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# A Deeper Dive into Enterprise POWER8

November 2014 | by [Jaqui Lynch](#)

2014 is the year of POWER8. In April, the scale-out servers were announced and, on October 6, the enterprise servers were announced with availability starting November 18. This announcement means that a full POWER8 line is now available for consideration. Specifically, the replacements for the POWER7 770 and 780 (E870 and E880 1-2 node) will be GA November 18 and the replacement for the POWER7 795 (E880 3-4 node) will be available by June 2015. So what was actually announced?

## Announcement

IBM announced two models of enterprise servers—the E870 and the E880. Both of these servers go into a 19" IBM rack and are built in a similar fashion to the modular design used with the POWER7 770 and 780 with the addition of some of the architectural features of the 795. One key difference from POWER7 is the addition of an external midplane. In the 770 and 780, the primary node (first node) and the second node housed the redundant service processors and systems clocks. For the new Enterprise servers, the reliance on the primary and secondary nodes is removed by the addition of the midplane—all nodes are now equal. Additionally, the slots in the servers are now PCIe Gen3 slots, which are capable of providing significantly improved I/O bandwidth.

## Structure

The first major change is the move for all nodes to the 19" form factor. Although the 770 and 780 were 19", the 795 was not. Everything in the POWER8 line now goes into a standard 19" IBM rack. There are 32 DIMM slots, which can contain a total of 4TB (1TB per socket). Cores are added as single chip modules (SCMs) and there are up to four of those per node. All SCMs in a server must be identical. Additionally, each node or drawer has redundant power and fans. Each server also provides for capacity on demand (CoD) with the minimum requirement being the activation of eight cores and half the memory. E870 nodes have two processor options—a 32-core 4.02ghz node or a 40-core 4.19ghz node. The E880 initial offering is a 32-core 4.35ghz node. Each server can have 1 or 2 nodes. The E880 will get more nodes and an additional core option in 2015.

The system control unit (SCU) or midplane is a critical component to the E870 and E880. Each system has one SCU and it's a 2U drawer that contains the service processors, Hardware Management Console (HMC) ports, master system clocks, vital product data and an optional DVD. The SCU must be adjacent to the system nodes and all of the nodes must be contiguous in the rack. The SCU is powered from the system nodes so doesn't plug into the power distribution units (PDUs).

Each node or CEC drawer is 5U, has four power cords and has 8 x PCIe LP (low-profile) PCIe Gen3 x16 slots for adapters. These slots use new low-profile blind swap cassettes and are hot pluggable. Each slot can handle Gen1, Gen2 or Gen3 low-profile adapters or can be used to connect to a PCIe Gen3 I/O expansion drawer.

Unlike the 770 and 780, the POWER8 E870 and E880 don't include disk bays or media bays in the nodes. To provide for DVDs, either a DVD drive must be added into the SCU, which requires a PCIe USB adapter in the CEC or I/O drawer, or a DVD must be added along with an external I/O enclosure.

The new PCIe Gen3 I/O drawer is a 4U drawer that provides for 12 full-height hot-plug PCIe Gen3 slots that use the same blind-swap cassette as the POWER7 I/O drawers (5877, 5802, etc.). The I/O drawer connects to the E870 or E880 using an optical cable and uses two PCIe slots in the node to connect. In 2014, only 0 or 2 I/O drawers can be attached per node with a total of 0, 2 or 4 drawers per system. Thus a fully loaded 2-node E8\* can have up to two drawers with a total of 36 PCIe slots available.

If there's a requirement for internal disk, then it's necessary to add a disk I/O drawer. The EXP24s (#5887) I/O drawer can be used as long as a PCIe adapter is provided for connectivity.

It should also be noted that IBM Manufacturing will always build and test the E870 and E880 in a 7014-T42 19" IBM rack. This is done to ensure thorough testing after buildout and cabling and also ensures the rules around only using horizontal PDUs in the rack are adhered to. IBM now offers a de-racking chargeable feature if you want the servers to be shipped to be installed into your own rack. There are also stringent requirements for any OEM (other equipment manufacturer) racks. IBM also requires a special lift tool with the server as the system nodes weigh 167 pounds. The IBM lift tool is the only tool certified and tested for installation.

## Operating Systems and Maintenance

The E870 and E880 come with one year of 7-24 hardware maintenance. As with the earlier POWER8 scale-out servers IBM is now using "machine code update entitlement at activation." This means that firmware can't be installed unless you have a current hardware maintenance agreement for that server. The E870 or E880 server should arrive with an update access key (UAK) installed that covers the first year or whatever maintenance period was purchased with the box.

Additionally, there are some minimum operating system requirements, depending on whether you want to take advantage of all of the POWER8 features, such as SMT8, or whether you just want to migrate across as is. The technical overview Redbooks publication provides the details on those releases. It also provides details of the minimum levels for Java and compilers. The E870 and E880 are classified as the AIX medium software tier and require 120 PVUs per core. The E870 and E880 are not supported by IVM but PowerVM Enterprise comes standard with the new servers. Both servers require HMC v8.20 as a minimum HMC level.

## Getting There

If upgrading, a couple of options provide for same serial number upgrade. A 770 D model can be upgraded to an E870 and a 780 D model can be upgraded to an E880, and the serial number can be retained. When upgrading, it's important to ensure the POWER7 is on maintenance and that the upgrade is installed promptly—the upgrades ship with a 60-day temporary key and should be installed before that key expires.

## Let's Go Swimming!

Power Enterprise Pools enable you to move processor and memory activations within a defined pool of systems at convenient times for you without having to contact IBM. Activations are used within their specific pool type and there are two pool types—one for the E880, 780 and 795 and the other for the E870 and 770. Each server type has a minimum required amount for static activations for memory and CPU. After that, mobile activations can be done as single cores or in 100GB increments for memory. The number of each is designated at purchase time although static activations can be converted to mobile activations. This provides for a very flexible environment that allows for the rapid movement of workloads as necessary.

## Performance

The I/O and memory bandwidth on the two new servers is phenomenal. A fully populated 2-node E870 or E880 can peak at 922 GB/s per node for memory and 256 GB/s per node for I/O. Contrast this with the 770D or 780D at 272 GB/s per node for memory and 80 GB/s per node for I/O, or the 795 at 576 GB/s per node for memory and 80 GB/s per node for I/O. When these are combined with new functions such as SMT8, it's clear the new enterprise servers are designed for performance. As a point of comparison, a 32-core 4ghz 795 is rated at 372.27 rPerf whereas the 4.02ghz 32-core E870 (1 node) is rated at 674.5 rPerf. The 795 requires a special 24" rack whereas the E870 would require 7U in a 19" rack. A 2-node E870 with 80 x 4.19ghz cores is rated at 1711.9 rPerf, the 2-node E880 with 64 x 4.35ghz cores is rated at 1432.5 rPerf. The 780 requires 128 x 3.7ghz cores to get to 1380.19 rPerf and the 795 needs around 128 cores to equal the rPerf of a 2-node E870. This is an incredible jump in performance, especially when you add in the improved memory and I/O bandwidth.

## Best Features

IBM has taken the best features of the POWER 795, 770 and 780 and combined those attributes with the POWER8 technology to create an incredibly robust and high-performing pair of servers, the E870 and the E880. Isolating the redundant resources (clocks, etc.) and moving to a single rack footprint makes it far simpler to integrate these servers into the data center. The use of enterprise pools makes the migration from the POWER7+ servers much simpler and ensures a smoother transition. But the real story is in the scalability and capacity provided while still ensuring the RAS (reliability availability and serviceability) that we've all come to expect from the 795.

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