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Building 5G infrastructure for the digital future

Extract from the Ericsson Mobility Report
November 2021

Building 5G infrastructure for the digital future

High-performance networks as the foundation for digital transformation.

Far EasTone (FET), Taiwan, is building a 5G network targeting premium performance and coverage to maximize customer experience. A network infrastructure that is the foundation to fulfill the increasing customer demand for daily and instantaneous digital access to healthcare, entertainment, education, e-commerce and information. An easy-to-access, and secure digital environment for consumers, enterprises, and society.

Strong demand fueling data traffic growth

Taiwan is a highly competitive market, with 5 service providers serving a combined total of 29.5 million mobile subscriptions. Mobile data consumption per subscriber is among the highest in the world, yet despite this high consumption, service providers in Taiwan are top ranked in global mobile network experience benchmarks measured by external parties. The first 5G networks in Taiwan were commercially launched in mid-2020, as a measure to meet the increasing demand for mobile data with cost-efficient capacity enhancements and to enable new digital services that require more network bandwidth and lower latencies for a satisfactory service experience.

In 2017, the average mobile data traffic per subscriber in Taiwan was over 5 times higher than the average in North East Asia – 13.7GB compared to 2.6GB per month. When all service providers introduced unlimited data plans at a comparably low price (USD 15 per month) in 2018, the average data consumption increased and reached 18GB per month in 2019. This has increased further over the last 2 years to around 26GB per month in 2021. Currently, the majority of mobile subscribers in Taiwan have an unlimited data plan which, together with a strong demand for mobile services, drives the high data consumption.

AI enables a cost–performance optimized network deployment

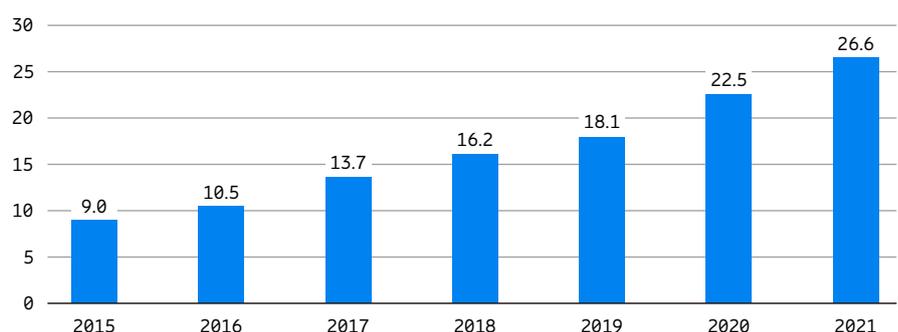
FET is one of the top 3 service providers in Taiwan, with around 7 million mobile subscriptions. At about USD 20, they have the highest average revenue per user (ARPU)¹ of all service providers in Taiwan. ARPU was in decline prior to the launch of 5G services, but is now growing due to 5G subscribers' higher contribution. FET launched its 5G commercial services in July 2020, achieving a 14 percent 5G penetration (1 million subscriptions) by August 2021, with a target of 20 percent by the end of 2021.

FET's initial 5G network deployment strategy is based on a large-scale, fast-paced, wide-coverage deployment of high-quality 5G New Radio (NR) equipment on the mid-band 3.5GHz frequency (80MHz bandwidth). This provides a significant increase in network speeds. It will be followed by deploying 5G NR on low-band frequencies and enabling 5G NR carrier aggregation to improve both throughput and mid-band coverage. Continuous field testing provides valuable insights for planning, designing, tuning and optimizing the network performance. When the 4G network was deployed, the geographical site selection was based solely on technical considerations.



For 5G network deployment, site selection is based on AI analytics of real traffic usage and user behavior. This enables a more precise cost–performance analysis to prioritize the sites that most urgently need capacity enhancements. However, for optimized network deployment it is not only site-level decisions that are considered, but also how to deploy 5G in clusters to achieve better network optimization and tuning across the whole network. FET's mid-band deployment has resulted in 5G population coverage of 75 percent in the first 12 months, with a target of 90 percent by the end of 2021.

Figure 22: Taiwan's mobile data traffic per subscriber (GB per month)



¹ Blended ARPU, Q2 2021.

Note: All service providers' subscribers included. 2021 data as of September.

COVID-19's impact on data consumption

On May 19, 2021, authorities raised the COVID-19 warning to level 3 throughout Taiwan, meaning the virus was in general circulation. Consequently, travel and meeting restrictions were imposed across Taiwan. The pandemic brought significant changes in mobile data consumption patterns, with traffic redistribution from densely urban areas to residential areas. People's mobility behavior changed and about 10 percent of FET's subscriber base stayed in their residential areas permanently, resulting in a high load on parts of the 4G network.

Before the pandemic, mobile traffic peak hours were usually 7:00 PM to 11:00 PM, but once restrictions were put in place high usage levels began at 7:00 AM as home working and remote study classes started, with longer busy hours throughout the day. The services that grew most during the level 3 restriction period (May–July) were primarily business communications services, video conferencing and streamed audio/video content. The 19 percent traffic growth during the 3-month restriction period became difficult to manage, as network engineers were restricted from going out to sites and installing additional network capacity.

Improving network performance during COVID-19 restrictions

FET adjusted its network deployment strategy to meet customer behavior changes and further enhance network performance to meet the increased traffic demand. In-person site visits to add additional spectrum resources and hardware were not an option. Instead, the priority was on tuning and activating software features. The importance of increased flexibility for assigning resources more dynamically to high-loaded network areas became apparent. This was achieved by using different techniques:

- a new customer relationship management (CRM) system supporting identification of areas with the most customer complaints
- leveraging traffic detection function (TDF) to accurately identify which areas displayed traffic pattern changes
- using TDF in the core network to impose the correct fair usage policies
- identifying the most congested areas and optimal use of the number of carriers for subscribers, for example, instead of having 3CC² carrier aggregation per subscriber, it was reduced to 1CC – giving less peak throughput per subscriber, and allowing more users to share the spectrum resources to secure user experience

These techniques resulted in an 80 percent drop in customer complaints in 90 percent of the network's most congested areas.

The change in customer behavior and the increased data consumption during the COVID-19 restrictions highlighted the need for fast and reliable broadband connectivity. It soon became clear that an agile response to free up network resources to meet the increased traffic demand was needed, with a priority to maintain high customer satisfaction.

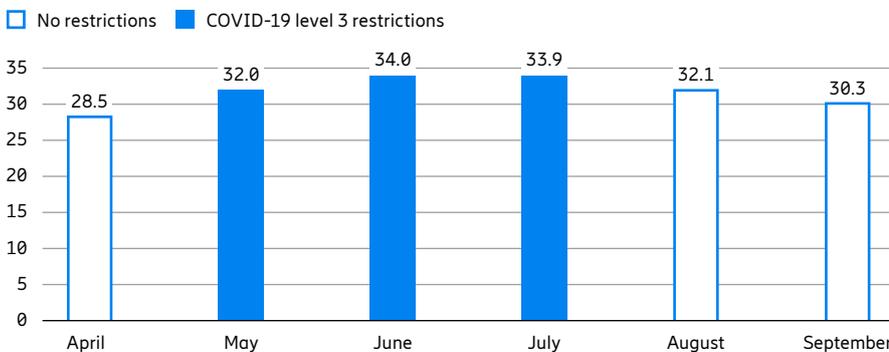
5G subscribers consume more data than 4G subscribers

The 4G network is highly loaded, so subscribers are migrating to 5G to experience even better network performance. In September 2021, 39 percent of 5G subscriber-generated traffic was carried by the 5G network and they were attached to the 5G network 25 percent of the time. The average data usage of FET's subscribers with unlimited 5G plans is 60GB per month compared to 51GB for 4G subscribers on similar plans, which is about a 20 percent difference. Compared to another leading 5G market with high average monthly data consumption, the consumption difference between subscribers on unlimited data plans in South Korea is around 35 percent (39.1GB compared with 28.8GB, September 2021). In both markets, early adopters migrating from 4G to 5G spend more time on consuming data and services in higher resolution or VR/AR formats, which contributes to the difference in data consumption between 4G and 5G subscribers.

The main contributing factors to FET subscribers' current high average monthly data consumption are:

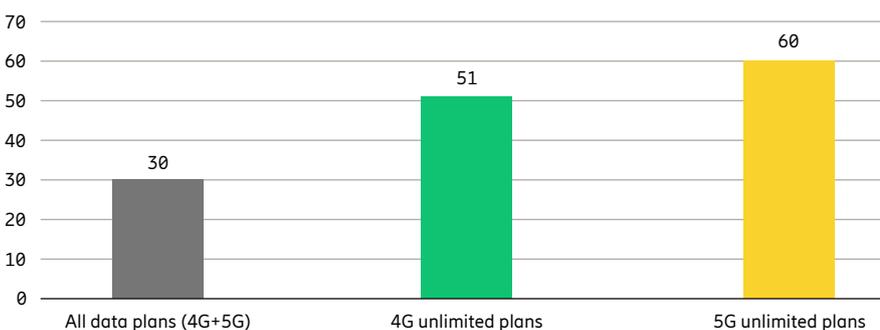
- high usage of video streaming services
- a large proportion of the subscriber base on unlimited 4G and 5G data plans
- with unlimited data plans, consumers continuously use their mobile phones over mobile networks instead of occasionally switching to Wi-Fi, which was especially apparent during the pandemic
- the continuing evolution of new device capabilities and improved network performance with 5G stimulates data consumption, that is, device-driven organic traffic growth
- fast 5G population coverage build-out, with 75 percent build-out during the first 12 months of deployment

Figure 23: FET mobile data traffic per subscriber (GB per month)



Source: National Communication Committee (NCC), Taiwan.

Figure 24: FET mobile data traffic per subscriber (GB per month), September 2021



Source: FET.

² Each aggregated carrier is referred to as a component carrier, CC. The CC can have a bandwidth of 1.4, 3, 5, 10, 15 or 20MHz and a maximum of 5 CCs can be aggregated, hence the maximum aggregated bandwidth is 100MHz. (www.3gpp.org).

Figure 25: Taiwan regions

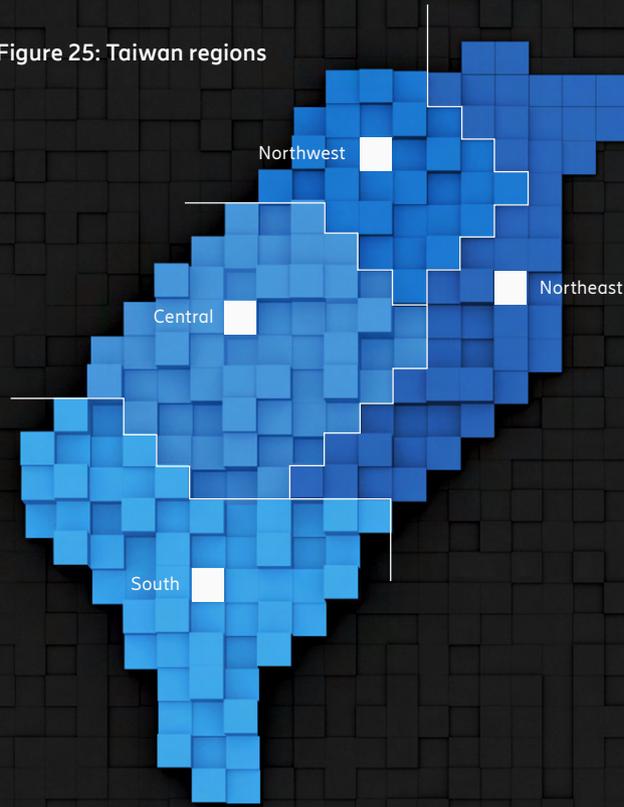
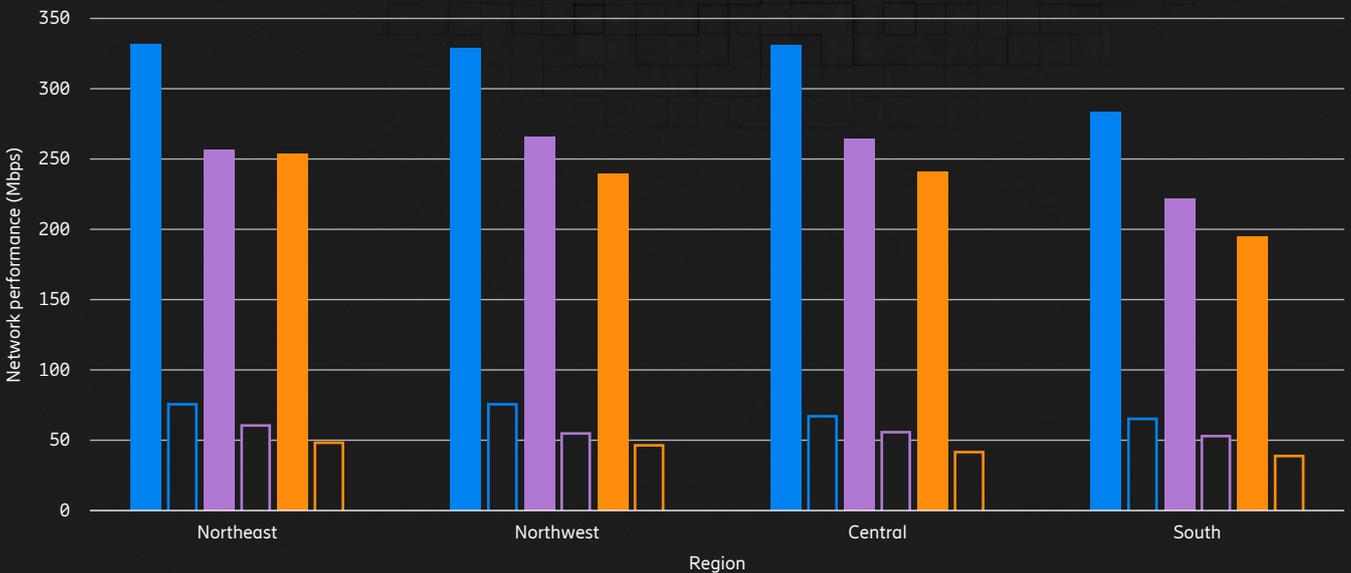


Figure 26: User average experienced speeds

Downlink: ■ 5G network – FET ■ 4G/5G network – FET ■ 4G/5G network – Taiwan average

Uplink: ■ 5G network – FET ■ 4G/5G network – FET ■ 4G/5G network – Taiwan average

5G network: Average 5G user experience speeds when within 5G coverage.
 4G/5G network: Average 5G user experience speeds when within 4G/5G coverage.



Source: Ericsson field tests, Q3 2021.

Note: The field test results are somewhat lower compared to third-party published network performance data. The difference mainly relates to methodology, where field tests are using full-buffer downloads. Hence, data transmission is included on top of the original network load. 5G speed samples are on 3.5GHz.

Improved network performance drives higher satisfaction

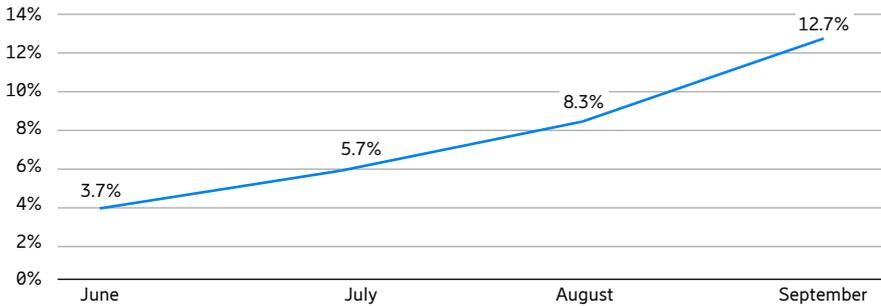
Service providers in Taiwan use 5G network performance as a key to differentiation in the highly competitive market. FET’s strategy of a fast-paced build-out and a continuously optimized 5G network has resulted in a high-performing network with

uplink and downlink speeds better than the average speeds for the three largest operators throughout Taiwan.

This strong focus on network performance has paid off. FET consumer research shows that the Net Promoter Score (NPS) of 5G subscribers is higher than the NPS of 4G subscribers.

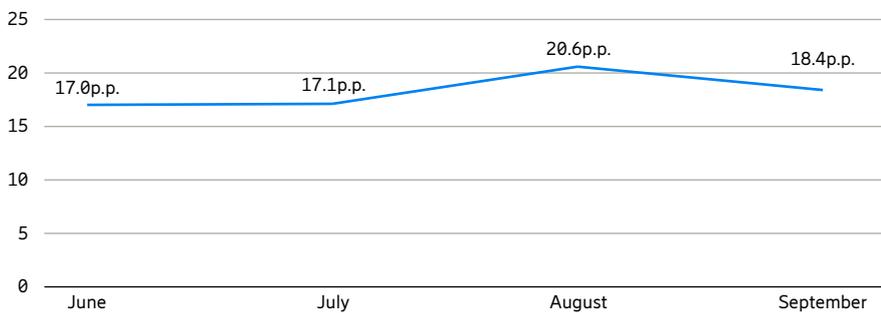
This difference is driven by better 5G network performance. FET adopted a targeted approach to achieve this, focusing on deploying capacity enhancements in 7,000 specifically identified village areas to improve smartphone experience for increased customer satisfaction.

Figure 27: FET's NPS (4G+5G users)



Note: Based on FET's regular monthly survey of existing customers.

Figure 28: Difference between FET's 5G and 4G users NPS (percentage points – p.p.)



Source: FET (Taiwan).

Note: Based on FET's regular monthly survey of existing customers.

FET's 5G subscriber NPS was about 18 p.p higher than for its 4G subscribers in September 2021.

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Video streaming services popular among 5G subscribers

FET pursues a long-term, focused consumer service strategy with a prime objective of providing a high-quality 5G network performance. The current main driver for consumers to upgrade from 4G to 5G is the elevated mobile internet user experience for streaming services made possible by 5G's improved network performance. Consumers who have migrated from 4G to 5G display similar usage behaviors as before, mainly using over-the-top (OTT), but streaming more video in higher resolutions. The most used services by 5G subscribers are video streaming and cloud gaming. However, 5G service usage is not yet driving significant traffic volumes.

FET's 5G digital entertainment services include 4K video streaming, VR and multi-view content, lossless sound quality music streaming and cloud gaming. These services provide new user experiences and differentiate 5G from 4G. The multi-view streaming video service is included on all 5G plans, while VR is only included on top of the four premium plans.

More 5G choice drives higher ARPU

FET offers a range of 5G data plans differentiated by price, data allowance, maximum speed and value-added services. An important strategy going forward is to add new content and devices while updating existing content and benefits on the different 5G service plans. This will help drive subscriber uptake further, motivate the price premium and differentiate from the 4G service plans. Offering a wider choice of data plan options and enticing customers to subscribe to premium 5G plans has resulted in higher ARPU. More than 85 percent of FET's 5G subscribers are on data plans priced USD 36 or higher, as of Q2 2021.

Emerging 5G enterprise opportunities

FET has initially focused on a fast deployment of a high-quality, wide-area 5G network to address the consumer business opportunity. FET is committed to developing new innovative 5G services through partnerships and collaborations, along with a continued strong focus on providing high network quality. New network capabilities will be implemented to enable a wide variety of services with enhanced network flexibility and faster time-to-market.

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At the same time, several initiatives have been launched with enterprises and the public sector to improve their services and efficiency with 5G applications in segments like smart manufacturing, smart cities, automotive intelligent transport systems, ports, mining, and healthcare (such as telemedicine). These represent some of the emerging business areas that will benefit from the reliability, security, high data rates and low deterministic latency that come with a 5G network.

It's possible to envision the 5G network infrastructure as the foundation for supporting all aspects of the customer's daily life. More applications and services will be developed to help meet consumer demand for a worry-free life as the digital future becomes the digital today.

About Ericsson

Ericsson enables communications service providers to capture the full value of connectivity. The company's portfolio spans Networks, Digital Services, Managed Services, and Emerging Business and is designed to help our customers go digital, increase efficiency and find new revenue streams. Ericsson's investments in innovation have delivered the benefits of telephony and mobile broadband to billions of people around the world. The Ericsson stock is listed on Nasdaq Stockholm and on Nasdaq New York.

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