Cloud & Container Update

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Spectrum Scale Cloud & Containers

- Spectrum Scale on Cloud - Vision
- Spectrum Scale Solutions
- Persistent Storage for Containers
- Future Plans

Spectrum Scale On Cloud - Vision

Cloud Readiness

- Public, Private, Hybrid
- Multi-Cloud

Offerings

Ecosystem Integration

Workload Support

- Analytics & Cognitive
- High Performance Computing
- AI Data Pipeline

Workload Ecosystem

- Containers
- CaaS
- Ephemeral and Persistent Volumes
  - Storage Enabler for Containers (SEC)
  - Container Storage Interface (CSI)
- Hybrid Use Cases
  - Cloud Burst
  - Multi Cloud Data Sharing
  - Archive
  - High Performance Tier

Spectrum Scale On Cloud - Vision

Cloud Readiness

- Public, Private, Hybrid

Offerings

Ecosystem Integration

User Deployed - DIY

- IBM Cloud

Spectrum Scale Solutions

- IBM Spectrum Scale on AWS

Private Cloud Solutions

- IBM Cloud Private (ICP)
- Others

Partner Solutions

Trials

- AWS Quickstart
- Google (soon)

Spectrum Scale On Cloud - Vision

Cloud Readiness

- Public, Private, Hybrid

Offerings

Ecosystem Integration

User Interface (Look and Feel)

Resource Provisioning and Initialization

- Provision Virtual Machines, Storage etc. and initialize

Deployment Automation and Orchestration

- AWS Cloud Formation etc.

Spectrum Scale Cluster Creation and Configuration

- Cluster Creation, File system Creation. Feature enablement and configuration

Digital Business Integration

Service & Support Processes

Durability & Elasticity

Spectrum Scale Journey on AWS

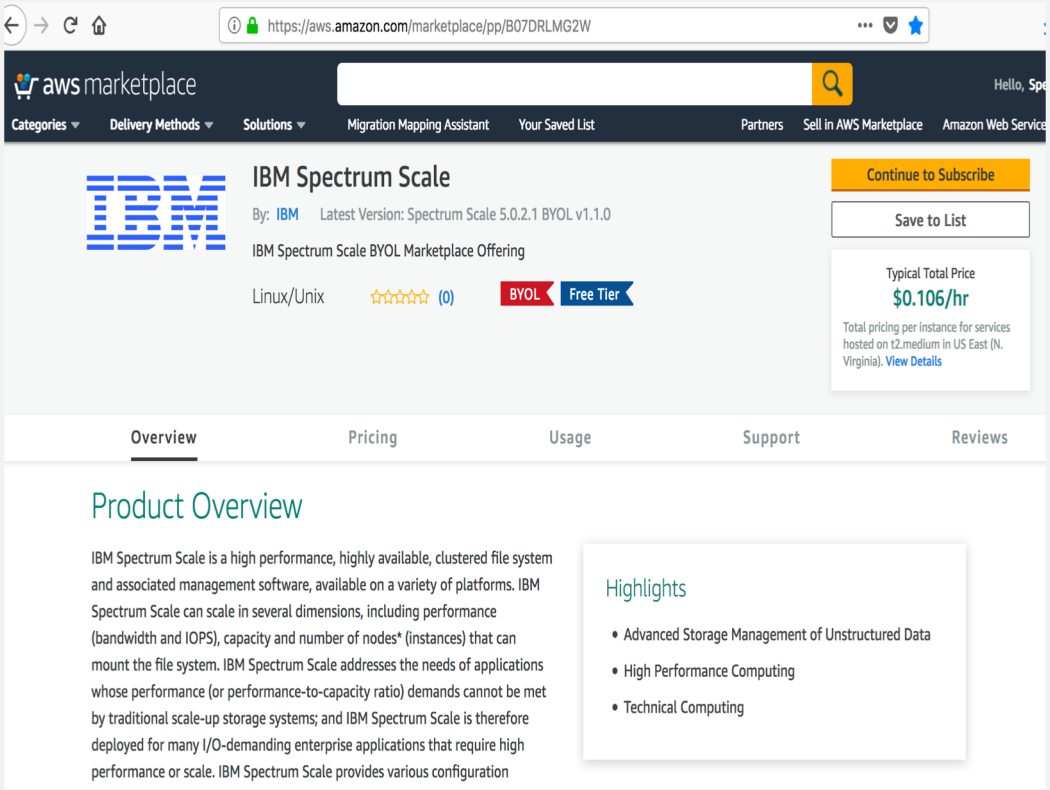
Spectrum Scale Trial link

- 3 months trial license
- Released Sept. 13 2017
- Data Management Edition

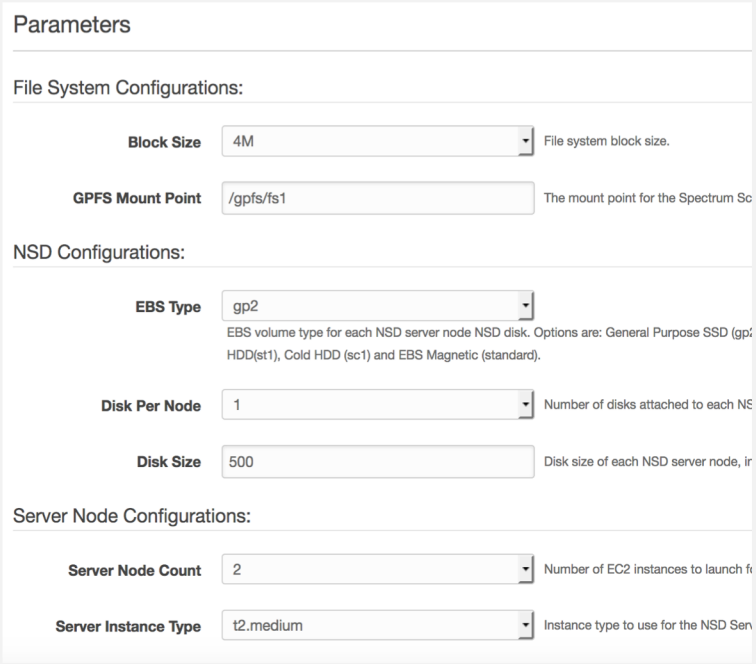
Spectrum Scale Marketplace link

- Bring your own license
- Released Sept. 28 2018
- Data Management Edition

Spectrum Scale Listing On AWS Marketplace

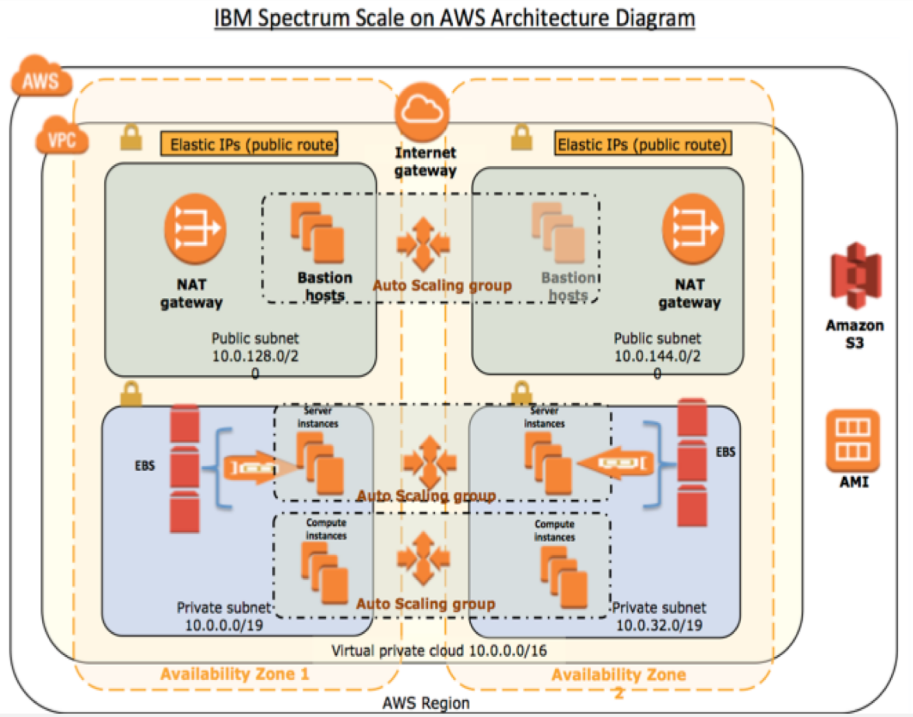


Easy configuration through cloud formation



Spectrum Scale on AWS – Architecture

- Solution based on EC2 instances and EBS volumes
- NSD servers separate from “Compute” nodes that will mount the shared filesystem
- NSD servers using AWS EBS storage for Spectrum Scale
- Data is replicated across multiple availability zones
- Support for creation of new VPCs or launching instances into existing VPCs.
- Connection to these instances only via a Bastion Host (as per AWS best practices)
- Focuses on simplicity/usability of deployment (e.g. reduced config. options) and leverages Amazon features such as Cloud Formation templates and AMIs (Amazon Machine Image)



Containers, Containers, Containers

HPC and Scientific Computing

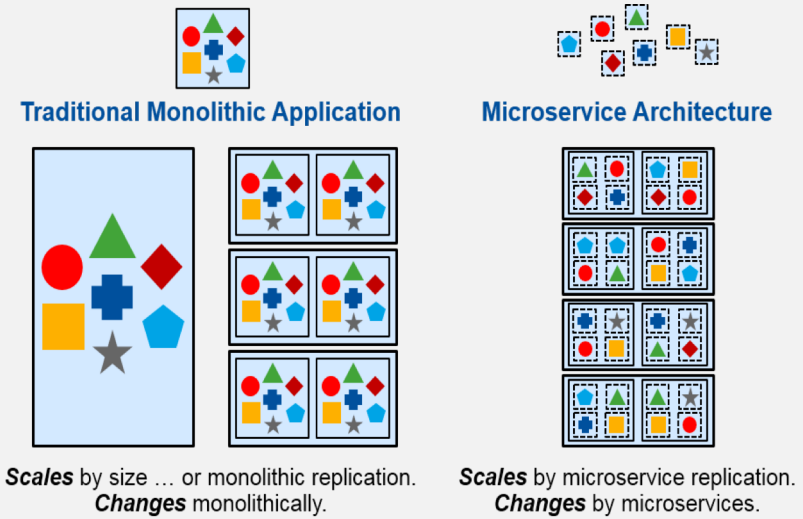
- Portable and reproducible science
- One-Click Laptop to Supercomputer

On-premise and Public Clouds

- Scheduling and Auto-Scaling
- Improved resource utilization
- Isolation and Multi-Tenancy

Development, DevOps and continuous integration

- Re-use of applications and services
- Simplify and accelerate application deployment



Next Gen, Micro-Service, and Traditional Applications

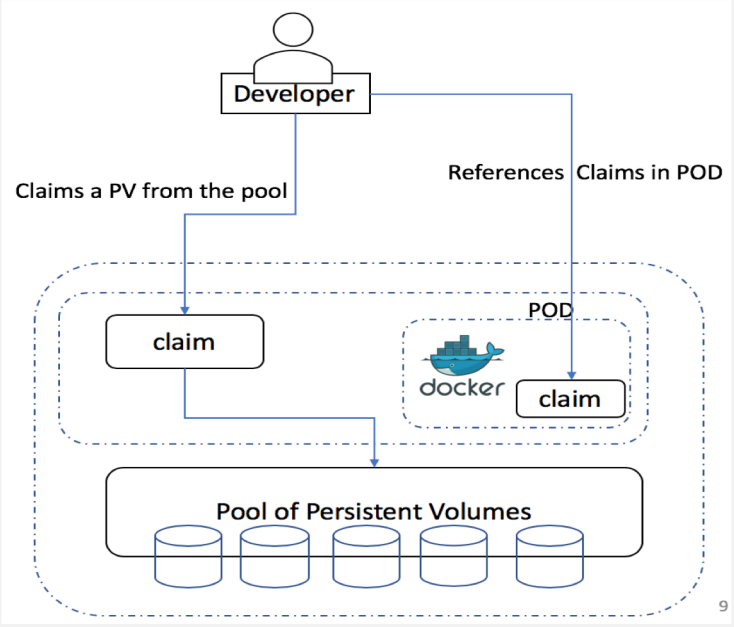
Persistent Storage For Containers

Stateful Containers: *Persistent data with high availability and data protection is one of the biggest barriers for container adoption in the enterprise for production workloads*

- Storage volume plug-ins are required to enable external storage to containers
- Each orchestrator has its own provisioning API for integrating storage

Concepts

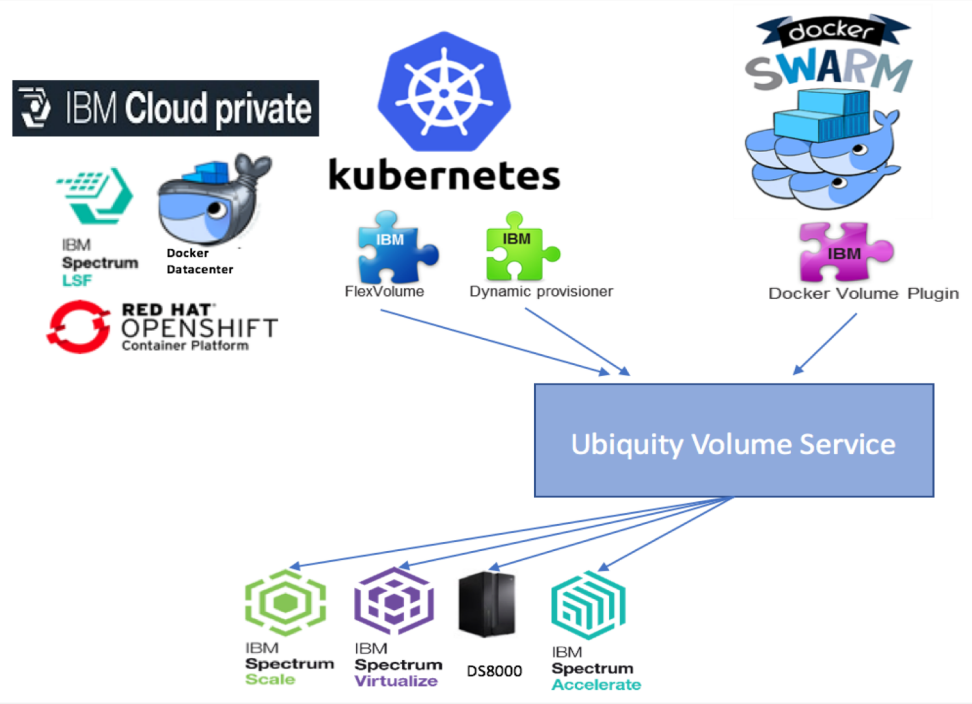
- *Persistent Volume (PV):* Unit of storage in the cluster that has been provisioned by an administrator or dynamically provisioned via a storage driver/plug-in
- *Persistent Volume Claim (PVC):* Is a request for storage by a user.
- *Static Volume Provisioning*
  - PVs created upfront
  - Storage requirements to be known upfront
- *Dynamic Volume Provisioning*
  - Volumes created on-demand
  - No need to pre-provision storage
  - Based on StorageClass



Spectrum Scale and Containers

Storage Enabler for Containers: *Solution to enable IBM storage for containers*

- Unified solution across IBM storage
- Supports different containers' orchestrators
- Provides storage specific extensions (CLIs) & tools
- Pluggable architecture to support 3rd party storage
- Open Source



IBM Spectrum Scale Offering For Containers

Spectrum Scale containers plugin (x & p) was GA'd as part of **IBM Storage Enabler for Containers** in Dec 2018

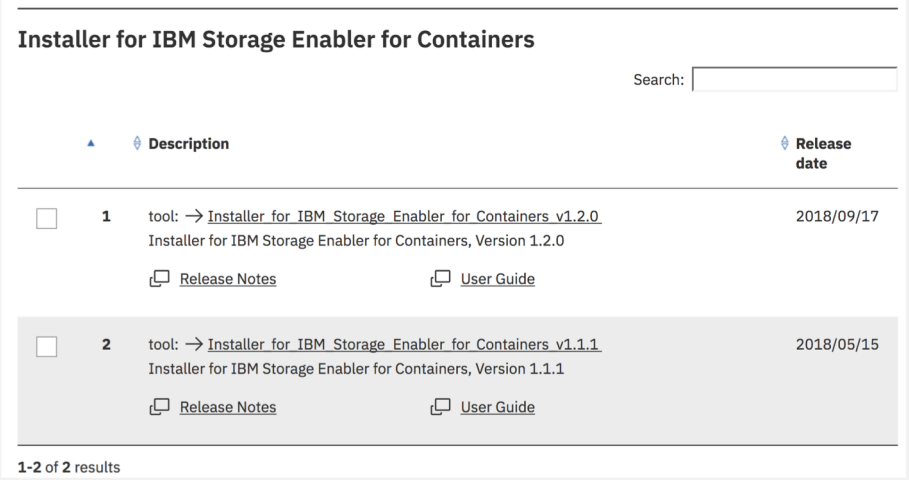
Support for Z on RHEL and SLES was GA'd in Jan 2019

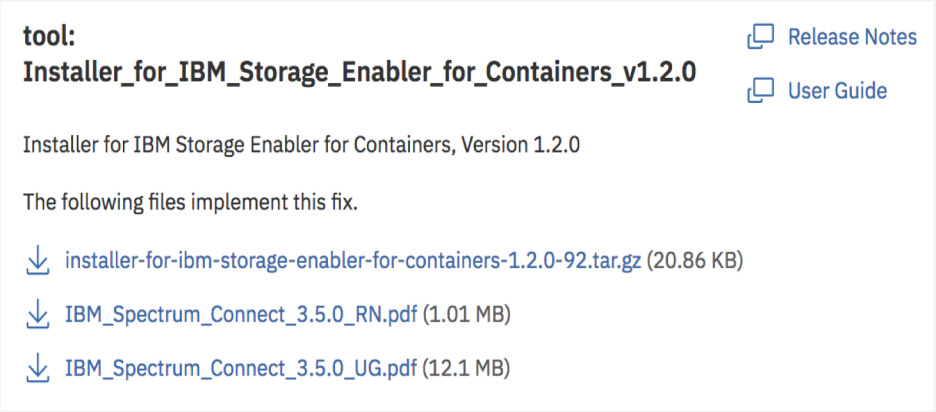
Key Features:

- Provides persistent volumes for stateful applications on **Kubernetes**
- Support for dynamic provisioning of volumes as well as creating volumes using existing filesets
- REST API based volume management
- Support for Quota management

Downloading From Fix Central

- Spectrum Connect landing page:
https://www.ibm.com/us-en/marketplace/spectrum-connect
- Click the "Download Now" button to come to the Fix Central Page
- From the Fix Central download links for Spectrum Connect, select the "Installer for IBM Storage Enabler for Containers" link:





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Thank you

In a nutshell: What is CSI and why is it important ?

Standardized storage interface for Container Orchestration Systems (Kubernetes, Mesos, Docker, and Cloud Foundry)

- In addition, makes installing new volume plugins as easy as deploying a pod

CONTAINER STORAGE INTERFACE

CSI spec V1.0 GA level of support in Kubernetes 1.13 (Dec 2018)

- ICP 3.2 plans to support Kubernetes 1.13 in May 2019
- OpenShift 4.1 plans to support Kubernetes 1.13 in May/June 2019

Flex Volume plugins can coexist with CSI plugins. SIG Storage will continue to maintain the Flex API so that existing plugins will continue to work.

New volume features (e.g. snapshots, resize) will be added only to CSI

The new standard requested by customers and adopted by the industry.