IBM Software Partner Academy Program

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DB2 & Hochverfügbarkeit

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Agenda – DB2 und Hochverfügbarkeit

1. Klärung des Begriffes/Definition Hochverfügbarkeit.

2. Überblick über die verschiedene DB2 LUW (**L**inux**U**nix**W**indows) Editionen.

3. Was versteht der Wettbewerb unter Hochverfügbarkeit ?
   - Erläuterung shared Disk / shared Nothing Architekturen

4. IBM SW Produkte:
   - DB2 HADR
   - DB2 HADR TSA
   - HACMP
   - Xkoto/Gridscale

   incl. HA-Lizensierungs Übersicht für DB2.

5. Übersicht Hochverfügbarkeitslösungen des Mitbewerbes

6. Fragen

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The Impact of Downtime is Significant

- **Losses due to downtime:**
  - Customer confidence
  - Employee productivity
  - Company or share value
  - Revenue and market share
  - Fees for penalties and fines

Availability	Downtime Minute per Year
99.999%	5 minutes
99.99%	50 minutes
99.9%	8 hours, 20 minutes
99%	3 days, 11 hours, 18 minutes
95%	18 days, 6 hours
90%	34 days, 17 hours, 17 minutes
85%	54 days, 18 hours

Source: Giga Group

Application Segment	Average Cost of Downtime/Hour
Shipping - Distribution	**$28,000 per hour**
Tele-Ticket Sales	**$69,000 per hour**
Airline Reservations	**$89,000 per hour**
Home Shopping	**$113,000 per hour**
Pay Per View - Television	**$150,000 per hour**
Credit Card Sales	**$2,650,000 per hour**
Financial Market	**$6,450,000 per hour**

- **At 99% Uptime, a Financial Market would lose over $540 million per year!**
- **Increasing the uptime to 99.99%, will reduce their annual loss to only $5,400,000 – a savings of $535 million per year!**

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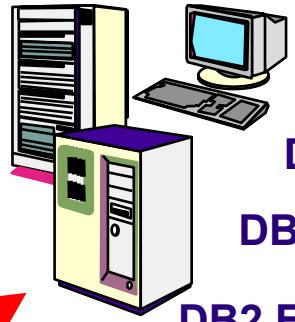
DB2 Familie

Volle Skalierbarkeit, vom Einzelplatzsystem bis hin zum Mainframe.

Host-Datenbanken

DB2 Connect

Datenbank-Server



DB2 Enterprise

DB2 Workgroup

Einzelplatz-Datenbanken

DB2 Express

DB2 Express-C (Fixed Term License)

DB2 Express-C (Community Edition)

DB2 Database Enterprise Developer Edition

DB2 Personal Edition
DB2 Everyplace

Editionen der DB2 Familie im Überblick

	DB2 Express-C	DB2 Express	Workgroup	Enterprise
Zielgruppe	Mittelständische Unternehmen, Entwickler, Partner, Communitys	Mittelständische Unternehmen und Partner, die sie betreuen	Arbeitsgruppen und Abteilungen in Unternehmen und Partner, die sie betreuen	Unternehmen, die anspruchsvolle OLTP-, Web- oder analytische Lösungen implementieren und Partner, die sie betreuen
Plattformen	Linux, Windows	Linux, Windows	alle	alle
Download	250-300 MB	390 MB	größer	größer
Max. Hauptspeicher	4GB	4GB	16GB	unbegrenzt
32/64 Bit	32/64 Bit	32/64 Bit	32/64 Bit	32/64 Bit
Max. CPUs	2	2	4	unbegrenzt
Max. DB Größe	unbegrenzt	unbegrenzt	unbegrenzt	unbegrenzt
Zusatzoptionen	keine	High Availability Disaster Recovery	Query Patroller	Data Partitioning, Query Patroller, Geodetic Extender
Lizenzierung	lizenzkostenfrei	Pro Prozessor oder pro Client/Server	Pro Prozessor oder pro Client/Server	Pro Prozessor oder pro authorisierten Benutzer
Support	Web Community Forum	Passport 24X7	Passport 24X7	Passport 24X7

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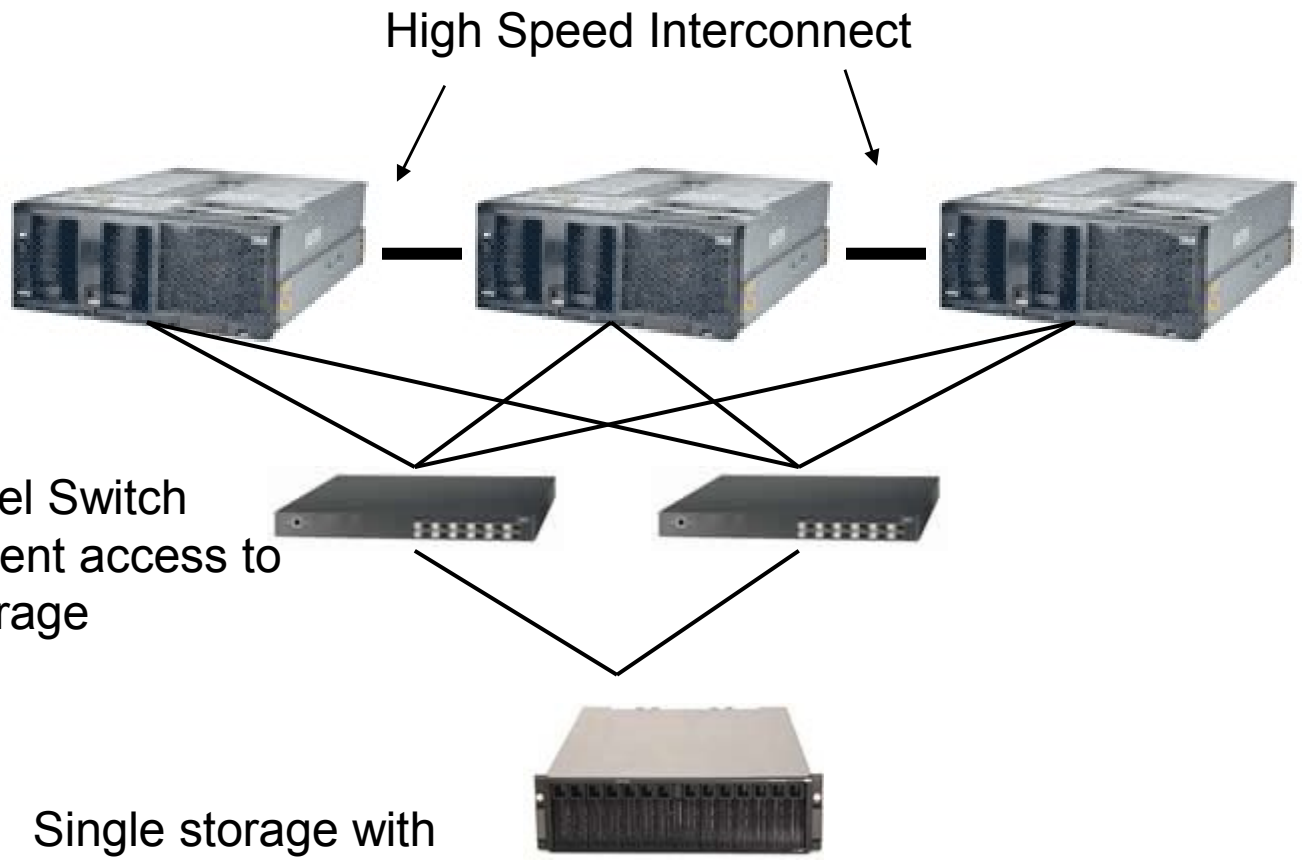
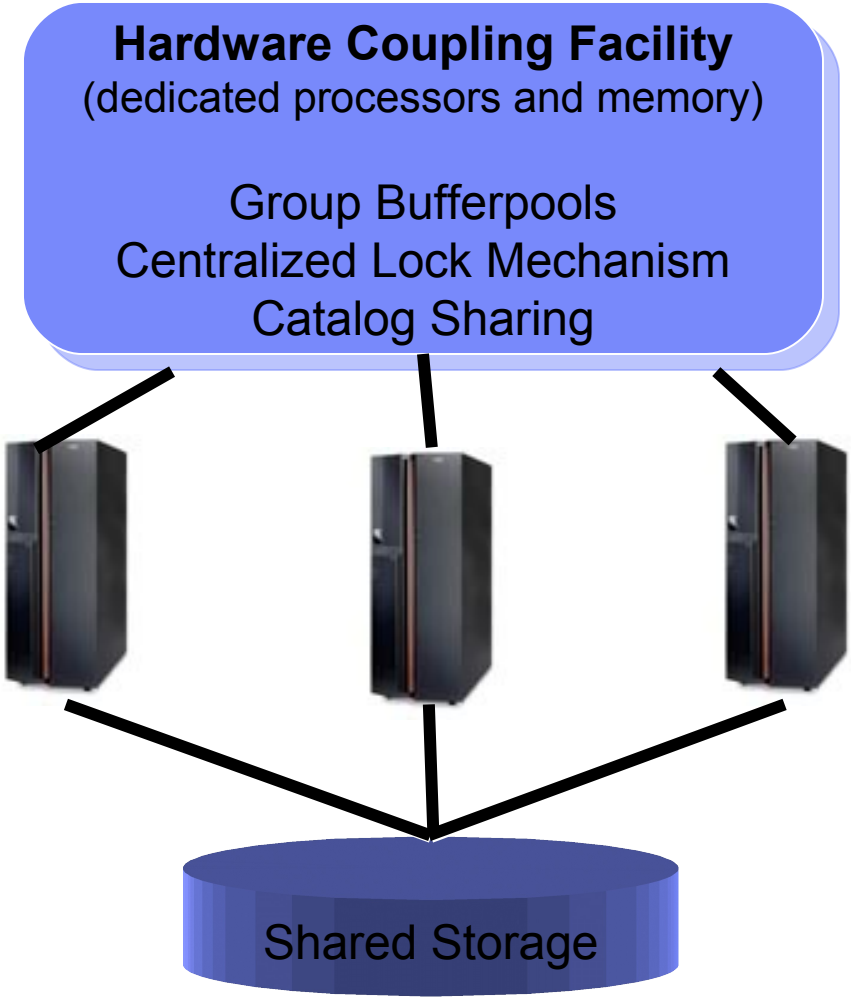
Oracle RAC Shared Disk Architecture



Shared Disk Comparison to DB2 for z/OS



- DB2 for z/OS delivers a truly scalable shared disk architecture
  - Hardware assisted locking
  - True shared caching
- DB2 for z/OS delivers better availability
- Parallel Sysplex exploitation for the entire environment
  - Workload Management
  - CICS
  - MQ
  - etc.

Why DB2 on Linux, UNIX, Windows does not share data

- DB2 for Linux, UNIX, Windows implements a “shared nothing” architecture
  - Somewhat of a misnomer – can use shared storage for higher availability
- No hardware coupling facility (CF) exists on Linux, UNIX, Windows
  - Requires software simulation of CF
  - Network traffic, data synchronization and serialization incurs large overhead – limits scalability and performance

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High Availability

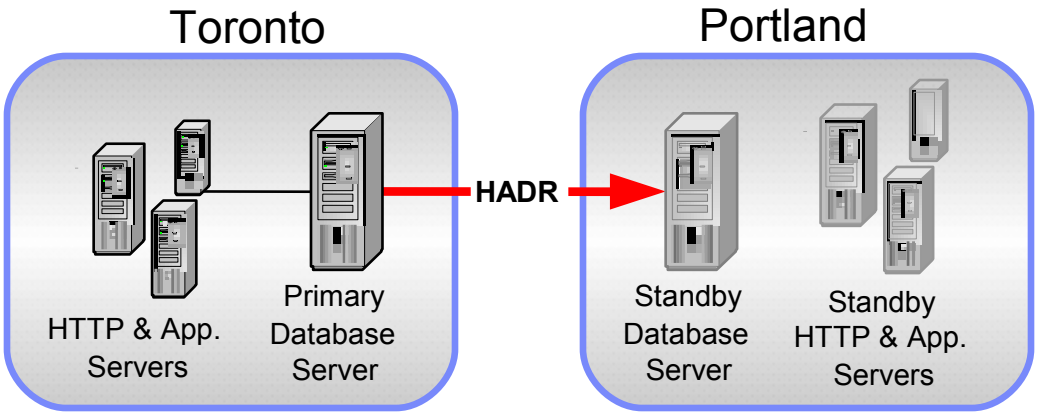
High Availability Disaster Recovery (HADR)

HACMP (High Available Cluster Multi Processing)

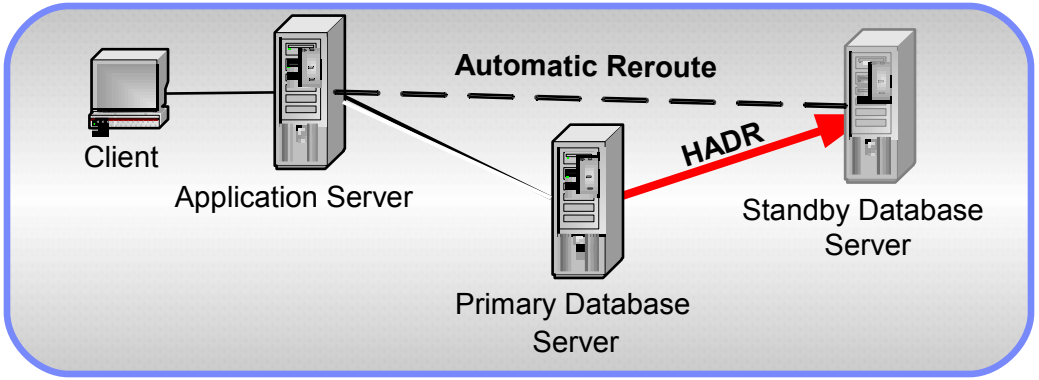
Gridscale (xKoto) HA - Solution

High Availability Disaster Recovery (HADR)

- Target Market
  - Online commercial applications
- Challenge
  - 24 x 7 Availability
    - Failover in seconds
    - Disaster recovery
- Solution : HADR
  - Single solution handles
    - Ultra-fast failover
    - Local and remote site recovery
- Value
  - Business continuation
  - Tight integration; Very simple to use

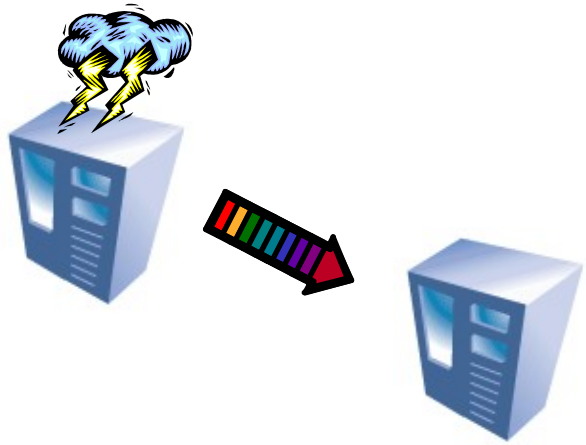


Offsite Disaster Recovery



Onsite Hot Standby

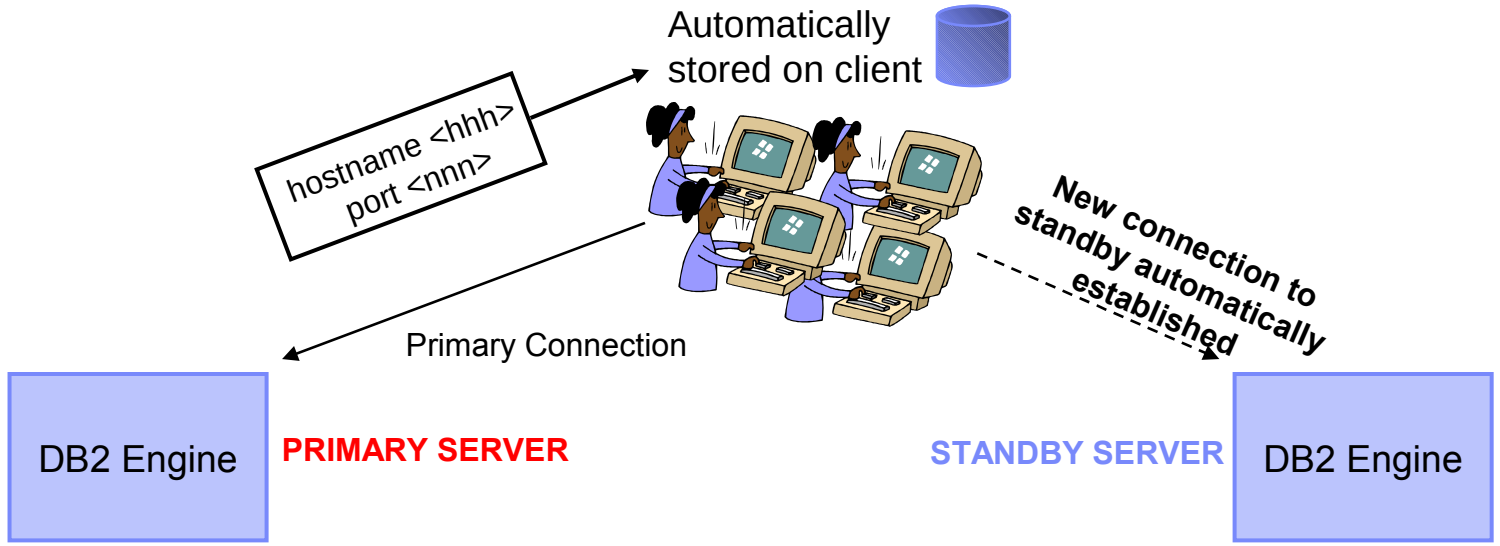
DB2 HADR Basic Principles



- **Two machines**
  - Primary
    - Processes transactions
    - Ships log entries to the other machine
  - Standby
    - Cloned from the primary
    - Receives and stores log entries from the primary
    - Re-applies the transactions
- **If the primary fails, the standby can take over the transactional workload**
  - The standby becomes the new primary
- **If the failed machine becomes available again, it can be resynchronized**
  - The old primary becomes the new standby

Automatic Client Reroute

- Automatic, transparent connection to alternate server when primary connection fails
  - If there is a currently executing SQL statement, it will fail with sqlcode -30108
  - Transaction can then be re-driven without re-establishing a connection
- Alternate information Stored on client
  - System database directory
  - alternateDataSource property (Java Type 4 driver)
- Works with HADR, WSE/ESE, DPF, Replication



db2 update alternate server for database <dbname> using hostname <hhh> port <nnn>

HADR und Tivoli System Automation (TSA) Integration

DB2 HADR with TSA (with TSA Tie Breaker)

- **TSA running on all 3 nodes**
- **TSA monitors and manages resources, i.e. DB2 instances, network interfaces, virtual IPs, mount points**
- **DB2 uses HADR service to keep the standby database in sync**
- **Client acts as a tie breaker to resolve split brain situation**

DB2 HADR with TSA and IP Quorum

- **Same as Tie Breaker setup, but …**
- **TSA on primary and standby nodes uses simple icmp ping to detect split brain situation**
- **Sufficient for most scenarios and very easy to setup**
- **IP Quorum can be i.e. the network gateway**

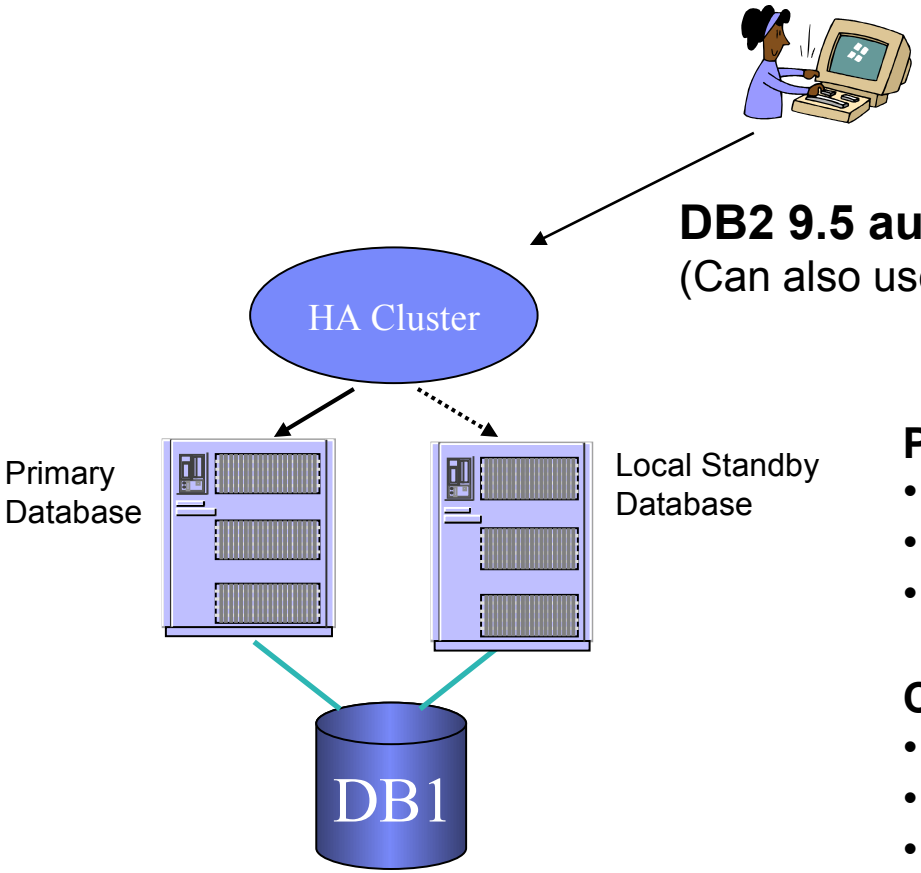
High Availability

High Availability Disaster Recovery (HADR)

HACMP (High Available Cluster Multi Processing)

Gridscale (xKoto) HA - Solution

Local Cluster Failover



DB2 9.5 automation with built in cluster manager
(Can also use HACMP, MSCS, Sun, Veritas, Heartbeat, etc)

Pros:
- **Inexpensive local failover solution**
- **Protection from software or server failure**
- **DB2 9.5 integrated with TSA cluster manager**

Cons:
- **No protection from disk failure**
- **No protection from site failure**
- **Failover times vary from 1 to 5+ minutes**

IBM HACMP – High Available Cluster Multi Processing

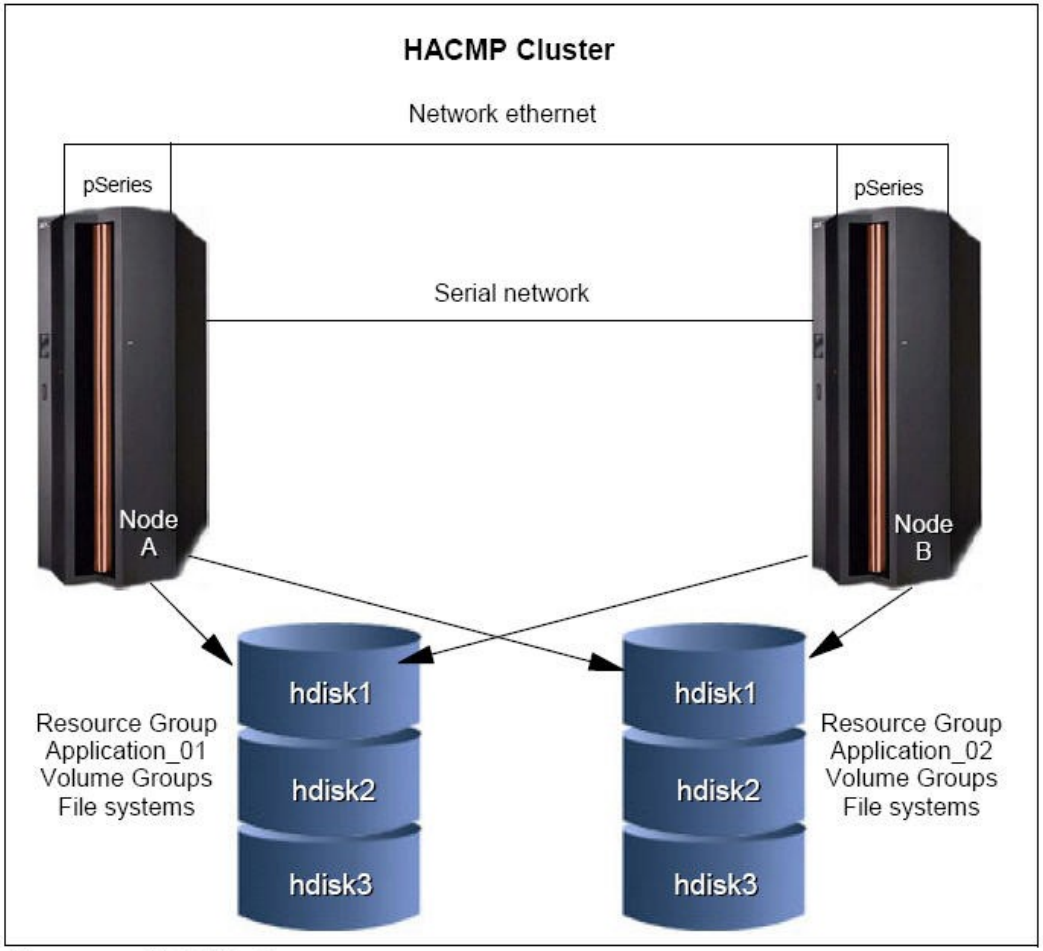


Figure 1-1 HACMP cluster

High Availability

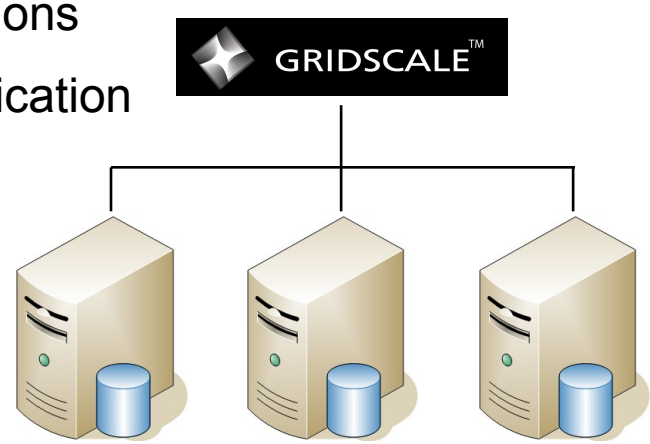
High Availability Disaster Recovery (HADR)

HACMP (High Available Cluster Multi Processing)

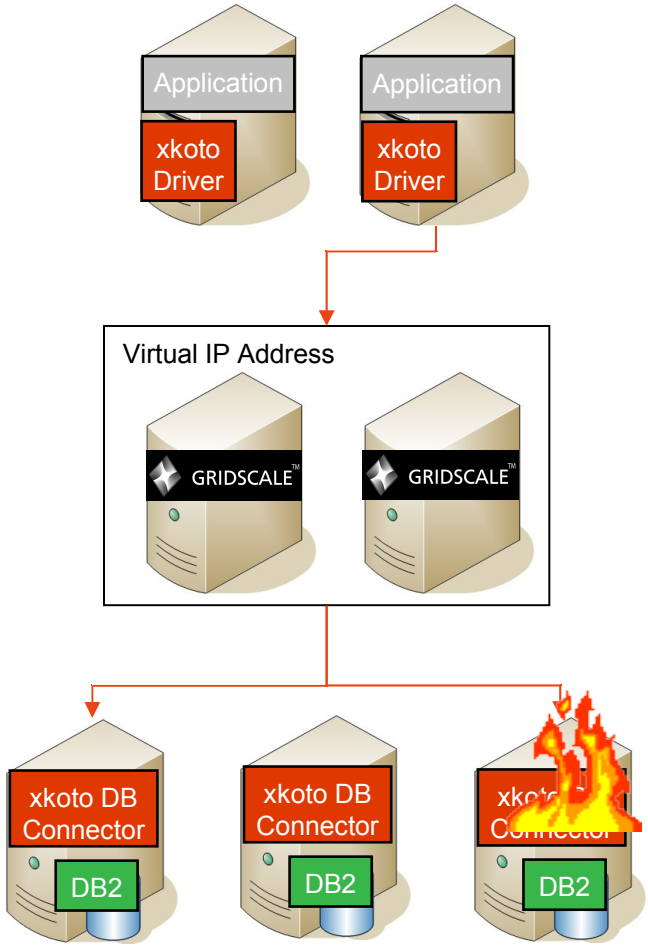
Gridscale (xKoto) HA - Solution

DB2 & GRIDSCALE Architecture

- **Shared nothing, active/active architecture**
  - Continuous availability with instantaneous failover
- **Each database server maintains its own copy of the database**
  - Can use direct attach storage or SAN
- **No distance limitations – uses standard Ethernet connections**
- **Provides**
  - Continuous availability for all applications
  - Incremental scale out for mostly read applications
  - Built in replication including long distance replication for disaster recovery



DB2 & GRIDSCALE Availability



- Read statements are load balanced to only one database server – the most up to date and least loaded database server
- GRIDSCALE automatically and transparently re-routes read statements if a database server fails
- GRIDSCALE automatically and transparently re-applies any outstanding writes when the database server is brought back on line

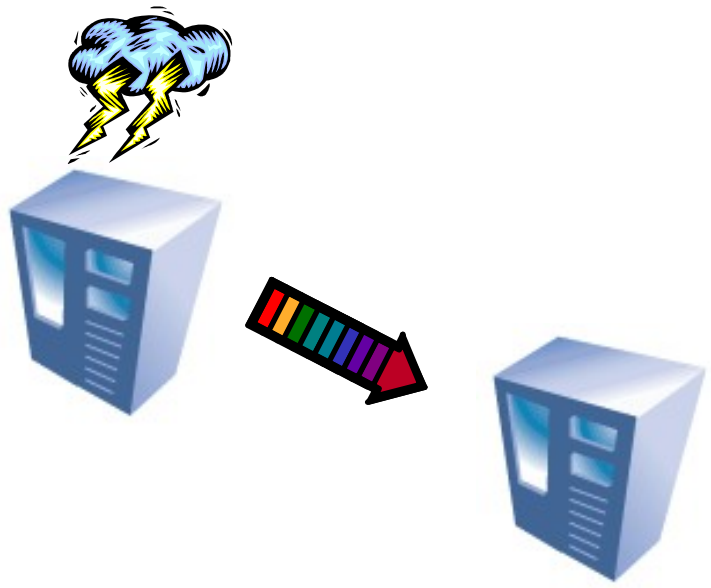
Summary

	Oracle RAC	DB2 & GRIDSCALE
Architecture	**Shared Disk & Shared Cache**	**Shared Nothing**
Ease of Use and Installation	**weeks/months**	**< 1 day**
Workload Management	**Session load balancing; limited load balancing.**	**SQL statement load balancing.**
Availability	**Loss of database access for short period after node failure.** **Transactions rollback on node failure.**	**Instantaneous failover.** **No loss of database availability on node failures.** **Transactions typically not rolled back.**
Disaster Recovery	**Not included; requires separate product.**	**Provided without additional cost & integration.**
Scalability	**Negative scalability possible out of the box.** **Requires code changes for significant scalability.**	**Provides significant scalability for mostly read applications out of the box – without code changes.**

IBM DB2 HA – Lizensierung -

Hochverfügbarkeit

- High Availability Cluster:
  Ein Produktions-Rechner sowie ein oder mehrere Backup/Standby-Rechner
- Beim Ausfall des Produktionsrechners wird die Workload vom Standby-Rechner übernommen
- DB2 9.5 Terminologie:
  Hot, Idle oder Cold Standby



Hochverfügbarkeit Lizenzierung

Cold Standby	Warm Standby	Hot Standby
▪ DB2 ist installiert ▪ DB2 ist nicht gestartet	▪ DB2 ist installiert und gestartet ▪ DB2 ist nicht betriebsbereit, d.h. kann keine Endbenutzer-transaktionen oder Abfrage-workloads bedienen ▪ DB2 wird ausschließlich für Verwaltungsaktionen in Funktionsübernahmesituationen genutzt (Protokollübertragungen, Flashkopie, Backup, Synchronisation via HADR)	▪ DB2 ist installiert und betriebsbereit ▪ DB2 kann Benutzertransaktionen oder Abfragen bereits vor einem Systemausfall verarbeiten
▪ Es fallen keine Lizenzgebühren an	▪ 100 PVUs ▪ Minimum Authorized User (5 für Workgroup/Express bzw. 25 für Enterprise)	▪ Volle Lizenzierung

Links

- Software Licensing Agreement search site
  - http://www.ibm.com/software/sla/sladb.nsf/search
- Announcements
  - http://www.ibm.com/common/ssi/OIX.wss
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- Sub-Capacity attachment
  - http://www.ibm.com/software/sw-lotus/services/cwepassport.nsf/wdocs/subcapacityattachments
- DB2 and IBM's Value Unit pricing
  - http://www.ibm.com/developerworks/db2/library/techarticle/dm-0611zikopoulos2
- Licensing distributed DB2 9.5 data servers in a high availability environment
  - http://www.ibm.com/developerworks/db2/library/techarticle/dm-0612zikopoulos
- Compare the distributed DB2 9.5 data servers
  - http://www.ibm.com/developerworks/db2/library/techarticle/0301zikopoulos/0301zikopoulos1.html
- Which distributed edition of DB2 9.5 is right for you?
  - http://www.ibm.com/developerworks/db2/library/techarticle/dm-0611zikopoulos/

Red Book zu „DB2 HA“ verfügbar unter:
http://www.redbooks.ibm.com ---- Dokument: SG24-7363-01

Übersicht HA Lizensierung Mitbewerb

Hersteller	HA Funktionalität:	Zus. Notwendige SW
IBM DB2	HADR SW ab WSE automatisch enthalten	----------
ORACLE	RAC muss sep. pro Knoten lizensiert werden.(pro Knoten und pro CPU 47.500 US$)	Zus. DataGuard Notwendig.(ebenfalls sep. zu lizensieren)
SQL-Server	Keine HA Lösung vorhanden	Microsoft Cluster Services (MSCS) ist zus. zu lizensieren

High Availability Cluster Solutions in DB2

- High availability clusters solutions are available for today's most popular operating systems:
  - Windows
    - Microsoft Cluster Services (MSCS)
  - Linux
    - Steeleye Lifekeeper
    - Veritas Cluster Server
    - Legato Cluster
    - Tivoli automation for Linux
    - Mission Critical Linx Convolo Cluster
    - Dataguard Edition
    - Linux Heartbeat (Open Source)
  - AIX
    - High Availability Cluster Multiprocessing (HACMP-POWER HA/XD) (XD=extended Distance)
  - Sun Solaris
    - Sun Cluster
    - Veritas Cluster Server
  - HP-UX
    - MC/Service Guard

Kontaktdaten:

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Vielen Dank für Ihre Mitarbeit!