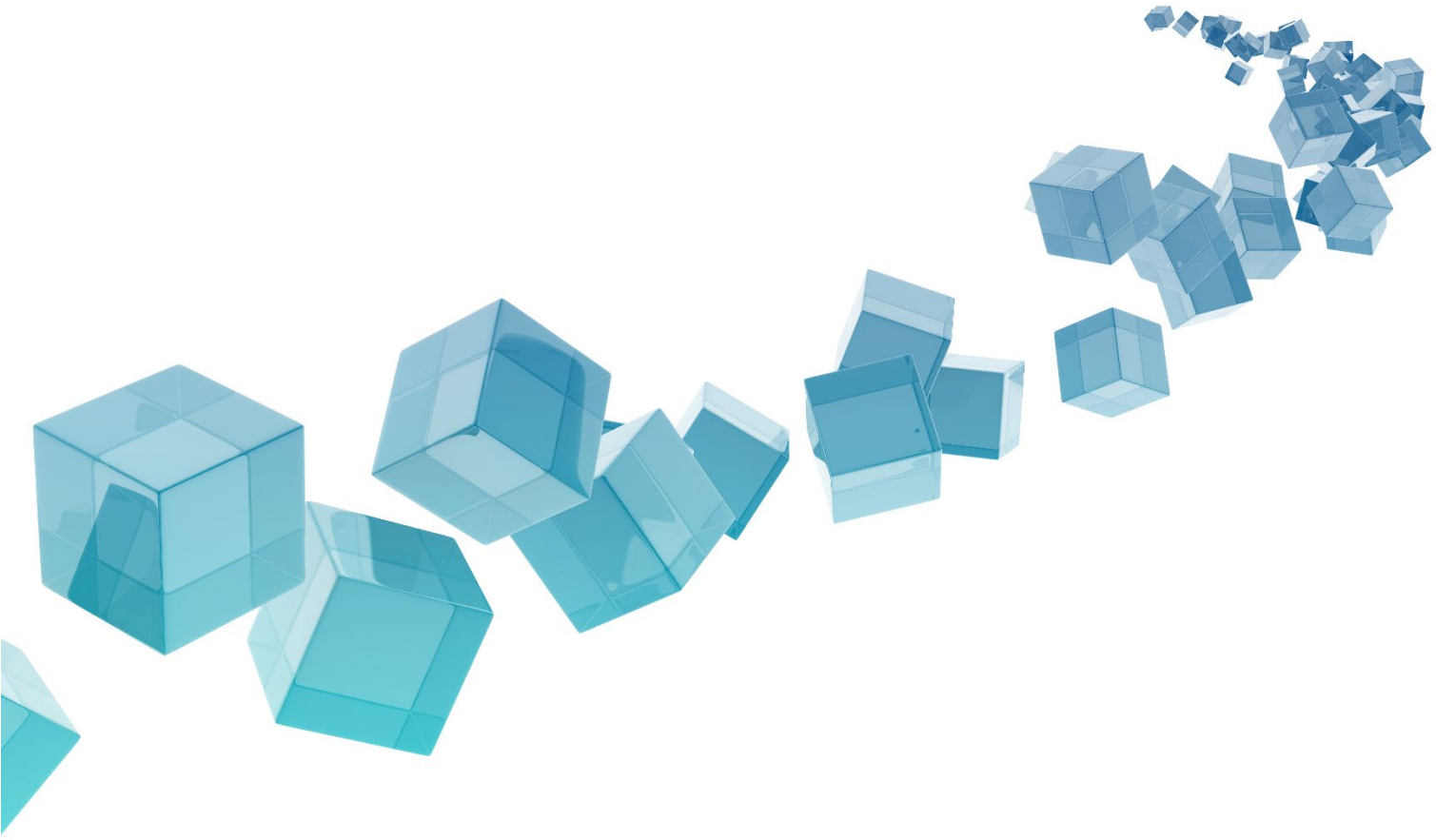

How IoT will Shape the Future of Payments

May 2021 | Whitepaper

Global Open Network

Table of Contents

1. Introduction

The availability of Internet of Things (IoT) devices and data is driving development of advanced payments services. More than 30 billion IoT devices are connected to the internet today, and that number is expected to grow to 44 billion by the end of 2021[1]. The advent of 5G and its ability to connect billions of IoT devices more seamlessly will drive consumers to become hyper-connected and digital-first, which in turn will lead to the emergence of innovative new products and services. These trends will likely influence and change how individuals and enterprises make payments. The global IoT payments market is forecast to be worth US$935 billion in 2024, of which 42% will be in the Asia-Pacific region, according to a study by Juniper Research[2].

Global Open Network Japan Inc., in collaboration with Mastercard, studied both the benefits that IoT payments could bring to consumers and the potential challenges that lie ahead in processing those payments. The study led to the design and development of an innovative new IoT payment method that can offer better user experiences and overcome issues faced by the payments industry.

2. IoT benefits for consumers, merchants and the payments industry

Device manufacturers and fintechs are exploring ways to integrate IoT devices and payments so that they can unlock new commerce experiences. This integration will bring many benefits to key stakeholders in the payments industry.

2.1 Benefit for consumers

The consumer purchasing journey consists of three processes – item or service selection, payment, and consumption. These processes have historically been out of sync from one another, disrupting the consumer journey and hindering merchants from maximizing sales while also impacting consumer trust and loyalty.

Subscription services solved a part of the challenge by seamlessly integrating service usage and payments on a recurring basis. Even though subscription services offer a way to match consumption and payments, they often require customers to make a long-term commitment to a merchant and charge a fixed fee regardless of the actual usage.

Connected IoT devices and pay-per-use automated payments can bring the consumer purchase experience up to the next level. By removing long-term commitments, IoT payments lower the barriers for consumers to access and enjoy a wider range of products and services. Consumers can use the services when they need them and only pay a fee based on the actual usage. This flexibility can encourage stronger consumer engagement with a product and drive higher service utilization for merchants. Moreover, consumers can enjoy personalized offers and benefits at the time they make their purchase if they allow merchants to access their data.

Examples of services where consumers can benefit from the enhancements IoT delivers include fitness club memberships, travel insurances, sharing economy services such as car sharing, digital content such as e-books, videos, and online games.

There are also opportunities to leverage payments and IoT devices to increase financial inclusion. With the Mastercard Pay on Demand solution, for example, unbanked consumers in developing markets can pay for services such as solar home systems as they use them, rather than making large one-time payments up front[3]. Similar technology can be used to give consumers the option to pay the cost of a smartphone in small installments[4]. If payments are not made, the IoT devices can simply stop providing the services.

2.2 Benefits for merchants

Merchants that use connected devices can acquire and use real-time customer usage data more effectively. The data is very valuable, as it enables the merchant to improve customer engagement and optimize customer satisfaction. Merchants can use payments data for personalization and marketing purposes such as providing "push" activities through mobile devices, for example, as long as they receive consumers' consent. Merchants can also offer services in smaller units, because they can digitally measure the usage of services such as fitness center equipment or travel insurance. This flexibility can retain existing customers and attract new customers.

Innovative merchants can use the data to offer customers better payment terms and incentives, which will improve customer engagement, because they can move money more efficiently. Merchants can also process micro-transactions, which can help them engage a broader range of customers and gain competitive advantage.

One example of merchants leveraging IoT devices and data to enhance flexibility in services is metered hot desks in co-working spaces. In 2017, Mastercard and WeWork piloted a metered payment capability for hot desks whereby WeWork members were charged only for the length of time that they used the service.

2.3 Benefits for the payments industry

The payments industry has consistently provided new payment choices, such as credit cards, debit cards, prepaid cards, QR codes, and contactless cards. These alternatives have been designed to fulfill needs and to support changes in technology or consumer lifestyles.

The integration of IoT and payments is expected to bring even more benefits to the industry. For Mastercard, "Every Connected Device is a Commerce Device" has been a vision for many years. IoT can enable expanded acceptance, with consumers making payments via connected devices. The connected devices range from consumer-owned devices such as wearables and cars or home appliances to merchant-owned devices such as cloud-based point-of-sale solutions. In addition, 5G

processing enables IoT payments that could allow autonomous and semi-autonomous devices to initiate transactions on their own. IoT payments are also expected to enable faster transaction speeds, increased processing capacity, and integrated analysis of customer behavior and purchase data.

Moreover, the integration of IoT devices or data and blockchain solutions may expand the customer base for cashless transactions.

3. IoT-related challenges in the payments industry

The payments industry is under pressure due to massive shifts in consumer and merchant behavior in a rapidly changing business environment that is increasingly digital and connected. The rapid growth of IoT payment transactions, which are expected to increase by 11 times to 32 billion by 2024[2], may exacerbate the challenges the industry faces. Legacy infrastructure could be at risk of not being able to support this high volume growth. The payments industry needs to create new network and payments solutions to address the challenges and capture the new opportunities that IoT payments bring.

3.1 Decline in unit prices, pressure on payment processors margin

One key challenge is that the rapid rise in the number of IoT devices will lead to an increase in the number of low-value transactions, which will in turn put additional pressure on acquirers' business processes and technology. In Japan, for example, the Ministry of Economy, Trade and Industry (METI) announced plans to raise the non-cash payment ratio from 19% in 2020 to 40% by 2025 and to encourage people to use non-cash payment solutions[5]. IoT devices will help to enable this rapid rise in digital payments. As the non-cash ratio increases, however, transaction volumes are expected to increase and the average transaction value is expected to decrease. The processing cost per transaction will remain fixed due to the limitations of current technology, so the average margin for payment processors will decline.

The payments industry needs to adapt quickly and drive the development of new solutions which will enable financial institutions (FIs) to process larger volumes of transactions at lower costs. In the meantime, acquirers will need to increase investment in legacy systems so that they can continue to meet customer, legal and security obligations.

3.2 Capacity of the domestic payment system

The introduction of 5G is expected to result in faster speed, increased capacity, and multi-connectivity while reducing latency. Innovative new services and business models utilizing 5G will start to be tested in early adopter markets very soon. As the number of IoT devices increases, the volume and complexity of data will increase tremendously, resulting in an acceleration of new services being created.

Payments provides face two issues with the current payments infrastructure that hinder their ability to process the massive volumes of new IoT payments data – capacity and scalability. These constraints are especially critical in markets where the acquiring infrastructure is based on old standards that are not optimized to support high-frequency, low-value transactions. In order to handle increasing transaction volumes, payment processors periodically enhance their systems. However, increased transaction volumes driven by IoT payments could require additional system maintenance, upgrades and investment by payment processors.

In Japan, for instance, some merchants distribute transactions across multiple acquirers to manage transaction peaks, such as ticket sales for popular music events or Black Friday sales at major ecommerce merchants. As IoT payments drive an exponential increase in transaction volumes, this temporary fix may add further operational complexity and financial burdens on merchants rather than solving their problems.

Payment service providers need to develop an alternative payments infrastructure that can operate effectively in a high-frequency, large-capacity, low-latency and multi-connection environment and that can easily interact with an increasing array of services provided.

3.3 Sophistication of cyber-threats

Research by IHS Markit estimated that 125 billion IoT devices[6], which equates to nearly 15 devices for every person on the planet, will be in use by 2030. These new devices and technologies can bring new business benefits. At the same time, they may pose new fraud and cyber-security risks if they are not managed correctly.

In recent years, cyber-attacks on connected power grids have resulted in breaches of tens of millions of consumer records. Manufacturers of consumer devices such as baby monitors have underinvested in security while still delivering connected devices to the market.

Devices are only one of many causes of cyber-risk. From the payments industry's standpoint, it is important to protect the payment aspects of IoT interactions and transactions. An effective transaction framework must ensure payer and device authentication to prevent impersonation, unauthorized transactions and account takeover. Payment network security must be designed to prevent malicious attacks and to protect personal information on IoT devices from being compromised. Protection from fraud and cyber-attacks is essential for ensuring the consumer confidence that is driving the increasing usage and democratization of IoT payments.

3.4 Management of customer information

The rise of IoT devices also results in a need for more measures to manage customer information. In countries around the world, requirements for personal data management have been strengthened through new laws which require IoT service providers and other businesses to pay more attention to

how information is handled.

In particular, regarding handling personal information, new regulations have been introduced in various countries over the past few years. The European Union (EU) General Data Protection Regulation (GDPR), enacted in 2018, is a good example. "Personal data" in the GDPR includes virtually any piece of data that could be used to identify an individual. It includes the customer's name, payments data, subscription ID, IP addresses, cookie information, location data and biodata. Range of personal information subject to control and regulations vary depending on regions and laws. When planning IoT services, businesses must ensure that their systems architecture and methods for obtaining information are compliant with the applicable laws and industry regulations.

In addition to complying with the law, service providers need to have architectures that meet Payment Card Industry Data Security Standards (PCI DSS). PCI DSS is an information security standard established by the payments industry that sets standards for how card-related data must be managed by all parties. Because of the substantial financial and human resource costs required to comply with the standards, many merchants use solutions provided by third parties.

4. Technology Solutions

When payment processors develop new services or make improvements through digitization, they need to consider the full range of options regarding payment types and methods to offer to meet each merchants' unique customer lifecycle journey and maximize their sales as well as their profits.

Global Open Network Japan and Mastercard have jointly studied how IoT machine-to-machine (M2M) payments can be delivered in ways that meet industry standards and effectively combine the solutions created by both parties.

4.1 Power the future with Mastercard solutions

Mastercard is a leading payment technology company that drives innovation in the industry. Mastercard has developed a variety of payments-related products and services for member banks, payment service providers, and merchants.

The Smart Contract Platform (SCP) is a Mastercard solution which enables its partners to build flexible commerce applications and supports high-frequency, low-value transactions. It can use smart contracts to enable self-execution of IoT payments and trigger events related to the transaction. The ability to create programmable logic which is customized to specific business needs and governed by Mastercard franchise rules allows merchants, consumers and FIs to establish agreements that are automated, immutable, and enforceable. The core value proposition of SCP includes:

- **Enhanced consumer experience** - Caters to consumer needs for simple and smart experiences that suit their lifestyle and preferences**.**
- **Reduced operational costs through automation and finality –** Automatically tracks

consumption of services or device usage through connected sensors and executes payments.

SCP can also connect to other Mastercard services or third-party solutions to provide capabilities such as cyber-security, business intelligence and access to Mastercard's multi-rail payments networks. Integration with trusted platforms in local markets, such as GO-NET in Japan, makes using SCP easy.

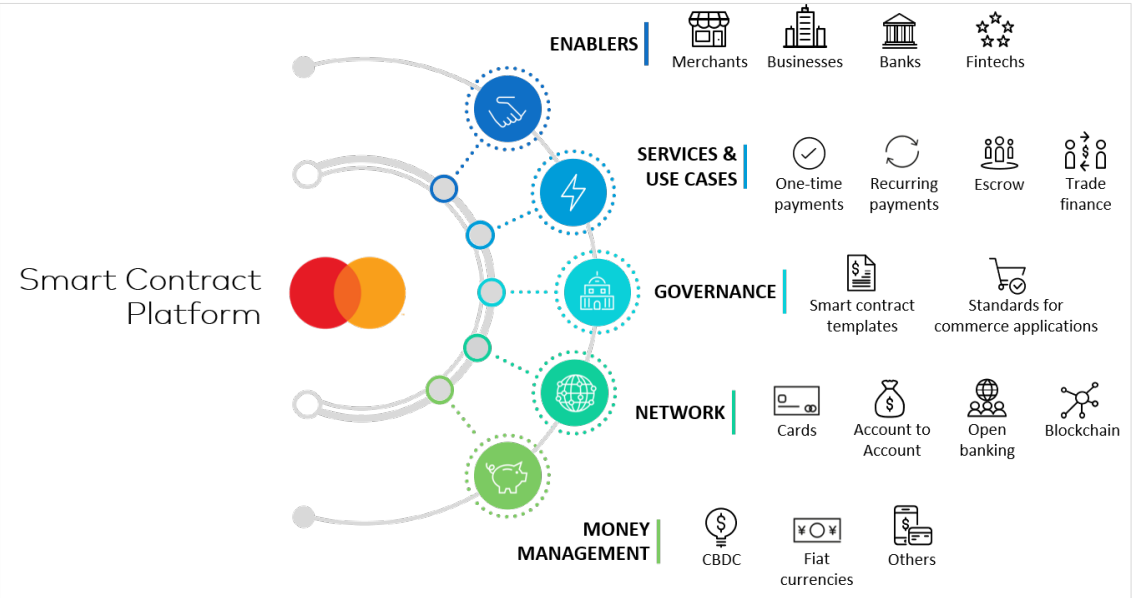

Figure 1. Mastercard Smart Contract Platform

4.2 Payment platform to support next generation services: "GO-NET"

In April 2021, Global Open Network Japan Inc., a subsidiary of Global Open Network Inc., a joint venture established by Mitsubishi UFJ Financial Group (MUFG) and Akamai Technologies Inc., launched "GO-NET". It leverages Akamai's technology and MUFG's expertise in payments. This payments platform is designed to process large volumes of transaction data more efficiently, with lower costs and higher throughput. It uses original blockchain technology to process transactions with high speed, low latency, high capacity and multi-connectivity, which are all essential for effective next-generation services.

The GO-NET platform consists of data cooperation servers and networks of interconnected wallet nodes, interconnected ledger nodes and interconnected storage nodes. A server provides administrative access to the platform and data processing services. The platform is designed to solve performance and scalability challenges that are commonly found among other platforms in the market.

GO-NET automatically takes advantage of existing features of the Akamai Intelligent platform to deliver performance, reliability, and security. Akamai has more than 320,000 servers in data centers around the world (as of Jan. 2021), which allows it to route traffic around congestion, deliver content faster over the internet and stop malicious attacks at the edge of the internet.

The initial use case for GO-NET is to handle credit card transactions from merchants to FIs, optimize the process, and reduce the systemic and financial burden on FIs. The network can also utilize its wallet capability to manage credit balances within the network to meter and process payments on behalf of card issuers, reducing stress in the system.

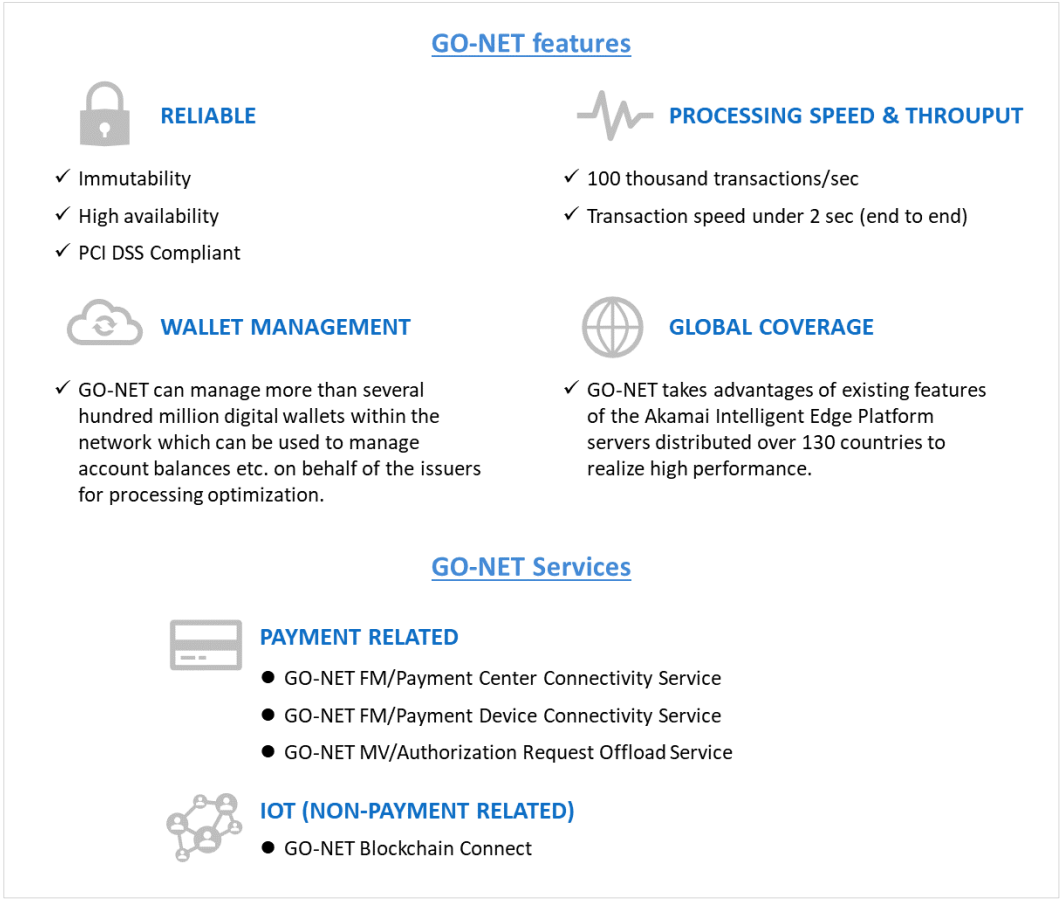

Figure 2. GO-NET features & Services

GO-NET also provides the following functions:

- **Wallet nodes -** Converts external requests from clients for transactions and transmits them to ledger services that will be recorded on the blockchain.
- **Ledger nodes -** Distributed nodes on Akamai's network record transactions on the blockchain using a proprietary algorithm developed by Akamai that achieves blockchain finalization in less than 2 seconds.
- **Storage nodes –** A distributed network of storage nodes provides a scalable and durable repository service for wallet and ledger services, maintains data that is critical for ledger and wallet services during disaster recovery processes, and ensures the availability of the services.
- **Data Cooperation Services** – Offers a set of API endpoints for administrative access into the GO-NET platform.

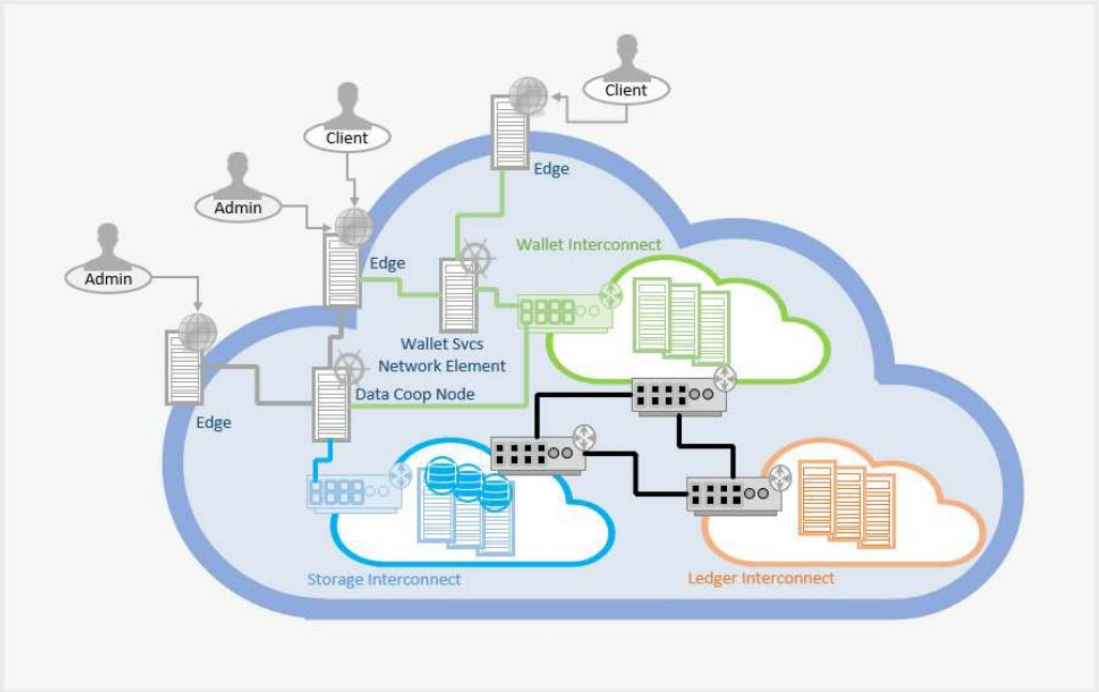

Figure 3: GO-NET platform overview

4.3 Mastercard SCP & GO-NET Collaboration

The combination of Mastercard's SCP and the GO-NET platform offers a secure and effective solution that enables merchants and FIs to explore new payment methods such as micropayments without significant concerns about backend capacity or scalability. This fit-for-purpose payment network for IoT and micro transactions imposes almost no limits on innovators and disruptors, which enables them to reimagine commerce. The diagram below shows an example of how the GO-NET wallet management capability can be expanded through collaboration with SCP to provide secure and effective loyalty programs to attract customers.

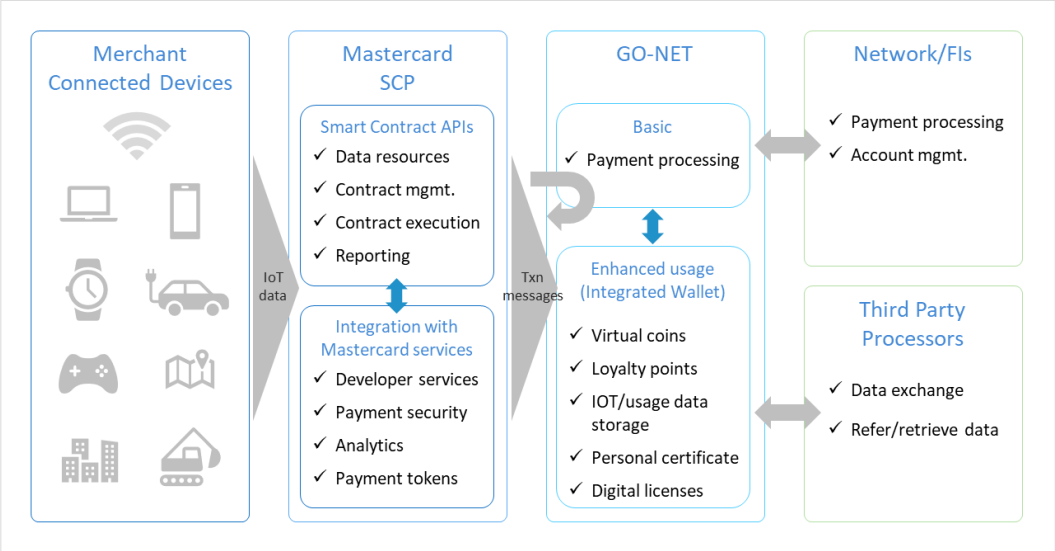

FIGURE 4: Conceptual diagram sample of the future vision of an Integrated Wallet

5. IoT payment use cases

The additional data available from IoT devices allows flexible payment terms such as pay-per-use and machine-to-machine (M2M) payments. The payments experience can be optimized by using IoT data and leveraging the combined functionalities of Mastercard SCP and GO-NET. Merchants can offer smart-contract-driven conditional payments triggered by IoT events for both B2C and B2B customers.

Use cases include both human-to-machine (H2M) and machine-to-machine (M2M) solutions. Examples of automated payment and service delivery use cases that could benefit from new IoT payments solutions include:

- Fitness centers or gyms: pay-per-use membership
- Hotels and short-term rentals: usage-based electronic appliances
- Shared offices and co-working spaces: duration-based hot-desking
- Micro-insurance: geo-location-based travel insurance or auto insurance
- Mobility-as-a-Service: pay-as-you-go shared bikes, cars or parking lots
- B2B usage-based machine replacement and maintenance: coffee makers, laundry machines and vending machines

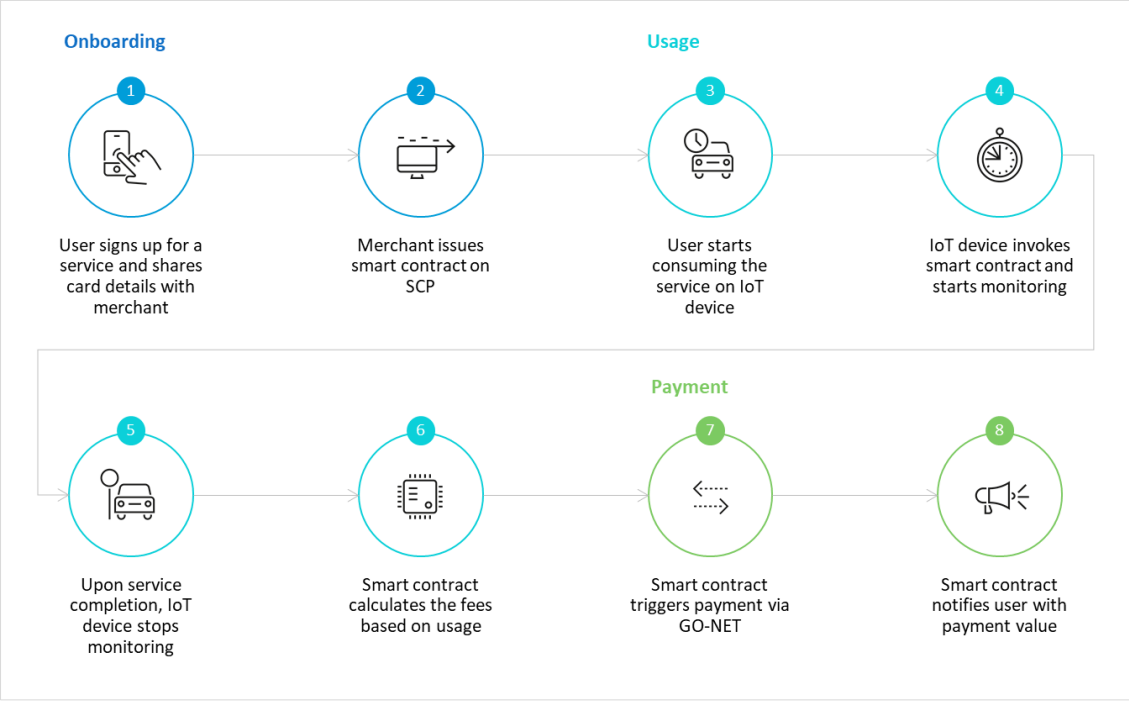

Figure 5. An example of the IoT payment user experience and process flow

6. Conclusion

The future of IoT devices and use cases continues to evolve. Regardless of what happens, the volume of payment transactions will definitely increase significantly over the coming decade. Traditional network architectures will have challenges in supporting the growth that is driven by consumer adoption of IoT devices. To meet the growing volumes, payments infrastructures need to accelerate enhancement of legacy platforms and adopt new technologies such as the GO-NET platform to enable efficient processing of high-volume, low-value transactions.

In addition to addressing growing transaction volumes, payments processors must enable merchants to go beyond the familiar practices that exist today and design better customer experiences with improved security. Mastercard SCP provides merchants with the ability to support conditional payments, for instance, using smart contract technologies.

Mastercard and GO-NET envision an increasingly hyper-connected society which could drive a shift in consumer behavior. Both are committed to supporting and delivering innovations to their partners that enable a better and more connected future.

For more information about this whitepaper, Mastercard solutions, and "GO-NET", please contact:

Mastercard contact:

Ashok Venkateswaran	Ashok.Venkateswaran@mastercard.com
Tobias Puehse	Tobias.Puehse@mastercard.com
Yuya Fukumori	Yuya.Fukumori@mastercard.com

Global Open Network Japan Contact:

Sales planning Division, sales-info@grp.go-net.jp

Citations

1. Ministry of Internal Affairs and Communications, Japan. (2019) "*Information and Communications in Japan Whitepaper 2019, Part 1 Special Theme: Evolving Digital Economy towards "Society 5.0""* https://www.soumu.go.jp/johotsusintokei/whitepaper/eng/WP2019/2019-index.html
2. Juniper Research Ltd. (November 2019) "*DIGITAL COMMERCE Key Trends, Sectors & Forecasts 2019-2024"* https://www.juniperresearch.com/researchstore/fintech-payments/digital-commerce-platform-market-research-report/subscription/key-trends-sectors-forecasts
3. Mastercard. (May 2018) *Extending Access to Necessities with Pay-As-You-Go.* https://newsroom.mastercard.com/2018/05/22/extending-access-to-necessities-with-pay-as-you-go/
4. Mastercard. (September 2020) *Mastercard partners with Samsung, Airtel and Asante to drive digital inclusion in Africa through Pay-on-Demand services.* https://newsroom.mastercard.com/mea/press-releases/mastercard-partners-with-samsung-airtel-and-asante-to-drive-digital-inclusion-in-africa-through-pay-on-demand-services/
5. Ministry of Economy, Trade and Industry, Japan (April 2018) "Cashless Vision" https://www.meti.go.jp/press/2018/04/20180411001/20180411001-1.pdf
6. HIS Markit. (2017) *"The Internet of Things: a movement, not a market"* https://cdn.ihs.com/www/pdf/IoT-ebook.pdf

About

Mastercard (NYSE: MA), www.mastercard.com, is a technology company in the global payments industry. Our global payments processing network connects consumers, financial institutions, merchants, governments, and businesses in more than 210 countries and territories. Mastercard products and

solutions make everyday commerce activities – such as shopping, traveling, running a business and managing finances – easier, more secure and more efficient for everyone.

Global Open Network

Global Open Network Japan Inc. is a technology company established in April 2019, providing “GO-NET”, a platform that leverages blockchain technology to support various businesses in areas such as payments and IoT. https://go-net.jp/japan/en/

Disclaimer（免責事項）

本文書は、情報提供のみを目的として提供されており、ここに記載される内容は予告なく変更される場合があります。本文書は、その内容に誤りがないことを保証するものではなく、また商品性ないし特定目的適合性に関する黙示的保証および条件などいかなる保証および条件も提供するものではありません。Global Open Network Japan 株式会社と Mastercard は、本文書に関するいかなる法的責任も否認し、本文書によって直接的または間接的に確立される契約義務はないものとします。本文書は Global Open Network Japan 株式会社と Mastercard の著作物であり、著作権法により保護されております。当社の事前の承諾なく、本文書の全部もしくは一部を引用または複製、転送等により使用することを禁じます。

This whitepaper is intended for general information purposes only and may be changed without prior notice. There is neither any assurance as to the accuracy or completeness of the contents nor any warranties or conditions including implied warranty of fitness for a particular purpose. Global Open Network Japan Inc. and Mastercard have no liability for any damages arising in connection with this document and this document does not give rise to any delegation or other contractual relation between readers and the parties. This document is copyrighted and is protected by copyright law. Any use of all or part of these materials, including quotes, duplications, or forwards, without our prior consent is prohibited.