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Modernizing Banking Accelerating Innovation

Building Secure and Modern
Core Banking Applications on the Cloud



Contents

Introduction	03
Business Drivers and Challenges	04
Leveraging the Cloud to Achieve Successful Transformation	05
Cloud Banking Transformation Journey	08
Temenos Transact on AWS Reference Architecture	10
Conclusion	13
Authors	19





Introduction

Financial Institutions across the globe are actively considering or migrating from legacy dedicated on-premises data center infrastructure to secure, modern applications built on the Cloud. This shift involves either opting to consuming banking solutions as a SaaS Cloud Service as part of their SaaS-First Strategy, or alternatively self-hosting solutions in the cloud. Key considerations around security, scalability and resiliency are top of mind while considering a move to the Cloud for core banking applications, in addition to regulatory requirements.

Amid increasing cloud adoption, the addressable cloud enablement market is forecasted to grow by 20% (CAGR) in absolute dollar value between now and 2026 which is roughly estimated to be of \$23B+.¹

The Triparty Initiative, consisting of Temenos, Tech Mahindra, and Amazon Web Services, has united to support Financial Institutions in their transition to the Cloud. Together, they have developed this specialized whitepaper on cloud migration tailored specifically for core banking clients. This specialized whitepaper is the result of collaboration between Tech Mahindra's Banking Products Centre of Excellence (BP COE) group and the teams from Temenos and Amazon Web Services.

The whitepaper provides an extensive overview of the primary drivers and challenges encountered during the migration of core banking solutions to the Cloud. It covers both the SaaS Cloud Service model offered by Temenos as the SaaS provider on Amazon Web Services (also known as Temenos Banking Cloud), as well as the alternative self-hosted Cloud model on Amazon Web Services. This collaborative effort aims to facilitate and optimize the Cloud enablement journey for financial institutions, offering valuable insights and guidance throughout the migration process.

¹Source: IDC, Ovum, Mckinsey, S&P CapIQ, CB Insights, Temenos estimates.

Business Drivers and Challenges

Depicted here are some of the common business drivers and challenges faced by Financial Institutions upon embarking their Cloud Banking Transformation Journey.

Financial Institutions are now realizing that the risk of maintaining legacy on-premises infrastructure is outweighing the risk of migrating to the Cloud.

These business drivers and challenges faced by Financial Institutions on Cloud migration are perceived as risks by Banks, and are materialized when the organization is not prepared sufficiently for a cloud-first operating model.

The Triparty Initiative between Temenos, Tech Mahindra, and Amazon Web Services offers skills and capabilities to address all these challenges to enable a smooth and successful migration to the Cloud.

The next section describes on how Amazon Web Services as a cloud provider, and Temenos as a SaaS provider, can help address the various technical challenges in the Cloud Banking Transformation Journey.



Leveraging the cloud to achieve successful transformation

According to IDC's 'Role of Technology in the Banking Industry' survey, the largest pain point for Financial Institutions in their digital transformation journey is in maintaining stability of the involved systems, minimizing downtime of their banking platform (47.8%), followed by managing operational risks of migration (43.7%). It also cited that 80% of banks revealed that security/identity and access management will be one of their key focus of technology investments.

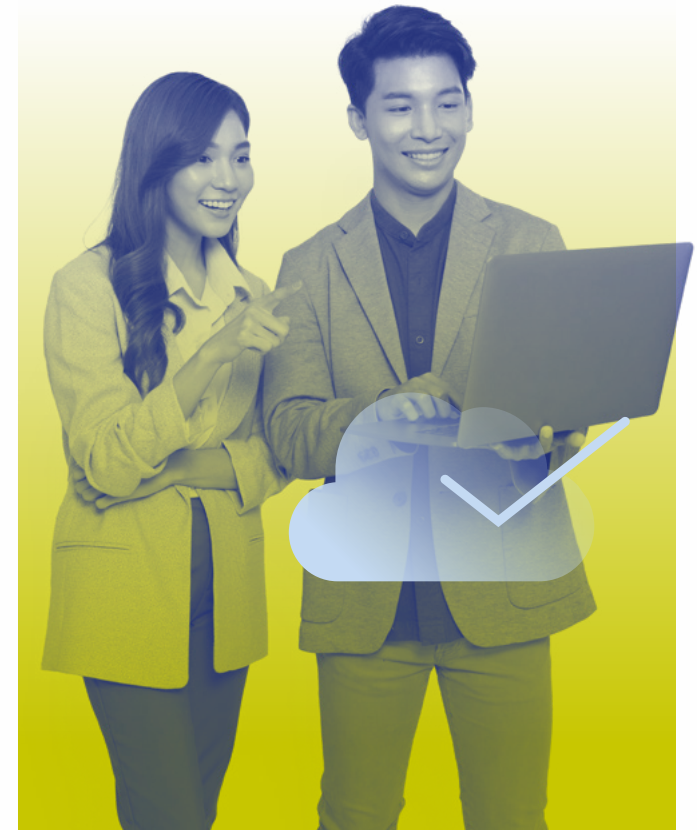
The Triparty Initiative between Temenos, Tech Mahindra, and Amazon Web Services helps Financial Institutions to launch new capabilities quickly and easily with modern core banking systems, improve customer experiences, reduce costs, and drive revenue growth. The important aspects which helps in quickly realizing these goals are discussed in the subsequent sections.

Core Banking Modernization

Financial Institutions are facing tremendous pressure to modernize their core banking platform, from customers who are looking for hyper-personalized products and experiences, and from regulators issuing ever-evolving regulatory and compliance requirements.

Deploying banking capabilities and integration with third-party solutions has been simplified with the advent of technologies such as open APIs, composable banking, and open banking, which are all also offered by Temenos.

Adopting a cloud-native core banking solution provides a secure, cost effective, scalable and resilient infrastructure that enables the banks to be more responsive to the growing needs of their customers, market and regulators. Tech Mahindra (BP COE group) provides access to a large pool of Temenos certified product subject matter experts with over 750 certified consultants. Accelerators such as Infrastructure as Code template automates the deployment of the infrastructure aligned with Temenos reference architecture helps in achieving modernization goals faster.





Some of Temenos product implementation specific tools and accelerators are listed below:

- System Change Manager (SCM) is an automated deployment and release management utility that enables both developers and release managers to control changes to all Temenos Transact technical environments in a centralized manner.
- STA is a regression testing tool which provides standard regression testing templates readily available to deploy for testing.
- Systematic Extract Migration (SEM) is an engine that allows Temenos Transact users to create their own personalized workflows, to expedite the migration.
- Upgrade discovery tool helps identify all the requirements from upgrade perspective.
- MagiX is Tech Mahindra's in-house flagship automation framework designed for test automation, which helps with automating manual tests with minimal efforts, generating early return on investment.
- C-BOT provides daily operation monitoring tool.

Performant and Cost-effective

Temenos on Amazon Web Services delivered by Tech Mahindra as a Temenos SaaS Cloud service model (also known as Temenos Banking Cloud) or as a self-hosted Cloud model, provides the scalability and elasticity to meet application demands and improve performance in a cost and time efficient manner leveraging various tools and enablers developed by the Triparty Initiative. In the [2022 Temenos high-water benchmark](#), performance results were achieved of up to 76 transactions per second per core on Amazon Web Services, using the benchmark of 100 million customers and 200 million deposit accounts with a processing throughput of 100,000 transactions per second. The cloud native architecture reduces total cost of ownership by utilizing Amazon Web Services managed cloud services and dynamically scaling the cloud infrastructure to match customers ever changing and growing demands.



Sustainable transformation

Often the key drivers in migrating to Cloud are based on business agility, scalability, cost savings, operational resilience and security. There's an increasing focus from Financial Institutions to look at the benefits of sustainability and it has become one of their key strategic priorities. According to IDC, 70.6% of banks believe that their ESG strategies will positively impact their profits. AWS Cloud can help reduce the environmental impact on banking IT operations.

In the 451 research, commissioned by Amazon, moving to AWS from on-premises infrastructure can reduce the carbon footprint by more than 78% and is five times more energy efficient compared to on-premises datacenters in the Asia Pacific Region. Amazon co-founded The Climate Pledge, including Amazon Web Services and Tech Mahindra, and more than 400 companies have committed to reach net-zero carbon emission by 2040 which is 10 years ahead of the Paris Agreement.

In addition, the Science Based Target Initiative (SBTi) has validated Temenos' commitment to reduce scope 1, 2, and 3 GHG emissions 50 percent by 2030 from a 2019 base year, aligned with keeping global warming to no more than 1.5°C compared to pre-industrial levels, the most ambitious reduction goal of the Paris Agreement

Observability Strategy

Understanding the key business needs and goals as well as the alignment between business and technology teams are imperative to the success of your observability strategy. The ability to support and run workloads effectively, understand their expected behaviors and gain operational insights is critical in achieving operational excellence. Built on top of Amazon Web Services observability and telemetry services, Tech Mahindra's Smart Monitoring And Resolution Tool (SMART) observability solution provides a single dashboard for all observability needs of Temenos deployments

for the self-hosted cloud option. It provides single pane of glass view, so operations teams can resolve issues faster and make more informed decisions. SMART utilizes the three pillars of observability: logs, metrics, and traces. It also uses machine learning to improve application availability by detecting abnormal application behavior, providing insights and contextual information about the anomaly and actionable recommendations to immediately remediate any potential issues.

Security, Regulatory and Compliance

When Financial Institutions opt to migrate to the Cloud and choose to consume the self-hosted Cloud option, or alternatively pick Temenos Banking Cloud, they encounter diverse risks and regulatory challenges. From evolving regulatory requirements that varies significantly across regions, dynamic security threat landscape, and limited compliance and cloud security resources. Amazon Web Services provides security tools, services and guidance to help customers navigate security and compliance in the cloud. Core infrastructure of Amazon Web Services is built to satisfy the security and regulatory requirements for the global banks and other high-sensitivity organizations. Amazon Web Services supports 143 security standards and compliance certifications, including PCI-DSS, HIPAA/HITECH, FedRAMP, GDPR, FIPS 140-2, and NIST 800-171, helping Financial Institutions satisfy compliance requirements around the globe. Compliance certifications and attestations are assessed by a third-party, independent auditor and result in a certification, audit report, or attestation of compliance.

Furthermore, if any Financial Institution intends to adopt the Temenos Banking Cloud, they can rely on Temenos as their SaaS provider, benefiting from value-added additional support for regulatory compliance. This includes meeting SaaS certifications and accreditations such as SOC 2 and ISO27k series, which are proven and established, given that Temenos already serves 700+ SaaS customers who are subject to regulation by over 30+ regulatory authorities worldwide.

Here is a comparison of the offerings between Temenos Banking Cloud and the Self-hosted Cloud option, with both Tech Mahindra and Amazon Web Services serving as strategic partners.

Business Process Outsourcing / IT Outsourcing Model	
 Self-hosted	 Temenos Banking Cloud
Run the bank	Run the bank
Access to internet	Access to internet
1st line support	1st line support
Change: Configurations & UAT	Change: Configuration & UAT
Direction, oversight and control	Direction, oversight and control
Governance, security & risk assurance	Governance, security & risk assurance
Service continuity (DR & BCP)	Service continuity (DR & BCP)
24x7 NOC, SOC, support desk	24x7 NOC, SOC, support desk
Infra/App management & maintenance	Infra/App management & maintenance
Upgrades & updates	Upgrades & updates
Licence & maintenance	Licence & maintenance
Change development	Change development

Responsibilities

	Bank		Temenos		Partner / Bank
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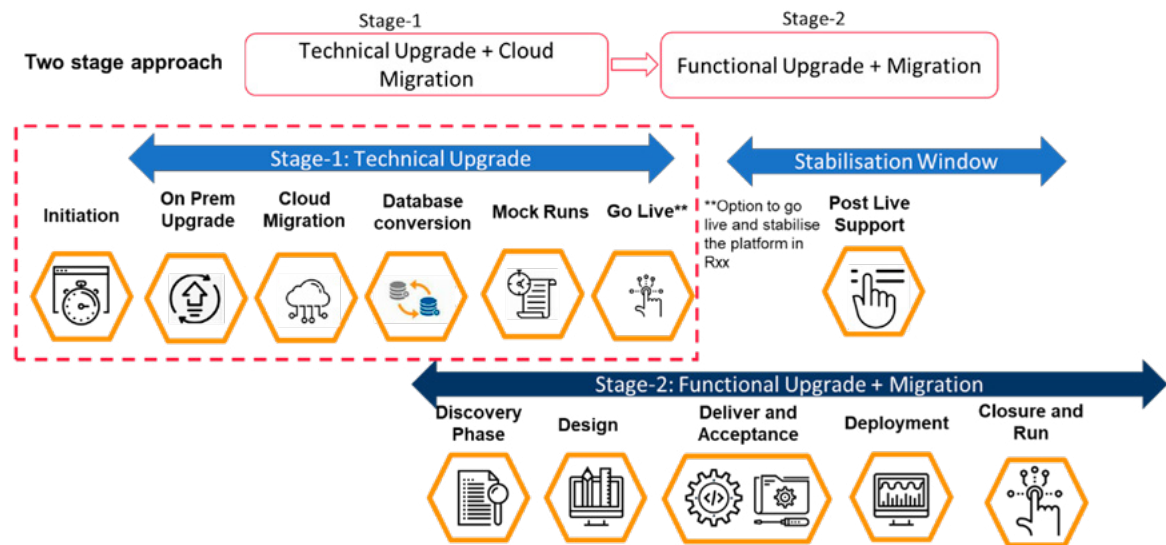
Cloud Banking Transformation Journey

Presented below are the approach for Cloud Migration, that could be handled along with Technical Upgrade and/or Functional Upgrade or Reimplementation of legacy version of Temenos product suite. Based on Tech Mahindra's experience in successfully delivering close to 100 upgrade programs including Temenos Transact and other Temenos banking products, we have come out with an efficient approach for migrating on-premises Temenos applications to Cloud. This approach is equally applicable to both the consumption of Temenos Banking Cloud, or a self-hosted deployment and has already been piloted in Tech Mahindra and Amazon Web Services lab set-up and proven successful. At the time of preparing this whitepaper, there is already an inflight engagement marching towards a successful cloud migration journey.

Tech Mahindra proposes a two staged solution approach for the upgrade as depicted below:

- **Stage 1 – Execution of Technical Upgrade + Cloud Migration**
- **Stage 2 – Functional Upgrade**

Figure 1. Two stage approach on upgrade and cloud migration



Stage 1: Technical Upgrade + Cloud Migration

- Follow the standard upgrade methodology to upgrade Temenos from RX to R23(Latest Temenos Release). Also, if required, perform TAFC to TAFJ conversion on-premises.
- Customized code conversion analysis and conversion activity to be initiated in parallel and in the case of Temenos Banking Cloud, they align with the best practice of no-code and low-code custom development.
- Set up AWS Cloud Environment including observability capabilities (logging, monitoring, alerting), enable code deployment using CI/CD.
- Post cloud environment setup, migrate Temenos Transact R23 to AWS Cloud.
- Finalize database conversion and data migration approach.
- Prepare the standard Runbook for upgrade and fine-tune it through the mock runs and dress rehearsals for upgrade and data migration.
- All integrations are validated and updated.
- Testing is performed to validate functional and technical consistency of the platform.
- Required training will be provided to bank's IT team to highlight the new technical features available as part of the R23.
- On completion of the Mock upgrades and testing, the bank has the option to go live with the stable cloud platform where Temenos products are upgraded to latest release(R23).
- For Temenos Banking Cloud, the Temenos SaaS Operational Readiness Board (ORB) will validate the implementation and offer any necessary recommendations for adjustments to ensure alignment with Temenos' SaaS controls and procedures.

A stable target platform, resulting from this stage will be used for design and build stage of the functional upgrade (Stage 2).

Stage 2: Functional Upgrade

Functional upgrade stage leverages all new functional capabilities which is offered by latest Temenos release to offer new functionalities or reduce technical debt by replacing customized functions by using out of the box functionality wherever possible. Discovery (Analysis) phase for functional upgrade to be started in parallel to the technical upgrade stage (Stage-1), to carry out the functional as well as technical Analysis. Standard design, development and testing cycles aligned to TIM (Temenos Implementation Methodology – best practices for implementing Temenos products) follow for functional upgrade phase.



Transact on AWS Reference Architecture

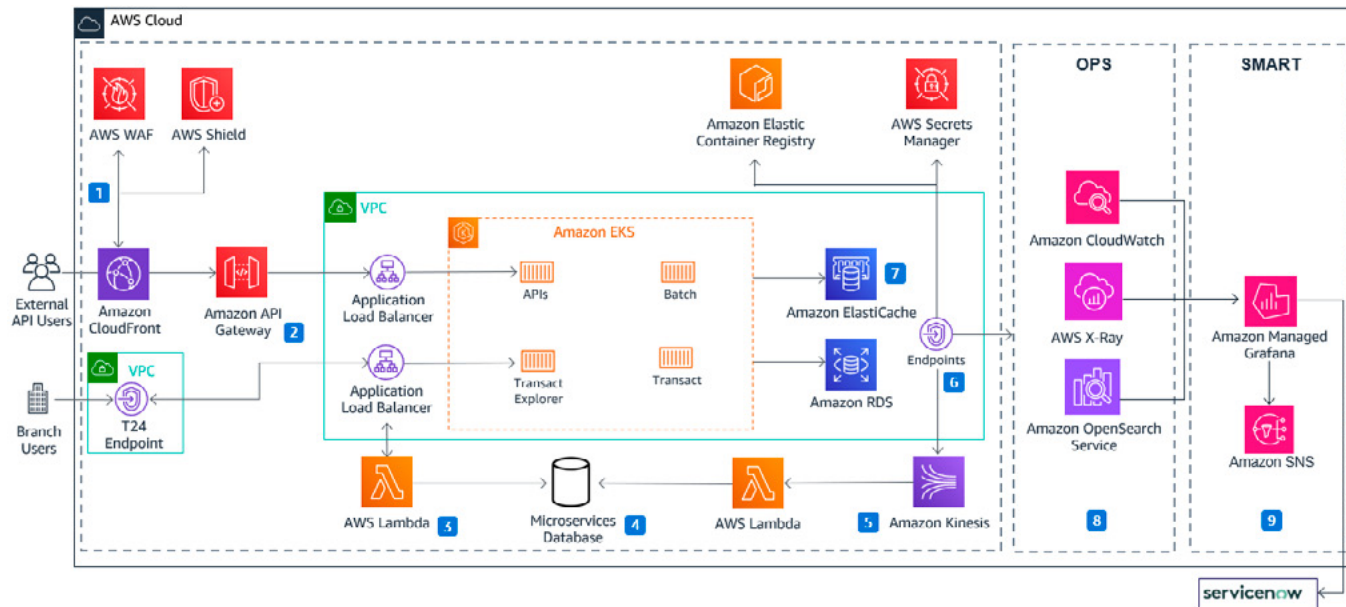
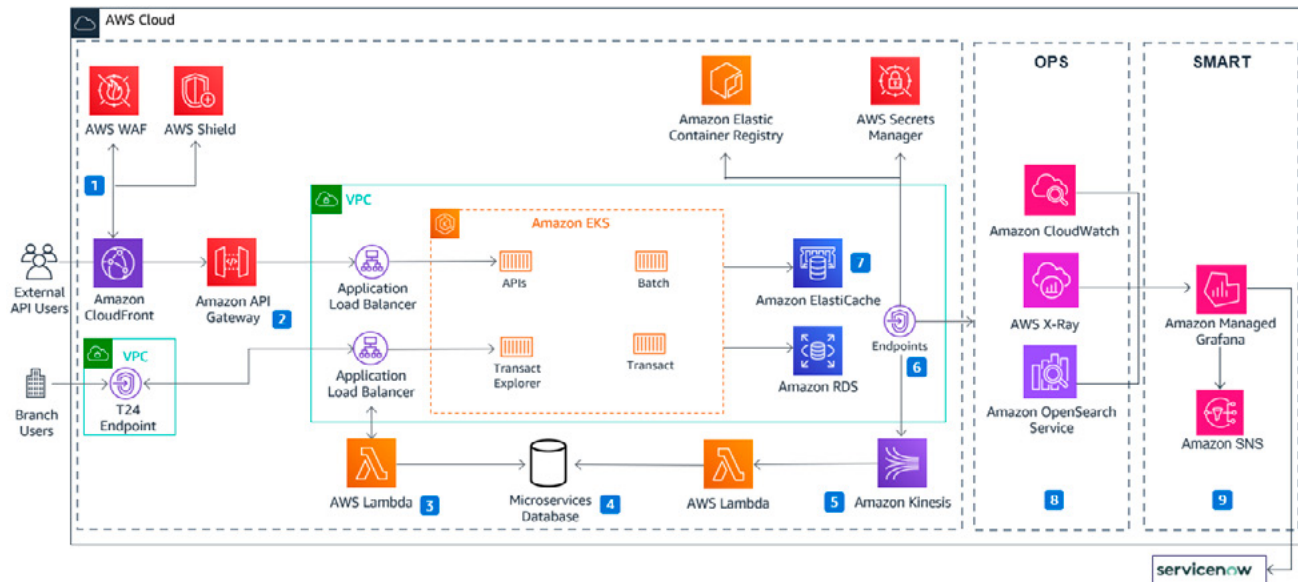


Figure 2. Transact on AWS reference architecture

Highlights about the reference architecture as per numbers marked in diagram:

1. Amazon CloudFront, AWS Web Application Firewall (WAF), and AWS Shield can be used to ensure security and performance for external usage.
2. Access to Temenos Transact is controlled and monitored through the Amazon API Gateway. Amazon API Gateway private endpoints can be used for secure on-premises access through a VPN or AWS Direct Connect.
3. Access to the VPC is available only through AWS PrivateLink. Read-only query activity is handled by AWS Lambda processing and query-optimized Microservices database.
4. Microservices use query-optimized SQL or NoSQL database engines, including Amazon Aurora and MongoDB.
5. Events from Amazon Kinesis Data Streams are ingested into database tables using AWS Lambda.
6. AWS services are accessed from within the VPC through endpoints, which removes the need for internet access.



7. Amazon Relational Database Service (Amazon RDS) is a web service that makes it easier to set up, operate, and scale a relational database in the AWS Cloud. It provides cost-efficient, resizable capacity and manages common database administration tasks. Relational database options include Amazon Aurora, Amazon RDS for Oracle or Amazon RDS for SQL Server. Amazon ElastiCache for Redis is used to cache frequently used data and accelerate key operations.

8. The transact resources are instrumented by Amazon CloudWatch, AWS X-Ray, and Amazon OpenSearch Service.

- Amazon CloudWatch: SMART uses CloudWatch logs to capture webserver logs, and then uses metric filters to derive metrics out of webserver logs. These metrics are used to derive application status and compute availability and latency Service Level Indicators (SLIs).

- AWS X-Ray: SMART leverages the AWS X-Ray traces from instrumented applications to derive application status and compute availability and latency SLIs.
- Amazon OpenSearch Service: SMART leverages the logs captured in OpenSearch domain through Filebeat and Logstash to derive application status and compute availability and latency SLIs.

9. TechM's SMART solution uses Amazon Managed Grafana to visualize and analyze operational data. It relies on different data sources to connect and query the aggregated data instrumented by the AWS services under the OPS group depicted in the architecture. The relevant metrics, logs, and traces can be queried and visualized. The SMART Alarm module helps configure CloudWatch alarms and provide customized notifications to users. In addition, supports integration with ITSM tools (like ServiceNow).



1. Amazon API Gateway HTTP API connects directly to the Application Load Balancer via VPC Link resource.
2. Amazon Elastic Kubernetes Service (Amazon EKS) containers can run on AWS Fargate, or a combination of both AWS Fargate and Amazon EC2. Containers can also be run on Amazon Elastic Container Service (Amazon ECS).
3. All container services use automated scaling capabilities to elastically adapt to expected and experienced demand.
4. Amazon RDS Multi-AZ deployment supports high availability for your application, it synchronously replicates the data to a standby instance in a different AZ. If a failure is detected, it will automatically failover. Relational database options include Amazon Aurora, Amazon RDS for Oracle or Amazon RDS for SQL Server, Yugabyte and MongoDB.
5. AWS Regions provide multiple physically separated and isolated Availability Zones, which are connected with low-latency, high-throughput, and highly redundant networking. This architecture diagram depicts two Availability Zones, but it can be extended to three Availability Zones.
6. As a managed service, Amazon CloudWatch, AWS X-Ray, Amazon OpenSearch, and Amazon Managed Grafana are protected by AWS global network security. You can use interface VPC endpoints to enable private communication between these AWS services and Amazon VPC. User authentication for each Amazon Managed Grafana workspace can use either IAM Identity Center, SAML, or both.

The following diagram provides further details on the VPC and network architecture:

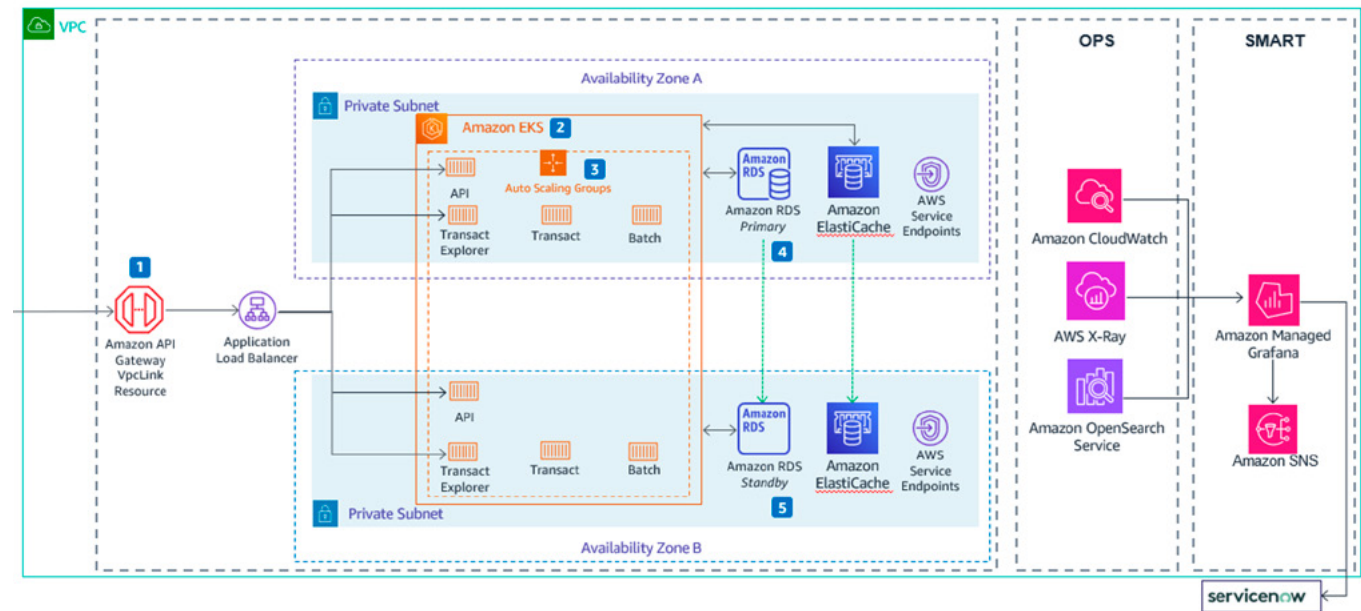
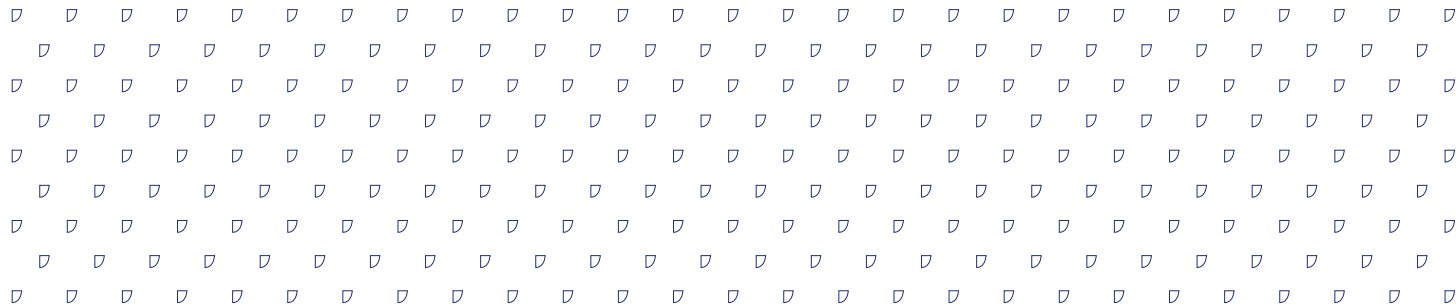


Figure 3. Transact on AWS VPC and network architecture



Conclusion

Amazon Web Services, Tech Mahindra, and Temenos - having already established a strong global strategic partnership - have come together to provide a framework that provides clarity on how the core modernization vision can come together for Financial Institutions in a multi-vendor environment with partners who are committed to proactively working together in order to mitigate the program risks. This framework alleviates any concerns or worries Financial Institutions may have when they embark on the Core-to-Cloud journey, enabling core banking platform on AWS Cloud and go-to-market at speed.

- This triparty joint synergy is designed to: Bring together the proven capabilities of Global Strategic Partners - AWS Cloud, Temenos Core Banking and Tech Mahindra Implementation Services
- Provide a 'ready-to-use' strategy and approach for Core-to-Cloud journey
- Lay out the detailed foundation for project success requiring active participation from involved parties within their well-established boundaries
- Guide the project to success with comprehensive implementation methodology based on industry best practices
- Reinforce commitment to timely reviews and actions from all parties via multi-lateral governance framework at project team and executive levels

About Amazon Web Services

Since 2006, Amazon Web Services has been the world's most comprehensive and broadly adopted cloud. AWS has been continually expanding its services to support virtually any workload, and it now has more than 200 fully featured services for compute, storage, databases, networking, analytics, machine learning and artificial intelligence (AI), Internet of Things (IoT), mobile, security, hybrid, virtual and augmented reality (VR and AR), media, and application development, deployment, and management from 99 Availability Zones within 31 geographic regions, with announced plans for 15 more Availability Zones and five more AWS Regions in Canada, Israel, Malaysia, New Zealand, and Thailand. Millions of customers—including the fastest-growing startups, largest enterprises, and leading government agencies—trust AWS to power their infrastructure, become more agile, and lower costs.

AWS is a pioneer at the intersection of financial services and technology, enabling our customers to optimize operations and accelerate innovation through the broadest set of services and partner solutions—all while adapting to ever-changing regulations. Thousands of financial services firms, from the fastest-growing fintechs to systemically important financial institutions, are redefining their future on AWS.

To learn more about AWS for financial services, visit <https://enterprise-resources.awscloud.com/fsi>

About Tech Mahindra

Tech Mahindra offers innovative and customer-centric digital experiences, enabling enterprises, associates, and society to Rise for a more equal world, future readiness, and value creation. It is a USD 6.5+ billion organization with 148K+ professionals across 90 countries helping 1250+ global customers, including Fortune 500 companies. It is focused on leveraging next-generation technologies including 5G, Metaverse, Blockchain, Quantum Computing, Cybersecurity, Artificial Intelligence, and more, to enable end-to-end digital transformation for global customers. It is the only Indian company in the world to receive the HRH The Prince of Wales' Terra Carta Seal for its commitment to creating a sustainable future. It is the fastest growing brand globally in 'brand value rank' and among the top 7 IT brands globally in brand strength with AA+ rating. With its NXT.NOWTM framework, Tech Mahindra aims to enhance 'Human Centric Experience' for its ecosystem and drive collaborative disruption with synergies arising from a robust portfolio of companies. It aims at delivering tomorrow's experiences today and believes that the 'Future is Now'.

Tech Mahindra is the part of the Mahindra Group, founded in 1945, one of the largest and most admired multinational federation of companies with 260,000 employees in over 100 countries. It enjoys a leadership position in farm equipment, utility vehicles, information technology and financial services in India and is the world's largest tractor company by volume. It has a strong presence in renewable energy, agriculture, logistics, hospitality and real estate. The Mahindra Group has a clear focus on leading ESG globally, enabling rural prosperity and enhancing urban living, with a goal to drive positive change in the lives of communities and stakeholders to enable them to Rise.

Connect with us on www.techmahindra.com

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 3000 banks from the largest to challengers and community 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, please visit www.temenos.com



About Tech Mahindra and Temenos

Tech Mahindra (TechM) is a leading **Temenos Global Partner** marking **22 years of excellence**. TechM is uniquely positioned to deliver this project with its **750+ consultants** skilled on Temenos solutions and having served more than **260 clients** across geographies, delivering entire range of Temenos products & services.

TechM has expertise across the entire Temenos product suite covering Transact (T24), Infinity, Temenos Payments Hub (TPH), Wealth (TAP), FCM, and Analytics. TechM is also investing a lot in training and certification, with **1350+ TLC Certifications** (Temenos Learning Community) and over **300 TLC memberships**.

Global Temenos Partner

22+ years of partnership

260+ clients served

450+ projects executed



750+ Temenos consultants

1350+ Certifications

300+ TLC Memberships

Certified Talent Pool

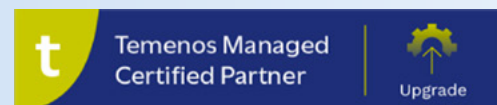


Global development, upgrade, & financial inclusion partner

Expertise across Temenos products - Transact, Infinity, TPH, FCM, Analytics

Digital banks, Retail & Corporate banking, Wealth & Private banking, Islamic banking, etc.

TechM is **Temenos Certified Services Partner, Managed Upgrade Certified Partner and Managed Migration Certified Partner**.



During this long association, TechM has been selected by the Temenos customers as **“Temenos Service Partner of the Year”** in the Temenos Community Forum (TCF) in the ear 2013, 2016 & 2017. TechM also received **Big on Operations in 2020** and has enhanced our alliance with Temenos.

Tech Mahindra has vast experience of serving clients covering various services like implementation, Upgrade, Testing, Integration, Consulting, Application Maintenance & Enhancement. Tech Mahindra's implementation methodology is fully aligned with Temenos recommended Implementation Methodology in Agile and Waterfall models. With deep expertise in Temenos products and technologies, various tools and accelerators are developed to ensure superior quality, faster execution and cost-effective solution.

TechM has a dedicated Temenos Testing COE for Temenos solutions, providing Testing as a Service (TaaS) – a model bank driven test packs and tools offering that covers the testing requirements for Temenos solutions and the wider end-to-end landscape. Tech Mahindra has also developed Testing automation solution for Temenos products and has expertise in implementing Temenos solution in Cloud and working with Temenos Banking Cloud.

Tech Mahindra's understanding and expertise with all aspects of services for the full end-to-end sustainment of Temenos systems provides tremendous insight and understanding of the needs and risks of any project. Tech Mahindra engages its onsite and offshore teams in the best combination to provide cost effective solutions for its clients while maintaining quality assurance, with its success proven through the satisfaction of its clients.



temenos

2013

Service Partner
of the Year



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2016

Service Partner
of the Year



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2017

Service Partner
of the Year



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2020

Big on
Operations



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**TECH
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Temenos Proficiency and Centre of Excellence

- 22 years+ Temenos Implementation experience
- 750+ Temenos consultants
- Global Certified Temenos partner with end-to-end capability



Scalability World-wide presence

- ODC in India with 200+ professionals
- 4 centres of excellence around the globe
- Delivery capability in APAC, UK, Europe, MEA, and Americas



Delivery Track Record & Experience

- More than 70 successful Temenos end-to-end implementations worldwide
- Comprehensive testing capabilities
- Managed upgrade factory delivering 75+ successful projects



Trusted Advisors Credibility

- A seasoned authority on Temenos solutions across all Temenos products
- Experienced and certified resources in Temenos solutions, 1350+ certifications
- Temenos Services Partner of the Year awards



Strategic Partnerships

- Temenos' first-ever implementation partner
- Expertise in various Temenos products - Transact, Infinity, Payments, FCM, Analytics
- Partners with Fintechs in Temenos Marketplace

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