

Montran RTGS on LinuxONE

A comparison of IBM
LinuxONE versus x86
for the Montran RTGS
payment solution.

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Platform choices for RTGS

Real-time gross settlement (RTGS) systems enable the transfer of money or securities from one financial institution to another on a real-time basis. Typically, these transactions are high value, require immediate clearing and are final and irrevocable. Due to the nature of real-time gross settlement payments, RTGS systems require speed, resiliency and security to deliver funds rapidly and reliably.

Financial institutions looking for an RTGS solution such as the Montran RTGS System need an efficient and cost-effective platform for their IT infrastructure and business requirements. Increasingly, banks are leveraging the advantages of IBM LinuxONE as an alternative to distributed x86 server environments due to its qualities of service and cost savings*. This paper provides a platform comparison of IBM LinuxONE versus compared x86 for the Montran RTGS System in terms of total cost of ownership (TCO), operating expense (OpEx) and business value perspectives.

* Why IBM LinuxONE outperforms Linux on x86 solutions http://www.ibm.com/systemsmag/mainframe/digital.com/nxtbooks/ibmsystemsmag/mainframe_20190102/index.php#/38

Montran RTGS System

Montran¹, a SWIFT Solution Provider, provides SWIFT certified applications for payment systems. The Montran RTGS System is specifically designed to meet and exceed the international standards required by today's Central Banks for real-time gross settlement processing². The RTGS System handles very high volumes of large-value domestic payments and combines efficiency and reliability of service with sound position maintenance and intraday liquidity management facilities.

RTGS is based on modern web technology, using Java Enterprise architecture and components, combined with RDBMS and PKI based security. The open architecture and the open standards simplify integration with other financial systems. Since the system is Java-based, it can run on a wide choice of hardware, operating systems and databases; and can be implemented, maintained and enhanced efficiently. The software architecture is designed to allow for maximum hardware platform independence, providing the overall RTGS solution with benefits of cost and reliability.³

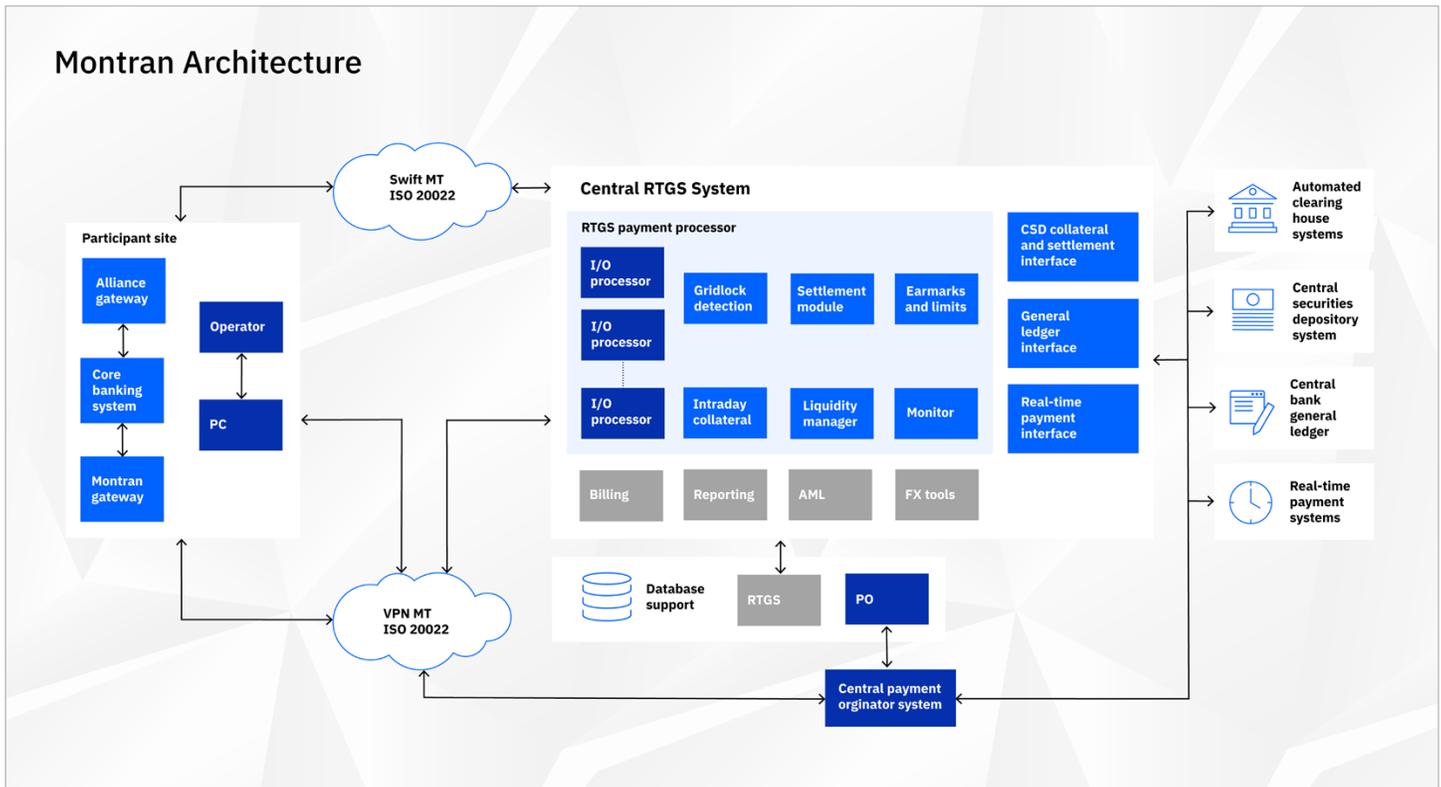


Figure 1: Overview of the Montran RTGS System

The Montran RTGS System can provide business values⁴ such as:

- **Enhanced liquidity optimization** with advanced features such as high performance gridlock resolution and priority payment streams
- **Efficient anti-money laundering (AML) support** by way of identification and blocking of transactions involving parties found on Office of Foreign Asset Control (OFAC) and other global AML lists
- **Extended messaging support** such as ISO20022 global financial messaging standards, as well as centralized message format conversion
- **Enhanced network resilience with reduction of participant cost** with simultaneous network agnostic processing capabilities
- **Improved return on investment and reduced total cost of ownership**

IBM LinuxONE

IBM LinuxONE is a centralized, 100% Linux®, enterprise server designed for large data serving and transactional applications⁵. It is designed for the highest level of HSM security (FIPS 140-2 Level 4, EAL 5+ certification) to protect against cyberattacks and other security threats, such as those to vital national payments systems.

LinuxONE servers are engineered to deliver enterprise proven qualities of services such as high availability, scalability and reliability

- Encryption and security with on-chip cryptographic performance to provide faster encryption of data in-flight and at-rest and pervasive encryption
- Large-scale server workload consolidation
- Advanced disaster recovery with Geographically Dispersed Parallel Sysplex®
- 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 advantages

Montran RTGS on LinuxONE and x86

To examine platform benefits for the Montran RTGS System, IBM and Montran defined two scenarios based on transaction volumes per day and market segments to compare LinuxONE and selected x86 capabilities:

Scenario one: up to one million payments per day using enterprise level software to deliver service level agreements demanded by larger financial institutions

Scenario two: up to 100 thousand payments per day, using open source or workgroup level software for smaller financial institutions

For both scenario one and two, the production systems are spread across two sites for x86, and one site for LinuxONE, with a separate site at a remote location for disaster recovery. Each production site has two nodes. Additionally, Montran recommends two User Acceptance Testing (UAT) sites, each with two nodes, and one development site with a single node for non-production workloads. For scenario 1 (one million payments per day) two LinuxONE Emperor systems were used for the LinuxONE case (one at the main data center and one at the remote data center), and 21 Xeon Gold 12 core and 6 core x86 servers were used for the x86 case (17 at the main data center and 4 at the remote data center). For scenario 2 (100 thousand payments per day) two LinuxONE Rockhopper systems were used for the LinuxONE case (one at the main data center and one at the remote data center), and 21 Xeon Gold 6 core x86 servers were used for the x86 case (17 at the main data center and 4 at the remote data center).

The calculations that follow below are based on Montran’s sizing guidelines for Montran RTGS System on LinuxONE and compared x86.

Payments per day	Platform	Environment	Number of sites	Number of nodes	Application cores	Database cores
1,000,000	LinuxONE	Production	2-3	2	4	2
		UAT	2	2	2	1
		Dev	1	1	1	1
	x86	Production	2-3	2	8	4
		UAT	2	2	4	2
		Dev	1	1	2	2
100,000	LinuxONE	Production	2-3	2	3	2
		UAT	2	2	2	1
		Dev	1	1	1	1
	x86	Production	2-3	2	6	4
		UAT	2	2	4	2
		Dev	1	1	2	2

Table 1: Montran core sizing recommendations

Depending on the type of workload, LinuxONE servers can provide as much as a 20:1 x86 to LinuxONE core consolidation ratio†. Consolidation of Linux workloads on LinuxONE benefit from significant performance and cost savings due to this core consolidation efficiency. Even using Montran’s current core sizing guidelines that assume a 2:1 core factor between x86 and LinuxONE, the results from the Montran scenarios show that LinuxONE users can find savings. Montran guidelines for the number of cores for the application and database nodes for LinuxONE are half the number of cores for x86 (see Application and Database core columns in Table 1).

For RTGS solution configuration and deployment, some of the following business and IT requirements have been taken into consideration for the two scenarios defined on the previous page.

- **Business requirements and transaction volumes:** for both environments sufficient resources were calculated for envisioned growth, albeit for the purpose of the model workload activity was forecasted to grow moderately within the configurations over five years.
- **Production servers consolidation:** Montran recommends three sites, with two in the same location and a remote third site for disaster recovery. With IBM LinuxONE high availability and scaling up capabilities, two production sites can be consolidated into one, enabling the use of only two physical locations.
- **Dev/Test/QA:** Montran’s sizing guidelines suggest Dev/ Test/QA could require 30%–75% of production capacity since users may prefer to use separate physical servers for production and non-production environments. LinuxONE virtual management efficiencies allow mixing non-production servers with production servers and requires a fraction of additional capacity for Dev/Test/QA.
- **Disaster recovery:** LinuxONE offers Capacity Backup (CBU) which allows minimum system configuration with additional CBU cores held inactive until needed, which can help reduce hardware and software license costs significantly since charges occur only for activated cores on LinuxONE.
- **Server utilization:** unlike stress tests in a controlled laboratory setup that target 100% utilization, data-center servers are typically run at lower CPU utilization to help avoid potential delivery disruptions or service level agreement penalties. LinuxONE workload

management capabilities are designed to utilize system resources so that datacenter workloads can run at high sustained utilization levels. Based on IT Economics assessments of compared customer x86 environments, average measured peak utilization is 16%.∞

- **High availability:** most banking solutions demand high availability, especially for their databases. Customers with x86 servers typically adopt a high availability option such as Oracle RAC with a doubled capacity. This doubling of capacity might not be necessary for LinuxONE due to its built-in qualities of service and design redundancy.
- **Data protection and encryption:** increasing data breaches and new security regulations (for example, the European GDPR) are becoming a critical concern to financial institutions. LinuxONE provides encryption and security management that add minimal IT overhead even when used to fully encrypt a database which can support your compliance responsibilities.

Cost advantages of LinuxONE

Using Montran’s guidelines, and hardware, software and datacenter costs such as energy, networking, floor space and labor observed in client environments in IT Economics assessments, the following total cost of ownership (TCO) and operating expense (OpEx) cost models illustrate the financial benefits that can be achieved with LinuxONE over compared x86 servers for the Montran RTGS payment solution.

The TCO model found a 41% reduction for scenario one (enterprise level software, up to one million transactions per day) with LinuxONE versus the compared x86 servers over five years. The TCO model also found a 40% cost

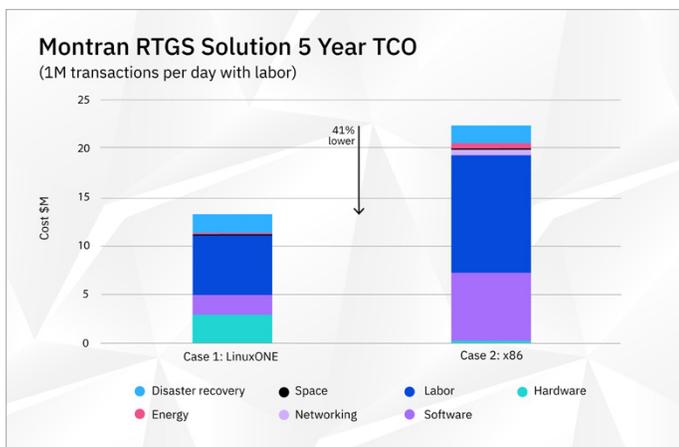
† Based on an IBM customer’s data, 30 x86 servers (300 cores total) can be consolidated into one IBM LinuxONE Rockhopper II server (15 cores total), yielding a 20:1 core consolidation ratio and a projected 55% lower total cost of ownership (TCO) over five years. The x86 servers contained Xeon E7-4870 Deca Core 2.4 GHz processors. The TCO estimates were made using tools from the IBM IT Economics team. The TCO numbers included estimated costs for hardware system software, application software, administration, networking, floor space, energy, and migration or services costs.) IBM IT Economics Studies are presented as illustrations of how clients can estimate their associated costs for IBM products and non-IBM products. Study results are projections using a total cost of ownership analysis, including costs such as hardware, software, network, storage, facilities and other costs over multiple years. Most costs and performance characteristics are provided by the client.

∞ Based on IT Economics assessments of customer x86 environments running a total of 13,800 x86 cores, average measured peak utilization is 16%. Peak utilization of 16% is derived from a weighted average of x86 workloads in four large enterprise client IT environments using a total of the compared 13,861 x86 cores in production and test environments. For additional information on x86 workload analysis, contact the IBM IT Economics team, IT.Economics@us.ibm.com.

reduction for scenario two (open source and workgroup level software stack, up to 100 thousand transactions per day) with LinuxONE versus the compared x86 servers over five years.[‡]

Findings with scenario one (one million transactions per day)

For scenario one, with up to one million transactions per day, the five-year TCO model showed significant cost advantages over the x86 non-virtualized case. Even with a higher initial hardware investment for LinuxONE over x86, other costs such as software and labor (people) described below resulted in a higher TCO for the x86 case.



LinuxONE enabled:

- Consolidation of two production sites onto a single LinuxONE server. In the scenario above, a single LinuxONE Emperor II server with 38 cores was used instead of two physical LinuxONE servers, each with 19 cores. Using a single LinuxONE server could provide as much as an 11% cost reduction due to lower hardware, energy, networking and floorspace costs.
- Consolidation of non-production (UAT and development) environments for the production site. In the scenario above the number of cores was decreased from 38 to 32, resulting in as much as a 9% reduction in lower hardware and software costs[^].
- Use of CBU in the disaster recovery site lowered costs. In the scenario above using six active cores and six CBU cores could enable as much as a 6% savings in hardware and software costs.
- Leveraging LinuxONE workload management and virtualization benefits enable more workload to be

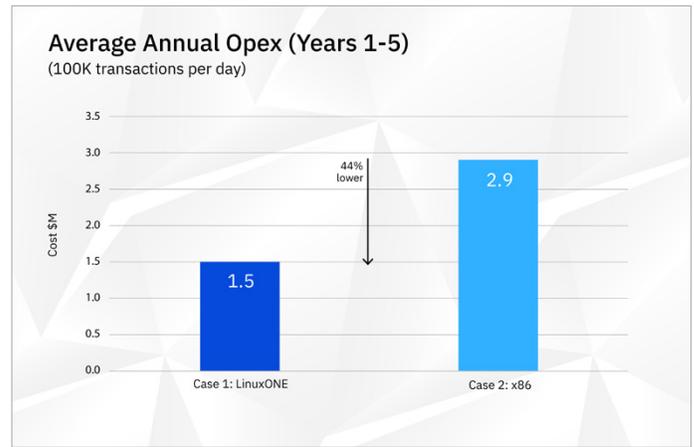
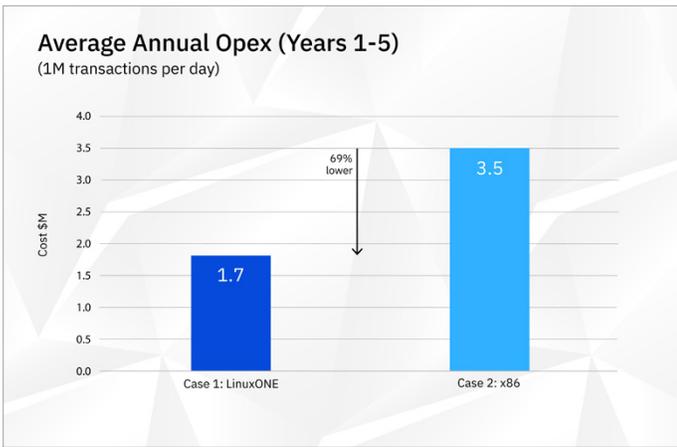
run on less hardware. Consequently, fewer software licenses are required, as well as other IT resources.

- Labor efficiencies of managing fewer physical servers can also contribute to savings. In the above scenario, x86 labor costs were projected to increase by 50% due to the larger number of physical servers requiring maintenance, patching, upgrading and administration.

Average annual (OpEx), calculated with software and hardware maintenance, people, energy, space networking, and no hardware or software purchase costs, averaged over five years also showed that LinuxONE generated lower expense (69% lower OpEx) than the x86 case.

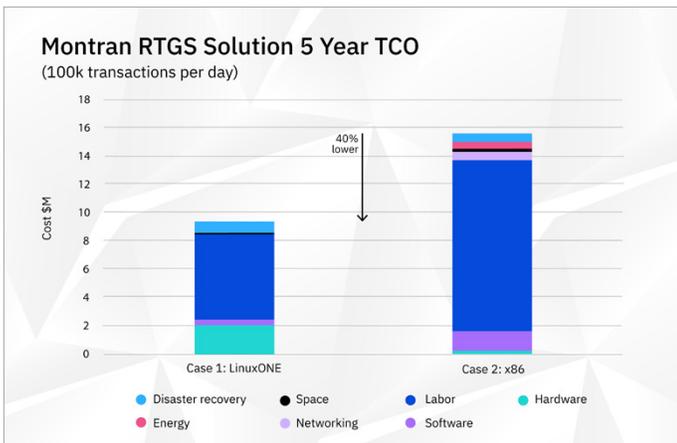
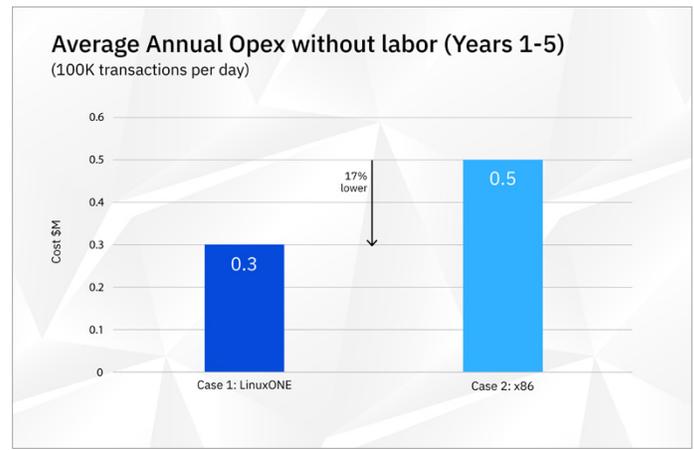
[‡] TCO differences between the Montran RTGS payment solution on IBM LinuxONE and x86 servers are modeled by the IBM IT Economics team based on Montran RTGS sizing guidelines. The TCO model compares hardware, software, labor, networking, floor space, energy, storage and disaster recovery environment costs over five years including initial investment costs in year one. x86 hardware pricing was based on list pricing minus a 38% discount. No discount was assumed for LinuxONE server hardware. Software for both x86 and LinuxONE assumed list pricing minus a 40% discount. For the Montran solution running up to 1,000,000 transactions per day, the model used two IBM LinuxONE Emperor II servers, with the main server using 32 cores to consolidate 2 production sites, 2 UAT sites and 1 Dev site, and a D/R server with 12 cores (6 cores plus 6 CBU cores) at the remote site. For the x86 case, non-virtualized servers were examined with Xeon Gold Gen 10 processors, with 3 production sites, 2 UAT sites and 1 Dev site. All the x86 application nodes used Xeon Gold 6128 3.4 GHz (2 chips, 12 cores), all database nodes used Xeon Gold 6128 3.4 GHz (1 chip, 6 cores) and all UAT and Dev nodes used Xeon Gold 6128 3.4 GHz (1 chip, 6 cores). For both the LinuxONE and x86 cases, IBM Db2 Enterprise Server Edition v12 for database servers, IBM WebSphere Application Server Network Deployment for application servers and system management tools including IBM Tivoli Composite Application Manager For Applications and IBM Spectrum Protect for Databases) were included in the model. For the Montran solution running up to 100,000 transactions per day, the model used two IBM LinuxONE Rockhopper II servers, with the main server using 28 cores to consolidate 2 production sites, 2 UAT sites and 1 Dev site, and one IBM LinuxONE Rockhopper II D/R server with 10 cores (2 cores plus 8 CBU cores) at the remote site. For the x86 case, non-virtualized servers were examined with Xeon Gold Gen 10 processors, with 3 production sites, 2 UAT sites and 1 Dev site. All the x86 application nodes used Xeon Gold 6128 3.4 GHz (1 chip, 6 cores), all database nodes used Xeon Gold 6128 3.4 GHz (1 chip, 6 cores) and all UAT and Dev nodes used Xeon Gold 6128 3.4 GHz (1 chip, 6 cores). For both the LinuxONE and x86 cases, IBM Db2 Workgroup Server Edition v11 for database servers, IBM WebSphere Application Server for application servers and system management tools including OpenDistro for ELK) were included in the model. Average annual operating expenses (OpEx) is based on total hardware maintenance, software, people (labor), disaster recovery, energy, networking, and floorspace costs averaged over five years. OpEx does not include capital purchases in year 1. For additional information on the TCO model, contact the IBM IT Economics Team at IT.Economics@us.ibm.com.

[^] Development sandbox and test servers are typically configured to match their production environment yet leave much of that provisioned capacity idle, which can result in significant savings if non-production and production environments are consolidated to the same server.



Findings with scenario two (100,000 transactions per day)

For scenario two, with up to 100 thousand transactions per day, the five-year TCO model also showed cost advantages with LinuxONE over the compared x86 non-virtualized case. While open source software decreased software licensing costs significantly for both cases, LinuxONE still illustrated a lower TCO.



With decreased software costs in scenario two, labor became the largest cost category in the TCO model for both LinuxONE and x86.

To further examine the impact of labor on IT costs for the platforms, scenario two was modeled with, and without, the labor category for OpEx costs. For the average annual OpEx models that excluded hardware and software acquisition costs, LinuxONE was still found to be less expensive compared to the x86 cases. Average annual OpEx found a 44% savings with labor costs and a 17% savings without labor costs with LinuxONE versus the compared x86 case.

Additional factors to consider

While not factored into the above cost models, some additional savings areas with LinuxONE to assess are:

- Encryption and security management
- Java performance advancement from pause-less garbage collection
- Risk avoidance such as unplanned downtime
- Seamless scaling to meet business growth requirements

Observations

The cost models for the two Montran RTGS System scenarios found that LinuxONE has significant cost advantages over the compared x86 platform especially with regard to software licensing and administration (labor) costs. The models also illustrated that even when open source software is used to reduce IT costs, the TCO for LinuxONE was still lower, regardless of labor costs. LinuxONE was also found to provide a lower average annual OpEx than x86.

While actual savings will vary according to the number of transactions and IT environment in a specific organization, LinuxONE can offer a significant decrease in IT cost, and improve the quality of services for financial solutions.

Learn more

IT Economics assessments, similar to the assessment conducted for Montran, is available at no-charge and can help identify cost savings and operations efficiencies. If your organization is need of an efficient and cost-effective platform for your IT infrastructure and business requirements, learn how you can leverage the benefits and cost savings advantages of IBM LinuxONE. Ask for an IT Economics assessment at IT.Economics@us.ibm.com today.

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 evaluations, and software and hardware comparative positioning. Through years of working on complex heterogeneous IT environments with clients, J C has gained deep insight into client IT operations and developed methodologies and tooling to evaluate IT strategy and quantify total cost of ownership. J C uses his expertise to work with clients worldwide to address IT Economics concerns, whether related to datacenters, mainframe application offloads, high-end server consolidations, fit-for-purpose assessments for solution deployment scenarios, or broader IT roadmap and strategy consultation.

Susan Proietti Conti, PMP® is an IBM Executive Project Manager and Program Director for the Worldwide IBM IT Economics Consulting and Research organization. She manages IT Economics projects and helps clients leverage IT Economics to increase IT efficiencies and reduce costs.

Endnotes

- 1 <http://www.montran.com/about-us/index.html>
- 2 <http://www.montran.com/products-services/index.html>
- 3 <http://www.montran.com/products/rtgs/index.html>
- 4 <http://www.montran.com/products/rtgs/index.html>
- 5 <https://www.ibm.com/it-infrastructure/linuxone>

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