WHITEPAPER

CompTIA

The Role of Emerging Technology in Digital Transformation

Emerging technologies have become a key part of the discussion around modern digital organizations. Across the high-tech industry, the term "emerging technology" has become a catch-all descriptor for the futuristic advances that will drive the next wave of innovation, and there is a wealth of resources available for understanding the individual trends that fall under that broad umbrella. From AI to quantum computing, there has been a hunger to find the next big thing.

However, there's a growing sense that emerging tech as a general concept is the industry's version of a Macguffin in film: something that is driving the plot forward but remains undefined. There has been a disconnect between the lofty promises of emerging technology and the practical applications. Adoption rates have not been as steep as some expected, and few emerging technologies appear to match cloud computing in terms of accessibility across a wide range of companies.

Research and observations from this nascent era of emerging technology suggest that companies are struggling to find the correct approach. To be sure, the enterprise technology space has seen massive shifts, with businesses transforming their mindset from a tactical attitude to a strategic implementation. It is no surprise that many organizations would view emerging technologies in the same way they have viewed previous technologies, but the landscape has shifted. Success with emerging technologies depends on a thorough understanding of how these trends rely on IT fundamentals while driving future transformation.

This whitepaper will explore the role of emerging technology in today's IT strategy and operations. The starting point for understanding this field is understanding the viewpoint of CIOs and other IT leaders as they navigate a digital future for their organizations. The next step is determining how emerging technologies are different from IT in previous eras. Finally, there are direct applications of emerging technology to IT practices, including evaluation, decision-making, workflow and, most importantly, skills. Emerging technology may have become a highly hyped concept, but businesses that cut through the hype can find ways to build competitive advantage.

The Motivation Behind Emerging Technology

The first question to answer when exploring emerging technology is whether there is any practical reason for focusing on the field or if it is simply a construction of media and pundits. The technology industry is no stranger to trends that dominate discussion for a short time but then fade into history. If emerging technology is truly a meaningful notion, where are IT leaders finding that meaning?

To start, consider the area where emerging technology holds little meaning: tactical IT operations. As an overarching concept, "emerging technology" is not a tactical undertaking. It does not describe a discrete function or goal, in the way that other categories such as "communications platform" or "customer service process" might do. There are individual technologies that companies may be implementing or exploring, but then the focus turns to the necessary details (e.g. IoT sensor integration or AI-enhanced process modification).

The fact that emerging technology is not part of a tactical conversation explains some of the disconnect between hype and reality. Tactical IT, which was the dominant IT methodology for decades, focuses on implementing and maintaining established technology to support business outcomes. The goals of tactical IT tend to be on the operational end of the spectrum—controlling costs, sustaining availability and monitoring performance. Exploring new technology is not directly in line with these types of goals.

Where emerging technology looms large, then, is on the strategic side. While there has always been some strategic component to enterprise technology, the demand for that way of thinking has risen drastically. CompTIA's *Using Strategic IT for Competitive Advantage* whitepaper outlined the new mindset that is needed for a strategic approach, including focus on the top line vs. the bottom line, measuring consumption vs. installation, and thinking about technology as a necessity vs. a luxury. It is clear that this approach is a radical departure from the traditional way of managing IT, and companies everywhere are adjusting to the new reality.

This new space is where emerging technology as a broad concept has significant relevance. There are two specific ways in which emerging technology is informing CIO actions. First, it is more important than ever to be aware of the trends that are on the horizon. Most IT departments have always had some degree of interest in the future, but the willingness to be educated on details or brainstorm about possibilities has differed depending on industry vertical or individual company desire to be on the cutting edge. Few companies today are willing to wait until a new technology has been widely adopted or built into a user-friendly product; there is more demand to push the envelope, which drives a need for prescribed exploration.

The second reason for IT leaders to focus on emerging technology is risk mitigation. While awareness helps predict new benefit to a company that comes from early adoption, risk mitigation focuses more on the potential impact of being a late adopter. One of the hallmarks of modern technology is the acceleration of certain business practices or cycles. Disruption may be the prime example of a trend that's speeding up. Thanks to new distribution paths and potential efficiency gains, new competitors can gain market share faster than ever.

Exploring new technology through a defensive lens will help IT leaders see where their current business practices are vulnerable. Companies are always concerned about falling into the innovator's dilemma, where their existing practices have helped establish market position but have also built lockin through investments over time. The odds of a new entrant using emerging technology to bypass a traditional barrier have risen, and technology professionals are on the front lines for helping businesses pivot before they are disrupted.

Emerging technology is highly important for today's IT leaders, but only to the extent that they are adopting a strategic mindset around the use of technology to meet business objectives. Trying to fit emerging technology into a previous paradigm basically reverses the approach that should be taken. Implementing any individual technology should be the end of the process, which should start with broad exploration and rely on creative thinking to construct new systems and workflow.

How Emerging Technology Is Different

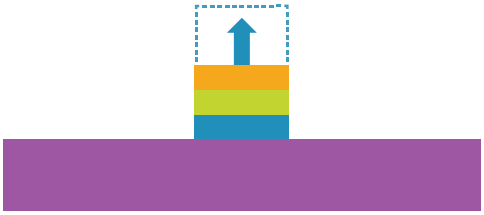
The notion of new things on the horizon is a familiar concept for the tech industry. Keeping an eye on the future has always been part of the game, especially for those with a passion for pushing technology to its limit. Accelerated technology adoption and heightened risk mitigation have certainly given new meaning to cutting edge trends. However, there is a more fundamental way in which today's emerging technology is different from what came before.

In a January 2020 article on his website Stratechery, tech analyst Ben Thompson proposes an argument that is at odds with much of the thinking around technology evolution. Many industry observers, including CompTIA, have divided the history of computing into three eras: the mainframe, the PC, and cloud/mobile. The prevailing thought is that there is some paradigm shift coming in the future that will define a new era of computing. Thompson argues that at a fundamental level, these three eras were actually points on a continuum, and we have now reached the final state of the basic computing foundation.

Thompson uses two criteria to define this foundation: where and when computing takes place. From a location perspective, computing shifted from a single room (mainframe) to an office environment (PC) to omnipresence (cloud). From a timing perspective, computing shifted from batch mode (mainframe) to deliberate computing tasks (PC) to constant use (mobile). Now that computing is happening everywhere all the time, there is no more growth taking place in the foundation.

Early IT activity focused on growth of the computing platform, with relatively simple applications built on the foundation. As the platform grew, applications grew in a variety and complexity, and IT efforts split between platform growth and application growth.

This does not mean that industry growth stops, though. It simply changes the direction. As the outward growth of the foundation platform slows or stops, there is more upward growth potential in the solutions that can be built on the platform. Not only does the final platform have more capability than ever before, but the stability drives more energy into the ecosystem. There is a link here to the shift between tactical and strategic IT. Most tactical IT activities revolved around growing or maintaining the platform, then stacking relatively simple solutions on top. In strategic IT, the platform is a given, and the activity is directed toward more complex solutions.



Moving forward, the platform has reached its full potential. Applications are now built from various components rather than being self-contained, and most of the effort is focused on further functionality of applications.

There is also a link to emerging technology. In the past, the most prominent new technologies were those that advanced the platform (PC, cloud, mobile). Other new technologies were often discrete solutions that rested on the current platform. Today's new trends do not fit either category. To the extent that any new technology applies to the platform (such as 5G), it is introducing improved capability rather than a new paradigm. However, these platform-related technologies are few and far between. The vast majority of developments in the emerging technology bucket are solution-related, yet still different from solutions of the past.

Rather than being self-contained applications that can be placed into an IT architecture, emerging technologies are primarily components for building new solutions. IoT does not get placed on a rack in the server room; companies build IoT systems using sensors which then collect new data to be used in decision making. AI is not a new software package; developers use AI algorithms to write new programs that apply probability to help automate business processes or produce new insights. Blockchain does not simply replace existing databases; business relationships are built around new agreements that leverage the unique properties of blockchain-based transactions.

Thompson opens his article with a brief history of the automobile industry. The early stages of that industry were marked by dynamic growth in automobile manufacturers. Over a quarter century, this foundation grew until economics drove consolidation around a fixed number of manufacturers, with relatively little change in the following century. With a stable foundation, the ecosystem flourished as society was reshaped around the existence of the automobile.

We are likely at the same point in the technology industry. While the industry up to this point has already had many facets beyond product manufacturing, there has recently been an inflection point in the number of business models based on the concept of ubiquitous computing. This has been especially true in the IT channel. An institution built primarily around product distribution has evolved into a countless array of businesses which enable client success with technology.

As with the strategic viewpoint on IT, building solutions on this steady foundation will require creativity. Emerging technologies add many new options to the IT pro's toolbox, leading to an infinite array of possible solutions. As with other industries, the highest value comes not through the sale and support of commodity pieces, but in crafting those pieces together to create tailored solutions. This next phase of industry evolution might be called the age of artisan IT. Those who have deep knowledge of available technology combined with a solid understanding of business process will be able to deliver high value solutions that meet specific needs.

The Impact of Emerging Technology

With emerging technology established as a strategic way for IT leaders to build solutions on a new platform, the focus turns to the practical applications of emerging technology in IT and business operations. It is well accepted that digital transformation is less about the new technology being introduced into an organization and more about a cultural shift in the way business gets done. Successfully implementing emerging technology demands a rethinking of previous practices.

As stated previously, individual technologies will eventually become important in tactical discussions around building systems. Broadly speaking, though, emerging technology is already reshaping other activities. Evaluating new technology shifts from a side activity to a formal cross-departmental initiative. The role of IT in the decision-making process has been evolving over the past several years, and awareness of emerging technology is part of that redefinition. Changes to workflow have followed technology adoption since the first mainframe systems, and those changes are tied more tightly than ever to success in implementation. Most importantly, the skills needed to maximize new trends are in high demand, and properly understanding the dynamics of today's workforce is key to filling the skill gaps.

Evaluation

Even before changes take place in existing tactical activities, there is a new activity that must be considered. Since emerging technologies act as solution components rather than standalone solutions, there is a greater need to evaluate technologies to understand functionality and drawbacks. There is certainly a strategic aspect to this activity, but it leads directly into tactical efforts.

IT leaders should take the lead on evaluating new technology. Most of the details that need to be understood during this stage are technical, and the IT function should be heavily involved in determining which new capabilities can drive business innovation and how those capabilities will be integrated into current systems. Additionally, this is the time when overarching schemes such as security and data management should be examined to address any incoming changes.

However, this is not strictly an IT activity. With most companies building a more collaborative environment between IT and business functions, this early phase is an ideal time to begin conversation across the organization. As different groups participate in evaluating new technologies, there will be opportunity to establish priorities, and there will also be a chance for each group to learn about the different tradeoffs that must be made between cutting-edge technology, cost and business resiliency.

Decision Making

One of the ripple effects of cloud computing was the rise of shadow IT (or rogue IT). As cloud systems were more easily accessible without deep technical expertise, business units began procuring their own infrastructure and software in an attempt to speed up their processes and select the tools that best suited their objectives. In short order, businesses began realizing the limitations of shadow IT. Selecting individual tools was only a partial solution; integration with other systems provided full functionality and required deeper technical knowledge. On top of that, security was typically not a primary consideration for business units, and IT teams were often brought in to patch vulnerabilities.

Businesses quickly began shifting to a collaborative model. Rather than previous models where business requirements were simply handed off and IT built systems in relative isolation, companies recognized that closer collaboration could potentially speed up the process for business units while maintaining system integrity for IT. In the collaborative model, the IT function was provided a better opportunity to leverage expertise, providing guidance on system construction and owning cybersecurity issues.

Emerging technology provides IT with another point of leverage in collaborative decision making. While business units may have surface knowledge of specific trends like artificial intelligence or blockchain, they rarely have enough depth to truly understand the issues involved. As ownership of the overall solution has shifted back to IT, it becomes the responsibility of that team to fully understand the different options available for delivering value. In order to provide innovative solutions and avoid disruptive threats, IT leaders must utilize the knowledge gained during the evaluation phase to properly describe the costs and tradeoffs involved in using emerging technology to construct new solutions.

Workflow

One of the great hurdles preventing companies from fully realizing the benefits of their technology investments has always been the ability to redefine workflow. In the era of tactical IT, this challenge was not always evident since many investments were made in backend infrastructure. The introduction of the PC certainly drove changes in workflow, and these changes have become even more important as technology becomes more integrated with daily activities.

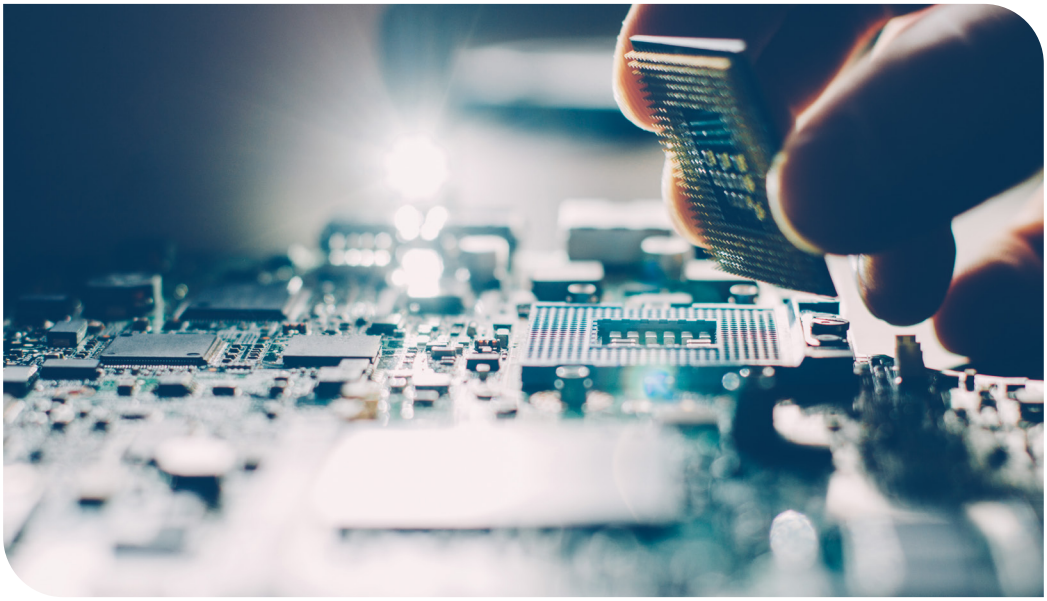
Recently, the primary example demonstrating the importance of workflow changes has been the adoption of cloud computing. CompTIA's research defines four stages of cloud adoption, and in the first two stages companies are typically forklifting existing systems onto cloud infrastructure. In the second two stages, companies begin to modify both their applications and their workflow to take full advantage of cloud capabilities. While there are many challenges involved with initial cloud migrations, businesses indicate that workflow modifications present even greater challenges, though the work is worthwhile because of the potential benefit.

For future technology implementations, there will be even less opportunity to start with a simple transition of existing workflow. The nature of emerging technologies as an integrated component of the solution means that the technology is nearly indistinguishable from the process. IT leaders will not build solutions in a vacuum but will work with business units to simultaneously build both the solution and the workflow that leverages the new technology.

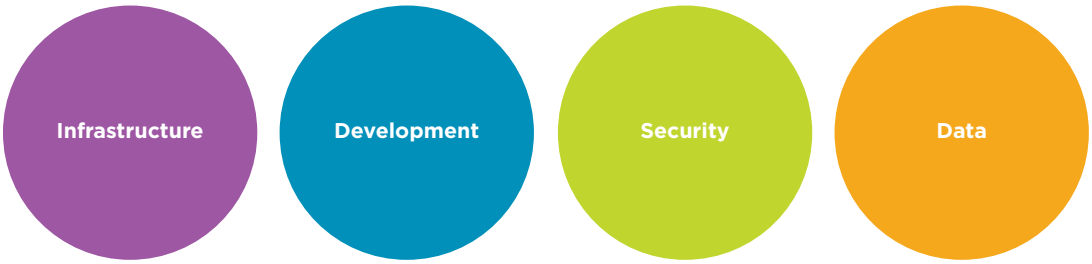
Skills

The issue of skills needed for emerging technology adoption is even more substantial than the issues surrounding decision-making or workflow, and it deserves deeper analysis. Reports of workforce changes during this dynamic time do not always provide the full context for understanding the job landscape. For example, job roles that are described as the fastest-growing often have small numbers of workers currently in that field. A role can be growing quickly but still not approach the numbers found in a job role that has existed for decades. Furthermore, there is often confusion thanks to job titles, which can have infinite variety. A highly specialized job title might be in demand among large enterprises, but not among smaller firms with less resources at their disposal.

It is useful, then, to begin with a fundamental model of IT operations and then expand to understand the most common groupings of the IT workforce. CompTIA's IT framework provides a basic structure that defines modern IT activity. Hardware infrastructure and software development are the primary pillars in this model, with cybersecurity and data management recently emerging as areas that carry broad implications for businesses and therefore require specialized focus. For more, see CompTIA's whitepaper *A Functional IT Framework*.



The Functional IT Framework

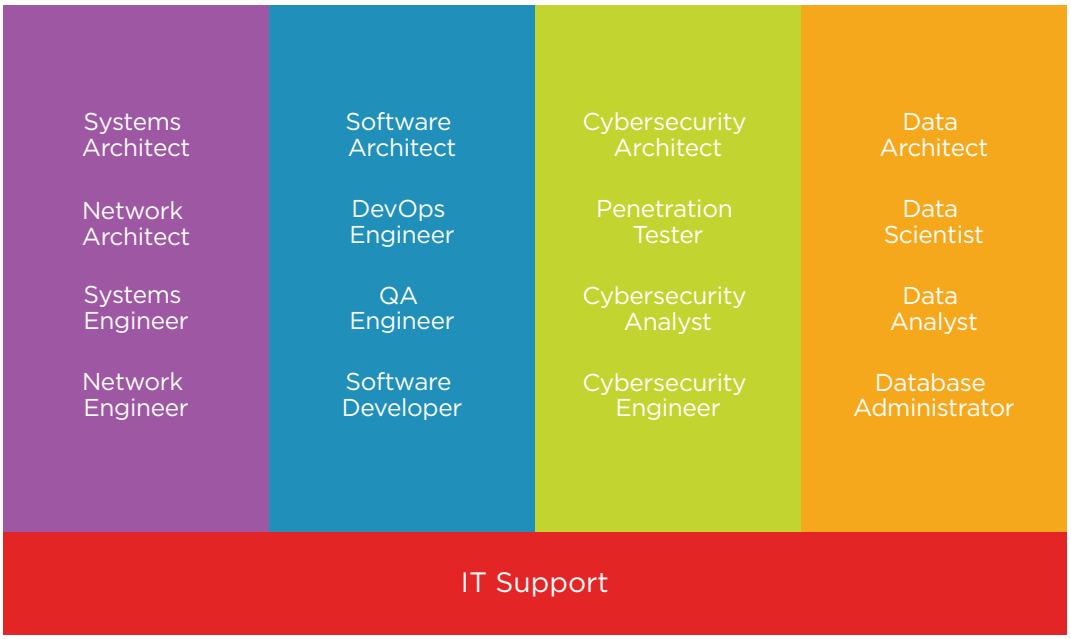


The first step in moving from the framework to common job roles is to separate the introductory role of IT support. Historically, this role has been part of the infrastructure function, providing first-level support for endpoint devices and performing triage to understand if user issues are related to networks, servers, storage or other components. Given the high degree of technology integration into most business processes and the overlap between the different functions in the IT framework, the support role now must have at least a basic understanding of each pillar. While hardware still features prominently in daily activity, the primary objective of problem solving across an evolving set of issues now requires some level of knowledge in software applications, cybersecurity practices and data structures.

The broad role of IT support then leads to career pathways in each area. In some cases, IT support may naturally transition into a more specialized career. Other career paths may have separate entry level positions. The traditional pipeline based off a four-year degree has not yet caught up to this new reality, but alternative routes to technology careers (such as boot camps or code schools) are springing up to address the high demand for technology workers and the rising costs of education. CompTIA's Career Roadmap is built using this model of IT support as the foundation for career paths across the framework.

The final step is defining the roles within each pillar. This step is the most challenging thanks to the difficulty in separating job roles and job titles. Using data from Burning Glass Labor Insights, CompTIA has defined 16 distinct roles that exist today. The definition is based on the skills needed in each role—job postings with different titles but similar skill requirements can be collapsed into a common role. The 16 roles not only describe unique job responsibilities but also convey scope and complexity.

Common Technology Roles



As an example illustrating the validity of the job roles, consider cloud computing. As cloud computing was emerging as a new IT trend, the initial expectation was that specialists would be needed. Companies migrating to cloud systems posted jobs for cloud architects or cloud engineers. These job titles can still be found today, but the number of postings is very low compared to postings for server administrators or system architects, and the skill requirements for cloud roles have a high degree of overlap with the more traditional jobs. Rather than hiring waves of uniquely skilled cloud engineers, most companies added training in cloud skills for their existing infrastructure employees.

The same pattern will hold for emerging technology. It will be possible to find job posts for specific titles, and these titles may even be listed as "fast-growing" since the current number of workers with that title is so low. However, the primary tactic for businesses will be to add emerging skills to their existing workforce. Over time, if demand grows, new roles will emerge just as they have in the areas of cybersecurity and data management.

The question, then, becomes around defining the emerging skills that are growing in popularity, describing how those skills fit in with individual job roles, and building a training pathway that allows technical workers to add the relevant skills. The answers to these questions are outside the scope of this paper, but they will be addressed in separate projects from CompTIA.

Ultimately, there is a place for emerging technology in IT operations. Just as companies have struggled to recognize that digital transformation goes beyond the traditional purchasing and implementation of technology, there is a challenge in adopting the approach that is required for emerging tech. As part of the ongoing evolution towards more strategic thinking, IT leaders of the future will embrace new techniques and responsibilities that will drive greater value into the business.

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