Enterprise IT as We Knew It

The transition to digital IT starts yesterday.

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The transformation from enterprise IT to digital IT is inevitable, and it will happen in the context and as a result of what industry analysts call “the digital revolution.” Companies must realize that digitizing IT isn’t a “thing” or two “things.” It’s more about “how” rather than “what.” It’s about a new way of doing IT things.

Companies are still focused on developing a digital strategy. Instead they should be focused on integrating digital into all aspects of their business, which in Cisco’s view includes channels, processes, a data-driven operating model, incentives, and culture.

We believe that digitization means **re-engineering the operating model**. This re-engineering entails simplification of operations, automation, pervasive security, adaptability, and continuous innovation. Guillermo Diaz Jr., Cisco Chief Information Officer, defines the pillars of the transformation from enterprise IT to digital IT as shown in Figure 1.

Figure 1. Digital IT Transformation Pillars

Digital IT benchmarking will be around operational efficiency, excellence in user experience, fast and seamless consumption of digital services, simplification, and risk reduction and mitigation.

The Evolving Role of IT and Integration of IT and OT Services

"Every successful business in the next 10 years will become digital."

–Cisco Executive Chairman John Chambers

The laggards will have a hard time catching up. The digital transformation will change the functions of IT organizations. Two schools exist in the industry regarding the role of IT organizations in the digital economy. The first school expects IT to continue operating mostly in the back office, and front-office services to be run with vertically specialized IT service organizations. For example, IT services on the manufacturing floor will be delivered not by the enterprise IT organization, but by specialized manufacturing IT service teams.

The second school believes that enterprise IT personnel will be able to extend their IT reach to operational technology (OT) through retraining, new hires, and focused talent strategy. All the cyber-physical parts of the front office – sales, workplace facilities, safety and security, manufacturing, and supply chain – will be connected to enhanced IT infrastructure and enabled by in-house retrained IT personnel. In other words, the lights, ceilings, smart space and building management, and sensor-based supply chain tracking systems will be connected to IT infrastructure. So, if the lights in the building go off, the first call goes to IT, because the digital ceiling is connected to IT switches. Australia's largest mining company, BHP, follows this model; IT and operations are integrated, even organizationally.

Of course, history shows that there is usually a third alternative that involves hybrid models, and buy-versus-build decisions driven by outcomes, price, and speed.

The integration probably will capitalize on digitizing the cyber-physical (OT) world connected to the IT network, which allows for building common services and new interfaces and opens up new business opportunities. The integration of IT and OT services will change the role of the network as an integration platform. Three major things will happen in the network as we know it. First, we will connect the cyber-physical enterprise world to the network like never before, generating new data. Second, we'll see telemetry data, analytics, and apps built in every single networking component like never before. Third, the cyber-physical devices will become a security surface for new varieties of security treats. All of the "connecting the unconnected" and IT-OT integration will impact the way digitized IT services are created, offered, and consumed.

Disruptive and emerging technologies will have a profound impact on enterprise IT and will force an unorthodox transformation to a digitized state of IT. The changes, direct or indirect, will impact operational workflows, scope of work, and personnel. According to Klaus Schwab, Founder and Executive Chairman of the World Economic Forum, the emerging technologies of the next industrial revolution encompass artificial intelligence; robotics, the Internet of Things (IoT), autonomous vehicles, 3-D printing, nanotechnology, biotechnology, material science, energy storage, and quantum computing.

A consensus among industry experts is that it will take time for some of these technologies to have a tangible impact. It will take time for the expected information flow to materialize into social demand for standardization and be integrated into business processes and an organization's culture. Nonetheless, some of the changes and challenges are distinguishable and already making an impact today. They include:

- Digital IT new business models and the role of disruptive technologies
- IoT technologies and services
- Vast data growth
- Analytics as a Service
- Workplace, workforce, security, and privacy

- Talent strategy, fast learning, and cultural challenges
- Cloud and data virtualization services
- Quantum computing as a pervasive service
- Innovation as market differentiator

Digital IT New Business Models and the Role of Disruptive Technologies

Digitizing operations will enable new business models that change the cost structures, people's functions, and operational practices. The price of storage, computing, and bandwidth will decrease exponentially, and their availability will increase exponentially. At the same time, the cost of real estate will grow and require new models of fast procurement and consumption of services and products.

The success of Uber, AirBnB, and other pioneers of the sharing economy will impact the way digital IT shares, uses, procures, and prices products and services. Digital IT will start sharing or start buying / using / enabling shared products and services instead of acquiring assets and services. Digital IT organizations will start using services with zero marginal cost. One good example: building enterprise solar panels plants elsewhere and prorating the company's energy bill globally.

When IT organizations understand and articulate the value generated from new technologies, the digital IT environment will naturally start to incorporate robots, drones, and highly intelligent systems such as personal advisers to help IT admins with some of the most routine, repeatable operations. I remember my first patent application at Cisco, for a Cisco equipment feature called "Expert in a box." It was 2002, and my application was denied. Today, we're probably a short time away from seeing intelligent voice and video capabilities or robots built into Cisco gear, helping us configure and troubleshoot devices and analyze the data. We're a short time away from seeing drones and driverless cars assisting in the supply chain and helping with logistical operations. We'll probably soon see 3-D printers helping IT to manufacture spare parts, and facility organizations harvesting energy from available sources or using wireless energy transmissions to connect and power sensors.

Considering the vast number of infrastructure and physical devices that will be deployed in the next decade, it's easy to envision virtual reality and reality augmentation as real game changers in the remote provisioning, installation, and activation of devices, infrastructures, and ecosystems. It's likely that we'll soon see the beginning of highly intelligent systems helping executives and all employees make decisions, deliver speeches, translate languages, and learn or discuss critical subjects. SIRI, Amazon Echo, and delivery drones are only the beginning.

IoT Technologies and Services

IoT is a key emerging technology in digital IT, as well as a fast-maturing and growing industry. The applications and services associated with IoT are gaining momentum after years of work on IoT standards, where Cisco plays a major role around things connected to the network. Still the standards work is mostly around connectivity and less around morphology. There is no consistent consumer demand for interoperability, which makes enterprise IoT deployments a daunting array of components, platforms, and software applications that require extensive services setup. Yet the digital impact and the opportunity is well under way. Here, simplification will play a critical role in market differentiation. The emerging IoT will consist of billions of digital, cyber-physical, and cyber-bio nodes enabling deeply interconnected things and systems that anticipate, adapt, and control while being smart, autonomous, and dependable. Such integrated networks will require unprecedented compute and communication capabilities and sophisticated knowledge extraction of complex information flows.

Vast Data Growth

All disruptive technologies will be generating an unseen amount of data. According to recent estimates, Cisco IT operates a total raw 109PB of data, and a total 81PB of usable data that will continue to grow at an unprecedented clip. Corporate traffic is expected to grow 60 percent by 2020, and 40 percent of the data needs to process at the edge. Cisco estimates that globally data stored in the data center is expected to grow threefold by 2020, reaching 10ZB. Cloud data will increase by four times in the next five years, reaching 9ZB. Seventy percent of the data will be stored in the cloud (an increase from 40 percent in 2012); global mobile traffic will reach 190EB per year by 2018 and 250EB annually by 2020. More than 90 percent of the newly generated data will be unstructured or semi-structured.

According to a report published by Semiconductor Industry Association and the Semiconductor Research Corporation, the growth of data is expected to surpass the speed of bandwidth growth by a factor of two. “Sufficient bandwidth” will not exist any time soon, and bandwidth will continue to be a precious resource.

What’s more, the nature and direction of the traffic will change. Traditional north-to-south traffic flow (data center to end user) will shift. Applications will become increasingly mobile, and the data will become increasingly cloud-based. New south-to-north traffic flows (consumer to cloud, consumer to data center) and crowd source models will emerge. Enterprises will capitalize on that data, and monetize new services and new business models. The network data will increasingly become a source of Big Data, and offer data sets for further machine learning, or data on the fly will be a source of anomaly detection, behavioral analysis, and advance deep learning technologies.

Analytics as a Service

Data as a Service will evolve to Analytics as a Service. Not all the generated data needs to be stored to be analyzed. The vast amount of data will be used as data sets for supervised machine learning technologies.

Conventional store-and-analyze systems will be used to explore patterns, but the volume, variety, and velocity of data will surpass the capacity and pace of infrastructure upgrades. However, the ability to extract insights from data that is widely distributed, with a short shelf life, and is “too big to move” will become a market differentiator. This transition to “analyze before you store” practices will require different modes of operations such as quantum computing, pub-sub data consumption, and parallel methods of feature extraction.

The role of machine learning and specifically the deep learning technologies and an IT organization’s ability to extract data insights for better-informed, faster decision making will become one of the primary indicators of the successful transition to a digital IT state.

Workplace, Workforce, Security, and Privacy

The digital revolution, as any revolution, will “nominate” a new dominant figure: the prosumer, the individual that can not only consume but also produce services and products. Thus, the new economy will elevate the role of the peer-to-peer economy. Employees will become prosumers; they will begin developing and offering services hosted on their mobile, residential, or personal clouds. This development will change the whole notion of what work is and how work-life balance is perceived.

Digital IT will enable a new type of employee and dominant skillset. Coding / fast prototyping and the ability to combine subject matter expertise with data science for both individual contributors and managers will become critical workforce differentiators. The nature of work will change. People’s work will be less associated with a location and be perceived more as a human function to be exercised in a location-agnostic way.

The surface, variety, and volume of security attacks will increase to challenge the new digital economy. The security posture will change. Information security, which is the main focus of IT organizations, will transform to digital security. The cyber-physical and bio-security, device integrity, and authority of end devices to make decisions on behalf of people will become equally critical.

Privacy and data governance will also change. Employees will live in a panopticon of sorts, where the boundaries of physical, virtual, and digital will be blurred. User-generated data will be complemented by device and bio-entity-generated data that will possibly challenge some ethics, moral, and legal concepts of enterprise IT. According to Michelle Dennedy, Cisco Vice President and Chief Privacy Officer, the privacy paradigm of digital IT will be about the four E's of the Internet: the Internet of everything, everyone, ethics, and experiences. Meanwhile, privacy itself is not a static value; it evolves in response to new developments, cultural norms, and attitudes.

Talent Strategy, Fast Learning, and Cultural Challenges

Employees have to learn to make better-informed decisions. In the new digital economy, they will develop inductive (pattern-based) reasoning, based on data science instead of deductive (hypothesis-based) reasoning. The competitive advantage for enterprises will come from investments in data science and Big Data analytics, and from a new generation of managers and individual contributors capable of making pattern-based decisions based on new workflows and processes.

Employees' ability to learn fast and digest information in the new digital economy will be challenged. Research shows that most of the top-ten paying jobs in 2010 did not exist in 2004. The technical information in the world doubles every two years. For students starting four-year degree programs, this means half of what they learn the first year will be outdated by their third year in college. In terms of people's ability to digest information, it's estimated that the content of the New York Times in one week today contains more information than a person was likely to see in a lifetime in the 18th century. There's probably a limit to the average person's ability to digest, consume, and use information. In this reality, it seems that a human's ability augmented by smart things is unavoidable.

Digital IT will also generate organizational and cultural changes. From an organizational perspective, decisions will have to be made on how to best optimize IT technologies to extract value from the new technologies most efficiently. Organizational analysis will need to be done to determine how resources will be allocated (concentrated, centralized, etc.). Recruiting of new talent with strong networking, data science, and software development skillsets must be considered, as should development of existing talent. Finally, educating all of IT on the opportunities and strategy around the new integrated IT-OT environment will ensure cross-functional alignment.

Cloud and Data Virtualization Services

The role of data virtualization and a cloud native ecosystem will expand. Cloud platforms will support the assessment and monitoring of sensory data at runtime. These platforms are also affordable as well as a proven, reliable method of information processing. Sometimes cloud technology is reviewed as a separate, equally disruptive technology. However, IT organizations are seeking business outcomes, and cloud technology is just one of the enablers. As Kevin Bandy, Chief Digital Officer at Cisco, says, "Customers don't buy cloud. Cloud is just a technology. Customers buy virtualization."

Quantum Computing as a Pervasive Service

Computing in today's enterprise IT is mainly concentrated in data centers or in a variety of clouds. At the same time, there are vast unused quantities of compute power and storage. For example, Cisco's 70,000-member workforce probably maintains close to 10PB storage and unused compute power on their PCs, iPads, and iPhones during off-business hours. Almost all enterprise IT doesn't deploy fully decentralized storage and compute models, based on residential clouds, personal clouds, or Berkeley Open Infrastructure for Network Computing (BOINC)-type specialized computing models. But even if they do, in the long term it will not be enough. The demise of Moore's Law will have a twofold impact:

- The exponential need for the computationally expensive machine learning and deep learning is all about processing massive amounts of data. Most of this data is structured, unstructured, or semi-structured, where CPU-based computing will be hugely ineffective and replaced with cheaper and more powerful graphical processor units (GPUs) capable of parallel computing. This is a major shift toward widely available GPU-based computing systems with embedded machine-learning capabilities that run 10 times faster, are 10 times more efficient, and also may be less expensive.
- Ultimately, digital IT will require a new way of computing that is not based on electronic computers but on transistors. The new computing, so-called quantum computing, that makes direct use of quantum-mechanical phenomena such as superposition and entanglement to perform operations on data will become common. This computing will be vastly available, vastly capable, and under the fingertips of individuals.

Innovation as Market Differentiator

Permission-less innovation will become a market differentiator. The pace, scope, and impact of the emerging innovation and the exponential change of what we know about enterprise IT will inevitably cause impulsive desire to control the development of new systems and guard against the well-known conventional system. We are about to see new instances of 21st century Luddites in action. Typically, enterprise policy restrictions around public and other threats will be referred to as precautionary principles. That's acceptable. However, the most common precautionary approach in innovation used today, in practical terms, will mean fewer services, lower quality, higher time-to-capabilities, and lost business opportunities.

For these reasons, to the maximum extent possible, the default view toward new forms of technological innovation should be "innovation allowed." This policy norm is better captured in the well-known Internet ideal of permission-less innovation, or the general freedom to experiment and learn through trial-and-error experimentation. Stated differently, when it comes to digital IT, the default policy position should be an anti-precautionary approach.

The Transition to Digital IT Starts Yesterday

For every enterprise, operational efficiency, employee productivity, and employee engagement are top of mind. The digital IT business objectives will likely involve improving asset utilization and employee productivity, building a no-waste supply chain, improving customer experience, and reducing time to capabilities and new IT services through innovation. There are myriad ways to reach these objectives. However, the growing gap between the maturity of the new technologies and the lack of service offerings that leaves value on the floor demands a faster transition today, not tomorrow. Being fast and first will create major new opportunities. A wait-and-see strategy will lead to productivity loss and employee disengagement and attrition.

All successful digitization projects and use cases must become architecture-driven services. Adhering to a set of simple guidelines, described below, will help businesses accelerate the transition to digital IT and avoid some of the early adopters' missteps.

Drive the transformation to digitize IT as a service. All successful digitization projects (use cases) have to become services. Enterprise IT will give birth to a set of new digital IT services never offered before, spurring a new service organization and architecture that eventually will bridge the transformation from enterprise IT to digital IT. It's important for this effort to be run as a service. Too many digitization projects start and end as programs, cool technology demonstrations, and proof of concepts, one-offs and minimum viable schema (MVS) without contributing to the bottom line or solving business problems. Enterprises must define the transformation's business goals and begin working toward delivering the new generation of IT services. Digitized IT services have to be designed to meet business objectives and deliver tangible, real outcomes.

Lead an architecturally driven transformation to digital IT. All successful digitization projects (use cases) have to be architecture driven. The digital IT architecture must clearly define the architectural pillars and common (reusable) digital IT services, a foundation of digitized IT. This approach will allow for investment rationalizing, sustainability, and protection. Any successful digitization service has to be integrated into existing backend systems (catalogs, portals, orchestrations, domain managers, etc.). This integration will guarantee the ability to enhance the number, scope, and variety of the digitized IT services with incremental, outcome-based results, not overlapping, incremental, investment-based, low time-to-capabilities efforts.

Invest in the goal to "simplify everything." Simplification isn't simple and could be costly at first. Simplification isn't about ordinariness, but about sophistication. The return on simplification could be leaner, faster, more efficient operations.

Building the new infrastructure, the exponential number and variety of devices, and associated services to be connected, deployed, and provisioned in the next several years may cause prohibitive complexity. Enterprise IT practices of manual deployment and activation will become prohibitively expensive and render many traditional provisioning models obsolete. For example, the Edge building in Amsterdam, Deloitte's new corporate headquarters certified as the most sustainable office building in the world, has 300,000 sensors. Imagine the amount of effort to install, support, and maintain them. In enterprises like this, zero-touch deployment, zero-user interface, one-click technologies, databases that never go down, zero downtime application upgrades with excellence in user experience for any service and any application with no IT admin involvement and little to no productivity downtime will become commonplace.

"Simplify everything" isn't only focused on technology, but also involves process simplification as well. Digitizing the planning, investing, reporting, and decision making also has to be ultimately sophisticated and simple.

Drive value via insightful data. Just say yes to Big Data – volume, variety, and velocity. Some experts add veracity and the network (the N-dimension) to Big Data. In enterprise IT, Hadoop became the de-facto standard. Data as a Service (DaaS) is being offered by all enterprises, and store and analyze analytics platforms are the core business of many vendors. Pundits may say, "Everybody has Hadoop, so what?" This is the reflection of the market shift from data to insightful data, from DaaS to Application as a Service (AaaS). Collecting and engineering data is the key, but learning and predicting and making pattern-based decisions fast is the outcome that leaders are looking for, and is a primary differentiator and critical component of digital IT.

Architect and design for premium user experience, not just infrastructure. Optimizing infrastructure provides limited value, but optimizing the user experience creates almost unlimited productivity potential. In an enterprise organization, there are always tradeoffs between complexity of the service and the simplicity of the implementation and operation. Day-to-day operations and management typically take no less than 45 percent of the total cost of operation (TCO) of a service. Many organizations will choose to operate with fewer but more reliable tools and will frequently make choices on behalf of excellence in user experience. In return they will see a reduction in the time to capabilities; easiness to develop, offer, and consume services; increased variety, availability, agility, and robustness of those services; cost avoidance and cost decrease; and a boost in company productivity.

Focus on digital security, risk avoidance, and mitigation. Many mature algorithms and tools used for traditional analytics can be applied today, but digital security brings new challenges that require features not found in other analytic realms or as often in other realms. Taking advantage of the network data as a source of Big Data for training machine-learning algorithms for anomaly detection, behavioral analysis, sensing, monitoring, and securing all the components of the service ecosystem is the significant market differentiator. Many experts believe that network forensics as a branch of digital forensics is the ultimate solution for advanced threat defense systems. Cisco's own Self Learning Network anomaly detection provides key differentiation in this area. Several other analytical technologies are relevant for smart and timely security decisions, including descriptive analytics reporting systems, visual data discovery tools, event streaming processing platforms, and predictive and prescriptive analytics.

Enable pattern-based decision making as a market differentiator. For technological companies, digital is the natural state of the art of their core business. However, operational processes – investment planning, budget planning, service reviews – and XML and template-based processes are not digital. The PowerPoint culture has to be replaced with a fast prototype/ device/ service / MVS/demo culture.

For IT to successfully implement end-to-end digitized business solutions, companies will need to invest in a wide range of new and / or updated technologies and skills for IT and lines of business personnel. Investing in data scientists is a high priority for big enterprises in the new economy. Industry analysis shows that each aspect of enterprise operations (from architecture to design, implementation, and operations) can be improved with better data analytics through the emerging multidisciplinary field of data science. New jobs such as data analysts, data engineers, and data scientists are emerging and are in high demand. Data insights extraction allows for actionable information from diverse data sources to drive data decisions and choices. It supports and encourages shifts between deductive (hypothesis-based) and inductive (pattern-based) reasoning.

Enterprises that take advantage of the opportunities in the digital economy and invest in it will become major enablers for adaptability. In Cisco IT, digital IT services are emerging. Cisco IT is moving toward digital IT in creating, or adopting, services such as location and presence services; smart space experiences; advanced video analytics services; self-learning advanced networks; network based security anomaly detection; and so forth. New ideas are springing up from many directions, while a new generation of engineers and an emerging data science-trained workforce gain their foothold.

No question, the shape of IT organizations is changing. Enterprise IT as we've known it is losing relevancy. Speed is of the essence. This dynamic barrier to entry will make it difficult for laggard organizations to invest enough to ever catch up.

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