

Fact Sheet

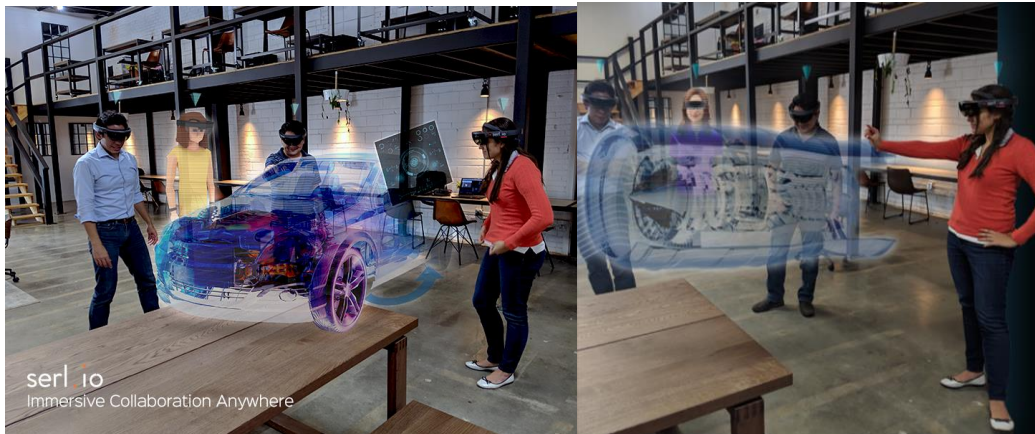
CATALYSING SINGAPORE'S 5G INNOVATION ECOSYSTEM

BACKGROUND

1. Singapore's vision is to be a global front-runner for innovation in 5G applications and services, supported by a thriving 5G innovation ecosystem as well as a high-performance, secure and resilient 5G infrastructure.
2. In support of this, the Minister for Communications and Information, Mr S Iswaran, announced in June 2019 that IMDA ("**Infocomm Media Development Authority**") and the National Research Foundation ("**NRF**") had set aside S\$40 million to build an open and inclusive 5G Innovation ecosystem.

SUPPORTING ALL COMPANIES' INNOVATION EFFORTS

3. To grow the innovation community and support the infocomm media (ICM) industry, IMDA launched its 26,000sqf PIXEL facility at the One-North innovation district in 2016.
4. PIXEL will be enhanced with 5G connectivity to facilitate industry efforts to develop new 5G solutions and build up technical capabilities. The opening of Living Lab@PIXEL 5G testbed in September 2020 will enable all businesses, including SMEs to experiment with 5G applications and use cases.
5. One focus area is virtual reality and augmented reality (VR/AR), which is critical for in-person experiences. This is especially salient today, given the rise of remote events and activities due to support sectors such as retail or building and construction that have been affected by COVID-19. PIXEL will also expand its programmes to provide a conducive and open environment for the ICM community to ideate, experiment, and develop 5G use cases.
6. Several companies has already expressed interest to leverage the 5G Living Lab@PIXEL.



7. **Serl.io**, a local start-up incubated by PIXEL, is developing an immersive platform that provides the tools to efficiently develop, deploy and manage collaborative mixed-reality experiences. They aim to prototype a holoportation feature, which enables real-time collaboration in mixed-reality over 5G networks.



8. Another company is **Hiverlab**, a technology innovation and VR content production company. Hiverlab's Storyhive solution is an immersive VR-based presentation and communication platform. Hiverlab has also embarked on mobile-based AR broadcasting over 5G networks, to make the next generation of online communication more accessible to consumers. One example of its offerings was the AR-enabled Chingay 2020 broadcast.



9. **UCCVR** is developing VooX, a solution which provides 5G-enabled, spatial and AI driven solutions to upgrade front-line productivity. VooX offers remote AR-based video collaboration tools, easy-to-use industry specific checklists platform, digital twins and Building Information Model (BIM)-based monitoring and diagnostic tools.

POSITIVE RESULTS FROM 5G IN MARITIME OPERATIONS



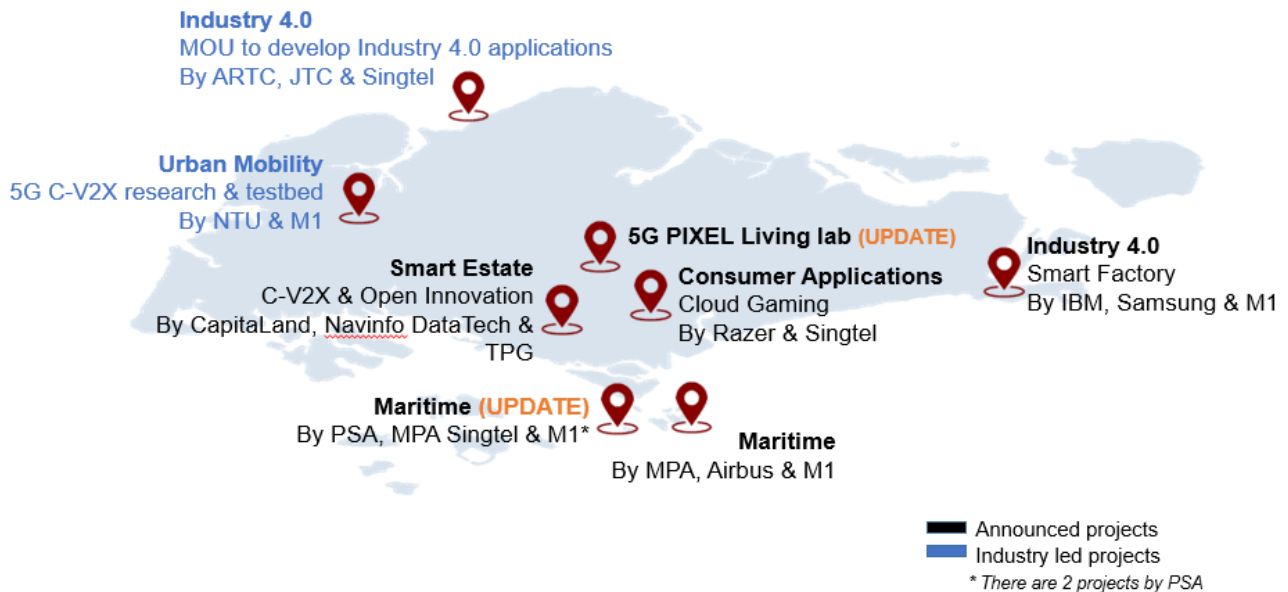
10. The Singapore port is a key global trading node and one of the busiest ports in the world. 5G is a critical enabler supporting the port's automation and remote operation initiatives that help it maintain its competitive edge.
11. In 2019, IMDA and PSA had issued the Technology Call to develop use-cases at Pasir Panjang Terminal in March 2019, awarding it to M1 and Singtel to test how 5G can support Automated Guided Vehicles (AGV) and Automated Cranes. The on-going trials in the highly metallic port environment, which has traditionally been challenging for mobile technologies such as 3G and 4G, have demonstrated promising results.

12. Crane operators can now operate the machines using a high-definition video feed enabled by 5G's higher bandwidth, lower latency, and enhanced reliability. This reduces the need for the operators to climb up the cranes to operate them, enhancing their productivity and improving worker safety.
13. PSA's AGV operations reduce the need for manually-operated prime movers. For AGV operators, 5G's reliability reduces the incidence of momentary stoppages due to connectivity disconnections. Such disconnections disrupt port operations, and may require port operators to perform troubleshooting to restart the AGVs.

UPSKILLING WORKERS IN 5G AND RELATED ROLES

14. IMDA will partner Institutes of Higher Learning (IHLs) to coordinate and aggregate demand for 5G and related skills development across the telecom sector and 5G ecosystem, including the end-user organisations and technology suppliers.
15. The partnership will involve reviewing existing 5G and related courses and securing relevant partnerships with training providers, to deliver structured training and certification pathways for our workers. IMDA will also forge stronger industry and education partnerships to drive organisation and industry-wide training, by integrating 5G curriculum into tertiary and continuing education to upskill a pipeline of 5G manpower for the industry.
16. Existing professionals in the telecom sector and 5G ecosystem, fresh graduates, and mid-career professionals can look forward to new training and career opportunities in tech roles such as Solution Architects, 5G Telco Engineers, Systems Analysts, as well as tech-lite roles such as Product Marketing Managers, Network Consultants and Drone Operators. Details on the training programmes will be released by Q42020.

SINGAPORE 5G INNOVATION USE-CASES (SUMMARY)



Since announced in June 2019, a total of five 5G innovation use-cases supported by IMDA along with 5G Living Lab @PIXEL.

- Cloud Gaming:** IMDA, Razer and Singtel announced Singapore's first 5G cloud gaming trial in October 2019. The technology trial will assess 5G's ability to meet the demands of cloud gaming. The trial will also look into how to design low latency cloud gaming hardware to deliver a quality gaming experience, and a broader range of gaming experiences. The trial is currently ongoing.
- Urban Mobility and Smart Estates:** Announced in October 2019, CapitaLand partnered Navinfo Datatech and TPG Telecom to create a 5G-enabled smart estate in Science Park 1 and 2. CapitaLand will leverage the ultra-high speed and ultra-low latency capabilities of 5G standalone networks at those sites to deploy and test innovative estate-level solutions. It is currently testing a 5G-enabled Cellular Vehicle-to-Everything (C-V2X) technologies for Smart Estates mobility solutions in a commercial space.
- IMDA-Microsoft MOI:** IMDA and Microsoft signed an MOI in November 2019 to offer a 5G development environment. This site will be connected to PIXEL as part of Microsoft's Centre-to-Centre collaboration programme to facilitate efforts to create new 5G applications, services, and capabilities.
- Urban Mobility:** M1 and the Nanyang Technological University (NTU) are collaborating to deploy 5G technology at the university's campus. The deployment, announced in October 2019, will enable NTU to expand its current C-V2X communications trials on autonomous vehicle, traffic infrastructure and unmanned aircraft systems to use 5G. Companies will also

be able to design and test their connected mobility solutions on the campus-wide testbed. This project, which is ongoing, is supported by the A*Star, NRF and the Singapore Economic Development Board.

- **Industry 4.0:** IMDA, M1, IBM and Samsung announced Singapore's first 5G Industry 4.0 trial in May 2020, to demonstrate the transformative impact of 5G for enterprises and drive the next bound of Singapore's digital economy. The trial aims to develop insights and showcase benefits of 5G in Industry 4.0. This trial is on-going.
- **Industry 4.0:** Singapore's Agency for Science, Technology and Research's (A*STAR) Advanced Remanufacturing and Technology Centre (ARTC), JTC and Singtel signed a memorandum of understanding in 2019 to develop Industry 4.0 solutions based on 5G technology.
- **Maritime Operations:** Supported by IMDA and MPA, M1 has partnered Airbus to conduct coastal 5G standalone network trials at the Singapore Maritime Drone Estate. This use case, announced in June 2020, aims to assess 5G standalone network performance in real-world environments to ensure that unmanned aerial vehicles can operate safely and efficiently during all phases of their flights.

Annex A (Additional Info) – Attributeable to PSA Spokesperson

PSA:

With the advent of 5G, PSA Singapore has been collaborating with IMDA, Singtel and M1 in a trial to gain a deeper understanding of 5G capabilities and its potential deployment within PSA's smart port.

The first phase of the trial, which ended in March 2020, showed that 5G enabled more immediate data communications with port equipment, thus allowing Automated Guided Vehicles (AGVs) to operate more efficiently than on current 4G networks. 5G also increased the precision of remote control of yard cranes, paving the way for job upskilling, improved productivity and safety where staff can operate multiple cranes comfortably from a control centre indoors.

Future applications for 5G can be expected in Tuas Port where 5G will be a key driver for smart port innovation, enabling the large-scale orchestration of automated equipment operations, augmented by widespread deployment of sensors and data analytics capabilities.



About Infocomm Media Development Authority (IMDA)

The Infocomm Media Development Authority (IMDA) leads Singapore's digital transformation with infocomm media. To do this, IMDA will develop a dynamic digital economy and a cohesive digital society, driven by an exceptional infocomm media (ICM) ecosystem – by developing talent, strengthening business capabilities, and enhancing Singapore's ICM infrastructure. IMDA also regulates the telecommunications and media sectors to safeguard consumer interests while fostering a pro-business environment, and enhances Singapore's data protection regime through the Personal Data Protection Commission.

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