IoT challenges
State of the art

Aghiles DJOUDI

LIGM/ESIEE Paris w& SIC/ECE Paris

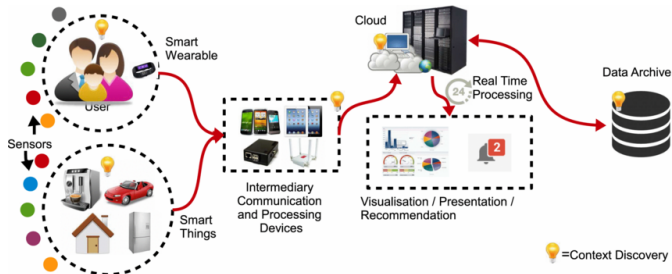July 14, 2019

Outline

Context

Figure 1: IoT platform.

Figure 2: IoT challenges.

Problematic
Where is the problem ?

1. How to Connect sensors to the best gateway?

   ➡ Decision and optimisation problem.

   ➡ Various network acces

   ➡ Various configuration of each network acces

   ➡ Lake of selection tools

2. How to connect sensors to this gateway with high Security level.

   ➡ Technical problem.

   ➡ Lake of selective tools

   ➡ How to select the **best** access point

3. How to extract knowledge from sensors data [1].

   ➡ a

   ➡ Lake of selective tools

   ➡ How to select the **best** access point

Figure 3: Key b
Industr

[1] Pascal Thubert, Maria Rita Palattella, and Thomas Engel. " 6TiSCH Centralized Scheduling: When SDN Meet IoT ". In: *2015 IEEE Conference on Standards for Communications and Networking (CSCN)*. 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 00035. Tokyo, Japan: Oct. 2015, pp. 42–47.
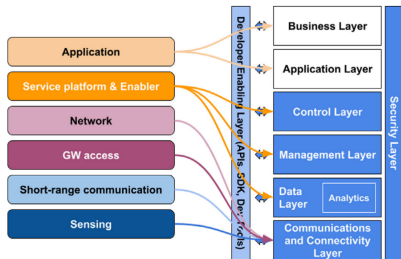
²**industrialinternetofthings**

Problematic

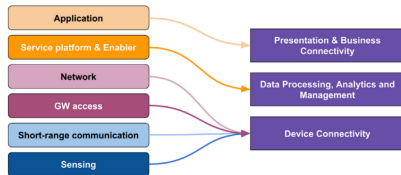## Where is the problem [2] ?

Figure 4: Intel view.

Figure 6: SAP view.

Figure 5: Microsoft view.
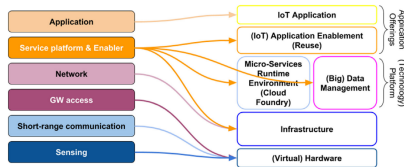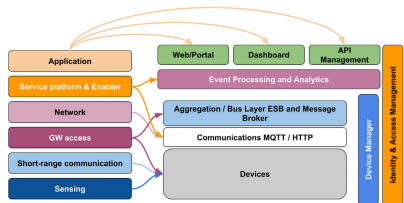

Figure 7: WS2O view.

Problematic

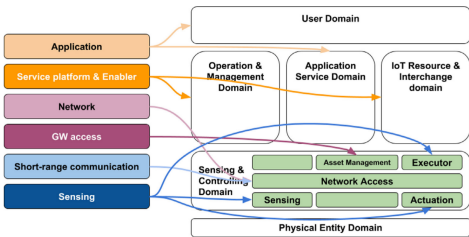Where is the problem [2] ?

Figure 8: ISO view.

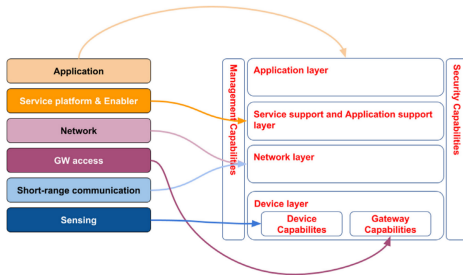Figure 9: ITU-T view.

Motivations

Why should we deal with such problems

1. → a
   - → Lake of selective tools
   - → How to select the **best** access point

2. QoS Analysis
   - → a
   - → Lake of selective tools
   - → How to select the **best** access point

3. Threats
   - → a
   - → Lake of selective tools
   - → How to select the **best** access point

Figure 10: Communication diversity.

Goal

Is it specific, measurable, achievable, réalistic, for 3 years ?

➡
1. Allow heterogeneous network to communicate
2. QoS Analysis
3. Threats

➡ How to select the **best** access point
1. Allow heterogeneous network to communicate
2. QoS Analysis
3. Threats

Figure 11: wsn-IoT.

Challenges
Where is the difficulty ?

1. Challenge 1
   - → 6720 possible settings
   - → Lake of selective tools
   - → How to select the **best** configuration

2. Challenge 2
   - → a
   - → Lake of selective tools
   - → How to select the **best** access point

3. Challenge 3
   - → a
   - → Lake of selective tools
   - → How to select the **best** access point

Figure 12: tets.

Contributions
How could be addressed ?

1. Contribution 1

   ➡ a
   ➡ Lake of selective tools
   ➡ How to select the **best** access point

2. Contribution 2

   ➡ a
   ➡ Lake of selective tools
   ➡ How to select the **best** access point

3. Contribution 3

   ➡ a
   ➡ Lake of selective tools
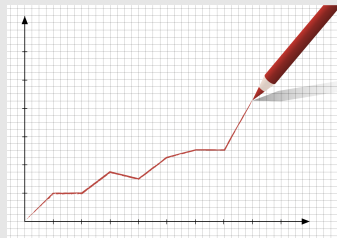   ➡ How to select the **best** access point

Figure 13: tets.

Outline

Outline

Outline

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

Marcov chain

Methods

$$V(s,\pi) = \mathbb{E}_s^\pi \left(\sum_{k=0}^{\inf} \gamma^k \cdot r(s_k, a_k) \right), s \in \mathbb{S} \tag{1}$$

$$r(s_k, a_k) = G_k \cdot PRR(a_k) \tag{2}$$

$$\pi^* = \arg\max_\pi V(s, \pi) \tag{3}$$

$$PRR = (1 - BER)^L \tag{4}$$

$$BER = 10^{\alpha e^{\beta SNR}} \tag{5}$$

Senarios
Methods

�./ Environnement
- ➤ Rural/Urban
- ➤ Static/Mobile
- ➤

➤ Senarios
- ➤ For each service (Smart building:Videos, Voice, Text. Smart trafic:Videos, Voice, Text)
- ➤ For each application protocol (MQTT, COAP, XMPP)
- ➤ For each network protocol (Start, Mesh)
- ➤ For each MAC protocol (LoraWan, Sigfox, ...)
- ➤ For each MAC configuration (SF, CR, BW, ...)

➤ Algorithms
- ➤ Input:
  - ✴ Service QoS metrics requiremnts
  - ✴ Network Transmission Parameters
  - ✴ Network QoS metrics
- ➤ Method:
  - ✴ MADM
  - ✴ Game
  - ✴ Neural
- ➤ Outputs:
  - ✴ Ranked networks

Genetic Algorithm

Methods

➡

➡ S = SF12, BW125, 4/8, 17 dBm

➡ Input:

    ➜ Problem: $f(x) = \max(x^2)$, $x \in [0,32]$

        ✳ $x_1 : 01101_b$

        ✳ $x_2 : 11000_b$

        ✳ $x_3 : 01000_b$

        ✳ $x_4 : 10011_b$

➡ Method: Genetic algorithm

    ➜ Generate a set of random possible solution

    ➜ Test each solution and see how good it is (ranking)

        1. Remove some bad solutions

        2. Duplicate some good solutions

        3. Make small changes to some of them (Crossover, Mutation)

➡ Output:

    ➜ x_1 : 01101 (169) (14.4)

    ➜ x_2 : 11000 (576) (49.2)

    ➜ x_3 : 01000 (64) (5.5)

    ➜ x_4 : 10011 (361) (30.9)

Game theory
Methods

➡ Players: $K = \{1, ..., K\}$

➡ Strategies: $S = S_1 \times ... \times S_K$

➡ S_k is the strategy set of the kth player.

➡ Rewards: $u_k : S \longrightarrow R_+$ and is denoted by $r_k(s_k, s_{-k})$

➡ $s_{-k} = (s_1, ..., s_{k-1}, s_{k+1}, ..., s_K) \in S_1 \times ... \times S_{k-1} \times S_{k+1} \times ... \times S_K$

... (step 2)

Methods

... (step 3)

Methods

➠

➠

... (step 4)
Methods

Results
Comparison

Table 3

Outline

Experimentation

Experimentation

- a

- b
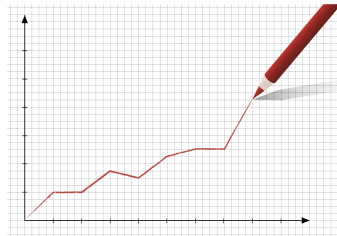
Figure 14: .

Outline

Results

Comparison

- a

- b
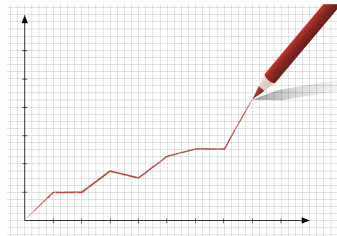
Figure 15: .

Outline

Conclusion

- a
- b
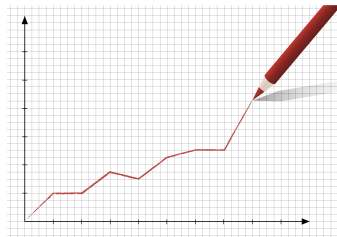
Figure 16: .

Outline

Conclusion

Our main goal was

➠

➠

Our main contribution was

➠

➠

Our main results was

➠

➠

Future Challenges

Conclusion

Our future goal was

➡

➡

Our future goal was

➡

➡

Thank you !

References

[1]   Pascal Thubert, Maria Rita Palattella, and Thomas Engel. " 6TiSCH Centralized Scheduling: When SDN Meet IoT ". In: *2015 IEEE Conference on Standards for Communications and Networking (CSCN)*. 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 00035. Tokyo, Japan: Oct. 2015, pp. 42–47 (p. **4**).

[2]   B. Di Martino et al. " Internet of Things Reference Architectures, Security and Interoperability: A Survey ". In: *Internet of Things* 1-2 (Sept. 2018). 00006, pp. 99–112 (p. **5**, **6**).