

# IoT challenges

State of the art

Aghiles DJOUDI

LIGM/ESIEE Paris

April 21, 2019

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Context

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Context

# Context

## Introduction

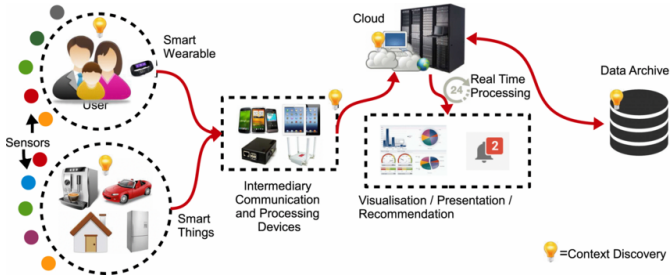


Figure 1: The IoT Platform

- ➡ Connect sensors to the gateway.<sup>[1]</sup>
- ➡ Connect the gateway to the infrastructure.<sup>1</sup>
- ➡ Store & Analyze sensors data.<sup>2</sup>

<sup>1</sup>jhh

<sup>2</sup>P. Thubert, M. R. Palattella, and T. Engel, "6TISCH Centralized Scheduling: When SDN Meet IoT," in *2015 IEEE Conference on Standards for Communications and Networking (CSCN)*, 00033, Tokyo, Japan: IEEE, Oct. 2015, pp. 42–47.



Figure 2: The IoT problematics

- ➡ How to communicate sensors efficiently
  - ➡ IEEE 802.15.4, 6LowPAN
  - ➡ Throughput, Delay, Jitter, Loss rate and Availability.
- ➡ How to communicate sensors with the infrastructure efficiently
  - ➡ LPWAN, LoraWan
  - ➡ Heterogeneity ?
- ➡ How to extract knowledge from sensors data.
  - ➡ Data mining: Classification, Clustering
  - ➡ Deep learning: Machine learning



Figure 2: The IoT problematics

- ➡ How to communicate sensors efficiently
  - ➡ IEEE 802.15.4, 6LowPAN
  - ➡ Throughput, Delay, Jitter, Loss rate and Availability.
- ➡ How to communicate sensors with the infrastructure efficiently
  - ➡ LPWAN, LoraWan
  - ➡ **Heterogeneity ?**
- ➡ How to extract knowledge from sensors data.
  - ➡ Data mining: Classification, Clustering
  - ➡ Deep learning: Machine learning

# Motivations

## Introduction

### ➡ First Motivation

#### ➡ First Motivation

- \* First Motivation
- \* Second Motivation

#### ➡ Second Motivation

### ➡ Second Motivation

#### ➡ First Motivation

#### ➡ Second Motivation

### ➡ Third Motivation

#### ➡ First Motivation

#### ➡ Second Motivation

### ➡ Fourth Motivation

#### ➡ First Motivation

#### ➡ Second Motivation

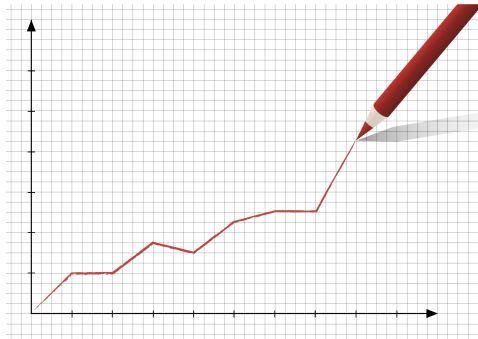


Figure 3

# Goals

## Introduction

- ➡ First goal
  - ➡ First goal
    - \* First goal
    - \* Second goal
  - ➡ Second goal
- ➡ Second goal
  - ➡ First goal
  - ➡ Second goal
- ➡ Third goal
  - ➡ First goal
  - ➡ Second goal
- ➡ Fourth goal
  - ➡ First goal
  - ➡ Second goal

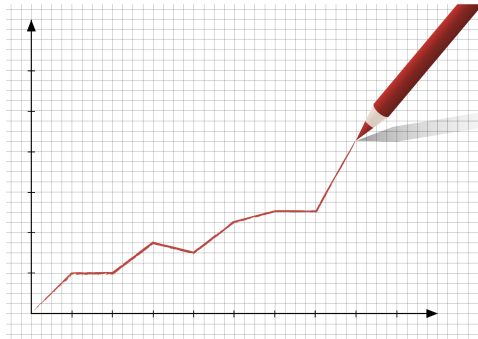


Figure 4



# Challenges

## Introduction

### ➡ First Challenge

- ➡ L'objectif est de réduire le taux de mortalité
- ➡ L'objectif est de rendre nos route plus sure

### ➡ Second Challenge

- ➡ Connecter les pietons et le vehicule
- ➡ augmenter la précision GPS
- ➡ réduire la latence

### ➡ Third Challenge

- ➡ Connecter les pietons et le vehicule
- ➡ augmenter la précision GPS
- ➡ réduire la latence

# Contributions

## Introduction

### ➡ First contribution

- ➡ Privacy settings
- ➡ Information propagation
- ➡

### ➡ Second contribution

- ➡ Privacy settings
- ➡ I

### ➡ Third contribution

- ➡ Privacy settings
- ➡ I

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Context

# Outline

1. Introduction
2. State of the art
3. First contribution
4. Second contribution
5. Conclusion

# State of the art

Standardization

# Conclusion

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work
2. Contagion process
3. Experimentation
4. Results exploitation
5. Conclusion

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work

2. Contagion process

3. Experimentation

4. Results exploitation

5. Conclusion



# Related work

## Comparison

Paper	A1	A2	A3	A4

Table 1: An example table.

# Related work

## Comparison

Paper	A1	A2	A3	A4

Table 2: An example table.

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work

2. Contagion process

3. Experimentation

4. Results exploitation

5. Conclusion

# ... (step 1)

## Methods

### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

## ... (step 2)

### Methods

#### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

#### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

## ... (step 3)

### Methods

#### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

#### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

## ... (step 4)

### Methods

#### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

#### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work

2. Contagion process

3. Experimentation

4. Results exploitation

5. Conclusion



# Experimentation

## Experimentation

### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work

2. Contagion process

3. Experimentation

4. Results exploitation

5. Conclusion

# Results

## Comparison

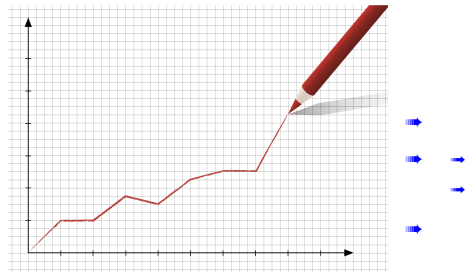


Figure 5

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work
2. Contagion process
3. Experimentation
4. Results exploitation
5. Conclusion

# Conclusion

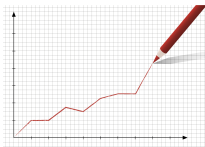


Figure 6: Cag.

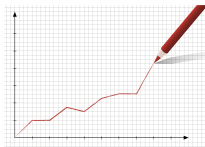


Figure 8: Cag.

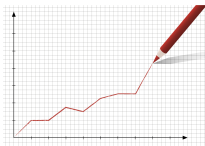


Figure 7: Cag.

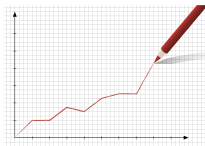


Figure 9: Cag.

# Challenges

## Conclusion

### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work
2. Contagion process
3. Experimentation
4. Results exploitation
5. Conclusion

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work

2. Contagion process

3. Experimentation

4. Results exploitation

5. Conclusion



# Related work

## Comparison

Paper	A1	A2	A3	A4

Table 3: An example table.

# Related work

## Comparison

Paper	A1	A2	A3	A4

Table 4: An example table.

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work

2. Contagion process

3. Experimentation

4. Results exploitation

5. Conclusion

## ... (step 1)

### Methods

#### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

#### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

## ... (step 2)

### Methods

#### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

#### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

## ... (step 3)

### Methods

#### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

#### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

## ... (step 4)

### Methods

#### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

#### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work

2. Contagion process

**3. Experimentation**

4. Results exploitation

5. Conclusion



# Experimentation

## Experimentation

### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work

2. Contagion process

3. Experimentation

4. Results exploitation

5. Conclusion

# Results

## Comparison

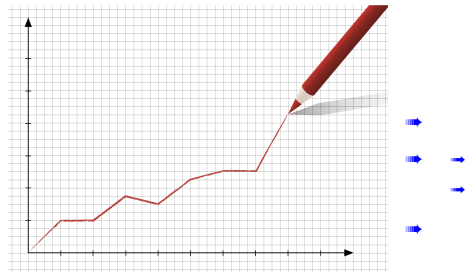


Figure 10

# Outline

1. Introduction

2. State of the art

3. First contribution

4. Second contribution

5. Conclusion

1. Related work
2. Contagion process
3. Experimentation
4. Results exploitation
5. Conclusion

# Conclusion

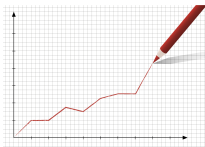


Figure 11: Cag.

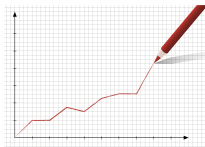


Figure 13: Cag.

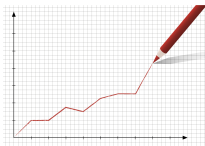


Figure 12: Cag.

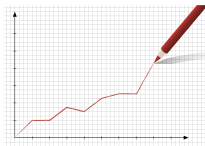


Figure 14: Cag.

# Challenges

## Conclusion

### ➡ Privacy threats

- ➡ Privacy settings
- ➡ Information propagation
- ➡

### ➡ Privacy protection

- ➡ Privacy settings
- ➡ I

# Outline

1. Introduction
2. State of the art
3. First contribution
4. Second contribution
5. Conclusion

## Conclusion

Routing protocol	Control Cost	Link Cost	Node Cost
OSPF/IS-IS	✗	✓	✗
OLSRv2	?	✓	✓
RIP	✓	?	✗
DSR	✓	✗	✗
RPL	✓	✓	✓

Table 5: Routing protocols comparison \_rpl2\_

Application protocol	Rest-Full	Transport	Publish/Subscribe	Request/Response	Security	QoS	Header size (Byte)
COAP	✓	UDP	✓	✓	DTLS	✓	4
MQTT	✗	TCP	✓	✗	SSL	✓	2
MQTT-SN	✗	TCP	✓	✗	SSL	✓	2
XMPP	✗	TCP	✓	✓	SSL	✗	-
AMQP	✗	TCP	✓	✗	SSL	✓	8
DDS	✗	UDP TCP	✓	✗	SSL DTLS	✓	-
HTTP	✓	TCP	✗	✓	SSL	✗	-

Table 6: Application protocols comparison



## Conclusion

Routing protocol	Control Cost	Link Cost	Node Cost
OSPF/IS-IS	✗	✓	✗
OLSRv2	?	✓	✓
RIP	✓	?	✗
DSR	✓	✗	✗
RPL	✓	✓	✓

Table 5: Routing protocols comparison \_rpl2\_

Application protocol	Rest-Full	Transport	Publish/Subscribe	Request/Response	Security	QoS	Header size (Byte)
COAP	✓	UDP	✓	✓	DTLS	✓	4
MQTT	✗	TCP	✓	✗	SSL	✓	2
MQTT-SN	✗	TCP	✓	✗	SSL	✓	2
XMPP	✗	TCP	✓	✓	SSL	✗	-
AMQP	✗	TCP	✓	✗	SSL	✓	8
DDS	✗	UDP TCP	✓	✗	SSL DTLS	✓	-
HTTP	✓	TCP	✗	✓	SSL	✗	-

Table 6: Application protocols comparison

# Thank you !

# Challenges

## Conclusion

### ⇒ Privacy threats

- ⇒ Privacy settings
- ⇒ Information propagation
- ⇒

### ⇒ Privacy protection

- ⇒ Privacy settings
- ⇒ I

# Challenges

## Conclusion

### ⇒ Privacy threats

- Privacy settings
- Information propagation
- 

### ⇒ Privacy protection

- Privacy settings
- I

Thank you !

# References

- [1] P. Thubert, M. R. Palattella, and T. Engel, "6TISCH Centralized Scheduling: When SDN Meet IoT," in *2015 IEEE Conference on Standards for Communications and Networking (CSCN)*, 00033, Tokyo, Japan: IEEE, Oct. 2015, pp. 42–47 (p. 4).