Why IIJ Seeks to Become a Full MVNO

2.1 MVNO Business Models

In 2018, IIJ finally begins full MVNO services, the biggest challenge we have had since launching our MVNO business in 2008. The phrase “full MVNO” is still not used all that commonly in Japan, and it may be difficult to understand it correctly. However, tens of MVNOs around the world have already successfully transformed their business model to “full MVNO,” and are providing advanced and diverse services through their platform.

“Full MVNO” is a phrase that defines a particular MVNO business model. Figure 1*1*2 shows typical MVNO business models, and the key to their classification lies in how many of the elements the MVNO operates by themselves (Figure 2*3).

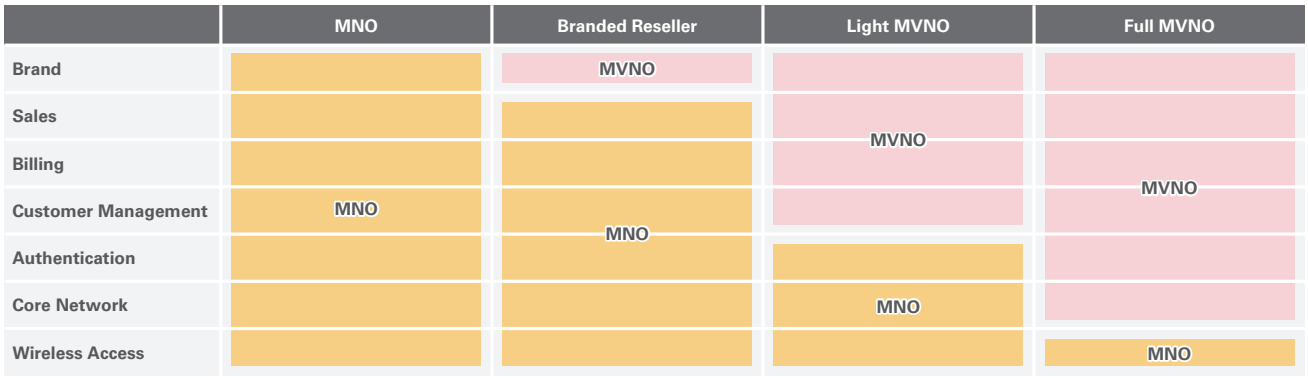

Figure 1: Types of MVNO

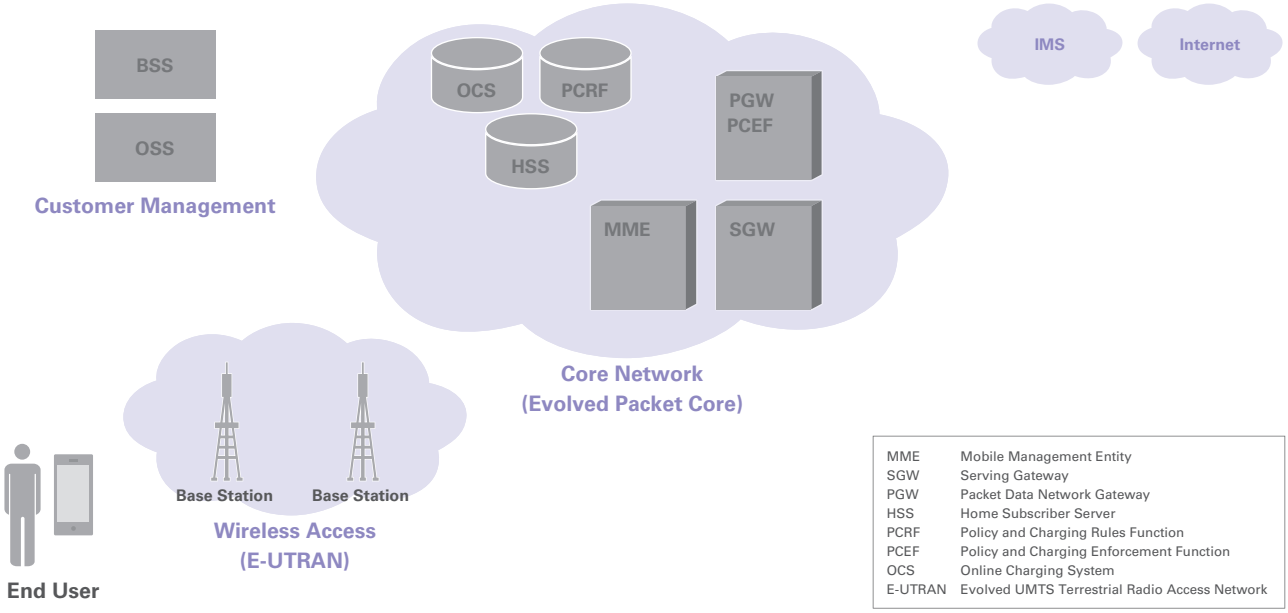

Figure 2: 4G LTE Mobile Communications Network Overview

*1 Figure 1 shows various types, but actual MVNOs may not always fit one of these categories. Many MVNOs could settle between these categories due to market trends and regulations in each country, as well as relationships between MNOs and MVNOs. There are also local varieties such as the Layer 3 MVNOs and Layer 2 MVNOs in Japan.

*2 Figure 1 is not intended to indicate which one is superior or inferior. Be aware that it is important to select a favorable business model based on a company’s characteristics and business objectives.

*3 This shows typical 4G LTE nodes, but MVNO business models differ as to which parts other than the wireless access are operated by the MVNO themselves and which parts are provided by their host MNO.

As the name indicates, an MVNO (Mobile Virtual Network Operator) is a virtual provider that essentially offers services under its own brand by relying on equipment that they do not operate themselves. However, when you are reliant on other companies for various elements other than your brand, you must be concerned about your business lacking uniqueness, making differentiation difficult. For that reason, depending on the business objectives of each company, there is the option of directly operating some, if not all, elements and equipment yourself, without relying on other companies.

For example, for a company like Disney that has a very strong brand and is highly competitive even when relying on the host MNO for all other elements, a "Branded Reseller" business model is probably the most suitable. The "Light MVNO" model that performs sales and customer management themselves while relying on the host MNO for network and authentication equipment is also spreading as a standard business model both in Japan and across the globe. "Full MVNO" is the MVNO business model closest to an MNO, operating most of the equipment other than wireless access by themselves.

2.2 Full MVNOs: Their Competitive Edge and Hurdles

The competitive edge of full MVNOs lies in the network equipment they possess, or their core network*4, as well as their authentication facilities. This equipment can be served by an MNO when using another MVNO business model, but by operating them by yourself it is easier to maintain the uniqueness of your business and differentiate yourself from other MVNOs or MNOs. Not only that, but by operating the core network at the heart of mobile communications, you can transition from a light MVNO business model where you are bound to a designated MVNO agreement with a single MNO, and take on new business areas through collaboration with multiple MNOs and MVNOs.

On the other hand, a full MVNO has the highest cost hurdle due to the investment in equipment and the many human resources required to operate it. Consequently, there seem to be many cases around the world where low value-added services like the low price plans for smartphones are provided by light MVNOs, and providers entering new business areas with high added value like IoT, international services, security, and FinTech go the full MVNO route.

2.3 The Shift Towards Full MVNOs

Until now, there were no full MVNOs in Japan, so IIJ is the first to commercialize it. Internationally, there are still only a limited number of countries where full MVNOs exist, including some European nations. For many countries the commercialization of full MVNOs will be a future challenge. As mentioned above, a full MVNO requires significant costs, so we have to consider whether an MVNO with the scale to make this investment already exists. MNOs must also have the maturity to accommodate partnerships with full MVNOs. In some cases, national telecommunications policies or regulations may not allow full MVNOs, and it may be necessary to hold discussions.

That said, looking at future advancements in mobile communications such as IoT and 5G, the innovation and diversity that full MVNOs bring to the mobile communication market will be crucial for all countries. We believe that for many nations the introduction of full MVNOs to the market will become a practical policy issue sooner or later. In Japan, discussions held at the Information and Communications Council's 2020-ICT Basic Policy Special Committee in 2014 recognized that full MVNOs were an important policy issue, and talks between the providers, IIJ, and NTT Docomo gained momentum. We expect that trends like this will continue to spread around the world.

*4 Core Network: A network that transports signals (signaling) for connecting devices to a network and data (user data) related to calls and communications within a mobile communications network. In 2G/3G architecture, legacy protocols are still in use. But nowadays, for the purpose of maintainability those legacy protocols are often transported by IP. In 4G architecture, all protocols are based on IP.

2.4 Full MVNOs and the Unbundling of HLR/HSS

Discussions related to full MVNOs in Japan, including those at the 2020-ICT Basic Policy Special Committee, have centered on the unbundling of HLR*5 and HSS*6 for MVNOs. HLR and HSS are nodes that have important roles in the core network for mobile communications. They are often described as subscriber management devices, offering the following diverse range of functions:

1. A database for storing and managing information such as the MSISDN (phone number) or IMSI (international number for subscriber identification) of all subscribers.
2. Responds to queries from each node within a network such as the MME, and authenticates the connection and function availability of subscribers.
3. Stores information on networks and switching equipment serving devices in real time to enable services such as voice calls and SMS (location management).
4. Stores information corresponding with SIM cards, and provides the encryption functions (along with other nodes) necessary for keeping the content of communications secret.

Until now, HLR and HSS had been operated only by MNOs in Japan, and were not available from MVNOs. IIJ is the first MVNO in Japan that operates HLR and HSS independently and connects them to an MNO's network directly*7.

However, care must be taken to treat the operation of HLR and HSS as the definition of a full MVNO, despite there being various nodes in a core network. The wider network model of full MVNOs that operate other nodes in core networks such as MME*8 and SGW*9 is also discussed worldwide. This is also called "RAN*10 sharing" between MNOs and MVNOs, but IIJ's commercial implementation of full MVNO does not adopt this wider definition. MME and SGW are almost incapable of developing high value-added services by themselves. However, for the upcoming 5G technology, introducing added value such as network slicing or NFV to core networks is a major topic, and we consider this to be a subject for future analysis.

2.5 MNC and SIMs

The benefits of an MVNO operating HLR and HSS are not always the direct result of HLR/HSS functions. One example is MNC*11. MNCs are the numbers that serve as identifiers for mobile communications networks when they are connected to one another. This is similar to an AS number in an IP network. Like IP networks, connections are made between mobile communications networks on a global scale, so the numbers used as identifiers must be globally unique. In Japan, an MNC is a five-digit number allocated by the Ministry of Internal Affairs and Communications under the Regulations for Telecommunications Numbers (Ministerial Ordinance), based on ITU-T*12 recommendation E.212. The three digits at the head of it are a country code called the MCC, for which Japan has been assigned 440 and 441.

*5 HLR: An abbreviation of Home Location Register. A node that stores information on subscribers and manages location information on 2G/3G mobile networks.
*6 HSS: An abbreviation of Home Subscriber Server. A 4G LTE network and IMS node that provides functions similar to HLR.
*7 Excluding "MVNOs that are also MNOs," such as KDDI and Softbank in Japan.
*8 MME: An abbreviation of Mobile Management Entity. A node that handles signaling in 4G core networks.
*9 SGW: An abbreviation of Serving Gateway. A node that handles user data in 4G core networks.
*10 RAN: An abbreviation of Radio Access Network. A network for connecting base stations (wireless station equipment) to core networks in mobile communications. For 3G this is referred to as UTRAN (UMTS Terrestrial Radio Access Network), and for 4G it is referred to as E-UTRAN (Evolved UTRAN).
*11 MNC: An abbreviation of Mobile Network Code. A unique number used to identify mobile communications networks.
*12 ITU-T: The Telecommunication Standardization Sector of the International Telecommunication Union.

According to the Regulations for Telecommunications Numbers, the requirement for allocation of this MNC is "the installation of equipment for identifying devices." IIJ has met this requirement by installing and operating HLR and HSS independently, and we have been allocated the MNC of "44003" by the Ministry of Internal Affairs and Communications, which is a first for an MVNO in Japan. Using this MNC, IIJ can connect its own HLR and HSS to DOCOMO and other mobile communications networks, making it possible to implement roaming services.

Another benefit is the capability to issue our own SIMs. SIMs are IC cards that are issued to each subscriber. They hold a number for subscriber identification (IMSI*13) and an encryption key. Subscribers can access the services of a mobile communications network by inserting this SIM into a device. MVNOs in Japan also issue SIMs and offer them to subscribers, but this is merely passing on SIMs provided by their host MNO. Now IIJ has obtained its MNC, we can allocate IMSI to the customer using our own equipment, and we can issue our own SIMs independently*14.

In terms of technology, there are two advantages when an MVNO is able to provision SIMs. One is greater flexibility to provide services. In the past, there was no way to provision SIMs without relying on the system of the host MNO. That means it was not possible to offer services the MNO's system did not allow. For example, under conventional light MVNO schemes, once a SIM is provisioned and its use started, it continues to be available until it is deactivated, and after deactivation, the SIM cannot be reused. That means it is difficult to activate it temporarily during pre-shipment inspections in cases where a communications module is to be embedded into the product for IoT purposes. In other words, because the process of removing the SIM used in the pre-shipment inspection and inserting a new SIM is performed after the check, the inspection could lose its meaning. Limitations like this are coming from BSS or OSS*15 on the MNO side. Ideally, if an MNO could develop BSS or OSS with enough flexibility to meet the demands of MVNOs, even light MVNOs would be able to overcome this issue. However, in reality the barriers are quite high.

IIJ's full MVNO services support the temporary activation of SIMs and the recycling of deactivated SIMs through IIJ's BSS and OSS implementations. We believe the merits can be leveraged where flexible activation or deactivation of the SIM is required, such as with IoT.

The other advantage is support for new SIM technology, such as eSIMs*16. In advanced IoT and roaming use cases, the restrictions of plastic SIMs that have been around for thirty years have become a new problem. We expect to see the spread of eSIMs that enable SIM profiles to be downloaded online without removing and inserting them, and virtual SIMs (software SIMs*17) that handle the essentials of SIMs virtually without any physical media or devices. Commercial devices equipped with eSIMs and devices fitted with software SIMs that provide prepaid inexpensive roaming have already appeared. By having a platform that enables independent provisioning of SIMs, we will be able to obtain the benefit of innovations using these new technologies.

*13 IMSI: An abbreviation of International Mobile Subscriber Identity. This is an identifier allocated to each mobile communications network subscriber that is stored on the SIM. The first few digits of an IMSI are the MNC of the issuing operator. HLR and HSS are used to manage the IMSI and handle SIM authentication.

*14 Provisioning: To make preparations for providing network resources to telecommunications service subscribers. In this case, it refers to preparing to provide a mobile communications service by writing the necessary information to the SIM and coupled information to HLR or HSS.

*15 BSS/OSS: An abbreviation of Business Support System / Operation Support System. These refer to systems in the back offices of telecommunications carriers. BSS covers customer-related systems such as those for subscription and billing management, while OSS covers operation-related systems such as those for SIM provisioning and logistics management.

*16 eSIM: A SIM that enables the telecommunications carrier profile stored inside to be rewritten remotely. Physically, a conventional plastic SIM or a dedicated solderable chip will be used. Currently, the GSMA, an industry group for mobile telecommunications carriers, is moving ahead with standardization on two tracks--one for Machine-to-Machine communication and the other consumer devices.

*17 Software SIM: This refers to remotely rewritable SIMs that do not use dedicated hardware, and are instead implemented through software using a processor's trusted execution environment (TEE). It is not a standardized technology, but certain software SIM platforms are compatible with standardized eSIM provisioning systems.

2.6 The Benefits of IIJ's Full MVNO

Some MVNOs in Japan other than IIJ have begun to implement HLR and HSS and secured the flexibility of SIM provisioning. This is some particular preamble of the trend of IoT. So, what are the differences between IIJ's full MVNO scheme and other businesses developing with a similar business model?

We think that the HLR/HSS implemented by other providers will generally only be connected to networks of overseas providers and not MNOs in Japan. Despite this, they can provide the connectivities of other mobile communications networks and can obtain the capability of SIM provisioning as described in this report in the same way as IIJ's full MVNO scheme does. However, in the case of these providers, the connectivity of MNO networks in Japan is provided based on a roaming agreement between the overseas operator and domestic MNO just as with countries other than Japan. As a result, they will only be able to offer services with less flexibility of pricing due to the comparatively expensive roaming charges in Japan.

Even for IIJ, there is no significant difference in countries other than Japan, because roaming services are provided at a relatively high cost via the networks of overseas roaming providers and their roaming agreements. However, in Japan IIJ connects its HLR and HSS to NTT DOCOMO directly, so the domestic data is more reasonable compared to roaming charges. That means we can provide domestic services with highly flexible pricing at a lower cost than our competitors in Japan, which is a major distinguishing characteristic.

Next, we will examine roaming services in countries other than Japan in detail. Generally, payments for international roaming are offset based on mutual use when services are provided bilaterally between two operators with a roaming agreement (each company opens their network to roaming from the other party). Consequently, depending on the roaming fees (tariff) set and the amount of traffic on both sides, it may not be too difficult for a company to procure data connectivities from other countries at levels that are similar to their own network costs. However, when connecting only HLR and HSS to the networks of overseas roaming providers, it is not possible to sell data connectivities in Japan to overseas operators, so they cannot make a bilateral roaming ecosystem. Thus, the cost of procuring overseas data connectivity depends solely on the roaming fees (tariff) set by overseas operators, making it difficult to obtain the flexibility of pricing.

Contrarily, IIJ can sell Japanese data connectivity procured from NTT DOCOMO at the MVNO data rate, to overseas operators through our own HLR and HSS. This means that, although it is necessary to use Multi IMSI*18 technology, we have an environment that enables us to provide bilateral services similar to roaming business between MNOs. We are currently working with overseas telecommunications carriers to discuss the possibility of offering such bilateral services and providing data connectivity in Japan using IIJ's IMSI. We are making preparations to be able to provide overseas data communication services with highly flexible pricing to meet the needs of Japanese customers. This is a business model that is only possible for IIJ, as the only Japanese MVNO with HLR and HSS connections to the host MNO in Japan, and I think that many customers will appreciate the pricing benefits this will provide.

*18 Multi IMSI: Usually a single IMSI is recorded in a SIM, but this technology enables users to switch between different telecommunications providers with a single SIM by changing the IMSI. Unlike the multi-profiles enabled by eSIM, an applet in the SIM handles switching the IMSI.

2.7 Future Challenges

IIJ has paved the way forward by becoming Japan's first full MVNO. This type of business model is one-of-a-kind in Japan, and has only been commercialized in a limited number of countries and regions around the world. For that reason, IIJ will avoid taking further risks, progressing with deployment in phases while verifying the operation of new facilities and systems to be implemented.

Also, services such as voice calls will be out of scope for this full MVNO. With regard to voice calls, we have taken into consideration the strict regulations, such as maintaining call quality, MNP (mobile number portability), and emergency calls. Currently, IIJ provides low-priced SIMs for smartphones as one of our main lines of business, by offering them through our own IIJmio brand and the brands of other partner companies. However, regarding voice calls, we will continue with our light MVNO-based scheme in the future.

IIJ will consider a full MVNO that includes voice call services while fully taking into account the trend of requirements for such a service and its future prospects.

Furthermore, as a full MVNO, we are proactively thinking about new trends such as IoT and 5G. In order to introduce cellular LPWA*19 on a worldwide scale, and enable a variety of added value through network slicing and 5G, we are considering what kind of equipment we should construct with our host MNO, and which advanced and diverse services we should forge ahead with as an MVNO. IIJ believes that as a front-runner in the MVNO space, we have a great responsibility to the MVNO industry going forward. We remain committed to the belief that an MVNO is not merely a second-tier provider piggybacking on the MNO, but a provider based on a unique business model that enables a variety of services not provided by MNOs.

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Since joining IIJ in 2000, Mr. Sasaki has been engaged in the operation, development, and planning of network services.
He was one of the founding members of IIJ's MVNO project in 2007 and has been in charge of corporate and personal MVNO services ever since.
He is a member of the MVNO Committee of the Telecom Services Association, an MVNO industry group.

*19 Cellular LPWA: A Low Power Wide Area mobile communications service for IoT that uses mobile phone technology, and is provided at a frequency (licensed band) that requires licenses to be obtained. Cellular LPWA communications standards such as LTE-M and NB-IoT are expected to be commercialized in 2018 and beyond.