

IEEE Symposium on Computers and Communications

25-28 June 2018 – Natal, Brazil



ShareFile: Sharing Content Through Device-to-Device Communication

Daniel M. Reis

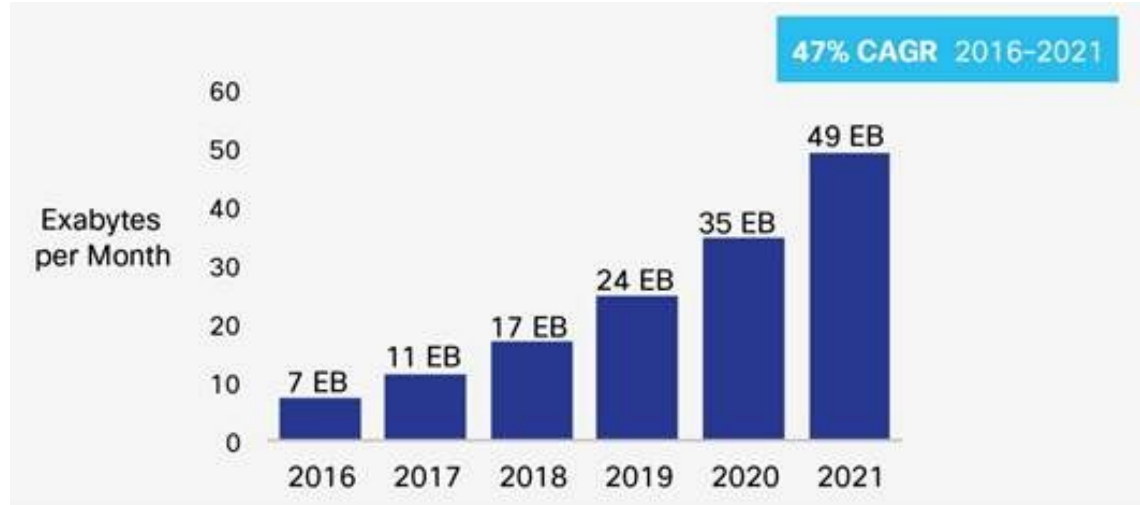
Theo S. Lins

José Marcos S. Nogueira

Vinícius F. S. Mota

Introduction

- + Devices
- + Mobile applications



Cisco visual networking index: Global mobile data traffic forecast update 2017

= Exponential data consumption growing

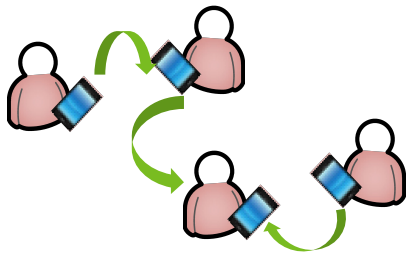
Introduction

- + Devices
- + Mobile applications



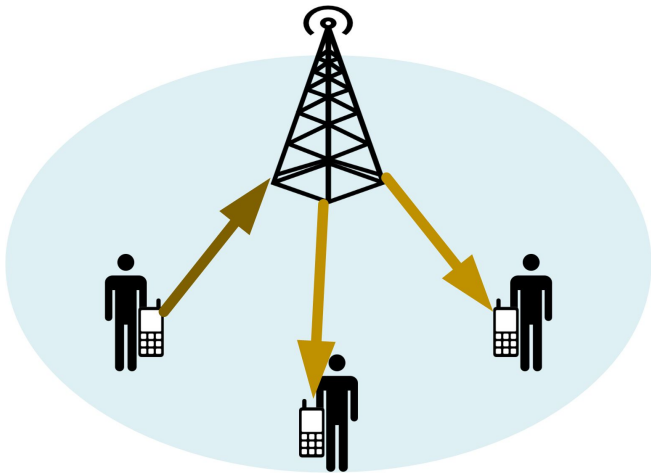
Cisco visual networking index: Global mobile data traffic forecast update 2017

= Exponential data consumption growing

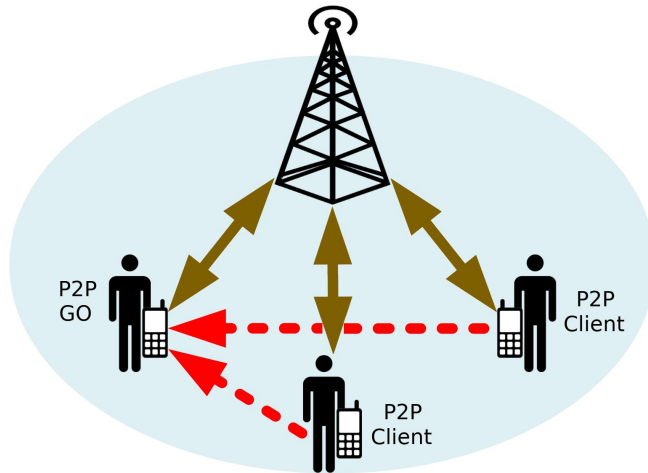


Introduction

Closer users could communicate directly



Infrastructure network X



Device-to-Device

Motivation

→ Dozens of D2D solutions only evaluated through simulations

Motivation

- Dozens of D2D solutions only evaluated through simulations
- Limits of D2D communication using Wi-Fi Direct;

Motivation

- Dozens of D2D solutions only evaluated through simulations
- Limits of D2D communication using Wi-Fi Direct;
- Content sharing:

D2D communication versus infrastructure network?

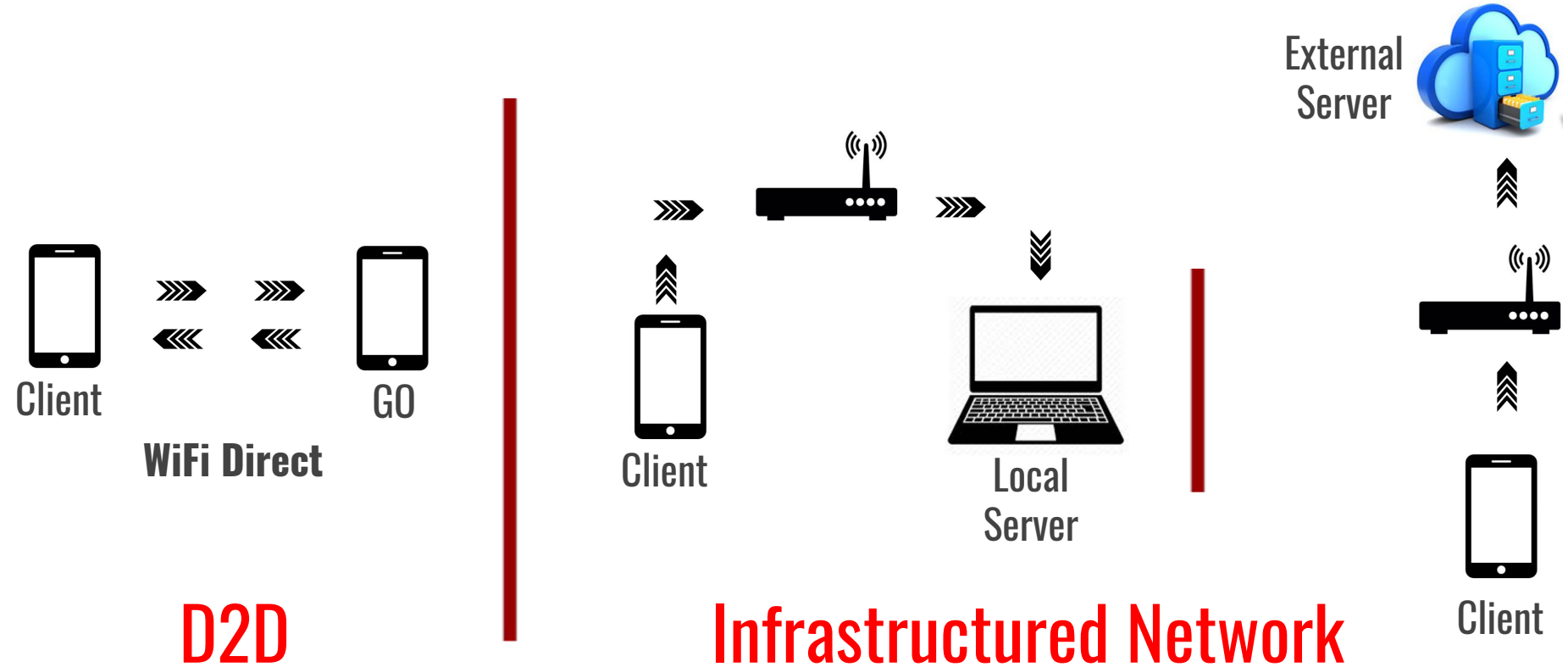
Goals

→ Compare D2D communication performance against traditional

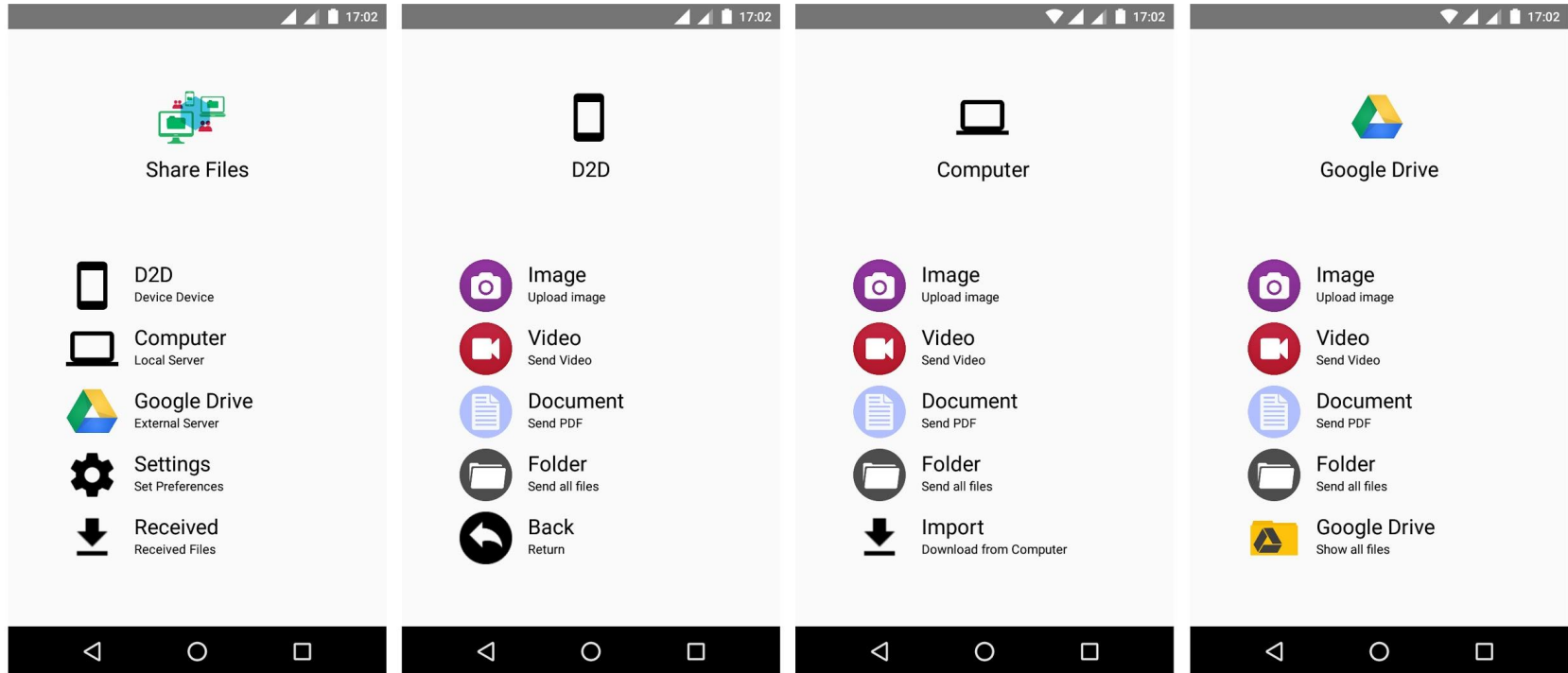
Goals

- Compare D2D communication performance against traditional
- Discuss limitations of D2D communication in devices already available in the market

ShareFile: Communication modes



ShareFile: GUI Snapshots



ShareFile: D2D - WiFi Direct

Device A (GO)



Device B (Client)



◀◀◀ ◀◀◀ ◀◀◀

Searching

◀◀◀ ◀◀◀ ◀◀◀

▶▶▶ ▶▶▶ ▶▶▶ ▶▶▶

Reply

▶▶▶ ▶▶▶ ▶▶▶ ▶▶▶

◀◀◀ ◀◀◀ ◀◀◀

Request connection

◀◀◀ ◀◀◀ ◀◀◀

▶▶▶ ▶▶▶ ▶▶▶ ▶▶▶

Connection ack

▶▶▶ ▶▶▶ ▶▶▶ ▶▶▶

◀◀◀ ◀◀◀ ◀◀◀

Data transfer

◀◀◀ ◀◀◀ ◀◀◀

◀◀◀ ◀◀◀ ◀◀◀

Request disconnection

◀◀◀ ◀◀◀ ◀◀◀

▶▶▶ ▶▶▶ ▶▶▶ ▶▶▶

Finalize group

▶▶▶ ▶▶▶ ▶▶▶ ▶▶▶

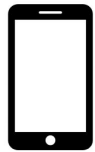
ShareFile: Event LOG

Timestamp and log all network events

- Searching
- Connection request
- Disconnection
- Device type - (GO, CLIENT), address and name;
- Number of devices found in the search;
- Size of the file being transmitted.
- Send/receive files

Performance Evaluation: Setup

- **D2D:** Two smartphones Motorola XT1069 16GB;
- **Local server:** One notebook Core I3 with 8GB of DDR3 RAM
- **External server:** Brazilian Web hosting service (LocaWeb)
15Mbps fiber optics Internet access
One modem Wi-Fi ZTE F660.



Evaluation: Methodology

→ Send files **10x** for each scenario: [**0, 1, 3, 5, 10, 15**] metros.

◆ 2200 transmissions in D2D (total = 55,21GB)

370 transmissions for each distance;

◆ 370 transmissions on the local server (total = 9.2GB);

◆ 370 transmissions on external server (total = 9.2GB);

Average RTT (servers) - Pings for 30s – before each file transfer.

→ **60 D2D connections** -> 10 for each distance;

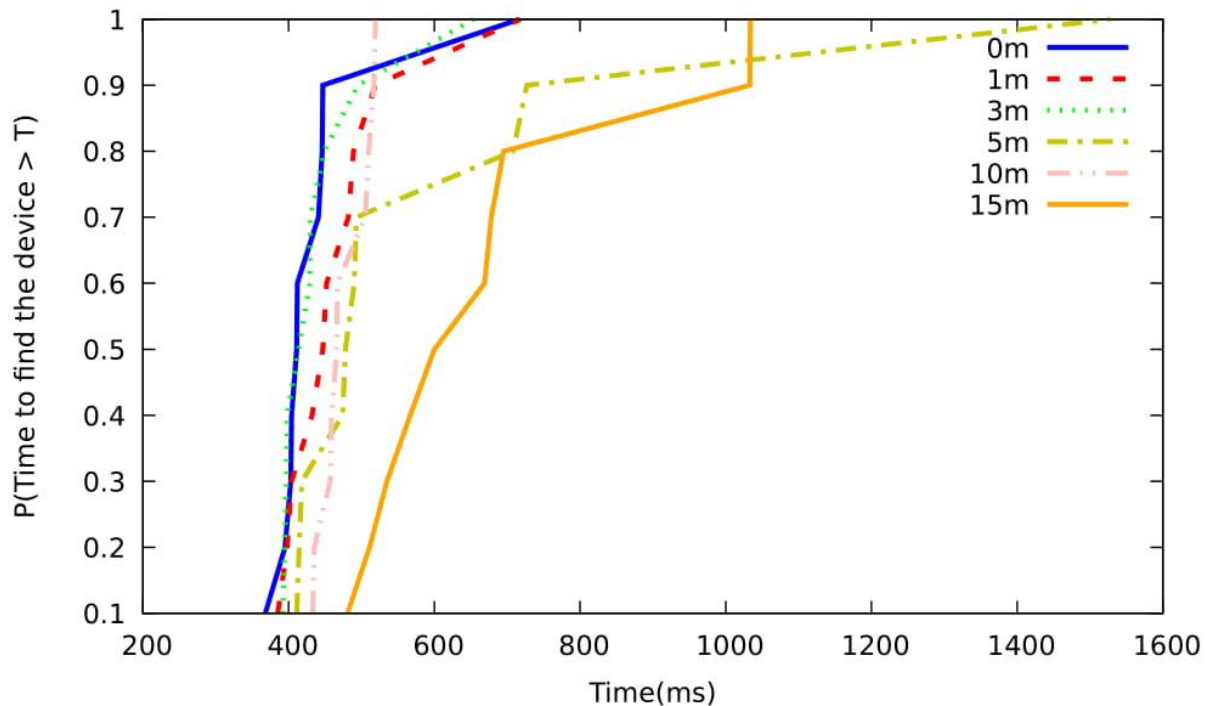
Evaluation: file set

Total = 37 files (942,3MB)

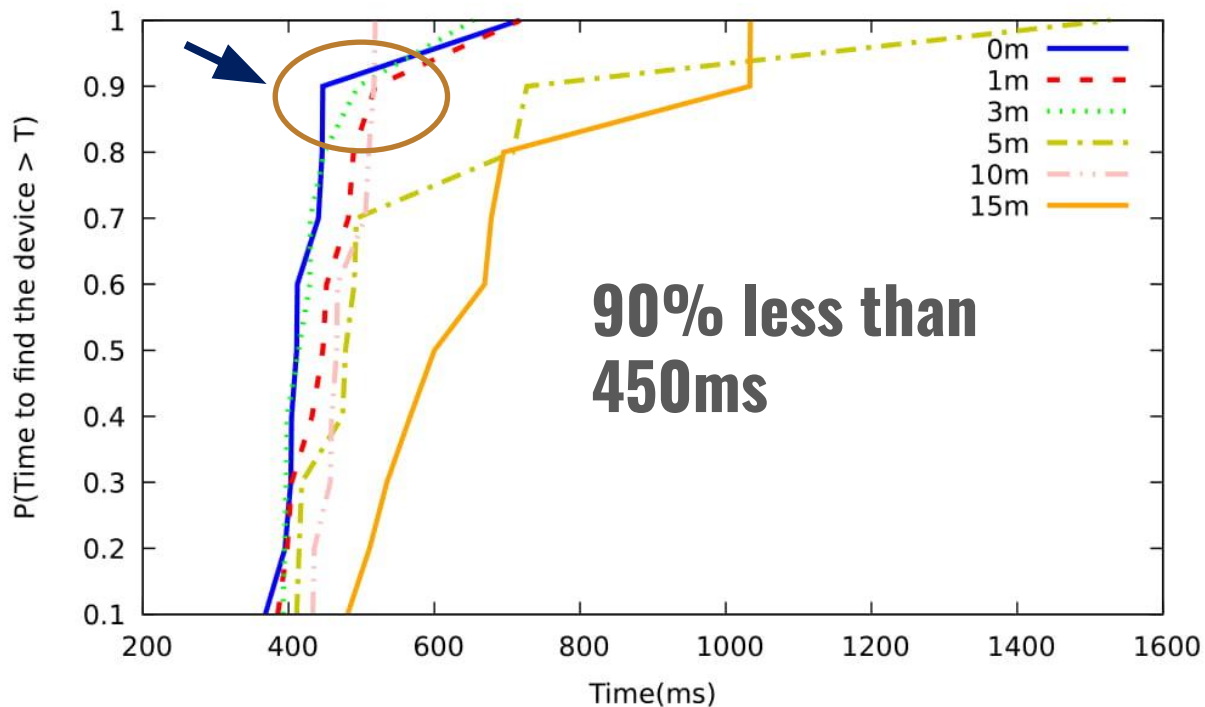
Type	Size
Image (png)	42.6KB; 59.2KB; 60.8KB; 60.9KB; 68KB; 76.5KB; 79.8KB; 84.5KB; 121.2KB; 828.9KB
Music (mp3)	3.2MB; 4.6MB; 4.7MB; 4.9MB; 5.7MB; 6.6MB; 7.2MB; 7.3MB; 7.6MB; 9.5MB
Doc (pdf)	104.5KB; 314.2KB; 396.2KB; 452.8KB; 560.4KB; 985.4KB; 1MB; 2.3MB; 3.3MB; 6.6MB
Video (mp4)	467.7KB; 589.4KB; 2.1MB; 7.6MB; 7.9MB
Disc (iso)	227MB; 617.8MB

Results

D2D: Searching time - Client to GO Device

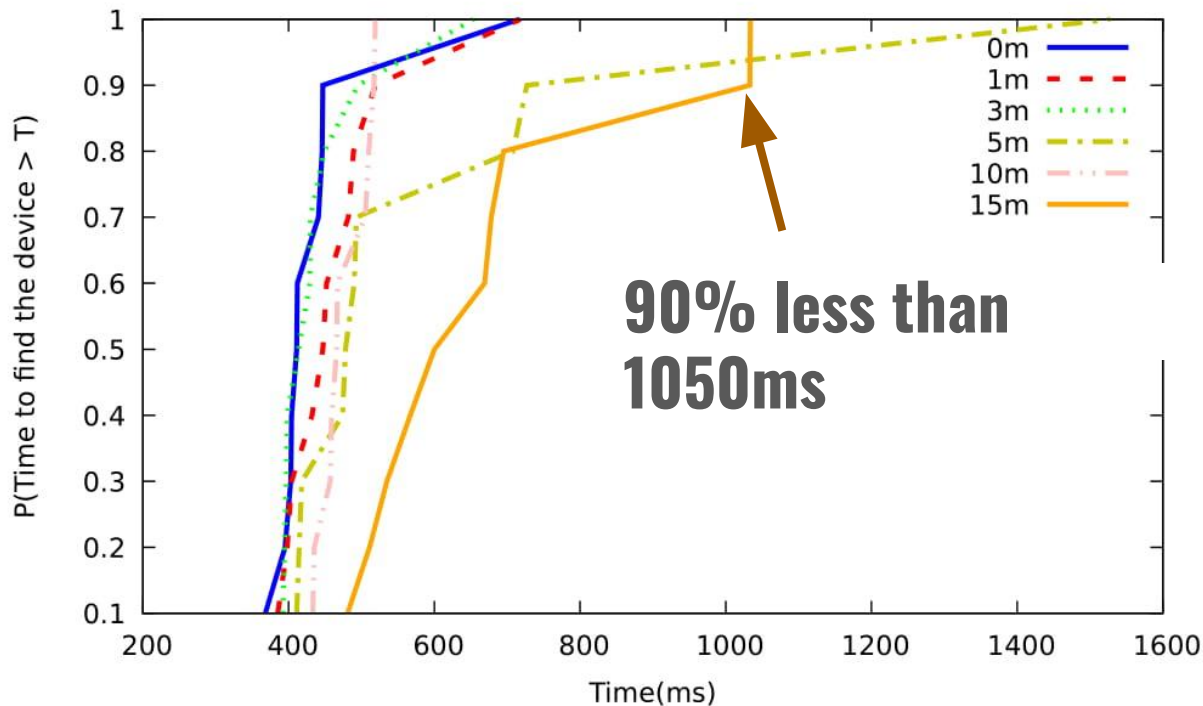


D2D: Searching time - Client to GO Device



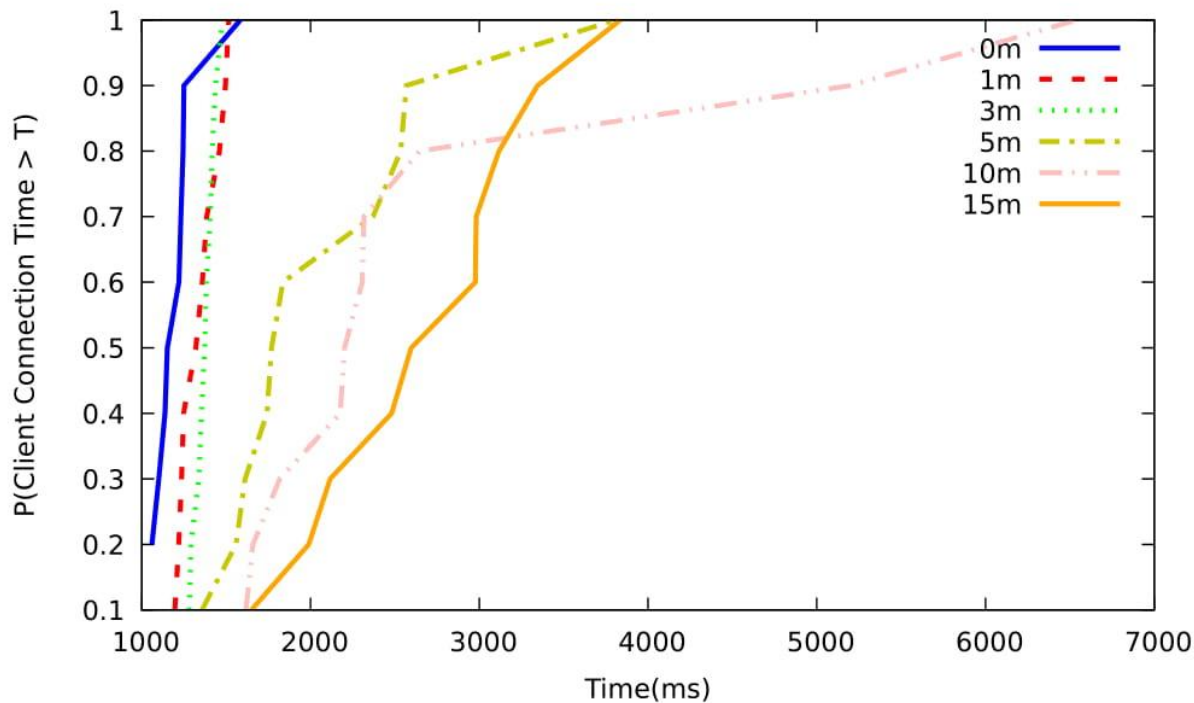
Results

D2D: Searching time - Client to GO Device



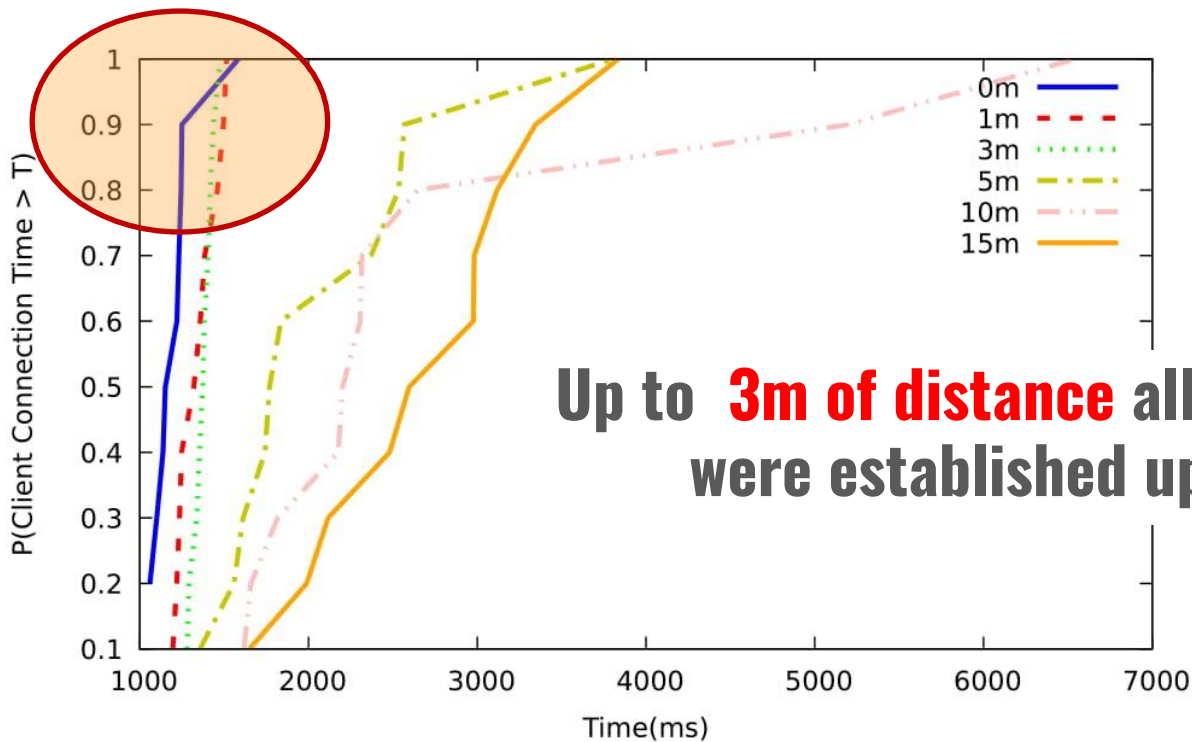
Results

D2D: Connection Time



Results

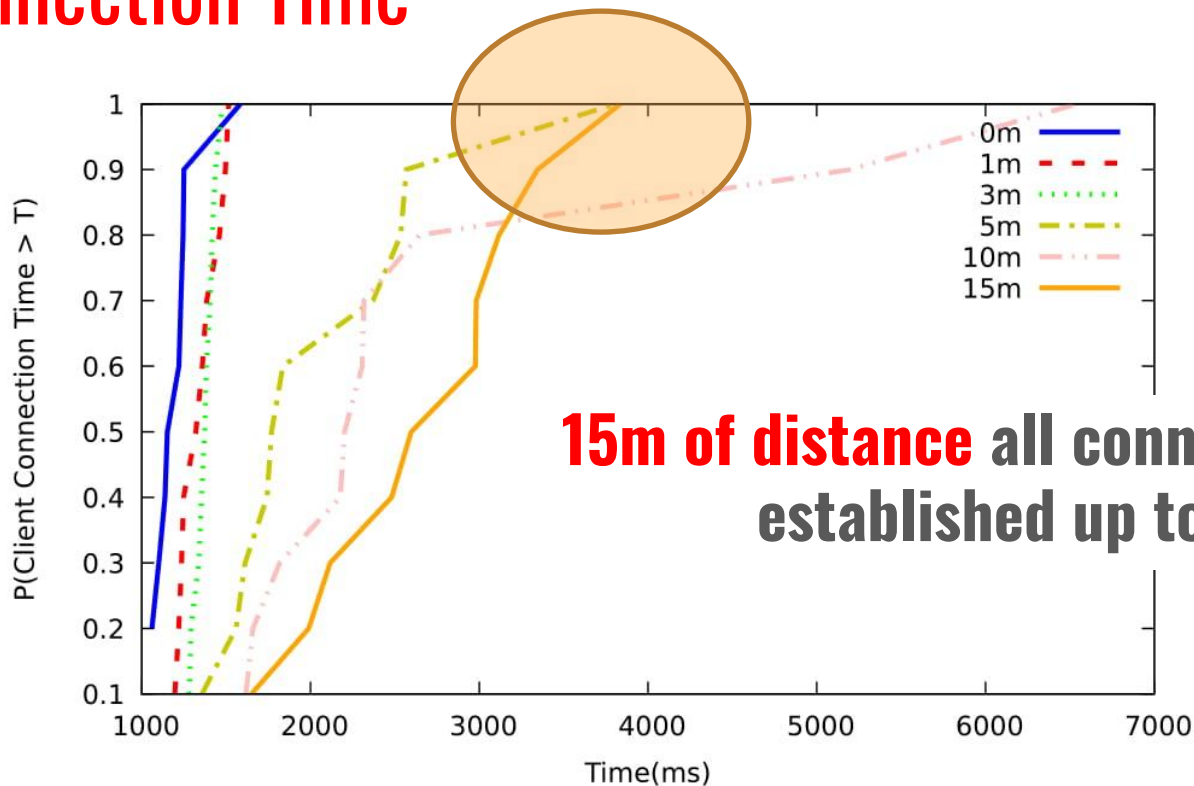
D2D: Connection Time



Up to **3m of distance** all connections were established up to 1.5s

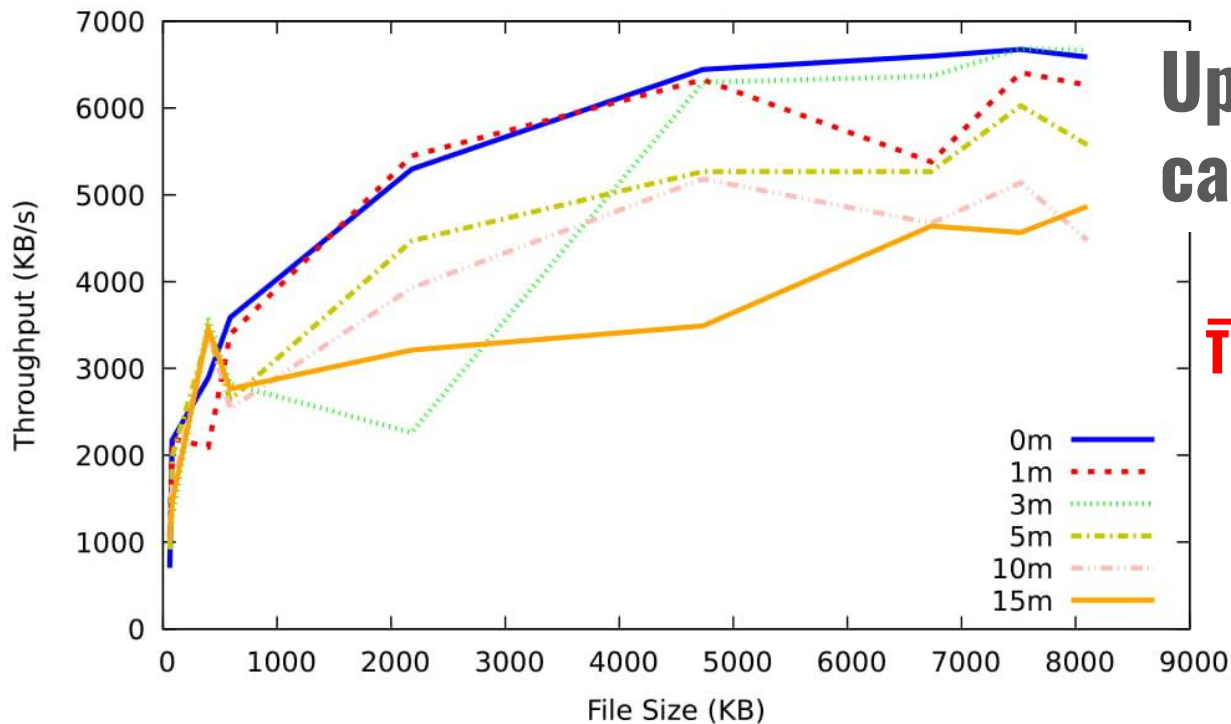
Results

D2D: Connection Time



Results

D2D Throughput



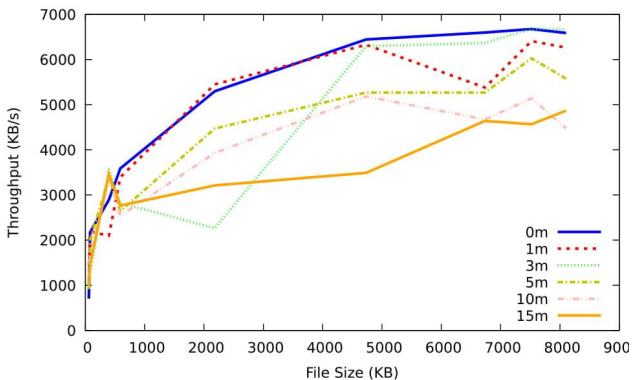
Up to **3m** -> 75% of cases up to 6591KBps

Throughput = 5008KBps

Results

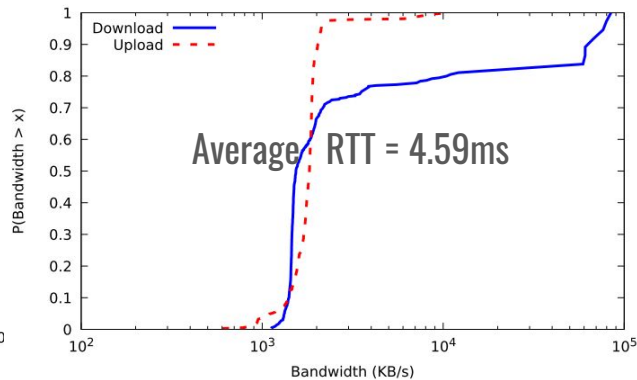
Throughput

D2D



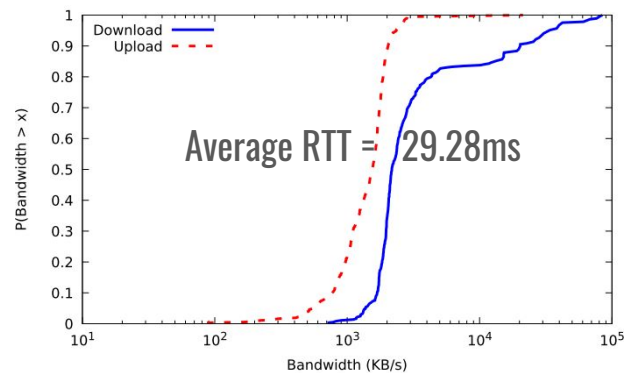
Average = 5008KBps

Local server



**Average Down Link
= 14900KBps**

Cloud (External server)



**Average Down Link
= 7900KBps**

Challenges and limitations

→ WiFi Direct must be better explored by developers

Challenges and limitations

- WiFi Direct must be better explored by developers
- Groups must be set manually in Android Devices (or users must have root access – not default)

Challenges and limitations

- WiFi Direct must be better explored by developers
- Groups must be set manually in Android Devices (or users must have root access – not default)
- Privacy is always a concern

Conclusions

- **D2D** avg. throughput **achieves 63%** of the **cloud** throughput
- Public available on *Google PlayStore*
goo.gl/gwEC3d

IEEE Symposium on Computers and Communications

25-28 June 2018 – Natal, Brazil

Thanks!

Daniel M. Reis

Theo S. Lins

José Marcos S. Nogueira

Vinícius F. S. Mota

danielmartinsreis@gmail.com

theo@decsi.ufop.br

jmarcos@dcc.ufmg.br

vinicius.mota@inf.ufes.br

Supported by

FAPES

CNPq

CAPES