Enabling Continuous Availability with IBM Multi-site Workload Lifeline

SHARE Session 17086

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Agenda

- Disaster Recovery and Continuous Availability
- Do I need continuous availability for my workloads?
- Steps to achieving continuous availability
  - Database replication
  - Multi-site Workload Lifeline
  - GDPS Active-Active Sites
Multi-site Workload Lifeline

Disaster Recovery and Continuous Availability
Do I need continuous availability for my workloads?
Steps for achieving continuous availability
  Database replication
  Multi-site Workload Lifeline
  GDPS Active-Active Sites
Business Continuity Definitions

- Disaster recovery (DR)
  - The reconstruction of the current physical production site in an alternate physical site, following the loss of the production site.
  - The process of bringing up systems and applications, utilizing the disk-replicated data, in order to support the business from the alternate site.

- Continuous Availability (CA)
  - The duplication of the current primary environment in order to restore the business following the loss of the primary site with minimal downtime.

- Recovery Point Objective (RPO)
  - Amount of data loss following a loss of the primary site when the business is restored.

- Recovery Time Objective (RTO)
  - Duration of time following a loss of the primary site until the business is restored.
Existing DR/CA solutions at metro distances

- GDPS/PPRC (Metro Mirror), based upon a multi-site Parallel Sysplex and synchronous disk replication, is a metro area Continuous Availability (CA), Disaster Recovery (DR) solution
  - Workloads can withstand site and/or storage failures

- Low recovery time and zero data loss

- Issue: This GDPS product does not provide enough site separation for some enterprises
Existing DR solutions at global distances

- GDPS/XRC and GDPS/GM, based upon separate sysplexes and asynchronous disk replication, are unlimited distance Disaster Recovery (DR) solutions
  - Disaster recovery for metro-region interruptions
  - Longer recovery time with “seconds” of data loss

- These GDPS products require the failed site’s workload to be restarted in the recovery site and this typically will take an hour or longer

- **Issue**: These GDPS products will not achieve a recovery time of seconds being requested by some enterprises
Continuous Availability at any distance

- Two or more sites, separated by unlimited distances, running the same applications and having the same data to provide cross-site workload balancing and Continuous Availability / Disaster Recovery
- Access data from any site (unlimited distance between sites)
- Provide workload distribution between sites
- Provide application level granularity
  - Allows customers to pursue a gradual, incremental approach to continuous availability that focuses on the most critical workloads first
- Can be used for both unplanned and planned workload outages
- Paradigm shift: failover model => near continuous availability model
  - For critical workloads requiring continuous availability
  - Not a replacement for disaster recovery of non-critical workloads
What is a continuous availability workload?

- A workload is the aggregation of these components
  - **Software:** 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
    (e.g., DB2 Tables)
  - **Network connectivity:** one or more TCP/IP addresses & ports (e.g.,
    10.10.10.1:80) or SNA application resource names (e.g., NETA.APPL1)
Multi-site Workload Lifeline

Disaster Recovery and Continuous Availability

Do I need continuous availability for my workloads?

Steps for achieving continuous availability

Database replication
Multi-site Workload Lifeline
GDPS Active-Active Sites
How much interruption can your business tolerate?

Ensuring Business Continuity:
- **Disaster Recovery**
  - Restore business after an unplanned outage
- **High Availability**
  - Meet Service Availability objectives, e.g., 99.9% availability or 8.8 hours of down-time a year
- **Continuous Availability**
  - No downtime (planned or not)

Enterprises that operate across time-zones no longer have any ‘off-hours’ window, continuous availability is required

**What is the cost of 1 hour of downtime during core business hours?**

<table>
<thead>
<tr>
<th>Yearly Cost Metrics</th>
<th>Best-in-Class</th>
<th>Industry Average</th>
<th>Laggards</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business interruption events</td>
<td>.3</td>
<td>2.3</td>
<td>4.4</td>
</tr>
<tr>
<td>Time per business interruption event</td>
<td>.1</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Total disruption (hours)</td>
<td>.03</td>
<td>2.3</td>
<td>39.6</td>
</tr>
<tr>
<td>Average cost per hour of disruption</td>
<td>$101,600</td>
<td>$181,770</td>
<td>$99,150</td>
</tr>
<tr>
<td>Total cost of business interruption events</td>
<td>$3,048</td>
<td>$418,071</td>
<td>$3,926,340</td>
</tr>
</tbody>
</table>

Source: Aberdeen Group, February 2012
Disruptions affect more than the bottom line ...

August 18, 2013
Google total eclipse sees 40 percent drop in Internet traffic

August 22, 2013
Nasdaq: ‘Connectivity issue’ led to three-hour shutdown

July 20, 2013
DMV Computers Fail Statewide, Police Can’t Access Database

April 16, 2013
American Airlines Grounds Flights Nationwide

... with enormous impact on the business

- Downtime costs can equal up to 16 percent of revenue
- 4 hours of downtime severely damaging for 32 percent of organizations
- Data is growing at explosive rates – growing from 161EB in 2007 to 988EB in 2010
- Some industries fined for downtime and inability to meet regulatory compliance
- Downtime ranges from 300–1,200 hours per year, depending on industry

Evolving customer requirements

- Shift focus from failover model to *near-continuous availability* model (RTO near zero)
- Access data from *any site* (unlimited distance between sites)
- Provide *workload distribution between sites* (route around failed sites, dynamically select sites based on ability of site to handle additional workload)
- Provide *application level granularity*
  - Some workloads may require immediate access from every site, other workloads may only need to update other sites every 24 hours (less critical data)
  - Current solutions employ an all-or-nothing approach (complete disk mirroring, requiring extra network capacity)
- Ensure successful recovery via *automated processes* (similar to GDPS technology today)
  - Can be handled by less-skilled operators
Multi-site Workload Lifeline

Disaster Recovery and Continuous Availability
Do I need continuous availability for my workloads?

Steps for achieving continuous availability
Database replication
Multi-site Workload Lifeline
GDPS Active-Active Sites
Database Replication

- What is data replication?
  - A solution for replicating transactions between databases, typically residing in different sites
  - Emphasizes the replicating of only changed data
    - An application makes updates to a database and these changes are captured locally and applied to a remote database
  - Replication scope
    - An entire database
    - A subset of the database (for example, a subset of tables)

- Why use data replication?
  - Offload read-only transactions to replicated database
    - Read-only database provides near-real time reporting
  - Continuous (High) Availability
    - Failover to replicated database during disaster recovery
Database Products

- InfoSphere Data Replication for DB2 for z/OS
  - A solution for replicating DB2 table or database updates

- InfoSphere Data Replication for IMS for z/OS
  - A solution for replicating IMS database updates

- InfoSphere Data Replication for VSAM for z/OS
  - A solution for replicating VSAM file updates
Multi-site Workload Lifeline

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What is Multi-site Workload Lifeline?

- Lifeline is a product that enables very high availability with load balancing and workload rerouting

- Lifeline plays a key role in solving 2 major problems in the Enterprise
  - Providing continuous availability for critical workloads during unplanned outages
  - Reducing downtime for planned outages

- Lifeline solution requires:
  - Data replication products
  - SASP capable load balancer
Multi-site Workload Lifeline Benefits …

Providing continuous availability for critical workloads

- Provides intelligent load balancing advice for TCP/IP workloads across two sites at unlimited distances to provide nearly continuous availability
  - Increases availability: New connections are routed away from failing applications, systems and sites in the event of outage.
  - Increases performance: Reduces response time by routing new connections to applications and systems with most capacity for additional work
  - Allows scalability: Additional application instances can be added on demand
  - Improves recovery time: Reduces recovery time from hours to minutes

- Improves analytic capability: Network Management Interface (NMI) provides access to workload, application and site status
Multi-site Workload Lifeline Benefits

- Enables movement of workloads from one site to another by providing graceful rerouting
  - Workload migration: Ability to move workloads from one site to the other with minimal disruption
  - Increased availability: Outages for maintenance updates or other planned events can be minimized
  - Verification of disaster recovery procedures: Simpler, non-disruptive testing of disaster recovery procedures by validating workloads remain accessible on the recovery site without requiring a site outage on the production site
What makes Multi-site Workload Lifeline different?

- Lifeline is not an all-or-nothing solution
  - Lifeline helps allow customers to pursue a gradual, incremental approach to continuous availability that focuses on the most critical workloads first

- Lifeline supports routing workloads to the alternate site, reducing the strain on the primary transaction system and allowing organizations to get more value from their secondary site investment

- Lifeline requires no configuration changes to:
  - Server Applications
  - Clients
  - The network topology
Continuous Availability Configurations

- Configurations
  - Active/Standby
  - Active/Query

- Configuration is specified on a workload basis

- Supported workloads
  - TCP/IP workloads
  - Linux on System z workloads
  - SNA workloads
Scenario 1: Active/Standby Configuration – Prior to workload outage

Site 1
Workload A active

Site 2
Workload A standby

z/OS Multi-Site Workload Lifeline is directing the workload distributor to route all traffic for Workload A to Site 1

Connections

Workload Distributor (SASP LB appliance & Lifeline)

Data Replication

IBM Systems – Enterprise Networking Solutions
Scenario 1: Active/Standby Configuration

Workload outage / Site available

Site 1
Workload A active

Site 2
Workload A active

z/OS Multi-Site Workload Lifeline is directing the workload distributor to route all traffic for Workload A to Site 2
Scenario 1: Active/Standby Configuration
Workload outage / Site outage

Site 1
Workload A active

Site 2
Workload A active

z/OS Multi-Site Workload Lifeline
is directing the workload distributor to route all traffic for Workload A to Site 2

Connections

Workload Distributor

Data Replication
data queued
Scenario 2: Active/Standby Configuration – Part 1 (multiple workloads – mutual continuous availability)

Site 1
Workload A active

Site 2
Workload A standby

Connections

Workload Distributor

Data Replication

DB2

VSAM

IMS

IMS

DB2

VSAM

IMS
Scenario 2: Active/Standby Configuration – Part 2
(multiple workloads – mutual continuous availability)

Site 1
Workload A active

Site 1
Workload B Standby

Site 2
Workload A standby

Site 2
Workload B active
Active/Query Workloads

- An Active/Standby workload is active on only one site
  - Workload transactions update data on the active site
  - Database changes are replicated to the standby site

- An associated Active/Query workload can be active on both sites
  - Workload transactions access same data being updated by Active/Standby workload
  - Workload transactions only query data

- Active/Query workload connections are distributed to a site based on routing type and average replication latency
  - Dynamic workload routing – distribution between sites based on availability and health of server applications within each site
  - Static workload routing – distribution between sites based on a configured percentage
  - Replication latency – Average delay between when update transactions for a workload to the active site are replicated and applied to the standby site
Scenario 3: Active/Query Configuration – Distribution of query workload across two sites

Site 1
Update Workload A active
Replication Latency: ‘Normal’

Site 1
Query Workload B active

Site 2
Update Workload A standby

Site 2
Query Workload B active

Replication latency, site capacity, and application health influence the distribution of query workload between sites.
Scenario 3: Active/Query Configuration – Replication latency rises above maximum configured causing all query workload to be routed to site 1

Site 1
Update Workload A active
Replication Latency: ‘Acute’

Site 2
Update Workload A standby

Site 1
Query Workload B active

Site 2
Query Workload B active

Replication latency, site capacity, and application health influence the distribution of query workload between sites.
Scenario 3: Active/Query Configuration –
Replication latency falls below minimum configured causing query workload to be distributed across two sites.

Site 1
- Update Workload A active
- Replication Latency: ‘Normal’

Site 2
- Update Workload A standby
- Query Workload B active

Replication latency, site capacity, and application health influence the distribution of query workload between sites.
Lifeline support for planned and unplanned outages

- Ability to distribute workloads between sites (and route around failed sites)
  - Based on capacity/health of sites and server application instances within a site
- Ability to detect workload or site failures
- Ability to perform automatic takeover or prompt for action
- Ability to switch workloads from one site to another site
  - Perform “graceful” takeover for planned outages
  - Perform “graceful” failback following a workload or site disaster
- Ability to maintain workload configuration states in event of a workload manager failure or planned outage
  - Keep a peer workload manager in sync with workload states
- Ability to dynamically add/modify workloads
- Ability to surface routing recommendations to network management agents
Workload Lifeline Providing Continuous Availability

Site 1
- Primary Controller
  - Lifeline Advisor
  - NetView

Site 2
- Backup Controller
  - Lifeline Advisor
  - NetView

SYSPLEX1
- sys_a: Application/database tier
  - TCPIP
  - Server Applications
  - Lifeline Agent
- sys_b: Server Applications
- 2nd-Tier LB

SYSPLEX2
- sys_c: Application/database tier
  - TCPIP
  - Server Applications
  - Lifeline Agent
- sys_d: Server Applications
- 2nd-Tier LB

1st-Tier LBs

(1) - Advisor and LBs
(2) - Advisor and Agents
(3) - Advisor to Advisor
(4) - Advisor and SEs
(5) - Advisor and NetView
Linux on System z workloads

- Provide support for workloads that have the application-tier hosted by Linux on System z and data-tier hosted on z/OS
  - End-to-End workload support

- Failure of application-tier results in failure of workload
  - Independent of status/availability of backend z/OS images in site
Linux on System z environment

Site 1

Primary Controller
Lifeline Advisor

Application tier

sys_y
Linux on System z

sys_x
Linux on System z

Lifeline Agent

zVM

Sysplex 1

Database tier

sys_a
Databases
Lifeline Agent

TCPIP

MQ

sys_b
Databases
Lifeline Agent

TCPIP

Site 2

Backup Controller
Lifeline Advisor

Application tier

sys_z
Linux on System z

sys_x
Linux on System z

Lifeline Agent

zVM

Sysplex 2

Database tier

sys_c
Databases
Lifeline Agent

TCPIP

MQ

sys_d
Databases
Lifeline Agent

TCPIP

Legend:

- Workload distribution
- Connections
- Data Replication
SNA-based workloads

- Provide support for workloads with SNA applications that use IP connectivity from the clients
  - Excludes direct client to data center connections over Enterprise Extender

- Lifeline Agent monitors the SNA application
  - Provides similar LPAR health information as TCP applications

- Support for different IP/SNA environments
  - TN3270 access to SNA applications
  - Remote API access to SNA applications
  - Message Broker access to SNA applications
  - Customer-written gateway access to SNA applications
SNA-based workload environment
Multi-site Workload Lifeline

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Steps for achieving continuous availability
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GDPS Active-Active Sites
GDPS Active-Active Sites

- The complete solution for providing continuous availability at extended distances for your business critical workloads
- In addition to the database replication product and Lifeline, the following products are required
  - GDPS/Active-Active
  - Tivoli NetView Monitoring for z/OS (includes NetView)
  - System Automation for z/OS
  - Optionally, the Tivoli OMEGamon XE suite of monitoring products
- GDPS Active-Active Sites provides
  - Automation for managing and switching workloads for planned and unplanned outages
  - Detailed monitoring of the components making up the GDPS Active-Active Sites solution
GDPS Active/Active Sites Structure

**Site 1**
- Primary Controller
- Lifeline Advisor
- NetView/SA/GDPS
- Application/database tier
  - sys_a: TEP Agents, Replication Servers, NetView/SA
  - sys_b: TEP Agents, TCPIP, NetView/SA

**Site 2**
- Backup Controller
- Lifeline Advisor
- NetView/SA/GDPS
- Application/database tier
  - sys_c: TEP Agents, Replication Servers, NetView/SA
  - sys_d: TEP Agents, TCPIP, NetView/SA

Legend:
- Orange dotted line: admin and monitoring
- Blue dotted line: workload distribution connections
- Green dotted line: connections
- Red dotted line: data replication

Sysplex 1
- TEMS
- TEPS
- Client

Sysplex 2
- TEMS
- TEPS
- Client
IBM Systems – Enterprise Networking Solutions

For more information... www-01.ibm.com/software/network/lifeline
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