



SDC 

STORAGE DEVELOPER CONFERENCE

SNIA  **SANTA CLARA, 2017**

Software Defined Data Infrastructures (SDDI) and the Role of Storage

Today's presentation located at: **www.storageio.com/sdc2017**

Greg Schulz @StorageIO
Server StorageIO™

www.storageio.com and www.storageioblog.com

Agenda For Today's Presentation

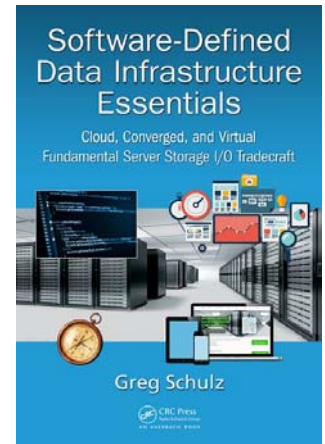
What Will Be Covered Among Other Topics – Slides at www.storageio.com/sdc2017

Software Defined Data Infrastructures (SDDI) and the Role of Storage

Software Defined Data Infrastructures (SDDI) are in your future if not already. SDDI spans cloud, containers, virtual SDDC, VPS, and DPS along with hybrid environments. This session looks at industry trends, technologies, tools along with techniques to expand (or refresh) your server, storage and i/o networking knowledge, experiences and tradecraft as you continue, or move into new data infrastructure focus areas.

- Data Infrastructures yesterday, today and tomorrow
- Industry buzz and adoption vs. customer adoption and deployment
- Expand your skills, knowledge and network (context and tools)
- Learning from lessons of past to avoid repeating faults in the future
- Start using new and old things in new ways vs. new things in old ways
- Software Defined Management of hardware, software, services
- Along with other related topics, technologies, tools, techniques and trends

Download today's slides via www.storageio.com/sdc2017



www.storageio.com/book4

Software Defined Data Infrastructures (SDDI) and the Role of Storage

Everything Is Not The Same

www.storageio.com/sdc2017

Industry Trends Perspectives



September 12, 2017

vmware®
vEXPERT

VSAN 2016

vmware® vEXPERT
Eight Time

Microsoft
Most Valuable Professional Award
Independent experts. Real world answers.



SNIA SDC 2017

Presented by Greg Schulz Server StorageIO™

Greg@storageio.com | StorageIOblog.com | Facebook.com/StorageIO | @storageio

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited
© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

Industry Trends – Storage and Solution Growth

Storage System, Appliances, Services, Cloud, Converged, Legacy, Software Defined



Performance (IO or Bandwidth)
Availability & Protection
Capacity & Bulk
Economics

Software Defined
Storage (SDS)
Block, File, Object
Queue, Tables, Services

Demand, Data Growth

Public Cloud Services

Hybrid

CI, HCI, CiB

All Solid State and AFA

CI = Converged Infrastructure
HCI = Hyper-Converged Infrastructure
CiB = Cluster / Cloud in Box

Legacy and Hybrid Arrays, Storage Systems and Appliances

Purpose Built Backup Appliances (PBBA) and Data Protection Appliances

Source: Software Defined Data Infrastructure Essentials (CRC)

Time

www.storageio.com/sdc2017

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited

© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

Context Matters and Terminology

Words, terms, acronyms have many meanings

BLOB	Data base storage item, object storage entity, page, block, append among others
Bucket	How storage managed, allocated, or organized, object, database, other data structure
Container	A storage bucket, repository, unit of compute aka docker/micro services/server less
Composable	Combine, orchestrate, aggregate, define HW and SW resources to scale
Endpoint	Address, target, destination, how accessed managed of block, file, object or network entity.
File system	Various layers, from low level in flash devices to higher level in databases
Flash	Adobe visualization software or NVM SSD media
Namespace	Collection of endpoints, addresses, resources for a given scope
Object	An entity, thing, database, file system, OS, hypervisor, network or other data structure item
PM	Physical Machine aka Bare Metal (BM) server, Persistent Memory
Role	Functionality, Capability, Feature, Service Enabled or what something does
SAS	Shared Access Signature, Serial Attached SCSI, Statistical Analysis Software
SCM	Storage Class Memory
SSD	Solid State Devices, Solid State Drives, Solid State Disks
Tiers & Tiering	Different types, categories, classes of resources, moving data or items between tiers
Volume	Block, File, Object among other storage allocation, organization

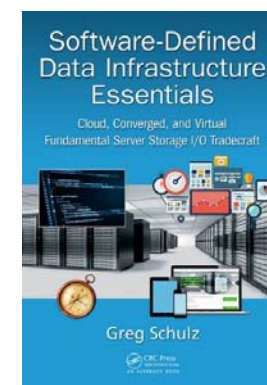
OS = Operating System; FS = File System; VM – Virtual Memory, Virtual Machine

Also keep context of NVM vs. NVMe in perspective, one is the media/medium, the other is how accessed.

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited

© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

*Refer to SDDI Essentials
Glossary for more examples*



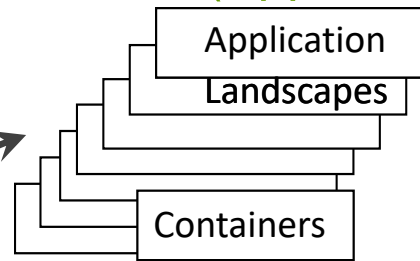
www.storageio.com/book4

Software Defined Storage and Data Infrastructures (Layering)

Protect, Preserve, Secure and Serve Information (Applications and Data)

Layers of functionality and resiliency

Data Services
Management
Abstraction



Operating Systems

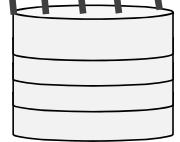
AIX, Centos, CoreOS, Nano, RHEL
SUSE, Ubuntu, Windows

Hypervisors

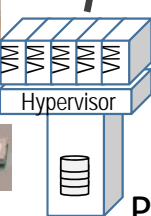
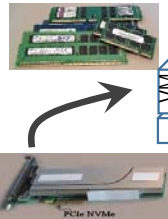
AzureStack, Hyper-V, KVM,
VMware, OpenStack, Xen

Software Defined Storage
Software Defined Networks

Ceph, ECS, Swift, vSAN
S2D, NSX and others



Storage
(NVMe, SSD, HDD)

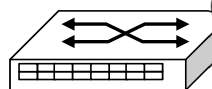


Physical Servers



Adapters

Adapters, I/O
Networks



Clouds



Value
Increases

Software Stacks
Layers (Altitude)



Defining Hardware, Software
Services into Data Infrastructures

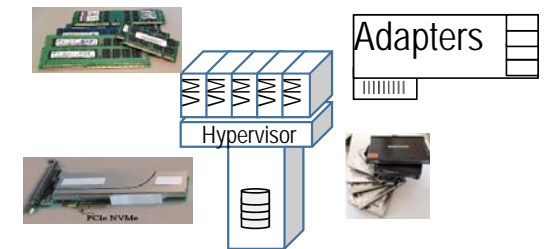
Source: Software Defined Data Infrastructure Essentials (CRC)

Storage Role in Software Defined Data Infrastructure

Where things get persisted to for some period of time

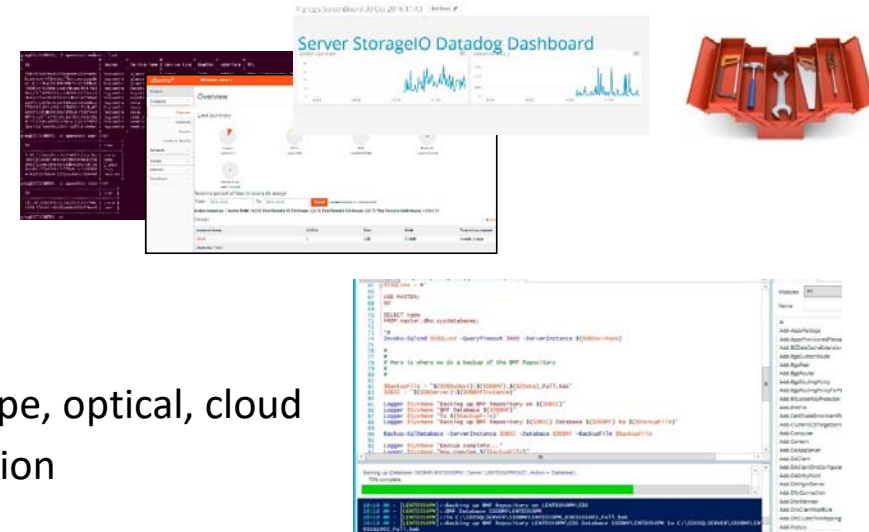
- Ephemeral (short period of time)

- Life of a server image/instance start/stop (may persist reboot)
- Temp, work, scratch or transient space
- May or may not be protected or resilient
- Can be stored on DRAM, flash or other SSD, HDD or tape (short retention)



- Persistent (longer period of time)

- Non-volatile, persists after server shutdown/startup
- Days, weeks, months, years, decades
- Fast, active, hot, warm on-line, near-line, off-line, cold
- Different levels of protection, availability, security, durability
- Can be stored on NVM, various flash and other SSD, HDD, tape, optical, cloud
- Mutable (change), immutable (worm), update, append, version



www.storageio.com/sds

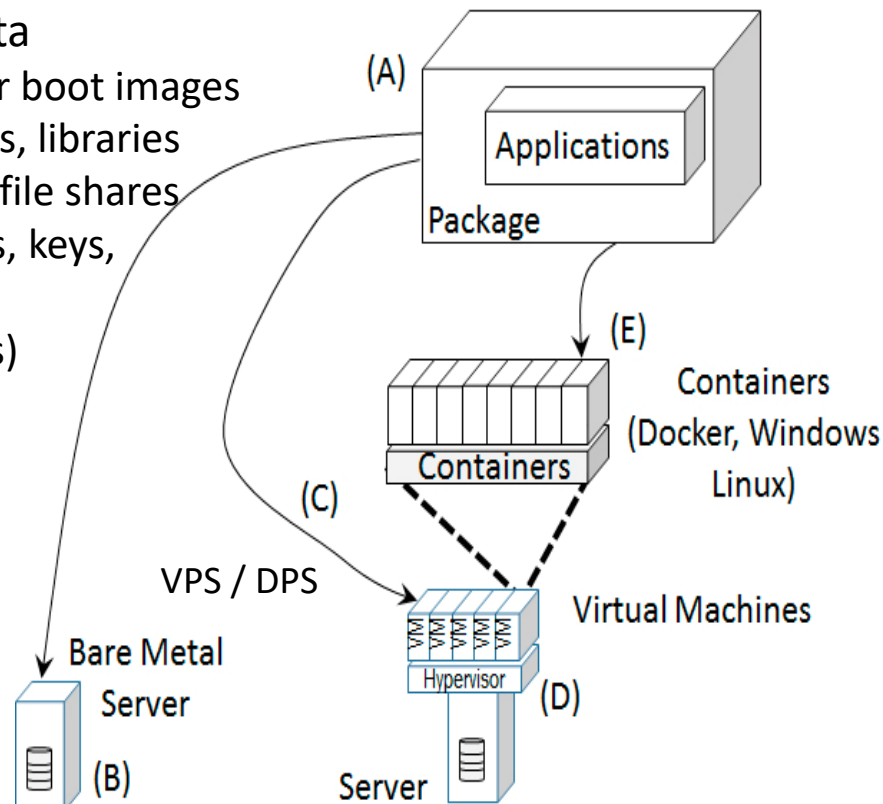
Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited

© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

Storage Role in Software Defined Data Infrastructure

Where things get persisted to for some period of time

- Servers are stateless without storage
- Where servers, networks, storage and applications save data
 - BM/PM, VM and Container boot images
 - Application programs, tools, libraries
 - Data, meta data, catalogs, file shares
 - Repos, Security certificates, keys, Configuration settings
 - Protection copies (backups)



Personality and Roles (functionality)

Tenancy Scope and Granularity
CPU, I/O, Memory, Performance
Security, Access and Space Capacity
Common or Separate Code and Namespace
Applications, Databases, Operating Systems
Hypervisors and Containers

Partitions Context
Databases, Network VLANs
Storage, Server, Operating Systems

VPS = Virtual Private Server
DPS = Dedicated Private Server
CM = Cloud Machine / Instance

Source: Software Defined Data Infrastructure Essentials (CRC)

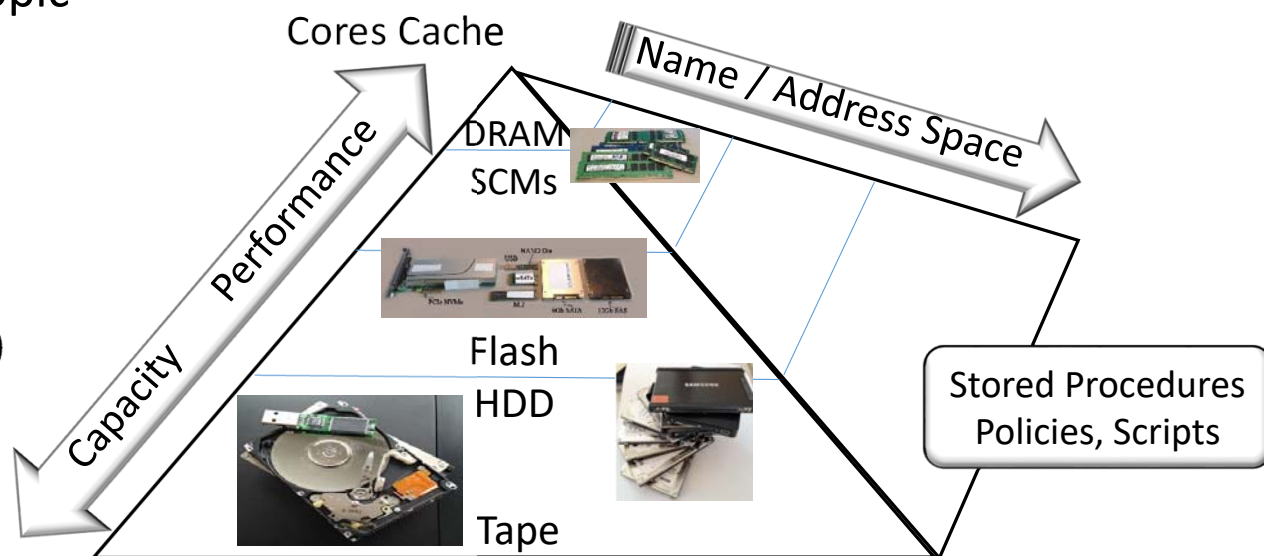
www.storageio.com/sds

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited
© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

Memory is Storage and Storage is Persistent Memory

Different Tiers, Types, Categories and Classifications of Memory along with Storage

- Address application Performance, Availability, Capacity, Economic (PACE) needs
- Various access (block, file, object, API, service)
- Different data services, features, functions
- Storage is multi-dimensional topic
- From components to solutions
- Hardware to software
- Legacy to clouds
- Various media
 - Semiconductor (NVM, Flash, SCM)
 - Magnetic (HDD, Tape)
 - Optical



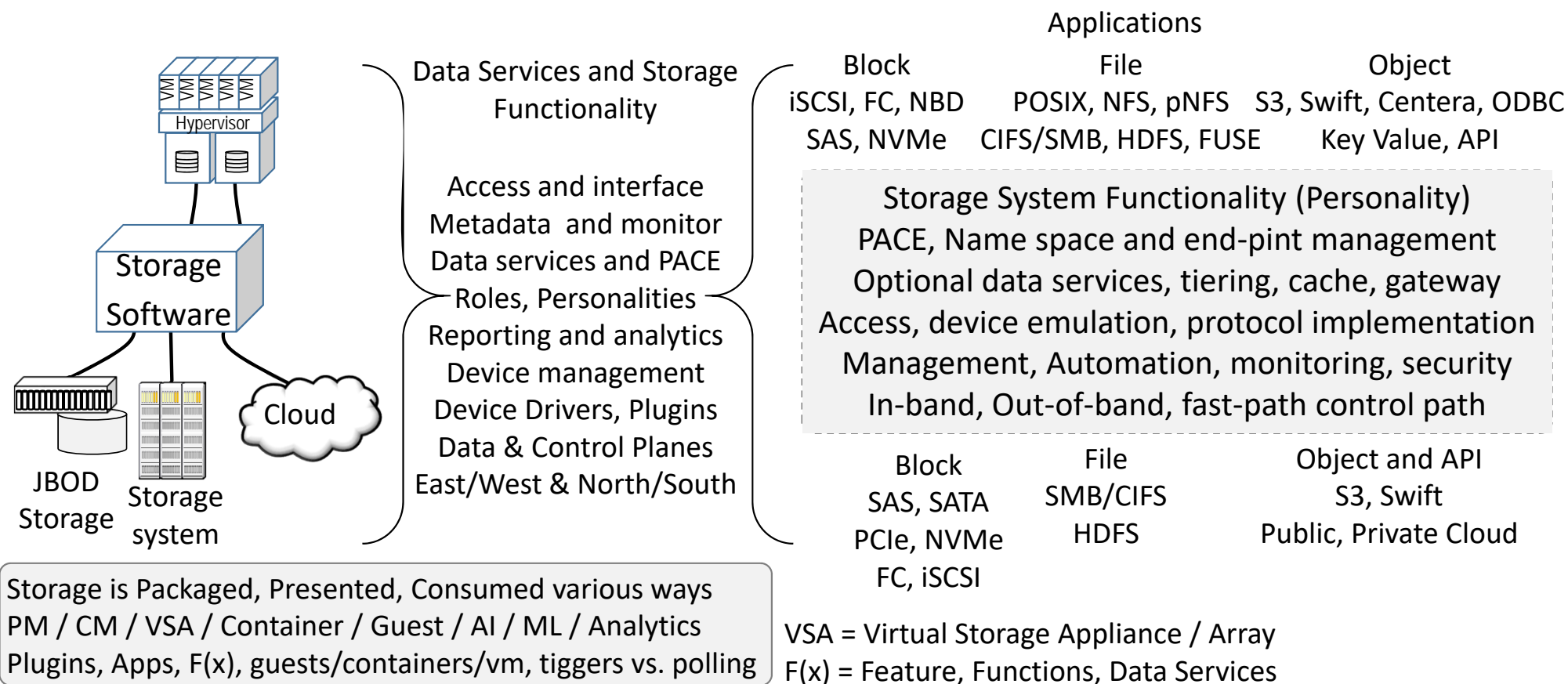
www.thessdplace.com www.thenvmeplace.com www.storageio.com/hdd www.objectstoragecenter.com

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited

© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

Common Storage Attributes Across Data Infrastructures

Internal Dedicated DAS, External Shared DAS, SAN, NAS, Container, Object, Cloud



www.storageio.com/sdc2017

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited
© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

Source: Software Defined Data Infrastructure Essentials (CRC)

Different Types of Data Infrastructure Storage Solutions

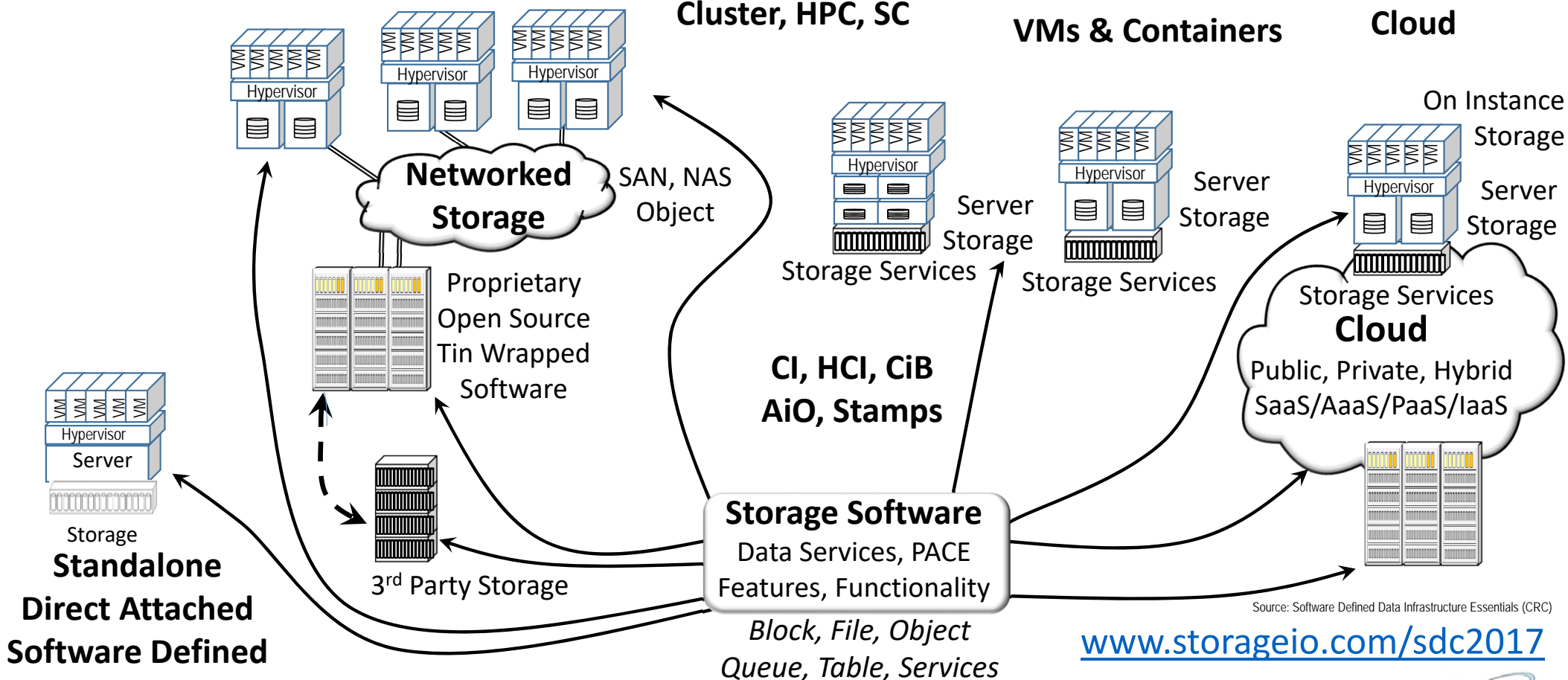
Internal Dedicated DAS, External Shared DAS, SAN, NAS, Container, Object, Cloud

Servers and Virtual Servers

Cluster, HPC, SC

VMs & Containers

Cloud



Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited
© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

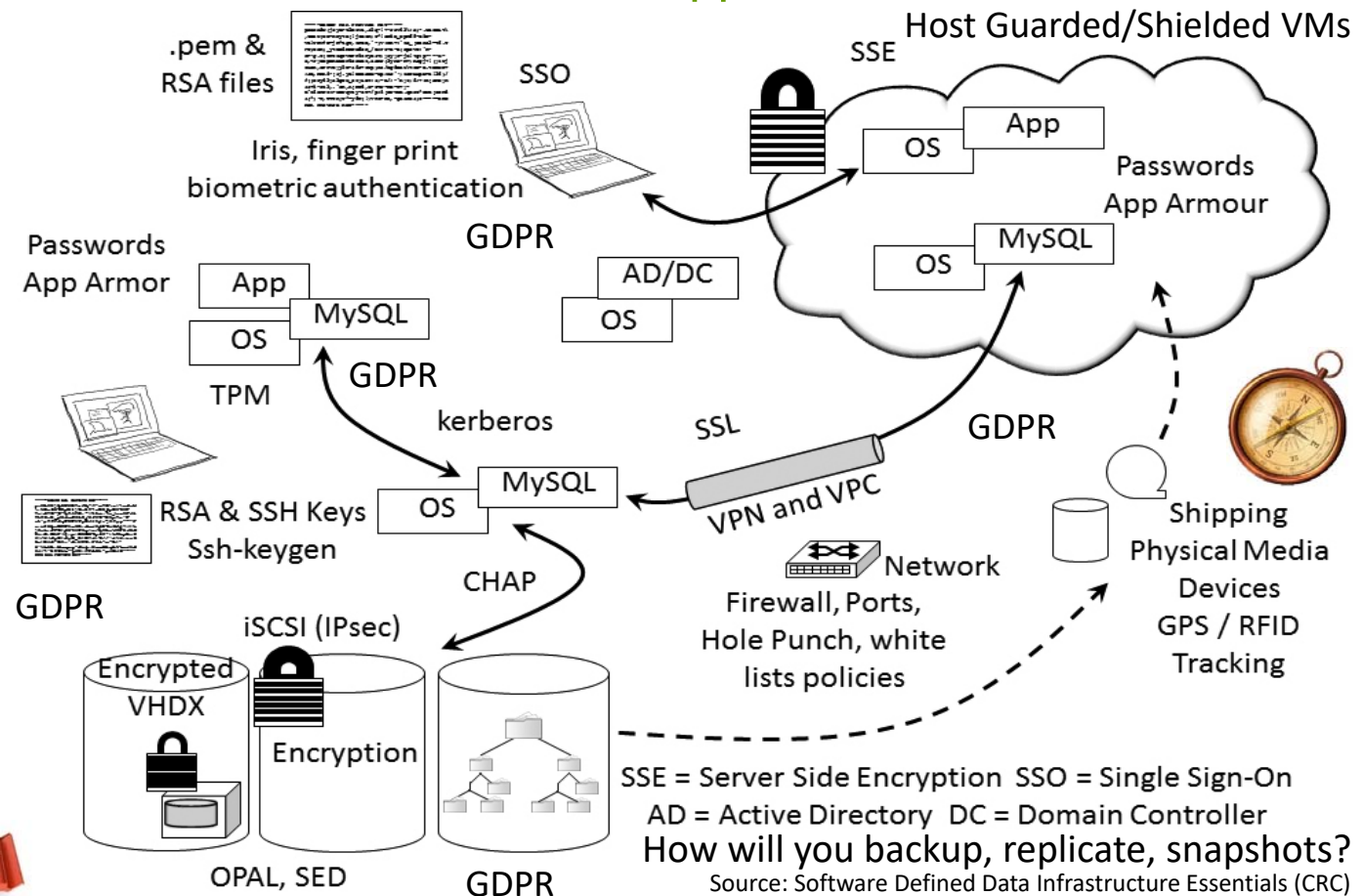
Industry Trends: Software Defined Data Protection and Security

How will you protect, preserve, secure as well as serve applications and data?

Considerations

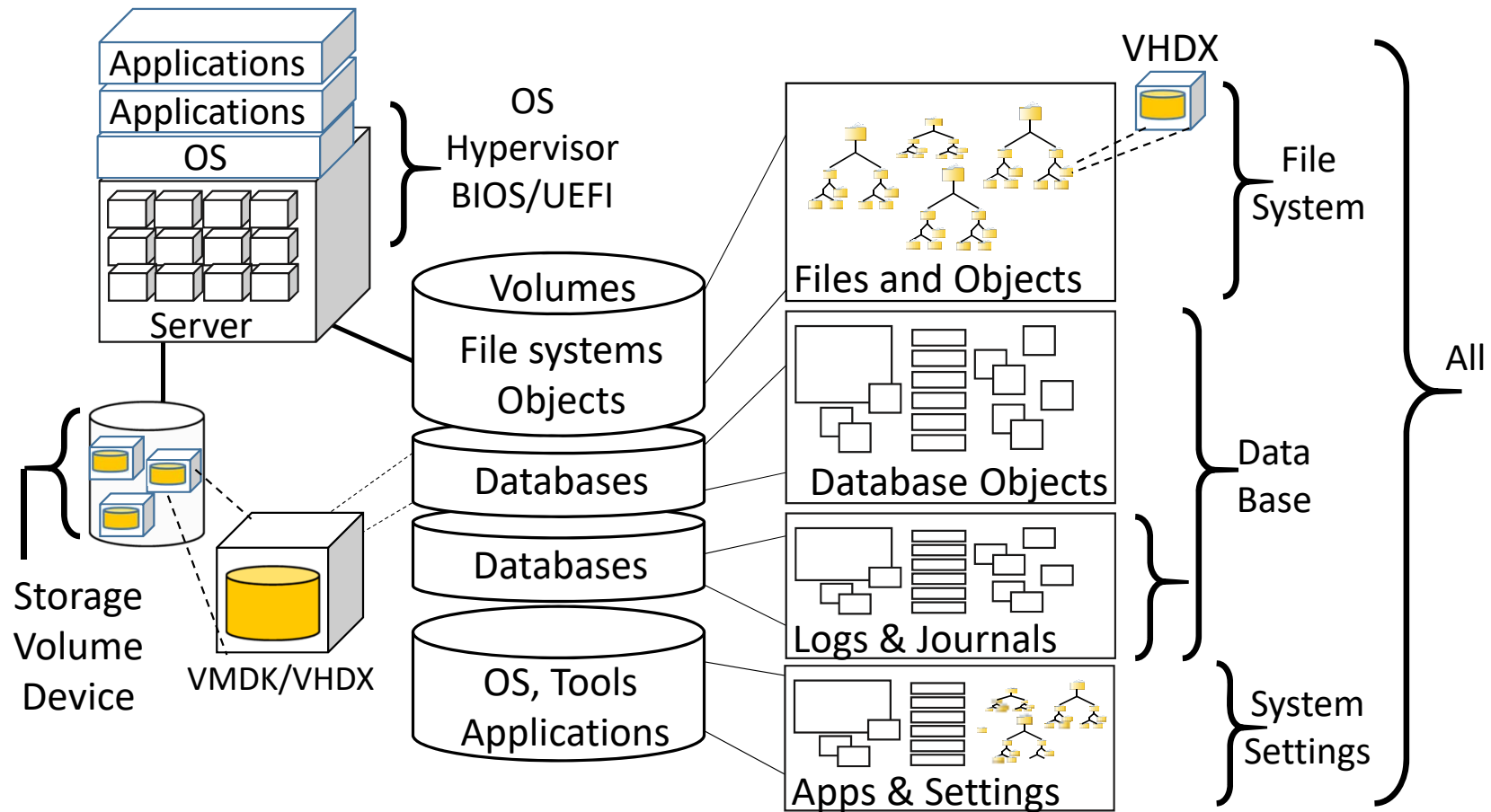
- What are threat risks?
- What needs protection?
- What level of protection?
- How and where to protect?
- Processes, rules and policies
 - What exists, what is needed
 - Shared responsibilities
 - Mobile, ByoD, Legacy, IoT
 - AD, IAM, SSO integration
 - IDS/IPS, AI, ML, SSE, SAS
 - Encryption at rest/ in-flight
 - Host Guarded/Shielded VMs
 - Secure disposition (shred)

Bitlocker, truecrypt, axcrypt



Software Defined Data Protection Management

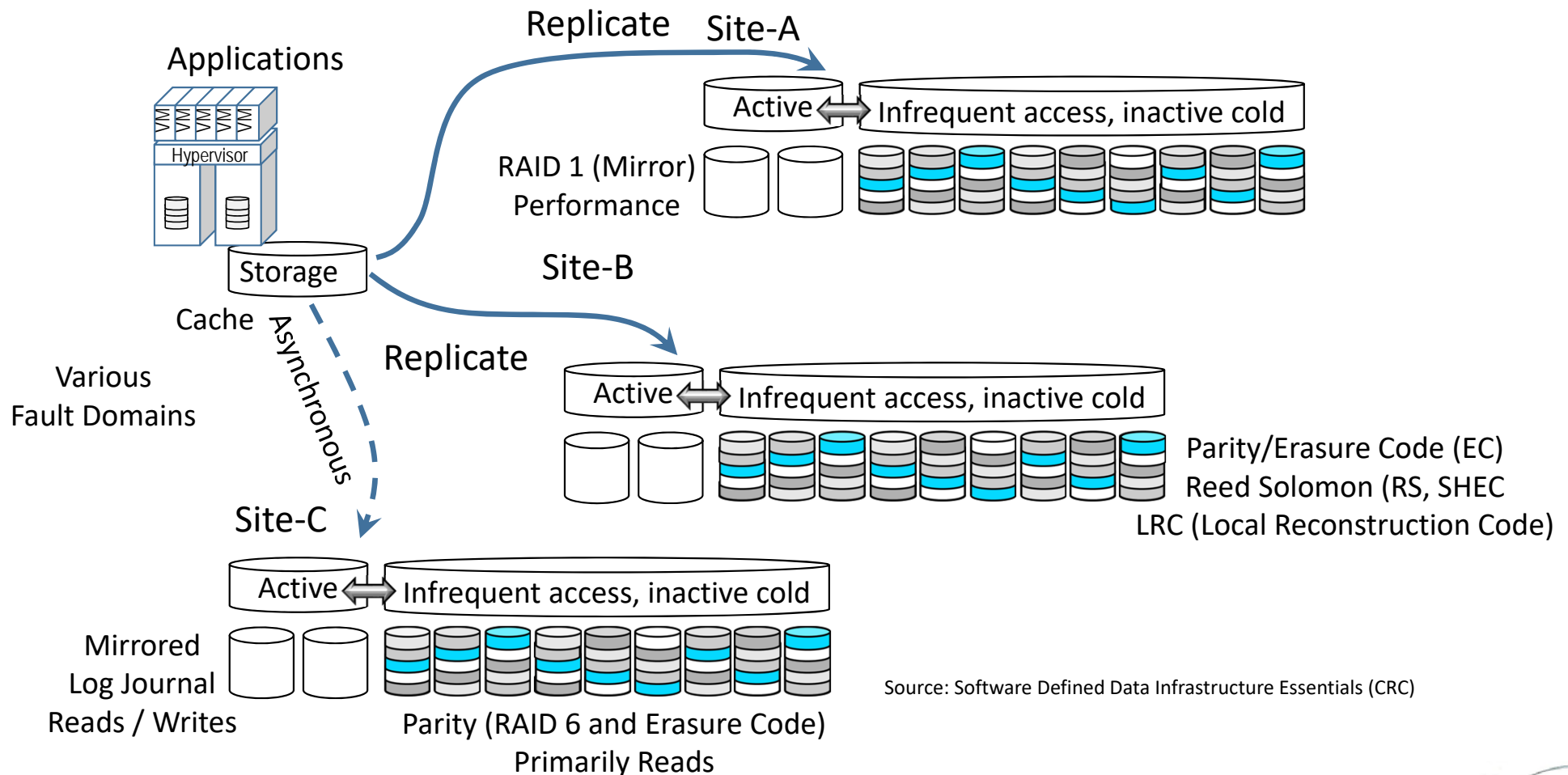
Various Protection Points, Granularity, Frequencies, Why Treat Everything The Same?



Source: Software Defined Data Infrastructure Essentials (CRC)

Storage Decision Making – Data Protection Availability & Durability

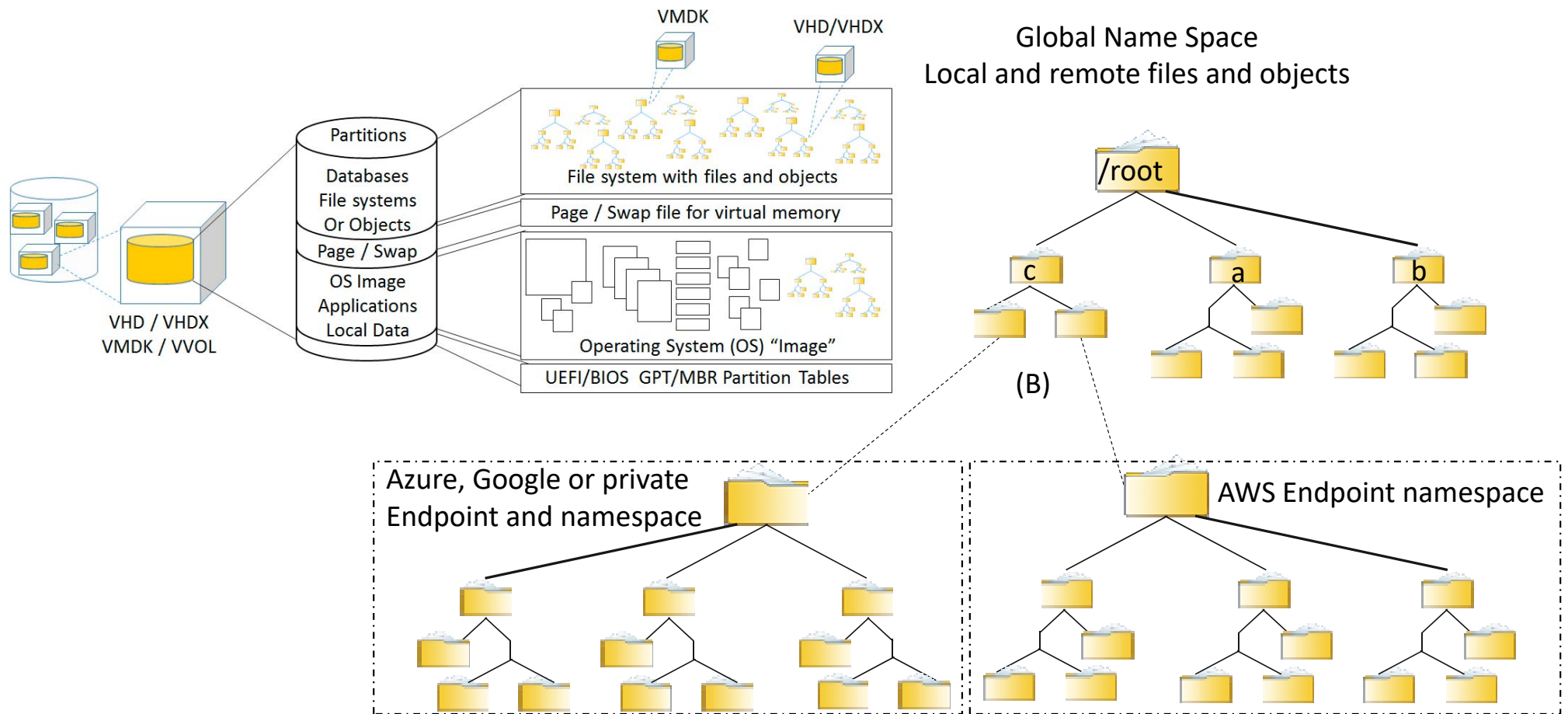
Using New and Old Things In New Ways - Balancing PACE



Source: Software Defined Data Infrastructure Essentials (CRC)

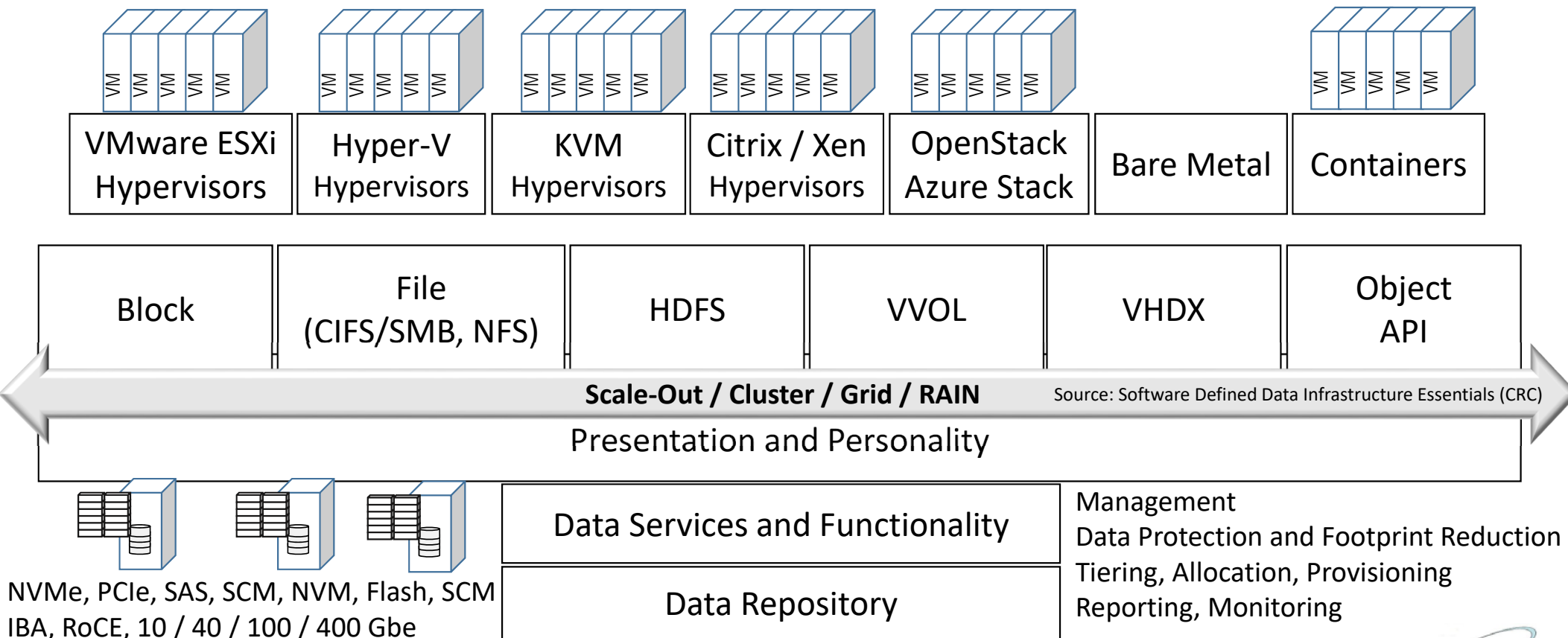
Software Defined Storage and Data Infrastructures Names Spaces

Different Layers and Abstraction of Storage and Underlying Storage Media (devices)



Software Defined Data Infrastructure and Storage

Putting IT All Together (HW, SW, Cloud Services, Tools and Management)



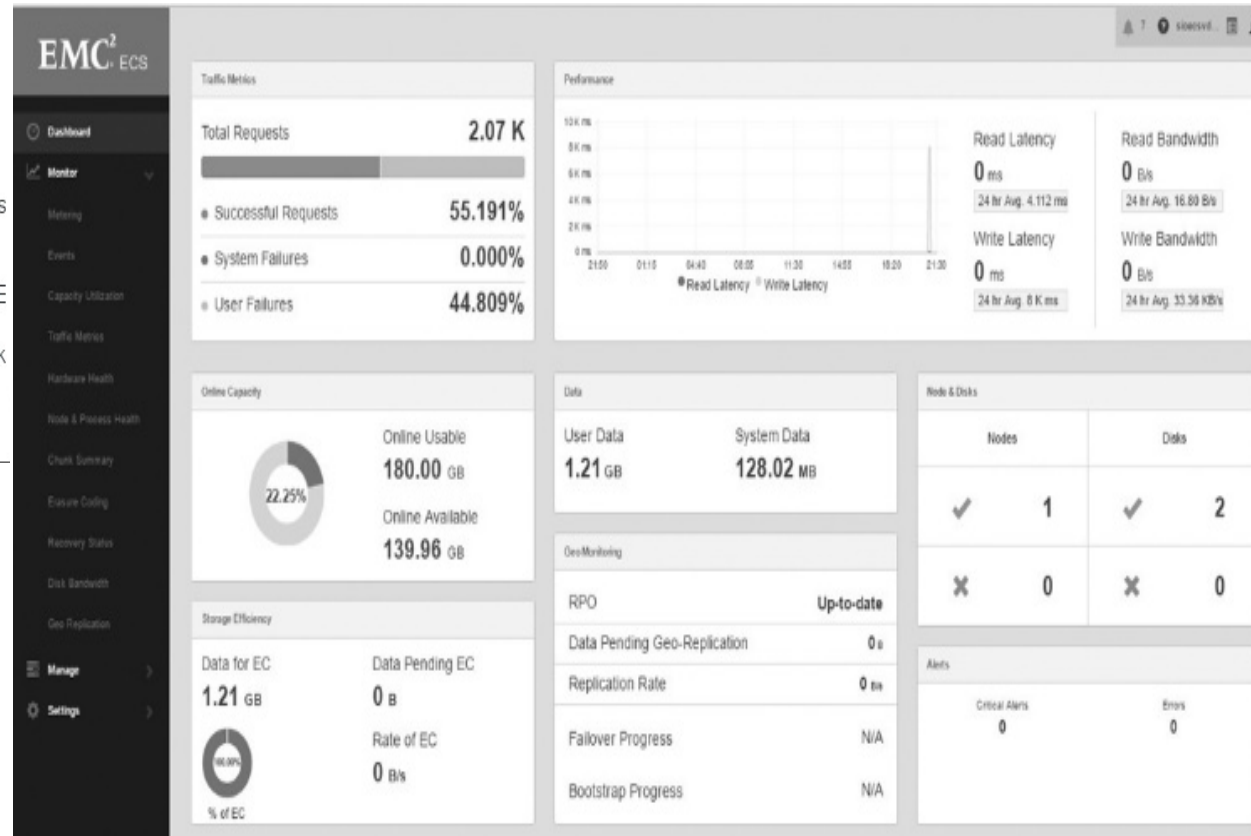
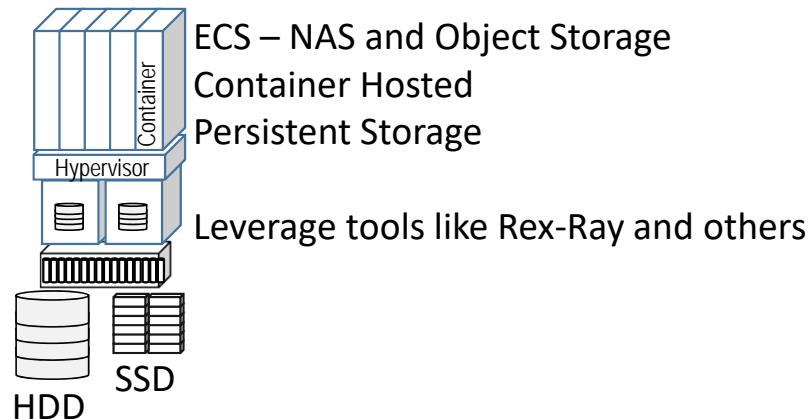
Source: Software Defined Data Infrastructure Essentials (CRC)

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited
© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

Industry Trend – Containers Hosting Software Defined Storage

Software Defined Storage (application and data) hosted via Containers with Persistent Storage

```
[greg@192 ecs-single-node]$
[greg@192 ecs-single-node]$ sudo docker images
REPOSITORY          TAG                 IMAGE ID            CREATED
docker.io/emccorp/ecs-software-3.0.0   latest             6bb2d293cc8b       3 weeks ago
docker.io/emccorp/ecs-software-3.0.0   latest             6bb2d293cc8b       3 weeks ago
docker.io/hello-world                   latest             c54a2cc56cbb        4 months ago
[greg@192 ecs-single-node]$ sudo docker ps -a
CONTAINER ID        IMAGE               COMMAND             CREATED
d064c43a1010       emccorp/ecs-software-3.0.0:latest   "/opt/vipr/boot/boot."   2 week
ago                Exited (1) About a minute ago       ecsstandalone
[greg@192 ecs-single-node]$
[greg@192 ecs-single-node]$
```

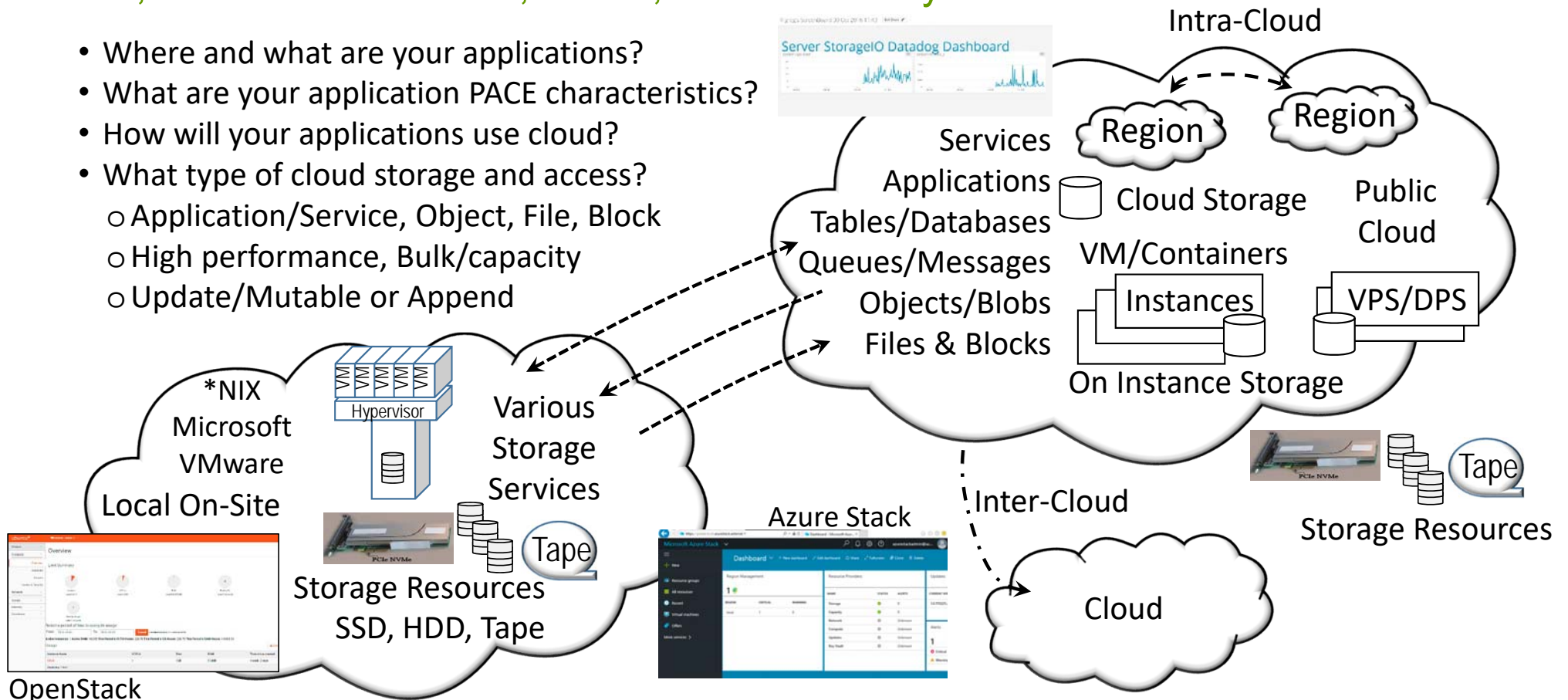


Source: Software Defined Data Infrastructure Essentials (CRC)

Cloud Storage Decision Making – What Are Your Requirements?

Local, On-site/On-Premise, Public, Private and Hybrid-Cloud

- Where and what are your applications?
- What are your application PACE characteristics?
- How will your applications use cloud?
- What type of cloud storage and access?
 - Application/Service, Object, File, Block
 - High performance, Bulk/capacity
 - Update/Mutable or Append



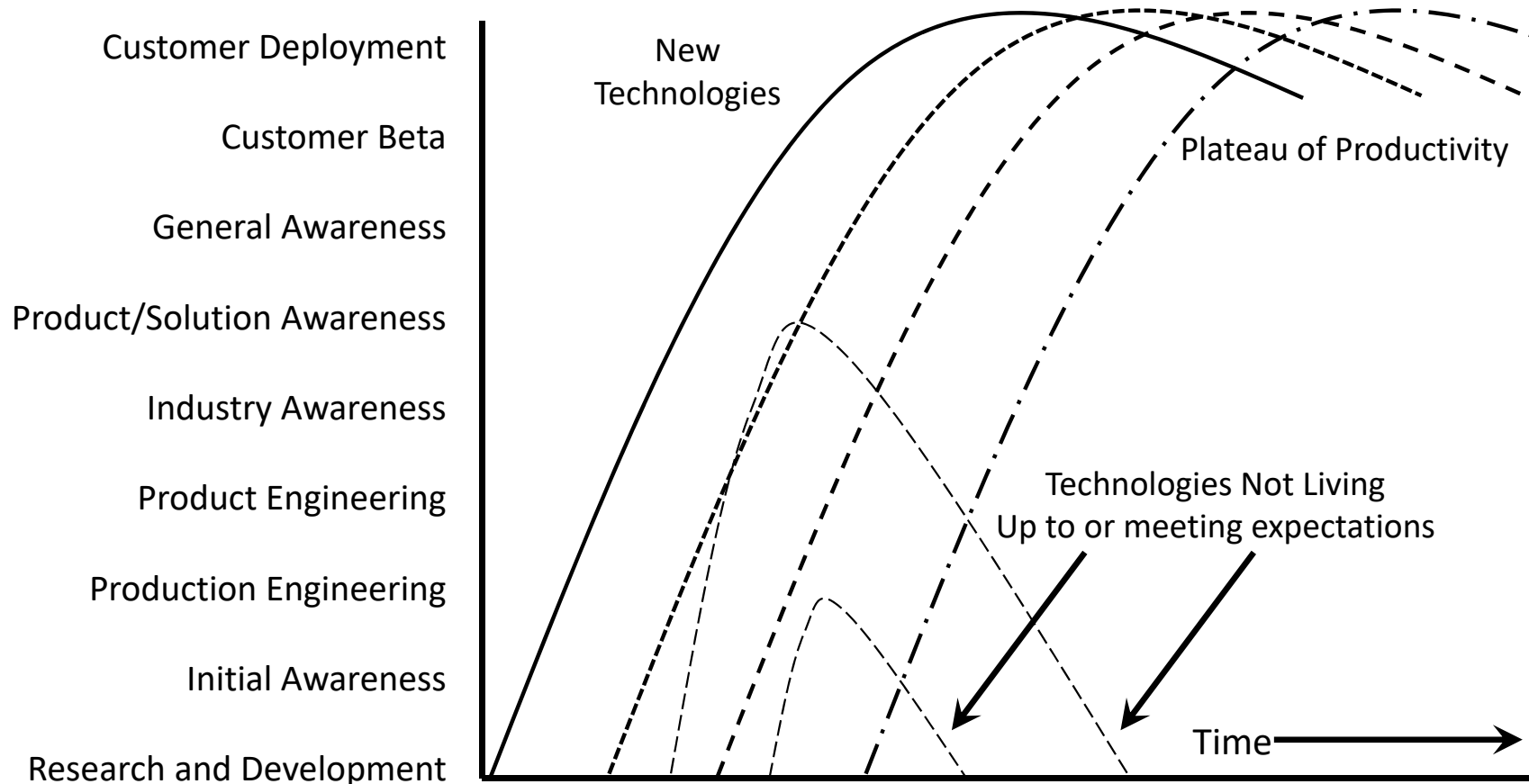
PACE = Performance, Availability, Capacity, Economics

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited

© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

Industry Trends and Different Timelines

Everything Is Not The Same Across Different Focus Areas and Audiences



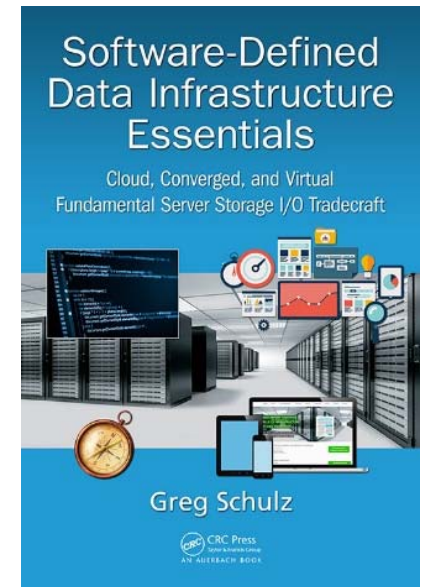
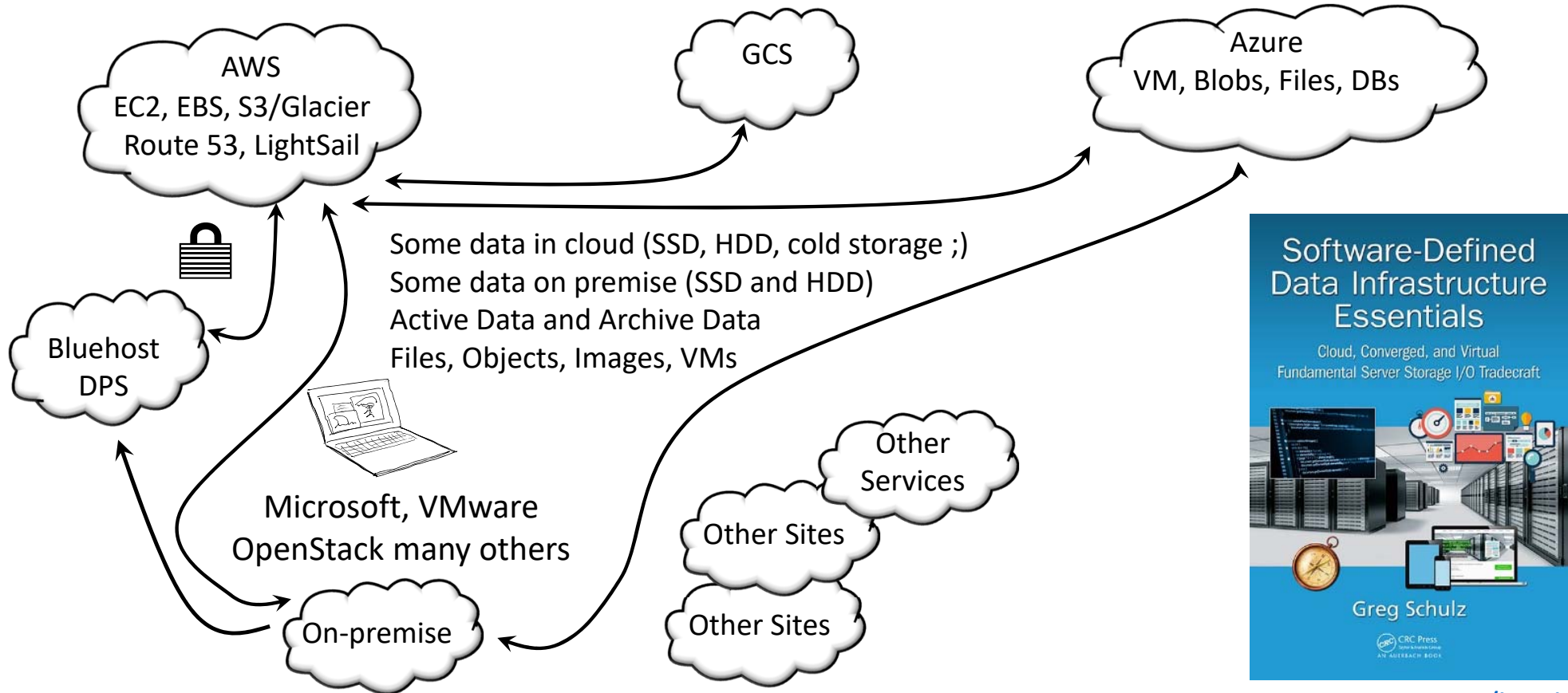
Source: Software Defined Data Infrastructure Essentials (CRC)

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited

© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

An example: My Hybrid Cloud and SDDI Environment

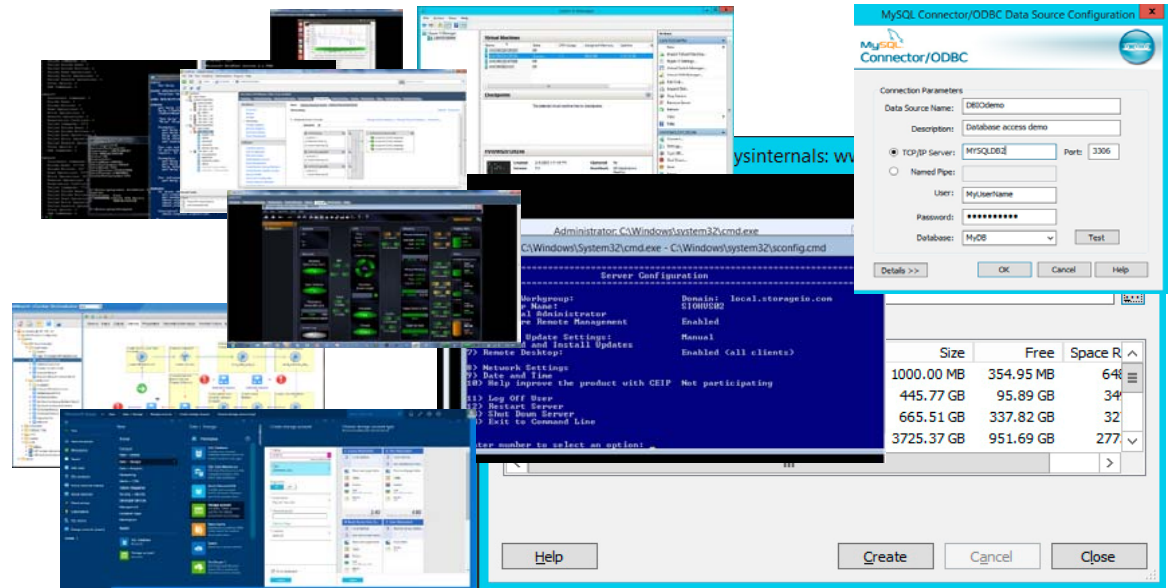
Storage Played Various Roles – Supporting My New Book Project



www.storageio.com/book4

Tools In My Data Infrastructure Toolbox

Hardware, Software, Devices, Scripts and More



Physical, Virtual, Containers
Cloud and Software Defined
Books, run books, scripts and tips
Cloud, virtual, container, physical



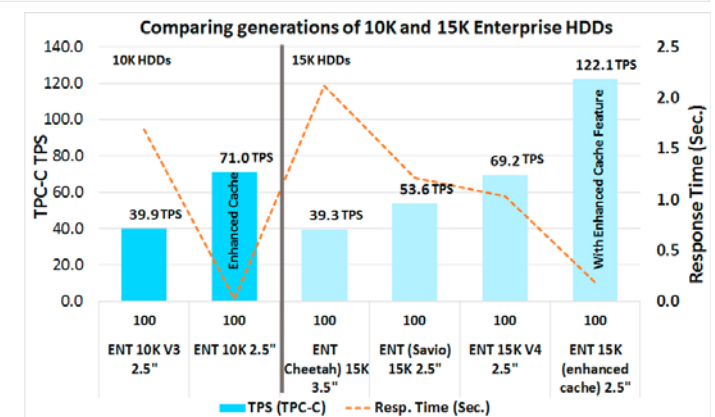
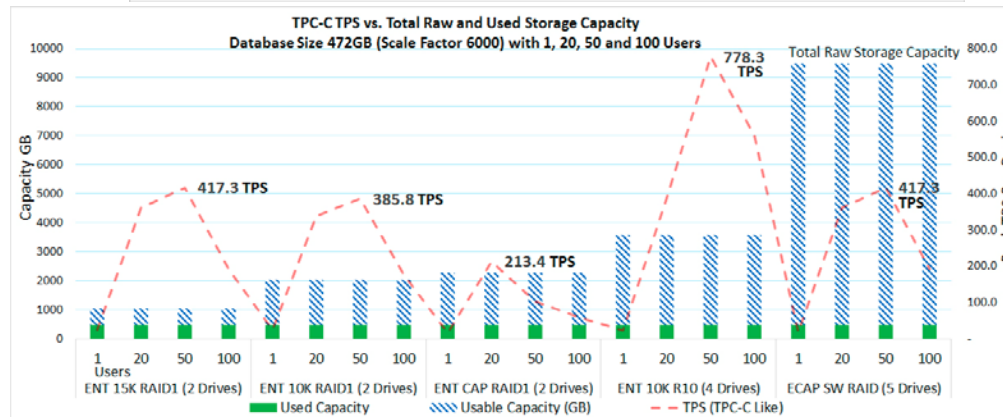
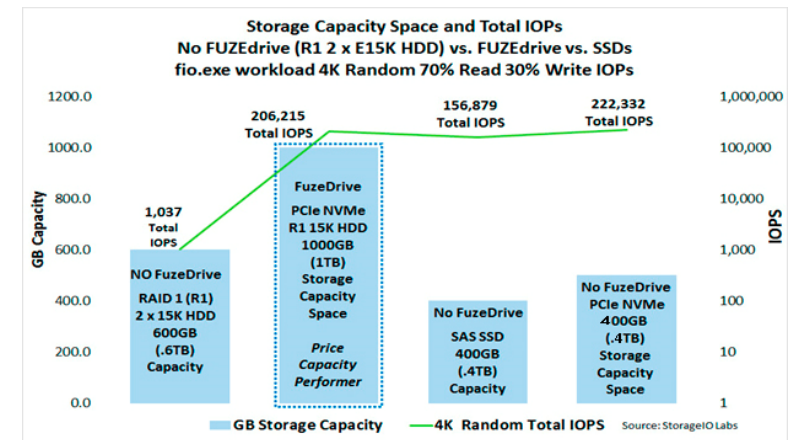
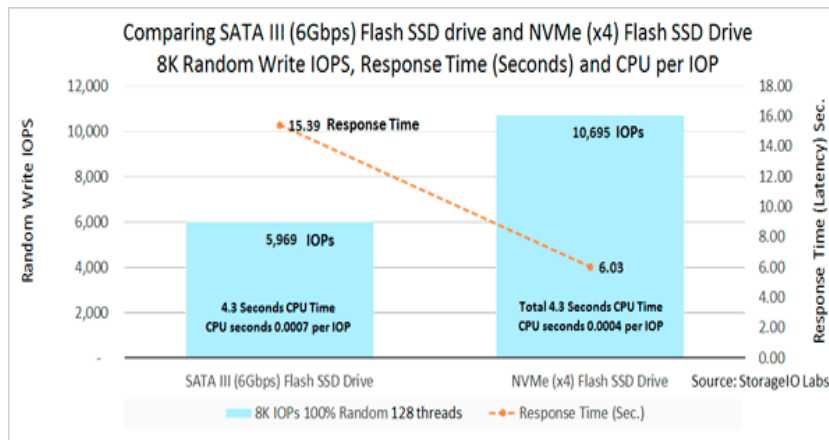
Data Infrastructure Tool Box

Hardware, Physical Tools, Cables
Connectors, Adapters, Storage
Servers and Management Software

Source: Software Defined Data Infrastructure Essentials (CRC)

Industry Trends: Software Defined Performance & Simulation

Everything Is Not The Same, Use The Applicable Workload and Tool



Tools In My Data Infrastructure Toolbox

Hardware, Software, Devices, Scripts and More

Benchmark and workload simulation

- General I/O (block, some file) Diskspd, fio, vdbench (and various harnesses for block and file) plus iorate, iometer, iозone
- HPC style parallel file (e.g. Lustre) IOR among others
- S3 Object (e.g. Not Lustre or HCP) Cosbench among others
- Databases (SQL/NoSQL) Benchmark Factor (BF), Hammer, SLOB, sysbench, YCSB and others

Others Login VSI, Moss (Sharepoint), Jet (Exchange), VDMark, HCIbench

www.objectstoragecenter.com

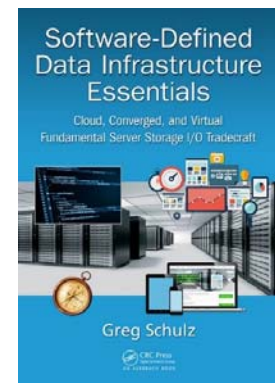
www.thenvmeplace.com

www.thessdplace.com

www.storageio.com/sds

<http://storageioblog.com/server-and-storage-io-benchmarking-resources/>

*Refer to SDDI Essentials
Glossary for more examples*



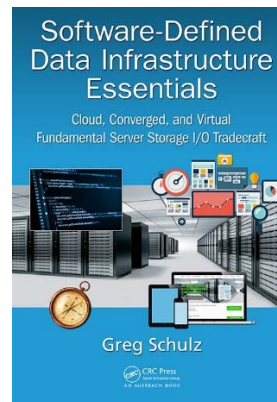
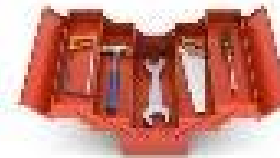
www.storageio.com/book4

Closing comments, for now...

Everything is not the same, use right tool, technology technique for task at hand

Expand your Data Infrastructure and Storage Tradecraft Experiences

- Everything is not the same, why treat everything the same?
 - ✓ Avoid flying blind, have awareness into adjacent technologies
 - ✓ Understand context of topics, terms, technologies, techniques
- Software Defined emphasis should be on “Defined”
 - ✓ How “things” defined, composed, crafted, programmed for an outcome
 - ✓ HW needs SW, SW needs HW, serverless and clouds needs HW & SW
- What you can do today:
 - ✓ Learn lessons of past to prevent future mistakes
 - ✓ Do a POC, gain insight, awareness and experience, have fun



www.storageio.com/book4.html

Where to learn more

- www.storageio.com/sdc2017 for a copy of this presentation
- www.storageio.com (articles, videos & webcasts)
- Feel free to call, IM, tweet, or email greg@storageio.com



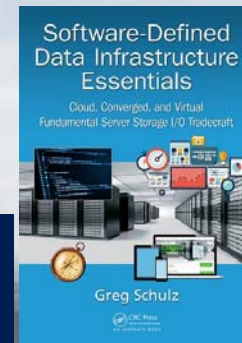
Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited
© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO

Software Defined Data Infrastructures (SDDI) and the Role of Storage

Everything Is Not The Same

www.storageio.com/sdc2017

Industry Trends Perspectives



SNIA SDC 2017

Presented by Greg Schulz Server StorageIO™

Greg@storageio.com | StorageIOblog.com | Facebook.com/StorageIO | @storageio

Licensed for use by SNIA SDC 2017. Any other use, copy or reproduction without StorageIO written permission is prohibited
© Copyright 2017 Server StorageIO® and UnlimitedIO LLC All rights reserved. www.storageio.com @StorageIO