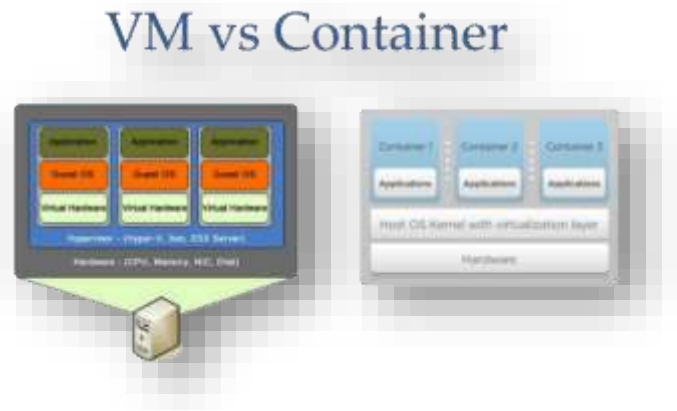
Using Containers with Computational Storage for Edge Computing Applications

Introduction

Edge-computing solutions in applications such as exploration analysis, aeronautics, defense, and self-driving vehicles are just a few that are highly space-constrained. In most cases, these applications cannot support compute resources in servers with standard rackmount form factors, even if they are 1 rack unit (1RU) high. Because of this, it is critical that edge computing solutions utilize the highest density resources available to achieve their needs.

One way to increase compute density is server virtualization, where multiple applications run on the same processor. For multi-core processors, server virtualization provides a very effective method to manage multiple applications across multiple cores. Unfortunately, standard server virtualization approaches utilizing hypervisors such as VMWare, Citrix, or KVM impose a high overhead on both processor and memory needs. This is because each virtual machine runs its own operating system instance, each of which requires a core, in addition to the one or two cores required to run the hypervisor.

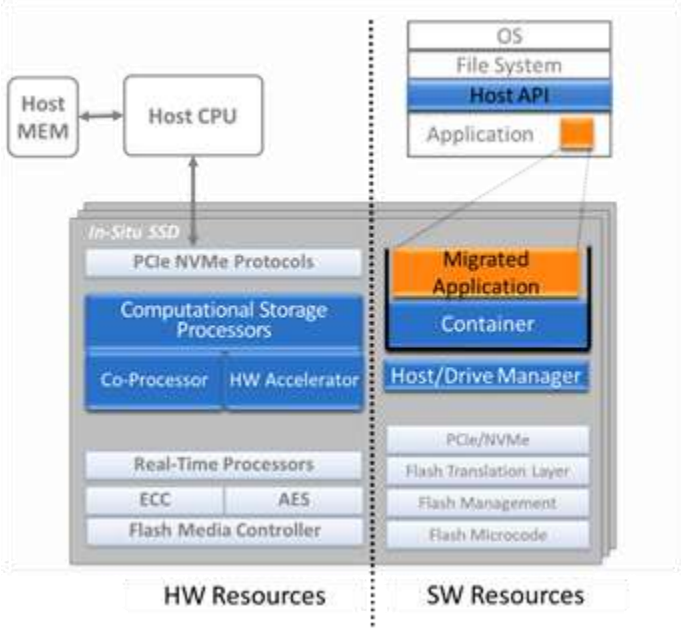
Using Containers to Increase Edge Computing Density



An alternative to classical hypervisors for server virtualization is the concept of containers. Unlike hypervisors, a “containerized” system would only run one copy of the operating system while providing separate spaces for each application to execute in. While this approach requires all the application instances to run the same operating system version, containers significantly increase the number of cores available to run application instances. For the ten-core example above, two cores would likely be utilized to run the operating system, and the remaining eight cores would be utilized to run concurrent application instances, nearly twice as many as can be run on the same processor if a hypervisor was utilized. Containers also provide near-bare metal performance and very low memory footprint. For space and resource constrained applications like edge computing, these advantages are extremely important to maximize application density.

Containers Solution Brief

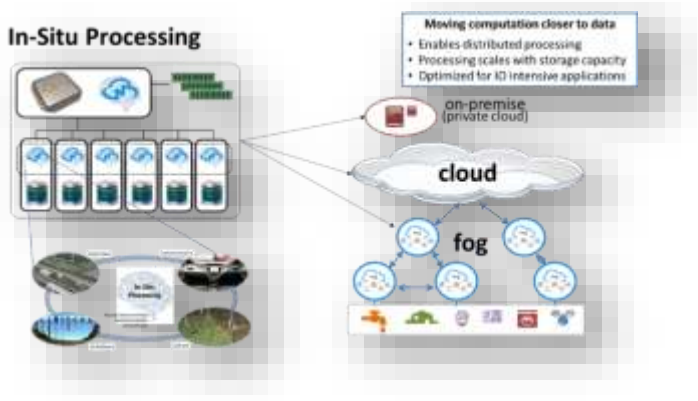
Containers Plus NGD Systems Computational Storage = Extreme Compute Density



One example of how containers can be a game-changer for edge computing is their use inside computational storage devices, like the NGD Systems Catalina-2 SSD. The Catalina-2 provides 16TB of NVME flash storage in a 15-mm thick U.2 package that only consumes 12 watts. While achieving 16TB in a U.2 package alone is quite a feat (NGD Systems is the first vendor to do so), what makes this device really remarkable is the computational capabilities that it contains. The Catalina-2 SSD provides users with an ARM multi-core processor, as well as hardware acceleration for data analytics workloads. For an example of the capabilities that this provides to applications, NGD Systems recently ported applications directly off the Docker Container store into the drive and ran them as if they were natively run on the host processing subsystem. An example of this is the openalpr (Open Automated License Plate Recognition) where NGD Systems ran this in a Docker Container within the In-Situ Processing Engines.

NGD Systems – Solving the Edge Computing Data Avalanche

The Internet of Things (IoT) aspires to collect mountains of data by instrumenting nearly everything in our existence. This creates challenges both in storing and processing this data. Gartner Research expects that there will be 20.4 billion IoT devices connected to the internet by 2020, generating 5X the data that we generate today. A single connected aircraft can generate 40TB of data per day, while an autonomous car may generate 2TB of data per hour, according to Intel. Making effective use of this data is critical for edge computing applications. The combination of containers and computational storage provides a means to embed incredible processing capabilities within a very small form factor, while at the same time simplifying the porting of existing applications onto the NGD Systems computational storage platform.



The result: Higher performance for parallel applications that approaches that of large server clusters, all in a package only consumes 12 watts of power with limited system level modifications due to the direct port of the application to the storage via Docker or other container technologies.