WHITEPAPER

Creating IoT-Ready Data Centers of the Future

Abstract

Technical advancements today have led to miniaturization of electronic components. This, in turn, has led to embedding intelligence into otherwise dumb devices or 'things' making them intelligent or 'smarter'. Who knows, a thing that we know today might have a different form or function in the very near future. Smartphone is only a case in point. On the other hand, as modern Compute architectures and data communication models began to emerge; the sheer variety, velocity and volume of data we can store and process is growing in leaps and bounds. These newer IT infrastructure models have not only led to accelerating aggregating humongous amounts of data but also led to envisioning and implementing statistical models on that data for predictive and prescriptive analytics for business/organizational and community benefits. As these models evolve, the context for the data processing becomes increasingly relevant, especially in the areas of Information Security and Trust. Together with the proliferation of miniaturization in electronic components, the acceleration of advanced computing models and superior data communication systems; the Internet of Things will play a pivotal role in Data Center Transformation. As the Smarter World begins to witness Data Center Transformation, Data Center Technologists will continue to have an increasing role in gauging these developments and hence, have to look forward to proactively meet these needs.

Thinking Forward: The IoT-driven Smart World and its Impact on the Data Center

In the 2000s, the Internet connectivity became the norm for many applications and today, it is expected as a part of many enterprises, industrial and consumer products. However, these devices are still primarily ‘things’ on the Internet that require more human interaction and monitoring through applications and interfaces. Businesses are just starting to realize the true promise of the IoT– an invisible technology operating behind the scenes, dynamically responding to how we want the ’things’ to act.

We see the IoT as billions of smart, connected ’things’ - a sort of universal global neural network in the cloud that will encompass every aspect of our lives and its foundation is the intelligence that embedded processing can provide. The IoT comprises smart machines, interacting and communicating with the other machines, objects, environments, and infrastructures. As a result, huge volumes of data are being generated and that data is being processed into useful actions that can command and control things to make our lives easier and safer and reduce our impact on the environment.

Data Center Capacity

As IoT devices increase and applications utilizing their data grow exponentially, the Data Center is impacted the most. As the quantity of data increases, businesses are trying to apply various software models to understand and act upon this data.

The IoT creates an intelligent, invisible network fabric that can be sensed, controlled and programmed. The IoT-enabled products employ embedded technology that allows them to communicate, directly or indirectly, with each other or the Internet.

“The IoT creates an intelligent, invisible network fabric that can be sensed, controlled, and programmed. The IoT-enabled products employ embedded technology that allows them to communicate, directly or indirectly, with each other or the Internet.”

Automating Intelligence

That IoT enables a rare insight into multitude of data is a given. However, what makes this more interesting is the level of automation that can be applied to an existing network, based on the data sets available.
The rise of the IoT has been driven by the convergence of market forces and parallel innovation of enabling technologies. Products have evolved from purely physical components to complex systems combining processors, sensors, software, and digital user interfaces that are now connected to the Internet and each other. As their definition has evolved, product capabilities have multiplied, creating new forms of value and capabilities to do things well beyond their primary function. The resulting impact is a fundamental transformation of how manufacturers create and exchange value with the customers. This transformation is shifting the sources of value and differentiation to software, the cloud and the service and spawning entirely new business models. To capture this immense opportunity of value creation, manufacturers need to rethink nearly everything — from how products are created and sold to how they are operated and serviced.

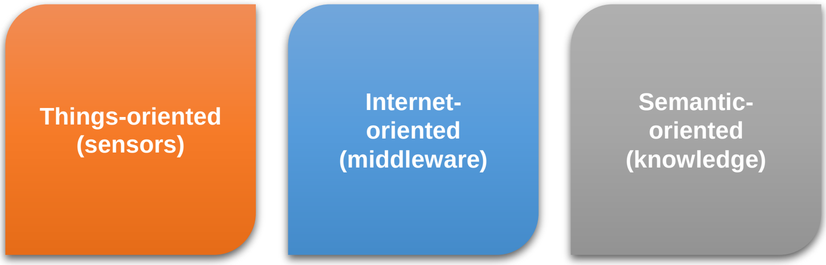
Consumers have connected things such as thermostats, energy meters, lighting control systems, music streaming and control systems, remote video streaming boxes, pool systems, and irrigation systems with more to come. Most of these systems might have connectivity through a Website so that a user can manage them through a standard Web browser or a smartphone application, which acts as a personal Network Operation Center.”

Evaluate the concept of IoT, using three paradigms of end-points, Internet, and analytics. The point of intersection of these paradigms is of immense value as this is the point of usefulness of the IoT ecosystem.

"Evaluate the concept of IoT, using three paradigms of end-points, Internet, and analytics. The point of intersection of these paradigms is of immense value as this is the point of usefulness of the IoT ecosystem."

Architectural Elements of IoT: Three Key Paradigms

We can categorize the IoT into three paradigms—



Although this type of delineation is required due to the interdisciplinary nature of the subject, the usefulness of the IoT can be unleashed only in an application domain, where the three paradigms intersect.

A better understanding of the IoT can be realized by applying the above paradigms to diverse industry verticals such as healthcare, aerospace and defence and transportation (as illustrated in Figure 1).

Things-Oriented Paradigm (Sensors or Sensing Nodes): Sensing nodes or sensors are devices for environmental data aggregation. Device control, supervisory and data aggregation are primary areas of discussion in this paradigm, as it addresses the objects' purpose to sense its environment and aggregate data.

Internet-Oriented Paradigm (Middleware): This paradigm encompasses systems infrastructure to enable data retention for deriving business value. Typical components involved include gateway, network and the Data Center.

Semantic-Oriented Paradigm (Knowledge): The primary purpose of data aggregation is to derive business value by analysing trends and deriving insights. In essence, cloud and business logic become the crux of this layer.

Use Case 1: Healthcare

Sensors	Infusion pump, a medical device that delivers fluids to patients, including nutrients and medications (such as insulin, hormones or chemotherapy drugs) can be used to administer medication electronically in preset-controlled amounts and in a timely manner - based on real-time diagnostics of patient health monitoring data from sensors. Smart devices such as these may enable healthcare professionals to better understand the patients' conditions and make accurate, timely and realistic recommendations.
Middleware	Devices or nodes will need to be connected and interoperable in order to realize the benefits of networking intelligent devices and enabling them to share patient data. This helps healthcare professionals understand and correlate patients' chronic conditions and make accurate, timely and realistic recommendations. Healthcare systems are becoming information hubs. From real-time logistics and supply chain management to production, planning and automated quality control, converged networks deliver visibility across the entire process and enable centralized control. This enables professionals to consult with specialists and colleagues in remote locations at any point during the course of the treatment. Healthcare systems will rely on data and automation to meet the growing patient demands. With the IoT, data is available whenever and wherever required, making diagnosis and treatment of illnesses more efficient and effective. In healthcare, access to the right data and solutions at the right time can literally mean the difference between life and death.
Semantics	Cloud-connected smart devices provide healthcare professionals with real-time patient information and visibility to better understand the patients' conditions and make accurate, timely and realistic recommendations.

Use Case 2: Aerospace and Defense

Sensors	Unmanned Aerial Vehicles or UAVs use complex payloads to perform intelligent surveillance and reconnaissance. Rather than simply being remote-controlled devices, UAVs are evolving to become autonomous decision-making entities, based on data from their own payload sensors as well as from the other nearby entities. Advanced aircraft platforms such as Boeing Poseidon provide single-fused tactical situation display, which is then shared over military data links, allowing for seamless delivery of information. The data collected is often a mix of highly- sensitive and less-sensitive data.
Middleware	Command Post (command and control headquarters) must be able to collect process and react to battlefield intelligence in real time from thousands of battlefield assets for increased situational awareness. It is critical that this real-time data be processed and actionable insights are derived. This mission-critical data needs to flow through a variety of systems, including satellite and space systems leveraging IPv6 to increase reliability and security. As a consequence, military systems leverage Network Functions Virtualization (NFV) for high-performance and reliability. Last but not the least, a trusted, reliable Data Center is required to process the petabytes of data generated in real-time battlefield assets every hour.
Semantics	Besides actionable analytics for tactical warfare decisions, the aggregated data in military cloud can be used to derive efficiencies and manage costs in personnel management, security asset management and security infrastructure. The connected battlefield, network-centric warfare, and the Global Combat Support System are just a few examples of how today's military uses the cloud infrastructure to accomplish its mission.

Use Case 3: Transportation

Sensors	Sensors within vehicles as well as in roadways and railway tracks can send critical information to traffic control sites and operators for efficient traffic routing, congestion management and maintenance deployment. Smart control systems for trains, based on a variety of constantly changing external data inputs such as weather, topography, location, distance from destination, track conditions and car-to-car communication can signal trains to slow down, indicating that another train is ahead. As connected vehicles transmit data in real time to engineers, they use this data for automated decisions to enhance the safety and reliability of transit services.
Middleware	Gateways within the buses or trains can help provide drivers and riders with location-based services and Wi-Fi connectivity. Additionally, optimized efficiencies and reliabilities can be achieved by analyzing real time data from these gateways. Real-time passenger information screens can help estimate where a train is exactly at any point during the transit. This information can be utilized by operators to understand if the train is operating as expected. These management systems make more efficient use of tracks and stations. Increasingly, railways around the world are adopting novel solutions and techniques such as wireless signaling, control systems, collision elimination and congestion tracking to ensure safety, reliability, better service levels and reduced costs by relying heavily on data and automation.
Semantics	Cloud-based communication enables operators to utilize equipment, tracks and stations more efficiently while dramatically reducing the risk of accidental collisions. Performance is optimized as critical decisions can now be made in milliseconds. The cloud based central control systems provide real-time equipment tracking, which alerts operators to the location of any piece of equipment at any time. Predictive analytics on transmitted defect data can be used to identify maintenance windows, reducing or eliminating the need to take equipment out of service for routine inspections and preventive maintenance.

WHITEPAPER

Creating IoT-Ready Data Centers of the Future

Impact of IoT on the Data Center

The IoT ecosystem will definitely impact the Data Center as more data, sciences-related activities are leveraged to make business work better. Data Centers need to be equipped to handle disparate platforms, varying amounts of data and capability to process the same in real time for decision making. This implies that more and more new technologies need to be deployed, tested and rolled out and the Data Centers need to be equipped to handle them with agility.

The analyst firm Gartner also estimates that the IoT will comprise 26 billion units by 2020 and expects incremental revenue generated from these devices to be in excess of US$ 300 billion. "Deploying the IoT-based solutions involves a significant change in capacity management methods. This is due to the fact that with these increased assets, there is a larger stream of data flowing between the device and the back-end systems, on which analytics and other processing work, efforts are carried out.

This also necessitates a change in certain business and organization behaviour as more real time inputs to data is made available to the organization units.

As businesses, organizations and governments look to transform and reinvent themselves for the future, it is essential for them to become proactively agile to respond to real-time situations by sifting through data-driven landscapes. In this regard, the need for a single unified framework for enabling data/information storage, processing and actionable analytics/insights from massive data sets becomes increasingly evident. Encompassing the best of breed technologies from embedded systems, cloud computing, data science and Big Data analytics, the framework will need to provide options/choices for real time responses that stakeholder/business owners demand in every aspect - be it sales, marketing, engineering, operations, finance or any other business function – thereby, empowering businesses to achieve proactive agility.

> *"In essence, businesses of the future must build techniques and capabilities to 'Store Everything, Analyse Anything and Build the Right Thing'."*

> *"The IoT ecosystem will definitely impact the Data Center as more data, sciences-related activities are leveraged to make business work better. Data Centers need to be equipped to handle disparate platforms, varying amounts of data, and capability to process the same in real time for decision making. This implies that more and more new technologies need to be deployed, tested and rolled out and the Data Centers need to be equipped to handle them with agility."*

Data Center Components Affected by IoT Adoption

Since real time analysis is required, the number of components that play into this segment gets quite large. The net effect is that IT organizations are supporting different streams of infrastructure in different layers of utilization. Right from asset management to security, trouble-shooting and decision making, the Data Center strategies need to evolve to support a completely different ecosystem of devices as well as the business that depends on these devices.

The core component of the Data Center that is impacted is storage, as the quantity of data is now exceedingly large and has to support a dynamic growth. Since real time analysis is required, it is also important to determine the speed and the IOPS of the operations to help businesses use performance storages such as SSDs and high-speed storage sub-systems.

Network and security concerns continue to dominate the requirements both internally and externally. While sensor data traversing wireless networks may be small in size, securing this data is extremely critical. An attempted hacking could result in wrong data being sent upstream, resulting in incorrect analysis providing businesses with inaccurate data that could impact the decision making.

Internal networks need to be robust and able to manage dynamic loads, as analytics of large data sets can impact the network, especially if the data is provisioned through network attached filers.

Asset management gets extremely complicated. The possibilities of end-users plugging in their own devices cannot be discounted anymore. Local Home Area Network, branch office, and on-site data generating equipment need to be monitored regularly and it is imperative that asset management teams update their asset monitoring frameworks.

Traditional methods of collecting IT information are no longer valid. Nor is the possibility of using a single tool that organizations can depend on. A heterogeneous set up of tools and processes need to be established by each IT organization to support the Data Center activities of the businesses.

In addition, audits and Service Level Agreements (SLAs) now need to encompass a larger stream of devices - both within the Data Center and externally. A business solution now needs collaboration among more sets of domain-specific users and value addition is possible only when the domain expertise can be exploited to enable the IoT to successfully enhance the businesses.

Planning for IoT Deployment

The need for the IoT stems from the business-end of the organization. From the perspective of IT directors and managers, there are four critical paths for the IoT success:

- A solid asset management plan – IT assets are going to increase with sensors and devices and this will need proper control
- A tested and validated security plan – laying out devices across different areas will likely to create security challenges, and it is important that security planning and updates are accurate
- Integrating analytics into other core systems of the organization
- Interfacing with business to determine the speed and the need to integrate business functions with the IoT platforms

References:
Gartner, The Internet of Things Will Transform the Data Center (March 2014), accessed Nov 2016, http://www.gartner.com/newsroom/id/2684616

Leveraging Data Center Management Expertise: The Cornerstone of IoT Success

The success of the IoT ecosystem depends significantly on service providers, who can help determine the options that can be explored for effective utilization of the IoT technologies - at both the infrastructure and the business levels. For service providers such as Microland, with extensive experiences in infrastructure and infrastructure management, designing and setting up Data Centers in the IoT landscape is an extension of our core capabilities.

Our Data Center methodology leverages a structured approach to analysis, design, deployment, and management, allowing us to include the IoT parameters at both, the analysis and the operations layers. Taking advantages of our strong methodologies, developed through years of experience, continual research and development, we can determine the various changes that the IoT brings into the Data Center. The critical part of the IoT deployment is neither the data nor the devices, but the way in which the data is utilized by the businesses in real time. At the end of the day, the data is processed within the Data Centers either on-premises or in the cloud and only a structured approach to managing this can enable organizations to make effective decisions in real time scenarios.

Public cloud platforms such as AWS and Azure that offer the IoT platform services, provide immense value to clients with their built-in APIs and a standardized structure of operations that can be implemented within an organization.

A Hybrid cloud solution is usually recommended in most cases to quick start the IoT solution. Reach us at cloud@microland.com for further information on our hybrid cloud suite of solutions and the IoT implementations.

About the authors

Sittula Kranti is the Consulting Manager of Professional Services at Microland. With over 10 years of domain experience, Kranti leads business, technical and consultative projects, delivering IT infrastructure solutions to customers. In his previous roles, he has handled global experience engineering for multi-vendor, multi-site IT infrastructure solutions, spanning diverse industry verticals such as healthcare, banking, finance, insurance, manufacturing, government and education.

Venkatesh ML is the Senior Consulting Manager of Professional Services at Microland. He brings to the table over 15 years of experience and supervises design, planning, analysis, cloud deployment and the Data Center transformations for global clients. He is also the manager of a team of VMware engineers for one of Microland's marquee clients. He possesses extensive knowledge of VMware virtualization products, Data Center technologies, discovery, analysis, planning, implementation, and troubleshooting of VMware products, and hardware and storage.

Nandakumar Padmanabhan is the Director of Professional Services, at Microland. With 17 years of experience in the consulting domain, Padmanabhan leads the Data Center transformation for delivery, handling multiple programs. In his prior roles, he has managed global delivery and has also served as the Enterprise Account Architect for various geographies.

For further information

Contact us at: + 201 793 7052 or Email us at : cloud@micoland.com

About Microland

Microland is a leading Hybrid IT Infrastructure Service Provider and a trusted partner to enterprises in their IT-¬as-a-Service journey. Incorporated in 1989 and headquartered in Bangalore, India, Microland has more than 3,400 professionals across its offices in Europe, Middle East, North America and India. Microland enables global enterprises to become more agile and innovative through a comprehensive portfolio of services that addresses hybrid IT transformation, workspace transformation, service transformation and end-to-end IT infrastructure management.

Lear more about us at:

www.microland.com

Microland Limited
1B, Ecospace, Bellandur Outer Ring Road, Bangalore 560 103, India
P: +91 80 3918 0000 | **F:** +91 80 3918 0044 | www.microland.com

MICROLAND®
Extraordinary. Everyday.