 gigabits per second
- Single-star, dual-star, dual-dual star, and replicated versions available
- 12 slots, other sizes available
- **Mesh, Dual Star (SU), and 7U Pluggable Dual Star**
- 2, 5, 14, and 16 slots

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<td><strong>I-BUS CORP.</strong>&lt;br&gt;; Santa Clara, Calif.; 408-450-7880; <a href="http://www.ibus.com">www.ibus.com</a></td>
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<td>Continuum C0118D</td>
<td>PICMG 2.16</td>
<td>Ethernet</td>
<td>40 gigabits per second</td>
<td>Point-to-point</td>
<td>18 slots</td>
<td>16 node slots and two fabric slots</td>
</tr>
</tbody>
</table>

**PICMG 2.16**
- **Ethernet**
- 40 gigabits per second
- Point-to-point
- 18 slots

**PICMG 2.17**
- **StarFabric**
- 100 gigabits per second
- NA
- 8 and 21 slots standard
- Two PICMG 2.17 fabric slots

**PICMG 2.18**
- **RapidIO**
- 190 gigabits per second
- NA
- 8 and 21 slots standard
- Two PICMG 2.18 fabric slots

**VITA 31.1 Gigabit VME64X Backplanes**
- **VITA 31.1**
- Gigabit Ethernet
- NA
- 8 and 21 slots standard
- Two VITA 31.1 fabric slots

**VITA 41.x VXS Switch Fabric Backplanes**
- **VITA 41**
- **VXS Switch Fabric**
- As fast as 6.4 gigabits per second
- Single-star, dual-star, dual-dual star, and replicated versions available
- 12 slots, other sizes available
- **Mesh, Dual Star (SU), and 7U Pluggable Dual Star**
- 2, 5, 14, and 16 slots

**I-BUS CORP.**; Santa Clara, Calif.; 408-450-7880; www.ibus.com

**Continuum C0118D**
- **PICMG 2.16**
- Ethernet
- 40 gigabits per second
- Point-to-point
- 18 slots

**KAPAREL CORP., A RITTAL COMPANY**; Waterloo, Ontario; 519-725-0101; www.kaparel.com

**Advanced TCA Shelf**
- **PICMG 3.0**
- Advanced Telecom Computing Architecture (ATCA)
- 1 to 2.5 terabits per second, depending on topology
- Dual-star or full mesh available
- 14 or 23 slots

**Full Mesh Backplane (Advanced TCA)**
- **PICMG 3.0**
- Advanced Telecom Computing Architecture (ATCA)
- 1 to 2.5 terabits per second, depending on topology
- Full mesh
- 4, 14, and 16 slots

**Dual Star Backplane (Advanced TCA)**
- **PICMG 3.0**
- Advanced Telecom Computing Architecture (ATCA)
- 1 to 2.5 terabits per second, depending on topology
- Dual star
- 4, 14, and 16 slots

**ONE STOP SYSTEMS INC.**; Escondido, Calif.; 760-745-9883; www.onestopsystems.com

**PCIe Backplane OSS-EBP-2006**
- **PCI Express**
- 4 to 64 gigabits per second, depending on lane width
- Point-to-point
- 17 slots

**PCIe Backplane OSS-EBP-2001**
- **PCI Express**
- 4 to 64 gigabits per second, depending on lane width
- Point-to-point
- 20 slots

**PENTAIR ELECTRONIC PACKAGING, SCHROFF PRODUCTS**; Warwick, R.I; 401-732-3770; www.schroff.us

**PICMG 2.16 Ethernet backplane**
- **PICMG 2.16**
- Ethernet
- 40 gigabits per second
- Point-to-point
- 16 slots

**AdvancedTCA Backplanes**
- **PICMG 2.16**
- Ethernet
- 40 gigabits per second
- Point-to-point
- 16 slots

**BPX 3/14**
- **PCI Express**
- 4 to 64 gigabits per second, depending on lane width
- Point-to-point
- 16 slots

**BPX 3/8**
- **PCI Express**
- 4 to 64 gigabits per second, depending on lane width
- Point-to-point
- 11 slots

**TRACEWELL SYSTEMS**; Westerville, Ohio; 614-846-6175; www.tracewellsystems.com

**T-Frame for VXS**
- **VITA 41**
- VXS Switch Fabric
- As fast as 3.125 gigabits per second
- Dual star
- 8 slots

Supports the optional Ethernet routing feature of the SHB Express specification. Two 10/100/1000Base-T Ethernet RJ-45 connectors are available for use on the backplane.

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