What is SKARN?

The project began in early March of 2024, as...

“I will make a basic AI workstation to learn stuff about this new AI Hype thing”

What proceeded was a yearlong endeavor to acquire the most powerful hardware possible at the lowest cost. From LGA-3647 dual socket to LGA-4189, and LGA-4677 based systems to dual AMD Mi50, P100, Dual 2080ti 22gb SLI. All of which fall into the same trap as the “Quad RTX 4090 AI 9000 MONSTER”.

Systems that are lack NVLink or InfiniBand cannot effectively pool their video memory. The Quad RTX 4090 system essentially has four separate VRAM domains that rely on the following communication path; when running AI models that spread layers across multiple PCIe GPU’s.

The comparison between a commercial AI workstation communication to Enterprise NVLink

GPU1 → PCIe Bus → CPU (RAM Pool/PCIe NVME-M.2) → PCIe Bus → GPU2

vs

(GPU1 → GPU2)=>PCIe Bus → CPU (RAM Pool/PCIe NVME-M.2)

Usually developers will opt to run separate models on individual GPU’s which are often limited in VRAM capacity. For example our RTX 4090 only has 24gb of GDDR6X at a premium price and

limited quantity. The newest RTX Pro Blackwell 6000 features 96gb of GDDR7 at an eye-watering price-point.

Don’t even think about buying a A100 PCIe or even any of the Hopper PCIe model GPU’s for your LLM’s or scientific compute projects. You will spend $8k for a used datacenter A100 that has been converted from SXM4 to PCIe as the cheapest option.

The more cost effective option is to run some layers on a commercial GPU while offloading all other layers to the CPU. Yes the system RAM pool can be absolutely massive based on CPU Architecture but CPU offload has a drastic drop in overall throughput performance compared to GPU’s.

There has to be a better way.

Today’s AI data-center boom is a treasure trove of SXM based systems and complementary components. Enterprise processors and motherboards are arriving on popular resale sites such as Ebay, at very reasonable prices. In addition to this, server power supplies are dirt cheap especially for blade redundant server PSU’s.

The destiny for the majority of this enterprise hardware is either a landfill or to run Arch Linux in a basement somewhere, developing the next 90% discounted Indie game on Steam.

What is keeping us from using enterprise hardware?

Currently enterprise hardware is trapped behind a wall of enterprise gate keeping. For example the Super-micro AOM-SXMV SXM2 NVLink host board is an incredible piece of engineering. This board originally was part of the Supermicro 1028GQ-TXR(T) Super-server system. A dual socket Xeon system that either used V100’s or P100’s.
AOM-SXM2 = P100 Only
AOM-SXMV =V100 Definitely...maybe the P100..?

The issue arises when trying to interface with the proprietary JPCIe connector on the AOM boards. This is a Super-micro proprietary connector that requires the “AOM-SXM-BRG”.

According to page 1-5 of Chapter 1 of Super-Micro’s Superserver 1028GQ-TXR(T) 1028GQ-TVR(T) manual. **Found here (https://www.supermicro.com/manuals/superserver/1U/MNL-1931.pdf)**

The 1028GQ-TVR(T) system supports four Volta SXM V100 GPUs installed on the AOM-SXMV add-on module which is connected to the motherboard by two bridges.

A direct connection between all GPUs is a double NVlink connection (2x25 GB/s). Fastest connections are afforded when GPUs are added in pairs.

A direct connection from the GPUs to the network is provided using the OCuLink cable from the add-on module connector to the riser card connector. A fast network (expansion) card installed on the riser card affords very high speeds. With OCuLink cables connected, data can go from GPU to the PLX to the NIC, bypassing the CPU. For the NIC, the system can support both FDR and EDR (in x16 slots).

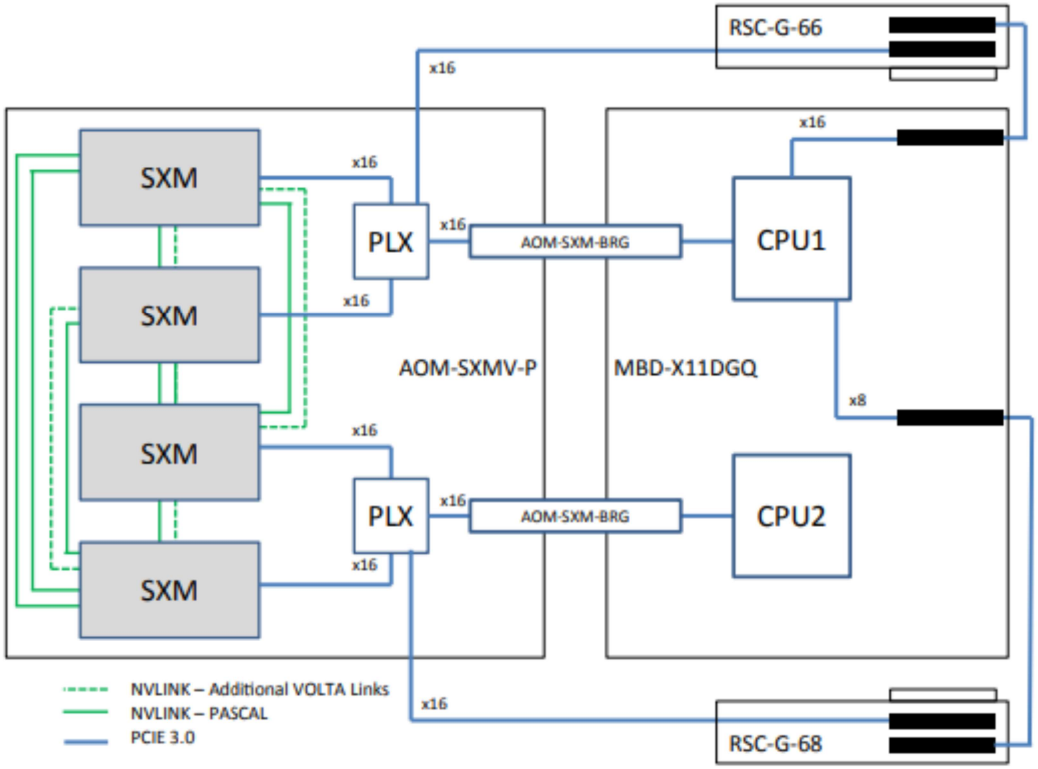
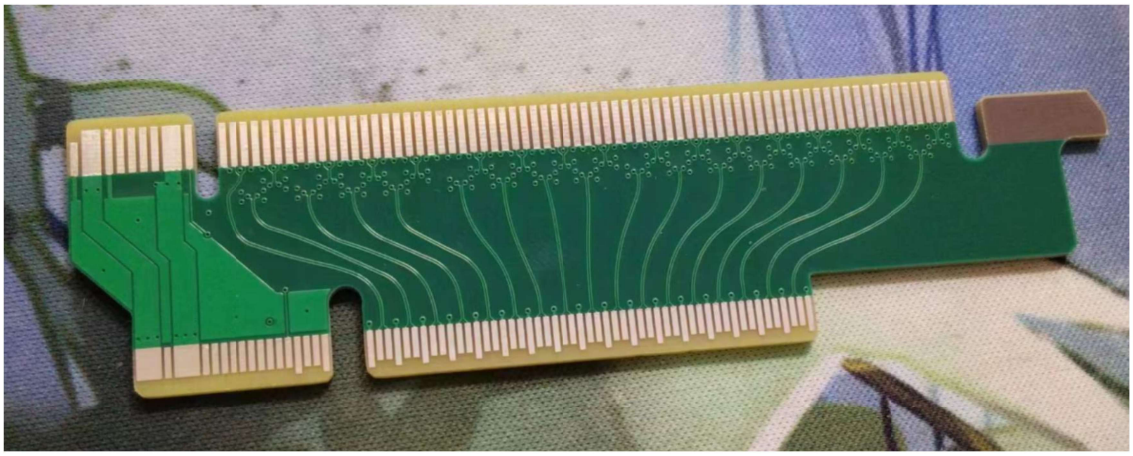


Figure 1-3. SXMV Add-on Module Block Diagram

In reality this simple JPCIe to PCIe bridge connectors that spans roughly five or so inches in length has almost no pictures of the part let alone parts for sale. I found some of these bridge boards sold by an Enterprise hardware re-selling company fors $900 each.

So a Chinese developer by the name
地摊垃圾佬-锂离子 or in English **“Street vendor garbage collector - lithium ion”**
made the following adapter. Now a PCIe3.0x16 Riser Cable can interface between two of these adapters and the almost any motherboard someone can purchase even X99 or below.

Original Link found here (https://oshwhub.com/keiskeis/pcie-to-aom-sxmv-adapter-board)
The original page contains Gerber files, BOM, PCB layouts that can be downloaded without an account.



This project intends to find online open source solutions that already exist in the case of the AOM-SXMV and also make adaptations or changes to other obsolete and discarded enterprise SXM trays.

The Four Pillars of SKARN

- **Hardware flexibility and aggressive cost effective solutions.**
- **Provide developers and educators with information on building advanced research compute nodes.**
- **Community of openly shared developer contributions for project progression.**
- **Reducing E-Waste by re-configuring obsolete or proprietary enterprise hardware.**

The printing press, metal lathe, voltaic pile battery, or even the typewriter were transformative. When these inventions became affordable or could be replicated, the average citizen of the world could leverage capabilities only Universities or Government Institutions had prior.

AI and Scientific Computing is not an insurmountable barrier for the average person let alone educators and professors in developing countries. These hardware limitations can be overcome with the builder community and educators openly sharing information.

“Great innovations, whether in art or literature, in science or in nature, seldom take the world by storm. They must be understood before they can be estimated, and must be cultivated before they can be understood.”

CLARENCE EDWARD DUTTON (winter-1880)

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