Paving the Path for Digital Transformation with Open Source Infrastructure
About this paper

A Pathfinder paper navigates decision-makers through the issues surrounding a specific technology or business case, explores the business value of adoption, and recommends the range of considerations and concrete next steps in the decision-making process.

About the Author

Jay Lyman is a Principal Analyst with 451 Research’s Applied Infrastructure & DevOps Channel. He covers infrastructure software, primarily private cloud platforms, cloud management and enterprise use cases that center on orchestration, the confluence of software development and IT operations known as DevOps, Docker and containers. Jay’s analysis encompasses evolving IT operations and software release models, as well as the technology used to create, deploy and support infrastructure and applications in today’s enterprise and service-provider markets. Key areas of research also include OpenStack, PaaS and enterprise end users.
Executive Summary

Digital transformation is real, and it’s happening – our quantitative research tells us that, although there is still a very long way to go. It is an inescapable truth that every business is becoming a digital business controlled by software, which is the manifestation of these digital transformations. Businesses must react, driven by the imperative to improve intelligence, agility and their customer-centricity, or be left behind. In this report, we explain digital transformation, look at enterprise demand and requirements, and explore the potential for implementing the software-defined infrastructure underlying a digital transformation using open source technologies.

Key Findings

• A growing proportion of enterprise IT organizations (68%) is executing or evaluating digital transformation, driven by a need for agility, efficiency and business requirements to stay competitive.

• Well more than half of enterprises (65%) are early adopters or act sooner rather than later to take advantage of new technology, making for a highly dynamic enterprise IT market.

• Most enterprise spending increases have to do with moving workloads between environments, adding resource capacity for business growth and new spending for new IT initiatives.

• Our research shows significant use of open source software, which underlies key technologies that are enterprise priorities, such as software-defined infrastructure (SDI) and cloud-native technologies including containers and Kubernetes.

• Open source software and flexibility are also critical for successful broader enterprise implementation of DevOps, which continues to expand in the industry.
**What Is Digital Transformation?**

451 Research defines digital transformation as the result of IT innovation that is aligned with and driven by a well-planned business strategy, with the goal of transforming how organizations serve customers, employees and partners; support continuous improvement in business operations; disrupt existing businesses and markets; and invent new businesses and business models. But what’s driving this, and why is it happening now? And what exactly is being transformed?

![Figure 1: Digital transformation status check](Source: 451 Research's Voice of the Enterprise: Digital Pulse, Budgets and Outlook 2019)

A growing number of enterprise and service provider organizations are executing or evaluating their digital transformation (see Figure 1), driven mainly by agility and a need to better serve developers and speed software development and deployment; a requirement for more efficient IT operations that can scale to more agile infrastructure with fewer people; and related business requirements that are necessary to compete in today’s fast-moving and disruptive market.

Although companies see themselves in many different places in terms of their current markets and opportunities – from all-out disruptors in the market to those staying the course – we can generally break them down into two main classes: the nearly three-quarters of companies whose digital transformation plans are being implemented or readied and the other one-third that are generally staying the course. The former includes market disruptors, market makers and existing companies under reinvention. In these companies, high levels of business transformation and IT portfolio transformation are occurring, but those staying the course do not see themselves requiring high
levels of business transformation. The growing swell toward digital transformation highlights the significant changes afoot at the transforming companies and the growing gap of innovation faced by organizations that are not transforming.

**Digital Transformation Imperatives**

There has to be a specific business reason for any organization to undergo (or at least attempt) a digital transformation beyond just survival. We believe there are three main business imperatives: intelligence, agility and customer-centricity.

Intelligence, in this context, means getting insight from data and moving to data-driven decision-making. We believe the organizations that own the data will win over those that don’t – in any field. There’s a reason Alibaba, Amazon, Baidu, Facebook, Google and Netflix go to such lengths to understand precisely what users are doing on their devices. That reason is intelligence – about what customers or prospects want to buy, where they want to travel, where they want to invest their money, what they like and what they dislike. Swap the word ‘customer’ for ‘employee’ or ‘citizen,’ and you see the same imperative to gather such intelligence.

The second imperative is agility. Business agility is essential because digital disruption is coming to your industry (if it hasn’t already). When physical assets become digital information, markets experience massive growth and disruption. Such a shift means things become knowable and measurable in ways that were not possible before – and the cost of adding new customers drops dramatically. Look at industries where this has already happened: music, photography, mass media, and (most recently) transport and hospitality with the rise of Uber and Airbnb.

The third imperative is customer-centricity. We’ve been around long enough to recall the previous wave of focus on this around the time of the dot-com boom and into the 2000s, when customers were supposedly king, and organizations had to bend to their will. But in reality, customers weren’t king, and companies didn’t bow. That’s because at that time, customer-facing organizations still held the balance of power in terms of technology. They had the CRM systems, the billing systems and so on, and all their customers had was a web browser – mostly on a computer tethered to a desk – and an internet connection measured in megabits, rather than megabytes, per second.

In this report, we are focusing primarily on agility because it is enabled by the underlying software-defined infrastructure and is also connected to developer speed and productivity. Business agility is essential because every industry is subject to disruption. For example, Uber has disrupted the transportation industry. With Uber, all a potential customer needs to do is install the app, add a credit card and request a driver – all accomplished digitally. Before Uber, travelers resorted to waving their arms to flag a taxi or calling for a taxi, often picking randomly from a list of unfamiliar local taxi services. The payment process in taxies can be frustrating, and there’s little way for passengers to ensure they obtain a good driver. Digital transformation improves the customer experience, which, in turn, improves customer-retention rates and draws in new customers as well.
Our research shows that over time, an approach that focuses on agility and risk becomes an increasingly higher IT priority relative to efficiency and cost-cutting. We also see a growing number of organizations aggressively adopting new technology (see Figure 2). Well more than half of companies describe themselves as either early adopters or pragmatic, but acting sooner rather than later, so it is again the unfortunate minority that are left to act and adopt more conservatively and slowly.

Figure 2: New technology adoption  
Source: 451 Research’s Voice of the Enterprise: Digital Pulse, Budgets and Outlook 2019

There has also been a shift in how organizations view IT; rather than being a budget line item or cost-loss center, IT is increasingly considered a strategic weapon and competitive advantage. This corresponds to the growing importance placed on agility and risk as the key technology drivers, a dramatic contrast to the old worldview that was built around efficiency and cost-cutting. Another way to think about this is that ‘new IT’ is focused on ROI and collaboration with the business, while ‘old IT’ is focused on TCO and servicing the business. The ‘new IT’ companies are the same kinds of companies that are reinventing themselves as market makers, market disruptors or those that need to keep up with software-defined businesses in their own verticals.

Facebook’s motto used to be ‘Move fast and break things.’ But as it grew, it discovered this approach didn’t scale, and didn’t work out so well for its customers (ad buyers tend to like it when their ads are displayed). Instead, two years ago, Facebook announced a new motto with a very different take – one that meshes with our research – ‘Move fast with stable infrastructure.’ This is exactly where the agility in digital transformation can make the difference that enables enterprises to keep up with their own competitive disruption without falling apart in the process.
Spending priorities with digital transformation

We can also gain insight into how organizations are approaching digital transformation by considering their cloud spending priorities. Our survey data indicates that for 2019, organizations are primarily focused on moving workloads among different environments, adding resource capacity for business growth, new spending for new IT initiatives, and buying new services (see Figure 3). These priorities are all consistent with the growth of multi-cloud and hybrid infrastructure and the ability to leverage new, mostly cloud infrastructure, and undertaking new implementations based on current trends such as DevOps and the move to cloud-native technologies.

Figure 3: 2019 spending priorities
Source: 451 Research’s Voice of the Enterprise: Cloud, Hosting & Managed Services, Budgets & Outlook 2018
Q: What is the top reason for the increase in your organization’s spending on deployment type in 2019, compared to 2018?

There are a large number of actions that must take place to support an all-inclusive digital transformation. All of these activities require putting the right platforms in place, which allows IT to better enable the business as a whole. Of note is that the top spending priorities by deployment type almost all center on new infrastructure, initiatives and services.
A Large Role for Cloud-Native Methodologies

Cloud-native technologies and methodologies represent a departure from monolithic applications and waterfall release processes, and their use is being driven by a desire for speed, efficiency, and support for applications and services that are distributed across hybrid and multi-cloud infrastructure such as public clouds, private clouds and on-premises environments.

Cloud-native software consists of applications designed from the ground up to take advantage of cloud computing architectures and automated environments, and to leverage API-driven provisioning, auto-scaling and other operational functions. Cloud-native architectures and software include applications that have been redesigned to take advantage of cloud computing architectures, but they are not limited to applications running in public cloud – we see cloud-native technologies and practices present in on-premises environments in the enterprise. We can also define the cloud-native trend by the technologies and approaches that characterize it, all intended to make software development and deployment more fluid and composable – containers, microservices, Kubernetes, service mesh and serverless computing.

451 Research survey data indicates cloud-native technologies such as containers, Kubernetes and serverless computing are priorities for enterprise and service provider organizations (see Figure 4). Our research also indicates that these different cloud-native technologies are complementary, with enterprise organizations typically leveraging multiple cloud-native technologies and methodologies across their many different releases and teams. The cloud-native trend also encompasses the full application lifecycle from development and deployment to ongoing operational management including health, security and availability management, as well as maintenance and eventual end of life. We contend that the cloud-native trend is far broader than application development and deployment. It also includes application and infrastructure architecture and organizational approach.
From an economic point of view, cloud-native technologies enable the true value of cloud by allowing applications to scale and evolve in much shorter timelines than previously. This agility creates new opportunities for the business in terms of revenue growth, efficiency improvements or a better customer experience. However, highly scaled, distributed cloud-native applications also demand new, automated management platforms, which is where Kubernetes management and orchestration, Istio service mesh, Prometheus monitoring and others come into play. The reason for these open source components is to automate, secure and keep track of the fluid and complex deployments of cloud-native services.

We expect the cloud-native trend to continue to grow, fueled in part by intersections with adjacent technologies and trends, including data and analytics, machine learning (ML) and artificial intelligence (AI), security, and IoT/edge computing – all of which play a role in facilitating digital transformation.
The Importance of Open Source in Digital Transformation

As enterprises adopt new tooling and modernize their infrastructure to support digital transformation, many requirements impact which tools and vendors they choose. Fitting into existing infrastructure is typically important because large enterprises can’t throw away everything from scratch and start over. Ability to access and modify source code, rapid technology advancement/innovation and avoiding vendor lock-in are also critical. Open source software can be a key element in meeting these requirements and demands given that it is modular, made to work with other software components and is driven by communities that include end users as well as providers. Recent survey research indicates that open source software is entrenched in enterprise application development and IT operations (see Figure 5).

Figure 5: Open source software is entrenched in IT for application development and IT operations
Source: 451 Research's Voice of the Enterprise: Digital Pulse, Organizational Dynamics 2018
Q. Does your organization currently use open source software for any of the following purposes?
Q. What are your organization’s most important reasons for using open source software?

<table>
<thead>
<tr>
<th>OPEN SOURCE SOFTWARE ADOPTION/USAGE</th>
<th>% of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comms, media &amp; publishing (n=21)</td>
<td>90%</td>
</tr>
<tr>
<td>Info tech (n=280)</td>
<td>79%</td>
</tr>
<tr>
<td>Retail (n=37)</td>
<td>78%</td>
</tr>
<tr>
<td>Telecommunications (n=51)</td>
<td>75%</td>
</tr>
<tr>
<td>Finance (n=121)</td>
<td>74%</td>
</tr>
<tr>
<td>Utilities (n=34)</td>
<td>74%</td>
</tr>
<tr>
<td>Manufacturing (n=100)</td>
<td>72%</td>
</tr>
<tr>
<td>Govt/educ (n=114)</td>
<td>71%</td>
</tr>
<tr>
<td>Services (n=107)</td>
<td>66%</td>
</tr>
<tr>
<td>Healthcare (n=65)</td>
<td>60%</td>
</tr>
<tr>
<td>Other (n=54)</td>
<td>57%</td>
</tr>
<tr>
<td>Total (n=987)</td>
<td>73%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>USE CASES FOR OPEN SOURCE SOFTWARE</th>
<th>% of respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application development</td>
<td>44%</td>
</tr>
<tr>
<td>Systems/infrastructure management</td>
<td>39%</td>
</tr>
<tr>
<td>Data platforms and analytics</td>
<td>28%</td>
</tr>
<tr>
<td>Communications and content</td>
<td>18%</td>
</tr>
<tr>
<td>Industry-specific applications</td>
<td>17%</td>
</tr>
<tr>
<td>Enterprise applications</td>
<td>13%</td>
</tr>
<tr>
<td>Other</td>
<td>3%</td>
</tr>
</tbody>
</table>
While cloud-native technology and methodology are critical to digital transformation, open source software can be an equally important element. Open source software such as Linux and MySQL database helped lay an open source foundation upon which much of today’s enterprise software is developed and deployed.

Today, at this time of great change, open source technology provides the best combination of risk mitigation and rapid innovation. Risk is reduced through broad industry support driving consensus and standards that ensure investment protection in the long run, plus core open source values of no lock-in and access to source code. Innovation comes from open source projects that are spearheading the advancement of digital transformation today with their prominent role in cloud-native technology, AI/ML, IoT, blockchain, etc.

In addition, nearly all cloud-native components are open source software: Docker containers, Kubernetes management and orchestration, Helm package management, Prometheus monitoring, Istio service mesh, the Knative serverless platform and dozens more. And because modern open source software projects and communities include not only vendors but also end users, which are among the project supporters and sponsors in the cloud-native market, users are helping to drive the advancement of the software to meet their needs.

OpenStack and SDI

Another example of open source software that serves a critical role for large enterprise and service provider organizations pursuing digital transformation is OpenStack. The open source OpenStack IaaS software has become a credible alternative for building and operating private clouds since the project’s establishment nine years ago. It has captured the mindshare of hardware and software vendors, enterprises, service providers and the investment community. The OpenStack ecosystem has proven to be fertile ground for M&A, typically involving startups and established giants.

OpenStack continues to grow and advance as more globally diverse developers, providers and customers work together to build out its capabilities and ecosystem. Despite more attention on the hyperscale public clouds, OpenStack has become a priority and credible cloud option for many IT professionals and suppliers based on our independent view. Our Market Monitor forecast service expects total OpenStack-related revenue to exceed $7.8bn by 2023 at a CAGR of 21%. OpenStack mindshare continues to grow for enterprises interested in deploying cloud-native applications in greenfield private cloud environments, as well as for service providers, particularly those that provide multi-tenant clouds.

While OpenStack is competing with other private and public clouds and their providers, it is also gaining interest and use among enterprises and service providers that include OpenStack with these other clouds in hybrid and multi-cloud deployments. Based on the 451 Research Cloud Price Index, enterprises achieving labor efficiencies of 400-500 virtual machines per engineer are poised to have lower TCO for self-managed cloud than public or managed cloud options. Where the private cloud is being operated at scale with labor efficiencies, it can be cheaper than public cloud – and in this case, OpenStack is likely the best way forward.
However, its appeal is more limited for legacy applications and for those enterprises more focused on hyperscale, multi-tenant cloud providers. There are several marquee enterprises with OpenStack as the central component of cloud transformations, but many enterprises are leery of the perceived complexity associated with configuring, deploying and maintaining OpenStack-based architectures. Processes for installation and upgrades, tooling, and API standardization across projects have improved over the last few releases because operators have become more vocal during the requirements phase.

Another technology that has been impacted by open source is storage; the adoption of software-defined storage has grown in concert with cloud as more customers expect their storage to act ‘cloudy.’ Open source storage has been enormously popular in the OpenStack ecosystem, with the open source Ceph leading as a preferred software-defined storage option.

Embracing PaaS and Cloud-Native Technology

Open source is dominant for on-premises environments at the PaaS layer. Although we have not released numbers on the size of the market for private PaaS adoption, we don’t see the race as open vs. proprietary because open has already won. Rather, it’s a contest of open source options – whether enterprises choose a more structured PaaS vs. a more composable option that requires more effort but allows greater flexibility. As more companies move to cloud environments of all sorts, they seek to adopt complementary and underlying technologies that can keep up with that shift to cloud.

Containers have also become a critical component of modern enterprise PaaS, and open source software is at the core of containers and other cloud-native technologies, such as Kubernetes, serverless computing and service mesh. PaaS software has generally become ‘containers as a service,’ with Docker, Kubernetes and other open source software now playing a prominent role in both community and commercial PaaS software. Kubernetes, in addition to being container management and orchestration software, is a distributed application framework that is well timed with the growing adoption of hybrid and multi-cloud infrastructure.
Technology’s Impact on Strategy

We can also get a sense of how organizations are undergoing digital transformation by considering the top technologies impacting them. Our survey research indicates that the biggest impacts are coming from software-defined infrastructure; containers and container management; ML and AI; serverless computing; and edge computing (see Figure 6).

Figure 6: Expected impact of technologies on overall IT infrastructure in the coming 12 months

Source: 451 Research’s Voice of the Enterprise: Servers and Converged Infrastructure, Budgets and Outlook 2018
Q: Which one of the following technologies do you think will have the biggest impact on your organization’s overall IT infrastructure strategy over the next 12 months?

<table>
<thead>
<tr>
<th>Technology</th>
<th>% of Respondents (n=655)</th>
</tr>
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<tbody>
<tr>
<td>Software-defined infrastructure (SDI)</td>
<td>24%</td>
</tr>
<tr>
<td>None will have an impact on IT infrastructure strategy</td>
<td>19%</td>
</tr>
<tr>
<td>Containers/container management</td>
<td>17%</td>
</tr>
<tr>
<td>Machine learning/AI</td>
<td>16%</td>
</tr>
<tr>
<td>Serverless computing</td>
<td>7%</td>
</tr>
<tr>
<td>Edge computing</td>
<td>5%</td>
</tr>
<tr>
<td>Blockchain</td>
<td>3%</td>
</tr>
<tr>
<td>Hardware acceleration products</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>6%</td>
</tr>
</tbody>
</table>

As enterprises iterate on technology, they’re looking to move faster and remove single points of failure in their infrastructure. SDI can be a key enabler of that, and we’ve already discussed the importance of containers and Kubernetes. Cloud-native methodology and software are also crossing over with ML and AI, including integrations of TensorFlow, an open source machine learning library, and projects such as Kubeflow for machine learning on Kubernetes. The combination enables data scientists to create and train models in self-contained environments with the necessary data and dependencies; these can then be deployed into production via Kubernetes, which provides autoscaling, failover, and infrastructure monitoring and management, as well as eXtreme venue abstraction.
The Growth of DevOps

In software development, massive process transformation has been happening for a few years now, and through DevOps, it is having a significant effect on the wider organization – beyond development and IT operations teams. Many software development teams have moved from so-called waterfall processes to agile methods and DevOps. Our research shows DevOps is expanding beyond organizational pockets and specific projects to broad implementation across organizations (see Figure 7).

Figure 7: DevOps set to expand in the coming year
Source: 451 Research’s Voice of the Enterprise: Digital Pulse, Organizational Dynamics 2018
Q. Which of the following statements best describes the current status of DevOps implementation in your organization?
Q. What do you think the status of DevOps implementation will be in your organization one year from today?

DevOps is a good example of effective process transformation, whereby teams are involved not just in the planning, coding and building phases, but beyond into testing, release, deployment and operations. Teams, therefore, have a shared understanding of how software is being used in the organization. DevOps enables organizations to react faster to customers’ demands, so it directly affects – and benefits – the overall customer experience. Having the right software-defined infrastructure and cloud-native application delivery platforms in place supports this DevOps transition. This is particularly true in terms of enabling agility through automation – whether it’s via continuous-delivery pipelines or automating the underlying infrastructure using clouds, configuration management and containers.
Conclusions

Digital transformation is imperative for enterprises that wish to survive in a rapidly changing world. With new entrants in every market and the ever-weaker geographic borders that previously held back some competition, it is vital that all companies become software-defined businesses to thrive. There is a growing swell of organizations that are embarking or progressing on their digital transformation journey and adopting new technology more aggressively, leaving the minority that fail to adapt at risk of extinction.

Enabling digital transformation in terms of agility, analytics and customer-centricity requires a technological shift as well as a business and cultural shift. Developers, IT operators and organizations overall must move toward collaboration, as well as new cloud-native technology and methodology and DevOps to successfully transform.

A sizable proportion of today’s application development and IT operations centers are using open source software with growing awareness of the benefits, which include flexibility and integration with existing infrastructures. The more that companies must invest in innovation, the more likely they are to adopt open source software. The reason? All of the dominant tooling in the most innovative areas of infrastructure is open source – including cloud-native software. Underlying that infrastructure are additional open source components and layers of the stack that include cloud, storage and the operating system.
As your company deploys new technologies such as IoT, edge computing and AI/ML, your application development and IT operations teams need a modular, flexible and open application delivery and IT infrastructure. For more than 25 years, SUSE has hardened, delivered and supported open source technologies and solutions for companies around the world, working closely with the open source communities, our partner ecosystem and our customers to deliver innovative solutions that meet these new business demands.

As the truly open, open source provider, SUSE delivers an application delivery and software-defined infrastructure approach leveraging open source solutions including Kubernetes, OpenStack, Ceph and Linux, freeing businesses from vendor lock-in and providing enterprise-ready application delivery, cloud, software-defined storage and multimodal operating system solutions that drive innovation and support the adoption of cloud-native and DevOps technology and methodology.

SUSE has helped thousands of businesses transform so they can successfully unify their IT operations, intelligently sense and quickly respond to new trends, experiment boldly to drive market-disrupting innovations, and keep evolving to meet whatever challenges tomorrow brings. To learn more about how SUSE can help with your digital transformation, visit https://www.suse.com/programs/digital-transformation/.
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