Kwiizya: Local Cellular Network Services in Remote Areas

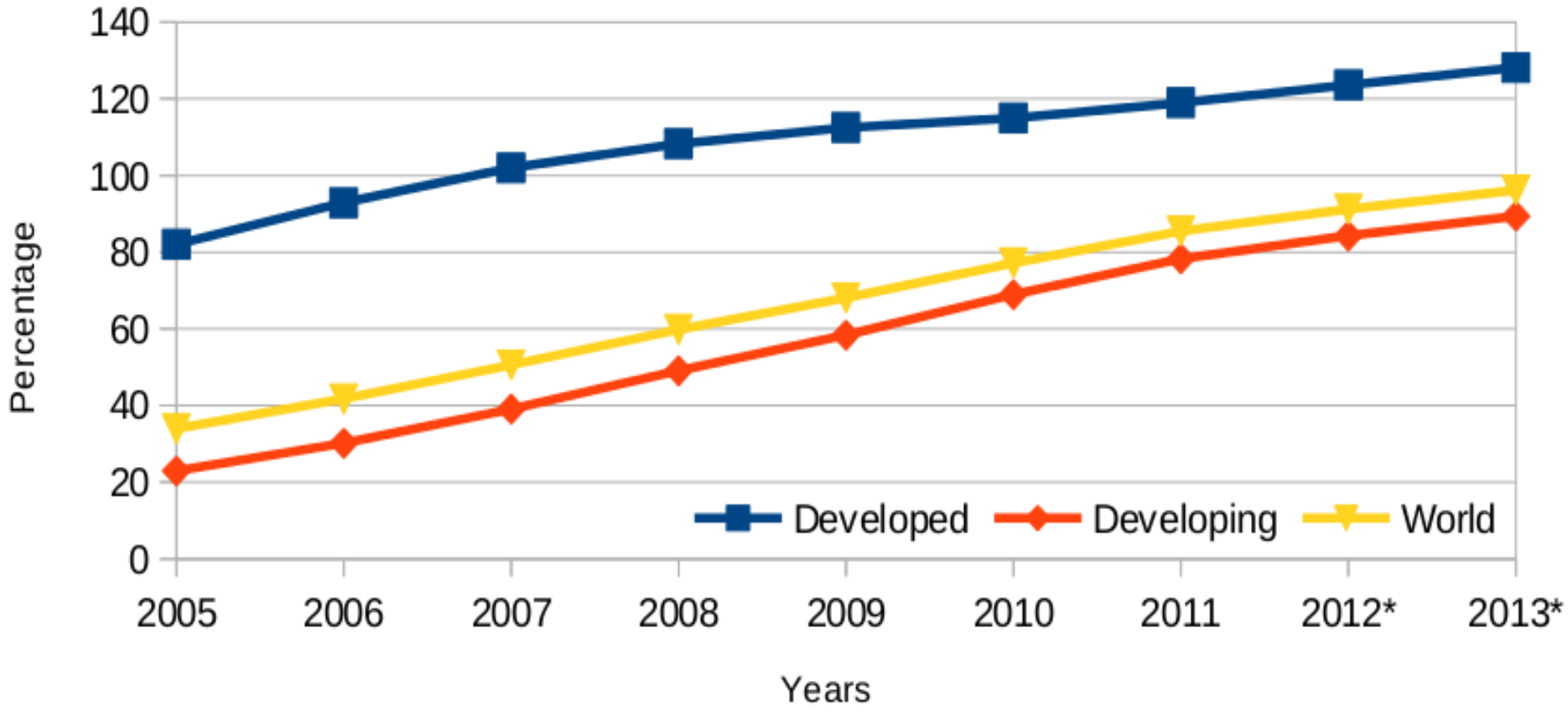
Mariya Zheleva,
Arghyadip Paul, David Johnson and Elizabeth Belding

University of California Santa Barbara

UCSB

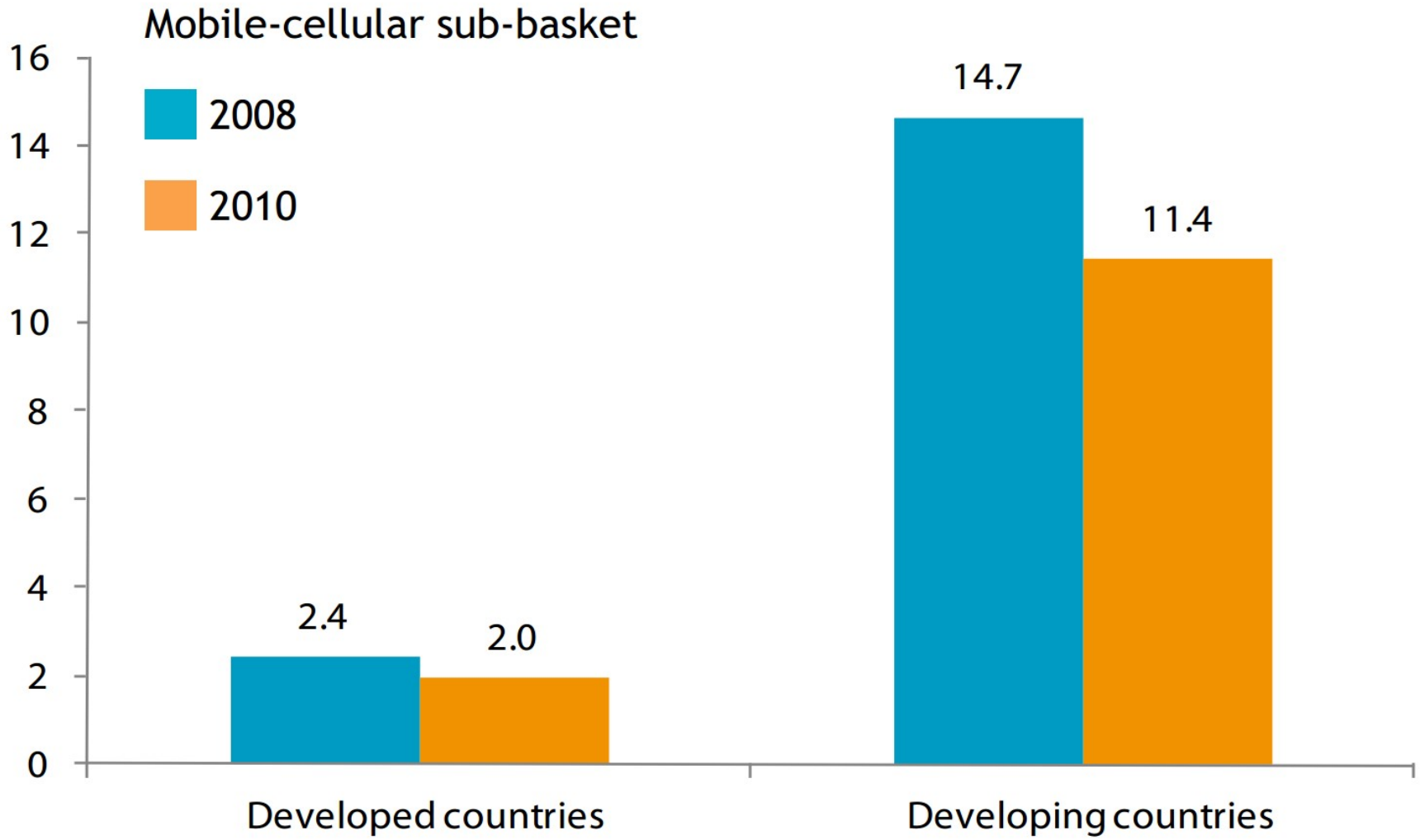
MOMENT LAB

Mobile-cellular subscriptions



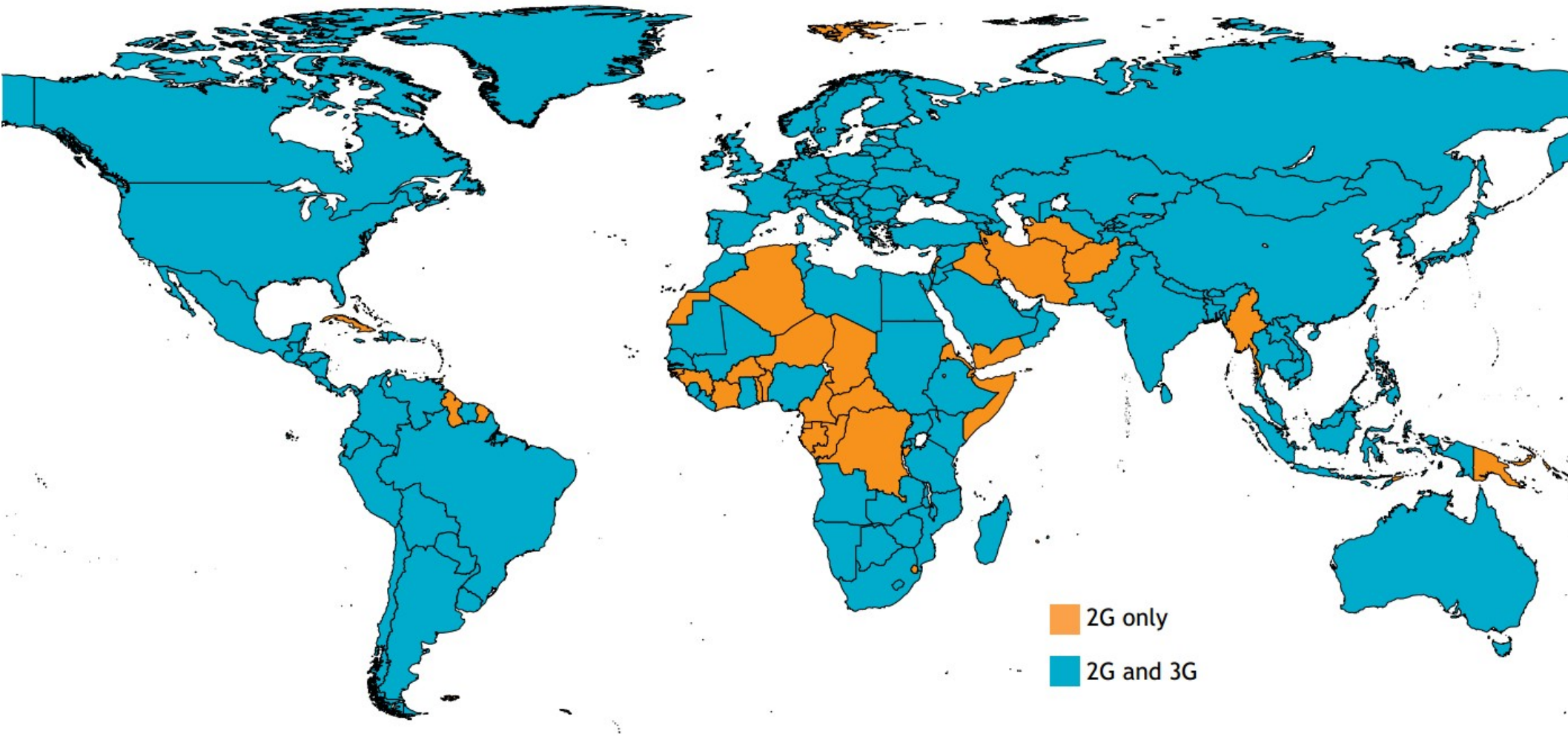
Source: ITU
* Estimates

Affordability and Accessibility



Source: ITU

Affordability and Accessibility



Source: ITU

“Mobile network operators find it commercially infeasible to operate in rural areas.”

World Bank's 2012 report on Maximizing Mobile

UCSB

MOMENT LAB

Goal:

Low-cost cellular network architecture with extensions for SMS-based applications.

Means:

- Free, open-source software
- Software-Defined Radio (SDR) hardware
- GSM-compatible
  - No need of user device modifications

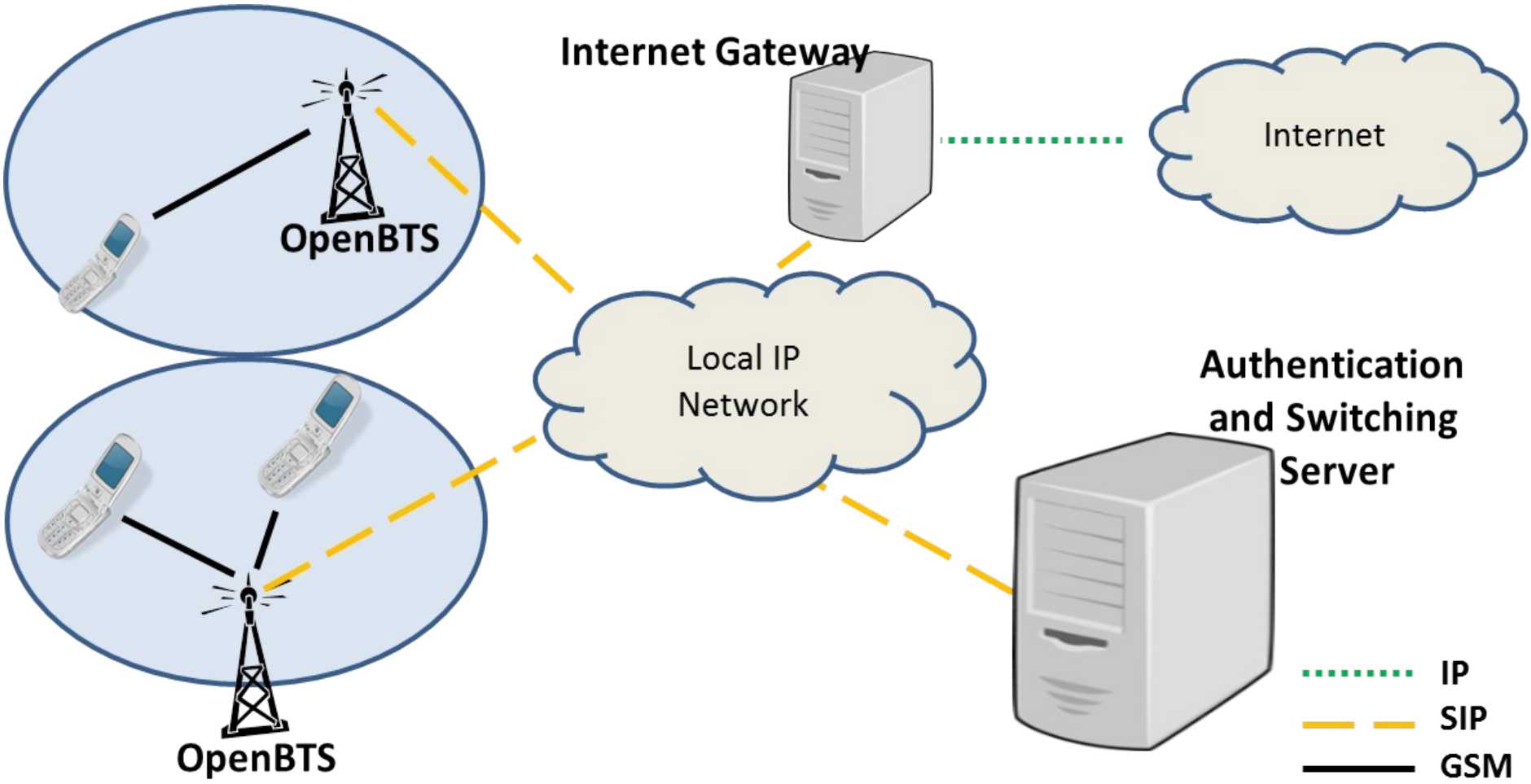
Macha, Zambia

Source: Google Maps

UCSB

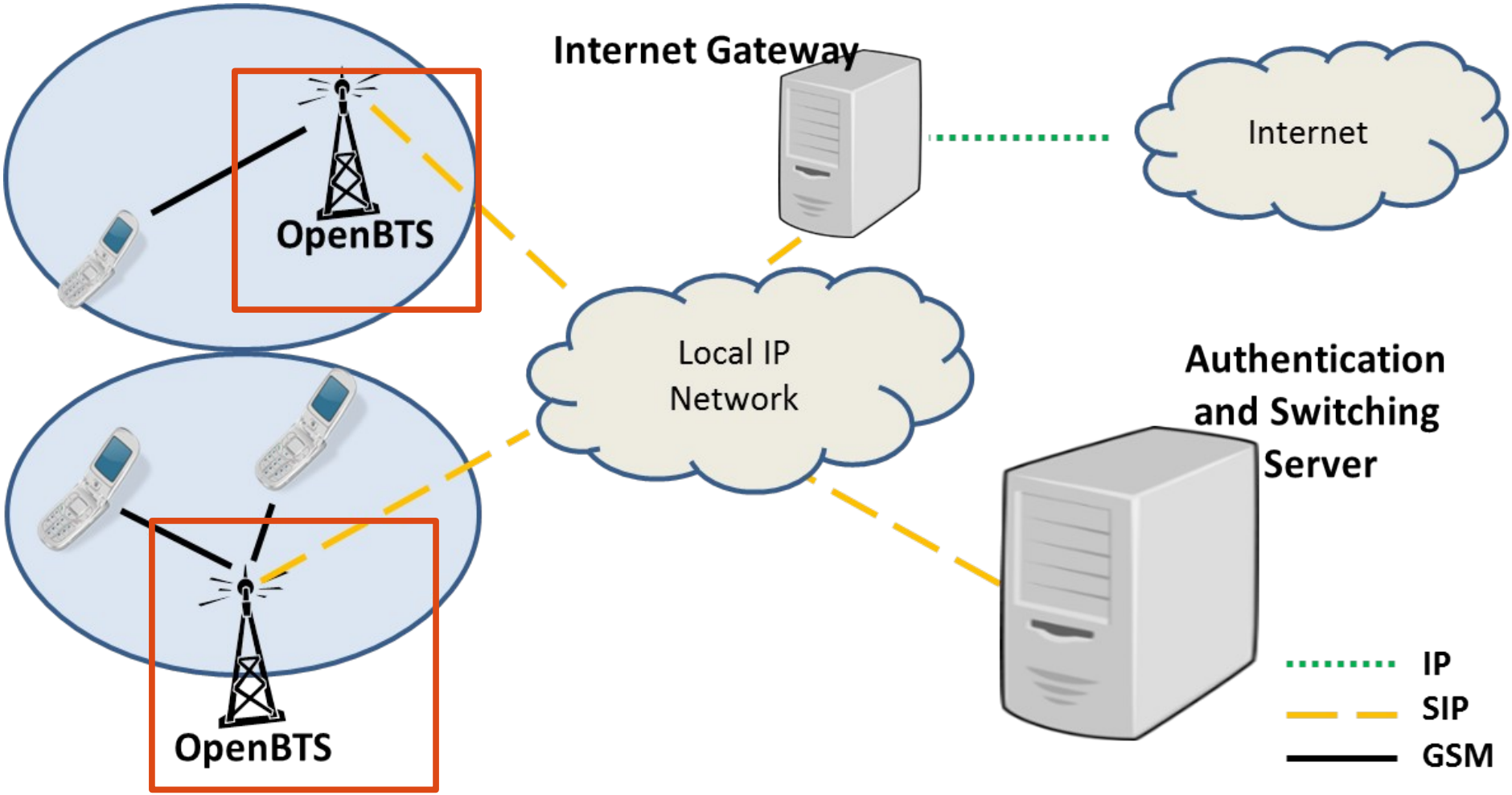
MOMENT LAB

Kwiizya* Architecture



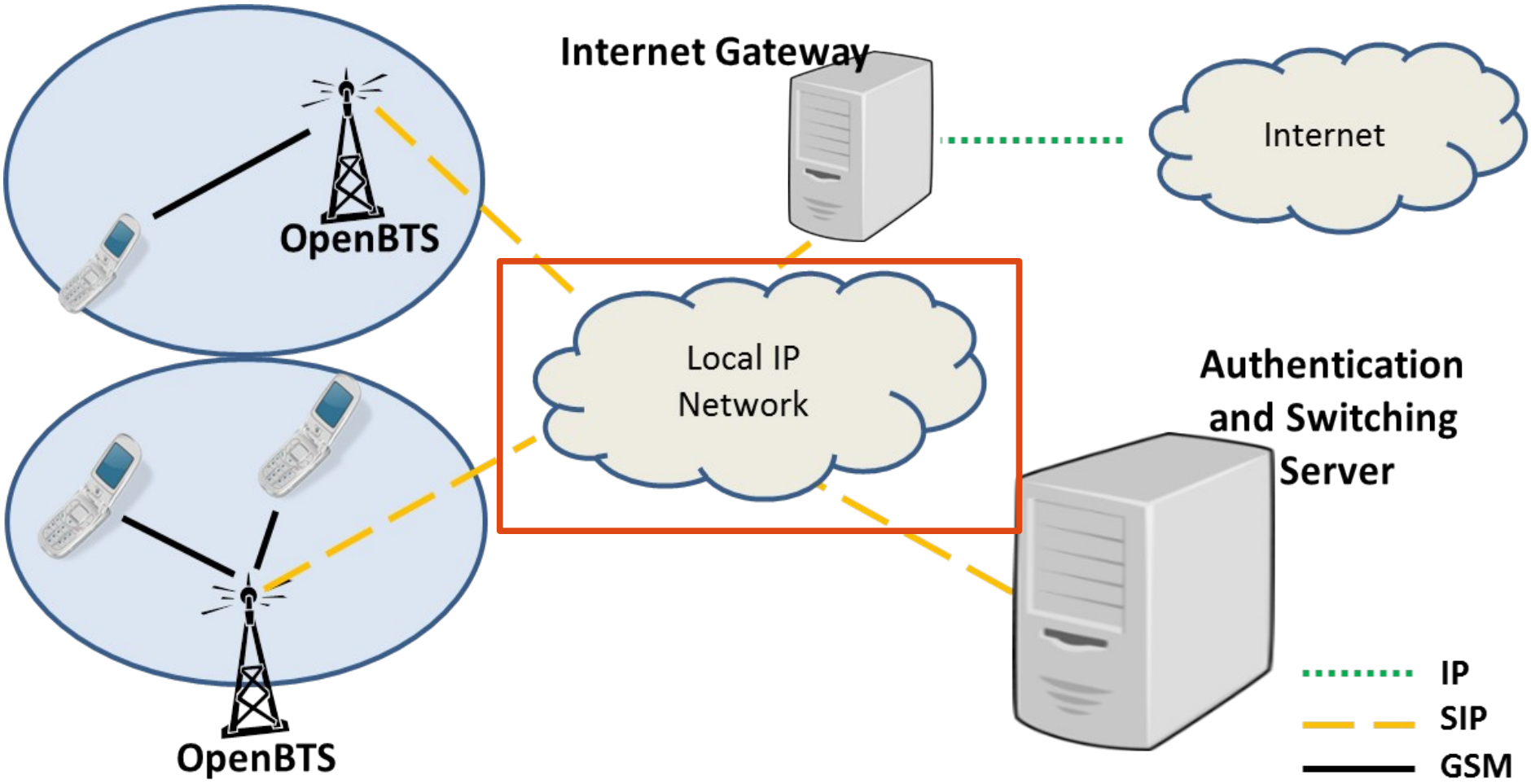
* Kwiizya means “to chat” in Tonga

Kwiizya* Architecture



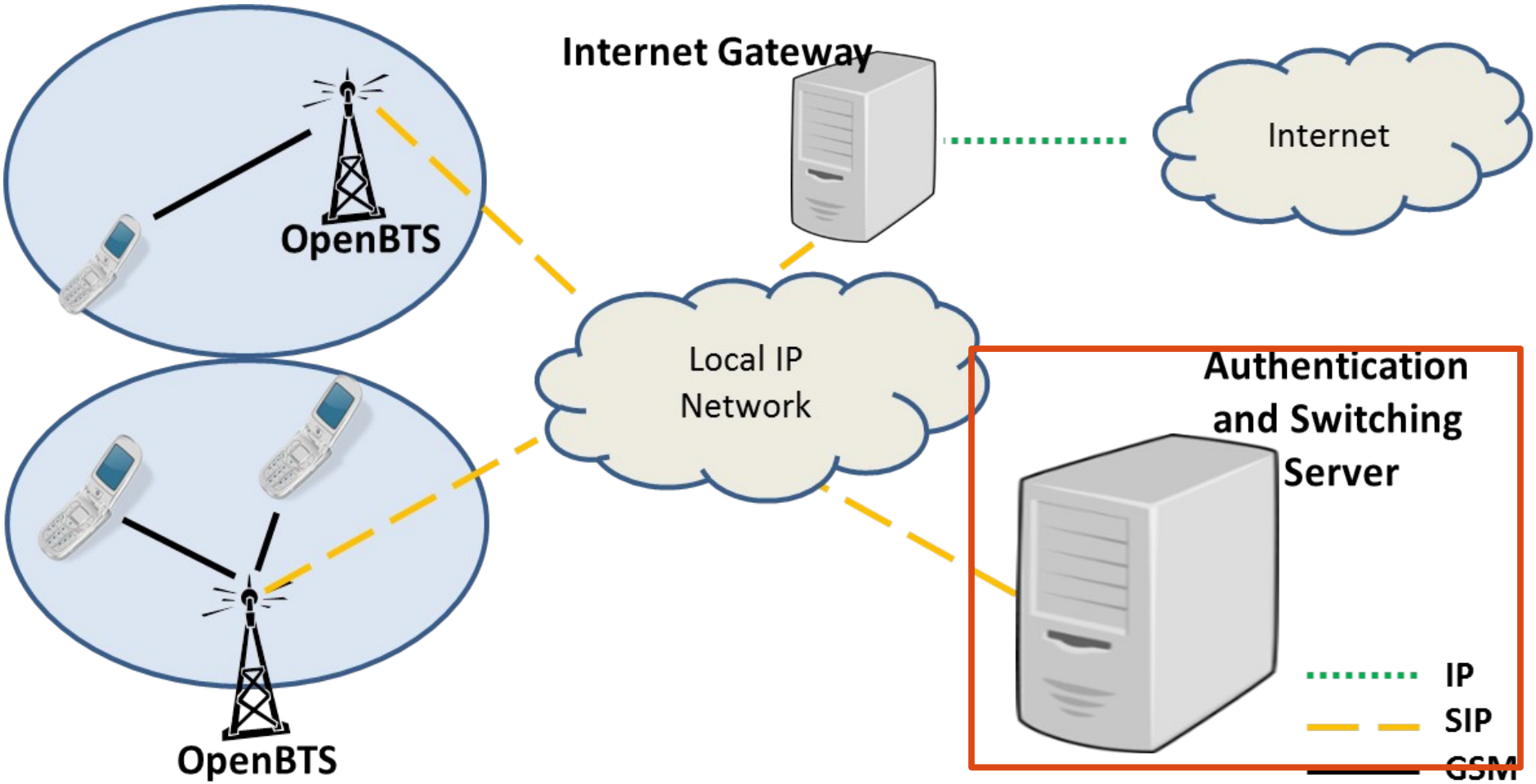
* Kwiizya means “to chat” in Tonga

Kwiizya* Architecture



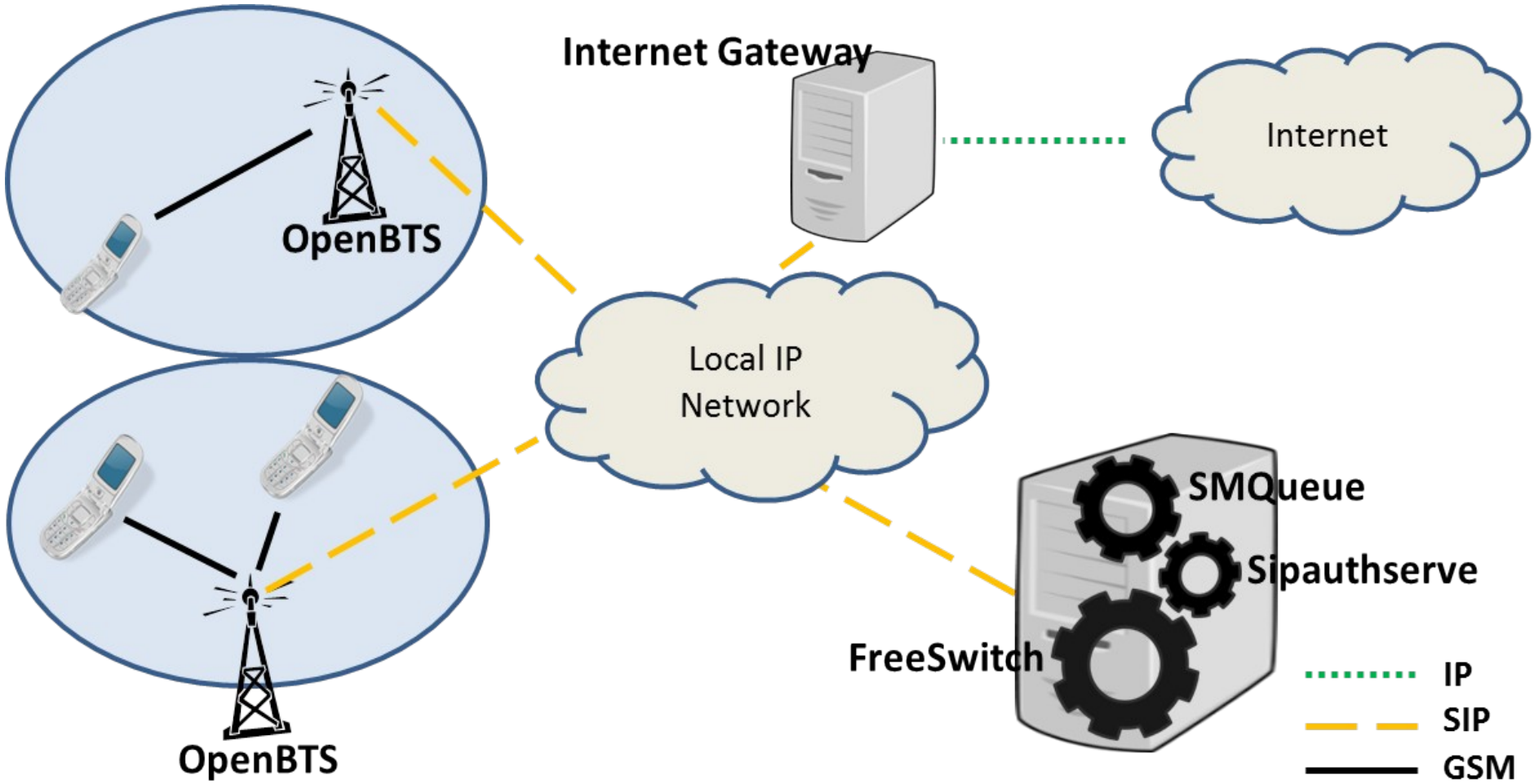
* Kwiizya means “to chat” in Tonga

Kwiizya* Architecture



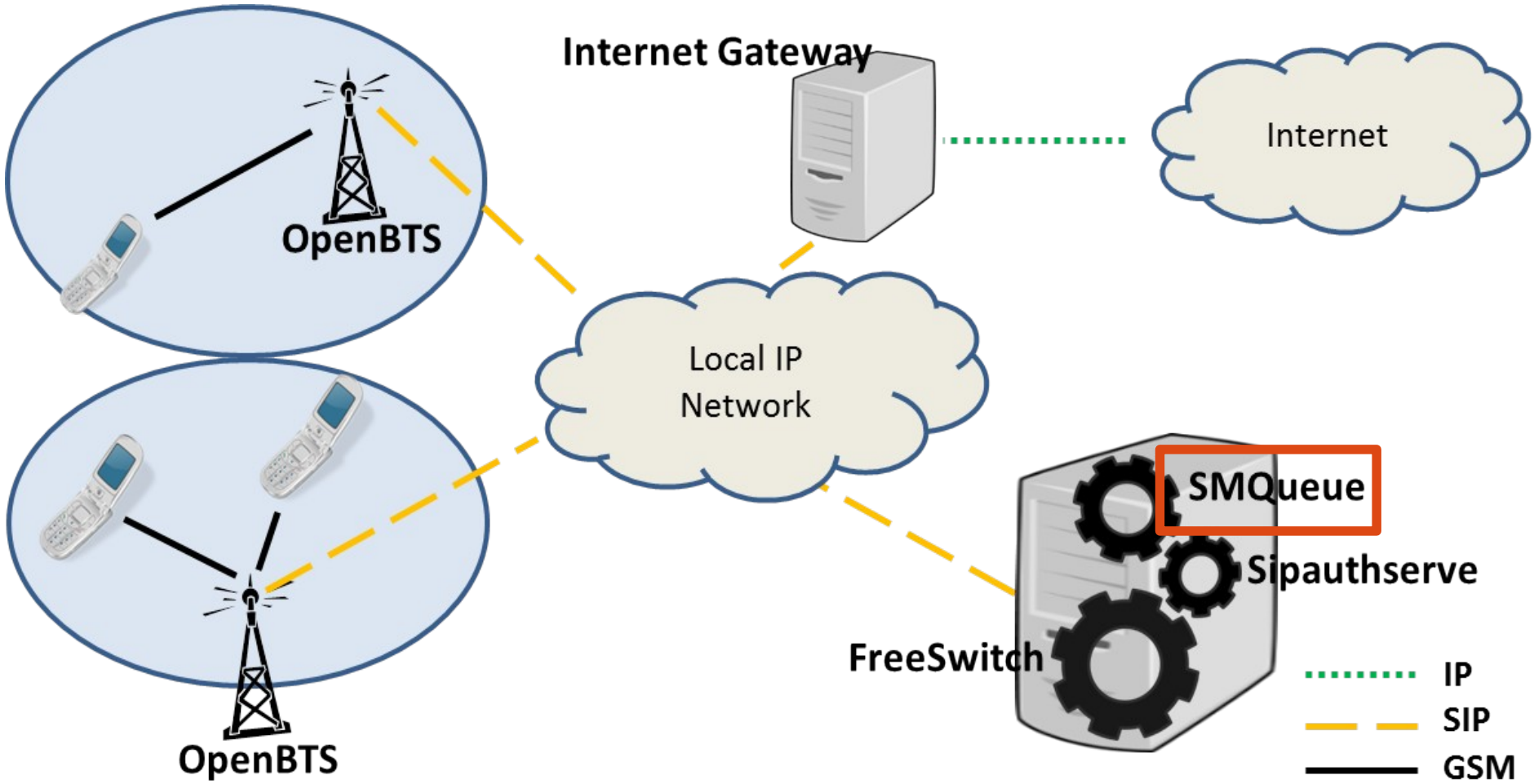
* Kwiizya means “to chat” in Tonga

Kwiizya* Architecture



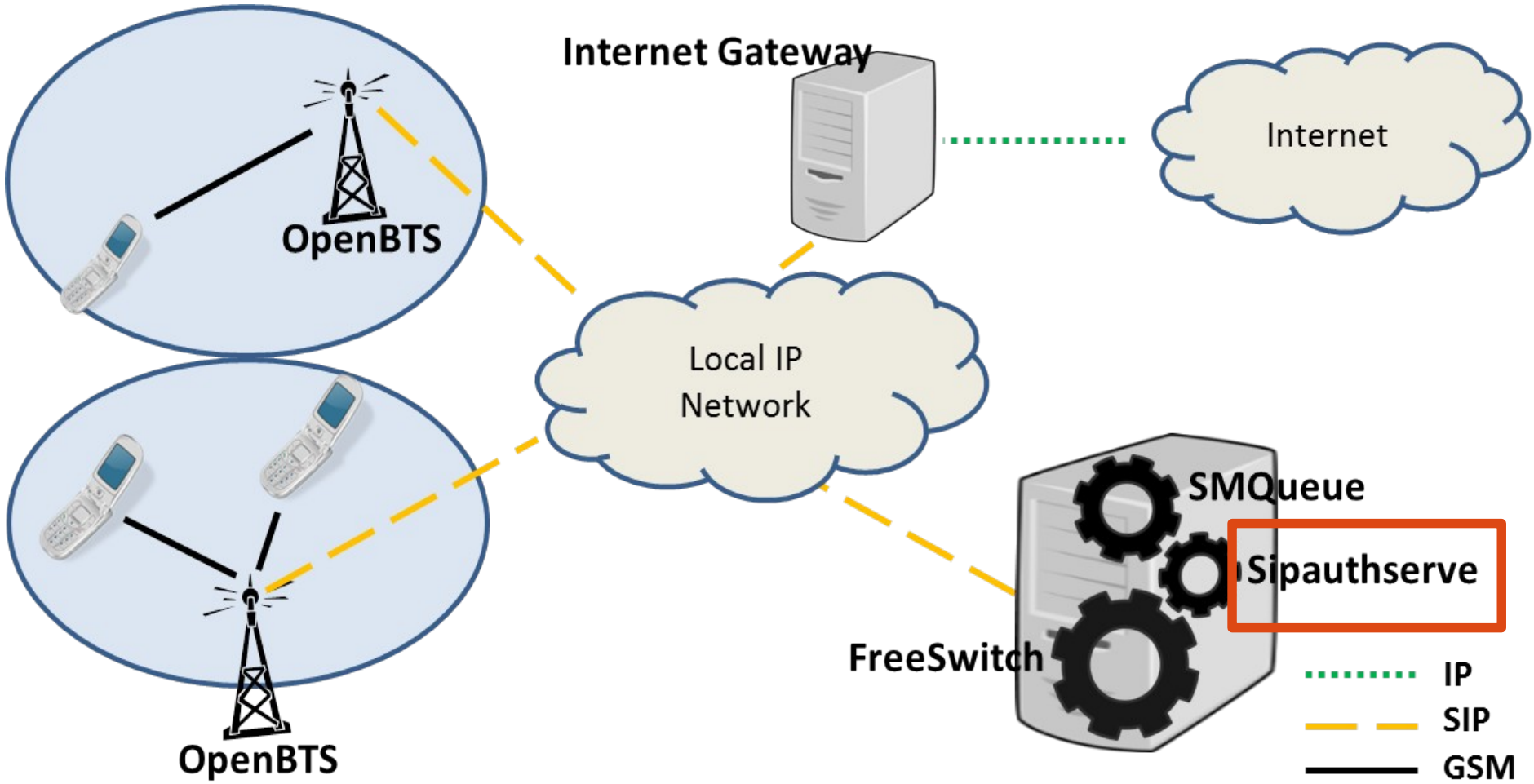
* Kwiizya means “to chat” in Tonga

Kwiizya* Architecture



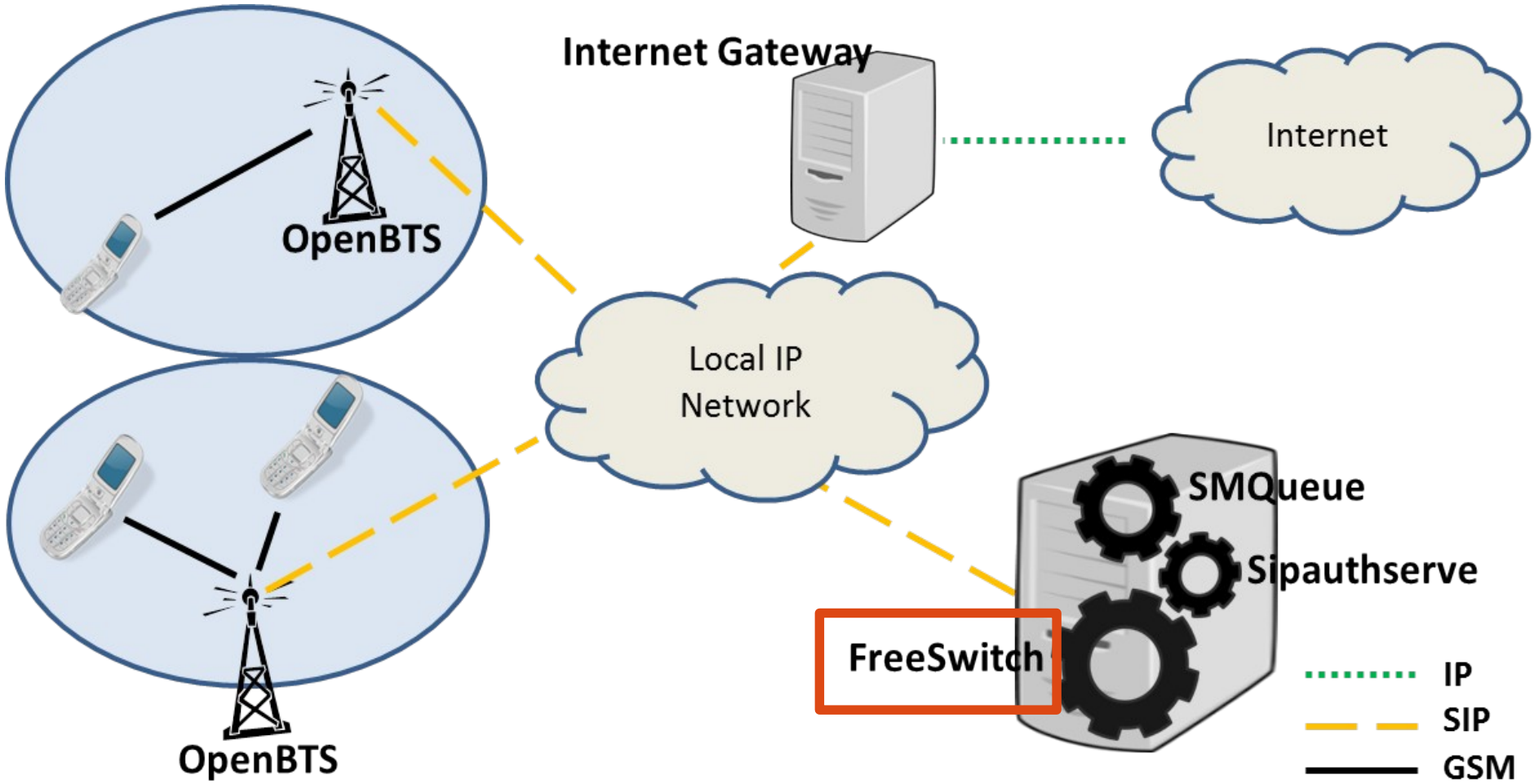
* Kwiizya means “to chat” in Tonga

Kwiizya* Architecture



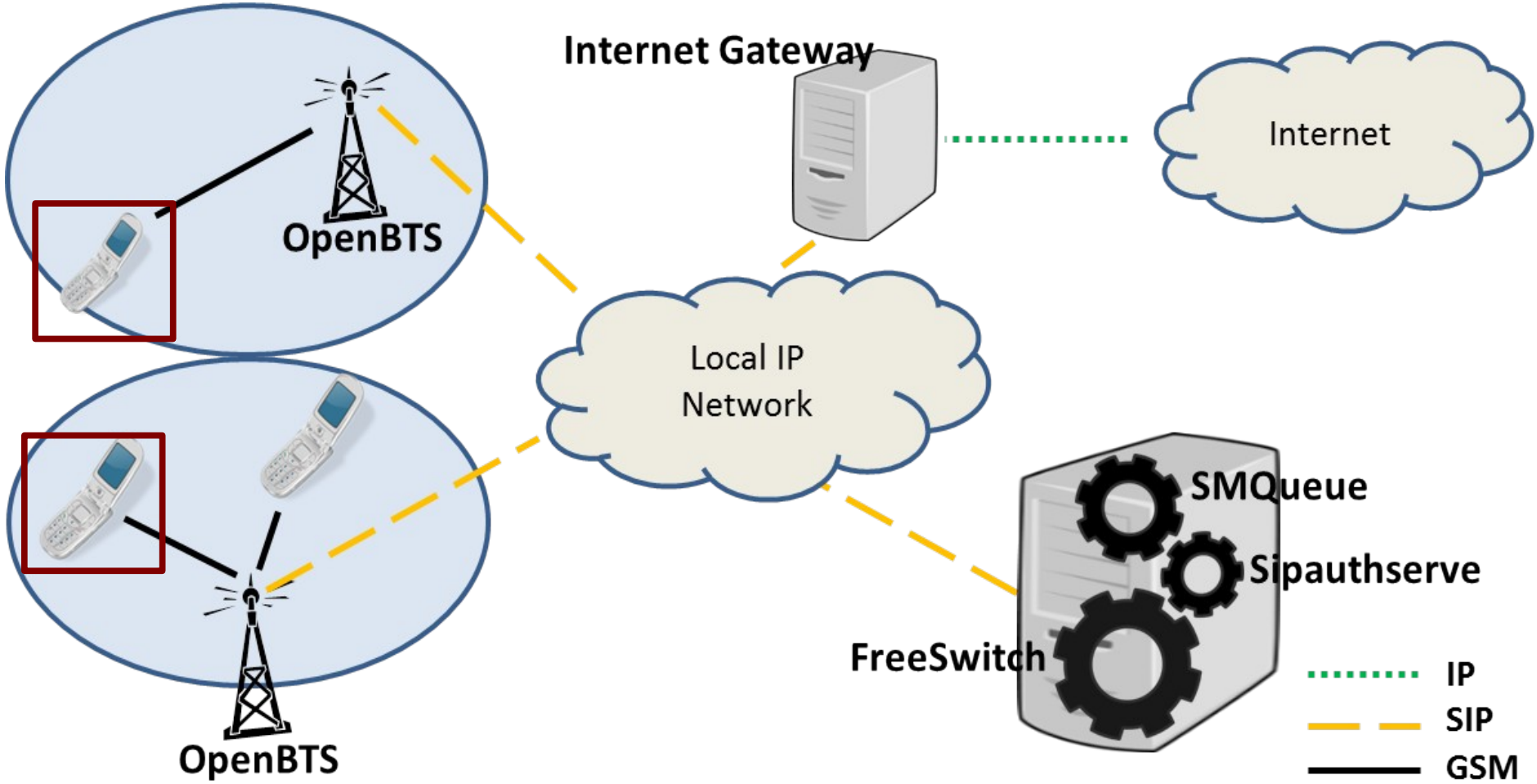
* Kwiizya means “to chat” in Tonga

Kwiizya* Architecture



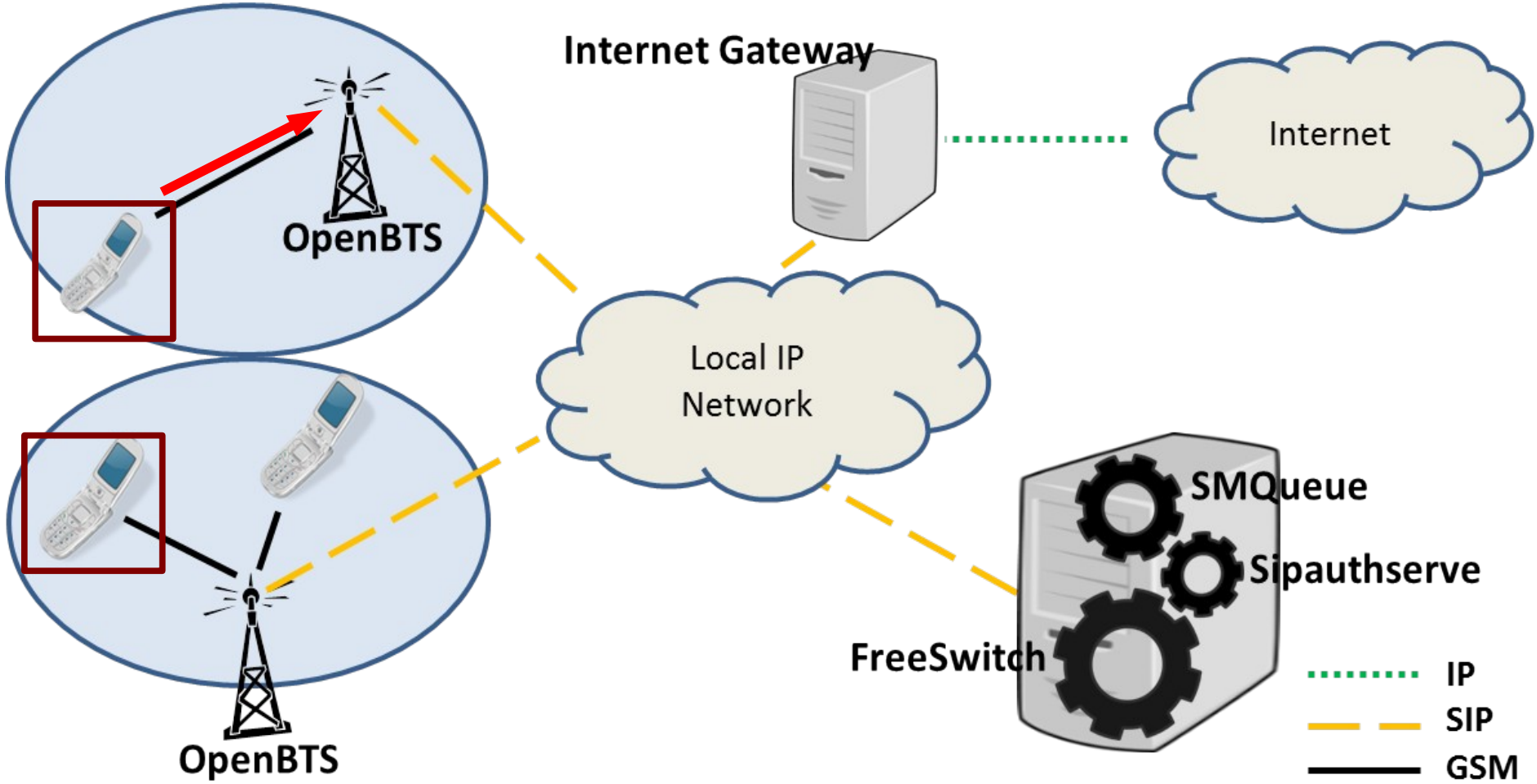
* Kwiizya means “to chat” in Tonga

Kwiizya* Call Switching



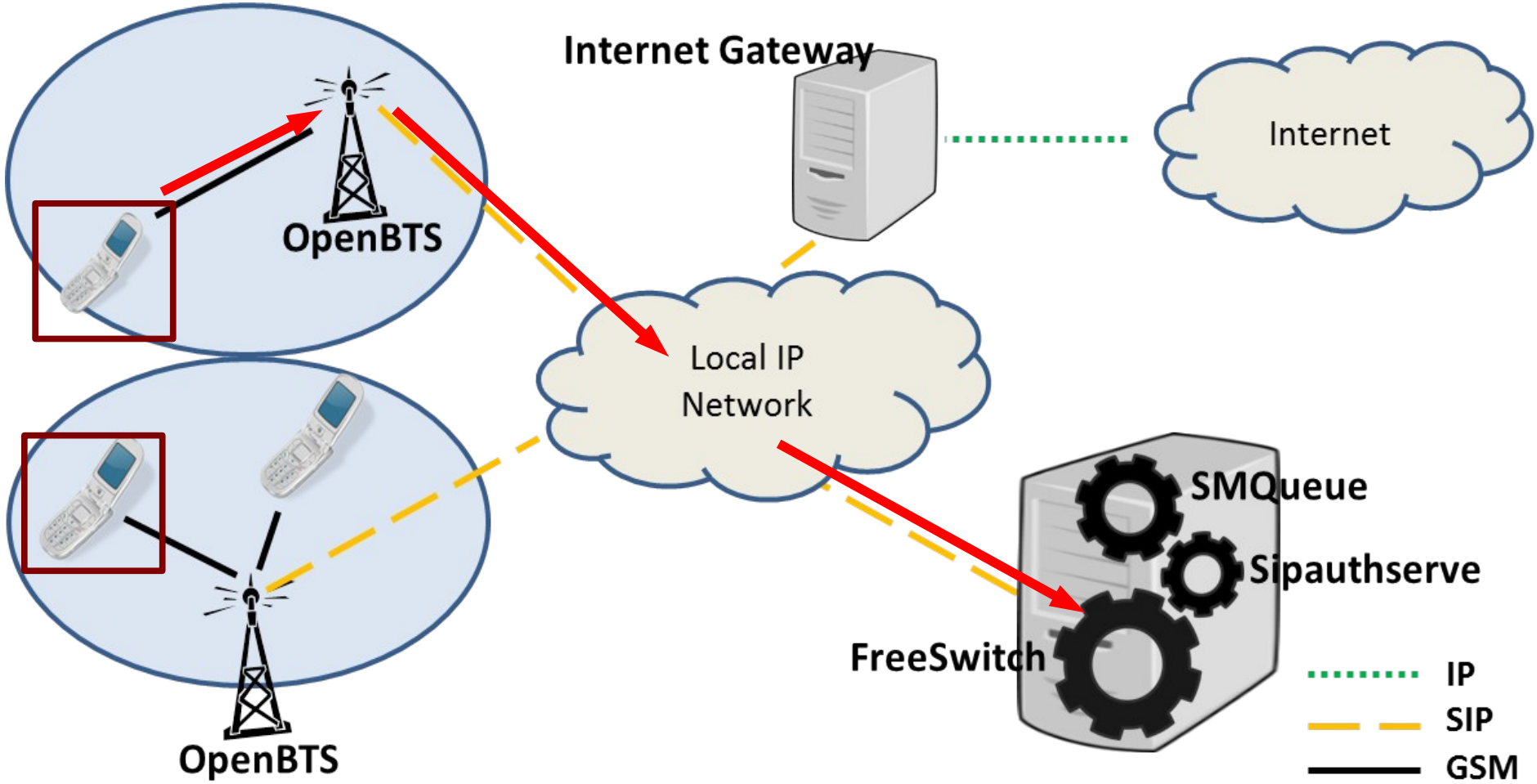
* Kwiizya means “to chat” in Tonga

Kwiizya* Call Switching



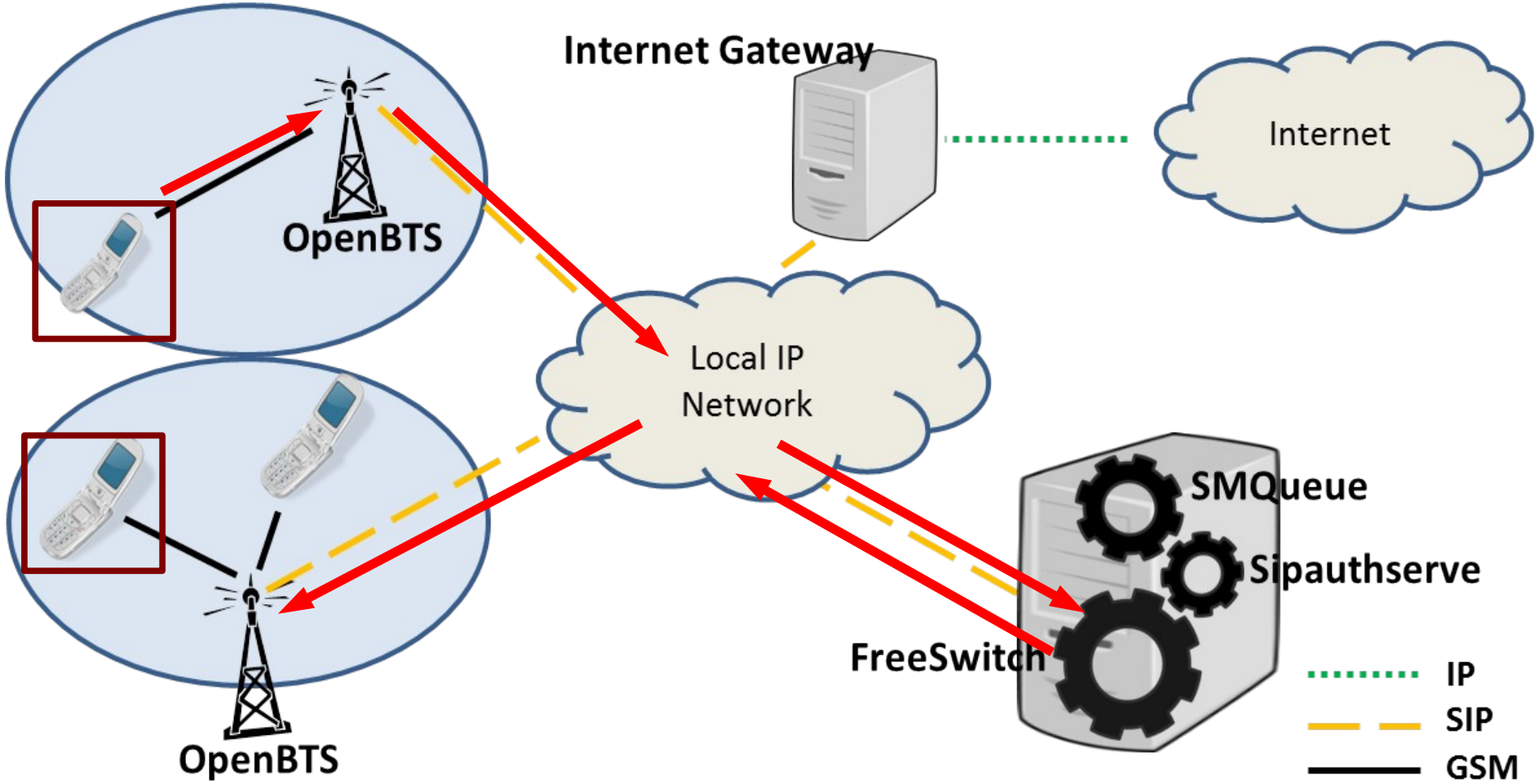
* Kwiizya means “to chat” in Tonga

Kwiizya* Call Switching



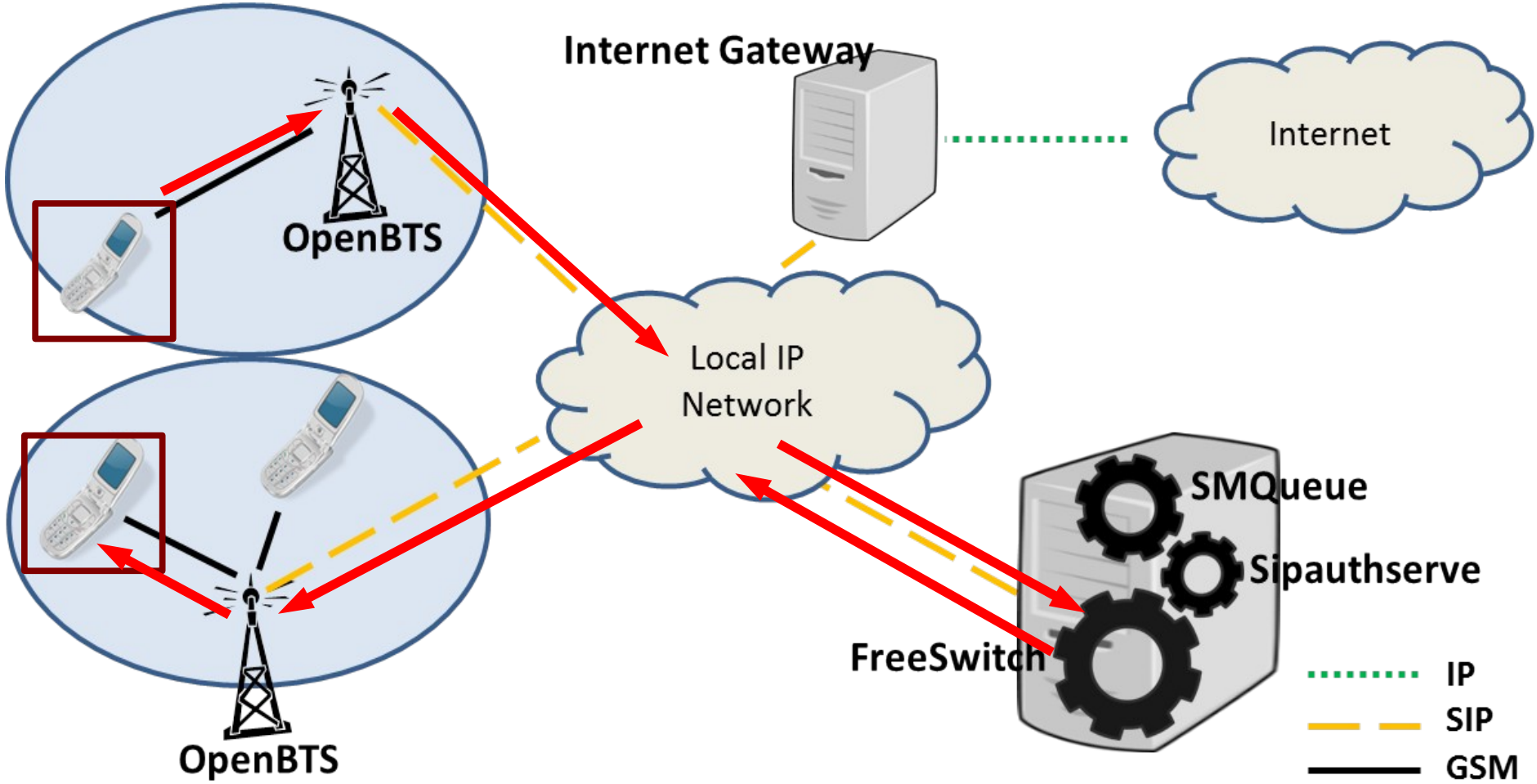
* Kwiizya means “to chat” in Tonga

Kwiizya* Call Switching



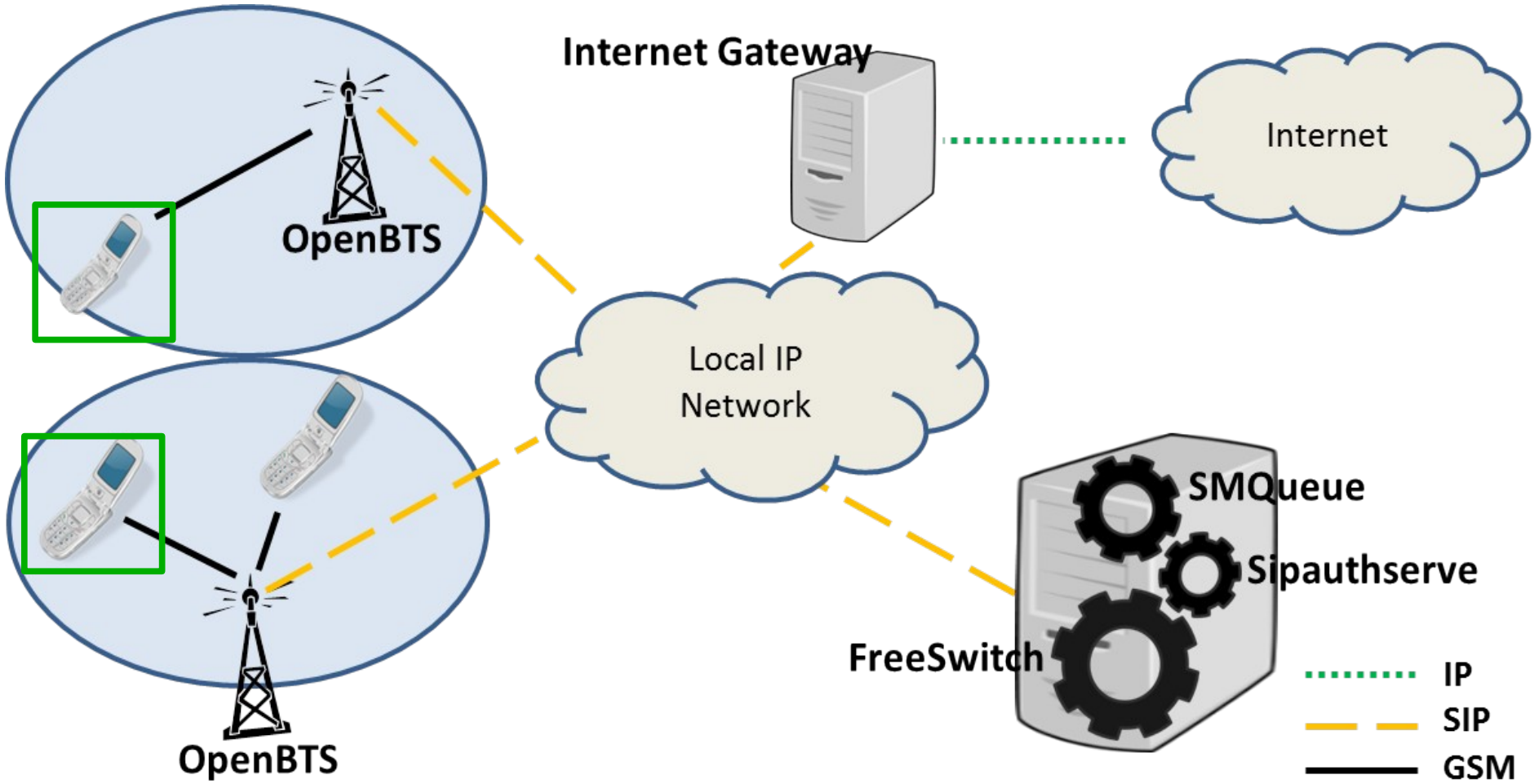
* Kwiizya means “to chat” in Tonga

Kwiizya* Call Switching



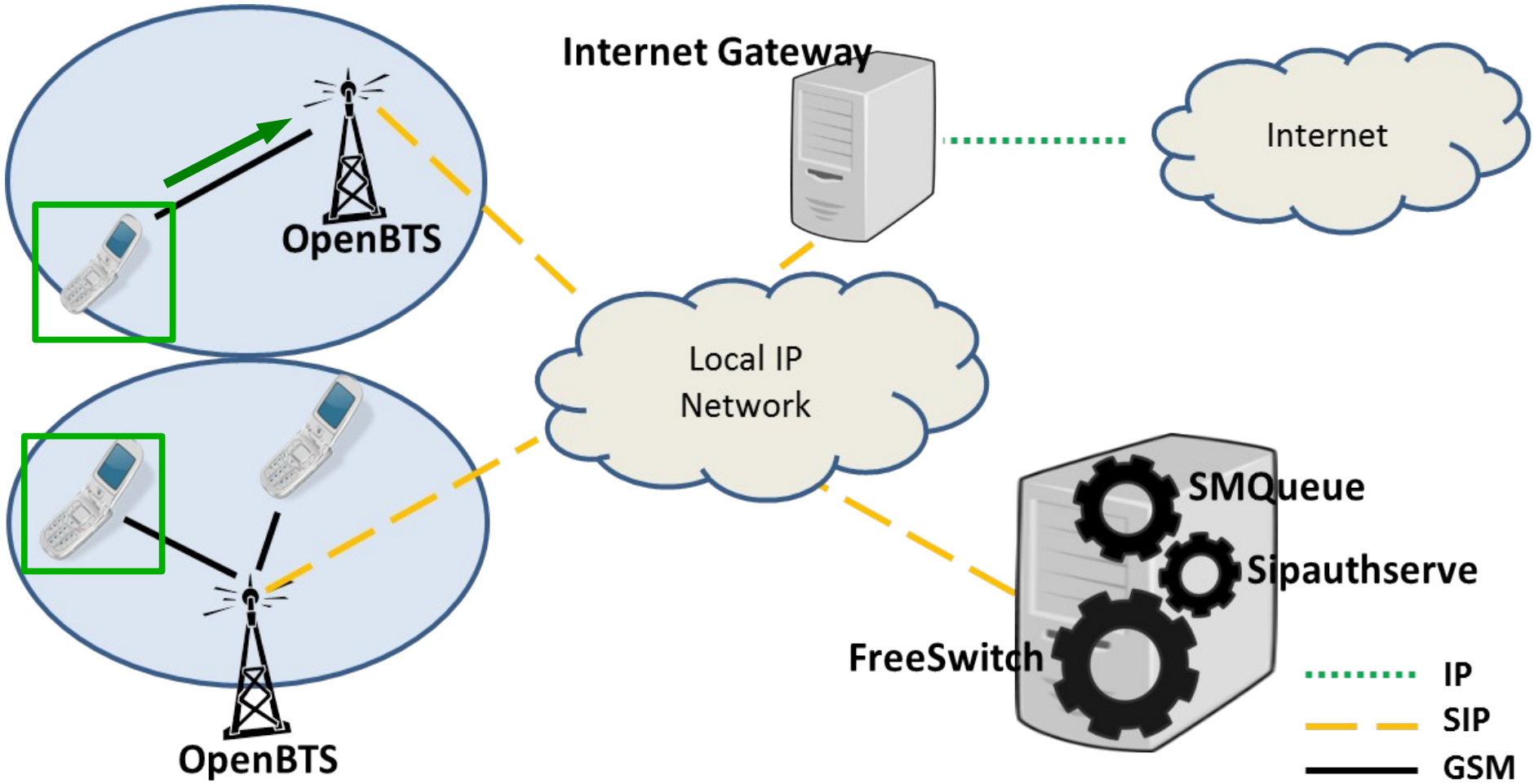
* Kwiizya means “to chat” in Tonga

Kwiizya* SMS Switching



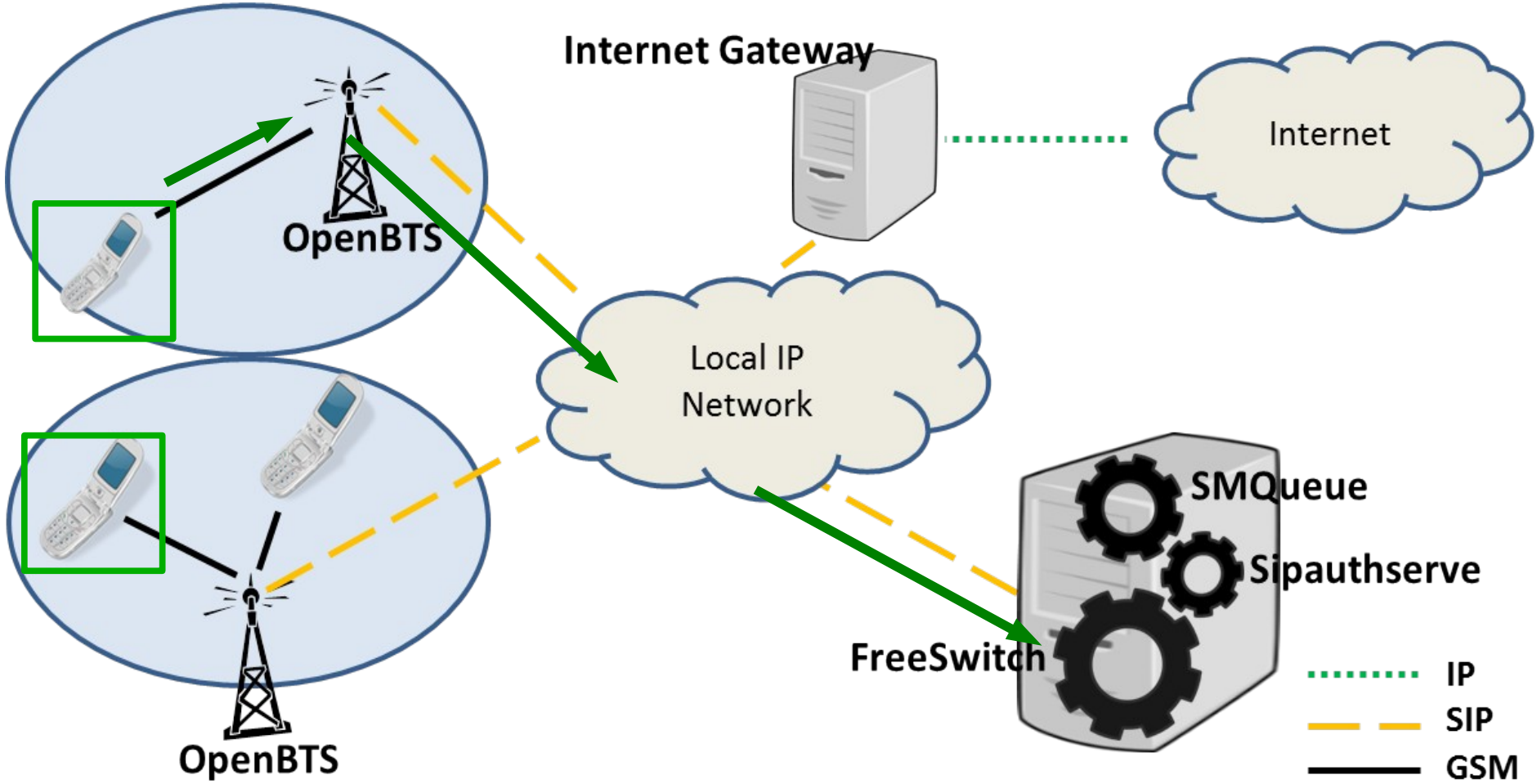
* Kwiizya means “to chat” in Tonga

Kwiizya* SMS Switching



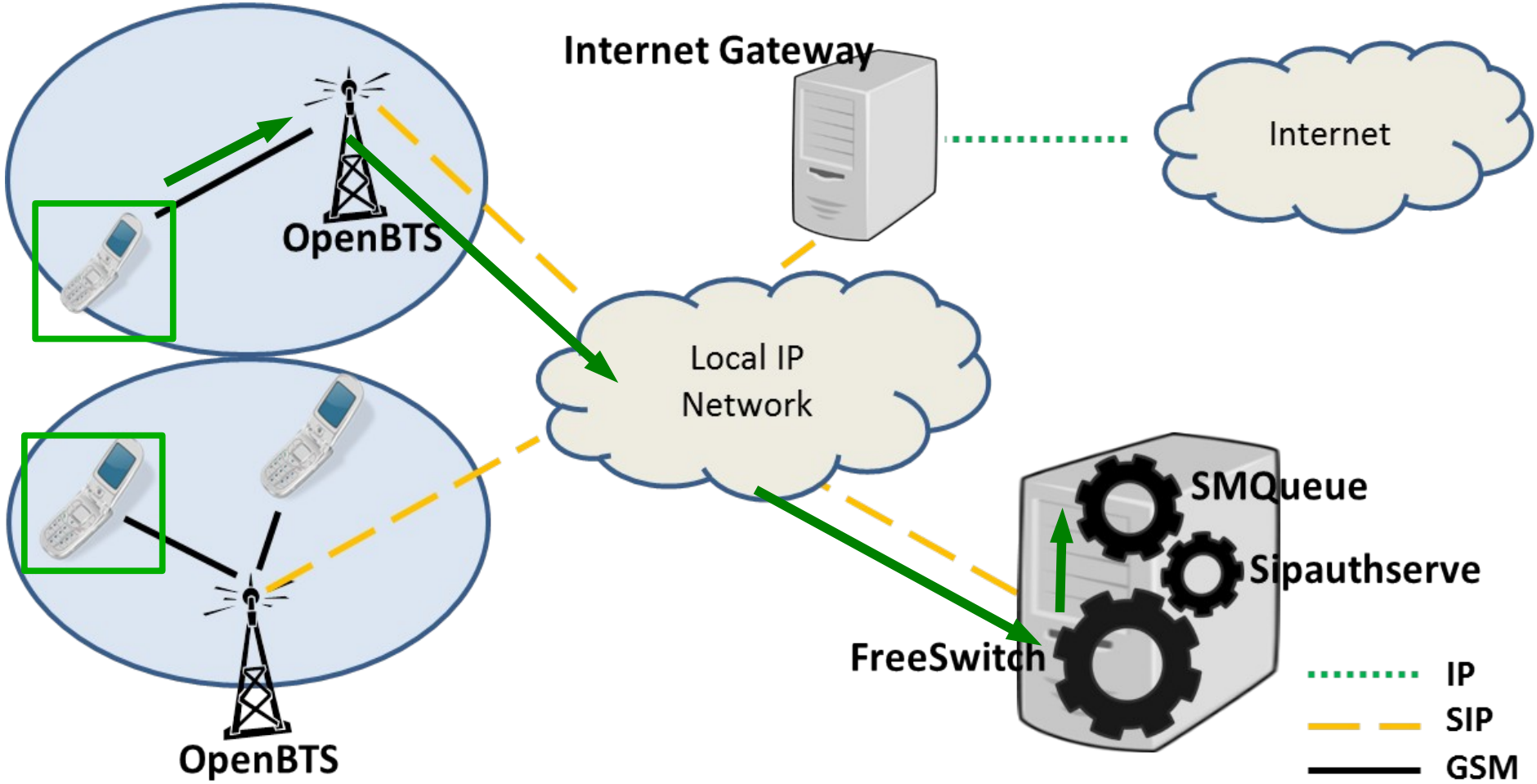
* Kwiizya means “to chat” in Tonga

Kwiizya* SMS Switching



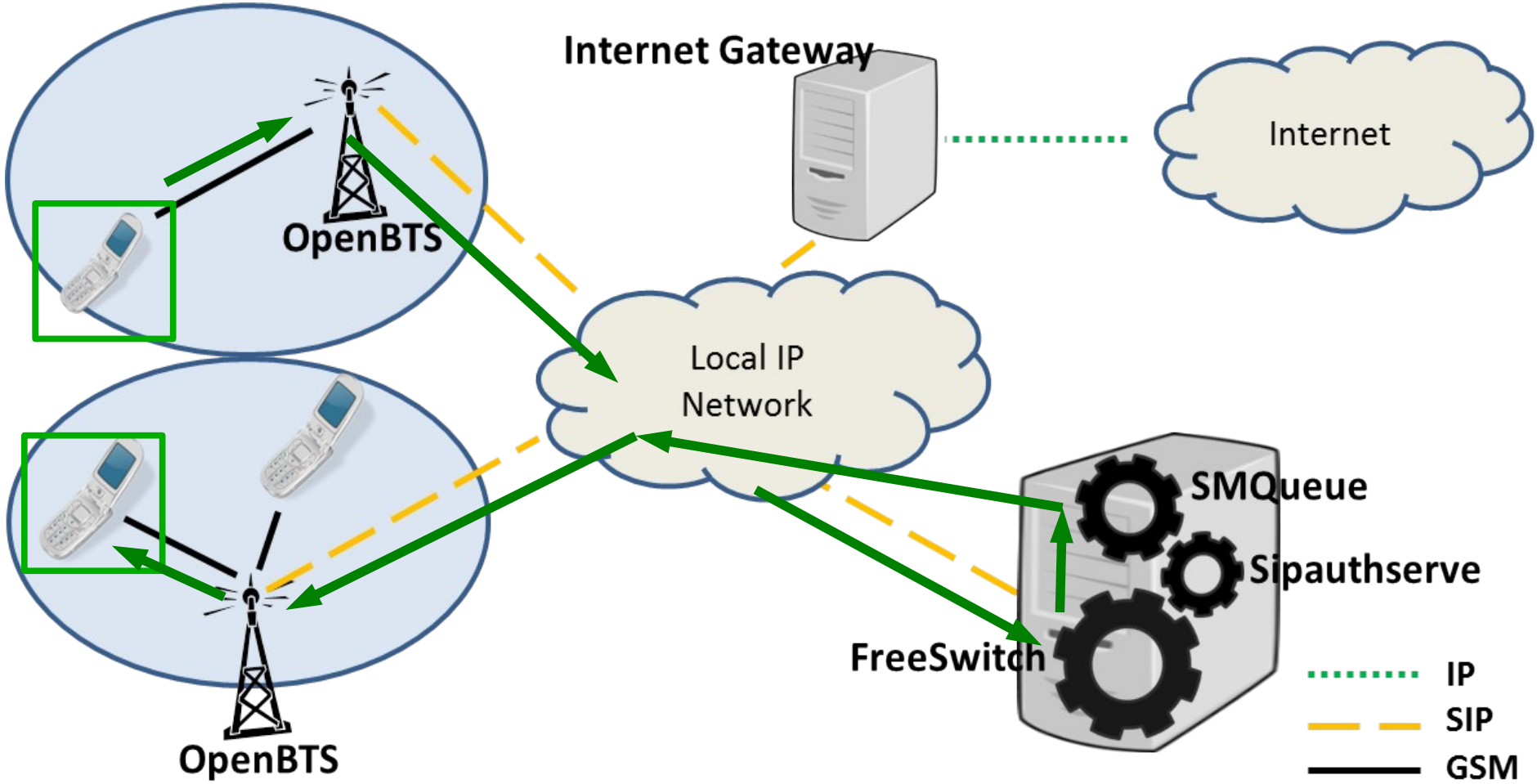
* Kwiizya means “to chat” in Tonga

Kwiizya* SMS Switching



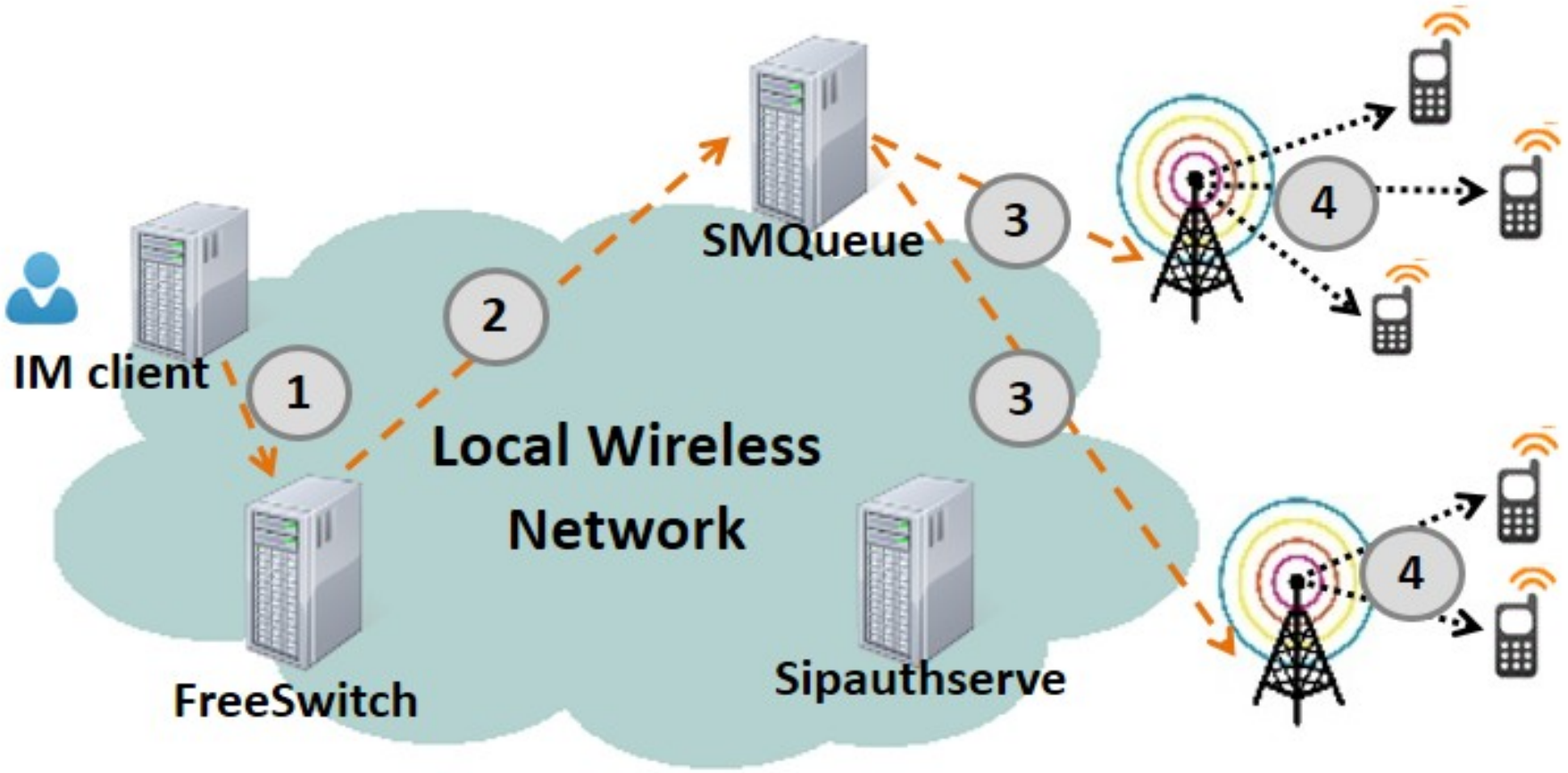
* Kwiizya means “to chat” in Tonga

Kwiizya* SMS Switching

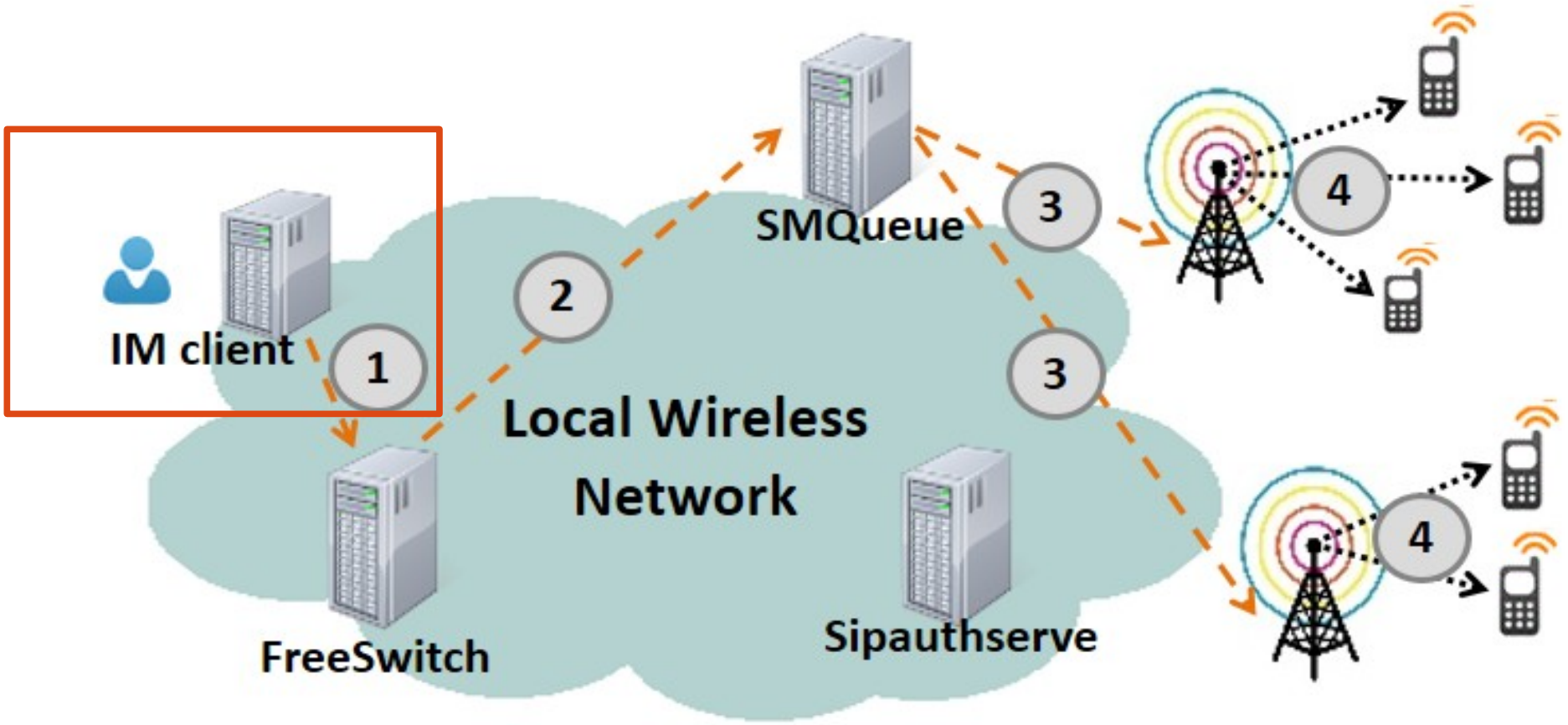


* Kwiizya means “to chat” in Tonga

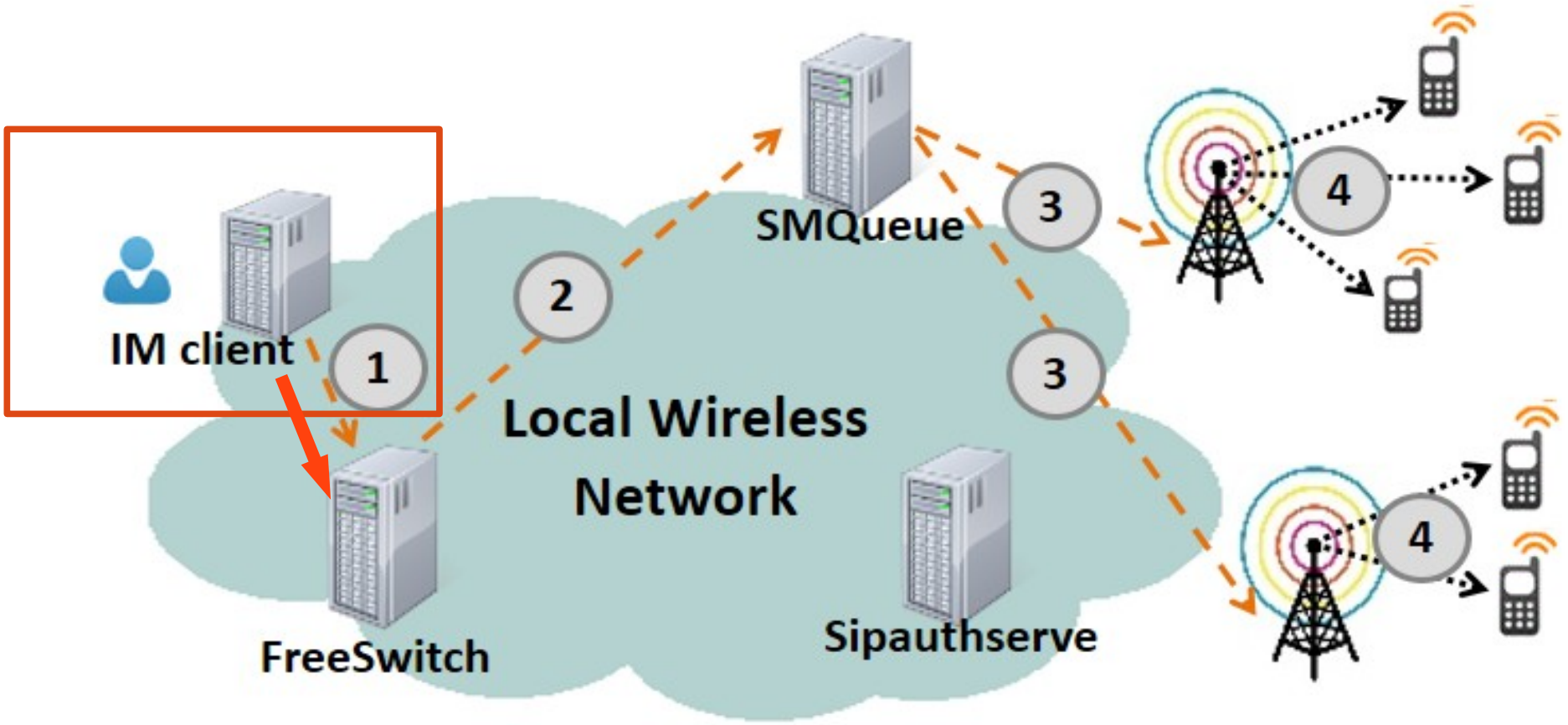
Instant Message to SMS



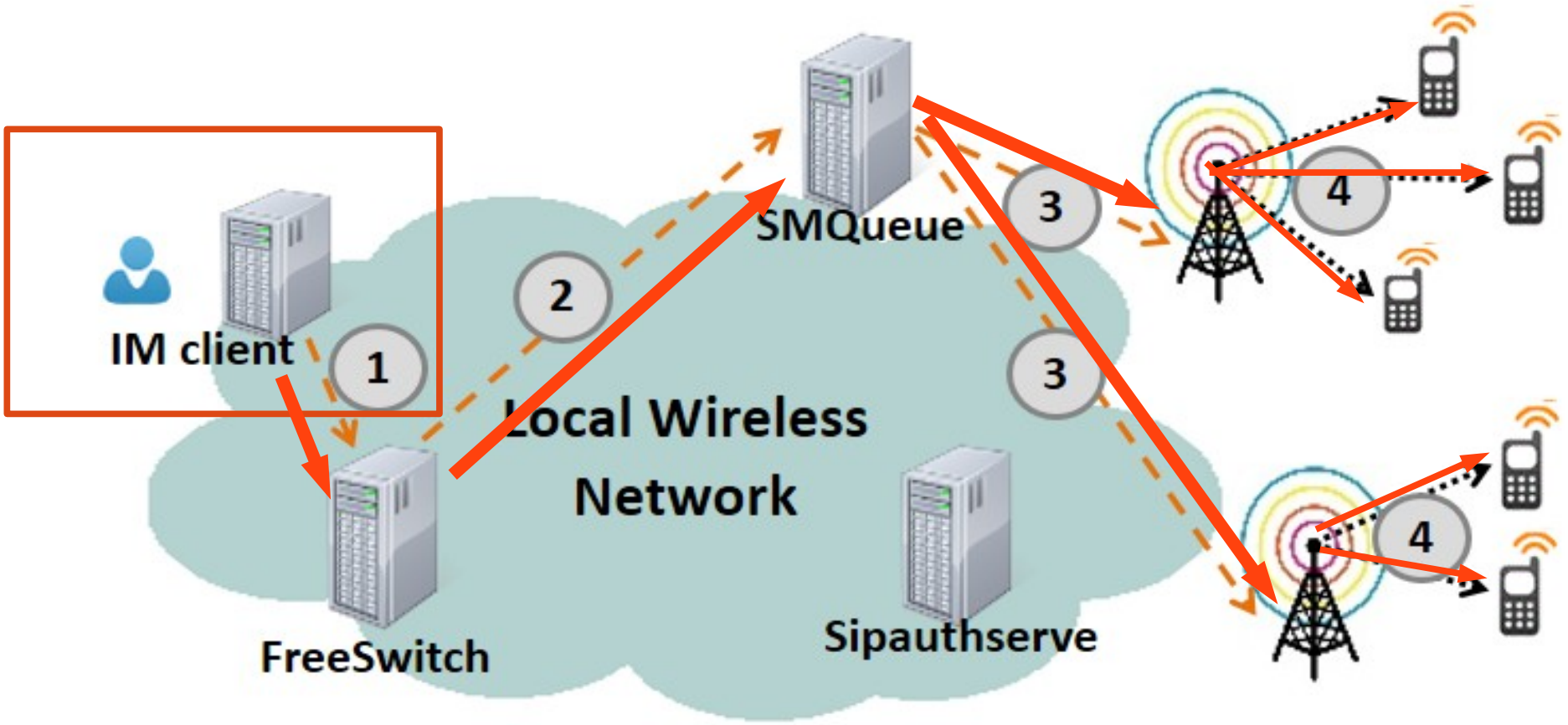
Instant Message to SMS



Instant Message to SMS



Instant Message to SMS



The Base Station

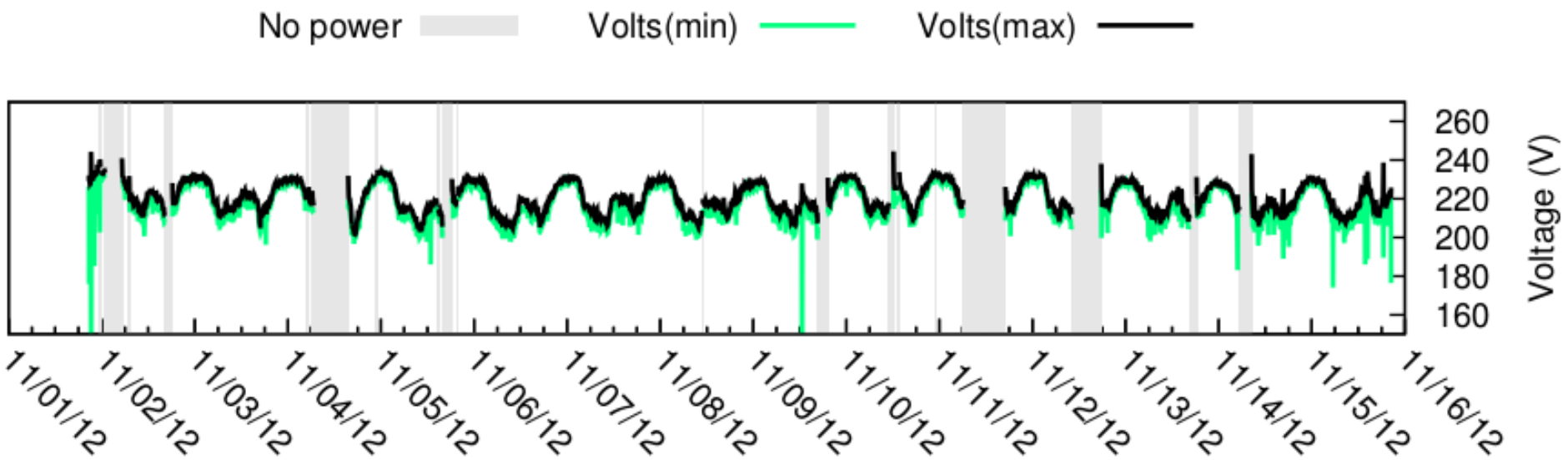
A RangeNetworks SNAP unit

Installation Sites

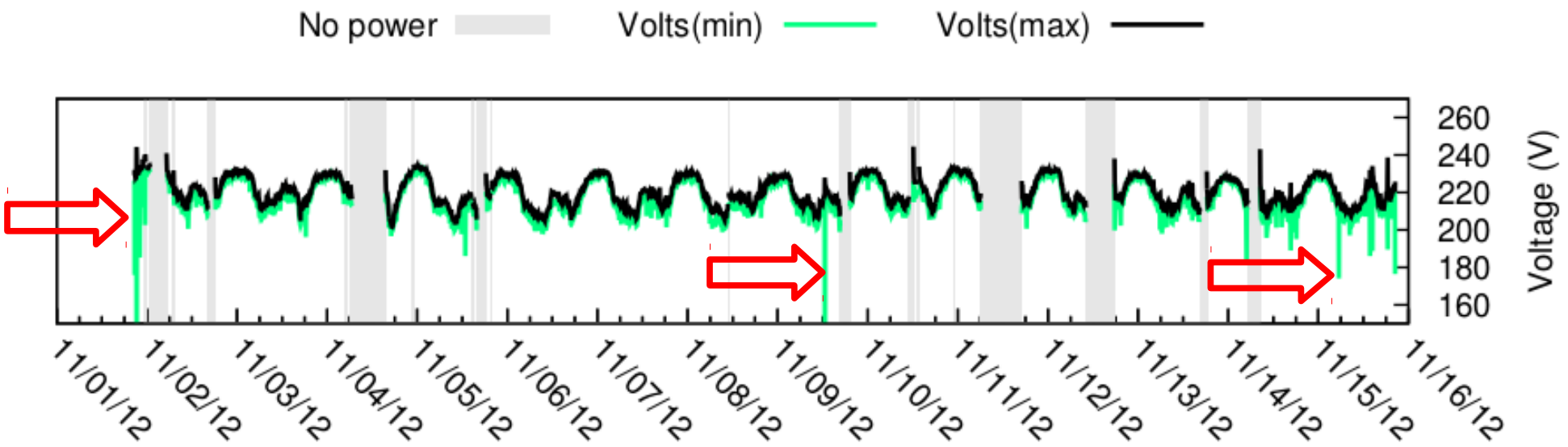
LITA

The Water Tower

Power Quality in Macha



Power Quality in Macha



The Power Supply

UCSB

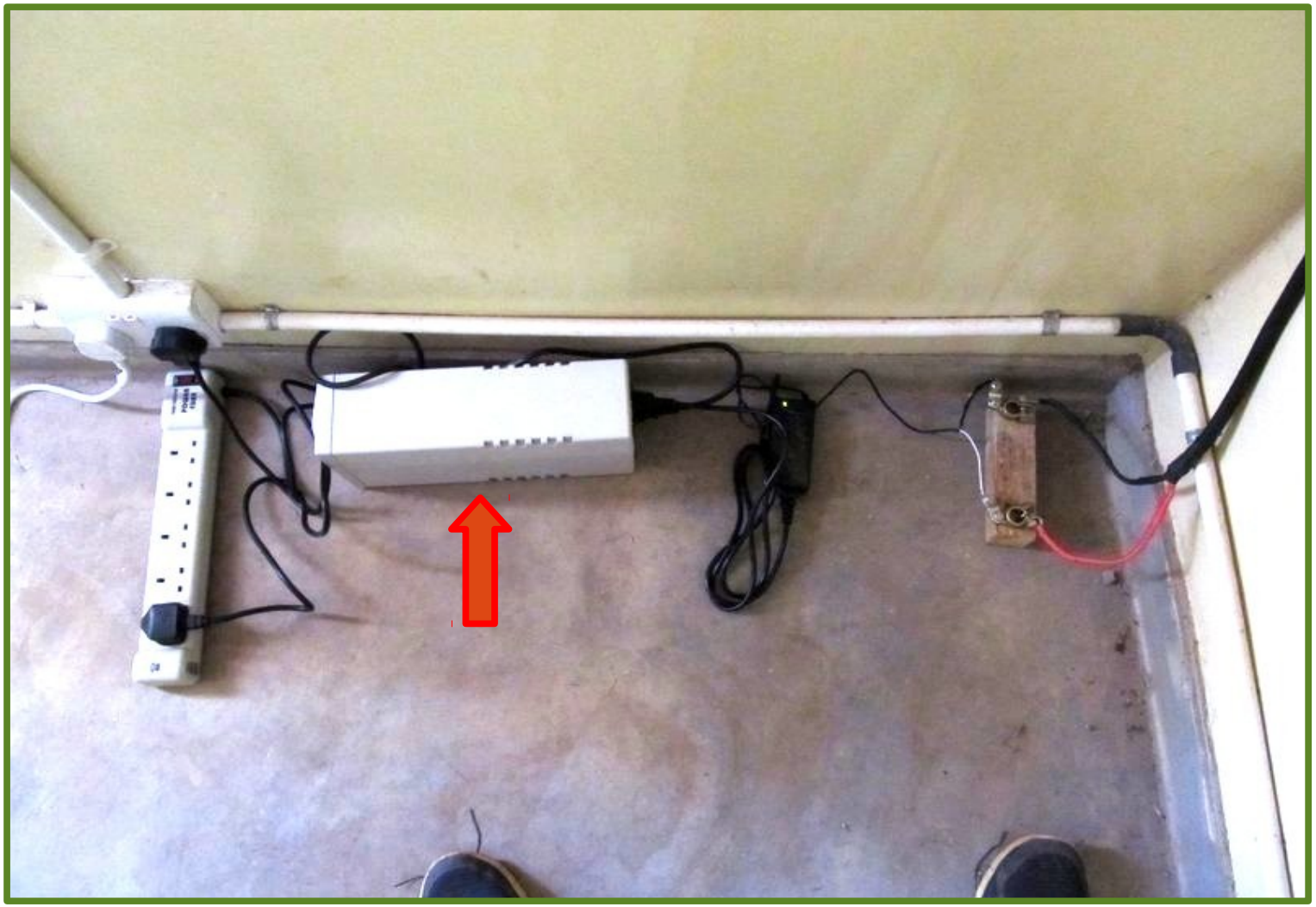
MOMENT LAB

The Power Supply

UCSB

MOMENT LAB

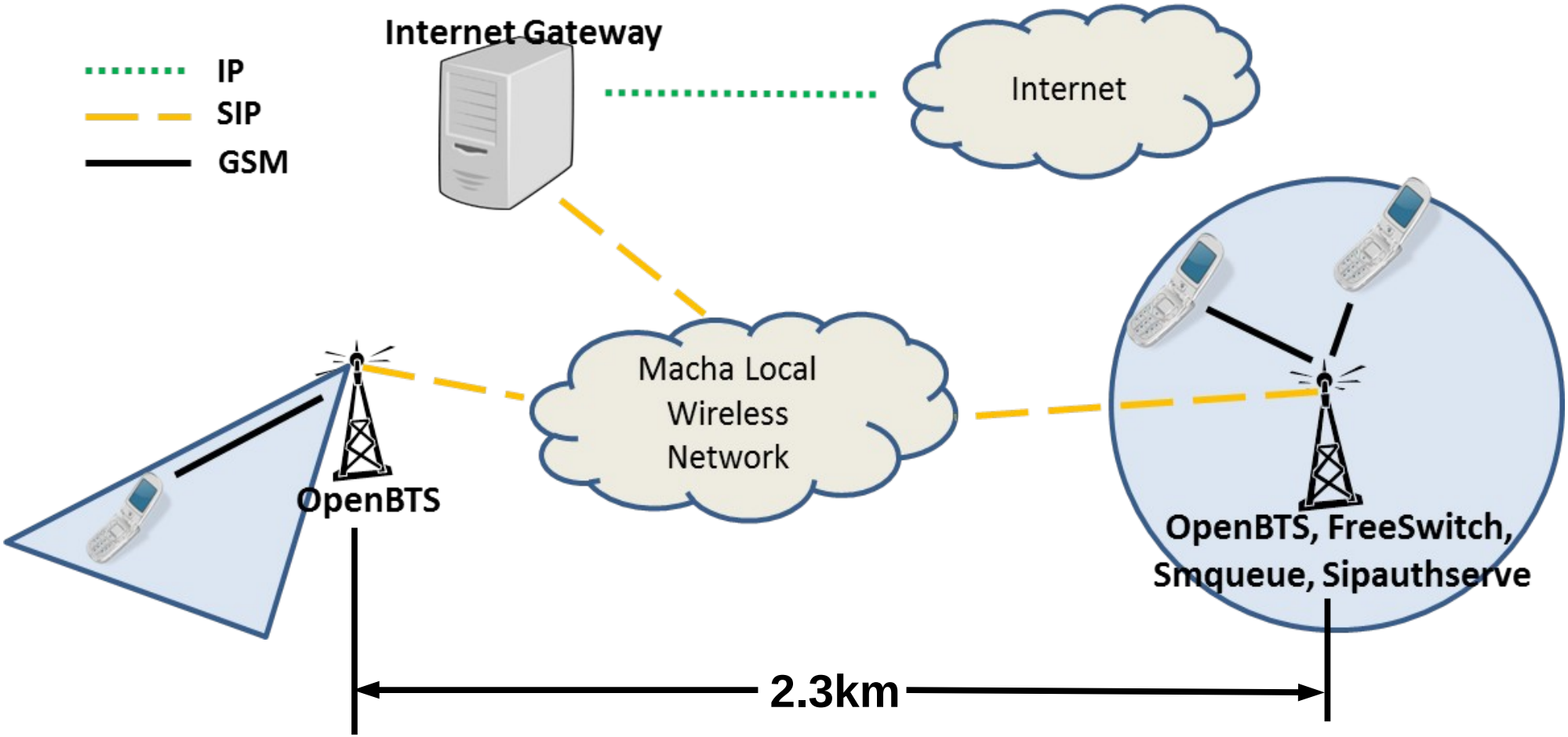
The Power Supply



UCSB

MOMENT LAB

The Network in Macha



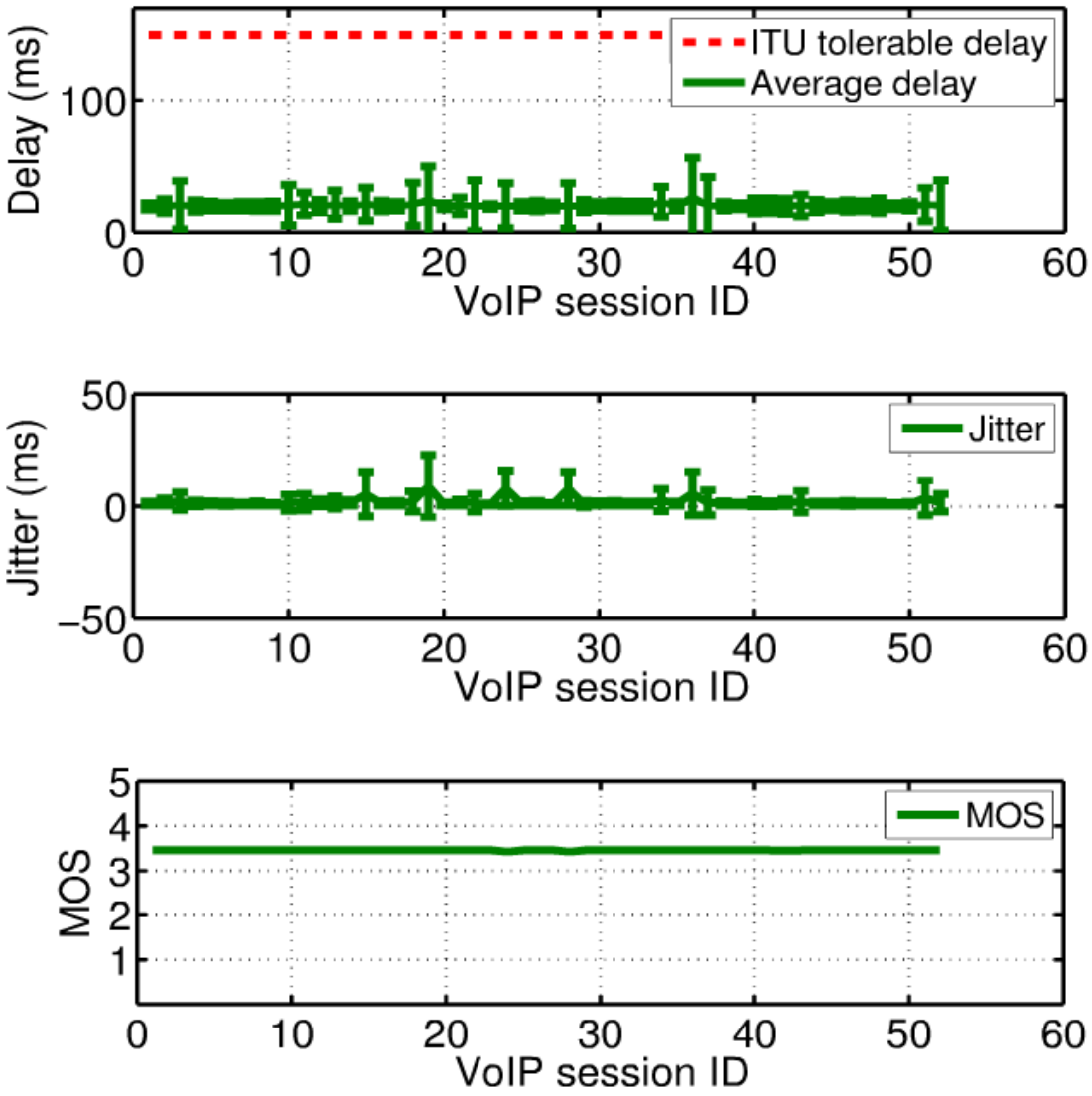
Evaluation Design

- 20 SIM cards
- Local partners (IT staff)
- Restricted registration
- Voice and SMS

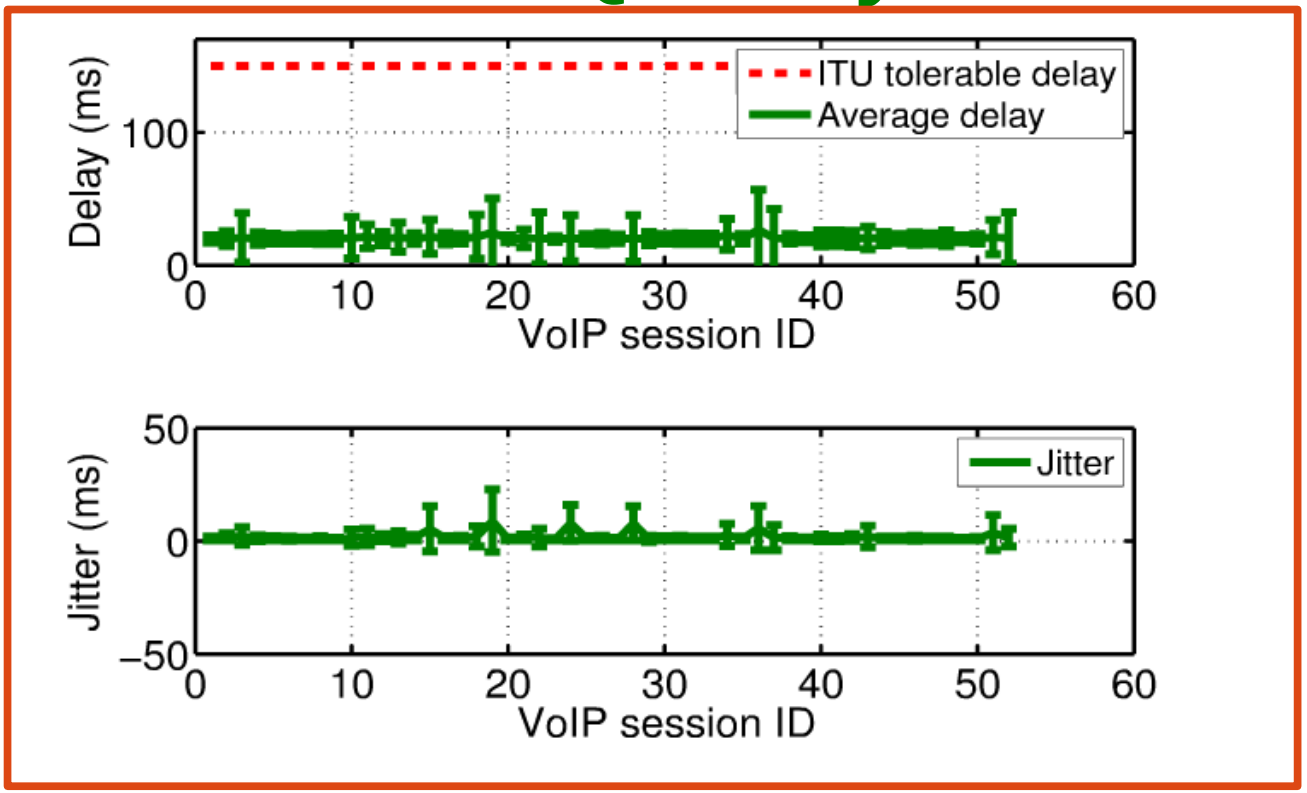
UCSB

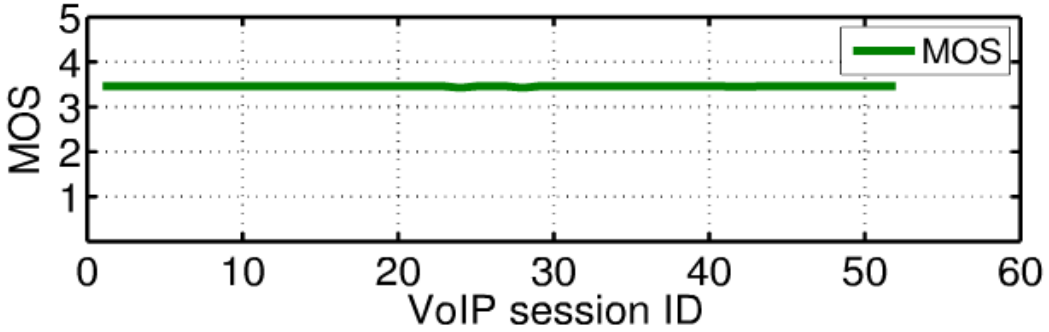
MOMENT LAB

Call Quality



Call Quality

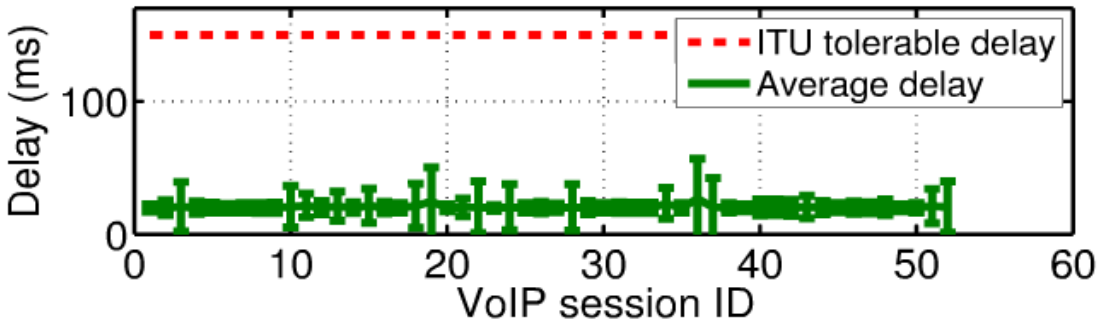


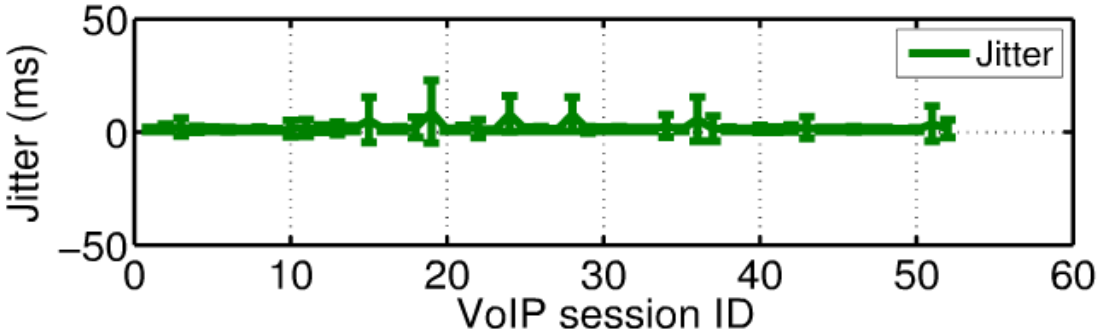


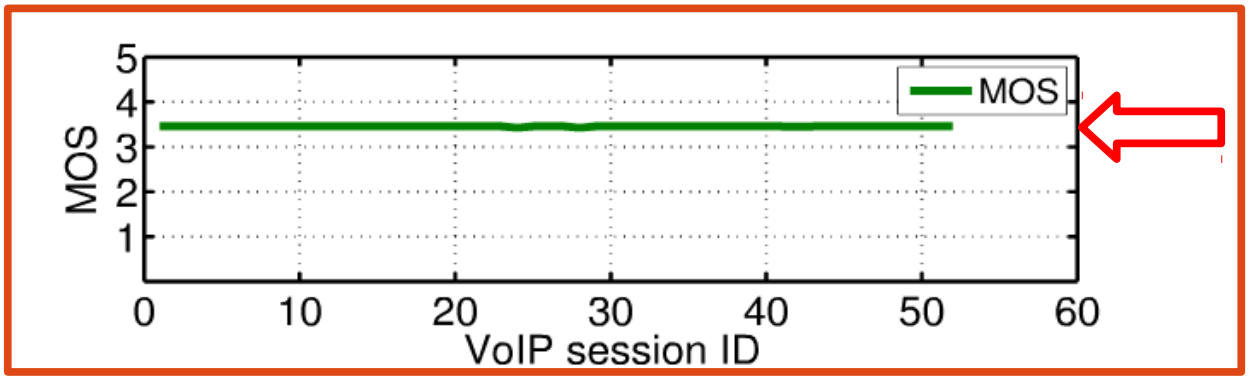
UCSB

MOMENT LAB

Call Quality



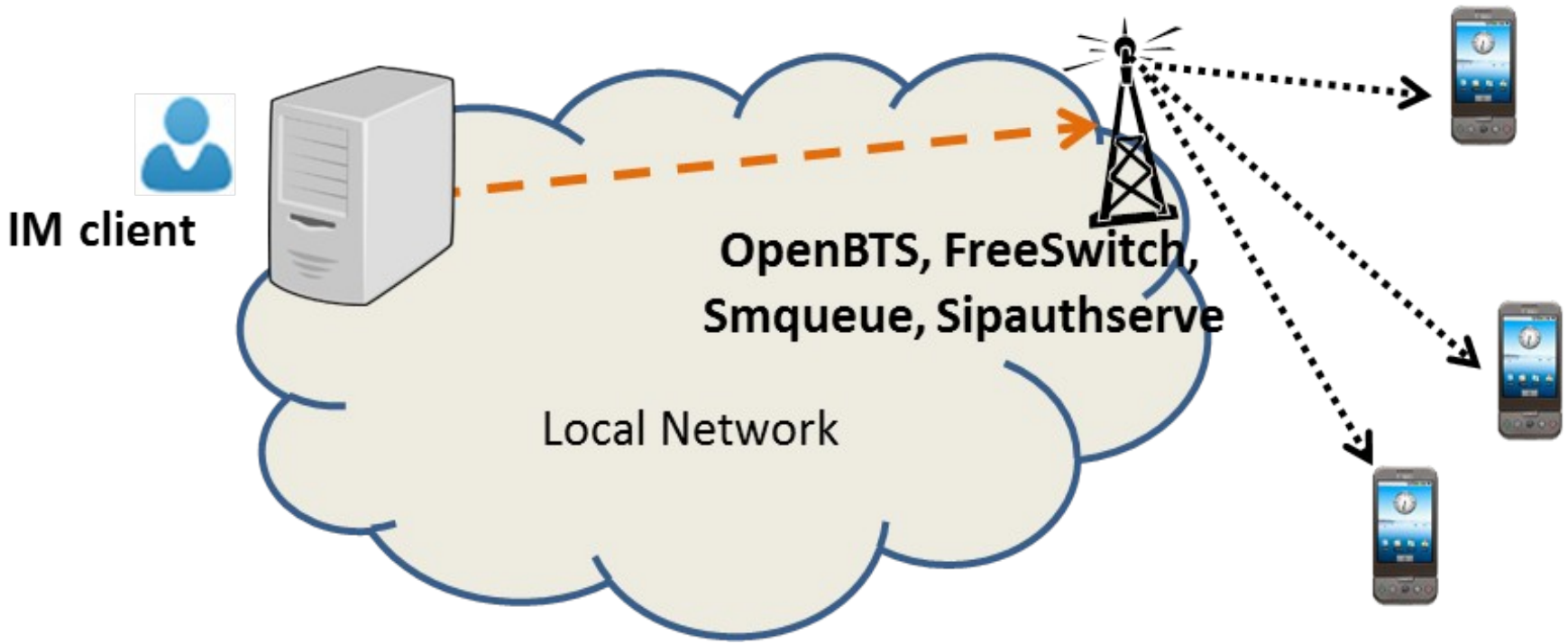




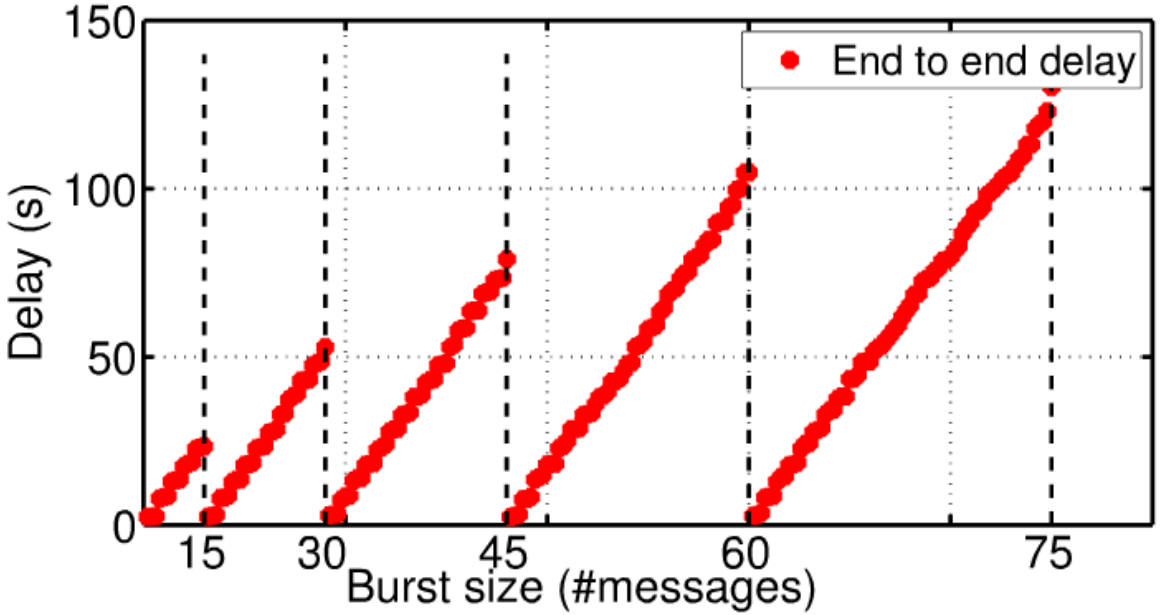
UCSB

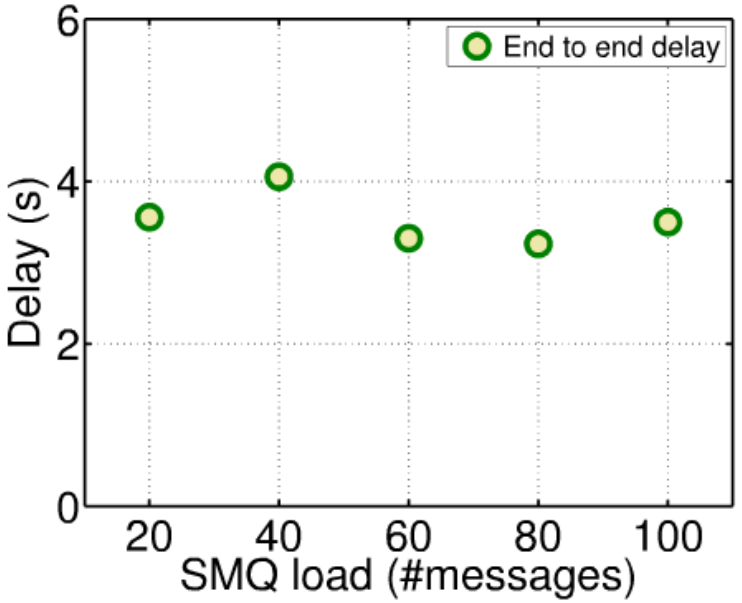
MOMENT LAB

IM-SMS Performance

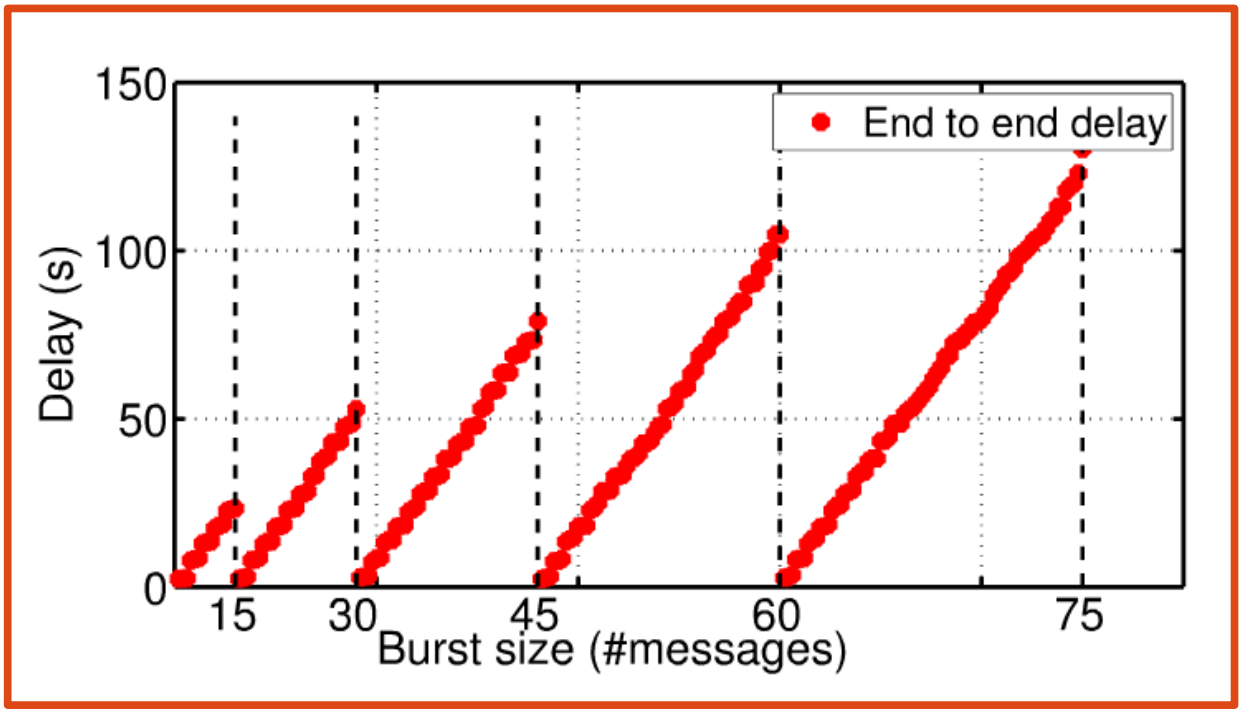


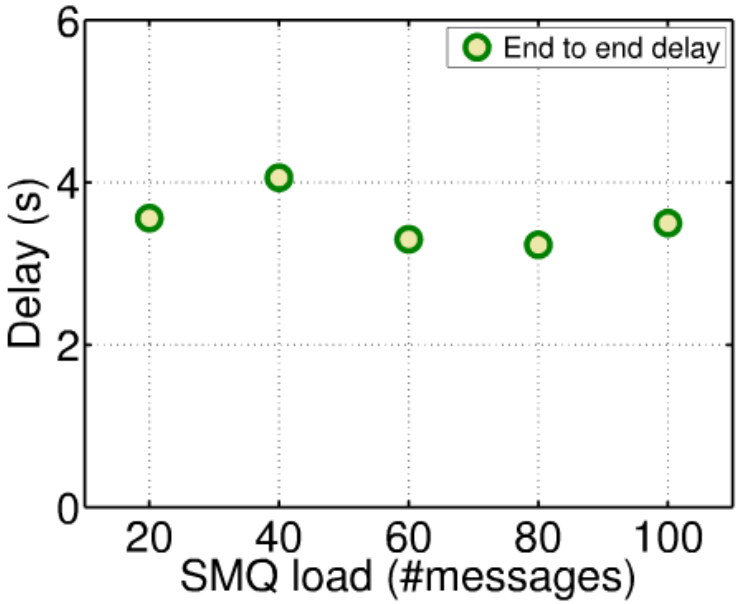
IM-SMS Performance





IM-SMS Performance

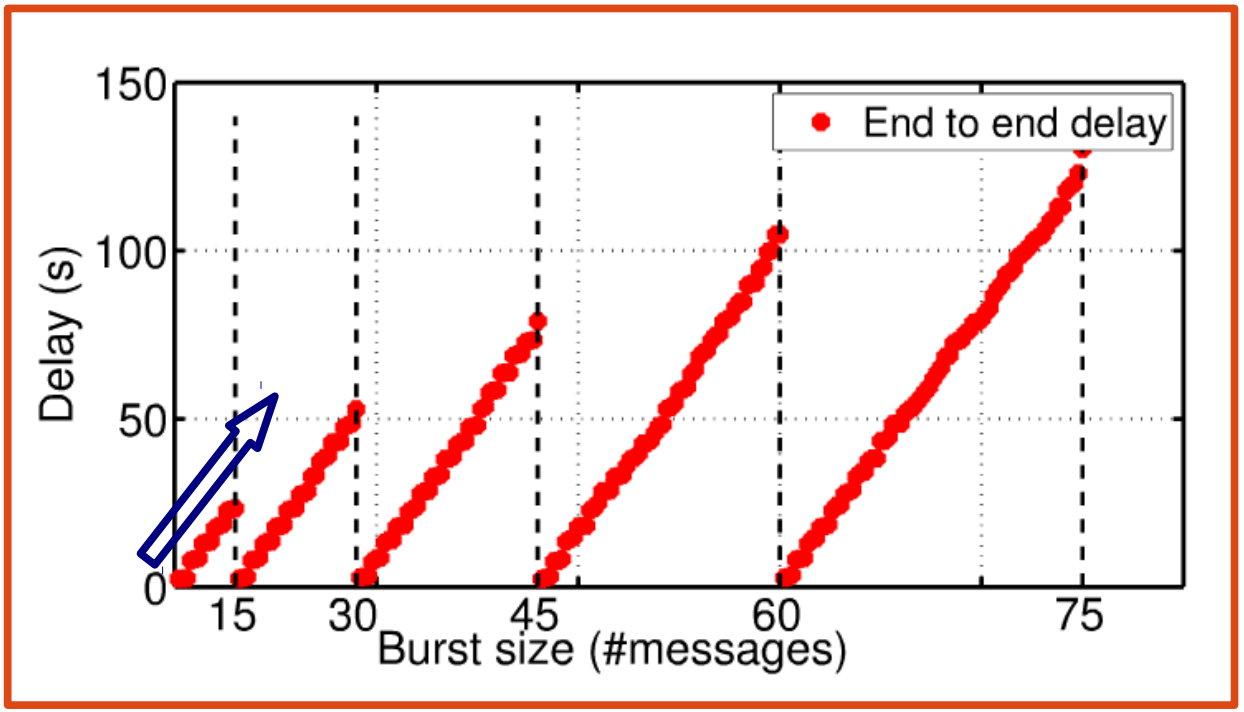


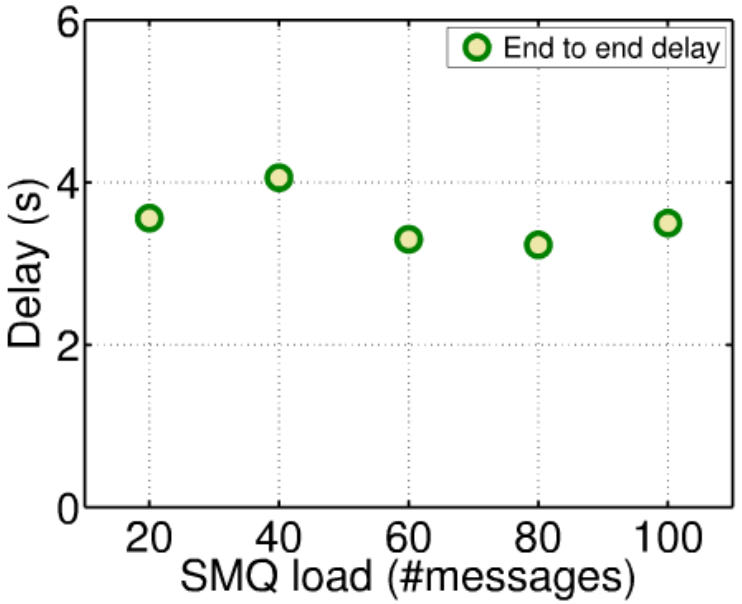


UCSB

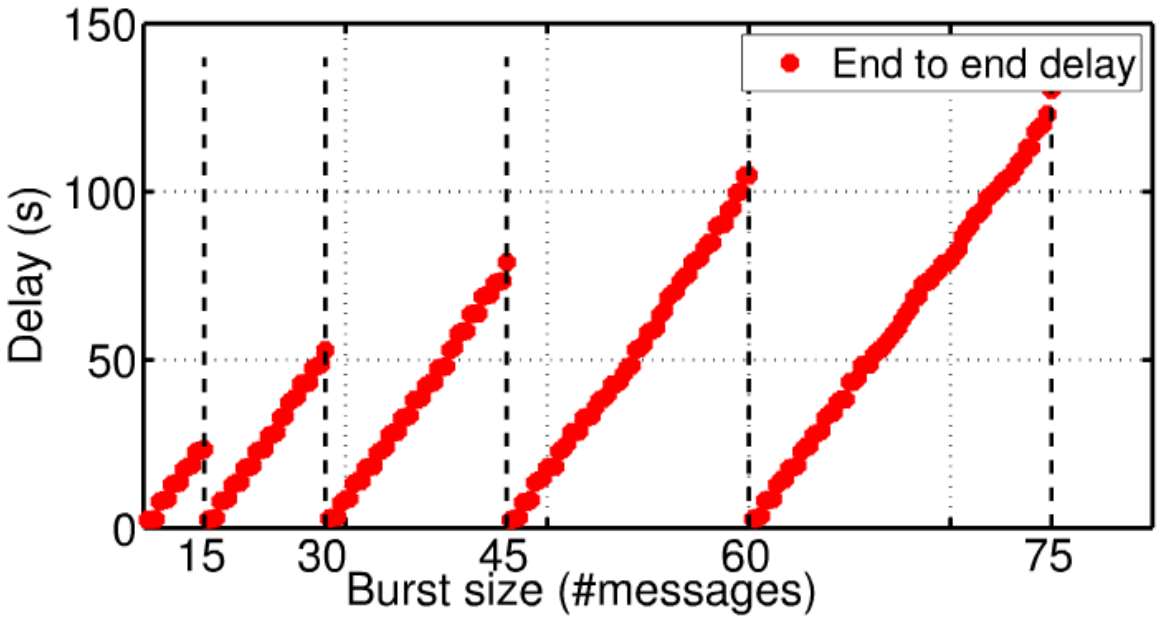
MOMENT LAB

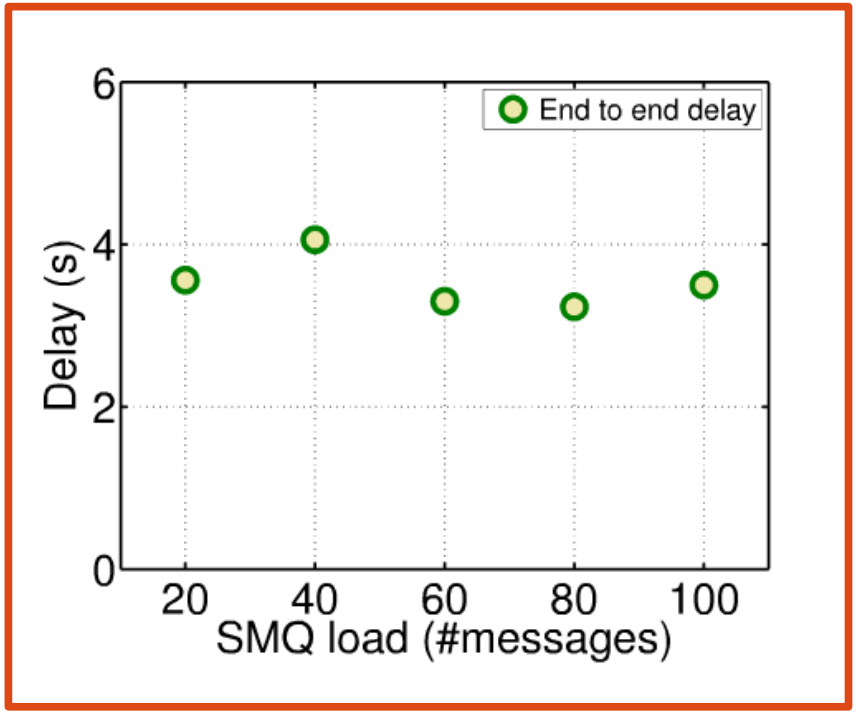
IM-SMS Performance





IM-SMS Performance





UCSB

MOMENT LAB

*The trash in front of a store in Macha is comprised of used talk-time vouchers.

UCSB

MOMENT LAB

UCSB

MOMENT LAB

Video

Edited by

Abigail Hinsman

Film and Media Studies, UCSB

and

Mariya Zheleva

Computer Science, UCSB

Interviews by

Prof. Lisa Parks

Film and Media Studies, UCSB

UCSB

MOMENT LAB

Thank you.

Mariya Zheleva
mariya@cs.ucsb.edu

Find out more at:
http://moment.cs.ucsb.edu

Acknowledgements:
LinkNet
RangeNetworks
NSF
Bill and Melinda Gates Foundation
David Kotz
Veljko Pejovic
Kate Milosavljevic

UCSB

MOMENT LAB