Data Demand Drives Data Centers

Consumers’ insatiable demand for data continues to be unsatisfied. The demand is directly impacting the data center as consumer data travels from cell phones, tablets, televisions, computers, even refrigerators through cell towers and eventually through the data center. The capital expenditure required to keep up with this demand is a daunting task to any company that deals with the expense of the data center expansion.

Of course, data centers can’t grow at the rate today’s data is increasing. The expense is too great. As a result, data centers are looking to faster speeds and better utilization to get the job done. Faster speeds are being implemented and you can see it happening as 40 Gbps interconnects are replaced by 100 Gbps; and now 400 Gbps. Getting a throughput improvement of 10x on the interconnect is helpful but only solves part of the problem.

The other challenge is maximizing utilization of the equipment inside of the data center. To improve efficiency, data center designers rely on network function virtualization to make the data center smart and quickly allocate resources to any underutilized piece of equipment; including servers, storage devices, and routers. The beauty of virtualization is utilization inside the data center increases and the data center, in turn, is more efficient. The difficulty is overall traffic in the
data center increases. It is estimated two-thirds of the world’s data traffic is occurring inside data centers. Thus, as the world’s insatiable demand for data increases, the data center’s need for speed becomes even greater.

**PCIExpress Brings It All Together — But Is It Fast Enough?**

Inside of the data center, a fundamental bus technology is PCIExpress (Peripheral Component Interconnect Express). PCIExpress connects equipment from external interconnects to connecting chips inside of the equipment. For instance, every server comes equipped with a CPU and memory, in many cases PCIExpress is used as the communication media between the CPU and the storage inside of the server on its principal design board.

As data traffic continues to increase, communication between the CPU and other components must also increase to keep up. In addition to speed improvements, data centers must react in real time.

Machine learning is in its infancy, but will become commonplace for the data center in the next several years. Machine learning requires instant access of core processing power of the CPU. The data center has other acceleration tools that are becoming increasingly important such as GPUs, FPGAs, and customer ASICs. Currently, PCIExpress is on its fourth generation and running at 16 Gbps. You can run up to 16 lanes, meaning that PCIExpress can support 256 Gbps. While this is fast, consumers inside the data center need a faster and even more efficient technology. PCIExpress works very well as a workhorse I/O, but it is not designed to maximize efficiency of acceleration enablers of the CPU/GPU/memory that have been enabled to handle the high demand of machine learning.

**CCIX Was Born from PCIExpress**

Innovative technologies such as Cache Coherent Interconnect (CCIX) have become available. The idea of these new technologies is to use the PCIExpress PHY layer, but change the function of the bus to allow for increased efficiency and faster speeds. While PCIExpress is currently at 16 Gbps (moving to 32 Gbps by 2020), CCIX currently is running at 20 – 25 Gbps, and has announced plans to move to greater than 40 Gbps in the near future, potentially providing a way to increase the throughput of chip-to-chip communications.
Will CCIX Change the Interconnect Game?

In addition to being faster, CCIX enables cache coherency. What is cache coherency?

Multiple copies of shared data can exist. There can be a copy in your main memory and one in the local cache of every processor that has requested the data. This means that if any of the data copies change, all the others must change too. Cache coherency makes sure these changes happen throughout the entire system quickly. With cache coherency, CPUs can communicate faster to the rest of the entire system. PCIExpress does not support cache coherency, while CCIX does. That gives CCIX an additional layer of efficiency.

Of course, cache coherency is not effective if it is not supported inside of the CPU, and if the accelerators don’t support it. Fortunately, cache coherency has been used inside of the CPU for many years to make sure that multicore and multiple processors are up-to-date with the latest settings. For CCIX to be successful, this idea of cache coherency must be implemented throughout the server food chain and extended to the other accelerator components.

In a new development, many key accelerator component manufactures have joined the CCIX consortium. If the entire ecosystem was to implement cache coherency through CCIX, all components would be automatically kept up-to-date in their cache, removing the need for DMAs and accelerating the overall communication of the device. The technology of CCIX is counting on the speed improvements of cache coherency and faster speeds in general to move an entire data center industry to specialize in CCIX for communication between CPUs and the accelerators.

New Demands Call for New Technology

CCIX is designed to help data centers increase throughput by providing specialization to maximize efficiency. Technologies such as CCIX and others will continue to be announced as the demand for data continues to grow. While existing technology and standards will continue to follow the trend of leveraging what exists to introduce future generations that run faster, the need for new thinking is increasingly important. Consumer demand for data will continue to grow. Big data, artificial intelligence and other technologies are only beginning to show how much data they will need to make their decisions. To support this progression, today’s technologists must be creative.
To Learn More

Below is a list of recommended test equipment and software to test CCIX.

- N5991 Receiver Compliance Test Automation Platform
- Infiniium UXR-Series Real-Time Oscilloscopes
- D9020ASIA Advanced Signal Integrity Software (EQ, InfiniSimAdv, Crosstalk)
- D9020JITA Jitter, Vertical and Phase Noise Analysis Software for UXR-Series Oscilloscopes

Learn more at: www.keysight.com

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