**AC922 FAQ**

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# Product

## What is being announced on December 5th, with the AC922?

We’re announcing commercial availability of the first Power Server for the P9, the AC922. This server is being positioned as the best server for enterprise AI.

## Who or what is this server for?

This server is primarily being promoted as the best server for enterprise AI, however, it’s also very useful for accelerated HPC and high performance analytics.

## Does this sever only sell with GPUs?

No, it’s possible to buy this server in a 0 GPU configuration, for those organizations not requiring accelerators, However, as this server is primarily designed for accelerated workloads and AI, we expect almost all purchases to be in 2/4/6 GPU configurations.

## Is every option available for the AC922 from day 1?

No, here are some initial limitations in availability for the AC922. Initially, only the air-cooled version will be available. This means you can only buy the 0/2/4 GPU configurations. However, the GPU configurations will be available in Q1 or early Q2 of 2018. 2TB configurations will also not be available until that timeframe, so initial configurations will be restricted to 1TB or less.

## What are the differences between Air and Water Cooled?

Air cooled configurations top out at 4 GPUs, whereas Water cooled are available in up to 6 GPUs.

## What’s NVLink?

NVLink is a technology that’s trademarked by NVIDIA, though IBM did assist with development. It’s a replacement for the aging and outdated PCIe standard that just about every other sever uses, providing much lower latency and higher bandwidth. Currently the technology is in its second generation (2.0); the POWER8-based S822LC (“Minsky”) shipped with NVLink 1.0.

## Do any other servers have NVLink?

At this time, NVIDIA and HPE have servers with NVLink, and Dell has announced one. However, none of them have NVLink between GPUs and CPUs. This is a big differentiator as it means we’re the only server that can share memory across CPUs and GPUs. Plus, many AI and HPC workflows involve work transitioning between CPUs and GPUs, in which case we’d be significantly faster.

## What are the differences between 4 and 6 GPU configurations?

4 or 2 GPU configurations provide more CPU-GPU bandwidth (150 GB/s) than their 6 GPU counterparts (100 GB/s). This is because the 300 GB/s pipe per socket is split 3 ways instead of 2 ways.

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## Are more GPUs always better?

No, ideal GPU density depends upon how accelerated and parallel the workload is. Typically, we expect the ideal density to be 2 GPUs per socket for most workloads, especially since the AC922 provides more CPU-GPU I/O in lower density configurations. However, in some scenarios a 3 to 1 configurations (for example: 6 GPUs in 1 AC922 node) might make more sense. We believe that, at this time, higher ratios than 3 to 1 are inefficient.

## How did we arrive at the 5.6x number?

The 5.6x is based on IBM Internal Measurements running the CUDA H2D Bandwidth Test

Hardware: Power AC922; 32 cores (2 x 16c chips), POWER9 with NVLink 2.0; 2.25 GHz, 1024 GB memory, 4xTesla V100 GPU; Ubuntu 16.04. S822LC for HPC; 20 cores (2 x 10c chips), POWER8 with NVLink; 2.86 GHz, 512 GB memory, Tesla P100 GPU Competitive HW: 2x Xeon E5-2640 v4; 20 cores (2 x 10c chips) / 40 threads; Intel Xeon E5-2640 v4; 2.4 GHz; 1024 GB memory, 4xTesla V100 GPU, Ubuntu 16.04.

## What is the 9.5x NVLink number?

Any references you might see to 9.5x I/O for NVLink are not applicable to the AC922, but refer to what is theoretically capable with POWER9. This would be in a custom system where all other connectivity interfaces were unused, and there was only one GPU per POWER9 socket.

## What’s Scale out vs. Scale up?

Scale out systems are HPC, HPDA, and accelerated compute. Scale up systems are our AIX and IBM i systems. Scale out systems tend to have more cores per CPU, whereas Scale up have fewer but more powerful cores.

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## What’s the difference between NVLink, PCIe, and CAPI?

NVLink is only used for communications with GPUs, and at this time it’s exclusive to NVIDIA. PCIe is a more generic technology, and it’s what you’d use to connect components like FPGAs, SSD, network cards, etc. The implementation of PCIe in the AC922 is the industry’s first PCIe Gen 4 system, which provides a 2x performance improvement over PCIe Gen 3.

Coherent Accelerator Processor Interface (CAPI) is a new standard that IBM has pioneered, in collaboration with the OpenPOWER foundation. CAPI connects a custom acceleration engine to the coherent fabric of the POWER chip. The hybrid solution has a simple programming paradigm while delivering performance well beyond today’s I/O-attached acceleration engines.

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| **Interface** | **Purpose** | **Speed** |
| PCIe 3.0 | Only interconnect in the x86 world used to connect GPUs, SSD, FPGA, NICs, etc. | 32 GB/s bi-directional  16 GB/s one-way  Measured at ~ 12 GB/s |
| PCIe 4.0 | 1st PCIe Gen 4 is on IBM Power!  It’s backwards compatible, so anything that works with PCIe 3 will work with gen 4. | 64 GB/s bi-directional  32 GB/s one-way  2x faster than PCIe Gen 3 |
| Open CAPI | Used for SSDs, NICs, and just about anything you’d use PCIe for, but want more speed. | 204.8 GB/s Theoretical  6.4x faster than PCIe 3 |
| NVLink 2.0 | Used specifically for NVIDIA GPUs both between GPUs and between GPUs and CPUs | 68 GB/s measured vs 12 GB/s measured with PCIe 3 |

## How much RAM does the AC922 support?

At launch, 1TB of RAM per node. In early 2018, however, 2TB configurations will be available. Note that the AC922 is always sold with every memory slot occupied by a DIMM, as leaving empty slots will reduce memory bandwidth considerably.

## What type of processor is in the AC922?

Two POWER9 scale out processors with NVLink. These include 16/20 cores, or 18/22 cores - more cores than the scale up CPUs, but reduced memory, cache, and threads.

## What types of internal expansion slots doe the AC922 include?

* GPU/NVLink
  + 4 or 6 SXM 2.0 sockets, for NVIDIA Tesla V100 GPU Accelerators with NVLink.
* PCIe/CAPI
  + 2x PCIe x16 4.0 slots 1x PCIe16x ( x8,x8) 4.0 slot (multi-socket host direct supported)
  + 1x PCIe x4 4.0 slot