IoT challenges

State of the art

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July 21, 2019

- 1. Introduction
- First contribution
- 3. Conclusion

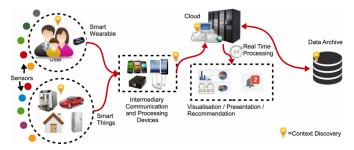


Figure 1: IoT platform.



Figure 2: IoT challenges.

1. Introduction | 1. Context

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

→ Lake of selective tools

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

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Figure 3: Key b Indust

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[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). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking (CSCN). 2015 IEEE Conference on Standards for Communications and Networking IEEE Conference on Standards for Communications and Networking

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Problematic

Where is the problem [3] ?

Bandwidth (BW) Spreading Factor (SF) Coding Rate (CR) Transmission Energy (Tx) Receiver Sensitivity (RS) Signal Noise Rate (SNR) Data Rate (DR)

Setting	Values	Rewards	Cost
BW	125 → 500 <i>kHz</i>	DR	RS, Range.
SF	2 ⁶ → 2 ¹²	RS, Range	SNR, longer packets, Tx.
CR	4/5 → 4/8	Resilience	longer packets, Tx.
Tx	-4 ⇒ 20 <i>dBm</i>	SNR	Tx

Table 1: [2]

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 4: Communication diversity.

Goal

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

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



Figure 5: wsn-loT.

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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 6: tets.

Contributions

Contributions

- Environnement
 - → Rural/Urban
 - → Static/Mobile

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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
 - M National Occionation
 - Network QoS metrics
- Method:
 - * MADM
 - * Game
 - * Neural
- Outputs:
 - * Ranked networks

Contributions

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- Environnement
 - Rural/Urban
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- Senarios
- → For each service (Smart building: Videos, Voice, Text. Smart trafic: Videos Voice, Text)
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 - * Game
 - * Neural
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- 1. Introduction
- 2. First contribution
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- 1. Related work
- 2. Contagion process
- 3. Experimentation
- 4. Results exploitation
- 5. Discussion

- Introduction
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Related work

Comparison

Paper	A1	A2	A3	A4

Table 2: An example table.

Related work

Comparison

A1	A2	A3	A4
	A1	A1 A2	A1 A2 A3

Table 3: An example table.

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Multi-Armed-Bandit Algorithm Methods

- → Arms: K = 1, ..., K
- → Decision: T = 1, ..., T
- Reward: X_t^k with $\mu_t^k = E[X_t^k]$
 - → Best reward: X_t^* with $\mu_t^* = \max \mu_t^k$, k∈K

Marcov chain

Methods

$$V(s,\pi) = \mathbb{E}_{s}^{\pi} \left(\sum_{k=0}^{\inf} \gamma^{k} \cdot r(s_{k}, a_{k}) \right), s \in \mathbb{S}$$

$$(1)$$

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

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

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

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

Marcov chain

Methods



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

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

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

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

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

Genetic Algorithm

Methods

-

- S = SF12, BW125, 4/8, 17 dBm
- Input:
 - → Problem: $f(x) = max(x^2), x \in [0,32]$
 - * $x_1:01101_b$
 - * $x_2:11000_h$
 - * x₃:01000_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:
 - → x₁: 01101 (169) (14.4)
 - → x₂: 11000 (576) (49.2)
 - → x₃: 01000 (64) (5.5)
 - → x₄: 10011 (361) (30.9)

Game theory

Methods

- → Players: K = {1,..., K}
- ⇒ Strategies: $S = S_1 \times ... \times S_K$
 - \rightarrow S_k is the strategy set of the k^{th} player.
- ightharpoonup 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

2. First contribution | 2. Contagion process

... (step 3)
Methods

2. First contribution | 2. Contagion process

... (step 4)
Methods

2. First contribution | 2. Contagion process

Results

Comparison



Table 4

- Introduction
- 2. First contribution
- Conclusion

- Related work
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Experimentation

Experimentation

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Figure 7: .

- Introduction
- 2. First contribution
- Conclusion

- Related work
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- 4. Results exploitation
- 5. Discussion

Results

Comparison



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Figure 8: .

- Introduction
- 2. First contribution
- 3. Conclusion

- Related work
- Contagion process
- Experimentation
- Results exploitation
- 5. Discussion

Discussion

⇒ a

→ b



Figure 9: .

2. First contribution | 5. Discussion 20/22

- Introduction
- First contribution
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Conclusion

Our main goal was



Our main contribution was



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Our main results was



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Future Challenges

Conclusion

Our future goal was





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Future Challenges

Conclusion

Our future goal was



Thank you!

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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] Marco Cattani, Carlo Boano, and Kay Römer. * An Experimental Evaluation of the Reliability of Lora Long-Range Low-Power Wireless Communication *. In: Journal of Sensor and Actuator Networks 6.2 (2017), 00942. 0, 7 (p. 5).
- [3] 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).