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وزارة التعليم العالي و البحث العلمي  
MINISTRY OF HIGHER EDUCATION AND SCIENTIFIC  
RESEARCH  
جامعة عمار ثليجي بالأغواط  
UNIVERSITY OF AMMAR TELIDJI LAGHOUAT



كلية العلوم  
FACULTY OF SCIENCES  
قسم الإعلام الآلي  
DEPARTMENT OF COMPUTER SCIENCE  
MASTER THESIS

**Field :** Mathematics and Computer Science

**Option :** Computer Science

**Specialization :** Distributed Networks, Systems, and Applications

**Submitted by :** FULL Name

**Theme**

Title Title Title Title Title Title Title Title Title Title  
Title Title Title Title

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Academic Year 2022/2023

الجمهورية الجزائرية الديمقراطية الشعبية  
RÉPUBLIQUE ALGÉRIENNE DÉMOCRATIQUE ET POPULAIRE  
وزارة التعليم العالي و البحث العلمي  
MINISTÈRE DE L'ENSEIGNEMENT SUPÉRIEUR ET DE LA RECHERCHE  
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UNIVERSITÉ AMMAR TELIDJI LAGHOUAT



كلية العلوم  
FACULTÉ DES SCIENCES  
قسم الإعلام الآلي  
DÉPARTEMENT D'INFORMATIQUE  
THÈSE DE MASTER

**Domaine :** Mathématique et Informatique

**Filière :** Informatique

**Option :** Réseaux, Systèmes et Applications Répartis

**Présenté par :** NOM Prénom

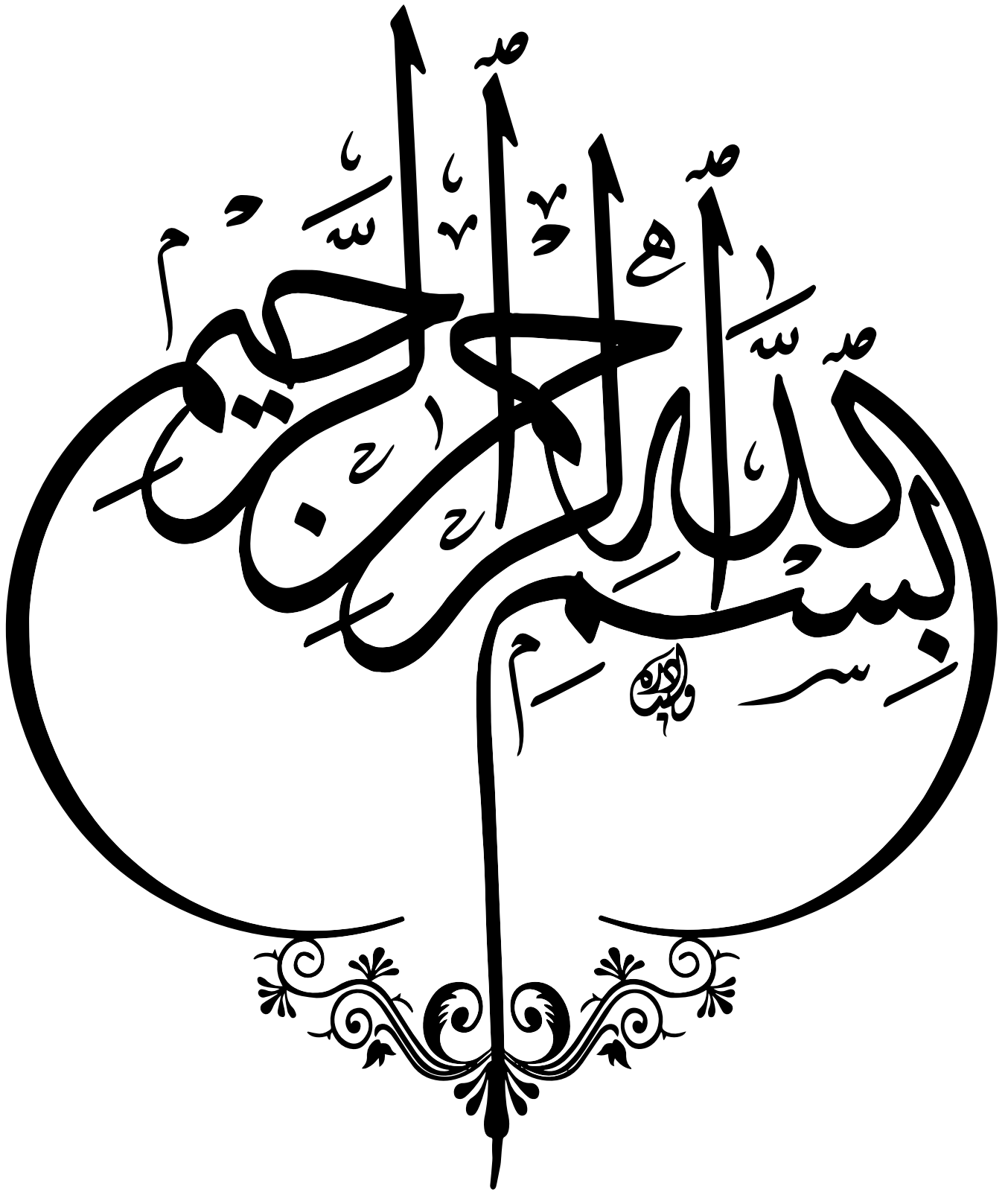
**Thème**

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Année Universitaire 2022/2023



# Dedications

I would like to dedicate this thesis,  
To...

*First Last-name*

# Acknowledgments

First and foremost, no volume of words is enough to express praise to ~~Allah Almighty~~. All praise is due to Allah, the Lord of the Worlds.

I extend my gratitude towards my supervisor Dr. First Last-name, for her ...

My sincere thanks go to the committee members : Dr. First Last-name, Dr. First Last-name, and Prof. First Last-name, for accepting to review my work, ...

....

*First Last-name, June 2023*



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## العنوان العنوان العنوان

العنوان الفرعي

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الكلمات المفتاحية : الكلمة الاولى، الكلمة الثانية، الكلمة الثالثة، الكلمة الرابعة، الكلمة الخامسة، الكلمة السادسة.

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Sous Titre

**NOM Prénom**

**Résumé**

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Résumé Résumé Ce sont des abréviations. Abréviation complète (full), courte (short) et  
longue (long) : (IOT) (WSN) [Message Queuing Telemetry Transport](#) (MQTT).

**Mots Clés :** Mot 1, Mot 2, Mot 3, Mot 4, Mot 5, Mot 6.



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# List of Acronyms

**IOT** Internet Of Things. [iii](#), [v](#), [1](#), [9](#)

**MQTT** Message Queuing Telemetry Transport. [iii](#), [v](#), [9](#), [11](#)

**WSN** Wireless Sensor Network. [v](#), [1](#), [9](#)

**WSNs** Wireless Sensor Networks. [iii](#), [11](#)

# Chapter 1

## Introduction

### Contents

---

1.1	Context . . . . .	1
1.2	Problem Statement and Objective . . . . .	1
1.3	Organization of the Thesis . . . . .	2

---

### 1.1 Context

Qu'est que c'est?. C'est une phrase français avant le lorem ipsum. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

We can cite like this [1] , [1,2] or like this [1-4].

Acronyms : [IOT](#), [Wireless Sensor Network \(WSN\)](#).

### 1.2 Problem Statement and Objective

In this paper, we study the ...

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## 1.3 Organization of the Thesis

The organization of this thesis is structured as follows :

- **Chapter two** (2) provides an overview of ...
- **Chapter three** (3) illustrates ...
- **Chapter four** (4) presents the contribution ...
- Finally, **Chapter five** (5) concludes the thesis with ...



# Chapter 2

## Generalities

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---

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<b>2.4</b>	<b>Section Three</b> . . . . .	<b>5</b>
<b>2.5</b>	<b>Conclusion</b> . . . . .	<b>6</b>

---

## 2.1 Introduction

Qu'est que c'est?. C'est une phrase français avant le lorem ipsum. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

We can refer to a figure like this : [Figure. 2.1](#).



**Figure 2.1:** Caption of the picture.

## 2.2 Section One

...

### 2.2.1 Subsection One

...

This is a list :

- Item one
- Item two

- Item three
- Item four

## 2.3 Section Tow

Qu'est que c'est?. C'est une phrase français avant le lorem ipsum. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Etiam lobortis facilisis sem. Nullam nec mi et neque pharetra sollicitudin. Praesent imperdiet mi nec ante. Donec ullamcorper, felis non sodales commodo, lectus velit ultrices augue, a dignissim nibh lectus placerat pede. Vivamus nunc nunc, molestie ut, ultricies vel, semper in, velit. Ut porttitor. Praesent in sapien. Lorem ipsum dolor sit amet, consectetur adipiscing elit. Duis fringilla tristique neque. Sed interdum libero ut metus. Pellentesque placerat. Nam rutrum augue a leo. Morbi sed elit sit amet ante lobortis sollicitudin. Praesent blandit blandit mauris. Praesent lectus tellus, aliquet aliquam, luctus a, egestas a, turpis. Mauris lacinia lorem sit amet ipsum. Nunc quis urna dictum turpis accumsan semper.

This is an other list :

1. Item
2. Item
3. Item
4. Item
  - (a) Sub-item
  - (b) Sub-item
  - (c) Sub-item

## 2.4 Section Three

...

This is a table : we can refer to the table like this [Table. 2.1](#).

**Table 2.1:** Caption of the table.

column 1	column 2	column 3	column 4
line 1	line 1	-	-
line 2	line 2	✓	✓
line 3	line 3	✓	-
line 4	line 4	-	✓
line 5	line 5	-	-

## 2.5 Conclusion

In conclusion, this chapter provided an overview of ...

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# Chapter 3

## Related Works

### Contents

---

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<b>3.3</b>	<b>Section Two</b>	<b>8</b>
<b>3.4</b>	<b>Conclusion</b>	<b>9</b>

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### 3.1 Introduction

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## 3.2 Section One

[1] proposed the ...

The study [2] proposed ...

The paper [3] explores ...

In the paper [4], the authors discuss ...

## 3.3 Section Two

The tables (Table. 3.2 & Table. 3.1) will analyze ...  
Table. 3.2 is a big table.

**Table 3.1:** Table caption.

column	column	column	column	column	column
[1]	line 1	line 1	line 1	line 1	line 1
[2]	line 2	line 2	line 2	-	-
[3]	line 3	line 3	line 1	-	-
[4]	line 4	line 4	line 4	-	line 4

**Table 3.2:** The caption of the table

column 1	column 2	column 3
<b>Author 1 and Author 2 [1]</b>	Description Description Description Description Description. Description Description Description.	Remark Remark Remark Remark Remark Remark Remark.
<b>Author 1 and Author 2 [2]</b>	Description Description <a href="#">WSN</a> Description Description Description Description. Description Description Description.	Remark Remark Remark Remark Remark Remark Remark.
<b>Author 1 and others [3]</b>	Description Description <a href="#">IOT</a> Description Description Description Description. Description Description Description.	Remark Remark Remark Remark Remark Remark Remark.
<b>Author 1 and others [4]</b>	Description Description <a href="#">MQTT</a> Description Description Description Description. Description Description.	Remark Remark Remark Remark Remark Remark Remark.

## 3.4 Conclusion

In conclusion, this chapter has provided . . .

# Chapter 4

## Contribution

### Contents

---

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<b>4.2</b>	<b>Section One</b>	<b>11</b>
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4.2.2	Subsection Two	12
4.2.3	Subsection Three	14
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<b>4.4</b>	<b>Section Two</b>	<b>15</b>
4.4.1	Subsection One	16
<b>4.5</b>	<b>Conclusion</b>	<b>18</b>

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## 4.1 Introduction

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## 4.2 Section One

Acronyms : [MQTT](#) system ... [WSNs](#), ...

We can refer to a section like this : [\(2.2.1\)](#) or [\(4.2.1\)](#)

A mathematical written :  $P_{mp}$  W  $T(n)_{max}$  or  $T(n)$ .

(i) Solution 1 : ...

(ii) Solution 2 : ...

(iv) Solution 3 : ...

- Item one.
- Item two.
- Item three.
- Item four

(iii) Assumptions : This research is based on certain assumptions listed below :

- ✓ Assumption one.
- ✓ Assumption two.
- ✓ Assumption three.
- ✓ Assumption four.
- ✓ Assumption five.
- ✓ Assumption six.

### 4.2.1 Subsection One

We can refer to a formula like this : (Formula 4.2) or (Formula 4.1).

We can put a remark like this :

*Remark.*  $T(n)_{max}$  represents the maximum value that  $T(n)$  can reach.

$$T(n) = \begin{cases} \frac{A}{1-B*(C \bmod \frac{2}{m})} * E_T, & \text{if } m \in G. \\ 0, & \text{otherwise.} \end{cases} \quad (4.1)$$

While :

$$E_T = \frac{E_r}{E_i}. \quad (4.2)$$

**Table 4.1:** Describing expression of  $E_T$ .

Giving Letter	Meaning
$E_T$	The energy total.
$E_{residual}$	The residual energy.
$E_{initial}$	The initial energy.

Another remark :

*Remark.* Let  $E_T$  be the total energy, then  $E_r$  is the initial energy.

### 4.2.2 Subsection Two

We can refer to algorithms like this : Algorithm. 4.2 and Algorithm. 4.1.

---

**Algorithm 4.1:** Algorithm '1' caption.

---

```

/* Comment 1 */
1 if variable then
2   | procedure(); /* Comment 2 */
3 else
4   | if variable then
5     | | function(); /* Comment 3 */

```

---

---

**Algorithm 4.2:** Algorithm '2' caption.

---

```
/* Comment 1 */
1 initialization; /* Comment 2 */
2 calculate E  $n_i..n_n(E_{residual}, E_{total})$ ;
3 calculate  $T_i(t)$  of each node ( $n_i..n_n$ );
4  $n \leftarrow RandomNumber(0, 1)$ ;
5 if  $n < 5$  then
6   |  $issmaller \leftarrow True$ ;
7   |  $sendmsg()$ ;
8 else
9   |  $issmaller \leftarrow False$ ;
10  |  $receivemsg()$ ;
11 end
```

---

### 4.2.3 Subsection Three

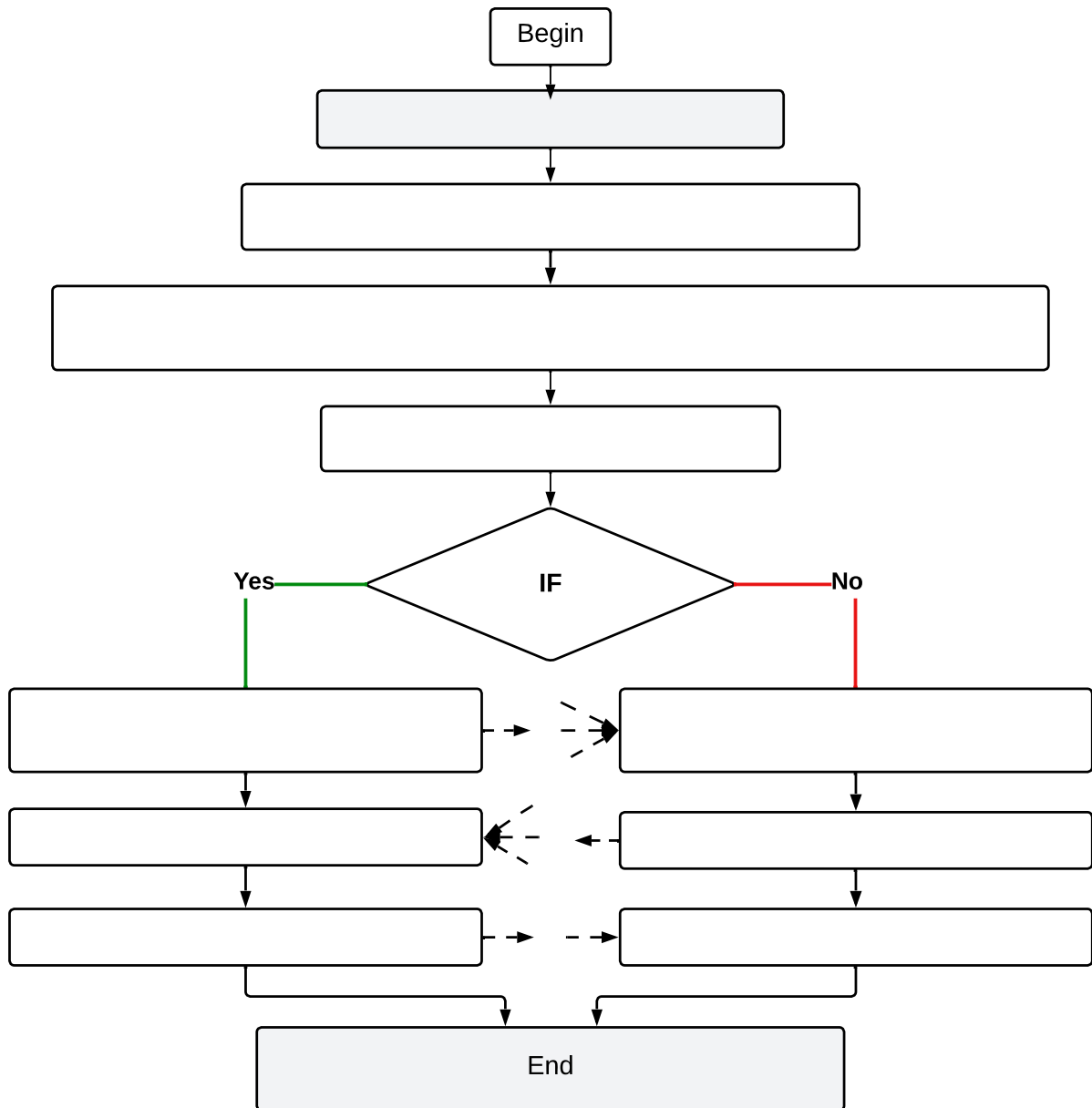


Figure 4.1: PDF figure long caption

Figure. 4.1 shows how to insert a pdf file into figure.

## 4.3 Section Two

We can refer to a section in the Appendix like this : [A.1](#).

We can make a reference like this [\[3\]](#).

### 4.3.1 Subsection One

The solution was carried out on a computer with the following configuration and software environment (Table. 4.2) :

**Table 4.2:** Hardware and software requirements used.

Parameter	Value
Processor	Intel(R) Celeron(R) CPU N3060 @ 1.60GHz 64 bits
RAM	4 GB
Hard disk	HDD 500 GB
Operating system	UBUNTU 20.04
Simulator	
Framework	

## 4.4 Section Two

We can make a plots with a figure caption like this :

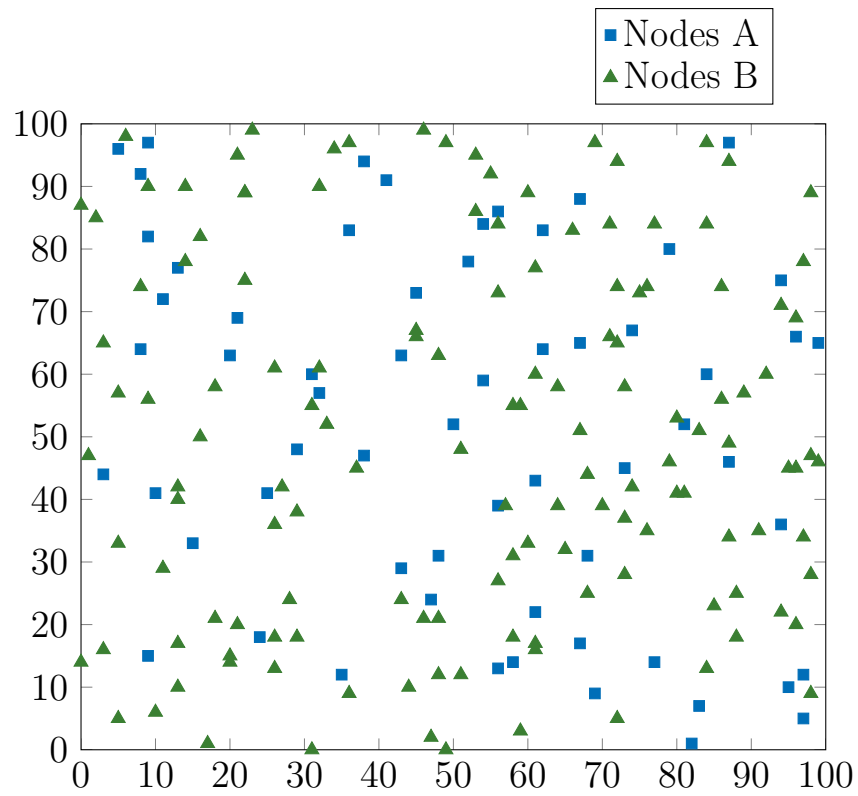


Figure 4.2: Heterogeneous nodes deployment in 100 x 100 area.

#### 4.4.1 Subsection One

The random 200-node network shown in Figure. 4.2 demonstrate that ...

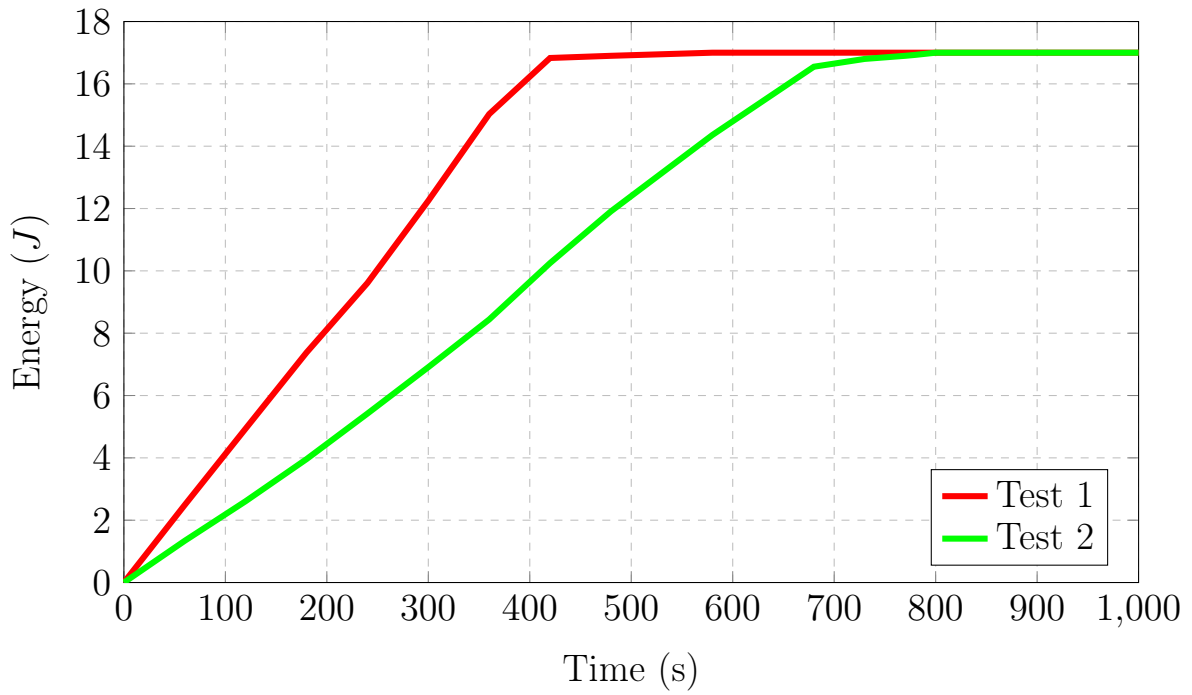


Figure 4.3: Consumed energy vs. time.

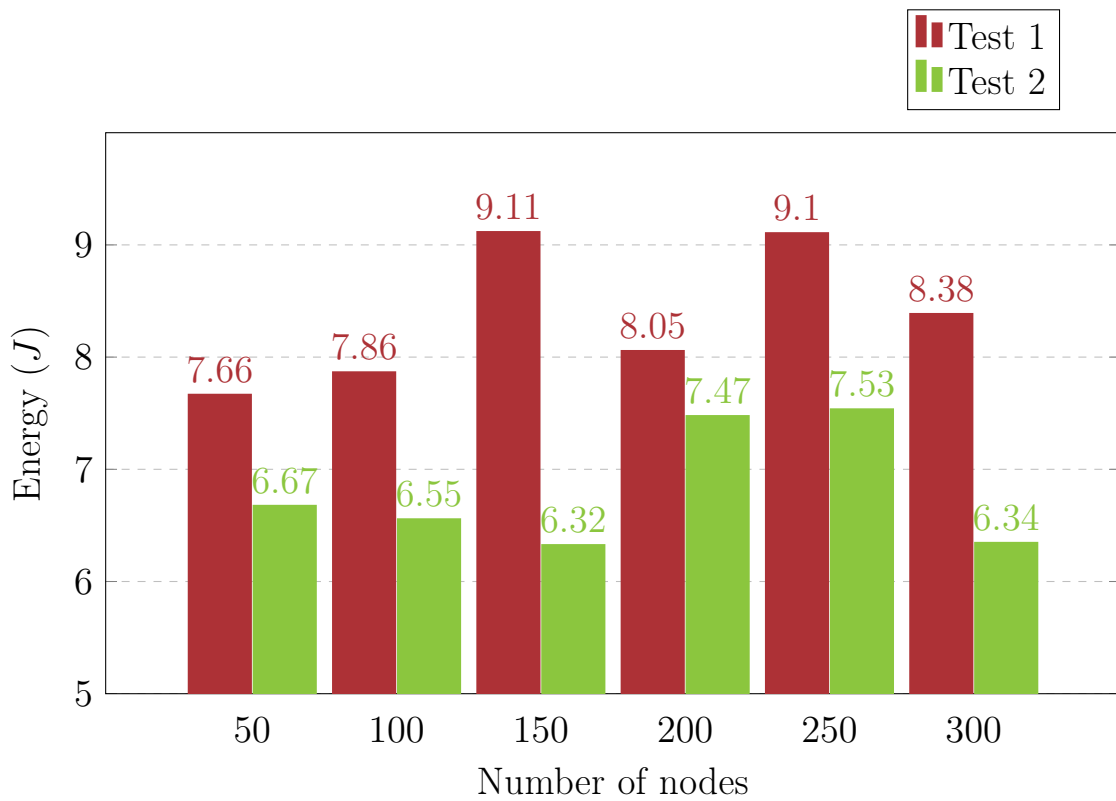


Figure 4.4: Energy consumption vs. number of nodes.

## 4.5 Conclusion

In conclusion, this chapter has presented . . .



# Chapter 5

## General Conclusion

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### 5.1 Summary of Work

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### 5.2 Future Perspectives

We aspire to implement in our forthcoming work . . .

- Implementation of . . .
- Integration of . . .
- Conducting performance analysis . . .

# Bibliography

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- [4] Title ,[online] available. <https://www.websiteexample.com/>. accessed : 15 April 2023.

# Appendices

# Appendix A

## The Appendix Title

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<b>A.3 Section Three</b> . . . . .	<b>C</b>

---

### A.1 Section One

To install the simulator in Ubuntu, follow these steps :

1. Install all packages needed, you can run the following command to install all packages for multiple platforms :

```
$ sudo apt-get install build-essential gcc g++ bison flex perl\tcl-dev  
tk-dev libxml2-dev zlib1g-dev default-jre\doxygen graphviz  
libwebkitgtk-1.0-0
```

2. Download src.tgz file from : <https://website.com/>
3. Unzip the file : `$ tar xvfz src.tgz`
4. Enter the folder : `$ cd folder`

### A.2 Section Two

To install the framework in Ubuntu, follow these steps :

1. Download the framwork folder from the site : <https://github.com/folder>
2. Extract the folder : `$ tar -xvzf folder.tar.gz`

```
3. Compile : $ cd folder/folder
              $ ./makemake
              $ make
```

## A.3 Section Three

```
1 // Start by '#include'-ing the Mosquitto MQTT Library and other standard
  libraries.
2 #include <mqtt/client.h> // Mosquitto client.
3 #include <ostream> // std::cout.
4 #include <chrono> // Time keeping.
5 #include <thread> // Sleep.
6
7 // With the library header files included, continue by defining a main
  function.
8 int main()
9 {
10 // In order to connect the mqtt client to a broker,
11 // Define an Ip address pointing to a broker. In this case, the
   localhost on port 1883.
12 std::string ip = "localhost:1883";
13 // Then, define an ID to be used by the client when communicating with
   the broker.
14 std::string id = "publisher";
15
16 // Construct a client using the Ip and Id, specifying usage of MQTT V5.
17 mqtt::client client(ip, id, mqtt::create_options(MQTTVERSION_5));
18 // Use the connect method of the client to establish a connection to
   the broker.
19 client.connect();
20 // Initialize an empty message with specified topic.
21 mqtt::message_ptr timeLeftMessagePointer = mqtt::make_message("consumer
   /in", "");
22
23 // Create a loop for counting down from N seconds.
24 for (int i = 10; i > 0; --i)
25 {
26 // Sleep for one second.
27 std::this_thread::sleep_for(std::chrono::milliseconds(1000));
28 // Configure Mqtt message to contain payload specifying time until
   end.
29 timeLeftMessagePointer->set_payload("Time Left: " + std::to_string(
   i));
30 // Publish the Mqtt message using the connected client.
31 client.publish(timeLeftMessagePointer);
```

```

32     }
33
34     // After counting down, configure Mqtt message for sending the quit
        signal.
35     timeLeftMessagePointer->set_payload("quit");
36     // Send quit signal to listeners.
37     client.publish(timeLeftMessagePointer);
38
39     return 0;
40 }

```

SourceCode/SimpleMqttProducer.cpp

The network description file used is depicted as follows :

```

1 //*****
2 /* NED file describe the base structure of the module.
3 //*****
4 package node.communication.routing.protocolRouting;
5
6 simple protocolRouting like node.communication.routing.iRouting
7 {
8 parameters:
9     string applicationID = default ("throughputTest");
10    bool collectTraceInfo;
11    int maxNetMessageSize = default (0);
12    int netDataFrameOverhead = default (14);
13    int netBufferSize = default (32);
14    bool isSink = default (false);
15    double percentage; //The percentage
16    double roundLength @unit(s);
17    double slotLength;
18    //Parameters used to power control.
19    xml powersConfig;
20 gates:
21     output toCommunicationModule;
22     output toMacModule;
23     input fromCommunicationModule;
24     input fromMacModule;
25     input fromCommModuleResourceMgr;
26 }

```

SourceCode/NedFile.ned

# Appendix B

## Title of the Appendix.

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B.1.1	Title of the subsection . . . . .	<a href="#">E</a>

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### B.1 Title of the section

#### B.1.1 Title of the subsection

