



## GSMA 5G TRANSFORMATION HUB

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# How 5G is transforming live theatre

An innovative 5G-enabled theatre production attracts 2.5 million views

The NTCH is using 5G millimetre wave (mmWave) connectivity to provide both in-person and online audiences with a highly immersive and customizable experience.



國家兩廳院  
NATIONAL THEATER & CONCERT HALL



# How 5G is transforming live theatre

## CASE STUDY LEAD: NTCH

### + CHALLENGE



Traditional theatre has always struggled to scale to a point where it can generate substantial revenues – only a small number of people have been able to attend a live performance and their experience can be constrained by the location of their seat – they have a fixed viewpoint. Theatres are increasingly looking to use technology to reduce or remove these constraints.

### + SOLUTION



The National Theatre and Concert Hall (NTCH) in Taiwan used a private 5G mmWave network to deliver high-definition live streams of its performance of Lunatic Town from

multiple angles and locations. The connectivity can also be used to help create an immersive three-dimensional “Metaverse-style” experience in which the audience can feel as if they are actually inside the production.

### + IMPACT & STATISTICS



Lunatic Town had 2.5 million views online. The NTCH estimates that more than 80% of the people who watched the production had never been into a theatre to enjoy shows. As a result, the 5G connectivity is helping the NTCH to reach new audiences and potentially increase revenues and its relevance within Taiwan.

### + WIDER IMPLICATIONS



5G mmWave could support a new form of live entertainment, which is both richer and more interactive than traditional shows. It has the capacity to deliver high definition multimedia services to all kinds of venues and locations where large numbers of people gather.

### + STAKEHOLDERS



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### SOURCES & FURTHER INFORMATION



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# How 5G is Transforming Live Theatre

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The National Theater and Concert Hall (NTCH) of Taiwan has installed a 5G millimetre wave (mmWave) network across its campus in Taipei. In October 2021, the NTCH used the new 5G connectivity to enable a highly innovative one-off production called Lunatic Town. Involving scores of actors, the production spanned an enclosed space (known as a black box) and an open plaza. Using a private 5G network, live video footage was relayed from inside the black box to four large 4K displays mounted in the plaza. (The actors in the black box played spirits - a metaphor of death separating people from their loved ones).

At the same time, characters in the show used 5G handsets to live stream from inside the performance. "We created a live stream studio on the plaza, so our actors, who played internet celebrities, can go in and just start hosting their channel with what they wanted to say," explains Lin Ting-Chun, Director of Programming/International Development Department of the NTCH and head of the 5G Future Theatre Operational Project.

As Lunatic Town was an immersive theatre production, the live audience was able to move around the theatre campus changing their viewpoint. Rather than sitting in seats, watching a stage, they were able to actually join the actors on the set.



The 5G connectivity allowed a remote audience to also customize their viewpoint. People watching Lunatic Town online could choose between three different channels. The first channel showed a live stream of what was going on the plaza, while the second channel featured video from the live streamers. The third channel took the viewer into a virtual world (a Metaverse) depicting the production. "All three channels were correlated and coordinated by one story," explains Lin Ting-Chun. "So you get different perspectives."

The Lunatic Town production, which involved 400 people, had to be very carefully choreographed using music to provide cues to the many different performers and actors. "It looks very freestyle, but actually everything is planned and it takes a lot of calculation," says Lin Ting-Chun. "Each channel has their own world and a different world view. So it's been very, very complicated."

After the success of the performance, NTCH concluded that 5G could enrich the experiences of both in-person and online audiences. The Lunatic Town pilot project "gave us some level of confidence" in the new technologies, says NTCH Artistic Director Liu Yi-ruu. "We had never been able to use that kind of technology in large scale performances and it turns out fine. It turns out more than fine, actually, it's pretty good."

Lunatic Town was viewed more than 2.5 million times online. "For the first time we got to have many different audiences from different levels and from different backgrounds, young people who never have been into a theatre to enjoy shows," says Liu Yi-ruu. "A lot of people got in touch with theatre, because we have this project. This might be the answer to our difficulties or our questions."





## The 5G network delivers coverage and capacity

Supplied by Chunghwa Telecom, the private 5G mmWave network installed in NTCH is able to support upload speeds of 600 Mbps – more than enough to handle the 4K video streams captured by four portable cameras. As they are connected via 5G, they can be located anywhere they are needed – 32 small cells ensure there is coverage throughout the 14,000 square metres of the theatre campus. These cameras can be employed for a variety of purposes. They can, for example, be used to transmit a live feed of a production to latecomers standing in the foyer of the theatre. They can also be used, as in the case of Lunatic Town, to

provide a live feed online, so people can watch the performance remotely.

The NTCH employed 5G mmWave because the connectivity is both fast and responsive. “We need speed” to support the transmission of high-resolution images, notes Liu Yi-ruu. “The low latency quality of 5G can also help us a lot,” she adds. “The timing is just perfect and it works. That’s the main reason we use 5G.”

For the NTCH, it is really important to have wireless connectivity to enable it to easily move connected equipment around without having to relay wires. But the building itself can interfere with wireless signals. “Our theatre is a really solid theatre built 35 years ago,” explains Liu Yi-ruu. “That means we have these really thick walls, so other things won’t work in our theatre. We do have Wi-Fi in our theatre. We do have 4G in

everyone’s mobile phone, but it doesn’t solve our problems and the technology level that can provide, just doesn’t work for us.”

The reliability of 5G is also an important factor. It is “probably the most stable technology that can be used in a live performance,” says Liu Yi-ruu. “We have been doing these multimedia technology kinds of performances over the past 10, 15 years here, but it never was able to reach the goal that we have been hoping for.”

As a highly complex, multi-faceted and very large scale production spanning an outdoor plaza and

an indoor theatre, Lunatic Town needed to be supported by cast-iron connectivity across the site. The show involved a tremendous amount of coordination. “We had 400 people from 15 organisations involved,” recalls Liu Yi-ruu. “What happened on the plaza will influence what happened in the black box, and what happened in the black box also will influence what happens on plaza and the interactions of the online audience, also influences the performances in both venues.”



## Underpinned by a public private partnership

The NTCH first began considering how 5G can enrich live performances four years ago. “We started to think about how technology can help us transform, and then we came into this opportunity from the 5G Program Office,” which was set up by the Department of Industrial Technology, Ministry of Economic Affairs, recalls Liu Yi-ruu. “Traditional theatre always has this problem of not enough industry scale. We don’t have enough audience to make a reasonable income.”

Backed by the Ministry of Culture and the Ministry of Economic Affairs, the NTCH embarked on a four-year project in conjunction with the Institute for Information Industry (III). Michelle Tsai of III says the project is underpinned by a public-private partnership model. As well as providing the connectivity and systems integration, Chunghwa Telecom sourced the necessary hardware and software from a mixture of Taiwanese and international vendors, such as 5G chip supplier Qualcomm. Nokia provided the core network and base stations, D-Link provided the backhaul equipment, WNC and Quanta

supplied the network access devices and ASUS provided 5G smartphones. To help build the 5G private network, Qualcomm provided technology guidance to some of the Taiwan-based vendors.

Working with III, NTCH set about exploring how 5G technologies could help it create a smart theatre. The first trial was a small project in the NTCH’s experimental theatre at the end of 2020. “We used a lot of new technology we had never had the chance to get our hands on,” recalls Liu Yi-ruu. “For example, we use VR multi-channel and

cameras, connected to 5G, to produce synchronised performances in different places. That give us some clues about what 5G can bring us.”

Over 2020 and 2021, the partnership has invested US\$3 million in 5G infrastructure for the NTCH. “The government support is very important,” notes Liu Yi-ruu. “If there’s no government support, I don’t think we can afford that, but if

government really support that and we’re willing to take the leap of faith to try everything, we can see more possibilities for the theatre in the future.”

Following the success of Lunatic Town, the NTCH is looking to stage a second production along similar lines in November 2022.

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## New interactions, new audiences

Although many theatres and concert halls around the world are subsidised by national or local governments, most are under pressure to maximise their audiences and generate revenues. For the NTCH, 5G connectivity opens up opportunities to engage more people in theatre and reach a broader audience.

Of the 2.5 million people that have watched Lunatic Town online, about 80% to 85% will not have been familiar with theatres, Liu Yi-ruu estimates. “That’s pretty amazing numbers because in the past our theatre, the national theatre, has an audience of 670,000 indoor annually, and most of them are repeat theatre goers.”

Although Lunatic Town was a free event, NTCH is looking to develop a business model for how it can monetise the enhancements enabled by 5G.

“For the second production, I’m very positive,” says Liu Yi-ruu. “I’m optimistic because with the help of new technology, we get a different physical feel. In the theatre, we emphasize a lot on how you get in touch or interact with the performances and technology. It helps us to increase the sense of interaction.”

Lin Ting-Chun envisions 5G will enhance live theatre in three main ways. The first is in terms of creating special effects for the audience in the theatre. For example, if the audience are wearing 5G connected headsets, digital information could be superimposed on top of the live images being viewed by the visitors.

The second opportunity is to use 5G to capture and deliver all kinds of digital content, including live feeds of productions, to people who can’t be physically in the building. This could enable people to watch the production on very large screens in a physical “overflow theatre” or in a virtual theatre in the Metaverse. In each case, the theatre could sell tickets to watch the production live.

The third opportunity is to use 5G connectivity to create a virtual world where the audience can experience the theatre both physically and virtually. Visitors would use an avatar to visit a virtual representation of a theatre in the Metaverse. “You just create a virtual world – we can maybe call it NTCH – and then you use 3D modelling and volumetric technologies and then maybe you can use VR,” says Lin Ting-Chun, “and distribute NFTs – non-fungible tokens or certificated digital content that people can collect. The theatre could, for example, create a limited edition NFT of a scene, musical performance or artwork from a popular production. By selling these NFTs, the theatre could generate significant revenues.

Although she believes all three use cases could generate revenues, Lin Ting-Chun says “we can’t really provide concrete numbers because we’re just starting right now and then we’re still seeing how people experience it.”

With the 5G mmWave network in place, the NTCH will be able to reach more people across Taiwan, Liu Yi-ruu adds. “We want to give people a very different feel about how to go to the theatre without the physical boundary of the actual wall. People in different areas of Taiwan, they will have the same opportunity, or chance to enjoy the performances that happen in Taipei.”

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## Keeping Taiwan at the cutting edge

For the III, an overarching goal is to help Taiwan's tech industry to further develop and deploy 5G. By supporting the rollout of 5G at the NTCH, III provides opportunities for Taiwanese companies to test new solutions and hone them further. "This kind of cross-domain cooperation is a new opportunity for our ICT industry," says Michelle Tsai, who advocates Taiwan's manufacturing companies and telecoms operators adopt "more design thinking" and develop cross-domain systems integration skills.

For the public-private partnership, the next step will be to deploy a standalone 5G network in the NTCH with a 5G core. The III believes a standalone architecture will deliver a faster and more reliable network. It will also give the theatre the opportunity to organise and manage its own network, says Michelle Tsai. "Then they can try more possibilities," she says. "This is the second year of the project. We will move to a standalone network and also we will engage more domestic and international companies. We will push our ICT industry to upgrade."

The NTCH is confident that 5G will transform live theatre in Taiwan and beyond. But some cultural barriers remain, according to Liu Yi-ruu. "It's the attitude and the mindset that could be the biggest difficulties," she says. "We have had to change almost everything. We have to study copyright from the beginning, from scratch, because it's all different. We have to change a lot of management procedures in our theatre, so we can make this happen and it takes all the people to get involved."

Another challenge can be the conservative views of the traditional audience for live theatre, some of whom may not want to see the format change. This reluctance could be compounded by the mindset of some performers, actors and artists, who may not wish to change their relationship with live audiences. "Then you can have all the new technologies you want, but it won't work," notes Liu Yi-ruu. "It takes people to forget what they used to do."

It's totally new. You have to learn to speak other people's language, because you have to work with people that we have never worked with before."



## About the GSMA

The GSMA is a global organisation unifying the mobile ecosystem to discover, develop and deliver innovation foundational to positive business environments and societal change. Our vision is to unlock the full power of connectivity so that people, industry, and society thrive. Representing mobile operators and organisations across the mobile ecosystem and adjacent industries, the GSMA delivers for its members across three broad pillars: Connectivity for Good, Industry Services and Solutions, and Outreach. This activity includes advancing policy, tackling today's biggest societal challenges, underpinning the technology and interoperability that make mobile work, and providing the world's largest platform to convene the mobile ecosystem at the MWC and M360 series of events.

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## GSMA 5G Transformation Hub

The GSMA 5G Transformation Hub is an authoritative source of information on some of the most innovative 5G solutions in the world. This portal contains case studies detailing design, benefits, key players, measured value and the future impact of scaling up these 5G solutions worldwide.

The 5G Era is now firmly established and this family of standardised GSM technologies, including mmWave, are being rolled out successfully across the globe. The GSMA 5G Transformation Hub, launched at MWC Barcelona in 2022, provides details of how 5G is best placed to deliver real value for a range of key sectors including manufacturing, energy, transportation, live entertainment, smart cities and construction. We acknowledge the kind support and sponsorship of Qualcomm Technologies with the creation of this case study.

Many more case studies will be added, in the coming months, covering even more industries and the GSMA is asking Members to nominate innovative 5G case studies to add to this global digital showcase.

[www.gsma.com/5GHub](https://www.gsma.com/5GHub)

