IoT challenges

State of the art

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LIGM/ESIEE Paris

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Outline

Context

Introduction

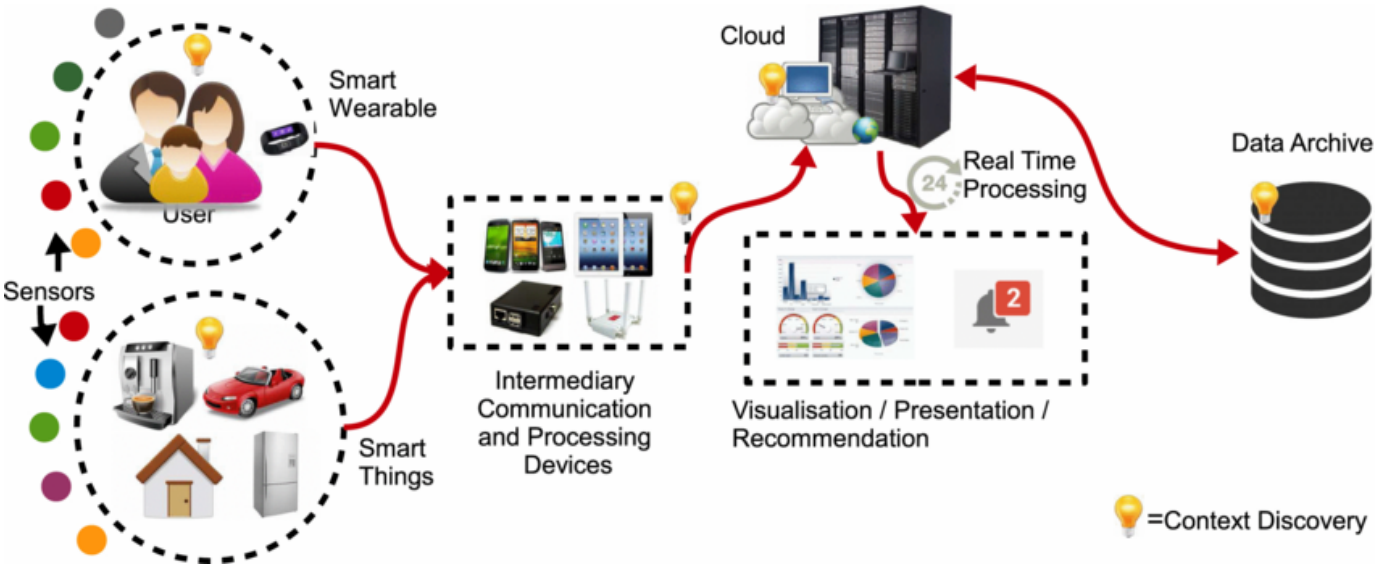

Figure 1: The IoT Platform

- Connect sensors to the gateway.
- Connect the gateway to the infrastructure.
- Store & Analyze sensors data.

Problematic

Introduction

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

Problematic

Introduction

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

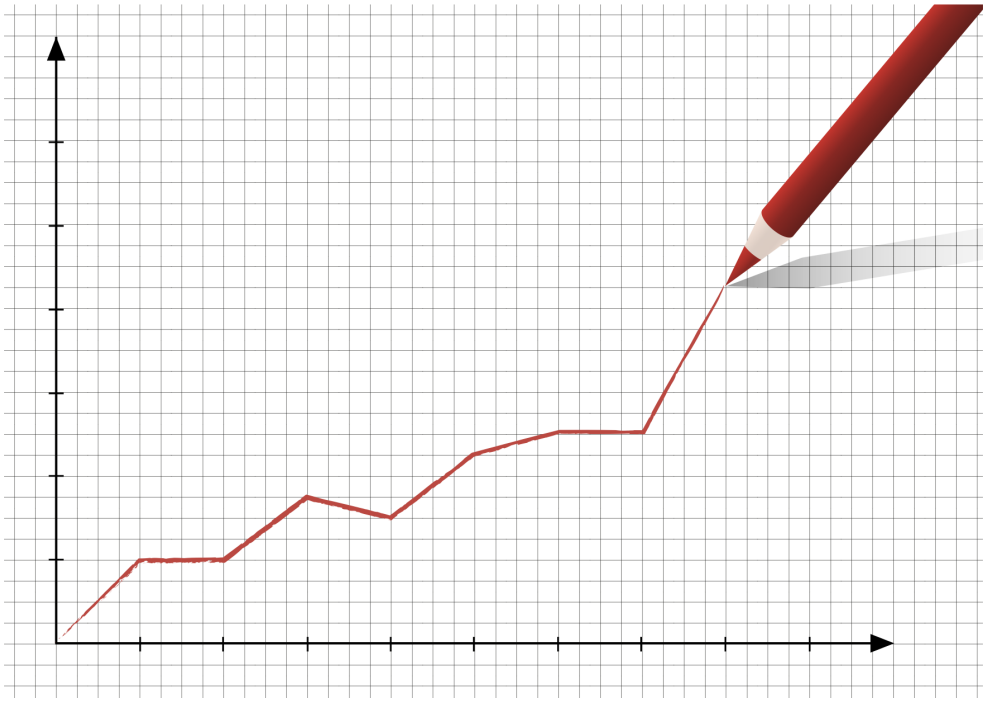

Figure 3

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

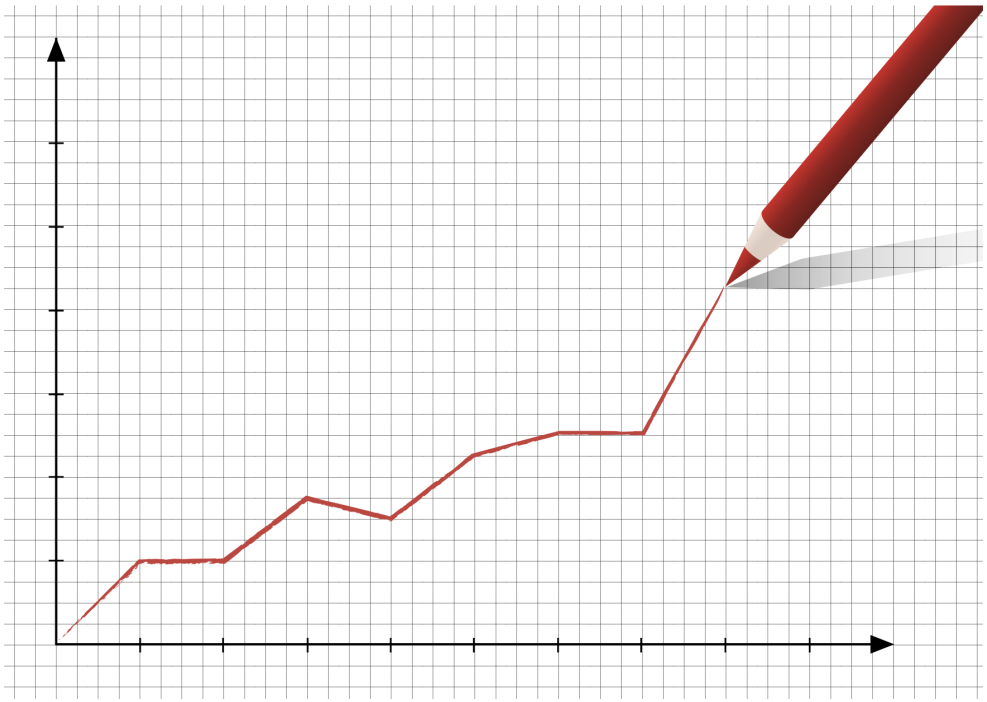

Figure 4

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 présision GPS
  - réduire la latence
- Third Challenge
  - Connecter les pietons et le vehicule
  - augmenter la présision GPS
  - réduire la latence

Contributions

Introduction

- First contribution
  - Privacy settings
  - Information propagation
  -
- Second contribution
  - Privacy settings
  - I
- Third contribution
  - Privacy settings
  - I

Outline

Outline

Outline

Literature review

Related work

[1] Many studies have identified SDN as a potential solution to the WSN challenges, as well as a model for heterogeneous integration.

[1] This shortfall can be resolved by using the SDN approach.

[2] SDN also enhances better control of heterogeneous network infrastructures.

[2] Anadiotis et al. define a SDN operating system for IoT that integrates SDN based WSN **(SDN-WISE)**. This experiment shows how heterogeneity between different kinds of SDN networks can be achieved.

[2] In cellular networks, OpenRoads presents an approach of introducing SDN based heterogeneity in wireless networks for operators.

[3] There has been a plethora of (industrial) studies synergising SDN in IoT. The major characteristics of IoT are low latency,wireless access, mobility and heterogeneity.

[3] Thus a bottom-up approach application of SDN to the realisation of heterogeneous IoT is suggested.

[3] Perhaps a more complete IoT architecture is proposed, where the authors apply SDN principles in IoT heterogeneous networks.

[4] it provides the SDWSN with a proper model of network management, especially considering the potential of heterogeneity in SDWSN.

[4] We conjecture that the SDN paradigm is a good candidate to solve the heterogeneity in IoT.

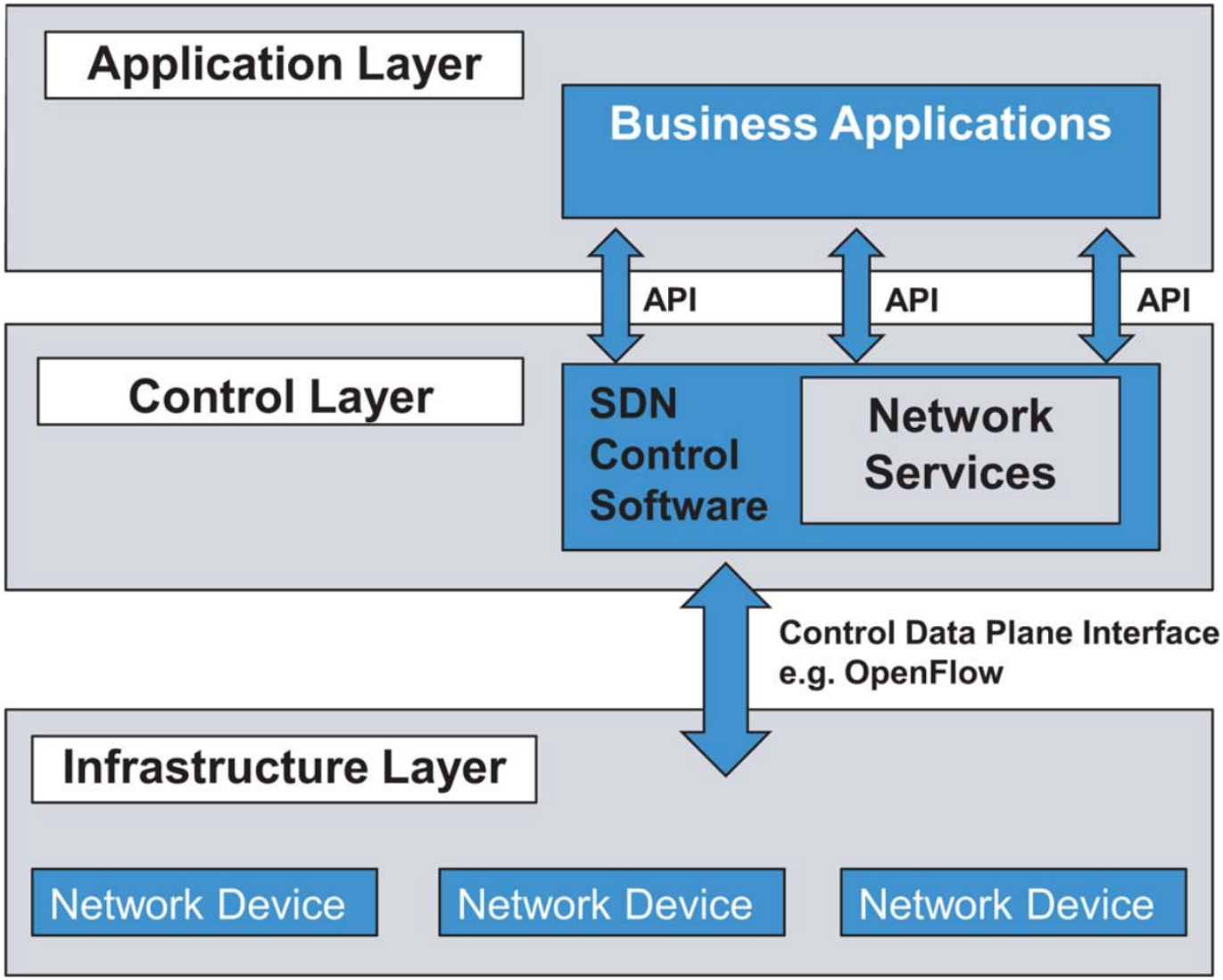

Figure 5: Architecture and technology abstraction.

Outline

Security in SDN

related work

WSN OSI Layer	SDN Plane	Threat
Application	Application	Poor Authentication and Control
		Fraudulent flows rules insertion
		Poor access control and accountability
		Malicious Application
		DoS
		Northbound Interface (API) attack
Transport	Control	Threats from applications
		DoS
Network		Unauthorised access
		Scalability & Unavailability
		Faulty or Malicious controller
Data Link	Data	Unauthorised access
		Fraudulent rules
		Forged/False traffic flows
		Flooding, Spoofing
Physical		Southbound Interface (API) attack
		Jamming, Tampering
		Sybil
		Compromised/hi-jacked controller
		Malicious node

Table: SDN vs OSI layer

SDN based sensor network

Management architecture	Management feature	Controller configuration	Traffic Control	Configuration and monitoring	Scapability and localization	Communication management
[5] Sensor Open Flow	SDN support protocol	Distributed	in/out-band	✓	✓	✓
[6] SDWN	Duty sycling, aggregation, routing	Centralized	in-band	✓		
[7] SDN-WISE	Programming simplicity and aggregation	Distributed	in-band		✓	
degante_smart_2014a Smart	Efficiency in resource allocation	Distributed	in-band		✓	
SDCSN	Network reliability and QoS	Distributed	in-band		✓	
TinySDN	In-band-traffic control	Distributed	in-band		✓	
Virtual Overlay	Network flexibility	Distributed	in-band		✓	
Context based	Network scalability and performance	Distributed	in-band		✓	
CRLB	Node localization	Centralized	in-band			
Multi-hope	Traffic and energy control	Centralized	in-band			✓
Tiny-SDN	Network task measurement	-	in-band			

Table 1: SDN-based network and topology management architectures. [3]

Outline

Outline

Related work

Comparison

Paper	A1	A2	A3	A4

Table 2: An example table.

Related work

Comparison

Paper	A1	A2	A3	A4

Table 3: An example table.

Outline

... (step 1)

Methods

- Privacy threats
  - Privacy settings
  - Information propagation
  -
- Privacy protection
  - Privacy settings
  - I

... (step 2)

Methods

- Privacy threats
  - Privacy settings
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... (step 3)

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... (step 4)

Methods

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Outline

Experimentation

Experimentation

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Outline

Results

Comparison

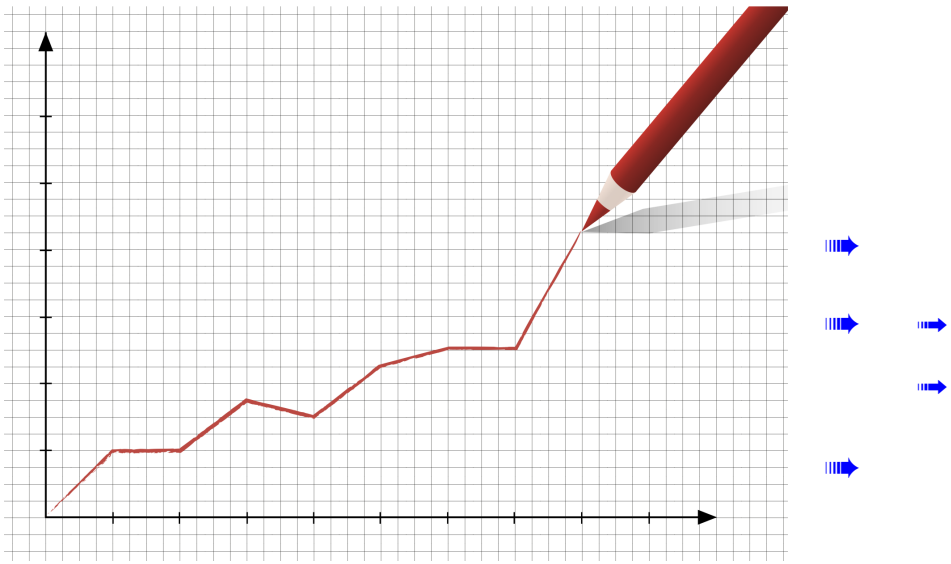


Figure 6

Outline

Conclusion

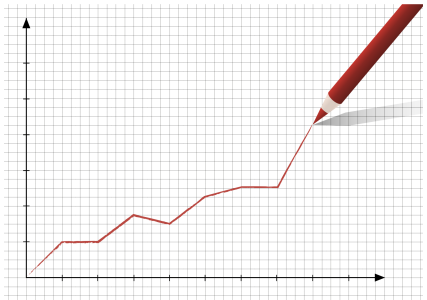
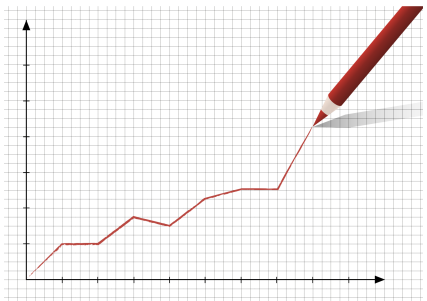


Figure 7: Cag.



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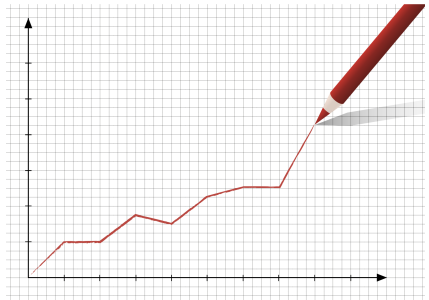

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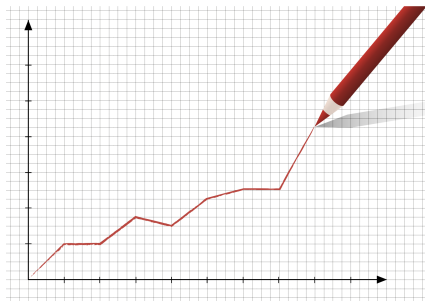

Figure 10: Cag.

Challenges

Conclusion

- Privacy threats
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Outline

Outline

Related work

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Table 4: An example table.

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Experimentation

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Results

Comparison

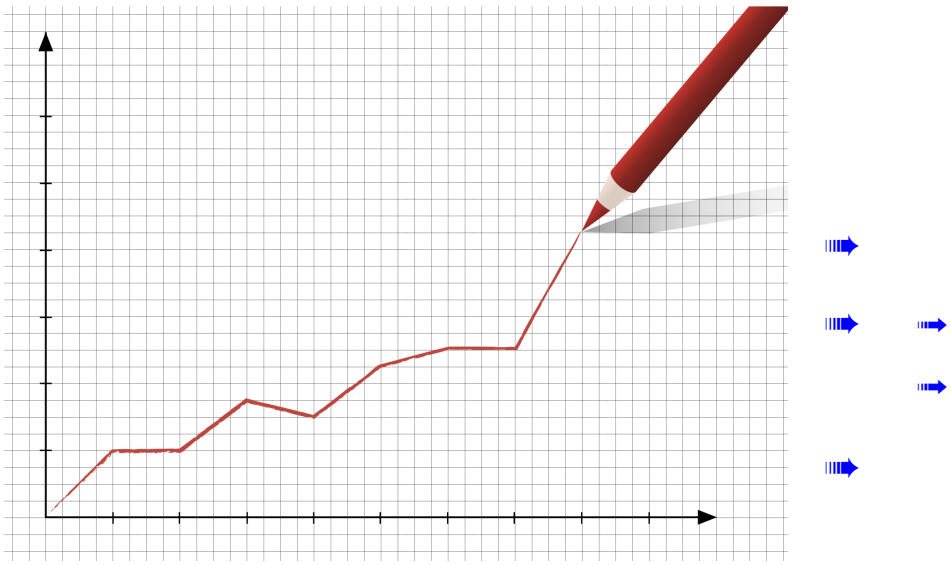


Figure 11

Outline

Conclusion

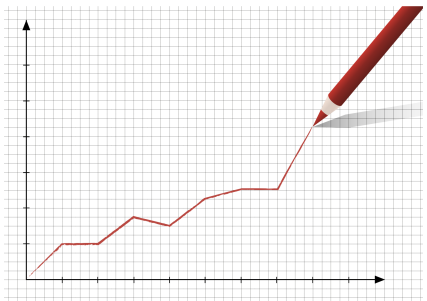
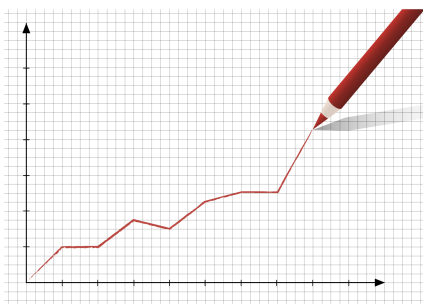


Figure 12: Cag.



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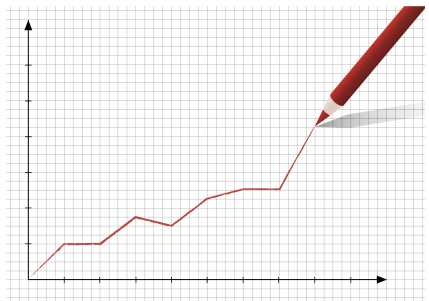

Figure 14: Cag.

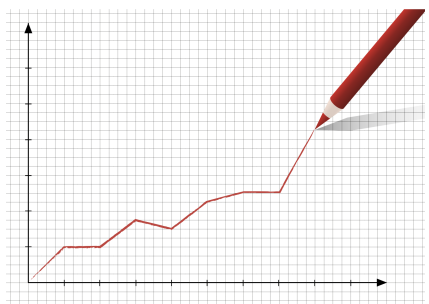

Figure 15: Cag.

Challenges

Conclusion

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Outline

Conclusion

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

Table 6: Routing protocols comparison **_rpl2_**

Application protocol	Rest-Full	Trans-port	Pub-lish/Sub-scribe	Request/Re-sponse	Secu-rity	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 7: Application protocols comparison

Conclusion

Routing protocol	Control Cost	Link Cost	Node Cost
OSPF/IS-IS	✗	✓	✗
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MQTT-SN	✗	TCP	✓	✗	SSL	✓	2
XMPP	✗	TCP	✓	✓	SSL	✗	-
AMQP	✗	TCP	✓	✗	SSL	✓	8
DDS	✗	UDP TCP	✓	✗	SSL DTLS	✓	-
HTTP	✓	TCP	✗	✓	SSL	✗	-

Table 7: Application protocols comparison

Thank you !

Challenges

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Challenges

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Thank you !

References

[1] Z. Qin, G. Denker, C. Giannelli, P. Bellavista, and N. Venkatasubramanian, “ A Software Defined Networking Architecture for the Internet-of-Things,” in *2014 IEEE Network Operations and Management Symposium (NOMS)*, 00250, Krakow, Poland: IEEE, May 2014, pp. 1–9.

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