

How the "disappearing" SIM card will liberate the consumer and scramble telco roles



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# Executive summary

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The SIM card is finally going virtual — and the world of telecommunications companies is about to be turned upside down by its "disappearance."

SIM (subscriber identity module) cards, critical components of mobile phones and the only parts of the phone still owned by network operators, can't get any smaller and still perform their functions — to identify and authenticate callers. The SIM card will soon be replaced by a combination of built-in software and apps, known as an electronic SIM, or eSIM. Over the next several years, this will appear in significant numbers of mobile phones and even sooner in many other connected devices.

With the physical card disappearing, the industry is entering a two- or three-year period of great flux, with large swaths of the telecommunications market potentially up for grabs. Consumers will soon be in control, choosing an operator and a price plan and connecting to telecom networks in much the same easy way as with Wi-Fi. This simple act of liberation will have complex ripple effects for device manufacturers, mobile network operators (MNOs), and mobile virtual network operators.

If MNOs aren't agile and resourceful enough to respond to the changing dynamics, their worst fears about the new age of the eSIM will come to pass. If OEMs are flat-footed, they will miss their opening. But if both sides do what they should, a new order will form. Remaining players will find their roles to be far more overlapping than they are now. They will also find that they are vying to divide up a far bigger pie.

# Welcome to the new world of the eSIM

Having snipped their landlines by the millions in recent years, consumers are about to lose their last physical link to telephone service providers. The SIM (subscriber identity module) card — the tiny heart of mobile phones that identifies and authenticates callers — is going virtual.

When the cards are replaced over the next few years by software and apps known as the electronic SIM (eSIM), the disappearing act will mark the final cutting of the cord that has tethered consumers to phone companies since Alexander Graham Bell called out to Thomas Watson.

The telco business will never be the same.

The shift to eSIM will inspire radical changes in consumer behavior, changes that have the potential to scramble the roles of all the players in the market.

Facing the biggest uncertainties are mobile network operators (MNOs), or wireless service providers, such as the five largest providers in the world — China Mobile, Vodafone, Airtel, América Móvil, and Telefónica. The need to have a physical SIM card inserted into a handset was what put the operators at the center of mobile connectivity, and the telcos fear they'll lose their place once the card is gone.

Presented the biggest opportunities are mobile phone manufacturers, which will have new incentives to sell more of their phones directly to consumers — and, while they are at it, to provide them with service as well, by becoming mobile virtual network operators (MVNOs). MVNOs piggyback on MNOs by buying bulk access to their network services at wholesale rates and reselling it to retail customers.

But the shock waves won't stop there.

Existing MVNOs will face an influx of new competition, and not just from phone makers. That's because OEMs in totally unrelated industries may also have a new role to play in the phone business. The products

that they make — cars, refrigerators, cameras, and many more — are increasingly connected through the Internet of Things (IoT), and eSIMs will greatly facilitate that process. And while these OEMs are making all of those connections, some may even become MVNOs, too.

That's a lot of activity to be set off by the disappearance of a component that has been getting smaller and smaller for two decades (see Exhibit 1, next page).

What's shaking everything up is the looming change in control of the means of connectivity. Throughout the history of mobile telephony, almost all roads to connectivity have gone through SIM cards, which are owned by MNOs. The cards have served as the companies' glue in the marketplace. MNOs have locked in countless consumers to multiyear service contracts through their so-called subvention model — the operators provide the newest SIM-equipped phones at a much lower signup price than the manufacturers offer at retail. (Some of the price differential is built into the service contract, with the rest mostly absorbed by the operators.)

Although future devices could still be preconfigured to a specific MNO, eSIM will largely shift the power to determine connectivity to the consumer. An eSIM-capable device is much easier to connect to a mobile network, so rather than having to purchase a service contract and a physical SIM for the device, consumers will select a price plan from an MNO or the manufacturer at purchase or when putting the device into operation for the first time, in much the same way they now choose among Wi-Fi networks.

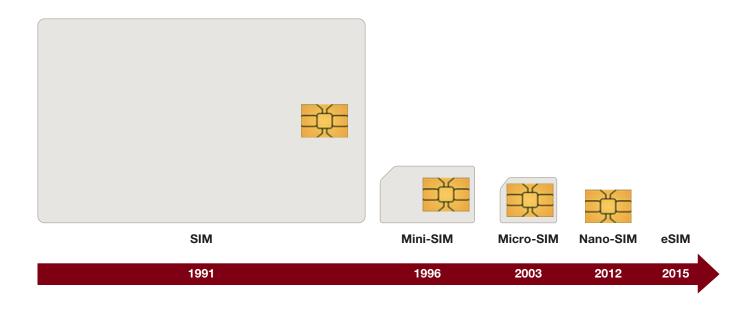
At that point, consumers could opt to add the device to a plan they are already using for other devices. As a result, multidevice plans will become the norm, simplifying contract management and making prices more attractive.

Corporate customers will acquire the power to configure connectivity, too. They will have more solutions available to manage connectivity and devices for their staff, and can more easily juggle multiple operators in multiple countries. (See "The end of roaming," page 11.)

To be sure, all of these changes are not going to happen overnight. The first eSIMs arrived in 2015, appearing in smart devices such as tablets and wearables, notably Apple's iPad Air 2 and the Samsung Gear S2 smartwatch. Industry expectations are that mobile phones will not become eSIM-enabled in significant numbers for several years. (See "eSIM pioneers," page 7.)

Almost all roads to connectivity have gone through SIM cards, which are owned by MNOs.

Exhibit 1
The evolution of SIM



Source: Strategy& analysis

We estimate that it will be at least two years before the eSIM technology begins to take hold in a major way. So now is the time for network operators and other players to reset their strategy and find their places in eSIM's new world order.

MNOs have to shake off their initial fears that eSIMs will turn them into bare-bones B2B infrastructure providers and figure out new strategies to compete with increasingly powerful phone manufacturers and more numerous and agile MVNOs.

The operators will have to play to their strengths by providing additional technical and personal services to fashion new ways to win customers. But there is also good news here for MNOs: Although the shift to eSIM poses substantial risks of marginalizing them, it also offers a tremendous upside in providing bundled subscriptions for multiple connected devices. Indeed, the new eSIM world could potentially give operators an even stronger lock-in with consumers than they have now.

# eSIM pioneers

The pursuit of SIM-less mobile connectivity has been moving forward for several years. Before becoming standard on any smartphone, eSIM is likely to roll out into devices that are typically not bought via mobile operators, especially products that connect machine-to-machine, including smart household appliances and automobiles; drones, cameras, and wearables, including smartwatches; and tablets, notebooks, and other personal devices. The prehistory of eSIM includes these kinds of devices:

- Amazon's Kindle offered mobile connectivity through a Vodafone contract in many countries starting in 2013 to allow for purchases of online books "on the go" and in the absence of Wi-Fi
- In 2014, Apple's iPad Air 2 introduced Apple SIM, a removable, multi-carrier card that lets users choose between carriers and plans a means of configuring connectivity that served as a first step toward eSIM
- In 2016, Samsung launched the Gear S2, a smartwatch that uses the first certified eSIM

For their part, phone manufacturers will need to explore their options and flex their new muscles. For starters, that means expanding direct and third-party sales channels. Their goal is the same one that operators have: to evolve into one-stop shops for consumers who own more and more connected devices and will prefer bundled subscriptions.

That puts the two groups on a collision course. But the good news for all players is that the industry's pie is growing much larger. By 2020, some 50 billion devices will be connected to the Internet. That's 100 times the number in 2003 and twice as many as in 2015, according to Cisco.

The eSIM will be a major facilitator of that growth. By 2021, 28 billion devices will be candidates for an eSIM, up from 15 billion in 2015, according to the Ericsson Mobility Report 2016. More than half will be cars, industrial machines, appliances, and other devices connected through the Internet of Things (see Exhibit 2, next page). Although all cellphones will eventually have an eSIM, the staggering numbers of these other connected devices will make them an even bigger driver of eSIM growth (see Exhibit 3, page 9).

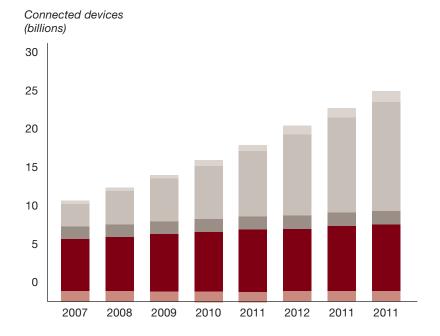
# What is SIM?

SIM cards are a feature of the GSM (Global System for Mobile Communications) standard for cellular networks. Developed in 1991, GSM started to win worldwide acceptance about 20 years ago, eventually overtaking CDMA2000, a system used by some providers that worked without a SIM card.

- SIM provides the fundamental elements of identity and authentication
- The size of SIM cards has shrunk to fit into smaller or more featurepacked devices

- The Nano-SIM, introduced in 2012, is the smallest possible "traditional" version that can fulfill SIM's core functions
- With the emphasis now on bundled products and multidevice contracts, the physical SIM card is no longer appropriate even though the card can be reprogrammed
- eSIM was introduced in 2015; the technology varies and sometimes includes hardware components as well as pure software solutions

Exhibit 2
The growing pool of connected devices for eSIM connectivity



	15 billion	28 billion	CAGR 2015–21
Cellular IoT			27%
Non-cellular loT	4.2	14.2	22%
PC/laptop/tablet	1.7	1.8	1%
Mobile phones	7.1	8.6	3%
Fixed phones	1.3	1.4	0%
	2015	2021	

Source: Ericsson Mobility Report 2016

# Exhibit 3

# Drivers of eSIM growth

## eSIM growth will be by smart devices, not by smartphones

**Tablets and notebooks**, as many are already equipped with SIM slots to provide connectivity

Acer, Apple, HTC, Huawei, HTC, IBM, Lenovo, Samsung, Sony



**Wearables**, including smartwatches, wristbands, and other devices that require a mobile connection

Apple, Fitbit, Garmin, Google, Jawbone, LG, Polar, Sony



**Machines and engines** that are billed by operating metrics or benefit from remote maintenance

Bosch, Gamesa, GE, IWR, OnFarm, Schneider Electric



Cars and other means of transportation

Alstom, BMW, Bombardier, Mercedes-Benz, Opel, Siemens. Volkswagen. Volvo



**Household appliances** that can enable remote servicing and supply ordering without requiring a Wi-Fi connection





Source: Strategy& analysis

# The transition period: Time to prepare for major changes

Over the next three years, all of the industry's players will start to adapt to eSIM technology, but without significantly affecting the market. Because mobile operators will ultimately feel the brunt of the shift, they especially need to use this transition period of relative calm to gear up for the inevitable storm.

First, operators need to embrace the new technology. Fulfillment processes must be developed on the back end, where business and operations support systems will have to be reconfigured for provisioning eSIM. (The shift away from physical SIM cards will actually make logistics in the operators' retail stores and front offices much simpler.)

Second, the operators need to revise their contract structures. If they haven't already done so, they should offer full connectivity packages for multiple devices, which customers will increasingly expect. And rather than basing charges on usage — a horrifying thought for customers with escalating numbers of devices and gadgets — pay-per-device models must be implemented. Put another way, the operators need to figure out a structure that uses the growing multiplicity of devices as a hook to lock in the consumer.

A pay-per-device approach will be a big change for some operators, which until now have sold data-only packages for non-phone devices like tablets or charged a significant premium for a second SIM card. But, as noted earlier, it is also a major opportunity to increase customer retention.

Third, as part of the contractual changes, the subvention model must also undergo major alterations. It can still be used for a primary device, but it will also have to morph into a financing vehicle that can cover multiple devices. Some operators are already starting to offer such financing.

Even if well executed, however, these changes will not be enough to safeguard the operators' position in the years following the transition.

To fully gauge what MNOs and other players need to do for long-term success, we have to analyze the different ways in which the market could evolve.

Rather than basing charges on usage, pay-per-device models must be implemented.

# The end of roaming

Besides scrambling the role of operators and manufacturers, eSIM's arrival will pound a nail into the coffin of roaming charges, those pesky, often painful fees imposed on consumers when they journey into the coverage area of another network, usually when crossing national borders.

Roaming fees are a major source of revenue for telcos. But the ability to switch SIM connections via a landing page — and the fact that phone services (including voice calls and messaging) are increasingly available through the Internet and thus carrier- and SIM-independent — will make it much easier for consumers to connect to local providers and control usage fees.

In fact, as switching eSIM connections becomes more widespread, metaservices that choose the optimal operator based on location, price, or quality of service are likely to emerge.

Additionally, MVNOs may discover entirely new ways to play. Instead of relying on roaming agreements imposed by MNOs, MVNOs might simply switch their users' eSIM connections based on location, providing a value-added service that allows their customers to avoid roaming fees altogether.

A first step toward the end of roaming fees is their abolition by the European Union, set to take effect in mid-2017.

# Down the line: Three likely scenarios

We see three paths taking shape, with dramatically different potential outcomes. The actual results will depend in large part on how well each player reads the signals of change, on the depth and daring of their new strategy, and on the timing of its execution.

# Scenario 1: Evolving status quo

This is the model that most phone providers are currently anticipating, at least for the short term, and, some hope, for much longer than that.

It is a logical evolution of today's three- and four-play offers, in which telcos provide service bundles that contain landlines, mobile, broadband Wi-Fi, and television. Due to the increasing number of devices per user, the telcos under this scenario position themselves as a manager of connectivity for multiple devices and a provider of new value-added services.

On the B2B side, for corporate customers that need to buy lots of connectivity to serve large staffs and/or large numbers of machines, telcos can differentiate through improved provisioning of equipment and the rollout of self-service processes.

In this way, telcos hope to maintain their role of connectivity provider and handset dealer in the eyes of the consumer. But the prerequisite for that is for telcos to remain the hardware resellers they are today, even without SIM cards serving as the hook.

If telcos successfully manage a transition into Scenario 1, they could even increase their customer retention and bind them for longer periods of time. As consumers will have multiple devices linked to their contract, new multidevice financing and subvention models could help lock them in for multiple years.

# Scenario 2: Path to partnership

Scenario 1 leaves the responsibility of maintaining and setting up connectivity to the consumer, but it is unlikely that this is fully in the interest of the large phone operators or phone makers.

The manufacturer of a smart refrigerator or dishwasher wants those appliances to offer value-added connected services such as an onboard maintenance shop or a button to order supplies. The OEM thus wants to make it as easy as possible for the buyer to access those services — without needing to arrange for a contract with an MNO.

This means that connectivity needs to come with the appliance, the way it does with e-readers such as Amazon's Kindle. And *that* means big telcos and phone manufacturers may not make it to the party if other players have gotten there first.

Under this scenario, a number of smaller phone operators and MVNOs will join manufacturers in partnerships to provide that connectivity. In fact, some OEMs have already approached operators to discuss such a model.

# Scenario 3: Free-for-all

If Scenario 2 materializes in a significant way, which seems likely, it will only be a matter of time before *all* manufacturers of smart devices, including smartphone and smartwatch makers, will want to offer connectivity — either to make things easier for consumers or to try to lock them into their ecosystem by offering to connect multiple devices.

In today's world, the customer starts by selecting a carrier. In the future, when connectivity is included in the manufacturer's device, customers will pick their smartphone first and then choose a carrier as they put the device into operation. This process will likely mean the buyer is offered a carrier selection page that allows the carrier to define price plans and invoice the customer. In some cases, however, the manufacturer will also operate as an MVNO, selling and invoicing for its own plans, although that route is harder because it involves acquiring new capabilities.

The inevitable result of this connectivity free-for-all will be to put more distance between the network operators and the consumer. It is possible that brokers will position themselves between them, offering the customer the lowest tariff or the best network, much as Orbitz does in the travel industry and Trivago does with hotels. The danger for the operators is that their role will be sharply marginalized, perhaps reduced to B2B connectivity provider.

It will only be a matter of time before all manufacturers of smart devices will want to offer connectivity.

In short, the roles of all major industry players — OEMs, MNOs, and MVNOs — could face drastic changes, along with that of the consumer, as eSIM's effects on the market are felt and players jockey for position (see Exhibit 4, next page).

The scope of those changes is not set in stone. Roles of the various categories of players will start to overlap and merge. Yet the precise contours of change for each particular player will depend on the course that it sets now and its success in implementation.

# Exhibit 4

# As the eSIM market develops, changes in roles accelerate

	Scenario 1: Evolving status quo	Scenario 2: Path to partnership	Scenario 3: Free-for-all
	An evolutionary stage to today's status quo	A mixture of Scenario 1 and Scenario 3: 1 for primary devices, 3 for secondary devices	All connected devices come with built-in connectivity and a value proposition
OEM: device manufacturer	<ul> <li>Markets device without connectivity to MNO/MVNO</li> <li>Bears all costs for eSIM</li> </ul>	<ul> <li>Secondary devices are sold directly to the customer with built-in connectivity</li> <li>Primary devices are sold to the MNO and the MVNO</li> <li>Bears all costs for eSIM</li> </ul>	<ul> <li>Markets devices with built-in connectivity directly to the customer</li> <li>Negotiates traffic/speed packages with the MNO</li> <li>Bears all costs for eSIM</li> </ul>
OEM: appliance manufacturer without digital core capabilities'	Same as OEM: device manufacturer	Sells goods with built-in connectivity options (eSIM, Wi-Fi) but no strings attached regarding eSIM activation	Same as OEM: device manufacturer
MNO (mobile network operator)	<ul> <li>Markets connectivity with or without device</li> <li>May still subsidize devices</li> <li>Cost savings through eSIM-related logistics and provisioning</li> </ul>	<ul> <li>Holds B2B relationships (for secondary devices) as well as B2C (for primary devices)</li> <li>Retains limited control over services and customer</li> </ul>	<ul> <li>Holds B2B relationship only, with the OEM; no direct customer contact</li> <li>Connectivity becomes a utility (a dumb pipe)</li> </ul>
MVNO (mobile virtual network operator)	Same as MNO	Same as MNO	<ul> <li>OEMs become MVNOs</li> <li>Traditional MVNOs are squeezed out of the market by new players</li> </ul>
Consumer	Customer behavior resembles today's status quo     Activation process is simplified	Purchases full-service secondary devices Has some transparency regarding network provider on primary devices Settles invoices with device manufacturers or MNO/MVNO	<ul> <li>Purchases full-service device</li> <li>Has no transparency regarding network provider</li> <li>Directly settles invoices with the OEM</li> </ul>
			* White goods, red goods, cars, etc.
			Source: Strategy& analysis

# How players should position themselves

Given these scenarios, MNOs need to play to their traditional strengths; they have been providing the network service, after all, and have the most robust retail networks. Device makers need to seize their opening.

# MNOs: Safeguarding their current position

To maintain their central, customer-facing position, MNOs need to double down on their current path of service diversification, fortifying their foothold with attractive value-added services that will help them lock in customers. The roster of services should include identity management, device management, security, TV, digital safe document protection, virtual private networks (VPNs), and user support.

The idea is to aggressively build out MNOs' existing strategic advantage over OEMs and avoid losing further ground to the so-called over-the-top (OTT) players, such as Google, Netflix, and Skype, which provide services over the Internet and through the cloud. In buying AOL and agreeing to purchase the online assets of Yahoo, Verizon, for example, is preparing to take on Google and Facebook. And in an even more ambitious move to compete against both OTTs and cable providers, not to mention other MNOs, AT&T is spending US\$85 billion to buy entertainment and media giant Time Warner, owner of HBO, CNN, and Warner Bros.

In addition, the MNOs need to leverage the relationships they have with their customers to use against both manufacturers and OTTs. Those relationships often go back many years, maintained through the operators' networks of dedicated stores, and are important differentiators. In the future, though, the best service will be personalized in nature, rather than just personal, and while retail stores will still play a role in delivering service, MNOs need to explore other distribution channels as well.

However, if even one operator opts to implement Scenario 2 or 3, a new competitive dynamic might take hold, forcing the entire market to quickly evolve into the other scenarios.

The best service will be personalized in nature, rather than just personal.

# Smaller operators: Favoring OEM partnerships to gain market share

Scenario 1 seems preferable for most large operators. But smaller, pure mobile operators with limited store presence or MVNOs may be able to boldly embrace Scenario 2 to establish themselves as the preferred partner for the OEMs. They will do anything to avoid Scenario 3, as the risks for today's MVNOs are high, perhaps even leading to a market exit.

# Device OEMs: Many choices, but limited decision time

Device makers find themselves with lots of choices, but they need to make decisions and move quickly.

Besides the obvious "multiplay" choice — allowing all providers on a device — smaller device OEMs with no regional presence might want to partner with operators to increase market share, thereby taking on the mantle of MVNO. It is also possible that the market will develop in a way that is similar to 2007, when Telekom was the only provider in Germany and AT&T the only one in the United States allowed to sell the iPhone.

Beyond that, the positioning of carriers within the interface where customers choose their service can become a new way for phone OEMs to monetize their devices. Rather than offering discounts or cashbacks to operators for marketing campaigns to sell their devices, they would request cashbacks to position the carriers on those devices.

# OEM and OTT combinations: The most important moves to watch

The major combined OEM and OTT players — mainly Amazon, Apple, Baidu, Google, Microsoft, and, to an extent, Samsung — may adopt differing strategies.

In the past, Amazon, Baidu, and Google provided higher-level services like shopping, travel planning, and search, where they could heavily monetize data about their customers. Then they entered the device market with the objective to round out their ecosystems. As Apple has shown, a strong device-centric approach may provide you additional power to sustainably tie the customer to your products.

By offering data packages and taking on the role of an MVNO, OTT players and/or OEMs could gain even more customer insight and new customer relationships. Although users may be largely unknown now to device manufacturers, that would change once they have purchased the

hardware from the OEM along with a monthly subscription. This will allow these players to collect usage data and also establish a regular contact with customers, which may be used to sell additional services. It is not at all surprising that Apple has already demonstrated a strong interest in eSIM with its iPad Air 2.

An eye needs to be kept on OTTs for still another reason: They are working on additional technological innovations that could further roil the market (*see Exhibit 5*).

Exhibit 5
Moves in the works by over-the-top players

Apple SIM	Google Loon	Facebook drones	Google Fi	SIM-based interface for eSIM management
Apple SIM card lets customers choose provider directly via their device  Apple SIM currently offers data tariffs (including short-term data tariffs) in over 90 countries worldwide  Billing via Apple	Network of helium balloons traveling in the stratosphere fill coverage gaps  Balloons carry solar-powered electronics that communicate with telecommunications network on the ground via a radio link  LTE signal is transferred from access point to balloon and then between the balloons until it is finally returned to the network on earth  Allows appx. 100 days of continuous use per balloon  High-speed Internet pilot project is happening in Sri Lanka	Solar-powered drones bring connectivity to areas that otherwise have little access  Autonomous drones are made of synthetic material strengthened by carbon fiber  A balloon transports the lightweight drones to a height of 18–27 km where they stay for 2–3 months; communication is based on interference-free laser  First proof-of-concept solar drone was tested in Arizona in July 2015	Google tariff plan starting at US\$20/ month. Unused data is credited back to the customer  Project Fi automatically connects to the best network (Wi-Fi or 4G) with one price plan across 120+ countries  Seamless transfer between Wi-Fi and mobile networks  One number for multiple devices  Offered with Google's Nexus phones	Developed by Giesecke & Devrient + Telefónica Digital  Enables eSIM management on existing devices that are not yet equipped with the LPA (Local Profile Assistant) — a software component used by the eSIM  Allows for faster market penetration

Source: Strategy& analysis

# Conclusion

For the big mobile network operators, SIM cards have served as golden handcuffs, tethering most consumers to them in lucrative, long-term ways. Now, as software starts to replace the cards, those handcuffs will be coming off. Consumers will soon get to pick and choose among an increasingly crowded field of providers — with no need, or requirement, to stay for the long term.

On its face, that is a formula for substantial growth for device manufacturers. Crowds of consumers will soon be window-shopping for new ways to connect — and if OEMs can draw their interest, manufacturers will have tapped into revenue streams that were always out of reach.

But if MNOs are the most endangered by all this change, they shouldn't be counted out yet, either. They are still the strongest players — and if they quickly and aggressively play to their traditional strengths, they can retain the high ground even as the landscape is redrawn.

Yes, the cuffs are coming off. But there are always other ways to keep a business relationship going. The customers, if they are getting the services they want, can always *choose* to stay. That's the best tethering device of all.

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