



IT Transformation for the Digital Age

Driving new value from a future-facing IT platform

Intel discusses five key principles for a holistic transformation of IT, and how Intel® technology and industry expertise can accelerate the IT transformation process

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Responding to Disruption as the New Normal

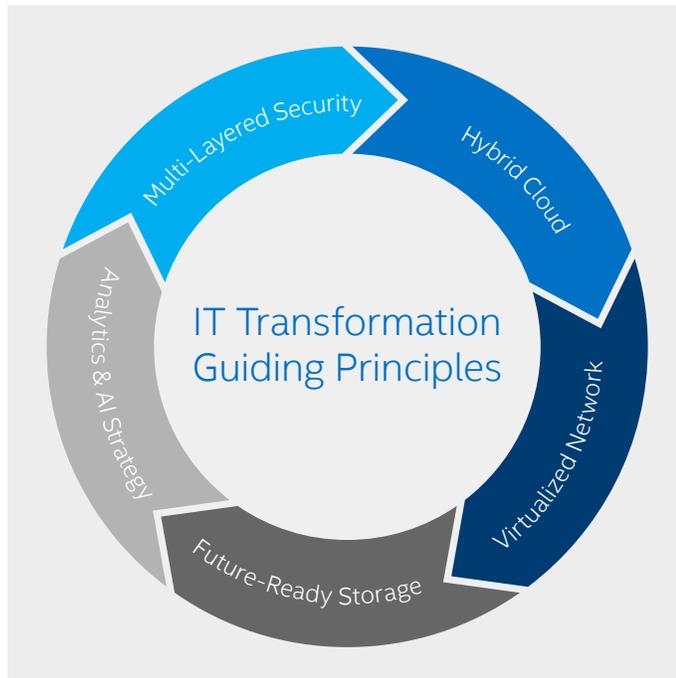
The world of business has changed. Traditional and digital economies have fused, and rapid disruption is the new normal across every industry. Companies are changing how they compete in the market with new and blended business models that rely heavily on technology to deliver digitally enhanced products and services. This new economic reality holds great opportunity to innovate, but it also holds great risk for companies lacking the IT infrastructure needed to successfully compete.

Heads of Infrastructure and their IT teams face complex technology choices in an effort to transform IT and build a stable, scalable platform that supports business growth and innovation. In addition to navigating newer disruptive trends, IT must also continue to prioritize modernization initiatives that can help them shed the burdens of legacy infrastructure, boost operational efficiency and maintain the security of the enterprise. To do this successfully requires a holistic approach that both innovates and modernizes across the entire data center infrastructure.

Intel has a unique perspective as a global enterprise, a leading supplier of data center technologies, and as one of the largest IT organizations in the world. Blending these vantage points together, Intel recommends a focus on five key principles to modernize and transform IT. These include:

- Accelerate services innovation and time-to-market with hybrid clouds
- Remove network bottlenecks from edge to cloud to the data center
- Manage, secure and access your data with future-ready storage
- Grow competency in advanced analytics to drive business transformation and competitiveness
- Deploy multi-layered strategy for security from the platform up

This paper will drill into these principles, explore the challenges and interdependencies of each, and offer recommendations for how to prioritize modernization and move forward with an IT transformation strategy designed to drive business growth.



1. Accelerate services innovation and time-to-market with hybrid clouds

Rapid service innovation and delivery with a hybrid cloud strategy is essential to conducting business at the pace demanded by the digital economy. Evaluating hybrid cloud strategies with a “best-of-breed” approach allows enterprises to realize the unique benefits of both public and private cloud usage models to accelerate business agility while maintaining critical stability where needed. When combined with a smart workload placement strategy, hybrid clouds enable CIOs to run a ‘no-compromise’ IT environment and both transform and modernize at the same time. IT must conduct a comprehensive evaluation of public cloud offerings as well as private cloud infrastructure solutions on the path to a hybrid cloud strategy with a focus on three critical actions:

Evaluate and Optimize Workload Placement

Organizations should start by conducting a comprehensive assessment of their current application portfolio and then optimize workload placement decisions based on a thorough evaluation of a variety of business, technical and ecosystem factors. To do this, organizations need to rationalize the business value of its legacy applications to determine whether they should be eliminated, repurchased, migrated or left as is. Determining where to place new and existing workloads depends on a number of business factors including service agility, flexibility, service level agreements (SLA), legal and geographic requirements. Technical factors also play a role and can be extensive, including security, performance, data size, data scale predictions, data transfer and service latency. Also consider current and future needs around the rate of innovation, portability and redundancy of applications across clouds or your data center with minimal

friction and re-engineering. If workload placement in a cloud-based model is identified, decisions around cloud infrastructure optimization are important to ensure best performance and TCO.

Build a Cloud-Ready Modern Infrastructure

Understanding the underlying infrastructure that is powering your cloud is an important step in any successful cloud strategy. At the core of a multi-cloud platform is a modern infrastructure that is stable and agile enough to support the dynamic demands of the digital economy. Modernize enterprise infrastructure with a highly virtualized, software-defined approach across all key domains—compute, storage and networking—to boost agility, performance, security and manageability. Achieve workload flexibility by building on a common Intel® architecture that has been software optimized by the ecosystem to allow live application migration between clouds. Whether a private or a public cloud, the world’s best performing, and most trusted clouds run on Intel® Xeon® processors. With powerful converged architectures and capabilities across compute, storage, memory, network and security, the new Intel® Xeon® Scalable platform delivers unprecedented scale and workload optimized performance on a common architecture for both on- and off-premises cloud deployments.

Accelerate Application Innovation with Internal PaaS/DBaaS

The digital economy has made rapid time to market for new apps and services essential to business success. More than ever, developers need access to on-demand compute and database resources to speed development time. IT can accelerate app innovation with capabilities such as internal Platform-as-a-Service (PaaS) and Database-as-a-Service (DBaaS) that provide developers the agility and service availability they need to rapidly build, test, prototype and deploy cloud, web and mobile applications without losing control and efficiencies. By providing a more robust set of internal cloud services that support the DevOps process, developers can move quickly to spin up the compute and storage resources they need and ultimately speed time-to-market with cloud-ready applications that support business innovation.

Learn More

- [Optimal Workload Placement for Public, Hybrid, and Private Clouds](#)
- [Utilizing PaaS for Business Agility and IT Efficiency](#)
- [How to Transform Your Business with a Hybrid Cloud Strategy](#)
- [The Road to Hybrid Cloud Success](#)
- [Explore more at \[www.intel.com/cloud\]\(http://www.intel.com/cloud\)](#)

2. Remove network bottlenecks from edge to cloud to the data center

Increasing network traffic volume, complexity and the increased use of cloud computing makes the network and its management a critical success factor for IT transformation initiatives. Enterprises need increased flexibility and the ability to maximize their network resources to enable intelligent, dynamic networks.

Choosing the right solution for modernizing enterprise networks involves focusing on the technical product specifications, as well as ensuring the design has the flexibility and capacity necessary to support the growing demands on the network now and in the future. In order to take advantage of new capabilities, focus your network transformation initiatives on three critical areas:

Virtualize Network and Functions with SDN/NFV

Virtualize network and security functions with software-defined networking (SDN) and network function virtualization (NFV) for a network platform that is centrally managed and programmable with better flexibility and control over network services provisioning. SDN and NFV abstracts network functions, allowing installation, control and management by software running on industry-standard, high-performance servers. NFV eliminates the need for an enterprise to purchase costly specialized appliances for networking functions. This shift away from manually managed fixed function network hardware to a virtualized, software-defined network platform removes bottlenecks resulting from manual processes and allows for dynamic services offered on-demand at a lower cost. Virtualizing security functions secures a workload where it resides at a more granular level and prevents single point of failure. Also, having virtual security functions inside the data center perimeter improves protection against ever increasing attacks that target an inside out method. Begin the transition with solutions powered by Intel® Xeon® Scalable family processors to enable SDN/NFV capabilities for agile service delivery, security, performance and lower total cost of ownership (TCO). Architecture consistency across virtual and physical products delivers economies of scale, a consistent programming environment and fewer interoperability issues—all of which can reduce TCO.

Virtualize your Edge Functions and Devices

Virtualize edge functions and devices to be more responsive to business needs. The traditional location-based router approach with WAN optimized appliances is no longer sufficient to meet the demands of enterprise users, applications and services that reside in distributed locations. As enterprises increasingly adopt multi-cloud/hybrid cloud models and cloud based services (SaaS, IaaS), networks require direct and secure connections from the edge to the

cloud. Software-defined wide-area network (SD-WAN) and virtual customer premises equipment (vCPE) platforms can address these challenges from both cost, performance and security standpoints, giving IT more control by allowing them to intelligently route network traffic over standard, high performance servers, dynamically change bandwidth requirements to avoid overprovisioning, seamlessly and remotely add and manage virtual security functions to the edge, and lower the TCO of their WAN while maintaining high levels of service.

Optimize for Multi-cloud and Micro-services

Optimize for multi-cloud and micro-services with virtual network functions to ensure scalable, secured and unified application experiences. Multi-cloud environments increase the focus on connectivity in an enterprise, making networking itself—and easier ways to manage them—essential. Micro-services are central to implementing a scale-out approach that meets enterprise user and traffic demands, as well as end-to-end encryption for across regions and enterprise sites, and within and between any public clouds. Furthermore, micro-services are fundamental to adopting lean DevOps methodologies towards service enhancements and upgrades to cloud applications that add more functionality or features over time. IT also must be prepared to continuously monitor ongoing operations to ensure quality of service and compliance. Centralized cloud networking management in single pane of glass lets enterprises see, control and troubleshoot all their cloud-based resources across all their clouds.

Learn More

- [Nasdaq: Developing and Deploying NFV Solutions Efficiently](#)
- [Intel® Select Solutions for NFV](#)
- [AT&T Fast Tracks Cloudified Network Transformation](#)

3. Manage, protect and access your data with future-ready storage

Data is exploding, arriving from previously untapped sources with a volume and velocity that can easily overwhelm traditional IT systems. New capabilities around advanced analytics and AI-driven data analysis create the ability to store and leverage that data to gain new insights that enhance competitiveness. However, legacy and traditional storage solutions running on proprietary hardware often lead to higher costs and can't support the consolidation and performance needs of modern applications and constantly

changing business needs. With today's breakthrough technologies, storage modernization can play a significant role in positioning your organization for success. To start, Intel suggests a focus in three key areas:

Create a Holistic, Intelligent Data Strategy

An enterprise-wide data strategy provides a holistic look at all available and needed data and maps it to strategic business needs and objectives. This strategy efficiently and securely pre-positions data for ready use when needed by the business. It also guides how IT architecture must evolve to support the complexities of modern data processing and data storage requirements and regulations. This advance work helps drive performance and efficiencies, as well as lays the necessary groundwork to execute on advanced analytics and AI strategies required by the business. A successful data strategy is composed of four basic elements:

- **Goals and Objectives:** A clear understanding of the value for each data element for any analytics needed by the organization.
- **Data Inventory:** A comprehensive understanding of the attributes and access needs of data being processed and stored.
- **Data Architecture:** A mapping of data to the compute resources and applications that will ultimately consume and process an organization's data.
- **Data Protection:** A data retention and protection strategy, defining how various data must be maintained long-term to satisfy both corporate needs and governmental regulations.

Optimize Performance and TCO with New Technologies and Tiering

Storage technologies are undergoing a period of radical and disruptive innovation that are redefining the cost, capacity, and latency of storage. Solid-state disk drives (SSDs) are quickly supplanting traditional magnetic hard disk drives (HDDs) in both enterprise storage arrays and traditional servers, and revolutionary technologies, like Intel® Optane™ technology and NVMe*, are rapidly redefining the capabilities underlying the enterprise data tiering model. These technologies combine the attributes of memory and storage to deliver very high-performance, low-latency, and persistent memory. Further they provide the industry with a variety of options for scaling high performance solid state storage within the datacenter. Intelligent tiering applies these technologies to business strategies to support the data demands of modern applications and manage the volume, velocity and variety of data flooding the enterprise in the digital economy.

Architect for the Future with Scale-out Storage

Legacy and traditional storage solutions running on proprietary hardware often lead to higher costs as they scale up and can't support the consolidation and performance needs of modern applications and constantly changing business needs. Software-defined storage (SDS) eliminates the proprietary, one-to-one storage model in favor of more flexible, abstracted software layers that run on industry-standard server hardware and can pool storage resources to be utilized effectively for specific workloads. SDS models can also cope with changing data requirements in flexible and dynamic ways, such as:

- **Eliminating islands of data:** SDS aggregates data using a single namespace and is able to use common APIs and interfaces.
- **Improved time to market:** SDS allows for faster provisioning of storage resources and updated applications for new features, improved security and compliance.
- **Automated deployment and operations:** Open SDS platforms provide compatibility with a wide range of policy-driven frameworks, APIs and orchestration options, including multitenancy management and heterogeneous workload balancing.

Learn More

- [Practical Steps to Defining Your Data Strategy](#)
- [Data, Data Everywhere - Storage on the Brink?](#)
- [Building a Data Strategy eGuide](#)
- [Modern SSDs set the Foundation for a Responsive Hybrid-Cloud Data Center](#)
- [Evaluator Group Reviews Intel® Optane™ Storage](#)
- [Explore more at \[www.intel.com/storage\]\(http://www.intel.com/storage\)](#)

4. Grow competency in advanced analytics to drive business transformation

Data insights are the currency of digital business and advancing your analytics competency is key to the success of digital transformation initiatives. The success of these efforts requires a holistic and comprehensive data strategy and a modern data foundation with the right infrastructure components to handle the complex demands of rapidly emerging workloads, such as machine and deep learning that use artificial intelligence technologies.

Get your “Data Foundation” Right

Enterprises have been slow to realize the full potential of their data, often struggling with expanding data silos across the enterprise, poor data hygiene, duplication of data across traditional data warehouses and legacy archival systems. This legacy environment has created ongoing challenges for IT, introducing latency and inefficiencies in analytics workflows. Additional complexity has resulted from an inability to stay ahead of new, massive streams of unstructured data flowing into the enterprise and now co-existing with more traditional structured data stores. Enabling access to a large data pool or “lake” sets the stage for enterprise developers and data scientists to deliver data-powered insights and be successful in their analytics and AI implementations. To create this kind of intelligent data foundation, Intel recommends the following as first steps:

- Unlock the data silos across your organization, and know what data you have and what data you will need.
- Ensure data can be used at scale through data aggregation, cleansing, transformation, normalization and modeling.
- Establish stringent, well-defined data governance, lineage and security policies.

Build a Flexible, Scalable Analytics Infrastructure

For success in analytics, infrastructure modernization is necessary across compute, storage and network, as these critical engines can either accelerate your analytics performance or become chokepoints for data-and-memory intensive workloads. The majority of enterprise analytics infrastructure is already built on high-performance, flexible Intel® Xeon® processor-based infrastructure, and IT can look to these current investments to begin modernization. The latest Intel Xeon Scalable family of processors have been designed to accelerate analytics, providing a more scalable, agile, and efficient platform with increased security features for all enterprise use cases. IT should prioritize technology investments that address inefficiencies in the data pipeline and legacy infrastructure bottlenecks impacting the performance of analytics. A modern infrastructure built on industry-standard Intel® hardware will also help maximize utilization to achieve TCO objectives, and eliminate complexities introduced by new architectures. In addition, combining modern infrastructure with key software optimizations and libraries can further improve performance and efficiency of data workloads, from infrastructure all the way up to the application layers.

Accelerate Your Path to AI

It is critical to business success to support early developer efforts in AI and plan for strategies to integrate AI into mainstream analytics workflows. There are many analytics and AI solutions to consider for this task, however these options are often expensive and may not be compatible with

your current infrastructure, slowing down implementation. Alternatively, running advanced analytics workloads, including AI, on industry-standard platforms maximizes utilization of existing infrastructure resources and also helps integrate AI into your organization's analytics workflows without adding complexities introduced by specialized hardware.

Intel delivers breakthrough advancements and optimizations for analytics and AI workloads and can help organizations accelerate your AI strategies. As developers and data scientists across your enterprise begin exploring the possibilities of AI through early proof-of-concepts, running those on your existing Intel® Xeon® processor-powered infrastructure offers the most TCO optimized path forward to AI. Key software optimizations on the new Intel® Xeon® Scalable processor for industry-leading deep learning frameworks render it a powerful AI platform. Intel offers developers a suite of open source libraries for building deep learning workloads including Intel optimized Tensorflow, Caffe and BigDL, a distributed deep learning library, for Apache Spark*. BigDL will enable you to run your deep learning workloads directly on top of your existing Spark clusters powered by Intel® Xeon® processors.

Learn More

- [Taming the Data Deluge](#)
- [The Business Impact of Advanced Analytics](#)
- [Future-Ready Analytics](#)
- [Five Steps to Delivering the Data Driven Business](#)
- [Explore more at \[www.intel.com/analytics\]\(http://www.intel.com/analytics\)](#)

5. Deploy multi-layered strategy for security from the platform up

The attack surface for the enterprise continues to grow as more and more devices connect to enterprise networks and the Internet, and IT moves more workloads to the cloud. Combined with the growing volumes of valuable data and the industrialization of hacking, CIOs must deploy a multi-layer security strategy that protects from the platform up, ensures data encryption at all stages of use and can proactively hunt the threats on the network through the use of analytics and machine learning.

Utilize a Hardware-based Root of Trust on Servers

Every enterprise should be built on a platform that features a hardware-based root of trust. Without that, nothing upstream can be trusted. Intel technology offers a silicon root of trust that includes unique and compelling security

features, such as Intel® Trusted Execution Technology (Intel® TXT), which is designed to protect the platform at all times, including applications, operating systems, firmware, BIOS, and hardware. This technology establishes a hardware-based security foundation that can help verify the integrity of other system components, such as the OS and hypervisor. At boot time, Intel TXT verifies the integrity of the OS; when a workload migrates to another virtual machine (VM) in the server pool, Intel TXT performs a measured launch environment test that enhances the integrity of the target server. Intel TXT helps create a trusted pool of servers that can handle live migrations while reducing the risk of security breaches.

Encrypt All Data

Protecting enterprise data is vital to protecting the enterprise. Wherever data resides and at any stage in its lifecycle—whether at rest, in-flight, or in use—it needs to be encrypted. Many organizations are reluctant to encrypt their data because they associate encryption with negative performance impacts. But a platform based on the Intel® Xeon® Scalable Processor includes accelerated instructions that greatly improve the efficiency of the Advanced Encryption Standard (AES) cryptographic algorithms used across the compute continuum, thus reducing the encryption performance “tax” to near zero.

Use Analytics for Transparency and Control

Simply locking the doors is not enough to protect the enterprise. The growing sophistication of organized crime and state-backed cyber threats means that a company's approach to protection must evolve and change as rapidly as the threat landscape. Businesses can no longer afford to wait months before a threat becomes obvious — detection and protection must be measured in hours. Using analytics to monitor and identify network traffic and patterns that deviate from the norm can reduce the window of time between attack and detection and remediation.

Intel has collaborated with cybersecurity industry leaders to contribute to a rich cybersecurity ecosystem, providing open source-based predictive threat deterrence solution, such as Apache Spot,* as well as a variety of commercial solutions. Using analytics to help fight cybercrime involves automating the process of data ingestion, machine learning-based advanced analytics, threat identification, and remediation. This is the kind of vigilance that is needed, along with platform and data protection, to improve overall infrastructure security.

Learn More

- [Boosting IaaS and PaaS Security in the Public Cloud](#)
- [Encryption Without Compromise – Are Your Missing Out?](#)
- [Intel® Trusted Execution Technology](#)
- [Apache Spot* - A More Effective Approach to Cyber Security](#)

Taking the Next Step with Intel

IT transformation takes more than an investment in compute power—it takes a holistic approach to infrastructure investment and a strategy that will transform the organization today and prepare it for the future. Intel's leadership and experience enables us to help organizations across a variety of industries optimize their current infrastructure, innovate across technologies and processes, and ultimately transform to meet the demands of the digital economy.

Powering the majority of the world's cloud services and present in virtually every data center around the globe, we have unparalleled experience and expertise in building and running modernized infrastructures that deliver on an organization's business and technology goals.

Intel is able to help at every stage of an organization's journey towards a future-facing infrastructure:

- We understand the role of the IT platform, as a scalable basis for innovation and service delivery, bringing in new developments such as advanced analytics and artificial intelligence as they become mainstream.
- We operate one of the broadest ecosystems of technology partners and providers on the planet, engaging in deep partnership to deliver optimized systems and solutions to meet the demands of the data-driven, digital business.
- We can speak from direct experience of IT adoption, operations and management due to our own, hands-on approach, across data center operations, supply chain management, manufacturing, sales and marketing and other domains.

As the business becomes more responsive and data-driven, IT will be a critical and central factor for success. Enterprise IT teams can rely on Intel as a trusted partner to help modernize and transform their infrastructure to drive further efficiencies and accelerate time to market with innovative products and services that meet the dynamic demands of the digital age.

References and Resources

For more information and to engage with Intel today, contact your Intel sales representative or authorized Intel reseller. More information can also be found online:

- Learn more about IT Transformation at www.intel.com/beready
- Learn more about Intel IT best practices at www.intel.com/it
- Find optimized solutions with Intel® Builders at <https://builders.intel.com/>
- Learn more about Intel® Select Solutions at www.intel.com/selectsolutions
- Stay connected and learn with Intel Communities, Blogs and Social@Intel at <https://www.intel.com/content/www/us/en/blogs-communities-social.html>

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For more complete information about performance and benchmark results, visit intel.com/benchmarks.

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