A Brush with Disaster Leads to a Virtualization Based DR Plan at the Las Vegas Valley Water District

Dave Trupkin
Greg Hearn
Sr. Systems Administrators
Introductions

- Dave Trupkin
  - Sr. Systems Administrator – Intel-based
    - VMware, Antivirus, NAS
- Greg Hearn
  - Sr. Systems Administrator – UNIX-based
    - Backup & Recovery, Oracle, SAN
- Las Vegas Valley Water District
  - Not-for-profit Public Utility
    - Serving over 1 Million People
    - Las Vegas, Blue Diamond, Searchlight, Kyle Canyon, & Jean
  - Microsoft Windows, Sun Solaris, Oracle, NetBackup
    - 200 + Servers in three locations
In the Beginning

- Environment
  - Server and Applications
    - AS/400 & OS/2 on Token-ring
    - Oracle on Sun Solaris (several stovepipe DB)
    - Windows – Each app on its own server
    - Development & production apps on same servers
  - Infrastructure
    - Old building with many renovations
    - Power and cooling
    - Floor & rack space
  - Growth led to server sprawl
    - Multiple silos of dissimilar hardware
    - No consolidated storage (all direct attached)
    - Tape backup required same hardware for Windows
    - Unreliable Servers
In the Beginning

- We Invented VMware Server to solve the problem
  - Actually scripting of VMware Workstation
  - IBM introduced ESX Server 1.5 to LVVWD
  - Attended xSeries Conference in Orlando to see ESX
  - Difficult to get evaluation copy without professional services
VMware ESX 1.5

- Single IBM x440 4-way
  - No SAN – IBM FastT
- Procuring hardware takes time
  - Long lead time for hardware led to developer acceptance
- Difficult to gain developer acceptance
  - Every application problem was fault of virtualization
- Impossible to gain vendor acceptance
  - Only when there was no other choice
VMware ESX 1.5

- Upgraded x440 to 8-way/32gb RAM
- Added additional x445 8-way server
  - Acceptance continued slowly
- Introduction of VirtualCenter 1.0
  - Added 9960 & Brocade switches (SAN)
  - Moved virtual servers to SAN
  - Introduced VMotion
- Additions helped with acceptance
  - Additional flexibility
  - Additional functionality
- Still we did not have full acceptance
The Disaster

- Dreaded phone call
- Upon arrival some servers still running
  - Oracle and many other redundant services
  - Power temporarily restored (fluctuations)
    - Decision to bring down all remaining servers
- Power surge overloads UPS - Complete power outage
  - Most physical servers down
  - Oracle DB down
  - Did not get time to shutdown VMware or Hitachi
    - Reliability!!
    - All VMs came up clean and in same state
    - AWSOME!
The Next Day

The District had a power failure in the North Wellfield resulting in the East Administration Building, the garage, distribution, and the modulars not having power. We are currently working on restoring the AS400 and other computer systems for customer service. We anticipate restoration of power between 9:00 AM & 12 Noon.

For more info, contact Bob Hulsheuser at 238-7277.
Limited power restored the following day (24 hours later)

- Management decision on critical applications
  - Network
  - AS/400 (Customer Billing)
  - Email (Lotus Notes)
  - Oracle (one cluster member)
  - Limited LOB applications

- Focus was on applications not dependencies
  - Required domain controllers, DNS, etc.
  - More power which we did not have
  - Foresight to have several VM servers
The Disaster (cont.)

- Brought up selected VMs
  - Support infrastructure
  - Production applications
  - Developer VMs re-tasked
- Ran in this mode for three business days
- High cost of keeping developers idle
  - Additional temporary power feeds installed
  - Full environment restored on temporary power within five business days
- Temporary feeds replaced with permanent power after eight weeks
Planning a DR Strategy

- **Existing Plan**
  - Paper only
  - Had no idea on application dependencies
  - Recover physical server infrastructure

- **Based on the Tape & Pray concept**
  - Find a ballroom
  - Obtain hardware
    - Servers
    - Tape libraries
    - Etc...

- 7-10 days estimated
  - In an ideal world!
Planning a DR Strategy

- New Plan
  - Application administrators and developers
    - Identified application dependencies
  - Appreciation for VM efficiencies and performance
    - VMware provides missing step
    - ESX infrastructure expanded
      - Now includes 15 hosts (standalone and BladeCenter)
      - New servers must be virtual unless impossible
- District priorities shift
  - Prior emphasis solely on water distribution
  - New appreciation for ancillary services
  - Expectations on LOB applications
- May not have existing facility next time
  - Fortunate that we did not lose the facility
Implementation

- Leased space at co-location facility
- Purchased second Hitachi
  - Upgraded 9960 with Sun 9990
  - Proved TrueCopy replication
- Purchased dark fiber
  - Two dedicated pairs (9.6 Miles)
    - One for network & One for SAN
  - Existing SONET OC-48
    - Added OC-12 prevision
- Installed CWDM on pair for SAN
  - Increased our data path to 4 x 2GB
- Additional Sun 9990 hardware & software
  - Cache & TrueCopy
Implementation

- ESX Server hosts
  - 1 xSeries 445 (8-way 32GB)
  - 1 xSeries 460 (4-way 32GB)
  - 1 BladeCenter chassis
- Backup and Recovery services
  - Virtual Tape Library (VTL)
  - NetBackup Media/master
- SunFire 6800
  - 3 domains (8-way 32GB)
  - Oracle database
  - Capacity for production applications
Data / LUN Configuration

- In the beginning
  - Large LUNS
  - Concatenation
- LUN contention
  - File Locks
- Created smaller LUNs
  - Different sizes
  - No concatenation
- Create logical LUN groups
  - Manageability
  - Data integrity
  - Based on data/server layout
Data Replication

- Use of Synchronous & Asynchronous
  - Oracle Archives Synchronous
    - Never split the pairs
    - High change rate
  - Oracle Database (RAC)
    - Asynchronous with splits
    - Medium change rate
  - VMware servers
    - Asynchronous with splits
    - About 5 TB total in 8 groups
    - Medium change rate
- All replication continues 24 x 365
Data Replication

- **Hardware**
  - Sun Hitachi 9990 (USP) to HDS 9960
    - Higher cache install on 9990
  - ADVA FSP 2000 CWDM/DWDM
    - 8 SFP (4 network & 4 SAN)
  - Brocade SilkWorm 4100 Switches

- **Software**
  - Hitachi TrueCopy
    - One primary to one secondary (1 PVOL to 1 SVOL)
    - Need two ports for RCU and MCU on both arrays
  - Hitachi HORCM CLI
    - Not difficult to use, but difficult to troubleshoot
    - Scripts & cron jobs
TrueCopy Configuration

- Synchronous copy of Oracle archive logs
  - 100 – 200 GB
  - High change rate
  - Impacts performance on production
    - Requires additional cache to keep performance up
- Asynchronous copy of Oracle DB
  - 1 TB RAW or 720 GB of data
  - Split pairs at 06:00, 12:00, 18:00 & 24:00 hrs
  - Minimal impact in performance on production LUNs
- Asynchronous copy of VMware VM servers
  - 5 TB RAW or 4 TB data
  - Refresh in groups starting at 18:00
  - No impact on performance on production
Data Replication Breakdown

Asynchronous = 6.5 TB
- VMware VM servers
- Oracle DB
- Other data

Synchronous = 200 GB
- Oracle Archives
Data Replication Breakdown

Duration

Minutes


lvvwd2 6AM
lvvwd2 Noon
lvvwd2 6PM
lvwd3
lvwd4
lvwd5a
lvwd5b
lvwd5d
lvwd6
lvwd7
Conclusion

- Lessons learned
  - Disaster comes in many forms and sizes
  - Regular review needed of application priorities
  - Application dependencies
  - May need to setup rest areas for employees
  - Critical knowledge may be in someone else’s head
  - Communication is critical
    - Co-workers
    - End users
  - Synchronous is not always better than asynchronous
Conclusion

- DR site adds value to daily operations
  - Protection from failed patches
  - Protection from failed upgrades
  - Provides “seed” data for populating development environments
  - Peace of mind (good for sleeping)
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