ENSURING HIGH AVAILABILITY

Maximize your Uptime with DELMIA Quintiq

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WEBINAR SERIES 2024

On Demand:

**Unlock the Full Potential of Your DELMIA Quintiq Solution –
Navigating the Post-Implementation Phase**
With Vincent Wiers

Upgrading your DELMIA Quintiq Solution: The WHY and the HOW
With Bas van der Bijl

Unleash the Full Potential of the DELMIA Quintiq Optimizer
With Vincent Wiers

LIVE Today:

Ensuring High Availability – Maximize your Uptime with DELMIA Quintiq
With Richard van Mersbergen

AGENDA

Introduction

DELMIA Quintiq HA Features

HA architectures

Best practices

Q&A

HIGH AVAILABILITY

High Availability
The ability of a system to **operate** during **intended business hours** even if components within the system fail
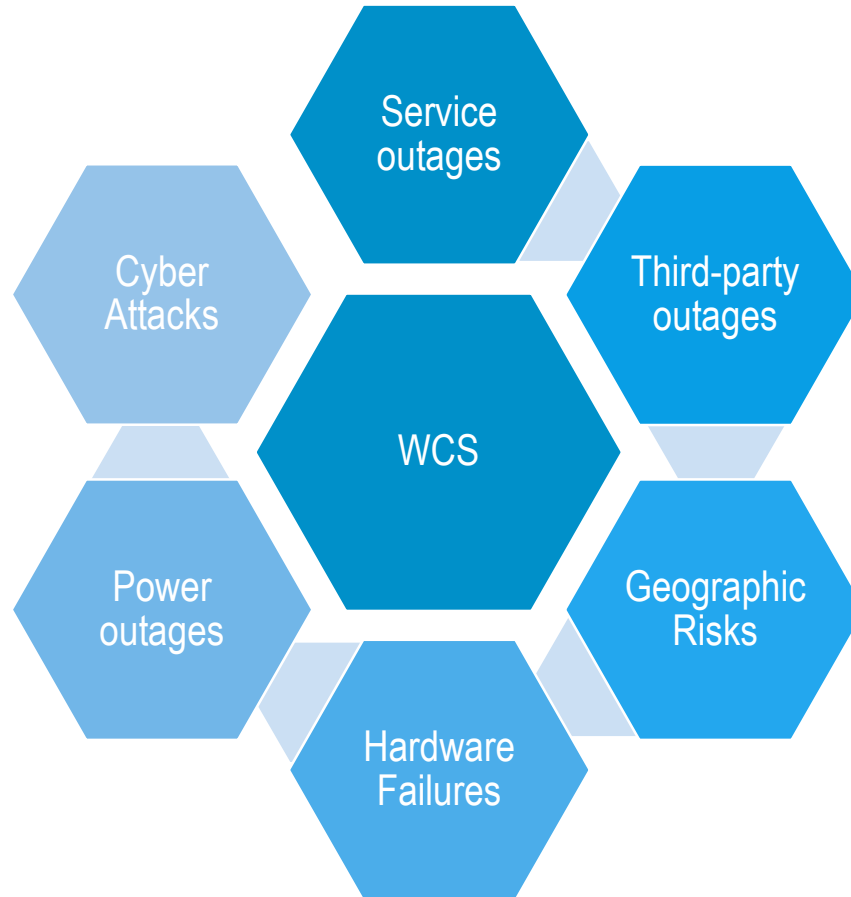
Business Impact
What is the business impact of unavailability?

Worst Case Scenarios (WCS)
Catastrophic events that severely affect the infrastructure of a company

THREATS TO AVAILABILITY

HIGH AVAILABILITY

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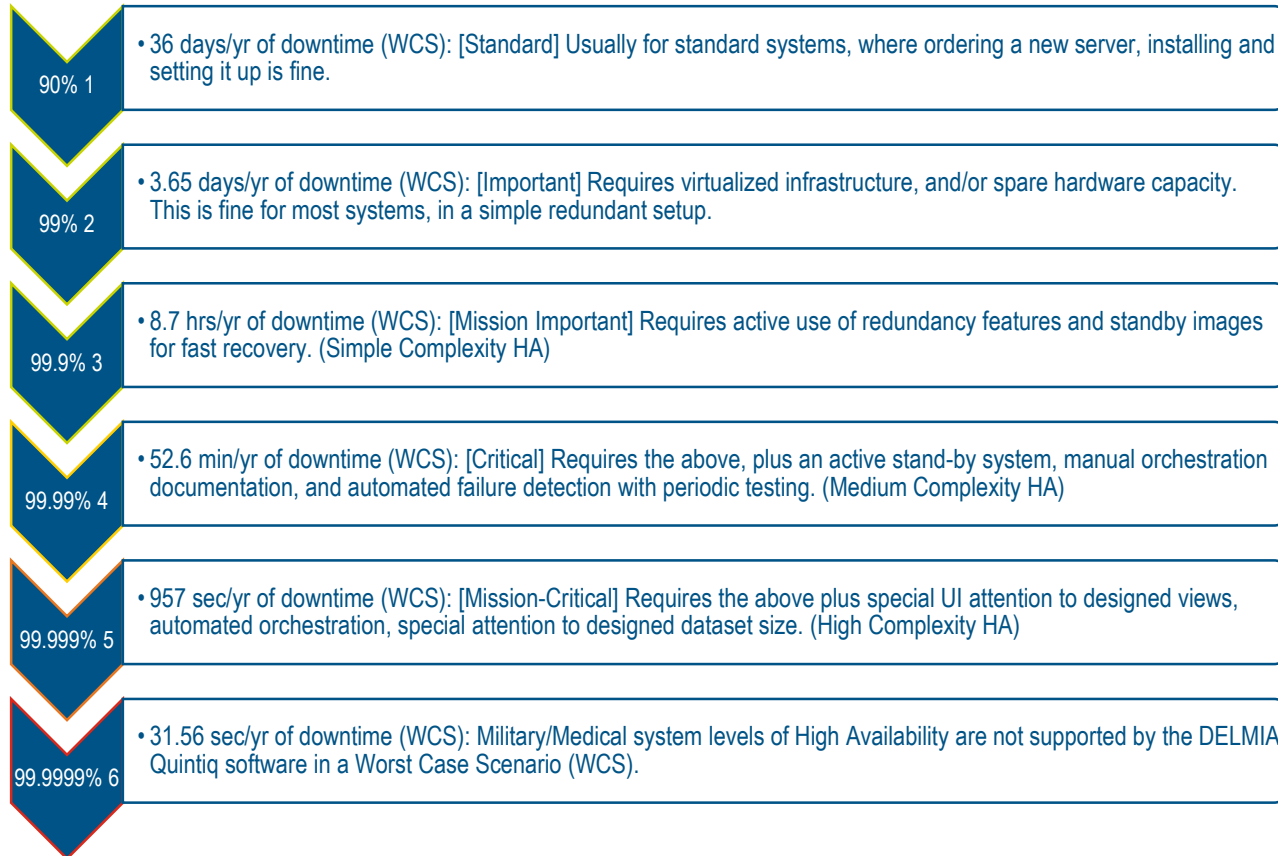
Business Impact
What is the business impact of unavailability?

Worst Case Scenarios (WCS)
Catastrophic events that severely affect the infrastructure of a company

Availability is typically measured **in percentage of uptime** of a service during a period of time (i.e., month, year…)

LEVELS OF AVAILABILITY

90% 1
- 36 days/yr of downtime (WCS): [Standard] Usually for standard systems, where ordering a new server, installing and setting it up is fine.

99% 2
- 3.65 days/yr of downtime (WCS): [Important] Requires virtualized infrastructure, and/or spare hardware capacity. This is fine for most systems, in a simple redundant setup.

99.9% 3
- 8.7 hrs/yr of downtime (WCS): [Mission Important] Requires active use of redundancy features and standby images for fast recovery. (Simple Complexity HA)

99.99% 4
- 52.6 min/yr of downtime (WCS): [Critical] Requires the above, plus an active stand-by system, manual orchestration documentation, and automated failure detection with periodic testing. (Medium Complexity HA)

99.999% 5
- 957 sec/yr of downtime (WCS): [Mission-Critical] Requires the above plus special UI attention to designed views, automated orchestration, special attention to designed dataset size. (High Complexity HA)

99.9999% 6
- 31.56 sec/yr of downtime (WCS): Military/Medical system levels of High Availability are not supported by the DELMIA Quintiq software in a Worst Case Scenario (WCS).

HIGH AVAILABILITY

High Availability
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Business Impact
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Availability is typically measured **in percentage of uptime** of a service during a period of time (i.e., month, year…)

The business impact and WCS define the High Availability requirements

AGENDA

Introduction

DELMIA Quintiq HA Features

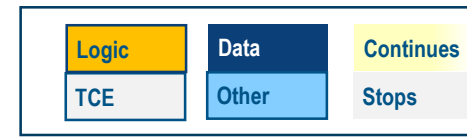HA architectures

Best practices

Q&A

DELMIA QUINTIQ SOFTWARE ARCHITECTURE

DELMIA Quintiq is a 3-tier system consisting of the following modules.
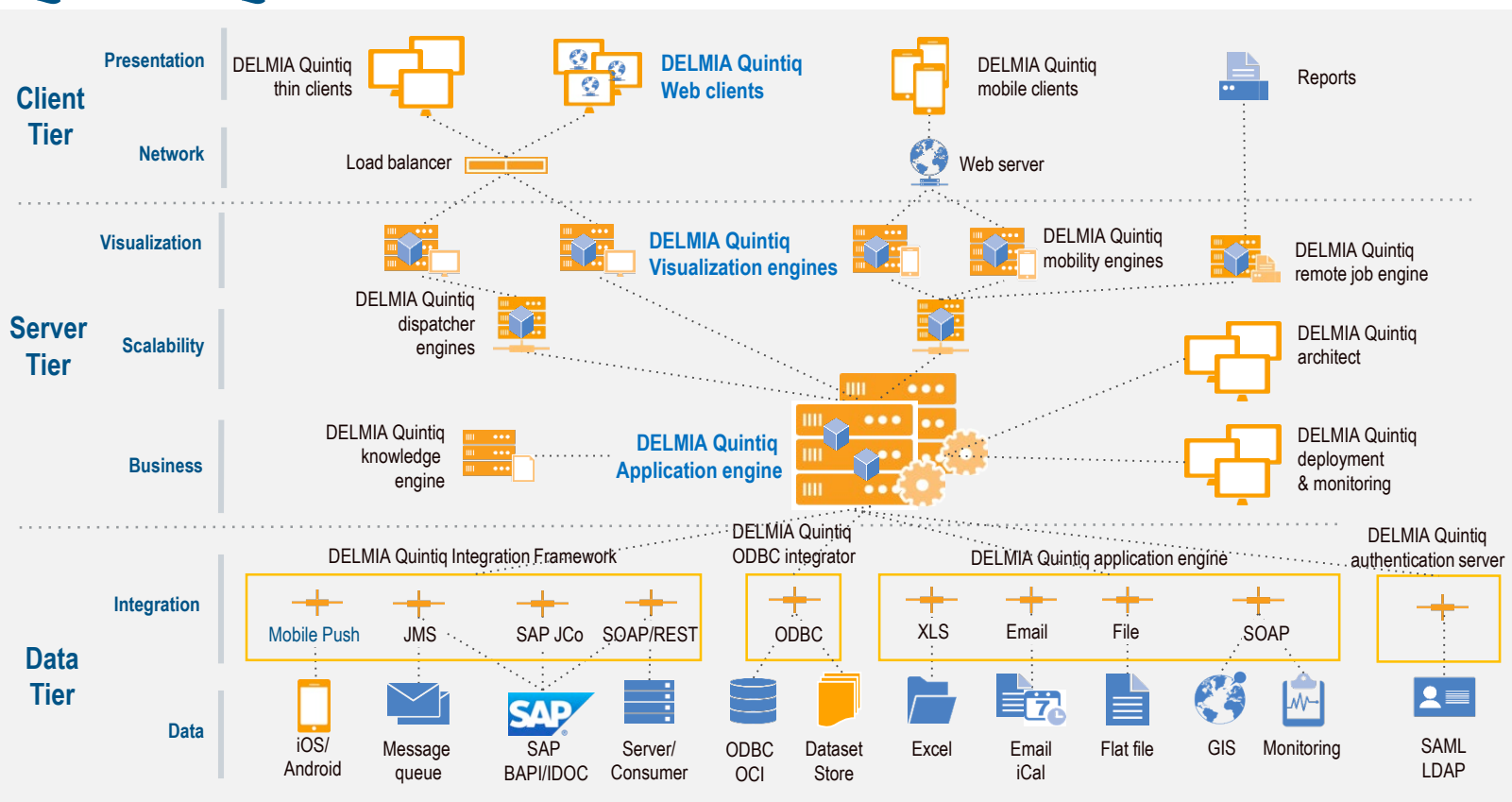
STARTUP SEQUENCE
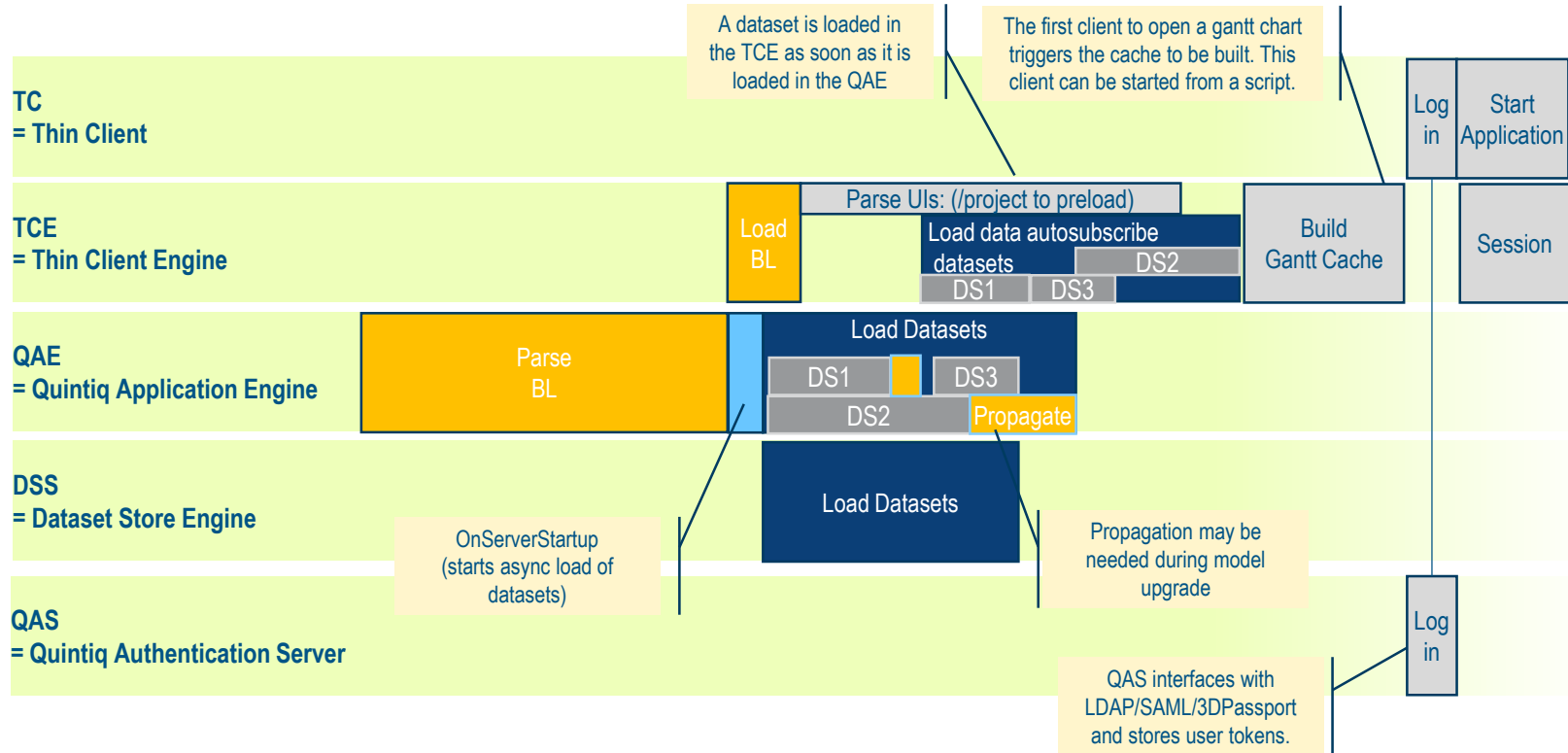
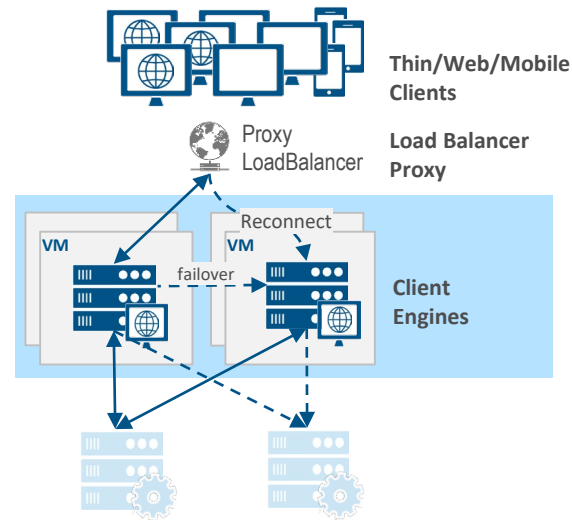# HIGH AVAILABILITY FEATURES

Server Layer

- Redundant components (QAE)

  - The TCEs/QMEs can connect to either QAE upon startup.
  - A stand-by QAE can be active, but datasets can only be loaded when the primary QAE stops.

- Shared License: local/SAN, standalone QAS

  - Allows sharing of license between servers. Enables containers and VM migration.

- Shared Server key: local/SAN, standalone QAS with Key Manager

  - The server key file should be stored on the local/SAN disk or in a stand-alone QAS. Use of NAS is strongly discouraged.

- Offline model upgrade

  - Allows upgraded datasets to be loaded into a QAE that is already running, without causing the QAE to switch to the 'maintenance mode'.
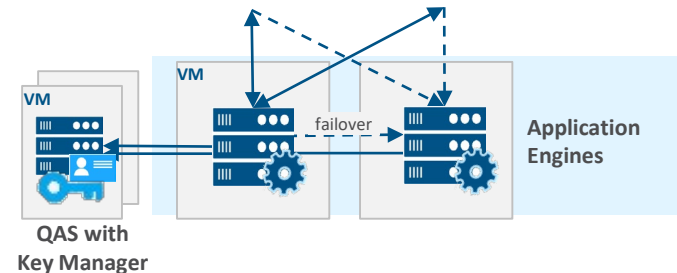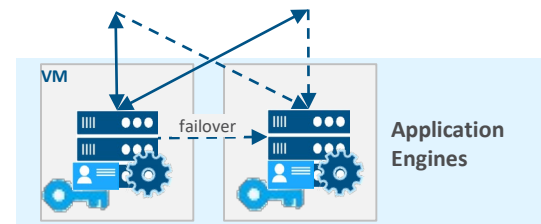
HIGH AVAILABILITY FEATURES

Client Layer

- Redundant components (TCE, QME)

  - Multiple TCEs/QMEs can be configured; If a TCE/QME fails the other active TCEs/QMEs can take over.

- Proxy/Load Balancer

  - An external load balancer can be used to simplify the (external) access for clients and distribute the load over TCE/QME

- Thin/Web Client Reconnect

  - After losing the connection with the TCE the TC will automatically connect to the (new) TCE when it is available. Users do not need to login again.

- Read-only TCE

  - After losing the connection with the QAE, a TCE will switch to read only mode. To minimize down-time the TCE can be stopped only when a new TCE is available; this requires orchestration.

Thin/Web/Mobile Clients

Proxy LoadBalancer

Load Balancer Proxy

Reconnect

VM

VM

failover

Client Engines

HIGH AVAILABILITY FEATURES
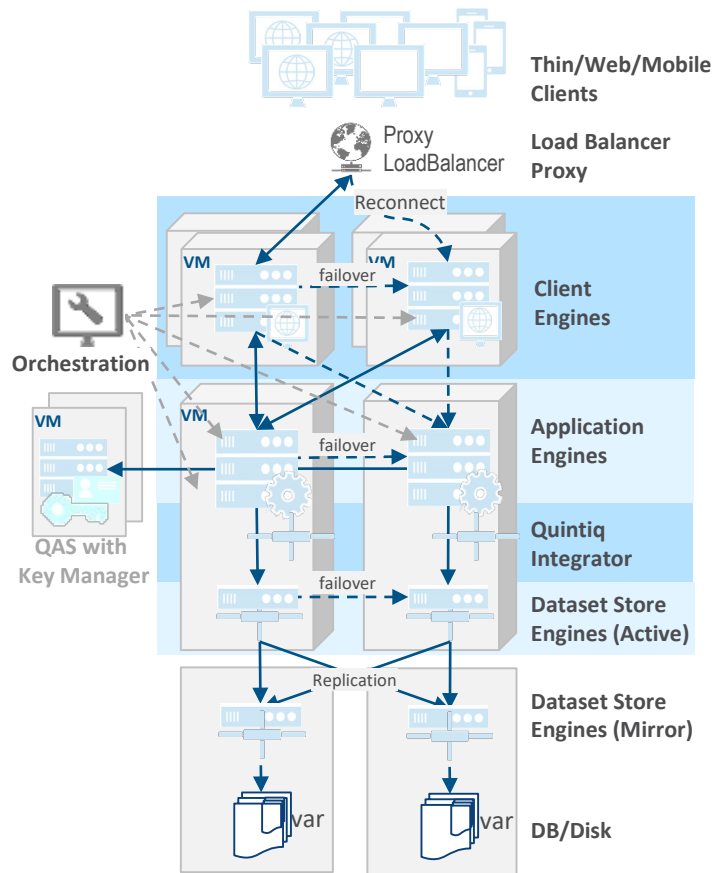
Data/Integration layer

- Redundant components (DBE/QI)
  - Multiple QI and DBE can be configured to improve high-availability.
- Dataset Store (DSS)
  - The dataset set store is optimized for high speed loading of datasets.
- Database (optional):
  - Adding a database is possible, but optional when using DSS standalone.
- Shared Variable data (KB, views, settings): local share or in DSS
  - Variable data can be stored on local or shared disk or in the DSS using the QFS in DSS feature.
- Use VSS Writer for filesystem backup
  - Using VSS Writer (frequent) periodic in-sync backups can be made of DSS and var files.
- DSS Replication:
  - Using DSS Replication ensures redundant storage on multiple local (fast) disks taking away the need for using shared disk (slow NAS or expensive SAN).
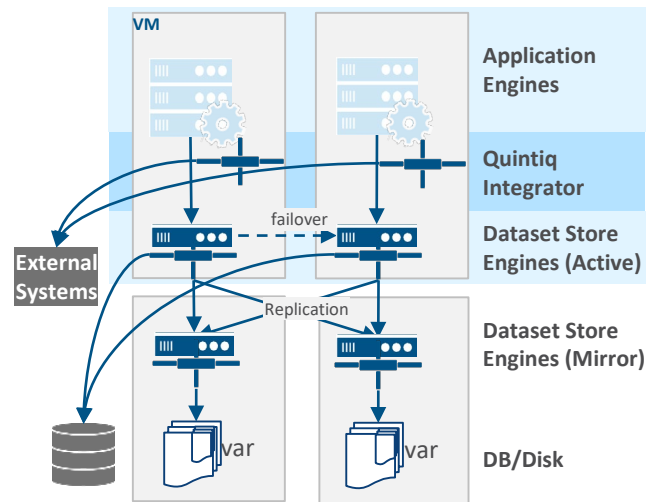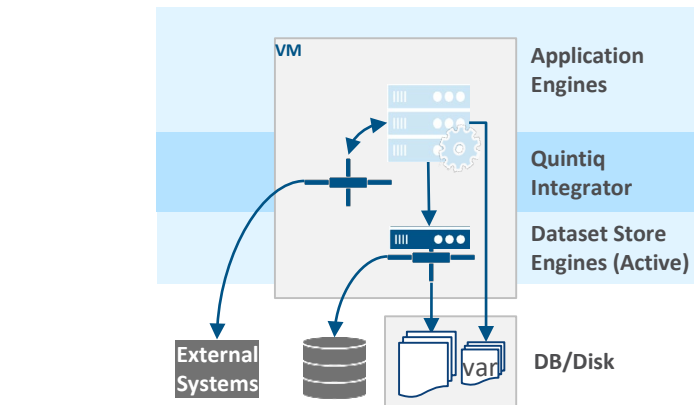
HIGH AVAILABILITY FEATURES

Infrastructure layer

- Dedicated hardware, VMs or Containers

  - VMs and containers simplify recovery in case of hardware failure

  - Using dedicated hardware may be needed for large optimization solutions.

- Windows services and Orchestration tools (e.g. QEM)

  - Automatic restart on failure is suitable for basic architectures

  - For larger architectures the monitoring, deployment and orchestration is best done using tools fit for that purpose (such as QEM, clustering or Docker/Kubernetes).

- Local disk, shared disk (NAS or SAN)

  - Storing persistent and variable data on local disk is best for performance, while backups are needed for disaster recovery.

  - Shared disks have the advantage of having built-in redundancy. NAS is simple to set up but impacts performance. SAN is more complex to setup, but is fast and reliable.

Thin/Web/Mobile Clients

Load Balancer Proxy

Proxy LoadBalancer

Reconnect

Orchestration

VM | VM
failover

Client Engines

QAS with Key Manager

VM | VM
failover

Application Engines

Quintiq Integrator

failover

Dataset Store Engines (Active)

Replication

Dataset Store Engines (Mirror)

var | var

DB/Disk

AGENDA

Introduction

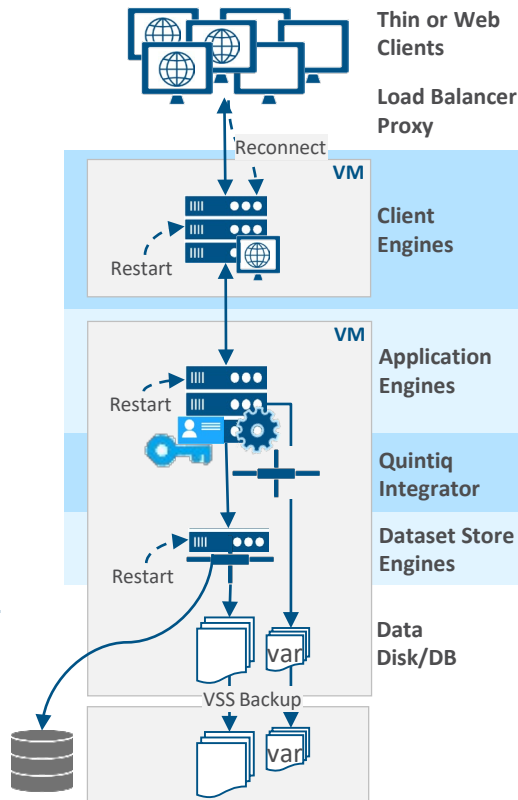DELMIA Quintiq HA Features

HA architectures

Best practices

Q&A

SIMPLE HA ARCHITECTURE

Restart on VM, periodic backup

- No redundancy; single instance per component
  - VMs can be shared if memory load allows.
- Windows Services to restart automatically.
  - Read-only TCE not available when using windows services.
- License/key file are local
  - in case of new QAE hardware a new license is needed.
- Use of local disk for storage in combination with VSS Writer backup
- (optional) Database for internal storage
  - The benefit of local disk performance is lost if a database is used.
  - Using a DB increases chance for mismatch between DB/DSS.
  - Benefits from customer database backup procedures.

Thin or Web Clients

Load Balancer Proxy

Reconnect

VM

Client Engines

Restart

VM

Application Engines

Restart

Quintiq Integrator

Dataset Store Engines

Restart

Data Disk/DB

VSS Backup

var

var

Hardware: Single instance per component – depending on memory load on separate VMs.

Configuration: Limited to windows services and VSS backup.

Performance: Local disk is fast especially when using SSD or similar technology.

Down-time: Windows services restart whole stack. Thin Client can reconnect but users are waiting.
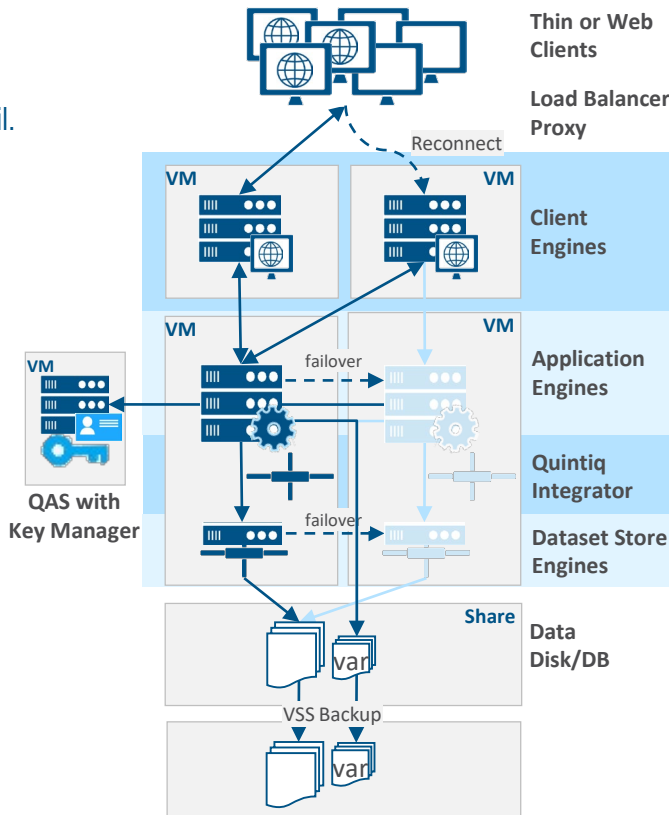
Data loss: Periodic backup has potential for data loss if backup is old.

Disaster recovery: Revert to periodic backup in case of disaster.

MEDIUM HA SCENARIO

VMs, Shared Disk, Redundant components

- **Redundant Client Engines**
  - TCs can reconnect to remaining TCEs when they fail. Also, TCEs are read-only while failover happens.

- **Stand-by QAE**
  - In some cases stand-by system can be used as a test system.

- **Standalone (shared) QAS with Key Manager**
  - Allows for QAEs to be used without hardware-dependent license. Stand-by QAE can be added on-demand, and no key file on disk is needed.

- **Shared disk (NAS)**
  - NAS is simple and has built-in redundancy, but impacts performance. Alternative is a SAN is performant but more advanced.

- **Backup using VSS Writer**
  - For disaster recovery make a periodic snapshot.

Thin or Web Clients

Load Balancer Proxy

Reconnect

Client Engines

Application Engines

Quintiq Integrator

Dataset Store Engines

failover

QAS with Key Manager

Share

Data Disk/DB

VSS Backup

Hardware: Key Manager enables automatic deployment possible.

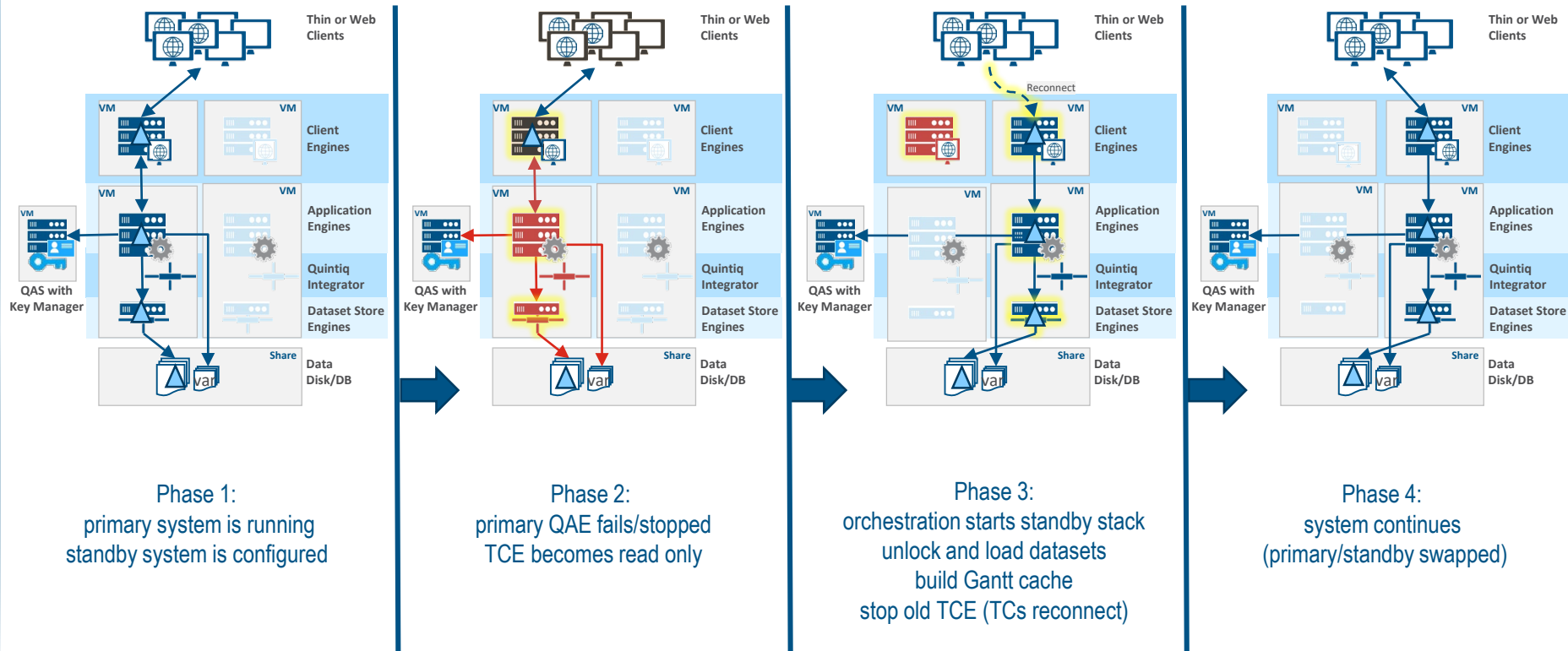**Configuration**: Redundant components and orchestration scripts are required for failover

Performance: NAS is simple but slow. For high performance complex SAN is needed.

Down-time: TCEs continue read-only while restart happens. TCs reconnect to other TCEs.

Data loss: Network shares have built-in redundancy minimizing the risk of data loss.

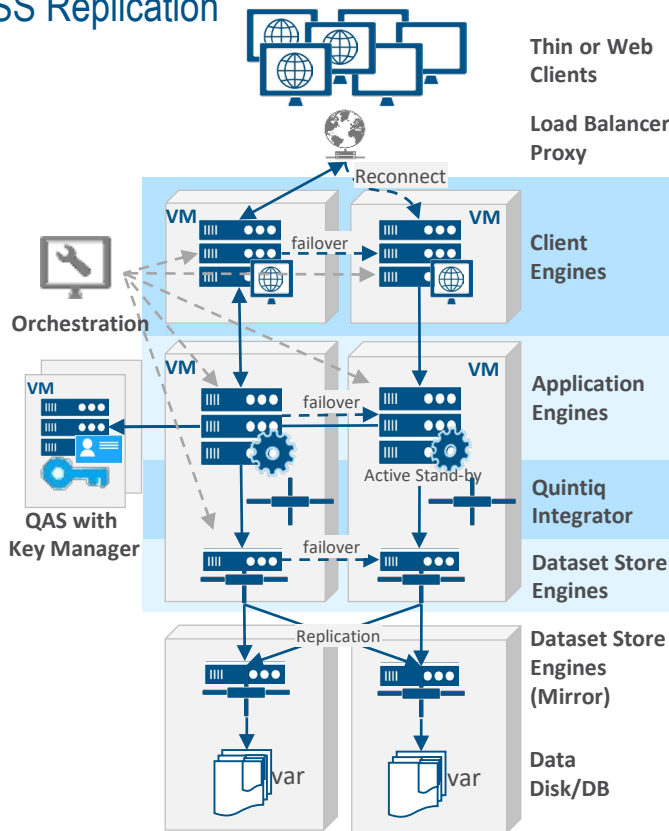**Disaster Recovery**: Revert to periodic backup in case of disaster.

MEDIUM HA FAILOVER SCENARIO

Phase 1:
primary system is running
standby system is configured

Phase 2:
primary QAE fails/stopped
TCE becomes read only

Phase 3:
orchestration starts standby stack
unlock and load datasets
build Gantt cache
stop old TCE (TCs reconnect)

Phase 4:
system continues
(primary/standby swapped)

Legend: gray = only for model upgrade; blue = also for failover

ADVANCED HA ARCHITECTURE

Orchestration, Containers, Key Manager, DSS Replication

- Active Stand-by QAE
  - QAE is active without data sets loaded
- Standalone (shared) QAS with Key Manager
  - Using a standalone QAS allows to use containers or on-demand VMs for QAEs.
- Containers and Orchestration
  - To automate the failover and minimize down-time orchestration is required.
- Var in DSS + DSS Replication
  - Using var-in-DSS means no separate backup is needed for var. DSS Replication combines the speed of local disks on redundant machines.

Thin or Web Clients

Load Balancer Proxy

Reconnect

Orchestration

VM · failover · VM · Client Engines

QAS with Key Manager

VM · failover · VM · Application Engines

Active Stand-by

Quintiq Integrator

failover · Dataset Store Engines

Replication · Dataset Store Engines (Mirror)

var · var · Data Disk/DB

Hardware use: Active Stand-by system requires hardware that is always on.

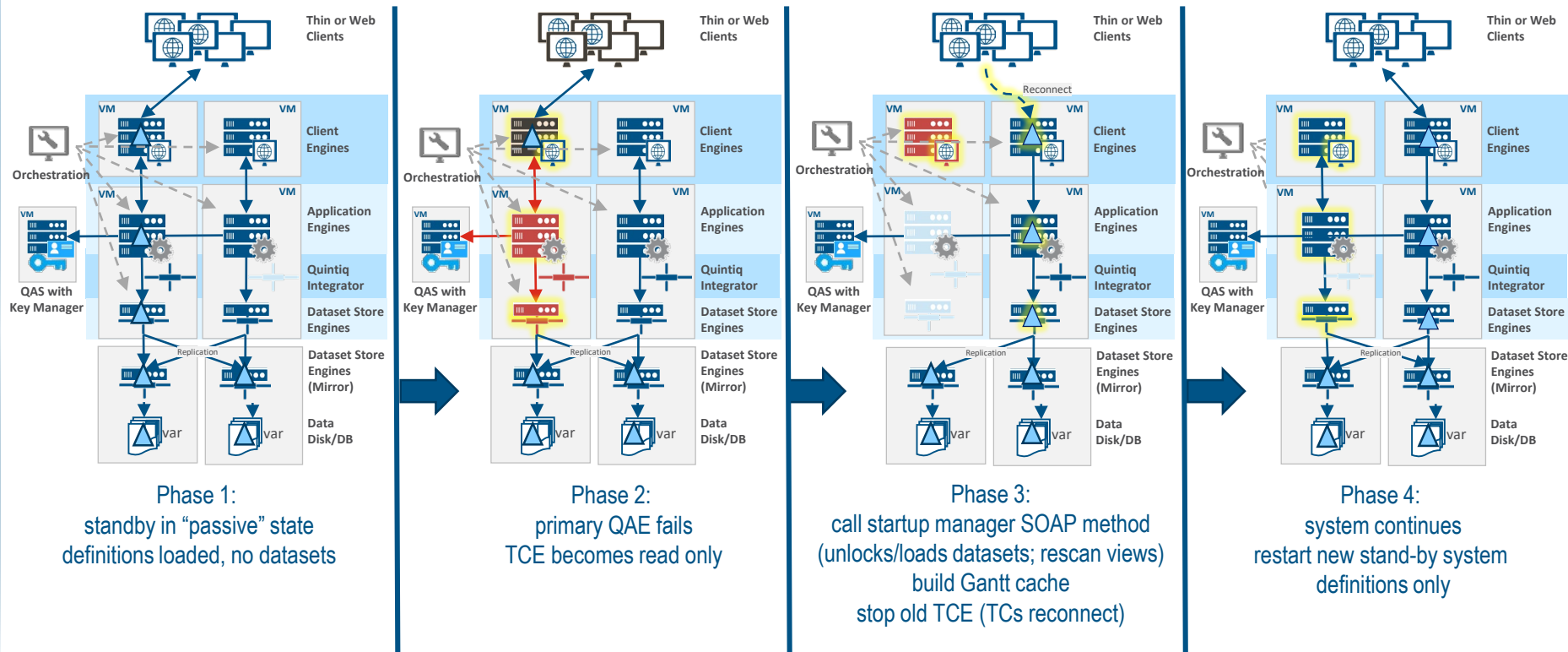Configuration: Many components and advanced high-availability features are configured.

Performance: Mirror dataset stores are fast when using local disk (SSD) and high-bandwidth connections.

Down-time: TCEs are read-only during failover. Active (hot) stand-by system only loads data.

Data loss: Mirror dataset stores are always up to date.

Disaster Recovery: Mirrors can be in different datacenters, depending on bandwidth (impacts performance).

ADVANCED HA FAILOVER SCENARIO

Phase 1:
standby in "passive" state
definitions loaded, no datasets

Phase 2:
primary QAE fails
TCE becomes read only

Phase 3:
call startup manager SOAP method
(unlocks/loads datasets; rescan views)
build Gantt cache
stop old TCE (TCs reconnect)

Phase 4:
system continues
restart new stand-by system
definitions only

AGENDA

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DESIGNING YOUR HA ARCHITECTURE

- Perform a risk analysis to determine worst case scenarios and business impact

- Take maturity and experience level of your IT organization into account

- Focus on reducing startup time of the QAE:

  - Dataset design
  - Dataset loading strategy

- Carefully consider what the conditions are for automatic failover

- Integrate DELMIA Quintiq software with monitoring and orchestration tools.

- Design and execute a DR test for every WCS
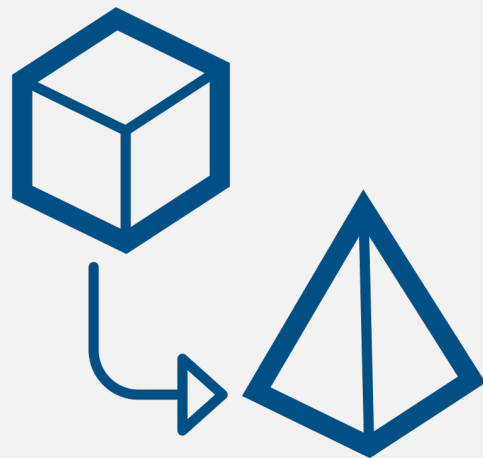
AGENDA

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DELMIA Quintiq HA Features

HA architectures and scenarios

Best practices

Q&A

3DS DASSAULT SYSTEMES

Q & A

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THANK YOU FOR ATTENDING!

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