

UiO : Department of Technology Systems

University of Oslo

TEK5110

L4 Information Distribution - Internet Lite



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Current	Basic Internet Foundation, University Graduate Studies (UNIK), University of Oslo (UiO), Movation AS
Previous	MobileMonday, Telenor R&I, Telenor R&D
Education	Ruhr University Bochum



Maghsoud Morshedi

PhD Fellow at Eye Networks AS

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| Information Technology and Services

Current	Eye Networks AS
Previous	Høgskolen i Oslo og Akershus, State Organization for Registry of Deed & Property, Karaj Islamic Azad University
Education	University of Oslo (UiO)

Starting Point:

JOSEPH E. STIGLITZ

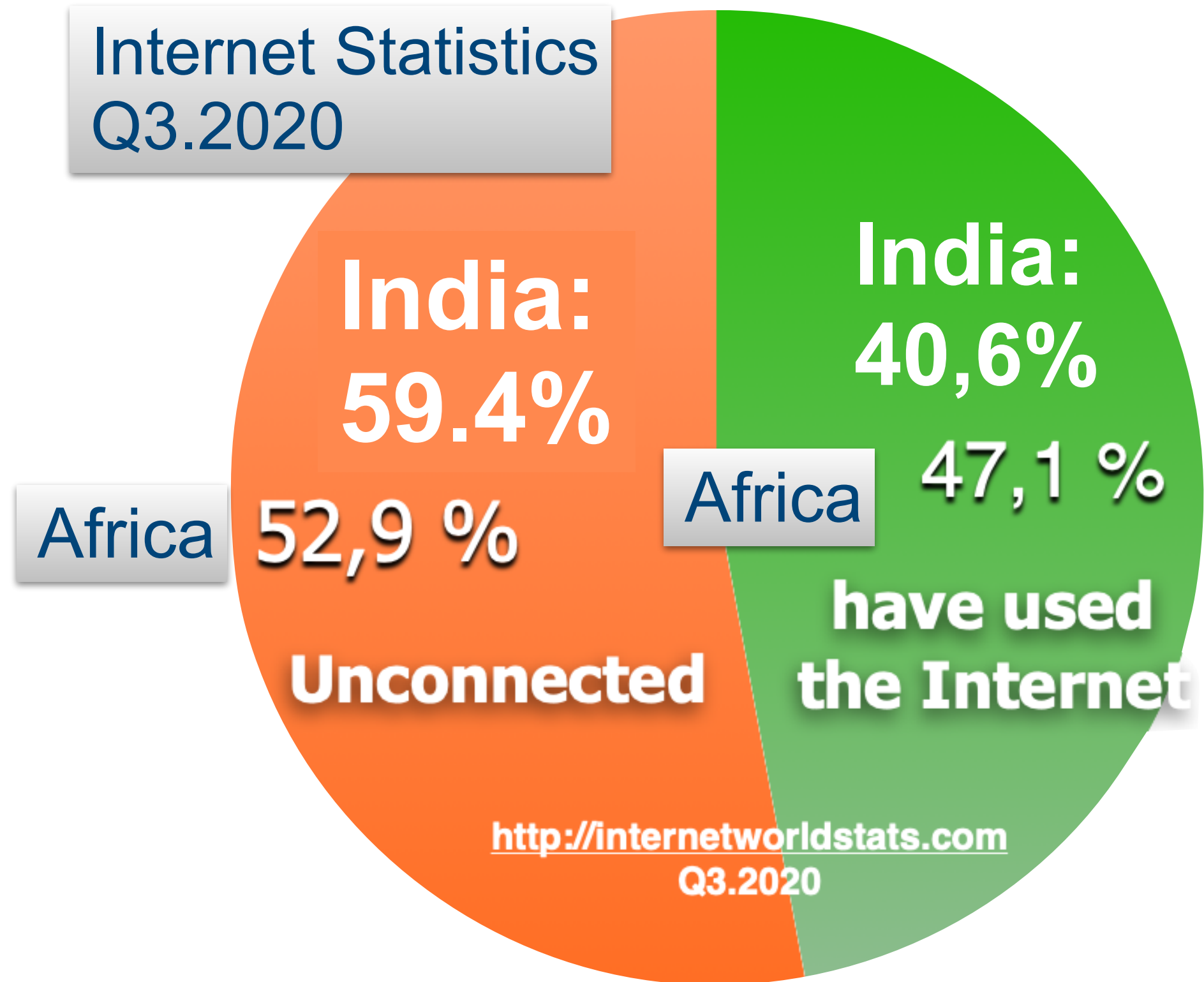
WINNER OF THE NOBEL PRIZE IN ECONOMICS



THE PRICE OF INEQUALITY

HOW TODAY'S DIVIDED SOCIETY
ENDANGERS OUR FUTURE

“Connect the >50% unconnected”



Reality on the ground

“There is no broadband in rural areas”
(in South of Sahara Africa - SSA)

Broadband = Mobile Broadband

TZ: 640 USD for 4 Mbit/s
GH: 600 USD for 5 Mbit/s
KE: 600 USD for 10 Mbit/s
“every single month”

The Buz model of operators / device manufacturer / mobile industry ...

ASIA INTERNET USE, POPULATION STATISTICS DATA AND FACEBOOK DATA - JUNE 30, 2020

ASIA	Population (2020 Est.)	Internet Users, (Year 2000)	Internet Users 31-MAY-2020	Penetration % Population	Users % Asia	Facebook 31-MAR-2020
<u>India</u>	1,380,004,385	5,000,000	560,000,000	40.6 %	24.3 %	251,000,000

United Nations Sustainable Development Goals

1 NO POVERTY 	2 ZERO HUNGER 	3 GOOD HEALTH AND WELL-BEING 	4 QUALITY EDUCATION 	5 GENDER EQUALITY 	6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY 	8 DECENT WORK AND ECONOMIC GROWTH 	9 INDUSTRY, INNOVATION AND INFRASTRUCTURE 	10 REDUCED INEQUALITIES 	11 SUSTAINABLE CITIES AND COMMUNITIES 	12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION 	14 LIFE BELOW WATER 	15 LIFE ON LAND 	16 PEACE AND JUSTICE STRONG INSTITUTIONS 	17 PARTNERSHIPS FOR THE GOALS 	 THE GLOBAL GOALS For Sustainable Development

Public Opinion on SDGs (afrobarometer.org)

→ Priorities by people in Africa

- decent work
- zero hunger
- good health
- ...

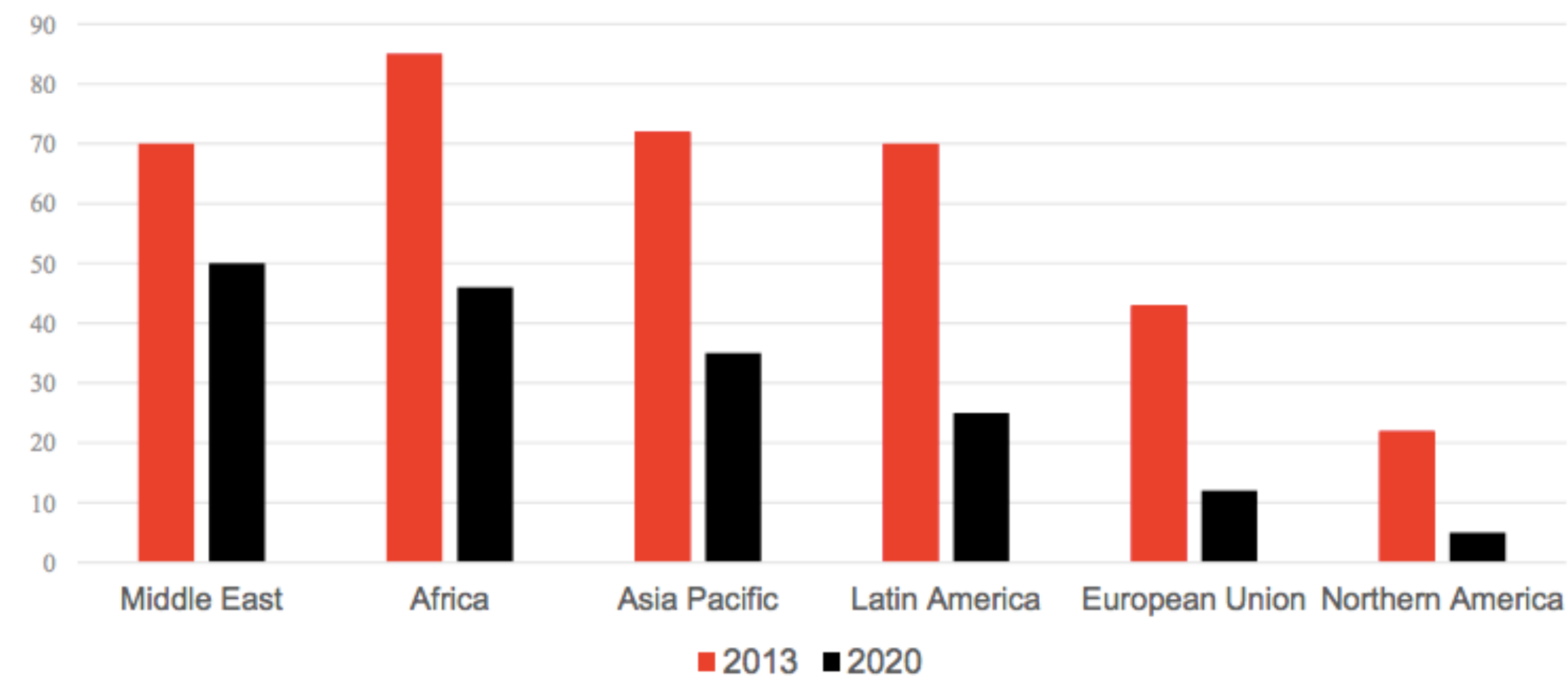


<https://blogs.worldbank.org/africacan/how-do-africans-priorities-align-with-the-sdgs-and-government-performance-new-results-from>

The challenge of area coverage

- Land area Norway, 385.178 km² - 7500 basestasjons
- <http://www.mynewsdesk.com/no/telenor/pressreleases/sjekk-naar-du-faar-4g-der-du-bor-1399662>
- Tanzania 947,303 km² = 3 x Norway,
- Mali 1.240.000 km² = 4 x Norway
- DR Congo 2.345.000 km² = 8 x Norway
- Economy in building Wireless Broadband
 - #5Gforall - *Discuss*

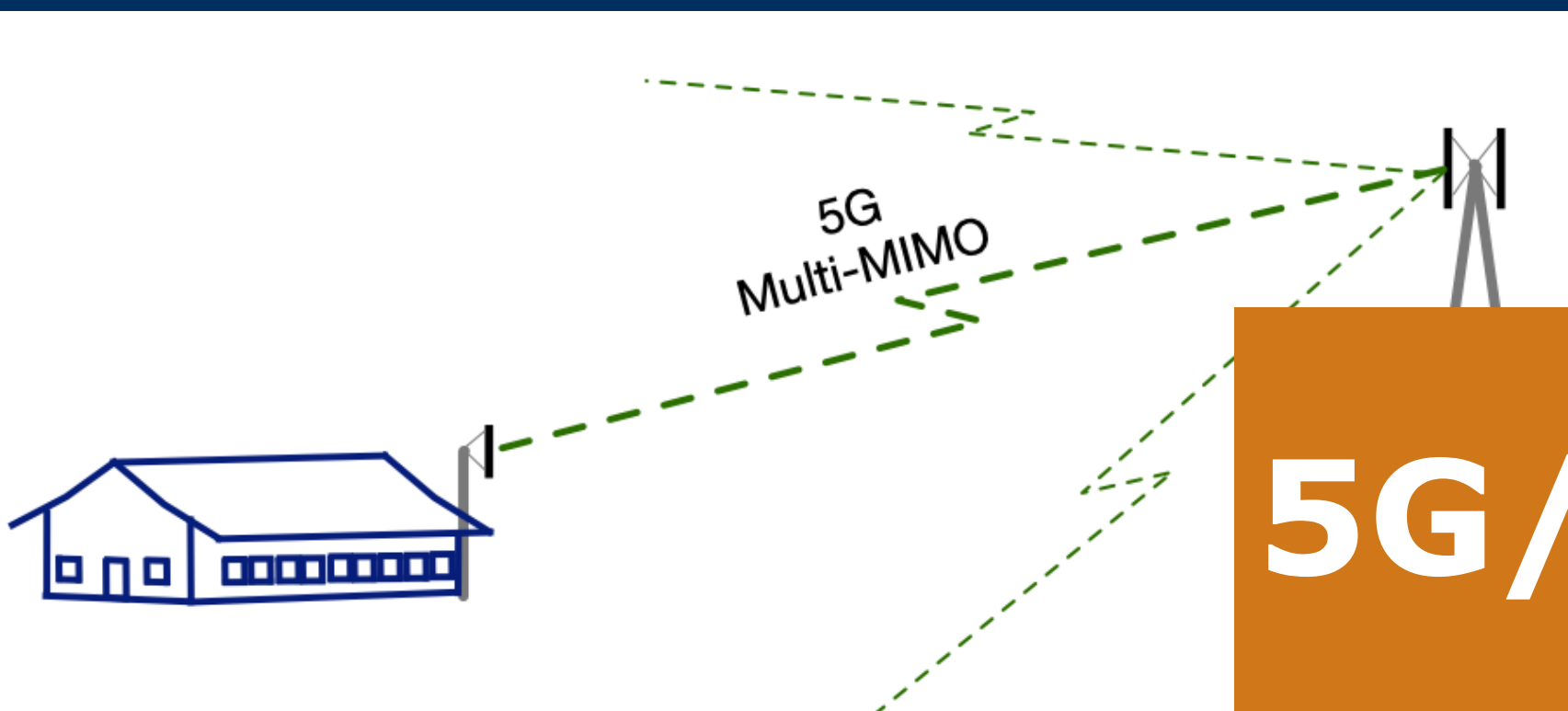
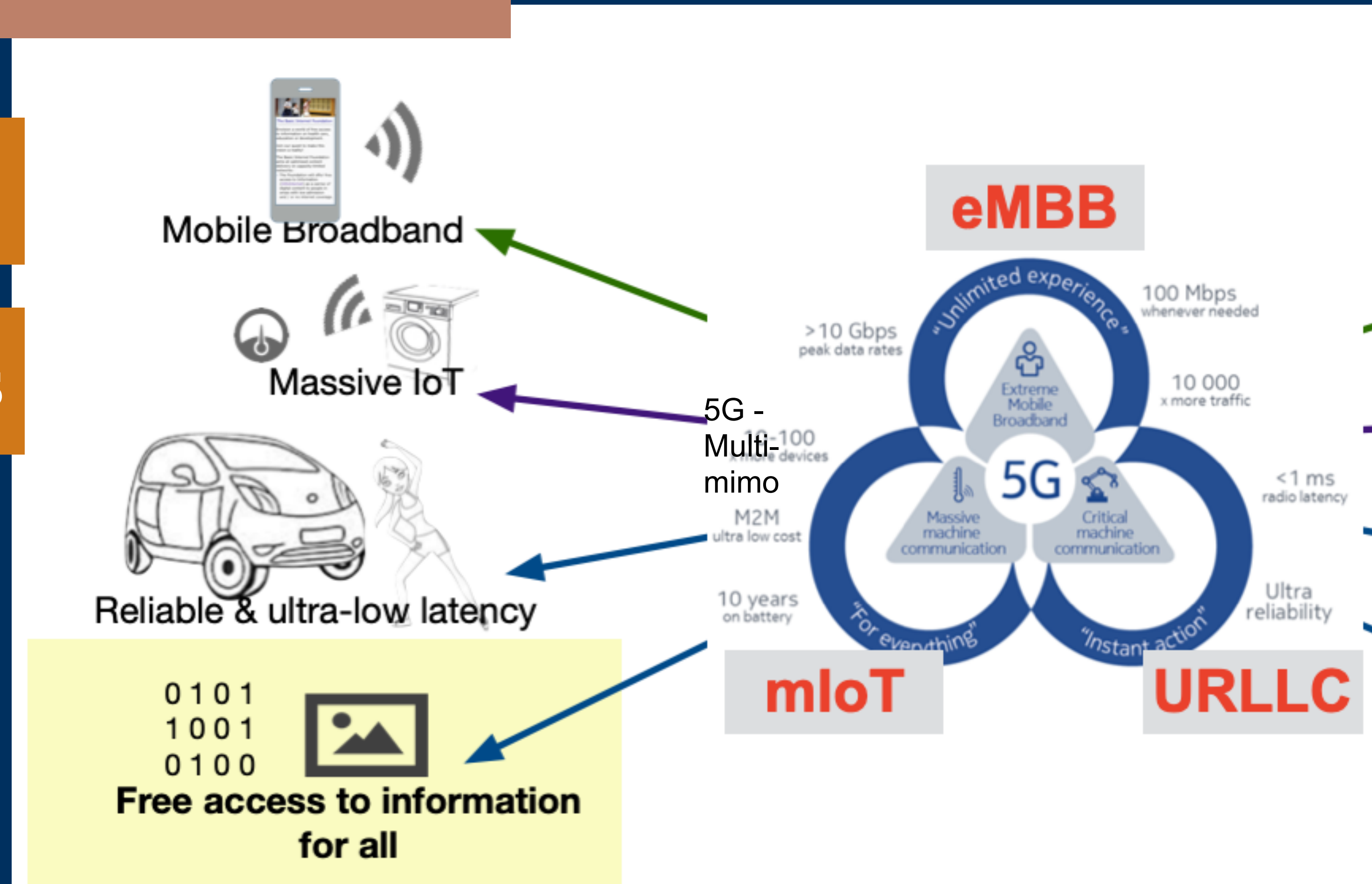
2G connections as a percentage of total connections



Paradigm Change (5G/6G)

Road model: pedestrians & cyclists

Internet: text & pictures



5G/6G for school/village connectivity

Providing Internet for All

- **Free access to Information** (Internet Lite)
 - 1) Access - one **Information Spot** per village
 - 2) Skills - Health, Education, Agriculture
 - 3) Regulations - Freemium model
 - 4) Inclusion -
Free access for all #LeaveNoOneBehind
- Internet Lite & **Freemium** model for access
 - **free access to National Knowledge Portal** for all
 - **premium** access to **broadband**
 - sustainable solution

+18 dB
>20 km

“Providing Internet to the basic of the pyramid isn't a question of affordability, but rather a question of sustainability”
Internet Governance Forum, Panel, WIN

At least
one Information Spot
per village

Operator model - tower

- Example: Digital Tanzania
 - ➔ Unconnected: 13 Million people in 4.000 villages



1 USD/month for Telecom

the village that got Internet:

<http://www.bistandsaktuelt.no/nyheter/2018/landsbyen--som-fikk-facebook/>



GSM + Wifi
➔ 200W
➔ MicroBTS

Cost: 70 kUS\$/village

What if?

1

- We adopt the model of the road?
 - free for pedestrians and cyclists // text & pictures
 - premium for cars // broadband

2

- We establish Digital Information Spots ("InfoSpots")
 - in every village
 - solar power, Wifi hot-spot, phone charger, light

3

- InfoSpot design and realisation
 - Health, Education, Agriculture, Digital,...

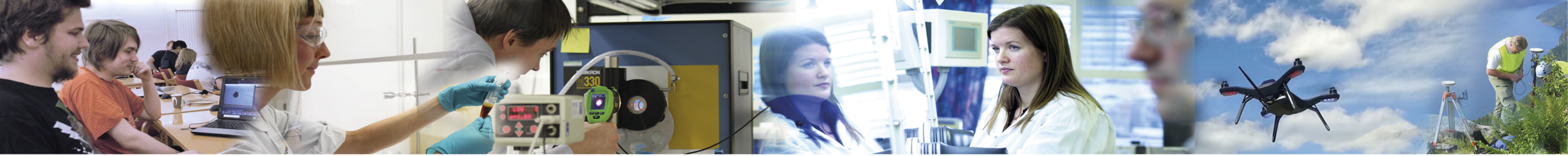
Internet Lite
free access to information



for every single human being

Discuss

- 1 - Freemium model
- Internet Lite
- 2 - 5G MIMO for village/school connectivity
- 3 - Decentralised Internet (InfoSpot)



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Internet Lite

the freemium model for access

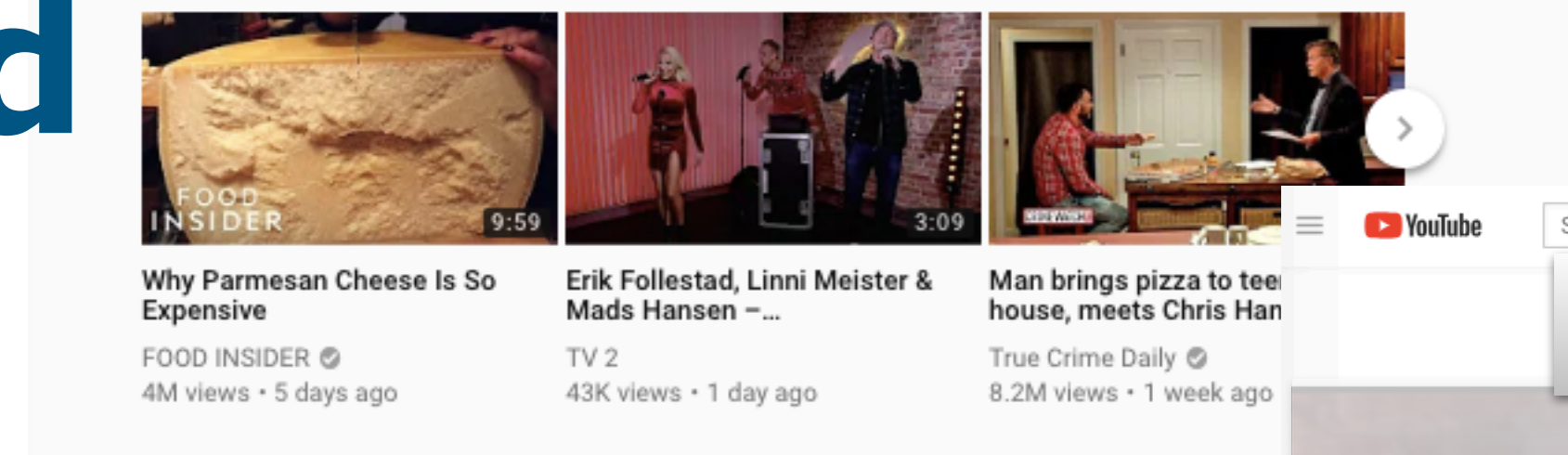


Internet Lite Standard

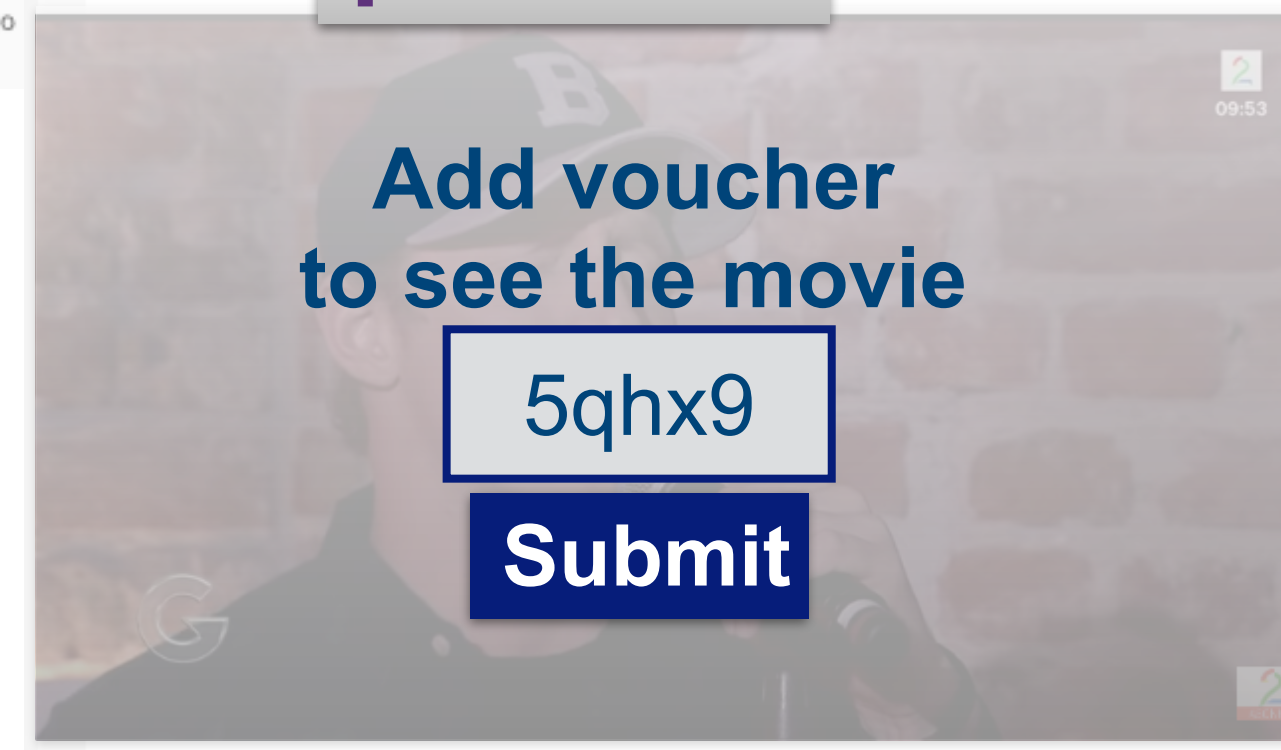
Konzept:

free

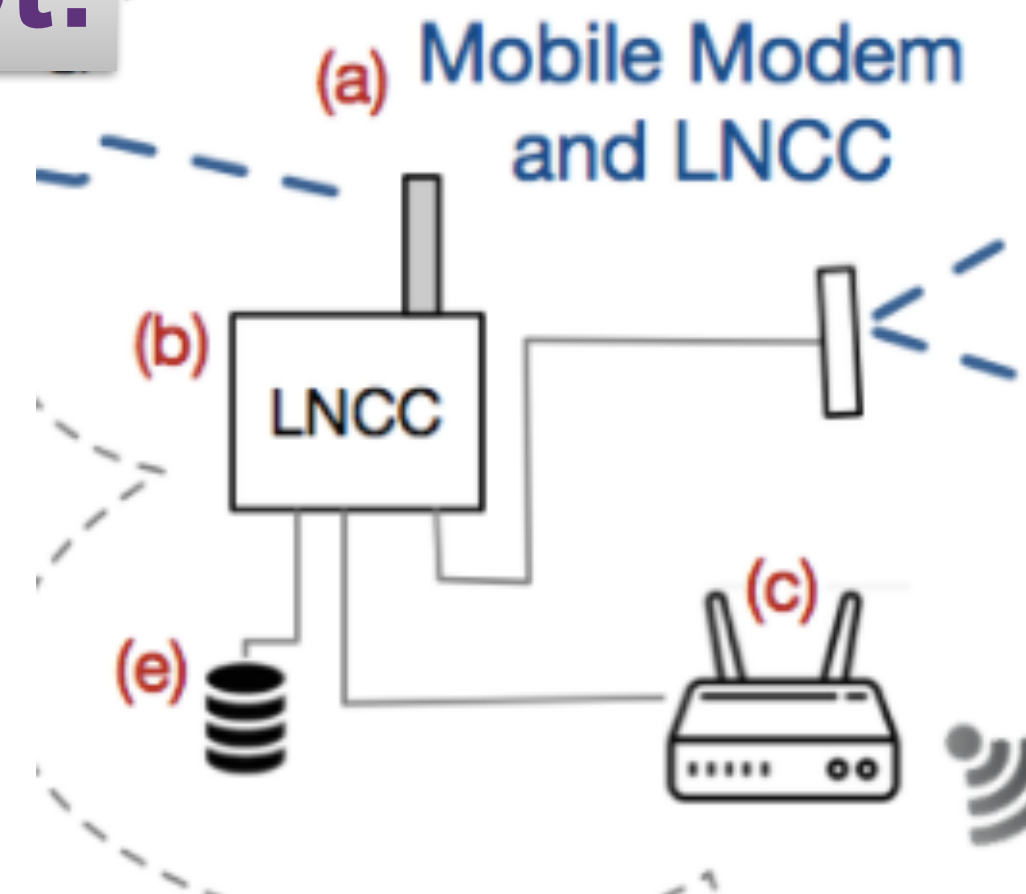
1



premium



Pilot:



Standard:



- Network responsiveness
- InfoInternet Standard development
 - **Konzept:** www-filtering
 - free: text & picture, premium: video
 - **Pilot:** www metadata & inspection
 - address, port & deep packet analysis
 - **Standard:** proxy & html5 standard,
 - <http://BasicInternet.org&standard=InfoInternet>



No magic, exist today.... Lightweight Protocols, e.g. AMP

<https://basicinternet.org/internet-lite-to-the-migoli-high-school/>

<https://basicinternet.org/internet-lite-to-the-migoli-high-school/amp/amp/>



Full Web experience

INTERNET LITE TO THE MIGOLI HIGH SCHOOL

By josef | 4 May 2019 | Uncategorized

The Migoli High School has 1271 pupils (Apr2019) and 35 full-time teachers. The high school is located about 3 km outside of Migoli in the Iringa district in Tanzania.

Migoli (Nyerere High School)



Basic Internet Found



Internet Lite - AMP experience

Internet Lite to the Migoli High School

josef

The Migoli High School has 1271 pupils (Apr2019) and 35 full-time teachers. The high school is located about 3 km outside of Migoli in the Iringa district in Tanzania.

Migoli (Nyerere High School)

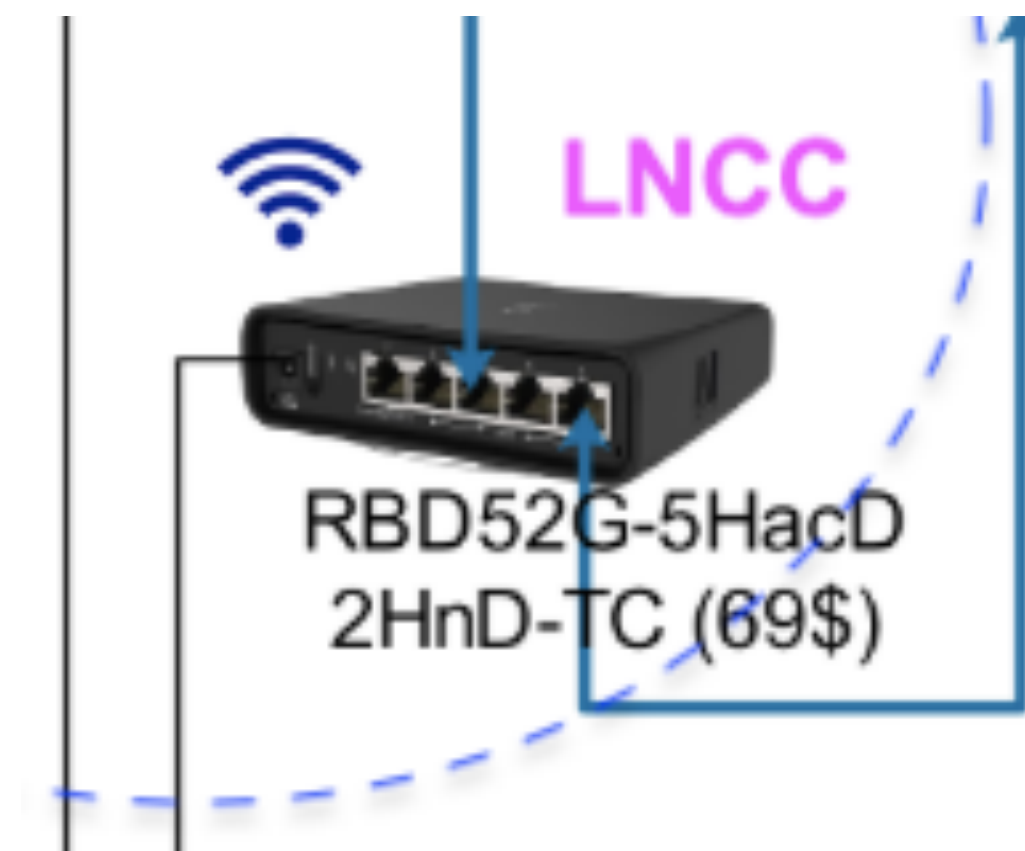


1271 pupils, 34 full-time teachers

Challenges:

Internet Lite - freemium model for access

- Standard: Internet Lite
 - AMP, other standards
- Realisation
 - local filtering on router (white/black-list)
 - Web page analyser (video yes/no)
 - DNS filter
 - Opera Mini concept





Technical details

https://nextcloud.basicinternet.org/index.php/apps/files?dir=/Mikrotik_config&openfile=17435

AMP DNS filtering for Internet Lite

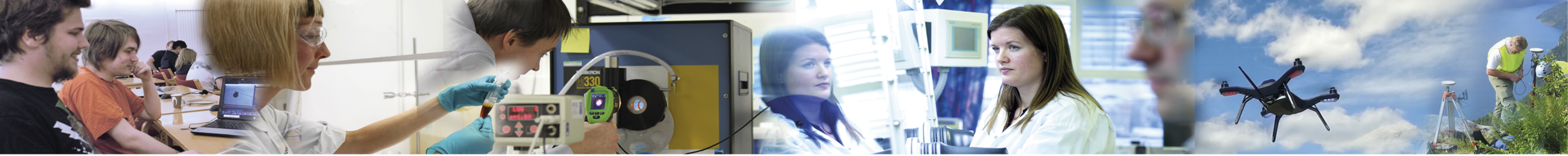
- if an amp page exists, by testing: <https://cdn.ampproject.org/c/s/BasicInternet.org/mission/> then a modified AMP URL will appear <https://basicinternet-org.cdn.ampproject.org/c/s/BasicInternet.org/mission/>
- if amp doesn't exist, e.t. <http://cdn.ampproject.org/c/s/NYTimes.com> then the return will be the ordinary NYtimes page
<https://www.nytimes.com>
- should the basis for a logic, either in the RPI, in the LNCC or in a DNS

Automatic configuration of the LNCC

- Public key from LNCC (to register on the Maincorerouter)
- Building the DNS for AMP filtering (allowing all AMP pages)
- Security analysis of Internet Lite

SMS-info communication with LTE antenna

- information for the end user to understand how much traffic is used (still available), typically done by SMS from the SIM "how much data"
- OTP, remaining capacity (GB left), MPesa based "another 10 GB" SMS 90838066 10 GB
- Can Mikrotik send an SMS? check...
- http post from LNCC to central administration



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2

School/Village connectivity

- infrastructure package
- access: 4G/5G MIMO

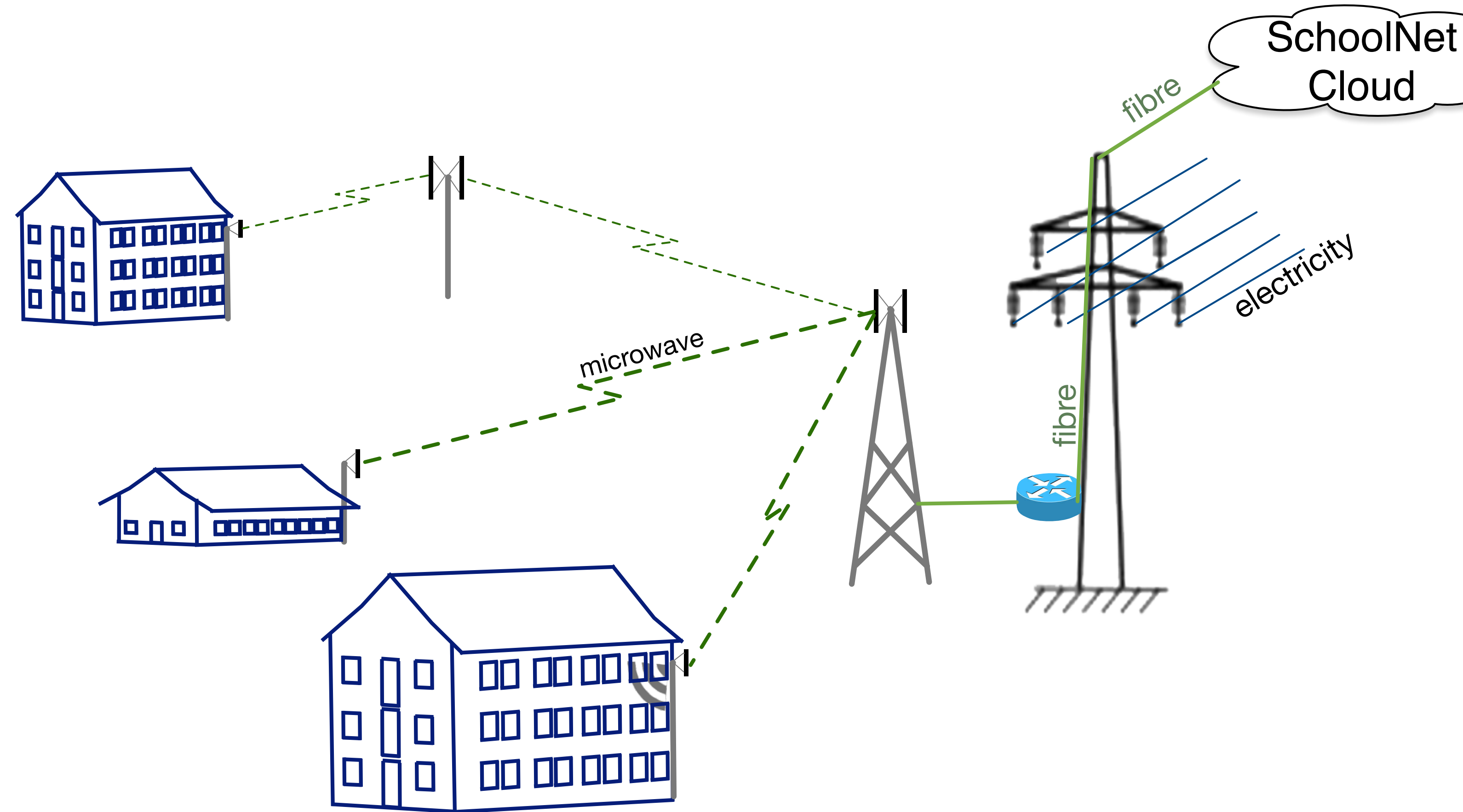


Governmental / Community model

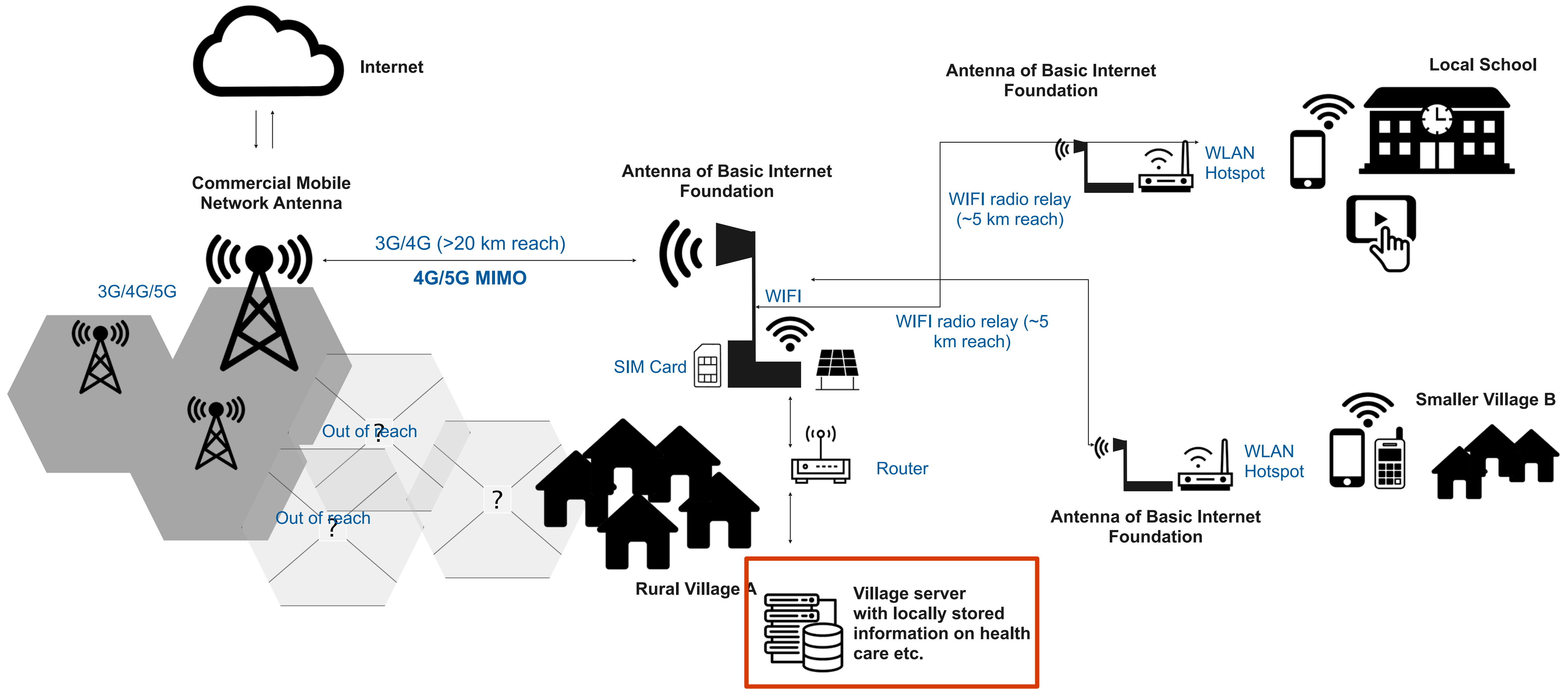
2



- SchoolNet distribution (Ethiopia)
 - educational network by Ministry of Education (MoE)
 - national fibre on high-voltage lines
 - fibre to microwave
- Microwave distribution
 - 0-5 km: point to multipoint
 - 5-15 km: point to point (mast)
 - >15 km: microwave relay mast
- Local school
 - receive microwave antenna
 - local Wifi distribution: local network controller & school server

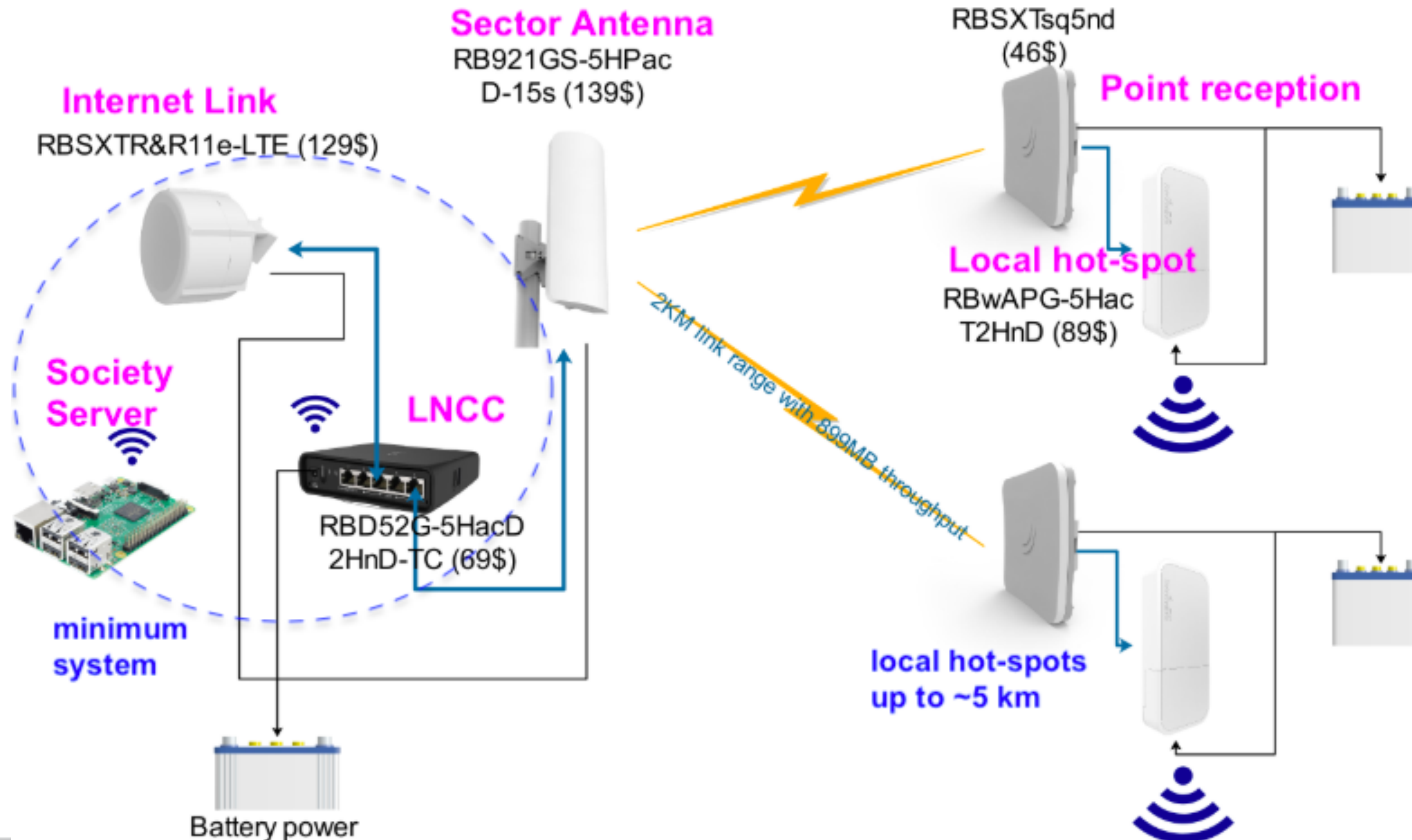


Set-up and Design – Connecting Rural Villages



Wireless infrastructure

<http://Solutions.BasicInternet.no>



“Connect the Unconnected” Selela Market Place



- Antenna in 6 m height
- Reaches Tigo tower > 20 km away

Digital Health Spot for 300 €

Creating digital access for the unconnected



Digital inclusion
The catalyst for sustainable development

300 € digital health hotspot
60.000 € connecting a village in TZ
250.000.000 € connecting all villages in TZ
89.000.000.000 € EU border control per year









 Digital society

 Agricultural and rural development

 Education

 Health

 Food, water and shelter

-  80 € Solar panel
-  50 € Hotspot
-  50 € Tablet
-  20 € Battery
-  30 € Regulator
-  20 € USB-charger
-  15 € LED light
-  20 € Materials

Challenges: School/Village connectivity

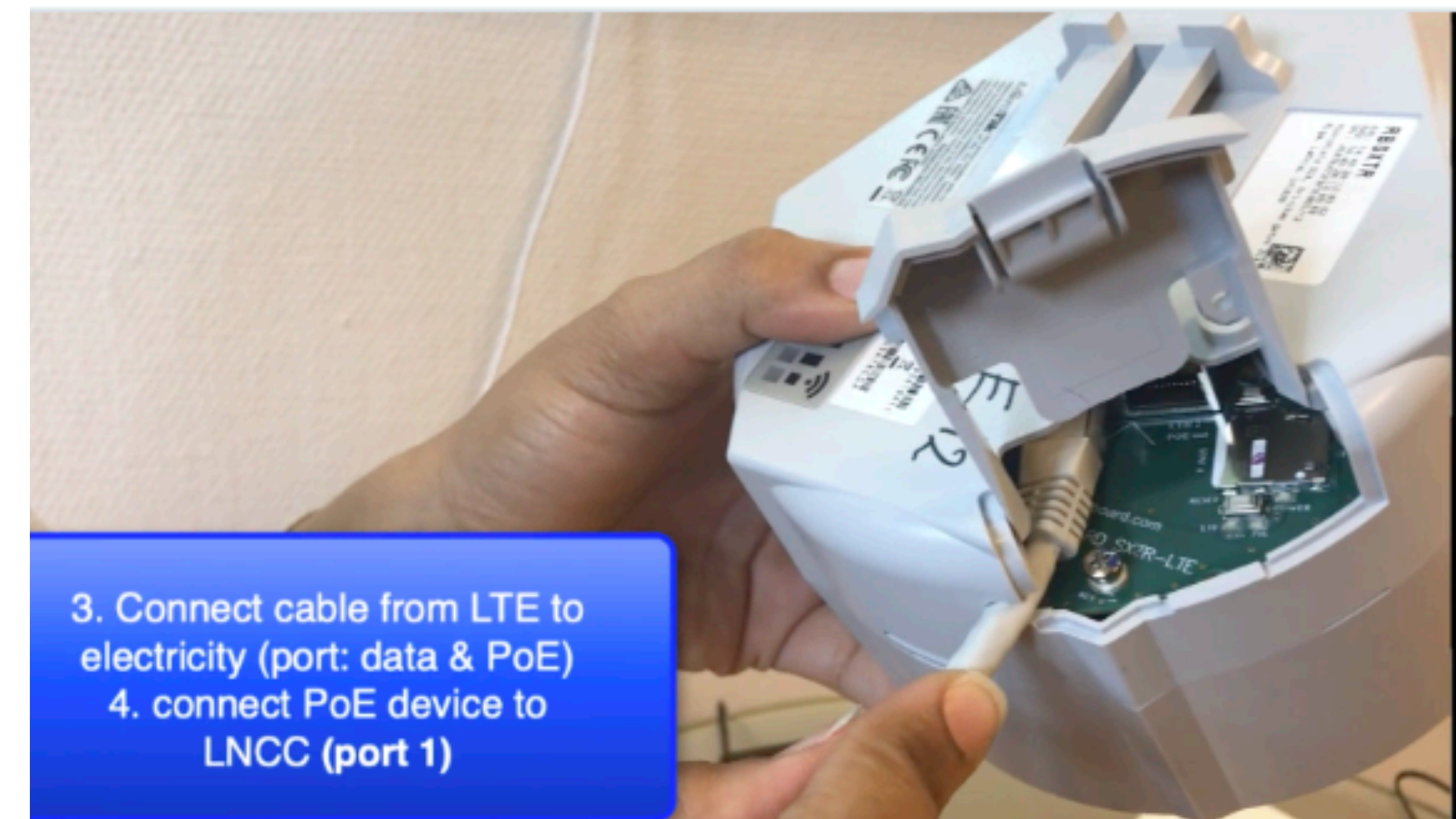
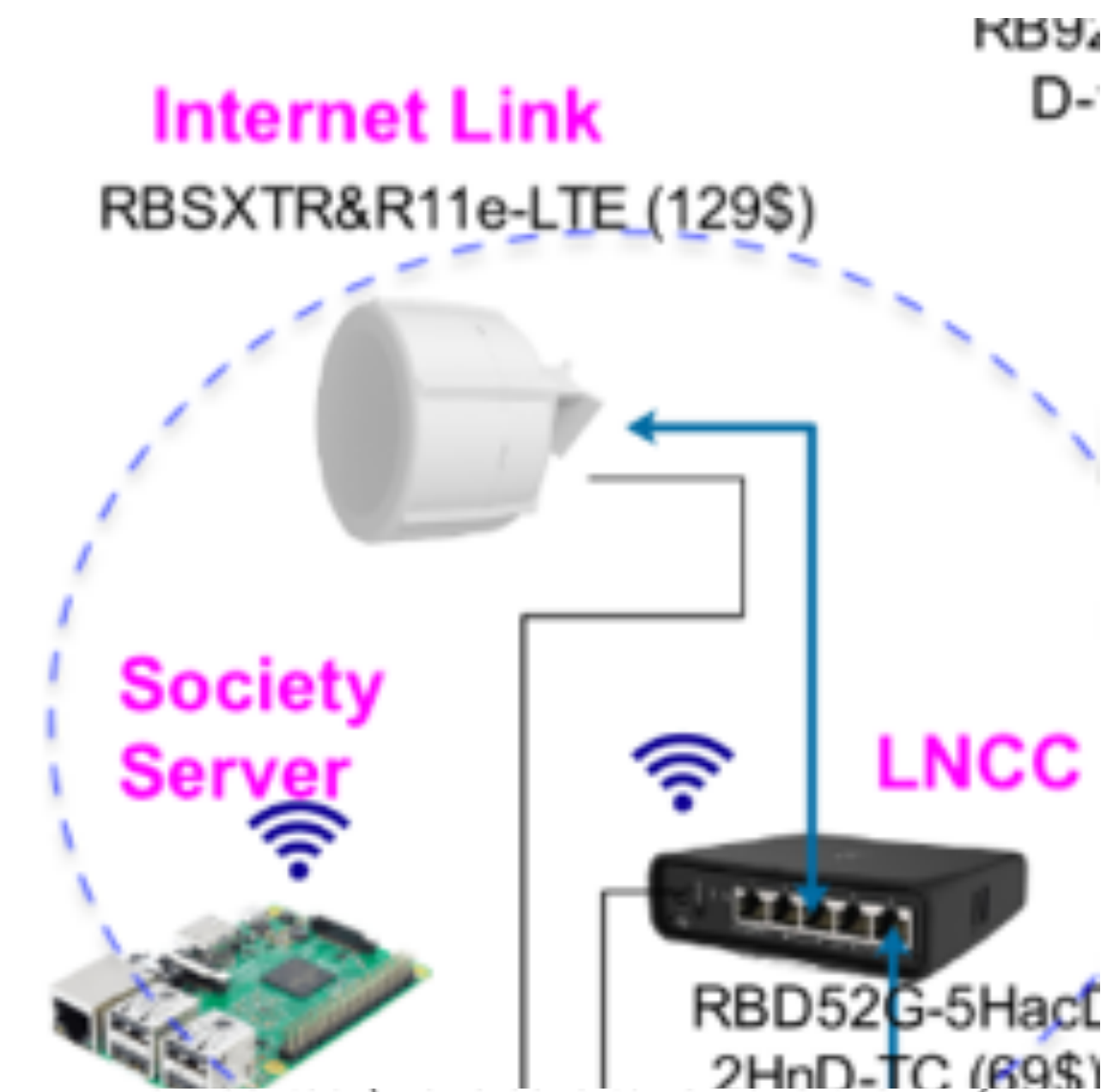
- 4G/5G MIMO
 - cell size
- Communication to LTE antenna
 - RPI or LNCC contact to LTE (GB used)
- LNCC scripts for reporting
 - communication with antenna on status
 - white list update
 - usage monitoring
- Monitoring of all Schools
 - Cabana server (monitoring.basicinternet.org)

SMS-info communication with LTE antenna

- information for the end user to understand how much traffic is used (still available), typically done by SMS from the SIM "how much data"
 - OTP, remaining capacity (GB left), MPesa based "another 10 GB" SMS 90838066 10 GB
 - Can Mikrotik send an SMS? check...
 - [http](#) post from LNCC to central administration
-
- Script for Whitelist update duplicates all the time (sometimes even an infinite loop) - CRLF challenge @Maghsoud? - see errors in some config files (needs further elaboration)

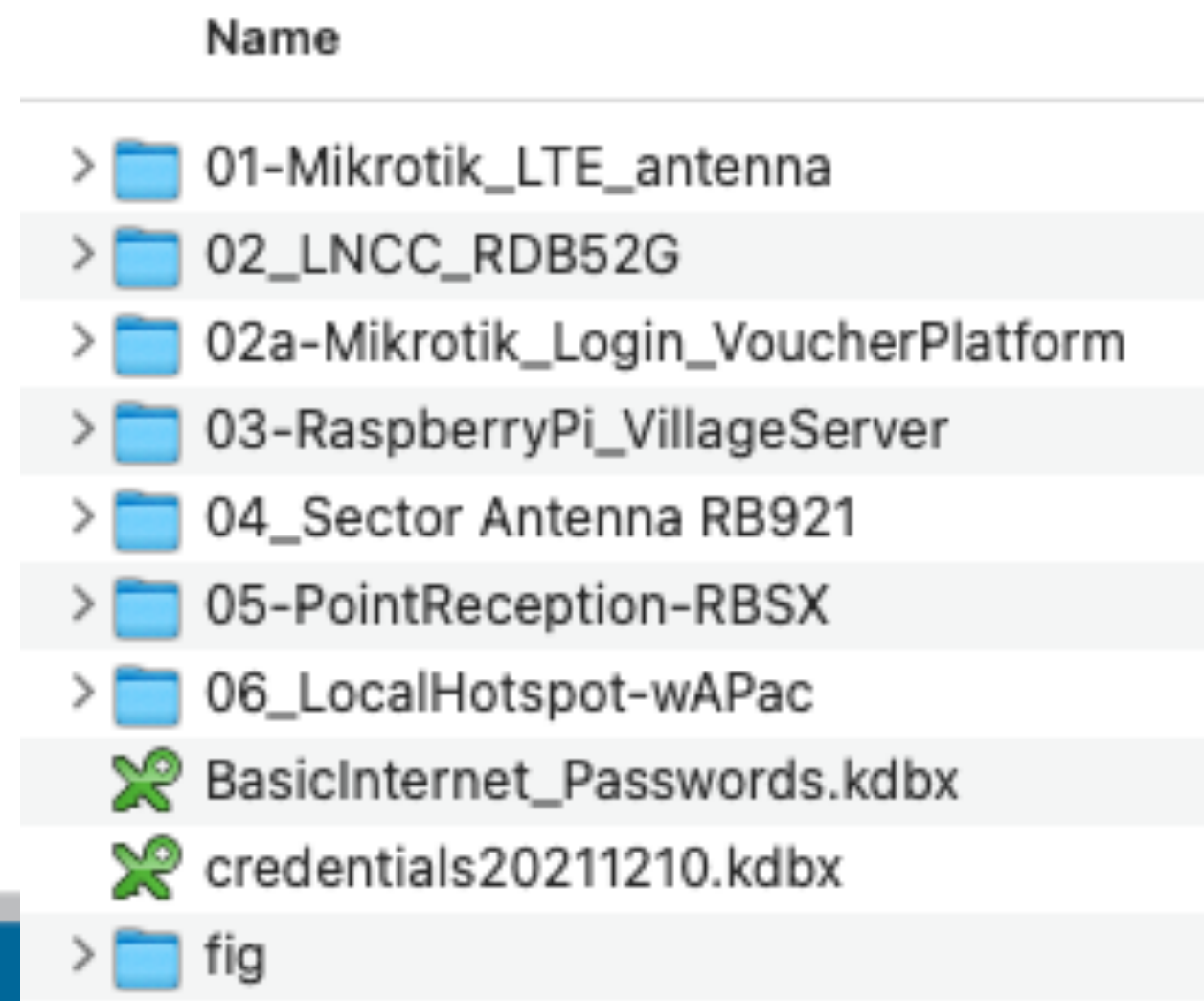
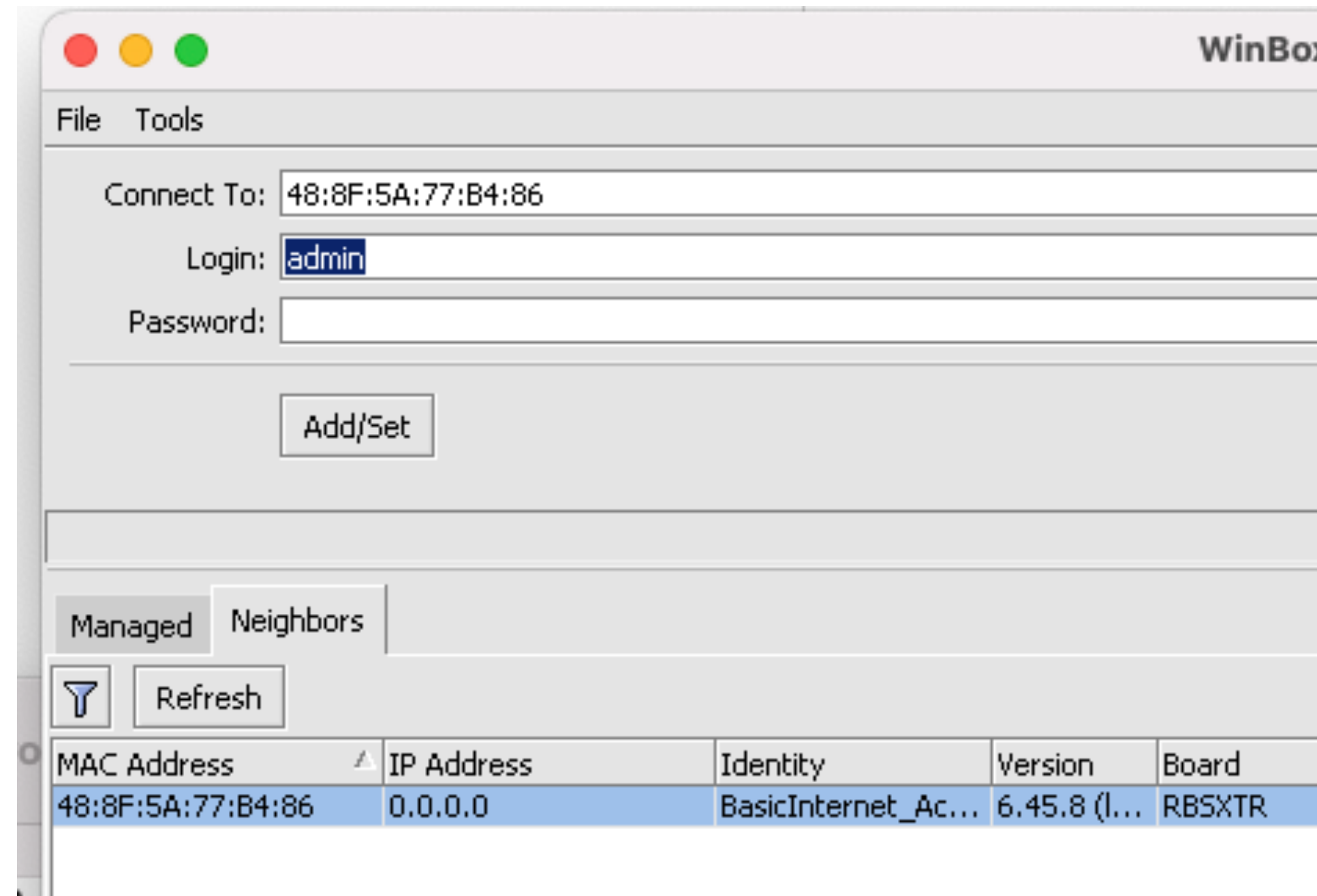
LTE antenna reporting

- ➔ Provides the 3G/4G Internet link
- allows communication with SIM card



Using Winbox to connect to LTE antenna

- ➔ nextcloud.basicinternet.org
- register (ask Josef/Maghsoud for member of config group)
- each device has an own directory
- ➔ see [Config.md](#) for configuration

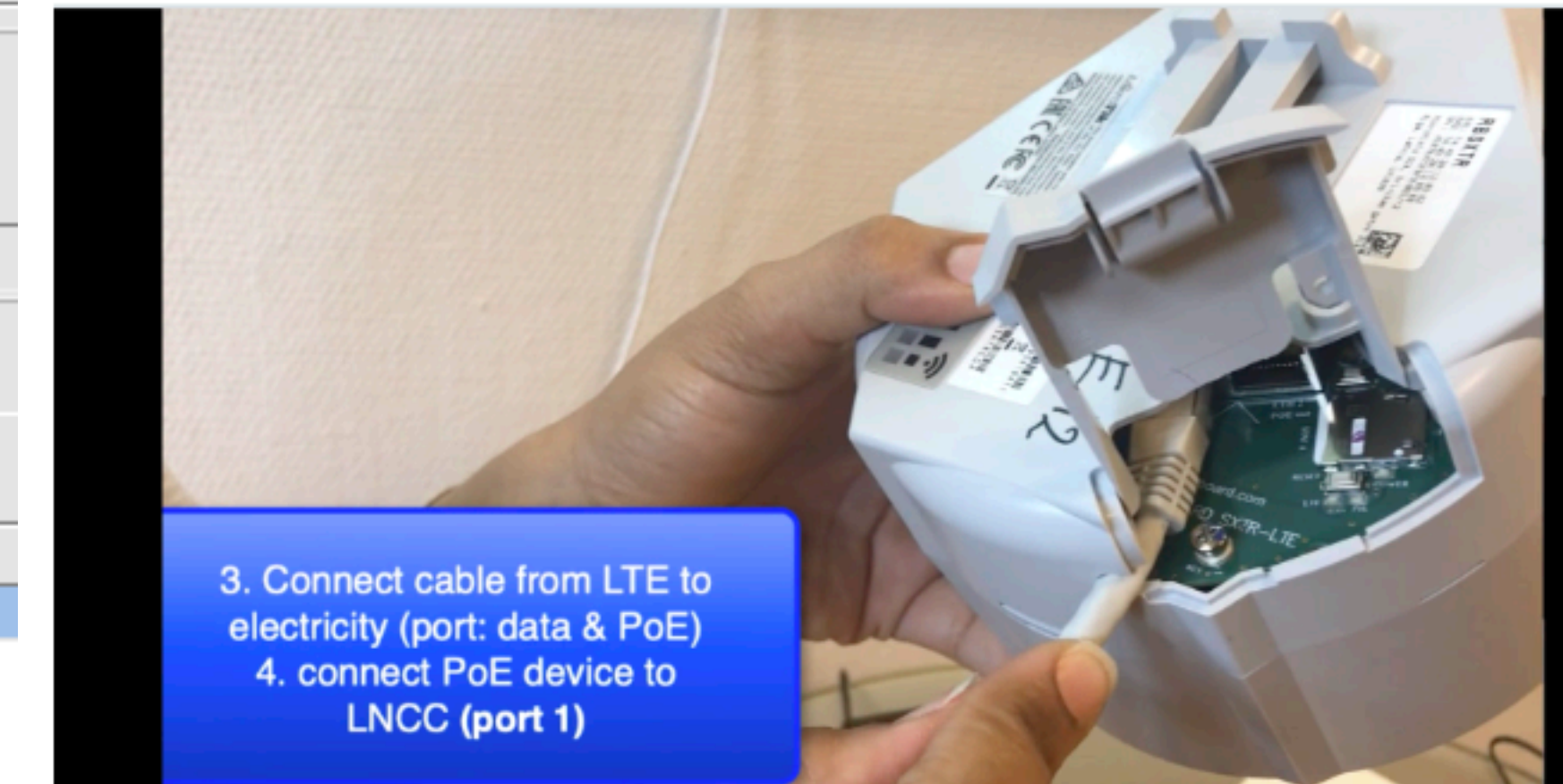


Readme for LTE antenna configuration

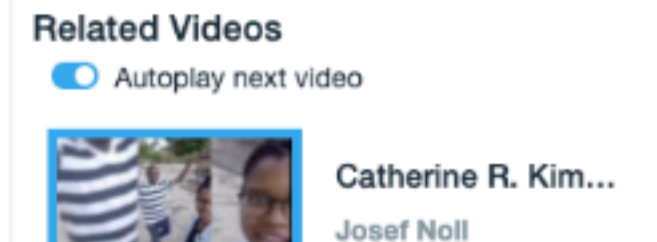
Download Winbox.exe from Mikrotik and connect your antenna. Make sure to

- connect the power over ethernet (PoE) adapter such that "data+power" goes to the antenna.
- cable connects to port 1 (PoE in), see <https://vimeo.com/354375901>

SIM card is inserted (make sure to remove the PIN)



Establishing a Village Information Spot for Free Access to Information

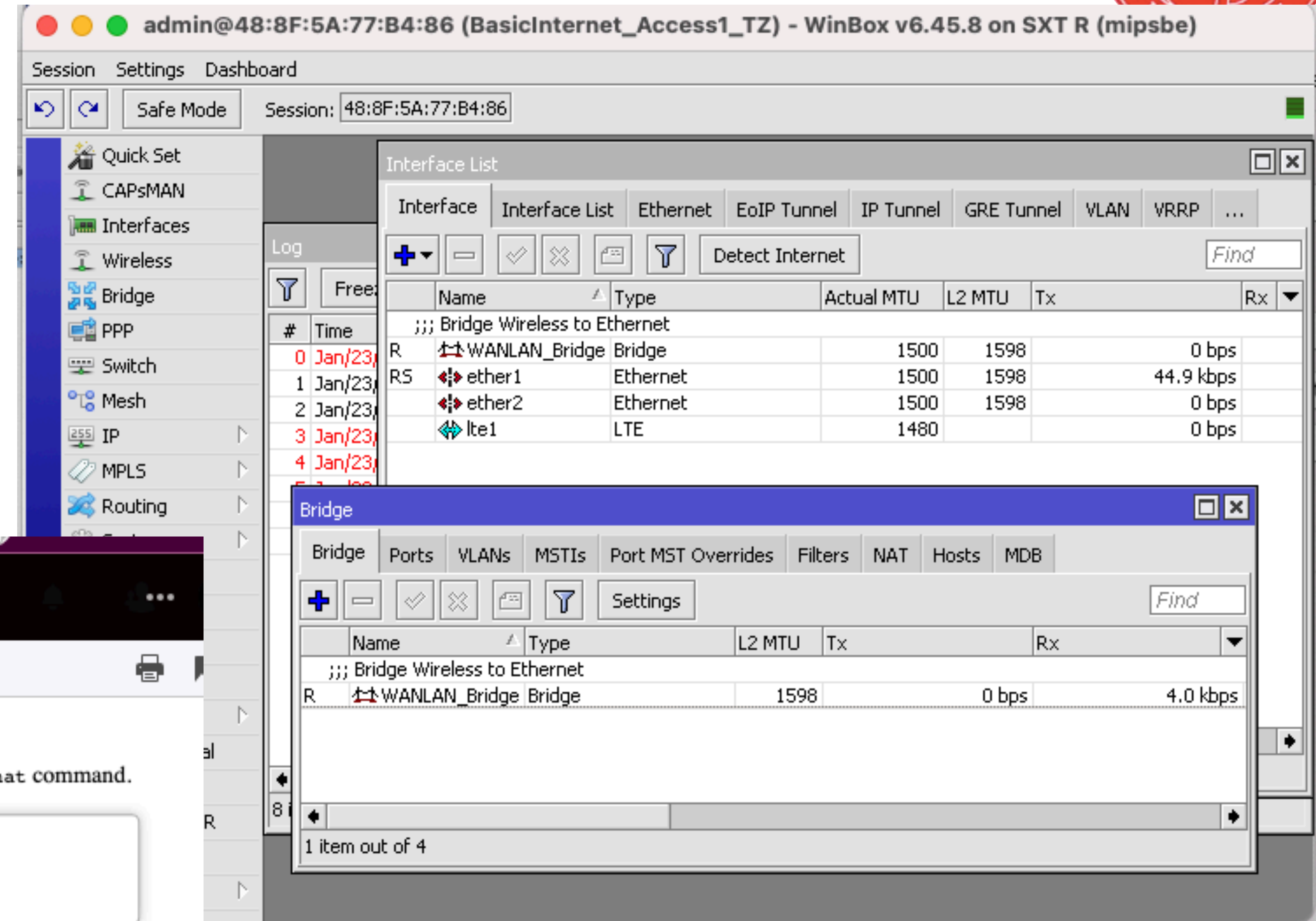


HowtoconnectBasic

First, check if you see two green diodes (power & SIM). If you only see one light, it means that the antenna is not working with the Operator network (Vodacom, Tigo, MTN,...). If your antenna is configured, go directly to [01Control.md](#) and check for errors - if not configured, follow the steps below to install the software.

LTE antenna tasks

- ➔ Communicate with SIM card
- Status (GB used)
- evtl reporting



The screenshot shows the Mikrotik WinBox interface. The main window displays the 'Interface List' for a bridge named 'WANLAN_Bridge'. The list includes the following entries:

#	Time	Name	Type	Actual MTU	L2 MTU	Tx	Rx
0	Jan/23, 10:00	WANLAN_Bridge	Bridge	1500	1598	0 bps	
1	Jan/23, 10:00	ether1	Ethernet	1500	1598	44.9 kbps	
2	Jan/23, 10:00	ether2	Ethernet	1500	1598	0 bps	
3	Jan/23, 10:00	lte1	LTE	1480		0 bps	

A secondary window titled 'Bridge' is also visible, showing a detailed view of the 'WANLAN_Bridge' configuration. It shows the bridge is connected to 'lte1' and has a Tx rate of 4.0 kbps.

Mikrotik_LTE_configuration_testing.pdf

User at-chat command

It is possible to send user defined "at-chat" command to LTE interface with `/interface lte at-chat ltel input="AT*mrd_imei\?"` command.

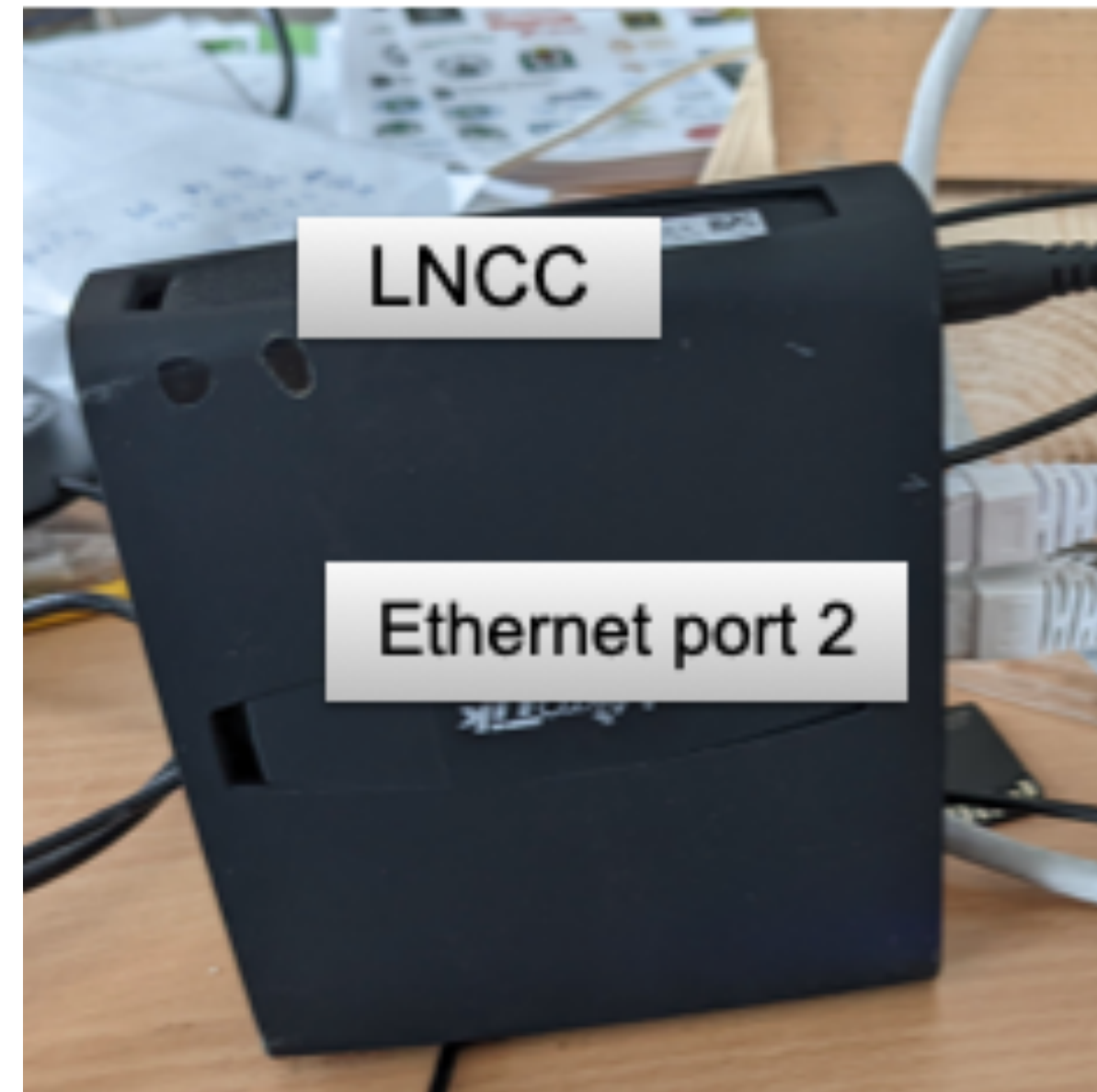
```
[admin@MikroTik] > /interface lte at-chat ltel input="AT*mrd_imei\?"
output: *MRD_IMEI:356159060388208
OK
```

You can also use "at-chat" function in scripts and assign command output to variable.

```
[admin@MikroTik] > :global "lte_command" [/interface lte at-chat ltel input="AT*mrd_imei\?" as-value ]
[admin@MikroTik] > :put "$lte_command"
output:*MRD_IMEI:356159060388208
OK
```


Local Network Control Center (LNCC) solutions.BasicInternet.no

- Using Winbox to connect
 - 192.168.60.1 or MAC address



File Tools

Connect To: 48:8F:5A:CB:95:4A

Login: admin

Password: *****

Add/Set

Managed Neighbors

Refresh

MAC Address	IP Address	Identity	Version	Boar
48:8F:5A:CB:95:4A	192.168.60.1	BasicInternet_TZ...	6.45.9 (l...	RBD!

Local Network Control Center (LNCC)

solutions.BasicInternet.no

- Internet Lite filtering
- Web page analysis,
- “most visited sites” (video?)

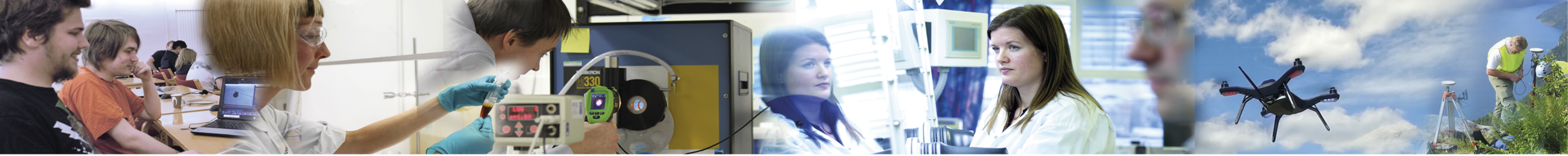
Safe Mode Session: 192.168.60.1

Script List

Name	Owner	Last Time Started	Run Count
Statistic	admin		0
;;; whitelist update TZS			
WhiteList_Up...	admin	Sep/13/2022 02:48:24	1

Hotspot

#	Action	Server	Method	Dst. Host
0	allow	server1		
;;; place hotspot rules here				
1	allow			
2	deny	server1		*porn*
3	deny	server1		*Youtube.com
4	allow	server1		*shuledirect.co.tz
5	allow	server1		*learninghubtz.c...
6	allow	server1		e-fahamu.vodac...
7	allow	server1		*.tetea.org
8	allow	server1		*necta.go.tz
9	allow	server1		*.tz
10	allow	server1		*google.com
11	allow	server1		*google.co.tz
12	allow	server1		*yeboo.com
13	allow	server1		*who.int
14	allow	server1		*unicef.org



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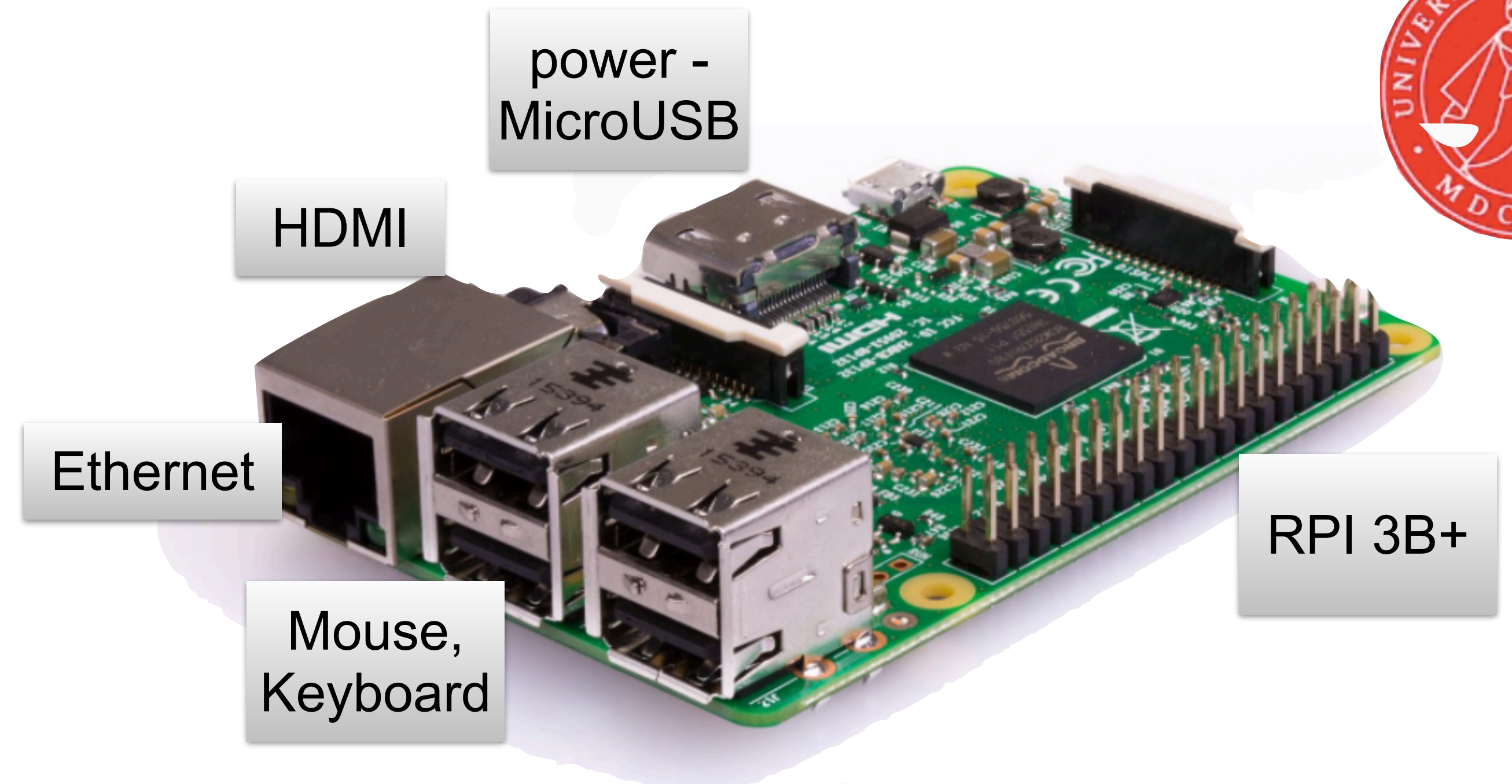
3

Decentralised Internet with InfoSpot for Education, Health, Agriculture, Digital

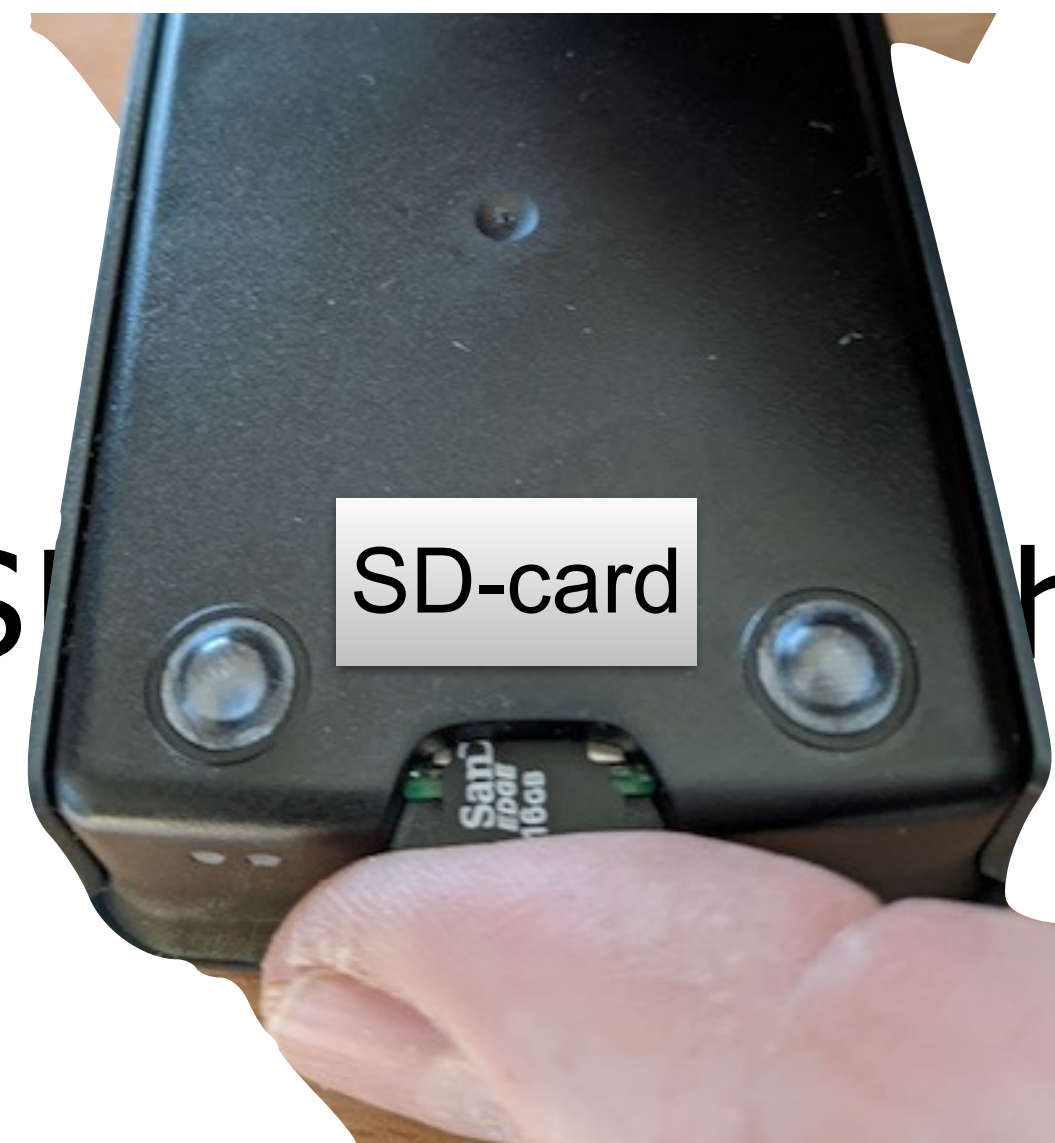


Raspberry Pi (RPI)

- A mini computer
- comes in different versions
 - RPI 3B+
 - RPI 4
 - RPI 4 integrated



- ensure that the SD-card is inserted correctly



Prepare for the session

Alternative A connect to an external screen

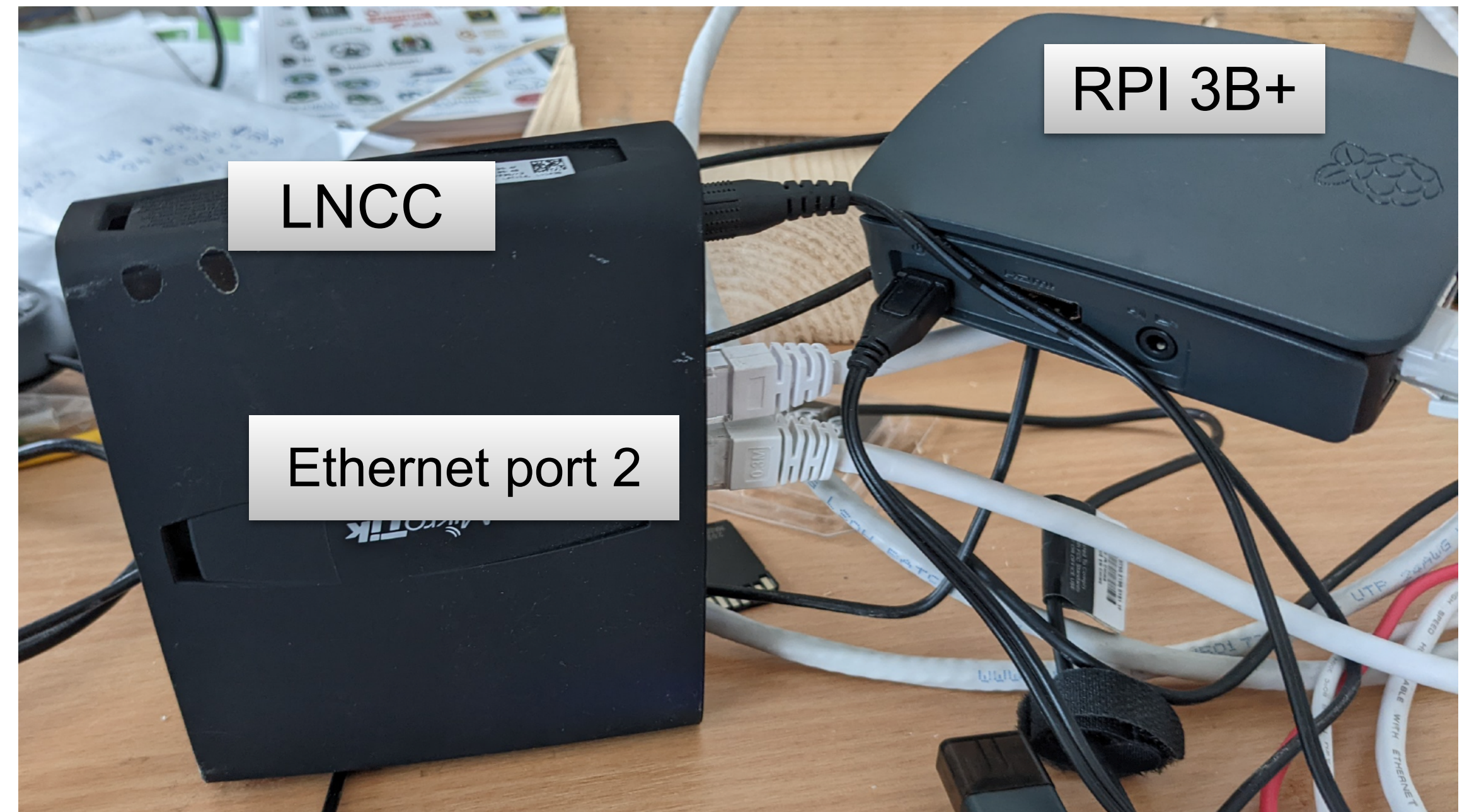
- connect the RPI with a keyboard and a mouse
 - connect to an external screen (HDMI cable)
 - power up the RPI
- you should see yeboo.com



Prepare for the session

Alternative B: connect an LNCC

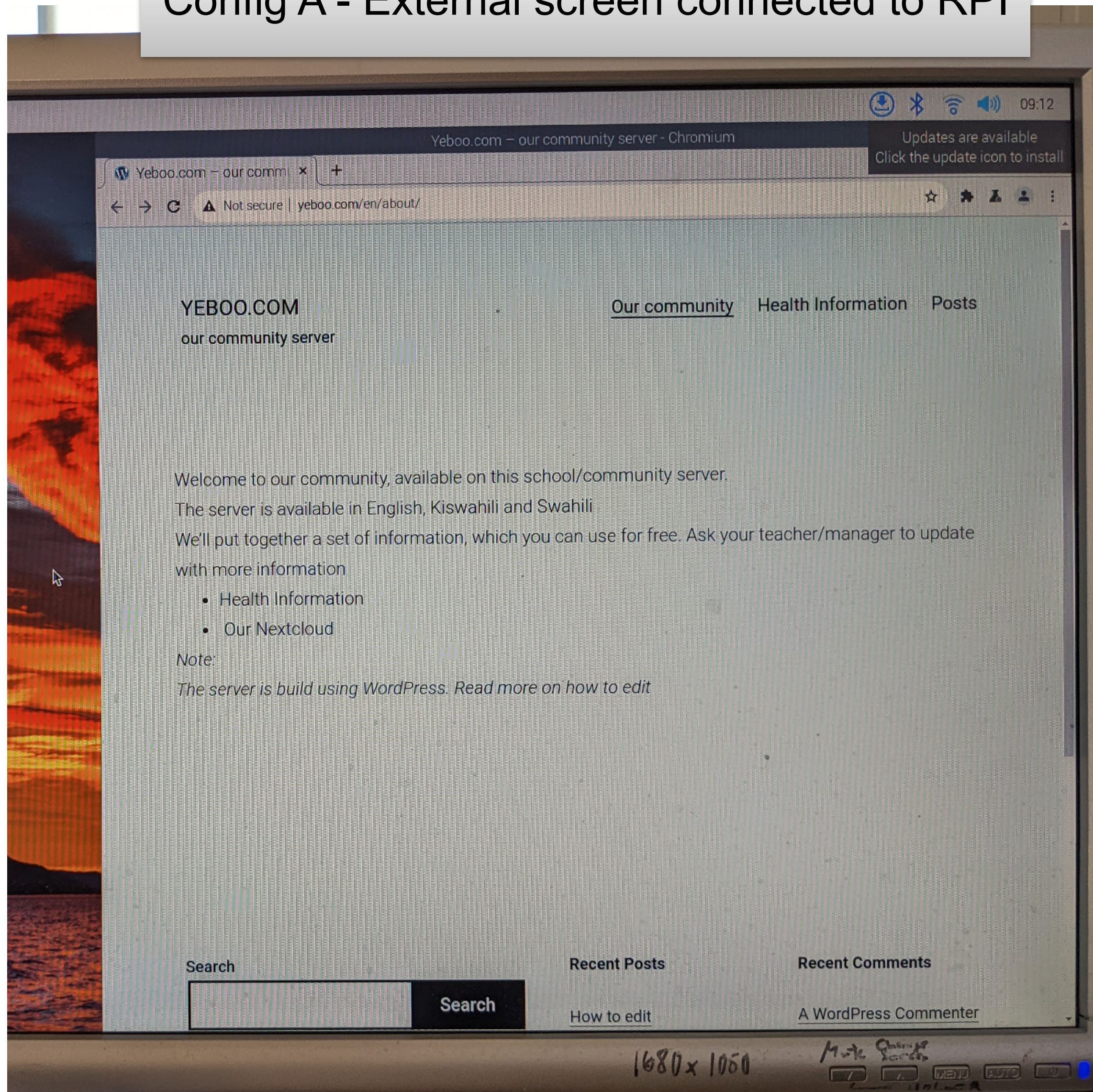
- Connect the RPI to a LNCC (port 2) using an Internet cable
- connect your laptop/mobile phone to Wifi "BasicInternet"
- Note: LNCC is the local network control center, which is configured as BasicInternet, see: solutions.basicinternet.no



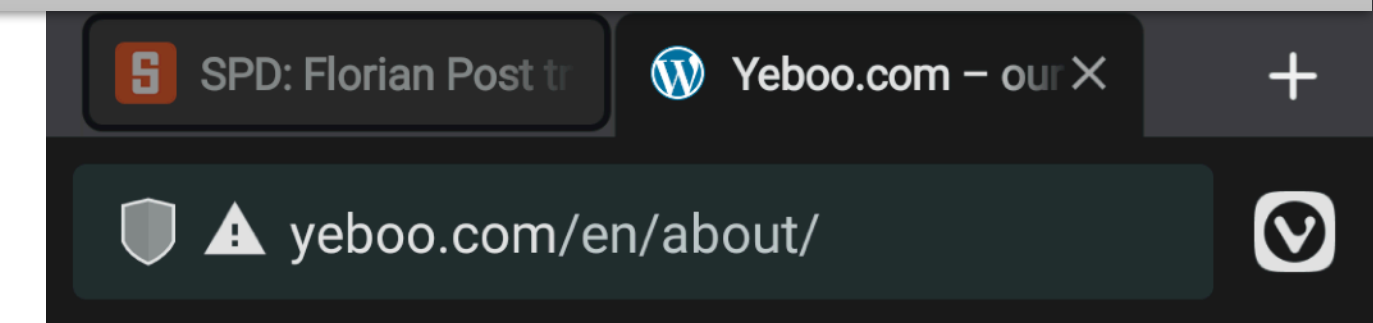


Welcome page yeboo.com

Config A - External screen connected to RPI



Config B - Mobile Phone connected to SSID BasicInternet on LNCC



YEBOO.COM

Menu ☰

our community server

Welcome to our community, available on this school/community server.

The server is available in

English, Kiswahili and Swahili

We'll put together a set of information, which you can use for free. Ask your teacher/manager to update with more information

- Health Information
- Our Nextcloud

Note:

The server is build using WordPress. Read

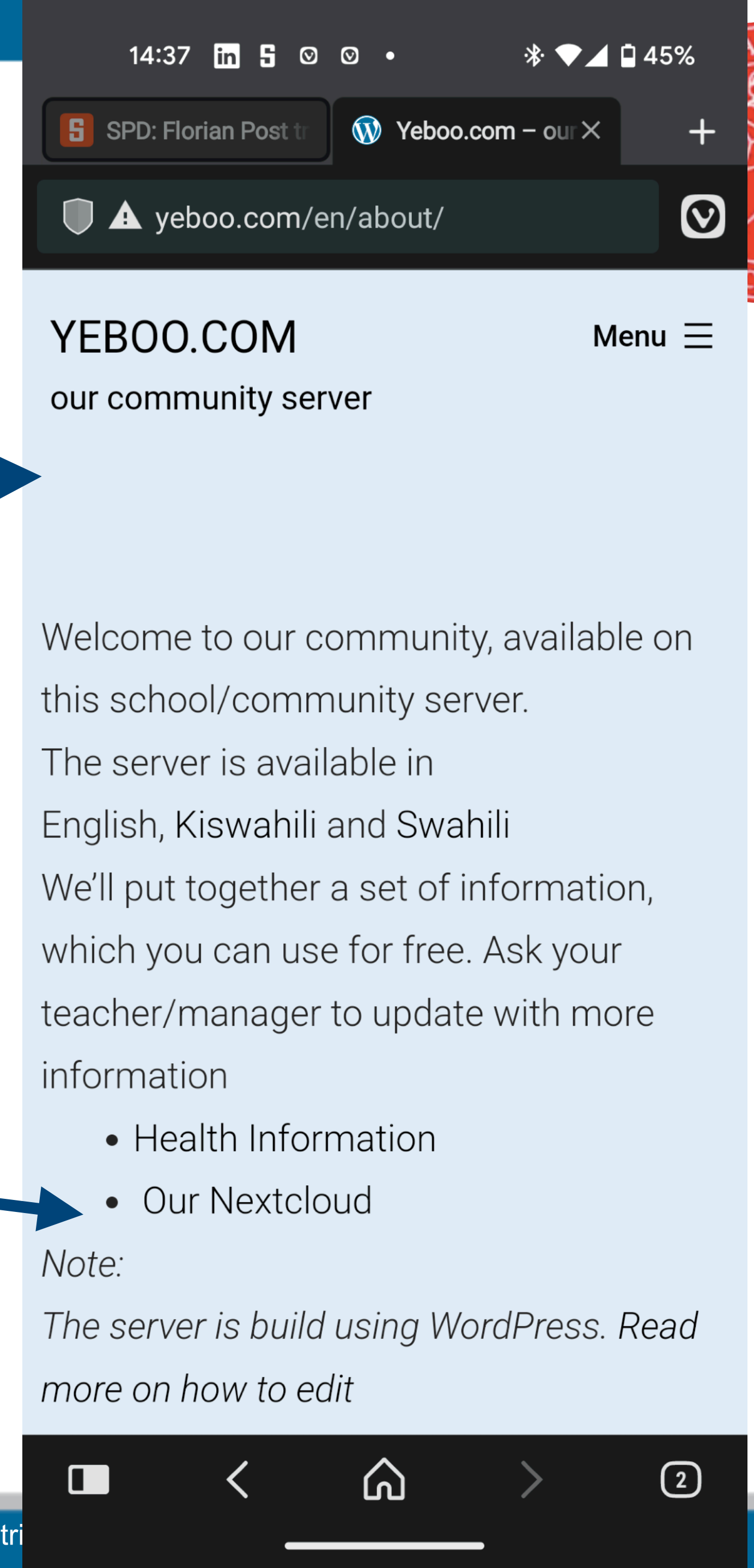


Goal

Use the RPI

- Create a **web page**
 - edit wordpress
 - add new sections (see health information)
- Share content with people
 - Add to Nextcloud
 - Add new videos/information

this is a web page on the RPI



- Web page creation**
 - use wordpress**
 - on RPI: <http://Yeboo.com>**

Edit a web page

→ yeboo.com is the local web page on your Raspberry Pi

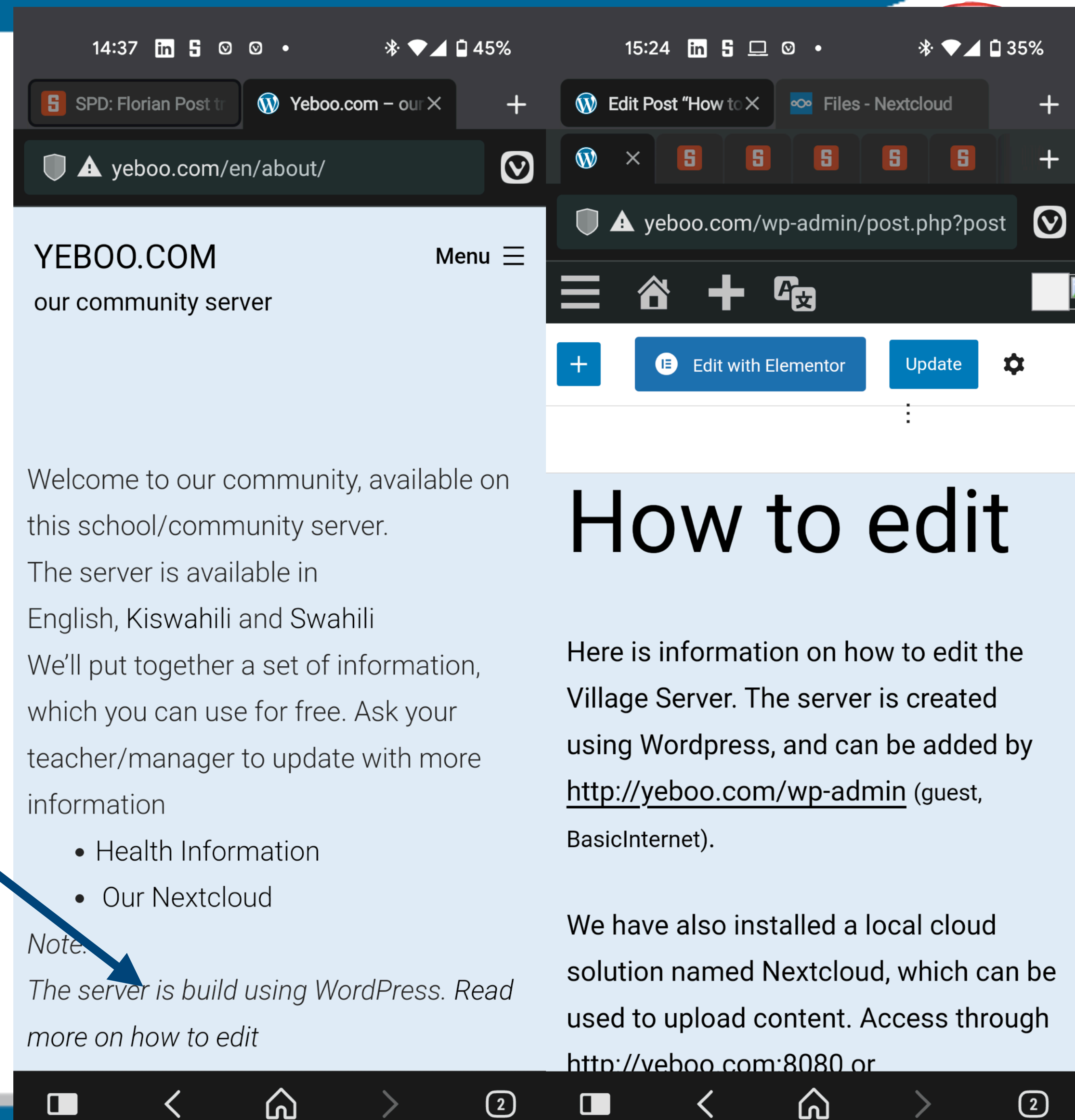
→ See the link "Read more on how to edit"

■ <http://yeboo.com/wp-admin>

→ Users

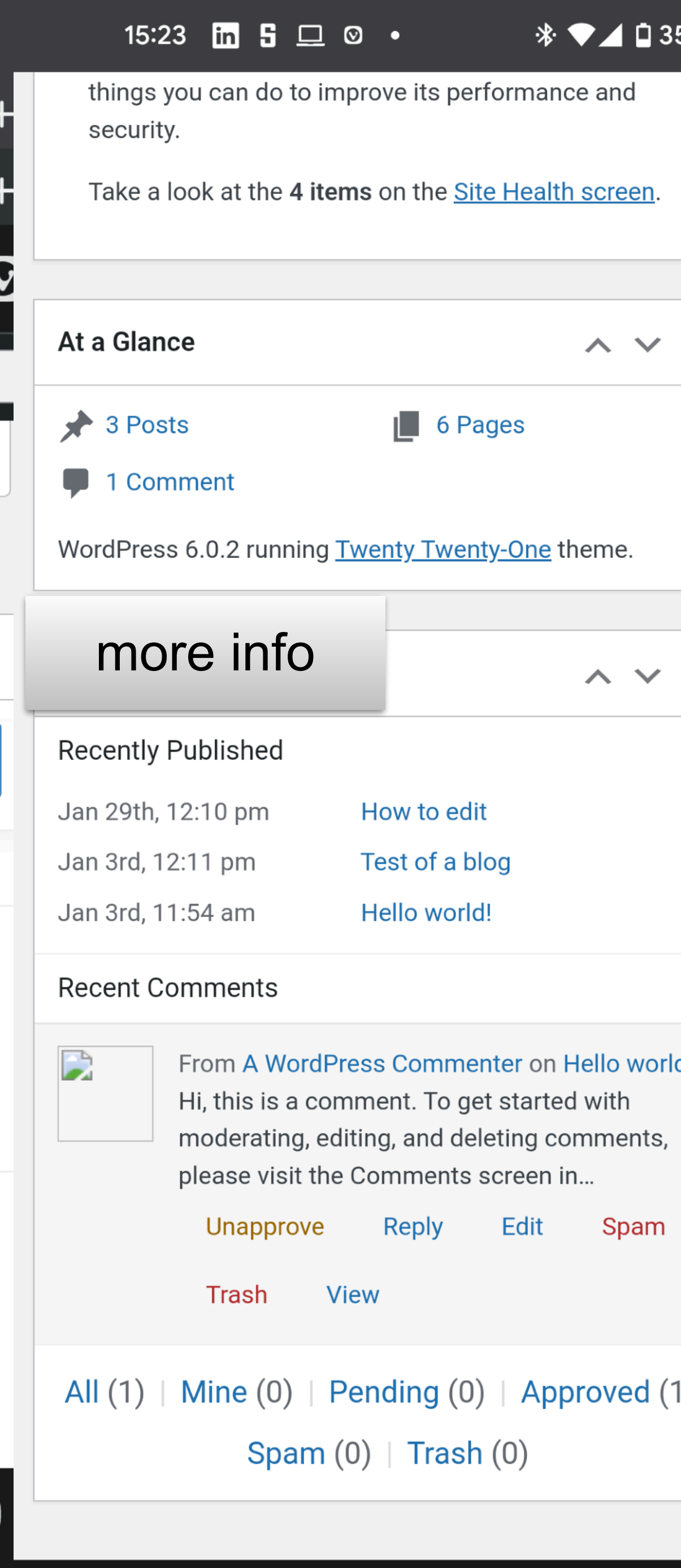
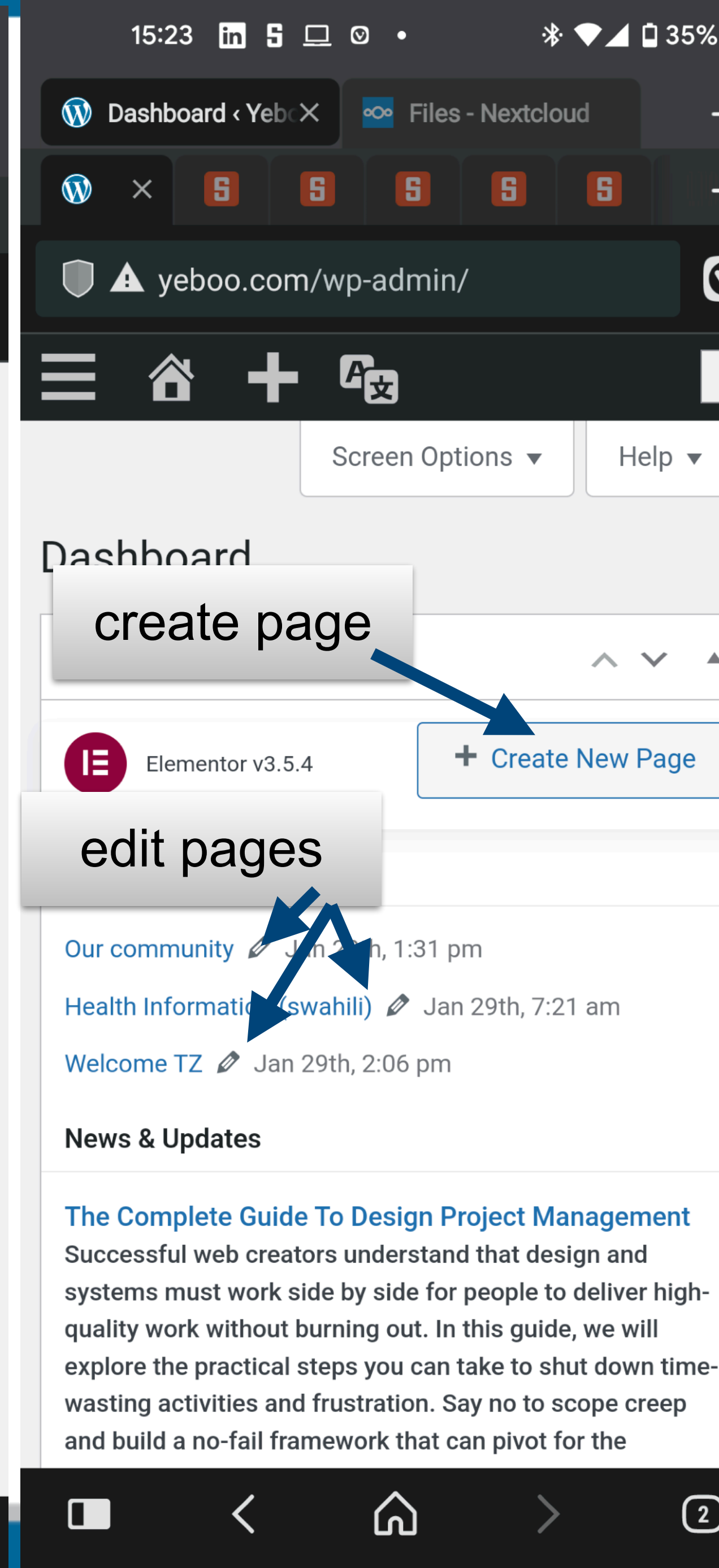
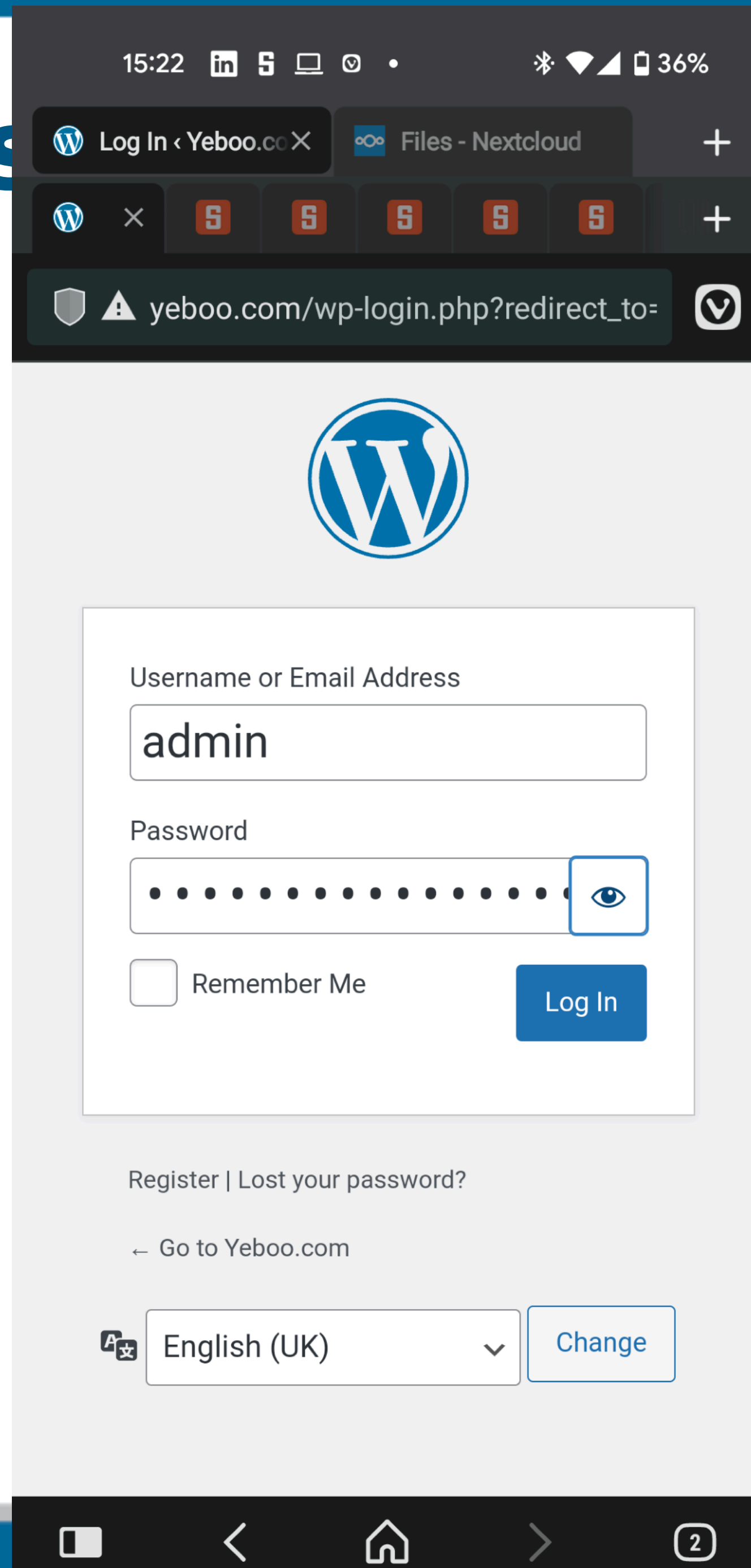
■ guest, BasicInternet or

■ admin, *****



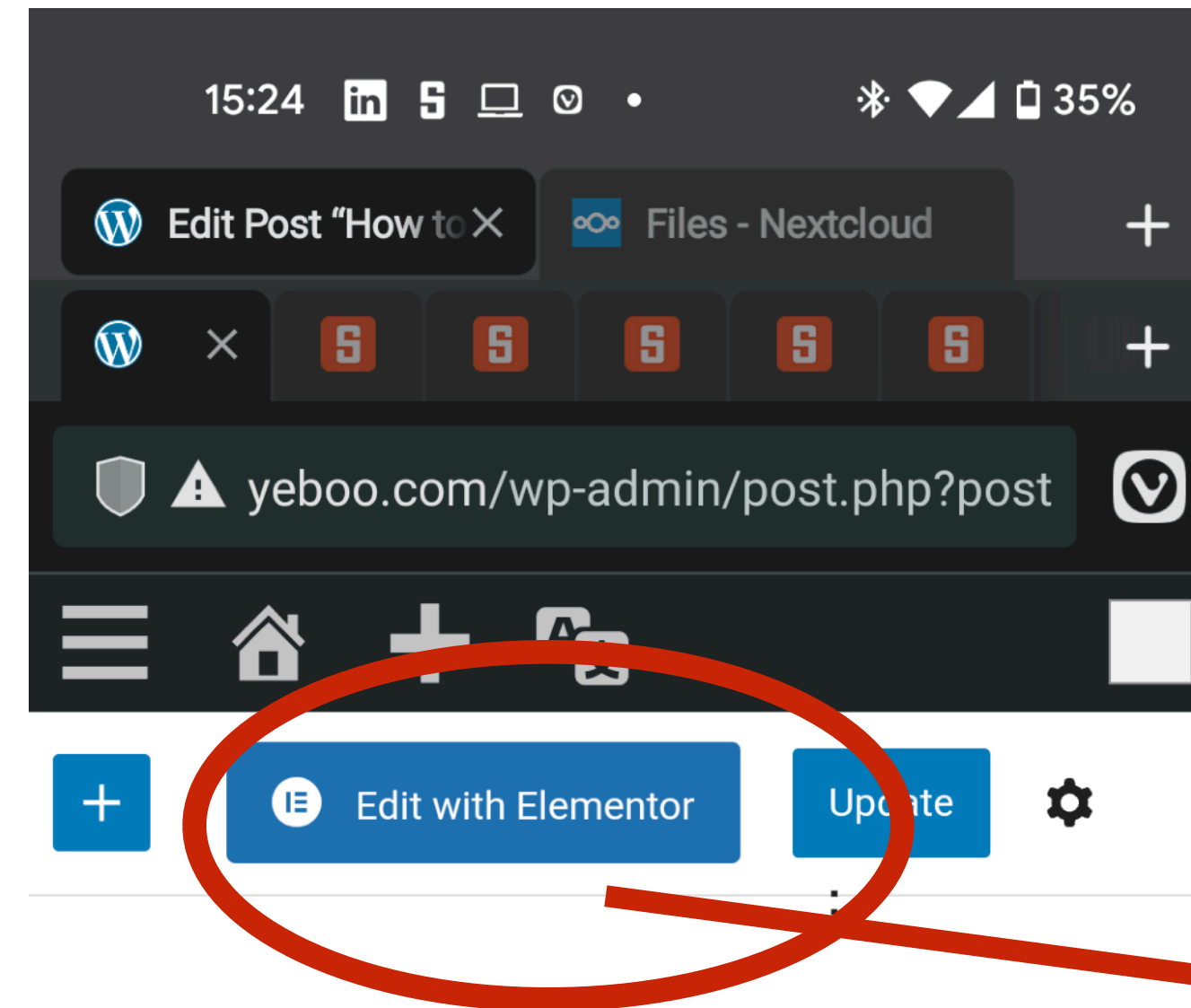
Wordpress

- Information on Wordpress installation
- update wordpress
- create users
- add pages



Using Elementor to create/add a new page

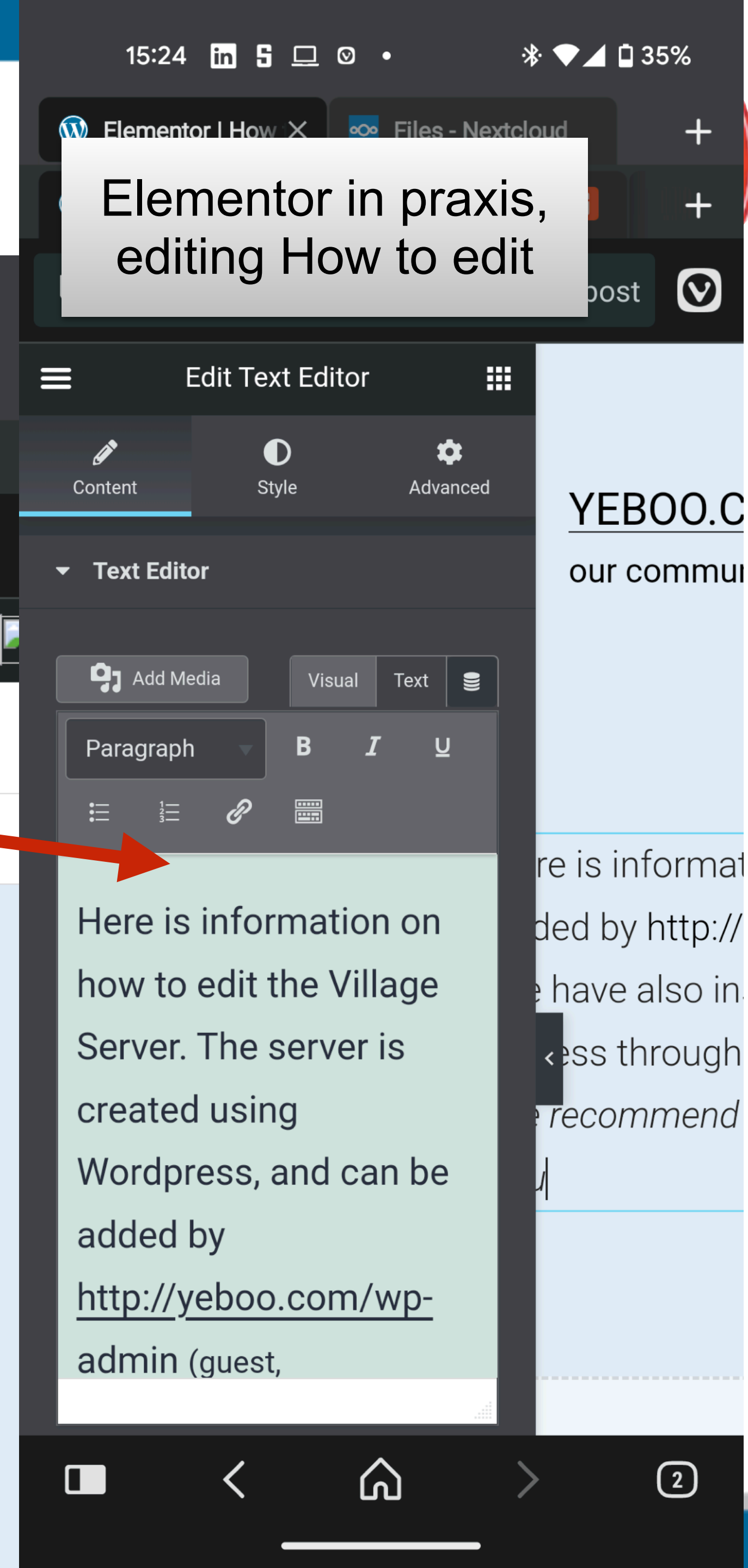
- Wordpress has two page editors
 - Block editor (default)
 - Elementor (easier to use)
- Suggest to use a PC/Mac to edit, too small on a Phone



How to edit

Here is information on how to edit the Village Server. The server is created using Wordpress, and can be added by <http://yeboo.com/wp-admin> (guest, BasicInternet).

We have also installed a local cloud solution named Nextcloud. which can be

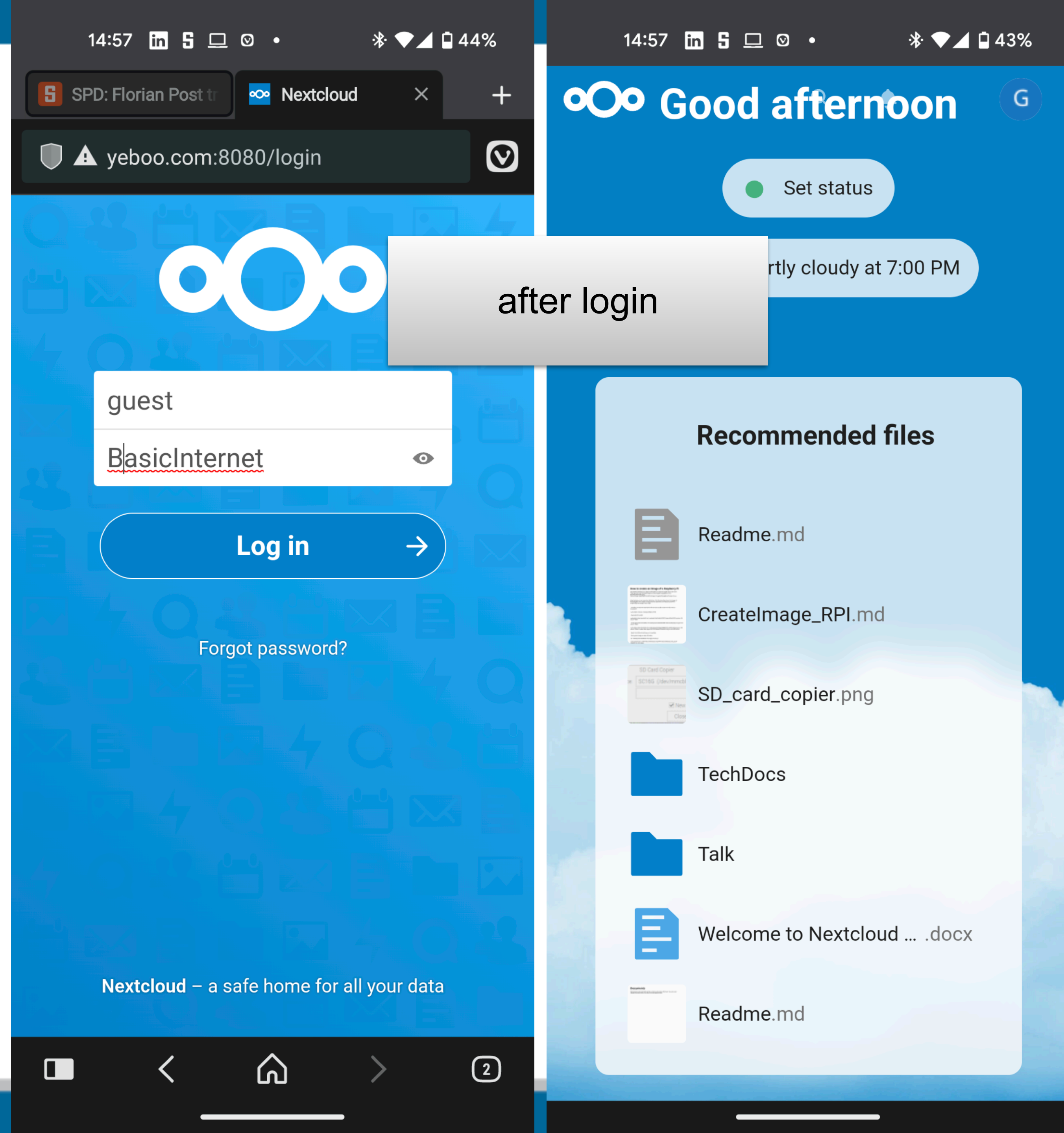


- Sharing information**
- use Nextcloud
 - on RPI: <http://Yeboo.com:8080>

Nextcloud

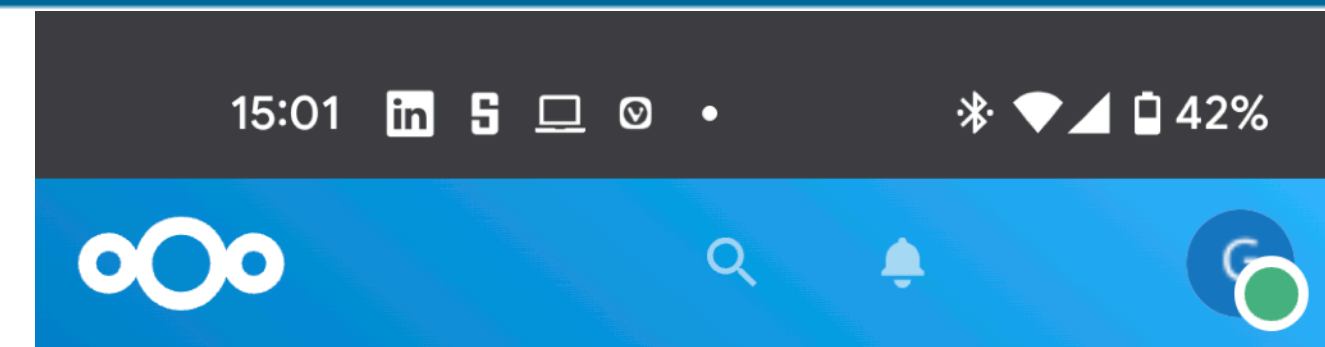
<http://Yeboo.com:8080>

- Sharing files/information with others
 - have your own information space
 - Dashboard shows new information
- create users (admin)
- common folders (admin)
- login
 - guest, BasicInternet
 - admin, ****



File examples

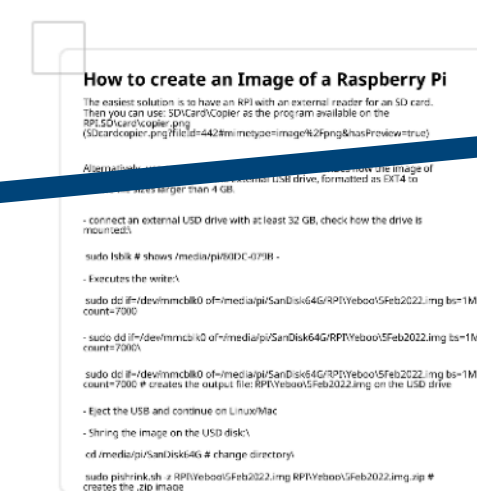
- TechDocs is a directory shared with everyone
- Readme.md files are the ones that are automatically shown (if exist) in each directory
 - .md is the markup language, allowing **bold**, *italics*, lists, tasks and include pictures
 - see CreateImage_RPI.md as example



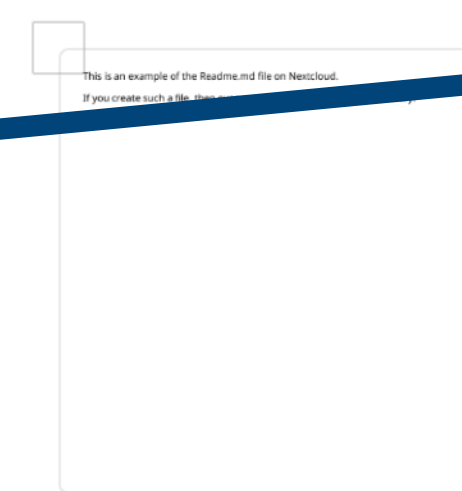
This is an example of the Readme.md file on Nextcloud.

If you create such a file, then everyone can read what is in the directory.

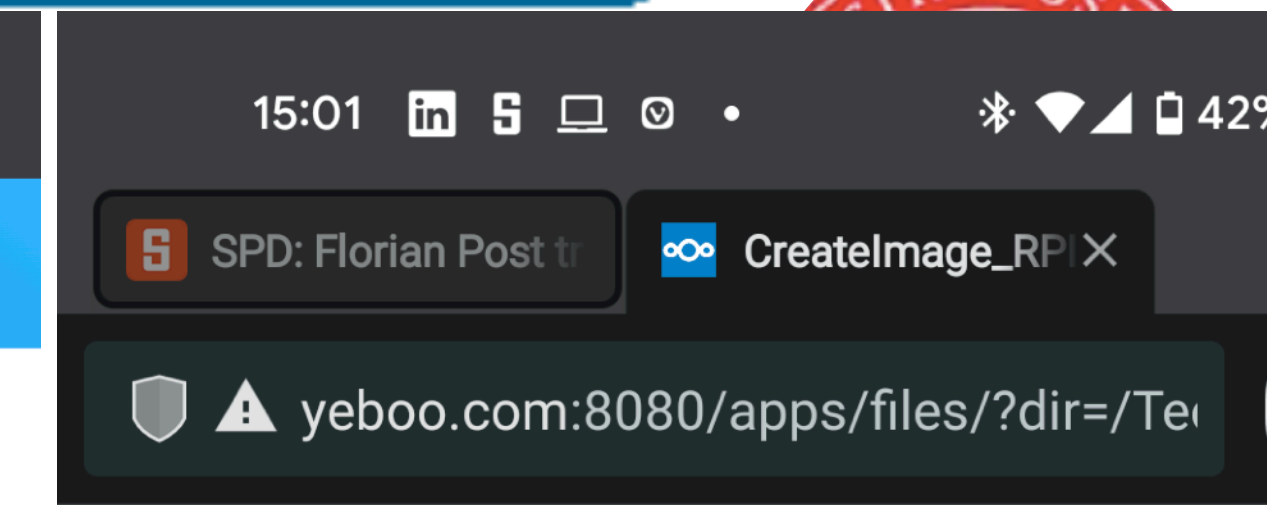
Name



CreatelImage...



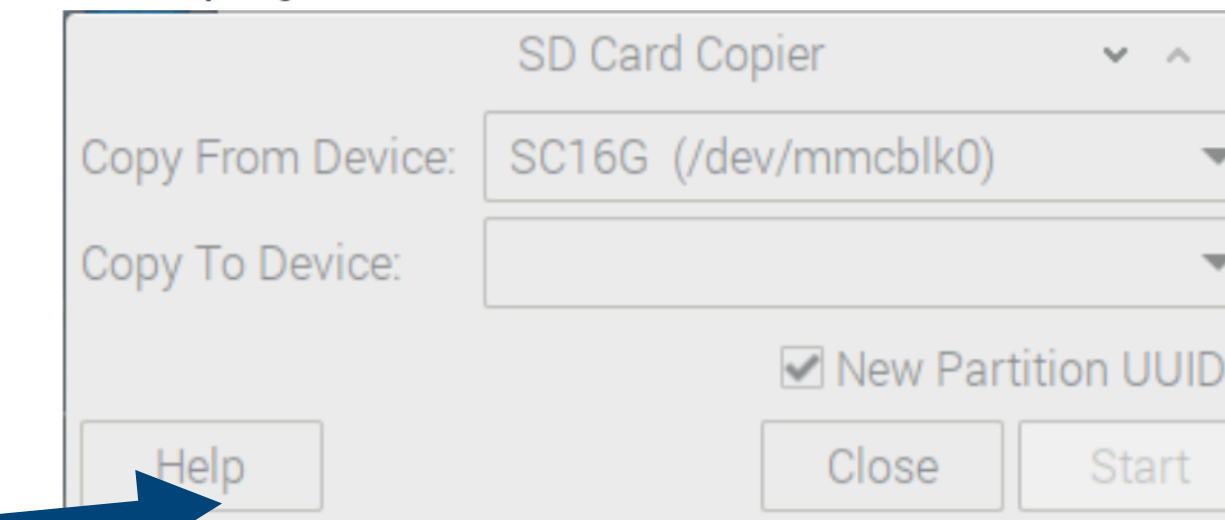
Readme



CreatelImage_RPI.md

a Raspberry Pi

The easiest solution is to have an RPI with an external reader for an SD card. Then you can use: SD_Card_Copier as the program available on the RPI.



SD_card_copier.png

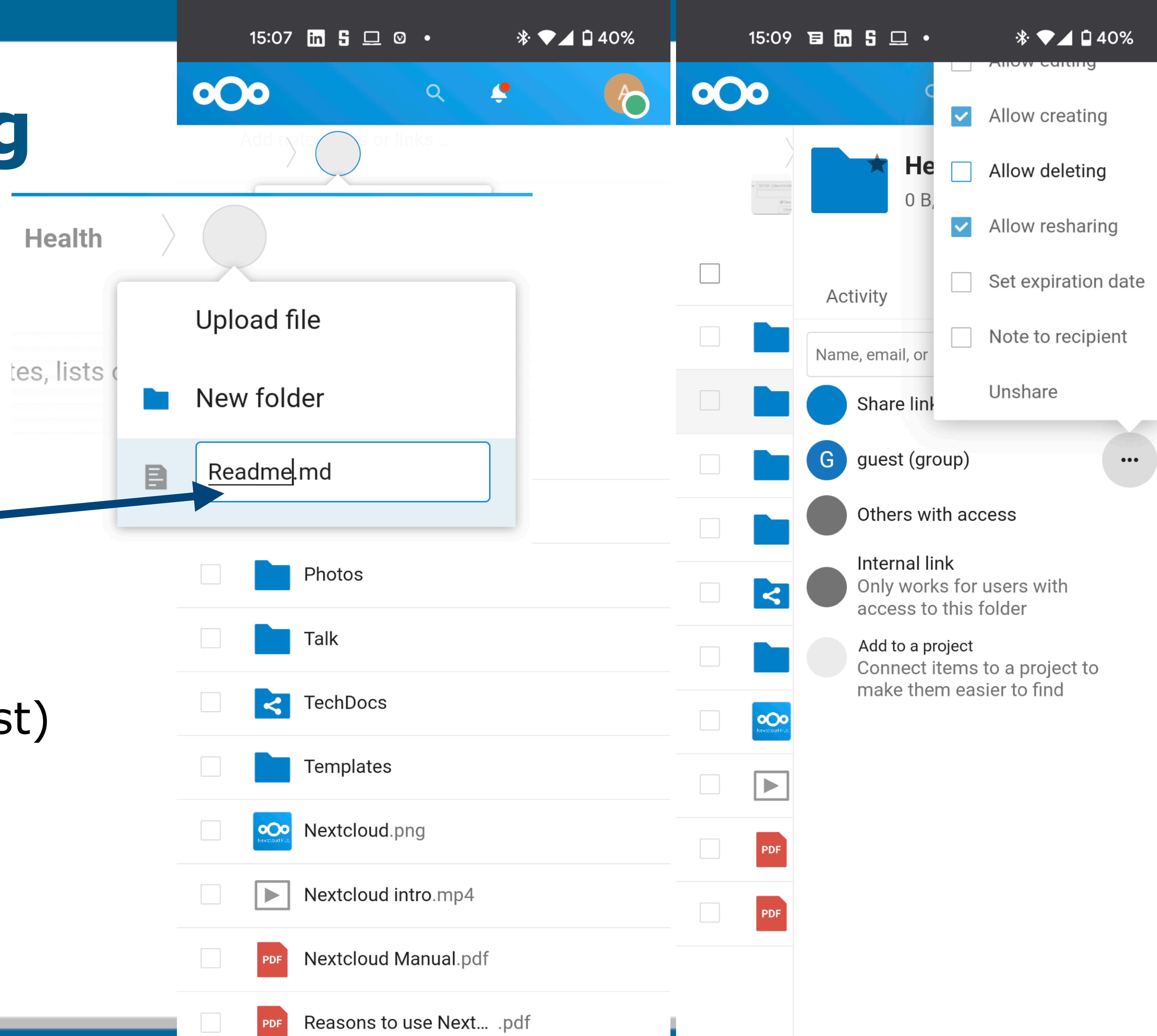
Alternatively, use an external USB drive. This file describes how the image of the Raspberry Pi is taken on the external USB drive, formatted as EXT4 to enable file sizes larger than 4 GB.

- connect an external USD drive with at least 32 GB, check how the drive is mounted:
`sudo lsblk # shows /media/pi/80DC-079B -`
- Executes the write:



Basic file handling

- Upload files
 - Create folders
 - Create new text (.md) document
-
- Share files & folders
 - with existing users (here: guest)
 - through a public link (can be added to wordpress)

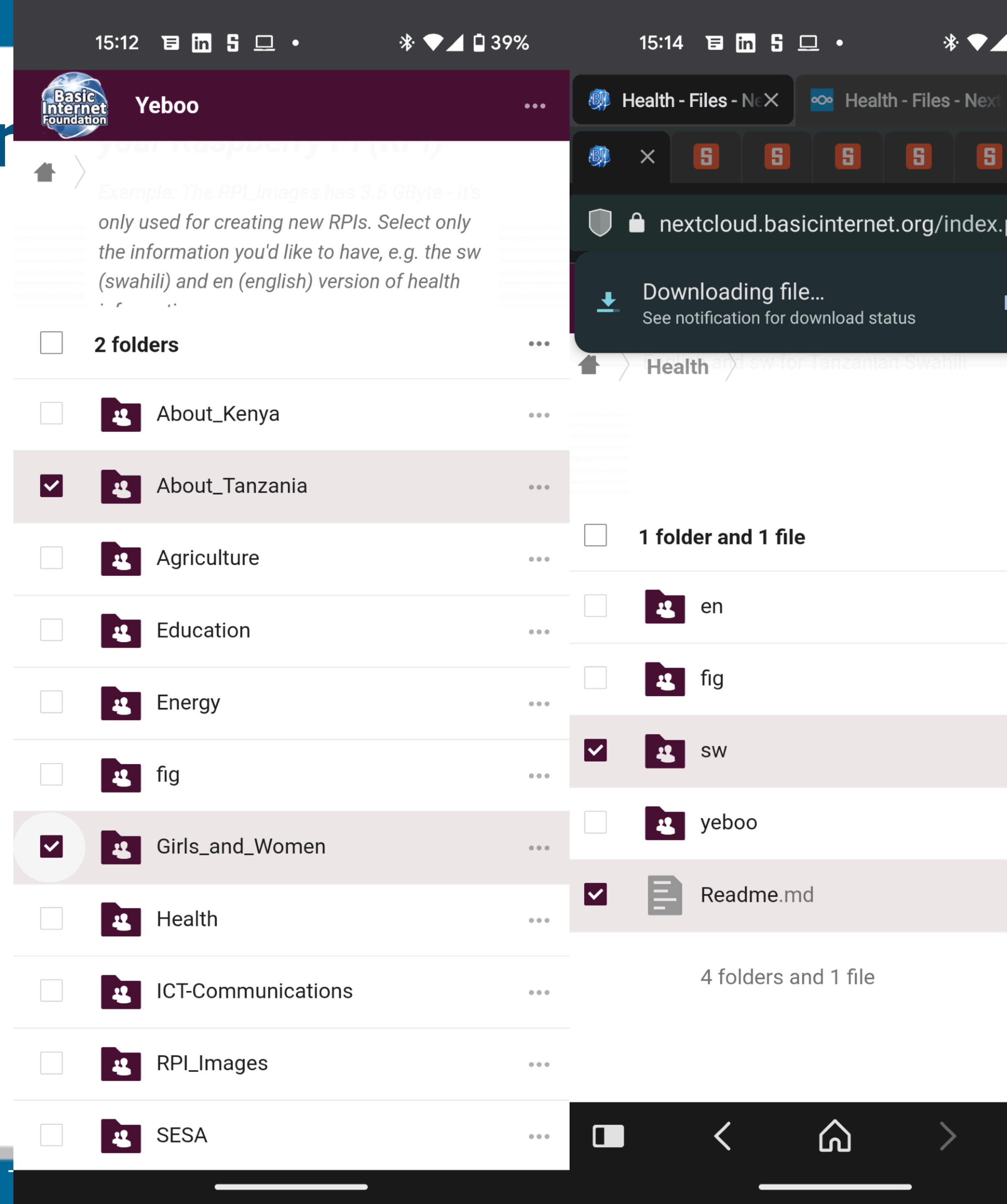


Download files from the Internet

→ Example:
yeboo.BasicInternet.org

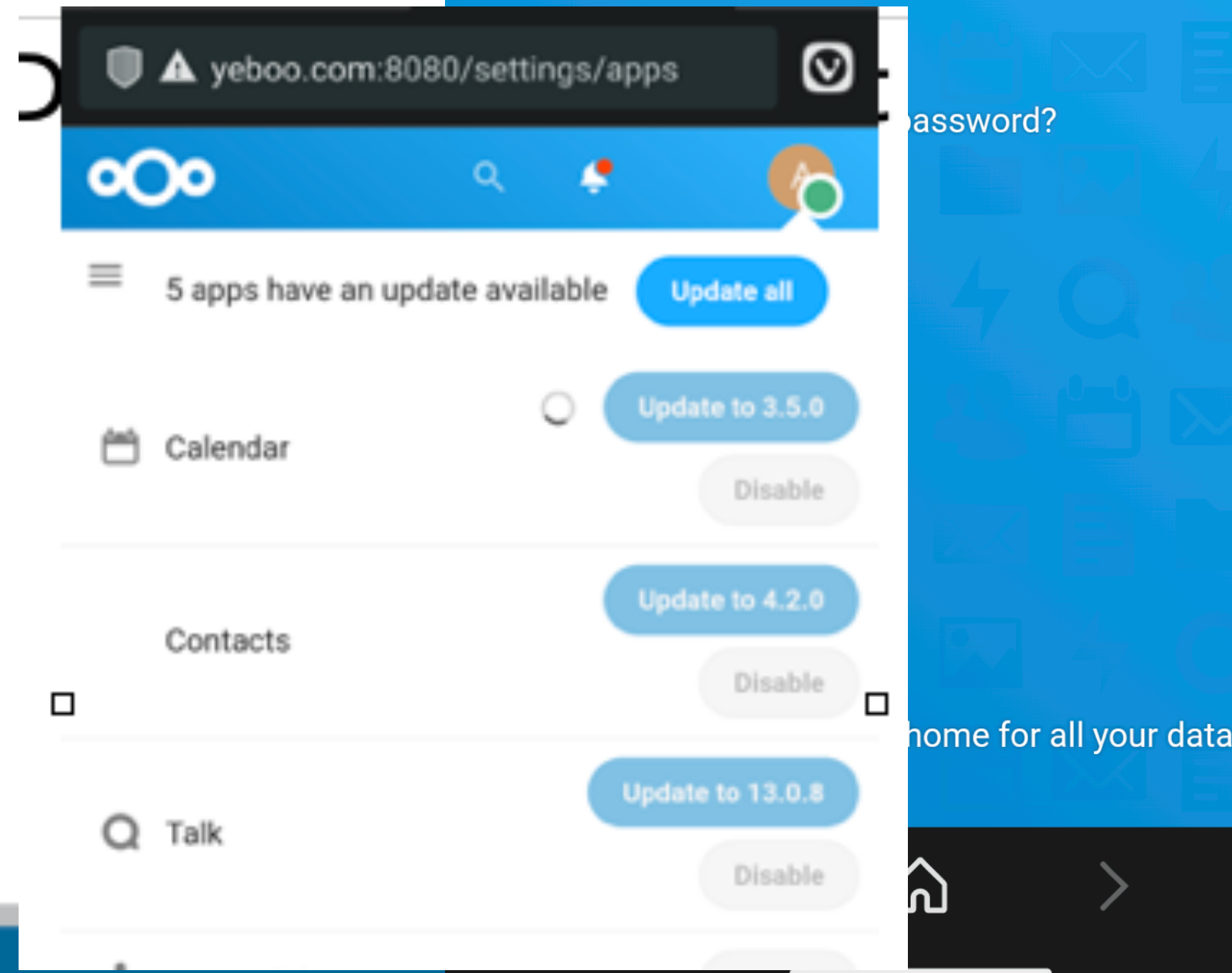
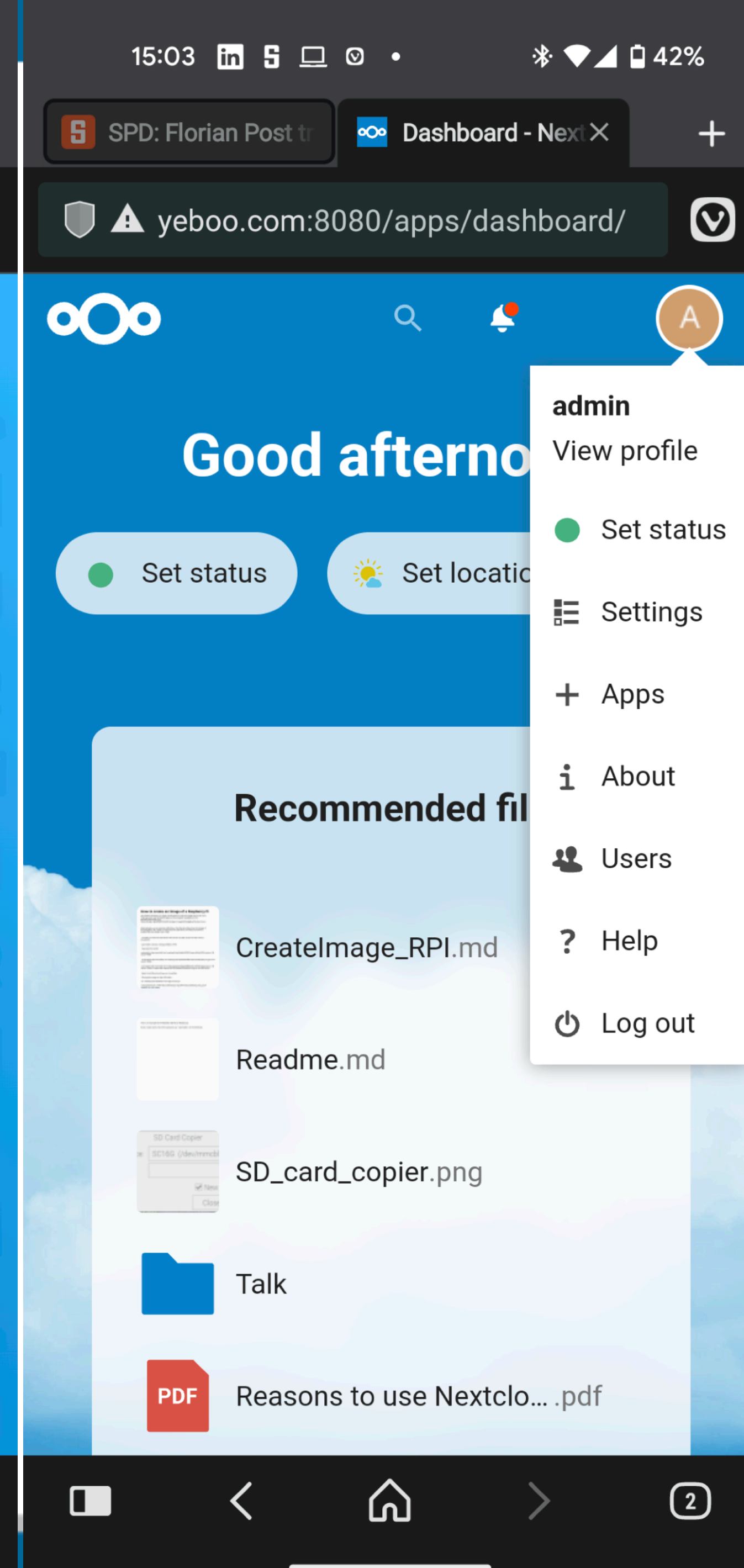
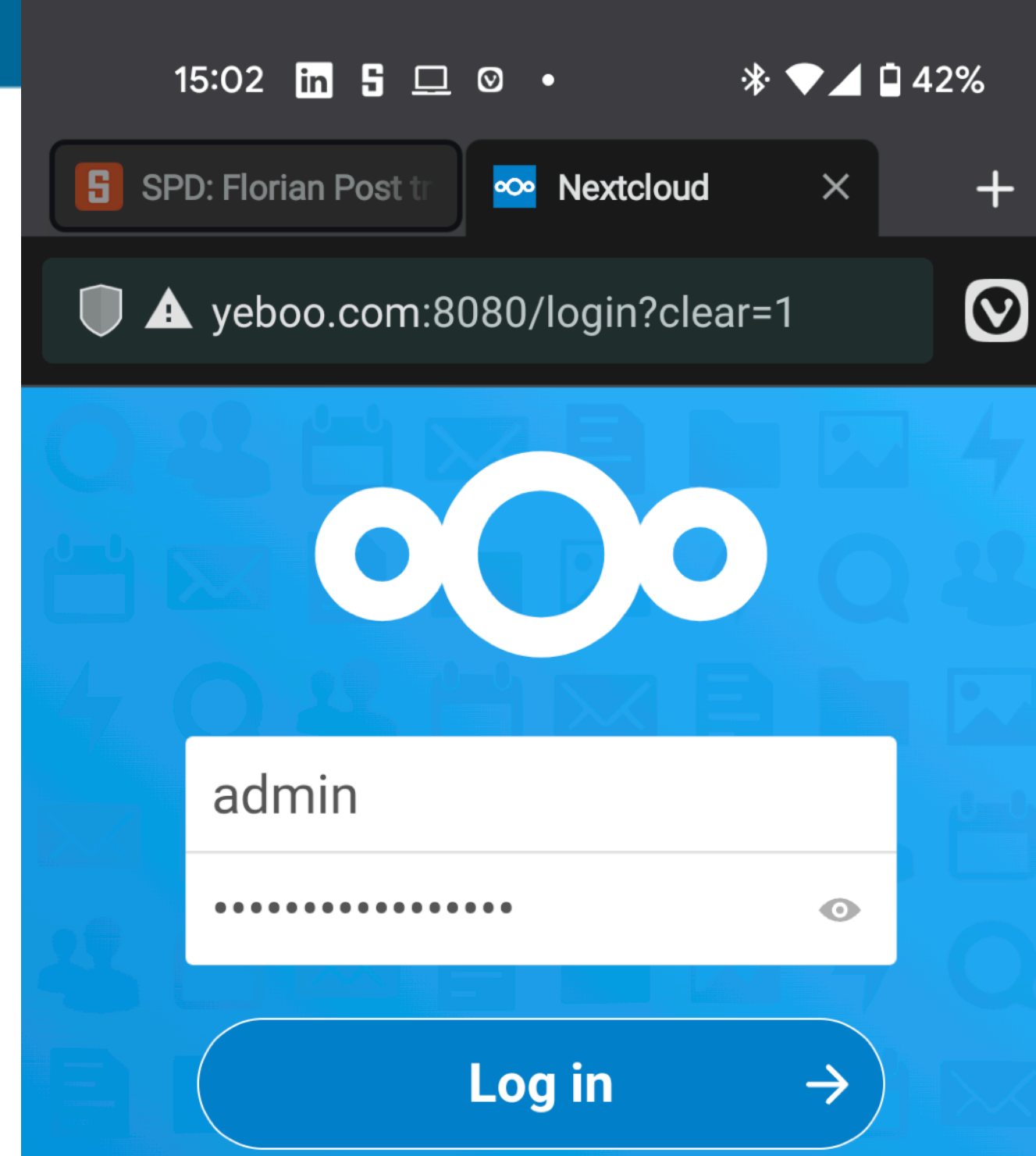
→ Other download

- YouTube downloaders



Nextcloud - admin







- Admin login allows administration
- update of nextcloud
- create users
- create common folders
-



Admin: User creation

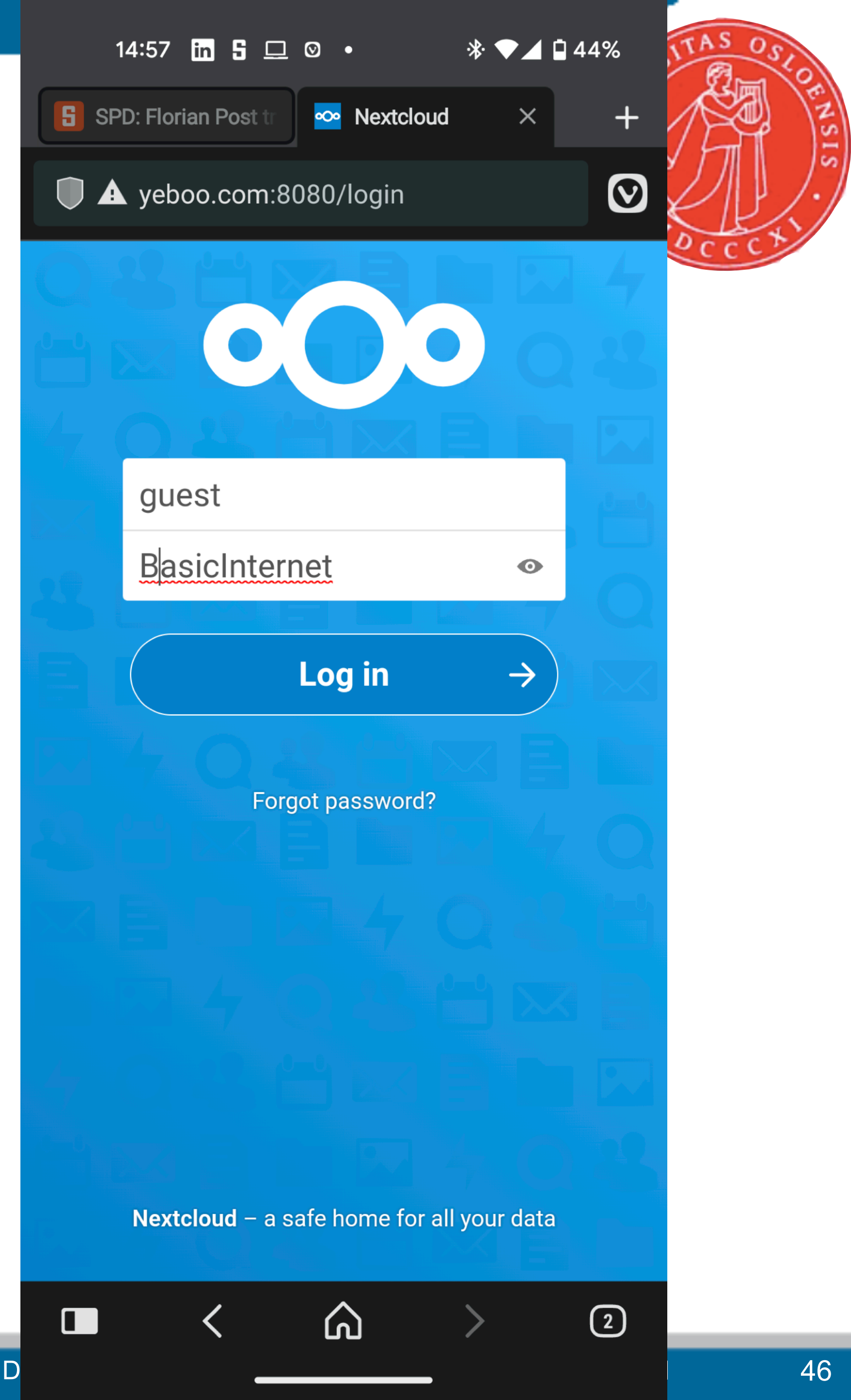
- See existing users
- Create new users
- click on the the 3 bars

The screenshot shows the Nextcloud mobile app interface. On the left, a 'More' menu is open, listing various app features like Dashboard, Files, Photos, Activity, Talk, Contacts, and Calendar. A blue arrow points from the '3 bars' icon in the text to the 'More' menu. On the right, the 'Users' management screen is visible, displaying a table of existing users. A blue arrow points from the '3 bars' icon in the text to the '3 bars' icon in the top left of the user list table.

	Username	Display name	Password
	admin	admin	
	guest	guest	
	josef	Josef Noll	

Tasks

- Create a directory
- Create a Readme.md and write some text
- Download a video from yeboo.BasicInternet.org and place it on Nextcloud
- Share you file with others
 - create a public link



Lessons learned

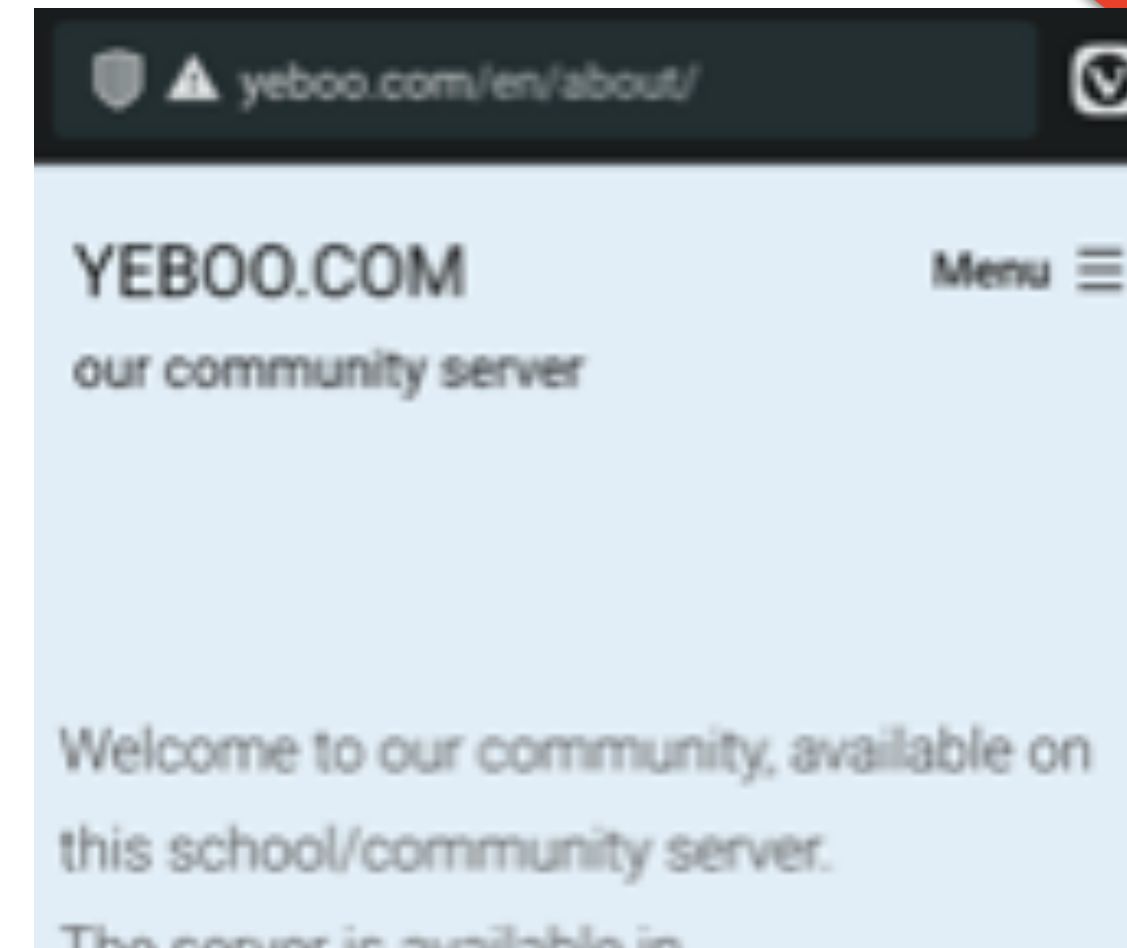
Use the Raspberry Pi as School server

- What is a Raspberry Pi
 - nothing else than a small computer
 - all information is stored on the SD-card
- Edit a web page
 - <http://yeboo.com/wp-admin>
- Add a video or other educational material
 - Use Nextcloud
 - create users
 - Share content



Challenges InfoSpot content

- Internet of Things (IoT) for rural usage
 - services: microgrid, humidity,
- Usage monitoring
 - Wireless Network analysis
 - InfoSpot usage (GByte used)
- Remote update
 - Sync between remote server
 - nextcloud.basicinternet.org and local yeboo.com
 - Scripts on LNCC



Ideas

- Establish markdown (md) as in this file in Wordpress (install new plugin)
- Test the sharing to a local RPI (public link?)
- Add culture/music

School Connectivity (ET)

- ➔ Koye Secondary and Preparatory School
 - connected as part of African Innovation Week 2019
 - using mobile network
- ➔ Local knowledge portal
 - yeboo.com health information



Addressing the Priorities of Norway

- Report to Stortinget 11 (2019-2020), **Priorities**
 - Access, skills, regulations, inclusion
- “Boys have the toys”
 - digital divide in both **devices**
 - and **mobile broadband** access
- **Integrated model for digital inclusion**
 - School connectivity (SDG indicator 4.A.1)
 - SchoolNet as Knowledge Portal
 - Knowledge transfer
 - Community involvement



Norwegian Ministry
of Foreign Affairs

Summary



Access

Meld. St. 11 (2019–2020) Report to the Storting (white paper)

Digital transformation and development policy

Skills

Regulations

Inclusion



Conclusions: What if...

- Freemium Model,
 - Internet Lite, AMP, other lightweight
 - Realisation: whitelist, DNS,
 - Opera Mini
- School/Village Communication
 - 4G/5G MIMO, cell size
 - Communication to LTE antenna
- InfoSpot design
 - Internet of Things (IoT) for rural usage
 - Usage monitoring
 - Remote update, Scripts on LNCC

1

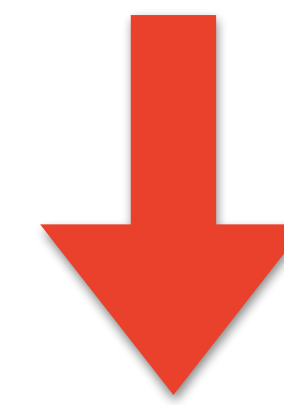
- We adopt the model of the road?
 - free for pedestrians and cyclists // text & pictures
 - premium for cars // broadband

2

- We establish Digital Information Spots ("InfoSpots")
 - in every village
 - solar power, Wifi hot-spot, phone charger, light

3

- InfoSpot design and realisation
 - Health, Education, Agriculture, Digital,...



Access to Information -
a basic Human right