Background :

NerveNet

- Disaster awareness system, a regional-area network for access to the Internet and for resilient information sharing and communications
- Base stations interconnected each other by using a variety of Ethernet-based wired or wireless transmission systems such as optical/metal Ethernet, WiFi, satellite etc., configuring a mesh-topological network.
- Each base station consists of a LAN switch and a CPU board for controlling the switch, providing packet transmission and applications using distributed database among all the base stations over a mesh network.

Targets:

- ➢ To improve the education methodology among the schools
- ➢ To narrow digital device gap between the city and rural areas
- ➢ Network for rural development such as Smart Village, Smart Farm etc.

Raspberry Pi 3
(RS Components)

Speaker: Mr. Van Khema

Project Members :

National Institute of Posts, Telecoms and ICT

National Institute of Information. and Communication Technology.

University of Computer Studies, Yangon

Dr. Seng Sopheap
Mr. Van Khema
Mr. Sorn Kea
Mr. John Chanthy

Dr. Masugi INOUE
Dr. Nobuyuki Asai
Dr. Yasunori Owada
Dr. Goshi Sato

Dr. Myint Myint SEIN

Project Duration : 3 Years,

Project Activities

2016	2018	2019

Cambodia NerveNet Field Testing

Skun District, Kampong Cham (Cheurng Prey TeleCenter)

- General Dep. Of ICT
- Telecom Cambodia (TC)
- Telecommunication Regulator Cambodia (TRC)
- Smart

TRC

Skun antenna towers

Kampong Leng District, Kampong Chhnang

- 6 Schools were Selected
- Data Centralization at NIPTICT
- NerveNet Base System run on the top of Rasberry Pi 3
- Distance learning application
- 8Mbps of Internet supported by Metfone

Phreh Sdach District, Prey Veng Province

To give proof of NerveNet Base System Performance
- Quiz chart development
- Test Management system Development

Cambodia Education Assistance Fund (CEAF)

Project Activities:

- Optical cable, microwave radio frequency, and Wi-Fi
- Solar-powered support Media converter and NerveNet base system
- 8Mbps of Internet have been provided with digital education content to TeleCenter
- Voice and video communication have been streamed at TeleCenter.

Project Activities
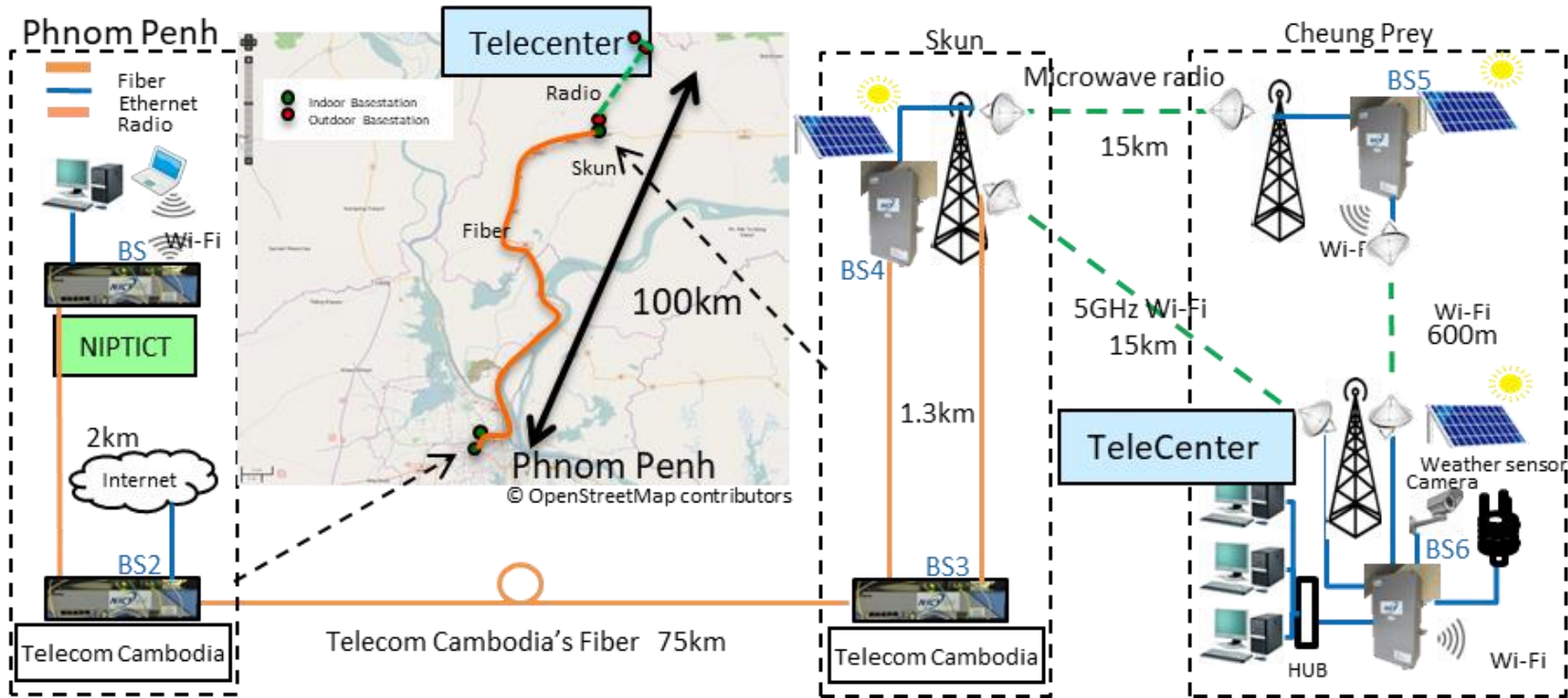
1. **Kampong Cham**
   - Cheurng Prey TeleCenter

2. **Kampong Chhnang**
   - Kampong Leng District
   - Kampong Leng High School
   - Dar Secondary School
   - Dar Commune hall
   - Samrong Sen Secondary School
   - Plov Touk Secondary School

3. **Prey Veng,**
   - Cambodia Japan friendship high school
   - Chea Sim Rakchey High School
   - Brotheat High School
   - Bonteay Charkey Secondary School
   - Hun Sen Takork High School
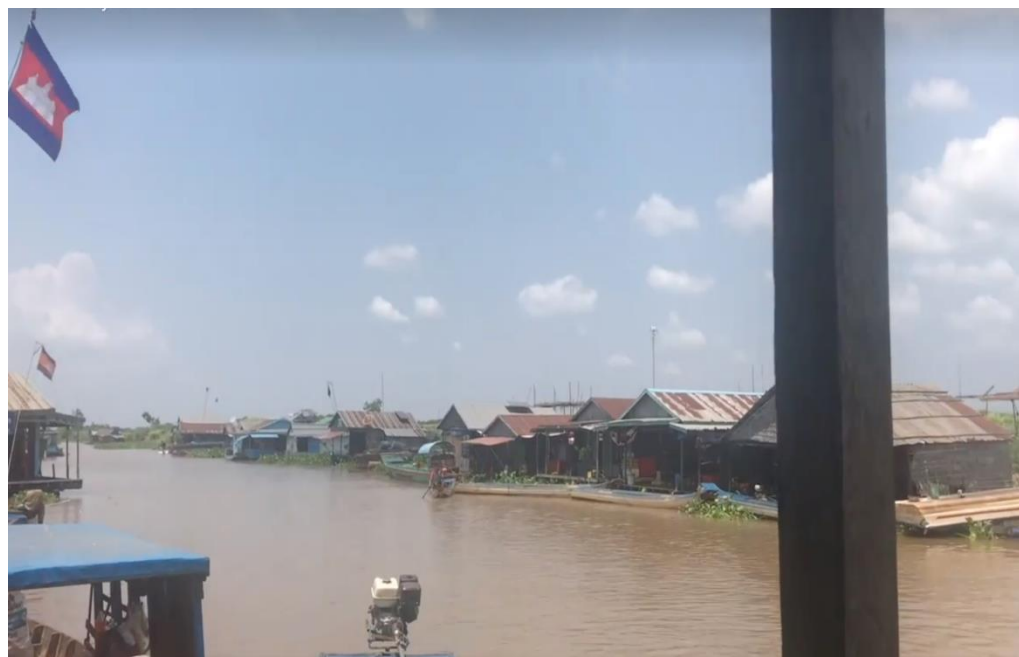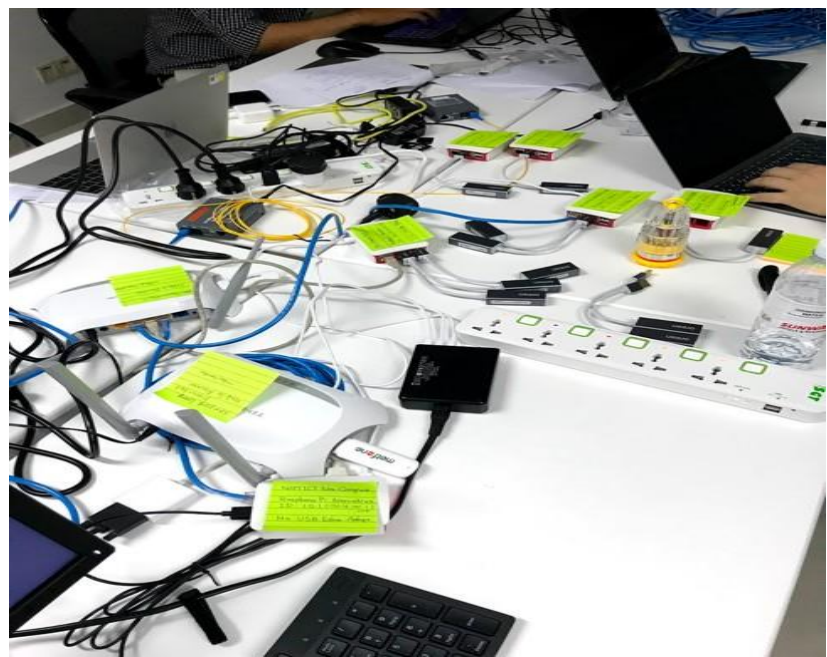   - Bromou Prom High School
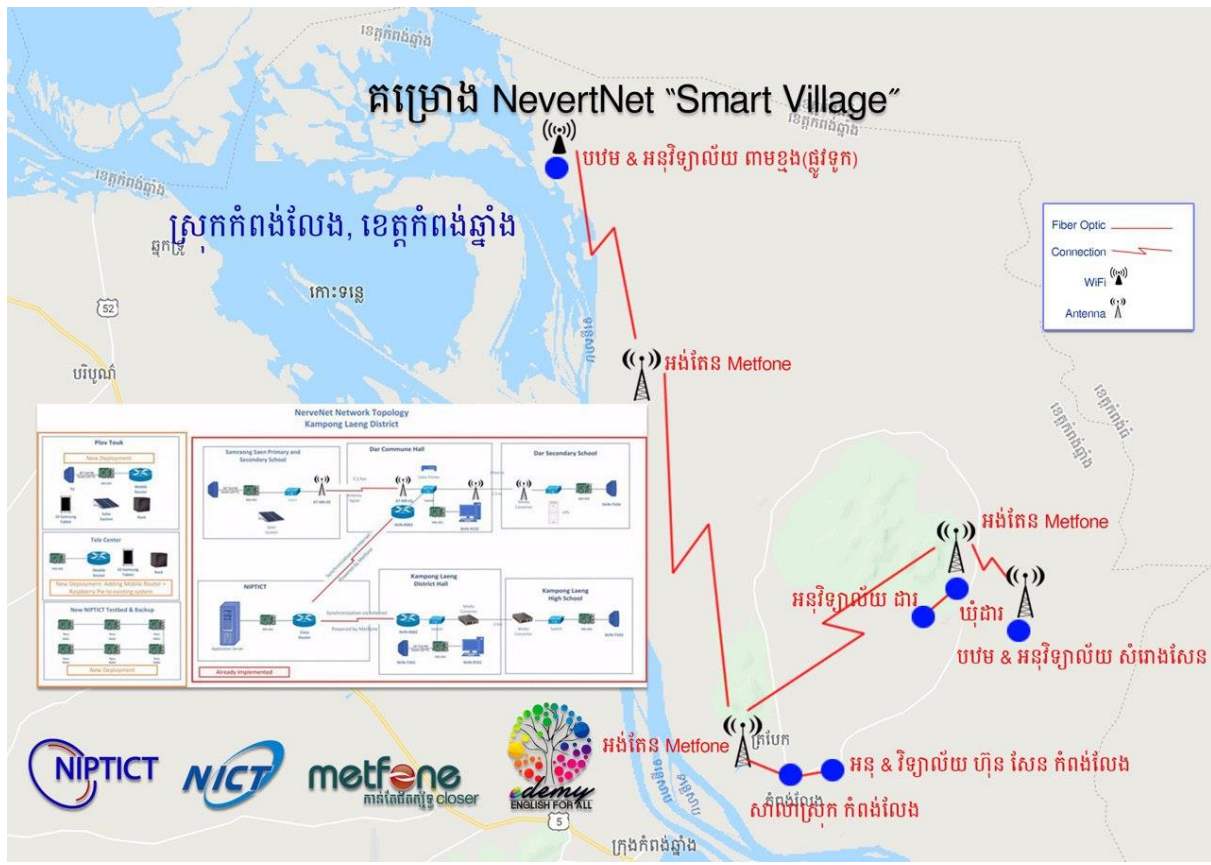
Resilient Communication Network for Schools in rural area (unlimited node configuration both wire and wireless)

Deployment in a FloatingVillage

Screening Application

1.1 Analyzing forms

Question 3 of 8   Score 3 / 8   Time : 04 : 10

Have they met before?

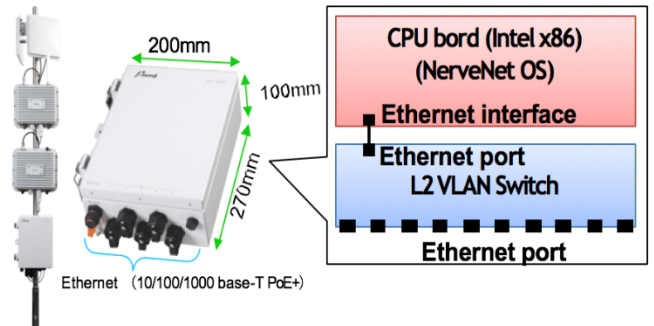| | Positive |
| | Negative |
| ✔ | Question |

Your answer is correct.

Check   Next

R&D results:

- Less electricity power consumption

- Temperature/Humidity resistance

- Storage can be upgraded

- Secure open source customization operating System

High-Performance Outdoor Type
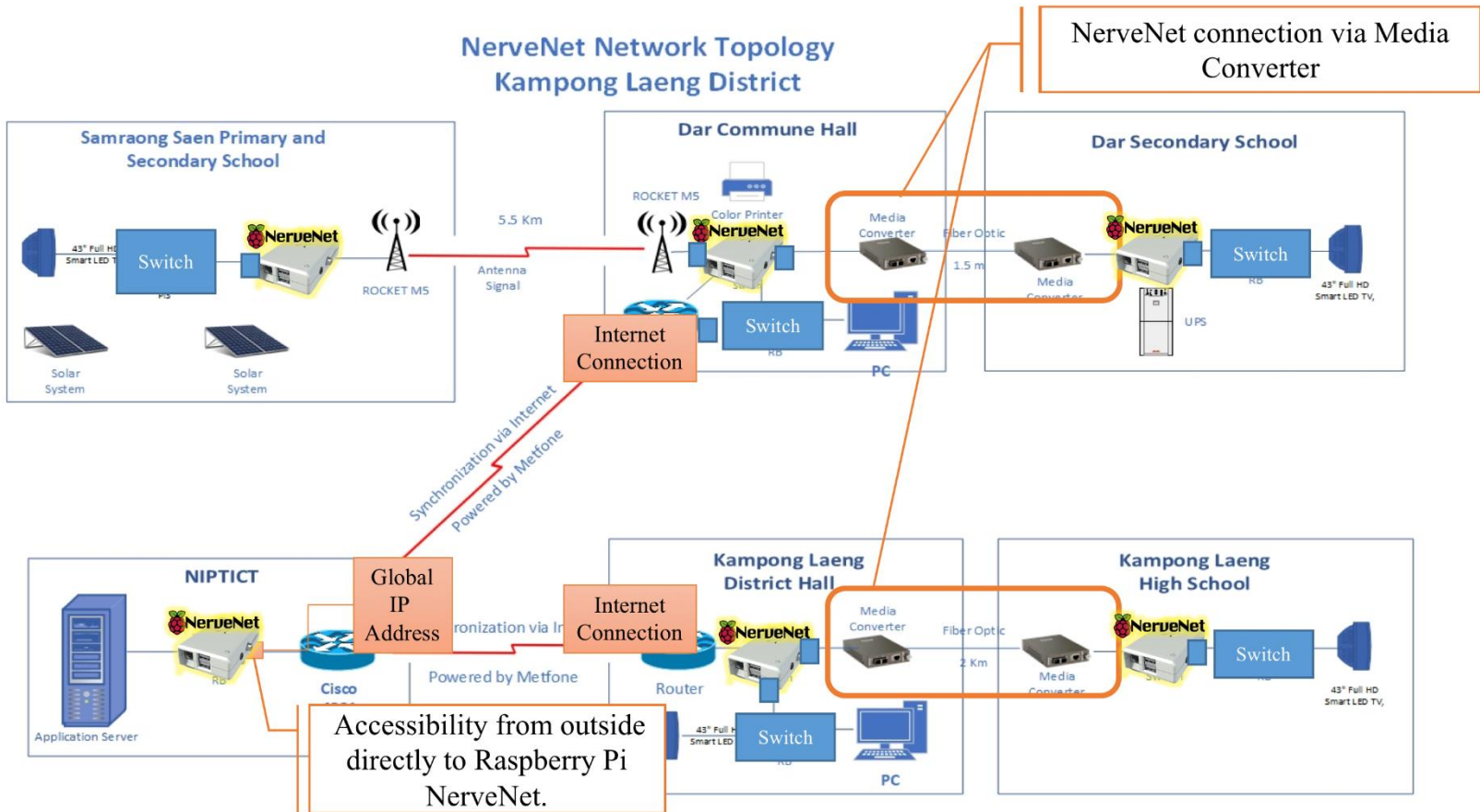
NerveNet NPS-108AC (Hirakawa Hewtech)

Type	NPS-108AC
Network Interface	IEEE802.3at(PoE+) Ethernet (10/100/1000 base-T) 5 ports
Operation Temp./Humidity	-10~50℃ / 20~85%
Power input/consumption	DC12V / 25W average (100W max)
Protection class	IP65
Weight	5.5kg
Other interfaces	Serial ATA, PCI-E, USB, SD, Serial
Storage	2.5 inch SSD8GB (default)
OS	Debian Linux 8 (NerveNet OS)
RAM	4GB
CPU	Intel Atom

All-Software Type

Raspberry Pi 3 (RS Components)

※No L2 VLAN Switch hardware
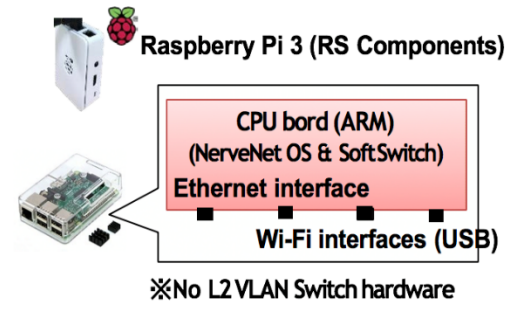
Type	Raspberry Pi 3 model B
Network Interface	Ethernet (10/100/1000 base-T) 1 port, Embedded Wi-Fi (11gn)
Operation Temp.	0~70℃
Power input/consumption	DC5V / 6.5W average (12.5W max)
Weight	120g
Other interfaces	USB2.0 x4 , micro SD, GPIO
Storage	2.5 inch SSD256 GB (Customization)
OS	Debian Linux 8 (NerveNet OS)
RAM	1GB
CPU Broadcom BCM2837	Quad Core 1.2GHz

R&D results:

NerveNet Network Topology
Kampong Laeng District

NerveNet connection via Media Converter

- Fiber Optical cable
- Rocket M5 Antenna
- Mobile Router

R&D results:

Rocket M5 Antenna

- Geographical location and status of the area do not allow us to implement the Fiber Optic Cable.

What We have Learned

- Antenna runs at Layer 3 as IP address is used between its antenna pairs. So, the default VPN Layer 2 does not work as tagged VLAN cannot be transmitted.
- VPN Layer 3 is instead used between each antenna

Rocket M5 Antenna

5km, 2.4GHz

Dar Secondary school

Metfone Antenna tower

L3 VLAN

L3 VLAN

Samrong Sen Secondary school
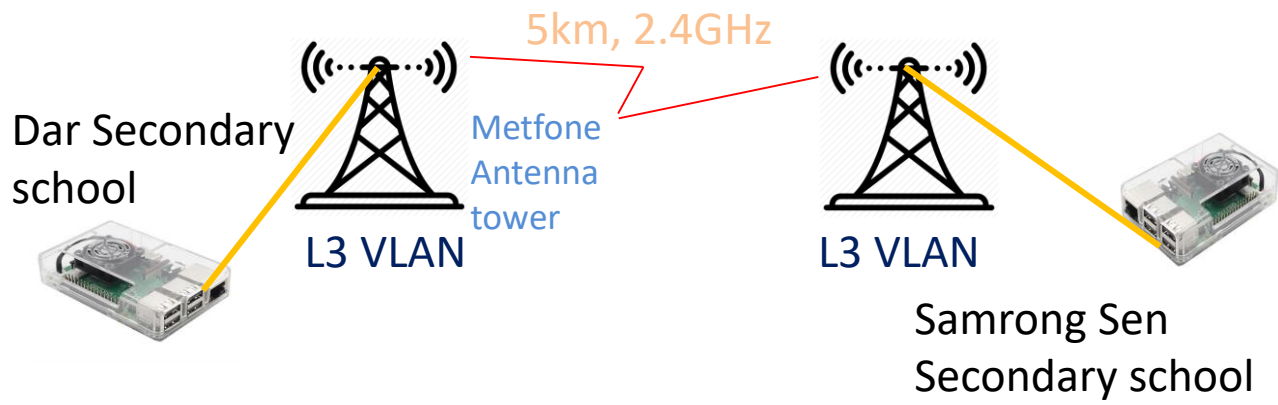
Logical Configuration

- Resilient, secure and scalable communication network for academic school with reliable mesh network unlimited node configuration both wire and wireless.
- Data Centralization and synchronization within all nodes
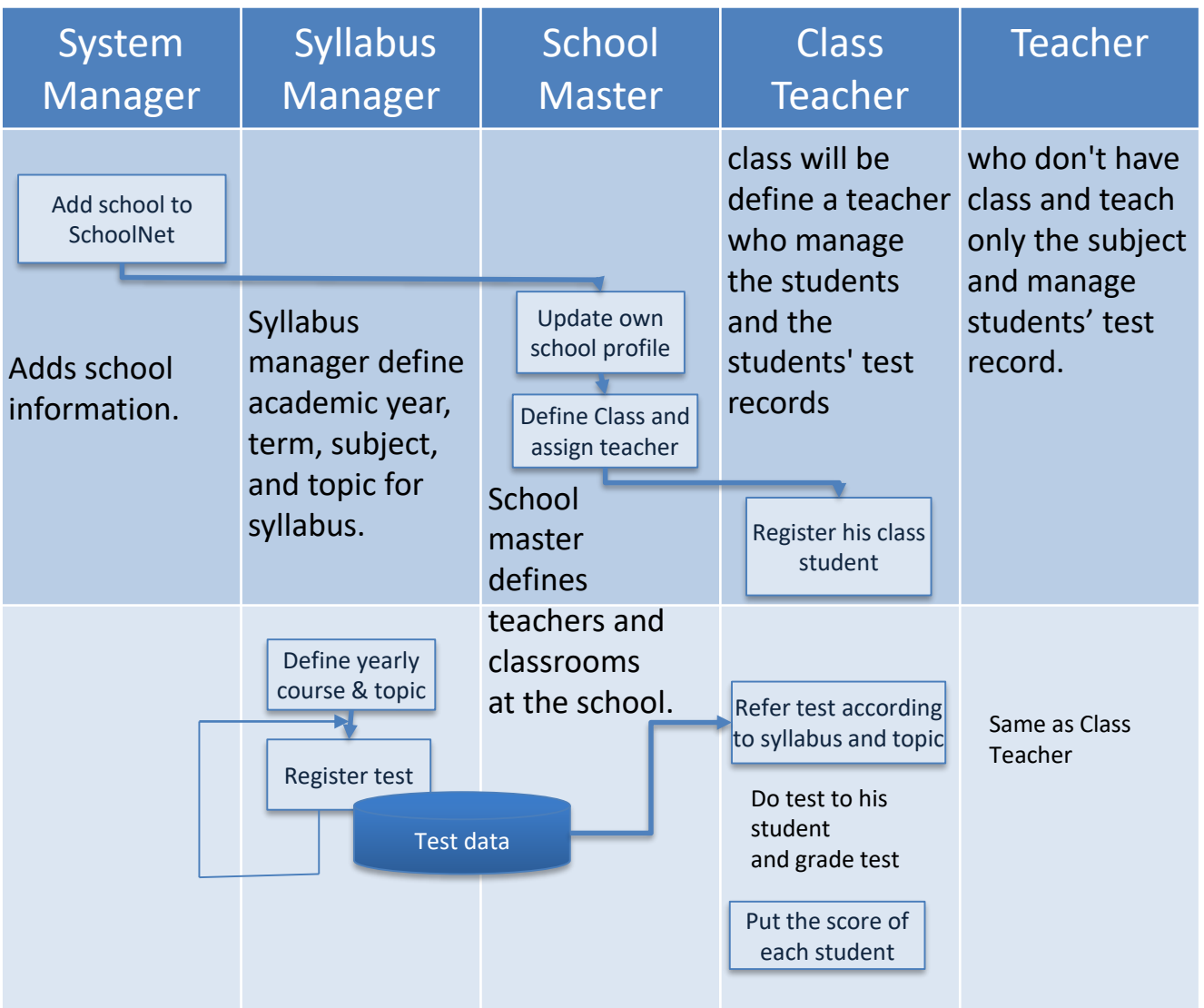- Off/On line database (using distributed database framework)

NIPTICT

Virtual Machine
Application Server

R&D results:
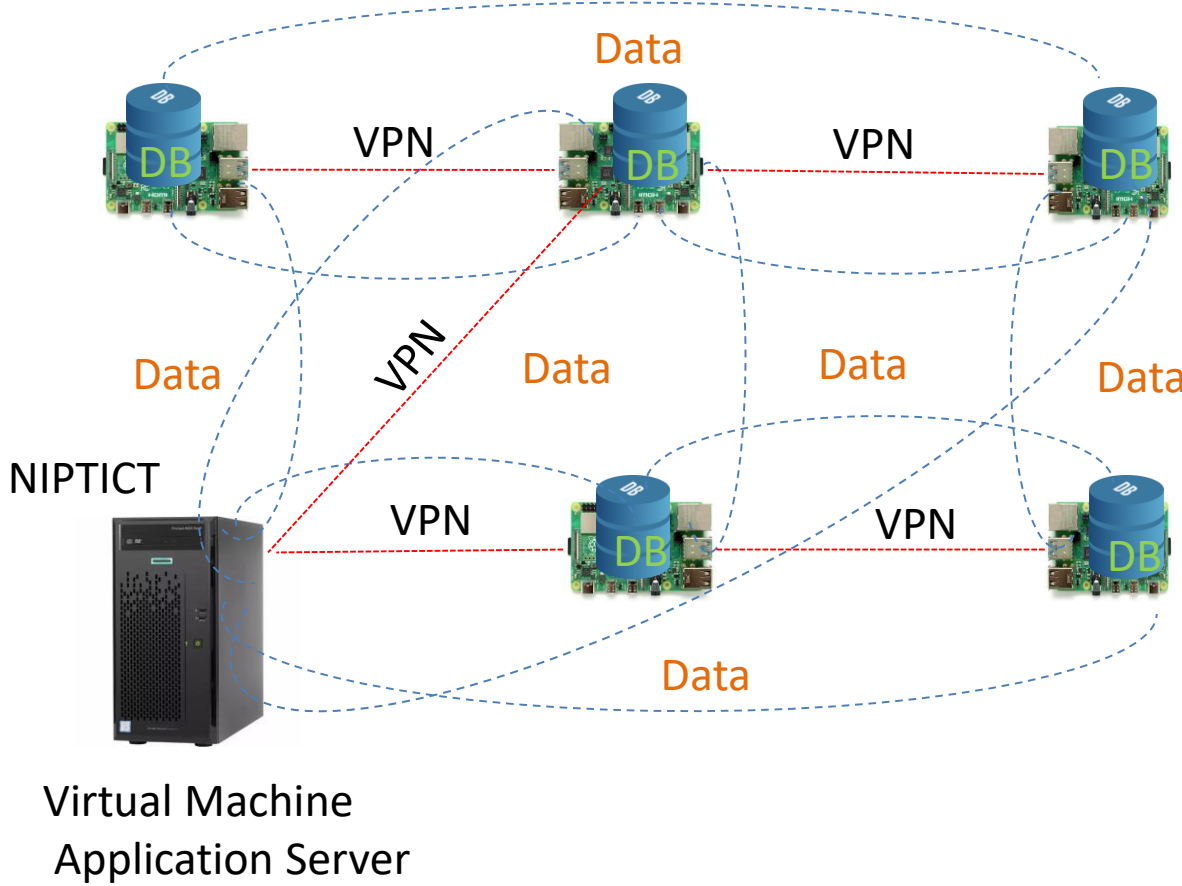
TEST MANAGERMENT APPLICATION DEVELOPMENT

Test Management is the application that teacher can share the test and check their student learning level to compare with other school student score.

User Authority

1) System Manager
2) Syllabus Manager
3) School Master
4) Class Teacher
5) Teacher

System Manager	Syllabus Manager	School Master	Class Teacher	Teacher
Add school to SchoolNet			class will be define a teacher who manage the students and the students' test records	who don't have class and teach only the subject and manage students' test record.
Adds school information.	Syllabus manager define academic year, term, subject, and topic for syllabus.	Update own school profile / Define Class and assign teacher / School master defines teachers and classrooms at the school.	Register his class student	
	Define yearly course & topic / Register test / Test data		Refer test according to syllabus and topic / Do test to his student and grade test / Put the score of each student	Same as Class Teacher

R&D results:
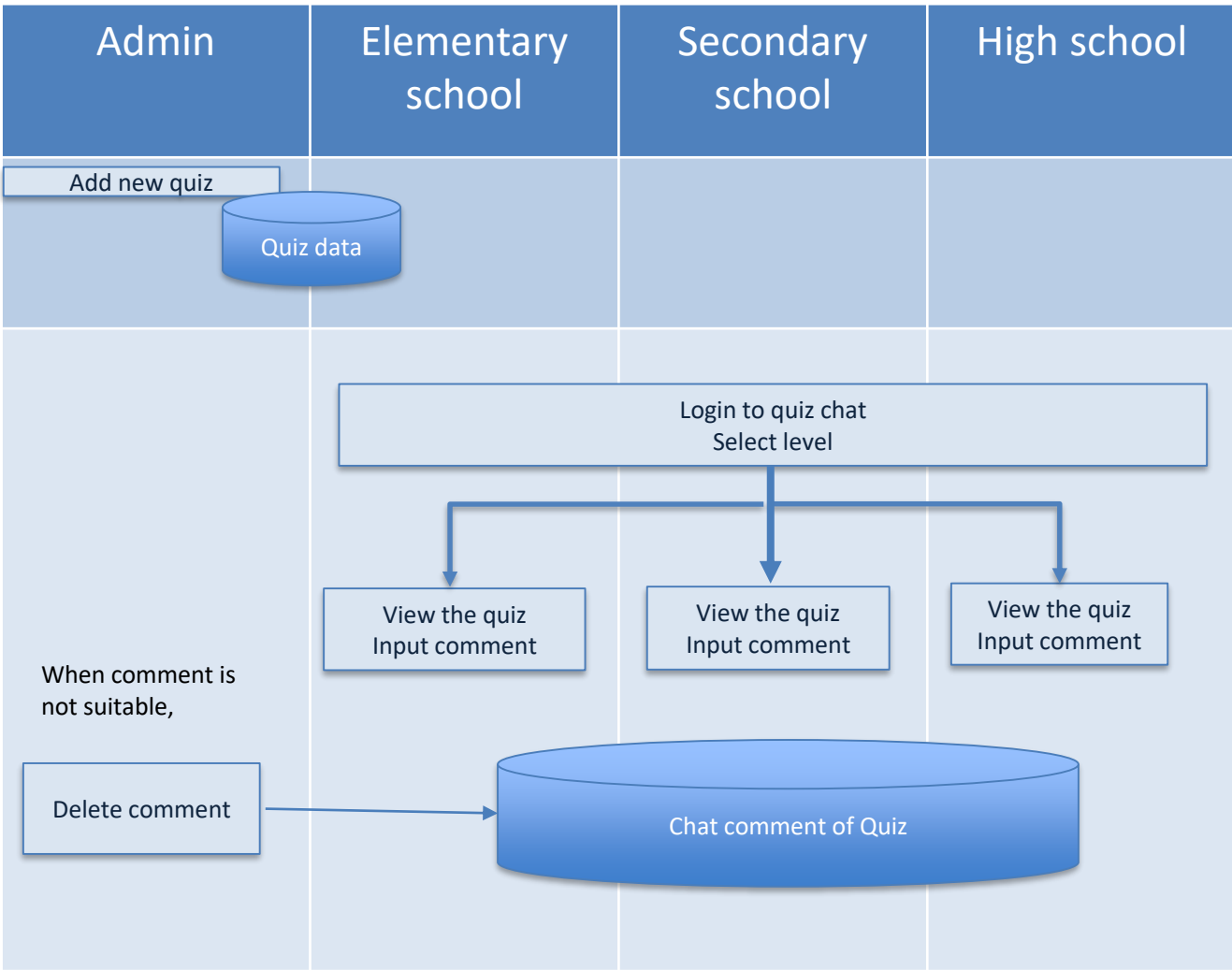
Quiz chat is an application of which the student can share their solution to explain another student in order to make the communication between different schools.

1) Quiz admin
Each school teacher has the right to manage the quiz chat by add new quiz, delete chat if some comment is not suitable in the chat.

2) Student
Any student can post their quiz and solutions into the application.

QUIZ CHAT APPLICATION DEVELOPMENT

Admin	Elementary school	Secondary school	High school
Add new quiz Quiz data			
	Login to quiz chat Select level		
	View the quiz Input comment	View the quiz Input comment	View the quiz Input comment
When comment is not suitable, Delete comment → Chat comment of Quiz			

After the system have been implemented, we saw positive impact on both the academic and friends.

- Remote area students get insights into the methodology of learning by technology.
- Exchange their idea in the course of study such as the solution of their exercises among schools.
- They can review the training videos at any time when they want to assure what they are not clear.
- Each school is possible to evaluate their students quality and manage.
- Integration test let them know the higher student scores compare with other school.

Conclusion:

We can say that NerveNet Base system is one of resilient system. It provide mesh network topology in L2VPN with data distribution and synchronization.

The network topology can be scaled from small to wide area by utilizing diversities of communication network connectivity and L2VPN provides data communication security, stability and reliability.

Data distributed synchronization is delicate framework and has high capability to protect database, content application platform from hacking and any destruction by any means.

NerveNet operating system is all-in-one, no complication, and easy to customize/make it suitable for many projects in main topics such as natural disaster awareness, urban and rural education, agricultural research and analysis etc.

Future works:

2019	2020

| NerveNet field testing Completed | Content Development and SchoolNet Pilot Project |

❖ **Myanmar Test Deployment**
   a. Set up " Taw Ku Village" with Mobile Internet
   b. Connect to NIPTICT
   c. Technically supported by NIPTICT

❖ **Application Development**
   a. Continue Developing Quiz chart, Test Management.
   b. Work with MoEYS, CMS, NPO for content development.

❖ **Conduct Government Workshop**
   a. Demonstrate to several sectors
   b. Require support from NGOs and government level

❖ **Find Pilot Project Fund Support**
   a. Raise proposal to APT for pilot project in 30 schools through out the country.
   b. Raise proposal to CBRD for 20 schools
   c. Setup working group for project management of system and content development.
   d. Distance learning on NerveNet Base System penetration in remote area.

Thank You for Your Attention!