Trends in Application Recovery

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Abstract

Trends in Application Recovery

- This session will appeal to Data Center Managers, Backup Administrators, Application Administrators and those that are concerned how data lost in an application or database could be recovered.
  - Challenges and trends in application backup and recovery.
  - You will be guided through all layers from the service down to the physical hardware.
  - You will learn how to recover individual lost pieces of information up to the recovery of the entire application distributed across complex and virtualized environments.
  - You will get some ideas how to deal with the human factor in IT environments with distributed responsibilities.
  - Finally the session discusses how to balance service levels against cost.
Challenges & trends
What to recover and by whom?
Application backup
  - Consistency
  - Backup window
Interfaces
Recovery
  - Application entirely
  - Single items
Virtualization & Cloud
Conclusion
Challenges

- Exponential data growth
  - Cheaper storage
  - More performance
  - Long term retention
  - Duplicate data

- Complexity growth
  - Scale up & out
  - High availability
  - Virtualization
  - Cloud – „EaaS“ (Everything as a Service)
  - Search
  - Security & compliance

- Blue line – exponential data volume growth & complexity growth = the bullets on this slide
- Green line – IT budget is flat
Where Does Recovery Live?

- Application resilience
- Application build in backup tools
- Templates
  - „Golden“ images
  - Virtual Machines
- Application specific 3rd party tools
- Storage specific tools
- Backup software
  - Across multiple applications & storage
- Operations management software
  - Across all IT
- The cloud
The “No Backup” Trend

- Application build in database replication
  - Optional automatic fail over
  - Lagged databases
- Transaction logging & replication
- Self healing
  - Consistency check and repair
  - Defect page detection and repair
- Versioning
- Dumpster & 2nd level Dumpster
- Build in archive
Application Backup Trends

- Different backup to disk service levels
  - Full copy backup versus backup of changes
  - Same disk quality as original versus cheaper disk
  - Retention: days versus months versus years (archiving)
- No performance degradation during backup
  - Backup from replica & proxy server
- Recovery to any point in time
- Data reduction
  - Deduplication, primarily of repeated full backups
  - Incremental and consolidation of incremental backups
- Seamlessly link disk with tape
- Recovery automation & simplification
  - The know how to recover is build into the software
- Server farm down to single document, mail, ...
What to Recover?

- Single items / end user domain
  - Files & Directories / Libraries
  - Entry, record, transaction
  - Document, e-mail, blog
  - Calendar, tasks, contacts
  - Table, list, tree, folder, wiki
  - E-mail box, user site
- Database
- Search index & services
- Application configuration
- Binaries, OS, configurations
- Physical servers
- Virtual servers
- Server farm
- Disk array
Use Cases Beyond Recovery

- Testing
  - Recovery
  - Development test data

- Data Migration
  - On premise -> cloud
  - Cloud -> on premise
  - Service provider A -> B

- Deployment
- Data warehousing
- E-Discovery
- Forensic analysis
- Archiving
  - Tax review, ...
Who Does What?

- **Different users groups use different user interfaces**
  - Users and administrators don’t want more tools, they want to manage from their tools.

- **Security**
  - User A should not be able to see data from user B.
  - The administrator should not be forced to break into the end user privacy.
  - DB administrator might not have the right to restore from backup.

- **Processes**
  - Application administrators might not be connected with backup administrators.
How to reduce the backup volume?

- **Full backup – file based or block based**
  - **Database**
    - Data files = “tables“ mapped to files
    - Control files to find data files & log files
    - Transaction log files, optional: move / delete
  - **Trend features**
    - Storing data outside of the DB: Files, Binary Large Objects
    - Search Index, services, encryption keys, ...

- **Incremental backup – changes since last backup**
  - **File based**
    - Transaction log backup and move / delete
    - Files: File system incremental backup of single instance file store
  - **Changed blocks**

- **Differential backup – changes since last full backup**

- **Compression**

- **Deduplication**
Application Consistency

When is an application consistent?
- Data is valid at the same point in time
- Data is complete

How to accomplish consistency for backup?
- Offline backup - application shutdown
- Crash consistent backup
  = snapshot without interaction
- Online backup – application interaction
Consistency - Offline Backup

- Shutdown the application / database
  - Guarantees application consistency
  - All cache data copied to disk
  - All transactions closed
  - Optional: database consistency check
- Backup to another disk / tape
  - OR create a snapshot
- Optional: move / delete the transaction logs
  - Frees disk space
  - Enables incremental backup based on transaction logs
- Start the application
- Optional: backup the snapshot to another disk or tape
- Recycle the snapshot
  - Keep the last N snapshots
  - Snapshot rotation
Crash Consistent Backup

- Create a snapshot while the application runs
  - Consistency has the same quality as after a system crash
  - Most applications / databases can survive system crashes
    - But some don’t and some not always.
  - Recovery can not be guaranteed

- Use cases
  - 7 x 24 operations -> no backup window
  - Virtual Machine backup without agent or service API
  - Application lacks online backup mode feature
  - No resources for transaction logging during backup
  - Snapshots enable more points in time
    - Might reduce the risk
Consistency - Online Backup

- Database(s) are in “backup mode“ during backup
  - Data files don’t change while in backup mode
  - Changes during backup happen in the cache and go into logs
  - After backup all changes are applied to the data files
  - Optional: backup of the transaction logs & delete logs afterwards
  - Optional: ongoing log file backup after database backup -> “CDP“

- Consistent search index
  - All databases need to go into the backup mode
  - Across the server farm

- Use cases
  - 7 x 24 operations -> no backup window
  - Guaranteed & fully supported consistent recovery
Application Backup Interfaces

- Application specific tools via GUI, CLI
- General purpose API
- Streaming backup API

  - Direct copy
    - Access to in-memory copy of data, cached by the application
    - Minimizes redundant memory copies
  
  - Incremental backup
    - Access to changed blocks / pages or transactions
  
  - Optional features
    - Granularity below database level
    - Compression
    - Encryption

  - Sequential access is optimal for streaming media
Volume based Backup API

- **Snapshot focused**
  - Creates application consistent volumes ready for backup

- **Use cases**
  - Copy the entire volume via snapshot
  - Copy all files needed to recover the application
  - Incremental backup
    - Changed blocks
    - Changed files
  - Feature set might be different compared to streaming API
  - Backup to disk & restore from disk

- **Trend: volume based backup**
  - Better for backup to disk
  - Better for virtualization
Reduced Performance Impact

- Separate backup proxy server
- Backup from full copy snapshot (mirror)
  - Application switches into backup mode
  - Split the snapshot
  - Back to normal mode
  - Separate backup proxy server copies the data from split mirror
  - Resync the mirror after backup
    - Copies changed blocks only
Application Recovery from Snapshot

- Application shutdown
- Optional incremental transaction log backup
- Switch to selected snapshot
  - Instead of restore from tape
- Transaction log roll forward from backup or original disk up to the most recent point in time
- Application back online
Single Item Recovery Options

- Dumpster, 2nd level dumpster, versioning, archive
- Lagged database replicas maintained by the application
- Full blown recovery environment & copy back
  - Spare systems
  - Virtual Machines
- The application can be used to extract single items from backup
  - Copy database from backup & mount as recovery database
    - Needs extra space and time to copy the entire database
  - Mount the database from the backup directly into the application
- Open the backup database with a separate tool & extract
- Extract single items directly from the backup
  - Catalog of all single items during or shortly after backup
- Single item recovery from single item backup
  - Needs a separate “brick level” backup
Single Item Recovery from Snapshot

- Mount the database from the snapshot
- Browse & search through the database
  - Using 3rd party tool
  - Using the application
- Unmount the snapshot
- Issues
  - Which snapshot to use?
  - Snapshot retention
Server Virtualization

- Resources shared among different applications
  - Normal load spreads evenly across day / week / month
  - Backup load is exceptional

- Resources on physical server often not enough for backup load

- Offload backup via dedicated physical machine
  - Utilize replication

Normal Operation

Backup

Resources shared among different applications

- Normal load spreads evenly across day / week / month
- Backup load is exceptional

Resources on physical server often not enough for backup load

Offload backup via dedicated physical machine
- Utilize replication
Application Recovery in the Cloud

Who does the backup?
- Same SLA for all VMs?
- Who can define the SLA?

Who recovers what?
- Hypervisor / host
- Individual Virtual Machine
- Single file from the VM
- Application
- Application data object
  - E-mail
  - Document
  - Tablespace
  - Record

Security?
Backup targets?
Empowered end user
- Self service
Conclusion

- Even an „unsinkable“ ship needs rescueboots
  - How many passengers?
  - Buffer?

- What are the data loss scenarios?
  - What can happen?
  - What are your recovery use cases?
  - Who is involved into the recovery process?

- Cost versus Risk
  - How much data do you accept to loose?
  - What is the backup time window?
  - How long is your acceptable recovery window?

- Backup stays the last line of defense
Refer to Other Tutorials

Check out SNIA Tutorials:

Trends in Data Protection and Restoration Technologies

Introduction to Data Protection: Backup to Tape, Disk and Beyond

Check out Hands On LAB:

Enterprise Content Management
Q&A / Feedback

Please send any questions or comments on this presentation to SNIA:
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Many thanks to the following individuals for their contributions to this tutorial.
- SNIA Education Committee

Andreas Schwegmann – this slide deck
Antal Nemes – application backup interfaces
Nancy Clay – tutorial program management
Klaus Bloecher