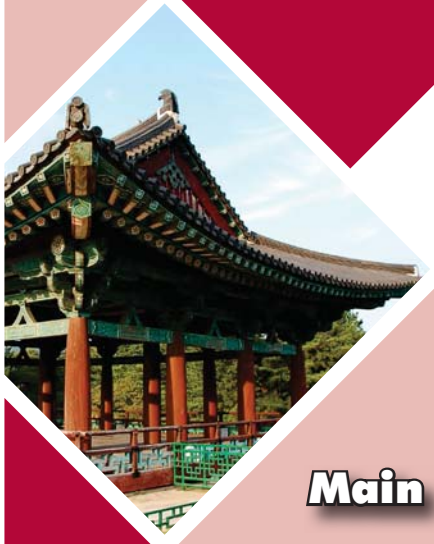
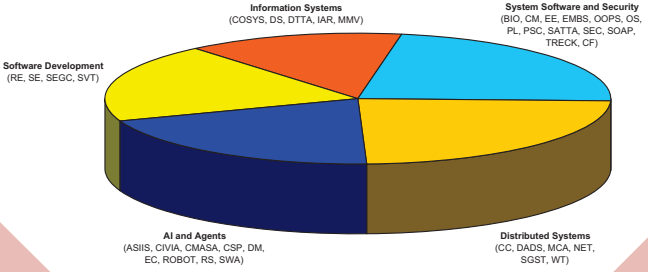
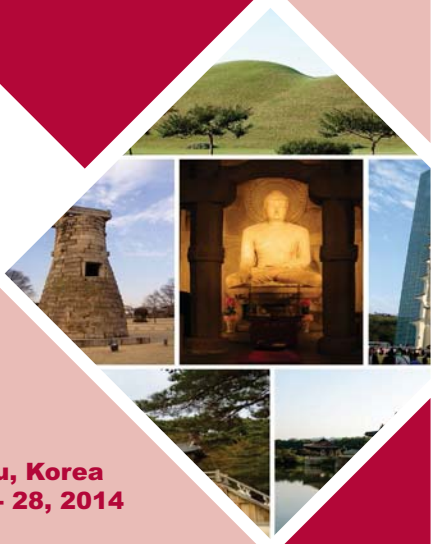
2014
Symposium on Applied Computing







Association for Computing Machinery

Advancing Computing as a Science & Profession

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Gyeongju, Korea
March 24 - 28, 2014

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APPLIED COMPUTING 2014

The 29th Annual ACM Symposium on Applied Computing

PROCEEDINGS OF THE 2014 ACM
SYMPOSIUM ON APPLIED COMPUTING

Gyeongju, Korea
March 24-28, 2014

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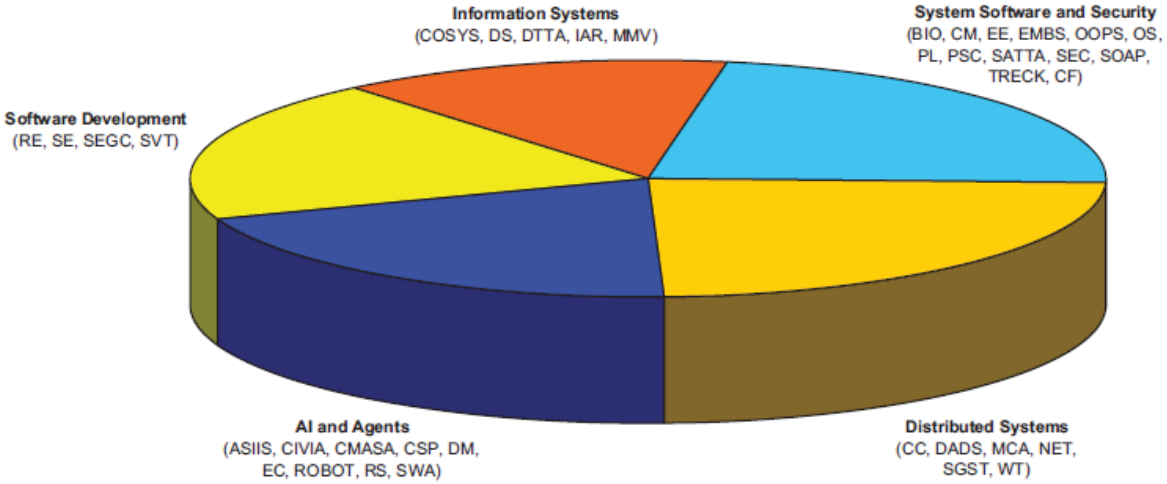

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Generative Adaptation of Model Transformation Assets: Experiences, Lessons and Drawbacks
Fábio Paulo Basso, Raquel Mainardi Pillat, Toacy Cavalcante Oliveira, and Marcos Didonet Del Fabro

A Hierarchical Model for Traceability between Requirements and Architecture
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On the Impact of Obliviousness and Quantification on Model Composition Effort
Everton Guimaraes, Alessandro Garcia, and Kleinner Farias

Research Challenges in Business Process Adaptability
Riccardo Cognini, Flavio Corradini, Stefania Gnesi, Andrea Polini, and Barbara Re

POSTERS LISTING

THU 9:40 - 12:50 TBD
Poster Session I

(ACI1) Advanced and Convergent IT

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Modeling for Context-Aware Healthcare Service using Ontology
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A Novel Double Linear–Cubic Convolution Interpolation for Digital Image Scaling
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Performance Analysis of the Golden-SM in the V2V Network
Myung Chul Park and Dong Seog Han

Matrix Correlation Distance for 2D Image Classification
Hyunsoek Choi, Jeongin Seo, and Hyeyoung Park

A New Device Discovery Scheme in Lighting Control Networks
Sang-Il Choi, Seoki-Joo Koh, Insu Kim, Sang-Kyu Lim, and Tae-Gyu Kang

Impacts of Delayed Replication on the Key-Value Store
Minwoo Jang, Woochur Kim, Yookun Cho, and Jiman Hong

(BHI) BioHealth Informatics Track

Similar MRI Object Retrieval based on Modified Contour to Centroid Triangulation with Arc Difference Rate
Byung K. Jung, Sung Y. Shin, Wei Wang, Hyung D. Choi, and Jeong K. Pack

Design and Implementation of a Personal Health Monitoring System with an Effective SVM-Based PVC Detection Algorithm in Cardiology
Huan Chen, Guo-Tan Liao, Yao-Chung Fan, Bo-Chao Cheng, Cheng-Min Chen, and Ting-Chun Kuo

A Low Cost Digital Operating Room
A. Klinger, G.L. de Lima, V. Roesler, G. Maron, G. Longoni, V. Goulart, F.S. dos Santos, M.D. Ferreira, and M.B. Mariano

(CC) Cloud Computing Track

Experimenting on Virtual Machines Co-Residency in the Cloud: A Comparative Study of Available Test Beds
Abdulaziz Alabdulhafez and Paul Ezhilchelvan

Towards Better Manageability of Database Clusters on Cloud Computing Platforms
Miguel G. Xavier, Israel C. De Oliveira, Robson D. Dos Passos, and Cesar A.F. De Rose

(COSYS) Cooperative Systems Track

Redesigning Transaction Load Balancing on Electronic Funds Transfer Scenarios
Rodrigo da Rosa Righi, Cristiano André da Costa, Luis Gonzaga, Kleinner Farias, Alexandre Luis Andrade, and Lucas Graebin

Towards a Learning Design Authoring Tool that Generates Personalized Units of Learning for CSCL
Geiser Chalco Challco and Seiji Isotani

Choosing my Partners based on How They will Evaluate my Behavior
Elane Cristina da Rocha Cardoso Saraiva and Viviane Torres da Silva

(DADS) Dependable and Adaptive Distributed Systems Track

Hierarchical Topology Adaptation for Distributed Convergecast Applications
Sandip Chakraborty, Suchetana Chakraborty, Sushanta Karmakar, and Hridoy Sankar Dutta

An Energy-Aware Service Composition Framework for Service-Oriented Wireless Sensor Networks
Tao Wang, Ke Zhang, and Lianglun Cheng

(DM) Data Mining Track

The Discovery of user Related Rare Sequential Patterns of Topics in the Internet Document Stream
Zhongyi Hu, Hongan Wang, and Jiaqi Zhu

(DTTA) Database Theory, Technology and Applications Track

Speaking in Tongues: SQL Access to NoSQL Systems
Julian Rith, Philipp S. Lehmayr, and Klaus Meyer-Wegener

A Test Framework for Large Scale Declarative Queries: Preliminary Results
Amin Mesmoudi and Mohand-Saïd Hacid

(EC) Applications of Evolutionary Computing Track

Mirrored Orthogonal Sampling with Pairwise Selection in Evolution Strategies
Hao Wang, Michael Emmerich, and Thomas Bäck

A New Device Discovery Scheme in Lighting Control Networks

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ABSTRACT
In the Remote Device Management (RDM) protocol, lighting devices are discovered by conducting a simple binary search based on the 48-bit Unique ID (UID). However, the existing binary search scheme tends to require large delay for device discovery. In this paper we propose a partition-based discovery scheme in RDM. From numerical simulations, we can see that the proposed partition-based scheme can reduce the device discovery time, compared to the existing binary search scheme.

Categories and Subject Descriptors
G.4 [**Programming Languages**]: Language Constructs and Features

General Terms
Algorithms, Experimentation

Keywords
RDM, Device Discovery, Partition-based

1. INTRODUCTION

Some protocols for device management have so far been made, which include the Digital Multiplex 512-A (DMX512-A) and the Remote Device Management (RDM) [1, 2]. In RDM, the controller uses a simple binary search scheme, based on the 48-bit Unique ID (UID). However, this existing device discovery scheme using a simple binary search tree tends to require large discovery time to explore theoretically 2^{48} possible devices.

In this paper, we propose a partition-based discovery scheme for device discovery in RDM. In the proposed scheme, all devices are divided into several partitions as per the device UID, and the controller performs the device discovery for each partition with a response timer for devices.

2. EXISTING DISCOVERY SCHEME

In RDM, a simple binary search scheme is used for device discovery based on 48-bit UID. In the existing discovery scheme, a controller performs a binary search for devices with UIDs ranged from 0 to 2^{48}. Initially, the controller sets the UID *search range* with (*lower, upper*) and sends a discovery message to all of the devices in the RDM network. If a single response message is responded to the controller, the corresponding device will be successfully found. Otherwise, if two or more devices respond to controller at the same time, the controller cannot process the multiple response messages due to collisions or corruption on the RDM link. In this case, the controller will divide the UID search range into the two parts: (*lower, mid*) and (*mid+1,upper*) as per the binary search algorithm. This search process will be repeated, until all devices in the network are found.

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3. PROPOSED DISCOVERY SCHEME

In the proposed scheme, all devices in the network are grouped into N_p partitions. Given the number of partitions (N_p), the partition of a device (0, 1, .., N_p-1) is determined by using the *modulo* (%) operator and the device UID, as follows: *Partition of device UID = UID % N_p.*

Then, the proposed device discovery scheme is performed for each partition, as summarized in Fig. 1.

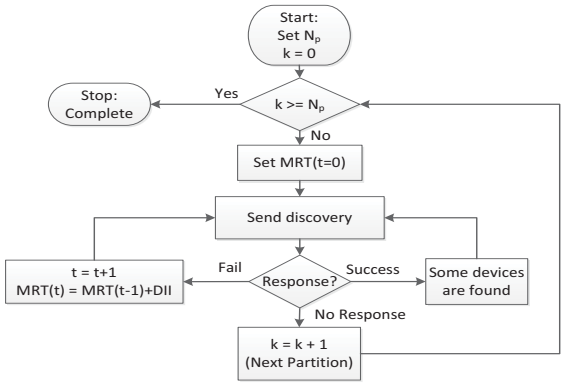

Figure 1. Proposed device discovery scheme

For each partition *k*, a controller first sends a discovery message to all devices. Then, all of the devices that belong to the partition shall respond to controller. If two or more response messages are generated at the same time, the controller fails to discover those devices due to collisions. Thus, to reduce the possibility of multiple responses, we employ the *Maximum Response Timer* (*MRT*) for devices. That is, when a device receives a discovery message from controller, it responds to the controller only after a certain waiting time which is randomly generated with a range of (0, *MRT*) by the device. This timer will facilitate to reduce the probability of multiple responses from many devices, and thus to increase the possibility of a single (successful) response.

In the figure, the responses from devices can be classified into the following three cases:

- ✧ *Fail Response*, in which all of the responses have arrived at controller at the same time and thus those are corrupted. The controller shall re-discover the devices after increasing the *MRT* timer by *Delay Increase Interval* (*DII*);
- ✧ *Success Response*, in which some of the responses have arrived at controller with different time intervals. However, the remaining devices shall be re-discovered;
- ✧ *No Response*, which means that there is no device to be further discovered in the partition. Go to the next partition.

In the case of *Fail Response*, the controller adjusts the *MRT* timer as '*MRT* + *Delay Increase Interval (DII)*', and then sends a discovery message to the devices again, as shown in the figure. In the *Success Response* case, some devices are found, but there are more devices to be discovered in the partition. These procedures will be repeated for each partition until all of the devices in the network have been discovered.

4. PERFORMANCE ANALYSIS

To evaluate the performance of the proposed scheme, we compare the device discovery time. For numerical analysis, we use the MATLAB [3].

For analysis, we set a unit transaction time of the discovery-response messages between controller and devices as 1 second. In the proposed scheme, the unit of time slot associated with *Maximum Response Time* (*MRT*) and *Delay Increase Interval* is set as 0.0028 second by referring to [2]. For example, a device responds to controller after the *MRT* x 0.0028 seconds, when it receives a discovery message from the controller. The initial *MRT* is set to 10 time slots.

Fig. 2 shows the impacts of N_p and the number of devices on device discovery time, in which *DII* is set to 10 time slots. From the figure, we can see that the device discovery time tends to get larger, as the number of devices increases. In the meantime, N_p gives slight impacts on the performance for the same number of devices. From the results, it is noted that there may be an optimal number of N_p for a given number of devices. For example, for 2^{10} devices, N_p = 3 gives the best performance, whereas the device discovery time is minimized at N_p = 6 when there are 2^{12} devices in the network.

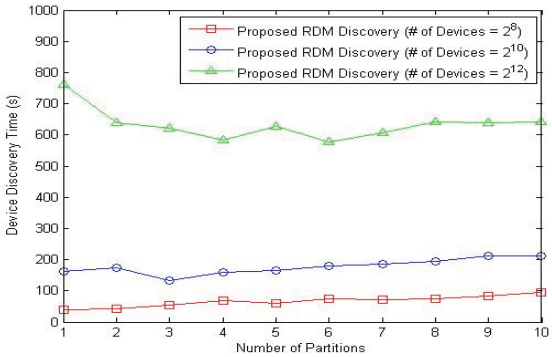

Figure 2. Impact of N_p and the number of devices on discovery time in the proposed scheme.

Fig. 3 compares the overall device discovery time for the existing binary search scheme and the proposed partition-based scheme. From the figure, we can see that the proposed scheme gives much smaller device discovery time than the existing scheme. Moreover, the performance gaps between the existing and proposed schemes get lager, as the number of devices increases. This is because the proposed scheme can reduce the attempts for device discovery by dividing all devices into several partitions and also minimize the possibility of multiple responses (collisions) from the devices, compared to the existing binary search scheme.

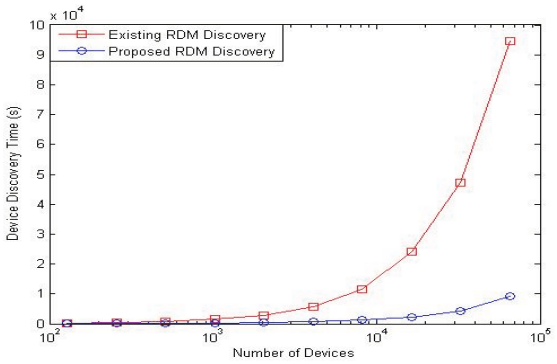

Figure 3. Comparison of existing and proposed schemes

5. CONCLUSIONS

In this paper, we have proposed a new partition-based device discovery scheme in lighting control networks. In the proposed scheme, all devices are divided into several partitions. In addition, to avoid the collisions by multiple responses, each device sends a response message based on a response timer that is configured by the controller.

From the numerical analysis, we can see that the proposed scheme can provide much smaller device discovery time than the existing scheme. Moreover, the performance gaps between the existing and proposed schemes get lager, as the number of devices increases.

6. ACKNOWLEDGMENTS

This research was supported by ICT Standardization program of MSIP (Ministry of Science, ICT & Future Planning).

7. REFERENCES

[1] ANSI E1.11 – 2008 (R2013), Entertainment Technology – USITT DMX512-A, Asynchronous Serial Digital Data Transmission Standard for Controlling Lighting Equipment and Accessories.

[2] ANSI E1.20 – 2010 Entertainment Technology RDM – Remote Device Management Over DMX512 Networks.

[3] MATLAB (MATHWORK), http://www.mathworks.co.kr