COMPUTERWORLD | **SNIA**
SNW

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A New Storage Model for the Cloud

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What's a Cloud
(other than a marketing term)?

- Next (maybe final) step towards treating computing as a Utility
  - Fungible compute & storage resources
  - Someone else owns the means of production – you rent capability
  - Make computing analogous to electricity, telephone, WAN
- Uniquely among Utilities, it contains persistent state (e.g. your data)!

Benefits of Clouds

- To the User:
  - No CapEx, maintenance, or admins
  - Pay only for what you use
  - No power, cooling, or footprint issues - just grow

- To the Cloud Provider:
  - Better control over utilization
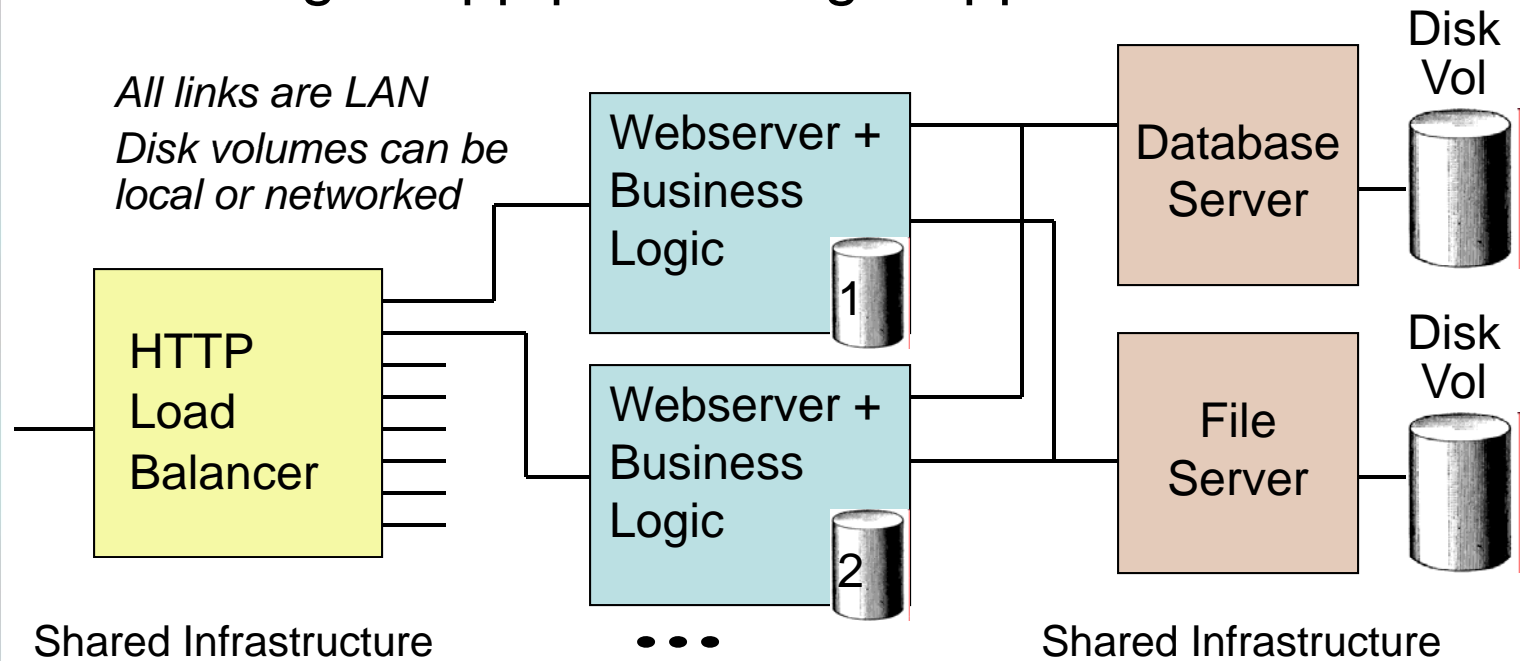 - Statistically predictable growth

Clouds = Virtual Everything

- Virtual servers host applications
  - Scalable application deployment
  - Auto-redeployment on server failure
  - Pay as you go (charge per MB-sec)
- Virtual storage servers hold data
  - Dynamic capacity, pay as you go
- Virtual networks connect the pieces
  - VLANs, FC switch zones, etc.
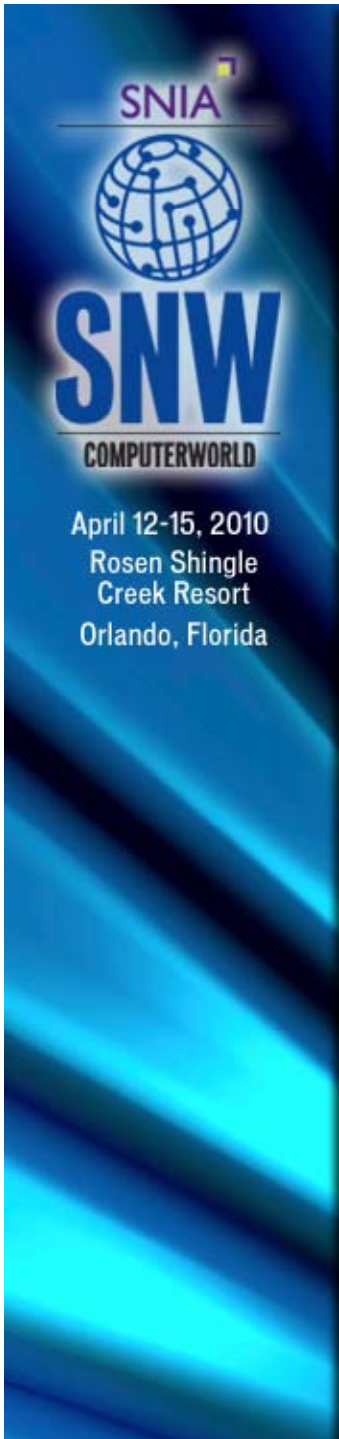
Example App: Web site

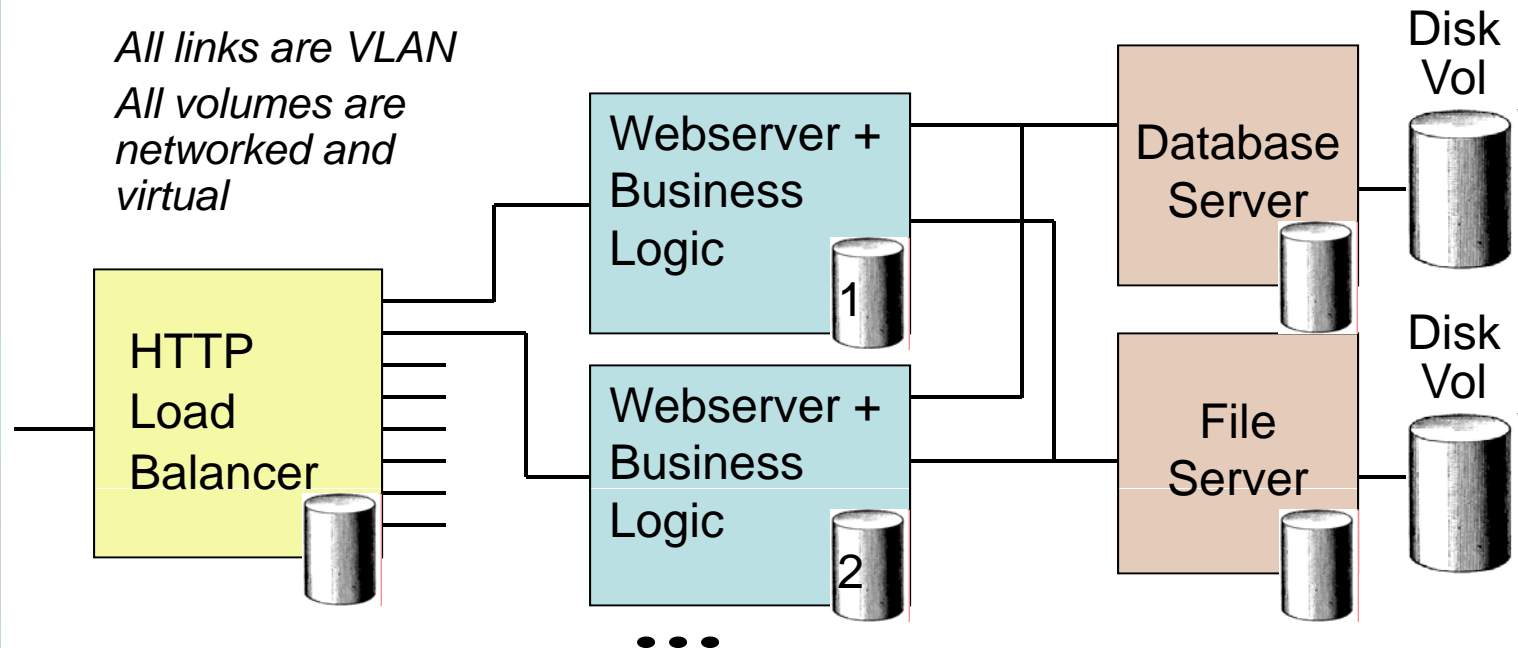- An application is more than its business logic – it needs its own infrastructure as well
- External database and file servers allow scaling of app past a single app server

All links are LAN
Disk volumes can be local or networked

Webserver + Business Logic — 1

Webserver + Business Logic — 2

HTTP Load Balancer

Database Server — Disk Vol

File Server — Disk Vol

Shared Infrastructure

Shared Infrastructure

Cloud Deployment of Example App

- For security and simplified management, all infrastructure becomes application-unique
- Each box represents a virtual machine with its own boot volume, instantiated just for this app

All links are VLAN

All volumes are networked and virtual

HTTP Load Balancer

Webserver + Business Logic 1

Webserver + Business Logic 2

Database Server

File Server

Disk Vol

Disk Vol

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Characteristics of Cloud

- Server utilization increases due to dynamic load balancing
- App components move around
  - Added / removed for scaling
  - Redeployed on server failure
- App-to-storage binding is dynamic
  - Boot volumes created on demand
  - App has "no fixed address"

Storage in the Cloud

- All persistent storage provided by networked, virtualizing storage controllers
- VM boot volumes provided by clones or snapshots of master copy
  - Copied to server internal drive (if any) or shared on network
  - Controller must provide efficient snapshot/clone facility if boot volume shared

Cloud Storage Implications

- Load on storage controller goes UP
  - Better server utilization ->
    more IO per server
  - Needs to handle boot volume I/O as
    well for diskless servers (e.g. blades)
- Disk volumes are more dynamic
  - Boot volumes created and destroyed
    as needed
  - Boot volume create times add to
    application startup time

Cloud Management

- Cloud Manager controls all aspects of virtualization needed to deploy applications
  - Creates Guest VMs for components
  - Creates boot volumes from master, adding appropriate software images
  - Binds persistent storage to app
  - Creates VLAN to connect components
  - Monitors servers and their loads, moves/adds/deletes VMs as needed

Cloud Mgmt Standards

- Open Cloud Computing Initiative (OCCI) from the Open Grid Foundation provides a standard way to create VMs and link resources to them
- Cloud Data Management Initiative (CDMI) from SNIA provides a standard way to create data volumes (containers) in a cloud.
- OCCI and CDMI interoperate – OCCI recognizes CDMI containers as resources and can link them to VMs.
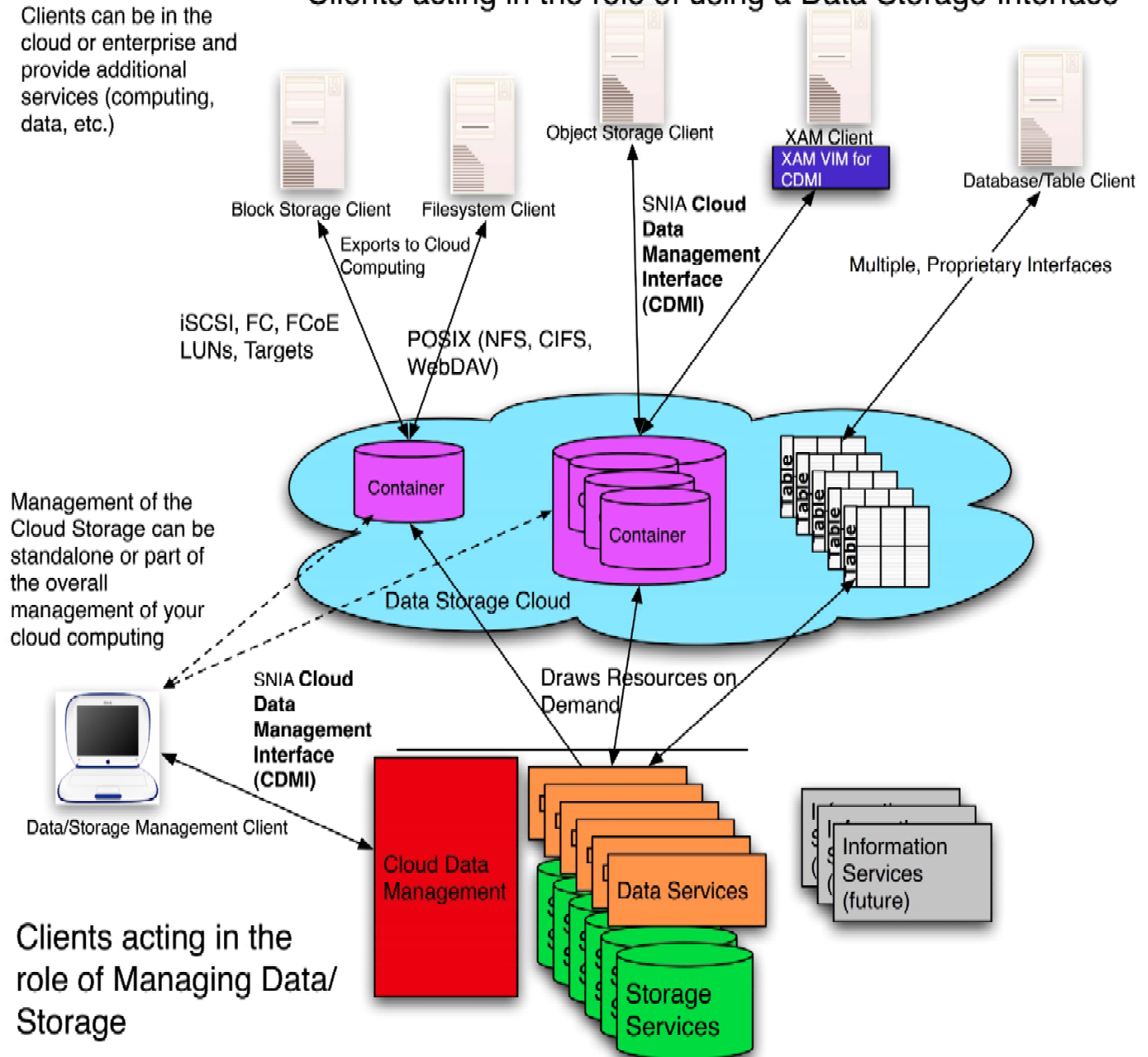
CDMI

- Is a RESTful interface (as is OCCI)
- Defines classes of objects
  - Data Object: analogous to a file (but can be served with a block protocol)
  - Container: analogous to a directory (with inheritance of attributes)
  - Domain: specifies users & billing info
  - Queue: used for notifications, logs
  - Capability: permits associated operation on other objects

Clients acting in the role of using a Data Storage Interface

Clients can be in the cloud or enterprise and provide additional services (computing, data, etc.)

Object Storage Client

XAM Client
XAM VIM for CDMI

Database/Table Client

Block Storage Client   Filesystem Client

Exports to Cloud Computing

SNIA **Cloud Data Management Interface (CDMI)**

Multiple, Proprietary Interfaces

iSCSI, FC, FCoE LUNs, Targets

POSIX (NFS, CIFS, WebDAV)

Container

Container

Table

Management of the Cloud Storage can be standalone or part of the overall management of your cloud computing

Data Storage Cloud

SNIA **Cloud Data Management Interface (CDMI)**

Draws Resources on Demand

Data/Storage Management Client

Cloud Data Management

Data Services

Information Services (future)

Clients acting in the role of Managing Data/ Storage

Storage Services

What's a RESTful interface?

- REST (REpresentational State Transfer) is a set of principles for manipulating objects on the Web.
- RESTful objects all have their own URI and a set of attributes (key-value pairs)
- RESTful methods are limited to the basic HTML operations (GET, PUT, POST, DELETE, etc) with standard HTML responses (e.g. 404 = object not found).
- RESTful interfaces are replacing WBEM interfaces for management protocols, as they are simpler and easier to aggregate

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