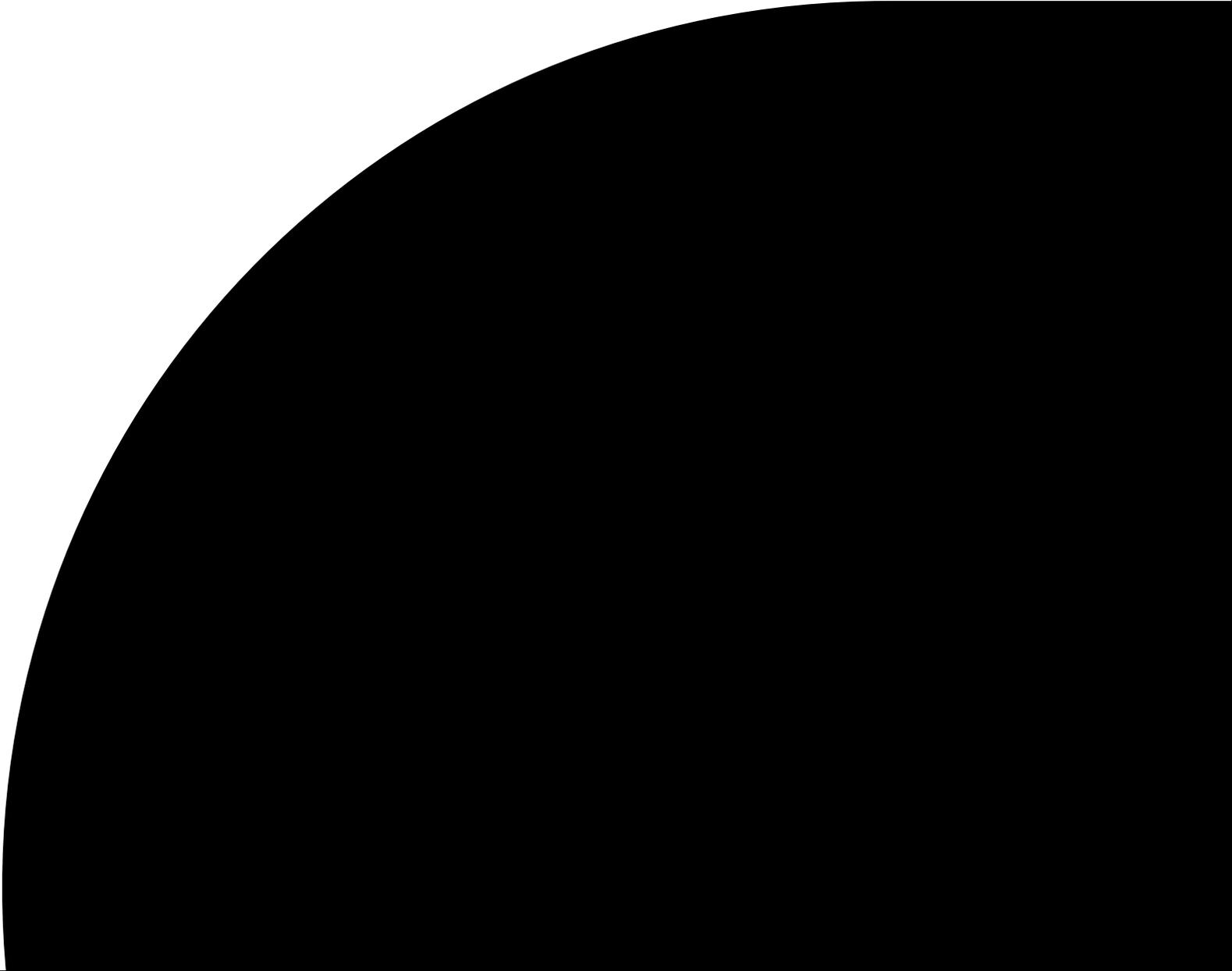# The Internet of Things

Opportunities and considerations
for service providers

Table of contents

Living in a hyper-automated world

The Internet of Things (IoT), a natural evolution of machine-to-machine (M2M) technology, is the interconnection of pervasive intelligent devices and management platforms that collectively enable the "smart world" around us. From live health monitoring to smart utility meters, integrated logistics, and self-driving drones, it's a hyper-automated world.

Internet
of Things

Smart
environment

M2M

Uses any device that can gain utility, will connect to the Internet
• M2M is phase 1 of IoT
• Billions of connections
• B2C, B2B2C being added
• Horizontal/consumer devices
• Open/standardized
• Big Data critical to uncover new insights across use cases
• New business models; VAS and bundling based; regulation/EU-driven

Is maturing
• Millions of cellular connections today
• Driven by regulation
• B2B and emerging B2C
• Vertical use cases
• Standards definition

Has reached a level of maturity
• Growth—20% CAGR in connections
• Focus on B2B
• Vertical use cases
• Complex/proprietary
• Limited Big Data applications
• ROI typically cost savings for enterprises

Figure 1. M2M to IoT evolution

Per Machina Research,[1] the total number of M2M connections will grow from 5 billion in 2014 to 27 billion in 2024, a compound annual growth rate (CAGR) of 18 percent. The speed and sophistication achieved in each market and industry may vary due to specific needs of different segments, the availability of connectivity and other supporting technologies, and economic and regulatory environments in each market. For example, European Union (EU) utilities and insurance industries are early adopters of the technology. It's considered a basic need due to clear and immediate business benefits and/or regulatory requirements. On the other hand, the healthcare sector is slowly adopting the technology, seeing it as an experimental innovation.

Capitalizing on the opportunities, many innovators are swiftly adopting IoT technology in their respective industries, as this new generation of devices is more useful and affordable, and easy to integrate. Additionally, national regulators in many industries are mandating M2M adoption as a technology enabler in achieving national socio-economic objectives.

Rapidly growing M2M adoption—in different industries—presents significant market opportunities for communications service providers (CSPs). Per market research published by Machina Research,[2] the total M2M revenue opportunity will be USD $1.6 trillion in 2024, up from USD $500 billion in 2014, a CAGR of 12 percent. This includes devices, connectivity, and application revenue, while connectivity average revenue per user (ARPU) is expected to witness massive decline during the same period. Fourteen percent of connections in 2024 will use Low Power Wide Area (LPWA) connections such as Sigfox, LoRa, and Huawei's Cellular IoT. These changing market dynamics will put more pressure on margins.

The exponential growth in M2M connectivity helps reduce the effects of the current decline in revenues, and also opens up new market opportunities for CSPs.

The evolutionary trajectory, from limited capability M2M services to the super-capable IoT ecosystem, has opened up new dimensions and opportunities for traditional communications infrastructure providers and industry-specific innovators.
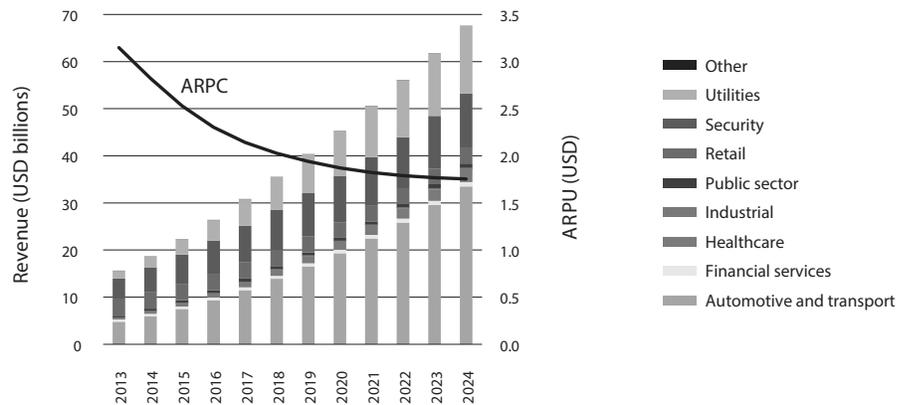
Figure 2. M2M connectivity revenue by industry sector and total connectivity ARPU, worldwide, 2013–2024[3]

Those exploiting the potentials of this technology—to introduce altogether new services and business models—can achieve unprecedented levels of experience for existing services, and in many cases transform their internal operations to match the needs of a hyper-connected world.

As the model of "everything connected" is no longer in doubt, there are only questions on different patterns of diffusion, timing, geography, and adoption areas. Utilities, security, and transport are expected to witness maximum growth in IoT applications in coming years.

[2] ibid

[3] Analysys Mason, http://www. analysysmason.com/Research/ Content/Reports/M2M-forecast-2014-Nov2014-RDME0/#13%20 November%202014

Seeing IoT as more than connectivity

In the early phase of IoT adoption, connectivity was a natural area of interest for most CSPs. However, it didn't take long to realize that the majority of revenue comes from areas outside of a typical CSP's traditional focus.

As connectivity is a readily available commodity, the majority of revenue lies in greater innovation and value-adds—innovation and practical use cases applied to specific industries. Close collaboration among participants of this complex M2M/IoT ecosystem is required to conceive and deliver a service that will make business sense for all participants. Key participants include:

• Smart device and sensor manufacturers

• Systems integrators for M2M/IoT services and industry-specific applications

• Managed Information and Communication Technology (ICT) infrastructure providers such as CSPs and data centers

• Management platforms for fulfillment, assurance, charging, device management, and analytics

• Identification, development, and rollout of industry-specific use cases to customers like public utilities, home automation, insurance, healthcare, national regulators, municipality, and other civic bodies

To deliver an end-to-end M2M service, different stakeholders need to collaborate and define/deliver key solution components.
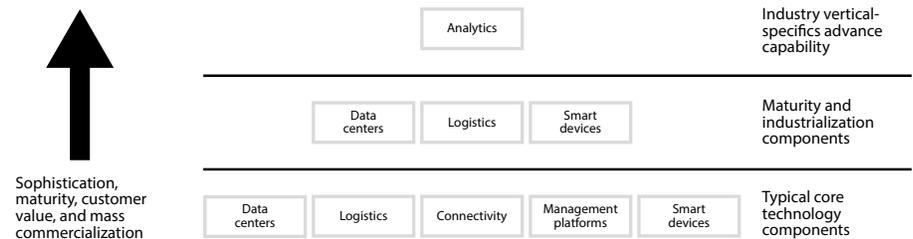
Figure 3. Components of IoT/M2M solutions

The core technology components that are mandatory to launch an M2M service, based on our experience, include:

• Smart devices

• Connectivity infrastructure such as 2G/3G, Wi-Fi, and 169Mhz

• Data center and computing infrastructure facilities

• Management platforms; OSS/BSS and device management

• Logistics and field service

These core components are typically provided by CSPs and form the foundation on which industry-specific solutions can be designed and delivered. In order to achieve maturity and industrialization of M2M services, these two components are necessary:

• Security

• Legal and regulatory frameworks

Security of the overall infrastructure and industry-specific application is an important aspect, especially in healthcare and financial/insurance industries. This can be delivered entirely by a CSP or in collaboration with third-party providers. Similarly, a regulatory framework fosters technology adoption and industrialization in the complex eco-system of IoT/M2M. This is typically championed by national regulatory agencies and industry forums.

In more sophisticated and advanced applications, vertical applications and analytics components are employed by industry players to meet niche requirements and be a market differentiator.

Reviewing key considerations

While CSPs are still trying to understand how small, data-only devices are impacting their business, the enterprise, consumer, and public sector are swiftly adopting all kinds of new connected gear, machinery, and devices. Following are key considerations to forming an effective IoT strategy.

Finding the right business model

IoT presents a unique opportunity for your organization to expand into the vertical industries you serve. Meanwhile, non-Telco players are presented with an equal opportunity to provide unique applications totally independent of a CSP or by using a CSP just as a pipe to their customers. Due to the wide variety of components and players involved in an IoT service, defining the right business model is one of the biggest challenges in designing and delivering an end-to-end IoT solution. Some of the major approaches being followed:

• **CSP-led solutions**—These are mostly ad-hoc solutions for specific customer needs using specific sensors and types of connectivity. In this model, you would own the customer and take full accountability of designing, installing, and managing the solution.

• **Non-Telco-led solutions**—A non-Telco player builds a highly productized solution to serve its customers. It manages the entire service on its own and uses CSPs only as a connectivity service provider. Usually, it's possible to employ multiple types of connectivity from multiple CSPs to deliver an end-to-end solution.

- **Partnerships between CSP and non-Telco players**—In this approach, both players design, build, and maintain the end-to-end service jointly to meet customers' specific needs, leveraging their independent customer relationship for the common benefit.

Due to the nature of the relationship between CSPs and their customers, and also to an industry's specific needs, some business models implemented are more common than others in each domain.

	CSP led	Non-Telco led	Partnership
Smart media for utilities		Less common	Most common
Transportation & logistics automation	Most common	Less common	
Security & surveillance		Most common	
Smart homes/buildings/cities	Less common	Less common	Most common
Point of sale, integrated manufacturing, and warehousing		Most common	
Health	Less common	Less common	Most common

Figure 4. Common business models per industry verticals

In our view, the best approach is collaborative—working with industry verticals to identify and implement use cases, with the right business model that is mutually beneficial to both. Working together with industry, you have the opportunity to play greater value-add roles. By leveraging the technical know-how and ownership of the underlying infrastructure, you could be a systems integrator or managed administration provider for IoT applications and services. The greater the value you add, the greater share of revenue you can control. So, it's necessary to keep inventing new business models and revising existing ones to create new partnerships.

Reviewing technology implications

Traditionally, a CSP's key role in IoT applications is as the provider of the connectivity backbone—in the form of a SIM card. This helps CSPs monetize their investments in the underlying cellular access infrastructure access such as 2G, 3G, and LTE. However, there are many applications that require alternate access methods where traditional CSPs have little or no role to play, resulting in a limited ability to tap into greater share of revenue. For example, gas smart meters in Europe are adopting lower frequencies (169MHz) to connect meters and must be able to cover a wider area and pass through walls. All that information is gathered by hubs that send the consolidated data through the mobile network or any other network available.

With this in mind, CSPs must start thinking about alternative access method enablement and provision seamless connectivity via multiple access technology when designing their networks. Convergence technologies like IMS and unified access, authentication, and charging architecture will become key in delivering a diverse set of IoT services across multiple industries with access-method implications.

Securing IoT/M2M services and information assets

While different components of the IoT eco-system—for specific applications—may be owned and managed by independent entities, it's extremely important that these entities are integrated in a cohesive manner. This delivers a seamless, end-to-end service without any impact on the user. And it makes security and end-to-end service delivery and assurance very important for complex IoT services. Some key security aspects are:

• Using identity management and authentication of the device or sensor

• Securing connectivity

• Managing fraud such as stolen and switching devices and blocking illegal use like voice calls and roaming, among others

Impacting management platforms

IoT services—in terms of volumes, margins, and the way services are sold, activated, charged for, and supported—make it clear that traditional business support systems (BSS) and operational support systems (OSS) may not be the best fit for your IoT strategy. Some important aspects are:

• **OSS/BSS software licensing**—BSS/OSS solutions are mostly licensed per subscription by system vendors. Service providers need to implement dynamic network resource provisioning, such as SIM, to conserve the license capacity.

• **SIM lifecycle management**—Traditional mobile, consumer-oriented SIM card lifecycle is not applicable to M2M solutions. Therefore, the management platforms should require adopting M2M-specific lifecycle management, with lots of controls provided to the customer via self-service.

• **Device management**—Device/sensor configuration and management solutions require integration with the rest of the OSS.

• **Provisioning and activation of M2M services**—Network resource optimization should be considered while activating M2M services in order to avoid unnecessary overloading of the CSP network and systems.

• **Charging and billing**—Real-time charging, policy control, and sharing of bandwidth across a customer's M2M solution are necessary requirements for M2M services, so charging and billing systems must be enhanced and scaled accordingly.

• **Fraud management**—M2M requires strengthening of fraud detection to ensure devices/sensors and the underlying infrastructure are not misused—intentionally or unintentionally.

- **Resource inventory**—Typically, inventory systems maintain very minimal information about SIM cards. M2M applications require comprehensive modeling of M2M services, underlying infrastructure, and resources such as SIMs and devices.

- **Self-administration**—M2M services, by their nature, demand a much greater degree of self-administration. This can be done in a fully automated fashion or by limited involvement of the customer's IT function, without requiring involvement of traditional brick-and-mortar support functions. This would require significant reshaping of the architecture, and relevant business processes would have to adapt accordingly.

Therefore, a dedicated and purpose-built BSS/OSS stack should be considered. One that caters to the volumes generated by IoT services without requiring corresponding exponential growth in total cost of ownership (TCO). This includes licenses and infrastructure, which enables greater self-administration and provides seamless integration with the customer's own management systems.

Using analytics as a differentiator

Low-value communication between devices and sensors and their users, in terms of ARPU, should be analyzed by CSPs and other IoT industry stakeholders and turned into highly valuable insight. You could leverage the information to further monetize the infrastructure and offer new innovative and personalized services and experiences. Some examples of how information could be used by different stakeholders:

- **New revenue opportunities**—Analyze user behavior and predict trends to proactively grab new revenue opportunities. At times, this would entail sharing insight and collaboration with unusual partners, not just to increase revenue but also to generate greater value to society. For example, studying an epidemic's spread by monitoring people's location and physical symptoms.

- **Strengthen existing products**—Identify and address niche user needs by offering differentiated services and experience for micro segments.

- **Monetization of the infrastructure**—Use network traffic trends and performance of different components, spurring optimization and monetization of the underlying infrastructure.

Effectively analyzing information that is massive in scale and continuously evolving is critical for the success of your IoT/M2M strategy. Application of Big Data analytics and related technologies enable you to tap into the endless data exchange and turn it into actionable intelligence. This enables you to achieve your business objectives by providing higher value products and services to stakeholders and users.
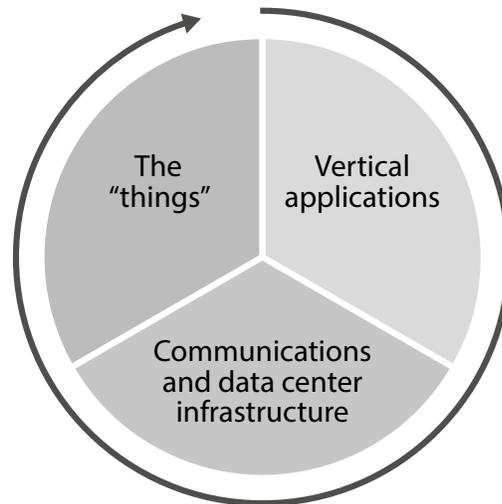
Figure 5. The three "IoT" dimensions of a CSP's operating model

Reviewing operating models and processes

Like any new disruptive technology, rapid proliferation of IoT/M2M services in coming years will force CSPs to reconsider or reinvent their organization and processes while scrambling to benefit from this technological phenomenon. Their ability to quickly transform their operating model to adapt to the unique needs of the IoT/M2M market will determine their level of success.

As we discussed, Machina Research predicts that cellular connections will grow from 256 million at the end of 2014 to 2.2 billion by 2024, of which the majority will be LTE. Just over 50 percent of those cellular connections will be in the "connected car" sector, including factory-fit embedded connections and aftermarket devices. These connections will be sold in bulk, delivered and serviced by third parties, and self-managed by the customer as part of complex industry-specific applications. End-to-end service assurance will not just be about connectivity. It will also involve other components like sensors installed on the "things" and vertical applications spread in a cloud environment (as a Service).

To be successful in this rapidly changing environment, CSPs must continuously evolve their operating model to maintain their key pivotal position in the IoT/M2M eco-system. Based on our industry experience, it's gradually becoming mainstream to set up dedicated business organizations for M2M offerings—product management, sales, partnership management, and operations and support. Often, IoT/M2M services are global in nature and involve very close partnerships with the vertical industry, device/sensor manufacturer supply chain, and global field service providers. A dedicated business unit ensures continuous focus and alignment with the rest of the ecosystem.

Similarly, we see that dedicated communications infrastructures for IoT/M2M services is also becoming a necessity. Due to fundamental differences between traditional telecommunications services and IoT/M2M services in terms of scale, complexity, and the nature of the business relationship, a dedicated infrastructure is often the best option. This, however, is not mandatory—or financially viable—for CSPs in the beginning. But it becomes a necessity and is feasible once a certain level of maturity is reached in terms of products offered and underlying technical solutions—economy of scale.

To prepare for the IoT/M2M explosion and reinvent your operating model, the as-is environment—technology, people, and processes—should be assessed by the TM Forum (TMF) Business Process Framework (eTOM). And necessary improvements should be introduced in an evolutionary manner in all impacted areas.
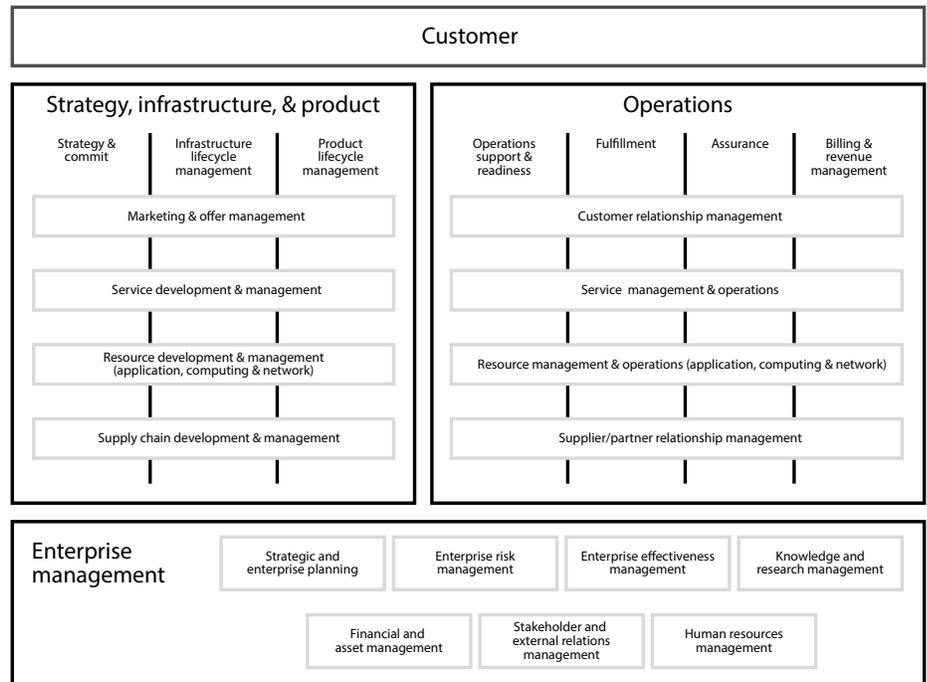
**Figure 6.** TMF Business Process Framework as a guidance

Getting help for your IoT journey

While IoT adoption presents great business opportunities, it also poses big technology and operational challenges that most CSPs aren't set up to handle. To effectively capitalize on this opportunity, you need to engage with a trusted advisor like DXC Technology.

We can help assess, plan, and apply proven technologies and methodologies— in line with industry best-practices—to define a comprehensive strategy and implementation roadmap. This will translate your IoT vision into reality in the most optimal and least disruptive manner. By engaging with DXC, you also get a global, proven technology solutions provider that offers IT infrastructure and global services, and user devices. We invent, engineer, and deliver technology solutions that drive business value, create social value, and improve customers' lives. We help organizations, like yours:

- Manage IoT operations

- Monitor IoT devices and SIMs

- Generate actionable, unparalleled customer intelligence

- Enable seamless, connected user experiences

- Deliver operational efficiencies and enable more innovation

Figure 7. DXC IoT framework

Figure 8. IoT roadmap

Mapping each M2M service onto the value/viability matrix
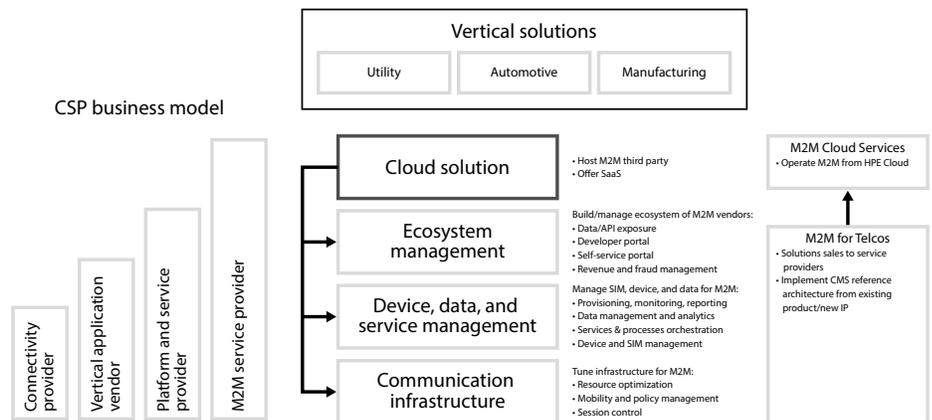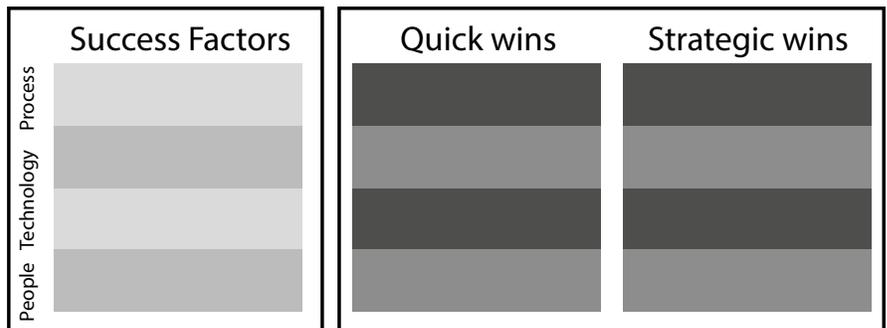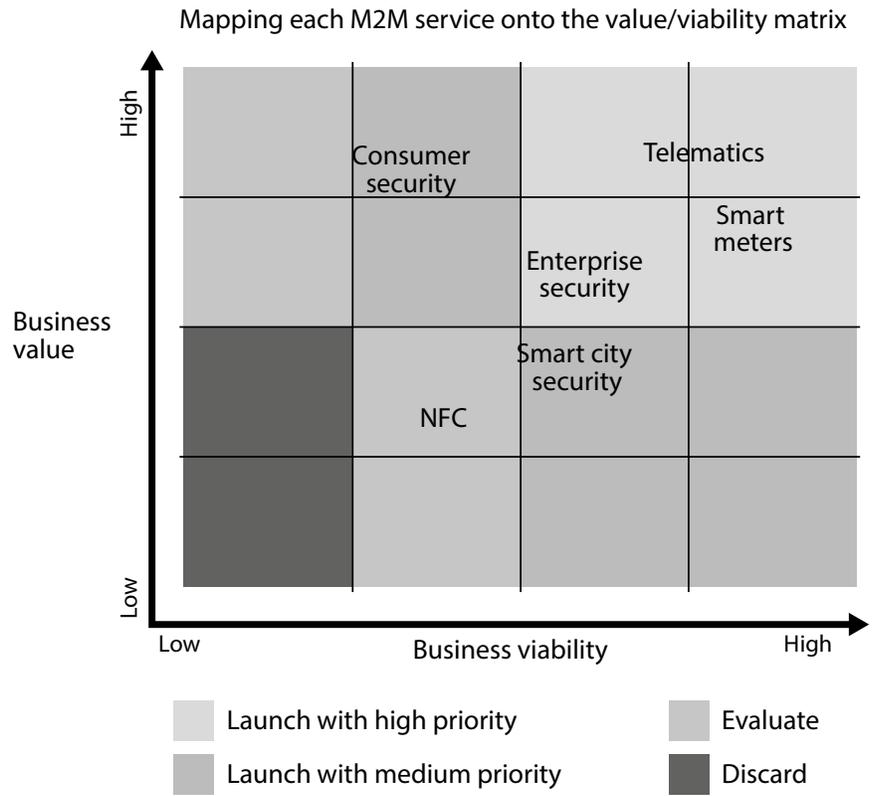
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