Customer:

A PCI level 1 certified and leading provider of SAAS based global electronic payment solutions for card-not-present merchants. It has highly customizable payment and real-time reporting platform that serves as suite of fraud solutions and risk management strategies.

Industry: **Payment Management**

Cybage Solution Center: Pune

Geography/Regions served: US

Project Team size:

Peak Team size: **8** Duration: **6** Months

Business Problem:

- Limitation increasing Quality of Service
- High data latency & inconsistency
- High Operational cost
- Limited business continuity solution

Business Solution:

- In Memory Data Grid (IMDG) for high performance
- Partition cluster for linear scalability
- Space replication for high availability
- Multi-site replication over WAN

Business Impact:

- Enhanced customer satisfaction with ultra-high performance using IMDG.
- Improved resource utilization with linear scalability.
- Improved business continuity with multi-site WAN replication, high availability and reliability.
- Reduced operational cost with advanced tooling available for application monitoring.

Customer Information

A PCI level 1 certified and a leading provider of SAAS based global electronic payment solutions for card-not-present merchants. It has highly customizable payment and real-time reporting platform that serves as a suite of fraud solutions and risk management strategies. Its multi-layered approach enables transaction risk management and mitigation, business optimization strategies, cardholder authentication and chargeback representment for all major credit card brands. Customer has specialties in chargeback reduction, fraud prevention, payment risk mitigation, chargeback dispute management, payment risk analysis, hosted payment page, fraud fighting gateway, Verified by Visa, Mastercard SecureCode

Business Problem

Initially when business was small LAMP platform was chosen to save significant upfront licensing cost. LAMP platform served good purpose when business needs were small and less complex. Now that business is grown and expanded, quality of service (QoS) has become number one priority for the organization. It is required to maximize the service level and provide right data (reliability) at right level of responsiveness (performance) no matter how many customers are simultaneously interacting. Further with business growth, opportunity cost due application downtime (availability) is significantly increased which needs to be controlled. The organization is finding difficult to increase quality of service due to limited capabilities of LAMP in further tuning applications for performance and scalability. Also controlling operational cost with limited operations, management and tooling functionalities with LAMP is difficult.

Business Challenge

The key challenges before customer were to have a solution platform that will provide –

1. High Performance to be able to process massive amount of data against complex business rules.
2. High Scalability to handle millions of API calls a day in real time and support scale out, linear scalability and dynamic scaling.
3. High data latency with MySQL Master Slave Architecture which fails reporting queries.
4. Multi-site data replication over WAN with minimum latency.
5. Lowering operational cost.

Business Solution

Cybage carefully analyzed business problems and proposed a technical solution based upon Java, Spring & Gigaspaces XAP 8 platform. Cybage did a small POC to demonstrate how proposed technical solution based on Gigaspaces XAP can easily tackle their business problems. The key points that were taken into considerations were;

1. High Performance with **In-Memory-Data-Grid** which provides high throughput using main memory as primary system of records. It not only resolves bottlenecks with disk based databases, but also helps to deliver results faster to the client.
2. Linear scalability with **partition cluster**. Using Gigaspaces partitioning mechanism large data that does not fit in single space is divided into partitions and assigned partitions to spaces running on separate physical nodes.
3. Dynamic scalability with Gigaspace mechanism to automatically provision new resources when they are needed and scale back when data volumes are low.
4. High Availability with **full space replication**. Gigaspaces synchronous replication capability is used to replicate data with in memory spaces while asynchronous replication capability is used with high latency disk based database.
5. Multi-site data replication over WAN using **mirror gateway synchronization**.
6. Manageability with web based deployment console, administration API and comprehensive monitoring tools makes it easy to monitor & troubleshoot issues in real-time.

Business Impact

1. Enhanced customer satisfaction with ultra-high performance using In-Memory Data Grid. Application is now able to execute 15000 transactions per second.
2. Improved resource utilization through linear & dynamic scalability. Application can now easily handle varying load from 50 – 500 concurrent API calls with predictable performance.
3. Improved business continuity with advance multi-site data replication over WAN and high availability. Each site now acts as failover site for another site.
4. Reduces latency & improves consistency with synchronous replication of data within space and ensures data is immediately available to reporting queries.
5. Reduced operational cost with advance management and monitoring tools.

Technical Solution

Overview

Cybage selected **Space Based Architecture** for the new technical solution. The technologies selected were **Java**, **Spring** and **Gigaspaces XAP** (Extreme Application Platform). The new technical solution was designed by attacking the key limitations with LAMP based solutions.

Old System & Limitations

The LAMP based solutions are largely constrained by MySQL database which becomes performance and scalability bottleneck. The scalability bottleneck is there because it introduces contention among distributed application components. On the other hand performance of MySQL database is constrained by disk I/O performance.

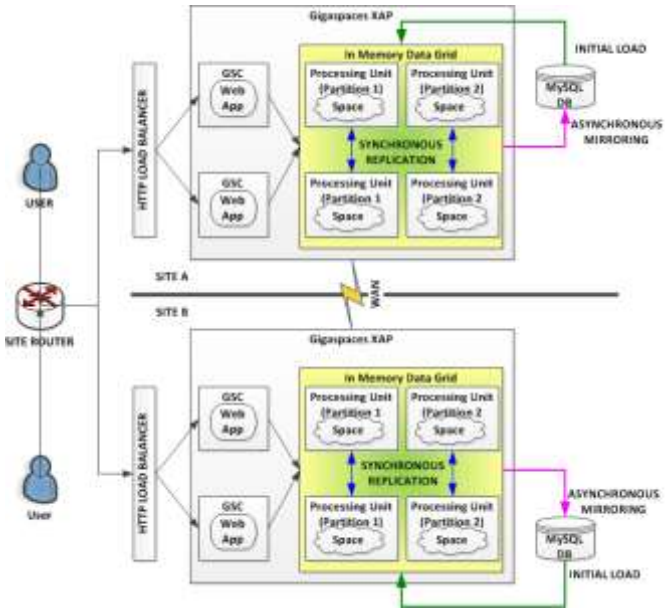
The old LAMP based solution partly addresses scalability and performance issues using database clustering and Memcached (a distributed caching solution). The MySQL database is clustered using Master Slave asynchronous replication. However asynchronous replication causes data inconsistency among databases. The customer is already concerned with data inconsistencies as it is failing many of its reporting queries. On the other hand Memcached only improves performance of read operations. Secondly it is just rudimentary caching solution with no support for transactions and advanced query semantics.

In Memory Data Grid (IMDG)

The key architectural decision made with new solution was to have high bandwidth low latency component that can handle intensive read-write workload. IMDG is not mere caching solution but it provides object-based database capabilities in memory, advance query & transactional semantics, indexing and locking. IMDG being a memory based component provides high performance and scalability. It **eliminates database bottlenecks** and guarantees consistency, ACID transaction, reliability and high availability.

Solution Architecture

Figure 1: Process Architecture



1. User requests are routed to the site that is geographically in close proximity.
2. At the individual site multiple GSC (Gigaspace Container) are configured for high availability.
3. The HTTP load balancer is used to balance the workload evenly between the web applications. With HTTP load balancer in place, additional GSC container and web applications can be linearly added to scale out application based upon the workload.
4. The solution uses IMDG as **Persistence Service.** The IMDG loads it initial state from database.

Once initial state of database is brought into IMDG, it acts as 'system of records' for the application.

5. The IMDG is configured using **'partition with back'** topology. Since database data is large and beyond the capacity of space on single node, it is divided and stored on partitioned spaces on multiple nodes. This enables linear scalability as more nodes can be added to accommodate more data over period of time.
6. The partition cluster uses **hash scheme** when reading and writing objects. The objects hash value is used to determine the partition for routing read/write request.
7. **Synchronous replication** is used between primary & backup partitions for high availability.
8. The IMDG is also configured to keep the database in sync using **asynchronous replication.** Asynchronous replication is used with database to reduce the performance overhead.
9. Transactions are resolved purely in memory to avoid performance and scalability bottleneck with distributed transaction involving database. To ensure transactional integrity with database, all updates are sent to database in batches and if updates to database fails, IMDG will retry those operations till it succeeds.
10. **Multi-site replication over WAN** is configured to enable **site failover**. The topology used for multi-site replication is multi master active-active replication. Reliable asynchronous replication is used to reduce the performance overhead. In the event of failure of primary space, the backup space will ensure missing data is also replicated.

Cybage Contact

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