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Performance Analysis and Implementation of Control Tower for CCTV Sites

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Abstract. In this thesis, the performance analysis was conducted using Emulab environment of KISTI as to the main functions of CCTV site integrated management. Also, an effective CT4CS (Control Tower for CCTV Sites) was designed and implemented for an integrated management of large-scale CCTV sites by utilizing the performance analysis results.

Keywords: CCTV site, integrated management, performance, implementation

1 Introduction

In South Korea, the deployment of video controlling system will be completed at all the municipalities nationwide until 2015 under the leadership of the government. The main functions of video controlling system are real-time monitoring of video data through network and search and log management of saved video data [1]. There are still some disruptions to the normal operation resulting from a failure of the equipment caused by an abnormality associated with the use and installation of equipment despite the rapid development of ICT technologies.

It is required to implement an integrated management as to the configuration, failure and power in order to stop the service as to hundreds of CCTV sites and minimize the on-site dispatch of maintenance staffs. In this thesis, the performance analysis was conducted using Emulab environment [2] of KISTI as to the main functions of CCTV site integrated management. Also, CT4CS (Control Tower for CCTV Sites) was designed and implemented for an integrated management of large-scale CCTV sites by utilizing the performance analysis results.

2 Related studies

2.1 SNMP and PING based management

As for the functional limitations such as processing of a large amount of data at SNMP (Simple Network Management Protocol) and the limited data representation,

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they were complemented through SNMPv2. Also, the security technique was improved by means of SNMPv3. Despite the improved version, it is still difficult for SNMP using the connectionless transport layer to respond effectively to an increase of network size and management information due to the limited data representation, message length and reliability [3]. PING (Packet Internet Grouper) is widely used for real-time failure management as a complementary tool of SNMP used in the general-purpose network management. In [4], the network load state for the campus network using the delay time and response presence of PING message was verified.

2.2 Video controlling system and power distribution unit

The main function of those video controlling systems such as 3VR and Verint of the United States, Bosch of Germany and XIDE-SD of South Korea is the video monitoring function rather than the integrated management of a site [1]. PDU (Power Distribution Unit), which is installed for the site power management, is classified into meter-type PDU allowing for current measurement and intelligent-type PDU allowing for on/off control of each power port. The intelligent PDU products are estimated to grow at a twice faster rate than those non-intelligent types until 2017 [5].

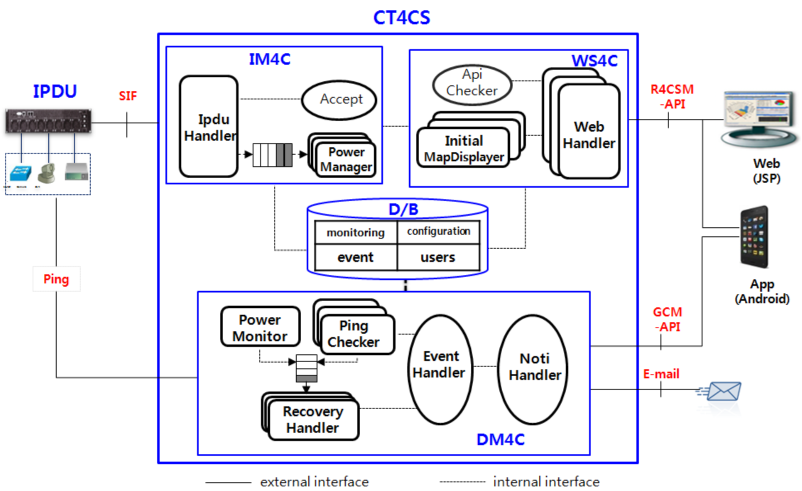

Fig. 1. CT4CS configuration

3 CT4CS performance analysis and implementation

As shown in Fig.1, the centralized integrated management system (CT4CS) performs comprehensively the configuration and failure management for the video and network equipments at CCTV sites and also the remote power management through IPDU (Intelligent Power Distribution Unit).

3.1 Performance analysis and implementation of WS4C and IM4C

WS4C (Web Server for CT4CS) module is consisted of WebHandler thread generated for each request through GUI as shown in Figure 1 and ApiChecker and InitialMapDisplayer that are called from each thread. ApiChecker verifies the effectiveness of REST-API. InitialMapDisplayer performs the function of outputting locations of CCTV sites registered in D/B on the map whenever the event monitoring is requested by an administrator. It took 37 seconds for InitialMapDisplayer of a single thread implementation and 7 seconds for 5 multiple threads in the case of outputting 100 CCTV sites. InitialMapDisplayer was implemented through the multiple threads in order to minimize the time to take for outputting locations of numerous sites.

IpduHandler thread of IM4C (IPDU Manager for CT4CS) module delivers the response and notification message from IPDUs to the message queue so that PowerManager thread can process it. Fig. 2 represents the processing time in accordance with the arrival rate of IPDU notification message as to the implementation structure of PowerManager thread. The dynamic structure has an advantage in terms of processing time as compared with the static structure. However, it may also increase system load due to the excessively generated threads resulting from a high message arrival rate and also the complexity of operation. PowerManager thread of IM4C was implemented through two static structures in order to process notification messages in real time, which are received from IPDUs of numerous CCTV sites.

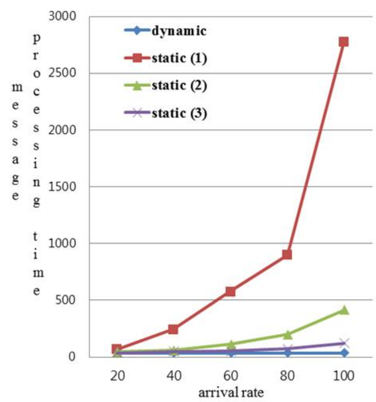

Fig. 2. Message processing time as to implementation structure of threads

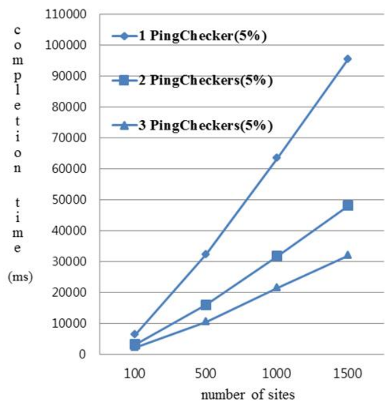

Fig. 3. Inspection time in accordance with failure rate and the number of threads

3.2 Performance analysis and implementation of DM4C

PingChecker thread of DM4C (Device Manager for CT4CS) module checks out the network status of each device periodically by using PING and inserts a recovery event to the message queue when a failure is detected. RecoveryHandler thread dynamically generates a thread that will recover a failure by reading the recovery event of the message queue. A recovery thread recovers a failure of the equipment remotely since it turns on again the power of equipment through IPDU.

Fig. 3 represents the inspection completion time of PING in accordance with the number of CCTV sites, the failure rate of PING and the number of PingChecker threads. This study assumed that each CCTV site has 3 devices to be checked by PING message and granted a delay time and PING failure rate for a similar performance analysis to an actual environment. PingChecker implemented by multiple threads is able to perform PING test concurrently. It is on standby until the completion of PING response time for the equipment having a failure in relation to the sequential inspection implemented by a single thread. Thus, the overall inspection completion time will be increased. In the case in which PingChecker had 2 threads, the inspection completion time was measured at 31,836ms for 1,000 sites.

4 Conclusion

We performed the performance analysis as to the main functions of integrated management in order to determine an effective CT4CS structure for a large-scale CCTV site. PowerManager was implemented through 2 static threads in order to process in real time the notification messages received from IPDUs of numerous sites. PingChecker was implemented through 2 static threads for PINC inspection of 60 second cycle at an environment having 5 percent failure probability in relation to the network status of equipment installed at the 1,000 sites. It was confirmed that the implementation of InitialMapDiplayer through multiple threads was decreased by 81 percent as compared with the implementation of a single thread for the output of 100 sites.

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