INNOV 2021
The Tenth International Conference on Communications, Computation, Networks and Technologies
October 03, 2021 to October 07, 2021

Comparative Study of RIP, OSPF and EIGRP Protocols to Manage WSN-IoT Traffic vs IPTV Traffic Using Cisco Packet Tracer

Authors:
José Luis García-Navas[1], Laura Garcia[1], Oscar Romero[1], Pascal Lorenz[2], Jaime Lloret[1]

Universitat Politècnica de València [1]
University of Haute Alsace [2]

Presenter: Laura García

laugarg2@teleco.upv.es

Laura García her bachelor's degree in Telecommunications Technology Engineering by the Polytechnic University of Valencia in 2015, her master's degree in Digital Post Production by the Polytechnic University of Valencia in 2016, and her master's degree in Business Administration in 2020 by the Universidad Católica San Antonio de Murcia. She also received her Ph.D. degree in Telecommunications by Polytechnic University of Valencia in 2021. Her research lines are focused on precision agriculture, ambient monitoring and water quality monitoring systems and the design of architectures and protocols for the aforementioned purposes. She is author or coauthor of several papers in SCI journals. She has been involved in several organization committees of international conferences since 2016.

Outline

1. Introduction
2. Related Work
3. Network and Simulation Design
4. Simulation and Results
5. Conclusion

1. Introduction

1. Introduction

- Wireless Sensor Networks (WSN) and Internet of Things (IoT) are widely used to monitor different aspects, such as agriculture, health care, sport, energy, traffic management, etc.

- IoT creates a world where all electronic devices are connected between them and communicate to monitor human life parameters. One of the areas on which IoT is widely implemented is agriculture.

- Traditional networks are not designed to transmit IoT-WSN information, and IoT traffic management can be a challenge. For that reason, capturing, characterizing and classifying IoT traffic is very useful to predict and improve traffic management.

- Regarding to data traffic analysis, Packet Tracer is a virtual networking simulation software developed by Cisco that can be used to simulate real networks, IoT devices IoT functionalities can be implemented.

- In this paper we present a study on the management of IoT data traffic through a traditional network. IoT data are analyzed through the network and compared using different routing protocol such as RIP, OSPF and EIGRP. The study is carried out in three different scenarios depending on the amount of IPTV traffic managed by the network

2. Related Work

2. Related Work

- There are some studies that use IoT and WSN to monitor different real life aspects and parameters, such as soil moisture, sewerage or to manage car's traffic flows.

- Moreover, some other studies are focused on the analysis of data traffic, in order to know how to classify IoT traffic and how to use that information to act on the way IoT devices and the network work.

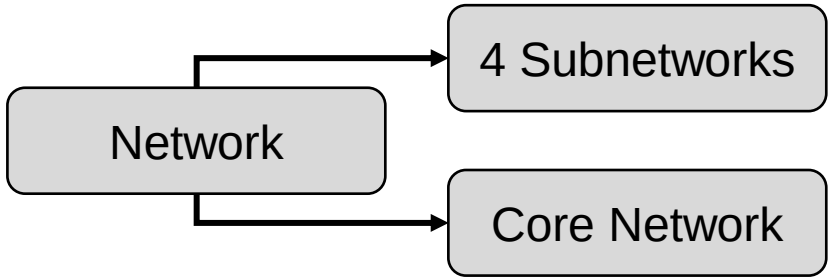
- Packet Tracer as a simulation tool has been used to analyze, study and simulate networks. In this type of studies some factors have been analyzed, such as delay on ICMP packets exchange, comparisons between routing protocol and traditional networks.

- In addition Packet Tracer has been used to implement smart home technologies and IoT functionalities, and to advance research in the development and implementation of IoT systems.

- Although there are studies about the aforementioned topics, the available studies do not study traditional networks performance managing IoT-WSN traffic.

3. Network and Simulation Design

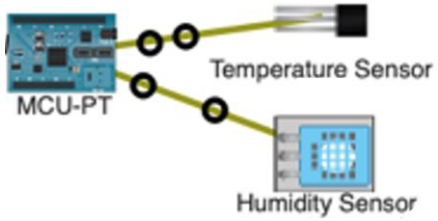
3. Network and Simulation Design

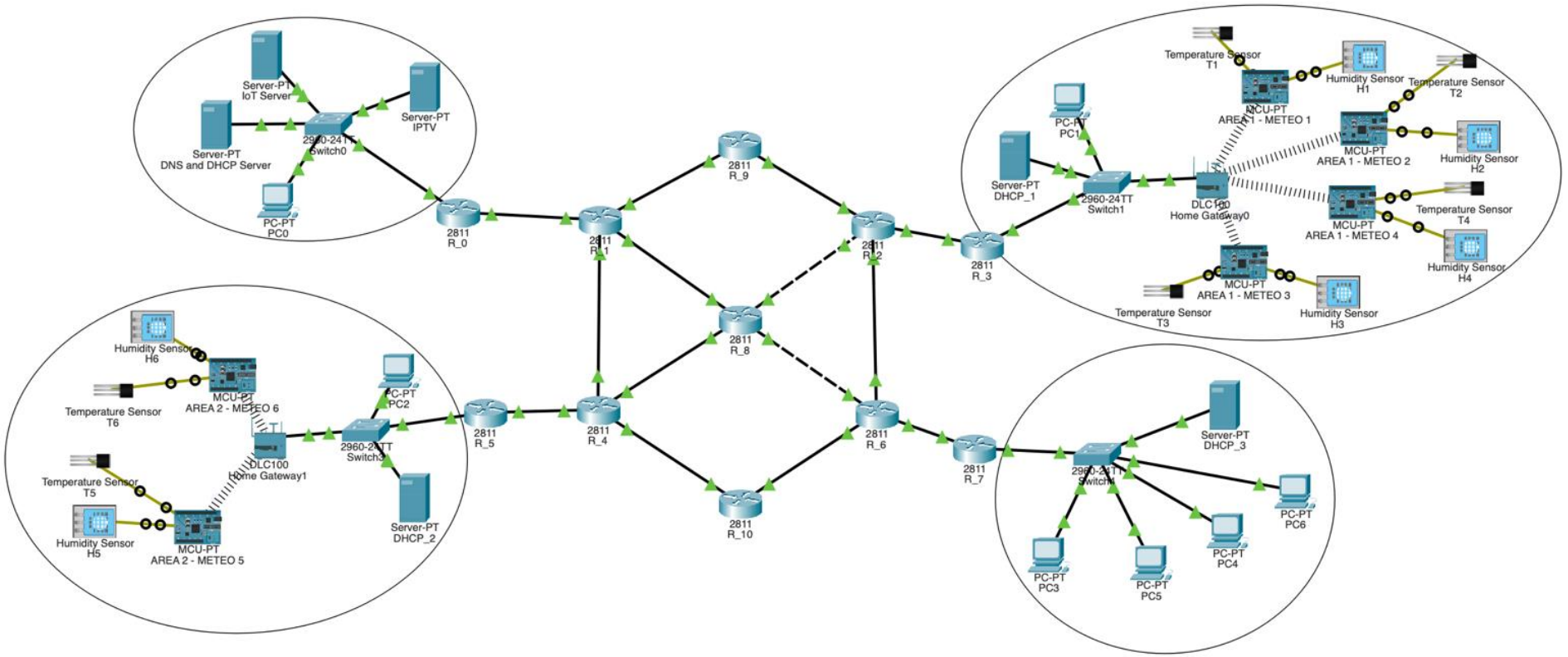


- 2 networks of IoT-WSN
- 1 network of servers
- 1 network of PC-users

Allows Multipath between subnets

MCU
- Humidity sensor
- Temperature sensor





WSN 1 (Area 1)
- Home Gateway (Wi-Fi)
- 4 MCU

WSN 2 (Area 2)
- Home Gateway (Wi-Fi)
- 2 MCU

Servers
- DNS + DHCP
- IoT Server
- IPTV Server

3. Network and Simulation Design

Network Performance

MCUs connect both to their Gateway and to the IoT server.

- MCU – Gateway connection require password authentication.
- MCU – IoT server connection require account authentication

1. MCUs read temperature and humidity data every second
2. MCUs send it to the IoT Server through their Gateway
3. IoT Server will show Real-Time temperature and humidity

Simulation Design

RTT - time since every MCU update sensor data until it receives an ACK message (TCP packets)

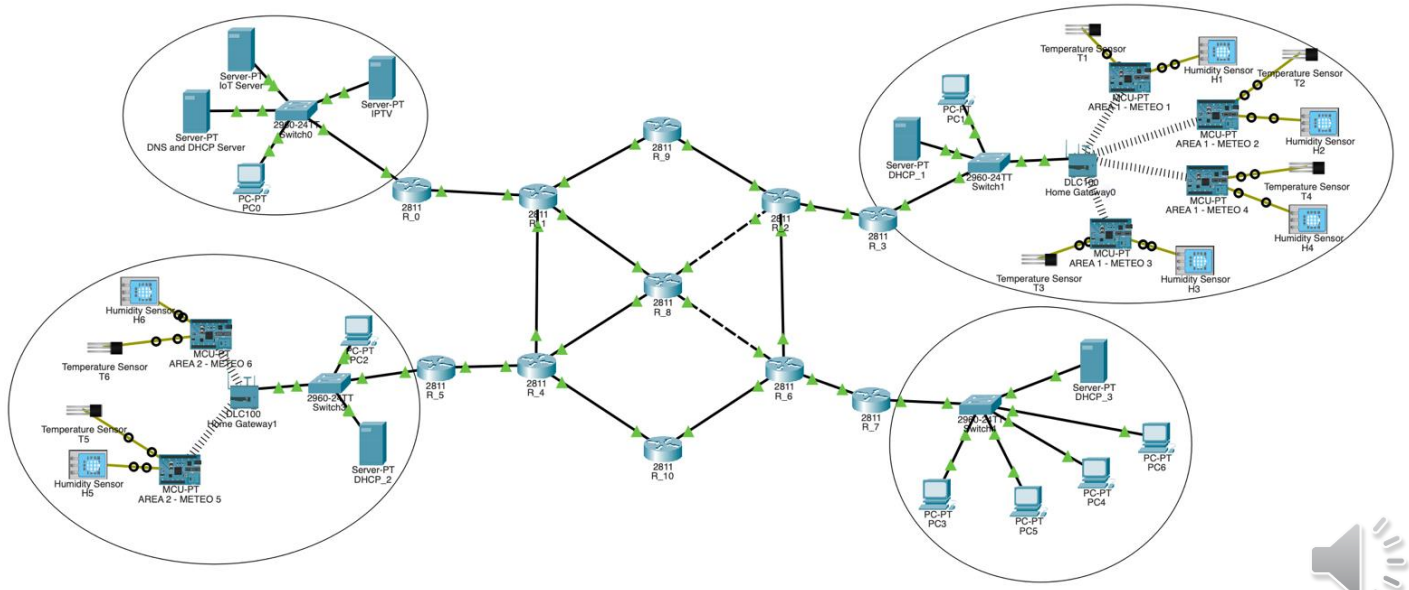
IPTV packets are generated by a Traffic Generator tool provided by Packet Tracer

Routing Protocols and Scenarios

- RIP
- OSPF
- EIGRP

3 Scenarios

- Only IoT traffic
- IoT vs 1 IPTV flow
- IoT vs 3 IPTV flows



4. Simulation and Results

4. Simulation and Results

Round Trip Time

- Each data shown is the mean of 5 different consecutive data measures
- Data has been captured using Packet Tracer Simulation Mode

Scenario 1: IoT Traffic

- Protocols perform similar
- EIGRP RTT seems to be worse than RIP and OSPF
- RIP and OSPF show similar results

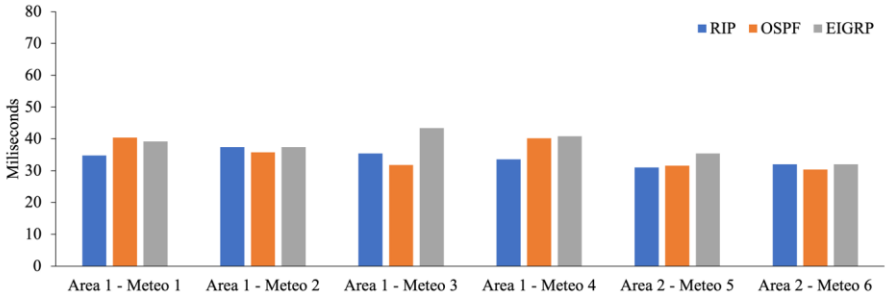
Scenario 2: IoT Traffic vs IPTV sent to network 3

- RIP protocol shows worst results when IPTV traffic is managed
- OSPF and EIGRP perform in the same way in both Scenarios

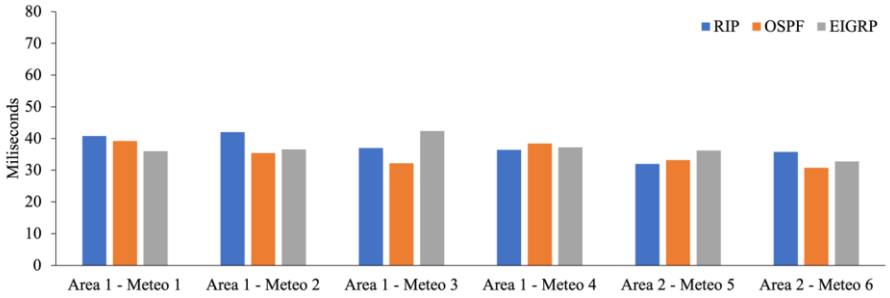
Scenario 3: IoT Traffic vs IPTV sent to the three network

- RTT shows a high increase when IPTV is sent to WSN in all protocols
- EIGRP is the one that performs better

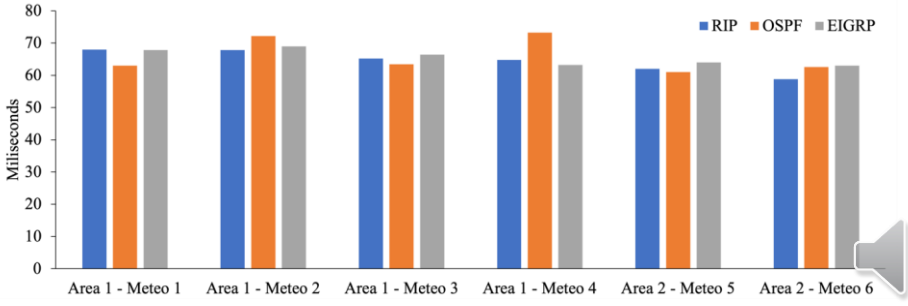
IoT Traffic



IoT Traffic vs IPTV Traffic sent to network 3 (no WSN)



IoT Traffic vs IPTV Traffic sent to the three subnetworks



4. Simulation and Results

RIP
OSPF
EIGRP

- RTT IoT Traffic: RTT measured on Scenario 1
- △1: RTT (Scenario 2) – RTT (Scenario 1)
- △2: RTT (Scenario 3) – RTT (Scenario 1)

	RIP			OSPF			EIGRP		
	RTT IoT Traffic	***Δ1***	***Δ2***	***RTT IoT Traffic***	***Δ1***	***Δ2***	***RTT IoT Traffic***	***Δ1***	***Δ2***
Area 1 - Meteo 1	34.80	6.00	33.20	40.40	-1.20	22.60	39.20	-3.20	28.60
Area 1 - Meteo 2	37.40	4.60	30.40	35.80	-0.40	36.40	37.40	-0.80	31.60
Area 1 - Meteo 3	35.40	1.60	29.80	31.80	0.40	31.60	43.40	-1.00	23.00
Area 1 - Meteo 4	33.60	2.80	31.20	40.20	-1.80	33.00	40.80	-3.60	22.40

	RIP			OSPF			EIGRP		
	RTT IoT Traffic	***Δ1***	***Δ2***	***RTT IoT Traffic***	***Δ1***	***Δ2***	***RTT IoT Traffic***	***Δ1***	***Δ2***
Area 2 - Meteo 5	31.00	1.00	31.00	31.60	1.60	29.40	35.40	0.80	28.60
Area 2 - Meteo 6	32.00	3.80	26.80	30.40	0.40	32.30	32.00	0.80	31.00

- EIGRP times are higher
- RIP is the protocol more affected by the presence of IPTV traffic
- OSPF and EIGRP don’t suffer any variation when IPTV is sent to other networks
- When IPTV traffic is sent to WSN, EIGRP is the one with less variation

5. Conclusions and Future Work

5. Conclusions and Future Work

RIP routing protocol is the one that best manages IoT traffic when no IPTV traffic is needed to be sent.

OSPF performs well in similar conditions whereas EIGRP is the worst.

When IPVT traffic is managed by the network, EIGRP is the better option while RIP is worst.

OSPF can be considered as a neutral option between RIP and EIGRP on managing WSN-IoT traffic vs IPTV traffic.

For future works, another comparative study can be carried out using different types of traffic instead of IPTV traffic. In addition, this type of study can be implemented in real scenarios. Moreover, this type of research can help to create data bases of different types of traffic, to classify and prioritize.

?