ORACLE DATA SHEET

Oracle TimesTen Scaleout: *Revolutionizing In-Memory Transaction Processing*

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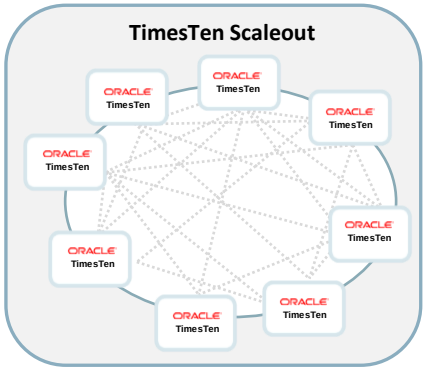
TimesTen Scaleout

TimesTen Scaleout is a brand new, shared nothing scale-out in-memory database designed for next generation extreme OLTP workloads. Featuring elastic scalability, full SQL, standard database APIs, ACID transactions, and built-in fault tolerance, TimesTen Scaleout allows databases to transparently scale out to hundreds of terabytes in size and supports extremely high OLTP throughputs exceeding hundreds of millions of transactions per second.



TimesTen Scaleout is based on the Oracle TimesTen In-Memory Database, the industry-leading in-memory database for OLTP applications which is used by thousands of customers across many different industries. TimesTen Scaleout therefore benefits from all of the industrial-strength functionality of TimesTen. For instance, TimesTen Scaleout features a sophisticated SQL processing engine with a full-featured cost based optimizer, far more advanced than offerings from so-called 'NewSQL' databases. TimesTen Scaleout also supports standard APIs such as JDBC, ODBC, OCI and Oracle Database compatible SQL, PL/SQL and datatypes.

Also, unlike many 'NewSQL' databases, TimesTen Scaleout supports full ACID properties, multi-statement distributed transactions, distributed joins, constraints, and global secondary indexes. These capabilities make it easy for existing TimesTen applications as well as for new applications to adopt TimesTen Scaleout, since no compromises are required by the application to evolve from a single node to this scale-out architecture.

This new scale-out architecture provides transparent scaling across a currently supported maximum of 64 independent hosts. Data is both distributed for scalability (with a choice of multiple distribution schemes), as well as duplicated for fault tolerance, with active-active copies.

TimesTen Scaleout is also extremely simple to deploy and manage. The steps beginning from performing the initial installation, to having a scale-out database up and running, can be accomplished in under 15 minutes.

WHAT IS TIMESTEN SCALEOUT?

- A scale-out, shared nothing, in-memory SQL database architecture
- New in release 18.1 of the Oracle TimesTen In-Memory Database
- Based on the class-leading TimesTen In-Memory Database
- Scales out to a currently supported maximum of 64 hosts
- Supports very large in-memory databases up to 100s of Terabytes
- Supports very high transaction rates exceeding hundreds of millions per second
- Extremely simple to install, configure and manage

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KEY FEATURES:

- Scales database size and throughput using a scale out, shared-nothing in-memory architecture
- Transactions with full ACID properties
- Built-in automatic high availability with active-active reads & writes
- Oracle compatible SQL, datatypes and APIs
- Elastic reconfiguration of hosts
- Commodity platforms: Oracle Linux, Red Hat Linux, CentOS, SuSE and Ubuntu on Bare Metal, VMs, containers and OpenStack on x86

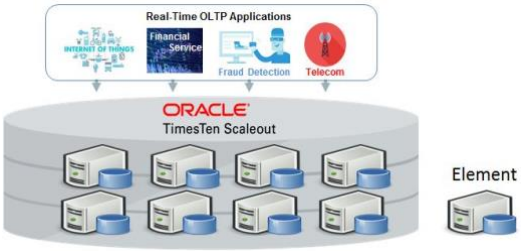
"With its elastically scalable architecture and strong HA, TimesTen Scaleout is a very attractive solution for the next generation of network systems!"

SHIN DONGKEUN
PRINCIPAL ENGINEER, SAMSUNG

Transparent Scale-Out

The architecture for TimesTen Scaleout enables simple and transparent scale-out across a distributed collection of compute and storage units, referred to as *elements*. Adding more elements to a TimesTen Scaleout database enables higher read/write transaction throughput as well as greater capacity for the In-Memory Database.

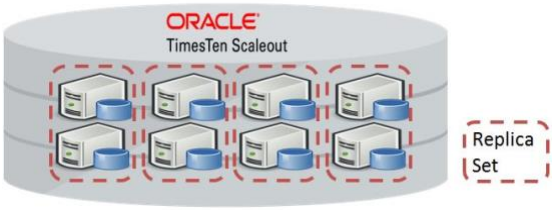
Elements may themselves run on a variety of host types including containers, virtual machines, or physical hosts. Large hosts enable scale-up processing in addition to scale-out processing, and allow higher peak throughputs to be achieved with fewer elements. This is because each element is based on the TimesTen In-Memory Database which scales extremely well on multi-core architectures.



Applications do not need to be aware of the location of the data in the database: All data in the database is accessible from any element, and a data request is automatically forwarded to the correct element(s) if that data is not present locally. However, TimesTen Scaleout also provides a *Data Dependent Routing API* that applications can optionally use to send operations directly to the optimal element.

High Availability

TimesTen Scaleout high availability is simple and automatic: Each element is automatically duplicated via a transparent fault–tolerance mechanism known as *k-safety*: Changes made by transactions are automatically replicated across all the copies of an element. This set of copies of an element is known as a *replica set.* All elements in a replica set are fully active and fully consistent; all data can be read and modified from any element. As long as at least one element in each replica set is available, the database continues to be fully available.



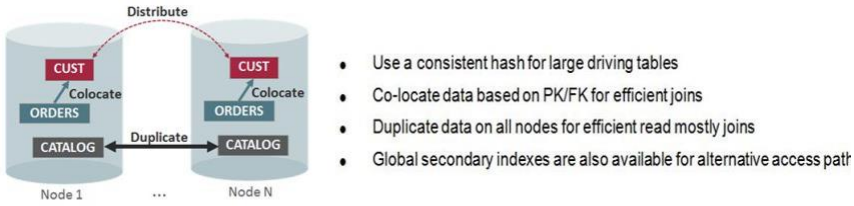
"As the world's first TimesTen Scaleout go live customer, our marketing service system was successfully deployed under the new TimesTen Scaleout architecture with almost no application code changes! Not only has performance improved by more than three times, but now we can successfully support a number of new high concurrency business modules! This fully demonstrates that Oracle TimesTen Scaleout is an excellent distributed relational in-memory database product for OLTP SQL based applications!"

TANG TANG
HEAD OF CONSTRUCTION AND MAINTENANCE, CHINA MOBILE (CHONGQING)

Data Distribution

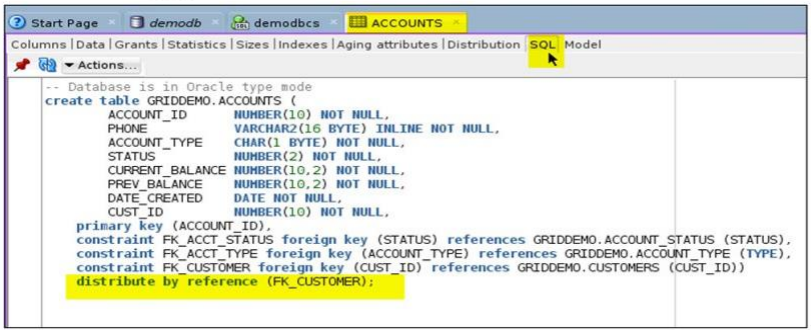
TimesTen Scaleout can distribute the rows in each table in multiple ways to accommodate different application data placement scenarios:

- **Distribution by Hash**: For larger tables that need to be accessed from multiple elements, the most scalable distribution mechanism is hash based distribution (using a variant of consistent hash). This allows the contents of the table to be uniformly distributed by the hash of a *distribution key* in the table; e.g. distribute rows in the CUSTOMER table by hash of the CUSTOMER_ID column. This distribution is the default.
- **Distribution by Reference:** In order to minimize remote element accesses, it may be desirable to co-locate child table rows with their parent rows; for instance to have the ORDERS rows associated with a given CUSTOMER row on the same element. This is possible by distributing the ORDERS rows by the hash of the `customer_id` foreign key column.
- **Duplication:** Small, frequently accessed reference tables, such as a CATALOG table, can be fully duplicated on all elements. This allows all lookups and joins involving the CATALOG table to be processed locally. Duplication is ideal for small, read mostly tables (such as dimension tables).



SQL, PL/SQL AND STANDARD APIS

- Oracle compatible Datatypes
- Oracle compatible SQL, PL/SQL
- Standard APIs: JDBC, ODBC
- Oracle APIs: Pro*C, OCI
- Open Source APIs: ODPI-C, Oracle R, Node.js, Python, Ruby, Go & PHP
- TimesTen proprietary C++ API (TTClasses)



"We are very excited by the TimesTen Scaleout Product! During beta testing, we successfully deployed our existing HLR/HSS application (C/ODBC) running against the TimesTen Scaleout Beta product in both direct mode and C/S mode just within one hour without any code or schema change! "

SUNGTAE KIM
CHIEF ENGINEER, ELUON

Application Development

TimesTen Scaleout supports Oracle Database compatible datatypes, SQL and PL/SQL. It also provides many different APIs to facilitate easy development:

- ODBC (C/C++)
- TTClasses (proprietary 'JDBC like' C++ API)
- JDBC (Java)
- OCI (C/C++)
- Pro*C (C/C++)
- ODP .NET (.NET)

In addition, many open source database APIs and adapters also work with TimesTen including ODPI-C, PHP, Node.js, Ruby, Python, Go, and Oracle R.

Management

All installation, configuration and management tasks for TimesTen Scaleout are conveniently centralized and are performed from a single management instance. This instance does not participate in application SQL or transaction execution; rather it stores metadata about the configuration and topology of the system as well as the state of various components. It orchestrates the installation and configuration of the TimesTen software across all the configured hosts. The administrator never has to log into the other hosts to perform these management operations. To improve availability a second management instance can be configured.

SQL Developer provides a graphical dashboard for installation, configuration and monitoring of TimesTen Scaleout; command line interfaces are also provided.

Use Cases

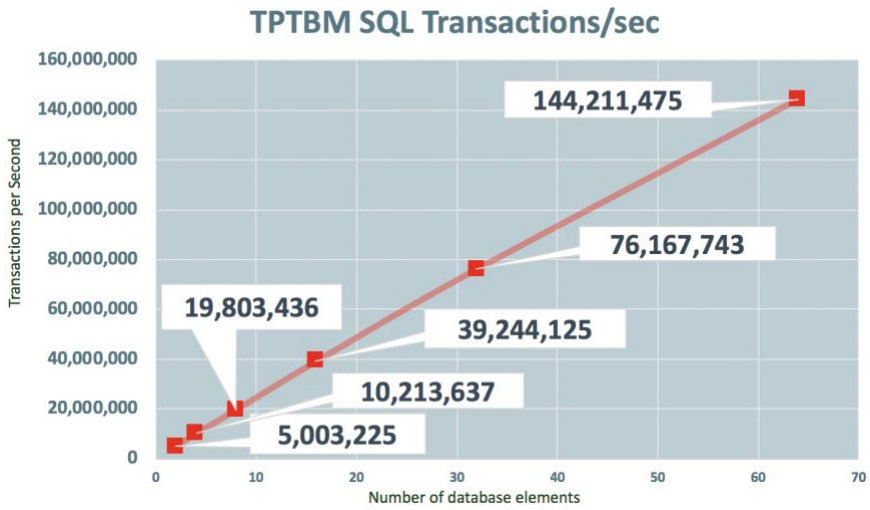
TimesTen Scaleout is optimized primarily for OLTP and IoT style workloads. TimesTen Scaleout also supports hybrid analytic (HTAP) workloads although high bandwidth OLTP is the primary focus.

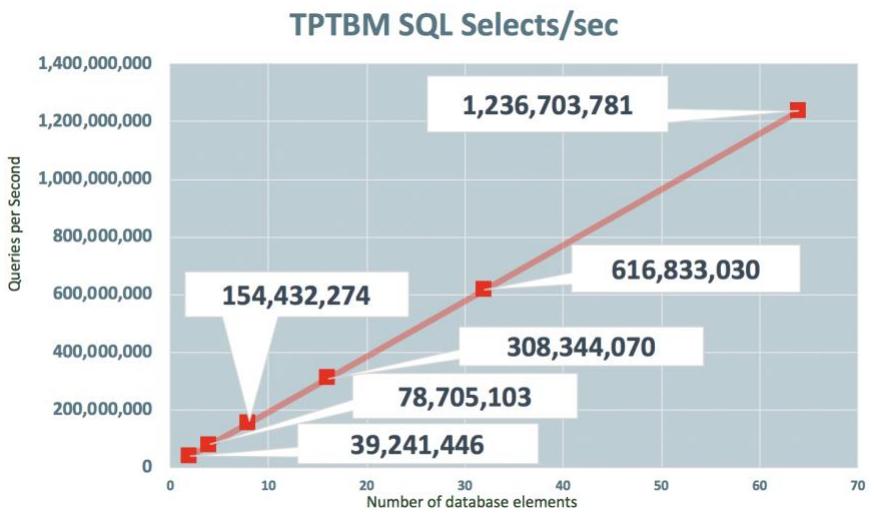
Example use cases include (but are not limited to) the following:

- Real Time Billing
- Real-Time Fraud Detection
- Real-Time Trading
- Real-Time Authorization
- Real-Time Device Tracking

Benchmarks

TimesTen Scaleout delivers class leading throughput for OLTP workloads. The following numbers are for the TimesTen Throughput Benchmark (TPTBM) which models a typical Telecommunications application, with both read/write and read-only workloads. Read-Write workloads (with an 80-20 read to write ratio) achieved a peak of 144 Million SQL transactions per second while a read only workload achieved an astonishing 1.2 Billion SQL Selects per second.





Both TPBM workloads used the same hardware:

- Oracle Cloud Infrastructure, 64 * BM.HighIO1.36, 10G Ethernet with NVMe SSDs

Summary of TimesTen Scaleout

New scale-out In-Memory Database	TimesTen Scaleout supports hundreds of millions of transactions per second and allows in-memory databases to reach hundreds of terabytes in size. A TimesTen Scaleout deployment supports up to 64 independent hosts, where each host can be a small VM or a large server with multiple CPU sockets.
Intended for Extreme OLTP applications	TimesTen Scaleout is optimized for extremely high volume OLTP and IoT workloads such as Telecommunications – real-time billing and device tracking, Financial Services - real-time trading and fraud detection, Smart Metering, etc.
Based on class-leading TimesTen In-Memory Database	TimesTen Scaleout is based on TimesTen In-Memory Database, which is the industry leading in-memory database for OLTP workloads with thousands of customers in many different industries. As a result, TimesTen Scaleout benefits from the many innovations in TimesTen such as scale-up processing on multi-core servers, a sophisticated cost based query optimizer, advanced SQL functionality, multiple indexing techniques, etc.
Flexible Data Distribution schemes for all Application Scenarios	The different data distribution schemes in TimesTen Scaleout support most, if not all, application requirements: • Hash distribution across nodes for large tables • Co-located distribution of related tables (for instance, co-located distribution of orders with customers) • Fully duplicated small reference tables, such as price lists, or a list of categories.
Built-In High Availability with full ACID properties and Global Secondary Indexes	TimesTen Scaleout provides a strongly consistent distributed database architecture with active active copies of data for fault tolerance. TimesTen Scaleout supports fully distributed multi-statement transactions as well as global secondary indexes and global constraints.
Simple and Standard Application Development	Since TimesTen Scaleout is based on TimesTen In-Memory Database, it supports Oracle compatible SQL and PL/SQL, Oracle compatible datatypes, as well as standard APIs such as OCI (Oracle Call Interface), JDBC, ODBC, ODP.NET.
Simple to deploy and manage	TimesTen Scaleout is a very simple product to install and manage. It has a centralized management repository, a simple command line utility for all Scaleout configuration and deployment operations, and SQL Developer integration.

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For more information about Oracle TimesTen Scaleout, visit oracle.com or call +1.800.ORACLE1 to speak to an Oracle representative.

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