

Study of p-ICN defined performance measurement Enterprise Architecture

Byeongnam Yoon*, Kwanghoon Kim*, Pham Dinh Lam**, Pham Thanh Dat**, Vu Viet Vu**, Do Hong Quan**,
Do Nang Toan**

*Computer Science Department, Kyonggi University, Suwon Korea

**Information Technology Institute, Vietnam National University, Hanoi Vietnam

{tomayoon, kwang}@kgu.ac.kr, {phamdinhlam, ptdat2006, vuvietvu, quandh, dntoan}@vnu.edu.vn

Abstract—

In this paper we propose the performance evaluation based Information Control Nets (p-ICN) to achieve the full compliance with the international organization UN recommendation to get the performance evaluation all over the e-Government projects due to its nature of huge scale and long term project plan of IT investment. However, current real world there is not enough suitable and tangible method for decision makers to make sure rationality of such a huge IT investment. Thus, we studied and defined new method so called as the p-ICN to provide them suitable capability to evaluate the performance of any Enterprise Architectures. Moreover, proved its effectiveness to achieve a solution of the defined problem with well-known applied enterprise architecture as simple as possible.

Keywords— EA, BPM, TOGAF, ICN, s-ICN, p-ICN

I. INTRODUCTION

Under the new transaction trend of the UN from the Millennium Development Goals (MDGs) to the 2030 Agenda for Sustainable Development Goals (SDGs) as their development agenda [1], the funding organizations are supposed to request the performance evaluation report of IT investment as well as monitoring the progress of achieving enterprise Key Performance Indicator (KPI) for stakeholders. KPIs are an actionable scorecard that keeps your strategy on track. The p-ICN defined enterprise architecture enables you to manage, control and achieve desired business results. The p-ICN defined enterprise architecture in its simplest form, the p-ICN defined enterprise architecture is a type of performance measurement that helps you understand how your organization or department is performing. The p-ICN defined enterprise architecture should act as a compass, helping you and your team understand whether you are taking the right path toward your strategic goals. To be effective, the p-ICN defined enterprise architecture must be well defined and quantifiable, be communicated throughout your organization and department, be crucial to achieving your goal, and be applicable to your Line of Business (LOB) or department. In the technical viewpoint, this p-ICN defined enterprise architecture should be a common language not only among the architect and implementation engineers, but also among the enterprise management group and the stakeholder group.

II. Related works

Modelling process of workflow is an important task in many applications. Many models are presented in literature such as communication-based model [4], activity-based model [3-5], perspective-based model [6], and transaction based model [6]. This section briefly reviews the ICN [3] and s-ICN [2] that is activity-based model. ICN is a model proposed more than 30 years that is classified as activity-model [8-9]. Many information systems of enterprises have been modelled by using ICNs. ICNs-based model can be defined by capturing the notations of workflow procedures, activities and their control precedencies, invoked applications, roles, actors, and input/output repositories [10]. The ICNs model is defined by the 8-tuple $\Gamma = (\delta, \rho, \lambda, \varepsilon, \pi, \kappa, I, O)$ over a set A of activities including a set of group activities, a set T of transition conditions, a set R of repositories, a set G of invoked application programs, a set P of roles, and a set C of actors including a set of actor groups where I is a finite set of input, O is a set of output, $\delta, \rho, \lambda, \varepsilon, \pi$, and κ are function mapping. [3]

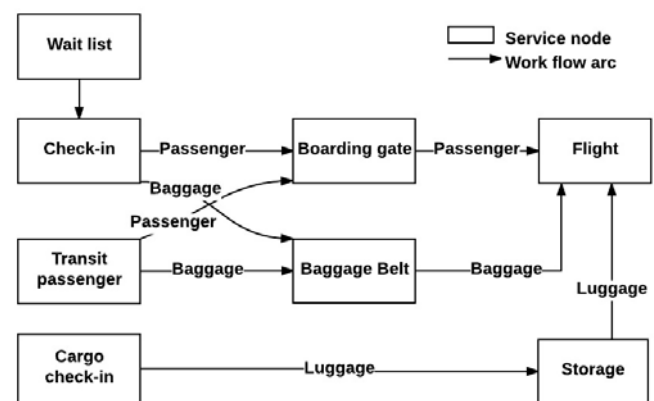


Figure 1. Top level Airport Out-bound Service Architecture of ICNs model

Figure 1 shows the top-level layout of the outbound service as a business reference model (BRM) in the enterprise architecture (EA) for the airport enterprises. In the airport out-

bound service, the main activity is a passenger check-in process as well as baggage check-in process. Here we can classify the out-bound service at the airport into 4 types of service events: ϵ_1 is the check-in passenger event. ϵ_2 is the waiting list passenger event. ϵ_3 is the transit passenger event. ϵ_4 is the air cargo check-in event. For Wait List, Check-in and Transit passenger, both passengers and baggage are controlled via Boarding Gates and the Baggage Belt. The two service nodes will perform activities related to the check-in of passengers and transfer passenger, baggage onto the corresponding flight. For Cargo check-in, this is a service of cargo and luggage, so it is necessary to have storage, management and transportation to the flight.

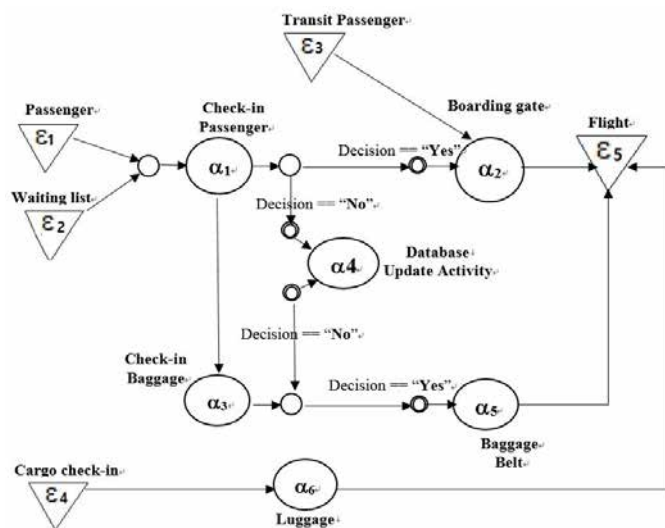


Figure 2. Airport Out-bound Service of ICNs model

The s-ICN model is presented in 2011, which is extended version of ICN by attaching to the arcs emanating from the split nodes. The limitations of both ICN and s-ICN like traditional methods, which presents only process flow work then the performance evaluation is used for batch job. This lets some waste time in many steps. In figure 2, an example of ICNs-based model is presented. From the figure, we can see that it shows only the workflow process and do not shows the time for each step. We can call the model as task-oriented model and not call as real time activity based model. For the real time activity based model, we defined the p-ICN as extension capabilities of ICNs, because through the real time activity based model we can achieve many merits and benefits to the customer satisfaction goals and enterprise KPIs, which could not be gotten via the traditional batch job model.



Figure 3. Performance evaluation batch job model

Figure 3 show us the traditional batch job model that is most popular way to measure and evaluate system performance, service level agreement (SLA), customer satisfaction, and also to get the intelligence via data and knowledge mining[7].

III. Methodology: p-ICN formal definition

Evaluating the performance of an organization is very important. It points out the shortcomings, limitations, problems encountered by the organization in the operation of the department in particular and the organization in general. Evaluate the performance, thereby providing corrective measures that make the development of the department, organization better, help save costs, time, and bring optimal efficiency. At present, the performance of an organization still has a number of issues, such as performance measurement focused primarily on financial performance indicators, business processes that are not measurable systematic. Planning, monitoring, measurement, and efficiency improvement are the crux of performance control. Performance monitoring is the process that involves observing, surveying and monitoring activities, processes and sequences, as well as the impact of these activities, to understand the scale and speed of achieving targeted and produced specific results desired. The purpose of monitoring is to look at a range of events in the organization's environment and the organization itself that may influence the process of planning the implementation process and achieving the intended objectives. This involves measuring performance, evaluating performance, comparing achievement and plan, and providing consistent feedback on performance. The performance comparisons has achieved with expected efficiency, ie, the expected performance determines the difference.[11-13]

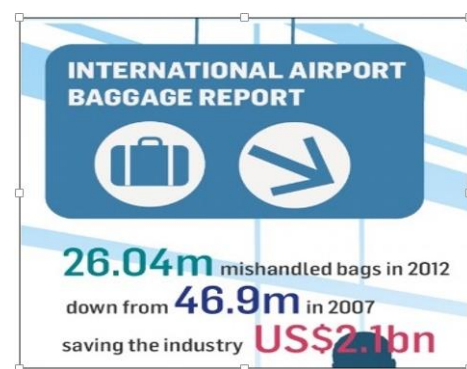


Figure 4. Status of Baggage Mishandling

This article provides the concept of p-ICN model, the extension of s-ICN [2] in measuring business KPI (key Performance Indicator) goals, and enhancing customer satisfaction as the performance objectives set for this example. Figure 4 shows us that the mishandling baggage problem that is still faced, it implicates that the airport business face the big defectiveness, not only the KPI related revenue of the airport

business enterprise, but also the KPI related customer satisfaction. Thus, we show how to enhance the existing airport outbound service enterprise architecture by using the p-ICN assets within this example issues as simple as possible because of conference paper.

p-ICN: A Performance Information Control Nets (p-ICN) is a work flow directed graph. The purpose of p-ICN is to transform batch job to real time work on IT system, to evaluate the waste time of whole system and to measure the capacity of some stages in the BPM process. The extended components of p-ICN consist of a real-time information and workflow arc, and a measuring flow control node as shown figure 4 with an example of using p-ICN in the out bound service of the airport business enterprise architecture.

- TS node: Time synchronize node means that the precedent workflows must be converge at the TS node. The evaluation here aims at zero defective related time of precedent works.

- MC node: Maximum capability node aims to evaluate the maximum quantities of aircraft to make maximum revenue. Which includes maximum number of seats and capacity of luggage, etc.

- RT arc: Real time information & Work flow arc.

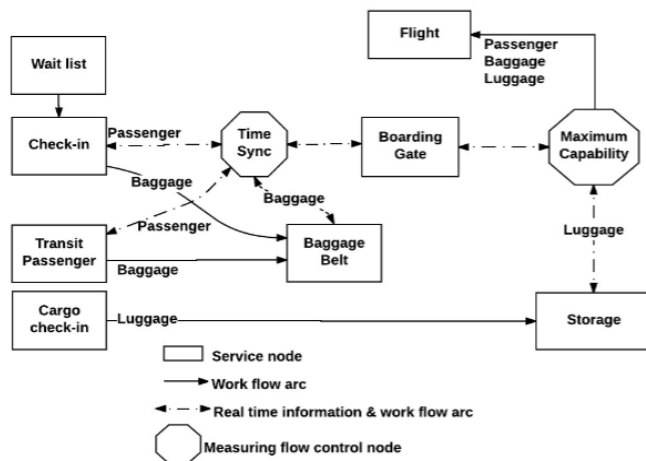


Figure 5. Top level Airport Out-bound Service Architecture of p-ICN model

Figure 5 shows the top-level airport outbound service architecture using the p-ICN model. Compared to Fig. 1, the p-ICN model adds three new notations for EA (Enterprise Architecture) architect: 1. Real time information & workflow Arc, 2. Time synchronize measuring flow control node and 3. Maximum Capability measuring flow control node. Brief explanation of the p-ICN notations is here, and in the next chapter, it will describe more details of definition along with the detailed graphical architecture. Information about passenger and his Baggage are synchronized through the time synchronize measuring flow control node for guarantying the none mishandling the passenger's baggage to achieve the customer satisfaction. The time synchronize measuring flow control node gets control the effectiveness of passenger's working time distance and his check-in baggage's belt system running distance time from the check-in desk to the gate for the on flight. All the details of the information on the cost of

time passengers and baggage check-in procedures easy to exploit at this node, from which to make adjustments as needed in real-time way of working. The Maximum Capability measuring flow control node contains information on the number of passenger seats, the maximum loading weight of the flight. This information is regularly updated after the passenger as well as baggage check-in procedures completed. This helps avoid overloading the flight, operating the air cargo service to make maximum benefits of the airport service business enterprise.

IV.EVALUATION

The real-time performance measurement of the enterprise IT system is essential and advanced one, comparing the traditional batch job IT system to know the reality of the customer satisfaction concerns with the delivery of his baggage and working distance related time consuming, and also to make the optimum utilization of the maximum capacity of the aircraft directly related to the revenue of the air cargo service business. It are most essential managing points, the customer satisfaction point and the increasing & measuring the benefit point, in the real-time way to achieve the KPIs of the enterprise. Without emphasized visual notations in the performance measurement enterprise architecture, there is no way to realize the implementation of the real-time performance measurement of the enterprise IT system

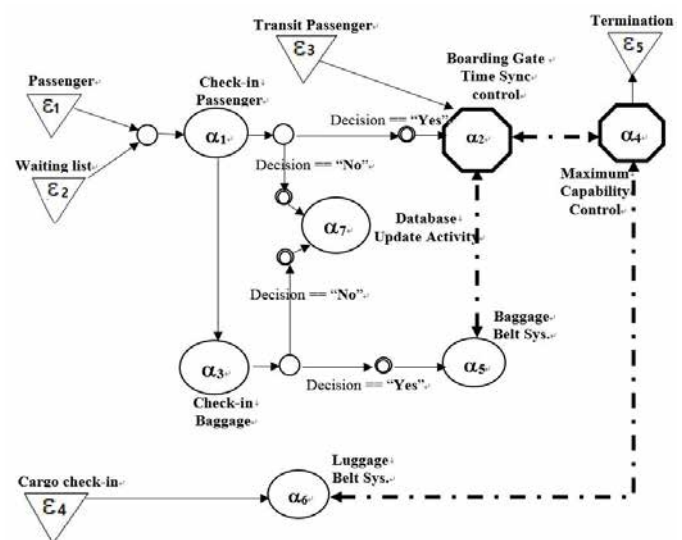


Figure 6. Airport Out-bound Service of p-ICN model

Figure 6 shows up the airport out-bound service by using the p-ICN notations to compare the previous Figure 2 - Airport Out-bound Service of ICNs model. It is very abstracted architecture model, but enlarge the focusing points of the performance measuring and control points. Concerning the mishandling baggage issue there are 3 events involved: The event 1 is the check-in passenger, the event 2 is the waiting list passenger, and the event 3 is the transit passenger. To solve this mishandling baggage problem, we need a measuring flow control node that make sure the baggage come

together with these 3 events passenger before the boarding gate opening time. On this purpose, the action 2 (α_2) places at the boarding gate time synchronization measurement control node. The α_2 check all the passenger's baggage delivery just in time before the boarding gate opening time. The α_2 checks all the details of the time information of the passenger working distance time and the baggage carrying belt system delivery time in real-time manner to control and give a prevent action to the delayed passenger and baggage. The α_2 stores all these practically happened on site time information for further processing the knowledge mining to innovate the enterprise architecture in the real-time job or the batch job manner depending on the predefined situations. The α_4 is the Maximum Capability measuring flow control node. One of the most important key performance indicator of the enterprise architecture as a vision is the target revenue of each year. The α_4 is working for how to make revenue maximization in this airport outbound service architecture. It measures all the weight of the passenger related ones, then calculates the maximum capacity of the aircraft, and decides to acceptable weight for the cargo service luggage. The α_4 controls it in the real-time manner and stores all these details in DBMS for further processing the knowledge mining to innovate the enterprise architecture and so on. The Real time information & workflow Arcs are placed between α_2 and α_5 , α_4 and α_6 . The Arc has two capabilities. The one is to present the bringing the information between the action node and the flow control node for controlling and preventing actions, the other is to present the workflow. Thus, the time information of passenger and baggage exchanges between α_2 and α_5 , weight information exchanges between α_4 and α_6 to control and measure the performance. In the figure 2 the ICNs model, it is not easy to depict the time information related abilities and maximum loading capacity to measure and control the passenger, baggage, and luggage on the flight outbound service architecture. But in the figure 6 Airport Out-bound Service of p-ICN model, we can clearly point out and depict the time information related abilities and maximum loading capacity to control the passenger, baggage, and luggage on the flight just in time by using the Real time information & workflow Arc, Time synchronize measuring flow control node and Maximum Capability measuring flow control node. By using the p-ICN model, we can easily design the performance measurement enterprise architecture to build management functions, assess the performance of the system involved in managing the enterprise's key performance indicators for all the stakeholders. It should be affordable common language for all the architects, implementers, managers, and stakeholders.

In the aspect of the maturity levels of the enterprise architecture, there are 5 levels. Level 1 is an architecture of each departments of the enterprise. Level 2 is an integrated architecture of the enterprise to provide the inter-operability among the departments of the enterprise. Level 3 is a global standard architecture to achieve the inter-operability with any other organizations that are following up the global standard. Level 4 is a performance measurement architecture to make

maximum performance & satisfaction of pertinent persons including the customers, staffs, managers as well as the stakeholders in real-time way of manner. Level 5 is the optimum level of the architecture to make innovation adapted in its architecture for all the life cycle of IT system.

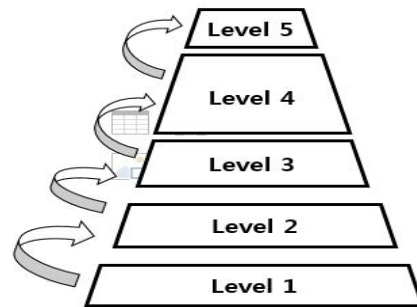


Figure 7. Enterprise Architecture Maturity Levels

This conceptual definition of these level of enterprise architecture is derived from the international standard capability maturity model SPICE and CMMI.[14][15] Throughout the figure 1 to 6, we can see what is the extended components and differences between the traditional architecture and the p-ICN defined performance evaluation enterprise architecture. Thus, by using these p-ICN notations, we can clearly define the performance evaluation enterprise architecture. Through this way of work, we can achieve the maturity Level 4. Furthermore, it is the right passage to go to the optimum level 5.

V. CONCLUSIONS

The main achievement of this paper is to simply shows down how to design the performance measurement enterprise architecture with the newly defined p-ICN notions. We have proved the effectiveness of this newly defined p-ICN notions, comparing the ICNs model. By using the p-ICN defined enterprise architecture, we can clearly communicate with between the architect and the implementation engineers in this p-ICN common language. And also we can expect the enterprise architecture development group and the stakeholder group to keep tracking the KPI goals in run time system. Finally, most important of this research is to give us how to reach to the optimum level 5 of the enterprise architecture. Our further study will be focused on various e-Government enterprise architectures to evaluate this p-ICN effectiveness.

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Byeongnam Yoon (M'97) He became a Member of IEEE in 1997. He was born in Seoul Korea 15 November 1949. He got the PhD in computer science, Chungnam National University, Dejeon city, Korea, 1997. He worked for the Sperryrand UNIVAC as a Computer Specialist 1974 -1978, Samsung as a Manager of Telecommunications Section 1978 -1982, Electronics & Telecommunications Research Institute (ETRI) as a Principal Researcher 1982 - 1999, National Information society Agency (NIA) as a Senior Executive Director General 1999 - 2010, Kyonggi University as an Associate Professor Faculty of Computer Science 2010 - 2016. Global IT Research Institute GIRI as a President 1999 - current. His research area include a Telecommunications, Internet, Software, Web programming & security, e-Government, Enterprise Architecture, Work Flow, Information Control Nets. System Work Method. SPICE, CMMI, BPM, etc



Kwanghoon Kim. He is a full Professor of Computer Science Department and Director of the Contents Convergence Software Research Center at Kyonggi University, South Korea. At Kyonggi, he is involved in research and teaching of workflow, business process management, groupware, coordination theory, computer networks, software architectures, and database systems. He received B.S. degree and M.S. degree in Computer Science from Kyonggi University and Choongang University, respectively. And, he also received his M.S. and Ph.D. degree from the Computer Science Department of the University of Colorado at Boulder, in 1994 and 1998, respectively. He had worked as a researcher and developer at Aztek Engineering, American Educational Products Inc., and IBM in USA, as well as at Electronics and Telecommunications Research Institute (ETRI) in South Korea. In present, he is a vice-chair of the BPM Korea Forum, a country-chair (Korea) and a ERC vice-chair of the Workflow Management Coalition. He has also been on the

editorial board of the journal of KSII, and the committee member of the several conferences.



MSc. Pham Dinh Lam got the MSc in computer science, Thai Nguyen University, Thainguyn, Vietnam, 2010. He worked in Thainguyn University from 2008 to 2016. From 2016-current, he works as Deputy head of Science, Technology and Training Department at Information Technology Institute, Vietnam National University, Hanoi. His research area includes Business Processing Management, Workflow, Information Control Nets, Artificial Intelligence.



Dr. Viet-Vu Vu received the B.S. degree in Computer Science from Ha Noi University of Education in 2000, a M.S. degree in Computer Science from Ha Noi University of Technology in 2004, and a Doctor Degree in Computer Science from Paris 6 University in 2011. He is a researcher at Information Technology Institute, Vietnam National University, Hanoi. His research interests include clustering, active learning, semi-supervised clustering, and E-government applications.



MSc. Pham Thanh Dat received B.S. degree in Computer Science from Hanoi National University, Viet Nam in 1995, a M.S degree in IT & Web from University Lyon 1, France in 2013. He works in IT department, Ministry of Health and Researcher at Information Technology Institute, Vietnam National University, Ha noi. His research area includes Business Processing Management, Work Flow, Information Control Nets, Enterprise Architecture.



MSc. Hong-Quan Do received a double M.S. degree in Information and Communication Technology from University of Science and Technology of Hanoi, Vietnam and The University of Rennes 1, France in 2015. He is a researcher at Information Technology Institute, Vietnam National University, Hanoi. His research concentrates primarily on Clustering, Semi-supervised clustering, and Image processing. At the present, he has been involved in many projects related to E-government

applications.



Assoc. Prof. Do Nang Toan is an Associate professor in Computer Science of VNU (Vietnam National University). He received BSc. Degree in Applied Mathematics and Informatics in 1990 from Hanoi University and PhD in Computer Science in 2001 from Vietnam Academy of Science and Technology. He is currently working as Director of Information Technology Institute (ITI), Vietnam National University. His main research interests are Pattern recognition, Image processing, Virtual reality and E-Government.