# Massive Scalability: The Ticket To Compete In Modern Day Banking

## Temenos Highwater Benchmark 2023 Report

August 2023





temenos

# Contents


**Massive Scalability: The Ticket to Compete in Modern Day Banking** 03

The 2023 Temenos Highwater Benchmark 04

The Results: Benchmark 2023 05

Better Performance and Sustainability Go Hand-in-hand 06

**Key Takeaways of the 2023 Benchmark** 07

About the Partners 08

The Temenos Banking Platform 09

The Temenos Benchmark Team 10

**Tech Report: High Water Benchmark – 150K TPS for Retail & BaaS** 11

Abstract 12

Introduction 13

High Level Architechture 13

Benchmark Stack 14

Microservices & Infinity 14

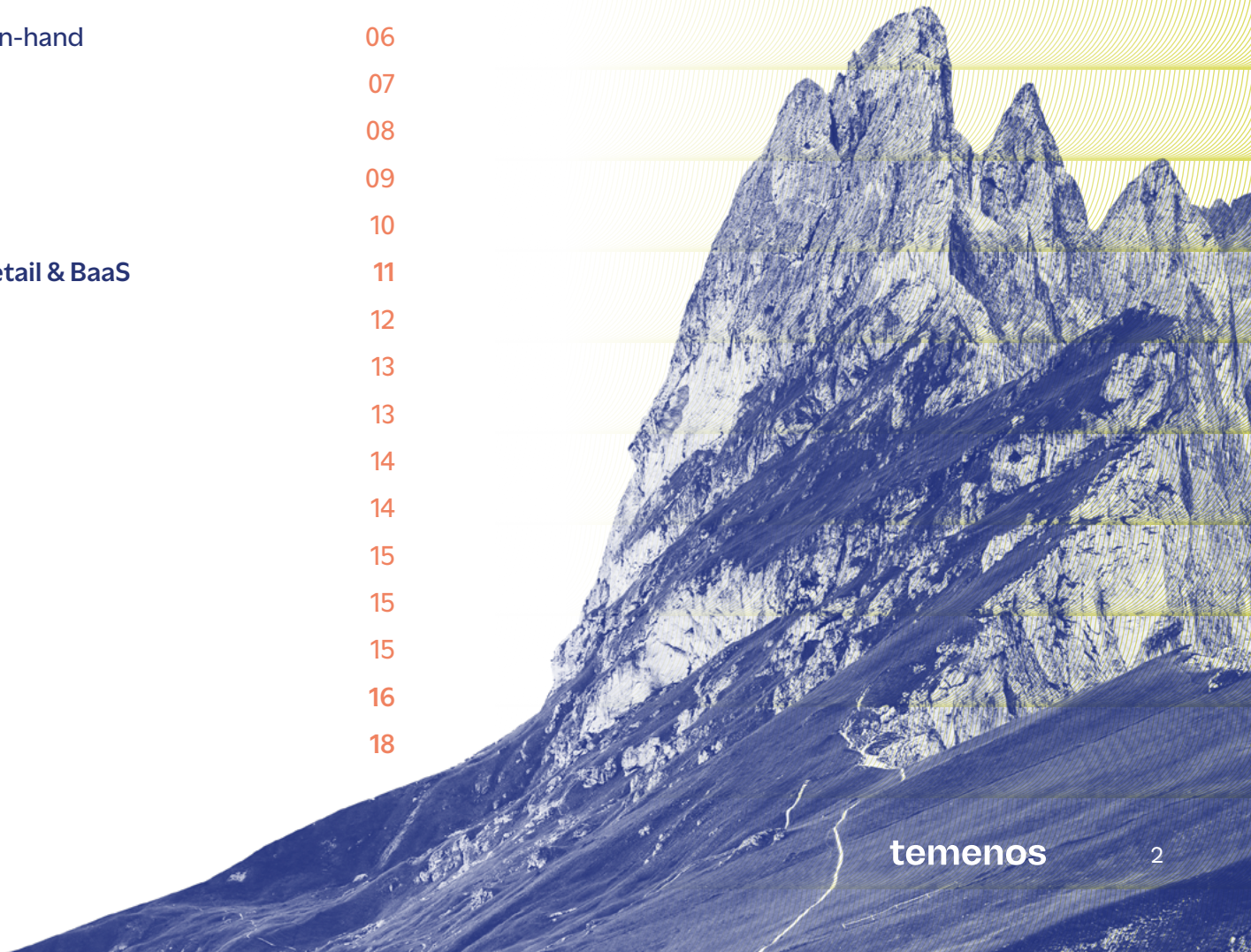
Temenos Payments Hub (TPH) 15

Transaction Mix 15

Summary 15

**Appendix 1: Scalability Test Results** 16

**Learn more** 18

# **Massive Scalability:** The Ticket to Compete in Modern Day Banking



For this year's Temenos Highwater Benchmark, we wanted to move the needle. At Temenos, we see the market moving to new business and distribution models. Banking-as-a-Service (BaaS) and several types of embedded finance services are driving a new generation of banking services, but all share a single prerequisite: highly scalable banking software.

In today's economy, banks are expected to perform around the clock. In a world where consumers are used to instant gratification and have a multitude of options to satisfy their needs, they expect their financial services to function flawlessly. A "please come back later" instantly puts the relationship at risk, as the option to go elsewhere is only a few clicks away.

This extends deeper into the value chain when it comes to embedded finance services. Here, the actual transaction and therefore purchase are directly connected to the ability to execute the enabling financial instrument. As such, flawless and instant delivery of financial services is key, especially as it's part of the buying journey. But, with the rapidly rising popularity of embedded finance and BaaS, performance factors come into play: massive scalability for any transaction volume.

At Temenos, we see our customers building a successful business model around BaaS. Being able to provide financial services, like accounts or loans to brands in Retail and commercial businesses opens a larger audience.

These brands vary from clothing, personal transport, streaming services, airlines, and gaming to marketplaces and operate at their own commercial pace. For example, they demand a minimum performance in the middle of the night but demand huge peaks at particular moments, like Black Friday sales. As such, our customers need efficiency, elasticity, and scalability to deliver on the commercial ambitions of the brands they service, and without exception, they expect it to be delivered in a sustainable and cost-efficient way.

**Efficiency**

**Elasticity**

**Scalability**

**Sustainability**

**Linear**

**Performance**

# The 2023 Temenos Highwater Benchmark

To replicate the needs of these flourishing models in financial services, we defined the benchmark test scenario for 2023. This simulates a larger Retail bank that launches a BaaS proposition to open the door to 50 brands. The hypothesis for this benchmark was to support all these banking models on an instance of software on a single platform, processing a representative transaction mix that was based on live data from our customers.

For 2023, benchmarking was conducted as an end-to-end composed solution with payments, financial crime mitigation (FCM), Data Hub, and digital channels on the Temenos Banking Cloud with the full core banking suite and Temenos Digital Banking. For the Cloud capabilities, the Microsoft Azure platform and the MongoDB Atlas database were used. We also integrated HID, a third party authenticator, replacing the existing authentication method.

## Benchmark test scenario

Retail Bank: 50m Customers and 100m Accounts

Bank launches BaaS proposition

Onboarded 50 brands (using multi-entity), 50m new customers, 200m embedded finance loans

Single platform

### What is the Temenos Highwater Benchmark?

Periodically, Temenos performs a production-like simulation in cooperation with key partners to test the latest release of the Temenos Banking Platform, deployed in a production-representative scenario and stack.

Here, we push the limits of what is possible in terms of elasticity, transaction performance, response times, efficiency, and sustainability. As Temenos invests market-leading R&D into its single platform, the Temenos Highwater Benchmark results help steer our innovation and investments where it matters most for our customers, as they require increasing performance, sustainability, and efficiency in the Cloud.

# The Results: Benchmark 2023




Microsoft Azure

MongoDB.

HID

- End-to-end solution
- Greater mix of transaction
- Full stack including Extensibility Framework

**59%** Average response time improvement

**<10ms** Average query response time

**21ms** Instant Payments response time

**52%** Like for like efficiency improvement

The result shows that banks on the Temenos Banking Platform can live up to the performance and scalability requirements of the near future as banks and non-banks are rapidly expanding in banking-as-as-service propositions.

# Better Performance and Sustainability Go Hand-in-Hand

**76** **Transactions per second per core**

**19%** **Improvement compared to 2022 benchmark**

In recent years, ESG (Environmental, Social, and Governance) has risen in importance on every bank's agenda. The lack of efficiency and therefore carbon impact of authenticated banking technology does not meet the sustainability commitments banks make.

The good news is that the 2023 Highwater Benchmark findings once again indicate an increase in Transactions per Second (TPS) per core of nearly 19% over the previous year. By enabling banks to process higher volumes of transactions while using far less infrastructure than traditional on-premises deployments, they can significantly drive down their carbon footprint and deliver on their ESG goals.






**Tony Coleman, CTO at Temenos presents the Temenos High-water Benchmark results at the Temenos Community Forum 2023 in Vienna.**



# Key Takeaways of the 2023 Benchmark



### Linear scalability

By demanding record scalability of the Temenos Banking Platform and the technology of our partners, we try to achieve linear performance and scalability. The results of this year's Temenos Highwater Benchmark 2023 demonstrates that when the software needs to perform more, the amount of hardware is equally growing. This ensures banks don't have to worry about overall scalability as increased performance is ultimately not requiring an unproportioned amount of hardware that would impact efficiency, sustainability, and performance.

### Scalability: the ticket to compete

As global economy is increasingly moving in the direction of digital experiences enabled by embedded finance models, banks need to embrace scalable infrastructure, operations, and performance to support future growth, to align their technology costs and prepare for future requirements around ESG targets.

### Single platform, strong partners

This benchmark with Microsoft, MongoDB, and HID proves the capability of Temenos' platform to power the world's biggest banks and their BaaS offerings with hundreds of millions of customers efficiently and sustainably in the Cloud.

### Leaner & greener

The benchmark also underscores the advances Temenos has made to provide a leaner and greener infrastructure, helping banks scale efficiently and achieve their sustainability goals. Temenos Cloud architecture elastically scales, enabling banks to process higher volumes of transactions, showing 49% like-for-like improvement for the tested workloads compared to the previous release.

# About the Partners

Every Temenos Highwater Benchmark is a collaborative project, as such we are very thankful to the supporting teams of Microsoft Azure, MongoDB, and HID to deliver these landmark results.

Microsoft Azure

In 2011, Temenos and Microsoft were the first in the industry to bring core banking to the Cloud. Today, the partnership supports financial institutions that leverage the Cloud around the world, including organizations such as Judo Bank, EQ Bank, Virgin Money Australia, ANSA, Banco de la Nación del eru, PBCom, and Varo Bank. The combination of the Temenos Banking Cloud and the Azure Cloud Platform enables banks around the world to leverage modern and trusted Cloud technology that can live up to specific requirements in regions, including data regulation, security, and compliance. Learn more about the Temenos and Microsoft Azure Partnership.

**Learn more about Microsoft Azure for Financial Services**

MongoDB

Temenos and MongoDB joined forces in 2019 and are on the quest to service the widespread, specific, and strict data requirements that banks need. As Temenos provides its platform for banks around the globe, MongoDB is the trusted partner with a developer data platform that enables financial institutions to innovate faster and build modern applications. Moving from legacy technology to a modern data platform has allowed banks to reduce and simplify their data landscape and achieve the greater scalability, high availability, and deployment flexibility that today's applications demand, on-premises or in the cloud.

**Learn more about MongoDB**

HID

HID provides pre-integration solutions that facilitate integrations and customization with the Temenos banking platforms. The solutions include identity verification, authentication and real-time risk management for true fraud prevention with a clear focus on offering the best security without compromising on user experience. HID has been a trusted Temenos partner for over 15 years and powers trusted identities of millions of people in more than 100 countries. Learn more about HID's available solutions as part of the Temenos Exchange ecosystem.

**Learn more about HID**



# The Temenos Banking Platform

The Temenos Banking Platform is the culmination of approximately 30 years of developing model banking software for over 3,000+ customers worldwide. The impressive outcomes of the 2023 Highwater Benchmark are the result of three decades of unrelenting efforts to satisfy ever-evolving demands, requirements, and applications. On a single platform, as a single piece of code, unparalleled R&D creates business value for all of our customers, today and in the future.

On the Temenos Banking Platform, our customers benefit from 1,800+ prebuilt banking processes across Retail, Business, and Corporate Banking, and Wealth Management. The Temenos Banking Platform is a single platform that supports banks of all types and sizes in any region, to create financial services from the broadest breadth and depth of banking services available on any platform. These services are precomposed, prewired, and pretested to launch proven banking services into your sandbox in a matter of minutes and introduce new services rapidly to your customers.

Using the Temenos Banking Platform, is all about choice. Delivered Cloud agnostic, the Temenos Banking Platform can be deployed or consumed to meet the needs of any bank. Depending on the preferences of our customers, regional availability, and applicable legislation, Temenos provides the freedom to deploy, on-premises through Cloud-like deployments or deploy on a hybrid Cloud with various Cloud platforms including Azure, AWS, and OpenShift, or consume the Temenos Banking Cloud as an end-to-end SaaS (Software-as-a-Service) service.

## temenos banking cloud

The **Temenos Banking Cloud** helps banks utilize Temenos banking solutions and Temenos Exchange services through SaaS. Currently, Temenos supports over 700 SaaS customers around the world, and SaaS enables them to rely on a fully supported service that underpins exceptional banking.

- Continuous updates and scale
- Service continuity
- Advanced computing power & modeling
- Governance security & risk
- Breadth depth of service

**EQ Bank**

Building Canada's challenger bank in the Cloud, EQ seamlessly managed a 400% year-on-year increase in transactions thanks to elastic Cloud scalability.

**EQ Bank Success Story**

**flowe**

Italy's most ethical and innovative bank builds on SaaS to deliver intuitive services with minimal environmental impact.

**Flowe Success Story**

**alex.bank**

Alex Bank outpaces Australia's market-leaders with ultra-fast, AI-powered banking services on the Temenos Banking Cloud.

**Alex Bank Success Story**

# The Temenos Benchmark Team

## Leading the Temenos Benchmark Team:



**K Bharath**

Associate Vice President - SaaS - Performance, Benchmarking and Sizing



**Raviteja Penki**

Associate Vice President - SaaS - Performance, Benchmarking and Sizing



**Sathyanarayanan S**

Associate Product Architect - SaaS - Performance, Benchmarking and Sizing

Do you want to learn more about the Temenos Highwater Benchmark? Please don't hesitate to contact the team or Please contact us here.

Author:



**Roel Jansen**

SaaS & Platform Marketing Lead at Temenos

# Tech Report:
# High Water Benchmark
## – 150K TPS for Retail & BaaS



May 2023

# Abstract

The key to the benchmarking is to use a modern database for Transact which is MongoDB Atlas, in addition to the latest platform enhancements. With Temenos Core Banking data backend firmly based on JSON and the document model, MongoDB's developer data platform with a JSON-based document database at the centre is the perfect fit.

This benchmark covers both Banking as a solution (Baas) as well as Retail Suite covering multiproduct implementation constituting largest Transact Suite, microservices such as PartyMS, Holdings MS, SRMS, Virtual Table MS, Infinity and TPH Solutions.

Throughout the document, we will use few acronyms which describes the Product components, Monitoring and Benchmarking terminologies which are illustrated below.

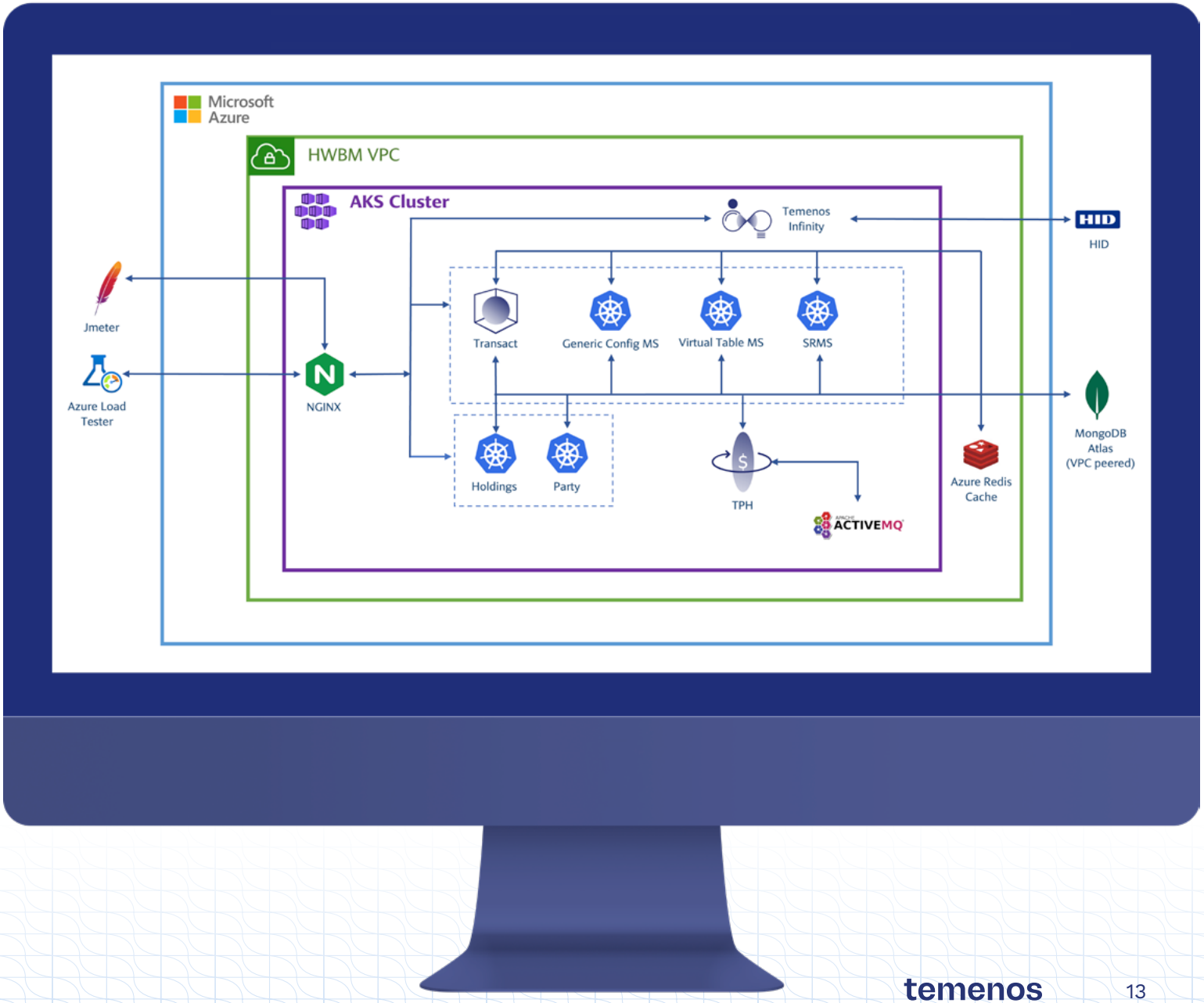
## Acronyms:

| Abbreviation/Term | Expansion/Description |
|---|---|
| HWBM | High Water Benchmark |
| SRMS | Service Request Micro Service |
| TPH | Temenos Payment Hub |
| VT | Virtual Table |
| MS | Micro-Services |
| API | Application Programming Interface |
| TPS | Transaction Per Second |
| Ms | Milliseconds |
| ALT | Azure Load Testing |
| SEAT | System Engineering Automation Tool |
| AKS | Azure Kubernetes Service |
| MDAL | Master Data Access Layer |

# Introduction

In May 2023, Temenos published the high-water benchmark performance results for Temenos Banking Cloud on Microsoft Azure . The benchmark encapsulates one year of innovation at Temenos since the previous benchmark in 2022, resulting in significant advancements for a leaner and greener architecture. The results are a testament to this: 100 million customers and 100 million current accounts, 200 million Loans with 150,000 transactions per second and up to 76 transactions per second per core. This improvement in TPS per core also shows up to 18.75% more efficient compared 2022 benchmarking. In this report, Temenos provides more data and insights to show how the Temenos Banking Cloud architecture elastically scales, automatically enabling banks to process higher volumes of transactions with lesser infrastructure than traditional on-premises deployments and a corresponding reduction in cost and carbon footprint.

# High Level Architecture



# Benchmark Stack

The Benchmarking was carried out on Temenos banking cloud with full Transact Suite on Microsoft Azure platform and MongoDB as the database.

This benchmark proves that Temenos Banking cloud on Azure and using the database MongoDB for both transact and Microservices enables the bank to benefit from scalability, Response time and innovation. Data Events were streamed to Event Hub and Redis was used as a managed service for external caching. The transaction mix covered on this benchmarking supported a typical banking which has Retail as well as Banking as a service.

# Microservices & Infinity

### Holdings Microservices

- Holdings MS is the solution for holding the accounting entries & customer account balances and the Arrangement MS is the solution for holding the basic information of accounts and related concat tables. The functionality of Arrangement MS has been merged with Holdings MS to act as a single microservice covering both functionalities
- Holdings Microservices are being invoked to perform enquiries on account balances, account transactions list, loan balances, loan transactions list and loan details.

### Virtual Table Microservices

- Virtual Table microservice allows user to define data models & services to support any new custom data additions.
- It also provides rest APIs to access any data collection. A data collection represents a data entity maintained in the Virtual Table Microservice. Using the Design Time API, an API has been created to define the data model for the standing order details of customers.
- With the runtime enquiry API, the repayment schedule of the customer has been retrieved.

### Service Request Microservice

- Service Request microservice provides a platform for the bank to define new service requests required for their banking needs
- It offers the ability to define new request types along with its associated mapping and other required configurations to fulfil the request
- Using design time API, a new service request called Repay Loan schema was created. Then using the runtime API, repayment of loan transaction was simulated.

### Party Microservices

- Party Microservices is the solution for managing customer related information. This microservice is invoked to create the customer.

### Infinity

- Infinity application has been integrated with a 3rd party authenticator called HID replacing the existing authentication method. When the Login API is hit, a call goes to HID to produce a OTP for authentication instead of password/token.

# Temenos Payments Hub (TPH)

Temenos Payments Hub (TPH) is a universal payments hub solution. It has Universal Payments Process, which enables centralization of all payment operations under a central infrastructure to support multiple payment formats and global payment mechanisms.

# Transaction Mix

- Model bank suite was used for this Benchmark with externalized cache.
- The Transaction mix used for this benchmark constitutes 12% of Transactions and 88% GETS from Microservice. This is to target both Business as a service ( Baas) as well as retail mix. For Baas the mix includes Loan creation, Disbursement, Repayments. Microservice GETS include Balance Enquiry and TransactionList for both Current accounts and Loans.
- Service request (SRMS) and Virtual table is also added as a part of mix to benchmark the latest innovations in product.

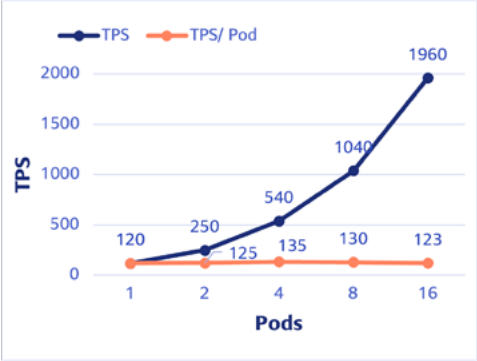
# Summary

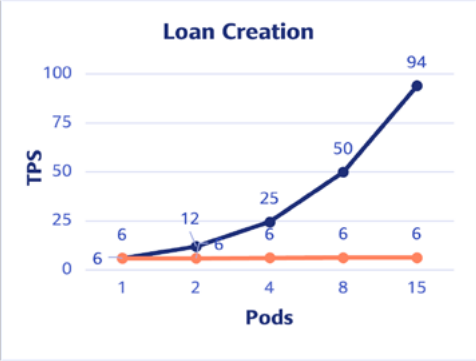
- Benchmark of 50 Million Retail customers and 50 Million Embedded Customers with 100 Million Accounts and 200 Million loans with 150,080 transactions per second and up to 76 tps per core on Azure.
- Funds Reservation response time is 30 ms and achieved 76 tps pre core which is 18.75% More than 2022.
- Query Response time is 11 ms which is 39% improved than 2022.
- New Microservices such as Virtual Tables, ServiceRequest are added in this benchmark with response time <10ms.

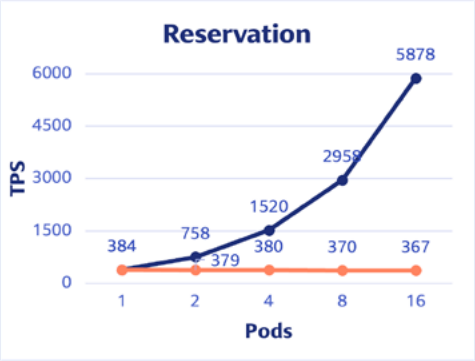
# Appendix 1: Scalability Test Results

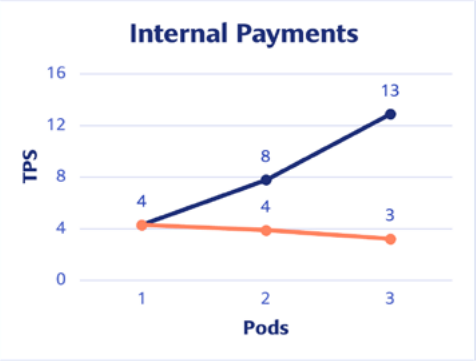
Linear Scalability of Transactions where X Axis are the Pods and Y Axis is the transactions per second.

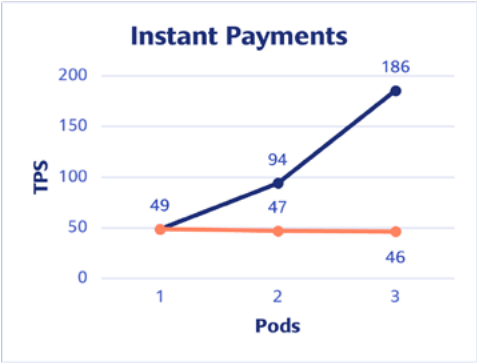


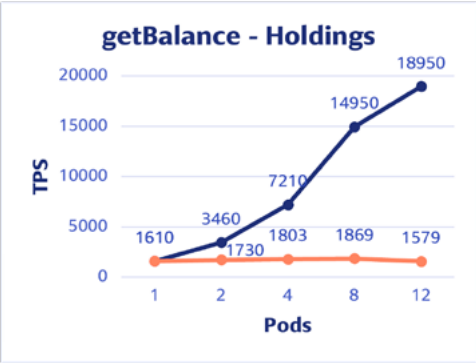



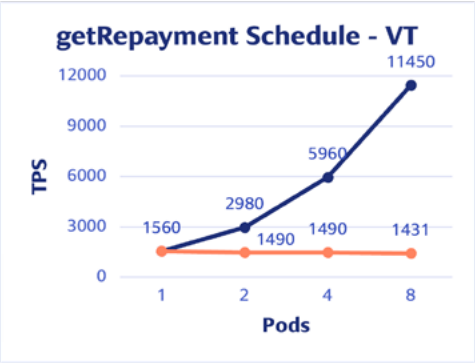



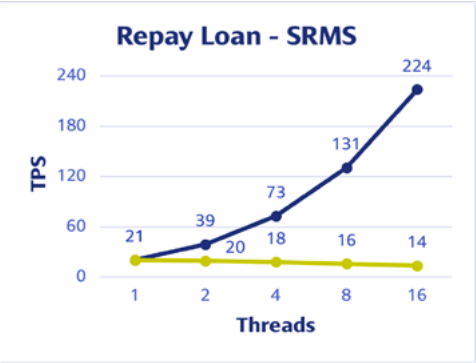



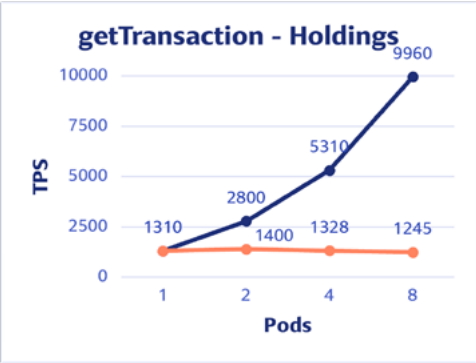



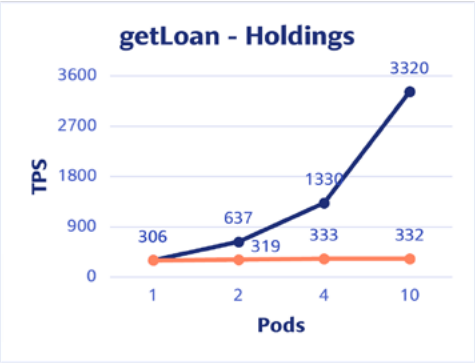



# Transaction Mix

## Transact Stats:

| Queries | | Target | Mix % | Achieved | Achieved Mix | Response Time (ms) |
|---|---|---|---|---|---|---|
| Get Loan Details | Holdings | 25,650 | 17.10% | 25,860 | 17.23% | 18 |
| Get Balance | Holdings | 49,500 | 33.00% | 50,875 | 33.90% | 7 |
| Get Loan Transactions | Holdings | 29,450 | 19.63% | 29,630 | 19.74% | 11 |
| Get Repayment Schedule | Virtual Table | 11,400 | 7.60% | 11,750 | 7.83% | 7 |
| Get TransactionList | Holdings | 15,000 | 10.00% | 15,490 | 10.32% | 11 |
| Login | HID | 1,500 | 1.00% | 830 | 0.55% | |
| **Transactions Post** | | | | | | |
| Booking | CSMBOOK | 10,640 | 7.09% | 6,900 | 4.60% | 146 |
| Reservation | CSMRESERVE | 6,125 | 4.08% | 8,200 | 5.46% | 37 |
| Loan Creation | Arrangement | 90 | 0.06% | 105 | 0.07% | 875 |
| Repayment | SRMS | 90 | 0.06% | 275 | 0.18% | 548 |
| Payments | TPH | 550 | 0.37% | 140 | 0.09% | N/A |
| Customer Create | Party | 5 | 0.00% | 25 | 0.02% | 50 |
| | **TOTAL** | **150,000** | **100.00%** | **150,080** | | |



# Learn more

- The highwater benchmark targeting 150,000 TPS was successfully completed by achieving 150,080 TPS which covers BAAS as well as Retail suite.
- The Individual Transact APIs scaled both vertically and horizontally when the resources scaled in parallel.

Do you want to learn more about the Temenos Highwater Benchmark? Please don't hesitate to contact the team or Please contact us here.

**About Temenos**

Temenos (SIX: TEMN) is the world's leading open platform for composable banking, creating opportunities for over 1.2 billion people around the world every day. We serve two-thirds of the world's top 1,000 banks and 70+ challenger banks in 150+ countries by helping them build new banking services and state-of-the-art customer experiences. The Temenos open platform helps our top-performing clients achieve return on equity three times the industry average and cost-to-income ratios half the industry average.

For more information, visit www.temenos.com

temenos