LokaLTE:

A Case Study of Using LTE Community Cellular Network to Enhance Digital Learning in the Philippines

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Digital Gap

The gap that exists between individuals who have access to modern information and communication technology and those who lack access.

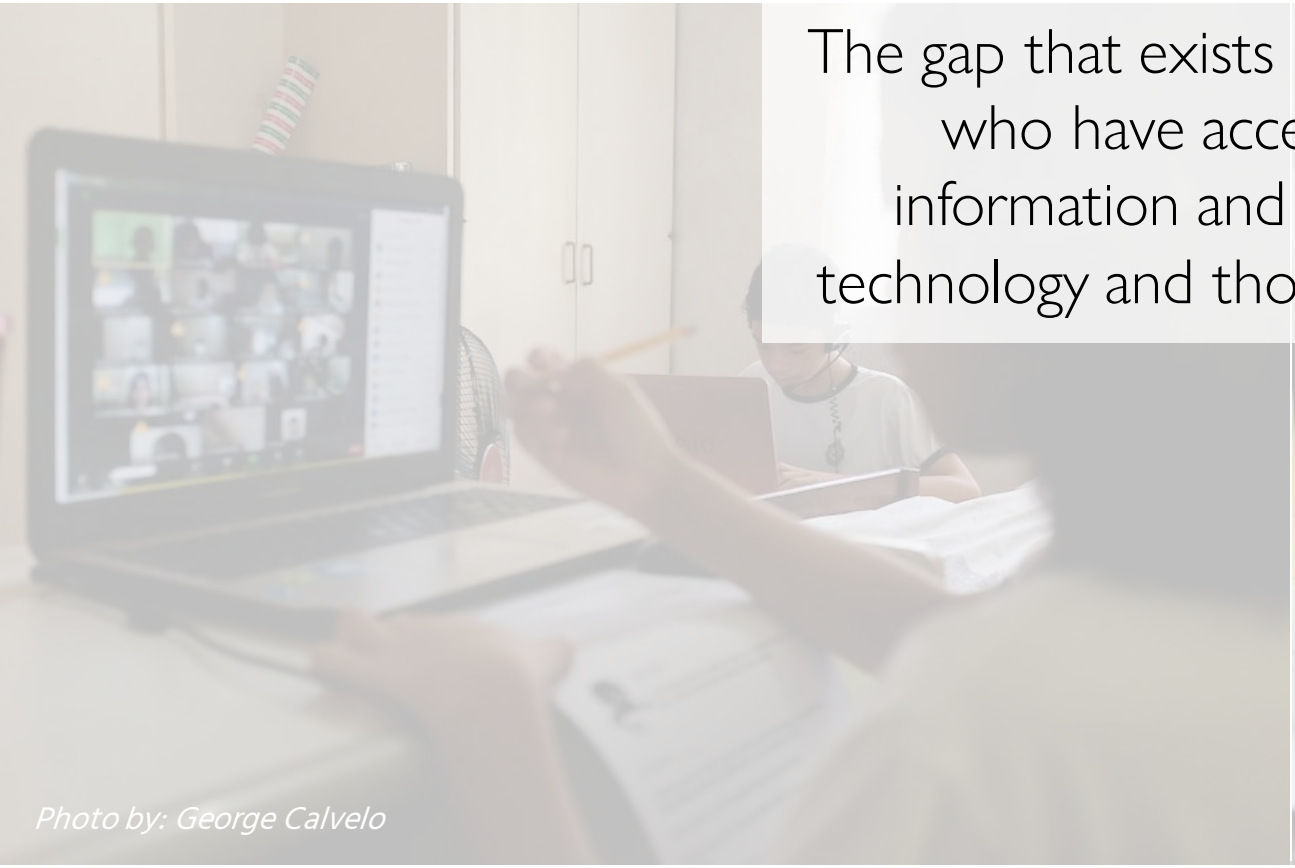


Photo by: George Calvelo

Photo by: UNICEF

TARGETS

Problem:

- The lack of quality, reliable, sustainable, and resilient ICT infrastructure remains as the top challenge in the implementation of remote learning in the Philippines.
- Big players using conventional, profit-oriented solutions can't fill for all available needs.

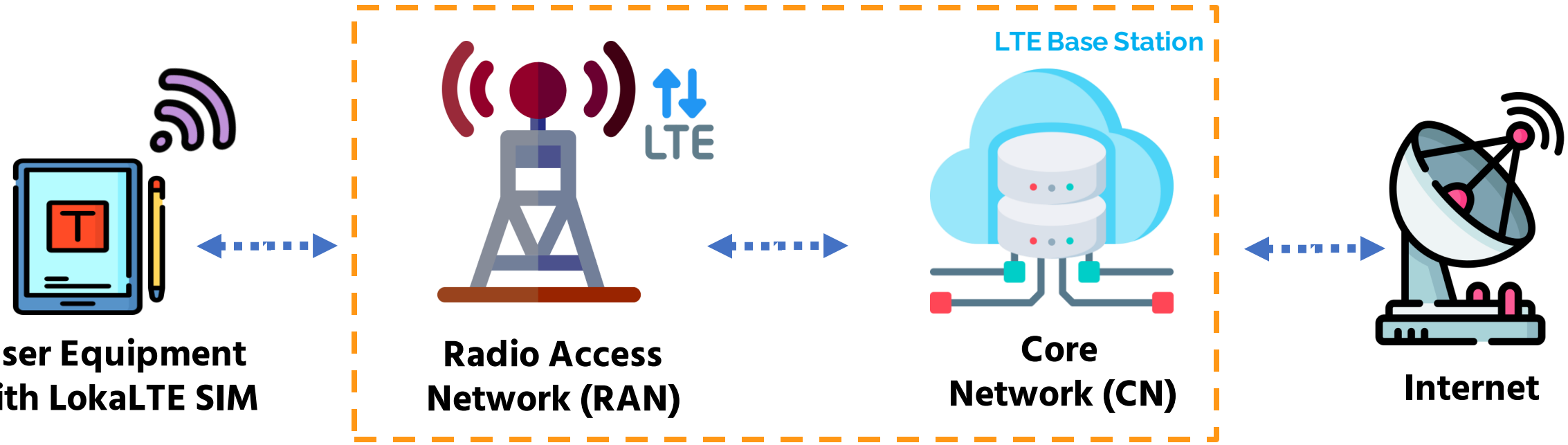
BRIDGING THE GAP

Project RESILIENT EDUCATION INFORMATION INFRASTRUCTURE FOR THE NEW NORMAL focuses on developing application frameworks and infrastructures to support the shift to remote learning and to minimize, if not bridge, the digital gap in the Philippines.

LokaLTE

- Band 71 LTE Community Cellular Network
- Provides digital connectivity and internet access to underserved and unserved areas in the country

LokaLTE System Overview



User Access
- Educational videos (LokalFlix)
- Cached content
- LokaLTE Portal (billing and management, user profile)

LTE Base Station
- LTE network monitoring and control
- Radio components (SDR, front-end, antennas)
- Housekeeping and monitoring circuit

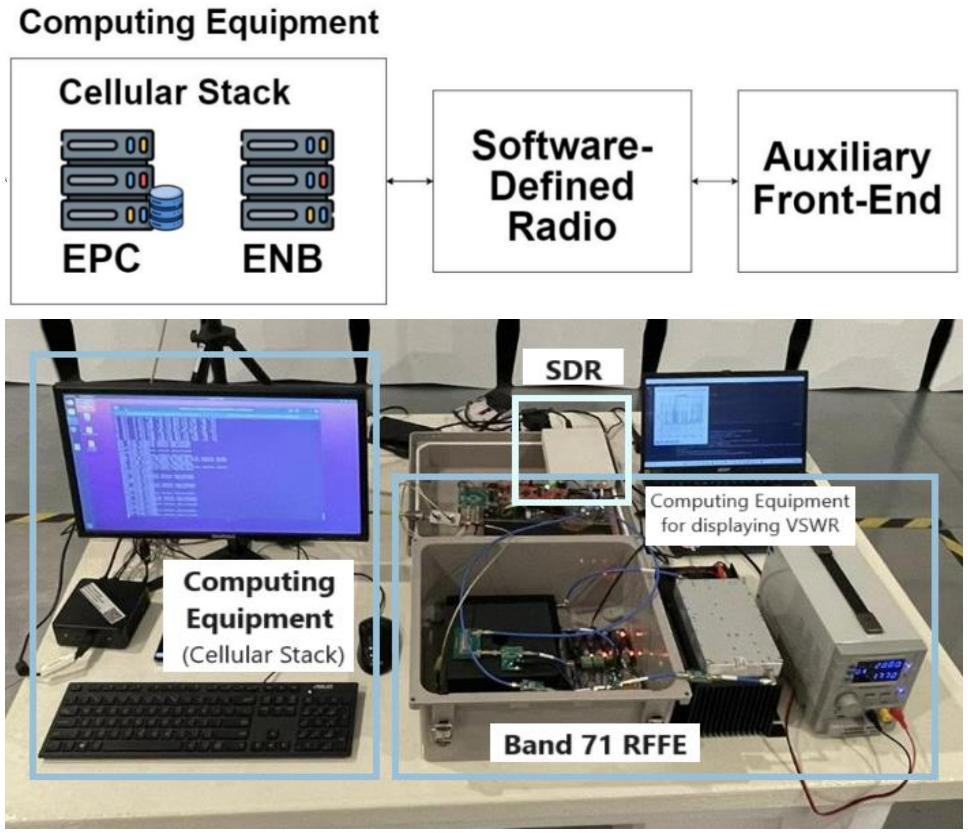
External Network
- Link to the outside world via VSAT (satellite internet)

IMPLEMENTATION

UE with LokaLTE SIM

- ✓ Band 71-enabled UE
- ✓ LokaLTE SIM
  - IMSI
  - MSISDN

LTE BASE STATION



- ✓ EPC: Open5GS
- ✓ eNodeB: srsENB
- ✓ COTS RFFE components

EXTERNAL NETWORK

Pilot Site

EXPERIMENTS AND FIELD TESTING

Walk Test Conditions

Parameter	Value
Tx Center Frequency, MHz	634.5
Number of Physical Resource Blocks (PRB)	50
Transmit Power, dBm	29
Tx Antenna Height, m	11.7

Results

Tx to Rx Distance, m	Received Signal Strength (RSS)			Speed Test (Local Loopback Test)				Speed Test (Backhaul)			
	RSRP, dBm	RSRQ, dB	RSSI, dBm	Ping, ms	Jitter, ms	Download Mbps	Upload Mbps	Ping, ms	Jitter, ms	Download, Mbps	Upload, Mbps
0	-68	-3	-51	13.3	23.1	12.9	2.14	633	1	9.52	3.96
25	-70	-3	-51	15.2	10.4	13.1	2.2	633	1	6.94	6.28
50	-69	-3	-51	11.5	21.6	13	5	774	0.9	12.9	4.36
75	-74	-3	-53	12.5	17.6	13.7	3.87	656	1	13.1	3.89
100	-92	-3	-69	31.1	3.36	12.8	2.21	674	1	13	1.14
125	-99	-3	-79	17.8	30.4	5.42	1.24	Disconnected			
200	-113	-5	-91	Disconnected				Disconnected			

- Received signal strength significantly declined as distance increased
- The user equipment was disconnected to the LokaLTE network at 200 m
- The user equipment was disconnected to the backhaul at 125 m

IMPACT

Scientific and Technological

- ✓ **LokaLTE as a technology demonstrator** to motivate relevant spectrum policy reform to empower community cellular networks in the Philippines

- ✓ **Repurposing of freed-up spectrum** due to migration to digital TV for mobile communications

- ✓ **Low-cost Network Equipment**
  - Use of SDR-based radio and open-source software
  - Commercial-Of-The-Shelf RF components

Societal

- ✓ **Support for education and healthcare**
  - Access to (additional) educational resources
  - Provide telemedicine services

- ✓ **Reduce Social Isolation**
  - Connection to the outside world

- ✓ **Economic Development**
  - Jobs creation
  - Access to markets

Collaborative

- ✓ **Partner Agencies** for digital content
  - Department of Education
  - *Bangko Sentral ng Pilipinas*
  - Ateneo De Manila University (Mathplus)
  - DOST-Science and Technology Information Institute (Starbooks)
  - National Musuem

- ✓ **LGUs** for Pilot Sites

- ✓ **Department of Science and Technology (DOST)** Regional Offices

IMPACT


DOST-ASTI
REIINN
OVP SCHEDULER
DOST, DepEd tackle collaborative plans for Project REIINN
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BSP, DOST-ASTI strengthen partnership to promote rural financial inclusion
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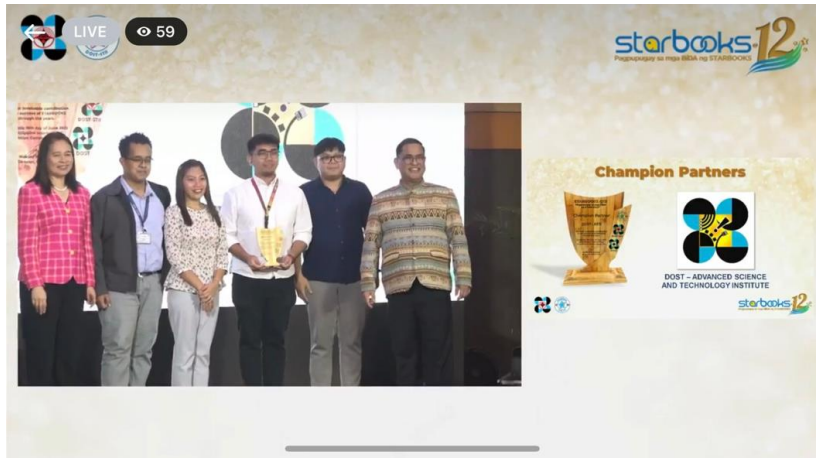
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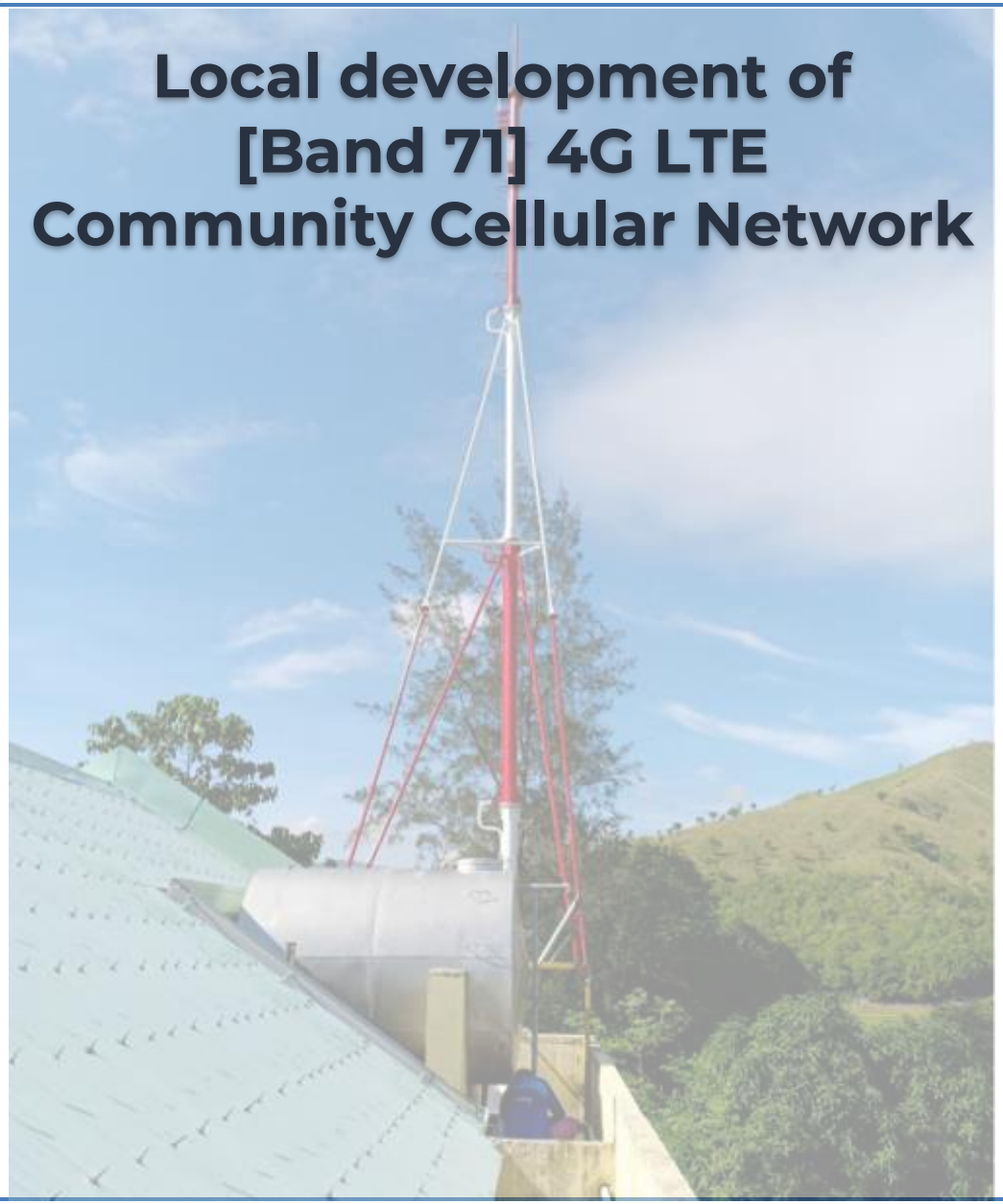
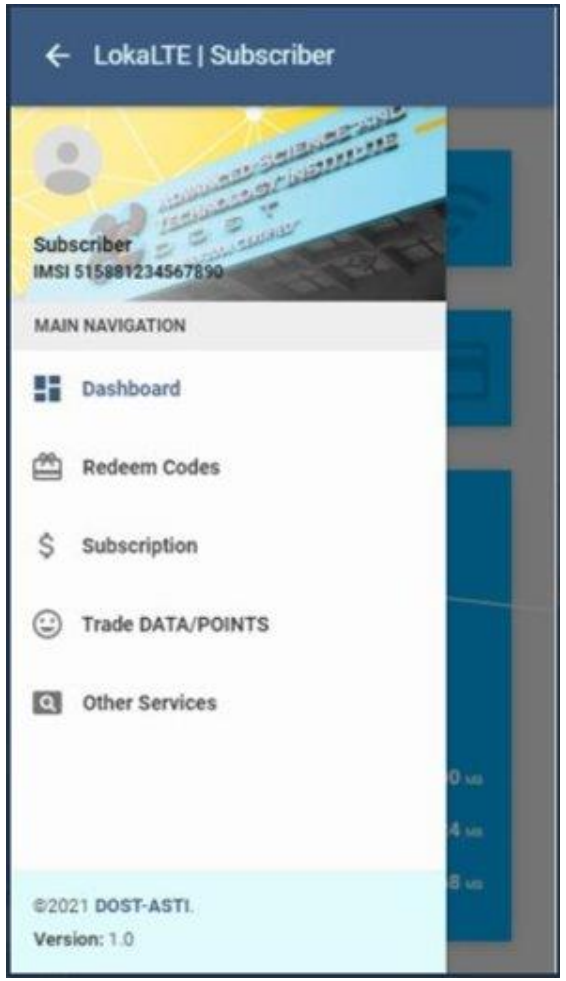
OUTPUT

Local development of [Band 71] 4G LTE Community Cellular Network

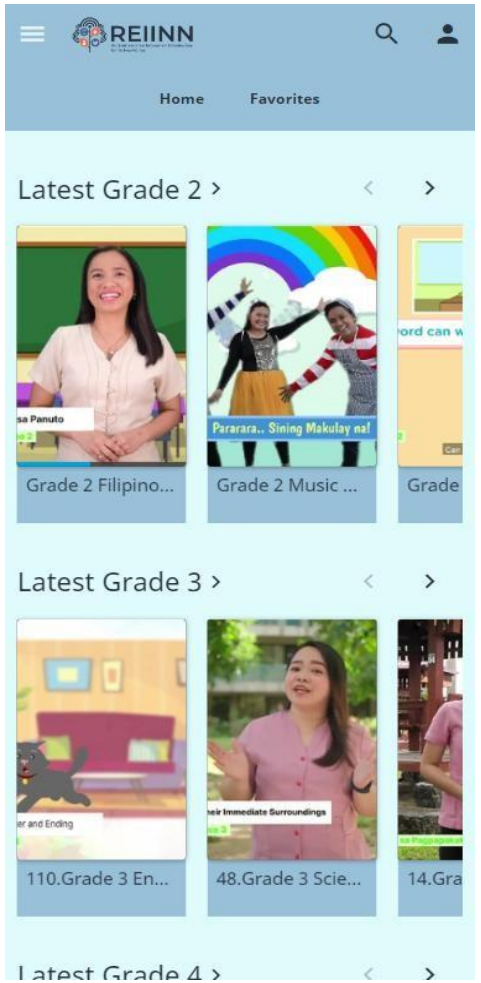


LokaLTE Portal



A billing management system for LokaLTE network

LokalFlix



A web page/application where students can watch educational videos

Long-term Output

1. **Promotion** and **implementation** of relevant **policies governing Community Cellular Networks** in the Philippines, including regulatory and operational framework, and spectrum allocation and management, that improve the state of connectivity of unserved and underserved areas in the Philippines.

2. **Upliftment** of **socio-economic conditions** in rural areas in the Philippines through timely availability of information that supports education, resilience, livelihood, and a better quality of life.

3. **Empowerment of communities** through social entrepreneurship opportunities such as through community cellular networks.

4. **Better appreciation** among Filipinos of the essential role of **technology** and **science-based interventions** in nation-building in general.

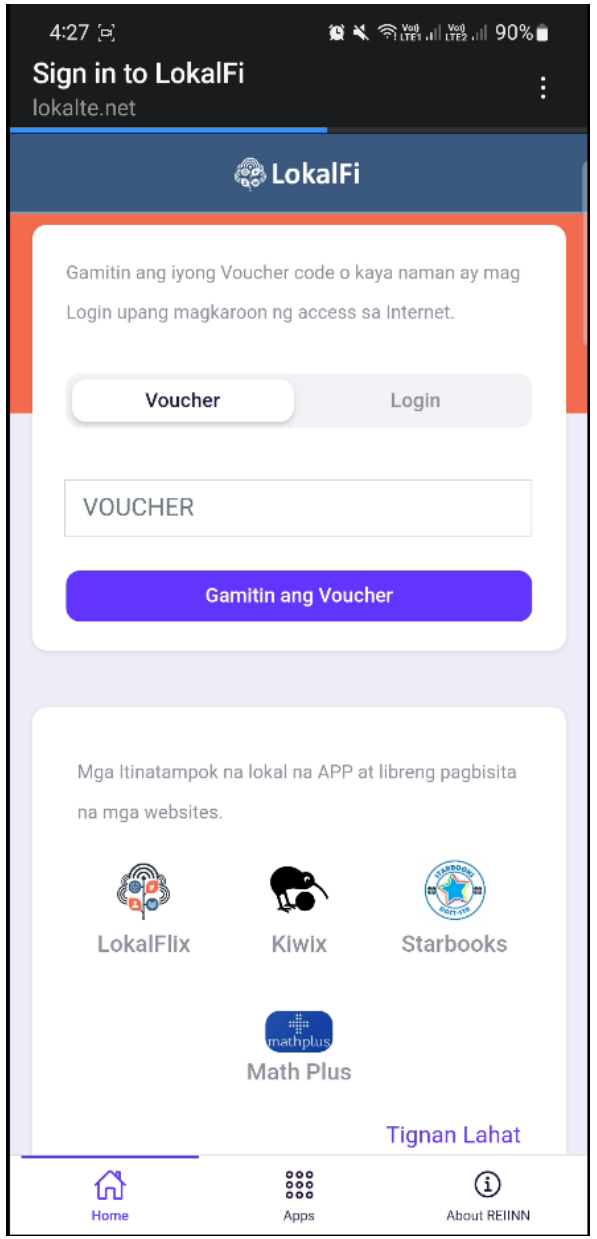
WHERE WE ARE NOW

The permit to operate in the 600-MHz Band for LokaLTE Community Cellular Network has not been granted yet.

Alternative Solution:

LokalFi

A low-cost, long-range WiFi network deployed to provide alternative internet access to target schools.



CONCLUSION

- ✓ LokaLTE is an intervention of Project REIINN that aims to bridge the digital gap by developing and deploying local LTE Community Cellular Networks in unserved and underserved areas in the Philippines
- ✓ LokaLTE operates in 600 MHz band to repurpose frequency spectrum due to the shift from analog to digital TV
- ✓ LokaLTE provides educational materials through LokalFlix and other free web apps to aid in the remote learning of students

Future Plans:

1. Explore bandwidth optimization solutions
2. Design a single-board (PCB) RF Front-End
3. Reconfigure locally cached content depending on the specific needs of the community
4. Process the permit to operate at 600 MHz

Thank you.

Contact us:

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