

Hybrid IT and Intelligent Edge Solutions

TOOLS AND TECHNOLOGIES TO ACCELERATE DIGITAL TRANSFORMATION

Marty Poniatowski

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Foreword

Technology continues to advance at a lightning-like speed. To succeed, enterprises of the future will require intelligent and autonomous IT systems that seamlessly connect their data from edge to core to cloud. Digital transformation is disrupting every industry and customers are looking for a trusted partner to help them navigate this new world.

With our innovative mindset and technologies, Hewlett Packard Enterprise is better positioned than ever to enable customers and partners to take advantage of the opportunities that exist now and that will emerge in the near future. At HPE, we are focused on building the world's best infrastructure solutions – intelligent, state-of-the-art technologies and services that provide the tools to harvest, analyze and store critical data from across the business. By quickly turning data into insights, enterprises will drive new business models, create new customer and workplace experiences, and increase operational efficiency.

In this book, HPE experts describe a number of tried and tested solutions that demonstrate these principles of innovation and collaboration in action. They illustrate the fact that Hewlett Packard Enterprise offers not just one or two locked-down proprietary platforms but a whole suite of open and flexible IT solutions with innovations such as HPE Synergy, OneSphere, and Aruba purposely designed to bridge the evolution to software-defined composable infrastructures, multi-cloud environments, and IoT at the edge. This aligns with HPE's vision to make hybrid IT simple, power the intelligent edge, while providing the services and expertise to make it happen.

In the end, it's all about the right mix of technology plus the right customer experience, driving the right business outcomes. To go further, faster. To accelerate what's next on your transformation journey.

Best Regards,



Antonio Neri
Hewlett Packard Enterprise
Chief Executive Officer

Introduction

The world of technology is changing and, at Hewlett Packard Enterprise (HPE), we are helping lead that change. To transform your business, you care about cutting edge topics such as gaining actionable insights at the intelligent edge, evolving the right mix of on-premises and cloud-based solutions for hybrid IT, and taking advantage of emerging tools, technologies, and services such as consumption-based spending for IT. You came to the right place to learn about these, and many other topics, in *Hybrid IT and Intelligent Edge Solutions*.

At HPE we have the unique ability to both advance IT continuously in our services and product portfolio and, at the same time, develop truly breakthrough technologies such as memory-driven computing. The chapters in this book cover tremendous HPE innovations that you can use today, including:

- Aruba, a key enabler of the Intelligent Edge
- Gen10, providing uncompromising security for next generation compute
- Superdome Flex, a scale-up solution with advanced SGI technologies
- Hyperconverged with SimpliVity, the ideal platform for hosting VMs
- Synergy, a new category of composable infrastructure to simplify hybrid IT
- Software-defined OneSphere for streamlined and simplified multi-cloud management
- Nimble and 3PAR, industry leading all flash storage systems
- OneView and InfoSight, powerful tools to manage and optimize your IT infrastructure

On the revolutionary horizon is memory-driven computing with The Machine. This is a change in the way compute will take place with memory at the center to dramatically improve processing performance and capabilities. Another technology that has had a meteoric rise is Blockchain, and here we take a look at the ways HPE can help you leverage Blockchain innovations for business success.

This book also contains numerous examples that you can view and potentially use as a starting point for your immediate IT needs. The HANA and HPC chapters provide a blueprint for the way in which we solved a specific problem for a customer using our products, services, and design expertise. At the same time, this book does not claim to discuss every solution that HPE has to offer. Cloud Technology Partners (CTP), for example, is the arm of HPE that helps firms manage the many aspects of developing the right cloud strategy. So, although this a topic that merits its own chapter, we do not cover here how CTP can take the confusion out of developing a hybrid IT strategy by providing consulting design and operational advisory services.

Why we wrote this book

At HPE our services and product portfolio is expansive and no book could comprehensively cover everything that we have to offer. As evidence of this, we would like to reference our previous book, *Ideal Platforms for Optimizing IT Workloads* published in 2017. That book covers twenty more workload solutions tailored to specific environments, and is essentially a companion volume to this. This edition is likewise meant to serve as a starting point to explore and understand the power of HPE technology to solve problems and seize opportunities. We hope you will be rewarded with many practical insights into how these HPE solutions can not only help drive, but also accelerate, your business transformation.

No matter what workloads you're running there is the ability to run them in a Hybrid IT manner, using a combination of on-premises data centers, private and public cloud. Similarly, any asset that you possess has the ability to provide useful data starting with the Intelligent Edge or Internet of Things. These two broad areas are the focus of this book and important to every business that we speak to about their IT needs. However, these conversations rarely lead to “one size fits all solutions” and virtually everyone has a unique approach to addressing these technologies and, in many cases, are not yet fully engaged with implementing them or are in the early stages of their use. Take containers, for example. Every business has a plan to implement containers, both as a way to streamline DevOps and as a great alternative to virtualization, but not many organizations have the majority of their workloads running in containers. This will advance, of course, but it provides an illustration of the transitions that continue to unfold and to evolve and where HPE can act as your trusted advisor in mapping a pathway to success.

How this book is organized

This book is designed to provide insights on tools and technologies that are designed to help accelerate your digital transformation journey. Chapters can be read independently to dive deeper on topics of interest or to explore solutions that are directly connected with your business needs and strategy. A summary at the end of each chapter highlights essential takeaways related to the topic at hand. The following is a list of some important chapters with an overview of key topics discussed:

Intelligent Edge

Chapter 1 is written by an expert who leads a team working on Intelligent Edge and Internet of Things (IoT). This is an area that is just beginning to realize its promise and this chapter covers many factors related to a successful Intelligent Edge endeavor.

Chapter 2 also relates to the Intelligent Edge and focuses on Aruba-related technologies. A key aspect of Intelligent Edge is having a network in place that is setup in a mobile first manner to overcome the limitations inherent using a traditional static and rigid network architecture.

Software Defined Data Center (SDDC)

The concept of software defined affects every aspect of Hybrid IT, so it is important to look at this area ahead of chapters on specific technologies and solutions. Chapter 3 covers many topics related to SDDC including bimodal IT in which two IT delivery models need to be supported: stable and agile. Another topic of particular interest in this chapter is HPE OneSphere which is a private-public cloud dashboard for your Hybrid IT environment.

Gen10

Much of the advanced hardware technology covered in this book is based on HPE Gen10 servers. Chapter 4 covers the key areas of Gen10 advancements including security, intelligent system tuning, persistent memory, and processor choice. Gen10 is also part of many subsequent chapters including Synergy, SimpliVity, Superdome, and Azure Stack to name a few.

Azure Stack, SimpliVity, Synergy, HANA TDI, Superdome Flex and HPC

The next set of chapters (5, 6, 7, 8, 10, and 12) focus on some typical customer problems to show you how a solution can be implemented. They provide some specific examples of how digital transformation can be achieved using the advanced capabilities of HPE's Gen10 and other platforms. There are, for instance, scale-up applications such as HANA TDI that requires as much memory as you can throw at them, and High Performance Computing (HPC) problems that can be solved with ingenious scale-out technologies. Some problems can be solved on a single platform, such as Synergy, which can be used for both scale-up and scale-out.

Memory-Driven Compute

In the age of big data, the information we are collecting is skyrocketing and we need memory storage that can process vast amounts of data, quickly, to extract business value. HPE Labs has developed a memory-driven computing model with The Machine that has, at its center, non-volatile memory, with System on a Chip (SoC) accessing this large pool of non-volatile memory. All of this technology is connected with a photonic fabric. This topic is covered fully in Chapter 9.

HPE OneView

The management of much of the modern IT infrastructure discussed in the preceding chapters can be done using HPE OneView. Chapter 11 discusses how OneView can not only handle basic management tasks on HPE products, such as BIOS and firmware updates, but can also be used to perform automation and orchestration on other platforms leveraging a powerful library of RESTful APIs.

Storage

The vast amount of storage required to support Intelligent Edge and Hybrid IT initiatives is growing dramatically. The need to process data in a high-performance and low-latency environment is key. In Chapter 13 on HPE Nimble, a section is devoted to InfoSight which helps you gain a meaningful understanding of application workloads by identifying I/O patterns, recurring performance patterns and noisy neighbor workloads. Storage Area Networks (SAN) and 3PAR solutions are covered in Chapter 14.

New IT Consumption Models and Secure Technologies

There are other chapters that cover a variety of topics including an alternative way to pay for your technology based on consumption (Chapter 15), and an overview of Blockchain (Chapter 17) which is quickly emerging as a disruptive technology in many industries. There is also a chapter on using secure encryption technologies for added security (Chapter 16).

In summary, this book is a window into Hybrid IT and Intelligent Edge from the perspective of both reference architectures as well as real-world proof points and design examples. I hope that you will find many useful pointers on ways to plan and execute your IT strategy using the best tools, technologies, and services to accelerate your digital and business transformation.

Thank you,

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About the Authors

This book consists of submissions from many authors who crafted the solution covered in their area of expertise. The primary author worked closely with the chapter authors to produce a book that comes as close as possible to reading as if one author produced the entire book.

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1 The Internet of Things (IoT) and the Intelligent Edge

INTRODUCTION

The new technology revolution is here, and for the first time in history, technology has exceeded humankind's ability to use it and has provided an "Art of the Possible" for leveraging information technology for almost anything. The combinations of cloud computing, mobile, and connected everything, everywhere and at any time along with the ability to sensorize and digitize any objects and things have produced an era of digital and connective disruption the like of which we have never seen before. This chapter discusses the possibilities presented by HPE technology for powering the new frontiers at the Intelligent Edge.

The Internet of Things

No longer is science fiction just fiction, it is becoming reality at a furious pace and what is feeding all this is the Internet of Things and for Things (IoT). IoT is feeding this wave of the new big data where old analog data that have long existed everywhere is now being captured and digitized to gain faster time to insights and real-time actions. Figure 1-1 depicts the type of objects that can be connected in IoT.

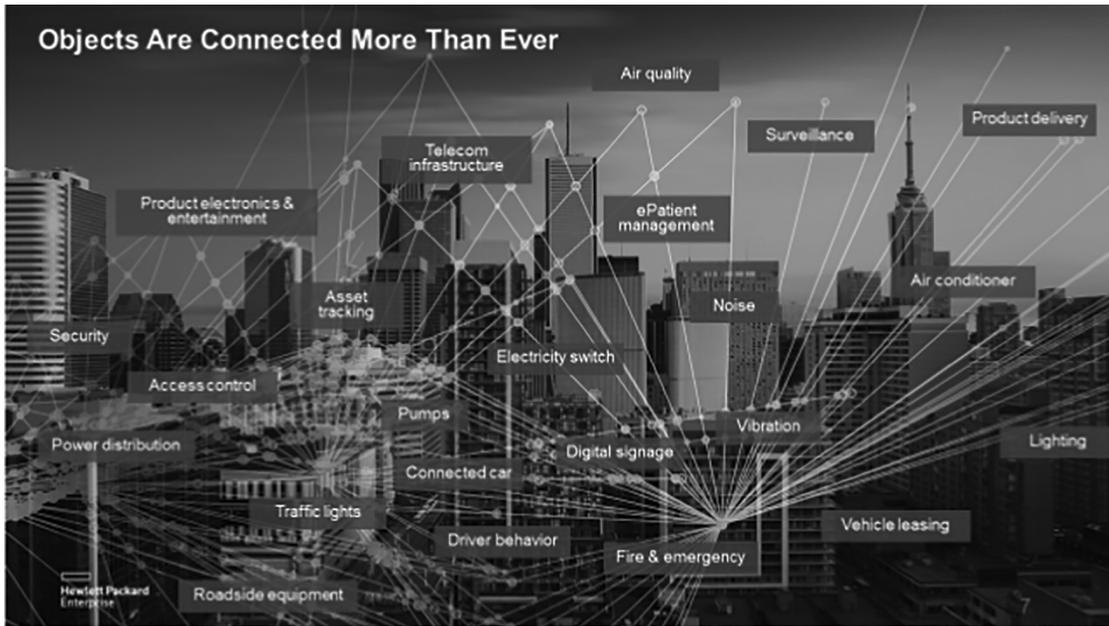


Figure 1-1 Objects and IoT

Big Data Analytics and Machine Learning

With all of these objects connected, there is a tremendous amount of data being collected. This new big data is now the new “gold,” and the ability to mine data for intelligence from anything is in turn enabling a whole new era of distributed analytics and edge intelligence. The information loop—of being able to sense the data, infer the data, and take action on the data—allows for distance deep learning from the edge to core to cloud and back, creating unlimited number of algorithms for unlimited outcomes. From this, the ability for machine learning and ultimately true Artificial Intelligence (AI) will influence all aspects of life as we know it. These technology buzzwords are now becoming household vocabulary, and we are entering the era of what may be all things possible.

The Evolution of Computing

In order to truly grasp the magnitude of this from a compute point of view, more clarity is needed to define how we got here and what this means for the future. Peter Levine, a general partner of Andreessen Horowitz, does a very effective job of describing the evolution of computing. As Figure 1-2 illustrates, the history of computing continues to be cyclical with centralization starting with the mainframes in the 1960s–1970s moving to a distributed client-server architecture with the advent of desktop and personal computers in the period from 1980 to 2000; then back to a centralized computing with the current mobile-cloud explosion, now accelerating back to a distributed model with edge intelligence. Along this timeline, the systems and devices have grown exponentially from ten million mainframes to multibillions of client-servers to innumerable machines in mobile cloud.

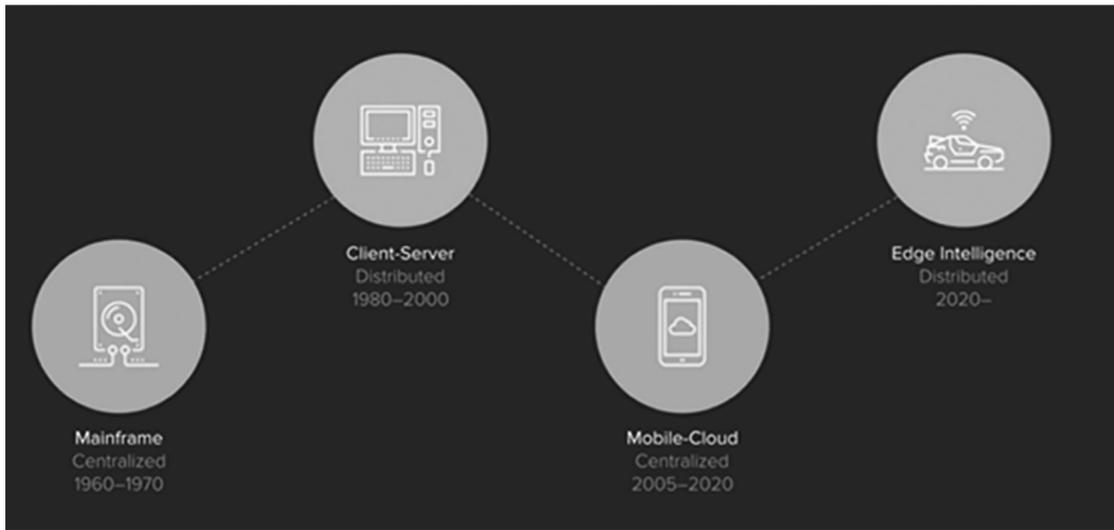


Figure 1-2 The Evolution of Computing
Source: Peter Levine

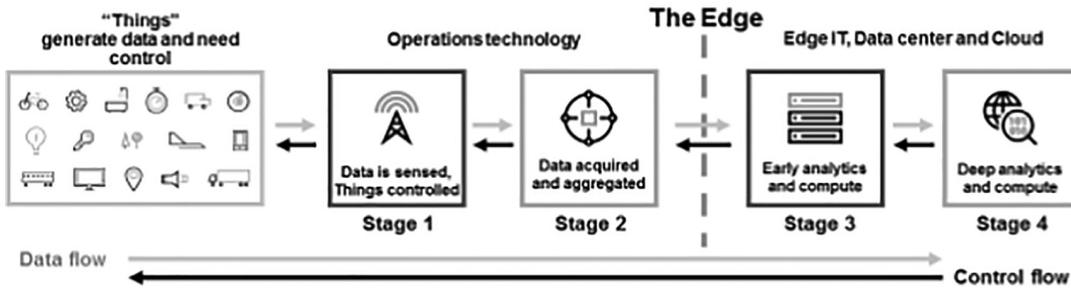
In intelligent edge, we are talking in terms of trillions of systems, devices, and machines due to the fact that in the age of the “Intelligent Edge” humans are not the common denominator but rather machines. Machines will be communicating to machines introducing the potential for amazing innovations such as autonomous vehicles, cognitive computing with robotics, and smart everything whereby everyday objects, devices, things and machines communicate seamlessly with one another to improve our everyday lives.

The Rise of the Intelligent Edge

Given the rise of the intelligent edge, what will happen to cloud computing? Will the cloud diminish or ultimately get eaten up by the edge? Using a sports analogy, the intelligent edge is the new playing field. The playbook and plays within the Intelligent Edge are virtually limitless creating and driving new business outcomes, use cases and ultimately changing the world. So let us define what and where the intelligent edge is, and how and why we want to enable intelligence at the edge and what will happen to the role of the cloud. At its most basic, the edge is anything outside the data center and/or cloud while the cloud is really a bunch of data centers that reside in various places. Figure 1-3 illustrates the key elements of the edge.

Where is the edge?

A fundamental shift in compute infrastructure is underway



IoT intersection of IT (information technologies) with OT (operational technologies)

The “Things” evolving operational systems producing massive amounts of new data

The “Edge” is a place, its outside the traditional data center or cloud – near the “Things”



Figure 1-3 Defining the “Edge”

You can see that the edge has various levels, but simply put it is a place outside of the traditional data center or cloud, near to the things and, in many cases, mission-critical things such as operations technology (a spectrum of objects and systems that produce products and/or services). This convergence of information technology and operations technology in IoT is creating the intelligent edge and every industry, organization, and business is in an arms race to enable intelligence at the edge to create innovation, to deliver new business models, and to lower operation costs while gaining competitive advantages in the marketplace.

Benefits of Compute at the Edge

One primary business reason for distributing compute and doing analytics closer to the data source is the sheer volume, velocity, and variety of data. Many of today’s desired business improvements can only be achieved by analyzing data that is being created at the edge or outside the data center. This data—that may be structured, semistructured, or unstructured—is growing exponentially in volume (megabytes to petabytes per day), variety (video, images, etc.) and velocity (real time). Considering the data economics, trafficking this data to a core/cloud data center for processing is cost-prohibitive and exposes the data to cyber-attack; thus a good deal of the data is going unanalyzed. Figure 1-4 highlights the benefits of performing computation at the edge.

Benefits of Compute at the Edge: (and not send the edge data to the data center / cloud)



Figure 1-4 Benefits of Compute-At-The-Edge

The following list describes each benefit in detail:

- 1) **Latency:** Latency in data transfer reduces “time-to-insight” from the data, which slows “time-to-action” for businesses and protracted responses to the data. By processing the data at the point of ingest, the time to insight is substantially reduced because the data is processed in real time.
- 2) **Bandwidth:** Reduce dependency on the Wide Area Network (WAN) by processing all the data at the edge and only sending the anomalies and insights over the WAN. One of the biggest inhibitors to processing more of the data being generated is network limitations. Very Small Aperture Terminal (VSAT) is low bandwidth and unreliable. Third-Generation Partnership Project (3GPP) has greater bandwidth than VSAT but has its challenges as well. There may not be Ethernet in many remote locations, and if there is, it may not be the necessary high bandwidth or reliable. By using a LAN for transporting the data and WAN for transporting the anomalies and insights, companies can save a substantial amount of money on their network.
- 3) **Cost:** Sending data synchronously to a data center for processing can be expensive. Costs can be greatly reduced by containing the data at the edge and computing the analytics close to the source.
- 4) **Security:** Transferring data over a network by definition exposes data to security threats. By collecting and processing the data at the edge, data traffic and exposure is contained with only the anomalies and insights being sent over the WAN.
- 5) **Supportability:** Most edge locations lack IT staff, so you need a solution that can be supported physically by local staff and remotely by Information Technology (IT) or Operational Technology (OT.) A converged edge system can do what a smart phone has done with all the disparate devices and simplify use, manageability and support.
- 6) **Duplication and Durability:** Most edge locations do not have IT conditions or resources, so the solution used at the edge has to be durable and flexible. The ability to handle inclement conditions yet flexible enough to place just about anywhere like on a wall, under desk in a closet, or even in a truck.

- 7) **Compliance:** Data sovereignty with region and country compliance issues can complicate data transfer across borders and long distances. By processing the data at the edge, the data never has to leave the country.

Impacts of Real-World Information

For the first time, we have real-world information requiring real-time action. The challenges are exacerbated by limitations in the legacy technologies currently in place and the data being isolated or trapped in a variety of disparate repositories, often owned by a variety of different users, as shown in Figure 1-5:

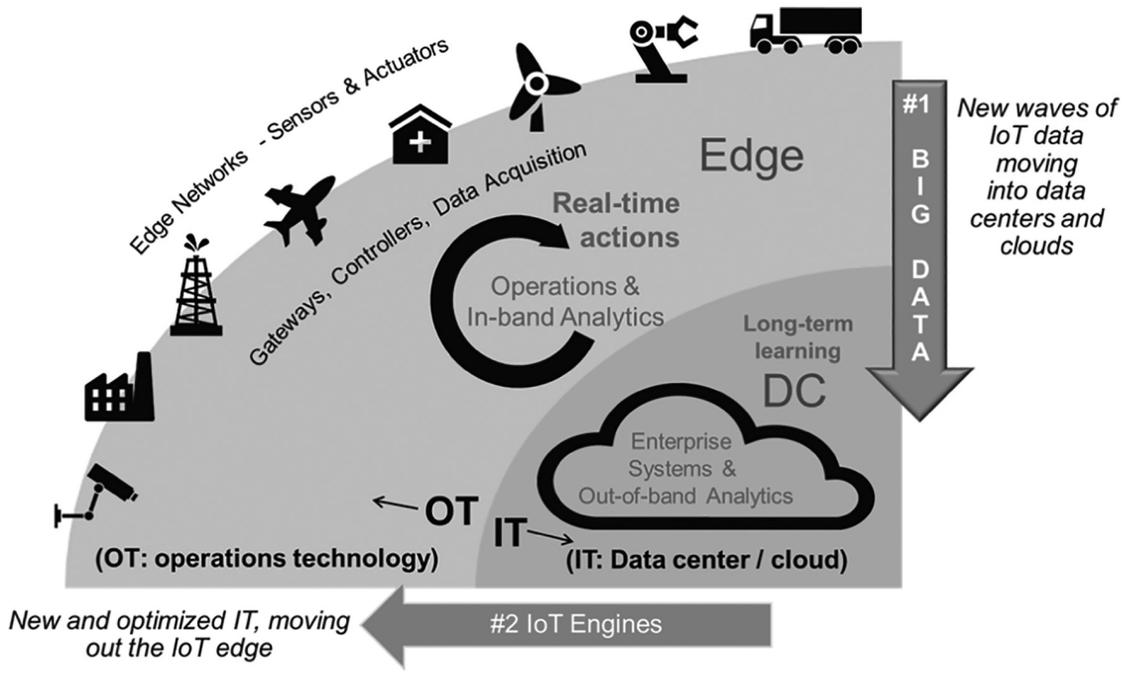


Figure 1-5 IoT Factors

Figure 1-5 illustrates that all the physical things at the edge, along with all the spectrum of systems that create products and services (many of which can be mission-critical), are being digitalized. This in turn creates vast amount of data that is either good (data that is useful immediately) or bad (data that cannot be used immediately but may have some purpose later) or ugly (data that can only be made useful with further analysis). The good data can drive immediate insights at the edge. The bad and/or ugly data, however, must typically be sent to the data center/cloud for long-term learning and data mining.