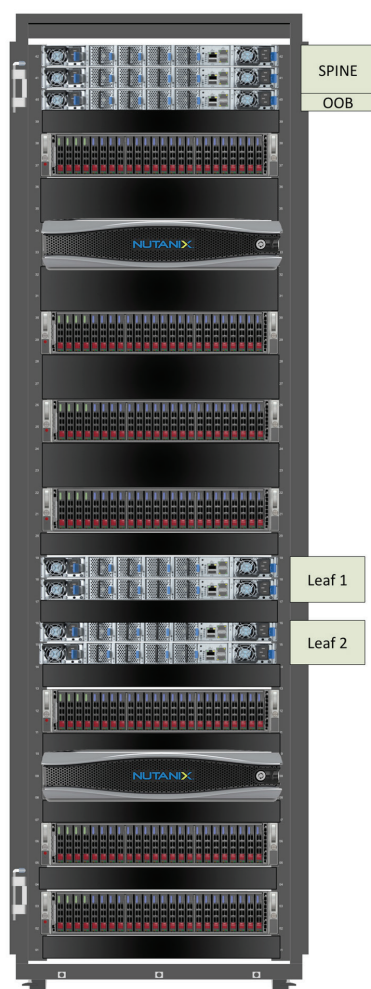


Digital Transformation for Core Banking Services, Delivered as an Enterprise Cloud

Nutanix offers a high-performance, turnkey, and certified solution to automate mission-critical core banking functions for major financial institutions, at lower cost than traditional architectures.



The motivations for moving enterprise workloads of all types and sizes to cloud infrastructures—whether public, private, or hybrid—are compelling. As an evolution of data center virtualization, cloud computing promises significant advantages in terms of agility, elastic scalability, performance, resiliency, and total cost of ownership. By decoupling workloads from the underlying server and storage, the software-defined data center further abstracts compute, network, and storage resources, compounding these opportunities to enable fluid, dynamic response to changing needs.

At the same time, many types of workloads have proven difficult to virtualize, limiting the extent to which the organizations that depend on them can take full advantage of digital transformation. In particular, applications that are mission critical, especially latency sensitive, or highly regulated have lagged behind. This reality has kept a measure of benefits beyond the reach of some organizations, including much of the financial services industry.

Core banking applications represent a convergence between mission criticality, latency sensitivity, and regulatory factors. Moving these workloads onto virtual infrastructure delivers significant business advantages to financial services institutions.

The Nutanix Enterprise Cloud Platform* illustrated in Figure 1 realizes this potential with a turnkey certified solution for delivering virtualized core banking functionality. This platform helps reduce risk by providing predictable and consistent performance, seamless scalability, self-healing, and nondisruptive upgrades.

The Nutanix Enterprise Cloud Platform is purpose-built to run 24/7—even during maintenance—making it well suited to the mission-critical needs of production banking workloads.

Core Banking Automation by CFT

Center of Financial Technologies (CFT) is a group of innovative companies that develop high-technology solutions for the finance sector and other industries in Russia and the CIS countries. CFT-Bank is CFT's automation platform, based on Oracle databases including Oracle Real Application Clusters (RAC), for core banking functions such as operations, accounting, and management systems. The platform provides more than 1,200 applications in its catalog, each of which automates a distinct business process. Major areas of functionality include the following:

- Corporate and retail services
- Securities operations
- Remote banking
- Account management and budgeting
- Internal activities administration
- Data warehousing

Figure 1. Intel and Nutanix solution for CFT-Bank.

Core banking platforms such as CFT-Bank must deliver robust performance and high availability. In addition to those foundational requirements, financial services customers also value openness, flexibility, and customizability. CFT-Bank addresses these design goals with its modular framework and deployment on standards-based Intel® architecture.

Traditionally, core banking systems such as CFT-Bank are implemented on bare-metal infrastructure, to help ensure the low latency needed to deliver high transaction rates with large numbers of concurrent customer sessions. Through studying how virtualizing CFT-Bank could enhance agility, simplicity, and cost-effectiveness for its customers, the company determined to explore delivering a virtualized platform as a preconfigured hardware and software appliance.

To satisfy the functional requirements of the preconfigured solution approach, CFT partnered with Nutanix, a provider with broad and deep experience in delivering virtualization and data center infrastructure for high-performance solutions built on Oracle database platforms. Table 1 summarizes the functional parameters of the CFT-Bank Enterprise Cloud developed as a result of that collaboration.

Table 1. Functional parameters for the CFT-Bank solution.

Functional Area	Requirement
Concurrent Users	Support for 20,000 concurrent branch users with more than 6,500 database transactions per second
Batch Processing	End-of-day operations for large groups of branches in no more than four hours
Oracle Licensing	Minimized number of processor cores to reduce Oracle licensing costs
Failover and Recovery	Effective Oracle Real Application Clusters node recovery and Oracle recovery test after failure

Turnkey Solution Based on Hyperconverged Nutanix Enterprise Cloud Platform

Hyperconverged infrastructure is a disruptive approach to driving increased agility for the enterprise. The Nutanix Enterprise Cloud Platform combines Intel architecture-based compute and storage building blocks with Nutanix web-scale design to create a flexible hyperconverged infrastructure that enables digital transformation. Nutanix servers (also referred to as “nodes”) fit in a rack-optimized form factor and replace legacy infrastructure consisting of separate servers, storage networks, and storage arrays.

Converging the entire enterprise stack—including compute, storage, storage networking, and virtualization—Nutanix appliances use software to distribute operating functions across a cluster that can contain an unlimited number of nodes. The primary Nutanix software components include the following:

- **Nutanix Acropolis***, a distributed data plane with enterprise storage and virtualization services.
- **Nutanix Prism***, a distributed management plane that incorporates data analytics and heuristics.

Using the Nutanix Enterprise Cloud Platform, Mellanox network switches, Acropolis, and Prism, Nutanix has created a rack-based system engineered to support the CFT-Bank core banking platform. This turnkey system provides a hyperconverged, fully virtualized solution for use in major financial institutions. Figure 2 provides an illustration of the solution stack. Table 2 provides further details about the hardware and software building blocks in the stack. Figure 3 illustrates the CFT-Bank application architecture.

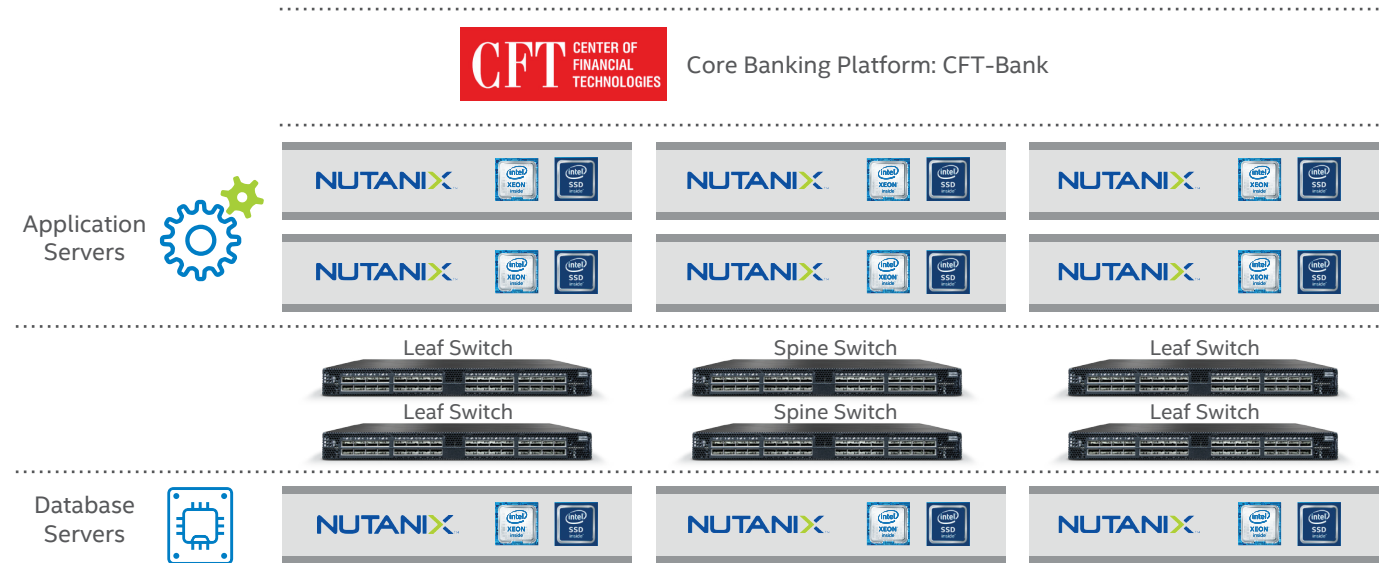


Figure 2. Nutanix CFT-Bank cloud appliance solution stack.

Table 2. Elements of the Nutanix CFT-Bank cloud appliance solution stack.

Solution Stack Layer	Infrastructure Elements
Database Servers	<ul style="list-style-type: none"> • 6x Nutanix NX-9000 series (a six-node cluster): <ul style="list-style-type: none"> - 2x Intel® Xeon® processor E5-2667 v4 per node - 512 GB DDR4 RAM per node - 8x Intel® SSD Data Center (DC) S3610 Series (800 GB) per node for capacity - 4x Intel® SSD DC P3700 Series (2 TB) per node for caching
Switching	<ul style="list-style-type: none"> • Mellanox SN2700 32-port 100 Gbps Ethernet switches deployed as two spine switches and four leaf switches
Application Servers	<ul style="list-style-type: none"> • 12x Nutanix NX-9000 series (a 12-node cluster): <ul style="list-style-type: none"> - 2x Intel® Xeon® processor E5-2699 v4 per node - 512 GB DDR4 RAM per node - 8x Intel SSD DC S3610 Series (800 GB) per node for capacity - 4x Intel SSD DC P3700 Series (2 TB) per node for caching
Data Plane	<ul style="list-style-type: none"> • Nutanix Acropolis*: <ul style="list-style-type: none"> - Virtualization: the native Nutanix hypervisor, AHV - Storage: Nutanix Acropolis Distributed Storage Fabric
Management Plane	<ul style="list-style-type: none"> • Nutanix Prism*: <ul style="list-style-type: none"> - Infrastructure management - Analytics: operational insights and planning
Core Banking Platform	<ul style="list-style-type: none"> • Center of Financial Technologies CFT-Bank <ul style="list-style-type: none"> - CFT-Bank Application Catalog - 2MCA (Mission Critical Application) platform

The Nutanix Enterprise Cloud Platform used for database and application servers in the solution is based on the Intel® Xeon® processor E5-2600 v4 product family and the Intel® Solid State Drive (Intel® SSD) Data Center Family. Based on Intel's industry-leading 14 nm process technology, this processor generation delivers higher core counts, more memory bandwidth, and dramatically increased parallel workload performance compared to its predecessors. It also provides significant virtualization enhancements, enabling superior latency and reducing the overhead associated with virtual machine (VM) exits. High core-level processor performance enables real-time inline de-duplication and compression.

The architects chose the specific Intel® Xeon® processors implemented for both the database and application servers for specification characteristics tailored to the solution's particular needs, as shown in Table 3. The processors in the database servers have a smaller number of higher-frequency cores than the application servers, providing for very high read-write performance. Conversely, the application servers have a higher number of relatively lightweight cores, to support high numbers of concurrent transactions. That higher core count is also supported by a larger last-level cache.

Both the database and application nodes in the solution incorporate two types of Intel® Solid State Drives: the Intel® SSD DC S3610 Series and the Intel® SSD DC P3700 Series. The Intel® SSD DC P3700 Series connects to the system board using PCI Express* and the NVMe* standard, providing

accelerated throughput and low latency compared to the use of SATA in the Intel SSD DC S3610 Series. The high performance of the NVMe-based SSDs makes them well suited to their role as write caches and quick-access storage for metadata, while the SATA-based SSDs store the entire dataset. Both types of SSDs also provide persistent storage. While the drives are local to each node, software distributes the storage in blocks across the entire cluster.

The Nutanix Enterprise Cloud Platform uses leaf-spine architecture based on Mellanox 100 GbE switches to achieve predictable, low latency at any packet size, with linear scalability and lower management overhead than traditional three-tier network infrastructures. High throughput and scalability enable the network to supply sufficient bandwidth for the high-performance NVMe-based SSDs to perform optimally without impacting other applications or services.

Table 3. Comparison of processors in database and application servers.

	CPU Frequency (GHz)	Cores per Socket	Last Level Cache (MB)
Database Server (Intel® Xeon® processor E5-2667 v4)	3.2	8	25
Application Server (Intel® Xeon® processor E5-2699 v4)	2.2	22	55

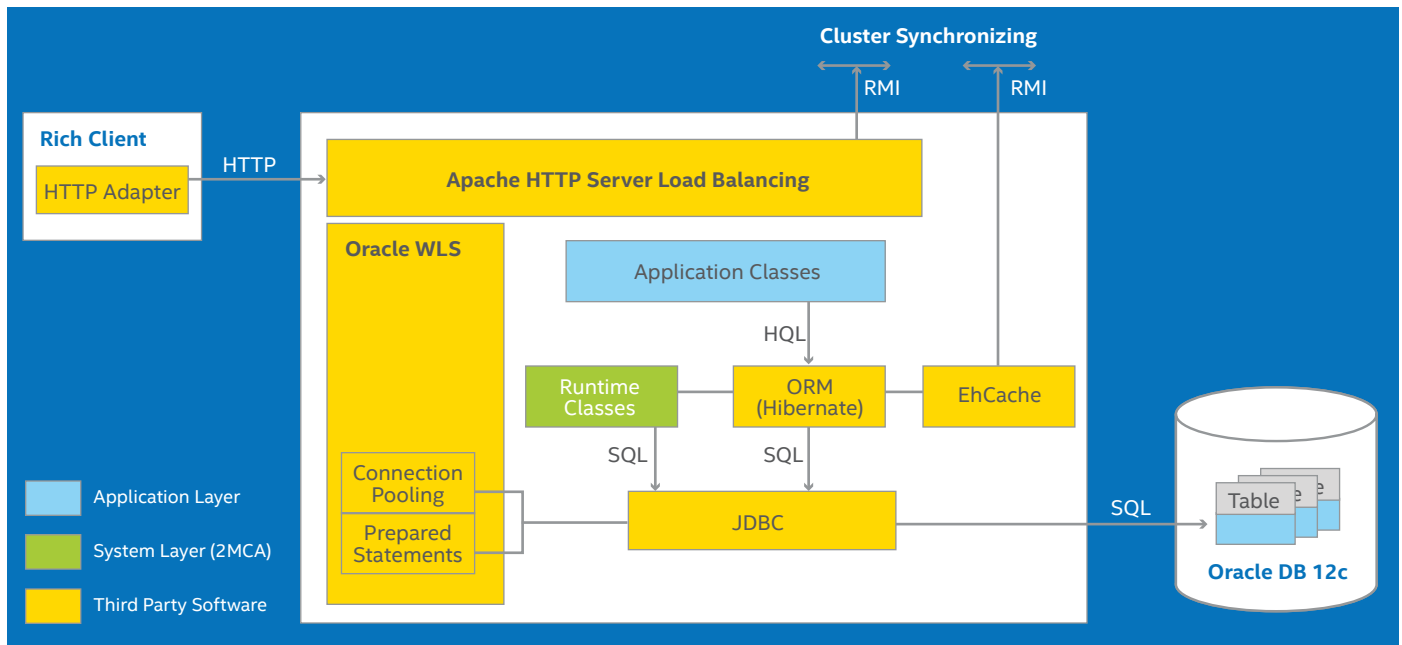


Figure 3. CFT-Bank application architecture.

Software Capabilities and Benefits Built into the Solution

Successful virtualization of mission-critical databases is made possible by the innovation built into the Nutanix Enterprise Cloud Platform. The CFT-Bank appliance solution includes the data plane functionality of Nutanix Acropolis and management plane capabilities of Nutanix Prism, as described below. Because the entire solution is delivered as a turnkey appliance, it supports rapid time-to-deployment, fully integrated management, and the full-stack, single-source support Nutanix provides on a global “follow the sun” basis, 24 hours a day, 7 days a week, 365 days a year.

Data Plane: Nutanix Acropolis

The data plane of the Nutanix Enterprise Cloud Platform is based on Acropolis, a set of software capabilities that natively converges compute and storage resources. The primary parts of Acropolis that underlie the CFT-Bank appliance solution are the native Nutanix hypervisor, AHV, which provides virtualization services, and the Acropolis Distributed Storage Fabric, which delivers software-based storage functionality.

Virtualization: Nutanix AHV

AHV is the appliance’s lean native hypervisor, based on proven open source technology. It is hardened right out of the box to deliver robust security, and comprehensive security automation streamlines the ability to maintain continuous compliance with banking regulations. AHV optimizes transaction capacity and response times available from infrastructure investments by intelligently placing and live-migrating VMs within the cluster to avoid resource

contention. It also automates high availability by means of VM failover and supports robust software-defined networking to optimize the flexibility and performance of the infrastructure as a whole.

Unlike other hypervisors that administrators must install and configure separately and that may be unduly complex because of unneeded features, AHV is purpose-built for and preintegrated with the larger solution. Customers benefit from eliminating the cost and complexity of legacy data center technologies, and preconfiguration provides optimized performance and simplified management and licensing.

Storage: Nutanix Acropolis Distributed Storage Fabric

The Nutanix Acropolis Distributed Storage Fabric provides an alternative to legacy shared storage with significant advantages in terms of reduced cost, reduced complexity, and increased performance. Rather than using coarse-grained storage based on layered Storage Area Networks (SANs), Acropolis offers a distributed, software-based storage fabric that simplifies and increases flexibility of the solution as a whole.

Acropolis pools the locally attached storage on nodes based on Intel SSDs across the entire cluster and exports it out to the virtualization layer. The Acropolis Distributed Storage Fabric supports VM high availability and live VM migration for the Nutanix Enterprise Cloud Platform, helping ensure its suitability for the mission-critical CFT-Bank appliance solution. The storage fabric helps ensure data integrity by checksumming every read and write, while self-healing from failures and safeguarding high performance and low latency. At the same time, it virtually eliminates traditional storage management tasks, removing the need for specialized storage or for administrators to have virtualization expertise.

Certification Results

CFT conducted a series of validation tests to verify that the solution meets the requirements listed in Table 1, including support for 20,000 concurrent branch users with more than 6,500 database transactions per second and the completion of end-of-day operations for large groups of branches in no more than four hours. Based on this load testing, the solution was certified to meet the requirements, as shown in the report that is excerpted in Figure 4.

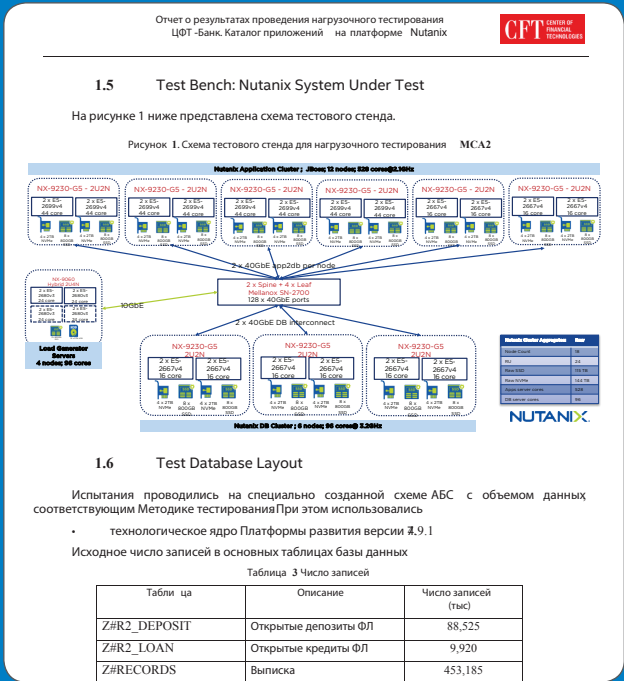


Figure 4. Report on CFT-Bank load testing results (2MCA Platform) on Nutanix platform (excerpt).

Figure 5 is a screen capture from Nutanix Prism during the end-of-day processing test.

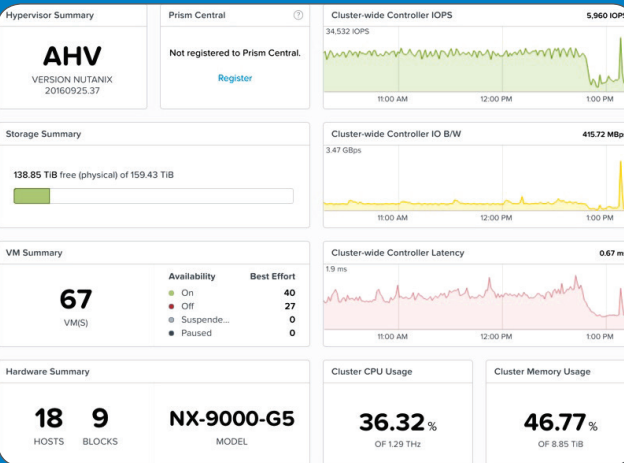


Figure 5. CFT testing in progress: end-of-day job.

Management Plane: Nutanix Prism

Nutanix Prism provides the management plane, incorporating advanced machine learning techniques to generate actionable insights and automate common tasks. Prism mines system data to optimize operations and provide deep, end-to-end visibility for the entire environment, including virtualization, storage, management, and analytics. It streamlines workflows for high efficiency and ease of use, by means of either its highly intuitive, uncluttered user interface or self-documenting APIs that can connect to a cloud management platform or configuration management database.

Infrastructure Management

Prism manages the software-based compute, network, and storage infrastructure, from the level of an individual device such as an SSD or network adapter, up to the cluster level, and down to individual VMs. This control spans the entire life cycle, from creation, deployment, and provisioning to configuration, access, and maintenance. For hardware management, Nutanix builds an out-of-band, autonomous mechanism based on Intelligent Platform Management Interface (IPMI) functionality into all Enterprise Cloud Platform nodes.

To provide a VM-centric operational view of the environment, Prism also delivers frictionless access to infrastructure resources for self-service, day-to-day capabilities. Administrators have one-click capabilities to create, delete, update, power on/off, pause/resume, snapshot, and clone VMs. Like the Acropolis functionality built into the Nutanix Enterprise Cloud, Prism is preintegrated, so administrators do not need to install or manage it separately.

Analytics: Operational Insights and Planning

Using advanced machine learning, Prism provides one-click capabilities to generate operational insights around infrastructure trending and analysis. This functionality includes a robust search engine that queries and performs actions across the infrastructure, as well as customizable dashboards that provide at-a-glance, action-oriented views into the operation and status of applications, VMs, and infrastructure.

Adding to the robustness of these insights, operators can easily perform proactive analysis by grouping and isolating information to display relevant, actionable alerts. They can also perform predictive failure analysis, complete with alerting and automated case generation for dispatch of needed parts if Nutanix Pulse is enabled, improving efficiency and performance.



Figure 6. Benefits of combined CFT-Bank, Nutanix, Mellanox, and Intel building blocks.

A Comprehensive Range of Business Advantages

The Nutanix Enterprise Cloud Platform demonstrates performance and resiliency for core banking that takes advantage of software-defined compute, networking, and storage in a turnkey appliance, to deliver a range of benefits as illustrated in Figure 6. Replacing higher-cost proprietary infrastructure with lower-cost, web-scale architecture based on technology building blocks from Nutanix and Intel, the solution provides a robust foundation for the CFT-Bank platform.

With performance that may actually out-perform bare-metal solutions based on specialized proprietary hardware, companies can adhere to stricter service-level agreements and achieve greater responsiveness, for an improved user experience. The appliance can support more than 20,000 concurrent branch users, with more than 6,500 transactions per second. In addition, it allows large groups of bank branches to complete their end-of-day batch operations in less than four hours.

Virtualization enhances agility, security, and performance, with an environment that improves availability and reduces risk through built-in self-healing capabilities. Whereas with traditional systems, customers may have had to wait weeks to get specialized repair services on site, the standards-based infrastructure and single-source support for the Nutanix solution streamlines resolution of outages. Advanced troubleshooting capabilities based on built-in platform analytics help accelerate those efforts even further.

In day-to-day operations, the solution's modular design allows administrators to upgrade software and components without disrupting production applications. Nutanix's VM-centric snapshot architecture creates point-in-time copies of data with little or no impact on performance, so that changes can be rolled back if needed. Synchronous replication ensures continuous availability of data and business-critical applications during disasters and planned maintenance.

Moreover, while it can take days or even weeks to create a copy of a traditional production system, the Nutanix system can create clones of an environment in minutes. This capability means that testing can be performed on refreshed, valid data during changes to core applications, helping customers get the updated environment into production faster and with fewer defects. Likewise, the system streamlines disaster recovery operations.

Conclusion

The Nutanix Enterprise Cloud Platform combines Intel architecture and Nutanix web-scale design into a hyperconverged solution that virtualizes core banking systems based on CFT-Bank. As a result, financial institutions can drive digital transformation aimed at improving customer experience and satisfaction, increasing revenue opportunities and lowering operational costs by deploying mission-critical infrastructure with reduced complexity, improved performance, and higher availability, while maintaining the security and resiliency demanded by banking operations.

Banks all over the world are now poised to streamline and improve their operations, eliminating the need for legacy solutions in favor of forward-looking, standards-based design. This solution from Nutanix, Intel, Mellanox, and CFT sets the stage for innovation, profitability, and competitive advantage for years to come.

Further Information

Nutanix solutions for financial services:

www.nutanix.com/solutions/financial-services

Intel financial services solutions:

www.intel.com/financial-services

Mellanox networking products:

www.mellanox.com/ethernet

Center of Financial Technologies solutions: www.cft.ru

Solution provided by:



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