Mobility-Aware Application Scheduling in Fog Computing

Luiz F. Bittencourt Javier Diaz-Montes Rajkumar Buyya
Omer F. Rana Manish Parashar

Presenter: Maicon Ança dos Santos

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Introduction

- With new levels of computing capacity provides by Fog computing, new forms of resource allocation and management can be developed;
- The grow of the number of devices scattered and connected to Internet, producing and consuming data, requires a scalable resource management at unprecedented levels
  - *Focus on IoT*

Introduction

- Data also are produced at the edge. Data generation and consumption can occur at many differents places and times;
- Different applications can have different requirements, especially in terms of response time.

Introduction

The problem

Resource allocation considering the hierarchical infrastructure composed of edge capacity and cloud data centers, analyzing application classes along with different scheduling policies.

Fog Computing Model

- User applications that access the public cloud do so through an access point that allows data exchange through the core network to reach the cloud data center;
- *Cloudlet*: access point extended to also provide computing and storage services.

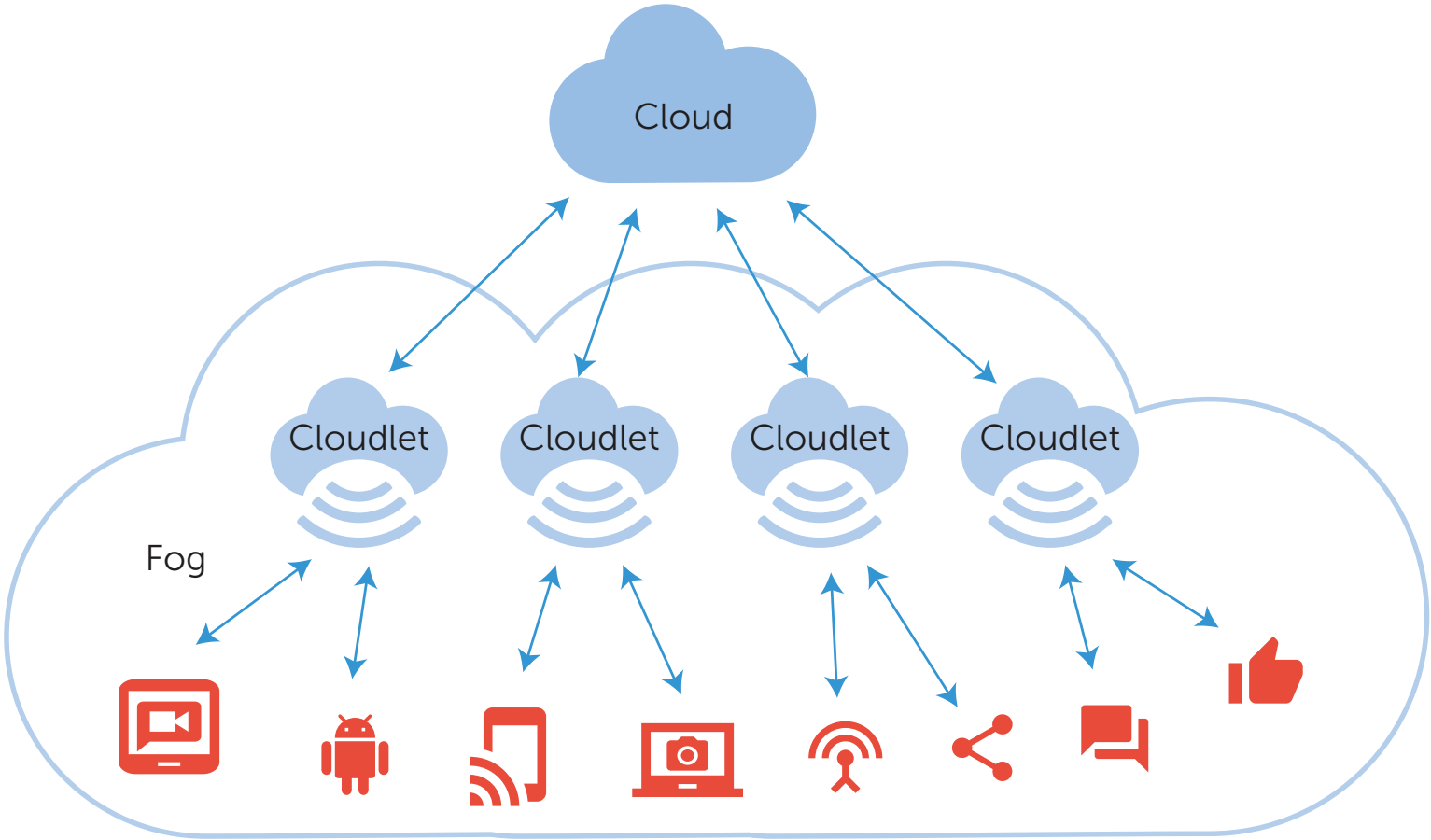


Figure: Fog computing: cloud, cloudlets and edge devices/applications ecosystem

Fog Computing Model

- Hierarchical, bi-directional computing infrastructure: edge devices communicate with cloudlets and cloudlets communicate with clouds.
  - *Cloudlets can also communicate with each other to perform data and process management.*

Fog Computing Model

- Processing and storage capacity in fog computing can benefit different types of applications
  - *Applications with low latency requirements;*
  - *Applications that currently rely on the cloud;*
  - *Cases in which raw data collected by many devices that generally do not need to be transferred to the cloud for long-term storage.*

Fog Computing Model

- Cloudlets can provide reduced latencies, however...
  - *New challenges: **what**, **when** and **where** carry out processing to meet QoS;*
  - *Fog scheduling must bring users location to the resource allocation policies to uphold the benefits of proximity to the user.*

Related Work

Related Work

Applications

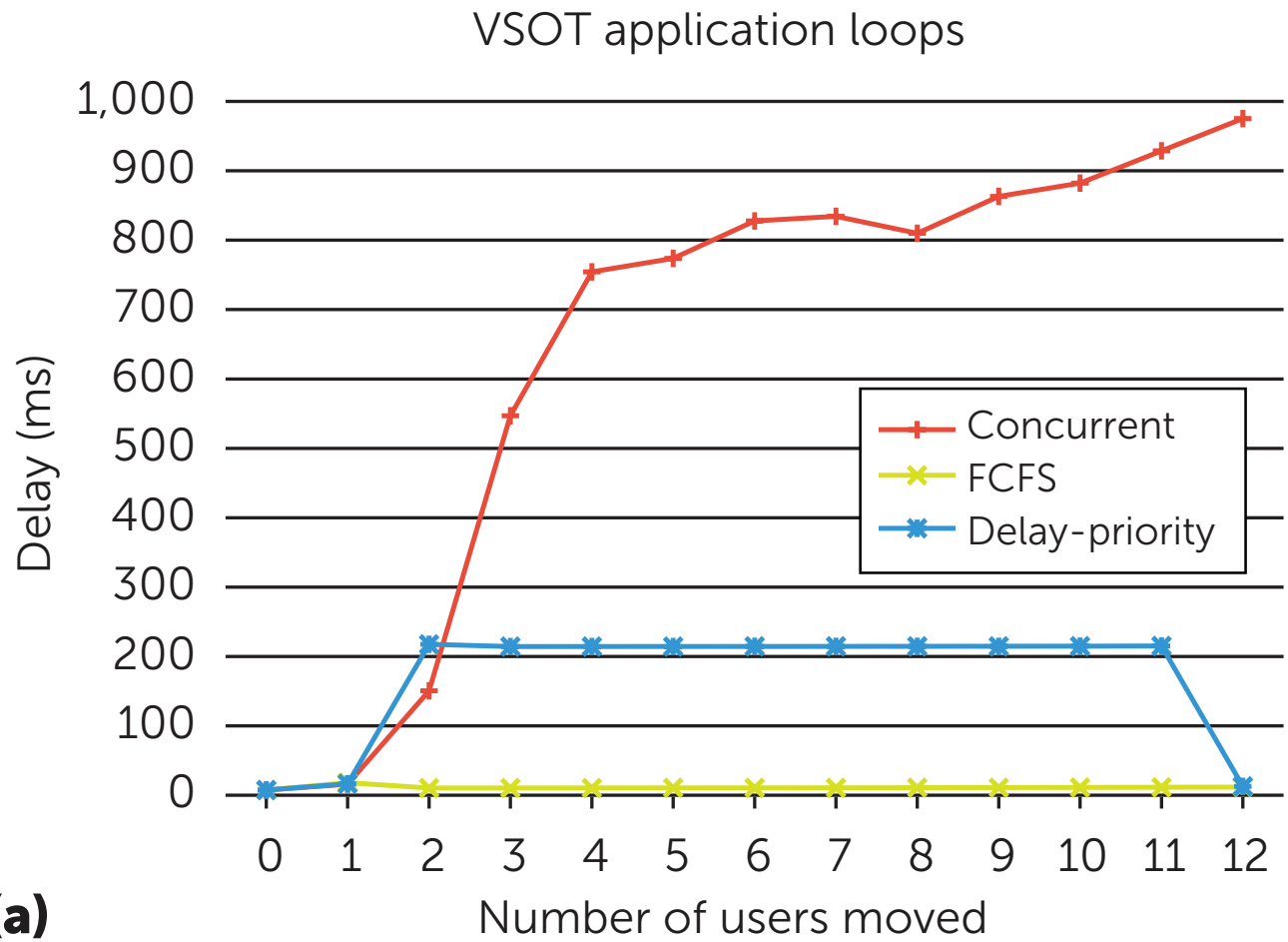
Applications

- The fog architecture is hierarchical, where the decision is subject to application constraints and user geo-location
  - *Application constraints;*
- - *;*


UPS

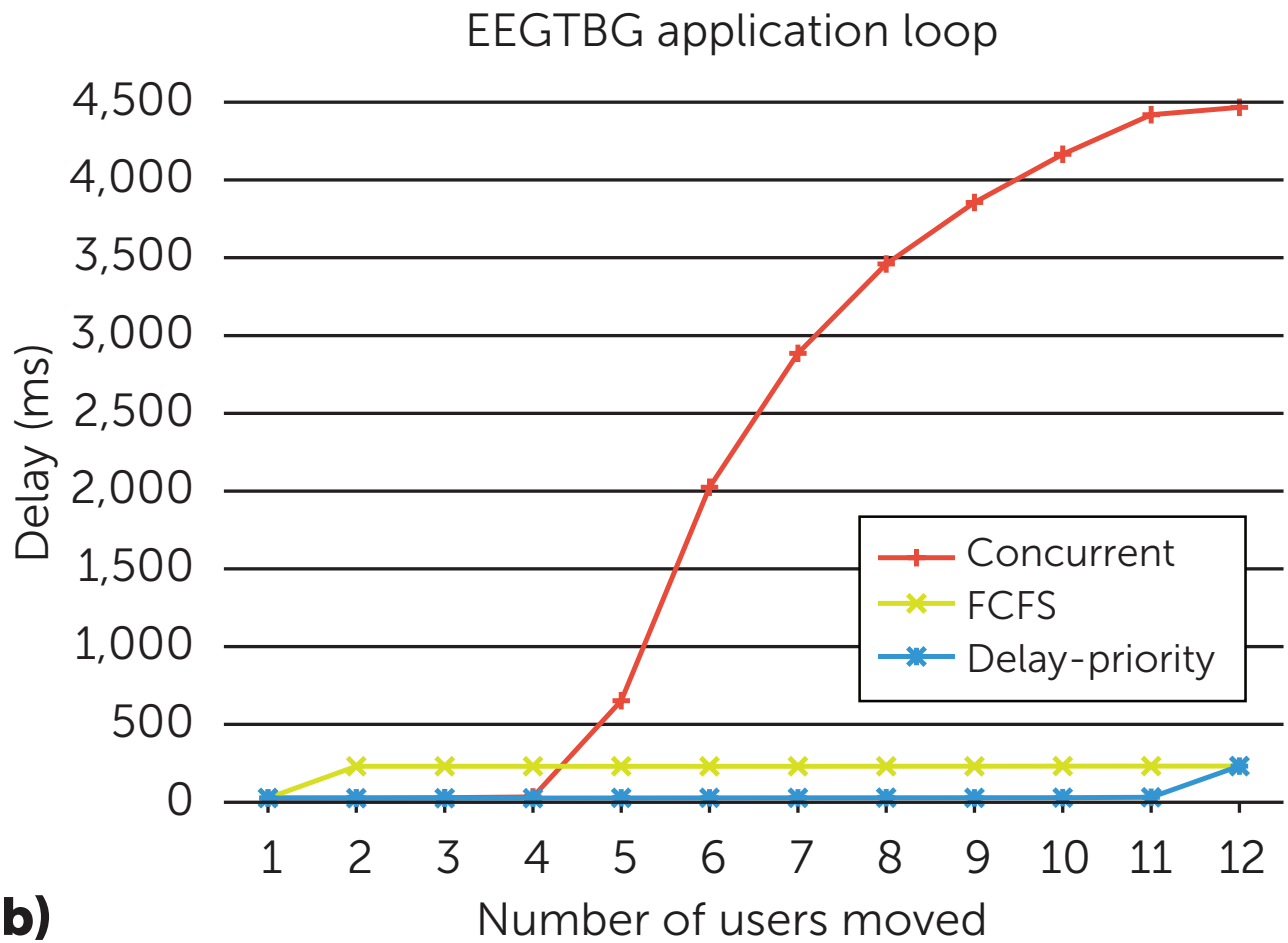

UPS


UPS


VSOT application loops
1,000
900
800
700
600
500
400
300
200
100
0
Delay (ms)
Concurrent
FCFS
Delay-priority
0 1 2 3 4 5 6 7 8 9 10 11 12
Number of users moved

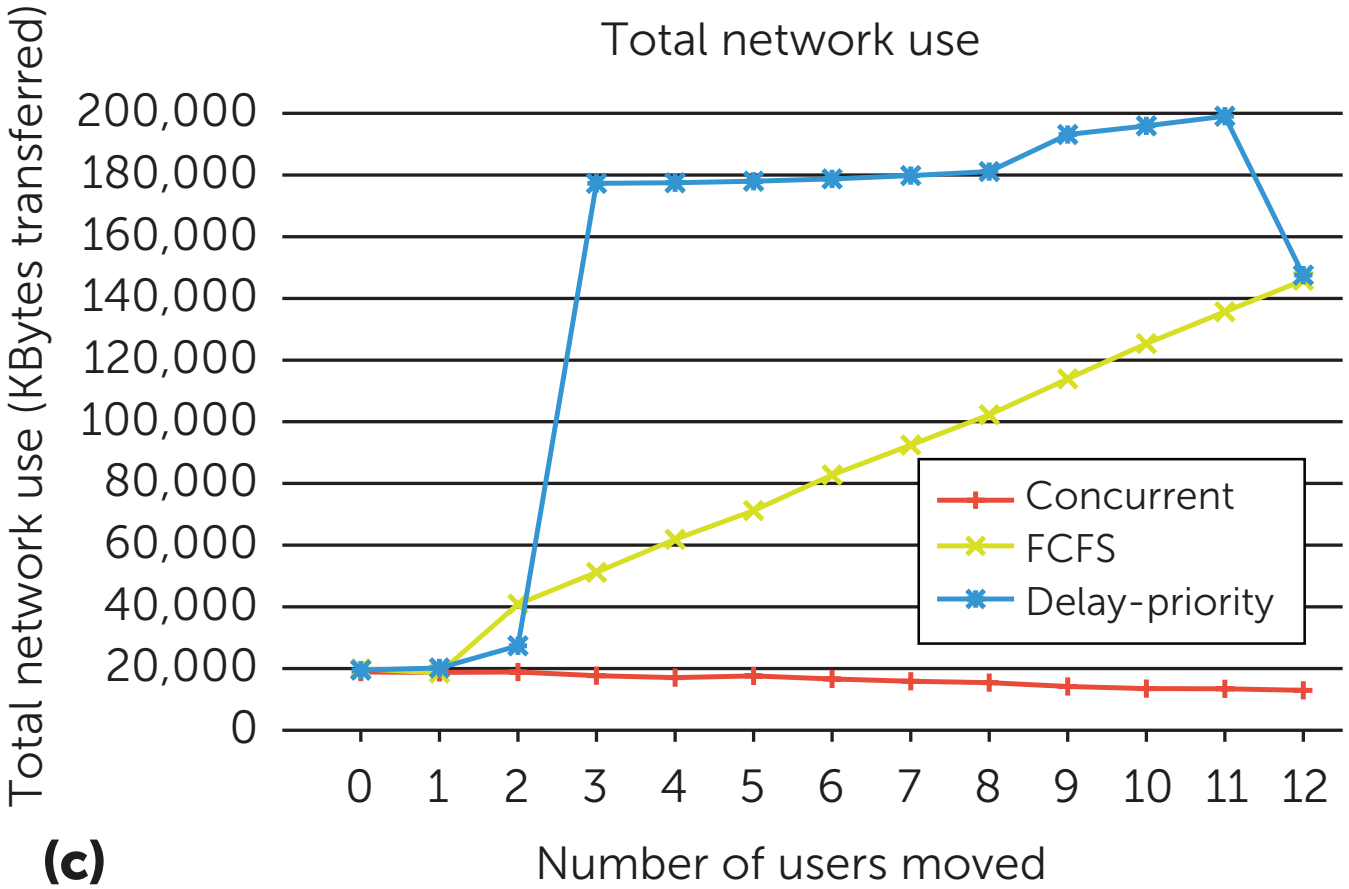
(a)

Figure

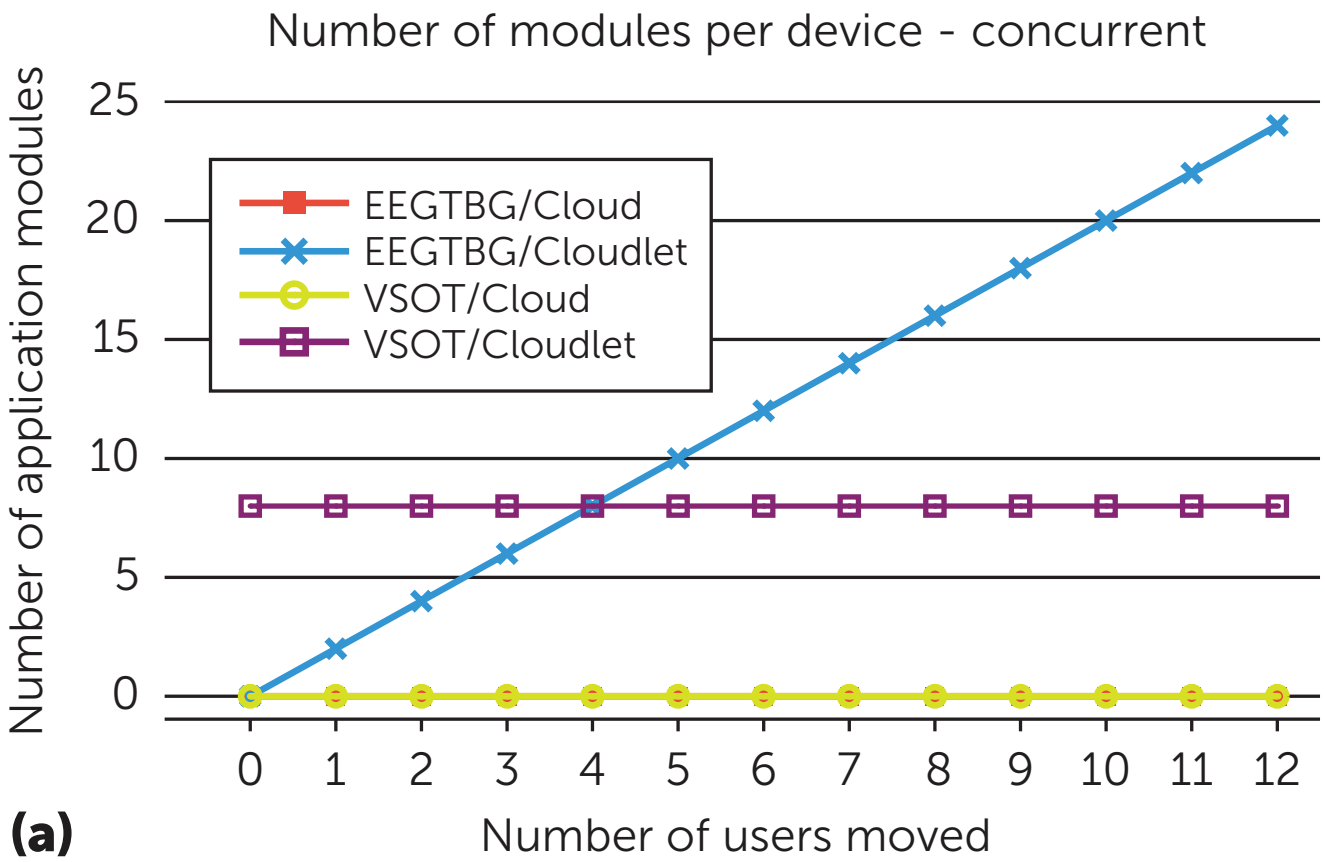

EEGTBG application loop
4,500
4,000
3,500
3,000
2,500
2,000
1,500
1,000
500
0
Delay (ms)
1
2
3
4
5
6
7
8
9
10
11
12
Number of users moved
Concurrent
FCFS
Delay-priority

(b)

Figure

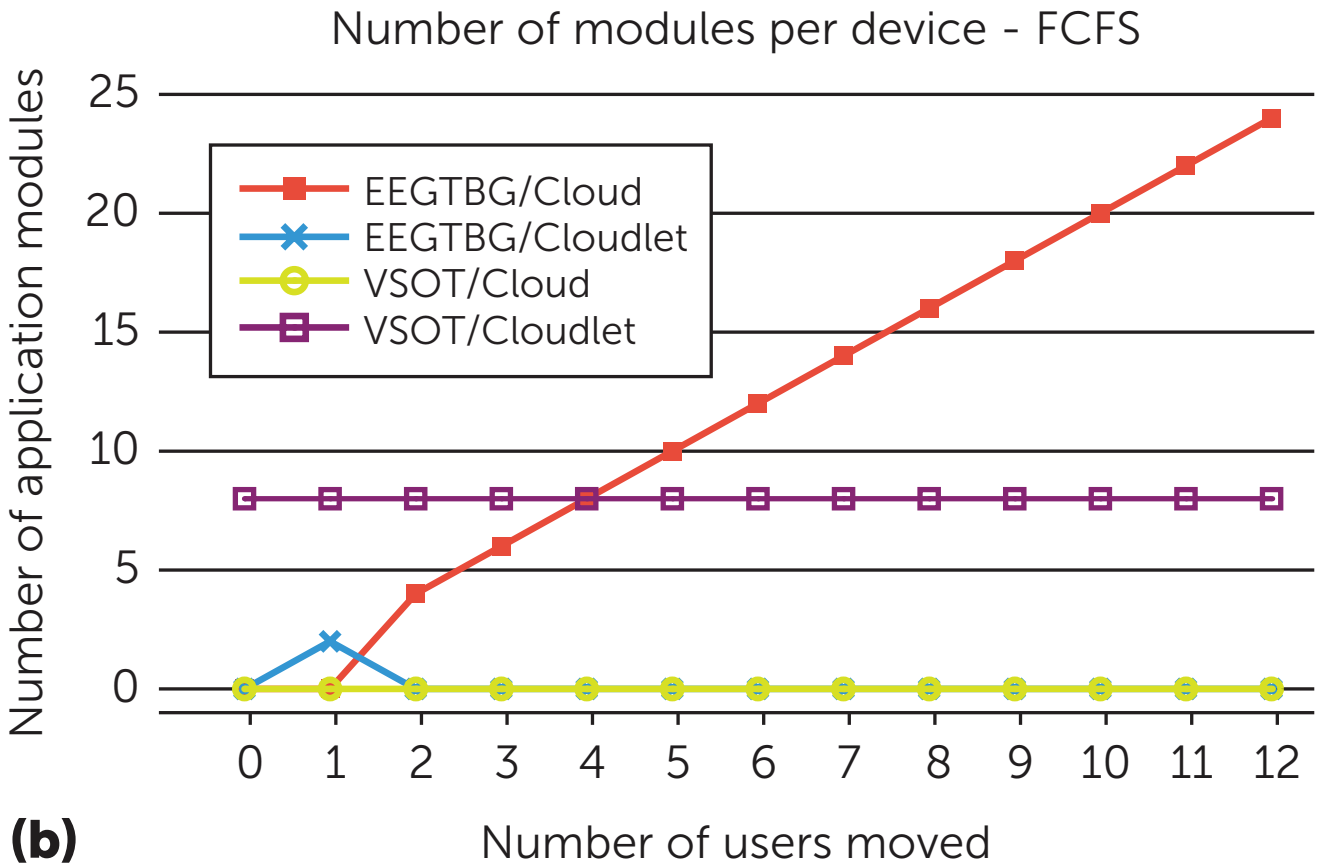

Total network use
Total network use (KBytes transferred)
200,000
180,000
160,000
140,000
120,000
100,000
80,000
60,000
40,000
20,000
0
0 1 2 3 4 5 6 7 8 9 10 11 12
Number of users moved
Concurrent
FCFS
Delay-priority
(c)

Figure


Number of modules per device - concurrent
Number of application modules
25
20
15
10
5
0
EEGTBG/Cloud
EEGTBG/Cloudlet
VSOT/Cloud
VSOT/Cloudlet
0 1 2 3 4 5 6 7 8 9 10 11 12
Number of users moved

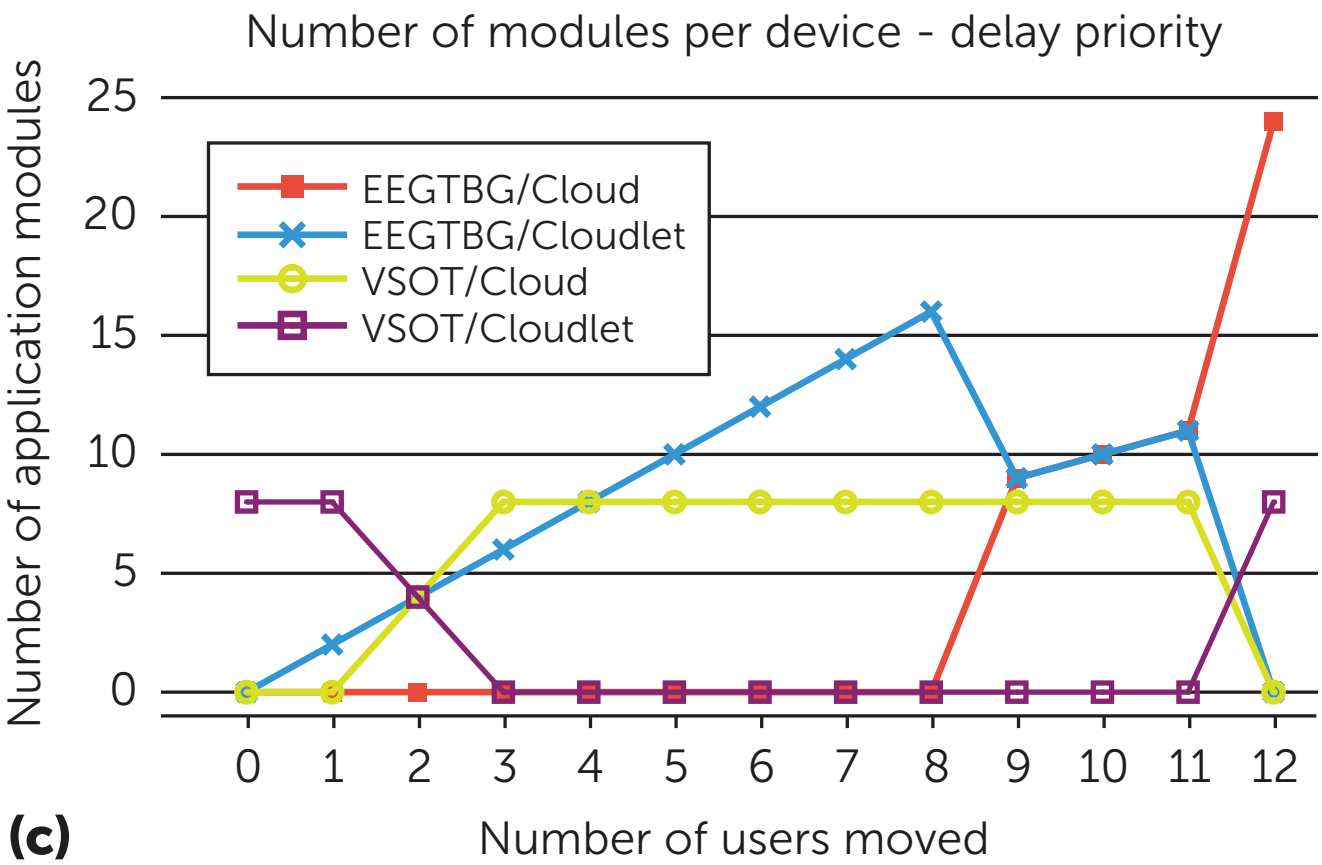
(a)

Figure


Number of modules per device - FCFS
Number of application modules
25
20
15
10
5
0
EEGTBG/Cloud
EEGTBG/Cloudlet
VSOT/Cloud
VSOT/Cloudlet
0 1 2 3 4 5 6 7 8 9 10 11 12
Number of users moved

(b)

Figure


Number of modules per device - delay priority
Number of application modules
25
20
15
10
5
0
EEGTBG/Cloud
EEGTBG/Cloudlet
VSOT/Cloud
VSOT/Cloudlet
0 1 2 3 4 5 6 7 8 9 10 11 12
Number of users moved

(c)

Figure

Challenges and Future Directions

Conclusions

Summary and Conclusions

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