

# Improving Operational System Performance of Internet of Things (IoT) in Indonesia Telecommunication Company

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**Abstract.** Telecommunications company have to improve their business performance despite of the increase customers every year. In Indonesia, the telecommunication company have provided best services, improving operational systems by designing a framework for operational systems of the Internet of Things (IoT) other name of Machine to Machine (M2M). This study was conducted with expert opinion which further processed by the Analytic Hierarchy Process (AHP) to obtain important factor for organizations operational systems, and the Interpretive Structural Modeling (ISM) to determine factors of organization which found drives the biggest power. This study resulted, the greatest weight of SLA & KPI handling problems. The M2M current dashboard and current M2M connectivity have power to affect other factors and has important function for M2M operations roommates system which can be effectively carried out.

## 1. Introduction

The current market value of IoT services in Indonesia has increased significantly since 2010. Increasing of IOT user, was certainly supported by mobile subscribers which in 2013 has reached 265 million users. The growth has pushed the interaction of machines as supporting information technology. Telecommunication companies can provide services in accordance to consumer, design a better system to support IoT operational performances. The structure of the report and information flow engaged in IoT, which part is considered more important and critical than others, producing maximum operating systems. With the framework of operational information systems in the IoT division will help the company to execute its operational systems synergistically and achieved successfully services for customers.

## 2. Literature Review

### 2.1 Internet of Things

Internet of Things as known by the acronym IoT, has evolved the need to interact to internet at anywhere. IoT is a concept that aims to add the benefits of internet connectivity as continuously connected. The ability of IoT as data sharing, as a remote control, can make connections to real-world objects. As for example; foodstuffs, electronics, collectibles, the equipment can all be connected to local and global networks via embedded sensors and always active. Currently IoT concept has been used in entire body with a network-based RFID technology [1].



## 2.2 Operation System Performance IoT on Telecommunications Company

Performance of company depends on services that has to be provided by company. Currently IoT operating system performance in telecommunications are not run in synergy which mutually not coordinated. The IoT operational system were done individually without coordination to each system, so the services can not meet the consumer needs. To improve the performance of company, the IoT coordination of all operational systems must be taken as to increase customer satisfaction.

In providing the best service to consumers, every company must have operating systems that support ministry. The IoT chart of operational systems has been established to support IoT services [2].

The IoT operating system consists of several criterias and sub-criterias [3]: technical dashboard – helpdesk, technical dashboard – application layer, technical dashboard – connectivity layer, customer complaint or problem handling, infrastructure or facility, NOC as services, training, M2M customer, and technical dashboard – network / system legacy.

## 2.3 Multi Criteria Decision Making (MCDM)

MCDM methods are aimed for the decision-making criteria, mutually conflict, and has sizes that can not be compared to each other. MCDM solve problems in quantitative or qualitative criteria [4]. AHP is a decision-making simple method in handling complex problems, with lots of unstructured attributes. AHP analysis models with orderly facing complexity problems using hierarchical structure forming a multi-criteria decision-making approach uses pairwise comparisons [5]

## 2.4 Interpretive Structural Modeling (ISM)

ISM is an in interactive learning process. In this technique, a set of differences are structured into a comprehensive systematic model. The model portrays structure of a complex issue or problem in a designed pattern implying graphics as well as words [6].

Interpretive Structural Modeling (ISM) is a well-established methodology for identifying relationships between IoT operational factors. Direct and indirect relationships operational factors describe the situation far more accurately than the individual factor taken into isolation [7].

This methodology is primarily intended as a group learning process, but individuals can also use it. The various steps involved in the ISM technique are as follows: i. Identify the elements which are relevant to the problem. ii. Establish a contextual relationship between elements with respect to which pairs of elements would be examined. iii. Develop a structural self-interaction matrix (SSIM) of elements. This matrix indicates the pair-wise relationship among elements of the system. This matrix is checked for transivity. iv. Develop a reachability matrix from the SSIM. v. Partition the reachability matrix into different levels. vi. Convert the reachability matrix into conical form. vii. Draw digraph based on the relationship given in reachability matrix. viii. Change resultant digraph to ISM-based model by replacing element nodes with the statements. ix. Review the model to check for conceptual inconsistency and make the necessary modifications [6]. Structure of self-interaction matrix (SSIM); ISM methodology suggest the use of the expert opinions based in various management techniques such as brain storming and NGT.

## 3. Research Methodology

This study has uses AHP method, through expert interviews to judge the important factor. Expert judging factors on pairwise matrix calculation. The results of calculations resulting factor matrix pairs with weights. Factor with value weights are used as input to the organization method Interpretive Structural Modeling (ISM) to generate structural models of organizational information flow. Expert interviews and through brainstorming has assessed the relationship between factors to produce contextual relationship between elements to develop a structural self-interaction matrix (SSIM).

## 4. Result and discussion

Questionnaire with a scale of 5 was given to four (4) experts to gain organizational elements which are important in the IoT pada metode AHP. The results of the questionnaire were processed and

searched Geomin values above 3.5, obtained no criteria 9 and 24 factors. Expert judging factors on pairwise matrix calculation. The results of calculations resulting factor matrix pairs with weights. Subsequent questionnaires given to experts to get an assessment of the degree of importance of the criteria with other criteria. All processed calculated by the AHP Expert Choice software. Produced the most important factor is the weight of SLA & KPI problem handling 0.275 (Figure 1).

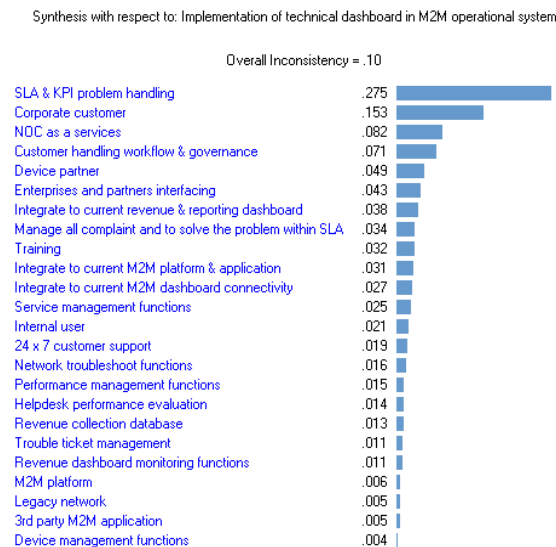


Figure 1 The weight of each factor

The next stage is using the Interpretive Structural Modeling (ISM) method and to create framework model. There are 24 factors established from expert judgment from previous method. A contextual relationship between factors  $V$ :  $e_{ij} = 1$ ;  $e_{ji} = 0$ ,  $A$ :  $e_{ij} = 0$ ;  $e_{ji} = 1$ ,  $X$ :  $e_{ij} = 1$ ;  $e_{ji} = 1$ ,  $O$ :  $e_{ij} = 0$ ;  $e_{ji} = 0$ . Expert has assessed the correlation of between 1 and 24 is  $v_i$ , assess the correlation between 1 and 23 is  $A$ , further illustrated in Structural Self-Interaction Matrix (Figure 2).

VARIABLE	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
1	V	A	A	A	V	X	X	A	X	X	X	A	A	X	X	X	X	X	X	X	X	X	X	
2	O	A	A	O	X	X	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	
3	A	A	A	A	V	V	A	A	A	A	A	A	A	A	A	X	A	A	A	A	A	V		
4	A	A	A	A	V	V	O	A	A	A	A	A	A	A	A	A	V	A	A	A	A			
5	A	A	A	A	V	V	O	X	X	A	A	A	A	A	V	X	V	V						
6	O	A	A	O	V	V	V	V	V	V	O	A	A	O	O	V	O							
7	A	A	A	A	V	V	O	O	O	V	A	A	A	A	O	X								
8	A	A	A	A	V	V	V	A	A	A	A	A	A	A	A	V								
9	O	X	O	A	V	V	V	O	A	A	A	A	A	A	O									
10	X	O	O	A	V	V	V	O	X	X	V	X	X	X										
11	O	A	A	A	V	V	V	V	V	V	O	O												
12	V	V	V	V	V	V	V	V	V	V	V	O												
13	V	V	V	V	V	V	V	V	V	V	V	V												
14	A	A	A	V	V	V	V	X	X	X														
15	X	X	V	A	V	V	O	A	X															
16	A	X	X	A	V	V	V	A																
17	X	X	X	A	V	V	V																	
18	A	A	A	V	O	X																		
19	O	O	X	V	V																			
20	A	A	A	A																				
21	X	X	X																					
22	O	O																						
23	V																							

Figure 2 Structural Self-Interaction Matrix (SSIM)

Based on the result of SSIM, next is the reachability matrix processing as the second step of the ISM methodology. ISM framework resulted from the partition 9 times iteration, iteration to-1 the 20 variables as internal factor, have values equal to the intersection reachability sets. The next 20 variables are at level 1 and will eliminate the next iteration, and proceed to the next iteration. Through drawing Chronicle matrix, and last stage is structural digraph Including links transitivity, resulting

ISM framework M2M on operational systems (Figure 3). ISM framework shows how the level of interest in the relationship between organizational factors IOT starting IX level up to level I result in maximum work performance.

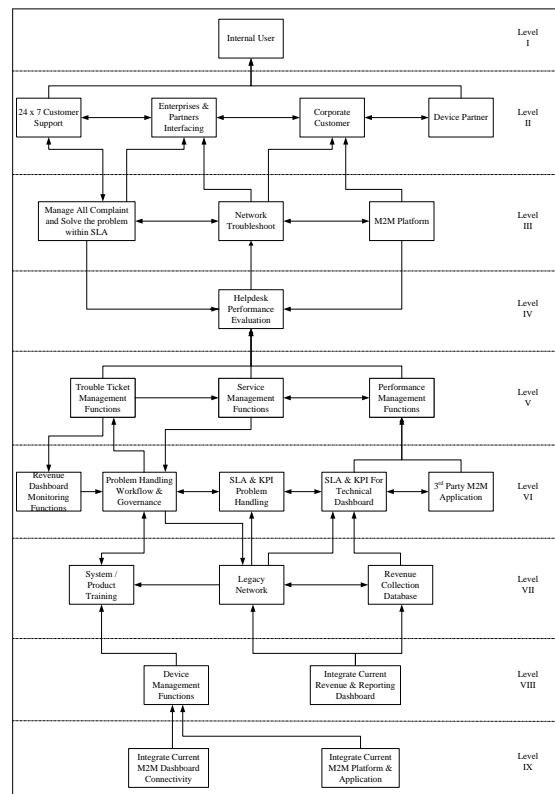


Figure 3 ISM framework on operational systems M2M

The level IX, has integrated M2M current dashboard, current M2M connectivity, and application platform which are governed a contextual relationship to other factors, and vice versa. This factors have power to affect other factors and has important function for M2M operations system which can be carried out effectively.

#### *AHP and ISM Analysis*

Weighting of the sub-criteria of global M2M operating system, shows it is not necessarily the highest weight by AHP, otherwise it has high power drives in the ISM . As can be seen, the factors at level 9, is the most influential factors in ISM model to integrate the current M2M platform with weight of 0,031 and integrate to current M2M connectivity dashboard with weight of 0.027.

Factors with the highest weight is the SLA & KPI handling problems with weight of 0.275, this variable at the level of VI, linkage has drives power and high dependence. This factors should carefully be studied, because of its strong driving force, effect, and interaction which can provide feedback to the system .

#### *5. Conclusion*

According to research objectives, the results of weighting the criteria and sub-criteria by AHP provides an overview to the company to focus sharply to problem of handling the SLA & KPI of 0.275, then corporate customers amounted to 0.153, and the problem of handling workflows and governance of 0.082. Second, retrieved draft framework of operational systems M2M with Interpretive Structural Modeling method (ISM) carefully describe the contextual information and organizational relationship between the operational factors in the M2M system. The initial framework design is to monitor the performance of the company's operating system so it can work synergistically and measurable. Based on the resulting framework, the factors influential to other factors in the height of the operational system is integrated to current M2M connectivity dashboards and integrate to current M2M platforms application.

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