z/OS Data Replication as a Driver for Business Continuity

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Agenda

• IBM’s z/OS Data Replication for DB2 and IMS High Availability

• Typical usage examples

• Shifting to continuous availability …
  Data Replication as part of GDPS Active-Active Sites
InfoSphere Replication Server for z/OS
InfoSphere IMS Replication for z/OS
IBM Replication for High Availability

• Focus is on
  • Mirroring the data … minimal or no transformation
  • Very high throughputs … must keep up with enterprise workloads
  • Very low latency … less than one or two second latency is typical

• Common characteristics
  • Log-based captures … non-intrusive – no application changes
  • Parallel apply engines … keep up with the workload
  • Recoverable … track where apply “left off” as the point of recovery
  • Asynchronous … unlimited site separation
InfoSphere Replication Server for z/OS

Synchronize like-to-like copies

Distribution, consolidation or synchronization of information in different databases

- **Multi-directional delivery:**
  - Unidirectional
  - Bidirectional
  - Peer-to-Peer

- **Ease-of-use features:**
  - Integrated monitoring & statistics
  - Changed data histories
  - Configuration options:
    - Wizard-driven GUI
    - Command-line processor
    - Script-driven processor
SQL Replication
Enables fan-out and heterogeneous replication
Too many “moving parts” for high availability

- Broad set of sources and targets
- Well suited to “fan out” requirements
- Flexible scheduling, transformation, distribution

Ni cknames
Staging Table

• Trigger based
• Log based

Capture
Staging Table
Apply

Federation Server

DB2
Sybase
Oracle
SQL Server
Informix
Teradata
Nicknames

SHARE in Orlando 2011
Queue Replication
Ideal for High Availability DB2 Data Synchronization

- **High Throughput, Low Latency, Multi-directional**
  - Unidirectional
  - Bidirectional
  - Peer-to-Peer

- **Features:**
  - Log based capture mechanism
  - Highly parallel apply process for high speed and low latency
  - Integrated monitoring & statistics
  - Changed data histories
  - Best of breed conflict detection and resolution
Queue Replication
Some Details of Highly Parallel Q Apply

- Transactions processed in parallel
  - By threads called ‘agents’
  - Serialized only if dependency detected by data server
InfoSphere IMS Replication for z/OS

Unidirectional Replication of IMS data

- Release 1:
  - Conflicts will be detected
  - Manual resolution will be required
  - External initial load of target DB
  - Basic replication monitoring

- Administration via built-in GUI & z/OS console commands

- IMS “Capture” supports
  - DB/TM, DBCTL, Batch DL/I
  - Capture x’99’ log records
  - Increase in log volume due to change data capture records

- IMS “Apply” supports
  - Serialization based on resources updated by unit of recovery
  - Parallel apply
  - Requires New IMS Replication Restart Database
Unidirectional IMS Data Replication

Source IMS Databases

IMS

Capture Services

Admin. Services

Replication Metadata

ACBLIB

Target IMS Databases

Target IMS Databases

Bookmark DB

IMS

Apply Services

Admin. Services

Classical Metadata Capture

Source IMS

Databases

TCP/IP

One Session Per Subscription

Source IMS,
Databases

 IMS

Logs

DBRC API

RECON

SOURCE SERVER

TARGET SERVER
Some Details of IMS Data Replication

Capture Services – Log Merge
Some Details of IMS Data Replication

Target Services – Parallel Apply

- Target Server
- Staged Unit-of-Recovery Data
- Writer Services
- Change Messages
- Dependency Analysis
- IMS
Business Scenarios for Software-Based Data Replication
Customer Scenarios for Replication

- An automobile company uses a DB2 database to drive the factory floor production. Running reports against that database slows down the manufacturing process. A replicated copy increases manufacturing efficiency while allowing for up to date reports.
  - *Same to same, low latency*

- A financial company seeks a database infrastructure that will provide for high availability copies of their database but at the same time provide a real time feed to their information warehouse.
  - *High availability in addition to ETL*

- An insurance company distributes data from their central database at headquarters to all branches. At many of these branches the data is further distributed to individual insurance salesmen.
  - *Many target copies, highly distributed*
CitiStreet
Selective “High Availability”

Challenge

• Support single sign-on access through both Web and IVR applications ensuring 24x7 portal access for plan participants and sponsors

Solution

• Support redundant, active single sign-on applications for failover processing replicating profile changes between them in real time.

"Since nearly 10 million of CitiStreet customers are offered 24-hour access to their retirement accounts, the company can't afford downtime and must be able to replicate data changes when they happen. We fully replicate our database over redundancy data lines, so to us the stability and speed of that asynchronous replication is strategic for us." Barry Strasnick, CIO, CitiStreet

Overview

• CitiStreet is one of the largest and most experienced global benefits providers servicing over 9 million plan participants across all markets. CitiStreet was formed in partnership between subsidiaries of State Street Corporation and Citigroup

Business benefits

• Ensure application availability for plan participants and sponsors
• The new solutions from IBM will improve data integrity with a reduced level of maintenance

Technology benefits

• Maintain bi-directional synchronization of profile updates in real time (approx 175,000 updates daily)
Corporate initiative to provide customers better performing real-time queries by utilizing multiple sites.

Replication of critical order processing details for core business functionality.

Business benefits:
- Replicating 5-10 Million transactions with less than 2 seconds latency.
- More efficient and cost-effective resource utilization.
- Secondary platform services reporting and business intelligence queries and acts as backup to primary.

Technology benefits:
- Real-time back up of secondary system provides results in increased capacity for peak workloads.

Solution:
- Q Replication for high speed movement of up to 10 Million transactions to secondary site several thousand miles away.
Today’s Automated High Availability Solutions
GDPS PPRC/XRC/GM
**Business Continuity Evolution with GDPS**

**GDPS/PPRC**
- Failover Model
- Recovery Time ≈ 2 min
- Distance < 20 miles

**GDPS/XRC or GDPS/GM**
- Failover Model
- Recovery Time < 1 hour
- Unlimited distance

**GDPS/Active/Active**
- Continuous availability model
- Recovery time < 1 minute
- Unlimited distance

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**Continuous Availability w/ Disaster Recovery within a Metropolitan Region**

**GDPS/PPRC**
- RPO = 0 / RTO <1 hr
- Two Data Centers
  - Systems remain active
- Multi-site workloads can withstand site and/or storage failures

**GDPS/GM & GDPS/XRC**
- RPO secs / RTO <1 hr
- Two Data Centers
  - Rapid Systems Disaster Recovery with “seconds” of Data Loss
  - Disaster recovery for out of region interruptions

**GDPS Active-Active Sites**
- RPO secs / RTO <1 min
- Two or More Data Centers
  - All Sites Active
  - Continuous Availability for planned and unplanned interruptions
Regional Continuous Availability

GDPS/PPRC

- Built on a multi-site Parallel Sysplex and synchronous disk replication
- Provides both:
  - Metro-area Continuous Availability (CA),
  - Disaster Recovery solution (DR)
- Supports two configurations:
  - Active/standby
  - Active/active
- Active/active customer configurations:
  - All critical data must be PPRCed and HyperSwap enabled
  - All critical CF structures must be duplexed
  - Applications must be parallel sysplex enabled
  - Signal latency will impact OLTP thru-put and batch duration resulting in the sites being separated by no more than a ~20-30 of KM of fiber network

Issue: Insufficient site separation for some workloads
Disaster Recovery at Extended Distances

GDPS/XRC and GDPS/GM

- Asynchronous disk replication
- Unlimited distance Disaster Recovery solutions
- Require the failed site’s workload to be restarted in the recovery site and this typically will take 30-60 min
  - Power fail consistency
  - Transaction consistency

Issue: Can NOT achieve RTO of seconds needed for some workloads
Customer Requirements
*RTO near zero, Replace roll-your-own, Leverage all resources*

Shift focus from failover to nearly-continuous availability

- “Recover my business rather than my platform technology”
  - Multi-sysplex, multi-platform solution
  - No application changes
  - Access data from any site with unlimited distance between sites
  - Provide application level granularity rather than the current “all-or-nothing” model
    - Some workloads may require immediate access from every site
    - Some workloads may only need to update other sites every 24 hours

- **Minimize costs and Optimize resource utilization**
  - Automated recovery processes (similar to GDPS technology today), minimizing operator learning curve
  - Provide workload distribution between sites
    - Dynamically select sites based on their ability to handle workload
    - Route around failed sites
GDPS Active/Active Sites Configurations

- Configurations
  - Active/Standby – Announced June, 2011
  - Active/Query – Stated Direction
  - Active/Active – Customer Defined Goal

- A configuration is specified on a workload basis
  - Mixed configurations can be used to handle the diverse recovery requirements

- A workload is the aggregation of these components
  - Software – user written applications (e.g., COBOL program) and the middleware run time environment (e.g., CICS region & DB2 subsystem)
  - Data - related set of objects that must preserve transactional consistency and optionally referential integrity constraints (e.g., DB2 Tables)
  - Network connectivity – one or more TCP/IP addresses & ports (e.g., 10.10.10.1:80)
Active/Active concepts

Two or more sites, separated by unlimited distances, running the same applications & having the same data to provide:

- Cross-site Workload Balancing
- Continuous Availability
- Disaster Recovery

Workload Distributor:
Workloads are managed by a client and routed to one of many replicas, depending upon workload weight and latency constraints, extending workload balancing to SYSPLEXs across multiple sites!
Replication:
Data at geographically dispersed sites are kept in sync via software-based data replication.

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- Cross-site Workload Balancing
- Continuous Availability
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Active/Active concepts

San Jose

London

Replication:
Data at geographically dispersed sites are kept in sync via software-based data replication.
Active/Active concepts

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Tivoli Enterprise Portal:
Monitoring spans the sites and now becomes an essential element of the solution for site health checks, performance tuning, etc.
Conceptual view

Transactions

Workload Routing to active sysplex

Active Production Workload

Workload Distribution

Standby Production Workload

S/W Data Replication

Control information passed between systems and workload distributor

Workload Lifeline, Tivoli NetView, System Automation, …

Controllers

Any load balancer or workload distributor that supports the Server Application State Protocol (SASP) e.g. • Cisco CSM • Citrix NetScaler • Nortel Gigabit
Thank You