Agenda

• Introduction
• Transaction integrity
  – TMF 3.6 (Feb 2009)
  – AutoTMF
• Protecting business service
  – RDF 1.9 (March 2009)
  – Tips for getting a fast Takeover
  – AutoSYNC
  – new SDR!
• Active/active issues
NonStop Business Continuity Strategy

Provide high performance, reliable, NonStop to NonStop database replication products that:

• Allow smooth migration and upgrade
• Support no lost business in disaster events – very hot standby
• Provide zero lost transactions where required

Provide access to our partners who offer heterogeneous data transformation, and replication options
NonStop Customers

• Many recent RDF sales as part of NS sales success stories
• Over 300 current business continuity accounts
  – Banking
  – Exchanges
  – Telecomm
  – Retail
  – Healthcare
  – Government
• Success experiences online, but some disasters don’t get publicity
HP Disaster Proof Project: A NonStop Success Story

- **HP-UX**
  - Integrity rx4640 server with ServiceGuard Extensions for RAC failing over to Integrity Superdome

- **HP OpenVMS**
  - AlphaServer ES40 with OpenVMS clusters failing over to Integrity Superdome

- **HP NonStop**
  - NonStop S88004 with RDF/ZLT failing over to Integrity NonStop NS16004

- **Red Hat Enterprise Linux**
  - ProLiant ML350 with HP Serviceguard for Linux failing over to ProLiant DL380

- **Microsoft® Windows® Server 2003**
  - Integrity rx4640 with Cluster Extension/XP and CA Synchronous Replication failing over to Integrity Superdome

- **HP StorageWorks**
  - XP Continuous Access
  - XP Cluster Extension
  - HP StorageWorks 4/256 SAN Director
  - HP Storage Essentials

- **HP ProCurve Networking**
  - Switches
  - Gigabit Ethernet

[www.hp.com/go/disasterproof]
Excellent HP NonStop results

- No lost transactions, at 550txn per sec!
- Fast Takeover ~30 seconds
- All HP systems performed as expected
  - All data protected on Storageworks XP 24000
  - All shared network gear (Procurve, Brocade, etc.)
- See our specific HP NonStop Disaster Proof video, white papers, FAQs

www.hp.com/go/nonstopcontinuity
Integrated HP NonStop Server products

- **Transaction Management Facility (TMF)**
  - Foundation for transaction integrity and data protection for fault tolerance

- **AutoTMF**
  - Automatically invokes NonStop TMF protection for non audited databases

- **Remote Database Facility (RDF)**
  - High-performance db replication – fast Takeover

- **AutoSYNC**
  - Synchronizes non database files

- **SQL DDL Replicator (SDR) coming this month**
  - Automatically replicates SQL DDL operations to target system
TMF 3.5 Integrity NS Servers/BladesSystem
NonStop OS H06.10

- Finer granularity for control of TMP Wait Timer
  - Allows fine-tuning commit processing performance
  - Resolution is now in milliseconds rather than centiseconds
  - Applications with highest transaction rate will see the most benefit
- Disk Process (DP2) now encourages smaller, faster I/O with smart “convenience writes”
  - Audit that does not have to be forced to disk gets shipped to Audit Disk Process
  - Disk Process attempts to write to audit trail immediately (avoiding multiple I/Os at TMP commit time)
- Improved audit write performance for audit trails on HP Storageworks XP (DP2)
  - Partial blocks can be written in parallel
  - Used to be parallel writes only on full 4KB blocks
  - Prior to H06.10, convenience writes were deferred until 128KB of data was queued up
  - Now convenience writes occur at 64KB if no active write underway to audit trail
NonStop TMF 3.6

Enhancements (for H and J Series)
- support different transaction types
- ANSI names for SQL MX objects
- faster audit trail release
  - pin from first write position, not txn start time
- manually abort (long running) transactions
- enable network transaction joins
- Coming Feb 2009

Future product plans, dates, and functionality are subject to change without notice
TMF 3.6 - Transaction typing

BeginTransaction API supports new parameters

- First new parameter: 64 bit txn attribute variable
  - at start of txn, allows app to inform TMF, and products that use TMF, about specific attributes
  - applies only to current txn
  - retrieved during life of txn
  - written in txn state records
  - we’ll change ARLIB2 for partners

Future product plans, dates, and functionality are subject to change without notice
Recognizing Transaction Types

Initial transaction types supported

- **No_Capacity_Abort**
  - overrides TMF safety valve - 45% full audit trail
- **User Flags**
  - for info such as who started txn
  - 8 bits, not validated or acted upon by TMF,

Future product plans, dates, and functionality are subject to change without notice
Transaction Timeout

- Second additional parameter with TMF 3.6
- 32 bit Transaction Timeout attribute
  - Timeout overrides generic AutoAbort time (2 hrs)
    - Zero - Use Auto-Abort Timer
    - n seconds - Tx will timeout in n seconds/
    - -1 - Txn will never timeout

Future product plans, dates, and functionality are subject to change without notice.
TMF 3.6 - ANSI names

- ANSI names for SQL MX objects
  - Current dump and restore requires Guardian names
  - Now use friendlier ANSI names in dump and restore of SQL/MX objects
  - In 3 TMFCOM commands
    - DUMP FILES
      - ‘SCHEMA (NSK.Willis1, NSK.Willis2)’
    - RECOVER FILES
      - ‘CATALOG NSK’, NOT ‘SCHEMA NSK.Willis’
    - INFO DUMPS
      - ‘SCHEMA NSK.Willis1’, ‘SCHEMA NSK.Willis2’
  - SQL wild cards not supported
TMF 3.6 – Faster audit trail release

• Pins Audit Trails from first write position, not txn start time
  – Reduces TMF-driven aborts due to audit trail capacity
  – Reduces need for OVERFLOW of TMF audit trail files

• Fewer number of audit trails pinned
  – Implemented because some SQL applications start txn, but do not update for long periods (SELECT * INSERT)
  – When txn starts, TMF marks current location in audit trail
  – Previously, audit trail file would remain pinned until txn terminated

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About synchronous active/active

- It’s established technology, successfully used today
- Has substantially same characteristics as asynchronous, except for application latency
  - throughput roughly the same
  - failure characteristics similar
  - use for unplanned downtime essentially the same
- Downside: application latency - can extend response time of transactions, waiting for remote systems’ responses
- Upside: can eliminate data collisions and data loss following node failure
TMF support for synchronous active/active

- Limited customer access to select OpenTMF APIs
  - Enabler for synchronous active/active from partners
  - Working to support partner’s first implementation
  - Target solution availability – late 2009
- Enabler product to be licensed from HP
  - “HP TMF Synchronous Gateway” (Spring 2009)
  - Only called by partner application
  - Reasonably priced by system/processor
- Based on safe participation in TMF commit process

Future product plans, dates, and functionality are subject to change without notice
TMF commit voting process

• Allows Resource Manager (RM) process to be involved in 2 phase protocol
• RM notified of txn ending and votes on commit or abort
• Allows RM to coordinate with 'foreign' system, even if it is another NonStop system

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Why NonStop AutoTMF software?

Automatic TMF benefits without changing programs:

- Improved application performance
- Ability to do online backups
- Recoverability from human error
- Only guaranteed foundation for database replication
- Distributed and supported world-wide by HP
NonStop AutoTMF
Update 8 May 2008

- Default AutoCommit feature for added safety
- NOWARNLONGTX suppresses unneeded EMS warnings for long running txns
- Flexibility to do commands (like COPY) under user txn rather than command interpreter-generated txn
- Can list commands used to change global default values
- Updates to User’s Guide in docs.hp.com

Next release: January 2009
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  – AutoSYNC
  – new SDR!
• Active/active issues
NonStop Remote Database Facility

- High throughput and low CPU utilization, out of the box
- *White hot standby* included
- Focused on data integrity (nodes in sync)
- Active/active split reciprocal
- Easy installation and maintenance
- Mar 2009: 8 enhancements - availability, performance, manageability
RDF Release 1.8  Fall 2007
H series - subset available on G series

• Performance improvement
  – Large 56KB buffer transfers for Extractor/Receiver and Updaters
  – Native code for select objects
    • RDFMONO, RDFEXTO, RDFRCVO, RDFPRGO, RDFUPDO, RDFNETO, MD5CHEK, MD5SRVO, RDFSNOOP

• Manageability
  – SQL/MX - MX tables: ANSI names in event messages
  – Quality fixes for EMS
  – More flexibility in naming volumes on target system
    • Subvolume naming can be different on target system than source though a mapfile
RDF 1.7 SPR (ABO) Fall 2007

G series

- Flexibility in naming subvolumes
- Interoperability code for communicating with RDF 1.8 on H-series (H06.10)
  - Recommended: when migrating to the NS series, migrate the target system first and run with the S Series as primary and NS Series as target
  - Prior to RDF 1.8, compatible versions have same features
  - RDF 1.8 introduces variation - Ex: ANSI names in EMS events not available in A07^ABO, but available on the H series
- Some Event Message System improvements (RFE) and fixes
- General quality improvements
Recent RDF version compatibility

- RDF A06 or A07 versions on S Series
- RDF H06, H07, H08 versions on NS Series

<table>
<thead>
<tr>
<th>S-series</th>
<th>NS-series</th>
</tr>
</thead>
<tbody>
<tr>
<td>T0346-A06-ABB</td>
<td>T0346-H06 (base)</td>
</tr>
<tr>
<td>T0346-A06-ABC</td>
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<tr>
<td>T0346-A06-ABD</td>
<td>&quot;</td>
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<tr>
<td>T0346-A06-ABE</td>
<td>&quot;</td>
</tr>
<tr>
<td>T0346-A07 (base)</td>
<td>T0346-H07 (base)</td>
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<tr>
<td>T0346-A07-ABF</td>
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<tr>
<td>T0346-A07-ABH</td>
<td>T0346-H07-ABG</td>
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<tr>
<td>T0346-A07-ABL</td>
<td>T0346-H07-ABK</td>
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<tr>
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<td>T0346-H07-ABP</td>
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<td>T0346-A07-ABO</td>
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</tr>
<tr>
<td>T0346-A07-ABS</td>
<td>T0346-H08-ABR</td>
</tr>
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</table>

NOTE: Only A07- ABO, ABS SPRs compatible with H08 versions

For BladeSystems
RDF 1.9 enhancements planned

• Performance
  – option for faster browse access of updater-replicated data via FASTUPDATEMODE (old SLOWMODE): forces RDF to write to target faster, with possible impact on throughput (supports aux audit as well)

• Availability
  – alter updater mode online, from Protected to Protected Open to Shared (and back), without full start and stop of updaters
    • makes it easier to do online dumps on target (best practice)
  – more guidelines for faster Switchover/Takeover configurations

*Future product plans, dates, and functionality are subject to change without notice*
RDF 1.9 enhancements planned (con’t)

• Manageability (customer requests)
  – return to one RDF thread for all three NonStop server platforms
    • doing more testing of interoperability
  – option for file level purge replication
    • follows include/exclude paradigm; useful with MQ Series
  – display SQL MX table names in selected events
    • Shared Access DDL event; instead of only Guardian internal name
  – support full-length process/volume names
    • volume names full 8 characters and process names full 6 char
  – see control subvolume name in RDFCOM Error Message
    • when RDF cannot initialize because control files present
    • option to purge existing control file(s)
  – major revisions and additions to RDF System Mgt Manual

Future product plans, dates, and functionality are subject to change without notice.
RDF 1.9 Testing Plan (draft)

<table>
<thead>
<tr>
<th>SL #</th>
<th>Primary System RDF</th>
<th>Back System RDF</th>
<th>Testing Planned</th>
<th>Regression Type</th>
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<tbody>
<tr>
<td>1</td>
<td>H-Series</td>
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<td>2</td>
<td>J-Series</td>
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<td>3</td>
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<td>Minimal</td>
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<tr>
<td>4</td>
<td>J-Series</td>
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<tr>
<td>5</td>
<td>H-Series ZLT</td>
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<tr>
<td>6</td>
<td>J-Series ZLT</td>
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</tr>
</tbody>
</table>

**RDF 1.9 code on G-Series Release (post release)**

<table>
<thead>
<tr>
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<th>Testing Planned</th>
<th>Regression Type</th>
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<td>Minimal</td>
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<tr>
<td>3</td>
<td>G-Series</td>
<td>J-Series</td>
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<td>Minimal</td>
</tr>
<tr>
<td>4</td>
<td>H-Series</td>
<td>G-Series</td>
<td>YES</td>
<td>Minimal</td>
</tr>
<tr>
<td>5</td>
<td>J-Series</td>
<td>G-Series</td>
<td>YES</td>
<td>Minimal</td>
</tr>
</tbody>
</table>

Note: We may be able to do more than minimal, based on resource availability
Getting a fast RDF Takeover  Highlights

- Know what is involved for your Takeover
  - document all DR plan steps: define primary “failure”
  - who decides? - know the protocol
  - won’t know unless you test

- Test the process
  - plan to switch and stay

- For typical SQL requestor-server environment
  - start servers on both sides, but keep work on primary only
  - start Pathway servers, but freeze them on target
  - if possible, consider one app for query only, and another for read/write
    - when just one app, must be read-only for target, then change to read/write at Takeover
Getting a fast RDF Takeover (con’t)

**Automate** script execution with RDF Takeover trigger

- automate comm lines switch (“primary 1” to “primary 2”)
- update statistics for SQL tables
- recompile SQL apps (consider AutoSYNC)
- ensure command/control files reflect h/w and s/w on target
- handle file opens so apps have read/write access
- user-specific tasks, example: Base24 change of IP addresses for ATMs/SWITCH providers
- if Pathway servers frozen, thaw
- route work to servers on target
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NonStop AutoSYNC features

- Whole file replication of files as complement to RDF, for system migrations and for multi-system application environments
- Synchronizes file sets between NonStop servers via HP Expand networking software or native TCP/IP
- Easy to install and manage: “set it and forget it”
- Fault tolerant and highly reliable
- Optional Triggers take action with updated file
  - (i.e. Automatic SQL compilation, change system names in config files, initiate batch job, etc…)
NonStop AutoSYNC
Yearly releases, or as needed

Update 11 now!
- Maintenance release

Update 10 June 2008
- USEBINDERTIME allows object files to be synchronized based on binder or linker timestamp differences
- TRIGGERONFILESET executes trigger commands after replication of entire file set
- Can list commands used to change global default values
- Updates to User’s Guide in docs.hp.com
NonStop SQL DDL Replicator (SDR)

- Captures, replicates and applies NS SQL/MP DDL operations to backup tables
- Companion to RDF
- DDL operations replicated
  - ALTER, COMMENT, CREATE, DROP operations
  - ALTER TABLE and ALTER INDEX (including split and merge partitions)
  - Configure to replicate DDL on non-audited tables
- No impact on performance or operations of applications on primary

Future product plans, dates, and functionality are subject to change without notice
NonStop SQL DDL Replicator (con’t)

• Easy to install, easy to use
  – User interface is like RDFCOM
  – Once installed, just leave SDR running
• Must be deployed on primary and target
• Requires SUPER group to configure and control
• Captures DDL on primary system
  – Independent of RDF and, like TMF-RDF, can be configured after SQL DDL capture
• Executes DDL on backup
  – Works closely with RDF to ensure correct sequence

Future product plans, dates, and functionality are subject to change without notice
SDR – general product information

- Marketing ID: (H)SA47V1
- Product ID: T2828H01
- Same product file set runs on all supported NonStop servers (G, H, J)
- Compatible with RDF IMP and IMP/X - back to T0346 AAJ (mid-2000)
  - with the exception of RDF SPRs ABJ, ABO and base release T0346H08
- Shipping this month!

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• Active/active issues
HP supports active/active education

- RDF has a safe, limited form, as do partners
  - One directional, split workload, reciprocal
- Partners have a variety of asynchronous methods
- Understand practical requirements
  - Is your environment ready? (power, comms, sizing etc.)
  - How much must you customize your app?
  - What successful model will you follow?
  - How will you handle collisions?
  - How frequently will you switchover to test?
  - What range of product + service costs can you accept?
    - POC may be required
Much promotion of a/a benefits

the Availability Digest

achieving 100% uptime

Bill Highleyman

GoldenGate®

Extractor/Replicator

f²

GRAVIC®

ShadowBase

DRNet

and by successful users
NonStop BC Sessions at CCE 2008

Monday

• NonStop Server Business Continuity Update (HP)
• Active/active Systems: Theory and Practice (Highleyman)

BTW: This was mostly a NonStop show!

Tuesday

• Business Continuity SIG (Connect)
• Advances in Active/active: State of the Art (Gravic)
• Best Practices for Maintaining Availability (GG)

Wednesday

• Active/active in the Real World (Lloyds Bank using DRNet)
• Road to Active/active (US Bank using GG)

Customers’ overall requirement for active/active solution: low to moderate
The Basics: Hot Standby (a la Conine/Bartlett)

- Two nodes, geographically separate and isolated
- Connected by network(s)
- Transaction updates are forwarded in some manner from primary to backup
- The network supports routing client users to the backup should the primary site go offline
Typical hot standby installation

- Primary/backup systems
- Client network is switchable to backup
- Fairly simple to explain and understand
- Requires extensive switchover test plan!
Active/Active: Two-way update

- Bi-directional asynchronous updates
- Identical databases
- Need partner product
- *Or do it yourself*
- Testing still required
- Adds much complexity
Active/Active complexity

• Requires solving four problems
  – Lost updates
  – Synchronization
  – Locks contention
  – Capacity concerns for failure state
### One view of design options

<table>
<thead>
<tr>
<th>Replication Strategy</th>
<th>Characteristic</th>
<th>Best use</th>
<th>Replication</th>
<th>Example</th>
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</thead>
<tbody>
<tr>
<td>Dual processing</td>
<td>all nodes process everything transaction control across nodes</td>
<td>Contained transaction</td>
<td>Transaction routed</td>
<td>XML docs any app with low latency network</td>
</tr>
<tr>
<td>Network</td>
<td></td>
<td>New programs</td>
<td>Programmed</td>
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<td>Reciprocal</td>
<td>2 way updates (no CD)</td>
<td>Few updates</td>
<td>2 way</td>
<td>call center</td>
</tr>
<tr>
<td>Collision avoiding, partitioned</td>
<td>split customer base</td>
<td>Regional users</td>
<td>2 way</td>
<td>branches, telco</td>
</tr>
<tr>
<td>Collision avoiding, key based</td>
<td>add uniqueness to key</td>
<td>Event logging</td>
<td>2 way</td>
<td>dispatch, orders, G/L</td>
</tr>
<tr>
<td>Collision detecting</td>
<td>check before image</td>
<td>*</td>
<td>2 way</td>
<td></td>
</tr>
<tr>
<td>Asymmetrical</td>
<td>1 read node, n write node(s)</td>
<td>OLTP 80/20</td>
<td>1 way</td>
<td></td>
</tr>
</tbody>
</table>

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*Interest in a technical session?*
Some key questions for active/active

- Must my customers (my business) see no outage...ever?
- Can I afford compromised data for some period of time?
- Do I have in-house resources and support to do a/a?
- Do I have budget for outsourcing, with buffer for extra?
- Does vendor understand my environment (done it before)?
- Will I fall back to fast Takeover if a/a too difficult?
- Future: Can I fall back to asynchronous if synch impacts performance too much?
HP NonStop Business Continuity: Be ready

Thank you - questions?
Robert.Loftis@hp.com
www.hp.com/go/nonstopcontinuity
www.hp.com/go/nonstop/bsm
RDF online db sync

General steps for RDF online db synchronization

1. Initialize RDF with the SYNCHDBTIME option
2. START RDF with UPDATE OFF
   - RDF extractor ships audit to receiver to be safely stored on target system
3. Create empty copies of database files
   - These files are big, so create them on primary rather than on the remote target
4. Load files with the Share option on
   - NOTE: New TMF Map Names feature being tested may replace steps 3 and 4
5. When LOAD finishes, enter RDFCOM STOP SYNCH command
6. Move loaded copies to backup target system
   - Backup/Restore is much faster to use for large files (DUP could clog comm line)
7. When files are in place on backup, enter RDFCOM START UPDATE
TMF 3.6 - Manual abort of very long txn

Designed for long running table loads – with caution

• Eliminates hung txns, cleans up all participating nodes in network
• No need for long running Backout to undo txn with data load
• Requires GMCSC password (serious db integrity consequences)
• Specifying NoBackout on aborting txn causes Backout termination
  – Redirects other txns being backed out to another Backout process
• Works across network: Active, Aborting, or Hung txns terminate on all participating nodes
• To abort ACTIVE txn, and not invoke BACKOUT, use NoBackout option
  – txn terminates with no undo of any work
  – a risk to database integrity
  – you have full responsibility for cleaning up db and restore integrity

Future product plans, dates, and functionality are subject to change without notice
TMF 3.6 - Network joins

• Enable network transaction joins
  – Provides mechanism for an app running on multiple nodes to participate in txn begun on another node without using standard file system TMF txn propagation
  – Foundation for potential performance enhancement - work done on remote node for txn without startup cost of network TMF

• Details
  – Network Extended TxId for new Network Join API calls
  – 128 bits vs standard TRANSID (64 bits)
  – Built-in checksums for validation
  – TMF Network Join is just an extension of existing TMF Join

Future product plans, dates, and functionality are subject to change without notice
NonStop RDF topologies

Centralized

Simplex

Multiple duplicate sites

Ring

Reciprocal/split workload

Network Transaction Replication

Triple contingency