The Topology of Disaster Notification System in a College Utilizing Smartphone Devices

Ahmad Sanmorino, Herri Setiawan, John Rony Coyanda, Rendra Gustriansyah, Husnawati

Abstract: ***Through this paper, we want to propose a disaster notification system in a college utilizing Smartphone devices. The proposed disaster notification system is still in the form of preliminary topology as a first step in designing the system. In this study, the topology of the disaster notification system intended for a college environment, with students as end-users. In an ideal condition, by using the proposed topology, the notification system can reach 100% accuracy in providing disaster information to the students. But if there is much disturbance, it could be a different case. We will discuss some obstacles and shortcomings from the proposed topology in future research.***

Keywords: ***Topology, Disaster, Notification System, College, Smartphone***

I. INTRODUCTION

If a disaster comes suddenly, anyone feels difficult to escape from the danger, but if there is a notice before or when the disaster is still far away, we as human beings can think and prepare to avoid disaster. That is the first idea behind us to try to make a disaster notification system in the college environment. This disaster notification system works by providing notifications on Smartphone devices that student use. We use Smartphone devices because based on our observations; smartphones are devices that are always with the student especially in the college environment. The utilization of notifications on Smartphone devices for various purposes already done by some researchers [1]-[5]. One of them is research that uses notification on Smartphone devices to tell the closest route to a safe place from the area that is hit by a natural disaster [6]. Other researchers used a notification system to give information about bus routes and bus stations within a city [7].

There is also research focused on the performance and features provided by the notification system [8]. For research related to the computer network [9][10], the notification system can also be used to tell wireless network hotspot information somewhere [11]. For the study, we did focus on the notification system for disaster warning in a college.

Revised Manuscript Received on September 22, 2019.

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The notification system like other systems is also an alternative system [12], which focuses on ways to handle a problem or a situation. Which mean the work of proposed topology not to estimate or predict the situation [13], but to give information about disaster event, so the student can run or avoid it. If it is part of the integrated system it is certain that the notification system is also vulnerable to cyber-crime, therefore we can ignore the security aspect. Our hopes with our proposed topology become a reference for anyone who wants to build a notification system for the community especially when the disaster happens in college.

II. METHODOLOGY

The method is the logical and systematic steps used to meet the research goals. The research conducted will stay focused and match with the goals set in the beginning. The research method used (Fig. 1) is as follows:

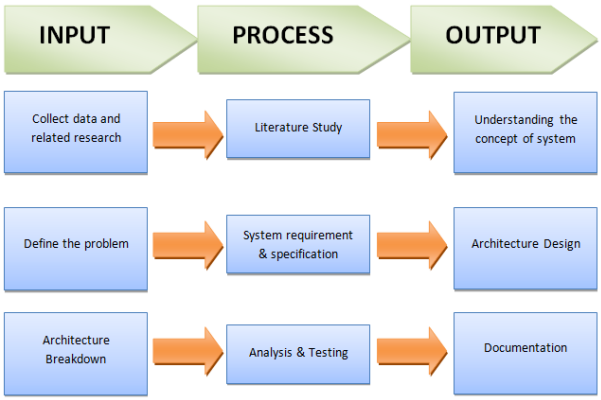

Fig. 1 Research Steps

We use the method consists of three main parts, namely input, process, and output. Then, the explanation of each stage of the research method above is:

A. Collect the data and Related Research

The first step we take is to collect the data and articles related to the research. We study the related research by searching the article on online journal directory. The data and articles obtained are filtered, to get the information relevant to the research. Data obtained in two ways, first, primary data is by conducting direct observation and second, secondary data collected by other researchers.

B. The Literature Study and Understanding the Concept of the System

After filtering, the next step is to study and understand the discussion in the article by other researchers. Conduct literature study articles obtained from the earlier stage.

C. Define the Problem and Find the System Requirement

Based on the literature study, we tried to define the problem. Furthermore, we do logical steps to solve the problem. At this stage also defined the needs of the system that will be the solution to the problems found.

D. Topology Design and Topology Breakdown

The topology design is the core of our research. After knowing the needs and specifications of the system, we try to make the topology of a disaster notification system as the answer to the problems. The topology design involves all the components needed in developing a notification system. In other words, the design of topology made based on components in the notification system. After designing the topology of the notification system, then we do topology breakdown to get detail solution to the problem. So based on the breakdown of our proposed topology, will help the steps of the developer in the implementation phase of the real notification system.

E. Analysis, Testing and Documentation

Next step, we carried analysis and testing of disaster notification system topology in the earlier stage and then, we compare the proposed topology performance to other system topology.

III. RESULTS AND DISCUSSION

Direct discussion on the topology design that we propose, assuming the student already registered to the service provider notification system. Therefore, we do not discuss the process of registering token or student ID from the beginning.

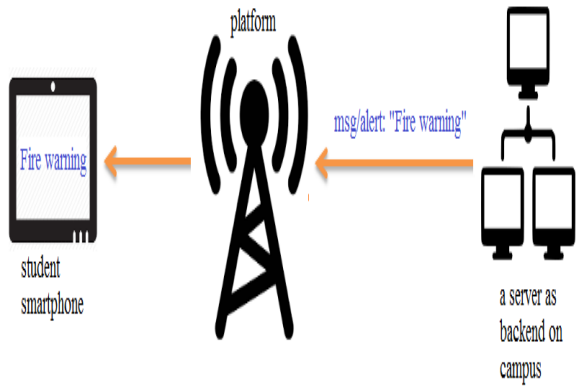

Fig. 2 Basic Topology of Disaster Notification System

Basic topology (Fig. 2) shows the simple mechanism of our notification system. Understanding the basic topology will decrease the failure of more complex topology. As a result of failure has to repeat everything from scratch. Back-end on campus sends disaster notification messages to the service platform for next broadcast to all Smartphone devices of students who have already registered. In the example above explain a message of fire warning disaster notification in the college environment, the basic topology is still one on one, one back-end app, one mobile platform and one client.

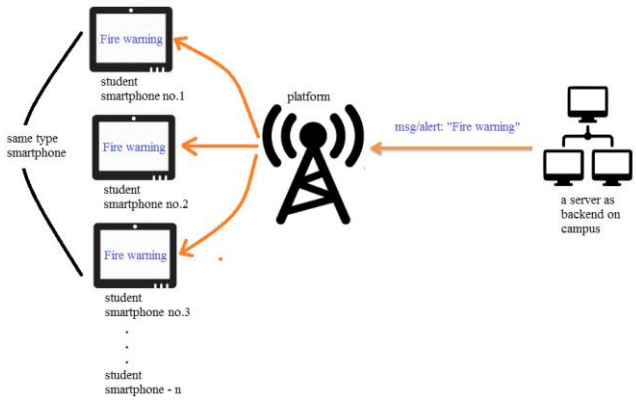

Fig. 3 The Notification System with Several Smartphone as Clients

In Figure 3, the mobile service platform sends a disaster notification message to some students (n). With a note, here students use the same type of smartphone. For other types of smartphones, back-end apps on the server-side should send notification messages to other mobile platforms. Currently, there are many platforms for notification service providers. But the problem is, if the type of smartphone device used is heterogeneous, requiring operators in the college to send the same message to each mobile platform (Fig. 4).

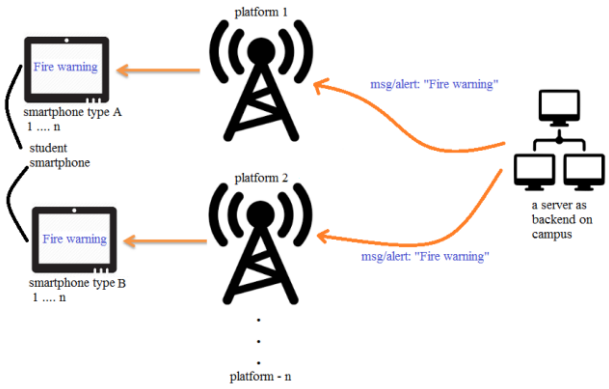

Fig. 4 The Topology Notification System with Several Mobile Platform Service

Knowing that a disaster happened, the students told the other students, to run to a safe and conducive place. Here is a simple code sample that used to send fire disaster notification messages for Android Smartphone. The example is in a Script language, which used for multi-platform.

{“data” : {“msg” : “Fire Warning” hub.send(“{msg_EN: “Fire Warning”} “); } }

Testing by comparing our proposed topology with other notification methods. Next, in Table 1 we tried to compare the notification system topology that we proposed to the traditional method and client-request topology in giving the disaster information.

Table. 1 A Brief Comparison between Proposed Topology (PT), the Traditional Method (TM) and Client-Request Topology (CT)

Parameter	PT	TM	CT
Multi-Platform	√		
High-Cost Topology		√	
Simultaneous	√		
Time Complexity		√	√
Dependency to platform	√		√
One-on-One Service	√	√	√
Capacity Availability	√		√
Dependency to Technology	√		√
Easy to Fix	√	√	√
Familiar to User	√	√	√

The traditional methods is a way of delivering notice of disaster coming with traditional media, announcement board or from one to another without the use of technology, while the client-request topology is a notification system topology that works if there is a request from the client. In other words, the notification system based on this topology works in one direction. Table 1 shows the notification system topology that we propose to support multi-platform services simultaneously, very familiar with users and a low-cost system. But behind the advantages of the notification system topology proposed, there are also various disadvantages. One of the drawbacks is the dependency reason with the mobile platform service. If the mobile platform service is not available, then the disaster notification service system cannot be used. But this is very rare, even almost 0%, so this limitation does not become a significant problem. Its mean, in an ideal condition, by using the proposed topology, the notification system can reach 100% accuracy in providing disaster information to the students. The only reason that can cut accuracy is the difference in the number registered with the number used by end-users. This happens because of several factors, such as end-users losing a Smartphone that has a registered number or deliberately changing a number that registered with another number.

The further the distance between the mobile platform and the end-users, the longer it takes to send a notification message, and vice versa. This happens because of the decrease in signal strength and can also be caused due to bad weather. The solutions that are now available, such as signal booster devices and collaboration between operators expected to accelerate the time to delivered disaster notification to the students as end-users. The notification system topology that we propose intended for multi-platform environments, such as the iOS, Android and BlackBerry. The topology of the disaster notification system we proposed just preliminary design or software model [14] from the system, so we have not done comprehensive testing. For testing part of the topology devices that we propose, namely sending of notification messages done by other researchers [15][16][17]. This test uses a notification message delivery on an Android device. The performance testing of the notification system (push) on the Android platform seen in the following chart (Fig. 6):

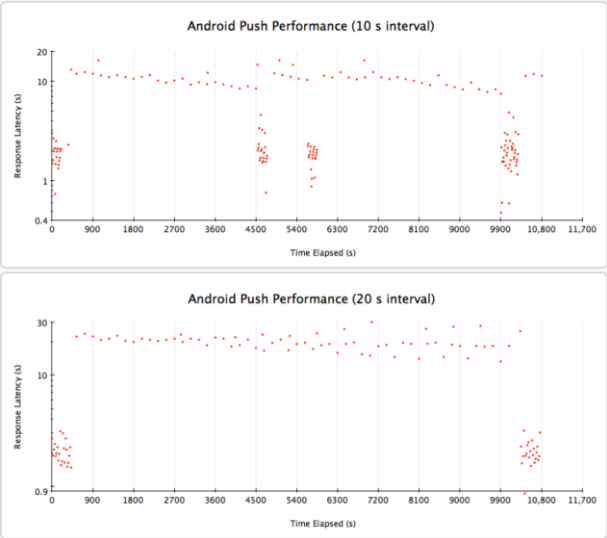

Fig. 6 The performance testing of the notification system (push) on the Android platform [16]

Test results in Fig. 6 show that there are restrictions on the number of notifications for the same device sent simultaneously. This seen when sending notification messages to the same device more than once in a period of 180 seconds. This is based on Android GCM docs which state that sending notifications (push) to the same device limited using the token bucket scheme [17]. Based on this reference also [16], note that the notification limitation using the token bucket scheme only exists on the Android platform, this does not apply to iOS and BlackBerry platforms. However, overall the notification (push) system performance on the Android platform is still in the good category. In the future, the topology of the disaster notification system we proposed can become integrated into college integrated system. So that information is easily synchronized and easy to find if needed, or it can also be used as a medium for distance learning and other learning tools that lecturer and college students can use.

IV. CONCLUSIONS

With the disaster notification system topology that we propose expected to become an alternative for anyone who wants to build a disaster notification system, especially in the college environment, to reduce damage and casualties, when a disaster occurs. The main contribution from the topology we proposed that is can increase the accuracy of disaster notification broadcasting. In an ideal condition, by using the proposed topology, the notification system can reach 100% accuracy in providing disaster information to the students. But if there is much disturbance, it could be a different case. We will discuss some obstacles and shortcomings from the proposed topology in future research.

ACKNOWLEDGMENT

We would like to thank you to Universitas Indo Global Mandiri (UIGM) for supporting this study.

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