ALTIBASE HDB
Product Introduction



Altibase Corporate Overview



Company Description

- Provider of in-memory data solutions for real-time access, distribution of high volumes of data in mission-critical environments
- Flagship Product: **ALTIBASE HDB™**, in-memory DBMS with Hybrid (memory plus disk) architecture
- Privately Owned
- Founded 1999

Revenue

- Profitable with consistent year-over-year revenue growth
- Revenue from license sales, support and maintenance

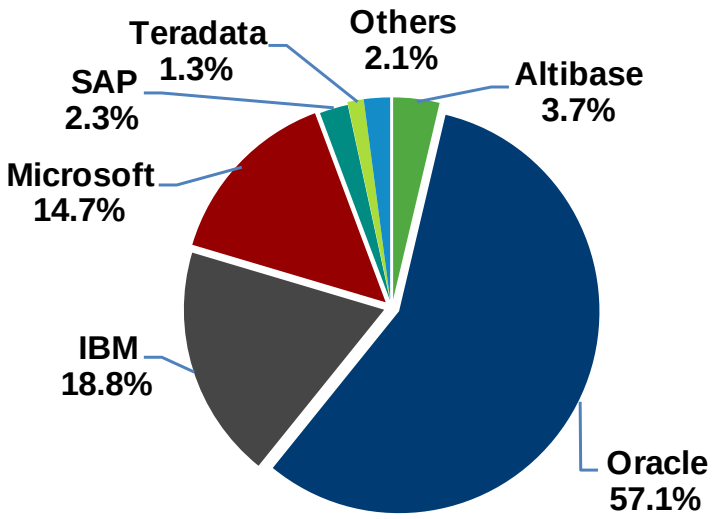
Customers

- 400+ customers with 1000+ deployments in telecommunications, financial services, government, and manufacturing
- Established, loyal customer base, with approximately 90% renewing contracts

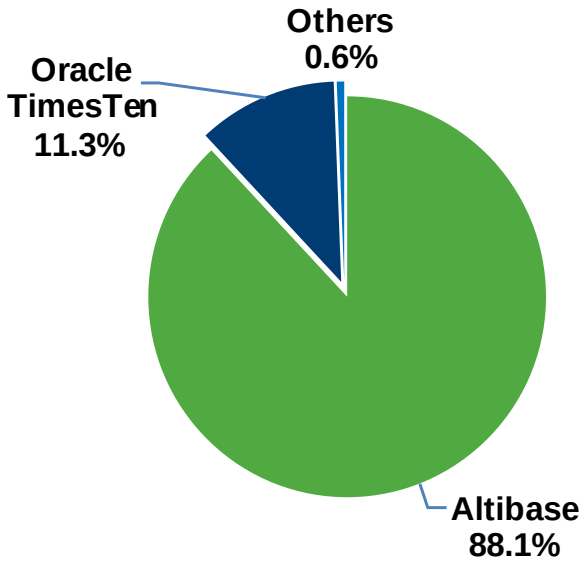
ALTIBASE® PERFORMANCE SOLUTIONS Copyright © 2012 Altibase All Rights Reserved

DBMS Market Share in South Korea

Overall DBMS Market Share(1)



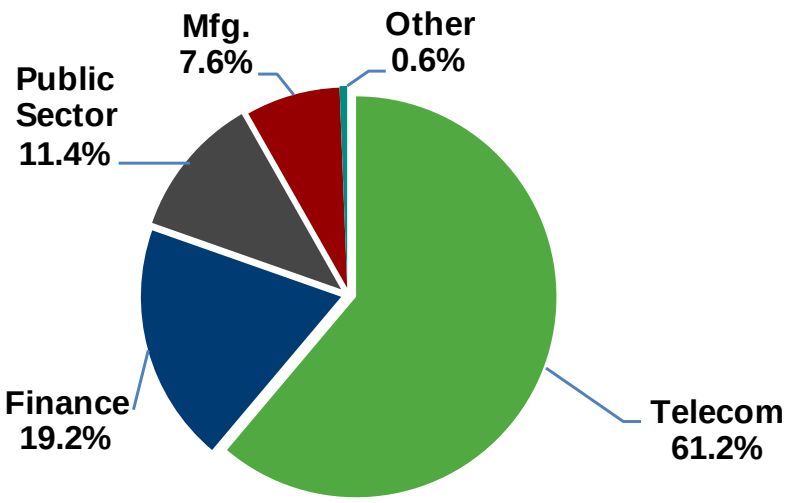
In-Memory DBMS Market Share(2)



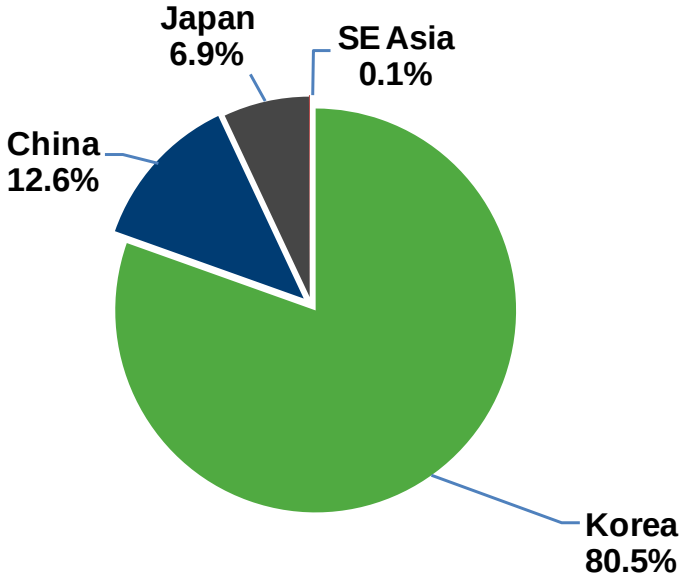
ALTIBASE® PERFORMANCE SOLUTIONS
Copyright © 2012 Altibase All Rights Reserved

Altibase Revenue by Region and Vertical

Revenue by Vertical



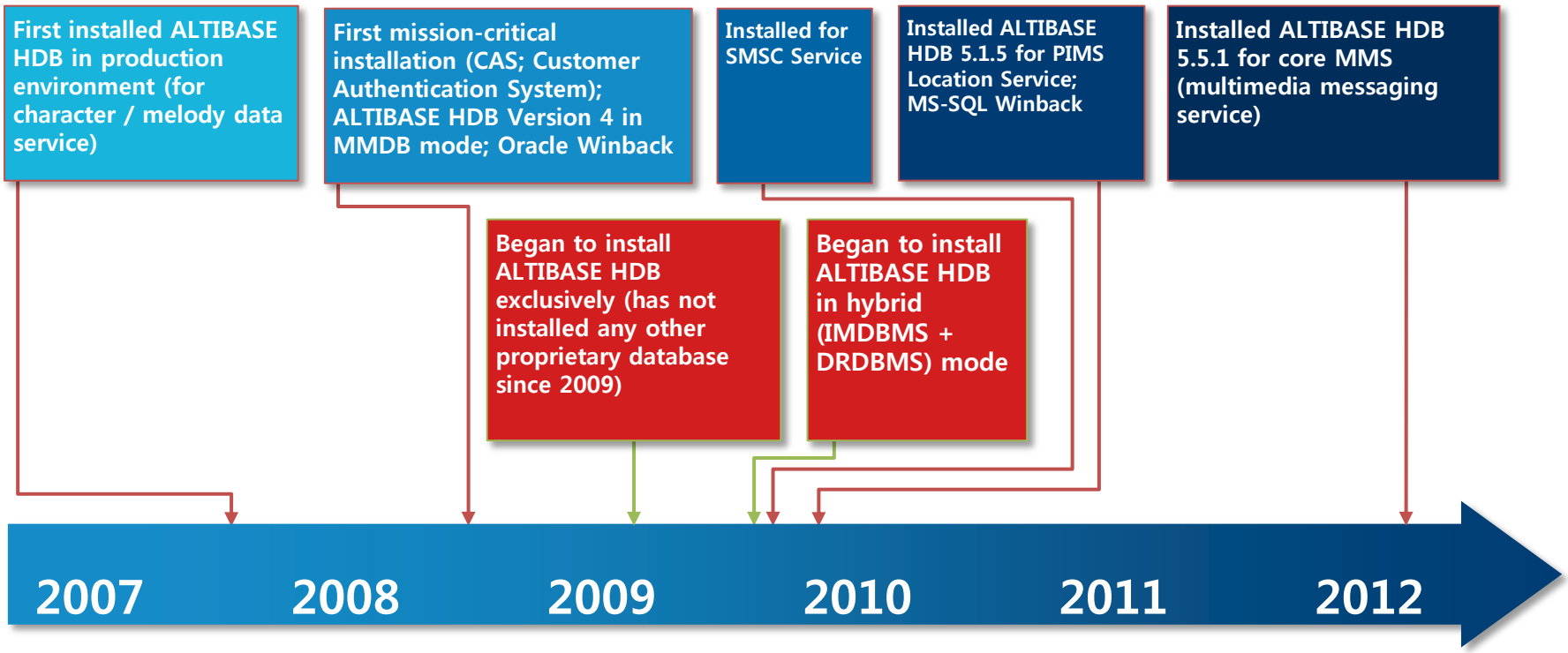
Revenue by Region



Solutions from Altibase have built a strong brand and foundation for growth across key verticals globally. It has grown from its foundation as a leader in in-memory DBMS into a reliable and innovative provider across growing industry segments.

ALTIBASE® PERFORMANCE SOLUTIONS
Copyright © 2012 Altibase All Rights Reserved

LG U+ is transitioning completely to ALTIBASE HDB



- Have installed ALTIBASE HDB for about 40 services since 2007
- ALTIBASE HDB now operating on more nodes than Oracle products
- Have switched services from Oracle, MS-SQL, and Sybase to ALTIBASE HDB

ALTIBASE® PERFORMANCE SOLUTIONS
Copyright © 2012 Altibase All Rights Reserved

All Three Major Chinese Telecoms Use ALTIBASE HDB

ALTIBASE HDB is used as an IMDBMS in billing and authentication applications by all major Chinese Telecoms in all Chinese provinces.



中国电信 CHINA TELECOM
59 servers in 4 provinces

中国移动通信 CHINA MOBILE
31 servers in 7 provinces

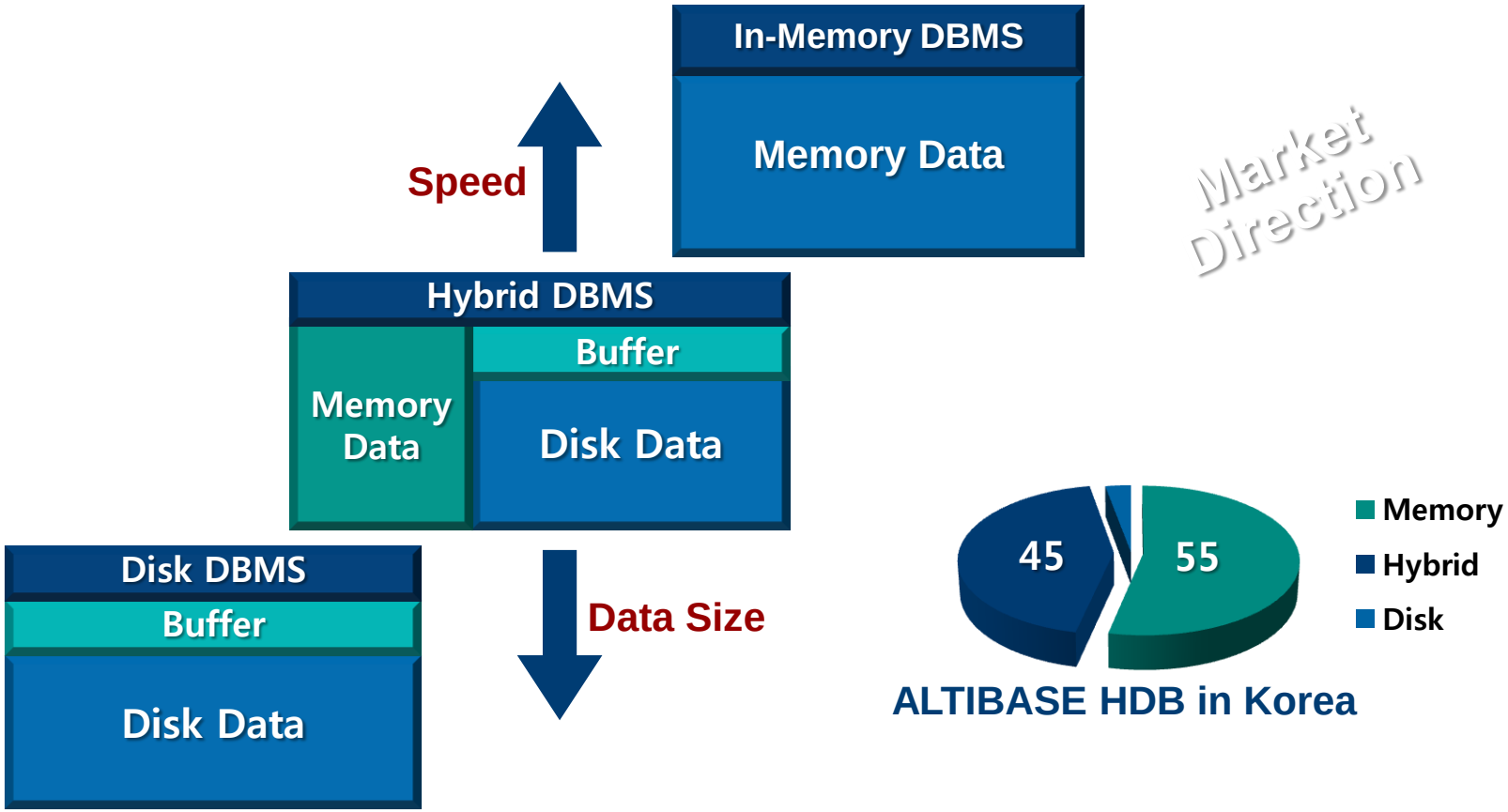
China unicom中国联通
114 servers in 29 provinces

Altibase In-Memory DBMS revenue China, 2008-2012

	License Revenue	Maintenance Service Revenue	Total Revenue
2008	¥4,610,940	¥238,590	¥4,849,530
2009	¥32,661,800	¥613,590	¥33,275,390
2010	¥16,430,816	¥2,732,000	¥19,162,816
2011	¥5,465,705	1,375,693	¥6,841,398
2012 1H	¥7,101,127	¥1,351,825	¥8,452,952

Copyright © 2012 Altibase All Rights Reserved

ALTIBASE HDB: A Smooth Transition to In-Memory DBMS

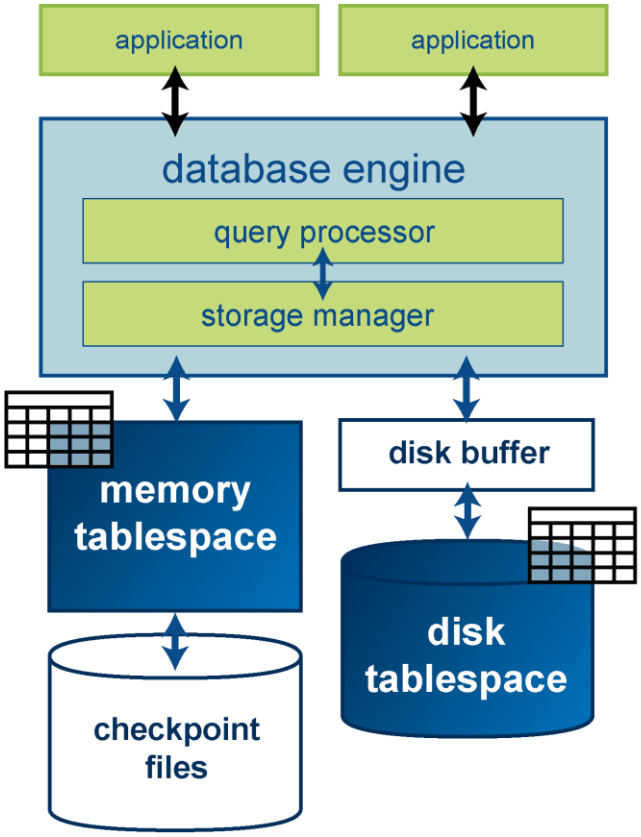


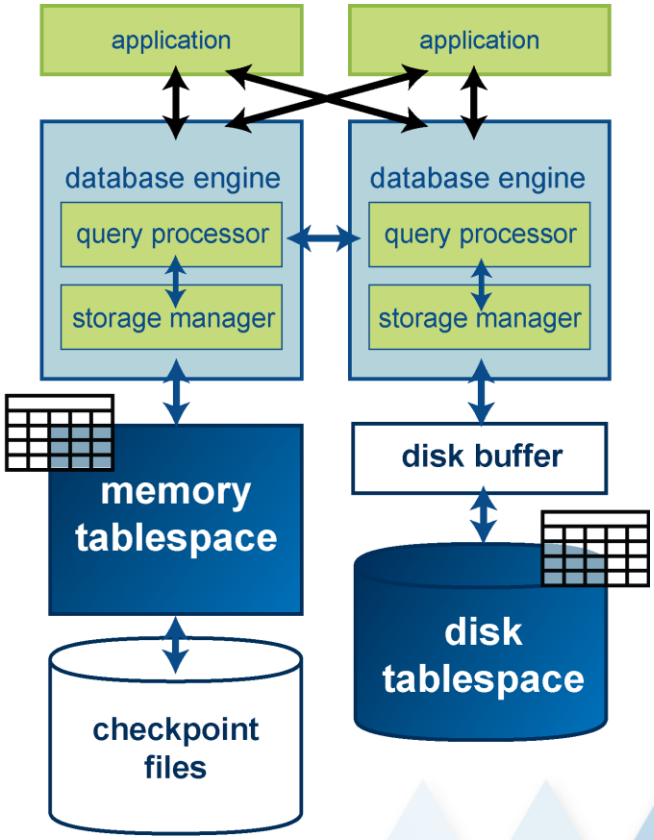
ALTIBASE® PERFORMANCE SOLUTIONS
Copyright © 2012 Altibase All Rights Reserved

The Hybrid Architecture Value Proposition

Lower TCO Because:

- Lower Initial Licensing Costs
- Hardware Investment Halved
- Maintenance Costs Reduced
- Greatly Simplified Application Development and Maintenance





- **Memory-resident tables and Disk-resident tables are accessed via a single interface**
- **The most frequently accessed disk data is loaded into memory for faster access**
- **Memory data is periodically backed up to disk to ensure data persistence**

ALTIBASE® PERFORMANCE SOLUTIONS
Copyright © 2012 Altibase All Rights Reserved

IMDBMS Functional Comparison

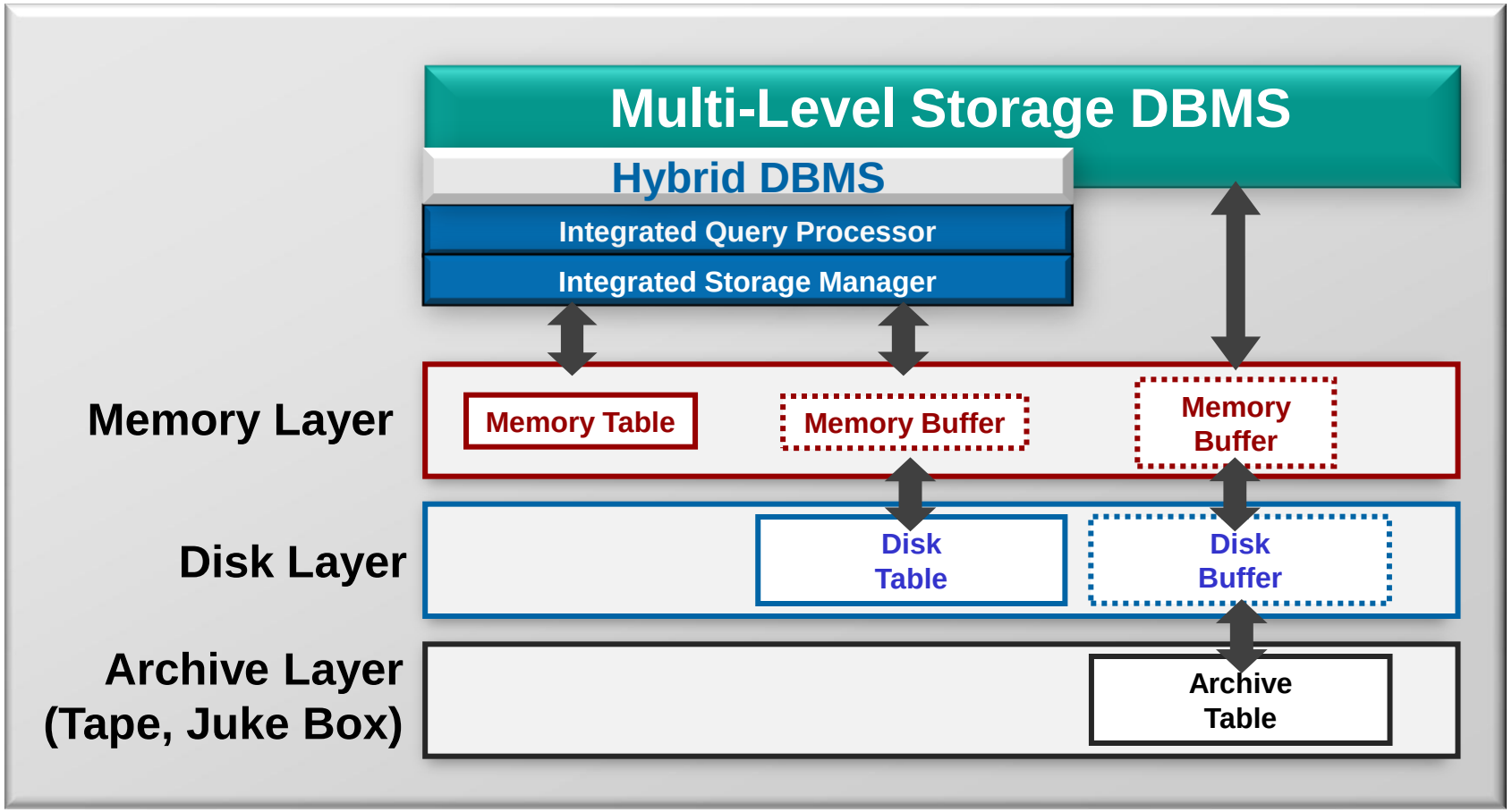
Feature	Benefit	ALTIBASE HDB	TimesTen	SolidDB	Hana
Fully ACID-Compliant	Ensures integrity of data, just like a disk-based DBMS	**Yes**	**Yes**	**Yes**	**Yes**
Supports the Full SQL-92 Specification	Increases lookup speed and reduces the number of queries required for a given task	**Yes**	**No**	**No**	**Yes**
Provides Archive Log Mode	Makes a greater variety of recovery methods possible	**Yes**	**No**	**Yes**	**Yes**
Allows dynamic adjustment of tablespace size while DB is online	Maximizes DB scalability and optimizes memory usage	**Yes**	**No**	**No**	**No**
Provides User-Created Memory Tablespaces	Makes it easy to manage data objects	**Yes**	**No**	**No**	**No**
Provides Offline Replication	Provides an additional method of ensuring high availability	**Yes**	**No**	**No**	**No**
Number of durability levels provided	Allows optimum performance/durability tradeoff to suit business requirements	**4**	**3**	**2**	**3**

Copyright ⓒ 2012 Altibase All Rights Reserved

ALTIBASE
Concept and Structure

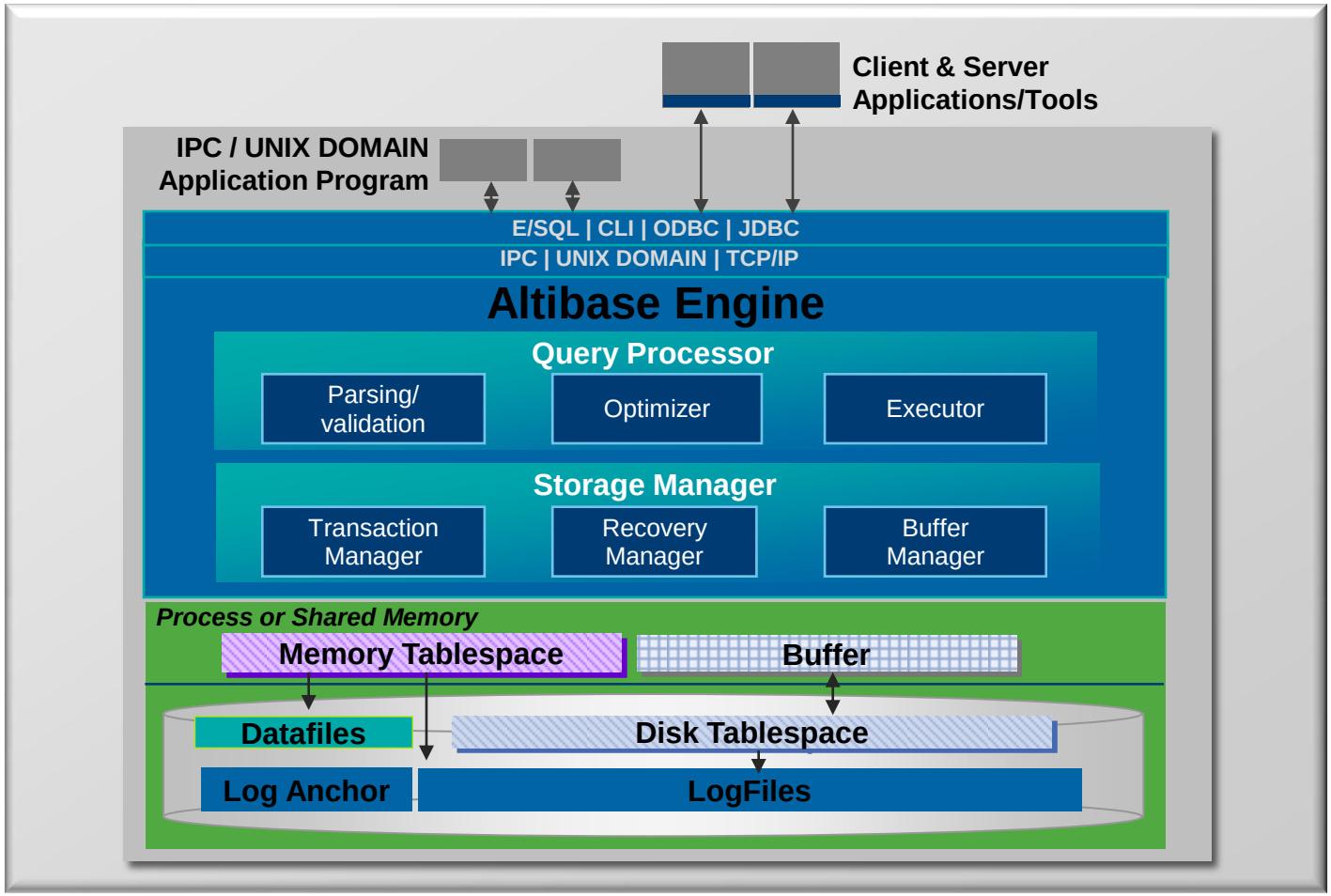
Hybrid DBMS?

- Multi-Level Storage DBMS implemented
- Real-time, large-sized DBMS



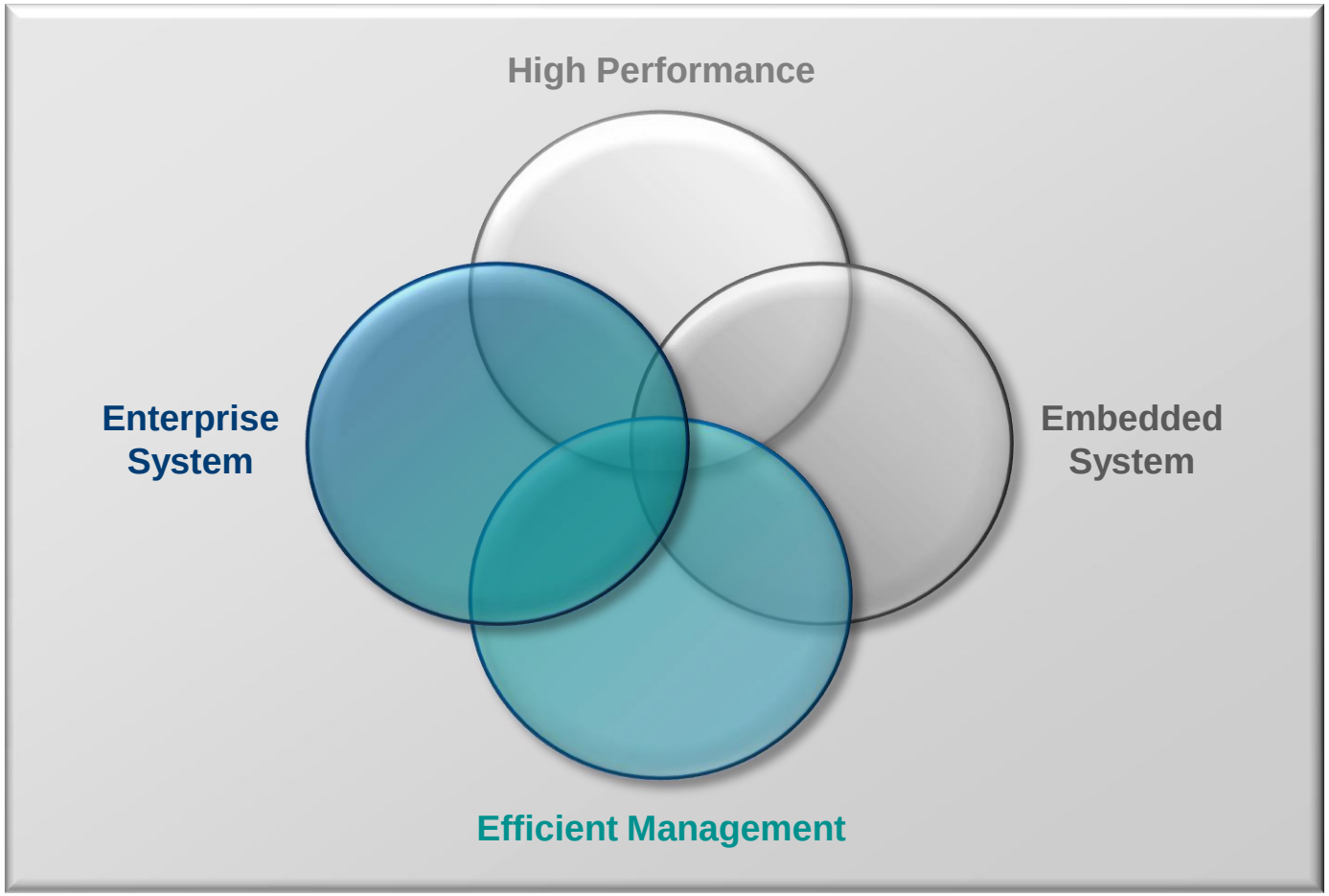
ALTIBASE: Convergence of Structures

- 1+1 != 2: One DBMS engine incorporating Memory and Disk DBMS
- Provides transparency in queries, transactions, recovery, development, and management



ALTIBASE: A Convergence of Concepts

- Advantages of Memory DBMS and Disk DBMS combined
- Convergence of Models and Applications ➔ Multi-Purpose DBMS

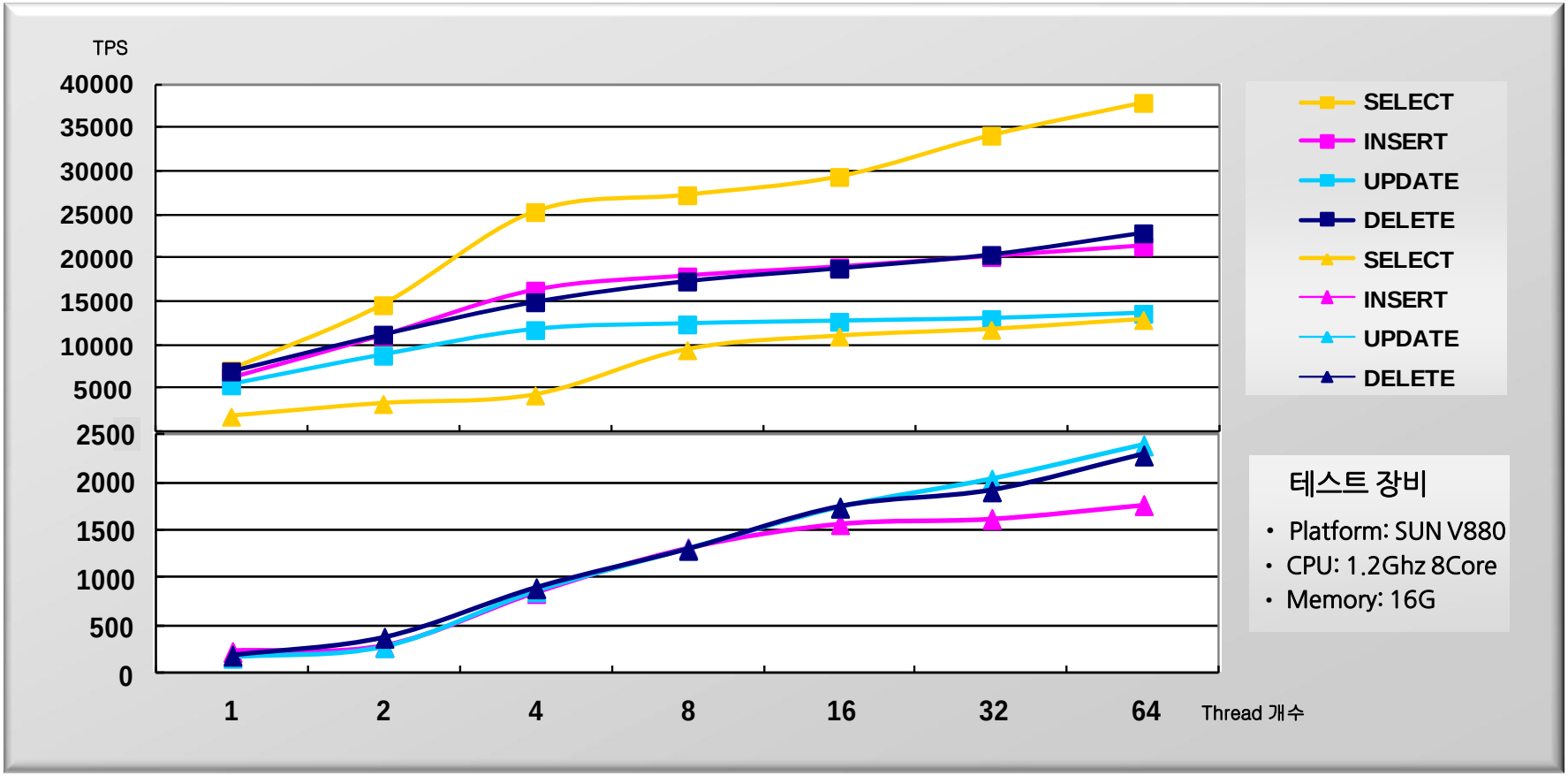


ALTIBASE
Functions and Features

How Well Does ALTIBASE Perform?

(1) Simple DML Performance

- Memory Table DML : Ten times faster than Disk DBMS
- Memory Table Select : From 2 to 5 times faster Disk DBMS
- Disk Table DML & Select : Almost the same speed as Disk DBMS

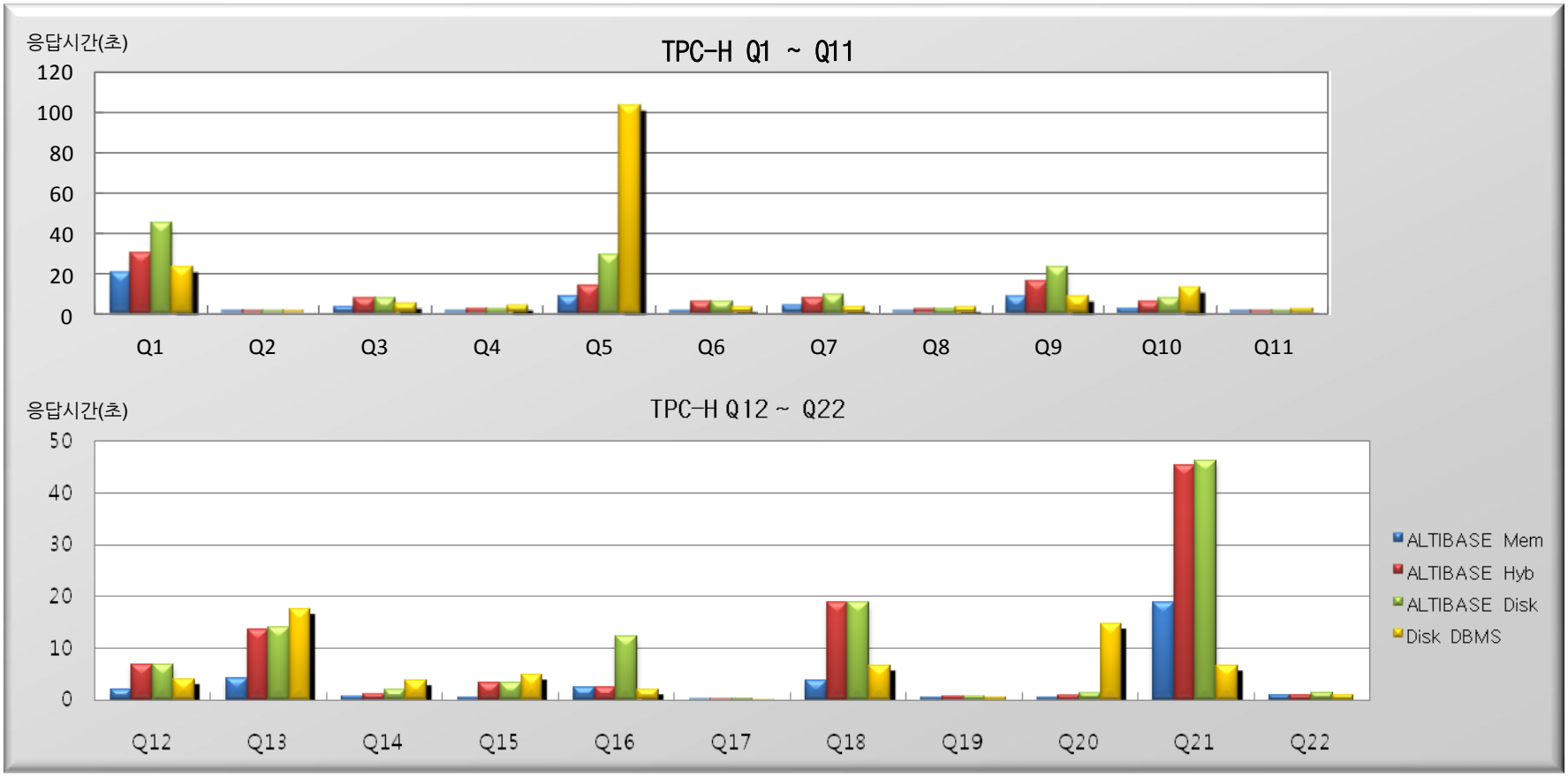


How Well Does ALTIBASE Perform?

(2) Complex Query(TPC-H) Speed

: It consists of 22 queries to explain complexity of modern business practices.

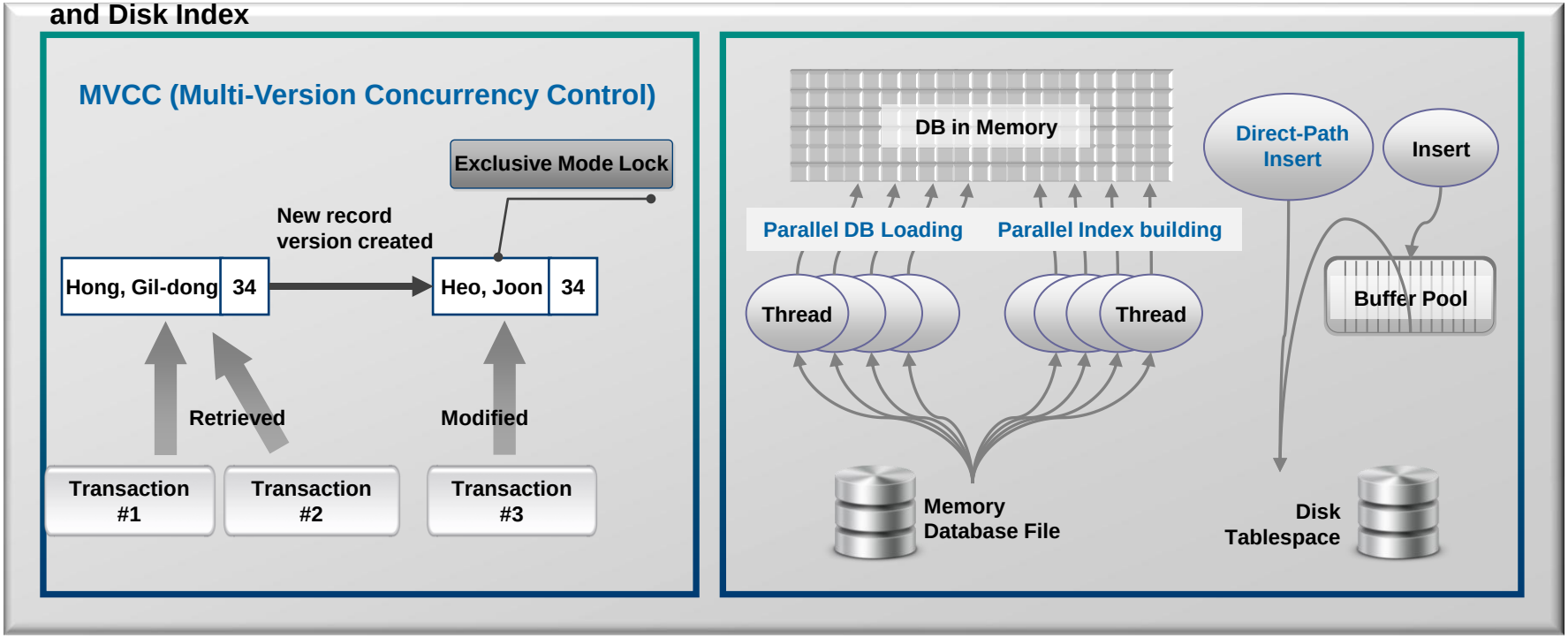
- In-memory DBMS is faster than on-disk DBMS in most queries when especially memory table used.



How Well Does ALTIBASE Perform?

(3) Other Performance Features

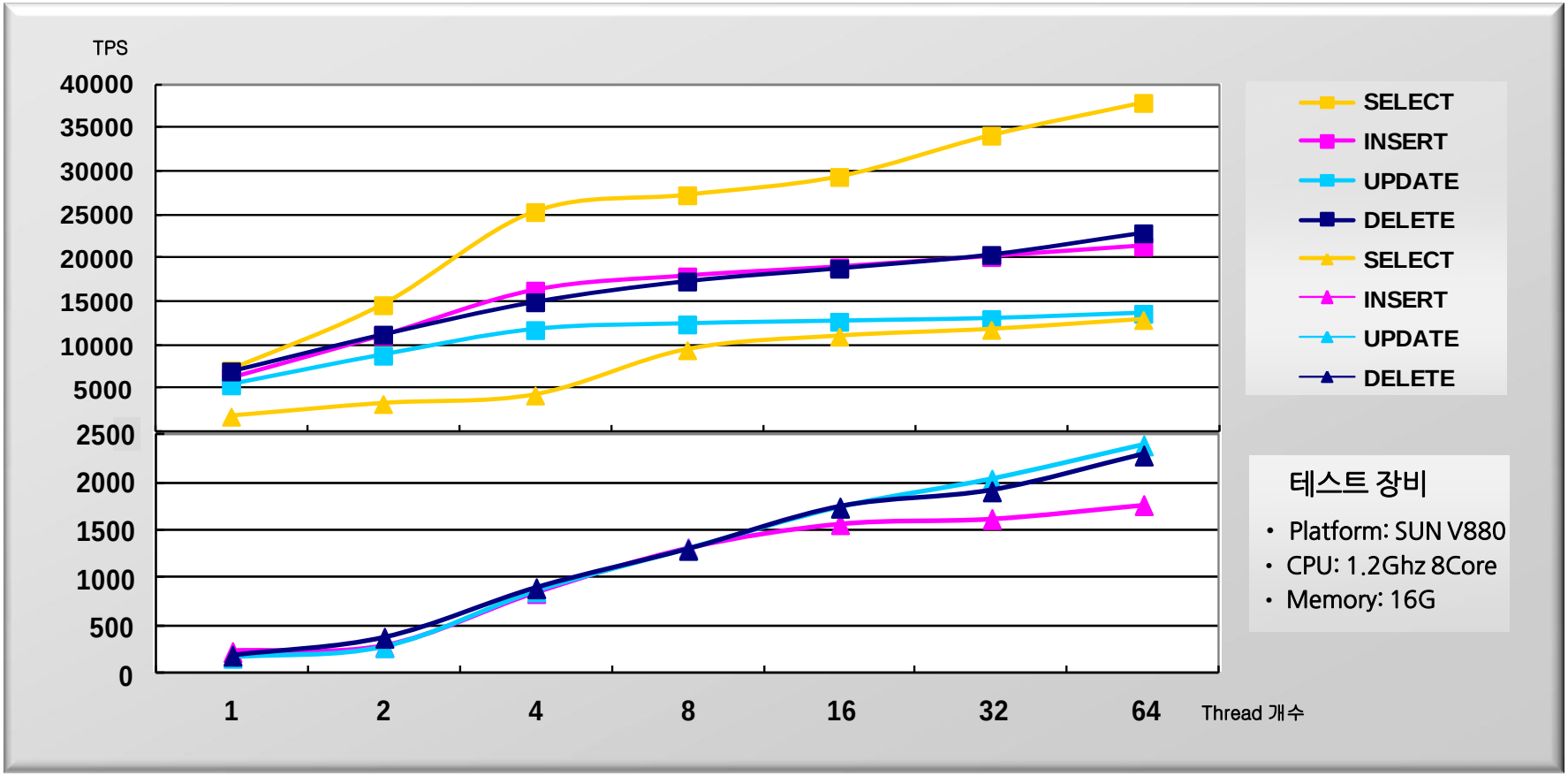
- **MVCC Concurrency Control: Optimized performance in large-sized transaction environments where data is modified frequently**
- **DB Startup Performance: Fast startup through Parallel DB Loading, Parallel Index building techniques**
- **Data Loading Performance: Effective creation and transfer of large-sized disk data by supporting Direct-path Insert**
- **Index Building Performance: Highly enhanced rebuilding performance of Memory Index and Disk Index**



How Fast Is Altibase?

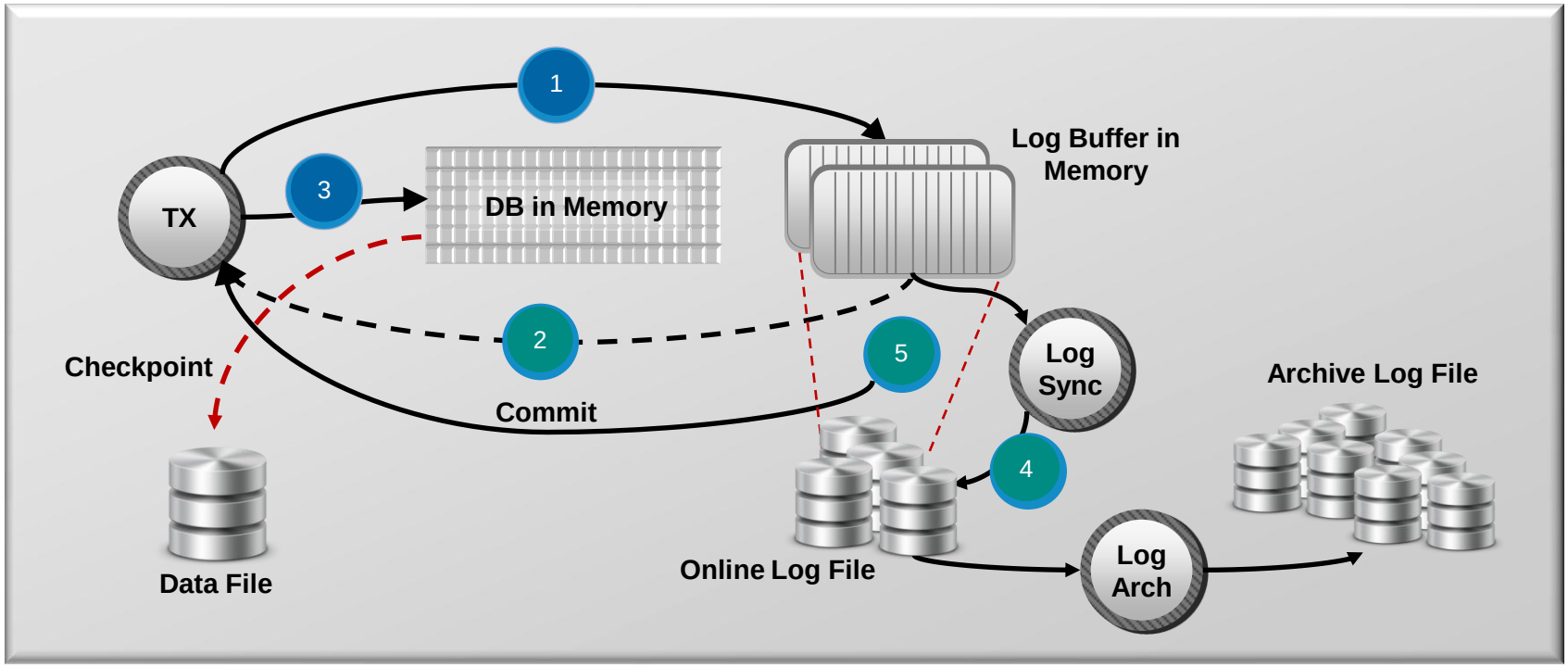
(1) Simple DML Performance

- Memory Table DML : Ten times faster than Disk DBMS
- Memory Table Select : From 2 to 5 times faster Disk DBMS
- Disk Table DML & Select : Almost the same speed as Disk DBMS



How is Memory Data Recovered?

- **Logging: Logging done while a transaction is being processed to recover the committed transaction**
- **Checkpoint: Minimizes the recovery lead time by writing the modified data pages from the memory to the disk when the number of log files exceeds a certain level or when the set time arrives**

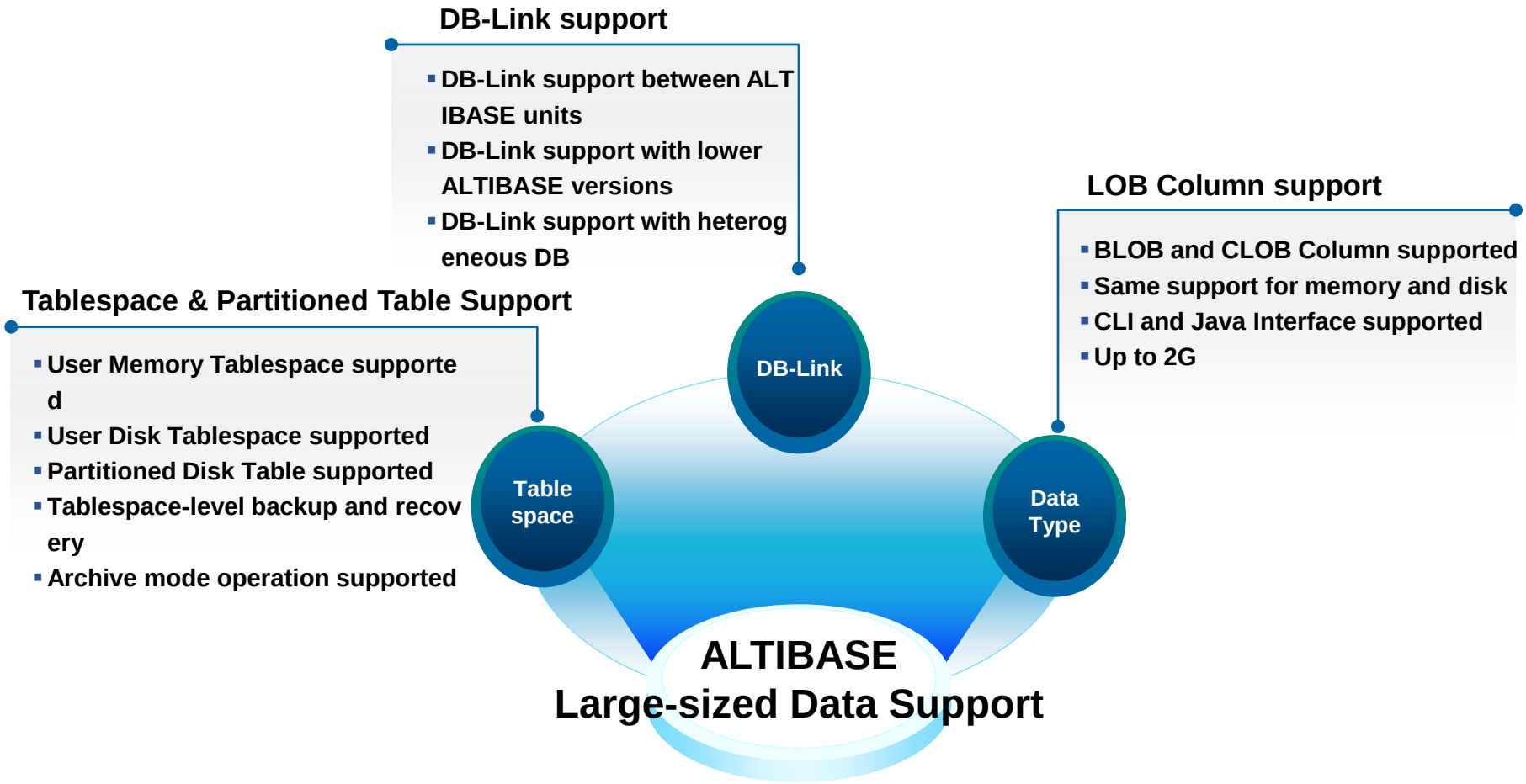


WAL (Write Ahead Logging)

- Means logging the details of the transaction to the file before saving data on the DB page and returning the result of the tr ansaction.
- If data in the memory is abnormal or lost, it can be recovered through the log file in the file system.

How is Large-sized Data Supported?

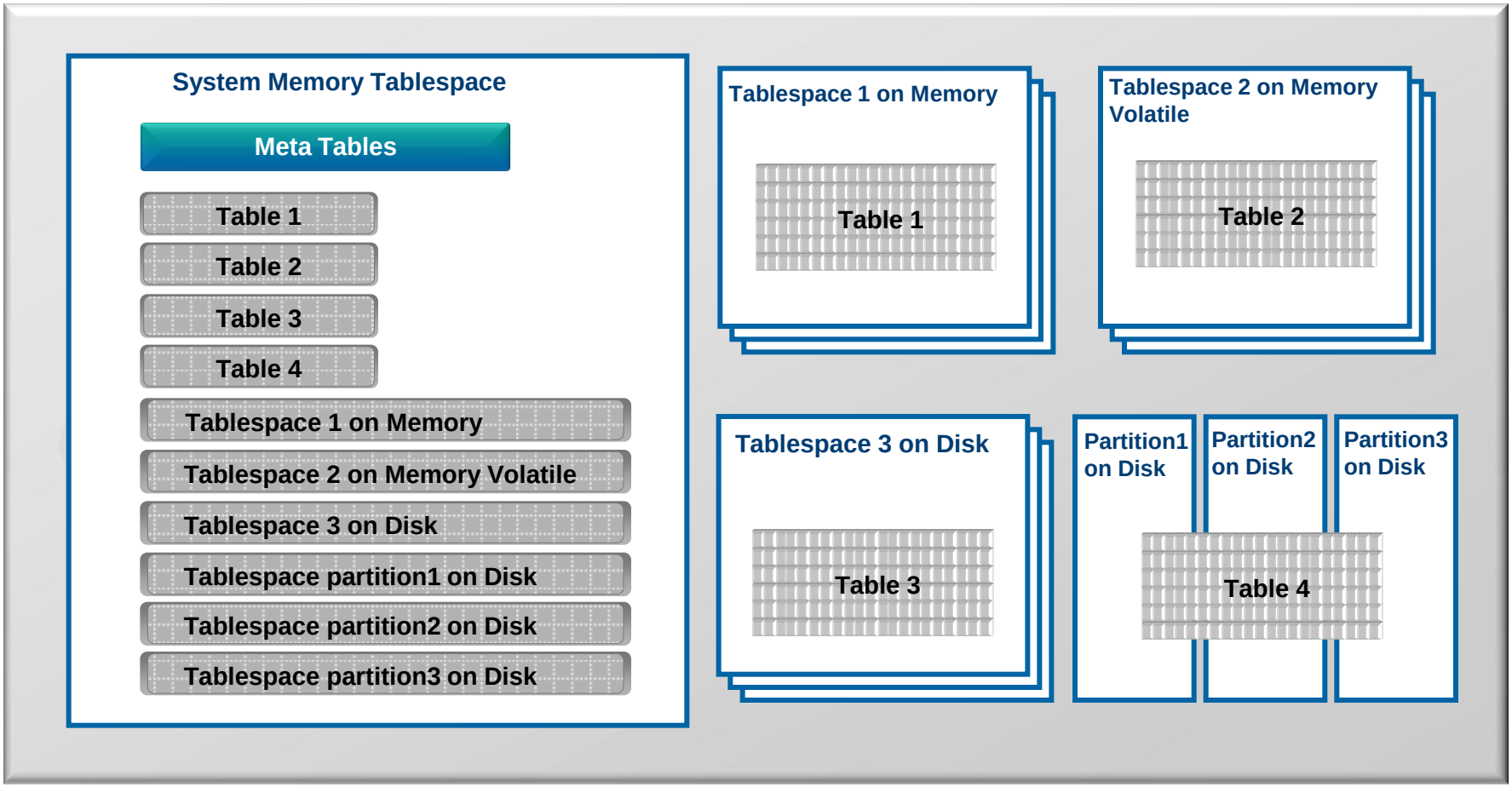
▪ **Provides functionality for saving and managing large-sized Memory and Disk data in the most efficient manner**



How is Large-sized Data Supported?

(1) Tablespace & Partitioned Table Support

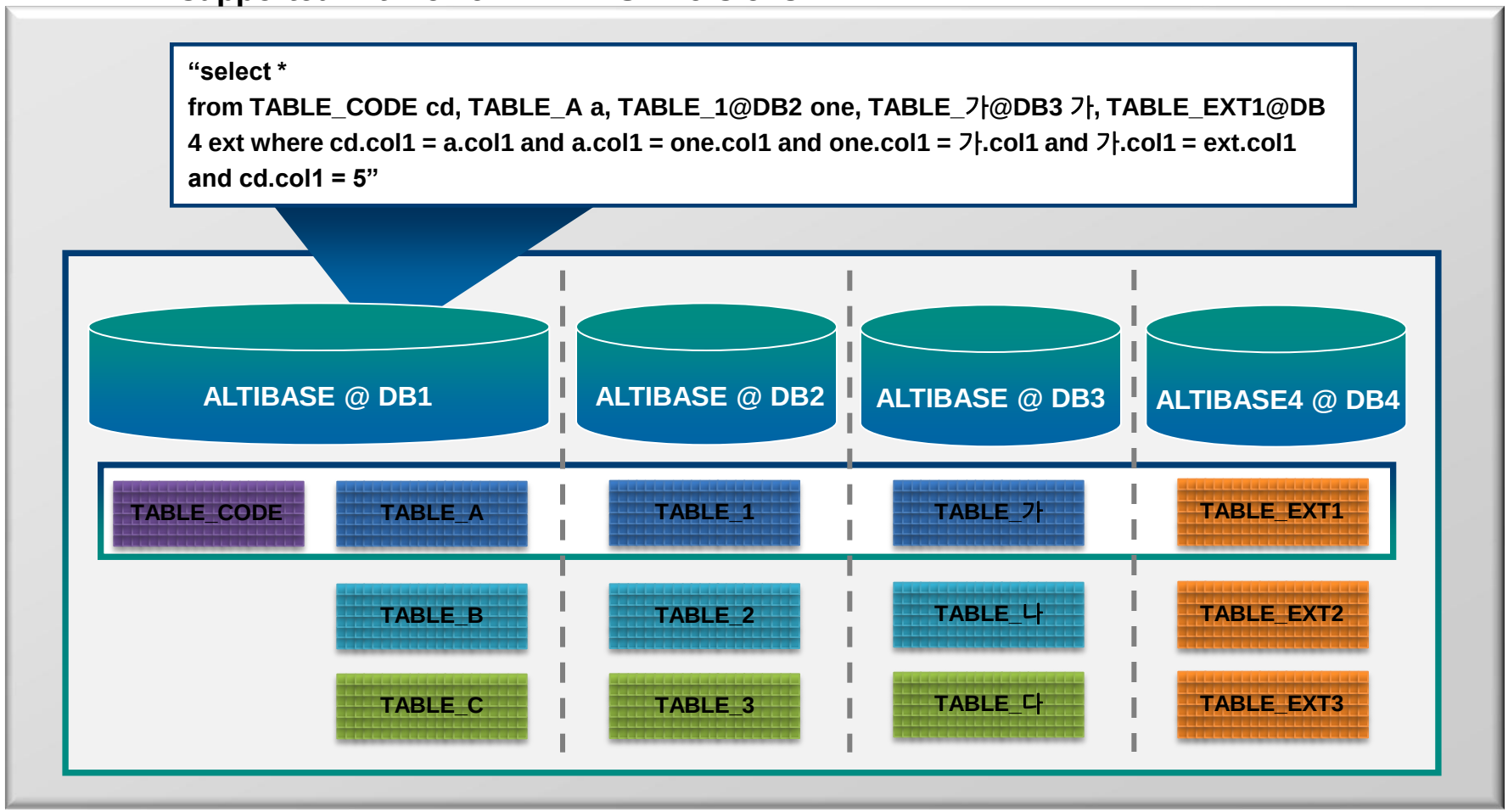
- Tablespace concept introduced into Memory DB to support the management of large-sized memory resources efficiently
- Partitioned Disk Table utilized to manage large-sized data efficiently



How is Large-sized Data Supported?

(2) DB-Link between ALTIBASE Units

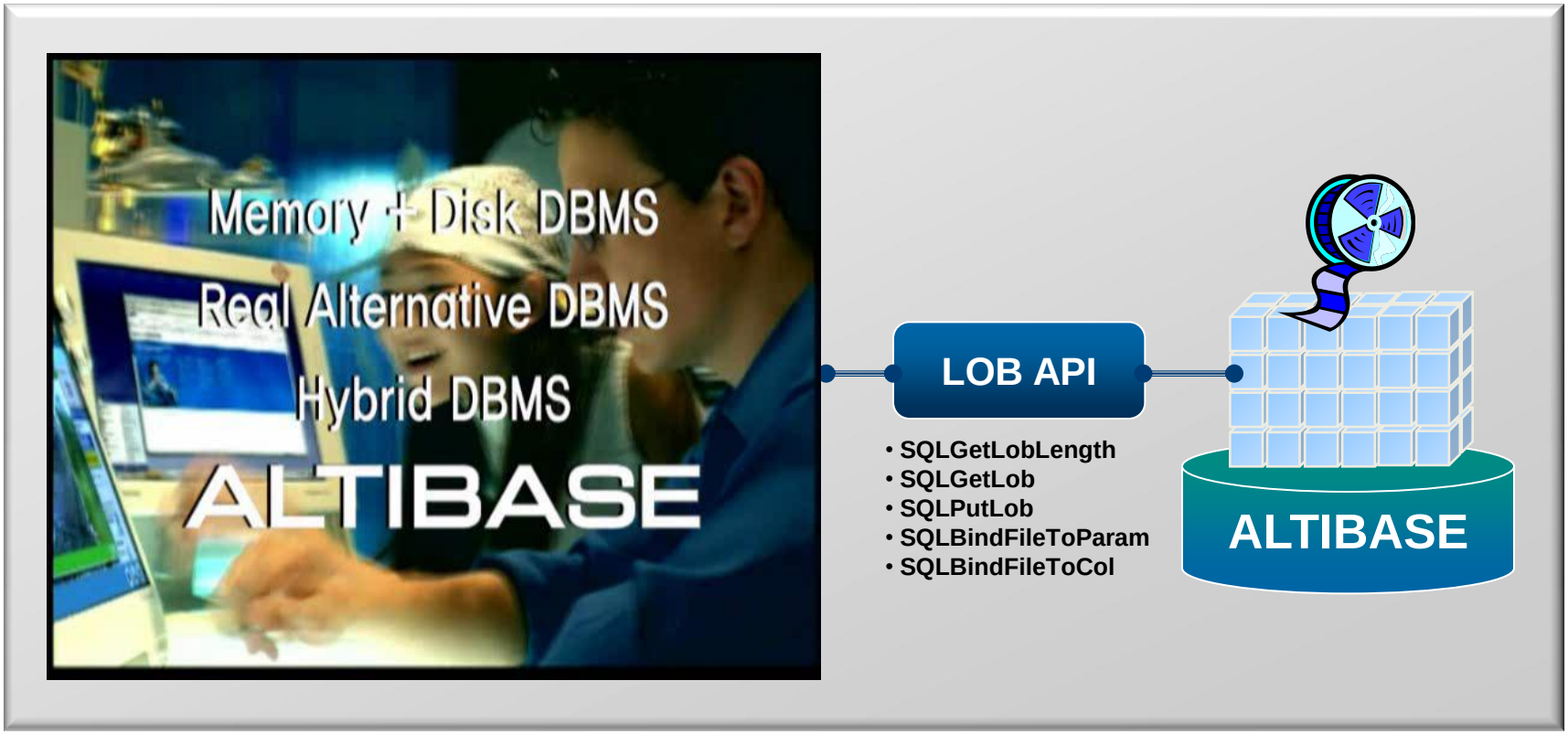
- DB-Link between ALTIBASE units supported to avoid data redundancy and establish a large-sized DB in a distributed environment
- DB-Link supported with lower ALTIBASE versions



How is Large-sized Data Supported?

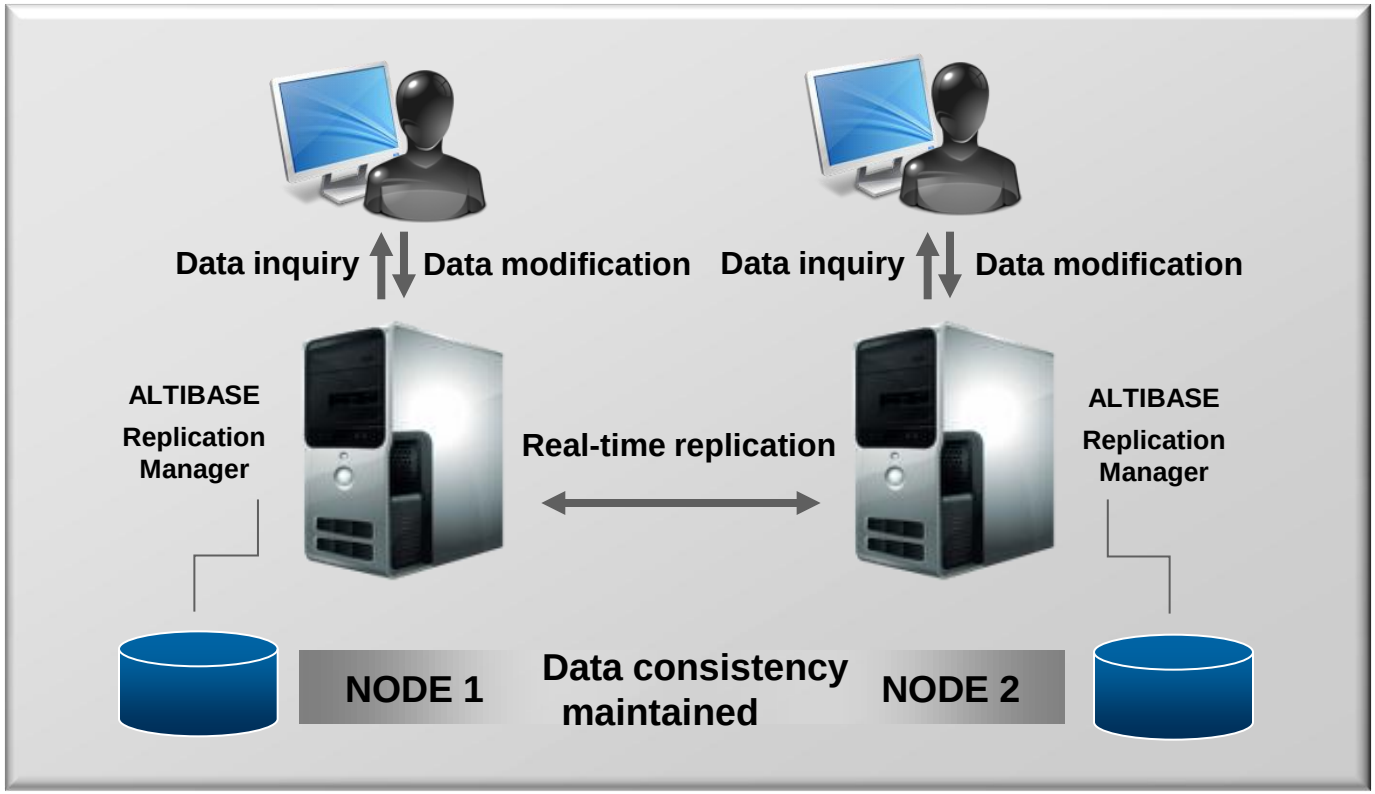
(3) Large-sized LOB Column Support

- **BLOB and CLOB Columns: Saves up to 2GB**
- **LOB API support: API to retrieve and save large-sized LOB data efficiently**



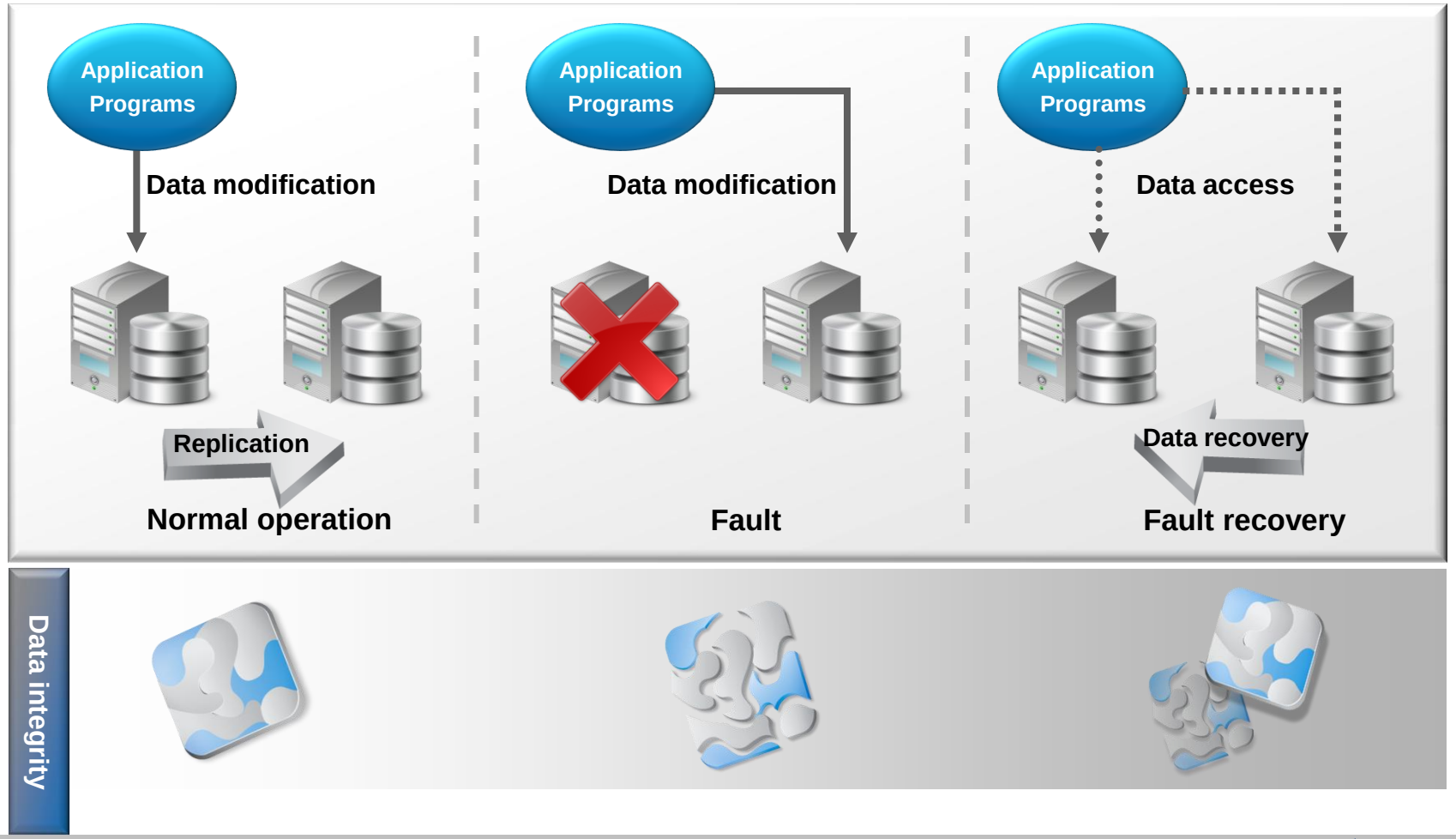
How is Duplex and Non-stop Service Supported?

- Replication: Any modified data is replicated between DB nodes to maintain data consistency.
- Lazy (async) and Eager (full-sync) data synchronization modes supported
- Features: ① TCP/IP network method ② Table-level duplication
  ③ Up to 1:32 supported ④ Duplication supported between heterogeneous servers



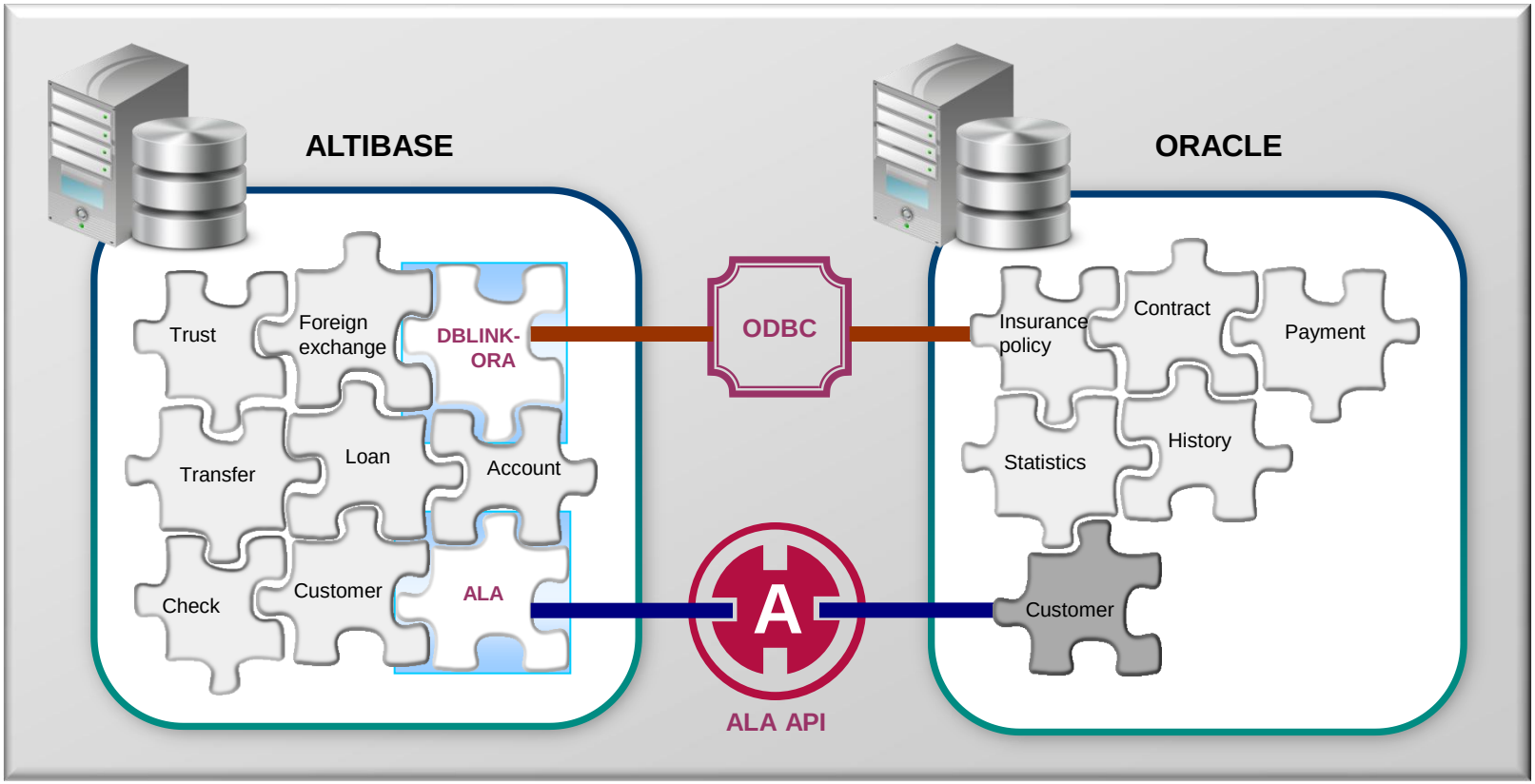
How is Duplex and Non-stop Service Supported?

- Non-stop service enabled by switching to duplex nodes when the active server is in a fault state
- Any data modified during the fault is recovered automatically from the duplex nodes following recovery from an active server fault



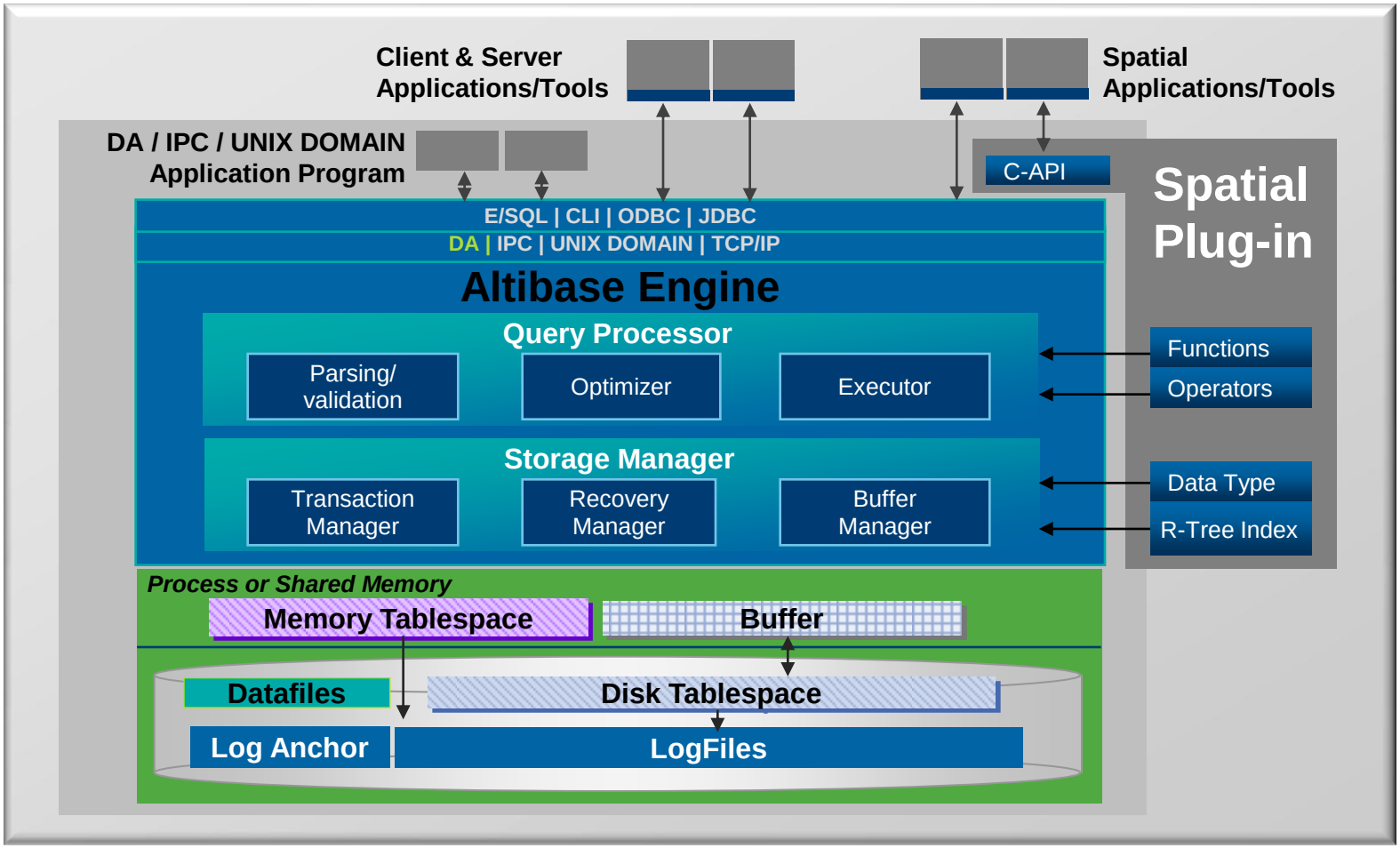
How are Heterogeneous DBs or Systems Connected?

- **DB-Link with heterogeneous DB supported: Table data can be retrieved directly from a heterogeneous DB through DB-LINK based on standard ODBC**
- **Log Analyzer (ALA) supported: Synchronization of data modified in ALTIBASE to a heterogeneous DB or another system using API based on replication**



ALTIBASE Spatial Structure

- Since ALTIBASE has a Spatial function plug-in, it supports memory-based, high-functioning spatial data processing and disk-based, large-sized storage structure simultaneously.



Spatial Data Types and Formats

▪**The following spatial data types and formats are supported by ALTIBASE:**

Supported Data Types

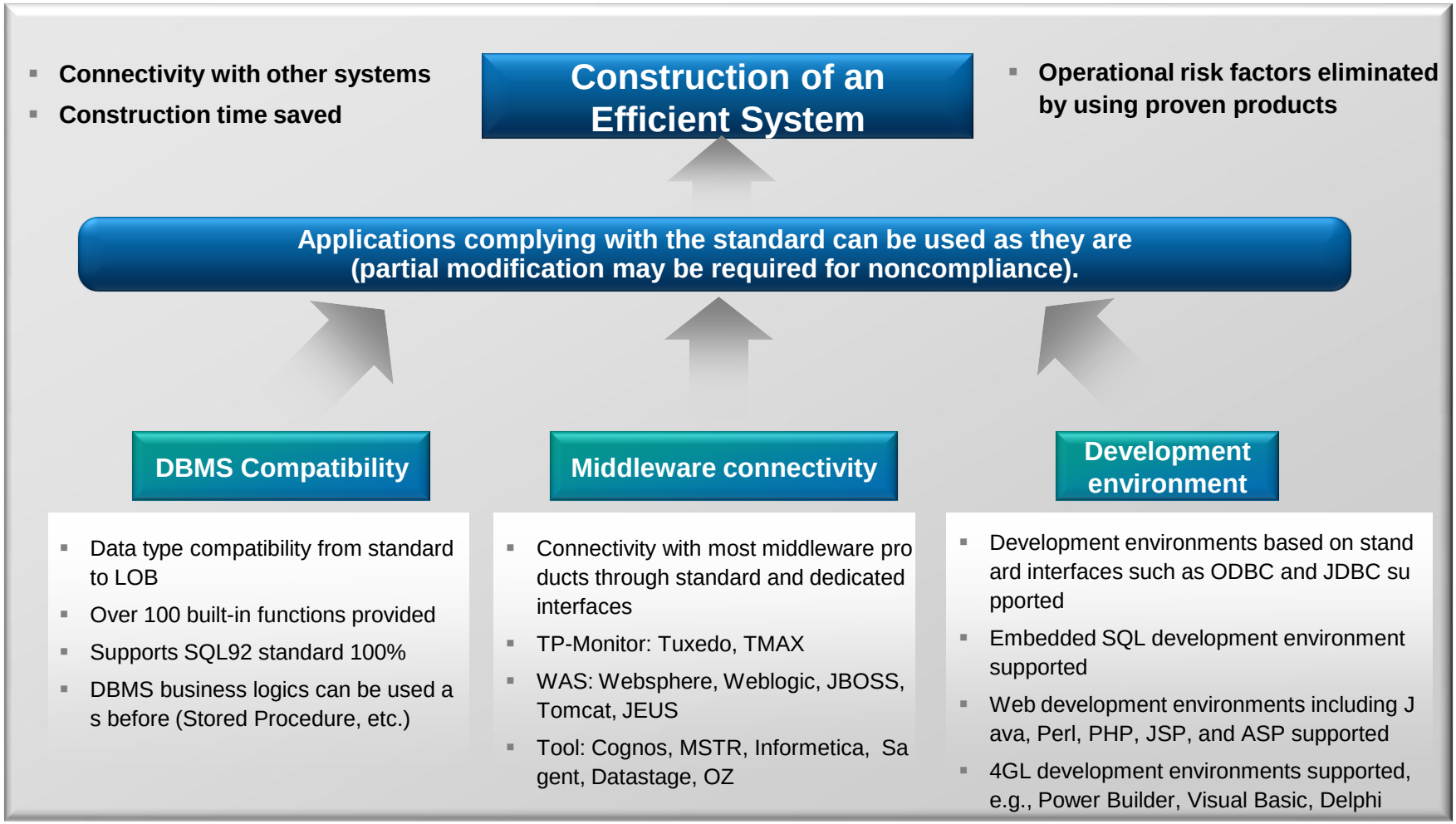
- ALTIBASE supports **all 7 standard spatial data types** defined by OGC (Open GIS Consortium) to manage spatial data efficiently. ➔ POINT, LINESTRING, POLYGON, MULTIPOINT, MULTILINESTRING, MULTIPOLYGON, and GEOMETRYCOLLECTION
- ALTIBASE offers all of the **standard and dedicated formats** defined by OGC ➔ WKT(Well-Known Text), WKB(Well-Known Binary), and ALTIBASE format

Formats

Format Type	Using Query
WKT (Well-Known Text)	INSERT INTO test_table VALUES (**GEOMFROMTEXT(?)**);
	SELECT **ASTEXT(obj)** FROM test_table;
WKB (Well-Known Binary)	INSERT INTO test_table VALUES (**GEOMFROMWKB(?)**);
	SELECT **ASBINARY(obj)** FROM test_table;
ALTIBASE format	INSERT INTO test_table VALUES (?);
	SELECT obj FROM test_table;

How is the Existing DB Replaced?

- **All DBMS standard interfaces are offered, and SQL sentences based on the SQL standard are 100% compatible.**



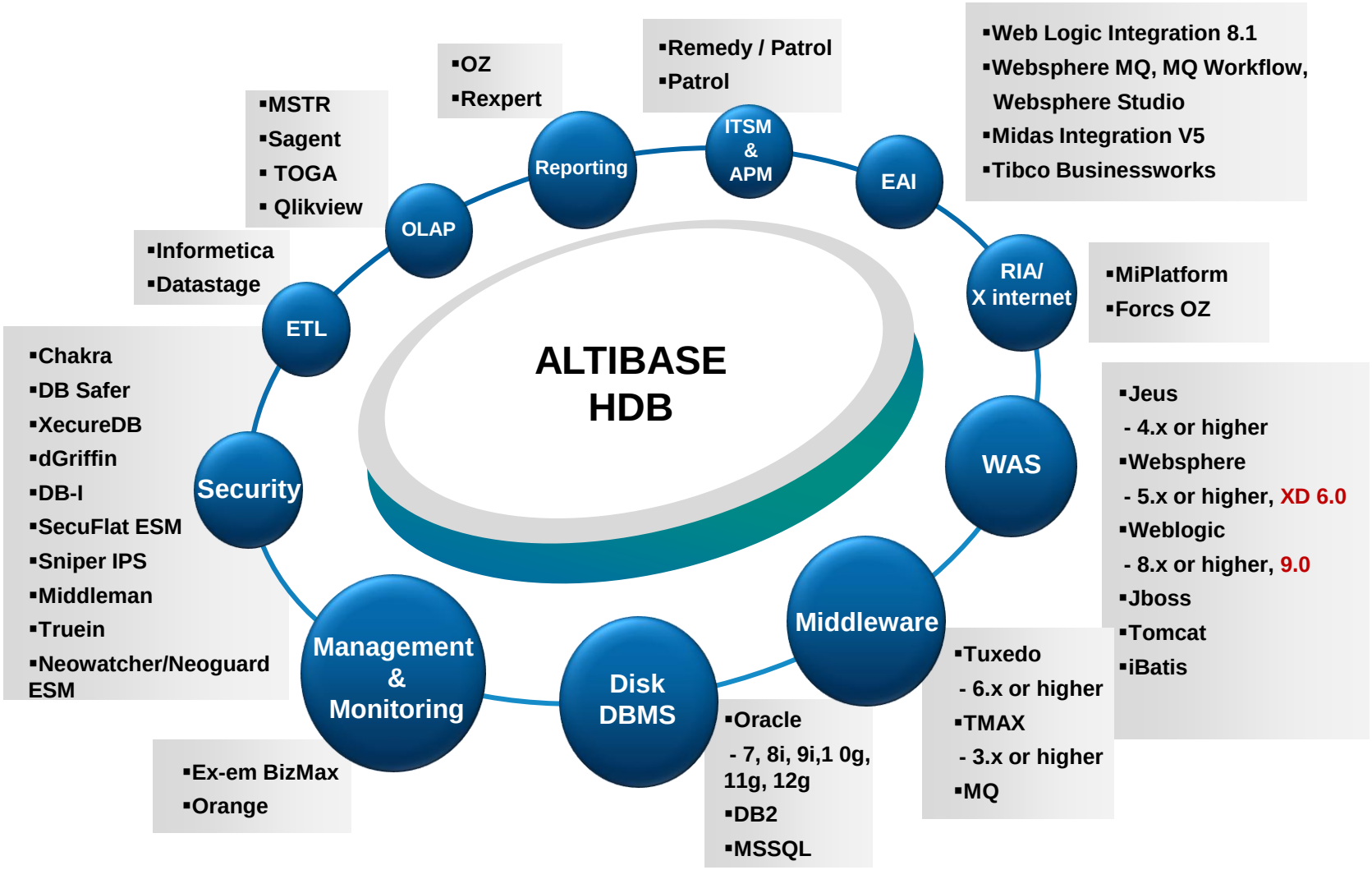
Development Environment Provided by ALTIBASE

Client Development Environment	
ODBC	• In addition to RAD (Rapid Application Development) tools such as Visual Basic and Power Builder, most development environments have access to ALTIBASE. • Standard support reinforced by reimplementation
JDBC	• Used when developing ALTIBASE applications in a Java environment • Used when constructing a Connection Pool in WAS • Performance enhanced through reimplementation • JDBC 3.0 supported
SQLCLI	• C language-based ALTIBASE low-level API • LOB API, ALA (ALTIBASE Log Analyzer) API, ACS (ALTIBASE Call-Level for Spatial) API provided
Embedded SQL (Pre-Compiler)	• Interface used with C or C++ host languages • Development productivity enhanced since SQL sentences are used in the host language
ADO.NET	• Common programming interface which accesses the data of the database in the Windows .Net Framework foundation
Unix ODBC	• Standard DB access API compatible with Windows ODBC source in Unix • Compatibility offered with ETL tools such as DataStage and Informatica and OLAP tools such as Sagent

Server Development Environment	
SQL	• Full-Featured SQL92 supported • International and complex queries supported, e.g., SUB QUERY, INLINE VIEW • Tuning with Hint and SQL implementation Plan supported • Scrollable Cursor supported
Built-in Function	• Over 100 built-in functions provided • Various calculations possible within SQL sentences by means of built-in functions
Stored Procedure & Function	• Stored Procedure and Stored Function based on SUB QUERY or INLINE VIEW supported • C/C++ supported • ResultSet can be sent from Procedure to Client • Structured type and Array type in Procedure supported • Dynamic SQL/DDL in Procedure supported • PL/SQL and Package supported
View	• Efficiently retrieve a number of tables in Union or SQL in View. • Materialized View supported • Updatable Join View supported
Trigger	• Trigger supported by standard for working data event formats • Update Trigger for certain columns supported • Instead of Trigger-supported
Schema Object	• Volatile Tablespace supported • Temporary Table supported • Function-Based Index supported

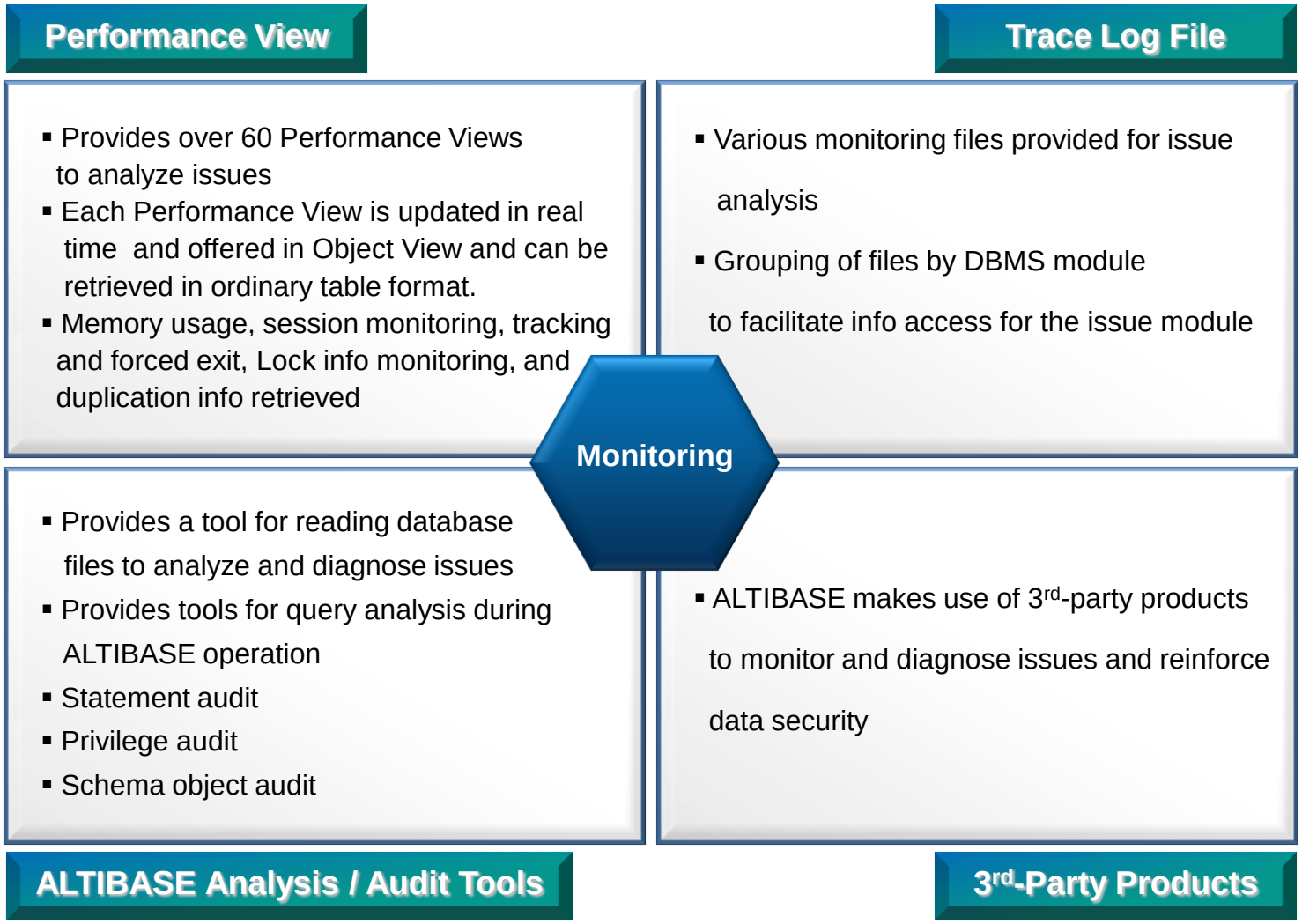
ALTIBASE Tool Connectivity

- Connectivity with various enterprise tools and increased connectivity ensured



ALTIBASE Monitoring Function

- **Provides diverse and efficient DB monitoring functions**



ALTIBASE Utilities



iSQL / Orange for Altibase

- **iSQL performs SQL sentences interactively.**
- AdminCenter provides all iSQL functions in the GUI method.
- Management are functions throughout ALTIBASE
- Table schema, user and Lock info, Connection status, transaction info

iLoader / aexport

- **Tool to enable efficient data migration**
- iLoader stores and loads data in text.
- aexport creates a script to back up and load database schema and data; useful when moving data between heterogeneous platforms

audit

- Comparison and inspection of data by table between ALTIBASE units
- **Function to maintain consistency between two different databases for any inconsistency identified**

altimon

- **Function monitoring of ALTIBASE server processes**
- Consistently monitors system resources usage and writes it to the log file
- The log file created is utilized as basic material for system operations.

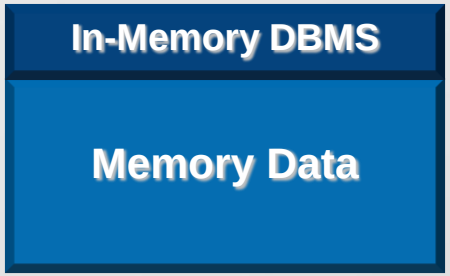
altiProfile

- **Query analysis tool during operations**
- SQL Statement, Bind Value, Plan info, Query performance time confirmed

ALTIBASE-applied Models and Benefits

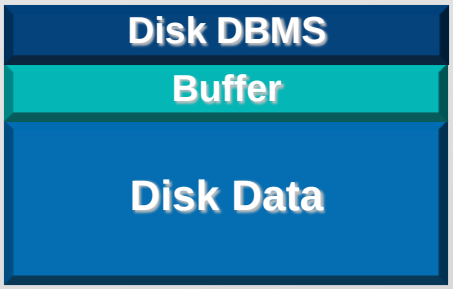
Various ALTIBASE-applied Models

- **HDB designed and built into various models**
  - ① Memory Table Only
  - ② Disk Table Only
  - ③ Memory & Disk Table



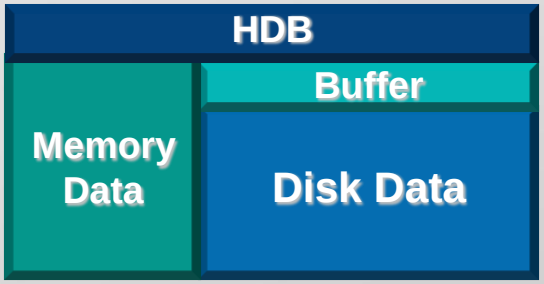
Enable Only Memory

- Applications wherein fast, real-time data processing is required
- Data is not stored in the disk; only the memory data table is used.



Enable Only Disk

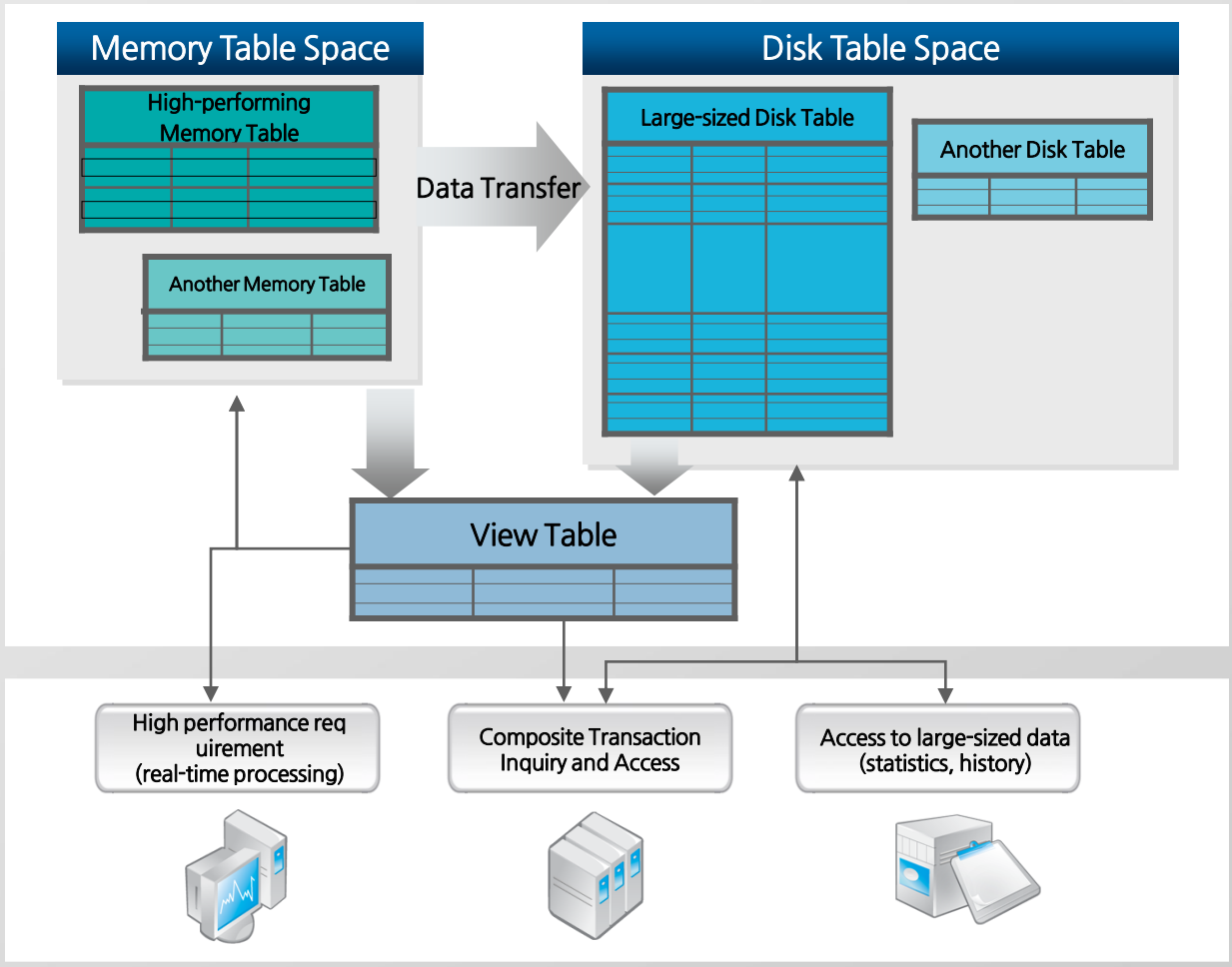
- Applications wherein large-sized DB needs to be managed reliably rather than quickly in real time
- No data stored in the memory



Enable Memory and Disk

- Applications wherein high performance and large sizes are required
- Memory and disk are both used to store data

ALTIBASE Real-time, Large-sized DB Models



ALTIBASE

• Integrated View
Union View is created by combining Memory Table and Disk Table, through which Client can access data.

• Data Move
Data entered in Memory Table is transferred to Disk Table online with Move DML supported, **maintaining memory space and high performance.**

Client Side

• Various data access methods
Client can use Memory Table or Disk Table, Union View **to access data regardless of the physical location of data.**

Effects of ALTIBASE Application



Differentiated data management and high-performing, large-sized service

Differentiating data storage and management areas based on data access frequency, life cycle, and service cycle

- High service level, access frequency, Life Cycle Data => Memory Data area
- Large-sized data service, short Life Cycle and frequency Data => Disk Data area

High Scalability (HA) and Reliable Backup (DR)

- Through the ALTIBASE Replication function, high availability and high performance are possible in a real time duplex alongside DR (Disaster Recovery) for reliable backups.





Development Convenience and Compatibility

- Enhances the convenience of development and productivity by thoroughly providing DBMS
- standard development interface
- Compatible with various middleware software and tools using the existing application architecture for consistency and improvement

Incorporation and Maintenance Cost Savings

- Higher tpmC than the existing commercial DBMS to save on server equipment and licensing costs
- Lower maintenance costs compared to foreign-made DBMS units and better maintenance service



Cost Savings by ALTIBASE Application

- **Hardware and DBMS incorporation and maintenance cost savings**

TPC-C

- Model C (1992) in benchmark standard specifications to measure system proc essing performance of online transaction processing (OLTP) system
- OLTP benchmark test implementing a combination of 5 types of hypothetical simultaneous transactions or querying delayed implementations

TRANSACTION Structure

- New-order – 45%
  Transaction of entering client's order
- Payment – 43%
  Transaction of deducting from a client's ac count to reflect payment
- Delivery – 4%
  Transaction concerning delivery
- Order-status – 4%
  Transaction of inquiry into a client's m ost recent order status
- Stock-level – 4%
  Transaction monitoring warehouse stock

