

SAMSUNG

Case Study

5G Launches in Korea

Volume 1: Key Success Factors for Early 5G Launch



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Korea has long been regarded a leader when it comes to mobile technology and service adoption, and it is a market that other operators and vendors follow closely.

Samsung's significant role in helping all three Korean mobile operators roll out their commercial 5G networks gives the vendor significant credibility as it looks to expand its 5G network solutions into other markets around the globe.

Daryl Schoolar, Practice Leader for Service Provider Technologies at Ovum

”



Korea, always on the cutting edge of telecommunication

No 1. Download Speed

No 1. LTE Availability

Korea certainly is the hottest LTE market in the world. Given the title of the first country to reach 100% LTE coverage, Korea featured in the No.1 rank for LTE availability, hitting 97.5% coverage according to OpenSignal.¹ The nationwide LTE coverage ensures subscribers have high-speed connectivity anywhere. OpenSignal also ranked Korea No.1 in terms of download speed experience over 3G and 4G networks.²

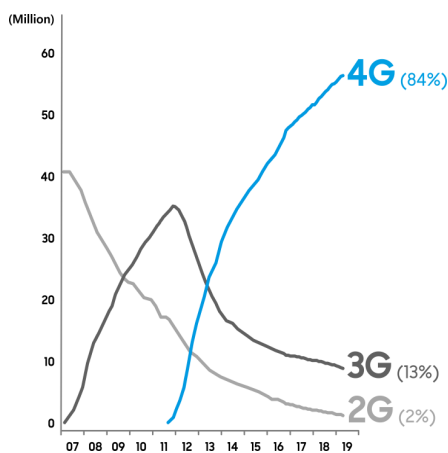
(OpenSignal 'The state of mobile network experience', May 2019)

Skyrocketing LTE Subscribers and Monthly LTE Data Traffic

9GB

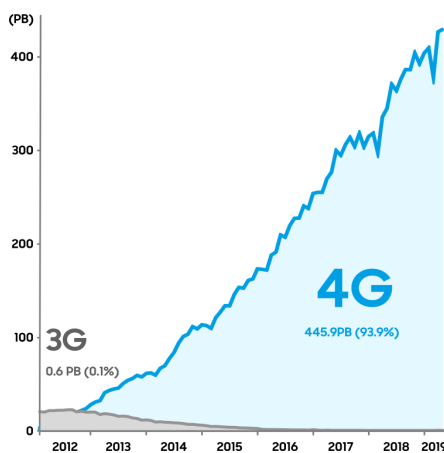
The monthly data traffic in Korea continues its high growth rate, reaching an average of 9 GB LTE traffic per user in May 2019, according to MSIT.³ During this same period, 4G's 445.9 PB accounted for 93.9% of the total monthly data traffic 475 PB. The LTE data traffic is about 807 times greater than that of 3G, which proves the solid technological stance of LTE in Korea.

[Total Wireless Subscribers ('07~'19)]



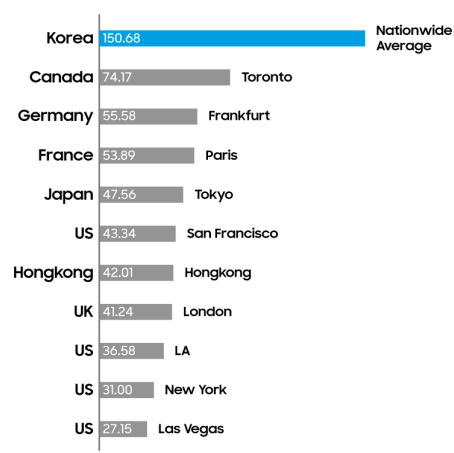
(MSIT, May 2019)

[Total Monthly Data Traffic ('12~'19)]



(MSIT, May 2019)

[Communication Quality Comparison '18]



(Korea Telecommunications Operators Association)

1. <https://www.opensignal.com/reports/2019/05/global-state-of-the-mobile-network>

2. Ibid.

3. MSIT : Ministry of Science and ICT

Korea switches on commercial 5G

5G Milestones in Korea

Korean mobile carriers are at the forefront of the 5G commercialization as well. In April, South Korea and the U.S. switched on the first mobile 5G networks, bringing the much-anticipated new technology officially into its first stage of global adoption, providing those fortunate enough to own a 5G-capable smartphone with a taste of the high-speed future.

2019 will be a cutthroat, yet exciting, year for Korea as 5G is about to bring changes in day-to-day lives of millions of people.



Feb. 2018 Pre-commercial 5G

At the 2018 Winter Sport Events, pre-commercial 5G services successfully showcased 5G services in Korea with Samsung's 5G end-to-end solution that demonstrated services such as "Time Slice," "Sync View," and "Omni Point View."

Jun. 2018 5G Spectrum Auction

Korea completed 5G spectrum auctions of the; 3.5 GHz and 28 GHz bands. KT and SKT each won 100 MHz of the 3.5 GHz band, while LGU+ clinched 80 MHz. All three carriers secured 800 MHz of the 28 GHz band.

Dec. 2018 Commercial 5G with Mobile Hotspot

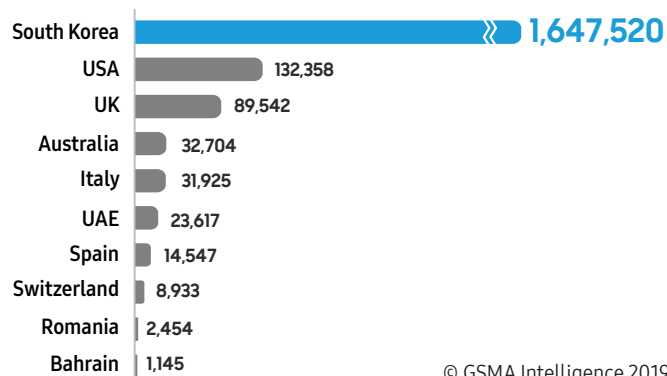
The three Korean carriers launched limited 5G commercial services in the capital city, Seoul, and six metropolitan cities in 3.5 GHz band. With 5G Mobile Hotspot as a device, initial services targeted B2B customers.

Apr. 2018 Commercial 5G with 5G Smartphone

Korea claimed to launch full 5G commercial mobile services in April with Samsung's Galaxy S10 5G. Korean carriers are providing 5G coverage in dense urban areas in 85 cities. Introducing immersive media, cloud/VR gaming and many other 5G services for general customers.

5G subscribers surge in Korea hitting 1 million in just 69 days

[Global 5G Subscribers (2Q 2019)]



© GSMA Intelligence 2019

Estimates indicate Korea would have 1.6 million 5G subscribers at the end of June 2019, accounting for an overwhelming 82.4 percent of the global total at 2 million 5G users, according to GSMA. The figure far surpassed 130,000 subscribers in the U.S. and 90,000 in the UK as of the end of June.

5G adoption in Korea outpaced early uptake of 4G. Korea hit 1 million 5G subscribers in only 69 days, beating 4G record of 80 days. 5G subscribers surpassed 1 million on June 10 — following the country's official April 3 launch of commercial 5G services — and has seen an average 17,000 new 5G customers each day. The industry expects that the total 5G subscriber number is expected to reach over 4 million by year's end, particularly with more availability of 5G smartphones.

Major Drivers

1 Greater weight on 5G subsidy

Carriers are putting greater weight on 5G subsidy to attract more 5G subscribers in the initial stage since subscribers usually sign a 2-year contract.

2 More attractive tariff than 4G

Unlimited 5G data plans are another growth driver. 5G subscribers can access data with virtually no limits in speed and capacity, resulting in a unit price that is cheaper than its 4G counterpart.

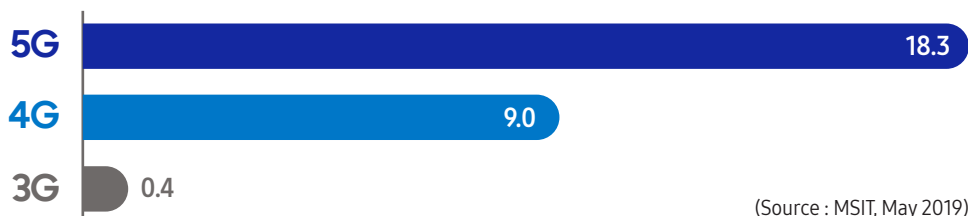
3 Compelling 5G contents

Bundling of large amounts of content with value-added services are attracting early adopters of 5G. Most of these new services relate to video, games and social applications in new formats, especially VR and AR.

Data usage on 5G is also going through the roof

Data use surges on Korea 5G network. Average data usage by 5G users is as high as 18.3 GB, while average 4G users use 9GB in the same period, according to MSIT in May 2019. 5G user data is about 2 times greater than that of 4G.

[Global 5G Subscribers (2Q 2019)]



(Source : MSIT, May 2019)

20% of 5G data traffic is from AR/VR contents

This remarkable traffic growth is driven by UHD and AR/VR contents. According to LG Uplus, new traffic services featuring AR and VR functions are proving popular and account for 20% of 5G traffic, compared with 5% for 4G traffic. The company said it aims to double the number of AR content to 1,500 applications by the end of this year, including K-pop dance, home training and sports videos, that will cater to varied consumer needs.

Key Success Factors for Early 5G Launch

Cooperation is the key

Amid intensifying competition among global mobile carriers, it is significant for the government and companies to join hands and reach the goal together. The success of the early 5G commercial launch in Korea is attributed to the close cooperation among government, carriers and vendors.

Korean government paved the way for early commercial launch by advancing the 5G spectrum auction date and forming 5G Strategy Promotion Committee. The carriers' passion to deploy 5G network fast enabled early and successful commercial launches fueled by unlimited data plans and compelling 5G services. Samsung's 5G end-to-end solution played a crucial role in fast deployment and operation.

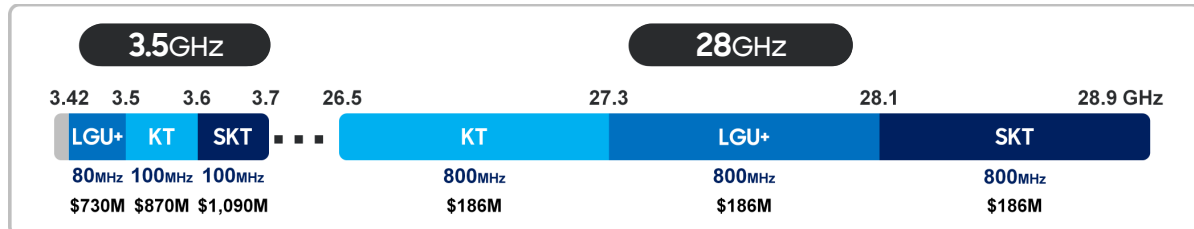
Government's Initiative

Earlier Spectrum Auction

In order to be at the forefront of the global 5G competition, Korean government advanced the 5G spectrum auction date. Consequently, a year earlier than initially planned, Korea completed a tender process in June 2018 for the 3.5 GHz and 28 GHz bands. The government made available a total of 280 megahertz in the 3.5 GHz spectrum band and 2,400 megahertz in the 28 GHz band.

The government divided the 3.5 GHz and 28 GHz spectrum into 28 blocks and 24 blocks, respectively. Participant operators SK Telecom, KT, and LG U+ had a 10-block cap per spectrum band. The telcos paid a total of 3.6183 trillion won (US \$3.3 B) for the spectrum, 340 billion won higher than the starting price of 3.3 trillion won. The 3.5 GHz band licenses have a ten-year term, and the 28 GHz band licenses have a five-year period.

[Korea Operators 5G Spectrum Auction Result]



“Our goal is to lead the fourth industrial revolution and to support the early commercialization of 5G technology”

Jun Sung-bae, Senior ICT Ministry Official

5G Strategy Promotion Committee

One of the crucial factors contributing to the successes of the Korean carriers' early commercial launches is the cooperative organization called the 5G Strategy Promotion Committee. Beginning in 2015 and led by Korean government, the 5G Strategic Promotion Committee met every six months with the goal of promoting a strategic delivery of 5G. In these meetings, the participants shared the current status of Korea's 5G policy, reviewed the difficulties being encountered in the private sector, and discussed plans for the future of 5G.

Global Standardization Effort

Before commercial launch, the committee promoted to ITU the option for recognizing the recently auctioned mmWave spectrum as 5G global spectrum. The committee also participated in 3GPP standardization to drive domestic standards into the global 5G standards.

Tax Breaks and Government Investments

After commercial launch and in order to maximize the 5G early commercialization effect, Korean government further enhanced the committee announcing 5G+ Strategy. The 5G Plus Strategy includes tax breaks and the availability of government investments totaling \$27 billion for use by 2022. To foster growth, government announced 15 5G-based "strategic industries," which consist of five "core services" and 10 "core industries."



[15 5G-based Strategic Industries]

5 Key Services



Realistic
Contents



Smart
Factory



Autonomous
Vehicle



Digital
Healthcare



Smart City

10 Key Industries



Intelligent
CCTV



Wearable
Device



VR/AR
Device



Next-generation
Smartphone



Network
Device



Future
Drone



Connected
Robot



5G V2X



Information
Security



Edge
Computing

(MSIT, 5G Plus Strategy, April 2019)

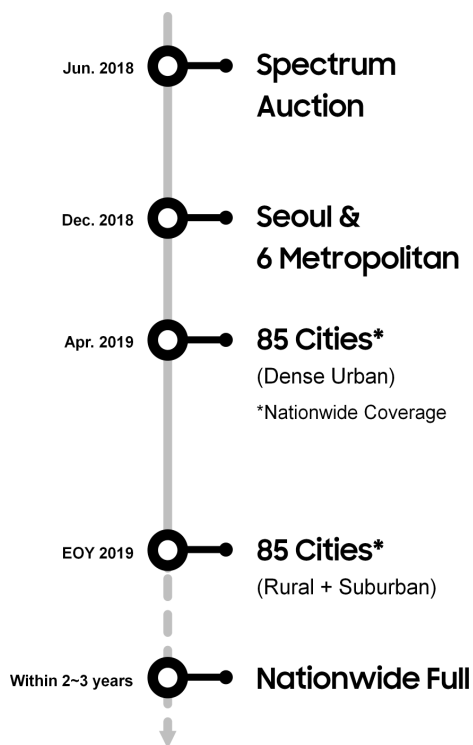
Carriers' Ambition

Aggressive Rollout

Korean carriers are leading the pack when it comes to deploying 5G. Korea has for many years been at the forefront of cellular technology deployment, often being one of the first to deploy advanced network features.

After the 5G spectrum auction in June 2018, 3 Korean carriers started limited commercial 5G services in December 2018 in Seoul and six metropolitan areas. In April 2019, full 5G commercial service launched with 5G smartphones, focusing on the dense urban areas of 85 major cities in Korea. By the end of 2019, carriers will cover both rural and suburban areas of 85 major cities, heading toward a perfect nationwide coverage for the next two to three years.

In addition, a shared 5G deployment model is one other factor that is driving faster deployment. Led by Korean government, the three carriers announced plans to share the 5G deployment costs, which will save nearly \$1 billion over a decade.



5G Unlimited Data Plans

All three Korean carriers adopted unlimited 5G tariff plans. "Unlimited" means that neither the amount of data nor the network speed is in any way reduced or capped. 5G plans are higher than 4G, but, due to availability of unlimited data, the unit data price of 5G can be cheaper than its 4G counterpart. Thus, many 4G subscribers are migrating to 5G, with more than 80% of them choosing an unlimited data plan.

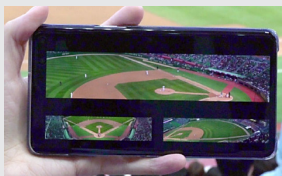
One characteristic influencing the higher adoption of the unlimited plans is the wide gap in the amounts of data between various data plans. There is a significant difference in the amount of data between the lightest data plan and the very next one, and this disparity supports the strategy to induce subscribers to choose an unlimited data plan.

Compelling 5G Services

The key differentiator to 5G service is the content it supports. With 5G, end users have better experiences in these new immersive applications. Korean carriers are actively introducing new 5G services in order to attract and secure initial 5G customers.

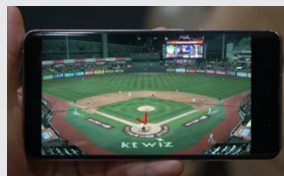
Immersive Media

The first killer media service is broadcasting of professional baseball games. Baseball is one of the most popular sports in Korea and each game demands 3 to 4 GB for watching, leading to higher data consumption.



Wide View (SKT)

Wide View shows a panoramic view of the stadium in 12K UHD quality with three 4K cameras. Users can expand the areas that they want without degrading image quality.

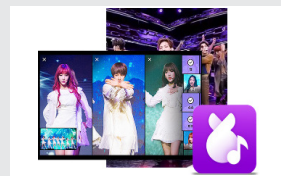


Motion Tracking (KT)

Motion tracking shows the movement of baseball and batter easily with four field tracking cameras. Users can check the trajectory, restraint, rotation direction, turnover rate, etc.

VR/AR

5G eliminates the motion sickness often experienced with 4G AR/VR, as 5G has latency as low as 1 millisecond. The immersive experience with wireless VR headsets is set to flourish. All three Korean carriers are trying to take the lead in the 5G era by competitively investing in AR and VR.



Idol Live (LG U+)

Idol Live is gaining huge popularity among K-POP fans. Users can focus on an individual idol and enjoy the stage as if they were sitting in a real theater.

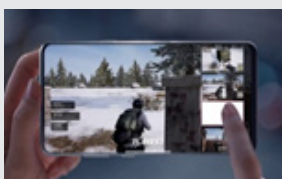


Social VR (SKT)

Multiple users can watch sports and movies together in a virtual reality environment. Users can gather in the same VR space to watch video content as if they are right next to each other.

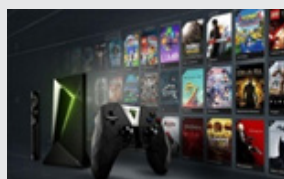
Game

There is also fierce competition in the areas of gaming and e-sports. Korean carriers have struck partnerships with global game developers and content providers to offer "killer content" on 5G smartphones.



e-Sports Live (KT)

e-Sports Live is a live streaming application of e-sports competition. Users can watch up to five game screens simultaneously and select which screen to watch.



Cloud Game (LG U+)

5G has flattened the experience of cloud games under wired conditions and wireless conditions. With a mobile device connected to the internet, everyone can play masterpieces anytime and anywhere just like playing a current web game.

B2B

In the era of 5G, B2B industry applications will become a key territory for operators' mid- and long-term success, providing new sources of revenue as businesses restructure to take advantage of the innovation now available in vertical industries.



Smart Factory (SKT)

5G-AI Machine Vision automatically identifies product defects. A 12-megapixel camera takes 24 pictures from various directions and sends to a cloud server, where AI checks for any defects and filters out defective products with robotic arms - in less than eight seconds.

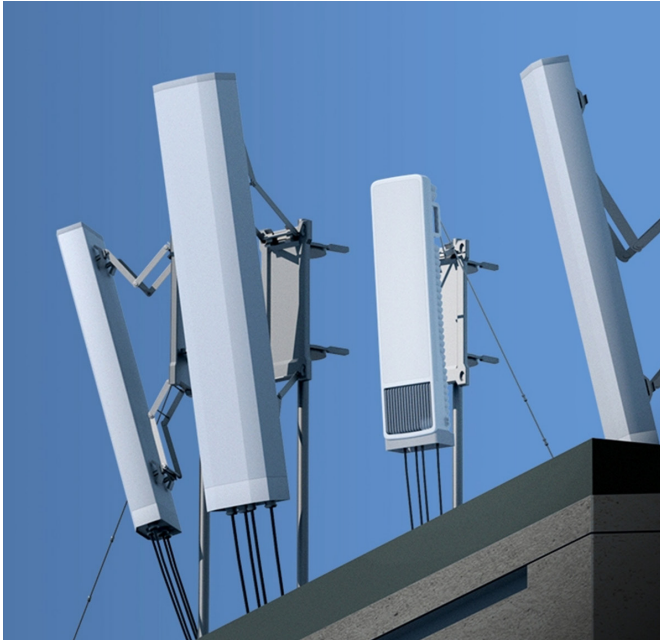


Barista Robot (KT)

A robot barista takes orders and serves customers drinks and coffee. The status of the robot and high-quality CCTV are sent to the control tower 24 hours a day. KT will apply voice recognition and AI function to enable voice orders for more customized service.

Samsung's 5G Leadership

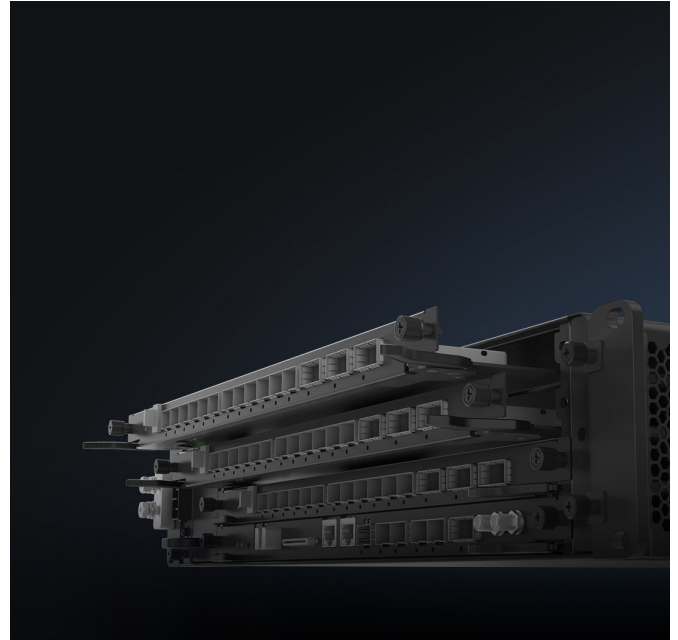
Samsung is a critical contributor in the early commercial 5G launches in Korea. Providing end-to-end 5G solutions covering chipsets, network equipment, core and even software tools, Samsung enabled successful 5G services ahead of others.



5G Massive MIMO Unit Fits in Conventional Sites

Samsung MMU has a slim and compact design, intended for efficient on-site installation. It is among the smallest and lightest in the industry and can be easily installed in carriers' existing cellular sites. Carriers can reuse the infrastructure that is already installed on-site with minimal changes necessary.

This ability to reuse existing sites and resources are instrumental to enabling the Korean operators to quickly deploy 5G network. With the need to activate tens of thousands of radios within a few months, the ability to turn up 5G on existing operating cell site is extremely critical when we consider how difficult the site acquisition process is for carriers when deploying commercialized 5G with new equipment.



5G Digital Unit Boost in Capacity

Based on the same footprint, Samsung's digital unit can handle three times more capacity than other company products. Samsung's digital unit allows operators to initially begin 5G deployment with one channel card to save CAPEX and gradually add up to three channel cards to increase cell capacity.

In addition, Samsung's digital unit supports both LTE and 5G NR with the same hardware. It is also backward compatible allowing operators to leverage and evolve current infrastructure when migrating from 4G to 5G. Existing LTE channel cards can fit right into the new digital unit, allowing operators to protect their previous investments.



5G NSA vCore

Provided to All Three Operators

The virtualized 5G core solutions support both legacy 4G networks and next generation 5G services in Non-Standalone (NSA) mode. The 5G Common Core can also migrate to Standalone (SA) mode through a simple software upgrade. Samsung's solution implements many of the key technologies of 5G networks, such as Control and User Plane Separation (CUPS), which are essential for network operators to scale their networks and support the new services enabled by 5G technology.

Samsung and SKT recently completed Korea's first interoperability test between 5G SA Core and other commercial network systems. This solution implements:

- Data Parallel Processing technology that performs QoS and transmission control simultaneously
- Data Acceleration technology that classifies and distributes similar traffic types; and
- Path Optimization technology that automatically delivers data traffic to Mobile Edge Computing platform.



End-to-End Solution

Enables Fast IoT

Samsung delivers complete 5G end-to-end solution, from chipsets to network equipment to core, device and software tools. By creating chipsets in-house, Samsung fine-tunes the software specifications included in the chipsets and develops our products on schedule without delay.

Samsung can conduct interoperability development testing faster than others. The successful interoperable connection of the end-to-end 5G system serves as a significant industry milestone towards commercialization of 5G NR technologies at scale, driving rapid development of 3GPP standards-compliant networks and devices.

SAMSUNG

About Samsung Electronics Co., Ltd.

Samsung inspires the world and shapes the future with transformative ideas and technologies. The company is redefining the worlds of TVs, smartphones, wearable devices, tablets, digital appliances, network systems, and memory, system LSI, foundry and LED solutions.

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