WP2: System Requirements and Specifications

UMOBILE PROJECT REVIEW

BRUSSEL, 20 OCTOBER 2016

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WP2: Objectives

▸ **O2.1:** Define the system requirements from the perspective of the network and the end-users.

▸ **O2.2:** Analyse the operational requirements and deployability aspects of UMOBILE platform.

▸ **O2.3:** Align application and protocol requirements with validation scenarios.

▸ **Task 2.1:** User Requirements

▸ **Task 2.2:** System and Network Requirements

▸ **Task 2.3:** System Deployability Design

▸ **Duration:** M 1 to M30

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UMOBILE WP2: Deliverable Status

Deliverables	Task	Task Leader	Status	Due on
D2.1: End-user requirements report	2.1	UCAM	Delivered	M5: May 2015
D2.2: System and network requirement specifications (1)	2.2	COPELABS	Delivered	M14: March 2016
D2.3: System and network requirement specifications (2)	2.2	COPELABS	In progress	M28: May 2017
D2.4: System and Network Deployability Design	2.3	TEKEVER	In progress	M30: July 2017

UMOBILE Areas of Action (D2.1)

Urban Area

- Dense network topology (**massive deployment of cellular, small-cells and Wi-Fi**)
- Environments are user-centric
- Some user **services may be stored closer to/in end-user** devices (e.g., content).
- User behaviour is very dynamic
- Users move and interact according to social ties

Remote Area

- A vast geographical area having an **intermittent connectivity**
- Internet access conditions are limited (**limited bandwidth of upstream and downstream**)
- UMOBILE assume that a **gateway** at the remote area **can request the services/ contents and cache** them whenever network connectivity is available.

Disaster Area

- Actual network infrastructure is **partially or fully disrupted.**
- Rescue operation teams **install ad-hoc UMOBILE hotspots** across the disaster area.
- Network connectivity is **highly intermittent**
- **UAVs** equipped with Wi-Fi to create **local network** infrastructure

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Summary of System and Network Requirements (D2.2)

Assumptions

‣ Existence of intermittent connectivity

‣ Type of networked devices (e.g., mobile devices, access points, UAVs

‣ Association of network functions with devices (e.g, surrogates, service migration)

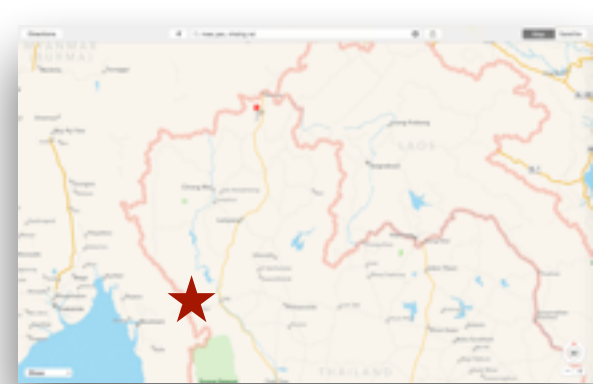‣ Network capability (e.g., WiFi, WiFi direct, bluetooth, cellular)

Requirements (13 MUST, 11 SHOULD, 3 MAY)

‣ Data exchange characteristics.

‣ Data properties (e.g. privacy, reliability, priority).

‣ Interface with applications.

‣ Communication range (e.g. to a group of nodes; in a geographic area).

‣ Internetworking (e.g. with IP networks).

‣ Data handling (e.g. fusion, filtering, pre-fetching).

‣ Context management

‣ Compatibility with existing applications

‣ Monitoring and tracking

‣ Coordination of distributed surrogates

Deep Analysis UMOBILE User and System Requirements

Best paper award ACM AINTEC' 15

A. Lertsinsrubtavee, L. Wang, A. Sathiaseelan, J. Crowcroft, N. Weshsuwannarugs, A. Tunpan, and K. Kanchanasut. 2015. Understanding Internet Usage and Network Locality in a Rural Community Wireless Mesh Network. In Proceedings of the Asian Internet Engineering Conference (AINTEC '15). ACM

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Impact Story

▸ **Collaborate with Asian Institute of Technology (AIT) to deploy the first wireless community network in Thailand**

▸ **Thai Samakhee, a small rural village in northern Thailand**

▸ **50 households with 300 populations**

Before 2013

2 ADSL links provided by ISP

28$/month for a subscription
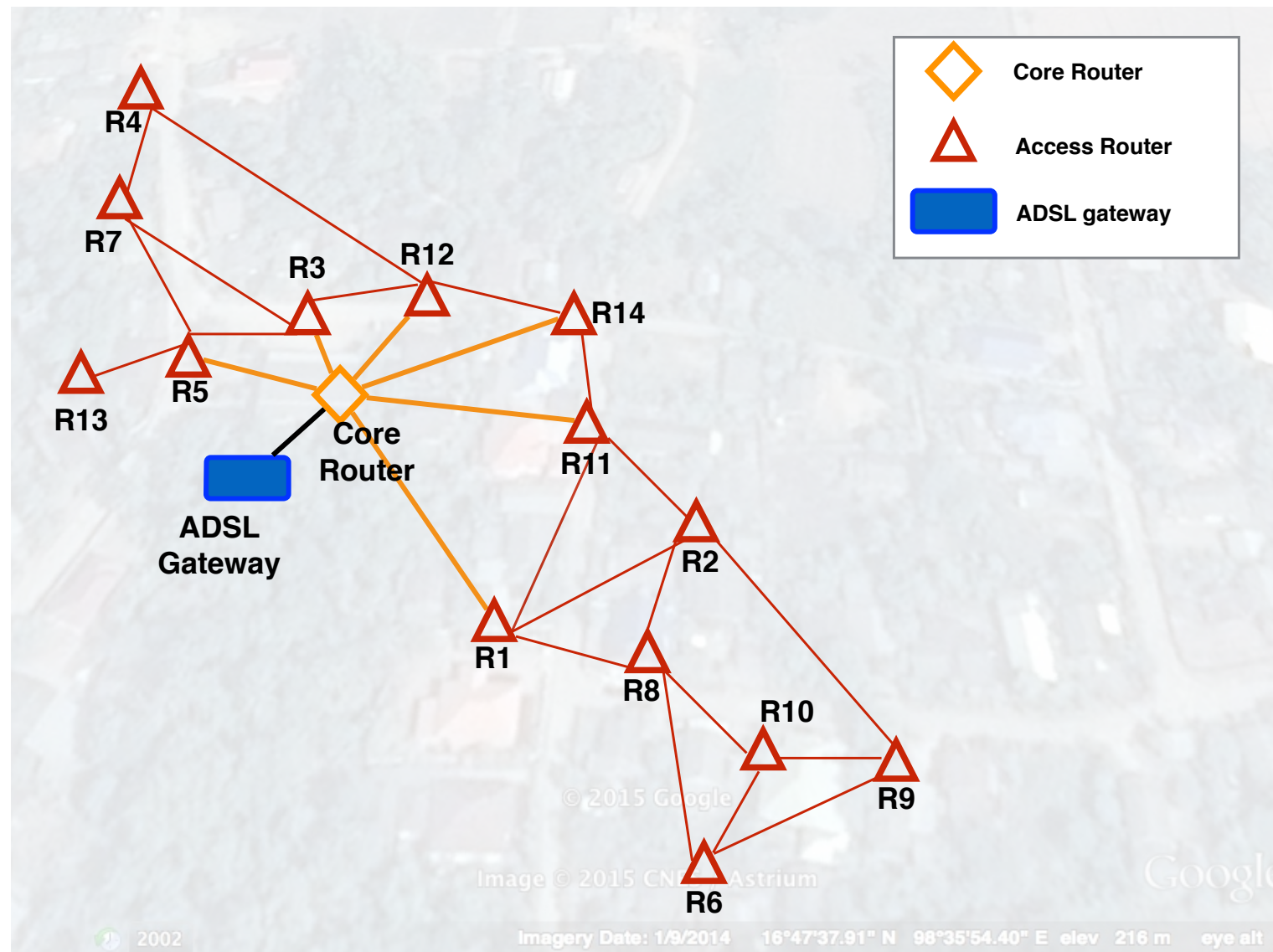
less than **10** villagers use Internet at home

TakNet CWMN

Internet cost is shard among villagers

5$/month for a subscription

Attract villagers to use the Internet

~200 active users (as of 2015)

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‣ **We first focus on Remote areas**

‣ **Analyse the Internet usage of a rural community network in Thailand (TakNet)**


‣ **Internet access is highly disrupted**

‣ **Sharing a ADSL gateway (4Mbps download speed and 512Kbps upload speed)**

New-R: Monitoring system SHOULD be able to detect the traffic constrain before hand

Action: Activate DTN tunnelling and congestion control

New-R: The system SHOULD be able to tolerate the high traffic demand

Traffic almost reached the committed speed (4Mbps)

Time of day (Hours)
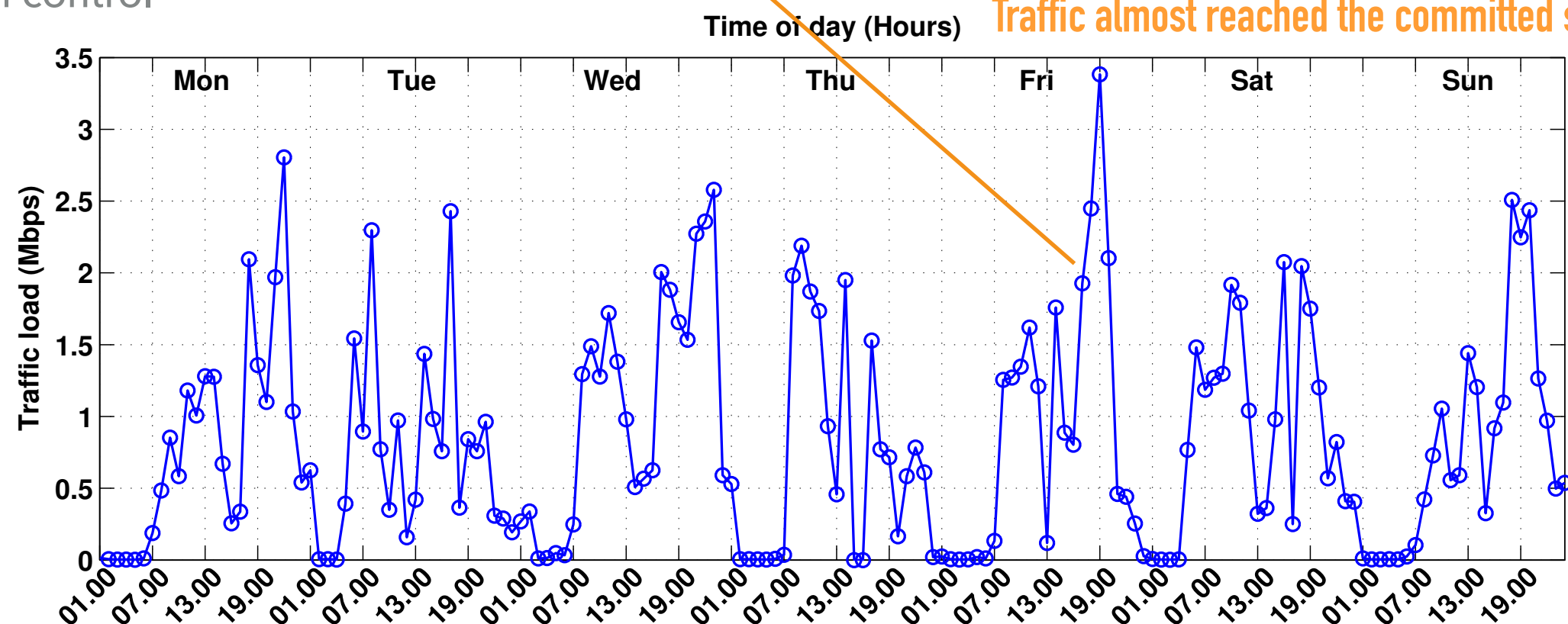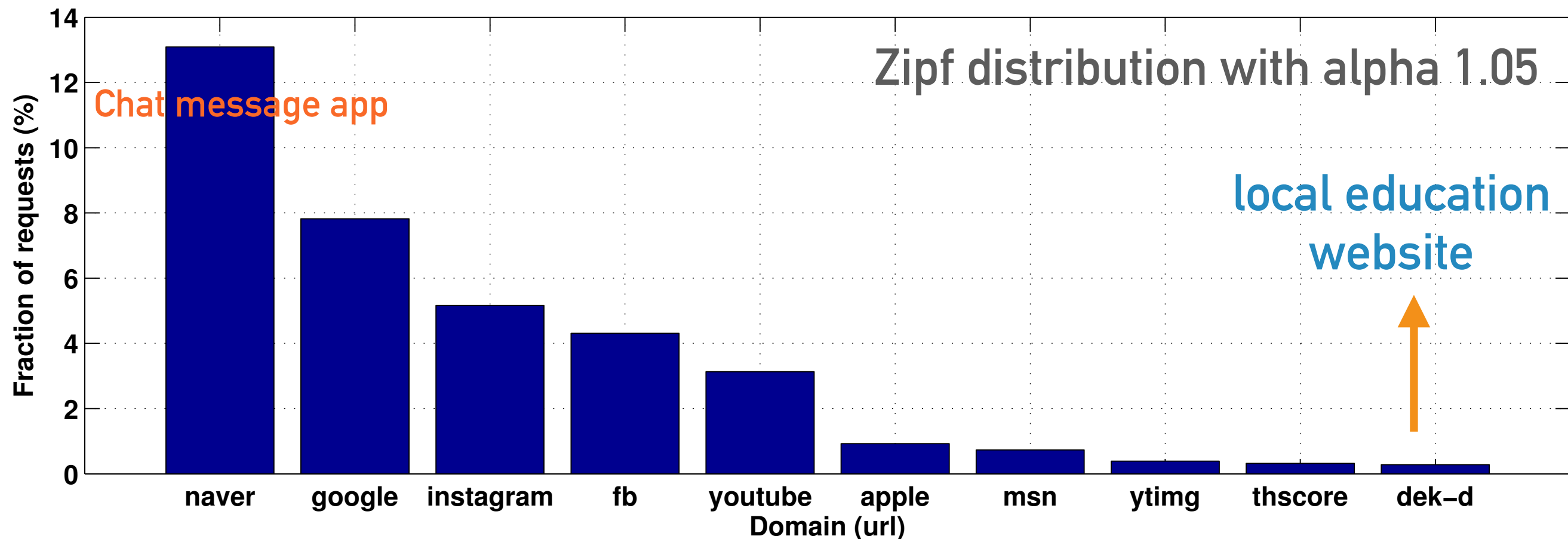
Dual off-peak hours

13:00 – 16:00 → How can we efficiently utilise these resources?

22:00 – 07:00

R-10 (D2.2): UMOBILE systems MUST be able prefetch data in order to improve service performance.

**Action:** Activate the service migration to meet QoS to prevent the critical bw constraint.

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R-10 (D2.2): UMOBILE systems MUST be able prefetch data in order to improve service performance.

## What could be the potential service/content for migration/prefetching (R-10) ?

Zipf distribution with alpha 1.05

Chat message app

local education website

Bar chart: Fraction of requests (%) vs Domain (url)

Domain	Fraction of requests (%)
naver	~13
google	~7.8
instagram	~5.2
fb	~4.3
youtube	~3.1
apple	~0.9
msn	~0.7
ytimg	~0.4
thscore	~0.3
dek–d	~0.3

New-R10: UMOBILE system MUST be able to prefetch the relevant service to the specific local community
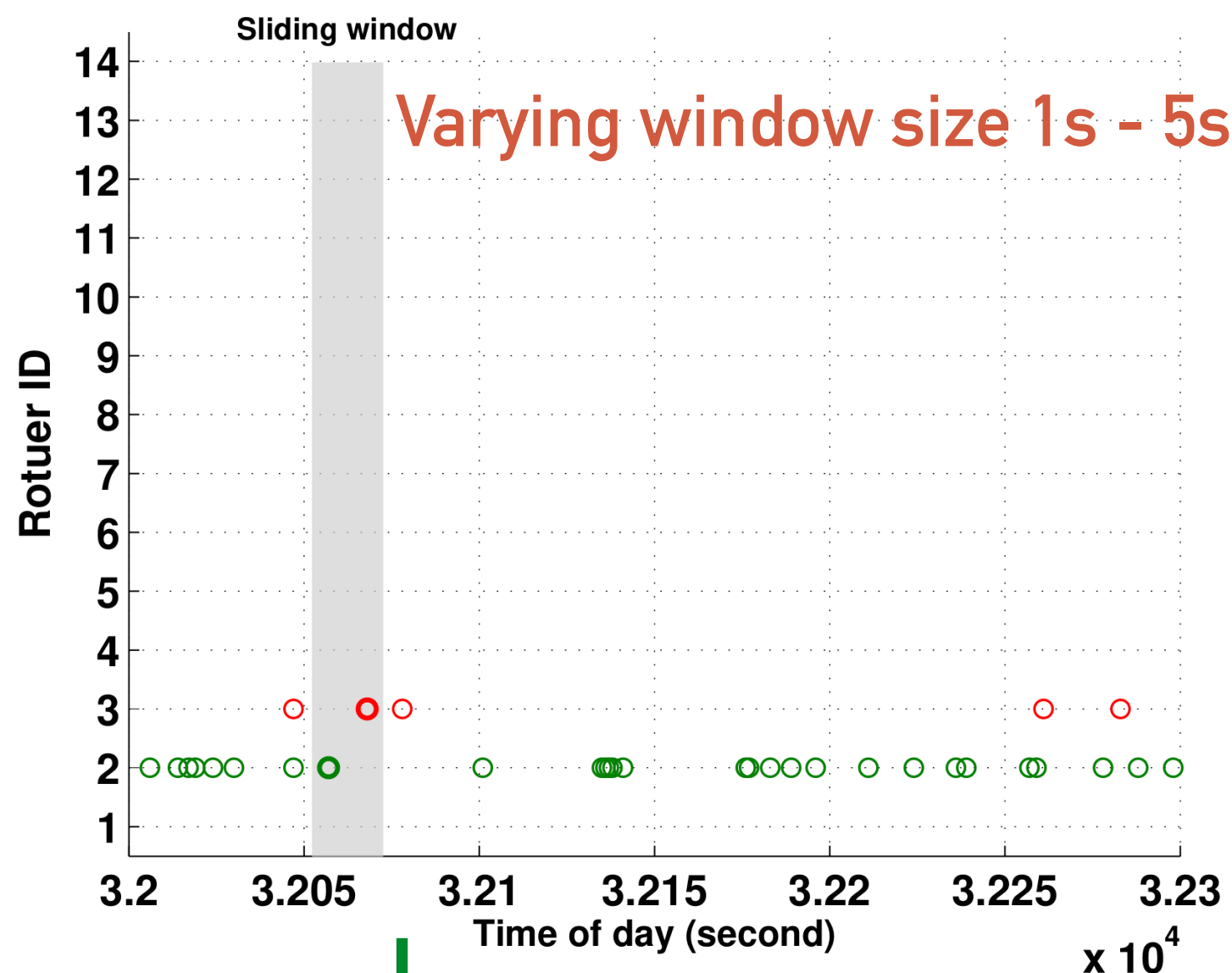
HTTP request to Line server from each router
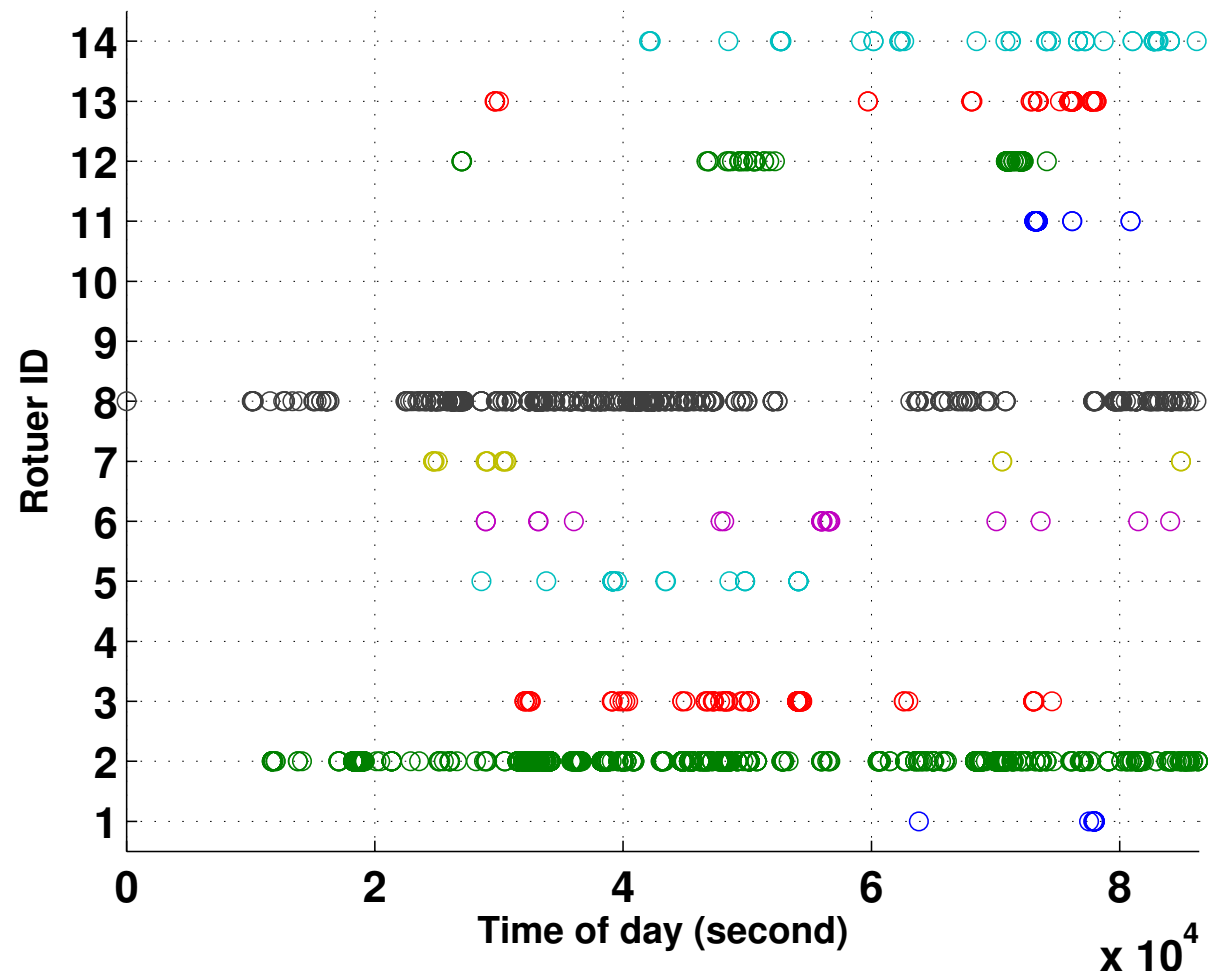
Line application (naver)
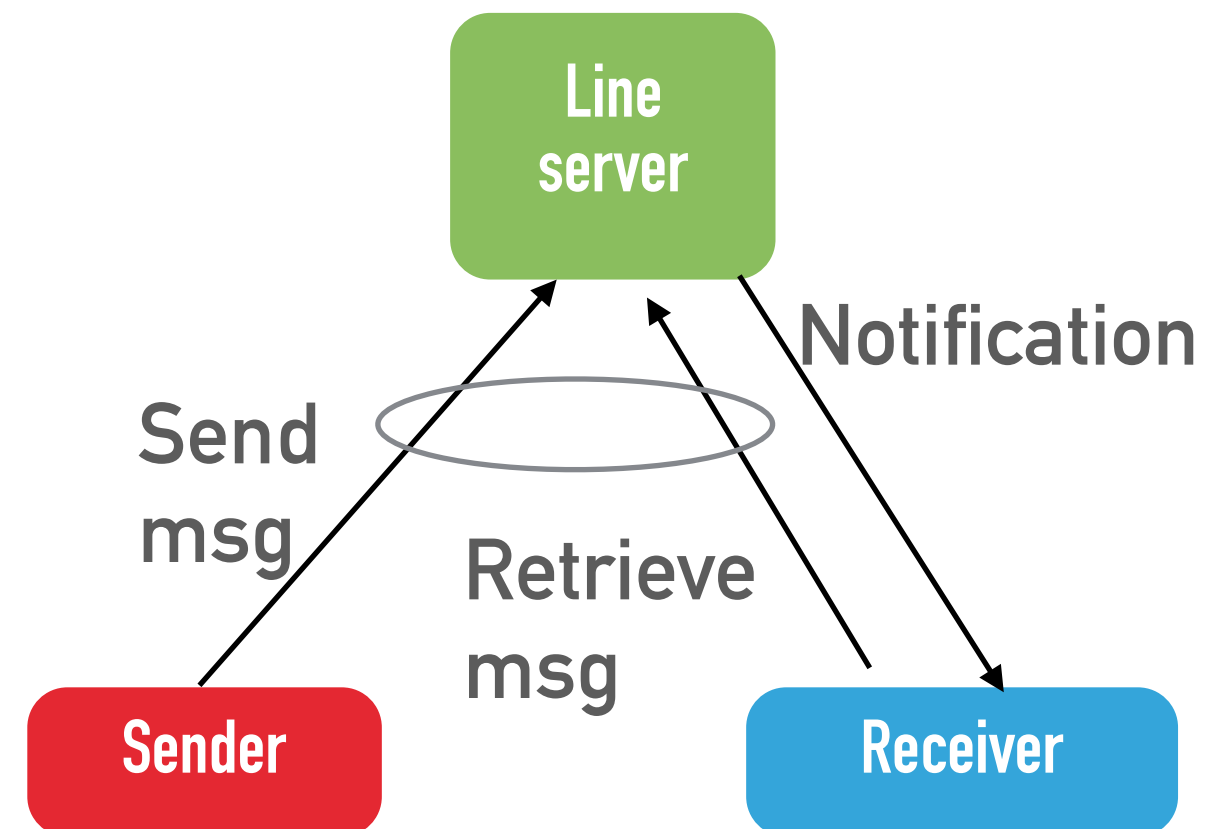
This supports the general requirement of UMOBILE in terms of supporting the localised services and communication.

→ **Action:** we developed Oi

Varying window size 1s - 5s

Achieve **10% - 15%** of identified pairs

From interview **10% - 20%** of messages are local

A pair of communication represents the localised communication

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Social Interview

R-1: UMOBILE systems MUST be able to harness multiple communication platforms.

R-3: UMOBILE systems MUST be able to exchange data through Wi-Fi (structured, direct), 3G and bluetooth

User information

52 interviewees

18   34

Kids
8-16

Teens
16-21

Adults
over 22

14

8

30

Monthly wages

$

140$ - 560$

Device used

40% **VS** **60%**

91%

Popular content

Adults	JOBS		Training		
Teens	Dek-D www.dek-d.com				
Kids	Animal Jam				

R-10 (D2.2): UMOBILE systems MUST be able prefetch data in order to improve service performance.

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Social Communications

87%
71%
33%
7.6%

81% of Line users

have local contacts within the same village

10-20% of messages

exchanged among local users

Usage pattern

30%   06:00 - 12.00

21%   12:00 - 17.00

80% 17:00 - 22.00

12.5% 22:00 - 06.00

User feedback

85% of users install CM battery application
(expect to improve their WiFi speed)

4 users opted out due to the extra cost incurred by

electricity bill (just 1-2$/month)

4 hours per day
on Internet usage

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▸ The results of analysis reinforce many of the original requirements (D2.2).

▸ At the same time, the deep analysis identifies some relevant requirements. These requirements will be updated in D2.3

▸ The analysis also encourages the UMOBILE applications (e.g., Oi app).

▸ The results also justify the implementation of the UMOBILE architecture. For instance:

   ▸ Decide what/when (e.g., off-peak) to **migrate the services**

   ▸ Activate the **DTN communication** and **Congestion control** (when the traffic demand is critically high)

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System Requirements and Deployability

▸ Definition of operational requirements (D2.4 in July 2017)

▸ How can we make our system deployable, operational and extensible?

▸ What are the constraints and barriers to deploy all UMOBILE systems?

▸ How can we minimise "backend" support?

▸ How can we minimise the barriers to future implementations?

▸ We will focus on deployability and operational requirements for the demonstrations

▸ How can we maximise the use of the systems we will have developed by the time of the demos?

▸ How can we demonstrate the full potential, taking into account regulatory framework?

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Use of drones

▸ Platform category

▸ Size, Weight and Power

▸ Range and endurance

▸ Hotspot integration

▸ Altitude vs. Coverage

▸ Interference issues

▸ Explore available links

▸ Regulatory constraints

▸ Scenario definition

Hardware specifications
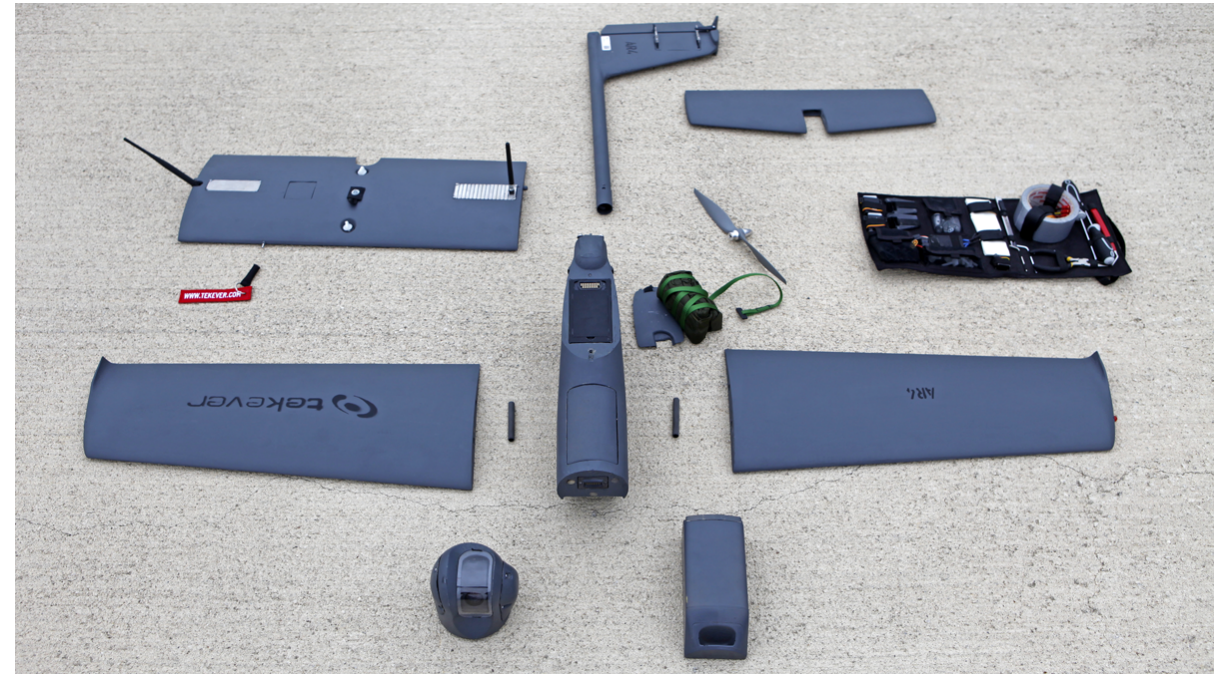
▸ OpenWRT support and compatibility with:

  ▸ consortium background

  ▸ installed AP fleet of the industrial partners (which prevents 64 bit usage)

▸ Outdoor

  ▸ Low power consumption

  ▸ Extending range of operating temperature

▸ Flexible radio interfaces 2.4 GHz, 5 GHz; 1x1, 2x2 MIMO

▸ Low cost

▸ Easy integration with 64 bit 'computing devices' (Raspberry PI)

System Requirements: Prototype

Model
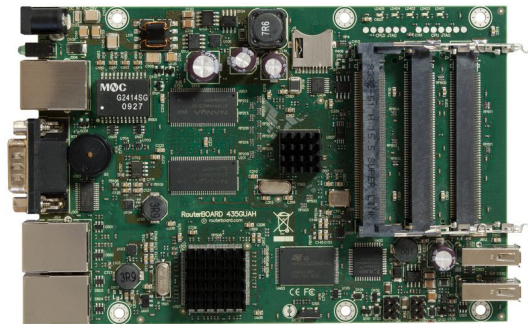
MikroTik RB493G

MikroTik RB435G
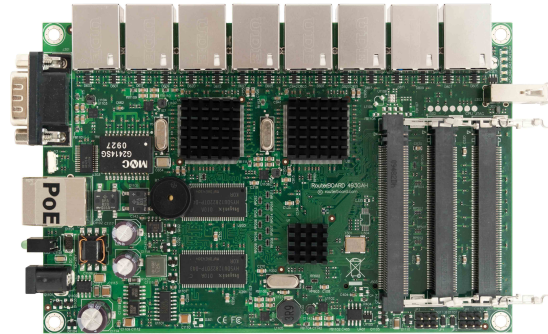
Features

CPU Atheros AR7161 680MHz
Memory 256MB DDR SDRAM onboard memory
Boot loader RouterBOOT
Data storage NAND memory chip and microSD slot
Ethernet Nine 10/100/1000 Mbit/s Fast Ethernet ports
miniPCI Three miniPCI slots Extras
Serial port One DB9 RS232C asynchronous serial port
Power over Ethernet: 10..28V DC
Power jack: 10..28V DC
Dimensions 105mm x 160mm, 189 grams
Power consumption ~3W without extension cards,
maximum – 16 W

CPU Atheros AR7161 680MHz
Memory 256MB DDR SDRAM onboard memory
Boot loader RouterBOOT
Data storage NAND memory chip and microSD slot
Ethernet Three 10/100/1000 Gigabit Ethernet ports
miniPCI Five miniPCI Type IIIA/IIIB slots
Serial port One DB9 RS232C asynchronous serial port
Power PoE: 8-28V DC on Ether1 (Non 802.3af).
Power Jack: 8-30V DC
Dimensions 105 mm x 154 mm, Weight: 153g
Power consumption ~4.5W without extension cards
Output to cards 19W

Benefits

Designed for Core Network (CR - CAPR)
OpenWRT support
Serial port console
Nine Giga Ethernet
MiniPCI slot to mount wireless module
MicroSD storage support

Designed for Access Point Access Network (APR)
OpenWRT support
Serial port console
Three Giga Ethernet
MiniPCI slot to mount wireless module
MicroSD storage support

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Model

MikroTik R52n-M

Raspberry Pi3

Features

• Dual band IEEE 802.11a/b/g/n standard
• Output Power of up to 23dBm
• Support for up to 2x2 MIMO with spatial multiplexing
• Four times the throughput of 802.11a/g
• Atheros AR9220, chipset
• High Performance (up to 300Mbps physical data rates and 200Mbps of actual user throughput) with Low Power Consumption
• Two MMCX antenna connectors
• Operating temperatures: -50ºC to 60ºC
• Power consumption MAX 1.95W

•Broadcom BCM2837 chipset running at 1.2 GHz
•64-bit quad-core ARM Cortex-A53
•802.11 b/g/n Wireless LAN
•Bluetooth 4.1 (Classic & Low Energy)
•1 GB LPDDR2 memory
•Supports all the latest ARM GNU/Linux distributions
•1 x 10/100 Ethernet port
•4 x USB 2.0 ports
•Chip antenna
•microSD card slot
•Dimensions: 85 x 56 x 17 mm
•Weight   41.2 g

Benefits

Designed for Wireless Network
OpenWRT support
MiniPCI Interface
Dual band 2.4GHz and 5 GHz
Support 2x2 MIMO
Temperatures range
Low Power Consuption

Designed for Service (SEG – LBB)
Linux 64bit support
Wireless integrated
MicroSD storage support
USB expansion slot

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Model

BPI-M2

Features

- CPU   A31S ARM Cortex-A7™ Quad-core
- Memory   1GB DDR3 (shared with GPU)
- Storage Support   MicroSD Card(up to 64GB)
- Onboard Network 10/100/1000 Ethernet RJ45
- WiFi   WiFi 802.11b/g/n
- Power Source 5V DC @ 2A
- USB Ports 4x USB 2.0
- OS Android and Linux etc.OS
- Dimensions   92mm x 60mm
- Weight   52g

Benefits

Designed for Testing (A4BB)
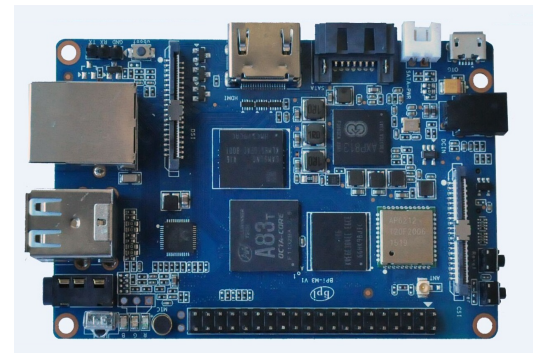
Android 4.X support

Giga Ethernet

Wireless integrated

SD Storage

USB expansion slot

BPI-M3

- CPU   A83T ARM Cortex-A7 octa-core
- Memory   2GB LPDDR3 (shared with GPU)
- Storage Support   eMMC(8GB onboard)
- Onboard Network 10/100/1000Mbps ethernet
- WiFi   802.11 b/g/n (AP6212)
- Bluetooth BT4.0 (AP6212)
- Power Source 5V DC port
- USB Ports 2x USB 2.0, USB OTG(Micro USB)
- OS Android and Linux etc.OS
- Dimensions   92mm x 60mm
- Weight   45g

Designed for Testing (A5BB)

Androind 5.X support

Giga Ethernet

Wireless integrated

eMMc storage support

USB expansion slot

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THANK YOU

Q&A