

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. Genetic Algorithm For LoRa
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Why I started a PhD ?

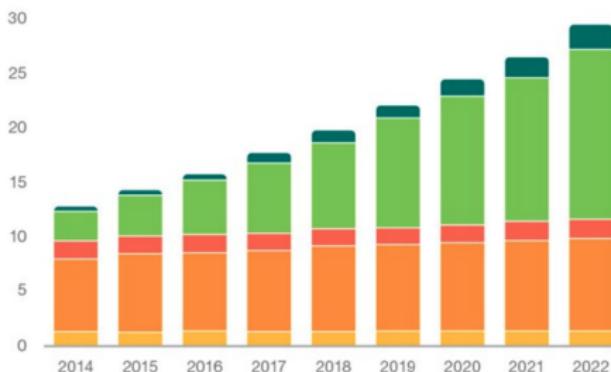
3 main reasons

- ➡ Research methodology lecture.
- ➡ Bac+5 in networking ? not really !
- ➡ Being paid to study and develop yourself !

IoT devices

IoT devices are useless without a good communication capability

Connected devices (billions)



	2016	2022	CAGR
Wide-area IoT	0.4	2.1	30%
Short-range IoT	5.2	16	20%
PC/laptop/tablet	1.6	1.7	0%
Mobile phones	7.3	8.6	3%
Fixed phones	1.4	1.3	0%
	16 billion	29 billion	10%



Figure 1. IoT devices [1].

IoT applications requirements

Each application has its own communication requirements

Challenges/Applications	Grids	EHealth	Transport	Cities	Building
Resources constraints	✗	✓	✗	-	✗
Mobility	✗	-	✓	✓	✗
Heterogeneity	-	-	-	✓	✗
Scalability	✓	-	✓	✓	-
QoS constraints	-	-	✓	✓	✓
Data management	-	✗	✓	✓	-
Lack of Standardization	-	-	-	-	✓
Amount of attacks	✗	✗	✓	✓	✓
Safety	-	✓	✓	-	✓

Table 1. Main IoT challenges [2] [3]



Figure 2. IoT Applications.

IoT platforms

IoT platforms is a chain of communication process

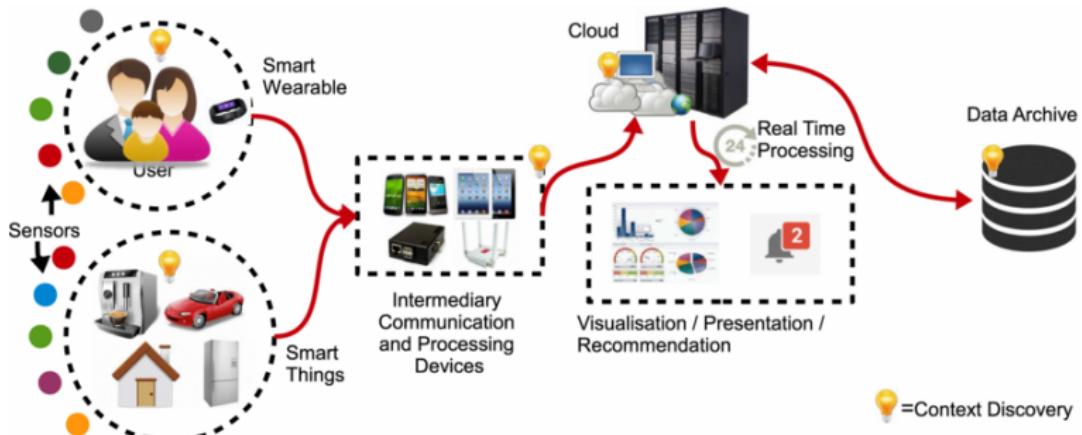


Figure 3. IoT platform.



Figure 4. IoT challenges.

IoT applications requirements

Context

Use Case	Packet rate [pkt/day]	Min success rate [Ps,min]	Payload Size [Byte]
Wearables	10	90	
Smoke Detectors	2	90	
Smart Grid	10	90	10-20
White Goods	3	90	
Waste Management	24	90	
VIP/Pet Tracking	48	90	
Smart Bicycle	192	90	
Animal Tracking	100	90	
Environmental Monitoring	5	90	
Asset Tracking	100	90	50
Smart Parking	60	90	
Alarms/Actuators	5	90	
Home Automation	5	90	
Machinery Control	100	90	
Water/Gas Metering	8	90	
Environmental Data Collection	24	90	
Medical Assisted Living	8	90	
Micro-generation	2	90	
Safety Monitoring	2	90	100-200
Propane Tank Monitoring	2	90	
Stationary Monitoring	4	90	
Urban Lighting	5	90	
Vending Machines Payment	100	90	
Vending Machines General	1	90	1K

Table 2. Application requirements for the use cases of interest [4] [3].

IoT wireless communication

Wireless communication performance need to be evaluated to match applications requirements

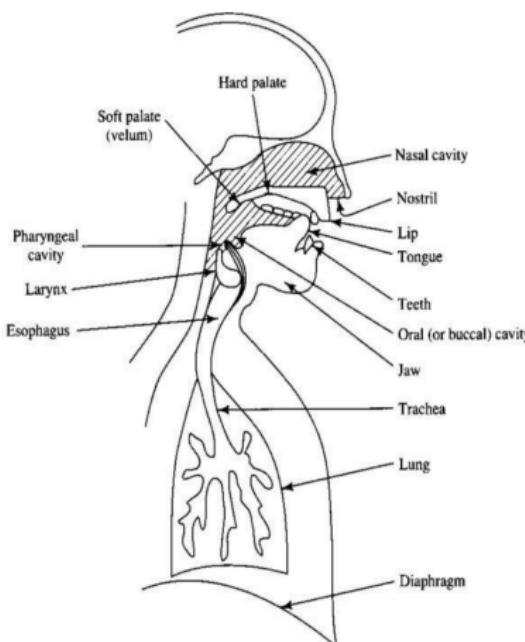


Figure 5. Human voice.

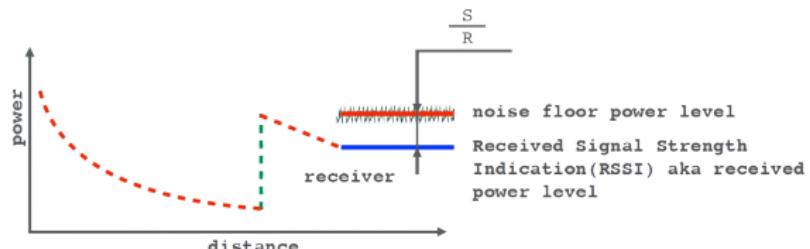


Figure 6. SNR & RSSI.



Figure 7. Time on air.

Problem statement

Introduction² ?

Parameters

- Bandwidth (BW)
- Spreading Factor (SF)
- Coding Rate (CR)
- Transmission Power (Tx)

Metrics

- Receiver Sensitivity (RS)
- Signal Noise Rate (SNR)
- Data Rate (DR)
- Air Time (AT)
- Payload length ($PktL$)

Setting	Values	Rewards	Costs
BW	7.8 \rightarrow 500kHz	DR	RS , Range
SF	$2^6 \rightarrow 2^{12}$	RS , Range	DR , SNR , $PktL$, Tx
CR	4/5 \rightarrow 4/8	Resilience	$PktL$, Tx , AT
Tx	-4 \rightarrow 20dBm	SNR	Tx

Table 3.¹

¹ M. Cattani, C. Boano, and K. Römer, "An experimental evaluation of the reliability of lora long-range low-power wireless communication", *Journal of Sensor and Actuator Networks*, vol. 6, no. 2, p. 7, 2017, 00042.

² dimartino_internet_2018.

IoT wireless communication

Exp: LPWAN in a new technology that satisfy IoT applications requirements

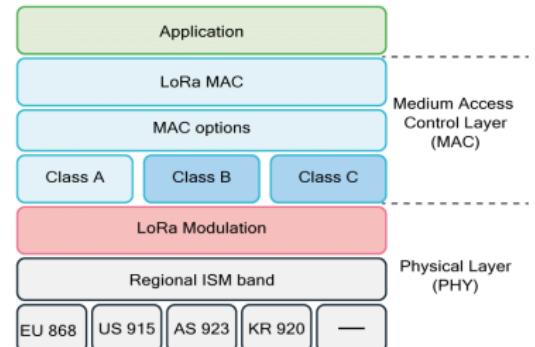


Figure 9. LoRa and LoraWan stack.

Problematic

Network configuration is the problem number one actually

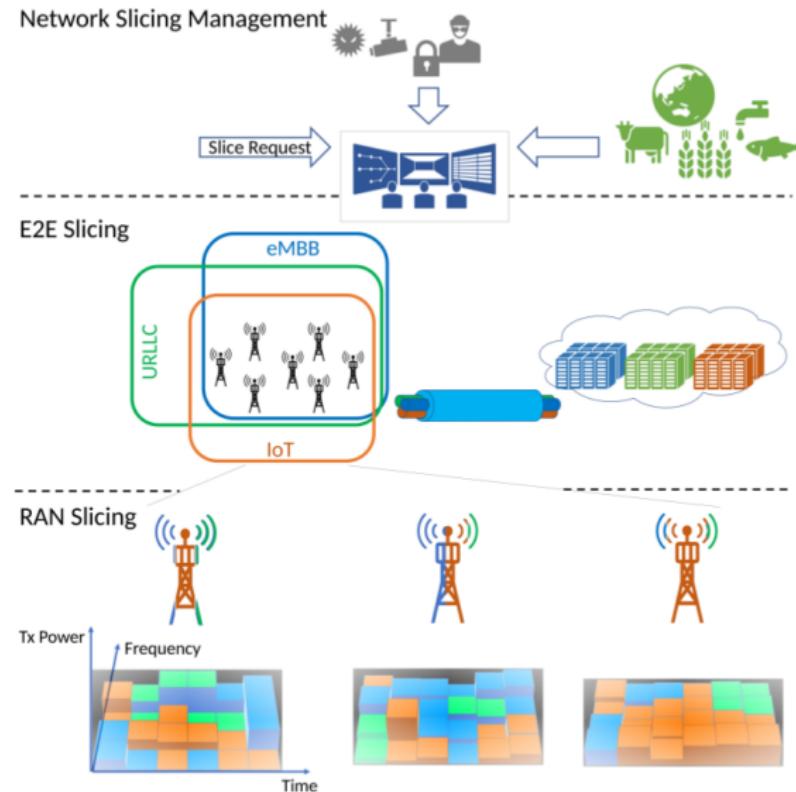


Figure 10. Key barriers in adopting IoT in the industry [5].

Problematic

Network configuration is the problem number one actually

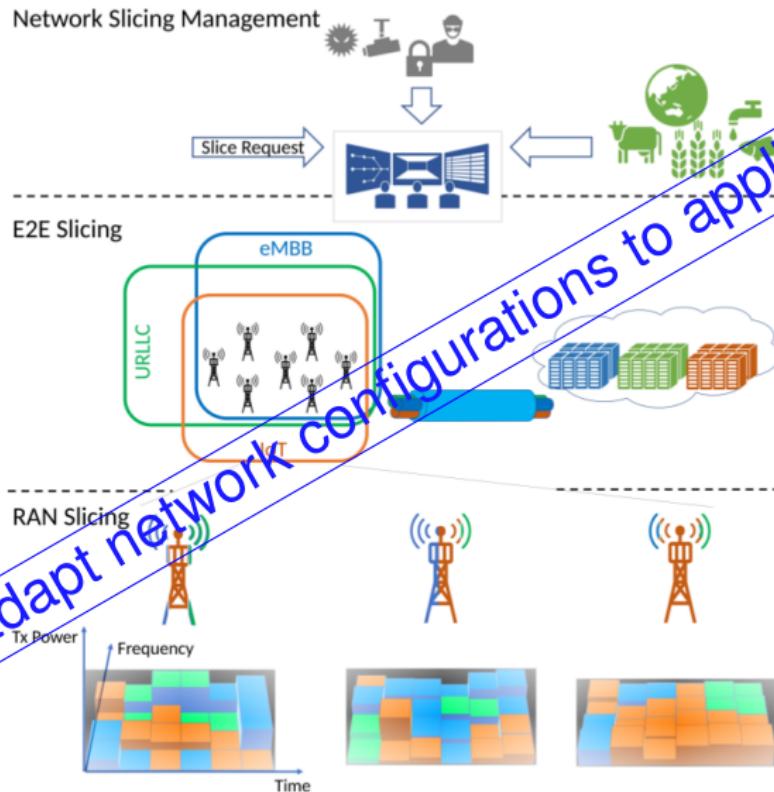


Figure 10. Key barriers in adopting IoT in the industry [5].

Problematic

Where is the problem ?

- ➡ Some network configuration are static and not adaptive to the application
 - ⇒ Decision and optimisation problem..
 - ⇒ Various network access
 - ⇒ Various configuration of each network access
 - ⇒ Lack of selection tools
- ➡ Users have to select the network and the application
 - ⇒ How to select the **best** network.
 - ⇒ How to select the network required by the application.

Network slicing

Exp: 4G/5G, Content provider (GAFA) want to be directly connected to users devices

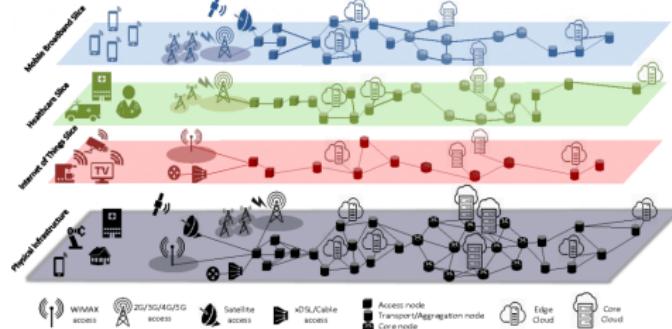


Figure 11. Network slicing [5].

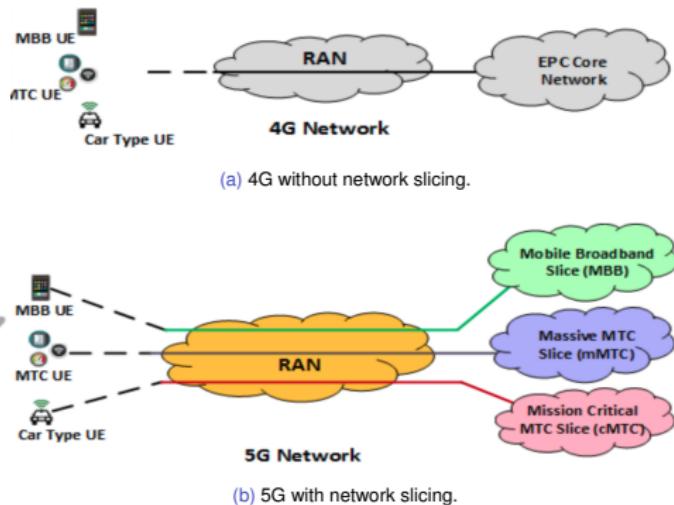


Figure 12. Network slicing concept [6].

Conclusion

In the future, network administration function will disappear and will be replaced by a slice orchestrator

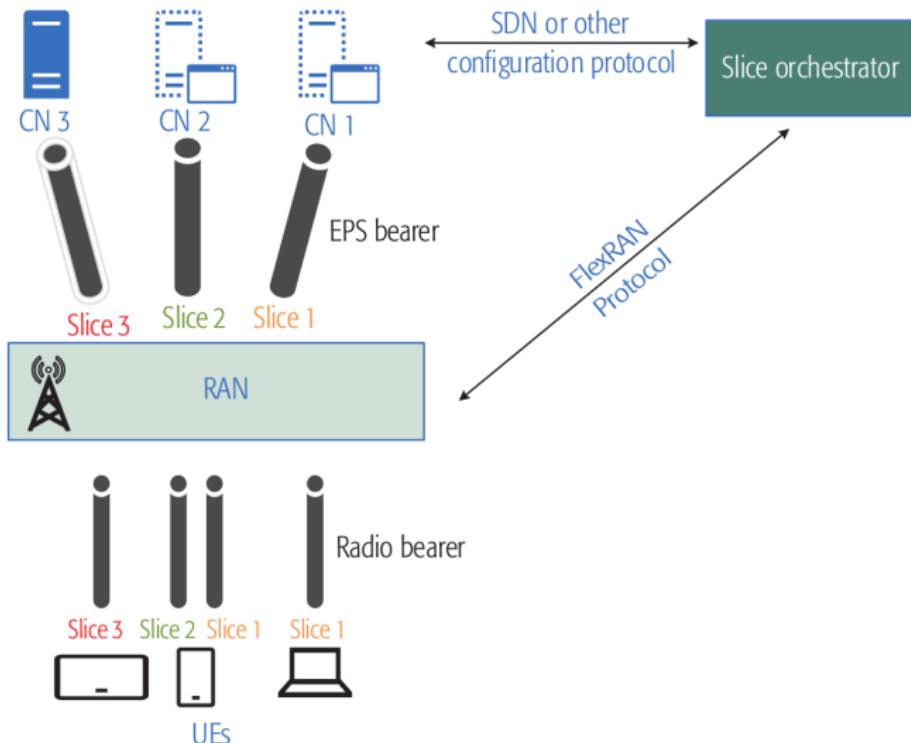


Figure 13. Slice orchestrator [7].

Conclusion

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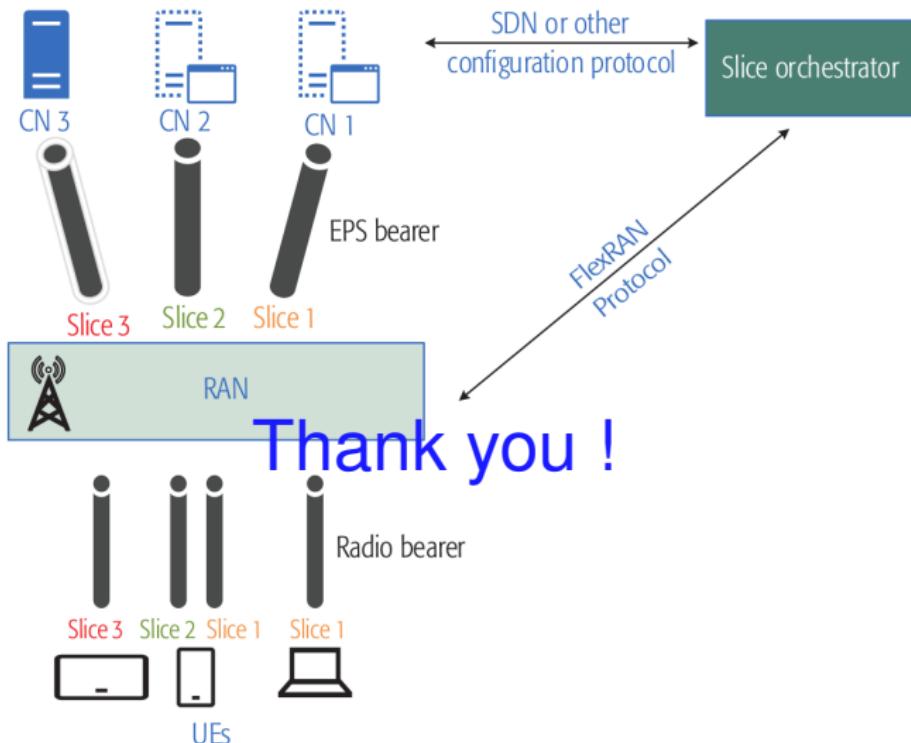


Figure 13. Slice orchestrator [7].

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Multi-Armed-Bandit Algorithm

Related work

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

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Genetic Algorithm

Related work [alkhawlani_access_2008a](#)

- ➡ Heterogeneous wireless network: (RAT 1 ,RAT 2 ,...,RAT n)
- ➡ Criteria up to i (c_1, c_2, \dots, c_i) the operators, the applications, and the network conditions.
- ➡
- ➡ The different sets of scores (d_1, d_2, \dots, d_i) are sent to the MCDM in the second component.
- ➡ GA component assigns a suitable weight (w_1, w_2, \dots, w_i)

Genetic Algorithm

Related work

- 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)
 - * Remove some bad solutions
 - * Duplicate some good solutions
 - * 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)

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Marcov chain

Related work

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

$$r(s_k, a_k) = G_k \cdot PRR(a_k) \quad (2)$$

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

$$PRR = (1 - BER)^L \quad (4)$$

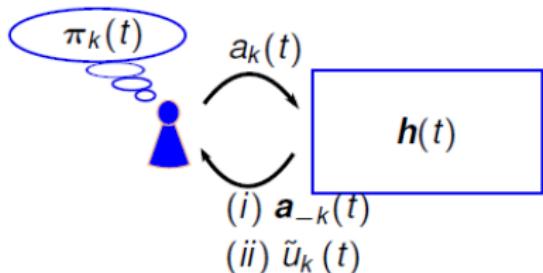
$$BER = 10^{\alpha e^{\beta SNR}} \quad (5)$$

Marcov chain

Related work

Learning Iterative Steps:

- **Choose** action $a_k(t) \sim \pi_k(t)$.
- **Observe** game outcome, e.g.,
 $a_{-k}(t)$
 $u_k(a_k(t), a_{-k}(t))$.
- **Improve** $\pi_k(t + 1)$.



Thus, we can expect that: $\forall k \in \mathcal{K}$,

$$\pi_k(t) \xrightarrow{t \rightarrow \infty} \pi_k^* \quad (1)$$

$$\bar{u}_k(\pi_k(t), \pi_{-k}(t)) \xrightarrow{t \rightarrow \infty} \bar{u}_k(\pi_k^*, \pi_{-k}^*) \quad (2)$$

where, $\pi^* = (\pi_1^*, \dots, \pi_K^*)$ is a NE strategy profile.

Figure 14. .

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Game theory

Related work

- ▶ **Players:** $K = \{1, \dots, K\}$
- ▶ **Strategies:** $S = S_1 \times \dots \times S_K$
 - ⇒ S_k is the strategy set of the k^{th} player.
- ▶ **Rewards:** $u_k : S \rightarrow R_+$ and is denoted by $r_k(s_k, s_{-k})$
 - ⇒ $s_{-k} = (s_1, \dots, s_{k-1}, s_{k+1}, \dots, s_K) \in S_1 \times \dots \times S_{k-1} \times S_{k+1} \times \dots \times S_K$

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Discussion

- ➡ a
- ➡ b

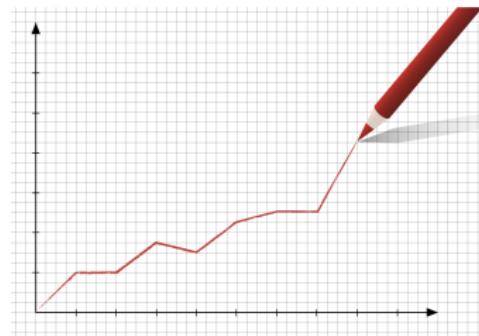


Figure 15. .

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Problem statement

Introduction

- ➡ a
- ➡ b

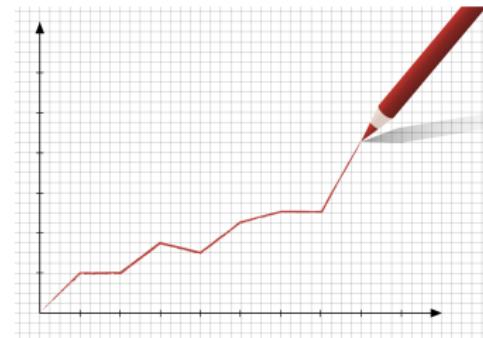


Figure 16. .

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Related work

Comparison

Paper	A1	A2	A3	A4

Table 4. An example table.

Related work

Comparison

Paper	A1	A2	A3	A4

Table 5. An example table.

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... (step 1)

Methods



... (step 2)

Methods



... (step 3)

Methods



... (step 4)

Methods



Results

Comparison

Table 6

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Experimentation

Experimentation

- ➡ a
- ➡ b

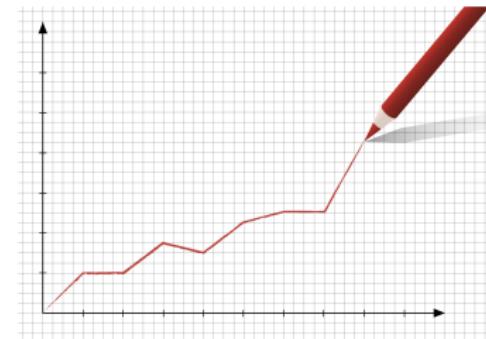


Figure 17. .

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Results

Comparison

- ➡ a
- ➡ b

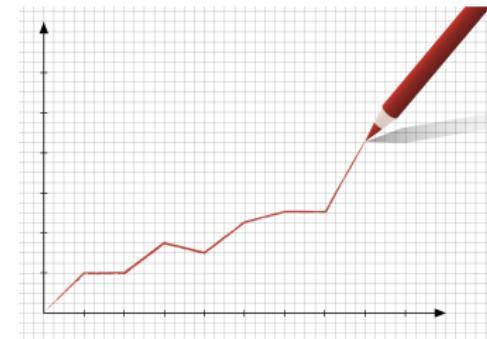


Figure 18. .

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Discussion

- ➡ a
- ➡ b

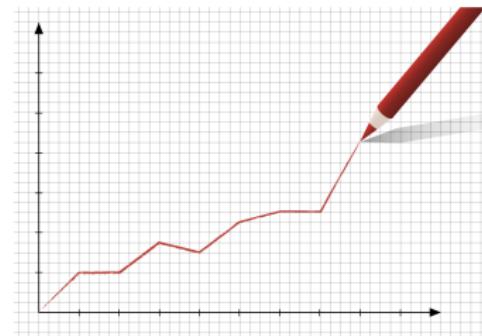


Figure 19. .

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Problem statement

Introduction

- ➡ a
- ➡ b

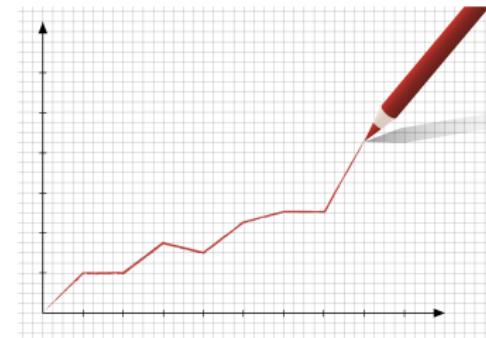


Figure 20. .

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Related work

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... (step 2)

Methods



... (step 3)

Methods



... (step 4)

Methods



Results

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Experimentation

Experimentation

- ➡ a
- ➡ b

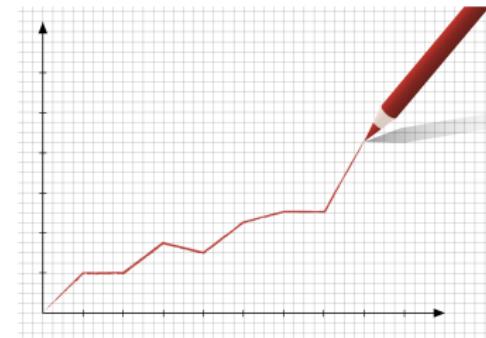


Figure 21. .

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Comparison

- ➡ a
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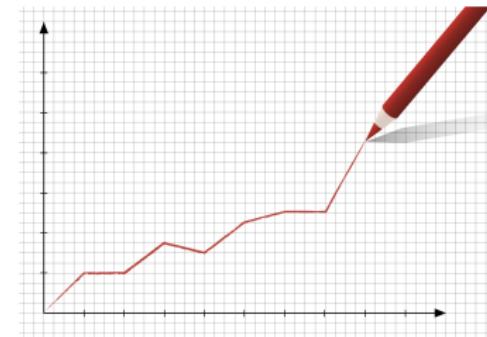


Figure 22. .

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Discussion

- ➡ a
- ➡ b

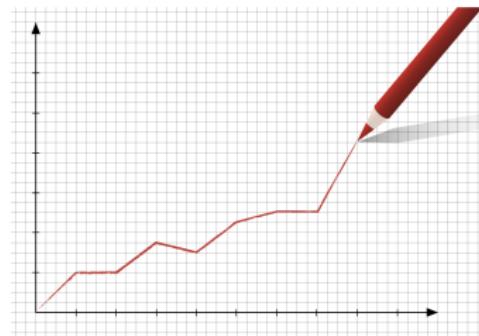


Figure 23. .

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- ➡ a
- ➡ b

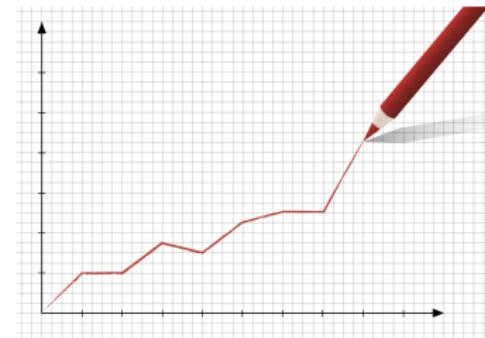


Figure 24. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
- 5. x-Long paper**
 1. Problem statement
 - 2. Related work**
 3. Contagion process
 4. Experimentation
 5. Results exploitation
 6. Discussion
6. Genetic Algorithm For LoRa
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Related work

Comparison

Paper	A1	A2	A3	A4
[8]				

Table 10. An example table.

Related work

Comparison

Paper	A1	A2	A3	A4

Table 11. An example table.

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
- 5. x-Long paper**
 1. Problem statement
 2. Related work
 - 3. Contagion process**
 4. Experimentation
 5. Results exploitation
 6. Discussion
6. Genetic Algorithm For LoRa
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

... (step 1)

Methods



... (step 2)

Methods



... (step 3)

Methods



... (step 4)

Methods



Results

Comparison

Table 12

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. **x-Long paper**
 1. Problem statement
 2. Related work
 3. Contagion process
 4. **Experimentation**
 5. Results exploitation
 6. Discussion
6. Genetic Algorithm For LoRa
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Experimentation

Experimentation

- ➡ a
- ➡ b

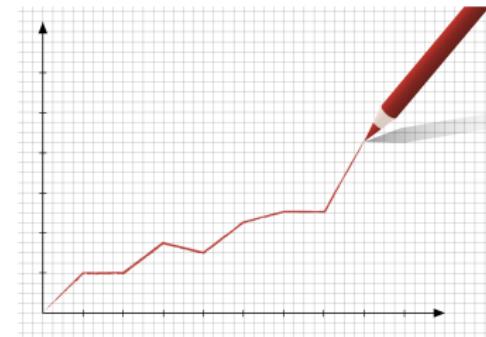


Figure 25. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
- 5. x-Long paper**
 1. Problem statement
 2. Related work
 3. Contagion process
 4. Experimentation
 - 5. Results exploitation**
 6. Discussion
6. Genetic Algorithm For LoRa
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Results

Comparison

- ➡ a
- ➡ b

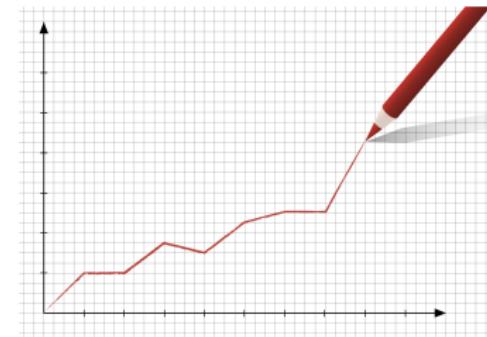


Figure 26. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
- 5. x-Long paper**
 1. Problem statement
 2. Related work
 3. Contagion process
 4. Experimentation
 5. Results exploitation
 - 6. Discussion**
6. Genetic Algorithm For LoRa
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Discussion

- ➡ a
- ➡ b

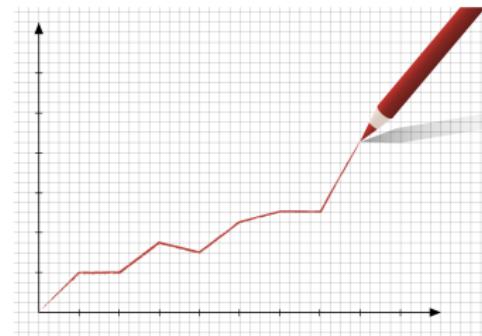


Figure 27. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. Genetic Algorithm For LoRa
 1. Problem statement
 2. Related work
 3. Background
 4. Method
 5. Experimentation
 6. Results
 7. Discussion
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. **Genetic Algorithm For LoRa**
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 2. Related work
 3. Background
 4. Method
 5. Experimentation
 6. Results
 7. Discussion
7. EES
8. Template
9. UTLC
10. Conclusion
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Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. **Genetic Algorithm For LoRa**
 1. Problem statement
 2. **Related work**
 3. Background
 4. Method
 5. Experimentation
 6. Results
 7. Discussion
7. EES
8. Template
9. UTLC
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1. Introduction
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4. x-Sentilo
5. x-Long paper
6. **Genetic Algorithm For LoRa**
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 2. Related work
 - 3. Background**
 4. Method
 5. Experimentation
 6. Results
 7. Discussion
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Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
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6. **Genetic Algorithm For LoRa**
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 3. Background
 - 4. Method**
 5. Experimentation
 6. Results
 7. Discussion
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

... (step 2)

Methods

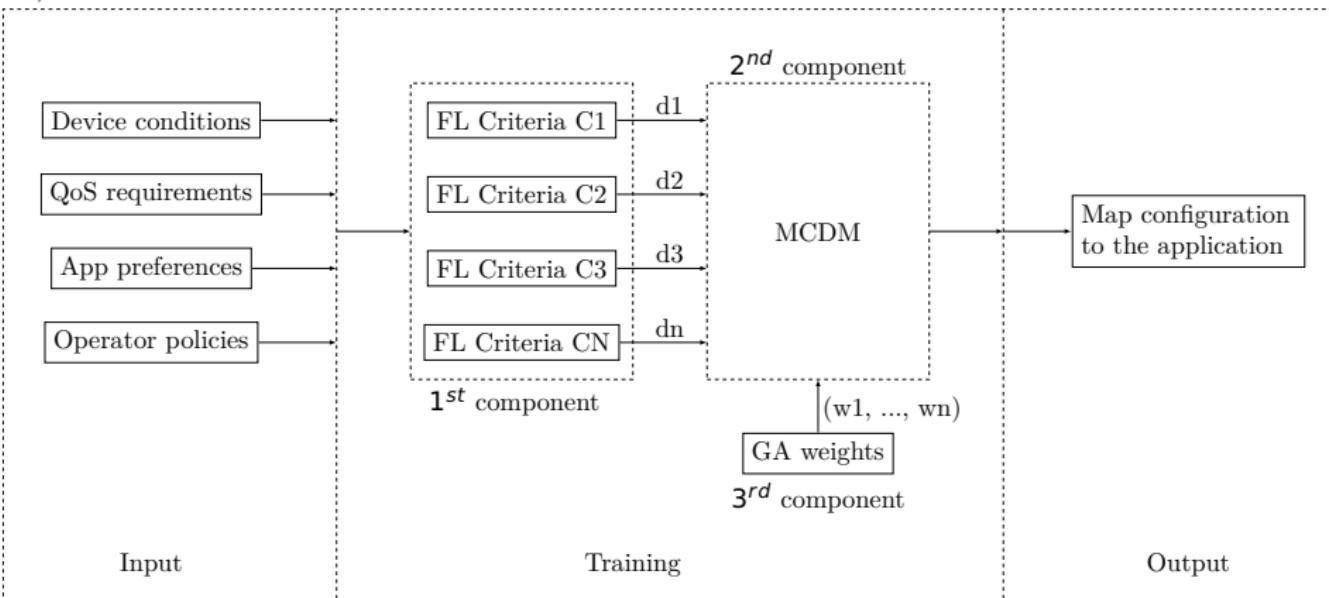


Figure 28. HH.

... (step 3)

Methods



... (step 4)

Methods



Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. **Genetic Algorithm For LoRa**
 1. Problem statement
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 4. Method
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 6. Results
 7. Discussion
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Contribution

Contributions

- ➡ **3 Applications**
 - ➡ Voice, Images and Text transmission.
- ➡ **3 Environment conditions**
 - ➡ Rural/Urban
 - ➡ Static/Mobile
 - ➡ Temperature
- ➡ **Many Scenarios**
 - ➡ Application protocol (MQTT, COAP, XMPP)
 - ➡ Network protocol (Star, Mesh)
 - ➡ MAC protocol (LoRaWan, Sigfox, ...)
- ➡ **Inputs:**
 - ➡ QoS metrics:
 - * User metrics: Cost
 - * Network metrics: Receiver sensitivity, SNR, DR, Air time, Payload length.
 - ➡ MAC configuration (SF, CR, BW, Tx)
- ➡ **Outputs:**
 - ➡ (SF_i, CR_j, BW_k, Tx_l)

Experimentation

Experimentation

- ➡ a
- ➡ b

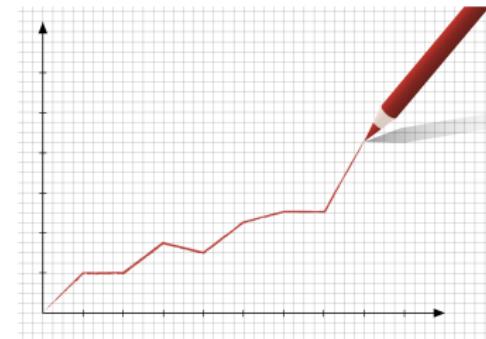


Figure 29. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. **Genetic Algorithm For LoRa**
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 7. Discussion
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Results

Comparison

- ➡ a
- ➡ b

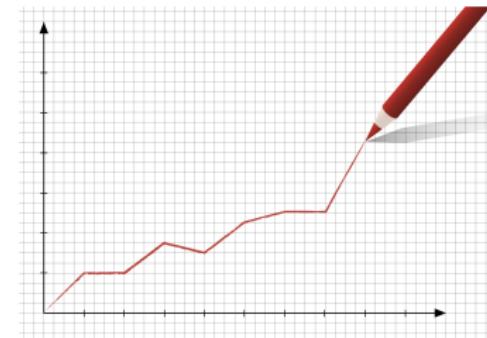


Figure 30. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. **Genetic Algorithm For LoRa**
 1. Problem statement
 2. Related work
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 4. Method
 5. Experimentation
 6. Results
 7. Discussion
7. EES
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Discussion

- ➡ a
- ➡ b

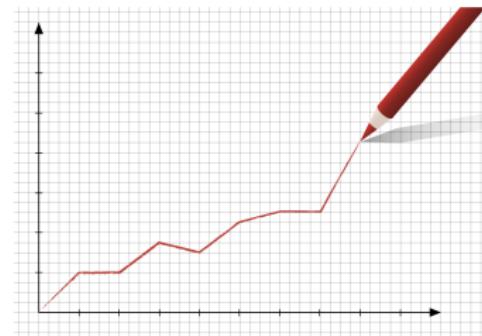


Figure 31. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. Genetic Algorithm For LoRa
7. EES
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 - 4. Experimentation
 - 5. Results exploitation
 - 6. Discussion
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

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 11. Survey Platforms
- 1. Problem statement**
 2. Related work
 3. Contagion process
 4. Experimentation
 5. Results exploitation
 6. Discussion

Problem statement

Introduction

- ➡ a
- ➡ b

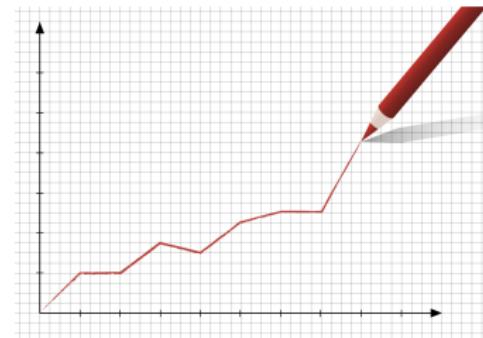


Figure 32. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. Genetic Algorithm For LoRa
7. **EES**
 1. Problem statement
 - 2. Related work**
 3. Contagion process
 4. Experimentation
 5. Results exploitation
 6. Discussion
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Related work

Comparison

Paper	A1	A2	A3	A4

Table 13. An example table.

Related work

Comparison

Paper	A1	A2	A3	A4

Table 14. An example table.

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
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1. Problem statement
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 - 3. Contagion process**
 4. Experimentation
 5. Results exploitation
 6. Discussion

... (step 1)

Methods



... (step 2)

Methods



... (step 3)

Methods



... (step 4)

Methods



Results

Comparison

Table 15

Outline

1. Introduction
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3. x-Testbed
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6. Genetic Algorithm For LoRa
7. **EES**
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 3. Contagion process
 - 4. Experimentation**
 5. Results exploitation
 6. Discussion
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Experimentation

Experimentation

- ➡ a
- ➡ b

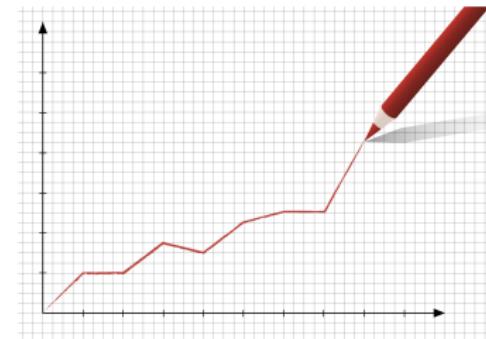


Figure 33. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. Genetic Algorithm For LoRa
7. EES
 - 1. Problem statement
 - 2. Related work
 - 3. Contagion process
 - 4. Experimentation
 - 5. Results exploitation**
 - 6. Discussion
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Results

Comparison

- ➡ a
- ➡ b

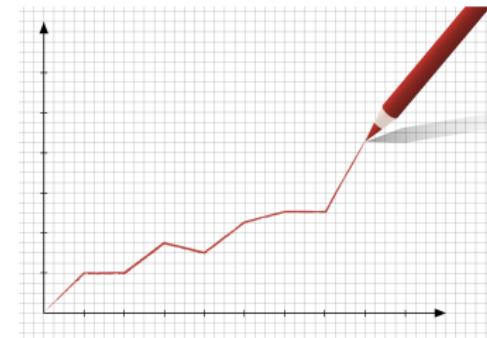


Figure 34. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. Genetic Algorithm For LoRa
7. EES
 - 1. Problem statement
 - 2. Related work
 - 3. Contagion process
 - 4. Experimentation
 - 5. Results exploitation
 - 6. Discussion**
8. Template
9. UTLC
10. Conclusion
11. Survey Platforms

Discussion

- ➡ a
- ➡ b

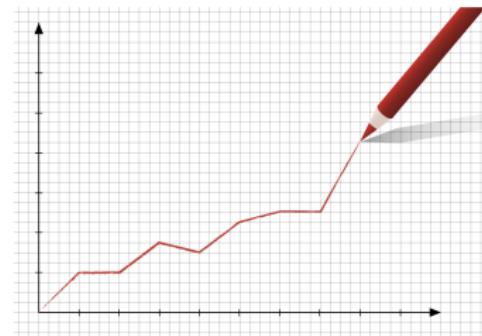


Figure 35. .

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
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 9. UTLC
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 11. Survey Platforms
- 1. Problem statement**
 2. Related work
 3. Contagion process
 4. Experimentation
 5. Results exploitation
 6. Discussion

Problem statement

Introduction

- ➡ a
- ➡ b

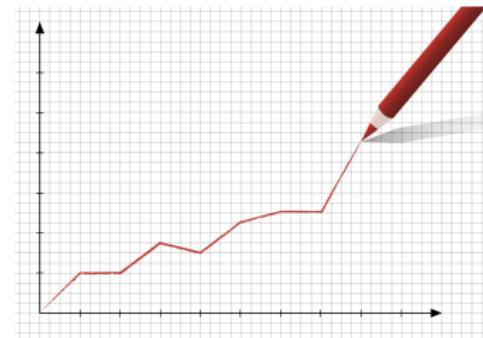


Figure 36. .

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
 7. EES
 8. Template
 9. UTLC
 10. Conclusion
 11. Survey Platforms
1. Problem statement
 - 2. Related work**
 3. Contagion process
 4. Experimentation
 5. Results exploitation
 6. Discussion

Related work

Comparison

Paper	A1	A2	A3	A4

Table 16. An example table.

Related work

Comparison

Paper	A1	A2	A3	A4

Table 17. An example table.

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
 7. EES
 8. Template
 9. UTLC
 10. Conclusion
 11. Survey Platforms
1. Problem statement
 2. Related work
 - 3. Contagion process**
 4. Experimentation
 5. Results exploitation
 6. Discussion

... (step 1)

Methods



... (step 2)

Methods



... (step 3)

Methods



... (step 4)

Methods



Results

Comparison

Table 18

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
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 8. Template
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 10. Conclusion
 11. Survey Platforms
1. Problem statement
 2. Related work
 3. Contagion process
 - 4. Experimentation**
 5. Results exploitation
 6. Discussion

Experimentation

Experimentation

- ➡ a
- ➡ b

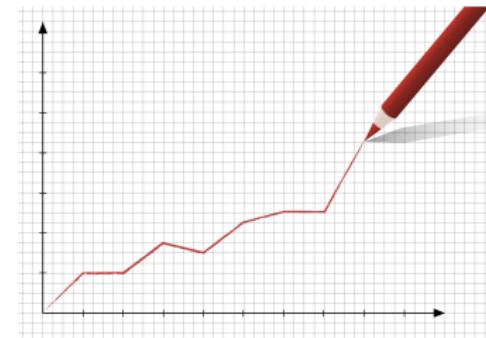


Figure 37. .

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
 7. EES
 8. Template
 9. UTLC
 10. Conclusion
 11. Survey Platforms
1. Problem statement
 2. Related work
 3. Contagion process
 4. Experimentation
 - 5. Results exploitation**
 6. Discussion

Results

Comparison

- ➡ a
- ➡ b

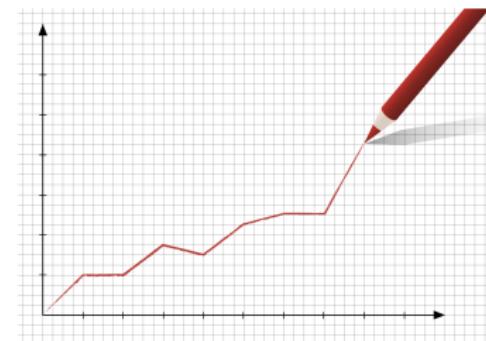


Figure 38. .

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
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 11. Survey Platforms
1. Problem statement
 2. Related work
 3. Contagion process
 4. Experimentation
 5. Results exploitation
 6. Discussion

Discussion

- ➡ a
- ➡ b

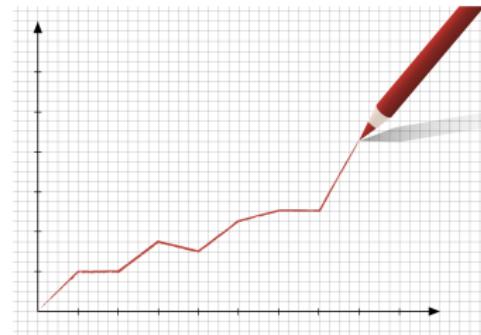


Figure 39. .

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
 7. EES
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 5. Results exploitation
 6. Discussion

Outline

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 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
 7. EES
 8. Template
 - 9. UTLC**
 10. Conclusion
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- 1. Problem statement**
 2. Related work
 3. Contagion process
 4. Experimentation
 5. Results exploitation
 6. Discussion

Problem statement

Introduction

- ➡ a
- ➡ b

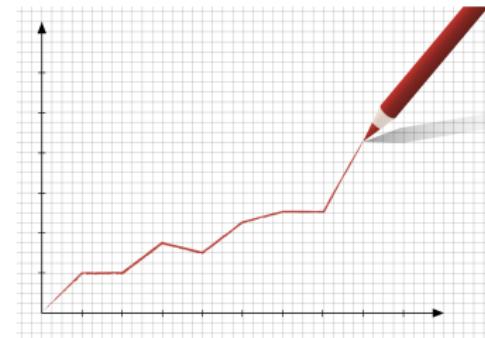


Figure 40. .

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
 7. EES
 8. Template
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 10. Conclusion
 11. Survey Platforms
1. Problem statement
 - 2. Related work**
 3. Contagion process
 4. Experimentation
 5. Results exploitation
 6. Discussion

Related work

Comparison

Paper	A1	A2	A3	A4

Table 19. An example table.

Related work

Comparison

Paper	A1	A2	A3	A4

Table 20. An example table.

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
 7. EES
 8. Template
 - 9. UTLC**
 10. Conclusion
 11. Survey Platforms
1. Problem statement
 2. Related work
 - 3. Contagion process**
 4. Experimentation
 5. Results exploitation
 6. Discussion

... (step 1)

Methods



... (step 2)

Methods



... (step 3)

Methods



... (step 4)

Methods



Results

Comparison

Table 21

Outline

1. Introduction
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 10. Conclusion
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1. Problem statement
 2. Related work
 3. Contagion process
 - 4. Experimentation**
 5. Results exploitation
 6. Discussion

Experimentation

Experimentation

- ➡ a
- ➡ b

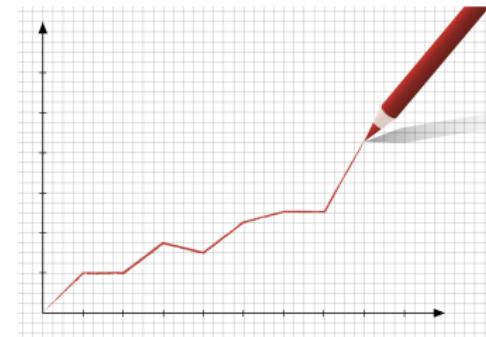


Figure 41. .

Outline

1. Introduction
 2. State of the art
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 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
 7. EES
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1. Problem statement
 2. Related work
 3. Contagion process
 4. Experimentation
 - 5. Results exploitation**
 6. Discussion

Results

Comparison

- ➡ a
- ➡ b

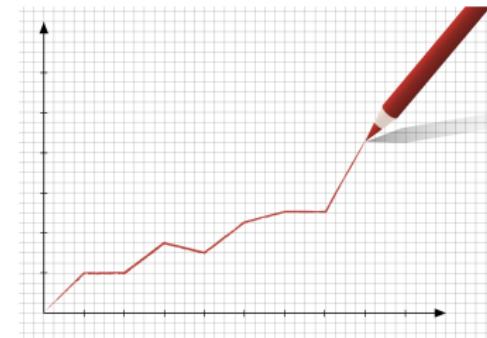


Figure 42. .

Outline

1. Introduction
 2. State of the art
 3. x-Testbed
 4. x-Sentilo
 5. x-Long paper
 6. Genetic Algorithm For LoRa
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 11. Survey Platforms
1. Problem statement
 2. Related work
 3. Contagion process
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 5. Results exploitation
 - 6. Discussion**

Discussion

- ➡ a
- ➡ b

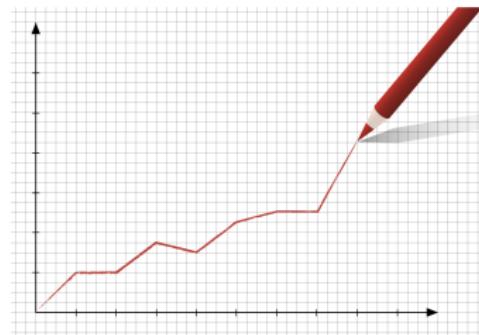


Figure 43. .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. Genetic Algorithm For LoRa
7. EES
8. Template
9. UTLC
- 10. Conclusion**
11. Survey Platforms

Conclusion

Our main goal was

- ▶ .
- ▶ .

Our main contribution was

- ▶ .
- ▶ .

Our main results was

- ▶ .
- ▶ .

Future Challenges

Conclusion

Our future goal was

- ▶ .
- ▶ .

Outline

1. Introduction
2. State of the art
3. x-Testbed
4. x-Sentilo
5. x-Long paper
6. Genetic Algorithm For LoRa
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9. UTLC
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