

Choosing a platform for the Temenos Transact banking solution

A platform comparison of IBM LinuxONE III versus x86



Platform choices

Banks looking for a core banking solution like the Temenos Transact™ banking solution¹ wish to determine the most effective platform for IT infrastructure savings and business requirements. Increasingly, clients are observing the advantages of Temenos Transact on IBM LinuxONE.

Temenos Transact is a banking solution suite with a Java™ application framework developed by Temenos Headquarters S.A., a provider of banking software systems for banks and financial service companies with customers in 145 countries worldwide.²

For years Temenos and IBM have collaborated on Temenos Transact solutions and have jointly supported multiple releases on IBM platforms. To examine the efficacy of IBM LinuxONE III for the Temenos Transact R19.08 banking solution, IBM and Temenos conducted benchmark testing to examine LinuxONE functional, performance and platform specific capabilities. This paper describes findings from Temenos performance testing on LinuxONE and x86, and examines IT costs when running Temenos Transact on both platforms.

Temenos Transact on LinuxONE versus x86

IBM and Temenos conducted performance tests with the Temenos Transact R19.08 banking solution on IBM LinuxONE III and compared the results with x86 performance data for comparable use case scenarios. Testing involved running a combined online workload using a representative mix of workloads for a retail bank with over 3,000 transactions per second (TPS). The data was then used to build 3-year total cost of ownership (TCO) models for five use case scenarios based on client transaction per second (TPS) requirements (100, 500, 1,000, 1,500 and 2,000 TPS) to compare banking IT operation costs on both LinuxONE and x86.

Temenos Transact on LinuxONE performance benefits

IBM and Temenos testing observed significant advantages with LinuxONE in terms of transactions per second, transaction response time (latency) and lower database capacity requirements compared to x86 on-prem and x86 private cloud environments.

Transactions per core

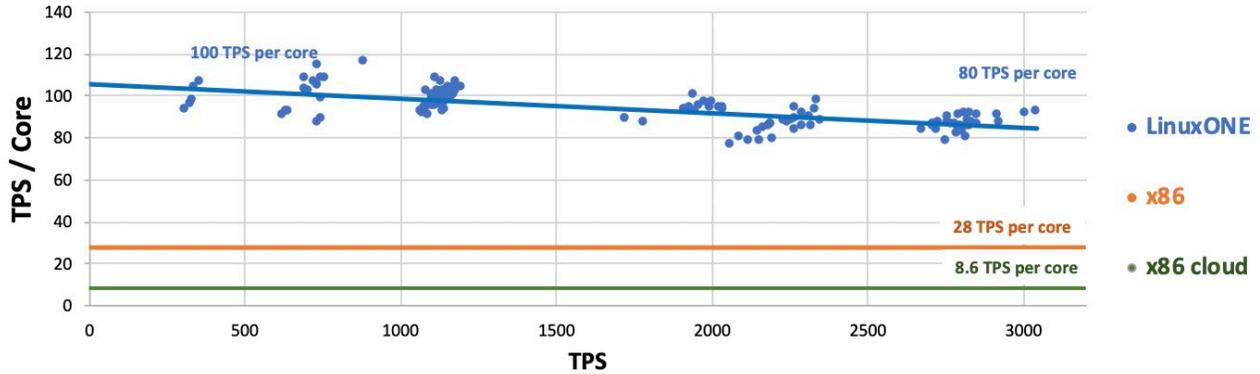
Lab testing found that Temenos Transact R19 on LinuxONE III LT1 provides over 80 TPS per core versus 28 TPS per core on compared x86 servers or 8.6 TPS per core in x86 public cloud environments³, offering increased transaction throughput and scalability for growing workloads. Testing also observed that for smaller TPS requirement use cases, for example the 500 TPS use case, LinuxONE III LT1 can deliver over 100 TPS per core (see Application Server Transactions Per Second (TPS) Per Core graph).

¹ Temenos Transact was formerly called Temenos T24 <https://www.temenos.com/us/news/2020/03/06/t24-is-now-temenos-transact/>

² <https://www.temenos.com/us/products/transact/>

³ Results were achieved using JMeter to drive transactions in a simulated client banking transaction environment using MQ to measure average transactions per second (TPS) and response time. Temenos Transact testing was performed at IBM on a LinuxONE III LT1 system with 52 IFLs to reach more than 3,000 TPS. Temenos testing was performed on Sandy Bridge x86 servers in both cloud and x86 on-prem environments. x86 results were extrapolated for newer x86 chipsets. TPS results were obtained under laboratory conditions, not in an actual customer environment. Results will vary.

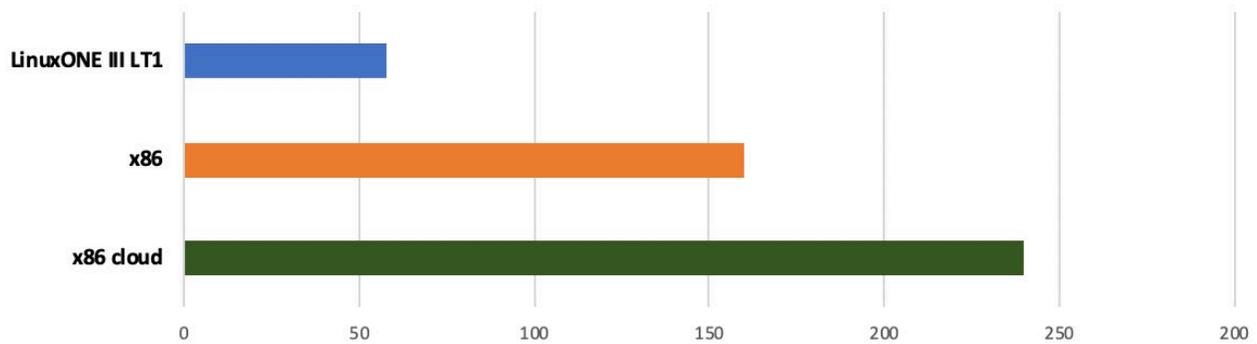
Application Server Transactions Per Second (TPS) Per Core for Temenos Transact R19 on LinuxONE, x86 and x86 cloud



Response time

LinuxONE is able to maintain low latency, enabling swift transaction response time. Temenos Transact R19 on LinuxONE III LT1 enables completion of transactions (58 milliseconds) in one third of the time of compared x86 servers (160 milliseconds) and one fourth of the time of x86 public cloud environments (240 milliseconds).⁴

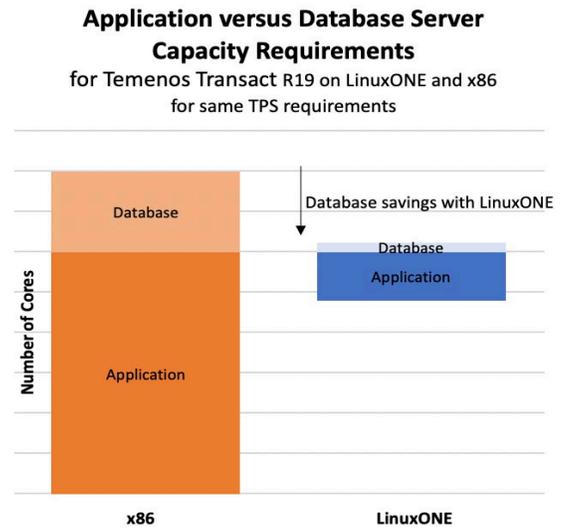
Average Response Time (milliseconds) for Temenos Transact R19 on LinuxONE, x86 and x86 cloud



⁴ Results were achieved using JMeter to drive transactions in a simulated client banking transaction environment using MQ to measure average transactions per second (TPS) and response time. Temenos Transact testing was performed at IBM on a LinuxONE III LT1 system with 52 IFLs to reach more than 3,000 TPS. Temenos testing was performed on Sandy Bridge x86 servers in both cloud and x86 on-prem environments. x86 results were extrapolated for newer x86 chipsets. TPS results were obtained under laboratory conditions, not in an actual customer environment. Results will vary.

Database requirements

Low latency can improve database performance and can decrease database capacity requirements. While Temenos Transact users tend to size approximately one third of application capacity for estimated database capacity, lab testing found that Temenos Transact R19 on LinuxONE III LT1 uses one fifth of the capacity of its application servers for its database capacity versus one third of the capacity of its application servers for the same database capacity on compared x86 servers.⁵ Less required database capacity can reduce infrastructure, maintenance efforts and costs.



Temenos Transact on LinuxONE financial benefits

IBM and Temenos examined the financial impact of running the Temenos Transact R19.08 banking solution on IBM LinuxONE III versus an x86 server environment. To analyze costs, a three-year TCO model was built for each of the five TPS requirement use cases using LinuxONE III and x86 servers. Each TCO model included acquisition and maintenance hardware costs, software, floor space, energy, networking and disaster recovery costs based on data from client environments in IBM IT Economics assessments with the following assumptions.

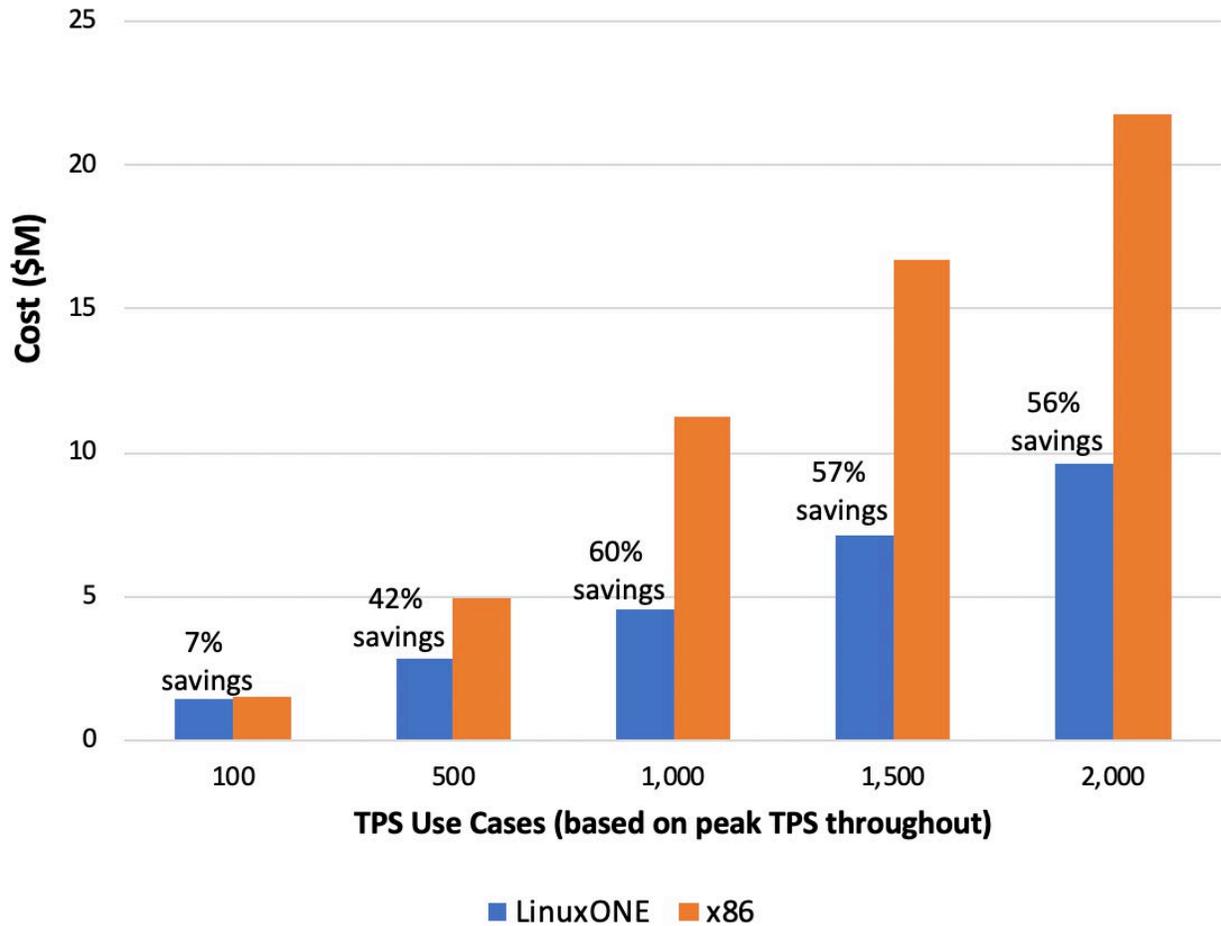
- All scenarios assumed 15% year-to-year production capacity growth based on peak TPS.
- The models included an additional 100% of production capacity to estimate non-production environments (development, test and quality assurance).
- All use case scenarios included a disaster recovery environment that required an additional 100% of production environment resources.
- All use cases were modeled with the smaller LinuxONE III LT2 system since TPS requirements over three years could be satisfied within the maximum number of available Integrated Facility for Linux (IFLs) in the smaller server.

Due to LinuxONE performance and workload density advantages, all models showed significant savings over three years. Depending on the infrastructure required for different client transaction throughput requirements (100, 500, 1,000, 1,500 and 2,000 TPS), total cost of ownership savings over three years with LinuxONE ranged from 7% for a 100 TPS use case, 42% for a 500 TPS use case, 60% for a 1,000 TPS use case, 57% for a 1,500 TPS use case, to 56% for a 2,000 TPS use case versus the compared x86 environments.⁶

⁵ Results were achieved using JMeter to drive transactions in a simulated client banking transaction environment using MQ to measure average transactions per second (TPS) and response time. Temenos Transact testing was performed at IBM on a LinuxONE III LT1 system with 52 IFLs to reach more than 3,000 TPS. Utilized application cores versus database cores data showed that LinuxONE used one fifth of application cores compared to database cores, while x86 data showed that utilized database capacity correlates to one third of application capacity. Temenos testing was performed on Sandy Bridge x86 servers in both cloud and x86 on-prem environments. x86 results were extrapolated for newer x86 chipsets. TPS results were obtained under laboratory conditions, not in an actual customer environment. Results will vary.

⁶ An IBM IT Economics total cost of ownership three year model was used to examine LinuxONE and x86 hardware, software, floor space, energy, networking and disaster recovery costs. Five use cases based on transaction throughput requirements, measured in transactions per second (TPS), were analyzed using LinuxONE III LT2 servers with 9 IFLs versus 42 utilized x86 cores on 11 16-core Skylake x86 servers for the 100 TPS use case, 31 IFLs versus 180 utilized x86 cores on 17 16-core Skylake x86 servers for the 500 TPS use case, 59 IFLs versus 360 utilized x86 cores on 17 32-core Skylake x86 servers for the 1,000 TPS use case, 90 IFLs versus 540 utilized x86 cores on 23 32-core

3-Year TCO Comparison for Temenos Transact R19 on LinuxONE and x86



Skylake x86 servers for the 1,500 TPS use case, and 124 IFLs and 717 utilized x86 cores on 15 80-core Cascade Lake x86 servers for the 2,000 TPS use case. Both environments included RHEL, a web application server, and a relational DB with high availability support. Prices, where applicable, are based on U.S. prices as of February 2020 from client data in IT Economics assessments with 40% discounting. x86 hardware pricing is based on IBM analysis of U.S. prices as of 06/10/2020 from IDC. The cost model assumes 15% annual growth of peak TPS to project production capacity. An additional 100% of production capacity was projected to provision development, test, and QA environments, and an additional 100% of production capacity was projected for a remote site for disaster recovery. LinuxONE and x86 TPS sizing requirements used in the cost model were extrapolated for LinuxONE III LT2 based on results obtained under laboratory conditions on LinuxONE III LT1, not in an actual customer environment. Results will vary.

Summary of Cost Case Results

| TPS Use case | Platform | # of Cores | # of Cores | # of Cores | 3-Year TCO (\$M) | 3-Year TCO % Savings |
|--------------|------------------|----------------------------|---------------------------|---|------------------------------------|--------------------------------------|
| Peak TPS | LinuxONE or x86 | Production only, no growth | In year 1 for all servers | At end of year 3 with 15% annual growth for all servers | Accumulated costs over three years | TCO percentage savings with LinuxONE |
| 100 | LinuxONE III LT2 | 3 (2.2 required) | 9 | 9 | \$1.43M | 7% |
| | X86 | 14 | 42 | 57 | \$1.55M | |
| 500 | LinuxONE III LT2 | 11 | 31 | 39 | \$2.85M | 42% |
| | X86 | 60 | 180 | 240 | \$4.94M | |
| 1,000 | LinuxONE III LT2 | 23 | 59 | 77 | \$4.53M | 60% |
| | X86 | 120 | 360 | 479 | \$11.28M | |
| 1,500 | LinuxONE III LT2 | 36 | 90 | 121 | \$7.16M | 57% |
| | X86 | 180 | 540 | 717 | \$16.73M | |
| 2,000 | LinuxONE III LT2 | 49 | 124 | 164 | \$9.62M | 56% |
| | X86 | 239 | 717 | 953 | \$21.75M | |

TCO model findings

- LinuxONE delivered better price/performance ratios in all TPS use case scenarios.
- LinuxONE III LT2 provides seamless scale up with a single production server for use cases requiring up to 3,200 TPS. LinuxONE III LT1 can be used to support 3,200 or more TPS use cases. In contrast, increasing TPS requirements over time could require deploying more physical x86 servers to satisfy transaction volume growth. Server deployment can drive incremental cost and administration effort.
- When peak transaction volume reaches 1,000 TPS, larger 32-core servers might be required to support database servers with higher peak TPS levels and anticipated annual workload growth. Larger x86 servers would need to be acquired, installed and maintained, resulting in incremental effort and cost. Alternatively, LinuxONE III LT2 can still provide sufficient buffer to support further growth, without the need for hardware upgrades.
- When peak transaction volume reaches 2,000 TPS, 80-core or larger x86 servers may be required to support database servers with even higher peak levels, while the same LinuxONE III LT2 server can support up to 3,200 TPS.
- With a maximum capacity of 190 cores in a LinuxONE III LT1, a dual server configuration with two LinuxONE III LT1 servers in the main data center can potentially support up to 8,000 TPS.

Why LinuxONE reduces cost

IBM LinuxONE is a centralized, 100% Linux[®], enterprise server designed for large data serving and Transactional applications⁷. It is designed for the highest level of HSM security (FIPS 140-2 Level 4, EAL 5+ certification) to protect against cyber-attacks and other security threats.

LinuxONE servers are engineered to deliver essential business-critical quality of services such as high availability, security, scalability and reliability through the following capabilities:

- Security with on-chip cryptographic performance to provide faster encryption of data in-flight and at-rest and pervasive encryption⁸
- Pervasive encryption features with HSM-based key management⁹ and Secure Service Containers¹⁰ to reduce security risks and facilitates compliance with security standards such as General Data Protection Regulation (GDPR)
- Large-scale server workload consolidation¹¹
- Seamless scaling to meet changing business requirements
- Java pause-less garbage collection capabilities that reduce pause duration and avoid potential impacts to Transaction response time
- Simultaneous Multi-threading (SMT) capabilities providing significant performance advantages¹²
- Reduced planned and unplanned downtime¹³
- Virtualization and system management tools to simplify and expedite administration¹⁴
- Lower administration costs compared to distributed server environments¹⁵
- GDPS[®] for robust disaster recovery processing¹⁶
- Average high sustained CPU utilization that enables consolidation of many workloads onto a single server¹⁷

⁷ <https://www.ibm.com/it-infrastructure/linuxone>

⁸ <https://www.ibm.com/security/cryptocards/hsms>

⁹ <https://www.ibm.com/downloads/cas/3V7EY7N9>

¹⁰ <http://www.redbooks.ibm.com/redbooks/pdfs/sg248447.pdf>

¹¹ <https://www.ibm.com/downloads/cas/G3QK9D8V>

¹² <http://www.redbooks.ibm.com/abstracts/redp5144.html?Open>

¹³ ITIC server reports <https://itic-corp.com>

¹⁴ <https://www.ibm.com/it-infrastructure/z/zvm>

¹⁵ <https://www.ibm.com/downloads/cas/XBZ7DOJM>

¹⁶ <https://www.ibm.com/it-infrastructure/z/technologies/gdps>

¹⁷ IBM internal tests show that application servers and databases exhibiting high-peak-to-average levels of workload demand in a distributed architecture running on average at 10% - 20% CPU utilization can run on LinuxONE III LT1 at the same throughput while maintaining a higher sustained average CPU utilization of 89% reducing wasted CPU resource. This claim is designed to replicate a mix of application servers and database workloads on x86 and IFLs on IBM Z using JMeter and HammerDB. Workloads were driven to emulate real customer environments running under a service level agreement of 130,400 TPS within 500 milliseconds 95% of the time. For the x86 environment workload activity drivers were configured to represent a population of servers with a variety of workloads exhibiting varying levels of demand for computing resources similar to that observed in 15 client environments for development, test, quality assurance, and production levels of CPU and throughput. The test measured average CPU utilization that varied between 10% and 20% for x86 workloads running on 65 16-core, 24-core and 28-core x86 servers with 1,476 cores total. For the IFL environment the same workload activity drivers were used on 120 LinuxONE III LT1 IFLs and driven at 89% CPU utilization achieving the same required transactions per second and response time as were observed on the x86 servers. LinuxONE III LT1 throughput was projected from actual LinuxONE Emperor II test results. Results may vary.

Looking for a robust and cost-effective platform your banking solution?

IBM and Temenos testing and TCO analysis found that LinuxONE delivered better price/performance ratios than x86 in the TPS use cases examined. While actual cost savings will vary according to client specific IT environments and business requirements, LinuxONE could be an effective alternative to x86 for the Temenos Transact banking solution.

To quantify savings for your IT organization, contact the IBM IT Economics team at IT.Economics@us.ibm.com for a no-charge customized assessment.

About the authors



Dr. J C Yao is the Chief Strategist of IBM IT Economics team. J C's expertise includes computer engineering applications, numerical modeling and analysis, middleware, software architecture, solution framework, IT financial analysis and software/hardware comparative positioning to help clients address IT concerns.



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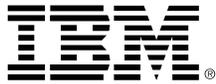
IBM ISV team:



Christopher Vogan is a Solution Architect in the IBM Z Ecosystems organization where he provides ISV enablement on IBM Z and LinuxONE platforms. He has 20 years' experience in software development and distributed system deployment. Christopher has worked extensively with Temenos to benchmark and validate their solution on IBM LinuxONE.



John Smith is the WW offering lead for Temenos on LinuxONE and has 25 years of sales and management experience in the financial services sector. John is specialized in identifying the value proposition of IBM technology with third party software for financial services solutions.



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