ORACLE®

Value of Embedding Oracle Technologies
An Overview of Oracle's Embedded Database Offerings

Shig Hiura
Sales Consultant, Oracle Embedded Global Business Unit

When you think of Oracle...

- **You may not think of embedded…**
  - **Large databases, lots of memory and big iron needed**
  - **Administration and maintenance required**
 - **Costly, inflexible pricing**

- **But, did you know…**

  - **Oracle is the leader in embedded databases**
    - **IDC Report Worldwide Embedded DBMS 2007-2011 Forecast**

  "Oracle's 23.2 percent of worldwide embedded DBMS software revenue by vendor surpasses the next closest vendor with 14.1 percent **"**

  - **Oracle has a host of embedded-able products**
    - **Designed to fit your products and solutions**
    - **Pricing models to fit your business**

ORACLE®

Do You Need an Embedded Database?
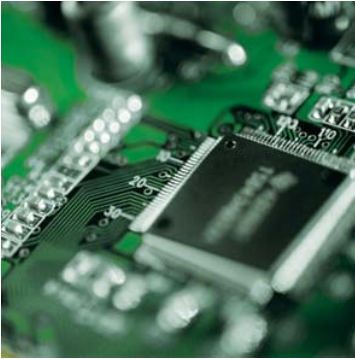
- Does your application store, find and deliver data as part of its operation?
- Do you maintaining a home-grown data manager today?
  - Are reliability and scalability a problem?
  - Do you need high performance and flexible data access?
- Does your application run unattended?
- Is your application a complete turnkey solution?
  - Do you need automated, silent install and configuration?

Different systems and services have widely different data management requirements

ORACLE®

Oracle's Embedded Databases
A Broad Spectrum of Industries and Applications

Example Embedded Database Partners
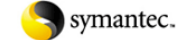
Program Agenda

- **Oracle TimesTen Product Overview**

- **Oracle Berkeley DB Product Overview**

- **Oracle Database Lite Product Overview**
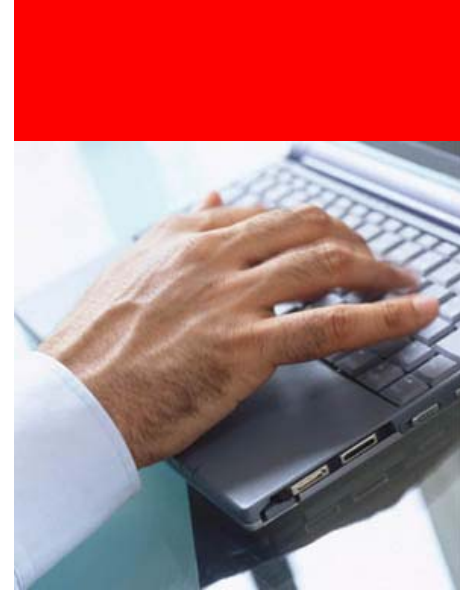
ORACLE®

Oracle TimesTen In-Memory Database

Memory-optimized RDBMS for real-time applications

- Application-tier relational database
- Delivers instant responsiveness and very high throughput
- Operates as database of record or as a read/write cache for Oracle Database
- Provides replication for high availability and scalability

"When milliseconds matter"
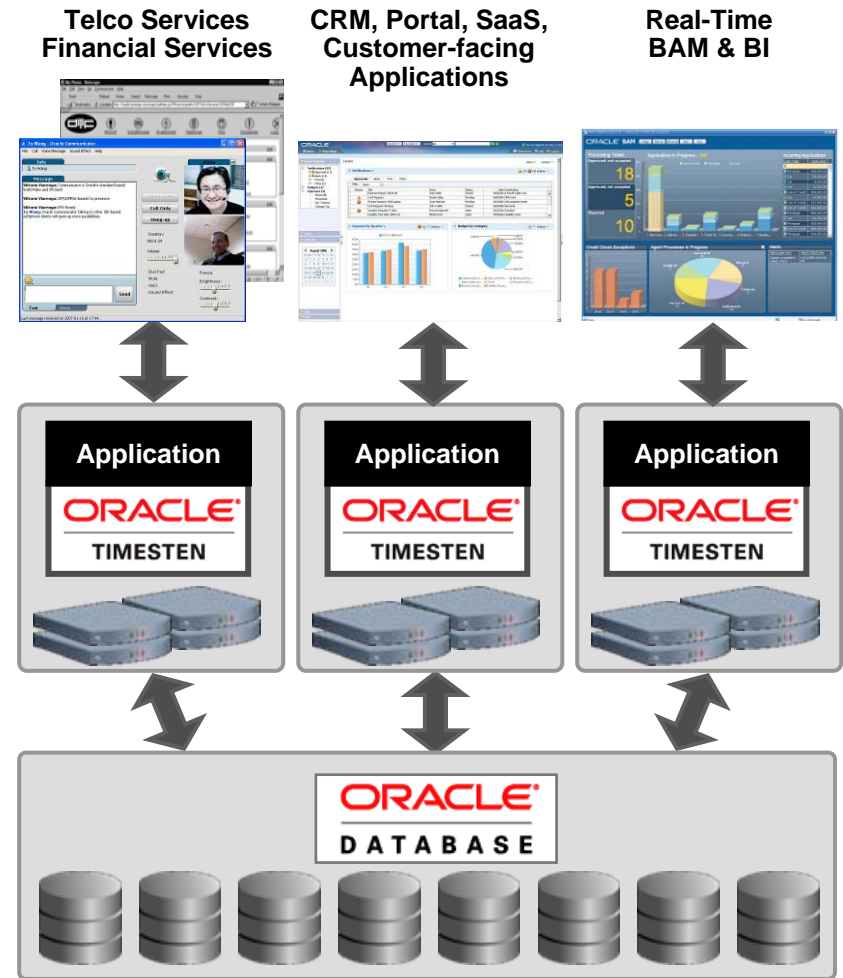
Oracle TimesTen Products

Product	▶	**Oracle TimesTen In-Memory Database**
Option	▶	**Replication: TimesTen to TimesTen**
Option	▶	**Cache Connect to Oracle**

Oracle TimesTen In-Memory Database
The Base Product

- Everything runs in-memory on the same platform - very efficient

- The data is safe - local disks used for persistence and recovery

- A full read/write, transactional RDBMS for shared, multi-user access

- All APIs are based on well-known industry standards

User Apps

ORACLE
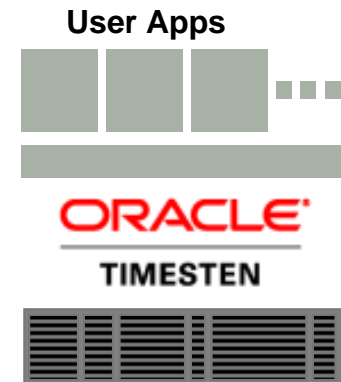
TIMESTEN

ORACLE

Oracle TimesTen Delivers Lightning Fast Response

Oracle TimesTen 6.0
4-CPU, 3 GHz x86 Xeon, 32-bit RHLinux
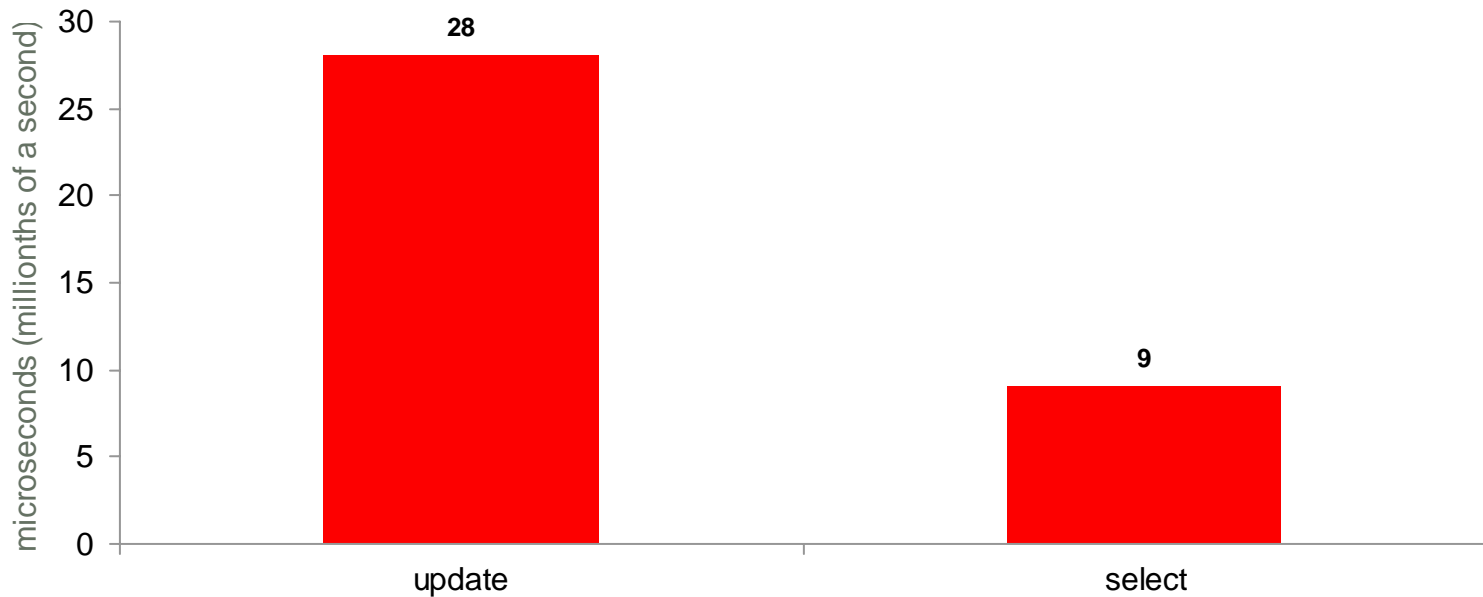
ORACLE®

Oracle TimesTen Offers Outstanding Platform Efficiency

Oracle TimesTen 6.0
4-CPU, 3 GHz x86 Xeon, 32-bit RHLinux

ORACLE®
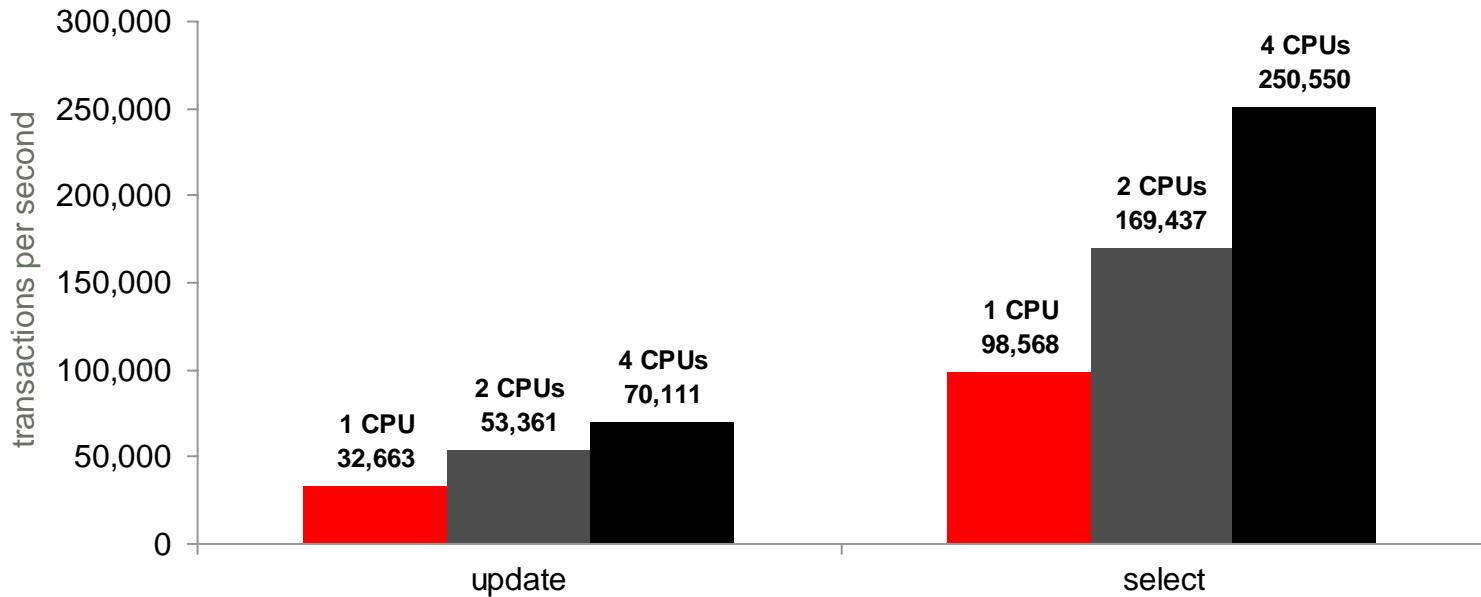
Replication: TimesTen to TimesTen
High-Availability for Application Tier Data

- Most often used by server pairs for hot-standby
  - Majority of deployments use this option
- Multi-master, n-way replication also supported
  - Scalable load balancing
- Very fast and highly configurable
- Works for stand-alone in-memory databases and Oracle caches
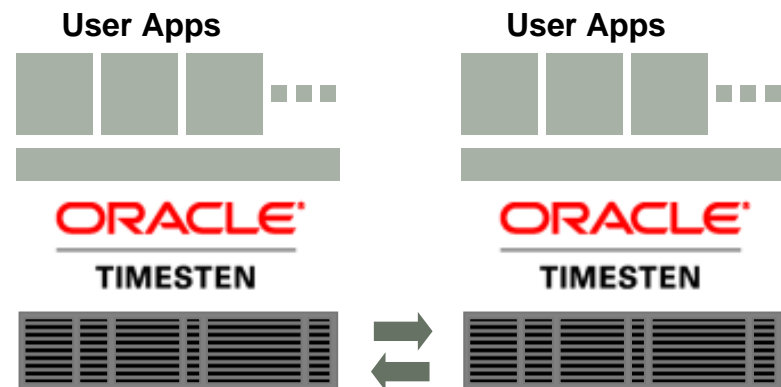
ORACLE

Cache Connect to Oracle
Using Oracle TimesTen to Cache Oracle Data

- Pre-load or load-on-demand the most active data from Oracle

- Synchronizes updates in both directions

- Transparent SQL pass-through for non-cached data requests

- Works with replication to protect application-tier data

- Keeps working even if the connection to Oracle is down
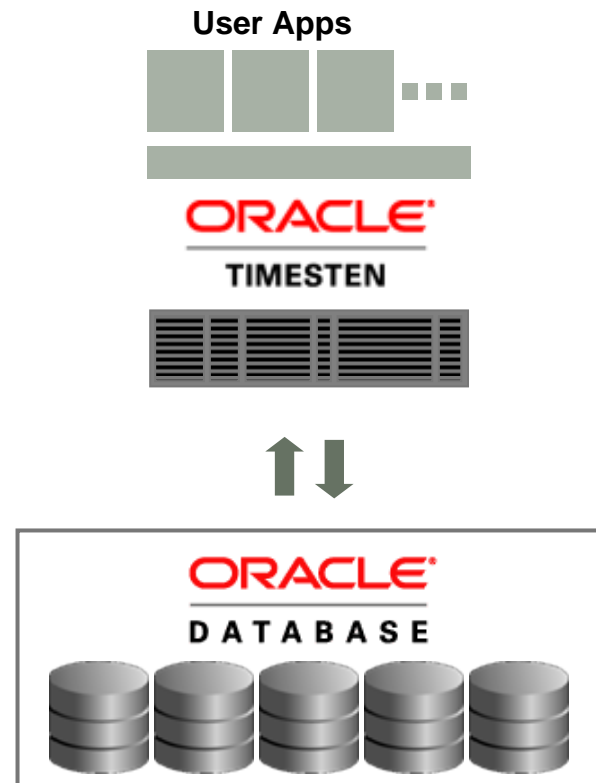
Oracle TimesTen + Oracle Database
End-to-End Data Management

1. Instantly Responsive

ORACLE
TIMESTEN

2. Tightly Integrated

ORACLE
DATABASE

3. Highly Scalable

ORACLE

Oracle Database 10*g* and TimesTen
Complementary Database Strengths

Database Characteristic	Oracle Database 10*g*	Oracle TimesTen In-Memory Database
Data Model	Relational – SQL	Relational – SQL
Target Applications	All	OLTP, some DSS
Optimization	Disk-centric	Memory-centric
Typical Deployment	Database Tier	Application Tier
Architecture	Client / Server	Direct Data Access
Response Time	Milliseconds	Microseconds
Data Capacity	Tens of Terabytes	Tens of Gigabytes
Scalability	Unlimited SMP/Cluster	Good SMP

TimesTen Case Study
TimesTen Enables Bullet Proof VoIP Services that Work

Telecom System Provider

TimesTen Usage
- Reference data lookups (subscriber profile mgmt.)
- Real-time data matching (routing info & location)
- Dynamic state management (active call status)

Performance Metrics
- Application Server (AS) 50,000 users
- Network Server (NS) 1M users 95/5 read/update workload

Configuration
- 2, 4, & 8-CPU Servers (plus hot-standby)
- Sun/Solaris platforms
- 2 Gigabytes Oracle TimesTen IMDB (DB of record)

Value of Oracle TimesTen
- Carrier-grade reliability
- Highly scalable throughput across wide geography
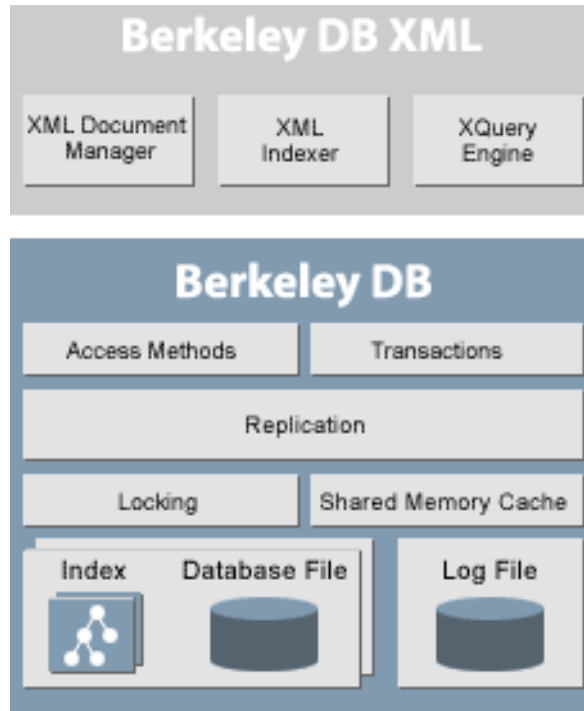- Enables advanced IP Centrex & productivity applications
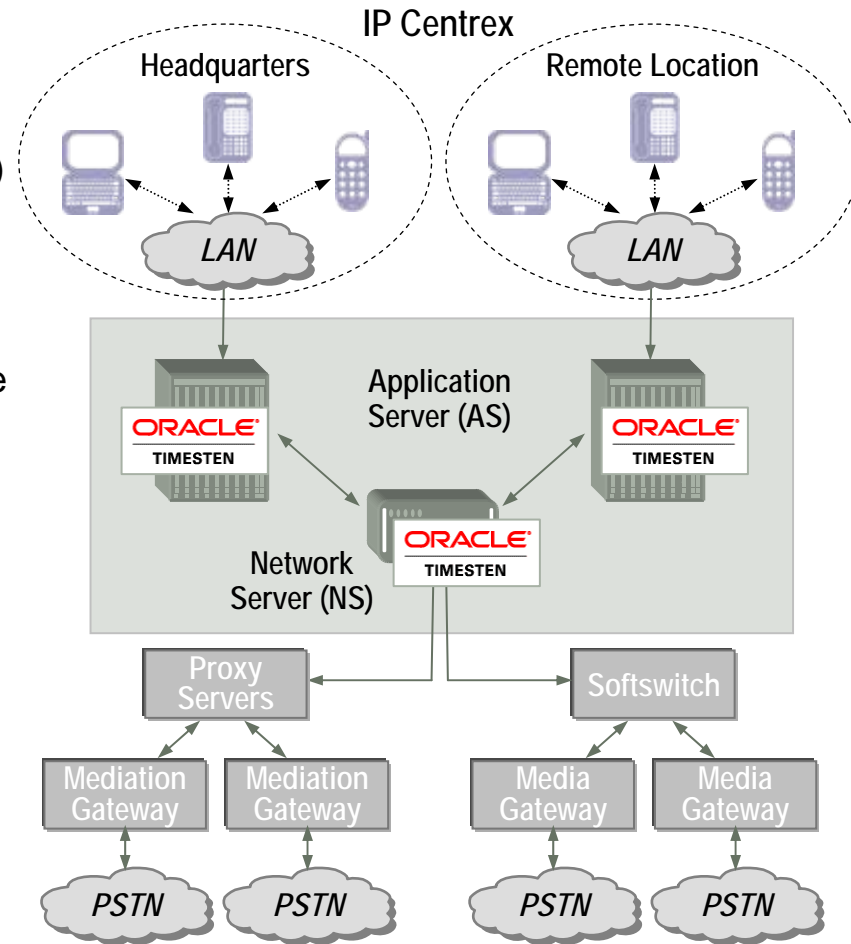
Program Agenda

- **Oracle TimesTen Product Overview**

- **Oracle Berkeley DB Product Overview**

- **Oracle Database Lite Product Overview**

ORACLE®

Oracle Berkeley DB Overview

- Most widely deployed open source, embeddable database in the world

- High performance database engine
  - Runs directly in application's address space
  - Application-native data storage
  - No SQL layer overhead

- Low total cost of ownership
  - High performance with less hardware
  - Embedded administration
  - Lower development cost: cheaper to buy vs. build

ORACLE®

Oracle Berkeley DB Product Family

Berkeley DB XML

| XML Document Manager | XML Indexer | XQuery Engine |

2 XML database built on top of Berkeley DB

Berkeley DB

| Access Methods | Transactions |
| Replication |
| Locking | Shared Memory Cache |
| Index | Database File | Log File |

1 High-performance, transactional database

Berkeley DB Java Edition

| Access Methods | Transactions |
| Locking | Heap Based Cache |
| Index | Database/Log File |

3 High-performance, pure Java database

ORACLE®

# Berkeley DB Product Family

All three Berkeley DB Products:

- Libraries linked to your application
- Simple, direct, indexed data storage
- Key-value pairs with simple, get-put style API
  - getDocument/putDocument for DB XML
- Operate in memory, on disk or both
- Programmatic administration API
- Low latency & high throughput
- ACID transactions and recovery
- Open source

ORACLE®
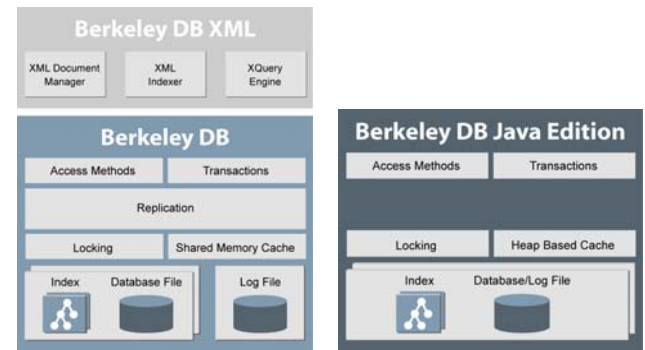
Berkeley DB
High Performance, Transactional Database

- Fast indexed and sequential retrieval (Btree, Queue, Recno, Hash)
- High availability via single master replication
- XA standard for distributed transactions
- Optional AES encryption on disk
- Footprint as small as 400KB
- Languages: C, C++, Java, and several scripting languages
- Platforms: UNIX, Linux, MacOS X, Windows, VxWorks, QNX, and others (POSIX-complaint)
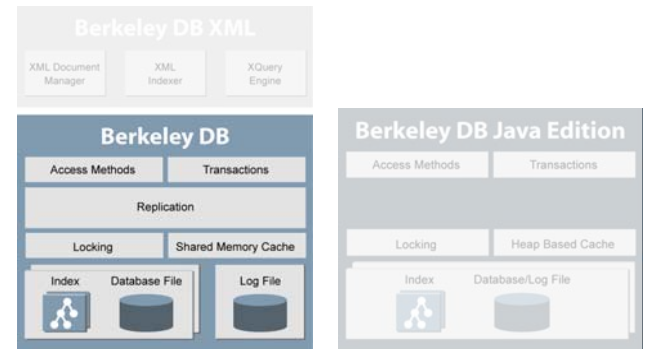
Ray van Tassle, Senior Staff Engineer, Motorola

"Berkeley DB was 20 times faster than other databases. It has the operational speed of a main memory database, the startup and shut down speed of a disk-resident database, and does not have the overhead of a client-server inter-process communication."

ORACLE®

Berkeley DB Java Edition
High Performance, Pure Java Database

- 100% pure Java for portability and ease of development
- Single JAR file – easy to install, runs in same JVM as application
- Fast, indexed retrieval (Btree)
- Optimized for highly concurrent access
- Additional object-based storage APIs
- Small footprint 820KB
- Supports J2SE & J2EE JVMs
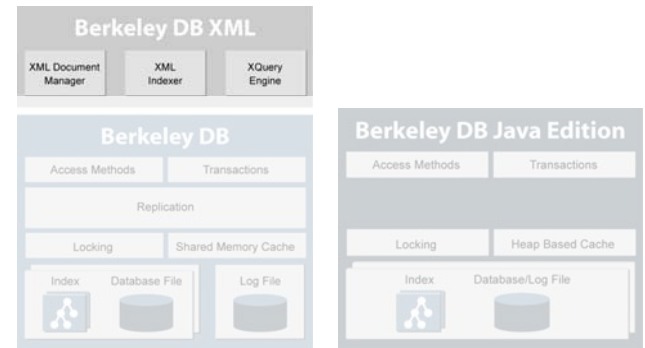 - JCA, JTA and JMX in J2EE environments
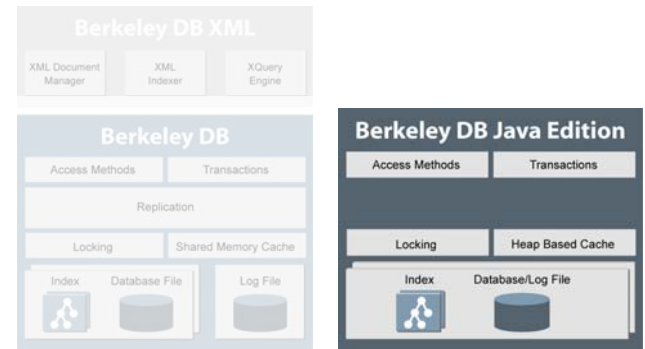
Eric Jain , Swiss Institute of Bioinformatics

"With Berkeley DB Java Edition, we have a simpler setup, a 3x increase in data import speed, a 5x increase in performance and a 10x decrease in disk storage requirements."

ORACLE®

Berkeley DB XML
XML Database Built on Top of Berkeley DB

- Native XML support via XQuery 1.0 and XPath 2.0
- Flexible storage control – nodes or whole document
- XML and non-XML data in the same database
- Query optimization via cost-based query engine
- Partial document updates
- XML Schema support, including validation
- Document streaming from URI, memory or file
- DOM-like navigation of documents and result sets
- Languages: C++, Java, Perl, Python, PHP and several other scripting languages

Berkeley DB XML
| XML Document Manager | XML Indexer | XQuery Engine |

Berkeley DB
| Access Methods | Transactions |
| Replication |
| Locking | Shared Memory Cache |
| Index | Database File | Log File |

Berkeley DB Java Edition
Access Methods	Transactions
Locking	Heap Based Cache
Index	Database/Log File

Jason Sabotka, Senior Manager, Starwood Hotels

"We evaluated several other databases and found that Berkeley DB XML was faster and more scalable."

ORACLE

Oracle Berkeley DB in Open Source

Operating Systems	Infrastructure	Applications	Email	Tools	Programming Language
All versions of Linux All versions of BSD UNIX	Apache Web Server, Directory, et al OpenLDAP — LDAP Directory redhat — LDAP Directory Kerberos Network Authentication	OpenOffice.org — Productivity suite OSAF — Chandler email/PIM The Webalizer — Website traffic analysis	sendmail.org — Mail server (MTA) POSTFIX — Mail server (MTA) SpamAssassin — Spam blocker SquidGuard spam blocker	XEmacs — Text editor ht://Dig — Internet search rpm — Red Hat Package Manager SUBVERSION — Subversion version control system	Perl Python PHP GNU C library

Berkeley DB

Oracle Berkeley DB
Summary

- Consider the Berkeley DB products when you need:
  - Blazingly fast performance
  - Simple, direct, indexed data storage – SQL adds unnecessary complexity
  - Local, in-process storage, not client/server
  - High availability and fault tolerance
  - Lights out administration
  - Embedded XML document management (DB XML)

Berkeley DB Case Study
TIBCO BusinessEvents Uses Berkeley DB Java Edition

- **TIBCO BusinessEvents**
  - Monitors disparate systems for interesting activity
  - Correlates business and IT events based on rules

- **Berkeley DB Java Edition stores:**
  - Rules identifying "interesting activity" and "business events"
  - Event descriptions
  - Log for audit and reporting
  - System state saved every 20-30 seconds

- **Why Berkeley DB Java Edition?**
  - High throughput and reliability
  - Scalability
  - Integration with Java runtime
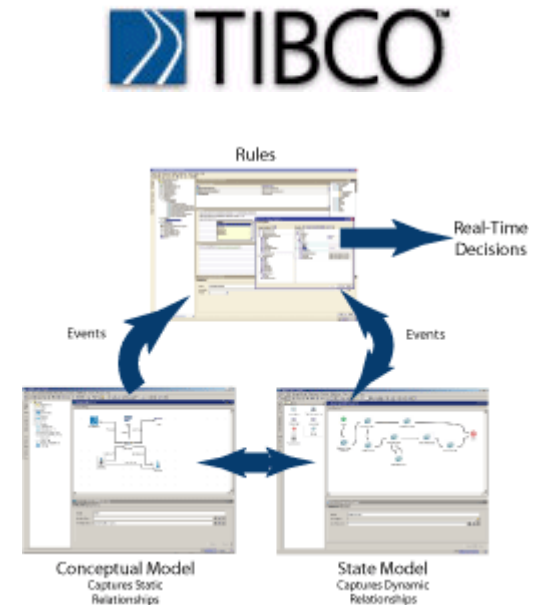
Matt Quinn, VP Product Strategy, TIBCO

"Berkeley DB Java Edition is the optimal choice for an internal database for BusinessEvents, because it provides fast, transactional persistence in a pure Java package."

ORACLE®

Program Agenda

- **Oracle TimesTen Product Overview**

- **Oracle Berkeley DB Product Overview**

- **Oracle Database Lite Product Overview**

ORACLE®
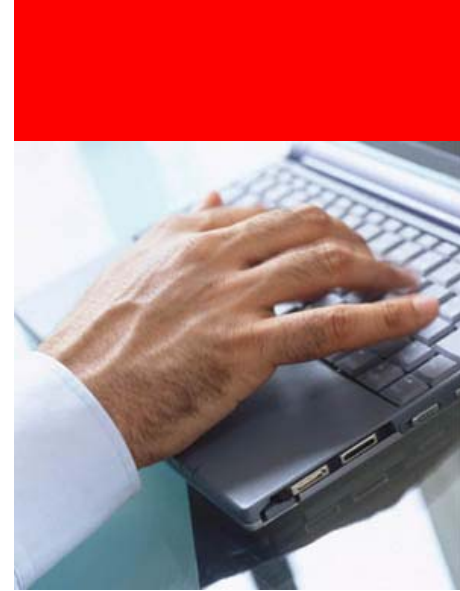
Mobile Applications

A persistent connection for mobile users is not always:

- Possible
  - Field force is in a remote environment that has no wireless coverage.
- Practical
  - There is no business case for a real-time connection; always-on connection ignores the cost of communication.
- Desirable
  - Wireless connection compromises security.

ORACLE®

Oracle Database Lite Advantages

- Enables the design and integration of robust embedded and mobile applications
- Survives system failures and requires zero administration
- Provides centralized system management of applications, users and devices
- Supports remote provisioning and deployment of applications and changes
- Secures data and prevents unauthorized access
- Supports complex data abstractions for data storage (e.g. multimedia content)

Oracle Database Lite
Enables Disconnected Applications

Embedded or Mobile Client

Mobile Server

Mobile Server Repository

Sync Layer

Oracle Lite Database

Secure Data and Applications

Data and Metadata

Data Synchronization
Application Provisioning
Device Management
Life Cycle Management

ORACLE®
D A T A B A S E
ENTERPRISE EDITION

Windows, Windows Mobile, Symbian, Linux, Embedded Linux, etc.
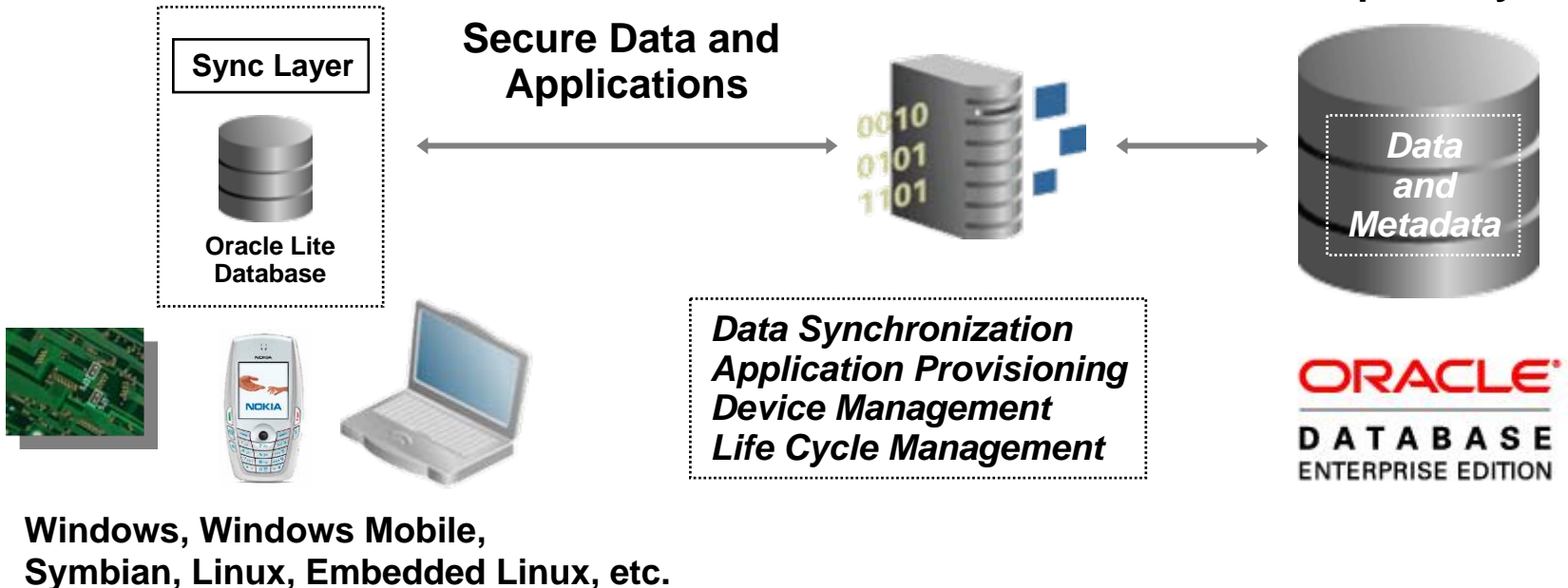
Oracle Lite provides mobile developers an infrastructure with application services that enables the development, delivery and operation of secure, personalized applications on mobile devices.

Oracle Database Lite Feature Sets

- Data Synchronization

- Oracle Lite Database

- Complete Life Cycle Management
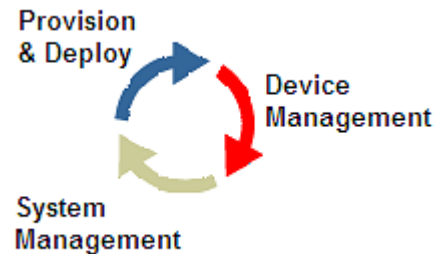
Data Synchronization
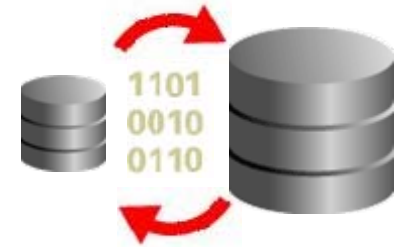
- Very fast
  - Data compression, fast refresh
- Designed for one-to-many synchronization
  - Very scalable, asynchronous
- Conflict detection and resolution
  - Client wins, server wins or customizable
- Synchronizes all database objects
  - tables, indexes, sequences, constraints
- Efficient transport
  - Checkpoints allow Synchronization to resume where it left off.
  - Protocol independent

Automatic Synchronization

- Synchronization may be triggered by satisfying conditions and events

- Supports continuous client synchronization while user continues to work

- Supports server initiated synchronization

- Rules Based Synchronization
  - Conditions – All must be true
  - Events – Only one must be true

Synchronization Process
Asynchronous Queue-based for Scalability

1. Sync moves updated rows from the client to the In Queue and from the Out Queue to the client.

2. Message Generator Process applies the changes from the In Queue to the base tables, and composes the Out Queue from the base tables.
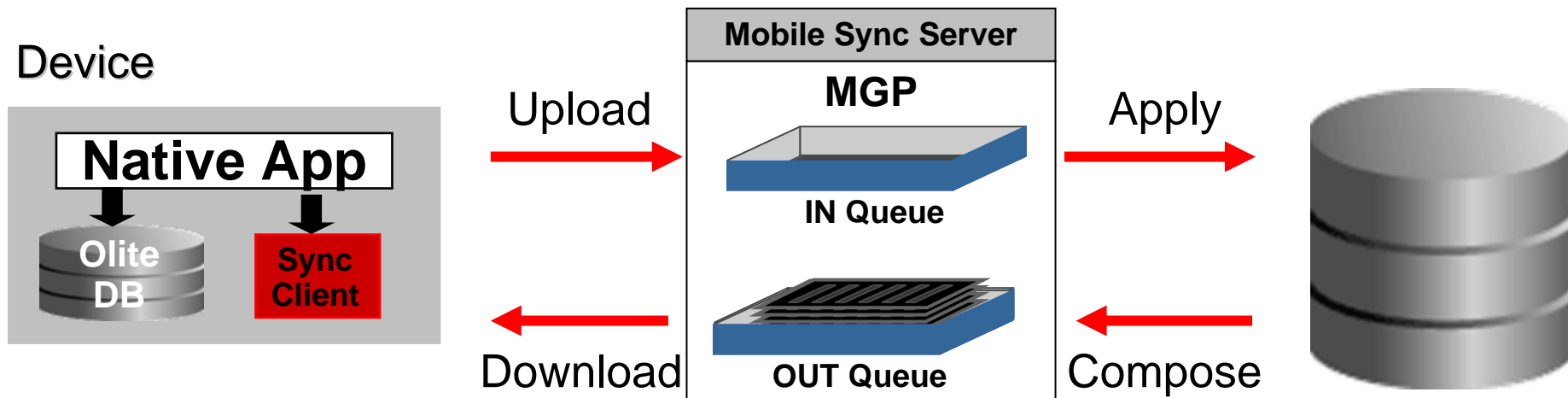
ORACLE®

Oracle Lite Mobile Server
Complete Life-Cycle Management

- Application Management
    - Application Provisioning & Deployment
    - Application Management
    - User Administration
- System Management
- Device Management
    - Remote Diagnostics
    - Command Execution

Provision & Deploy

Device Management

System Management
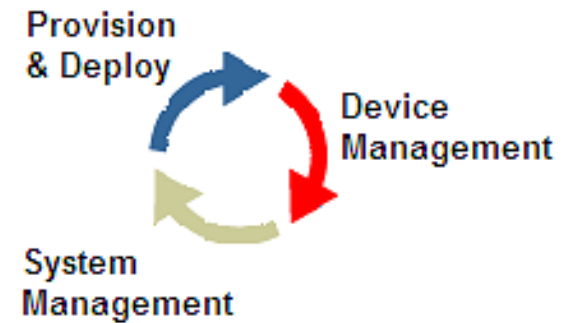
ORACLE®

Oracle Database Lite
Summary

- Extends your enterprise data
  - Extends the grid environment to mobile and embedded devices
  - Provides continuous data availability for embedded and mobile applications
- Oracle Database Lite has direct business impact
  - Connection is often:
    - Not possible
    - Not practical
    - Not desirable
- Oracle provides complete infrastructure
  - High impact solutions
  - Rapidly implemented solutions
  - Comprehensive life cycle management

ORACLE

Oracle Lite Case Study
Cubist Pharmaceuticals extends CRM app to field

Setting:

- Complex application used by sales force to manage leads, orders, contacts (physicians, pharmacists, hospitals, other healthcare organizations) as well as to initiate and manage workflows.
- 100+ Remote Sales Reps.
- Tablet - Windows XP, SP2

Problem:

- Need embedded data storage with minimal administrative overhead, high performance and implementation flexibility
- Mapping and storing a complex data schema which potentially changes by end users
- Security of captured data
- Synchronizes with the backend Database

Solution:

- Oracle Lite extended Oracle data model to Tablet PCs.

ORACLE®

Which Embeddable Database?

ORACLE
DATABASE

- Choose Oracle Database when:
  - Advanced features (spatial, triggers, stored procedures) are required
  - Clustering via RAC or integration with Fusion Middleware is required
  - Footprint is not a constraint

ORACLE
TIMESTEN

- Choose TimesTen when:
  - Low latency and high throughput required
  - Oracle caching is needed
  - SQL is required
  - Database fits into memory

ORACLE
BERKELEY DB

- Choose Berkeley DB when:
  - Low latency and high throughput required
  - Data access is predictable
  - XML/XQuery is required

ORACLE
DATABASE
LITE EDITION

- Choose Oracle Lite when:
  - Devices may be occasionally disconnected from the network
  - Synchronization to Oracle Database is required
  - Small footprint is required
  - SQL is required

ORACLE

Where to go... What to do...

- **Embedding Oracle Within Your Product – Main page for information on embedding Oracle Products**
  - http://www.oracle.com/technologies/embedded/index.html

- **Embedded Developer's Center - Free Developer Downloads, white papers, technical articles, podcasts, discussion forums regarding embedded database products**
  - http://www.oracle.com/technology/tech/embedded/index.html

- **Oracle is the #1 Embedded Database in the world – IDC report**
  - http://www.oracle.com/corporate/press/2007_dec/embedded-vendorshare-idc.html
  - http://www.oracle.com/corporate/analyst/reports/infrastructure/dbms/idc-209653.pdf

- **Independent Software Vendor (ISV) Getting Started Page**
  - http://www.oracle.com/technology/isv/index.html

ORACLE®