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Cloud Computing for Urban Transportation System

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Abstract---*Todays with the rapid growth of city, transportation is becoming more complex environment. People face different problem on their daily life while by going to work, study, recreation etc. Hence, transportation play a vital role by carrying people from one place to other. Government need to solve transportation problem like traffic jam to make people can travel effectively. Not only government responsibility, but also people needs to participate because they share the same public infrastructure. Different type of cloud computing can become used to minimize the impact of traffic jam. This paper describes different type of cloud computing including the environment to build one. We also describe several challenges in order to implement cloud computing in urban transportation system.*

Keywords*---transportation, cloud, traffic, challenges*

I. Introduction

Traffic light is much giving an effect into traffic in a city in Indonesia. When driver waiting a car because of traffic light, the driver will loss time, energy, fuel, etc. We need to develop an an intelligent based system that can intelligently to perform an effective way to perform an efficient traffic light into big city in Indonesia. Intelligent monitoring need to be implemented in order to performing a deep analyze about the current traffic system. It require the agent based monitoring system so it can maximize the benefit on real time system and data storing. Large scale use of mobile agent system will lead to emergence of a complex, powerful organization layer that requires enormous computing and power resource. At the current system is difficult challenge to deal with the problem if each traffic light had separated coordination, and there are no information retrieved by another road user.

II. Roles Distributed Computing in Solving Stated Problem

The basic principle of cloud computing is to distributed the computing task to many distributed computers. Cloud computing Caters to the idea of "local simple, remote complex" in parallel traffic system. With mobile agen technology, an traffic management system in city based on Agent based Distributed and adaptive platform for transportation System is both feasible and effective. Such system organize cloud computing to manage computer experience, test the performance in the each traffic strategies. Urban base computing system based on cloud computing have two role there are consumer and service provider. All service provider such as the test bed, of typical traffic scenes, Artificial Transportation System(ATS), traffic strategy contained in database, and intelligent agent database about traffic management, are all veiled in the system's core: intelligent traffic cloud. With the development of intelligent traffic cloud, it can saving resource because of numerous traffic management system can connect and share the cloud infinite capability. It can be integrated

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with the current traffic light system to make an optimal waiting time that can reduce traffic jam. Citizen can have an access to via internet how to drive trough the city to minimize their wating time.

III. Literature review

Component in distributed computing

The components are storage resource, network resource, computing resource, and service layer.

Architecture of distributed computing

The basic principle of cloud computing is to share the computing jobs to many computers, not local computer or remote servers. According the element of Cloud Computing, and intelligent. Traffic clouds have 4 basic architecture schemes: integrated source, platform, application, and fabric. The relation between the layer and show explanation of each layer showed in figure below.

a. The application layer consist of all application that ran in the cloud. It's main task is to gives supports inside applications such as agent management, agent generation, agent optimization, agent testing, agentoriented task decomposition, and decision support for traffic management. The customer will be able to access the cloud by taking standard interface.
b. The platform layer is made of Artificial Transportation System(ATS), provide platform as service. This layer contain population synthesizer, path planner, and so on. It provide service to upper traffic application and agent development.
c. Integrated source layer rules the basic hardware resource in the artificial layer to gives scheme as a service.
d. The fabric layer consist of the basic hardware element resource such as a computing, storage, and network resource.

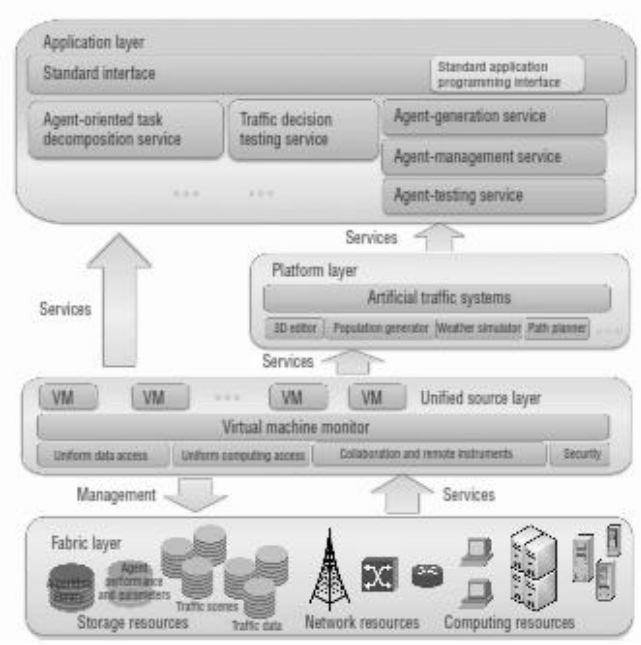

Figure 1 Cloud Infrastructure

Cloud and distributed computing by definition

Definition of cloud computing included by cloud architectures, security and development strategies. There are 5 element that build into fully integrated cloud computing and the relationship with traffic.

On-demand self-service: A traffic light as vital component of transportation can provide computing resource like CPU, disk storage, network and software in automatic way. This mean, human will limit interaction to this device and lead to benefit to human as more available time to do more job.

Broad network access: The traffic light as computing resource are connected through the network and used by various monitoring application. In addition, support for heterogeneous platform are important to make this resource completely available.

Resource pooling. A cloud service provided by transportation are 'pooled' together in order to sever consumers with virtualization or multi-tenancy. Consumer demand are variate, special purpose cloud could be built to fulfil this demand. The objectives to make a pool-based computing paradigm lies with two important factors: economies and specialization. The result of this scheme is physical computation become invisible to consumers, generally they cannot control or having a knowledge about the location, formation, and the origin behind of these resources. For example, the vehicles are not able to tell their record will be stored in the cloud.

Rapid elasticity. In consumers point of view, computing resource become urgently required rather than persistent. This mean no ahead commitment and contract because they can use it to rescale whenever they want, and finally release it after finishing the scale down. In addition, resource provisioning become unlimited to them, in the other hand, the consumption can increase rapidly to meet the expectation at any time.

Measured service. Like previous explanation, computing resource are pooled and shared by multiple consumers, cloud infrastructure must able to use proper mechanism to build measurement matrix through each individual resource usage. For example in traffic management by monitoring resource usage of vehicles capacity in each intersection then sent the information on time to the stake holder.

Service Model

Cloud service environment divided into three category model. The transportation mechanism based on cloud might adapt into these categories as described below:

Software as a service (Saas). Cloud consumers (government unit on transportation) could place their application on web hosting infastructure, which can be opened by multiple client (for example: user, driver etc by smartphone) on specific application. Consumers are prohibited to control cloud infrastructure. In multitenancy system architecture, different application can be server by single logical environment. The benefit of Saas cloud is it can scalable and optimized to meet economical condition and increasing the speed, security, availability, mitigation and maintenance. The example of Saas include Gmail, Google docs etc.

Paas (platform as a service). Paas makes cloud consumers to make his own cloud service and application on the Paas cloud. The different is in Saas only host completed cloud application which ready to hold application. While in Paas offers more feature, not only host the application but also development platform to host both in-progress and completed cloud application. The objectives of paas is to support web hosting, prepare programming development environment,tools, configuration, and so on. Example of Paas is Goole appEngine.

Infrastructure as a Service (Iaas). Sometimes cloud consumers directly access application's infrastructure like storage, network, processing, memory and the other computing resources. Iaas make it available to the user. Iaas cloud implement virtualization extensively to integrate or disintegrate own physical resource in an ad-hoc way to consumers demand which sometime growing or shrinking. The strategy behind virtualization is to make individual virtual machine that securely isolated from other vm and actual hardware specification. The benefit is to transform the application software architecture to run multiple instances (some cloud consumers) on single machine and application holder. An example of Iaas is Amazon's EC2.

Data storage as a Service (Daas). In this architecture separate cloud service with data storage on virtualized environment. Daas seems as special type of Iaas. The reasons behind this architecture is enterprise database system are licenced on limited physical machine the more machine utilized the more cost to be spend. Daas enable consumers to make a payment for what they need rather than use entire machine which is highly cost. In real case of database management system, Daas offers table-style abstraction to support rescale or growing of store and retrieve large amount of data at a low time. For example of this service is Amazon S3, Apache HBase, etc.

Cloud and distributed computing deployment

Currently there are four cloud deployment model available in he cloud community.

Private cloud. The cloud infrastructure which is operated fully within a organization, and commonly organized by third party or organization by different or same location. The reasons behind this model is divided into several aspects. First, about utilization of existing resource by maximizing and optimizing current resource. Second, security on the data and service becomes the interesting part for the company to utilize. Third, about the data transfer cost becomes considerable when making migration from local IT I public cloud. Fourth, organization sometimes needs full control over common activities that lies behind system's firewall. Last, in academic domain sometimes needs to build private cloud to support their activities like teaching and research. In transportation infrastructure, cloud must meet these requirements to make its service available to the consumer effectively.

Community cloud. Several cloud infrastructure organizations together in the same way as policies, the same requirements, values and problems. The cloud community is formed with consideration of democratic scalability and economic manner. Cloud infrastructure can be stored by parties when in a hosting or in a community in the society.

Public cloud. Current community models are popular. public cloud is used by the general public and service providers with full ownership of the public cloud, complete with appropriate policies, values, profits, costs and models. Examples of public clouds are Amazon S3, EC2, and Google app Engine.

Hybrid cloud. This cloud infrastructure consist of two or more clouds (private type, or public) forming a unique entity but integrated according to standards in the form of technology that is inclusive of data and applications with portable

properties (for example: cloud bursting which plays a role in balancing load between clouds). Companies use this model to improve their employee's resource capabilities and competencies. One of them is by limiting business functions by transferring them to the cloud via private cloud.

Issue in Distributed Computing

Issue in distributed computing contains three important topic. First, issue that a distributed system gives a support to build secure connection within processes. A secure connection, basically, provides the means to securely connected the communicating parties, and authenticated messages against modification during their transfer process. Indonesian government have a regulation about the radio transmission control, but it still a challenge to deal with this problem. Second, is access control, or authorization. Authorization must faces guided resources in such a way that only use that have the proper privilege can actual utilize and use those resources. Access control always placed after a process has been log in. Related to access control is preventing denial-of-service attack type, which becomes a unordinary condition for machine that are accessible through the Internet. The transportation department must secure the system from intervention. The third problem in secure distributed systems lies on management. There are particularly two important subject: authorization management and key management. Key management includes the share of of cryptographic keys, for which certificates as released by trusted third parties s very important. Important regards to authorization management are delegation and attribute certificates.

Cloud computing vs high performance computing

High-performance computing (HPC) is a computing device with a specific goal of using super computers and clusters to solve complex calculations. Associated with big data and smart businesses that require high demand performance. Cloud computing has different initial goals than high-performance computing, generating computational paradigms and of course the resulting applications are also different. In general, high-performance computing is widely used for scientific work while cloud computing is devoted to doing work in business. The parallelization relationship has been carried out by high-performance computing where business applications would be difficult to use using lots of data by. The current cloud doesn't really lead to high-performance computing for several reasons: First, HPC has a specific design that is difficult for the cloud to fulfill. Second, in contrast to cluster computing, cloud infrastructure is seen as a single entity that is seen in overall performance improvement. Third, high-performance calculations for completing specific tasks with resources in the company. In carrying out high-performance computing the interaction with humans is very high, so that capacity is often improved. This is different from cloud computing that is able to stand alone with little user intervention in it and consumers are only faced with services that they themselves do not know according to specifications.

IV. Discussion

Future Research for Distributed Computing

The future research about this topic is: Integration intelligent traffic control system into the transportation node. For example each of the public transportation has a computer installed into the system so it can retrieve information automatically about the traffic condition around the city. Urban traffic management system must generate, store, manage, test, optimized, and effectively use large number mobile agent.

V. conclusion

The conclusion about this discussion is tt is easier to integrated different application running on many computer into a single system using distributed computing. Traffic light system can be integrated and automatically receive the optimal setting to reduce waiting time and traffic jam from the intelligent traffic cloud system. Mobile agent provides the real time traffic monitoring system trough the cloud computing system. Consumer also choose what is the right cloud computing type to be implemented in transportation domain. The right decision of cloud type can increase benefit and problem solving.

REFERENCES

[1] ZhenJiang, L. Cheng, C. "Cloud Computing for Agent-Based Urban Transportation System," IEEE Intelligent Systems, vol. 26, no. 1, 2011, pp. 73-79.

[2] Necula, E. Necula, R. Iftene, A. "Distributed Traffic Management System," Symbolic and Numeric Algorithms for Scientific Computing (SYNASC), 2010 12th International Symposium, Sep. 2010, pp. 159-166.

[3] A.S.Tanenbaum, and M.V.Steen. Distributed System Principles & Paradigms, 1-633, Prentice Hall. Upper Saddle River: United States, 2007.

[4] Prakash, G., Darbandi, M., Gafar, N., Jabarullah, N.H., & Jalali, M.R. (2019) A New Design of 2-Bit Universal Shift Register Using Rotated Majority Gate Based on Quantum-Dot Cellular Automata Technology, *International Journal of Theoretical Physics*, https://doi.org/10.1007/s10773-019-04181-w.