Cloud Seeding

Some Practical Methods for Moving Data between the Enterprise and the Cloud

Chris Dunder and Gradimir Starovic

Symantec, SAMG
Outline

- Why we are looking at clouds
- Amazon AWS storage services
- Symantec products we used
- Cloud storage as a tier
- Replication and failover between on-premise and cloud
- Things we learned while using cloud storage
- Things to try next
Why cloud storage

- There is obviously a wave of interest in clouds among users and product/service providers.

- Some of the potential benefits:
  - on demand capacity, massive scale
  - pay as you go
  - reduced need for IT staff and premises
Why cloud storage

- And some concerns, such as
  - security
  - availability
  - performance
  - integration with the legacy applications and data
Assumptions

- Cloud-based computing and storage will co-exist with other, traditional ways of provisioning

- Options for applications and data, to be
  - both on-premise or both in cloud
  - one on-premise and the other in cloud
  - in two different clouds
This talk

- About ongoing prototyping work
- Exploring feasibility and finding the limits
  - applications on-premise and using cloud storage
  - failover between on-premise and cloud
  - using existing products (Veritas Storage Foundation and Cluster Server) to migrate or replicate data, monitor/failover applications
  - using AWS storage
Using Amazon AWS storage

- For pragmatic reasons, seems to be more mature and widely used at the moment than other public clouds

- Looking at both Elastic Block Storage (EBS) and Simple Storage Service (S3)

- Would like to do similar experiments with other clouds
Symantec products used

- Storage Foundation (SF), enterprise-class management for online data
  - Veritas Volume Manager (VxVM), host-based disk virtualization - Windows & UNIX/Linux
  - Veritas Volume Replicator (VVR), network data replication for SF - Windows & UNIX/Linux
  - Veritas File System (VxFS), advanced-feature file system - UNIX/Linux
  - Veritas Dynamic Storage Tiering (DST) – Unix/Linux
Symantec products used

- Veritas Cluster Server (VCS)
  - Shared storage clusters supporting application failover within a data center and campus-wide
  - Global Cluster Option (GCO), extending failover across distances spanned by WAN
- Windows & UNIX/Linux
Storage Foundation (SF) in the cloud
Storage Foundation in the cloud

- Single machine in cloud
- Includes VxVM and VxFS; Basic functionality ok
- Xen kernel
- EBS devices respond to only some SCSI commands
- Single path to all EBS devices
  - No Dynamic Multipathing (DMP)
  - DMP is irrelevant to performance w/ EBS
    (160-400Mbps w/ EBS, and higher on the local scratch drive)
Cloud storage as a tier
Cloud storage as a tier

- Storage with availability, performance and cost characteristics different from other available storage (other tiers), and the difference is such that it justifies movement of data between them

- In cloud
  - storage classes (EBS, S3)
  - cost is space and usage based
  - performance varies between the storage classes, between regions and availability zones
Veritas SF dynamic storage tiering

- A mechanism for placing data on the suitable tier
- Location transparency
- Policy controlled initial file placement (on creation), migration and removal
- Based on: file name and size, directory, time of last access, access frequency, ownership
- Multi-volume file systems, for performance, availability and migration
Example: dynamic storage tiering

Example DST relocation policy:
- Create files on tier1
- Move to tier2 if inactive for 30 days
- Move to tier1 if accessed more than twice in last 7 days

File system name space /fs1/...
EBS as a tier - process

- In cloud
  - using a public Linux AMI provided by Amazon
  - export iSCSI target
  - storage provided by EBS volumes

- On-premise server
  - create a multi-volume filesystem, some volumes are iSCSI targets in EC2
  - create DST policy
  - attach the policy to the file system
Cloud storage as a tier & issues

- Requires 24x7 instance
- Access through firewall
Cloud storage as a tier – status

- Currently tiers inside and outside of cloud, utilizing VPN to avoid firewall issues
- Placement rules: time of last access, access frequency, name pattern
- Investigated use of S3 w/ FUSE and EBS w/ iSCSI
S3 as a tier – details

- Provides file-level access only
- PUT: 32-64Mbps; GET: 20-96Mbps  
  (cloudstatus.org averages for week of Sep-6-09)
- Snapshots: Not provided
- Replication: Automatic (3 copies in 3 locations)
S3 as a tier – issues

- FUSE-based products provide only a file system view
- Elastic Drive provides a block level device, but it still doesn't respond to any SCSI commands
- VxVM won't work without at least some working SCSI commands
- Result: Poor performance when treated as a pseudo-block-level device
  - S3 is optimized for file-level access
EBS as a tier – details

- Provides block-level access to devices
- EBS devices: 160-400Mbps
- AWS internal network: 250-1000Mbps (S3 to EC2 large file transfers)
- Snapshots: low performance if compared against VxVM or VxFS snapshots, but expected since it is using S3
- Replication: Automatic, but transparent
EBS as a tier – details

- Costly
  - Requires EC2 instance (24x7)
  - $75-$600/mo not including data transfer costs
- EBS volumes act as pseudo-SCSI devices which limits some functionality (e.g., no DMP)
- Limit on the size and number of EBS volumes (can be increased by request)
Replication and failover using cloud
Background: Veritas Cluster Server

- 2-32 application servers
- Shared storage devices
- Two geographically separated VCS clusters
- Unreliable “heartbeat” network
- Long-distance replication of critical data
- Can be asynchronous
- Single-node “clusters” at each location
- Failover now only over WAN
VVR replication - prototype

On-premise server, SF VVR

VPN

Amazon cloud

VPN server

AMI instance with VVR

Control & monitor
Cloud as a DR site

- Veritas Volume Replicator (VVR) for replication to and from the cloud
- VCS/GCO for failing over an application between on-premise machine and AMI instance in the cloud
  - Single-AMI cluster is failover target in the cloud
- Can serve as the DR solution for multi-node on-premise cluster
Cloud as a DR site

- Main data center on user premises
- Based on a public Linux AMI provided by Amazon
- Storage provided by EBS volumes

Assisted application failover & failback

Replication of critical data

Amazon Machine Image (AMI) instance
Elastic Block Storage (EBS) volume
Steps for VCS/GCO failover

- GCO heartbeat (usually ICMP ping) times out
- Cluster in the cloud declares on-premise cluster down
- Replication target volume in the cloud becomes primary data
- VCS mounts file system on former replication target volume
- VCS restarts application on AMI instance in the cloud
- VCS updates DNS
- Manual steps: clear DNS cache or application-specific state
Cloud as a DR site – current status

- Replication
  - from on-premise machine to AMI instance in the cloud
  - from AMI instance in the cloud to on-premise machine

- GCO failover with VVR-replicated live data
  - from on-premise 1-node cluster to 1-node cluster in the cloud
  - “Repair” on-premise machine and fail back from cloud AMI instance to on-premise machine

- On Linux and Windows Server platforms
- Corporate firewall: requires open port or use of VPN
- Requires 24x7 AMI instance for heart-beating
- EC2 instances support one NIC
- Clearing stale DNS cache entries or other application-specific non-persistent state
Cloud as a DR site – performance

- Difficult to be exact
- Limit is local connection in our case, better results inside the cloud
- Sync VVR: ~150 MB/min
- Amazon: 250+ Mbps, but no guarantees
In future would like to do

- More tests using tiering, replication and failover
  - between on-premise and cloud
  - in the cloud
- EBS volumes shared by multiple instances
- I/O fencing for shared volumes
- Using other clouds
Prototyping team

- Matthew Cheung
- Manav Deshmukh
- Chris Lin
- Chitrak Ojha
- Paul Massiglia
- Niranjan Pendharkar
- Ajay Salpekar
Thank You!

Questions?