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.
Application Recovery - Agenda

- Challenges and trends
- What to recover and by whom?
- Architectures
- Application backup
  - Consistency
  - Backup window
- Interfaces
- Recovery
  - Application entirely
  - Single items
- Virtualization
- Conclusion
Application Trends & Challenges

- Exponential data growth
  - Cheaper storage
  - More performance
  - Long term retention
  - Distributed data -> duplicate data

- Complexity growth
  - Scale up & out
  - Different data types in one application
  - High availability
  - Virtualization
  - Cloud
  - Everything as a Service
  - Search
  - Security & compliance
  - More features

Blue line – exponential data volume growth & complexity growth = the bullets on this slide

Green line – IT budget is flat
Application Recovery Trends

- Recovery to any point in time
- Snapshot based recovery
- Seamlessly link disk with tape
- Data reduction
  - Incremental and consolidation of incremental backups
  - Deduplication, primarily of repeated full backups
- Recovery automation
  - The know how to recover the application is build into the backup software
- Server farm down to single document, mail, ...
- The “cloud” – somebody does it for you
What to Recover?

- **Single items / end user domain**
  - Entry, record, transaction
  - Document, e-mail, blog
  - Calendar, tasks, contacts
  - Table, list, tree, folder, wiki
  - E-mail box, user site

- **Database**
  - Files system or raw disk
  - Cache

- **Search Index & Services**

- **Application configuration**

- **Binaries, OS, configurations**

- **Server farm**

- **Virtual servers & physical servers**

- **Disk array**
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.
Application Architectures

- Single server, single database
- Server farm with multiple databases of different types
- Database across databases – search index
- Databases with links into the file system
  - Using standard files
  - BLOBs
- Cluster: 2 – N nodes
  - Load sharing, fail over, majority node, ...
- Replication
  - Active and passive databases
- DAS, SAN
- Physical servers, virtual machines
- On premise, cloud
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**
    - Files, BLOBs – typically used for storing large files outside of the DB
    - 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
- Application 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

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

**Resources on physical server often not enough for backup load**
- Offload backup via dedicated physical machine
  - Utilize replication
Virtualization – Who Does What?

- **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

- **What’s public / private?**

- **Security?**
Conclusion

❖ Application specific solutions needed
  ❖ There is no one size fits all
  ❖ Hybrid solutions might be needed

❖ High complexity - many options
  ❖ Who are your customers & users?
  ❖ What are the requirements?
  ❖ How complex is your environment?
  ❖ What are your use cases?
  ❖ What is your budget?
  ❖ What are the Service Level Agreements?
    ➢ Backup window, RPO, RTO
Q&A / Feedback

Please send any questions or comments on this presentation to SNIA:
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