COM Express Type 7 Carrier Boards: The Hot Rod of Embedded Computing

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Introduction

Technologies associated with Industry 4.0 — like 5G and IIoT — have affected industries by generating potential. However, Industry 4.0 relies heavily on Big Data, distributed computing and high-speed communication. Consequently, network capabilities on carrier boards have had to grow to adequately meet these new needs. Companies, including Sealevel, have built out COM Express Type 7 Carrier Boards that provide Industry 4.0 solutions for surveillance, industrial edge computing and Big Data network applications, especially in transportation.

What is COM Express Type 7?

As of 2016, COM Express Type 7 is the latest iteration of the Computer-on-Module system, defined by the PICMG consortium COM.0 Rev 3.0. This pinout type expands the applicability of previous COM express standards from personal computing to server applications, making it a Server-on-Module specification.

The Type 7 board is not a revision of COM Express Type 6 for replacement but as an alternate use category. Intended uses include headless servers, such as for data centers at the edge and within fog computing networks. The core computing of the board remains the same, but some of the interfaces changed. This board does not include native wireless communication; although, that can be added via expansion interfaces available on the module and integrated onto a custom carrier board.

COM Express Type 7 Board Changes

This latest version departs from earlier specifications with three key changes.

Ethernet: The Communication Throughput IIot Needs

First, Type 7 is the only COM Express board with 10 Gigabit Ethernet (GbE) capabilities. Previous specifications were 1GbE. This new pinout supports up to four 10GbE interfaces. This addition also allows the easy inclusion of fiber optic transceivers, which contributes to overall improved communications capabilities.

The upgrade makes Type 7 an ideal module for lower power applications that require high computing performance and intense data transmission specifications, including high bandwidth and throughput. These applications include server scenarios, from remote data centers to IIoT edge servers receiving and transmitting video or imaging.

Graphics IO: Maximizing Server Usage

Another key change is the removal of all graphics IO, audio and visual, and the halving of USB 2.0 and SATA ports, to four and two respectively. An example of a graphics interface would be HDMI to an external monitor. The lack of graphics makes the Type 7 board ideal for headless solutions. There are workarounds to the removal, but they are 2D solutions, which may not be sufficient for all users. This excludes the board from being used on

COM Express Type 7 Board Changes

any computer that requires 3D imaging or rendering as well as complex Graphics User Interfaces, such as public safety dispatch computers. However, losing these interfaces is not an issue for operation as the buildout can be configured and controlled remotely.

PCI Express: Rapid, Scalable Storage

The final key change involves the addition of 32 high-speed PCI Express (PCIe) lanes, a partial intention behind the removal of all graphics IO, and partial removal of the USB and SATA interfaces. Although this available space could be used for anything, the intention is to create room for Non-Volatile Memory Express (NVMe) which interfaces with mass storage devices. This move increases storage capabilities necessary for data-intensive applications.

NVMe is a protocol for accessing high-speed storage media, such as solid-state drives (SSD), of which engineers can add many to the board for data center applications or Storage Attached Networks. SATA is the old protocol for this function and geared toward rotating hard drives that have natural seek time limitations. However, the industry has moved to the new SSDs that make use of parallel flash operations. SATA hinders this flash capability while NVMe efficiently uses it. Moreover, NVMe does very fast seeking and rewriting of SSDs. While SSDs have shorter longevity compared to previous memory storage, due to limited write cycles, they are reliable. Given the module architecture, these disks are easily changed if they do fail.

XEON Processing: Powering Operations for Real-Time Data Analysis

Apart from the previous key changes, the COM Express Type 7 does work best with an updated server-grade processor. The Intel Xeon technologies have been perfect fits for boards using this specification. XEONs feature native 10GbE interfaces and are designed with high performance servers in mind.

Although these processors do require more power, they operate without a significant increase in associated cooling issues. Moreover, some selections within this family have industrial temperature ranges (-40°C to +85°C) that allow the board to be utilized for rugged computing. This ruggedness brings server capabilities into more temperamental or extreme environments.

Why COM Express Type 7?

The COM Express Type 7 specification grew out of the need for computing hot rods: embedded edge servers, in networks with distributed devices, that had massive bandwidths capable of real-time communication. Servers with these requirements could be anything from local industrial clouds to fog servers, carrier-grade installations, rugged IoT edge and content distribution/broadcast infrastructures.

Prior to the Type 7 specification, devices in these kinds of networks were experiencing "bandwidth bottlenecks" or network congestion. The "edges" of networks, the devices or "things" distributed, had reached a point where they were collecting, transmitting or requesting data faster and at higher volumes than available systems could provide. This congestion was especially true for networks receiving or sending data from vision control systems, such as video surveillance or medical imaging; aggregated sensor data transmissions or content viewing platforms.

The reasons Type 7 functions as a "hot rod" of COM Express are its high speeds, configurable memory and powerful processing. The bottleneck seen previously disappears with the new upgrades. Several Industry 4.0 requirements are met by the upgraded capability:

1. Real-time synchronization between IIoT and IoT devices within the server's network.

2. Massive data stream exchanges without latency.

3. Real-time data analysis and control.

4. Precise deep-learning algorithms.

COM Express Type 7: Applications and Use Cases

COM Express Type 7 Carrier Boards offer solutions for a variety of industries, especially those that use massive streams of data. Relevant industries include mining, energy and gas, manufacturing and factories, automation, military and transportation. Consider the below use cases of Type 7 COM Express in military and transportation.

COM Express Type 7 for Military

As the front-lines of military ventures become digital, intelligence forces are navigating greater volumes of data. This is especially true for military surveillance and reconnaissance missions using cameras, visual control technology, audio files and other large data producing systems.

For example, consider an airspace surveillance center located in a remote area, perhaps a mountainous border. With localized cameras and radar systems constantly collecting information, soldiers need a device that can return the information immediately as planes can enter, or leave, airspace rapidly. However, this information must be delivered securely — aided by speed that reduces the window of opportunity for malicious agents to access the data — between endpoints. Moreover, collected information may be transmitted or requested, which requires capable storage.

Thus, with network security being the highest priority for military operations followed immediately by integrity and speed of mission critical communications as well as sufficient infrastructure, Type 7-based servers offer an excellent mobile computing choice. This is largely because the massive bandwidth from the 10GbE ensures rapid, real-time communications and the available PCIe lanes for NVMe and subsequent SSD storage. The rugged potential, although dependent on enclosure, makes the Type 7 especially attractive.

COM Express Type 7 for Transportation

As mass transit and commercial multi-passenger vehicles grow popular in booming urban areas and between growing population centers, so will connected vehicle and intelligent transportation technology. These vehicles include trains, large airplanes, cruise ships, buses and light rail. Smart transportation systems can be anything: cruises with on-board theaters; airplanes with on-demand, in-flight media stations; train centers with intelligent, automated security; railcar compartments with app-connected passenger systems and autonomous buses running on a local route.

COM Express Type 7: Applications and Use Cases

In each of these cases, traditional datacenters or server farms do not support the distributed or isolated nature of the applications. Moreover, previous COM Express modules for mobile purposes cannot support the bandwidth requirements of, for example, hundreds of in-flight media stations requesting video content on-demand. Therefore, COM Express Type 7 expands smart and connected transportation applications as well as improves previously implemented designs.

COM Express Type 7: For the future

COM Express Type 7 boards offer computing solutions "for the future." With this carrier-grade board, industries across the spectrum will have the opportunity to access data for superior analysis, efficient automation and improved operations. Moreover, it will lead to the overall enhancement of edge devices as these server nodes become more than capable of handling the various information streams, increasing the power of Industry 4.0 technologies.

Sealevel Systems has world-class embedded and electrical engineers with experience designing applications that rely on COM Express Type 7 carrier boards. Moreover, our engineering team is well-versed in IIoT technology and keeps up-to-date on the latest advancements in computing solutions. If you believe Type 7 is the board for your application, please contact us for more information about how we can design the product you need.

About the Authors:

Leah VanSyckel is a marketing communications specialist for Sealevel Systems. Certified in research and technical writing, she spends her days creating and delivering content relevant to our technical community and business partners.

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