Active/Active:
Achieve Continuous Availability During Planned and Unplanned Outages

Tuesday, September 9, 2008

Karsten Stöhr, Solutions Consultant

Transactional Data Management

Agenda

§ HP and GoldenGate Software Relationship

§ 3 States of Availability

  § Active; Planned Downtime; Unplanned Downtime

§ How GoldenGate works!

  § Topologies & Platform Coverage

§ Technology Architecture considerations

  § Active/Active

  § Synchronous vs Asynchronous

  § Conflict Detection & Resolution

§ Real-world Case-Studies

  § Bank of America; SwedBank & Retail Decisions

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HP & GoldenGate Software Partnership Highlights

§ GoldenGate's First Product on HP NSK Delivered 1996

§ Success across all geographic regions and verticals including:
  - § banking; financial services; healthcare; retail & government.

§ The majority of HP NonStop customers use GoldenGate solutions today.

§ HP customers drove GoldenGate to support open systems.

§ HP customers brought us to Active/Active.

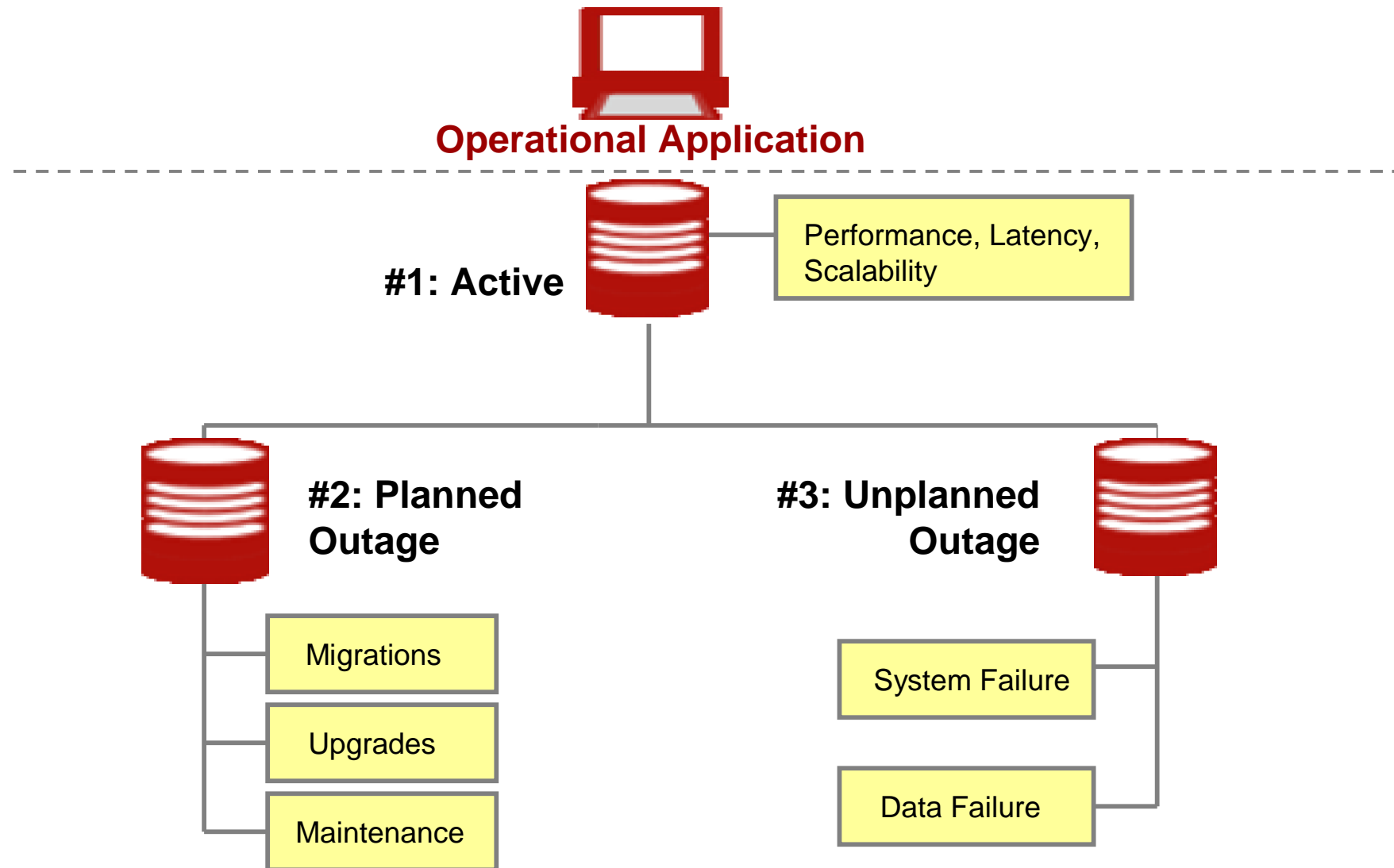§ Currently engaged in other areas of HP. HP-UX & HP Neoview.

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What is Availability?

Transactional Data Management (TDM) Software
Platform

The 3 States of Availability: Systematic View

Operational Application

#1: Active

Performance, Latency, Scalability

#2: Planned Outage

Migrations

Upgrades

Maintenance

#3: Unplanned Outage

System Failure

Data Failure

High Availability – State 1 (Active)

§ Data availability: the degree to which data can be instantly accessed

   § Performance is a high availability issue

   § When the performance degrades to negatively affect user experience, availability is impacted

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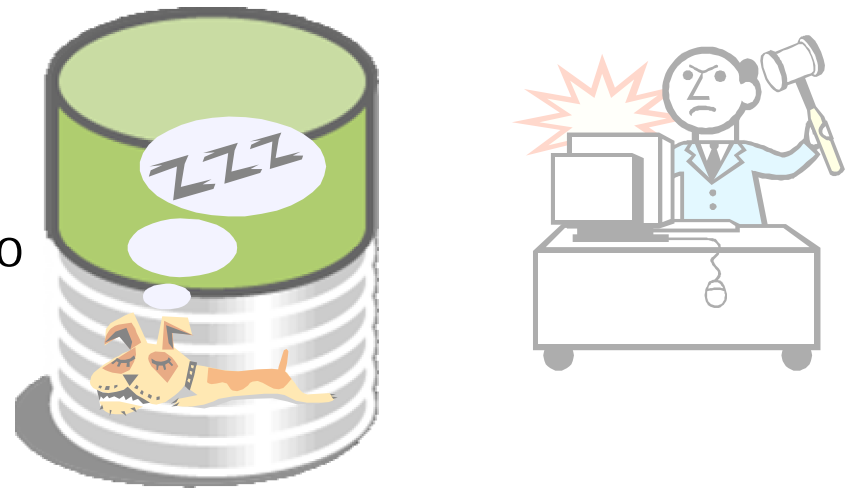
High Availability – State 2 (Planned Outage)

§ Regular Maintenance Operations

§ Hardware / Software / Infrastructure Upgrades

§ Platform / Application / Geographic Location Migratio

§ Many businesses need 24x7x365 uptime

  § 99% ~ 3 days 15 hours 40 minutes

  § 99.9% ~ 8 hours 46 minutes

  § 99.99% ~ 52 minutes 36 seconds

  § 99.999% ~ 5 minutes 15 seconds

  § 99.9999% ~ 32 seconds
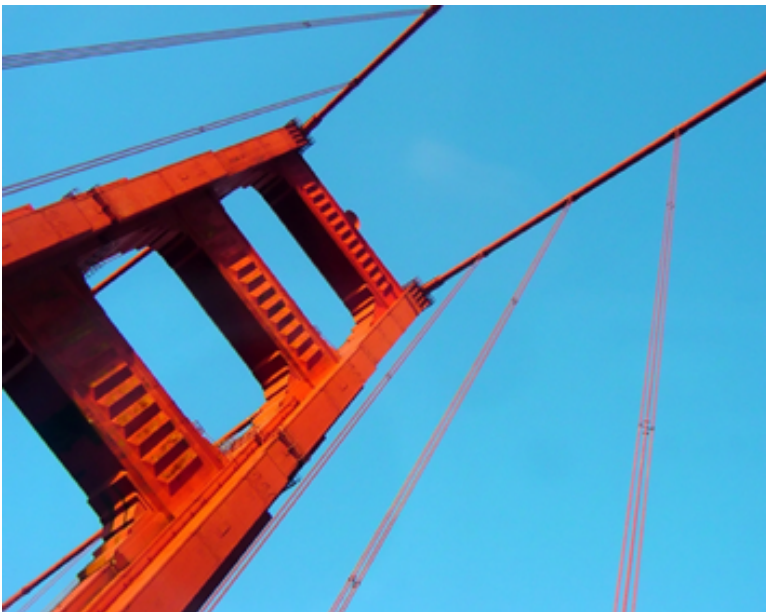
(30 Mins/Week = 26 hours = 99.7% Uptime)

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§ Traditional Disaster Recovery is all about unplanned outages

§ Unplanned outages include:
- § System and hardware failures
- § Malicious intent / security breaches / human error
- § Natural disasters

§ Business continuity plans should specify:
- § Recovery Time Objectives
- § Recovery Point Objectives

§ Data is an irreplaceable asset !!!

§ Analyst Trivia
- § 60 % of Businesses Experiencing a Disaster will Cease Operations within Two Years

Source: Gartner Group Study "Businesses are Fragile Entities" December 2000

How GoldenGate Works

Transactional Data Management (TDM) Software Platform

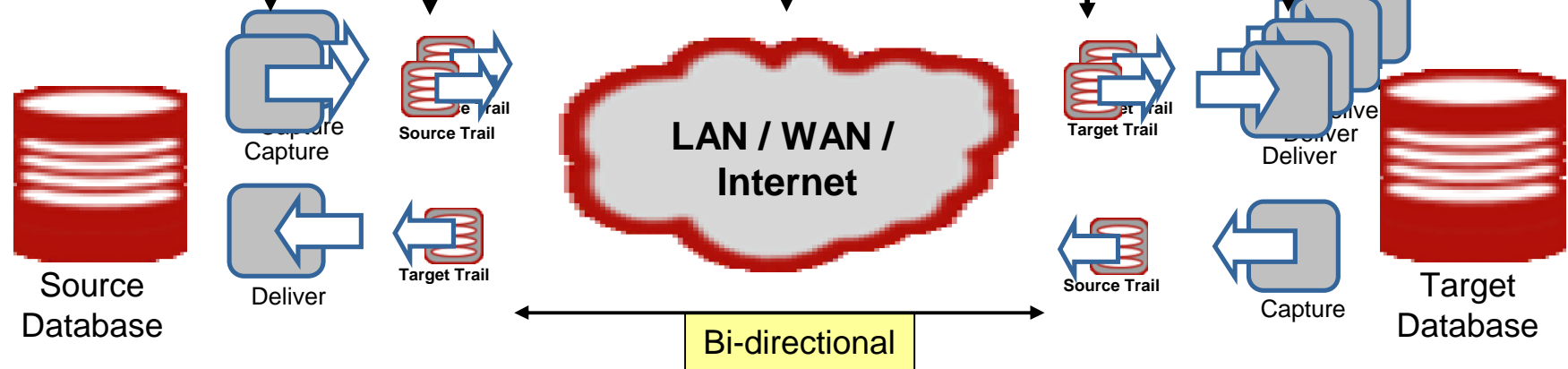# How GoldenGate TDM Works: Modular "Building Blocks"

Capture: Committed changes are captured (and can be filtered) as they occur by reading the transaction logs.

Trail files: Universal data format enables heterogeneity.

Route: No distance constraints via TCP/IP. Compression & encryption.

Delivery: Applies transactional data with guaranteed integrity.

Scale: Parallel Capture and Delivery

Capture

Source Trail

LAN / WAN / Internet

Target Trail

Deliver

Source Database

Target Trail

Deliver

Source Trail

Capture

Target Database

Bi-directional

GoldenGate TDM: Heterogeneity Supports Applications Running On...

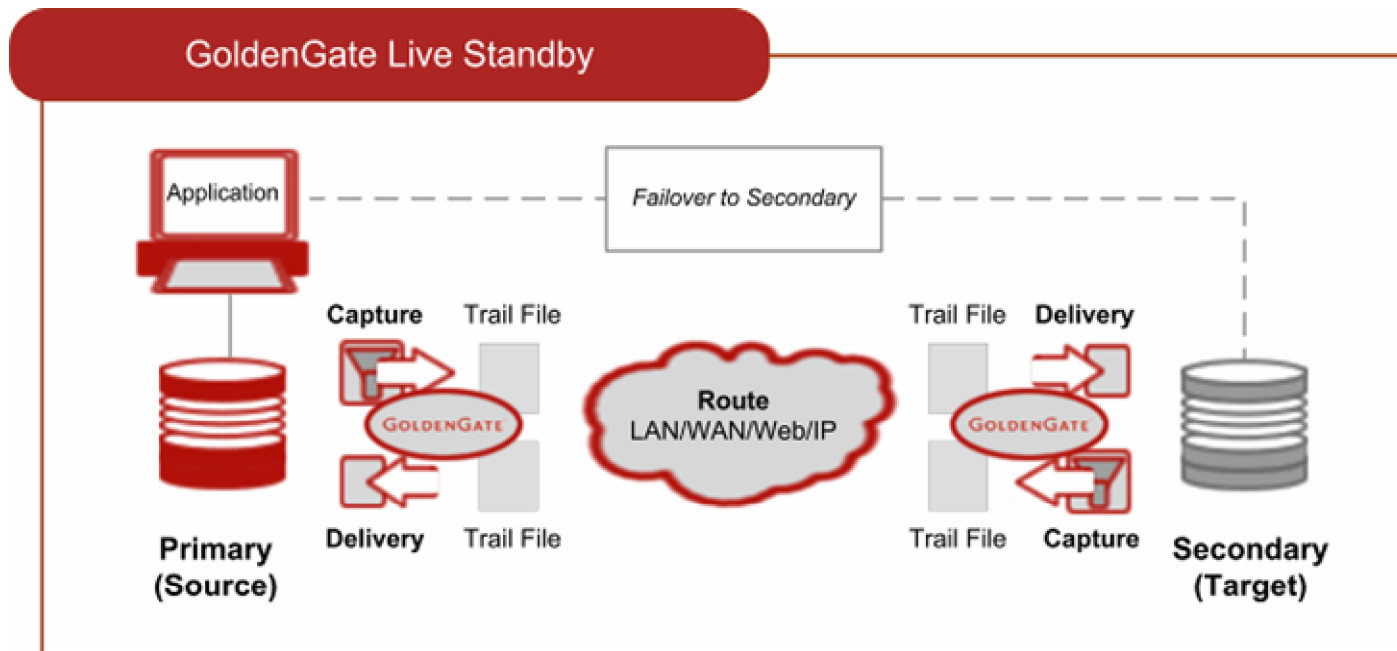| Databases	O/S and Platforms
Capture: § Oracle § DB2 UDB § Microsoft SQL Server § Sybase ASE § Teradata § Enscribe § SQL/MP § SQL/MX Delivery: § All listed above § Ingres, MySQL § and any ODBC compatible databases	Windows 2000, 2003, XP Linux Sun Solaris HP NonStop HP-UX HP TRU64 IBM AIX IBM z/OS OpenVMS

What is Active/Active?

Transactional Data Management (TDM) Software Platform

Live Standby (Active – Passive)

GoldenGate Live Standby

Application — Failover to Secondary

Capture — Trail File — Route LAN/WAN/Web/IP — Trail File — Delivery

Delivery — Trail File — Trail File — Capture

Primary (Source) — Secondary (Target)

When you need:

§ Fastest possible recovery & switchover

§ Resynch of backup and primary systems

§ No geographical distance constraints

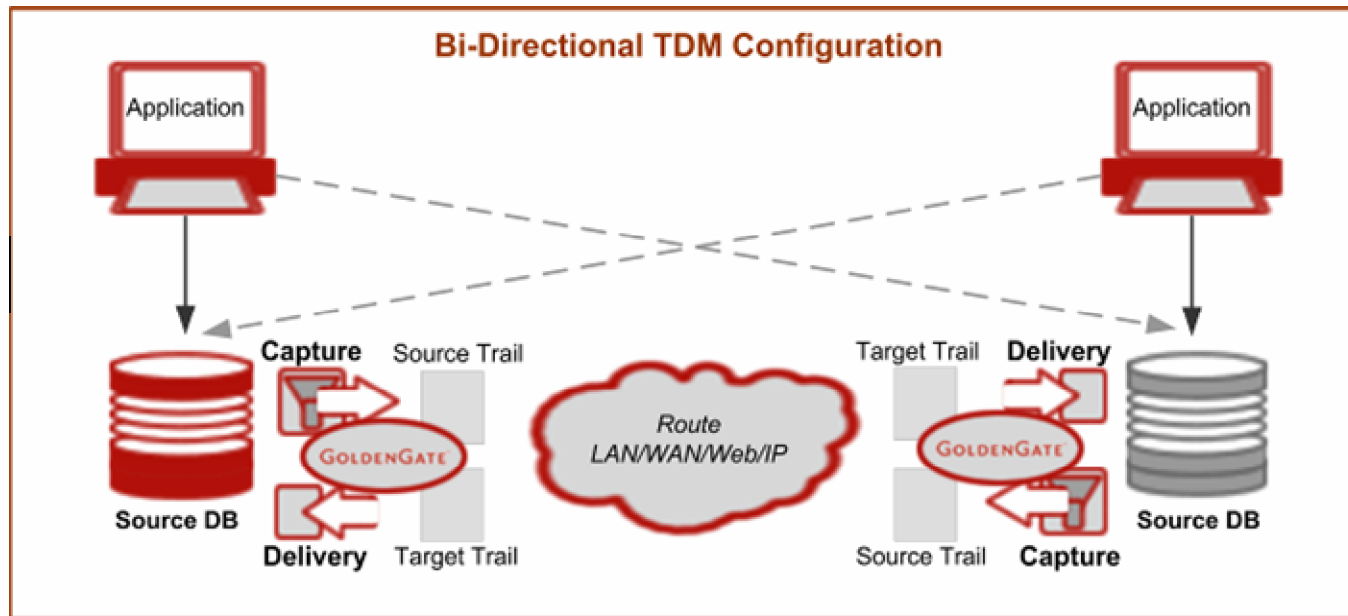§ Backup that can be used for reporting

Under Normal Operating Conditions

PRIMARY SYSTEM AVAILABLE for

§ BOTH READ and WRITE

SECONDARY SYSTEM AVAILABLE for

§ ONLY READ operations

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Active-Active

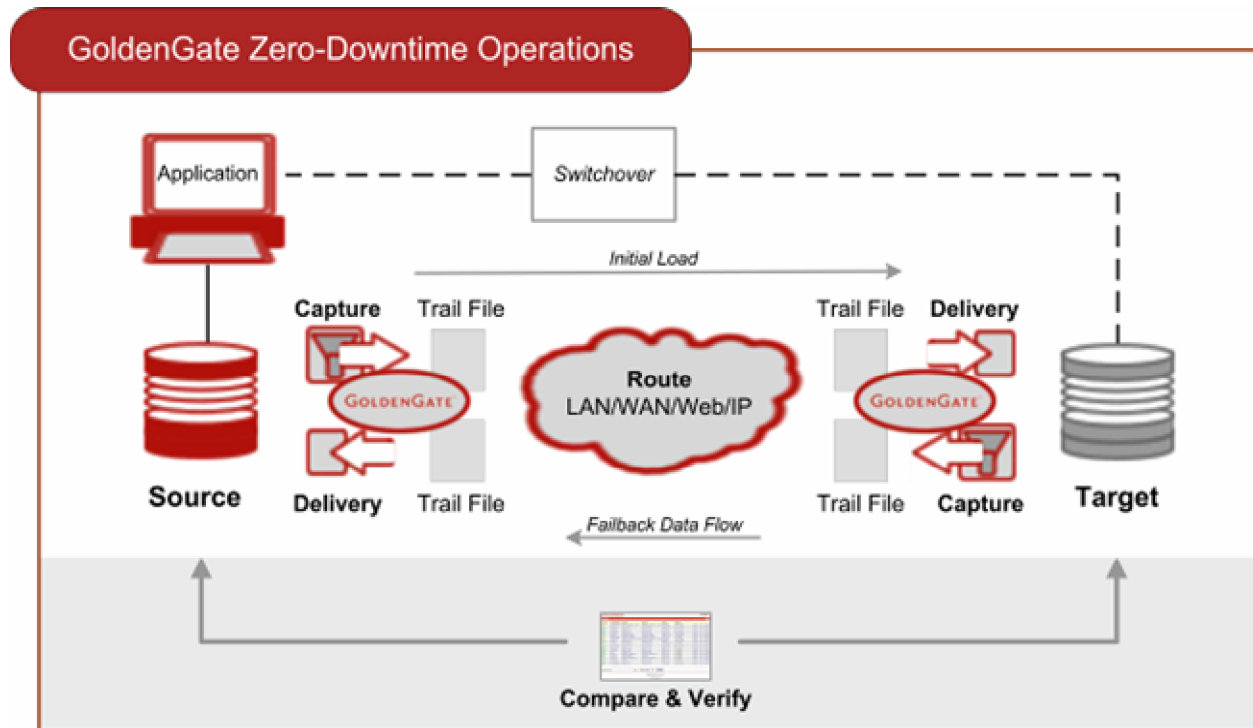**Bi-Directional TDM Configuration**

When you need:
- § Continuous availability
- § Transaction load distribution
- § Performance scalability
- § Conflict detection & resolution

BOTH SYSTEMS AVAILABLE for
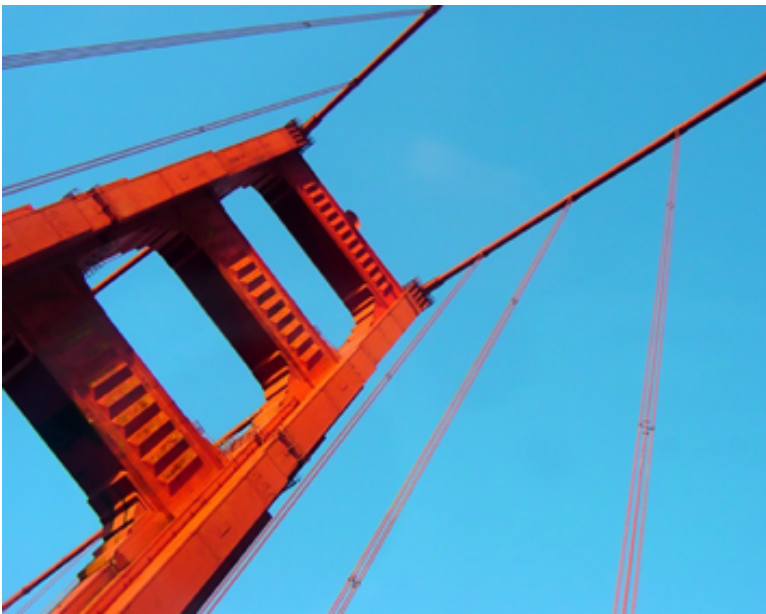- § BOTH READ and WRITE

High Availability: Zero-Downtime Operations

When you need:

§ Reduced or eliminated "planned downtime" during:

  § Migrations

  § Upgrades

  § Maintenance/Testing

§ For hardware platforms, databases and/or applications

Synchronous Versus Asynchronous

Transactional Data Management (TDM) Software
Platform

Transactional Data Management

Pros and Cons of Synchronous Replication (Transactions)

§ Advantages

§ Consistency across all sites

§ No Data Loss in event of single site failure

§ Disadvantages

§ Slow

§ Primary Site Throughput

§ High overhead

§ Topology limitations

- Severe performance degradation with multiple participants.

§ Reduced Availability

- When one participant is unavailable, the other blocks and waits.

§ Concerns over WAN distribution with regards to network SLAs

2 Phase Commit Protocol

Capture

Deliver

Source Database

Target Database

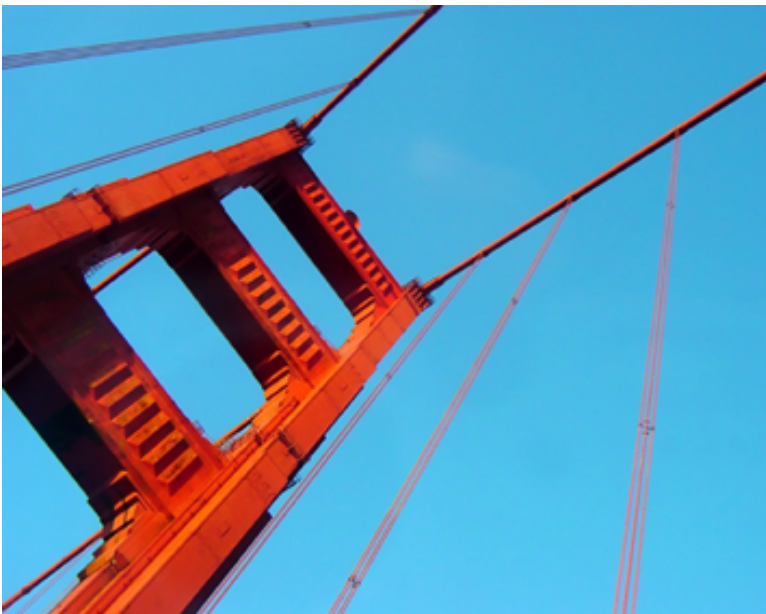GOLDENGATE®
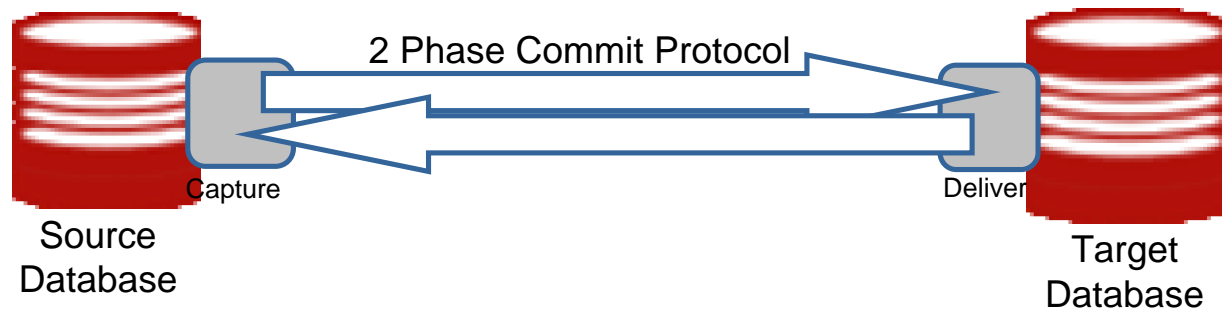
Pros and Cons of Asynchronous Replication

§ **Advantages**

  § Fast

  § Low overhead

  § No blocking and waiting

  § No distance limitation or dependency on network SLAs

  § Decoupled architecture

  § Support for varied topologies

  § Ability to do transformations to transactions

  § Can Support Active-Active

§ **Disadvantages**

  § Primary and Secondary can be out of sync

  § Potential data loss in rare site failure scenarios

Capture → Source Trail → **LAN / WAN / Internet** → Target Trail → Deliver

Source Database → Target Database

What is Conflict Detection and Resolution?

Transactional Data Management (TDM) Software Platform

Conflict Scenarios

§ Database Design

   § Key Sequencing

§ Application Logic

   § Account Balance

   § Inventory

   § Customer address

§ Network Outage

   § What do you do?

Synchronous Replication

§ Conflicts
  § Database
  § Network Outage

§ No Conflicts
  § Application

Asynchronous Replication

§ Active - Passive

  § Conflicts

  - Database
  - Network Outage

  § No Conflicts

  - Application

§ Active – Active

  § Conflicts

  - Database
  - Application
  - Network Outage

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Conflict Resolution Approaches

§ Exception handling / management
- § Human intervention
- § Automated approaches

§ Simple automated approaches
- § Timestamp
- § Trusted source / site priority
- § Hybrid of timestamp and site priority

§ Complex automated approaches
- § Quantitative resolution
- § Complex rules-based resolution

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Conflict Avoidance

§ Application partitioning
- § User-based
- § Account number based
- § Geographic
- § ...
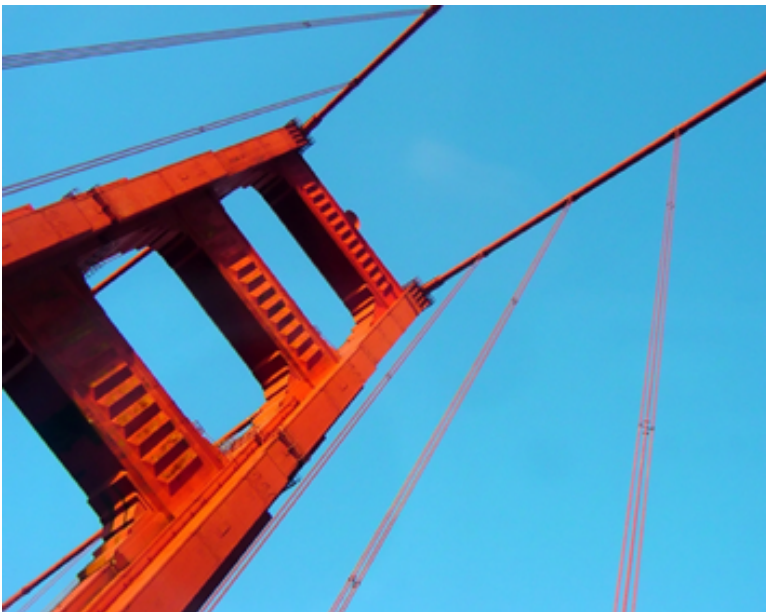
§ Database Key partitioning
- § Even vs. Odd
- § Increments by server count (1,4,7,10...) (2,5,8,11...) (3,6,9,12...)

Customer Case Studies

Enabling Real-Time Access to Real-Time Information

Transactional Data Management

Case Study: Bank of America
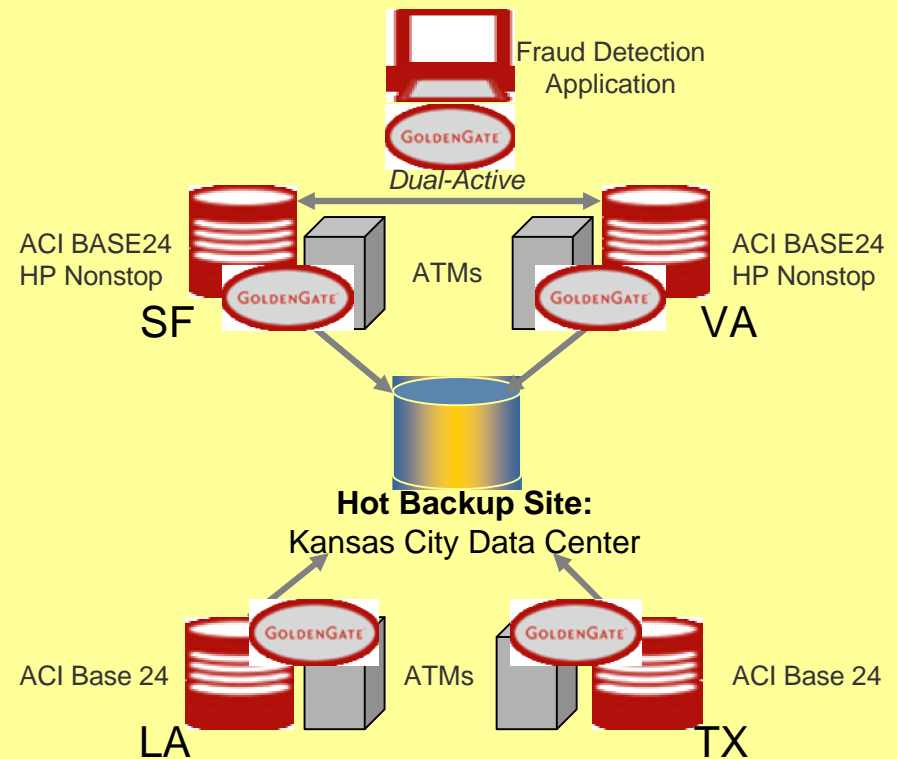## Zero Downtime for 18,000 ATMs

Bank of America

Business Challenges:

§ **100% availability** for systems supporting **18,000 ATMs**

§ Disaster Tolerance: Reduce switchover time

§ Consolidate data from 4 geographically dispersed Data Centers into a single system

§ Support active-active for HA and fraud detection

§ Synchronize **thousands of transactions per second, millions per day**

GoldenGate Solution:

§ High availability, dual-active solution with advanced conflict resolution capabilities

§ Live Standby into data centers

§ Enables zero downtime migrations, system upgrades

§ Results:

  § **Reduced application recovery time by 90%**

  § **Eliminate outages** for application, database and OS upgrades

18,000 ATMs Continuously Available

Fraud Detection Application

Dual-Active

ACI BASE24 HP Nonstop — SF

ATMs

ACI BASE24 HP Nonstop — VA

Hot Backup Site:
Kansas City Data Center

ACI Base 24 — LA

ATMs

ACI Base 24 — TX

"GoldenGate offered us benefits that would also enable us to meet our long term goals."
- Michele Schwappach, SVP Senior Technology Manager, Bank of America

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Case Study: Swedbank
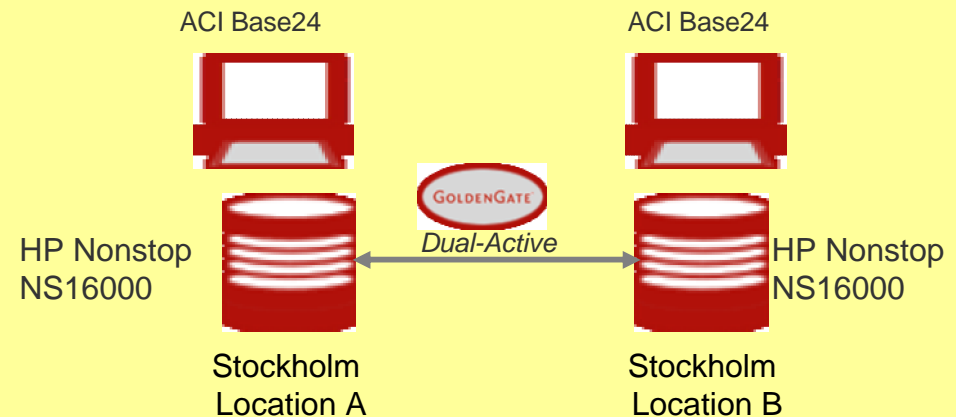## Active/Active for Electronic Payment & ATM Processing

Swedbank

Business Challenges:

§ Ensure **High Availability** for electronic and ATM payment processing **of 1 billion transactions** per year.

§ Support and synchronize two **geographically distinct** data centers

§ **Handle performance demands** during increased workload at peak times.

§ Each system responsible for its own cut-over

GoldenGate Solution:

§ Phased approach: **Live Standby** first then moved to **Active/Active** for continuous availability

§ Both sites active and sharing load, using **GoldenGate's BASE24 module D24** for conflict detection and resolution

Processing 1 Billion Transactions per Year

ACI Base24   ACI Base24

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Dual-Active

HP Nonstop
NS16000

HP Nonstop
NS16000

Stockholm
Location A

Stockholm
Location B

"GoldenGate has given us the assurance we were looking for and we can maintain our level of customer service no matter what. We have been using this full dual site Active/Active solution with GoldenGate continuously since 2006 with no outages or service issues."
- Magnus Kleveby, Systems Area Manager for Authorization Processing, Swedbank

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Case Study: Retail Decisions
Enabling Real-Time Fraud Prevention/Detection for Blue-Chip Retailers

Business Challenges:

§ Typical Service Level Agreements dictate **99.95% availability with aggressive sub-second average response times**

§ Must ensure **quick, massive scalability**

§ High cost of downtime; if technologies are not working, RED's clients lose millions of dollars per hour
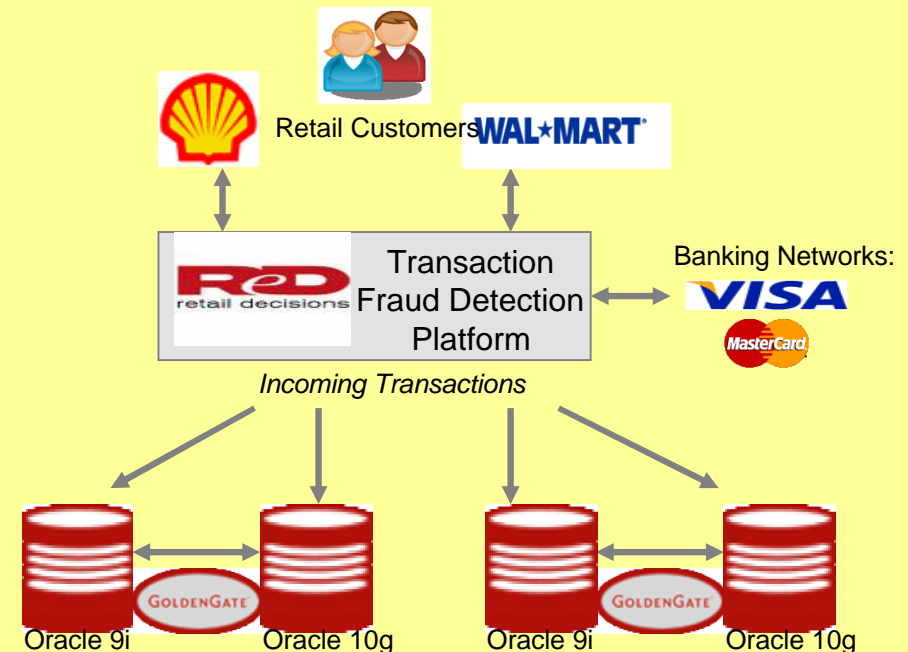
§ Clients are **global**

GoldenGate Solution:

§ GoldenGate for **Active-Active** with Oracle 9i and 10g databases ensures continuous availability & scalability

§ Enables **geographic distribution**

Results:

§ "Lightening Fast"

§ Reduces database license and infrastructure investment costs

Active-Active High Availability

"We needed a mega-scalable architecture capable of handling increasing holiday e-commerce traffic, while meeting our retail customers' stringent service level agreements."

- Chris Uriarte, CTO, Retail Decisions

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GoldenGate for NonStop Version 9.5

- § SQL/MX platform support
  - § SQL/MX Log Based Capture
  - § SQL/MX ODBC Apply
  - § G06.x and H06.x operating systems
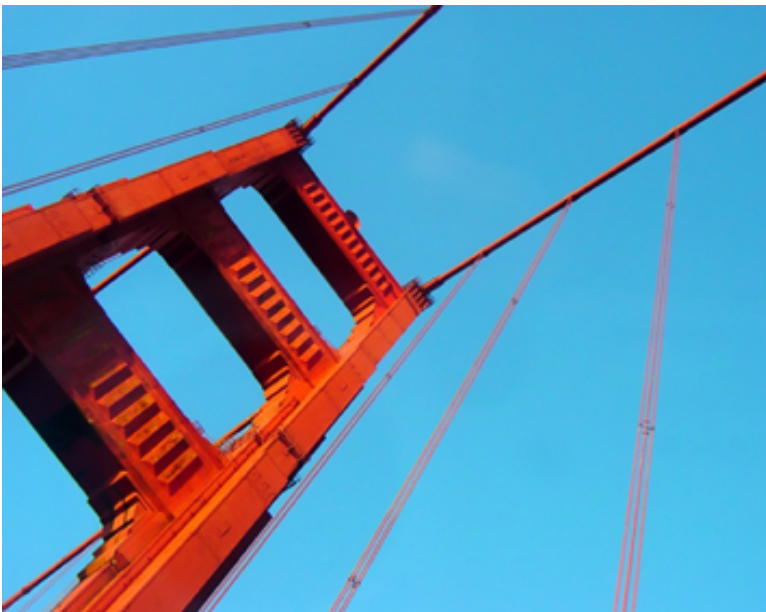 - § NS14000 and NS16000
  - § NS1000 for Live Reporting

Breaking News

GoldenGate has been validated with HP for Neoview !!

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Thank You

Karsten Stöhr
kstohr@goldengate.com

Transactional Data Management