



# NaaS & NetApp

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# X as a service (XaaS)

**dir** - Yahoo  
**find** - Google  
**rcp** - Dropbox  
**man** - stackoverflow  
**w** - twitter, facebook  
**finger** - LinkedIn  
**l** - IFFT, Zapier  
**sudo** - GCHQ, NSA

# It's all about Service Level Objectives

No presentation is complete without a definition copied from Wikipedia

- A **service level objective (SLO)** is a key element of a service level agreement (SLA) between a **service provider** and a **customer**.
- SLOs are agreed as a means of **measuring the performance of the service provider** and are outlined as a way of avoiding disputes between the two parties based on misunderstanding.
- The SLO may be composed of one or more **quality-of-service measurements** that are combined to produce the SLO achievement value.

# In other words...

- Customer has a set of workloads
- Customer has some expectation about the performance these workloads need to be executed at

# In the past...

- For *each* workload
  - Define SLO
  - Talk to “experts” about sizing
  - Buy sufficient compute, networking, storage for the workload
  - Deploy & monitor
  - Upgrade hardware if SLO or workload changes
- Result
  - Collection of underutilized physical resources
  - Costly, esp. with redundancy/fault-tolerance added in
  - Diverse IT staff expertise required (“server guy”, “network guy”, “storage guy”, “db guy”)
  - But: SLOs were relatively easy to meet and workloads were isolated

# Enter virtualized infrastructures

- Customer deploys a lot of uniform white-box compute, network, storage
- Add some sort of datacenter OS (OpenStack, VMware, etc.)
- **Goal: run all workloads here**
- Cost savings! Yay!
- **But SLOs still matter (actually, matter *more*)**
  - Customer performance expectations derive from past bare-metal deployments
  - But want to run physical resources at higher utilization levels – harder to maintain
  - Still want isolation between workloads
  - Need to be able to diagnose *and fix* SLO issues (“why is this slow?”)
  - Multi-tenancy and always-on encryption add additional challenges
- **Goal: SLO-based management of workloads in virtualized infrastructures in a way that spans compute/network/storage**

# NaaS is the network part of this problem

Well, to me at least

- Compute virtualization farthest ahead (and maybe also easiest)
- Networking being looked at now
- Storage is last (and maybe also hardest)
  - Cost of NAS access no longer equal to cost of DAS access (probably also SAN)
- Storage hierarchy getting deeper
  - Past: DRAM – DAS/NAS/SAN – tape
  - Now: DRAM – flash – DAS/NAS/SAN – tape – cloud
  - Soon: DRAM – NVRAM – flash – NAS/SAN – archive disk – tape – cloud
- New apps (in-memory computing, etc.)
  - File/block abstractions less and less relevant
- **Open question: data management in such a world**