Tibero 7 Introduction

TMAXTibero

Contents

TMAXTibero

Chapter 1

Product Introduction

Database management software (DBMS) to store, process, and manage data

Tibero 7 effectively supports on-premises and cloud environments, **Performs Everywhere**

Tibero 7

Korea's first disk-based RDBMS

- Tibero 1.0 released in 2003

No.1 Domestic DBMS products

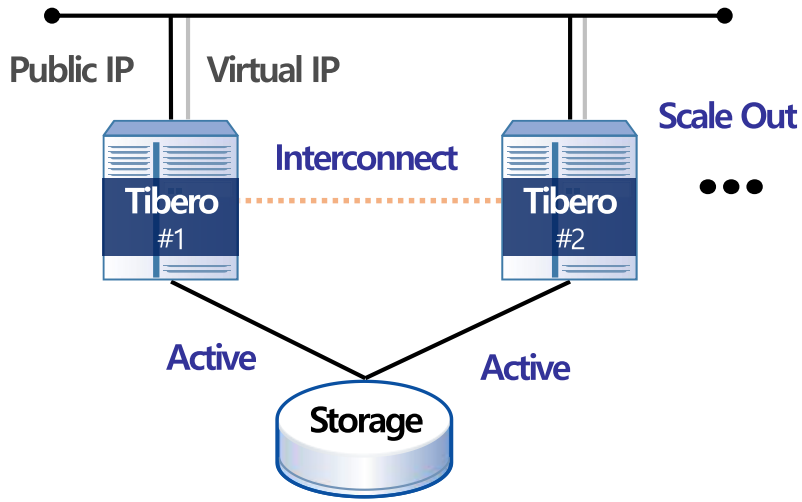
- No.1 Domestic DBMS growth rate for 3 yrs

Multiple references

- Total of 9,900 references as of '25/02
- Over 1,860 win-back references
  (85% Oracle, 15% MS-SQL/DB2 and others)

Shared disk-based TAC* technology

- Only 2 companies in the world
- 1,520 TAC references

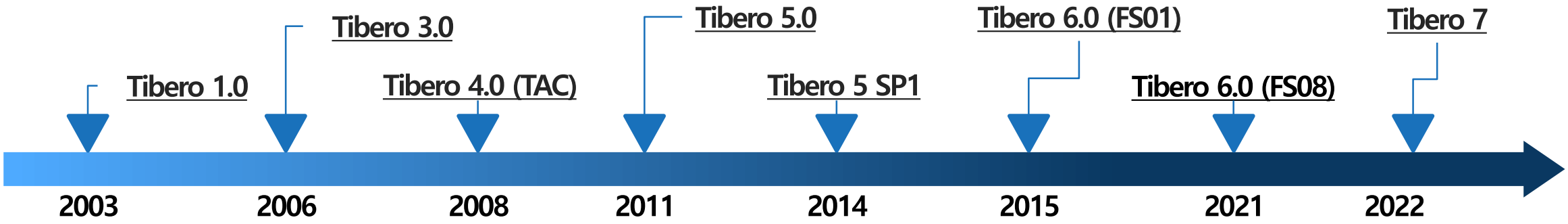


*TAC, Tibero Active Cluster

Tibero - Ongoing Evolution and References

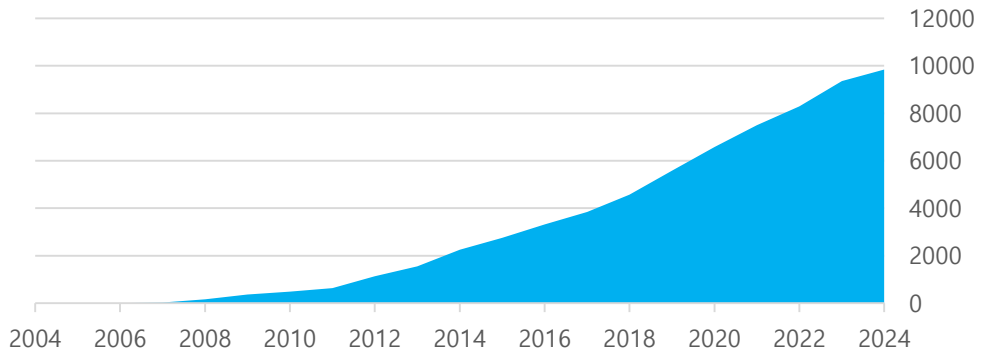
TMAXTibero

Over 20 years of continuous research and development experience



Tibero Reference

Over 9,900 total (as of 25/02/25)



Heterogeneous DBMS Transition Reference

- 1,860 Cases, including Oracle, MS-SQL and DB2
- Migrated multiple DBs in various industries and environments

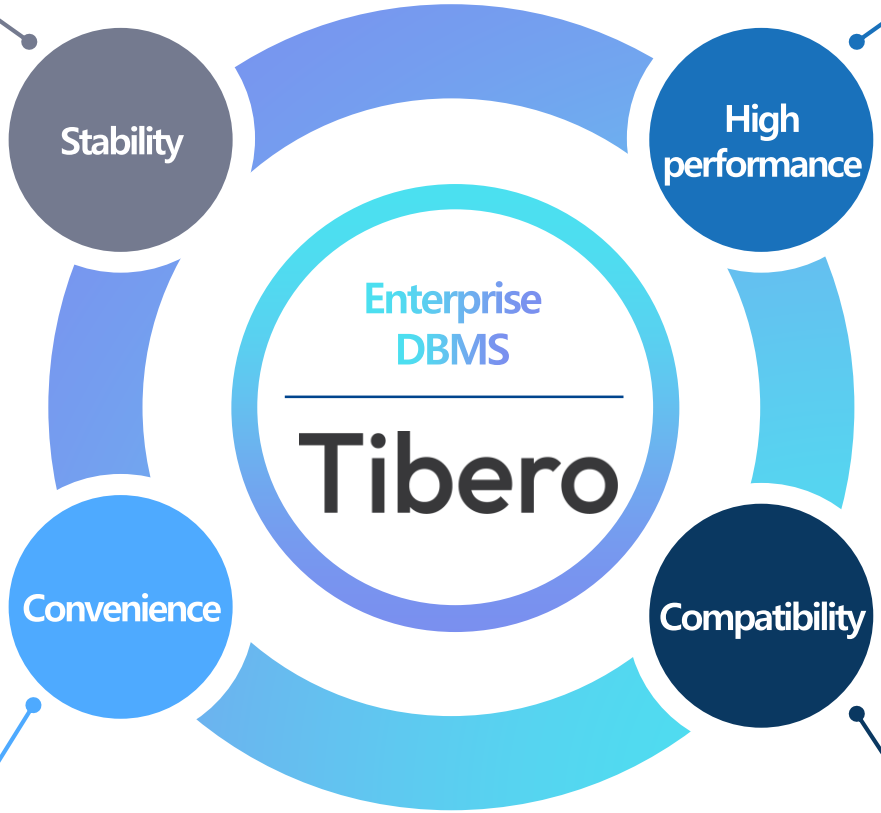
TAC references from various work environments

- Finance, public, manufacture, distribution, services, etc.
- Powerful mission-critical operations

Tibero - Strengths and Advantages

TMAXTibero

Ensures reliability, high performance, convenience, and compatibility - the four most important elements of a persistent DB



- A wide range of backup and recovery features
- **Redundant clustering TAC, TSC**
- **Flashback Database**
- DB encryption (TDE) and access control

- Monitoring and development tools
- **Various utilities for DBMS management** (expanding TAS automation)
- **Integration with** nearly 400 **3rd party solutions**

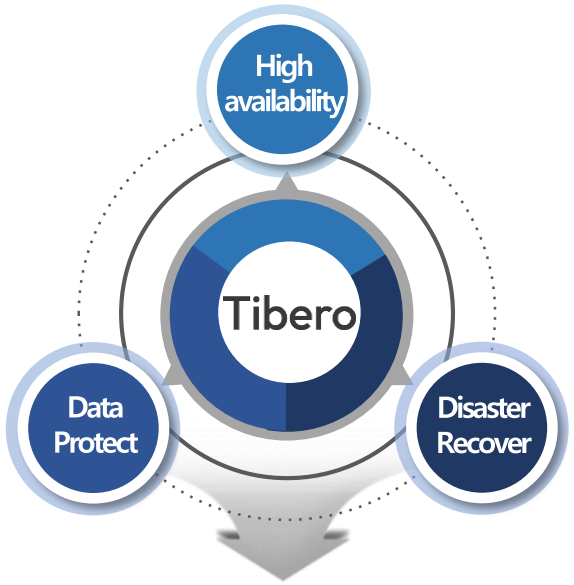
- Row Level Lock, MVCC
- **Parallel Processing Technology** Processing large amounts of data
- **Various indexes and partition table features**
- **In-Memory Column Store**

- Support for SQL and standard interfaces
- **Oracle SQL and PL/SQL compatibility**
- Heterogeneous DBMS Integration with DB_Link

Tibero - Reliability and High Availability - TAC, TSC

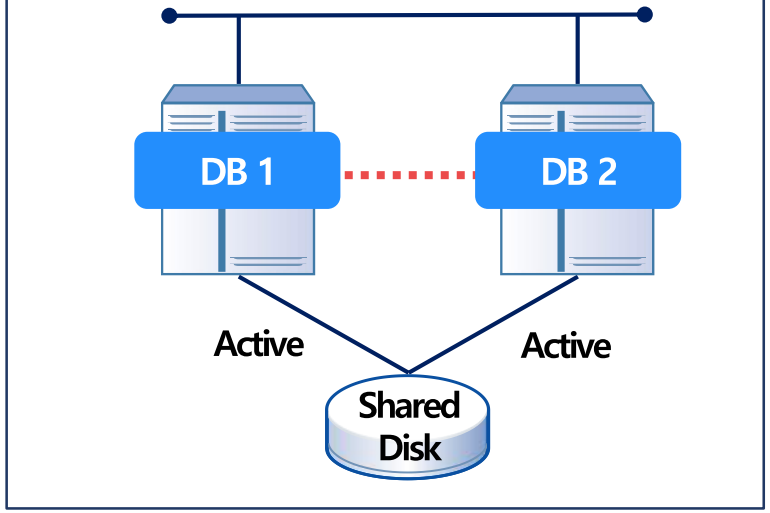
TMAXTibero

With world-class reliability and high availability, Tibero ensures reliable protection and service continuity



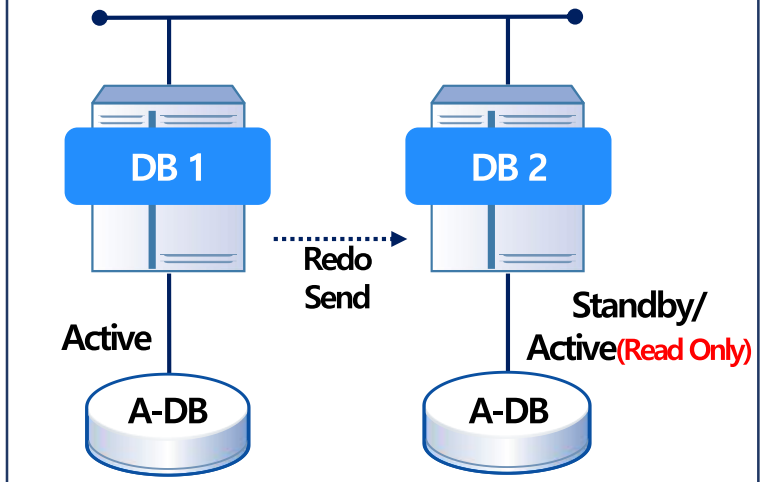
TAC
(Tibero Active Cluster)
TSC
(Tibero Standby Cluster)

Tibero Active Cluster (TAC)



- Shared disk-based **Active-Clustering Method**
- For uninterrupted system operation

Tibero Standby Cluster (TSC)

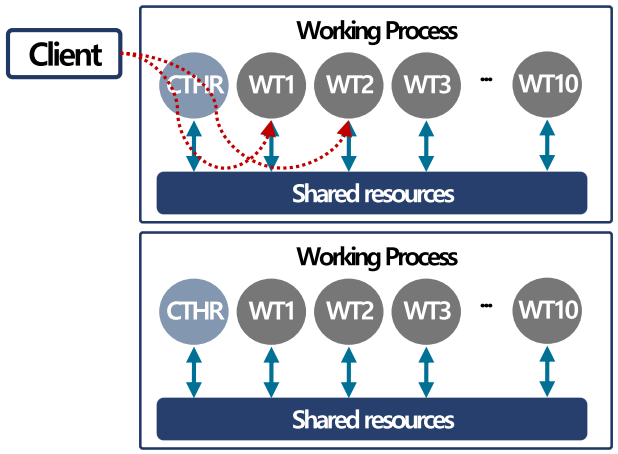


- Standalone disk-based **Active-Standby or Active-Active (Read Only) method**
- Data protection, disaster recovery purposes

Tibero - Technologies/Features - High Performance Technology

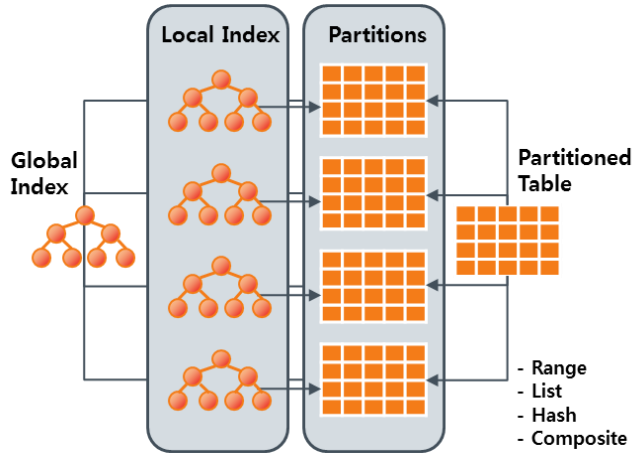
TMAXTibero

Hyper Thread Architecture



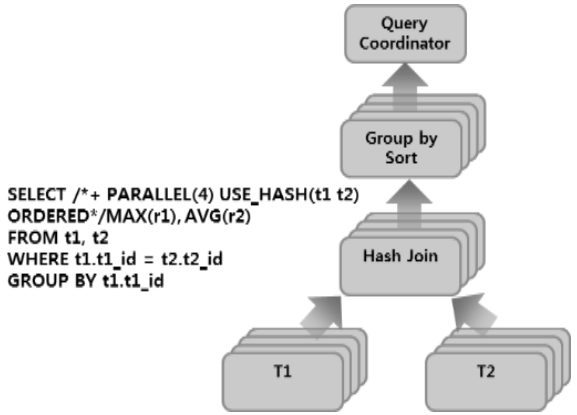
- Thread-based optimization architecture
- Efficient Shared Server structure
- Optimize performance **with CBO-based** optimizers

Various Index/Partition



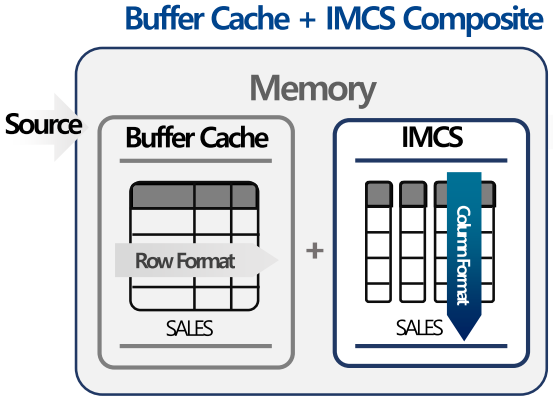
- **Provides various partition functions**, including Range/List/Hash/Composite
- Provides Local/Global Index functionality

High-performance parallel processing and compression



- **Parallel Query/DML/DDL/Backup Features**
- Support for **table compression**

In-Memory Column Store



- **Faster data analysis with column** lookups instead of full table lookups
- **Increased compression efficiency compared with** Row Format method

Tibero - Technologies/Features - Tibero vs. Oracle core features

TMAXTibero

Tibero is an enterprise-class DBMS that enables DB management, development, tuning, and more, providing a wide range of features for seamless operation in enterprise environments

Contents	Oracle	Tibero
DBMS Process Structure	Multi Process	Multi Process + Multi Thread
Model	RDBMS	RDBMS
Locking Mode	Row Level	Row Level
system catalog view	Yes	Yes
PERFORMANCE VIEW	Yes	Yes
Communication architecture	Client Server	Client Server
Shared disk-based redundancy	Supported (RAC)	Supported (TAC)
High Availability - Data Replication	Supported (Active DataGuard)	Supported (TSC)
Storage virtualization	Assisted Virtualization (ASM)	Supported (TAS)
Automatic performance collection	Supported (AWR)	Supported (TPR)
Explain Plan	Supported	Supported
Auto Trace	Supported	Supported
SQL Trace & tkprof	Supported	Supported

BMT based on TTA evaluation test for next-generation local tax business

Tibero scores highest on technology out of eight providers

	Item	Evaluation metrics	Scoring (60)	Result
Basic Features (13))	Manage Users	Ability to create user accounts, set passwords, set permissions, etc.	3	PASS
	Concurrency control	Row-level locking and multi-version concurrency control (MVCC) features	1	PASS
	Manage Tables	Various table partitioning features and more	2	PASS
	Monitoring	Query execution plans and whether statistics (execution time, IO) are available for a query or session.	3	PASS
Availability (27)	Backup/Recovery	Ability to fully recover after an online backup	4	PASS
	Fault Management	FailBack functionality for DBMS instance failures	4	PASS
		FailBack functionality for network failures	5	PASS
		Failback functionality for InterConnect failures	5	PASS
		FailBack feature for DBMS server failures	4	PASS
	Uninterrupted service	Provide uninterrupted service in case of DB server instance failure	3	PASS
		Provide uninterrupted service of DB server in case of interconnect failure	3	PASS
		Provide uninterrupted service in case of DB server failure	3	PASS
Performance (20)	**Response time**	**TPC-H performance time**	**10**	Tibero Advantage
		Bulk/Concurrent Insert Processing performance	**5**	
		Bulk and concurrent update Processing performance	**5**	

Tibero - Outstanding Technology/Features - Ease of Use/Operational Support

TMAXTibero

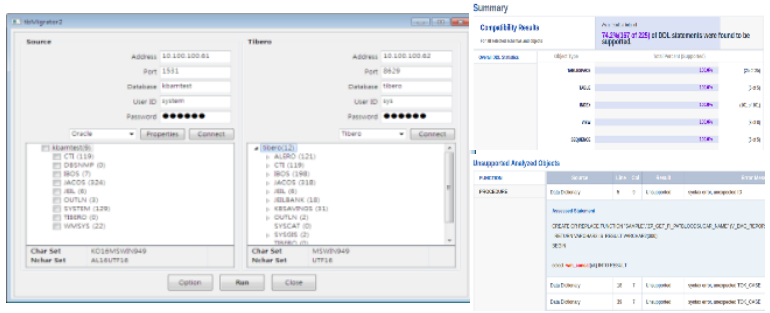
Develop / Operations

TiberoStudio

- DBMS monitoring and administrator features
- SQL Developer Features

Migration

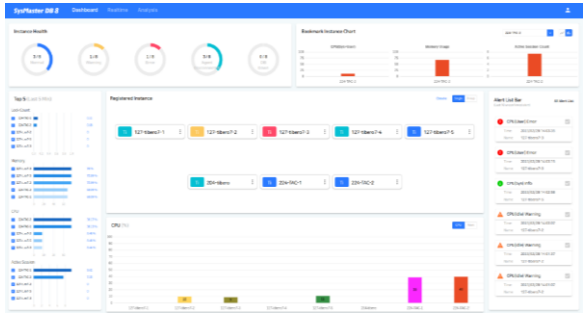
T-Up



- Easy migration of data and objects from other DBMS to Tibero

Monitoring

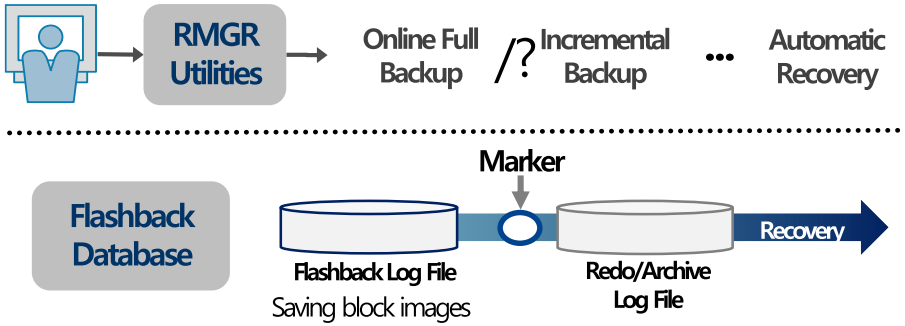
SysMasterDB



- Before and after the Tibero migration
- Monitors DB operational status and stabilization

Backup / Recovery

tbRMGR/Flashback DB



- Easily performs online backup and recovery of databases providing rapid recovery

Tibero - Compatibility - Highly compatible with Oracle

TMAXTibero

1,580+ Oracle to Tibero migration Case Studies

Data Type

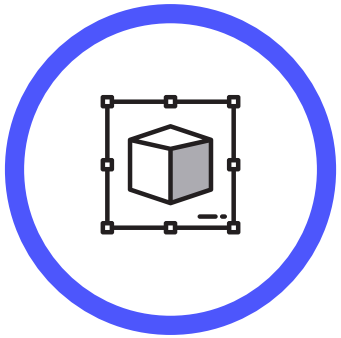
Oracle Data Type compatibility

- Character types - CHAR, VARCHAR, RAW, LONG, etc.
- Large object types - CLOB, BLOB, XMLTYPE, JSON, etc.

SQL

Standard SQL syntax and non-standard Oracle grammar support

- SQL-92 Entry Level (ISO 9075)
- SQL-99 Core Level Compliance
- Extended SQL (Extended SQL)



Object

Table, Index, View, Trigger, etc. Oracle Object support

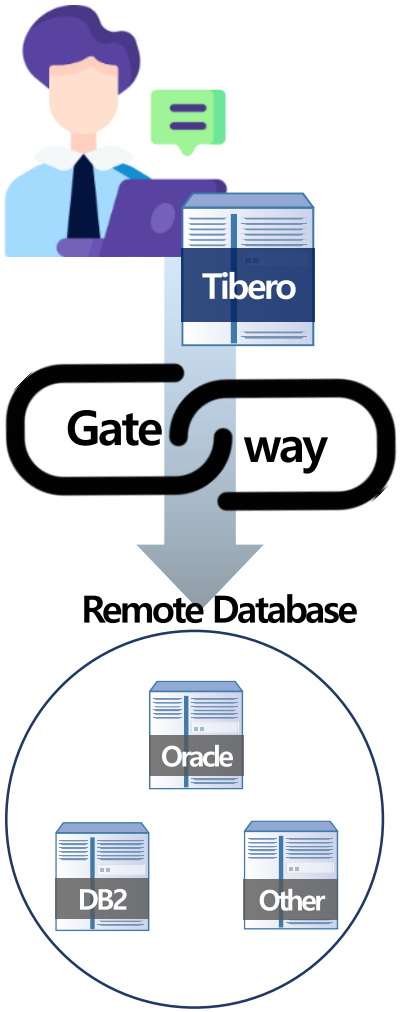
- Partition Table (Range, List, Hash, Composite)
- B-tree, Global, Synonym, etc.

Functions

Oracle Functions 95% ↑ support
(Development possible for Unsupported functions)

- Ensure compatibility with PL/SQL syntax
- Control your action plan with about 45 hints

DB Link feature allows you to connect remotely with heterogeneous DB servers for table querying, entering, modifying, and deleting tables



Separation	Tibero to Oracle	Tibero to DB2	Tibero to Other DBMS
Gateway	Tibero gateway for Oracle	Tibero gateway for DB2	Tibero JAVA Gateway
Gateway method	Local or Listener method	Local or Listener method	Listener method
Supported languages	C, JAVA	C, JAVA	JAVA
Query support	O	O	O
DML support	O	O	O
JOIN Support	O	O	O
Global Tx support	O (Oracle OCI)	O (DB2 XA Library)	O (If remote DB JDBC driver support XA API)
LOB support	X	X	X
DDL support	X	X	X

Tibero - Compatibility - 3rd Party Solution Integration

TMAXTibero

Highly compatible with solutions you already use

Tibero Integration 3rd Party List

- Security/Encryption
- ETL/CDC/EAI
- Cluster/HA
- ERP/CRM
- BI/OLAP
- Backup/Restore
- Monitoring
- System S/W
- ...

Supports integration with nearly 400 SWs

"Continued expansion of integration offerings"

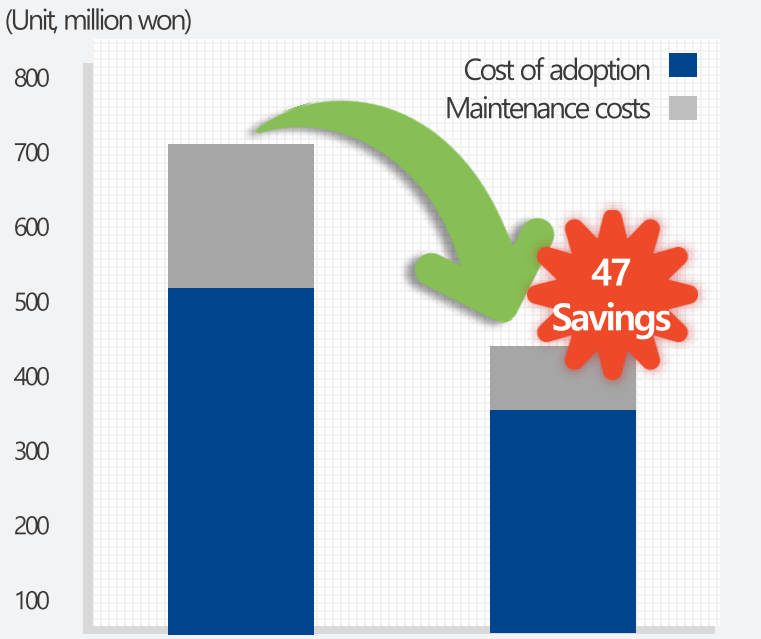
Collaboration	Expand your integration offerings through collaboration
Dedicated	Dedicated departments and specialized processes
Led	Tmax-driven integration work in progress

Tibero – Cost reduction - Save money when you adopt Tibero

TMAXTibero

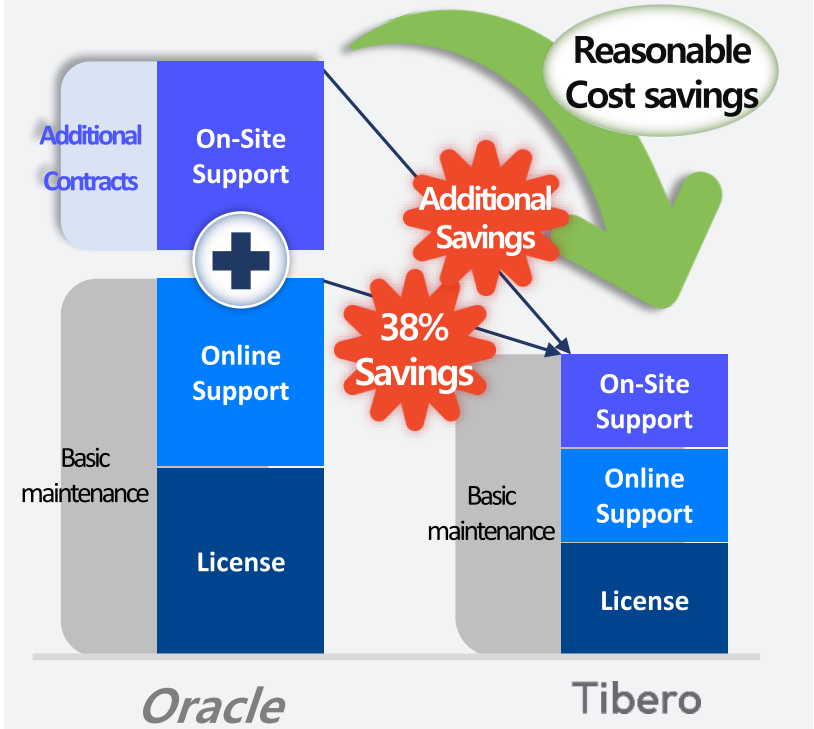
Reasonable adoption and maintenance cost policies versus high-cost policies for foreign DBMSs

5-year TCO



IBM P7 3.8Ghz 1Processor, 8core, based on List Price

Maintenance costs



"Tibero reduced TCO by approximately 47% compared to foreign DBs"

"Breaking the Risk of Specific Vendor Lock-in and Reducing Costs through Vendor Competition"

Chapter 2

Technical support, Maintenance services

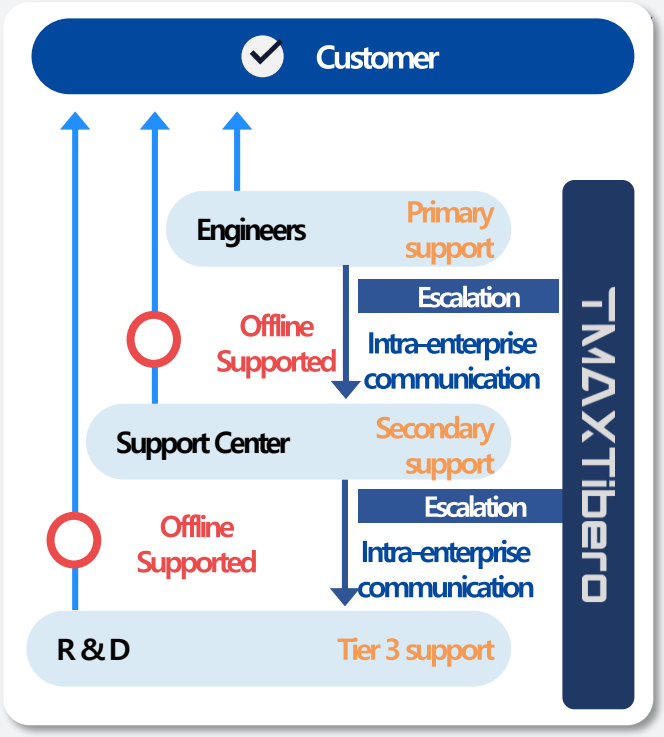
Advantage in technical support and maintenance services

TMAXTibero

Based on domestic original technology, Deliver customer-centric services with immediate and effective support

TmaxTibero

Fundamental service differentiation with 20 years of

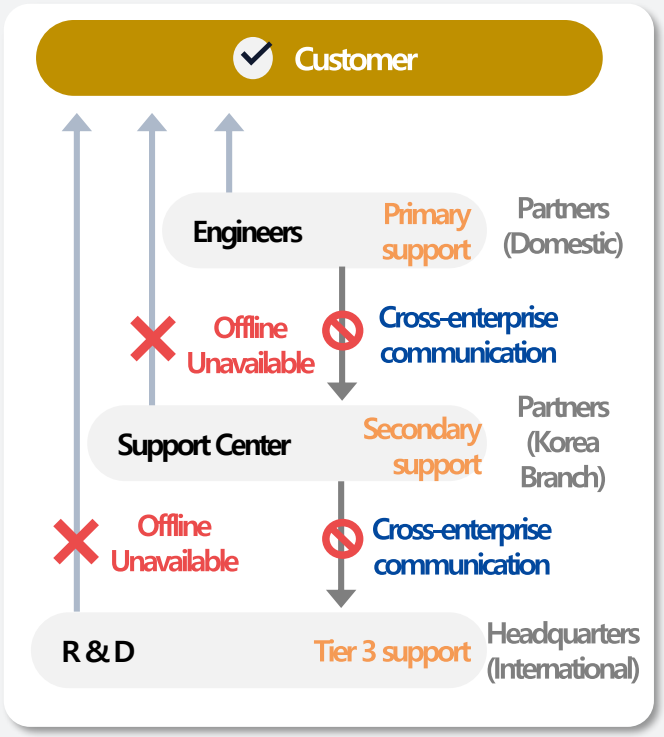


- Reliable technical support
- Quickly determine the cause
- Tuning guide
- Help connecting related solutions

VS

Foreign DBMS Vendor

Technical support is limited in the event of a failure

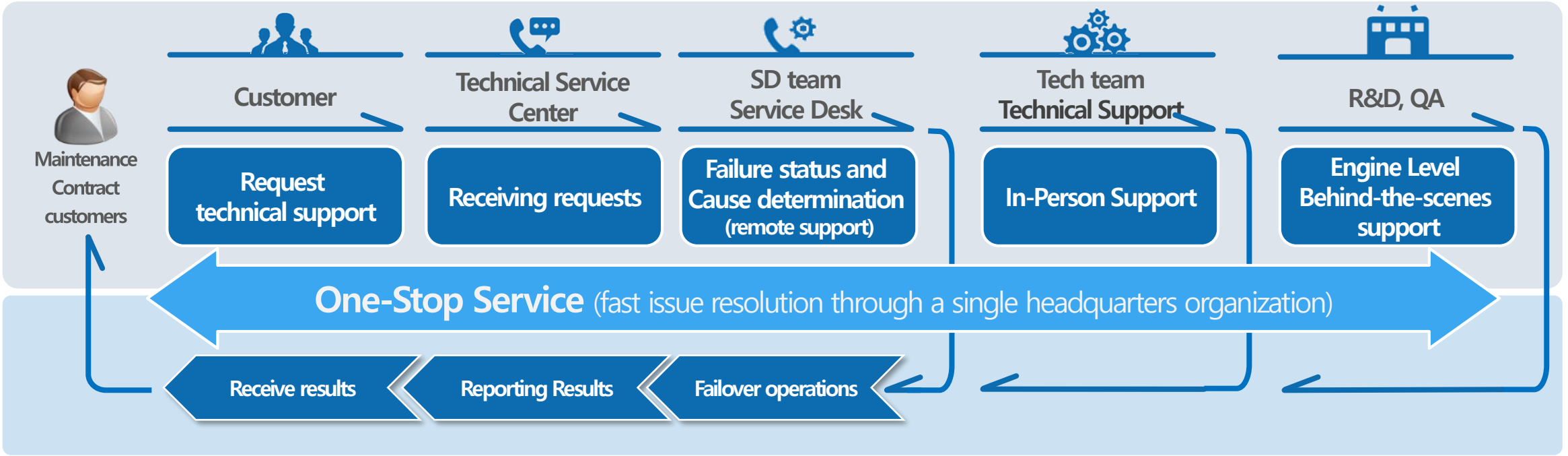


- Lack of technical support
- No offline support
- Lack of technical support staff
- Unable to respond quickly

Operational stabilization support – 24 hour call center

TMAXTibero

Enterprise-wide technical support



24*365 Domestic call center reception channel

- 24x7x365 outage response system (including walk-in support)
- Immediate technical support via remote support when needed

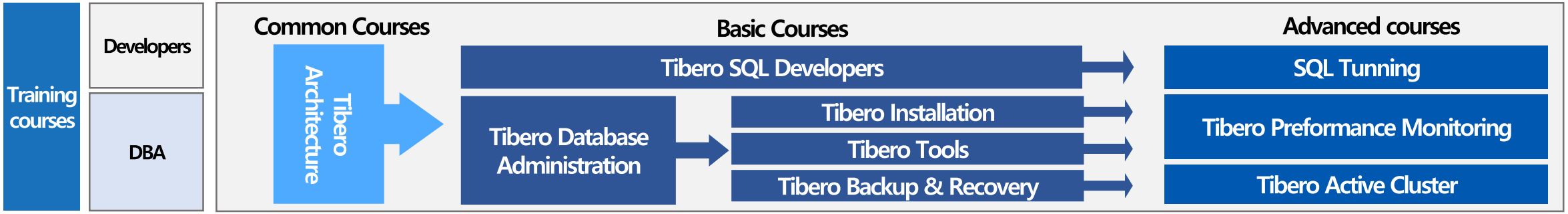
Organize a second expert engineer visit

- If you need a visit from a Tibero engineer to resolve an issue, request in-person support

Skills Transfer Organization - Training Plan (South Korea)

TMAXTibero

Step-by-step training curriculum for independent and reliable operation. Free remote training and on-site project training



Courses and training content

Course name	Training content	Duration	For
Tibero Architecture	Tibero structure and features	1 day	Developer / DBA
Tibero SQL Developers	How to use Tibero SQL syntax	1 day	Developers
Tibero SQL Tuning	Tibero SQL Tuning	1 day	Developers
Tibero Database Admin	Tibero Database Management	3 days	DBA
Tibero Tools	Tibero tools	1 day	DBA
Tibero Installation	Install Tibero	1 day	DBA
Tibero Backup & Recovery	Tibero Backup, Recovery	2 days	DBA
Tibero Performance Repository	Tibero Performance Analytics Report	1 day	DBA
Tibero Monitoring	Tibero monitoring	1 day	DBA
Tibero Active Cluster	Tibero Database Clustering	2 days	DBA

Operating a Tibero Training Center (Korea)

Separation	Training Center Training	On-site training
Places	TmaxTivero Training Center	Customer Training Grounds
Target	IT personnel Database operators and developers	Account staff Database operators and developers
Date	Monthly training (1 or 2 days per subject)	On request
Teaching materials	Provide Korean product documentation for each course	
Cost	Support with education coupons	

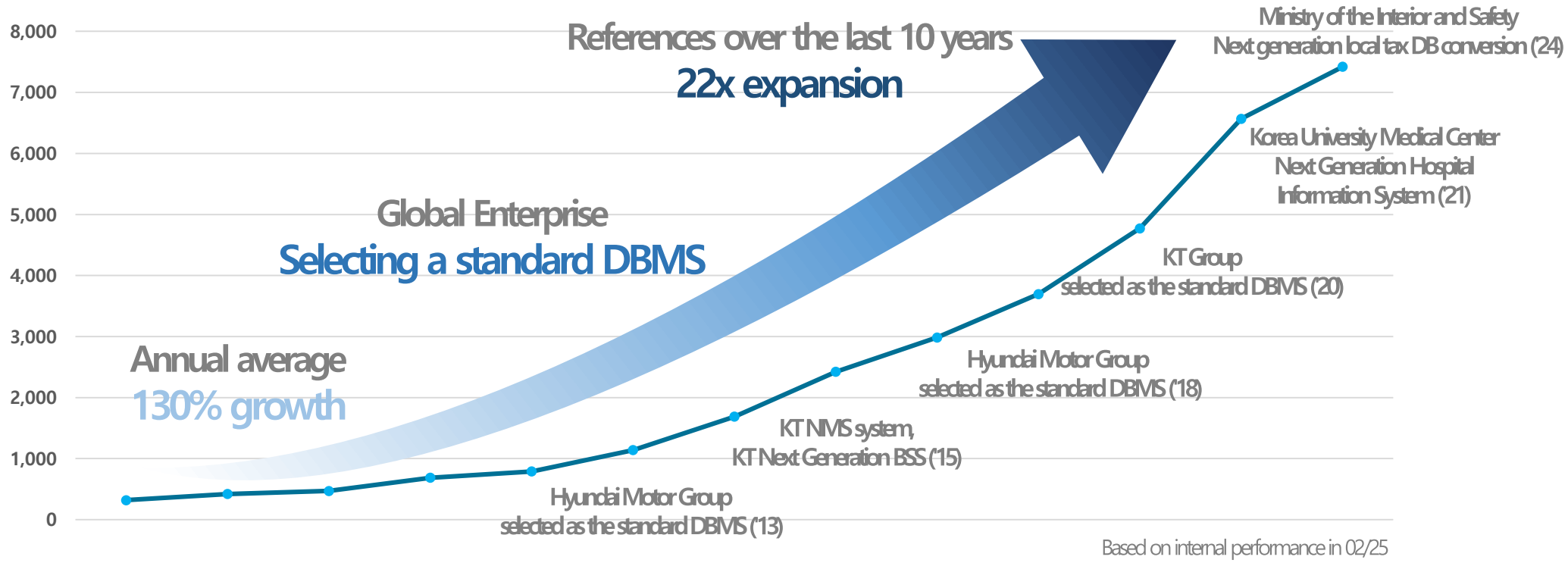
Chapter 3

Case Studies

Tibero - Reliability

TMAXTibero

Tibero is market-validated for DBMS reliability with over 9,900 references



High-capacity, high-performance References	Increase the importance of your task (For mission-critical operations)	Group/enterprise-scale Mass adoption	DBMS Modernization Applying services

Tibero - Adoption/Migration Stories

TMAXTibero

Major domestic companies, government departments, public institutions, financial institutions, etc. Tibero is up and running in various industries

1,480+

Number of Tibero Customers
(as of 25.02)

TMAXTibero

Manufacturing · Public · Finance · Distribution · Telecommunications and more

emart, LOTTE, GS 리테일, 보건복지부, 신세계, SBS, 대한민국 국방부 Ministry of National Defense, 행정안전부, LG, SK, SK telecom, 우리은행, NCIS 정부통합전산센터, SAMSUNG, KB 금융지주, kt, 신한은행, NH농협은행

9,900+

Tibero total number of references
(as of '25.02)

Tibero - Adoption highlights

TMAXTibero

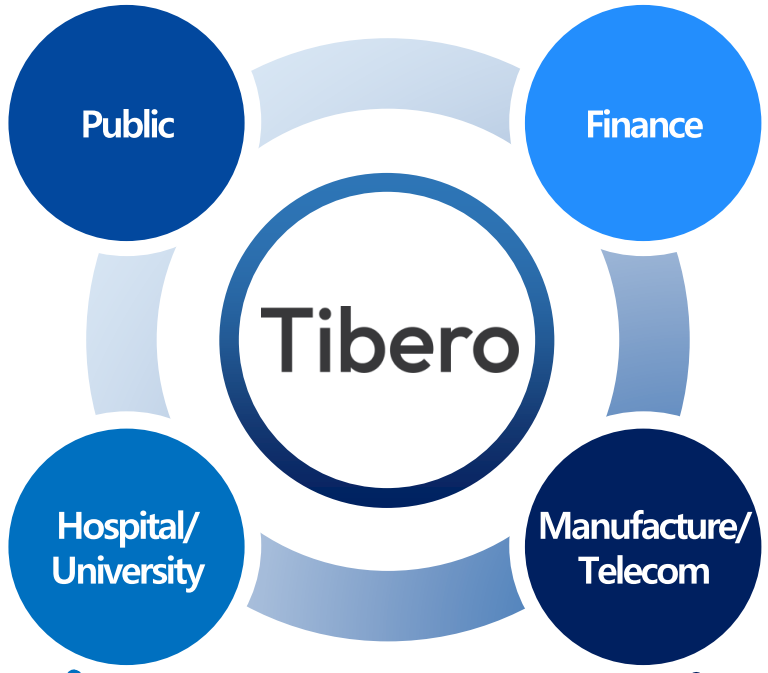
Proven reliability in high-volume, high-performance applications in manufacturing, finance, hospitals, and other industries

Public Sectors

- Converting, implementing 243 municipal DBMS integration to build a municipal tax system
- Replacing the Oracle-based National Legal Information System with Tibero TAC and improving data management structure

Financial institution's main system

- Expanding contactless services by adopting Tibero for core mobile banking and digital teller systems
- Managing and operating Korea's first digital damage accounting cloud-based system through Tibero



Hospital/university system adoption

- First EMR cloud deployment for an ancient medical center hospital
- TAC proves superior performance to O-sa in large-scale enrollment test at Yonsei University

Enterprise-wide standard DBMS

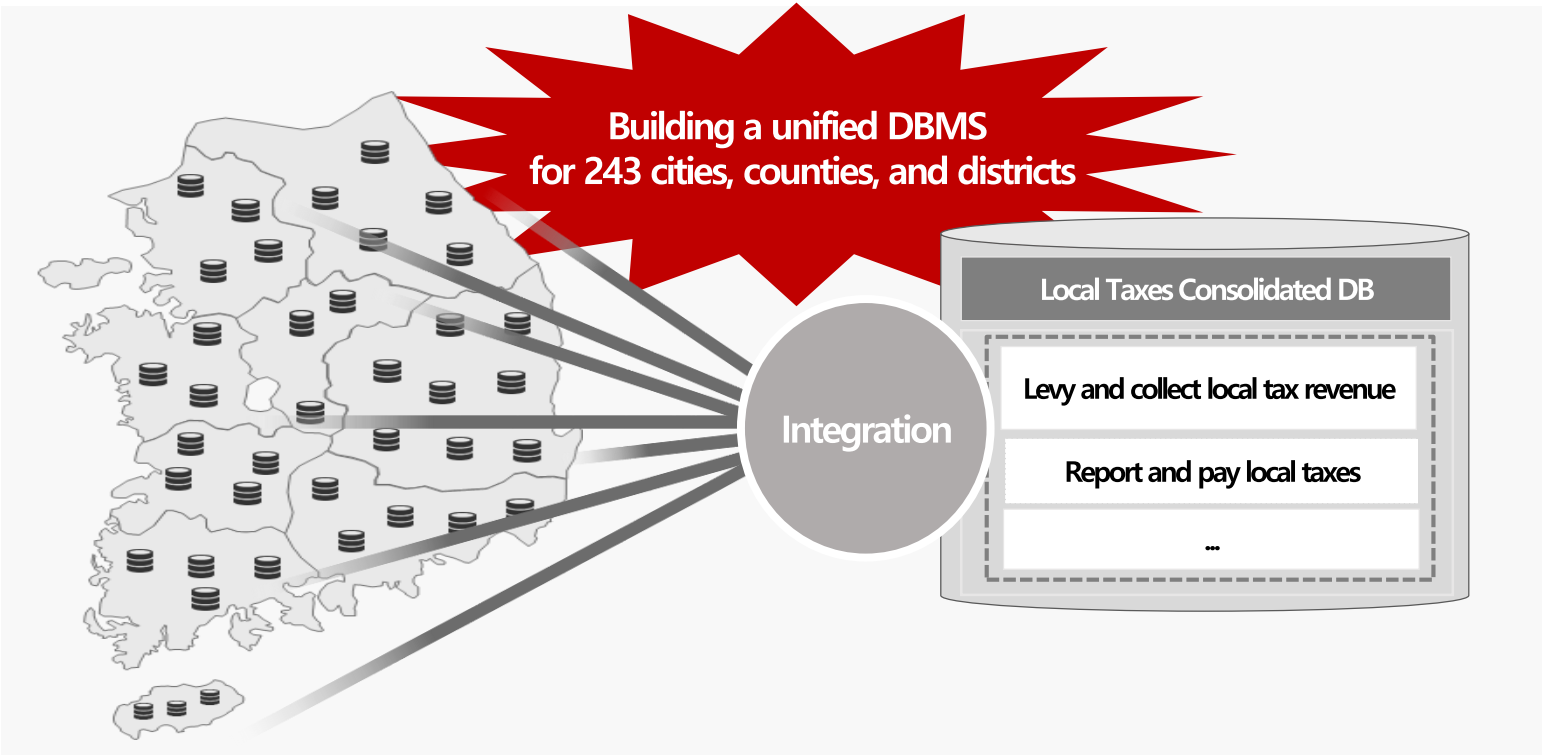
- 10-year ULA targets full transition to Oracle DBMS by '29
- Selected as a standard DBMS through PoC in '20, switched to Tibero in stages, including membership system and NMS integrated analysis, through ULA contract by '25

Ministry of the Interior and Safety's Next Generation Local Tax System

TMAXTibero

Tibero

Ministry of
the Interior and Safety



Building a High-Volume consolidated DB

- 3 sets of tripled TACs*, 2 sets of redundant TACs
- 800 Core Scale
- 20 TB datasize fulfillment

Chapter 4

Why Tibero?

Why Tibero?

TMAXTibero

"By adopting Tibero as the optimal DBMS, customers can achieve stable and efficient system operations."

We will actively support you with Tmax's core DBMS technologies, proven implementation expertise, and outstanding products and technical professionals.

TMAXTibero

INNOVATING TODAY, LEADING TOMORROW

Tibero 7 effectively supports cloud environments, and provides enhanced performance, reliability, high availability, and manageability

Demands of a "data-centric, data-driven digital environments

Data volume and Type spikes

- Data management difficulties
- Increased development complexity
- Data processing performance limits

Cloud Spread application

- No redundancy
- Minimize DB change risk
- Easy to deploy/manage

New Next Generation DBMS required

Tibero 7

Customizable, high-performance DBMS for on-premises and cloud environments

- Cloud-optimized DBMS
- High performance in handling large amounts of data
- Backup/Recovery, Redundancy, and Security
- New data types and management features added

Tibero 7 Features

TMAXTibero

High performance in on-premise and cloud environments, DBMS that ensures reliable data security

Highly available cloud DBMS

- Support for **different configurations** in cloud environments
- **Flashback Database & Standby Resynchronization**

Performance improvement for large-scale data processing

- **Data Processing** (In-Memory Column Store)
- **High-performance compression technology**

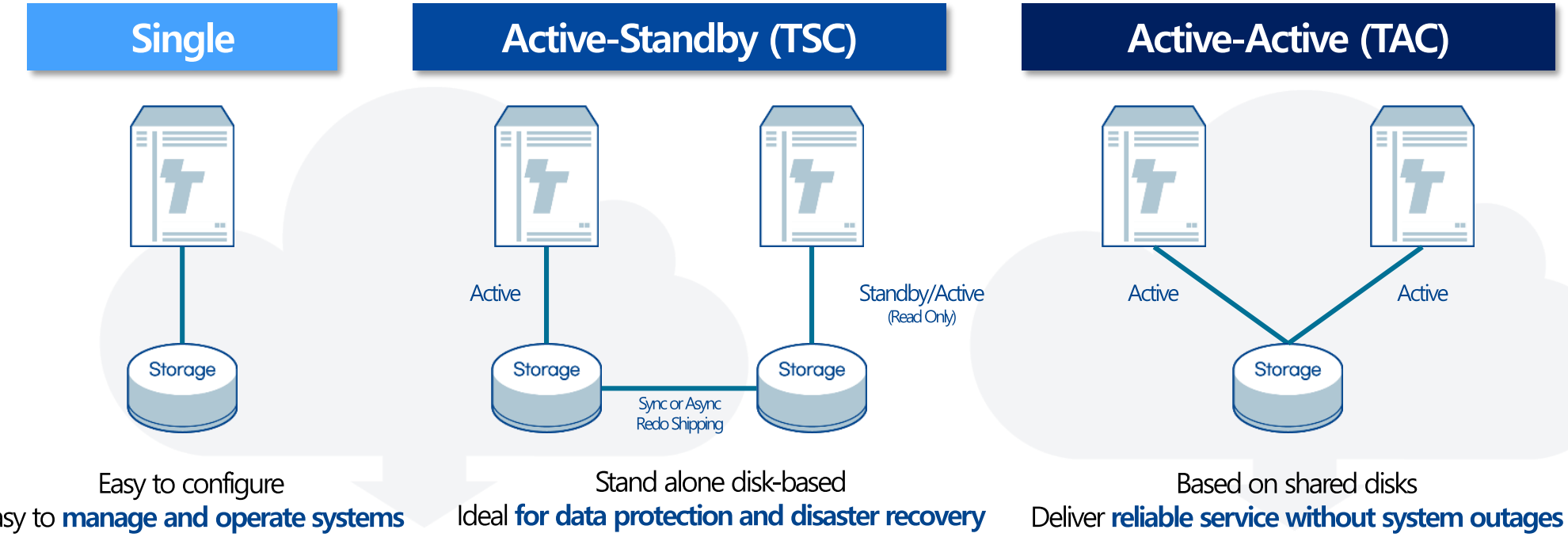
Improved convenience in development and management

- **Support for JSON** as an explicit data type
- **Provides various query functions**

Enhanced data security

- **Reliable** data security (Label Security)
- **Audit** features

Support for a wide range of configurations without performance limitations in cloud environments



Easy to configure
Easy to **manage and operate systems**

Stand alone disk-based
Ideal **for data protection and disaster recovery**

Based on shared disks
Deliver **reliable service without system outages**

Cloud Service Provider

NAVER CLOUD PLATFORM
kt Cloud
aws marketplace
kakao i cloud
NHN TOAST
gabia.cloud
Microsoft Azure

Performance improvement for handling large amounts of data

TMAXTibero

Enhanced processing performance for large-scale data through in-memory data processing and high-performance compression technology

Tibero 7

In-Memory Column Store

- Storing data **in an in-memory columnar format**
- Ideal for **DW deployments, real-time operations/analytics**, and more
- Optimize **your core analytic tasks** for high performance

OLTP Compression

- Providing compression during online transactions
- Support with **all DMLs**
- **Efficiently utilized** storage

Index Prefix Compression

- **Increased** space **utilization**
- **Improved resource efficiency** with compression
- Index Keys **share common parts** to organize and manage by compression

TMAXTibero

Effective failure response supported through enhanced backup, recovery, and redundancy technologies, along with reliable data security

Flashback Database

- **Return the entire DB to a specific point in time** without a DB backup file
- **Support for quick recovery** from user mistakes

TAS Meta Validation

- **Consistency verification between TAS File Meta and TAS Disk Meta**
- **Quick issue identification** with periodic validation

Snapshot Standby

- Pause TSC Standby and using **it as a Clone DB**
- Efficiently utilize idle resources

Cascade Standby

- Standby - **Send Redo Log** to Standby Node
- Delivering **scalability**

TAC
Recovery Parallel Reconfiguration

- Resource redistribution through parallel processing when changing TAC nodes
- **Availability and** reliability under heavy work loads

Fine Grained Audit

- Use audit policies to enable more **detailed audits**
- Provide **auditing** capabilities **under different conditions**

Label Security

- **Separate data access levels** in the same system
- Effective for work loads requiring **strong security**

HSM support

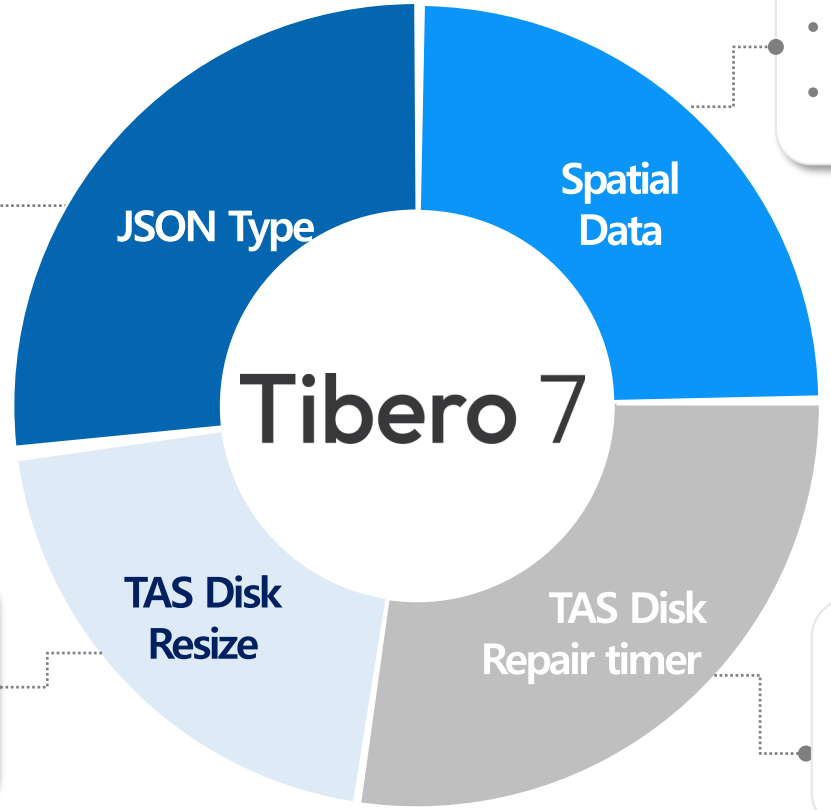
- Storing DB Master Key on the **HSM** device
- Increase security with **encryption key separation**

New data types and management features

TMAXTibero

Supports various development environments through JSON and Geography data type support, with management convenience through expanded automation of TAS*

- Support for JSON **as an explicit data** type
- Provide a variety of query functions



- Enhancing **existing Geometry & Geography** features
- Addition of nearly 40 Spatial Data Functions

- Enhanced **automatic rebalancing** by adding TAS disks
- Flexibility and ease of TAS Disk management

- On disk failure, **Performs automatic drop and rebalancing**
- Easier Disk Failure Management

* TAS: Tibero Active Storage

Tibero 6 vs. Tibero 7 key feature comparison

TMAXTibero

Feature improvements in high performance, high availability, and scalability

Tibero 6

High performance

TTA | Parallel Execution | Index
Partitioning | Table Compression
Bitmap Index | Interval Partitioning

Security

Encryption | Audit | TDE

Stability

Backup | Recovery | RMGR
Flashback Query/Table
Multi Node Parallel Recovery

Data Types

INTEGER | DECIMAL | LOB
STRING | DATE/TIME | GIS

High availability

TAC | TSC | Rolling Upgraded
Tibero Active Standby

Other

Performance View/Monitoring
Automatic Storage Management
Enterprise Management | TAS

Tibero 6 New Features

Tibero 7

High performance

TTA | Parallel Execution | Index
Partitioning | Table Compression
Bitmap Index | Interval Partitioning
OLTP/Index Compression | IMCS

Security

Encryption | Audit | TDE
Fine-Grained Audit | GOST
HSM support | Label Security

Stability

Backup | Recovery | RMGR
Flashback Query/Table
Multi Node Parallel Recovery
Flashback Database | TAS Meta Validation

Data Types

INTEGER | DECIMAL | LOB
STRING | DATE/TIME | GIS
Geography | JSON

High availability

TAC | TSC | Rolling Upgraded
Tibero Active Standby | Snapshot
Multi-Node Standby
Cascade Standby

Other

Performance View/Monitoring
Automatic Storage Management
Enterprise Management | TAS
TAS disk Resize / Repair

Tibero 7 New Features

Tibero 6 to Tibero 7 operator perspective feature changes

TMAXTibero

DBMS Engine

SQL Plan Management	Flashback Database	In Memory Column Store
JSON type	Fine-grained Auditing	Change the default character set
Snapshot Standby	Multi-Node Standby	DBMS_SCHEDULER Enhancements
Multi-Node Standby	Cascade Standby	Reconfigure TAC Parallel Recovery
AWS QuickStarts	Separation of encryption keys using HSM devices	Prioritize log flushes
Record cloud billing information	GOST encryption	Tibero Recovery Catalog
OLTP Compression	Index/Prefix Compression	File copy according to ASCMD REDUN
Support for Geometry KNN operations	TAS disk resize & repair timer	MVIEW view
TAS Meta Consistency Check	TAS Meta patches, rollback functionality	CONTEXT INDEX
GIS Geography & Geometry	Label Security	Local partition Index Verify support
System VIEW type	DBMS_UTILITY type	DBMS_XMLGEN Procedure

Utilities

- Enhancing Recovery Manager
- Gateway for Oracle 19c
- ESRI shapefile conversion features
- tbSQL SET MARKUP Function

Client Drivers

- Support for JDBC 4.1 and 4.2 standards
- Change the default character set

Operator perspective Improvements

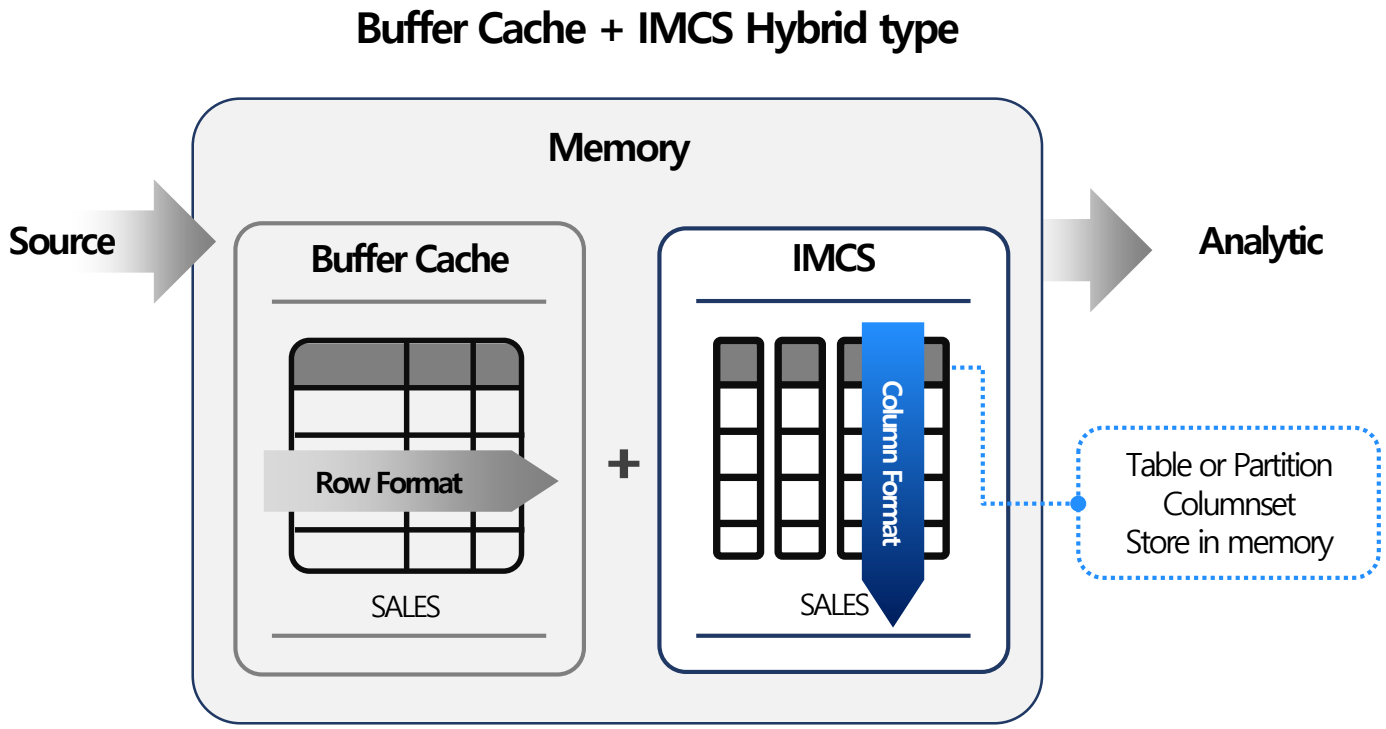
1. Addition of JSON type functions
2. Flashback Database
3. Addition of GIS-related features
4. Support for JDBC 4.1 and 4.2 standards

Enhanced High Performance - In-Memory Column Store

TMAXTibero

Simultaneous support for the existing Row Format and Column Format ensures optimized analytical tasks and high performance

In-Memory Column Store (IMCS) Conceptual Diagram



Key Features

- Stored in Row + Column format
- Faster data analysis with column lookups instead of full table lookups
- Increased compression efficiency Compared to Row Format method

Applications

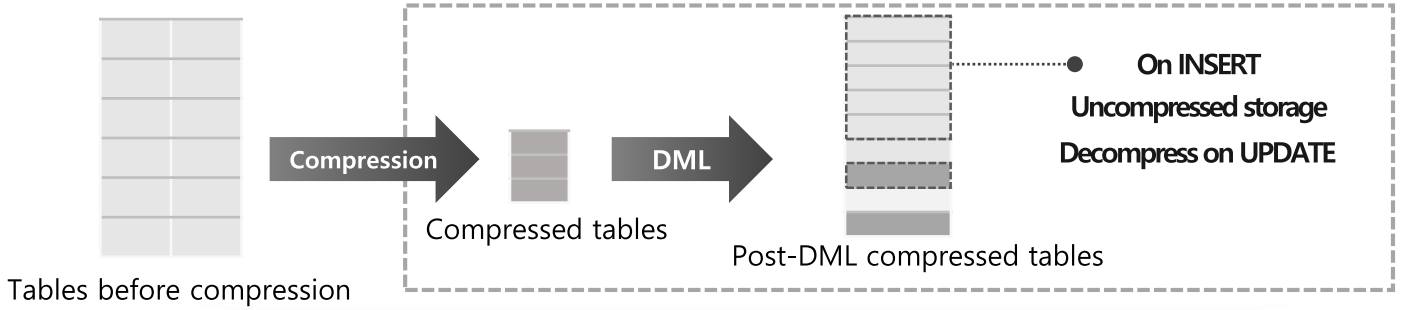
Data warehouse (DW) construction that queries large data sets for real-time data analysis, and real-time operational/analytical business systems

TMAXTibero

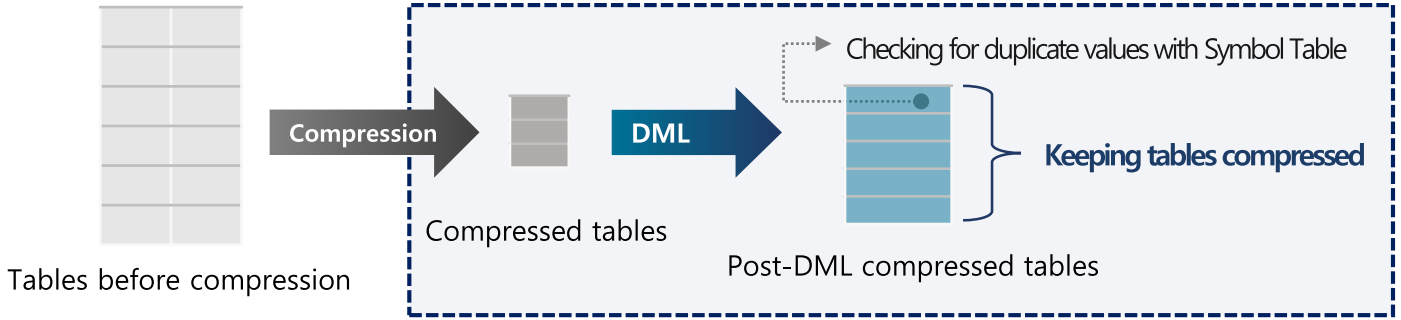
Adding Online Transaction compression to existing compression methods to Efficiently utilize storage

OLTP Compression

General Compress method



OLTP Compression Methods



Key Features

- On DML, proceed with Row Compression
- Collect rows per DML run
  ➔ Compress all at once if criteria is met
- Ideal for workloads with constant DML and efficient space requirements

Applications

Tasks requiring efficient space utilization due to continuous occurrence of DML operations

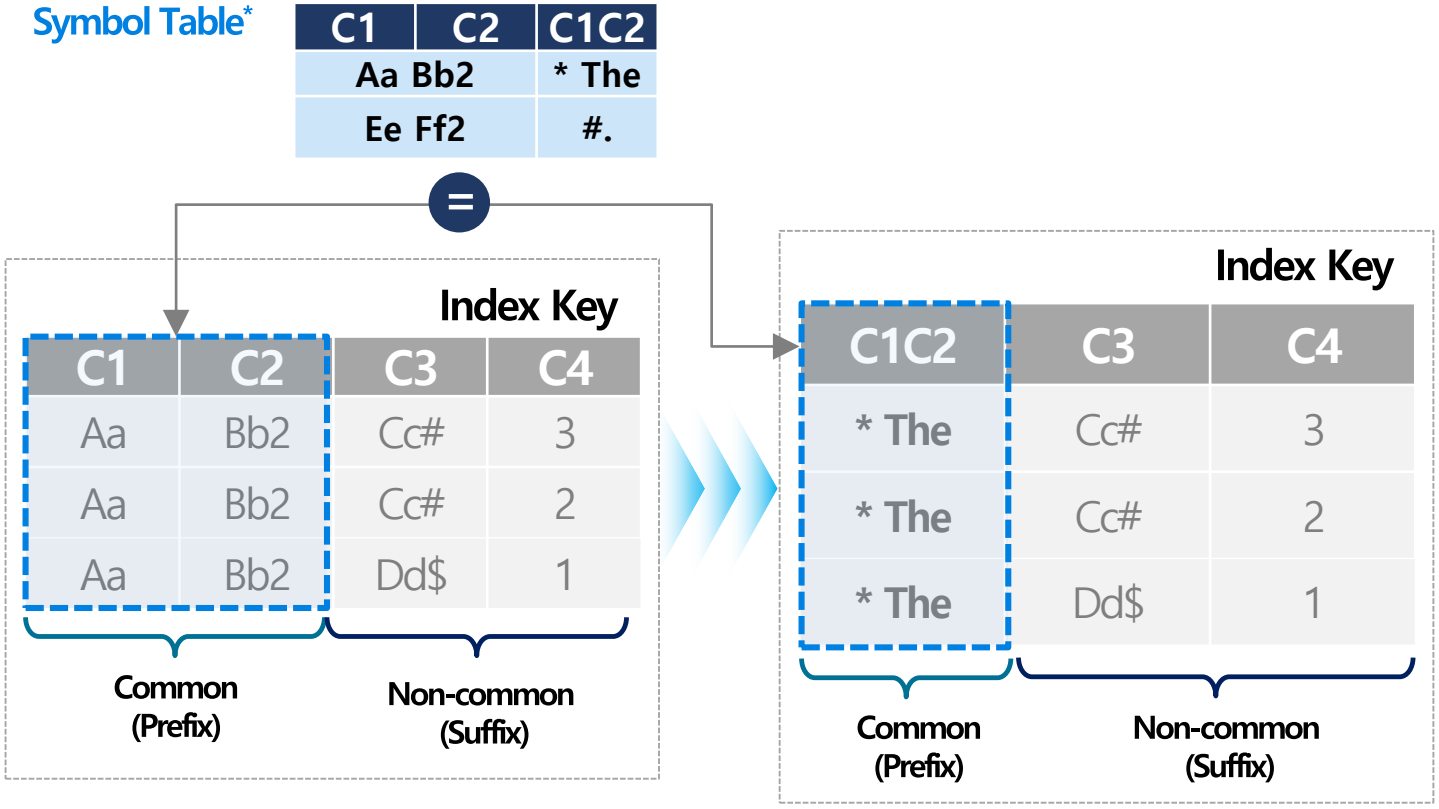
* Symbol Table: A table that contains the information you need, with a structure that matches keys and values one-to-one.

Enhanced High Performance Features - Index Prefix Compression

TMAXTibero

Improves resource efficiency by compressing and managing common parts of index keys through the Symbol Table

Index Prefix Compression Conceptual Illustration



Key Features

- Index Key
  = Symbol Table + Suffix
- Managing Common Parts with Symbol Tables
- Utilizing information from the Symbol Table, auto-compress common parts

Applications

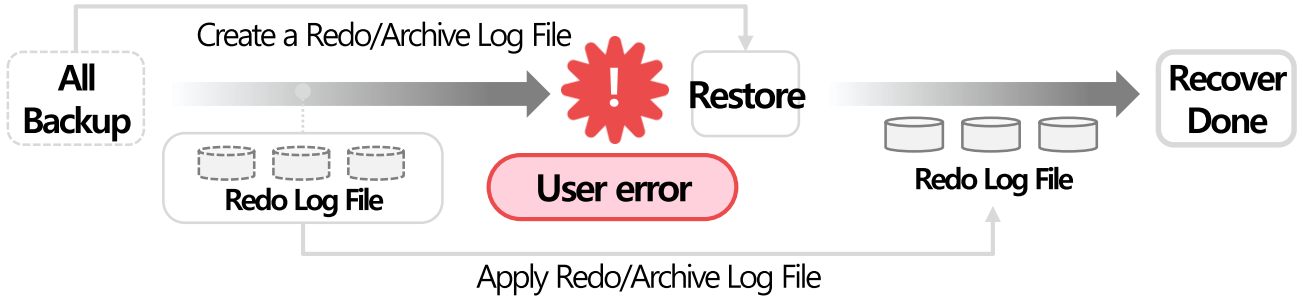
Business with Large-scale data that prevents index key duplication to improve resource space efficiency

High Availability Features - Flashback Database

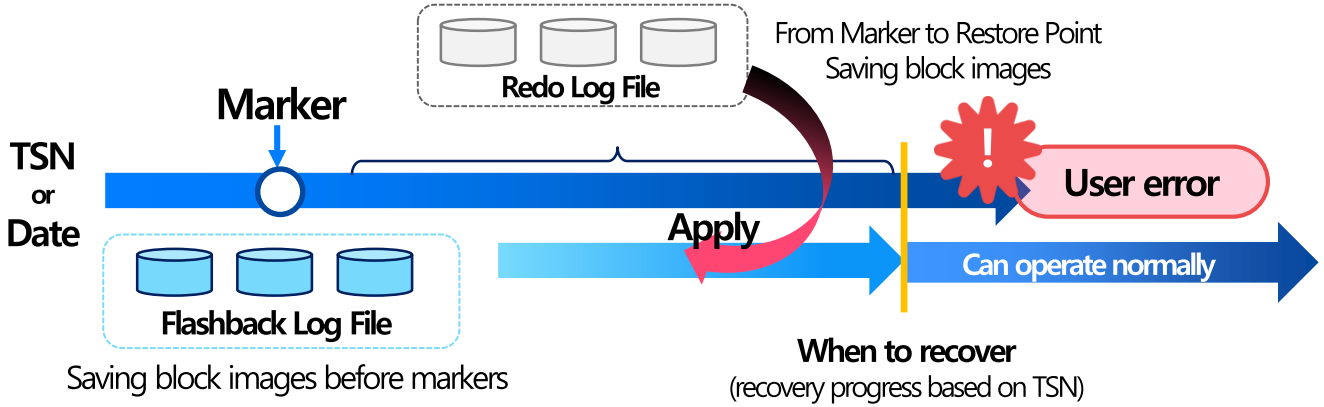
TMAXTibero

Enables full database recovery without backup files, providing a more simple and fast recovery environment

Traditional recovery methods



Flashback Database Behavior Conceptual Illustration



Key Features

- Supports DB recovery to a point in the near past without Restoring from a Backup File
- Flashback Log File
  Performs backups with Redo/Archive Log File

Applications

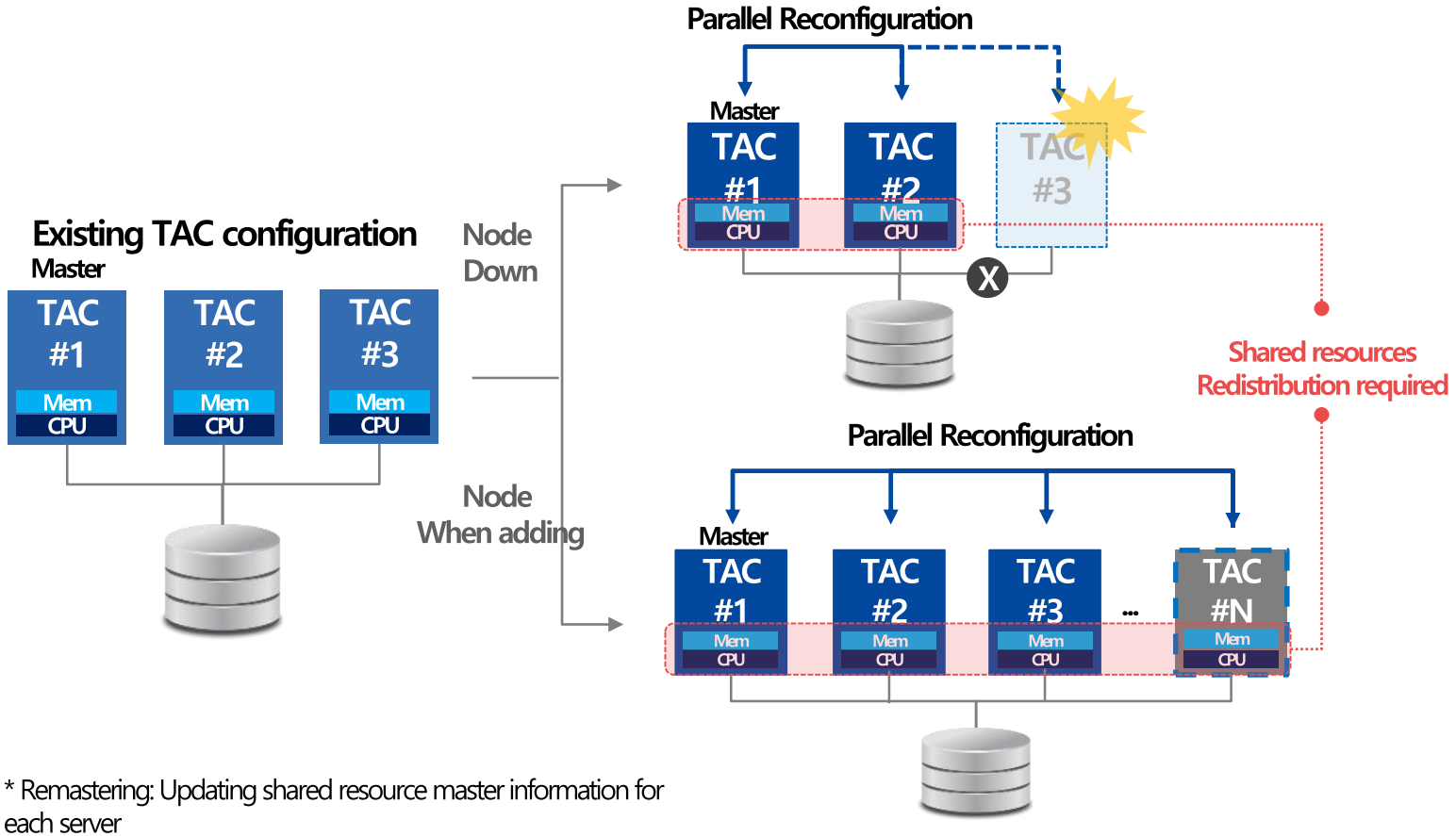
Provides rapid recovery from user-induced data corruption, regardless of database size

High Availability Features - TAC Recovery Parallel Reconfiguration

TMAXTibero

Delivers enhanced availability and stability in systems where node reconfiguration causes heavy load concentration

Remastering*/Reconfiguration due to TAC Node changes



* Remastering: Updating shared resource master information for each server

Key Features

- When changing node configurations, Reduce time with rapid resource redistribution
- When redistributing shared resources, perform in parallel
- Under heavy load, Ensure high performance in terms of speed

Applications

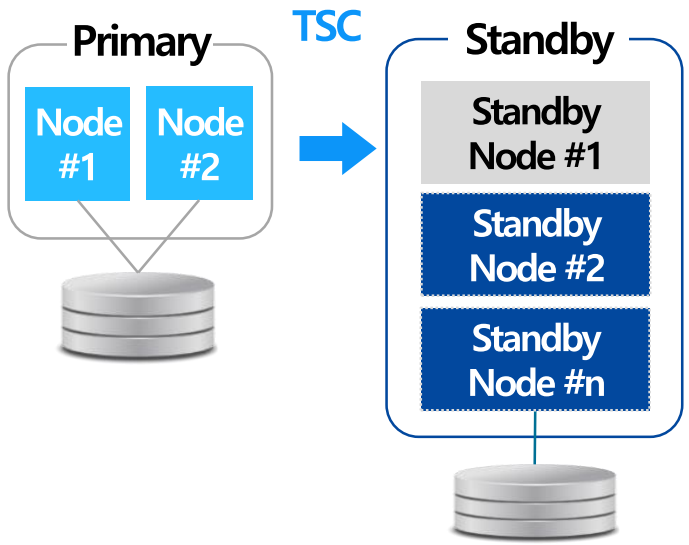
Prevents delays in resource reallocation during node changes in services with high transaction volumes

High availability capabilities - multiple architectural configurations

TMAXTibero

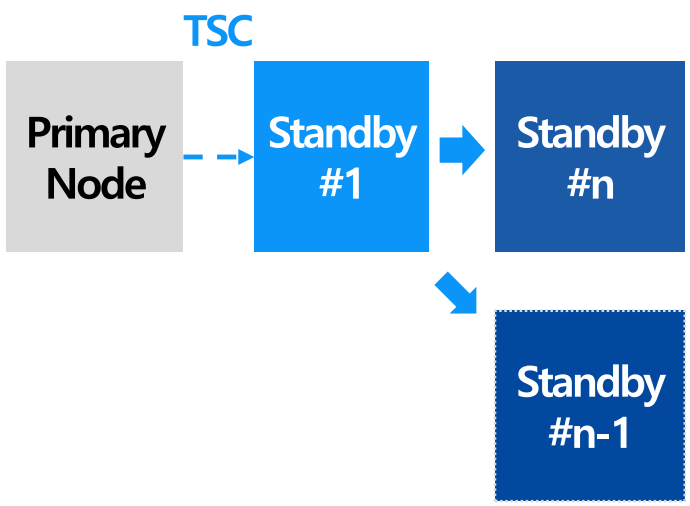
Supports various scalability options, including high availability through multi-standby configuration and flexible test environment setup

Multi-node Standby



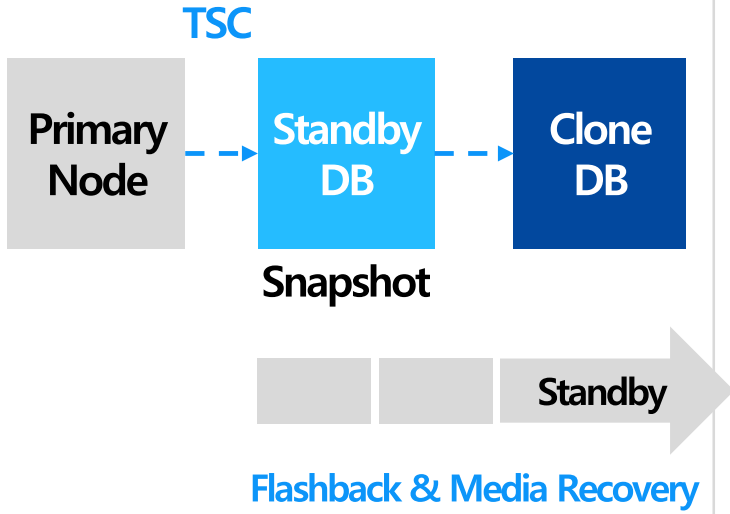
- Multiple configurations of Standby
- Improve data lookup performance
- Scaling high availability

Cascade Standby



- Log shipping on Standby Nodes
- Resolves sync load issues
- Increase data utilization/availability

Snapshot Standby



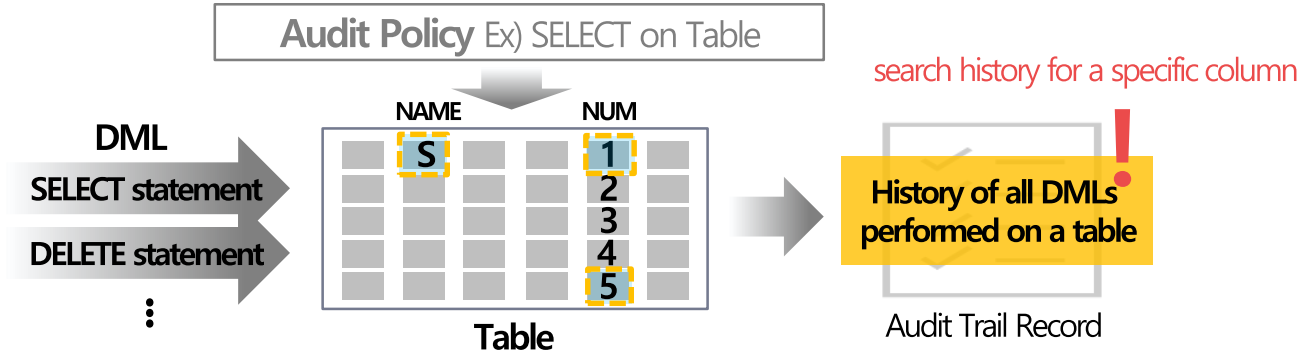
- Perform DDL/DML on Clone DB
- Leverage testing/validation
- Revert to Standby at the time of the snapshot

Enhanced reliability features - Fine Grained Auditing

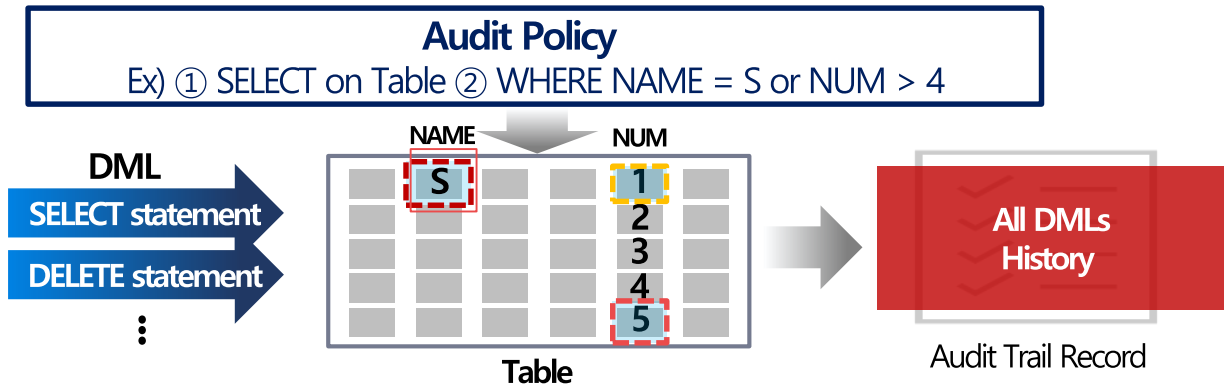
TMAXTibero

Detailed auditing of data based on conditions
Detailed auditing capabilities to quickly pinpoint the cause of issues

Database Auditing



Fine Grained Auditing Conceptual Illustration



Key Features

- Provide a granular level of auditing based on WHERE clauses
- Provide a history of DMLs performed on specific columns
- Help you better manage your performance history

Applications

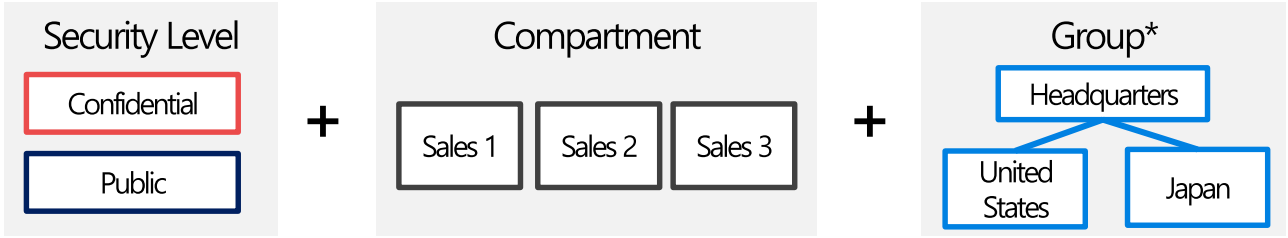
Enables detailed tracking of data access by condition-specific DML history for swift root cause analysis of data loss

Enhanced reliability features - Label Security

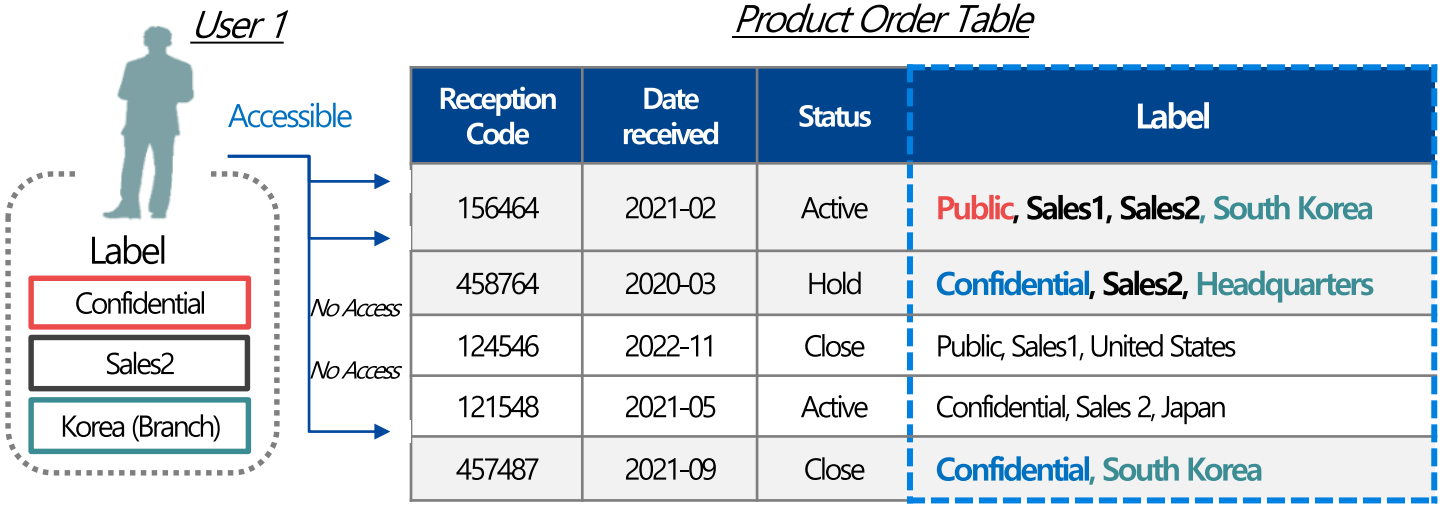
Enables control over data access through labels, supporting a wide range of security configurations

Label Security behavior structure

Example) Label



***Group:** The child nodes will have their own Label and Simultaneously have the Label permission of the parent node



Product Order Table

Reception Code	Date received	Status	Label
156464	2021-02	Active	Public, Sales1, Sales2, South Korea
458764	2020-03	Hold	Confidential, Sales2, Headquarters
124546	2022-11	Close	Public, Sales1, United States
121548	2021-05	Active	Confidential, Sales 2, Japan
457487	2021-09	Close	Confidential, South Korea

Key Features

- Access control through comparison operations
- Access permission with a combination of Level, Compartment, and Group
- Tables or schemas without assigned labels are accessible by default

Applications

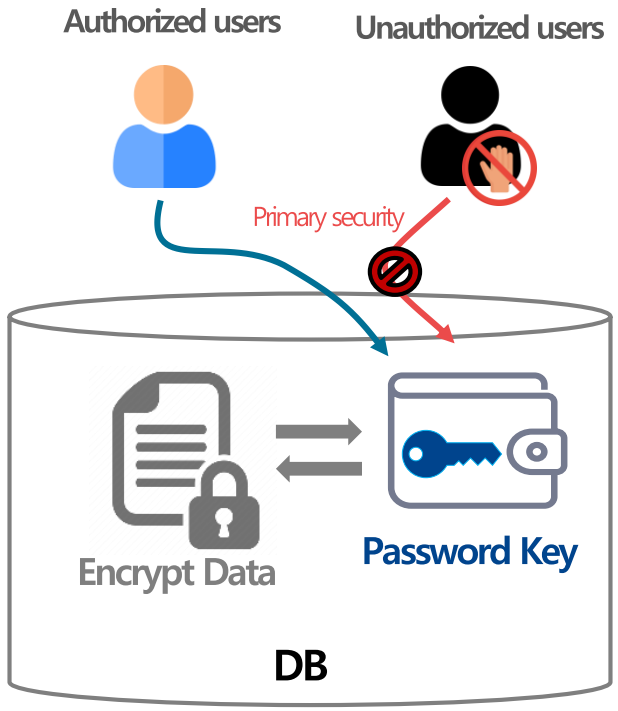
Systems requiring high security and flexible security models such as the military, government, and financial institutions

Enhanced reliability features - Hardware Security Module (HSM) support

TMAXTibero

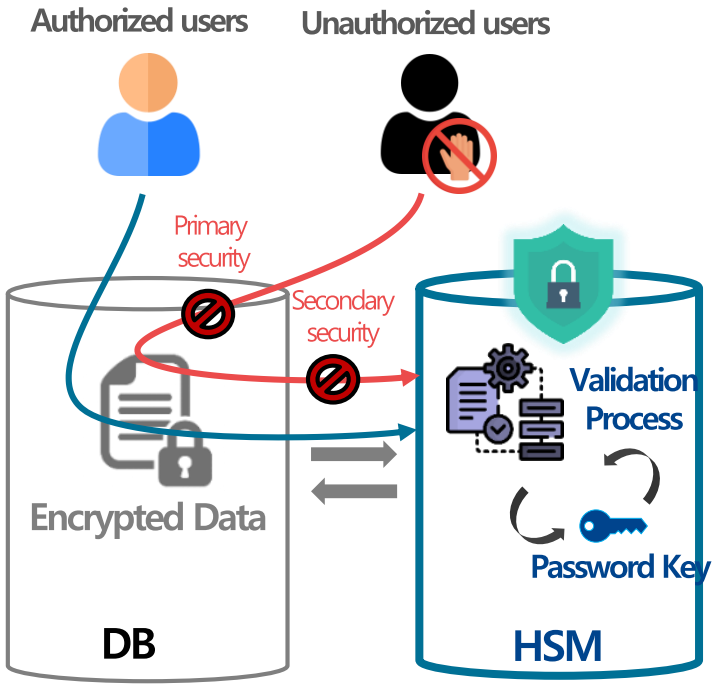
Enhanced security by integration with third-party encryption hardware to enable key separation

General encryption methods



Storage of encryption keys on the same server

Encryption via HSM



Separated H/W for encryption keys creating a secondary security level

Key Features

- Provides support for dedicated hardware modules to securely manage and protect decryption keys
- Compatible with various third-party solutions
- Provides two layers of security with independent, dedicated encryption H/W

Applications

Essential security regulations for public institutions and certification services to minimize intellectual property and financial losses

Various data processing capabilities - JSON Type support

TMAXTibero

Effectively supports diverse development environments such as IoT and big data through explicit type support for JSON data

JSON Data type support

SQL
(Relational Table)

Roll_No	Name	Age	GPA
1	Arya	21	4
2	Bran	19	3
3	John	24	4.3
4	Max	24	1

NoSQL
(JSON)

```
{
  "Id": 0,
  "FirstName": "string",
  "LastName": "string",
  "Name": "string",
  "EmailAddress": "string",
  "TerritoryId": 0
}
```

Additional support

Tibero 7

JSON support features

- JSON_VALUE
- JSON_QUERY
- JSON_TABLE
- JSON Function

SQL

Work with SQL-based reporting and analytics on JSON-type data

Key Features

- JSON type support for easy usability
- Support for Objects, Arrays, and other functions to improve user convenience
- Combine NoSQL and relational concepts in the same database

Applications

Big data industry integration based on semi-structured data, focusing on data storage rather than fast retrieval

More Data Processing Capabilities - Enhancing Spatial Data

TMAXTibero

Geometry features and new functions for enhanced spatial data processing

Applying Geometry & Geography Features

Data

Real world Information

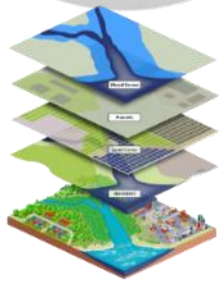
GIS

Tibero 7

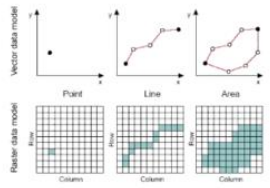
GIS Operation

- Geometry Functions
- Scalar calculation functions
- Phase relationship functions
- MBR-related functions
- Geography Functions
- ...

Analysis



Use Case



GIS modeling

Mining/Analytics

Decision support

Key Features

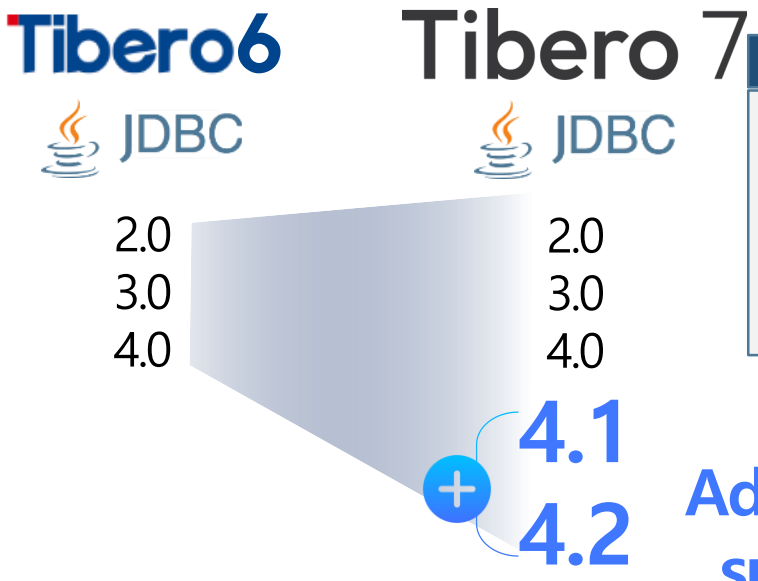
- Complies with GIS standards and provides 40+ additional spatial data functions
- Enhanced accuracy through added support for Geography (spherical coordinate system)
- Supports spatial indexes for fast spatial data retrieval

Applications

Business applications for spatial data analysis that demand spherical coordinate systems for accurate GIS implementations

Supports JDBC 4.1 and 4.2 standards, adding various interface methods and key features

Support for JDBC 4.1 and 4.2 standards



Additional support topics

- Java.math.BigInteger, JDBC Type BIGINT
- Connection.abort support
- Schema using functions, support for specifying timeout
- Affected row count value long type support
- Support for additional Java Time types

•••

Key Features

- Added standard JDBC support API for executing SQL in Java
- Provides support for BIGINT, Connection, Statement, and ResultSet via JDBC 4.1
- JDBC 4.2 adds support for java.time, SQL Type, and Statement related features

Applications

Enhances Java capabilities and ensures compatibility across all platforms and RDBMSs, accelerating new application development