Study and evaluation of heterogeneous network for smart community and smart city applications

ASEAN IVO Forum 2017

Nov 24, 2017

Chulalongkorn University (CU), Thailand
MIMOS, Malaysia
Universiti Tunku Abdul Rahman (UTAR), Malaysia

Presented By
Teerapat Vongsuteera (teerapat.vo@student.chula.ac.th)
Adsadawut Chanakitkarnchok (adsadawut.ch@student.chula.ac.th
Faculty of Engineering, Chulalongkorn University

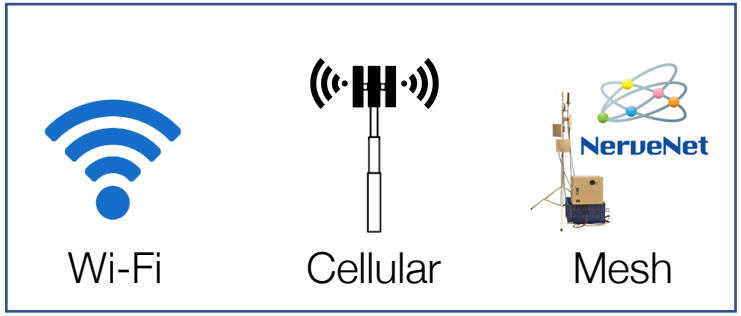
Project Theme

Smart Society

ICT applications on heterogeneous network for smart community and smart city

Smart Community
MIMOS

Smart City
Chula



Multilateral verification on Heterogeneous Network

Objectives

The wireless mesh network using NerveNet overcomes many limitation issues from the regular wireless communication.

Scalability

Cost Reduction

Disaster Recovery

Objectives (2)

Vehicular Cloud System

- Heterogeneous Network for Vehicular Network
- Support in Larger Scale Scenario
- Never Die Network in Disaster Recovery

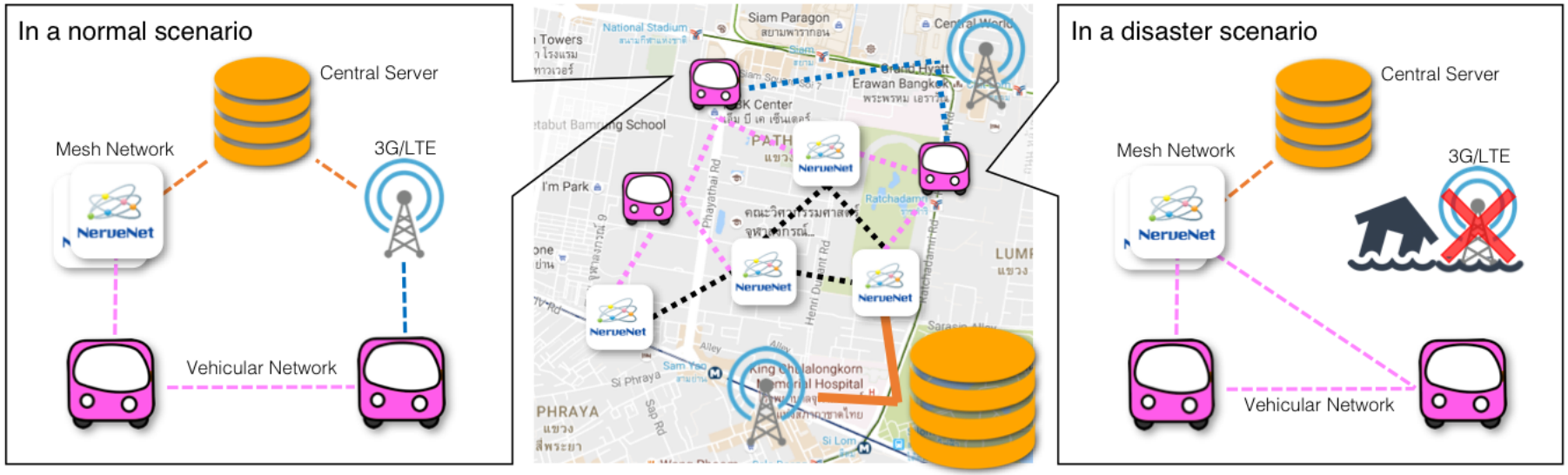
Presentation Delivery Gateway System

- Support Larger Number of Receivers
- Highly Collaborative and Interactive

Outcome

Vehicular Cloud System

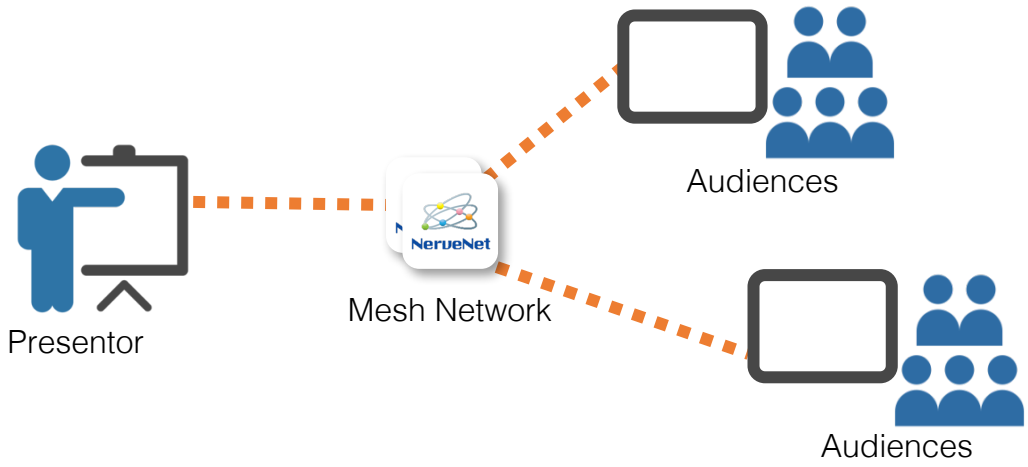
- Vehicular Cloud System using wireless mesh network
- Never Die Network



Outcome (2)

Presentation Delivery Gateway System

- Interconnect to External Network Infrastructure
- Support of Collaboration and Interaction



Vehicular Cloud System

Chulalongkorn University (CU)

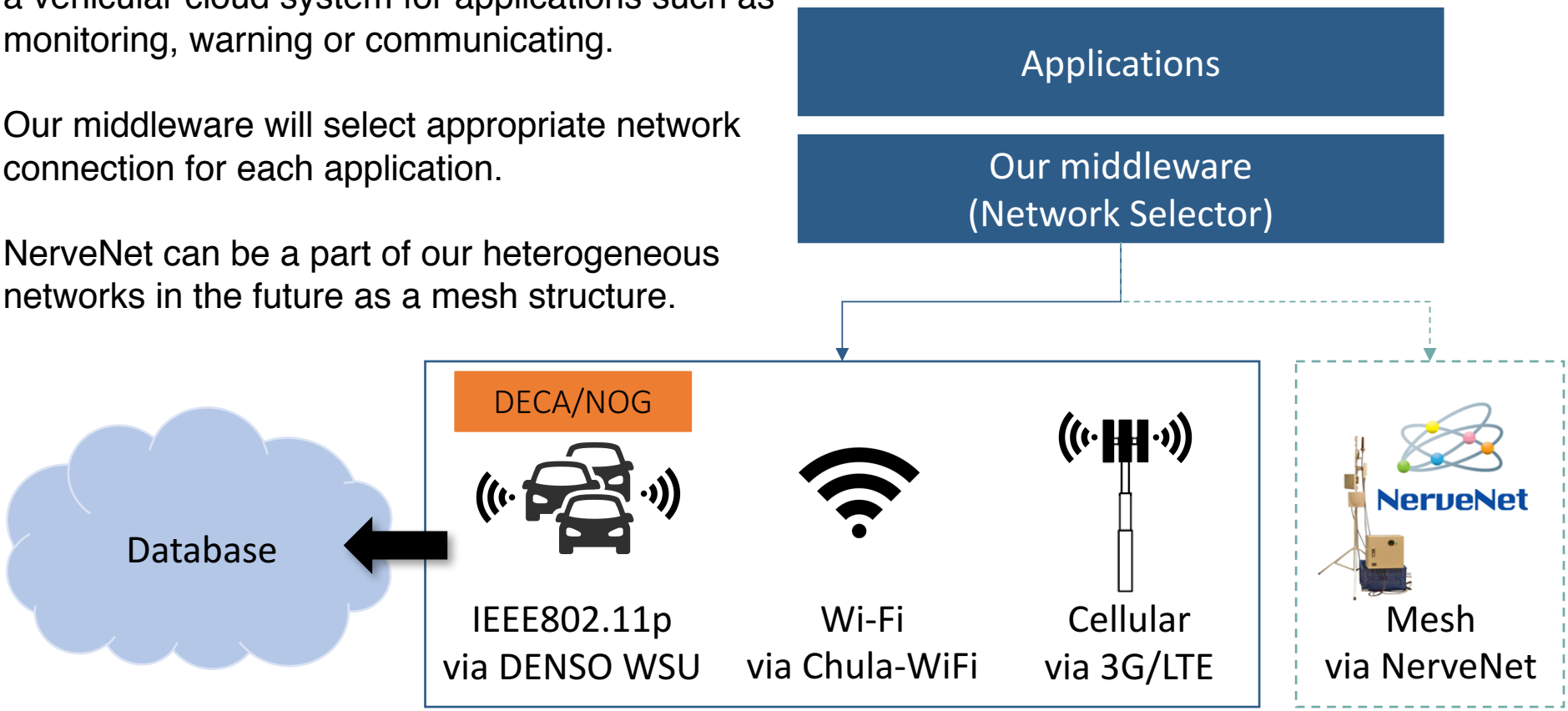
Project Update

Vehicular Networks
Heterogeneous Networks

Currently, we develop our testing platform to be a vehicular cloud system for applications such as monitoring, warning or communicating.

Our middleware will select appropriate network connection for each application.

NerveNet can be a part of our heterogeneous networks in the future as a mesh structure.



Supported by

NBTC ITS Thailand สมาคมระบบขนส่งและจราจรอัจฉริยะไทย DENSO

NerveNet

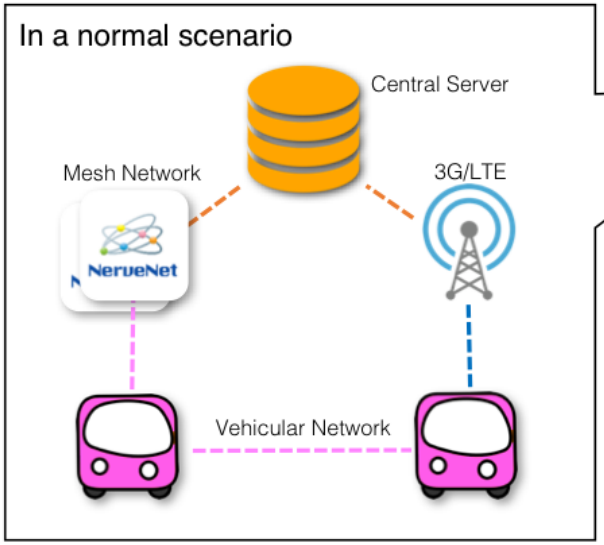
Never Die Network in Thailand

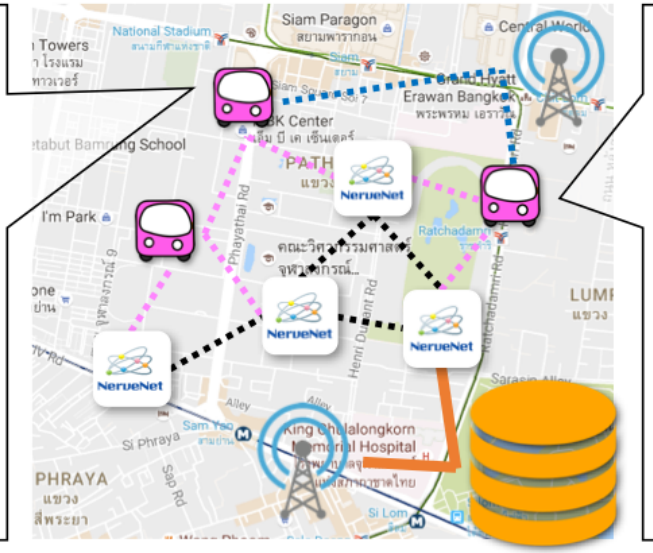
In a normal scenario

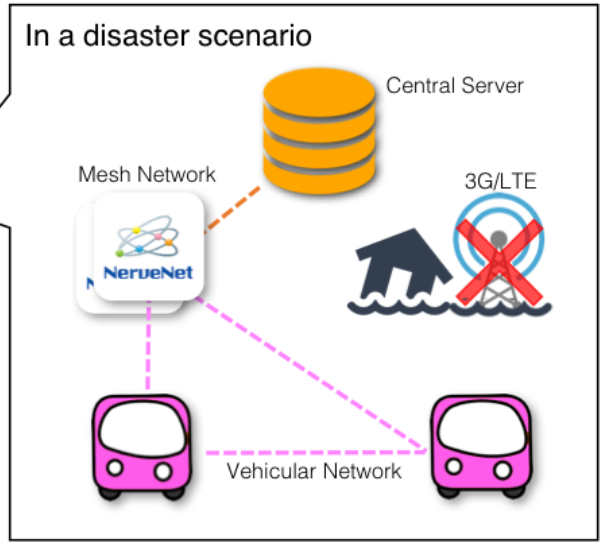
NerveNet mesh network can be a part of network infrastructures to provide more network capacities and availabilities for IoT devices such as Chula shuttle buses.

In a disaster scenario

Other infrastructures were destroyed, the NerveNet mesh network can serve as the main infrastructure for the IoT devices to communicate to the central server. Therefore, search-and-recue applications or disaster-recovery applications can take benefit from the network.







Project Timeline

Schedule	Details	Status
June – December 2017	• Study on NerveNet System • Study on Mesh Network Protocol for NerveNet • NerveNet Routing Protocol Deployment and Testing	60% done
January – June 2018	• Heterogeneous Network Middleware Deployment and Testing • Communication Testing (On-Site) • Application Design and Implementation for NerveNet	
June – December 2018	• Application Deployment and Testing • Infrastructure Installation and Performance Evaluation (On-Site) • Publication Preparing and Submitting on an International Conference	
January – March 2019	• Results Analysis and Discussion • Project Report • Publication Presentation at an International Conference	

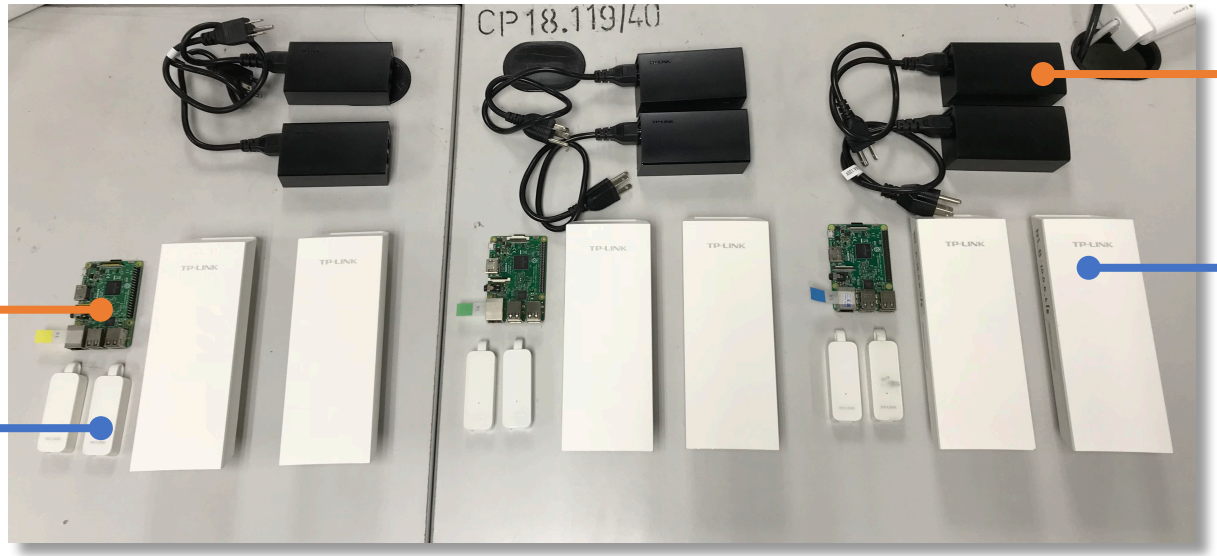
Problems	Proposed solutions
1. Project started in June 2017 but end in March 2019 2. Financial process take very long time and complicated 3. Cannot manage budget as planned 4. Document in English not provided	1. Extend project to June 2019 2. Shorten financial process 3. Transfer the remaining budget to next fiscal year 4. Provide document in English

Progress

June – December 2017

First quarter work details

- Study on NerveNet System
- Study on Mesh Network Protocol for NerveNet
- NerveNet Routing Protocol Deployment and Testing (Indoor)



Future Plan

Infrastructure

- NerveNet protocol Deployment and Testing (On-Site)
- Communication Performance Evaluation

Possible applications

- Emergency message broadcasting
- Search-and-rescue
- Public chat room

Evaluation metrics

- Bandwidth
- Throughput
- Delay
- Packet delivery ratio
- Communication range

PROJECT UPDATE (NICT)

Study and evaluation of heterogeneous network for smart community and smart city applications

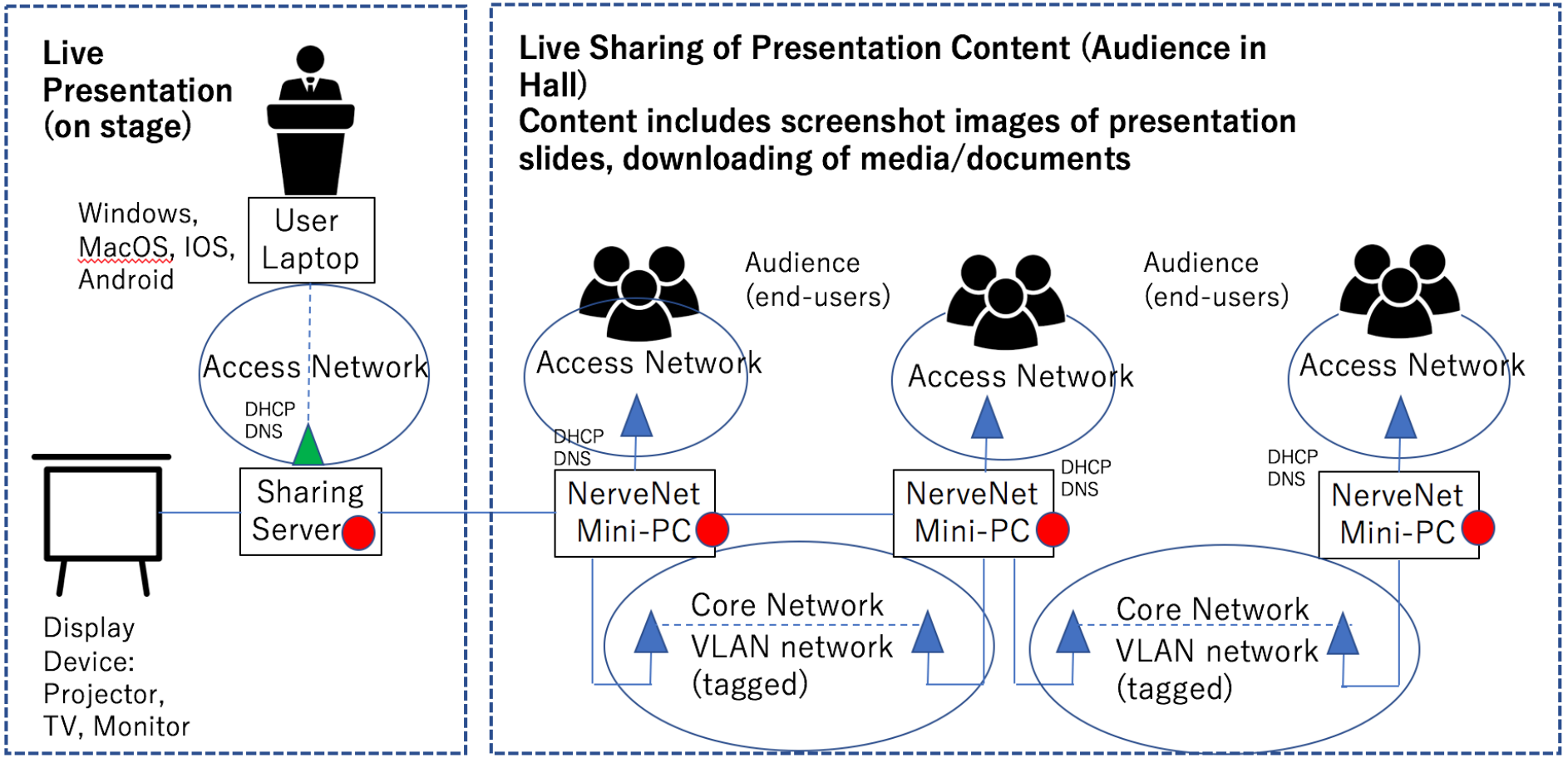
Innovation for Life™

Summary of Updates

- List of equipment to purchase submitted to NICT.
- Total fund of US8,449.42 shall be transferred from NICT around mid Nov 2017
- Identified application use case of NerveNet
  - Instant sharing of presentation content over NerveNet
  - This application leverages on NerveNet to extend the WiFi coverage in order to provide better services to users
- Defined testbed using NerveNet to serve the application requirements
- Determined set of network performance metric and tool for measurement use
- Experimenting a subsystem setup (Using Intel mini-PC and Ruckus AP) of the identified application, verifying the application layer communication protocol

Use Case: Instant Sharing of Presentation Content

Objective: To deliver presentation more effectively to a bigger size of audience, enriched with multimedia/interactive services



Co-locate Sharing server component with NerveNet. Performance is expected to improve due to nearer access to content/service

Network Performance Measurement

- To use Kali Linux to run network performance diagnosis and analysis
- Testing tool: Aircrack-ng or Wireshark
- Performance metric as follows:
  - Ø Data rates
  - Ø Radio signal strength
  - Ø Data frames
  - Ø Control frames
  - Ø Management frames
  - Ø Packet injection

Project Timeline

Schedule	Tasks Description	Status
June – Dec 2017	Define testbed + equipment Explore use case of NerveNet + Sharing System Set up of testbed Performance verification of testbed	50% done
Jan – June 2018	Configure NerveNet to support the new use case Design/Customize/Develop Sharing System to work with new use case	
June – Dec 2018	System/Application Testing Performance Evaluation and analysis System enhancement and fine-tuning of system Publication preparation and submission	
Jan – Mar 2019	Project report Paper presentation Identify future work based on results achieved	

Problems	Proposed solutions
1. Project started in June 2017 but end in March 2019 2. Financial process take very long time and complicated 3. Cannot manage budget as planned 4. Document in English not provided	1. Extend project to June 2019 2. Shorten financial process 3. Transfer the remaining budget to next fiscal year 4. Provide document in English