ORACLE

Empowering Fintech Transformation with Oracle's Globally Distributed Database

Disclaimer

This document in any form, software or printed matter, contains proprietary information that is the exclusive property of Oracle. Your access to and use of this confidential material is subject to the terms and conditions of your Oracle software license and service agreement, which has been executed and with which you agree to comply. This document and information contained herein may not be disclosed, copied, reproduced or distributed to anyone outside Oracle without prior written consent of Oracle. This document is not part of your license agreement nor can it be incorporated into any contractual agreement with Oracle or its subsidiaries or affiliates.

This document is for informational purposes only and is intended solely to assist you in planning for the implementation and upgrade of the product features described. It is not a commitment to deliver any material, code, or functionality, and should not be relied upon in making purchasing decisions. The development, release, and timing of any features or functionality described in this document remains at the sole discretion of Oracle. Due to the nature of the product architecture, it may not be possible to safely include all features described in this document without risking significant destabilization of the code.

ORACLE

Table of contents

ORACLE

Introduction

In the bustling world of financial services, where data flows as the lifeblood of transactions and decisions, the role of databases is akin to that of a silent conductor orchestrating a symphony of operations. Picture a global marketplace bustling with transactions, from stock exchanges to mobile payments, insurance claims to international fund transfers. In this modern digital landscape, financial services aren't just about dollars and cents but milliseconds and microseconds.

In this modern digital landscape, financial services aren't just about dollars and cents but milliseconds and microseconds.

In this dynamic milieu, financial institutions face a twofold challenge: to meet the voracious appetite for instant transactions and real-time analytics while safeguarding data integrity and regulatory compliance. Here, Oracle's Globally Distributed Database emerges as a beacon of possibility. This ground-breaking solution transcends the confines of traditional databases, offering a seamless fusion of scalability, availability, and security. It caters to the insatiable hunger for speed by delivering ultra-low-latency access to data, enabling institutions to process transactions, analyze trends, and make informed decisions with unparalleled precision.

The Oracle Globally Distributed Database doesn't just satiate the need for speed; it also addresses the core requirements of the financial services domain. In this era of distributed operations and cross-border transactions, the database's global distribution capability ensures data is where it needs to be—closer to customers, compliant with regional regulations, and immune to the disruptions of network latency. Additionally, as financial institutions grapple with data privacy and compliance complexities, the database's advanced security features, encryption protocols, and audit trails provide a robust fortress for sensitive information.

Amid the challenges of constant change and the demands for instant gratification, Oracle's Globally Distributed Database catalyzes seamless operations and reshapes the financial services landscape. It empowers institutions to offer frictionless user experiences, make informed decisions quickly, and navigate the labyrinth of global regulations with finesse. In this digital age, where fortunes are won and lost at the speed of light, this enterprise-grade distributed database isn't just an enabler—it's the bedrock upon which the financial future is being built.

A Glimpse into the Modern Financial Services Ecosystem

Operational Resilience Regulations in Fintech

In the dynamic financial landscape, operational resilience has emerged as an imperative. The convergence of rapid digitization and cloud-based architectures has heightened complexities and potential disruptions. Notably, trends identified by experts underscore the urgency of operational resilience. These trends, including muted financial performance, accelerated digitization, and new cloud-based models, accentuate the imperative of resilience.

The digital acceleration introduces new risks, amplifying the need for robust practices such as evidence-based approaches, traceable processes, adherence to cloud regulations, and comprehensive exit plans. The financial sector isn't immune to disruptions, with frequent outages topping the list.

Regulatory bodies are heightening operational resilience standards to confront the ramifications of pandemics, security events, and technology glitches. For instance, discussion papers from the UK's Prudential Regulation Authority (PRA), Financial Conduct Authority (FCA), and Bank of England (BOE) emphasize operational resilience. Moreover, the European Union's (EU) announcement of the Digital Operational Resilience Act (DORA) as part of the new digital finance strategy reflects efforts to consolidate ICT risk requirements across financial entities, ensuring adherence to common standards for mitigating ICT risks. The Bank for International Settlements, a global coordinator for the banking industry, is also poised to introduce its standards.

ORACLE

Financial institutions must adeptly navigate an interconnected environment where risks emerge. Ensuring service delivery becomes a shared obligation. The consequences of failures magnify the significance of operational resilience, a business imperative and societal responsibility.

Operational resilience augments an institution's value proposition, empowering every facet of the financial ecosystem. Institutions prioritizing operational resilience navigate challenges, sustain services, uphold trust, and contribute to industry stability.

Navigating Risks and Regulatory Compliance

Global companies are facing a shift in strategy due to the emergence of data localization regulations worldwide. Formerly, businesses benefited from a uniform approach across regions, but this approach is strained as countries impose varied data privacy and protection regulations. These rules necessitate a shift from a global mindset to a local one, leading to increased costs for regional compliance. However, companies that adapt seamlessly to these changes stand to gain growth, market share, and improved customer experiences.

According to Gartner's projections, modern privacy regulations will extend to include the personal data of 65% of the world's population by 2023.

Fintech compliance entails navigating complex regulatory frameworks to safeguard consumers and investors in innovative financial technologies. These regulations address a spectrum of risks, including robust risk assessment and data breach prevention for **data privacy**, as seen under the General Data Protection Regulation (GDPR) with potential substantial fines. **Anti-money laundering** (AML) policies are globally essential, with collaborative efforts among regulatory bodies ensuring transparency in financial activities. The vulnerability of financial assets to **cyberattacks** prompts specialized fintech laws to protect against threats, exemplified by measures like the New Payment Service Directive that bolster cybersecurity practices.

World map of data regulations labeled with data privacy regulations for the region or country they apply to.

Data sovereignty entails adhering to region-specific regulations that dictate the data's storage, access, processing, and lifecycle within that region. With data traversing borders and cloud environments, 100+ countries enforce data storage and transfer regulations. Regulations focused on personally identifiable information (PII) stress compliance with data protection laws where it's gathered. These regulations require physical storage in specific locales impacting

ORACLE

application architecture.This can involve regional data storage while allowing remote access and processing, or both storage and processing within one location.

Key regulations like Europe's General Data Protection Regulation (GDPR), the US California Consumer Privacy Act CCPA, and the recently introduced California Privacy Rights Act (CPRA) establish robust data protection measures. These mandates rigorously control collecting, processing, and storing personal and financial data. GDPR necessitates explicit user consent, data access rights, and stringent breach reporting. Similarly, CCPA empowers Californian users regarding their data. CPRA strengthens data privacy in California by introducing additional rights and business responsibilities. In the global expansion of fintech, grasping and following these regional data privacy laws, including CPRA, is vital. They shape fintech's development, ensuring trust and regulatory adherence. Adapting to these shifting regulations presents significant competitive advantages for agile companies.

Transformative Business Paradigms and Shifting Customer Demands

Emerging and transformative business paradigms are reshaping the fintech landscape, challenging conventional financial norms. These innovative approaches, fueled by technology and novel strategies, redefine how financial services are conceived, developed, and delivered. Simultaneously, customer demands within the fintech sector are undergoing a dynamic evolution. As customers become more digitally savvy and connected, their expectations shift towards seamless experiences, personalized solutions, and instant access to financial services. This dual force of disruptive business models and evolving customer demands is steering the fintech industry towards an era of unprecedented transformation, where adaptability and customer-centricity are paramount for success.

As per the leading analyst firm, 77% of business leaders believe that enhanced personalization directly correlates with heightened customer retention. Likewise, 70% of consumers regard a cohesive experience across multiple channels as either extremely or highly significant when selecting their primary banking institution.

The rise of open banking is fostering greater collaboration and innovation. Fintech firms are increasingly integrating with open banking platforms through APIs (Application Programming Interfaces) to offer customers a more comprehensive range of services. These APIs allow for seamless data sharing and the creation of innovative financial products and services.

Fintech companies are leveraging their wealth of customer data to deliver personalized financial solutions. Artificial Intelligence (AI) and Machine Learning (ML) algorithms analyze customer data to provide tailored recommendations and experiences, meeting the growing demand for highly personalized financial services.

The ability to scale efficiently and cost-effectively is a fundamental aspect of fintech's ability to adapt to changing customer preferences and industry trends.

Common Use Cases

In today's financial landscape, a multifaceted ecosystem is shaping the course of the industry, driven by technological advancements, evolving customer expectations, and regulatory dynamics. This dynamic milieu demands a strategic approach encompassing innovation, agility, and adaptability to cater to the diverse needs of financial institutions and their clientele.

Modernization and Innovation

The fintech industry's digital transformation, characterized by innovations such as mobile banking apps and AI-powered robo-advisors, is reshaping customer engagement and operational efficiency. Fintech leaders are setting new industry benchmarks with seamless user experiences and innovative financial services. However, as the surge in data continues, both opportunities and challenges arise, demanding data analytics for informed decision-making and innovative financial products.

ORACLE

To address these challenges effectively, fintech companies are turning to advanced solutions such as Oracle's Globally Distributed Database. Its built-in Raft replication empowers financial institutions with high availability, ensuring that their systems are always accessible, and supports data consistency across Availability Domains (ADs). Moreover, it enhances security, ensuring compliance with industry regulations, and offers real-time analytics for data-driven decision-making.

The support for multi-model data and columnar storage opens up new possibilities for creative data handling and analytics. Oracle Database enables customers to form predictive insights with embedded AI/ML and an extensive set of built-in advanced analytics capabilities, aiding in modernizing the infrastructure. It provides easy access to Oracle's parallelized, scalable in-database Oracle Advanced Analytics' ML algorithms.

Developers in the fintech industry now have the opportunity to channel their efforts toward pioneering innovative sharded database applications and addressing global-scale challenges with the best-in-class scaling and performance provided by Oracle's Globally Distributed Database. This comprehensive suite of features positions Oracle as a pivotal enabler for fintech modernization and innovation, helping maintain a competitive edge in the digital era.

Data Sovereignty, Compliance, and Global Connectivity

Regulations demand data protection and secure technologies, making distributed ledger technologies a focal point. Compliance ensures transparency, data privacy, and systemic stability.

In an interconnected world, financial services expand beyond geographical boundaries. Cross-border transactions, international payments, and global investments require seamless interactions while addressing currency conversion, regulatory compliance, and data security.

Oracle Globally Distributed Database empowers financial institutions by enforcing local data placement for geographic sovereignty, satisfying data residency requirements through local data storage and replication, ensuring low latency access with regional data replication for operational sovereignty, including load balancing and fail-over. This enables financial institutions to maintain a unified data view across different regions, ensuring regulatory adherence, and seamless global connectivity for sustained success.

Fault Isolation and Breaking The Monolith

Traditional monolithic databases introduce a significant vulnerability, on a single machine or a cluster. Even a minor glitch can disrupt the entire database.

Oracle's Globally Distributed Database resolves this by promoting the division of large databases into smaller, more manageable units. These units can be strategically positioned across multiple availability domains, guarding against local and data center outages and eliminating single points of failure. In case of issues with one unit, the others continue to function seamlessly, ensuring uninterrupted operations.

Hyperscale Performance and Scalability

In the fast-paced world of finance, hyperscale performance and scalability are non-negotiable.

Oracle's Globally Distributed Database empowers financial institutions with linear scalability, supporting millions of transactions and petabytes of data through its shared-nothing architecture. This capability ensures that even during peak loads, the system remains unswerving, eliminating single points of failure.

The built-in replication mechanisms, including the Raft consensus protocol and Oracle Data Guard, guarantee strict data consistency and zero data loss, safeguarding the financial institution's operational efficiency and data integrity. Imagine a financial giant swiftly processing millions of customer transactions within seconds, efficiently managing surges in data during stock market fluctuations, and rapidly expanding its services to cater to a global customer base.

In navigating this complex landscape, financial institutions must be prepared to embrace change, leverage technology to their advantage, and cultivate a customer-centric approach. By aligning with the demands of the ecosystem,

ORACLE

financial institutions can position themselves for growth, resilience, and sustained relevance in a rapidly evolving industry.

## Oracle Globally Distributed Database Case Studies

Strengthening Data Residency and Compliance for a Multinational Bank

In the face of rigorous data sovereignty requirements mandated by the Reserve Bank of India, a multinational bank headquartered in the United States successfully tackled the mission-critical challenge of upholding data residency for its core global payment application.

The bank tacked the data residency requirement by deploying a unified global application stack with database shards in both the United States and India, with Oracle's Globally Distributed Database. This strategic approach ensured compliance with Indian regulations while safeguarding efficient data access and system performance.

The application is Java-based, and integrating with the new setup required minimal changes, ensuring a seamless transition and minimum disruption to the ongoing operations.

To fortify disaster recovery capabilities and ensure business continuity, the bank leveraged Oracle Exadata for the database shards and Data Guard for cross-region replication for disaster protection, bolstering system resilience and availability. Oracle's Globally Distributed Database solution helped this customer achieve data sovereignty, regulatory compliance, and enhanced global operational resilience, setting a model for other financial institutions grappling with complex data sovereignty and regulatory compliance issues in an increasingly globalized financial landscape.
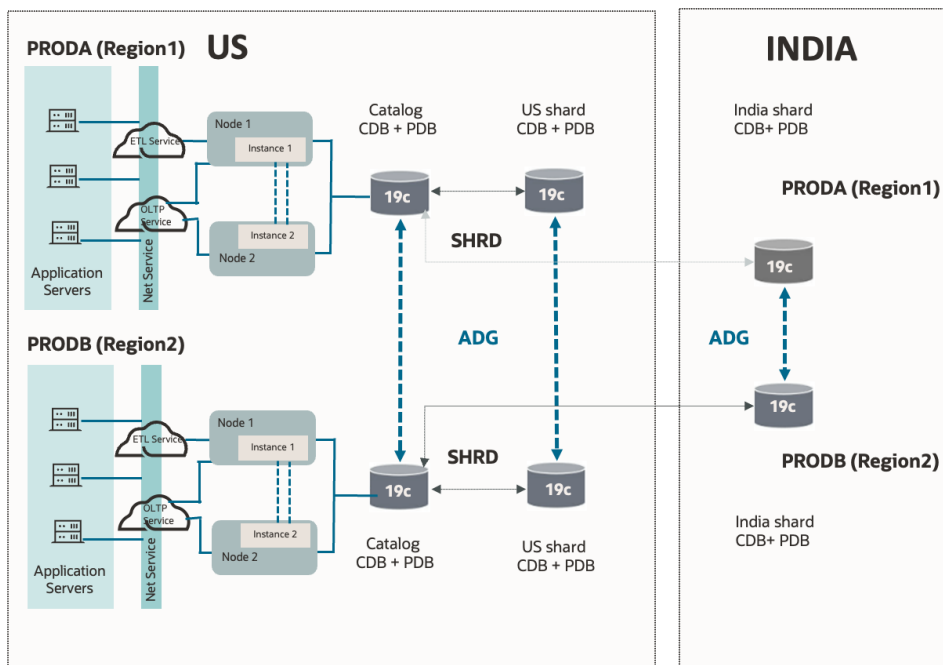
Data sovereignty global payment processing architecture diagram displaying the flow of information between the US and India for the multinational banking use case.

ORACLE

Elevating Real-Time Credit Card Fraud Detection for a Global Financial Services Corporation

For a leading Global Financial Services corporation based in the United States, ensuring robust credit card fraud detection was paramount. Their real-time query execution requirement for every credit card transaction necessitated lightning-fast processing, with each query to be scored for fraud in just 1 to 2 milliseconds, all while managing a staggering 200 terabytes of data.

The customer mandated robust architecture, extreme availability, performance, scalability, and stringent security and auditing standards. Additionally, they needed a scale-out solution to match rising customer expectations and grow with flexibility based on workload demands. To ensure no single points of failure during a catastrophic crash, the customer implemented a user-defined distribution methodology for shard isolation, dividing data into four shards. Data sovereignty was strictly enforced to prevent cross-region data leakage.

Leveraging Oracle's robust AI and ML capabilities on massive data volumes, the customer employs the system for credit card fraud detection, where they face the formidable task of deciding the legitimacy of a transaction in mere milliseconds. It's a high-pressure environment where split-second decisions are made to distinguish between valid and fraudulent transactions.

With each shard supported by two Data Guard replicas, one in the local region with synchronous replication and another in a remote region with asynchronous replication, the data distribution and disaster recovery mechanisms were impeccable, ensuring that the AI and ML models always had access to the most up-to-date data for real-time decision-making.

This setup was further fortified by including a Global Service Manager (GSM) in the primary region, as well as its local standby host, and in a remote region, ensuring maximum availability and a robust hyperscale use case implementation. Oracle Globally Distributed Database, with the capability to hyperscale, played a pivotal role in this case, exemplifying how an enterprise-grade distributed database enable a global financial giant to maintain real-time fraud detection efficiency, even under immense data processing pressure, ultimately securing financial transactions with precision and speed.
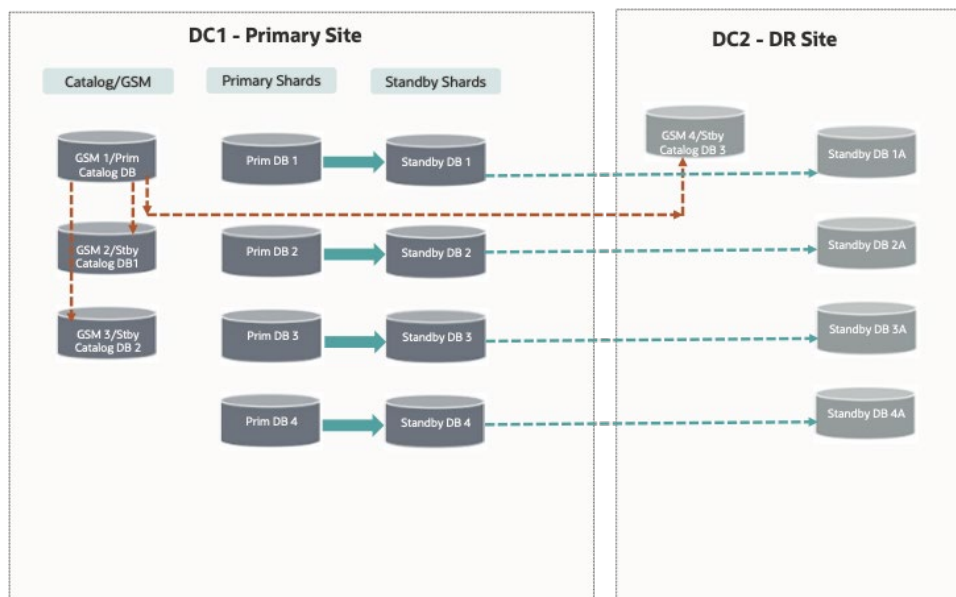

Distributed architecture with Oracle Data Guard for a sharded database primary, local standby, and remote DR site.

ORACLE

A Scalable Solution for a Payment Processing Application

Confronted with surging transaction volumes and the pressing need for real-time processing, a global payment-processing leader embarked on a transformative journey. Their quest led them to Oracle Globally Distributed Database's Raft Replication Configuration, an architecture designed to meet the most demanding requirements.

We conducted a proof of concept (POC) to showcase the solution's potential. The setup was meticulously engineered, featuring three high-performance shards, each serving as a single-instance Oracle database in a multi-AZ environment. With thirty-six chunks supported by six replication units, this design enabled parallelism for seamless data replication across the entire system. The Raft-based replication system was configured with a Replication Factor of three, ensuring synchronous data replication to all three shards. This design guaranteed external consistency, with one leader and two followers assigned to each chunk in a replication unit.

The remarkable outcome of this endeavor exceeded all expectations. Failover times were consistently less than three seconds, even in the face of challenging network latency conditions (10ms). The system maintained exceptional performance handling 36,000 commits per second, and processing a staggering 123,000 SQL statements per second. This achievement firmly established the payment-processing giant's capacity for seamless scalability and uninterrupted operation, even during peak loads. Oracle's POC demonstrated its transformative potential in payment processing, setting new standards for the industry.
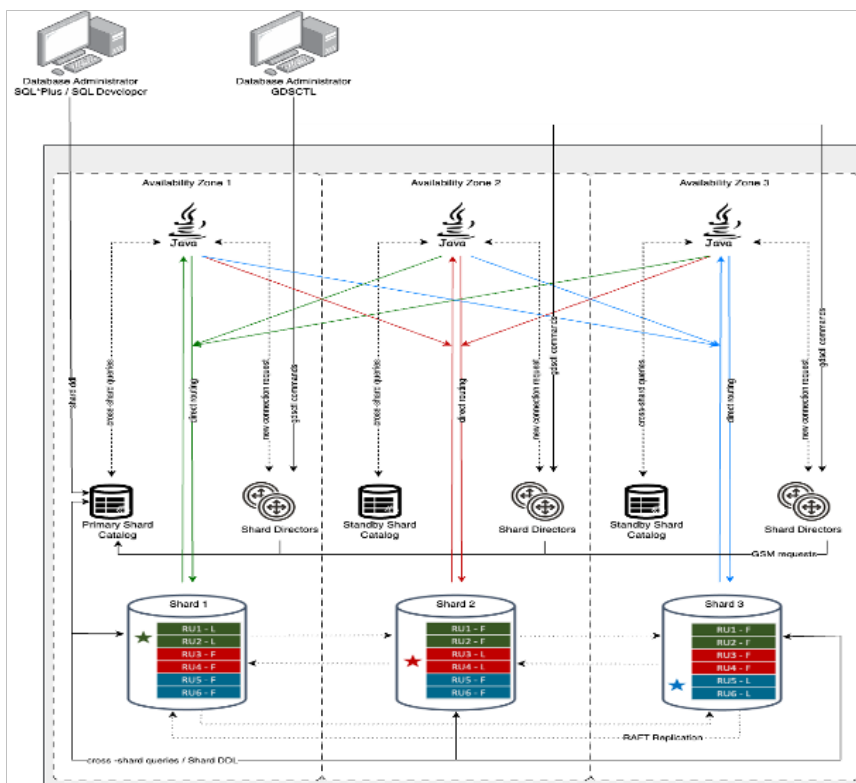
Deployment across multiple availability zones - a 3-shard Globally Distributed Database across 3 availability zones.

ORACLE

Addressing Multi-country Data Residency Challenges for a Germany-based Multinational Insurance Company

As the demand for a monitoring and assessment application expanded across multiple countries, a multinational insurance customer based in Germany faced the challenge of meeting data residency requirements imposed by regulators. Insurance providers also sought more efficient ways to analyze the rapidly growing data volumes and extract valuable business insights.

To address these needs, this customer embarked on a journey to develop enhanced reporting capabilities and harness the potential of automation and artificial intelligence for advanced analytics. To support these endeavors, the customer decided to migrate the application to a cloud-based infrastructure, ensuring robust security, compliance, scalability, and advanced analytical capabilities.

The customer explored multiple vendor options, all of which entailed constructing a globally distributed database; however, this approach was time-intensive, involving several years to migrate the data model and adapt the existing code. In contrast, the decision to migrate the Oracle Database to Oracle Cloud Infrastructure (OCI) proved to be a more efficient choice, as it did not require any code modifications, and OCI offered built-in database solutions that could enhance data security and reporting.

Furthermore, the integration of Oracle APEX and Oracle Database significantly expedited the development of analytical dashboards. This not only reduced the time required for dashboard creation but also contributed to a decline in human errors and enhanced security measures.

Moving the application to Oracle Cloud Infrastructure (OCI) yielded several key advantages. Oracle's Globally Distributed Database within the Oracle Database facilitated compliance with vital data residency requirements. This enabled the customer to store data segments in the OCI Cloud Region of their choice, enhancing data accessibility and control by allowing a single logical database to span multiple geographical regions while retaining the application within a single region.

Consequently, data proximity minimized the need for global data replication, eliminating the process of copying substantial data from a central warehouse as distributed parallel queries, and resulting in expedited reporting and analytics. Furthermore, the Oracle Globally Distributed Database played a crucial role in reducing data security risks by limiting user access to specific, authorized areas.

Additionally, customer-leveraged machine learning for R in the Oracle Cloud Database applied AI models seamlessly without exporting data. This approach simplified advanced analysis while enhancing security and performance.
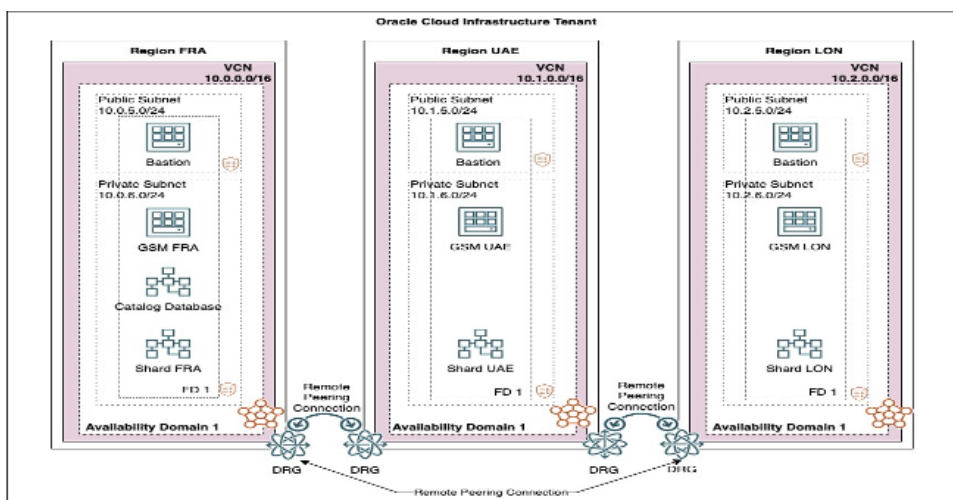
Deployment of Oracle Globally Distributed Database across multiple regions - 3-shard Globally Distributed Database located in 3 regions.

ORACLE

Addressing the Migration, Performance, Availability, and Regulatory Challenges with Oracle Globally Distributed Database

WHAT DO YOU NEED?	HOW YOU CAN ACHIEVE IT WITH ORACLE GLOBALLY DISTRIBUTED DATABASE
Hybrid cloud	Oracle Globally Distributed Database reference architecture patterns can be used in Kubernetes or Docker cloud on-premises and or on cloud providers' hosting. Explore Terraform-based Oracle Globally Distributed Database deployment : On-premises and Oracle Cloud Infrastructure
Multi-cloud	Shards can use different cloud providers (multi-cloud strategy) and replicas of a shard can be in a different cloud or on-premises. Read Deploying linearly scalable Oracle sharded databases across multi-cloud (Oracle Cloud, Microsoft Azure, and Amazon Web Services)
Seamless data migration	• Data Migration with Oracle Data Pump • External Tables to Load Data into a Sharded Database • Oracle GoldenGate to Replicate Data Between Sharded and Non-Sharded Databases Read Migrating to a Sharded Database
Linear scalability	Add shards online to increase database size and throughput. Online split and rebalancing provisioning. Read How Oracle BlueKai Data Management Platform scales to 1 Million transactions per second with Oracle Globally Distributed Database deployed in Oracle Cloud Infrastructure
Data sovereignty & data proximity	Geo-distribution: User-defined data placement for performance, availability, DR, or to meet regulatory requirements. Read How to Achieve Data Sovereignty with Oracle Globally Distributed Database
Availability	Shared-nothing hardware architecture. Fault of one shard has no impact on the others. Oracle Globally Distributed Database is integrated with Oracle Database replication technologies for high availability and disaster recovery at the shard level. Read Replication in Oracle Globally Distributed Database

ORACLE

Elevating Fintech Success with Oracle Globally Distributed Database

Embark on a fintech transformation journey with Oracle Globally Distributed Database, the cornerstone for redefining your financial technology operations. In a dynamic landscape that demands an unwavering commitment to digital customer experiences, compliance with complex regulations, revenue diversification through personalized, data-centric services, and the modernization of legacy systems, Oracle's Globally Distributed Database offers the transformative edge your fintech business craves.

Experience the transformational power of Oracle's Globally Distributed Database, a game-changer for the fintech industry. Oracle's SQL language forms the foundation, ensuring seamless object creation, strict data consistency, complex joins, and ACID transaction properties. With distributed transactions, relational data stores, and fortified security and encryption, Oracle offers unparalleled data protection and performance optimization.

But that's just the beginning. Oracle's innovations, from Advanced Security to Automatic Storage Management, Advanced Compression, and Exadata, position your fintech business at the pinnacle of enterprise-level features. Scale easily through SMP scalability, harness Oracle RAC, and explore the world of in-memory columnar storage. Dive into the future with the JSON document store and redefine your data management.

Oracle doesn't just equip you with robust features; it empowers you with sharding-aware tools, such as SQL Developer, Recovery Manager (RMAN), and Enterprise Manager Cloud Control. These tools simplify sharded database application development and management. Access programmatic interfaces such as JDBC, OCI, and PL/SQL, complete with extensions tailored for sharded application development.

You have a range of high availability choices to safeguard your data in Oracle Globally Distributed Database. Options like Oracle Data Guard, Oracle Active Data Guard, and the built-in Raft replication starting from version 23c.

Oracle's support for multi-model data, including relational, text, and JSON, ensures you have the versatility you need. You can seamlessly integrate your existing life-cycle management and operational processes, leveraging in-house and worldwide Oracle Database administrator skill sets. With Oracle, you don't just get a database; you get an ecosystem that supports your fintech journey.

Benefit from enterprise-level support that underpins your operational excellence. Embrace the extreme scalability and availability to fuel your growth. In the fast-paced world of fintech, Oracle's Globally Distributed Database emerges as the strategic choice, enabling you to meet the future head-on with confidence and capability.

Why Oracle's Globally Distributed Database is the First Choice for Fintech Over Any Other Distributed Database?

Oracle's Globally Distributed Database offers many benefits and advantages over other solutions:

- Architecture seamlessly integrated into Oracle Database, providing a unified and optimized solution, unlike other competitors that use multiple disparate software modules, Oracle offers a mature Globally Distributed Database with a mature storage engine and multiple HA options including Raft replication (starting from release 23c.)

- Capitalizes on familiar Oracle Database features, including SQL transactions and ACID properties, providing a robust foundation.

- Built on Oracle Database industry-leading technologies such as partitioning, parallel query execution, sharding, and Global Data Services, enhancing its offering.

- Offers pluggable replication architecture – Oracle Active Data Guard for replication across high-latency networks (e.g., across the globe), Raft replication for low-latency networks (e.g., across ADs within region), and Oracle GoldenGate for ETL and upgrades.

ORACLE

- Supports a wide range of data distribution methods, including range, consistent hash, list, range-hash, range-list, fine-grained custom, and sub-partitions, surpassing many competitors.

- Employs the concept of table families, optimizing transactions to be predominantly local to a shard. Additionally, Oracle's multi-shard query coordinator serves as a robust and highly available transaction coordinator, helping ensure data integrity and consistency.

- Incorporates the concept of table families, significantly enhancing its capability for high-performance query processing and join operations.

- Provides full SQL support.

- Features a dedicated multi-shard query coordinator optimized for both row and columnar access, enabling robust support for analytics and reporting.

- Encompasses all of Oracle Database's essential features, including security, parallel query, indices, secondary indices, and support for diverse data formats (e.g., relational, JSON, Text, Vector) in both Row and Columnar formats.

- Incorporates intelligent routing mechanisms that efficiently direct queries to the appropriate data shards, minimizing network overhead. It offers versatile data access methods, including direct routing, enhancing overall efficiency. Furthermore, Oracle's Globally Distributed Database provides proxy routing for multi-shard queries.

- Delivers in-country data storage while maintaining a unified global perspective, enabling organizations to comply with data sovereignty regulations while retaining a comprehensive view of their data.

Connect with us

Call +**1.800.ORACLE1** or visit **oracle.com**. Outside North America, find your local office at: **oracle.com/contact**.

🅱 blogs.oracle.com   📘 facebook.com/oracle   🐦 twitter.com/oracle

ORACLE