

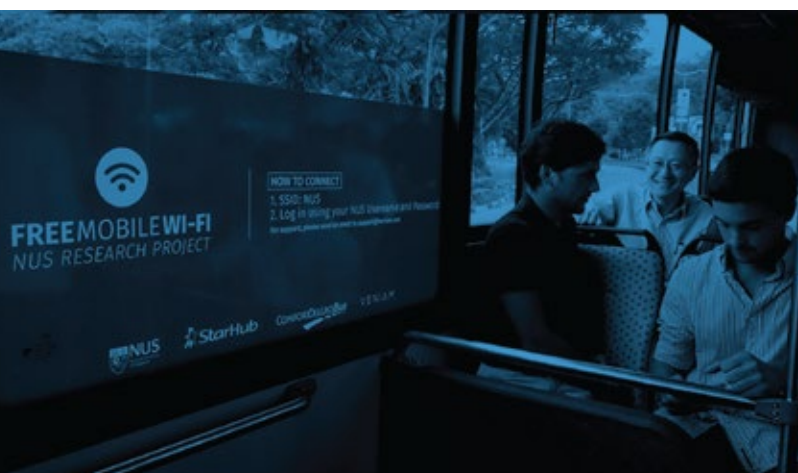
SMART CONNECTED BUSES IN A SINGAPORE UNIVERSITY

How Veniam's vehicle mesh network delivers seamless mobile Wi-Fi connectivity to thousands of passengers

ABSTRACT

Each day, more than 40,000 students and staff use the shuttle service at the National University of Singapore. This case study shows how Veniam, in partnership with StarHub and ComfortDelGro Bus, overcame an unusual set of challenges to build the first vehicle mesh network in Asia, and deliver seamless Wi-Fi to thousands of commuters on the move.

How is the Internet of Moving Things shaking the foundation of urban mobility? With consumers demanding high-quality internet access everywhere, bus fleets, cities and universities are looking for solutions to provide an exceptional Wi-Fi experience for every passenger on the move.



Veniam, in partnership with StarHub, ComfortDelGro Bus and National University of Singapore (NUS) collaborated on a project to deploy Singapore's first mesh network on NUS's Kent Ridge campus, offering wireless connectivity on board 38 shuttle buses that operate in campus.

A GLIMPSE INTO THE WI-FI SERVICE ON BOARD THE NUS SHUTTLE

Campus-wide vehicular mesh network operating from June to December 2016

38



SHUTTLE BUSES CONNECTED

20



VENIAM NETRIDER™ ACCESS POINTS

66,000+



UNIQUE USERS

6M+



INTERNET SESSIONS

475,000+



HOURS INTERNET TRAFFIC


620,000+



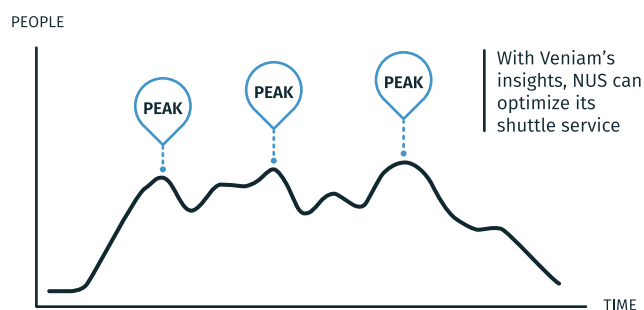
CONNECTED KM


CHALLENGES


To fulfill its commitment to deliver seamless Wi-Fi access to thousands of students and staff who use the shuttle service in the 150-hectare campus, Veniam overcame an unusual set of challenges:

 The uneven terrain and dense vegetation on the Kent Ridge campus made it challenging for a classic Wi-Fi solution to keep connections alive and deliver the desired quality of Internet experience.


• INSIGHTS INTO NUS: INTRA-DAY SHUTTLE USAGE •





 The moving speed of the shuttle buses demanded a seamless connection based on a multi-network solution of 4G LTE, DSRC* V2X access points and the campus Wi-Fi service.


 With more than 40,000 daily trips and a commitment to improve its shuttle bus service quality and experience, NUS constantly looks out for solutions that could collect the relevant data to enable the University to make data-driven decisions.

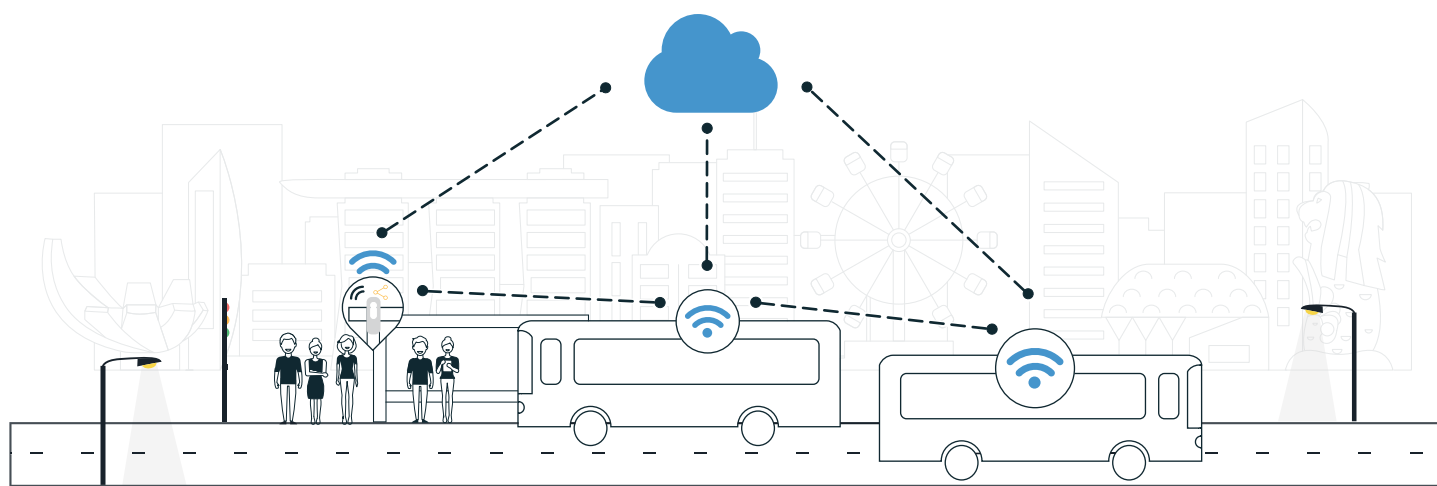
SOLUTION

 NUS collaborated with StarHub, Veniam and ComfortDelGro Bus to deploy a campus-wide vehicle mesh network that provided a secure Wi-Fi connection to passengers on board the internal shuttle bus service. Veniam partnered with StarHub, a key leading telecommunications operator in Singapore, whose expertise and network infrastructure helped deliver a seamless Wi-Fi experience.

 To connect all shuttle buses plying around the NUS Kent Ridge campus, Veniam installed their 38 NetRider™ On-Board Units (OBU) equipped with multi-network interfaces, which turn the vehicles into mobile hotspots. In addition, 20 Veniam NetRider™ Access Points (AP) connect passing vehicles to the wired infrastructure and the cloud.

 To guarantee a seamless transition within the campus Wi-Fi service and full integration with the university's authentication system, Veniam worked with the NUS back-end services and provided secure communication between the mobile Wi-Fi service and the University's network.




 By leveraging the capabilities of DSRC, Veniam's network brought a 10x improvement in area coverage, reducing the number of APs needed across the campus. Following the implementation and acceptance tests, NUS was able to provide Wi-Fi on the move for more than 15 000 daily users. In addition, NUS has access to the user generated data collected by Veniam to make operational decisions and improve the internal shuttle bus services.



*Dedicated Short Range Communications (DSRC) is an open-source protocol for wireless communication intended for highly secure, high-speed wireless communication between vehicles and the infrastructure.

RESULTS

With the deployment of Veniam's mesh network and data management services, NUS was able to:

-  Offer mobile Wi-Fi to more than 15 000 passengers daily, through 6 million Internet sessions and more than 13 000 days of Internet browsing.
-  To gather insights into passenger usage patterns, fleet utilisation and network activity within the campus to further improve the internal shuttle service.
-  Collect terabytes of valuable data for research into a Smart Nation design.

“The deployment of wireless mesh vehicular technology will allow NUS to conduct research into areas such as wireless mesh network enhancements, commuting and mobility trends, and other technologies that will drive us towards becoming a Smart Nation.”

PROFESSOR LAWRENCE WONG,
Deputy Director of the NUS Interactive Digital Media Institute who
is leading the NUS Living Lab initiative



Partners:

VENIAM®



StarHub

COMFORT DELGRO Bus

ABOUT VENIAM

Veniam turns vehicles into Wi-Fi hotspots and builds vehicle mesh networks that expand wireless coverage and collect terabytes of actionable city data. Our hardware, software and cloud components are delivering managed services to intelligent transportation systems in Singapore and New York, as well as in the world's largest network of connected vehicles, which includes taxis, waste collection trucks and the entire public bus fleet in Porto, Portugal, offering free Wi-Fi to more than 480,000 active customers, while completing more than 30 million of connected Kms.