GAIA WG Notes IETF105
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Slides: https://datatracker.ietf.org/meeting/106/session/gaia
Note takers: Esther Jang, Matt Johnson
Introduction: Jane Coffin, co-chair

Talks:

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Connecting Remote Community Networks to an IXP
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Presenter: Dr. Kanchana Kanchanasut, intERLab, AIT (Thailand)
Other authors: Kanchana, Weshsuwannarugs, Samadi, Kongjue, Sribuddee,Tripatana, and Sriprasert
Works for a company running community IXP
TakNet (Tak province), villages in Mae Kasa 60 km from Mae Taan
Thai Samakhee- first TakNet village, NW Thailand, pop. 300; $33/mo for subscription, <10 w/ Internet at home
Now with 21 mesh network sites, $8/mo, mesh network now has >1000 users (map on slides)
Net2Home: community ISP (Type 1- can't have own infrastructure, only sell internet access), because had to legally register as a business. anyone in community can be shareholder. Western border of TakNet only so far.
Goal: CNs sharing common resources/services, exchange content amongst themselves. (complicated b/c each community chooses their own backhaul provider, and these backhaul providers may not interconnect or cooperate with each other)
Want to have a common ecosystem for interconnections, want a common IXP to prevent unnecessary routing outside of country and understand failures
For CNs to handle high bandwidth applications such as streaming, video, etc.: need proxy and cache servers, local applications

Don't own infrastructure, so how can they implement these services?
Distribute proxy and cache hardware at each CN, then tunnel to Net2Home (N2H)-- allows to be big enough to work with international CDNs, also local content providers, big enough to handle BGP relationships with other ISPs
"Community IXPs":
-international CDN and also local CDNs, also member and non-member ISPs
IP tunneling between CNs and N2H border router, connected in Community IXP
-"BKNIX" established 2015, 29 ASNs, 39 Gbps peak and 12.5 avg

Now working on content delivery, how to cache popular content and reverse proxy to gather content from villages and promote local content across CNs, local service platform for resource sharing (name in Thai script, see slides)

Ack: THNIC foundation, intERLab AIT, Net2Home, BKNIX, TakNet members

Questions:

Kurtis Heimerl UW
Q: Curious about caching at the CN level, what are you using for that?
A: Currently have not decided, are trying a bunch of different things. Talk more later.

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LoRaWAN & The Things Network (TTN): A Global IoT Community Network

Presenter: Jonathan Brewer

Jane: This is a real thing, and being deployed in a lot of CNs around the world right now

Offers equivalent of a controller for LoRa mobile networks.

LoRa: PHY radio protocol for IOT, operates in sub-GHz ISM bands
Proprietary to Semtech, designed for long range, low power, low data rate
(Speaker: I'm from NZ, living in Singapore now)
Kanchana's network- 10s of Mbps, backhaul is 200s of Mbps, these LoRa networks are like 1 Kbps or less
LoRaWAN- wireless network for IOT, open non-proprietary, adds addressing, mobility, localization to LoRa
- nodes send out message, can be picked up by any other node that can fwd, base stations can do de-duplication, routes back more messages to nodes through nearest basestation
- network and application encryption
- Also does adaptive data rate and scheduling
- A network operator doesn't see the application data by design, doesn't have keys.
LoRAWAN architecture is LoRA -> Gateway -> Backhaul -> Network Server -> Applications on server
-Applications are running on same computer as network server

-Based on RFC 8376
LoRa client device (mote): always communicates with gateways (not other motes), has DevEUI global unique identifier, DevAddr network-unique identifier.
Classes of devices: Class A (low power, ALOHA based, transmissions always initiated by end device, time slot set up for gateway response which it tells the device when to wake up again), Class B (deterministic, listens on a schedule, less low power), Class C (Class A transmission plus active listening for network messages, not low power)

Gateways:
A radio on the infrastructure side, also called a basestation or concentrator
Communicate with the network server via TCP/IP, can coexist on multi-protocol base stations, can even have multiple instances on the same box

The Network Server: terminates the MAC layer, even though there's TCP/IP in between!
-center of star topology, devices which gateway talks to which end device
Examples of network server: TTN, Ubidots, LorIOT, ResIOT, recommends The Things Network now

Join Server: (see slides)

Uplink message: communications from node to server/application
Downlink Message: communications from server or application

Application:
Code running on end device, AND behind the server. Keys that tie both of these together
Individual devices probably only talk to one application server, applications do device management and access control
Can offer an API and route to external applications (Pick your favorite web api style)

Encryption: all payloads encrypted, have sequence numbers (antireplay), and have data integrity

(checksums), MAC commands encrypted so hard to see messages above noise floor

Pre-joined devices: end devices must have 2 symmetric session keys- network session key (NwkSKey) and application session key (AppSKey)
Over the Air Join: NwkSKey and AppKey (diff from AppSKey) unique to end device

SO! What is the things network (TTN)...
It's a free, open source distributed network controller built out of the Netherlands
Allow for community LoRAWAN networks-- anyone who wants to connect can do it, and can generate their own applications that run on top of existing networks.
Web platform allows gateway owners to provide coverage
Can use someone else's gateway! People can provide a gateway too.
TTN webpage allows community to connect together via some chat platform (eg LinkedIn pages in Singapore, Telegram chat group in Chile)
TTN has integrations for cloud applications- myDevices, OpenSensors.io, IFTTT(If this then that, many LoRaWAN & TTN devices available

Questions:
Q: Speaker (M.J. Montpetit) I work in northern Quebec, have people thought about how to reach places that will not be served by traditional broadband networks
A: This is a group of communities, not a service. Entry is buying a gateway, need very little backhaul (kbps)
Q: Thinking about using credit unions/banks as hubs
A: That would be great!

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Optical fiber as a commons in the neighborhood of Viladordis
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Presenter (remote): Francisco del Aguila - Guifibages & UPC
Village of Viladordis, 300 inhabitants, also scattered households, low bandwidth ADSL backhaul
-2010, community wireless network, community maintenance in associative way- person with tech expertise had maintenance; initial contribution 35 euros for connection + maintenance.
-200 euros for private equipment
-finally supported 35 homes
- 40 euro/month monthly cost, also created a reserve fund to handle expansion and repair with excess collected revenue
-45000 euros to connect to fiber network 10 km away; needed connect to fiber backbone, and also wanted fiber to individual homes.

Financing the network:
Contribution from each home to build fiber to wireless node. see slides for detailed budget.
Needed 50 homes to build the project, did a survey to get commitments, got to ~50 with 5k euro total commitment
5K euros matched by Guifibages Assoc.

Collecting funds: over 2 yrs 600 Euros collected via donation, 150 Euros per person.
Some households contribute different amounts, diff options: F2Node vs FTTH. between 100 and 300 Euros per year
2018- contracted fiber installer, next year installation carried out. over next year 10 more households will be connected.
See slides for table of final income/expenditures
There is a surplus in gathered finances to extend fiber to other locations in the future (61k raised, vs capex

of 53k for the build in current state)

See slides for map of deployment. The network is connected to the main backbone, 12 fibers per cable cables used
Running from top to bottom is the main backbone.
Branch lines visible at top right and bottom left to cities

Nowadays in the maintenance stage, commitment for repairing with installers
Members make a donation of 6 euros for maintenance in the future (OPEX of the network)
-15 euros per month total fee per user with Guifibages as operator
Connect via regional fiber backbone to wholesale regional fiber network, managed by guifi.net

Conclusion: possible to have rural broadband w/out traditional operators.
Tax deductions help with motivation and decrease the cost substantially
Initiative is possible because of the guifi.net project and the present of other actors such as the Guifinet foundation (guifibages association)
The final existence of this network promotes others to join later

Questions:
Q: One in chat about the traffic, capacity

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Community Cellular Networks in the Philippines: Experiences from the VBTS Project

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Presenter: Maria Theresa (Mia) Perez, University of the Philippines Diliman

Outline: CCNs in the Philippines, deployments, sustainability challenges, future of CCNs
-GSMA (2018)- 64% of Philippines pop has broadband

Particularly true in rural and remote areas
Lack of power and remoteness leads to non-profitability
-most barangays lack grid power

Partners with telcos to deploy community cellular networks
- customized for the community, flexible power, managed and operated locally
- alternative source of power (solar), 10th of the cost of traditional deployments
- VSAT backhaul, cloud management of basestations

Pre-deployment challenges: 2 years of negotiations with telco partners for frequency bands, 80-20 revenue share; regulatory requirements- telco partner had to manage all certifications, could not deploy own built equipment because not type certified.
-7 deployed sites in an RCT framework

Sites are remote (2-3 hours travel) from nearest available mobile network, Aurora Province
Local government uses HF radio for emergency comms

Timeline of deployments:
Sept 2017-Jan 2019

Status: 7 community sites, 2000+ subscribers, 2 yr operation, 10k+ voice min and 2000+ sms per month
SMS is predominant traffic, equal volume both directions

-"call-me" behavior to our rural networks, 6x inbound as outbound
-peak usage in evening
-no "promos" or special offer data/voice bundles so far- only flat rate

Have noticed that people demand data access as time goes on, also become increasingly reliant on the service and more annoyed with service disruptions over time

Sustainability challenges:
Regulatory- nearing end of agreement with telco partner, need permits to purchase and operate. also, backhaul (VSAT) opex is very high.
Service perceptions and expectations are tougher-- the project is now being compared to the incumbent MNOs
Personnel retention on the ground is hard, brain drain as they train repair people who are able to move to more lucrative livelihoods

Future options:
Cellular data or LTE
would have a high dependency on regulations still
Need policy revisions such as "social use frequency"

Or an Internet only network:
- Last mile internet costs are still super high, satellite, etc.
- Want to explore efficient bandwidth use options

Questions:
Q: Mallory Knodel - Can you give us a sense of where you are at in the policy process in the Phillippines?
A: Don't have policy draft yet, not shared publicly.

Q: Jane - In Mexico they have a social purpose license, which allowed the network to exist. Traditional operators can't get ROI, but CN's can't get the license, is a weird place we're stuck in currently. A modest proposal that governments change licensing- require big operators to give backhaul to smaller ones.

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ID: Village & Rural Internet
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Presenter: Onno W. Purbo

Indonesia, 50% of the population is in the village, lots of community networks but licensing is not easy, need policy change

Hoping for International Acknowledgement that creates pressure on the government to reform

Top down approaches: MPLK margkak, $60 million, did not work
Community initiatives:
Wajanbolic- type of antenna that is Indonesian style- locally constructed using a (wok-like) wajan; Parabolic antenna built with local materials for community networks

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Developing the Rural Internet for Pemalang Society (Some trouble with the slides, eventually displayed from a phone)

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Presenter: Sumitro Aji Prabowo

Other authors: Onno W. Purbo, Bara Ramadhan A.- PUSPINDES

Onno: I am from Jakarta, these guys are actually from the villages (on the ground). While waiting for slides to load... To show how hard it was: In the past, WiFi was not free, $2000 per year for access pt from govt. From 2005, WiFi was liberated. Use antenna for long distance connection, not using cellular like Philippines yet (legally), but Kurtis (Heimerl) managed to run cellular network in Papua for 6-7 yrs and became an example for Indonesian govt.

In 2018 the govt signed an act saying we can experiment with any tech in rural areas for free. The office told us we can use any frequency! All thanks to Kurtis.

Pemalang Regency- 14 districts, 211 villages; many "blankspots" without signal coverage (mostly highlands)

- building internet access- tower in every village, we have a monitoring map through Ubiquiti network monitoring system

See slides for network map

-5 training activities in one year. Types of trainings:

-Network training: crimping cable, network maintenance and design

-Village map training: make maps with drone and other tools

-Village Information System Training: resource systems for the community; SIDEKEM- VIS created for Pemalang area

-Basic computer training- LibreOffice, discussing about open source applications

-"IT Jamboree": held once a year, ~300 participants per year

-Social Media, Website, Journalistic training

-IOT training: sensors, bluetooth, etc. Training is for free.

2018: received WSIS prize in Geneva, Switzerland

Questions:

Q: Kurtis:I am curious about the use cases for the IoT, what are the use cases, how did people use them?

A: Onno: TBH at the moment it's still in the early states, some takeup from junior high school group building a hydroponic farming system. I'd like to talk to Jon (LoRaWAN)

Q: Philip Martinez UP: Where do you get your backhaul connection to the Internet?

A: Onno: There is an internet exchange at the center, 110mbps backhaul from multiple ISPs, shared to the other villages, have local servers; unlike Kanchana who set up cache, we set up own streaming servers.

Closing: Jane:

These are real networks that are working and providing real service. Leandro is saying that in Vancouver at the next IETF we are going to talk about our next steps as a research group. We will be looking at the interface between CNs, IXPs, wholesale fiber networks, and other types of network (RANs, fiber, etc.)

Find more information on our website (gaia), join the list.