QoS for Integrating WSN with Heterogeneous Data Traffic with the Internet

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Introduction

The future of the IoT is envisaged to consist of a high number of wireless resource-constraint devices connected to the Internet. Moreover, a lot of novel real-world services offered by IoT devices are realized by WSN. Integrating WSN to the Internet has therefore brought forward the requirements of an end-to-end QoS guarantee.

This research [1] focuses on the issues related to co-existence of real-time and delay-tolerant data packets, and the differences between WSN QoS and Internet QoS [2] that imposes a mechanism for a seamless QoS over both networks .

Research objectives

This research aims at designing a QoS framework to achieve an end-to-end service differentiation that preserves the QoS mechanism between WSNs and the Internet.

The objective of the research are:

- ❑ To design a QoS model that deals with different requirements of heterogeneous data of the WSN
- ❑ To implement a DTN architecture and achieve seamless QoS interactions [3] for the integrated networks

References

[1] S Ezdiani, A Al-Anbuky "Modelling the Integrated QoS for Wireless Sensor Networks with Heterogeneous Data Traffic" Open Journal of Internet Of Things (OJIOT), Volume 1, Issue 1, 2014.

[2] S. E. S. N. Azlan and A. Al-Anbuky, "Quality of Service Modelling for Federated Wireless Sensor Network Testbed Gateways," in *Proc. of 5th Int. Conf. on Commun., Theory, Reliability, and Quality of Service (CTRQ 2012)*, Chamonix, France, pp. 14-18, 2012.

[3] M. Marchese, QoS Over Heterogeneous Networks: Wiley.com, 2007.

[4] M.H. Yaghmaee and D.A. Adjeroh, "Priority-based Rate Control for Service Differentiation and Congestion Control in Wireless Multimedia Sensor Networks, " *Computer Networks*, vol.53, pp.1798-1811, 2009.

Abbreviations

WSN - *Wireless sensor networks* ***IoT -*** *Internet of Things*

QoS - *Quality of Service* ***DTN -*** *Delay-tolerant networks*

The Proposed QoS Framework

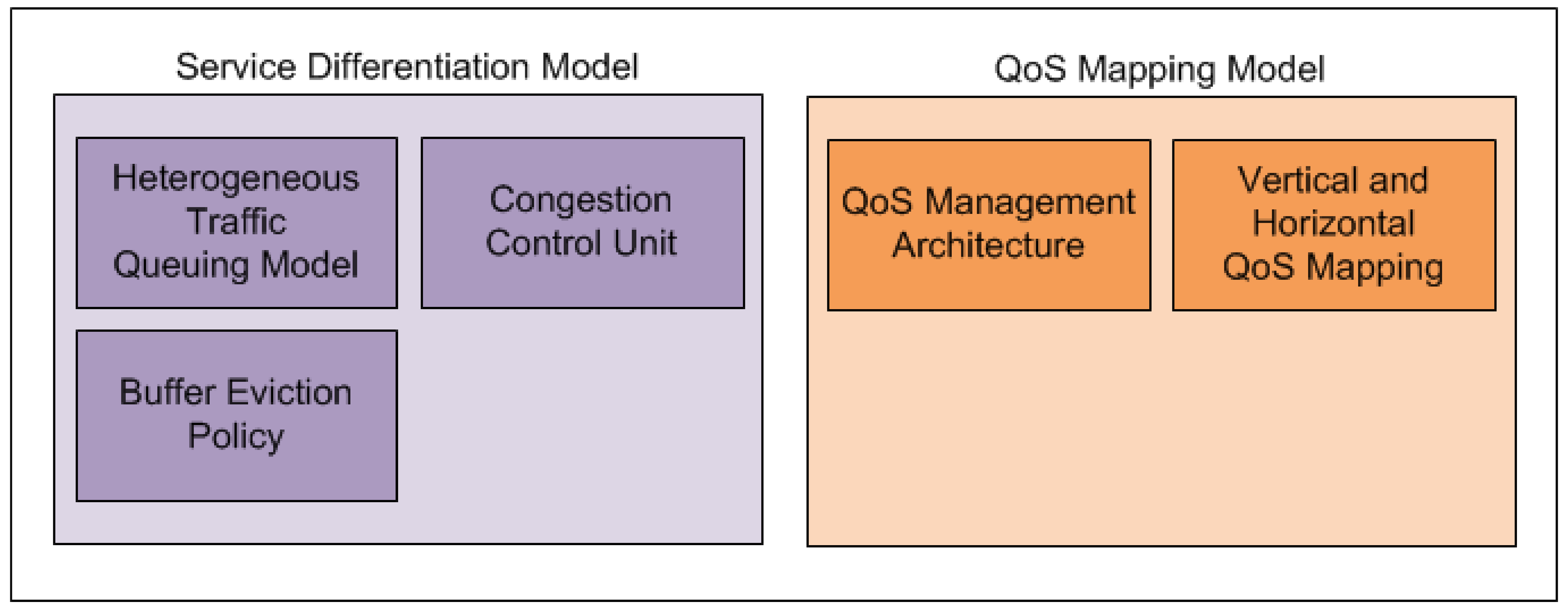
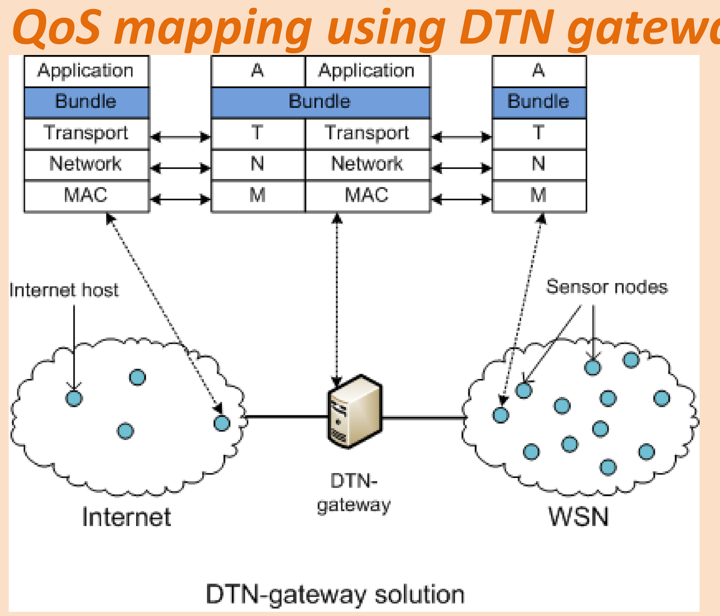


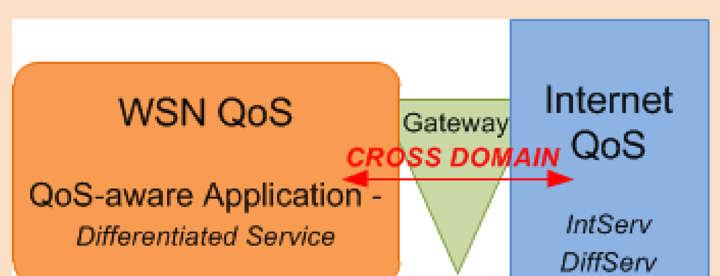
Figure 1: Block diagram of the proposed QoS framework components

QoS Mapping Model

QoS mapping using DTN gateway



A DTN QoS gateway [3] located in between both networks links the QoS solution employed in the WSN with the QoS solution employed by the Internet.



The DTN gateway facilitates the cross-domain QoS mapping between the different QoS mechanisms implemented in both sides of the network.

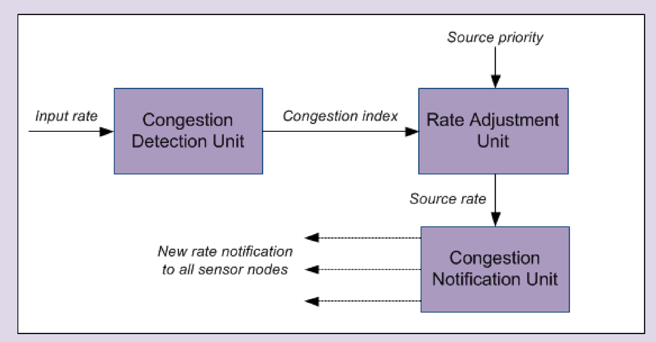
QoS Management Architecture

Name	Intervention Time
Flow/Traffic class identification	Packet time
Traffic shaping	Packet time
Scheduling	Packet time
Flow control	Round trip time
Call Admission Control	Connection time
QoS routing	Connection time
Resource allocation and reservation	Connection time (long term)

Vertical and horizontal mappings implemented with the use of QoS management function. The table consists of a list of QoS management functions with an indication of the time interval at which they applied.

Service Differentiation Model

Congestion Control Unit

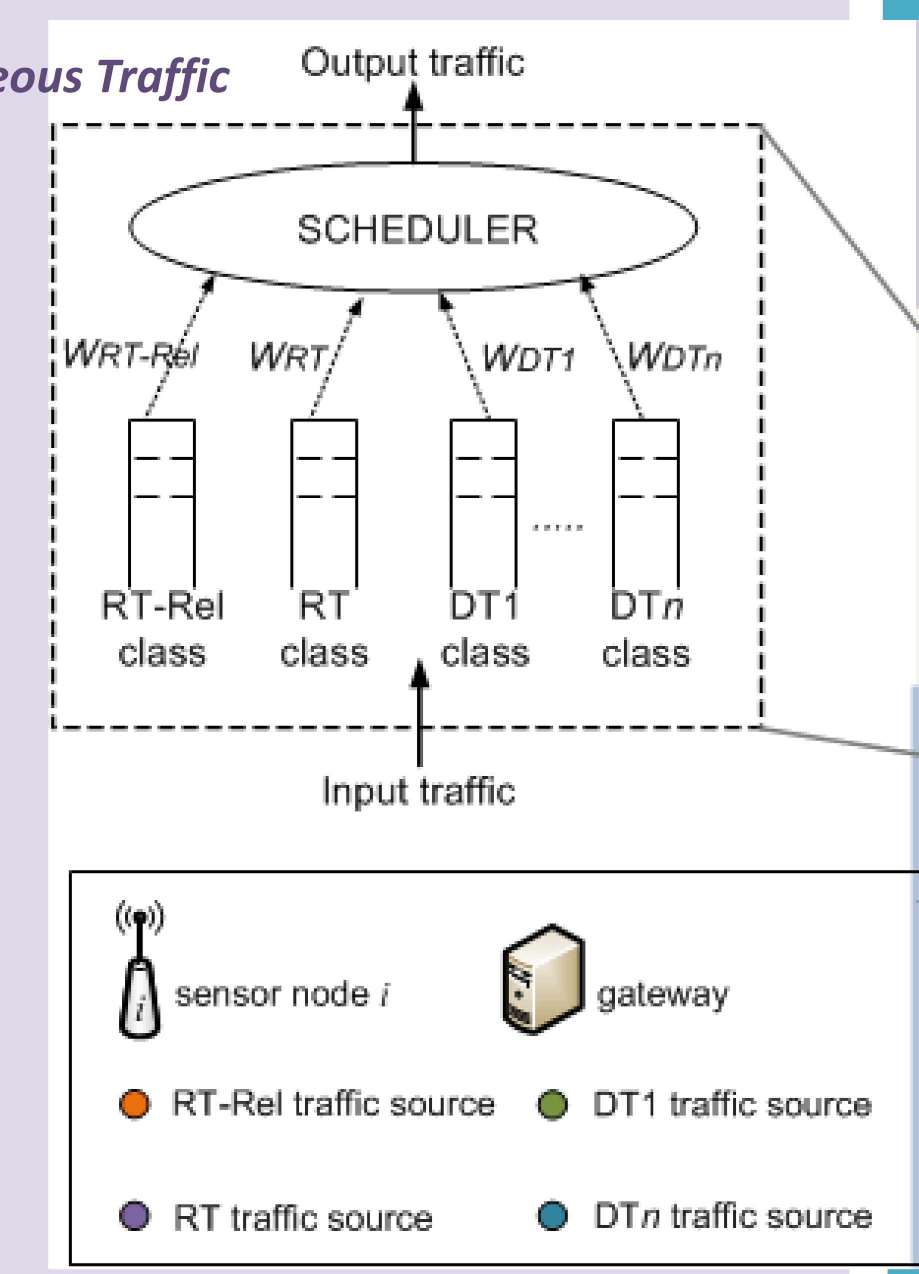


Acts as a scheduler between network layer and MAC layer, which maintains queues according to traffic types [4].

Buffer Eviction Policy

Allows delay-tolerant data with reliability-constraint to be allocated more storage and longer duration in the buffer.

Heterogeneous Traffic Queuing Model



Research Design

Design Parameter	Performance Parameter
System dimensions:	*Buffer usage*
Traffic dimension	*Queuing delay*
Data flow rate	*Traffic dropped*
Network Architecture:	*End-to-end delay*
Node density	*Bandwidth utilization*
Gateway capacities	
System Variants:	
Communication protocol	
IoT architecture	

1. QoS Requirement Analysis

- ❑ Real-time and delay-tolerant traffic management
- ❑ End-to-end service differentiation
- ❑ Integrated QoS mapping
- ❑ Seamless QoS interaction

2. Network and QoS Modeling

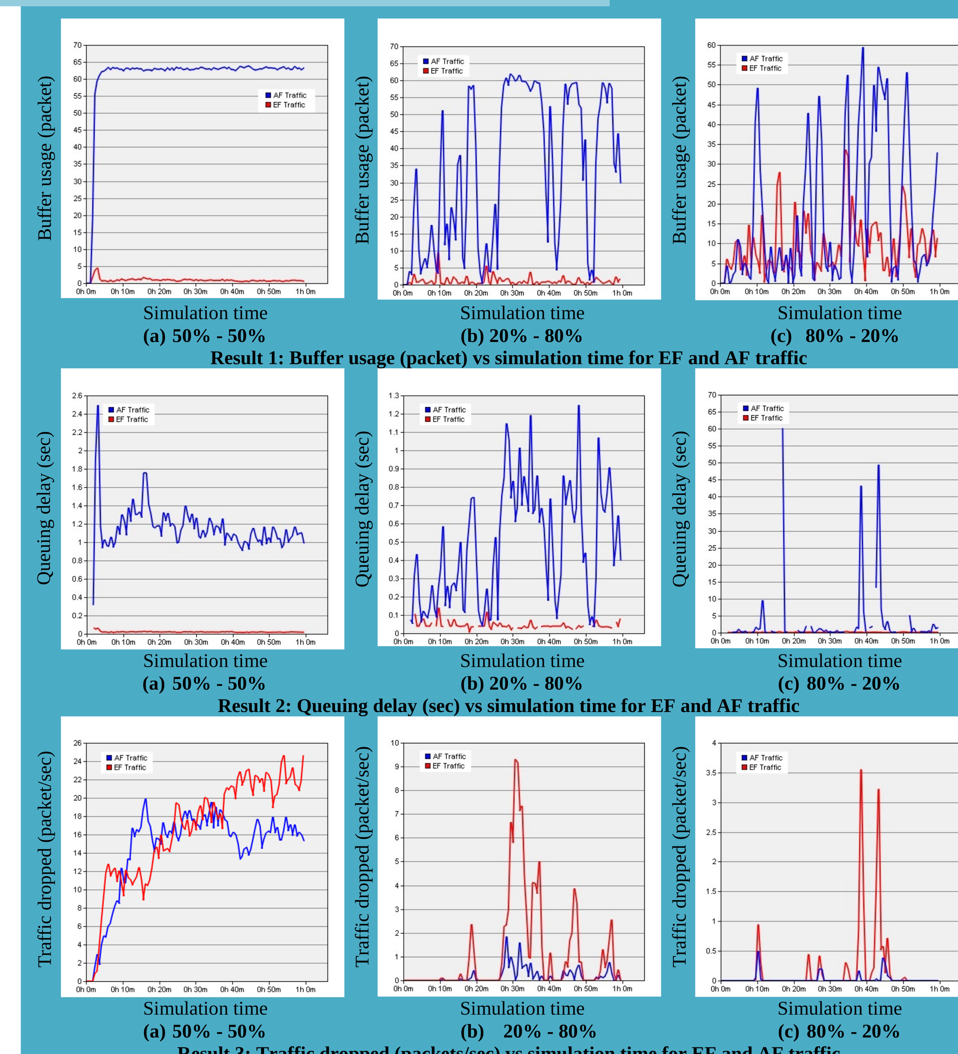


Figure 3: Network performance through network simulation

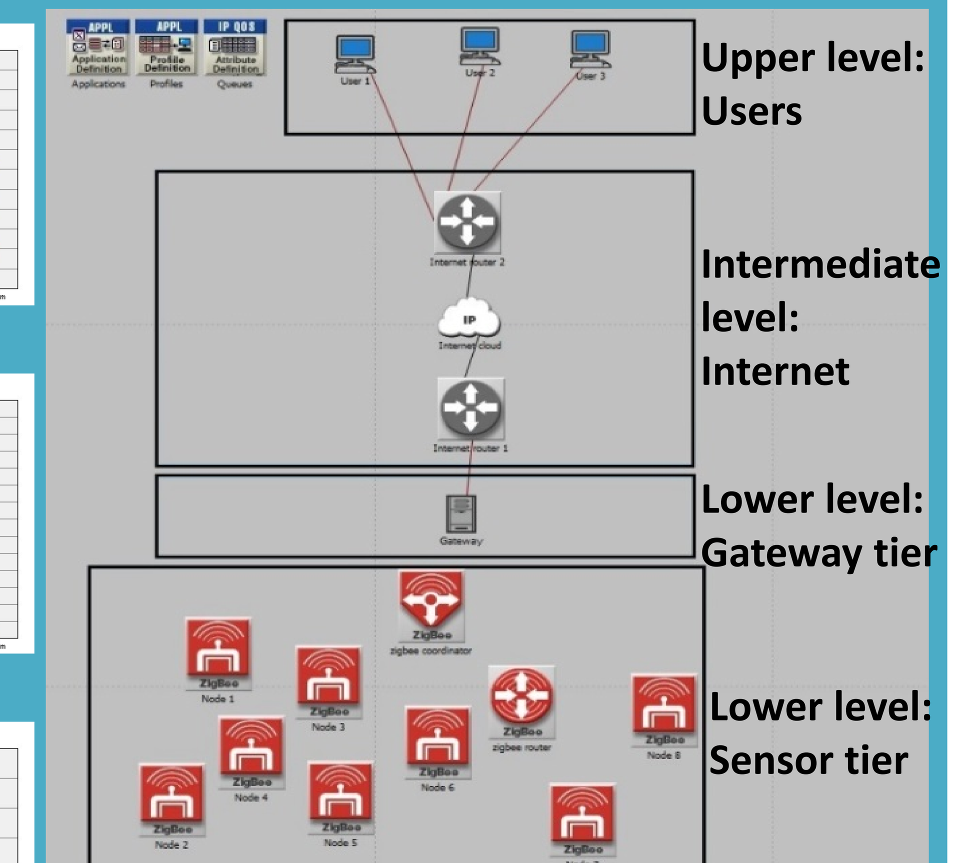


Figure 2: Simulation on OPNET Modeler

3. Validation on a Physical Testbed

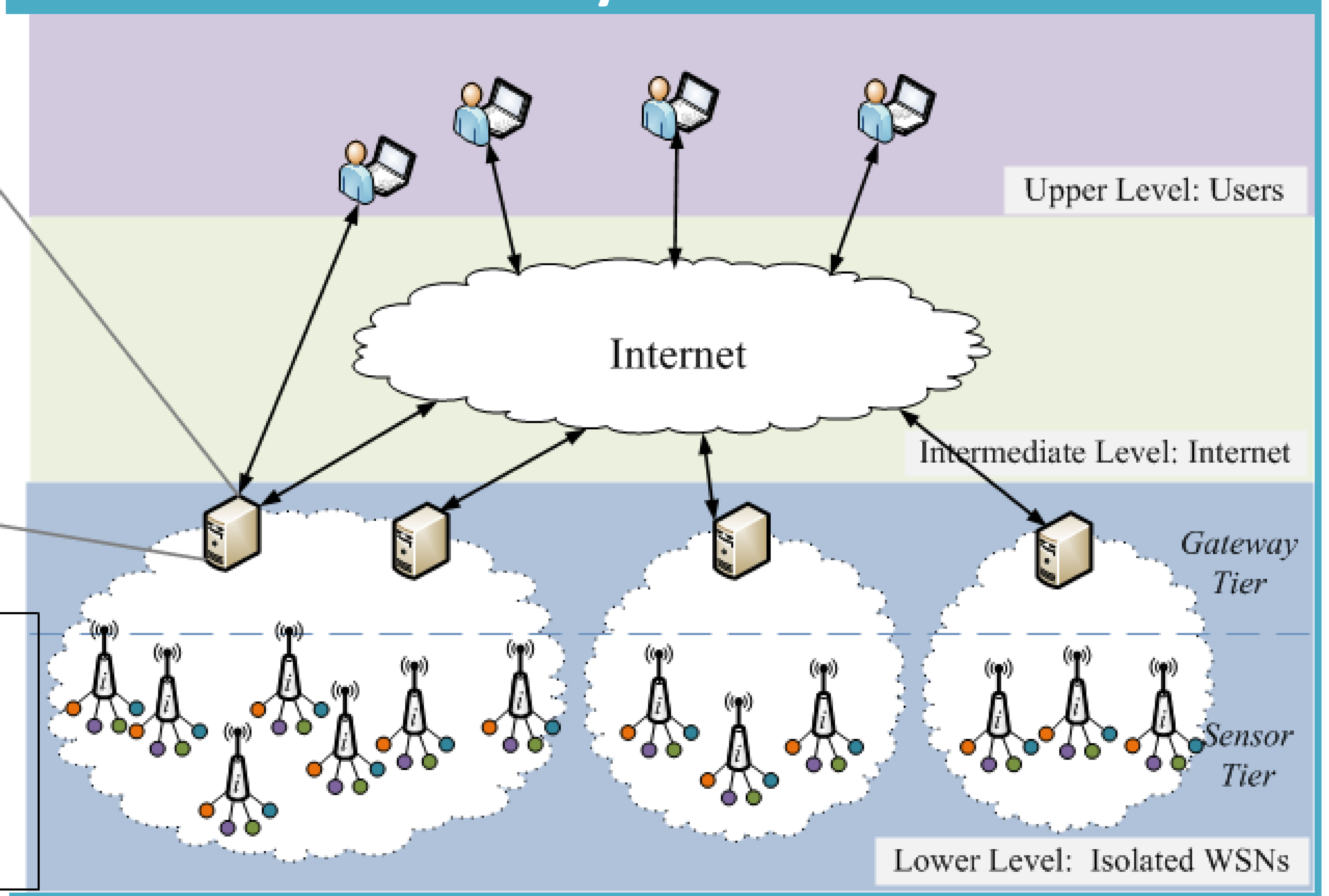


Figure 4: Reference Architecture