Abstract

Humans have used technology to transform their societies from prehistoric times up to the present. Society begrudgingly accepted the transformative changes, yet the changes moved society forward. Now information technologies and the information revolution are again transforming society. The COVID-19 pandemic further accelerated the transformation from many years to just a couple of years. This 3-part series will discuss digital transformation (DT) from several perspectives. Here, Part 1 discusses the key DT business drivers, concepts, and technology trends, how they are transforming organizations and society, and how the trends are affecting business users and customers. Some technology trends such as real-time data analytics are on-going, while others are more recent, such as blockchain.

Part 2 will discuss the critical factors for a successful DT journey, because organizations need to do a "mind-shift" from traditional records and information management (RIM) practices to content services (CS). This means imaging the "art of the possible" for a new future using a cloud computing model to deliver transformative change. This includes defining the product scope of the DT journey and the digital products and services that will deliver transformative change for a new future.

Part 3 will discuss how to manage the various DT risks. One essential step is developing the DT business case and connecting it with the critical success factors (CSFs) and the product scope. This discussion will include methods, tools, and techniques such as using personae and identifying use cases that have high business value, while minimizing project risks. This part will also discuss managing CS risks such as ransomware, privacy, change management, and user adoption. Finally, Part 3 will look to the future, will present next steps, and will discuss key takeaways.

Introduction

When an organization's senior management team decides to embrace DT and move forward with the initiative, the team may have varying ideas about DT, the key concepts, the scope of the initiative, the end product, and so on. This is a best-case scenario. More likely, the organization will resist DT – its new tools and processes to support new business models.

So, at the outset, a good question to ask is *What is DT*? Gartner (2021) has two related definitions:

- Digital Transformation: "can refer to anything from IT modernization (for example, cloud computing), to digital optimization, to the invention of new digital business

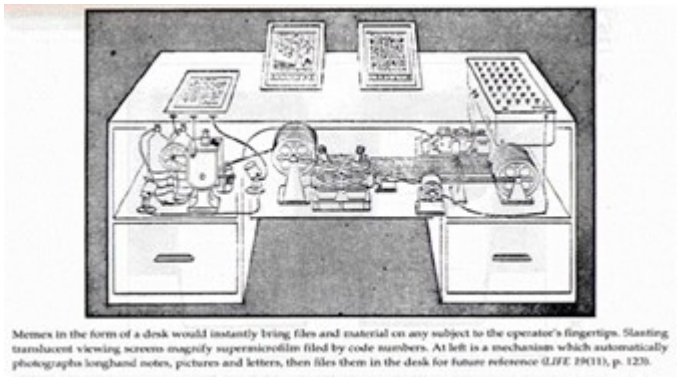
models."
- Digital Business Transformation: "is the process of exploiting digital technologies and supporting capabilities to create a robust new digital business model."

In Gartner's view, DT includes using new processes and technologies to create new business models in order to deliver new products and services.

The Genesis of Digital Transformation

Communication technologies have continued to change societies and human interaction. Inventions such as the telegraph, the wireless radio, magnetic recording, and the telephone have enabled faster and wider dissemination of information to wider audiences of business users and customers.

The invention of the transistor in 1947 can be considered the seed for the Information Revolution, because the transistor is at the heart of every electronic device used today! Two years earlier, Vannevar Bush put forth the idea of an information system device he called 'memex.' The memex was a hypothetical information-centric hypertext device that would permit people to access any information, regardless of where it was stored. His vision and prediction influenced the development of ARPANET, and eventually the Internet. Bush's vision coupled with the commoditization of computers and communication devices, the development of the Internet, the Hypertext Transfer Protocol (HTTP), the World Wide Web, and the web browser by Tim Berners-Lee, along with many other developments accelerated the information revolution. (Srivastav 2014) See **Figure 1** (HistoryComputer 2021).



Memex in the form of a desk would instantly bring files and material on any subject to the operator's fingertips. Slanting translucent viewing screens magnify supermicrofilm filed by code numbers. At left is a mechanism which automatically photographs longhand notes, pictures and letters, then files them in the desk for future reference (*LIFE* 19(11), p. 123).

Figure 1: Illustration of Bush's Memex

Peter Drucker (1999) compared the Industrial and Information Revolutions and their impacts on societies, industries, and jobs. He made some interesting predictions about the

Information Revolution that have since come to pass, such as the fact that new industries based on computers and information technology would become transformative. So, the concept of DT is not new and was predicted as the foundation for the Fourth Industrial Revolution.[1] "The Fourth Industrial Revolution represents a fundamental change in the way we live, work and relate to one another. It is a new chapter in human development, enabled by extraordinary technology advances commensurate with those of the first, second and third industrial revolutions" (WEF 2021).

Information and Content Explosion

Information and data are synonyms but have different definitions. ARMA defines information as "Data that has been given value through analysis, interpretation, or compilation in a meaningful form" (ARMA 2016, p 28). ARMA defines data as "Any symbols or characters that represent raw facts or figures and form the basis of information" (ARMA 2016, p 12). In the context of DT, this article defines content as **information or data that has context and is consumable by humans and automated systems that allow them to make decisions, support operations, take actions, and monetize value by delivering products and services.** Therefore, in this article the terms "information," "data," and "content" are synonymous.

The exponential growth in content is fueled by a plethora of connected devices, colloquially called "Internet of Things (IoT)," from cell phones, mobiles, and wearable technologies, to sensors in homes, appliances, cars, and so on. By some estimates, connected devices now outnumber people, and both are generating data. IDC estimated the world created .16 ZB (zettabytes) of data in 2006, then 2.83 ZB in 2012, and the forecast is a mind-boggling 175 ZB by 2025! That is almost 2000 times more data in less than 20 years (Press 2013, Patrizio 2018). The information explosion is shown in **Figure 2**.

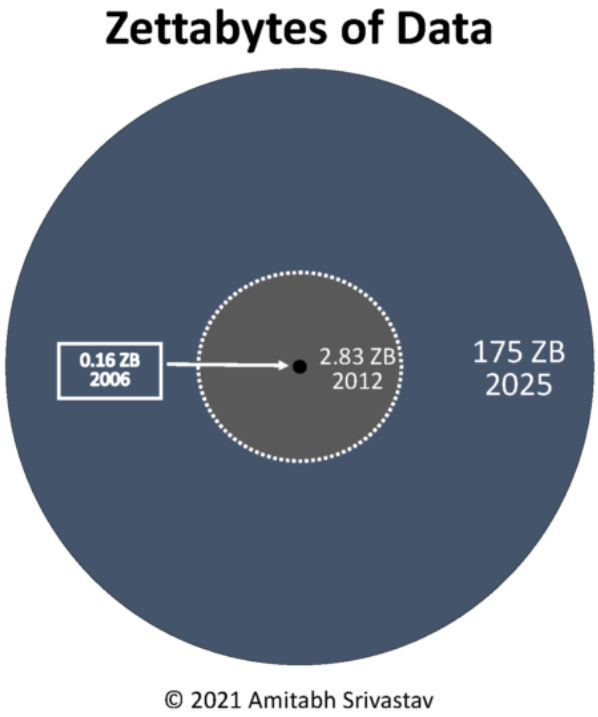


Figure 2: Information Explosion

Understanding DT Concepts and Technology Trends

DT may seem like one technology trend, but, in fact, it consists of numerous technologies – some that compete with each other while others that complement one another. The COVID-19 pandemic exacerbated the hyper-rate of change of the emerging technologies. Thus, the impacts of these trends on DT are difficult to predict. Nevertheless, this section does discuss key trends and technologies evident today. Note that DT encompasses technology and non-technology concepts. Therefore, understanding these key concepts can help the organization define its DT journey and its business case, while increasing the probability of success.

1. Cloud-First

Cloud-first is about cloud enablement. This is a cultural "mind-shift" whereby the organization leverages capabilities and tools to deploy services that are outside the firewall. This implies a cloud computing model that ARMA defines as "A model for enabling ubiquitous, convenient, on-demand network access to a shared pool of configurable computing resources (e.g., networks, servers, storage, applications, and services) that can

be rapidly provisioned and released with minimal management effort or service provider interaction" (ARMA 2016, p 9).

A cloud enabled approach uses computing, data storage and development, or networking resources in an Infrastructure as a Service (IaaS), Platform as a Service (PaaS), Application as a Service (AaaS), or Software as a Service (SaaS) model. The nomenclature can extend to include Data as a Service (DaaS), Content as a Service (CaaS), and Managed Content as a Service (MCaaS) to deliver digital interaction experiences to customers. More recent technology trends include Blockchain as a Service (BaaS) and Artificial Intelligence as a Service (AIaaS). Leveraging a cloud-first approach also allows organizations to deliver new market-leading solutions more expediently to customers. The customer can be internal to the organization or external, such as partners and regulators.

2. Content Services (CS)

Organizations and customers can engage across multiple channels – in-store, mobile, online, social media, etc. DT is a means to do so better tomorrow than today. Thus, the migration of CS to the cloud is a logical next step in DT to leverage cloud-based technology. The success or failure of a new digital product and service can determine the success or failure of the organization's DT initiative and journey. The migration involves using a cloud enablement strategy to deliver products and services on-demand to business users and customers anytime, anywhere, and on any device, while evolving and adapting to business users' and customers' needs as new formats, standards, and devices emerge. Together, the products and services constitute CS. Much lies "under the hood" to provide CS on-demand because they involve a confluence of content with classifications and content management with supporting processes and policies. Consequently, CS are inextricably linked to a cloud-first strategy.

3. Content Services Platforms (CSP)

Content can be delivered via a CSP. Techopedia (2021) defines a CSP as "a software environment where users can collaborate as well as create and work on different types of content such as text, audio and video pieces. These systems are often part of enterprise design and are branded and maintained for specific clients." Meanwhile, Gartner (2021) defines a CSP as "a set of services and microservices, embodied as an integrated product suite and applications that share common APIs and repositories. A CSP exploits diverse content types and serves multiple constituencies and numerous use cases across an organization." The common theme in both definitions is delivering content to clients for their consumption.

For example, organizations can re-package video libraries, songs, research, and course material for different audiences – customers, researchers, academics, students, and so on; and they can monetize the content via CaaS. Organizations can even re-package their corporate history to tell their narrative for public relations. For example, re-packing corporate records can help weave a narrative to promote a brand, enhance corporate social responsibility outreach programs, improve employee loyalty, enhance diversity, equality and inclusion training, and highlight environment, social and governance initiatives.

4. Content Marketing Platforms (CMP)

Closely related to a CSP is a CMP used by an organization's marketing team. A CMP is a set of "tools and services used by marketers to create, curate, collate and cultivate branded, user-generated and third-party content across multiple channels" (Gartner 2021). Marketing teams can create and share marketing content such as online blog posts, white papers, e-books, or short videos that can be posted on social media platforms and targeted towards various audiences.

5. Customer Data Platforms (CDP)

A CDP aggregates in real-time customer information such as transactional, behavioral, and demographic data to present a complete 360 and unified view of the customer. This data can be structured, semi-structured, and unstructured. The Customer Data Platform Institute (CDP 2021) defines CDP as "packaged software that creates a persistent, unified customer database that is accessible to other systems." In other words, a CDP integrates data from different repositories to help meet customers' expectations of a unified and seamless experience. CDP is essential for digital marketing and a cornerstone of marketing technology (colloquially called "martech") because much of the data is digitally generated. "CDPs apply specialized technologies and pre-built processes that are tailored precisely to meet marketing data needs. This allows a faster, more efficient solution" (CDP 2021). For examples, CDPs analyze vast amounts of real-time data generated and aggregated from various repositories, help streamline data standardization, and use AI-powered analysis for modeling and predictive analysis.

6. Digital Experience Platforms (DXP)

A good digital experience can underpin a good customer experience. DXP is about delivering better digital experiences that engage customers so they can find the products and services they require. This also means that CSP, CDP, and CMP technologies evolve and adapt to customer needs in today's digitally-driven and multi-channel service delivery

models using CaaS, DaaS, and McaaS – all part of the cloud enablement model. “A digital experience platform (DXP) is an integrated set of core technologies that support the composition, management, delivery and optimization of contextualized digital experiences” (Gartner 2021). This can also include customer’s expectations such as intuitive navigation, faceted search, search experience, multi-language support, web accessibility, customer privacy, tracking cookies, and marketing opt-out.

7. Digital Asset Management (DAM)

Another important DT trend is DAM. Organizations use DAM technologies to manage and identify multimedia content used by creative specialists, production teams, and business users in operational roles. DAM is defined as “a content management system (CMS) that centrally stores and manages all digital files produced by an enterprise. It allows an organization to control and centralize management of digital content or data that is accessed or shared by staff members or other users” (Techopedia 2021).

Multimedia is an essential part of an organization’s content management strategy, ensuring that the content is available on demand to authorized business users and customers. DAM is more about implementing the correct business processes for storing and retrieving multimedia content than just the DAM technology. This means that DAM is a cultural “mind-shift” towards thinking about, treating, and managing digital assets, as well as applying a value to the assets and identifying opportunities to monetize them. This includes the digital content previously mentioned, but with a greater emphasis on multimedia, such as podcasts, video, digital images, and movies. Digital assets can also include architectural and design documents, intellectual property, logos, trademarks, copyrights – anything the organization considers an asset.

8. Digital Rights Management (DRM)

Closely associated with DAM is DRM. Organizations use DRM technologies and solutions to securely manage intellectual property (IP) rights and monetize the content. If digital assets have a business value, then organizations have to manage and control access to those assets. DRM is defined as “any access control technology used to protect and license digital intellectual property (IP). DRM is used by publishers, manufacturers and IP owners for digital content and device monitoring” (Techopedia 2021). DRM helps ensure the secure and trusted exchange of content between a seller and a buyer and ensures that only the buyer is granted the privileges allowed by the seller.

Similar to DAM, DRM is also about implementing the correct business processes and less

about the DRM technology. Without the correct business processes, the efficacy of the DRM solution is limited.

9. Artificial Intelligence (AI) and Auto-Classification

AI is constantly mentioned in popular media, and for many years the promise has been that its benefits will fundamentally change all areas of business operations, social interactions, academic, scientific, and medical research, etc. – essentially transforming society itself. To date, this has remained in the realm of science fiction, but advancements in the last several years in chip design, processor speeds, and data networks are starting to deliver some of the promised benefits. Software vendors are promoting their AI capabilities and solutions as a service to meet this challenge. For example, IBM, Amazon Web Service, Microsoft, and Google offer AIaaS.

As the use of AI becomes ubiquitous, it offers the ability to process complexity at scale and speed not previously possible. AI using machine learning (ML) involves processing samples of data to learn. Then using what was learnt, run data analytics on vast amounts of content from many sources. Analytics using robotic process automation (RPA) can examine, analyze, and identify unstructured content and auto-classify data based on rules learned by the "AI engine." When tagging and auto-classifying content, the AI engine can extract metadata to provide context to unstructured content. The result is improved enterprise content auto-classification, searchability, findability, knowledge sharing, security of sensitive data (for example, personal, health, financial, customer, IP), information governance, and compliance. AI can also reduce the human effort required to "crunch" vast amounts of content – generated and stored in an organization's content repositories – in order to identify redundant, obsolete temporary (ROT)[2] content that has no business value.

10. Blockchain, Provenance, and Authentic Information

Blockchain is another technology that is frequently mentioned in popular media, mostly in the context of Bitcoin and other cryptocurrencies. Blockchain is based on Distributed Ledger Technology (DLT) and has applications across a broad range of DT use cases, besides cryptocurrency. "Blockchain will be included as an important technology in the enterprise's digital transformation journey … alongside technologies such as artificial intelligence/machine learning (AI/ML)" (Roe 2019). Today, Microsoft, Google, IBM, and Amazon Web Services are providing BaaS, along with other vendors.

From a DT perspective, how can blockchain help manage the content explosion of digital assets, control access rights, validate authentic information, confirm ownership, and so on?

Since the blockchain stores an immutable record of digital transactions, it provides reliable and trustworthy information about the transaction without the need for an intermediary to complete and validate the transaction.

One use case is supply chains. In this use case, the provenance of the product from source to destination is essential to help ensure the safety, security, and authenticity of the product. Think of contaminated food, sub-standard medical supplies, unethically sourced products, and fake luxury goods, to name a few. The shipping manifest information about the product is digital and the product is tracked digitally using radio frequency identification (RFID) tags. This digital information is stored on the blockchain to show the chronological custody of the product as it moves through the supply chain from the source to the destination, and helps ensure the authenticity of the product once it reaches the customer.

Another use case is professional credentials and academic degrees. In this use case, the issuing organization, such as a professional association, a training and certification organization, or a teaching / academic institution, stores an immutable record of the credential or degree on the blockchain. This record is represented by a series of numbers – i.e., a token. An employer or another interested party can use the token to verify the credential.

A third use case is asset ownership, such as art or IP. In this use case, the provenance of an asset and the transference of its ownership are represented by a token that is stored on the blockchain as an immutable record conferring a certificate of authenticity and ownership. Called a non-fungible token (NFT), it provides proof of ownership of digital art, digital information, video clips, IP, and more. NFTs can represent both digital and real-world items that have high values. Investopedia defines NFTs as “cryptographic assets on blockchain with unique identification codes and metadata that distinguish them from each other. Unlike cryptocurrencies, they cannot be traded or exchanged at equivalency. This differs from fungible tokens like cryptocurrencies, which are identical to each other and, therefore, can be used as a medium for commercial transactions” (Sharma 2021). NFTs are part of a new “industry” and will affect how two or more parties confirm ownership of IP and collectables and sell them. In March 2021, Jack Dorsey, co-founder of Twitter, sold his first tweet for $2.9 million using an NFT to guarantee the authenticity. In the same month, Christie’s sold a work of digital art for $69.4 million, also using an NFT to guarantee the authenticity.

There are many other use case examples, including confirming voter identity for e-voting, identifying the source of contaminated food, managing access to digital identities and personal information, reducing transaction costs of business processes, validating

professional credentials and academic degrees, confirming ownership of real-estate, and other assets (3DPDF 2019).

A discussion of blockchain is not complete without discussing cryptocurrencies and digital money. When Jack Dorsey, CEO of Twitter sold the NFT for his first tweet, the buyer paid using Ether – another cryptocurrency. In fact, digital cash and related start-up companies have been around since the 1990s. Most of these failed, while others were bought by other companies (Reiff 2019). With DT touching every aspect of society in the Fourth Industrial Revolution, cryptocurrencies are poised to play a more significant role in the ability of DT to move forward, especially for financial technologies companies (colloquially called "fintechs") and for transferring money, buying assets, and trading. Fintechs are investigating how to incorporate blockchain technology into their operations to ensure secure and trustworthy payment systems. Meanwhile, central banks and market regulators are investigating how to incorporate digital fiat currencies and cryptocurrencies into the world's financial systems, all while managing new risks and maintaining trust.

There still is hype around blockchain technology, but it is maturing and becoming mainstream, too. The hype started with Blockchain 1.0, first with bitcoin in 2009 and then other cryptocurrencies such as Ether and financial transactions. Then, in 2014 came Blockchain 2.0 for other business applications involving trustless transactions, reducing transaction costs, executing smart contracts to transfer ownership, prove ownership, confirm identities, confirm credentials, etc. Now enthusiasts of the technology are discussing Blockchain 3.0, which will solve scalability challenges – processes transactions faster, is more cost-effective, uses less energy, and is more environmentally sustainable, according to some anecdotal information.

11. DevOps, NetOps, and SecOps

One technical aspect of DT is the development and deployment of IT solutions – referred to as "DevOps." This involves people, processes, policies, and technologies. DevOps is an IT cultural "mind-shift" that involves integrating software development and quality assurance with IT operations, as shown in **Figure 3**. The DevOps cycle involves several processes within these three areas. Some key processes are requirements management, planning, agile development, integrated testing, quality assurance, continuous deployment, operations, and production monitoring – with the goal to deliver rapidly high-quality software. Gartner (2021) defines DevOps as "a change in IT culture, focusing on rapid IT service delivery through the adoption of agile, lean practices in the context of a system-oriented approach. DevOps emphasizes people (and culture), and it seeks to improve collaboration between operations and development teams." Collectively, they enable a

continuous “develop and deploy” strategy so that IT operations can respond quickly to content changes, marketing trends, and data breaches. Furthermore, DevOps enables IT operations to scale up or scale down services on demand.

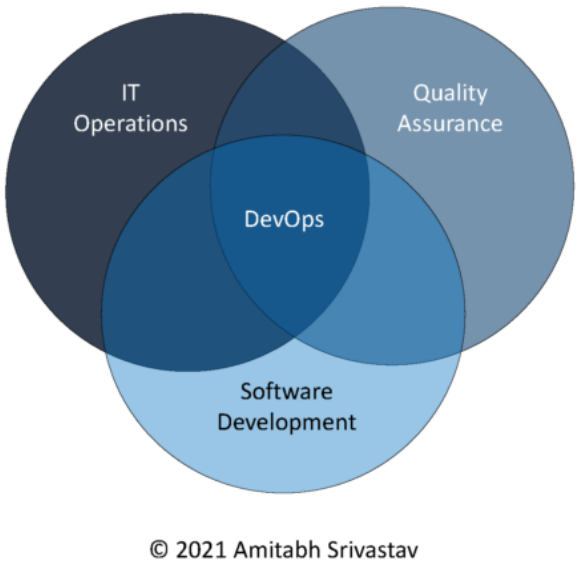


Figure 3: A Process “mind-shift” for DevOps

DevOps is crucial to supporting key DT processes that cross organizational boundaries to deliver products and services to employees and customers at any time, on any device, and anywhere. Imagine Netflix, or Disney+, or YouTube, or Twitter, or Amazon going off-line for updating software or backing up databases. Business users and customers of cloud enabled services expect sites to be accessible 24/7 without exception.

This nomenclature can extend to other areas of DT and IT with a more specific focus. One area is network operations (NetOps). NetOps is about improving network operations and agility of applications and services delivered to employees and customers. This means improving network speed, efficiency, availability, and adaptability. Like DevOps, NetOps is also a cultural “mind-shift.” Cisco (2021) explains NetOps as an “approach to network operations that prioritizes agility and rapid deployments. The approach incorporates techniques such as automation, virtualization, and orchestration.” Another area of IT is

security operations (SecOps), which focuses on monitoring security, assessing risks to corporate assets, and improving agility to respond to cyber threats. VMware (2021) defines SecOps as “a collaboration between IT security and operations teams that integrates tools, processes, and technology to keep an enterprise secure while reducing risk.”

12. Data Management

Data management has been the purview of enterprise architects, data architects, and other IT roles for many years. The difference now is that managing data involves other business areas and roles because data is ubiquitous throughout the organization. Here, the article does make a distinction between data, information, and content.

Data management is digital enablement because data is considered the “fuel” behind DT that helps deliver value through better understanding and alignment with the organization’s goals. Data management includes data security and access, quality assurance and control, data integration, long-term digital preservation, and so on. Furthermore, data management supports collaboration and facilitates timely decision-making. Gartner (2021) defines data management as “the practices, architectural techniques, and tools for achieving consistent access to and delivery of data across the spectrum of data subject areas and data structure types in the enterprise, to meet the data consumption requirements of all applications and business processes.” The expanded business areas and roles include data governance, data science, data policies and processes, information and records management, and compliance and privacy. “A data management platform is software that controls the flow of data in and out of an organization. It supports data-driven … strategies, such as segmentation” (Gartner 2021). Therefore, business and IT teams need to collaborate to develop and execute data strategies via data management platforms. A final point, which Part 2 will discuss, is that good data management practices align with good RIM practices.

13. Data Analytics

Organizations are under increasing pressure to be agile and respond quickly to changes in the business environment. DT is creating real-time data that can be “mined” to uncover information about products, customers, market trends, and financial risks. Real-time information in context can provide the predictive analytics essential for an organization to adapt quickly and survive. Otherwise, the organization can face an uncertain future. Consequently, data operations (DataOps) has come to the forefront to help organizations gain insight from their data and act. Gartner (2018) defines DataOps as “collaborative data management practice focused on improving the communication, integration and automation of data flows between data managers and customers across an organization.”

Of course, analyzing vast repositories of data is now possible by using AI. Building the AI models is a collaborative effort between data scientists, business, IT, and quality assurance teams. The business teams can be from marketing, customer service, finance, shipping, and more. Together, they can rapidly design and deploy solutions that provide timely access to information in context. The information together with experience gives insight for decision-making and business readiness to act. Acting generates new data, causing the cycle to repeat, as shown in **Figure 4**.

Figure 4: From Data to Action Using DataOps

For example, in customer experience, AI and DataOps can “mine” customer feedback, an influencer’s social media posts, and real-time purchase data to predict responses to marketing campaigns focused on different market segments. A rapidly designed and deployed solution provides new analytic-driven capabilities to improve customer engagement, product design, and service delivery.

Another example is real-time traffic and public transit data captured by the IoT. Consider a scenario involving a public transit rider complaining about the lack of information on delayed buses. The public transit department and the DataOps team can rapidly make the

data available by working with the DevOps team to deploy an app delivering the bus schedule content on any device. Riders can receive this content in real-time and know immediately if the next bus is late.

A third example is involving drivers complaining about unsafe intersections due to rush-hour traffic accidents. The police department and the DataOps teams can collaborate to use the same real-time traffic data to provide content on intersections that have a higher probability of traffic accidents. Then, drivers can act based on their experience to avoid those intersections during rush hour. At the same time, first responders can also use the app to avoid those intersections when responding to emergencies.

The fact is that the number of connected devices continues to increase means generating more complex data from the IoT. In fact, society is moving from the IoT to the "Internet of Everything (IoE)." This is will require the scalability of data analytics using AIaaS to process more complex data at increasing scale.

Looking Ahead to Part 2

From the early days of DT, content generation has been increasing, but exploded with the Fourth Industrial Revolution. Since data is the "fuel" driving DT, many technology trends focus on content from storing it, processing it, managing it, to gaining insight and making decisions. Part 2 will discuss how DT can deliver content for new products and services to business users and customers, and help them to gain insight and make decisions.

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[1] The Information Revolution is also called the Third Industrial Revolution. The First Industrial Revolution started in mid-18th century. The Second Industrial Revolution started in the late 19th century.

[2] Obsolete can also include outdate content, while temporary can also include trivial and transient content.

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Business Analysis 2021.09.27 Part 3: OMG! Not another digital transformation article! Is it about effecting risk management and change management?

Business Analysis 2021.09.22 Part 2: OMG! Not another digital transformation article! Is it about the evolution from RIM to Content Services?

Business Analysis 2021.09.13 Part 1: OMG! Not another digital transformation article! Is it about understanding the business drivers?