IoT-based Big Data secure management in the Fog over a 6G Wireless Network

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***Abstract*— This work proposes an innovative infrastructure of secure scenario which operates in a wireless-mobile 6G network for managing Big Data on Smart Buildings. Count on the rapid growth of telecommunication field new challenges arise. Furthermore, a new type of wireless network infrastructure, the sixth generation (6G), provides all the benefits of its past versions and also improves some issues which its predecessors had. In addition, relative technologies to the telecommunications filed, such as IoT, Cloud Computing and Edge Computing, can operate through a 6G wireless network. Take into account all these, we propose a scenario that try to combine the functions of the Internet of Things with Cloud Computing, Edge Computing and Big Data in order to achieve a Smart and Secure environment. The major purpose of this work is to create a novel and secure Cache Decision System in a wireless network that operates over a Smart Building, which will offer the users safer and efficient environment for browsing the internet, sharing and managing large-scale data in the fog. This CDS consisted of two types of servers, one Cloud Server and one Edge Server. In order to come up with our proposal, we study related cache scenarios systems which are listed, presented, and compared in this work.**

***Index Terms*— Security, Big Data, Management, 6G, Cloud Computing, Edge Computing, Internet of Things, Wireless Network, Smart Building.**

I. Introduction

As we know by the scientific studies of the 5G, it quotes 300Mbps of downlink, 50Mbps of uplink, an end-to-end latency of 10ms and a mobility which is on demand between 0 and 100km/h [1]. Moreover, 6G performance requirements are a peak data rate of 1,000 Gbps (gigabits per second) and air latency less than 100 microseconds (μs), 50 times the peak data rate and one-tenth the latency of 5G [2] [3]. Thus, 6G offers larger communication channels than 5G. Particularly, the existing mobile network generations could not handle the explosive traffic growth due to the capacity limitations of radio access, backhaul and core mobile networks. So, with the aim to support this traffic expansion, the 6G, which consists the sixth generation of the mobile net-works, is under preparation and improvement. Thus, 6G is expected to offer 1000x higher throughput, sub-millisecond service latencies [2]. Moreover, caching of popular content during off-peak traffic periods at different levels of the wireless network architecture has occurred as a major technology trend for the next generation of wireless systems, which is the 6G technology [4]. By moving the location of the caches more closely to the edge of the network we could take the advantage of reducing the latency that required for accessing and delivering users' requests [4] [5]. Furthermore, the mobile cellular networks are moving toward the 6G wireless networks, where new technologies like ultra-dense networks, massive multiple-input multiple-output (MIMO), millimeter-wave communication, edge caching, device-to-device communications, Cloud Computing (CC), Edge Computing (EC), Internet of Things (IoT) and Big Data (BD) [6] [7] [8].

Regarding the data used in a wireless network there are security and privacy issues that need to be addressed. The problem with security and privacy in everyday life could be solved or could be minimized by the use of BD analysis tools and services. BD is a novel popular term, used to derive the surprisingly rapid increase in volume of data in any form (structured and unstructured) [9] [10] [11]. BD usually uses CC as a base technology in order to operate. Similar to this, another technology that could be used as a base technology is EC.

In addition to this, CC and EC could be used as a base technology for multiple affiliated technologies of the communications field, IoT. The basic idea of the IoT is the pervasive presence of various things or objects used by people such as radio-frequency identification tags, sensors, actuators, and mobile phones. Through exclusive addressing schemes, these things communicate with each other and cooperate with other things near them aiming to reach the common goals [12] [13] [14]. Thus, the exhaustive computations and the mass storage, which are supported by clouds, are in sometimes inefficient. A number of examples contain the limitations of storage, communication capabilities, energy and processing. Inefficiencies such these motivate us to combine the technology of CC, EC and IoT [15] [16] [17].

In the other hand, CC is consisted of a technology of internet services offering remote use of both hardware and software. Furthermore, another technology that relays on CC and arisen in the recent years is Mobile Cloud Computing (MCC). Many types of Cloud services could be processed by

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the usage of Cloud technology in a large number of mobile devices. Considering this MCC, and also CC in general, could be settled as a base technology offering an operation area for other technologies such as IoT and subsequently to be achieved an integration of Cloud and IoT [18] [19].

Concluding CC and EC could '*offer*' cache in a wireless network. Specifically, the wireless caching advocates are adding storage at the wireless network infrastructure in order to address the eruptive growth in mobile data demand. The main motivation and efforts of wireless caching is to reduce the response time and the network infrastructure energy, bandwidth or monetary costs [20] [21]. Wireless caching for example, caching content within the wireless access network is gaining interest, especially in ultra-dense networks where many connected devices try to access various network services under latency, energy efficiency, and bandwidth limitation constraints. Also, the major difference of CC and EC that makes the use of both technologies necessary in a novel system is that on the one hand the CC provides a well-established and secure data allocation system, while on the other the EC provides speed and immediacy in the response to access network data. EC operates on the '*edge*' of the established network and thus the immediate and fast access to data occurs, while on the other hand CC gives stability due to the hardware infrastructure.

As a result, the presentation of the basic theoretical information of the research field of this work we can provide the main contributions of our work. The main contributions of this work are:

- ✓ Propose an innovative system of secure caching scenario which operates in a wireless-mobile 6G network for managing BD on Smart Buildings (SB).
- ✓ Proposed scenario combines the functions of the IoT with CC, EC and BD (on SB).
- ✓ Create a novel and secure Cache Decision System (CDS) in a wireless network that operates over a SB, which offer the users a safer and efficient environment for browsing the internet, sharing and managing large-scale data in the fog.
- ✓ The CDS model consists of two types of servers, one Cloud Server (CSe) and one Edge Server (ESe).

The rest of the paper divided as follows. In section 2 there is a review of the related research analysis. Section 3 presents and illustrates our proposed system with a new type of caching scenario. In Section 4 there is a comparative analysis about former works that deal and propose caching scenarios systems. Moreover, in Section 5 there is a presentation of experimental results that have been made. Finally, Section 6 offers the conclusions of the current work and provides new possibilities for the development of future work.

II. Related Work Review

For the purpose of the research existing literature, on the fields of 6G Networks BD, IoT, CC, EC, and caching, has been also studied and analyzed. We realized that the usage of remote storage space become more popular and widely used over the years. So, new ways in caching systems appear in order to improve the current status so far. Subsequently, there is a need for further research in this area as the growing numbers studied indicate. Figure 1 demonstrates the rapid growth of the papers related to the issues of cache scenarios systems, and also how other technologies, such as those mentioned in this work, can help improve it. As we can observe, the last seven years the interest of the researchers has growth considerably compared to the previous decade.

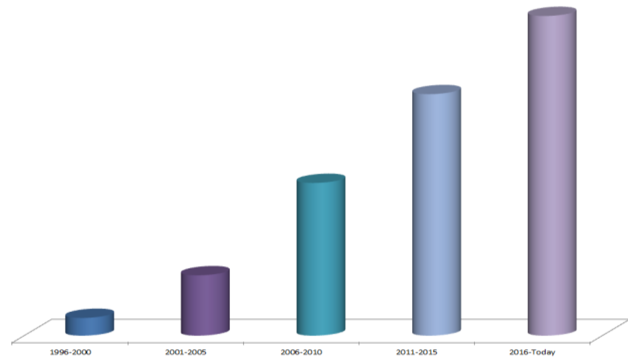

Figure 1: Change in the number of related works over time.

One of the biggest challenges in big data is data mining. Raichura & Padhariya in their work [20] try to deliver data in an efficient way. Specifically, to access the data efficiently and to transfer the data in a cost-effective way, researchers pro-posed a cache-based architecture, which was named "*BigCache*". Through that system, the caching of the static vs the dynamic data, the storage and the access speed have been taken into consideration and have been improved.

Also, improvements have been done in bandwidth utilization, in the availability of the data, in the updating of the data by fresh ones', and in costs which are reduced. In *BigCache* are included three caching schemes, a Cache Decision System (CDS), and a cache replacement process. As results of the performance evaluation of the system are the reduced bandwidth and the reduced server-load.

Jin et al. [18] in their work present several mobile wireless caching frameworks such as those based on Information-Centric Networking (ICN), on Mobile Cellular Networks (MCNs), on Wireless Ad Hoc Networks (WAHNs), and on Hybrid Networks (HNs). The ICN is based on name contents, which means that the network routes the users' requests by the content name. After the searching for the content in various caches, the requested content is forwarded to the users. Some technologies used in ICN are the Named Data Networking (NDN) or name based routing, the information naming, and others. In the MCNs the caching is done in both the core network and the access networks. Generally, the users through their mobile devices are connecting to the specific Access Point (AP) to gain multimedia services. In the WAHNs there are multi-hop communications by the mobile nodes, and by that fact cache can be deployed, so that the exchange of data between these nodes can be managed. Finally, in the HNs a combination of a WAHN with an infrastructural network is done. The HNs are also supporting ad hoc and cellular communications based on mobile devices.

Another region based approach discussed by Sun et al. [22] about the BD in mobile social networks and the QoE that provides to the users. The big amounts of data as it is known suffer from their large volume and variety, and from their large value and velocity. Because of this, a framework for efficient big data transmission through content-centric mobile social networks to the mobile devices is presented.

Meoni et al. [23] through their work try to investigate how leverage machine learning on this huge amount of data with the aim to discover patterns and correlations useful to growth the overall efficiency of the distributed infrastructure in terms of CPU utilization and task completion time. More specifically, this work proposes a scalable pipeline of components built on top of the Spark engine for large-scale data processing. The goal of this proposal is collecting from different sites the dataset access logs then organizing them into weekly snapshots, and training, on these snapshots, predictive models which are able to forecast which datasets will become popular over time.

In their work, Djemaiel et al. [24], in the context of Wireless Sensor and Actuator Networks (WSANs), proposes a cloud-based WSAN approximation that enables the storage and the management of health data in an efficient way by representing the collected data and their reliance using Temporal Conceptual Graphs (TCGs). The authors with the aim to demonstrate the efficiency of the proposed approach illustrate for different defined scenarios of diseases and their associated health data demonstrated through generated TCGs.

At the end, Rafique et al. [25] with the aim to address challenges related to Cloud scenarios, present PERSIST, which is middleware architecture. This architecture initially externalizes the complexity of federated cloud storage architecture and the complex storage logic from the SaaS application to storage policies, allow tenants to enforce different storage grained level. Also, the PERSIST supports the dynamic re-configurability of the underlying federated Cloud storage architecture.

III. Evaluation Approach System-Framework

The purpose of caching is to perform better with the websites and to save bandwidth. By tacking in advance all the previous works and all the aspects that come out from the limitations in wireless networks, we would try to propose a new caching system for a wireless network. This proposed caching system is established on a SB over a University, in order to let the mobile users in the building access the internet faster and safer. The proposed system consists of a main local server which is connected to two storage cache servers, one Cloud cache server and one Edge cache server. But, how a cache server works? A cache server can be divided into two parts: the webserver cache and the application cache.

Figure 2 demonstrates the operation of our proposed system. More specific, the users will be connected to the internet through a mobile network settled in the campus and based on the novel 6G technology and its’ benefits. The 6G network could offer to the users faster and responsive network environment. In addition to this, they can send requests to the cache servers depending the occasion. More particular, the scenario is as follows, if all users request the same content-item, then the first request is only computed and the rest users will access the requested content-item from cache since it is stored there, after the first computation. As also shown in Figure 2, there is a need of a proxy cache server between the local server and the webservers. Thus, thereafter the requests will be sent to the proxy first.

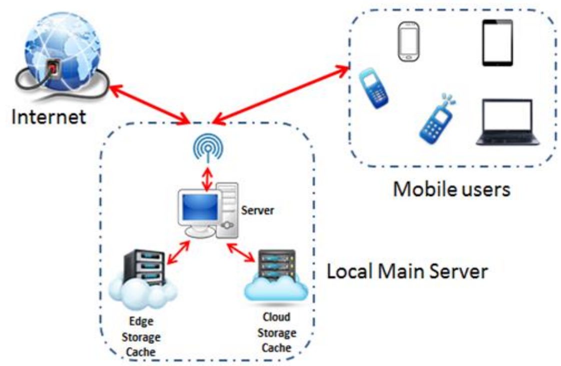

Figure 2: Proposed System Architecture.

More specifically, regarding the operation of the Cache Decision System, when a user tries to connect to a web page, an algorithm will run and check if the user chooses a secure web site or not. Particularly, a Cache Decision Algorithm (CDA) manages the preference and then the Mail Server retrieves data from the proper Storage Server. For instance, an example scenario is as follows, if the user wants to access a web site that was hosted as “*https://...*” the Cloud Storage Cache will be used, otherwise, if the user wants to access a web site that was hosted as “*http://...*” the Edge Storage Cache will be used. In the first situation, caching of https can be controlled with the use of response headers.

Moreover, the users which request a content-item are being categorized in those who need a secure communication and request websites under the “*https://*”, and those who need speed in their communications and request daily-common websites under the “*http://*”. The first category has the priority to keep its users safe. Then, the requests of “*http://*” websites can be served faster with the use of the Edge Cache Server.

Consequently, we choose Cloud Storage Server in order to store secure data because Cloud technology offers better security scenarios instead of Edge technology. On the other hand, Edge technology could offer users easier and quicker access in not securely encrypted web sites.

Based in previous works we realized that CC and EC differ in data management. CC offers better security and privacy than other technologies, such as IoT, due to its data encryption system [9] [12] [18] [26] [27]. CC used as a based technology for a major number of IoT-based and BD-based applications because of its function. On the other hand regarding previous works EC used in high-speed networks due to its feature of high-speed transmission [8] [12] [15] [28] [29] [30].

In addition to this, a CDS that is able to decide and choose the better cache system which also could manage data consisted of large-scale data and produced be various IoT devices could be count on our proposal. IoT's features such as *Service over Internet*, *Application over Internet*, *Energy Efficiency* and *Computationally Capable* could have a positive impact from the proposed system due to the use of both CSe and Ese. Furthermore, BD that transferred and used through the network of the proposed system could be stored depending the occasion either on CSe or Ese, in order to be managed from the users that have access on them. The ability of storage and services offers new possibilities of using data analysis application.

A. *Scheme Implementation Scenario*

After studying various researches about caching in wireless mobile networks and after we proposed a CDS for a Smart Building, it is time to consider which caching algorithm fits the proposed system. There are lots of algorithms for caching but only few are the most used and fit to such systems like the proposed one. Some of them are explained below:

- ✓ First In First Out (FIFO): the cache behaves as a FIFO queue.
- ✓ Last In First Out (LIFO): the cache behaves in the opposite way of FIFO.
- ✓ Least Frequently Used (LFU): one of the most commonly used caching algorithm. This algorithm is used to remember the most frequently used content-items. The rest, which are rarely used, are rejected first.
- ✓ Least Recently Used (LRU): one of the most commonly used caching algorithm. This algorithm is used to reject the LRU content-items first. It is also used by Dropbox and Android.
- ✓ Least Frequent Recently Used (LFRU): A hybrid algorithm of the previous two: LFU and LRU.
- ✓ Most Recently Used (MRU): This algorithm works in the opposite way than the LRU algorithm. This means that the rarely used content-items are kept in cache and the recently used are rejected.
- ✓ Adaptive Replacement Cache (ARC): This algorithm is a combination of LFU and LRU and it improves the result of that combination. It also makes a good management of the cache storage spaces.

The algorithm that fits to the proposed system is the LFRU. This hybrid algorithm is divided into two partitions. The first one which is called "*privileged partition*" (where it is used the LRU algorithm) is used for the popular content and it is protected. The second one is the "*unprivileged partition*" (where it is used the LFU algorithm) in which the replacement of a popular content item is required and the content is then send to the privileged partition.

Count on the proposed scenario, when a user, connected to the wireless network, request access to a web place, the CDA of the CDS "*examines*" the occasion, depending on the request, and then provides the requested access through the predetermined in each case a server. Thus, after the inspection to be carried out by CDA, if the user chooses a secured network space to access the connection will be routed through the CSe, while if the user chooses a not secured network space to access the connection will be routed through the ESe. In many case, due to the major characteristics of each of Cloud and Edge technologies, the requested access routed by default through a specific server, depending on how a similar connection was set up in the past.

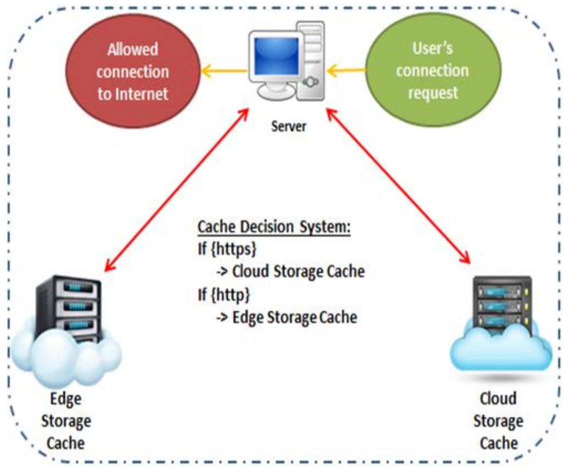

Figure 3: Proposed Cache Decision System (CDS).

B. *Algorithm Approach of CDS*

Except the algorithms, there are also caching frameworks. Some of them are the *EHCache* and the *WhirlyCache*. Both frameworks support the LRU and LFU algorithms and that means, both support LFRU the same. Because of this, these frameworks fit to the proposed caching system. After performance evaluation tests carried out by several researchers the *EHCache* framework is the one that performs better for cache miss and cache hits, and offers characteristics such as distributed functionality and monitoring statistics. When saying cache hit it means that the content-item desired after checked if available in cache storage it can be used. Even though, when saying cache mish that means that the desired content-item has not been found in the cache storage.

The CDS is the system which is responsible for the cache replacement operation. In our case study, the CDS considers if the requested content is protected (e.g. HTTPs) or if it is just a simple web page (e.g. HTTP). Figure 3 above demonstrates the CDS operation of the Proxy Server. In the Algorithm 1 below, the pseudocode of the proposed CDS is presented.

Algorithm 1: Cache Decision Algorithm (CDA)

LS= Local Server
ESe= Edge Server
CSe= Cloud Server
PS= Proxy Server
x= data-item
y= content-item HTTPs to be cached
z= content-item HTTP to be cached
for each x **do**
    check with PS
    if x=y **then**
        if x found in CSe **then**
            open content-item
        else

```
            store x in CSe with LFRU
            open content-item
    else if x=z then
        if x found in ESe then
            open content-item
        else
            store x in ESe with LFRU
            open content-item
    else
        break
    end if
end for
```

Algorithm 1 represents the *CDA* procedure operating on *CDS* of the proposed scenario, during the interaction with a user who tries access a web page. In particular, when the user requests a content-item its *PS* request evaluated with the data-item *x*. When this request received the data-item *x* evaluated and checked if it is related even to *HTTP* or *HTTPs*, in order to proceed accordingly to the next procedure. Then, depending on the case, it follows the corresponding steps. In case of $x = HTTPs$ (value of *y*), the content-item is re-evaluated if it is already exist, by a previous connection, in the *CSe* storage space, and if it is not the content-item stored with the use of *LFRU* algorithm. Respectively, in case of $x = HTTP$ (value of *z*), also, the content-item is re-evaluated if it is already exist, by a previous connection, in the *ESe* storage space, and if it is not the content-item stored with the use of *LFRU* algorithm. Consequently, in both cases with the use of *LFRU* algorithm that operates simultaneously and subsequently of the proposed algorithm the user would be able to access the requested web page. In each case, the running time of Algorithm 1 (*CDA*) is estimated less than 3 to 5 seconds, regarding the need of quick response to the client and relaying to the calculations which need to be done in any case. The *CDA* improves the communication of the proposed system providing more direct and faster response of the *LS* to each user requests a connection. *CDA* scenario leads us to leads us to a more energy efficient operation of the system, which is presented in more detail in Section 5 below. Moreover, regarding the complexity of *CDA* is very low due to lack of multiple variables, and the importance of the hardware infrastructure in each occasion.

IV. Comparative Analysis

The study of previous works cites us relevant frameworks and systems proposals for assorted types of wireless networks, based in different cache types, which on several occasions supported and combined with other technologies, such as BD and CC. In this section we will make a brief study of relative works and proposals of frameworks with cache-based scenarios.

On the study conducted we singled out four (five) previous framework proposals relating to wireless networks with cache scenarios. Here, there will be a comparison between some features and the technical specifications of each proposed system.

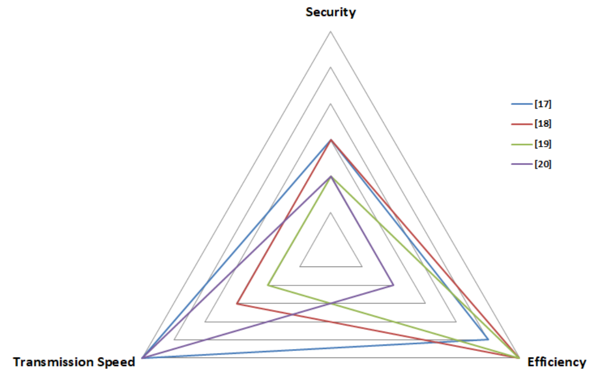

Figure 4: Comparative analysis of basic Framework's features.

TABLE I
FRAMEWORK COMPARATIVE ANALYSIS

Relative Works	[17]	[18]	[19]	[20]
Based Network	Wireless / Wired	5G wireless network	5G wireless network	Mobile wireless network
Cache Type	Local-based Conventional Server	Cloud-based (CDH4)	Cloud-based	Local-based Conventional Server
Supported Types	all types	all types	all types	all types
Mobility	No	Yes	Yes	Yes

As we can observe from Table 1 and Figure 4 most former works deal with the Efficiency of the network. On the hand, the relative works which studied in deal less with the Security of the network. Also, another feature of the wireless networks is the Transmission Speed, but only two of the four relative works deal with this feature, with the aim to provide high-speed transmission. Moreover, to offer a better analysis of Figure 4, we can specify that the 'short' cylinders describe the Low contribution and the 'tall' cylinders describe the High contribution. In addition to this, as we can observe from Table 1, the most proposed of network scenarios use Cloud-based cache storage, this could initial lead us that CC recommended for cache systems, but in addition we have the opportunity to propose a new scenario for cache systems based on EC. Furthermore, both four former works used a wireless network for their proposed scenarios, in two cases this wireless network based on 5G. Another notable feature drawn from Table 1 is the mobility that 3 of the 4 former works adopted into their scenario. Count on Table 1 and Figure 4 we can conclude that the proposed new scenario would be good to operate through a modern wireless network, including the feature of mobility and certainly assisted by a Cloud-based server or in general a Fog-based server.

Thus, the main purpose of these works is to provide secure and quality transmission procedure through a novel wireless network environment, such 6G, based on an integrated model for the cache system.

V. Experimental Results

By implementing the proposed scenario-framework in our campus, we have tested its efficiency and its security on sharing and managing our data.

We perform a number of measurements through which we can realize that we have done a good effort, but however there also many other improvements need to be done.

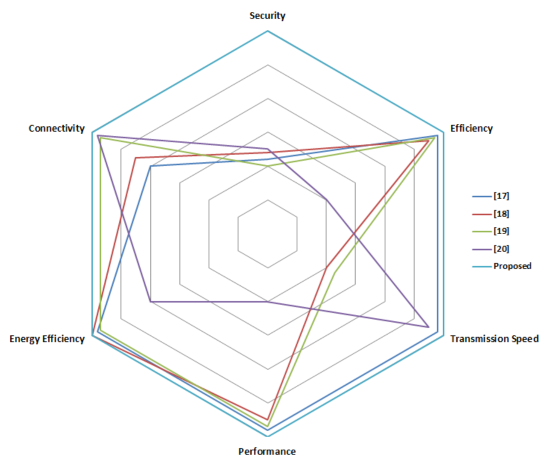

Figure 5: Frameworks comparison including proposed.

Figure 5 demonstrates the features from former works frameworks compared to our proposed framework. The features that we choose to compare are: *Security*, *Efficiency*, *Transmission Speed*, *Performance*, *Energy Efficiency* and *Connectivity*. As we can observe, our proposed scenario reaches the "*High Level*" of contribution and operation of these features than the former scenarios. We have better contribution in the Security level, which is the main objective in data, due to their value. For better understanding, we offer Table 2 which lists the compares features of all frameworks too in a different point of view.

TABLE II
Frameworks Comparison Including Proposed

Relative Works	**[17]**	**[18]**	**[19]**	**[20]**	**Proposed**
Security	Low	Low	Low	Low	High
Efficiency	High	High	High	Low	High
Transmission Speed	High	Low	Low	High	High
Performance	High	High	High	Low	High
Energy Efficiency	High	High	High	Medium	High
Connectivity	Medium	Medium	High	High	High

Moreover, Table 2 demonstrates the selected features as they are mentioned/used in each of the previous works studied and compared here. In contrast to the previous work that has been done, we notice that our proposal is more concerned with the *Security*. While, we can observe that like our proposal so most of the former proposals (3 out of 4) deal with both *Energy Efficiency* and *Performance*.

With the aim to study further the power consumption and the efficiency of the proposed system we have adapted and implemented the following equations:

$$PC = PO * (TT + CT + RT) \qquad (1)$$

$$EE = \frac{\left(\frac{DA}{CS} * PO\right)}{PC} \qquad (2)$$

TABLE III
Data Used

Abbreviation	**Description**	**Abbreviation**	**Description**
CS	Cache Speed	*PC*	Power Consumption
CT	Connection Time	*PO*	Power
DA	Data	*RT*	Reply Time
EE	Energy Efficiency	*TT*	Transmission Time

Table 3 demonstrates what each abbreviation represents. Moreover, it shows all the information we used in order to calculate the energy efficiency of our proposed system.

Equation (1) calculates the Power Consumption (PC) of the system by multiplying the Power used with the summary of all Time, which are Transmission Time, Connection Time and Reply Time. All time parameters affect the energy consumption of the system, as based on each time; more energy is consumed in the system.

Equation (2) calculates the Energy Efficiency (EE) of our proposed system by dividing the product of the division of Data with Cache Speed and Power, all this divided with the Power Consumption of the proposed system.

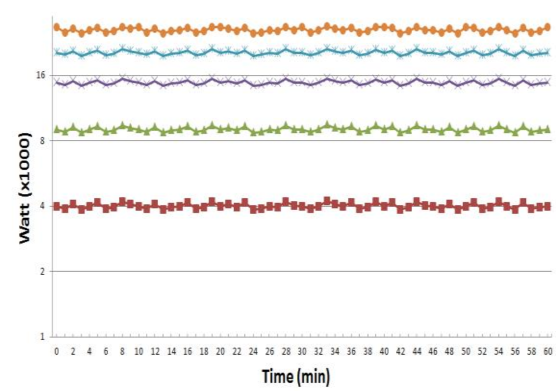

Figure 6: Frameworks comparison including proposed.

Initially, to be more specific, in Figure 6 the following clarifications are given: orange line represents Raichura & Padhariya work [20], light blue line represents Jin et al. work [18], purple line represents Li et al. work [19], green line represents Luo et al. work [17], and red line represents our proposed system. Figure 6 presents the Power Consumption (PC) of our proposed system in the duration of time, compared to other systems studied in this work. We can realize that our system could be characterized as energy efficient due to its unchanged energy consumption during its operation and the less power needed compared to the other systems.

Concluding, we can add a System of Extremely Scale Analytics tool in our proposed system in order to exploit all the data stored in our Cache Servers in order to extract useful information about the use and the reliability of the network. Something that we can deduce in the first instance, relaying on the results presented in Figure 6.

TABLE IV
POWER CONSUMPTION COMPARISON

Systems	Time (min)							
	0	5	10	15	20	25	30	
Proposed	4	4	4	4	4	4	4	**Watt (x1000)**
[17]	5	5	5	5	5	5	5	
[18]	5,8	5,8	5,8	5,8	5,8	5,8	5,8	
[19]	5,5	5,5	5,5	5,5	5,5	5,5	5,5	
[20]	6,5	6,5	6,5	6,5	6,5	6,5	6,5	

Table 4 additionally represents with more information the Power Consumption of the related systems in comparison with our proposed system in numerical details. In detailed, Table 4 demonstrates the power consumption measured in Watts at 7 time points within the time period measured in minutes. These numbers / elements resulted from the application of equations (1) and (2) both in the previous 4 works and in our proposed scenario.

Furthermore, Figure 7, Figure 8 and Figure 9 describe the better Energy Efficiency offered in an academic framework implementing our proposed scenario. As we can observe our proposed scenario needs less energy power than the others through the time of its use. This can offer to the academic society a better option of energy consumption and offer a more environmental friendly framework.

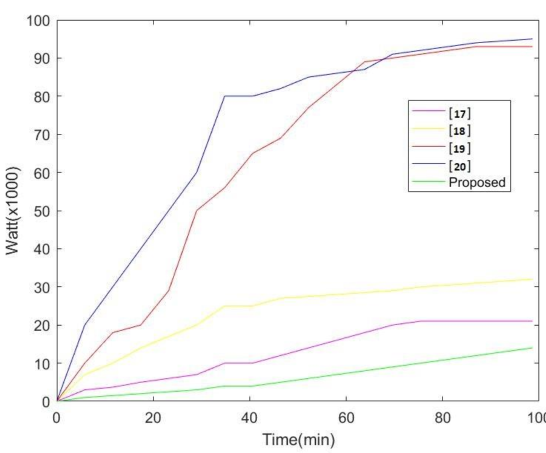

Figure 7: Energy Efficiency Comparison (a).

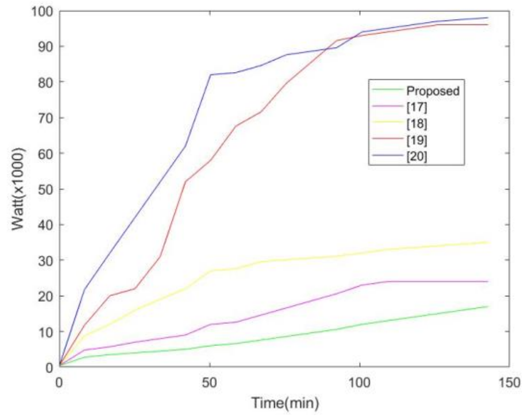

Figure 8: Energy Efficiency Comparison (b).

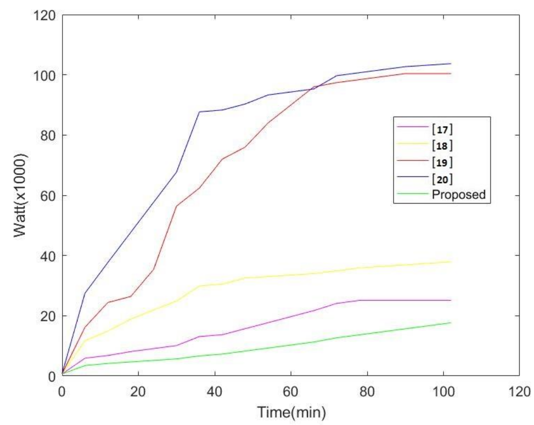

Figure 9: Energy Efficiency Comparison (c).

Furthermore, in Figures 7, 8 and 9 the following clarifications are given: blue line represents Raichura & Padhariya work [20], yellow line represents Jin et al. work [18], red line represents Li et al. work [19], purple line represents Luo et al. work [17], and green line represents our proposed scenario.

VI. CONCLUSION & FUTURE DIRECTIONS

With this work we aim to offer a better scenario on a Cache Decision System of a Smart Building established on a University campus through a wireless network. Through this wireless network we can combine the functions of IoT, CC, EC and BD which play a vital role in telecommunications field. Regarding the telecommunications sector, the wireless network of the intelligent-smart building was based on 6G technology, with all the benefits this technology offers. Thus, as a main purpose, this work proposes a novel CDS through a 6G wireless network, which will offer to the users, safer and efficient environment for browsing the internet, sharing and managing large-scale data in the fog. The proposed CDS consisted of two types of servers, one CSe and one ESe. In order to come up with our proposal, we have studied related caching system scenarios from former works, which are listed and presented in this paper.

As future work, it is planned to improve our proposed system and investigate for an even better CDA for the CDS in which all necessary configurations will be taken into consideration, such as every services that will be provided by the Intelligent Building to the users that have access on it. Last but not least, this research could be a start point for better and more efficient wireless networking scenario, for managing and sharing Big Data on a Smart Building. Furthermore, as an extension of the proposed scenario, it is planned to be tested on a Smart Hospital, due to the meaning of the data used and transferred on a hospital, which are needed to be secured and immediately accessible. Thus, as case study for the future, we can implement an Extremely Scale Analytics System (ESAS), relaying on the experimental results of this work. The ESAS would be installed in the central server of proposed CDS, and so it will take advantage of the system's efficient operation settled in the SB.

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