IMPLEMENTATION OF E-HEALTH GRID MODEL IN INDONESIA
USING GRID LIPI

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Abstract

Indonesia is an archipelagic country that needs a model of e-Health Grid for connecting and sharing its resources in the health area. The use of Information and Communication Technology (ICT) for health purposes is growing fast as people need for better services in healthcare. Grid computing technology has proven for large parallel data computation process. Health practitioners and researchers can use it to find new invention and to improve services. Our previous research has proposed a topology of Indonesian e-Health Grid based on referral hospital and province in Indonesia. This work is the advanced research of our e-Health Grid model. We design a Software Defined Network for Indonesia e-Health Grid and implement it using Grid LIPI machine owned by t Indonesian Institute of Sciences. Grid LIPI is a public high- performance computing for open collaboration. The result of this research is a performance evaluation of e-Health Grid networking design in Indonesia that can be used to model e-Health Grid in the country.

Keywords: e-Health, SDN, Grid

Introduction

❖ The previous works of this research is an inter-hospital network design based on referral hospital in Indonesia using NS-3 Simulator (Rachmawati et al., E-Health Grid Network Topology Based on Referral Hospital Clustering in Indonesia, Journal of Computers, Volume 11, Number 6, November 2016). We designed the hospital network based on the province in Indonesia (Rachmawati et al., E-Health Grid Network Topology Based on Province in Indonesia, International Journal of Bio-Science and Bio-Technology, Vol.8, No.2 (2016), pp.307-316). We implemented the network design based on referral hospital in Indonesia using a Software Defined Network (SDN) (Rachmawati et al., Software Defined e-Health Grid Networking Design Based on Referral Hospital in Indonesia, Indian Journal of Science and Technology, Vol 10(4), January 2017). This work is an implementation of E-Health Grid network design based on province in Indonesia on Grid LIPI Machine Using Message Passing Interface (MPI)

Introduction

❖ Grid LIPI is Indonesian Institute of Sciences (LIPI) is a non-ministerial government institution of the Republic of Indonesia coordinated by the State Ministry of Research and Technology. Grid LIPI is a public cluster for open collaboration

❖ In this work, we use Message Passing Interface (MPI) to support the performance improvement of the LIPI grid machine. The process of each instruction is divided into several directions and sent to the processor involved in computation simultaneously.

Grid LIPI

Grid LIPI Machine

Objectives

❖ Implement the e-health grid model based on province in Indonesia using MPI.

❖ Measure the performance of the e-health grid model based on province in Indonesia using MPI.

PREVIOUS RESEARCH

UA. Rachmawati, et al, "E-Health Grid Network topology based on Province in Indonesia", International Journal of Bio-Science and Bio-Technology, Vol.8, No.2 (2016), pp.307-316. Scopus Index

E-Health Grid Network Topology Based on Province in Indonesia

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Abstract

Information and Communication Technology (ICT) has enhanced human life including in health care. Consequently, professional workers in the field of health services are required to improve productivity, accuracy, efficiency and service. The use of ICT for health purposes is known as e-Health. The development of e-Health can use the grid technology for resource sharing and interoperability. The technology can process a very large data for parallel computation. It can also be used to facilitate health practitioners and researchers in the field of health, including to find a new virus, discovery new drugs, disease, an image of organs and to determine the actions for a patient. As an archipelago country where many health services centers distributed in the country, Indonesia needs an appropriate model of e-Health Grid. AS preliminary study, this paper proposes an e-Health Grid network topology based on the province in Indonesia.

Keywords: e-Health, e-Health Grid, Network, Topology

1. Introduction

Science and technology development have changed the paradigm of human life. People need an Information and Communication Technology (ICT) to share, obtain and access information quickly and easily. It has changed the pattern of management services in various fields, including in health care services that are known as e-Health. The fundamental consequence is that the productivity should increase without compromising the confidentiality, accuracy, efficiency and prompt service for the patient.

According to World Health Organization (WHO), health is as state of complete physical, mental and social well-being and not merely the absence of disease or infirmity [1]. Factors that interfere health degree in society are attitude, an environment, ancestry and health services [2]. E-Health services including electronic health records, consumer health informatics, telemedicine, health knowledge management, virtual healthcare teams, healthcare information systems, m-Health, and medical research using Grid technology.

The development of e-Health involves the community, hospitals, health centers, universities, drug manufacturers, the pharmaceutical industry, Government, and others. The environment needs resource sharing between those elements. Grid computing systems can resolve the problem of resource sharing such as information, data structures, databases, processor, and storage resources on separate location dynamically using open-standard protocols [3]. It is necessary to use an open-source to meet the requirement of the e-Health. Grid computing system has already designed a set of middleware to support e-Health applications. Grid computing for e-Health can reduce the cost and fully utilize the existing IT resources.

UA. Rachmawati, et al, "E-Health Grid Network topology based on Referral Hospital in Indonesia", Journal of Computers, Volume 11, Number 6, November 2016, pp. 513-519.

E-Health Grid Network Topology Based on Referral Hospital Clustering in Indonesia

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Abstract: Information and Communication Technology (ICT) has made a great change in human life including in health care area. Professional workers in the field of health services are required to improve productivity, accuracy, efficiency and service. The use of ICT for health purposes is known as e-Health. Grid Technology can be used in the development of e-Health for resource sharing and interoperability. Grid can process a very large data for parallel computation. Grid can be used to facilitate health practitioners and researchers in the field of health to find a new virus, discovery a new drugs, disease, images of organs and to determine the actions for a patient. This paper is the result of health policy study in Indonesia and simulation of network topology based on referral hospital clustering in the country that aims to model e-Health Grid in Indonesia.

Key words: E-Health, grid, network, topology.

1. Introduction

Science and technology become a necessity for human life nowaday. People need to communicate and share many things through technology we called Information and Communication Technology (ICT). Many areas use the ICT to obtain and to access information quickly and easily. These advances have changed the pattern of management services in various fields, including in the health area. The fundamental change is related to productivity that should increase without compromising the confidentiality, accuracy, efficiency and prompt service for the patient. The use of ICT for health services is known as e-Health.

Data and information integration are critical to health agencies in Indonesia since many reports said that the country is an epidemic country for several diseases such as dengue fever, tuberculosis, malaria and others. Data interaction and technology collaboration is required to find new methods to solve health problems.

Interoperability system is necessary for the national e-Health development to attain an integrated use, secure and efficient data and information. Interoperability supports a system to share and integrate information and processes using a set of standard work. Grid technology is one solution for interoperability problem. Grid services integrate services across distributed and heterogeneous virtual organizations on different resources and relationships [1].

We have simulated e-Government Grid in Indonesia based on province and population using GridSim toolkit [2]. We proposed this study to support the Government for giving a better services to people and also to support the health research among researcher, practitioner, university, pharmacist, and government agency.

UA. Rachmawati, et al, "Software Defined e-Health Grid Networking Design Based on Referral Hospital in Indonesia", Indian Journal of Science and Technology, Volume 10, Issue 4, January 2017 .
ISI Thomson Reuters Index

Software Defined e-Health Grid Networking Design Based on Referral Hospital in Indonesia

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Abstract

Indonesia is an archipelagic country that needs a model of e-Health Grid for connecting and sharing its resources in the health area. The use of Information and Communication Technology (ICT) for health purposes is growing fast as people need for better services in healthcare. Grid computing technology has proven for large parallel data computation process. Health practitioners and researchers can use it to find new invention and to improve services. Our previous research has proposed a topology of Indonesian e-Health Grid based on referral hospital. This paper is the advanced research of our e-Health Grid model. We design a Software Defined Network for Indonesia e-Health Grid. Software-Defined Network (SDN) allows applications to control the network. SDN is expected to be able to facilitate e-Health grid management. We set some scenarios with different link bandwidth and packet rates to evaluate the performance of the system. The result of this research is a design of e-Health Grid networking that can be used to model e-Health Grid in the country based on referral hospital.

Keywords: e-Health, Grid Computing, Software Defined Network, Topology
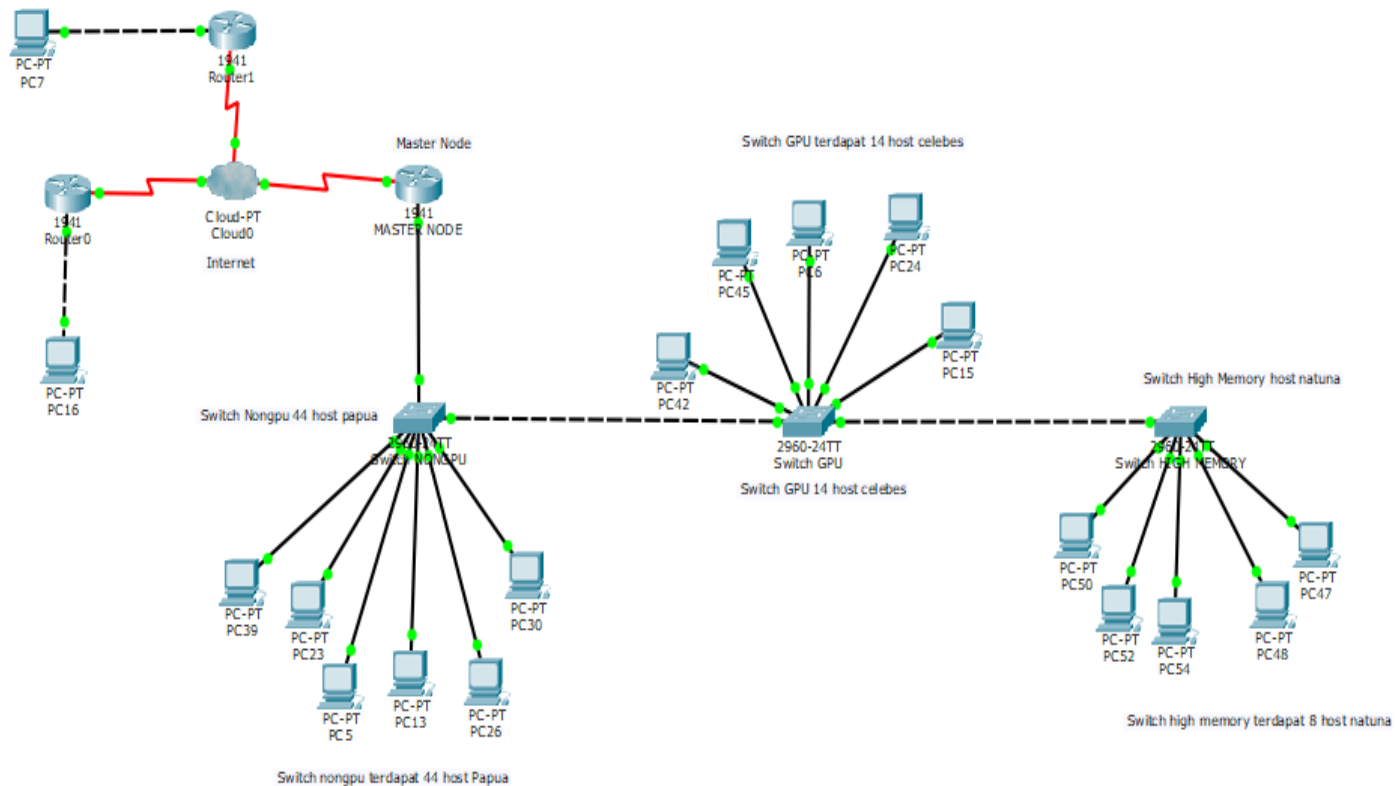
1. Introduction

Indonesia is one of the most populous country in the world that has vast areas separated by the sea. The distance between islands resulted in differences in access to health care for the urban and rural, including in remote area. Indonesia has health-related targets in the process of national health development to strengthen the capacity
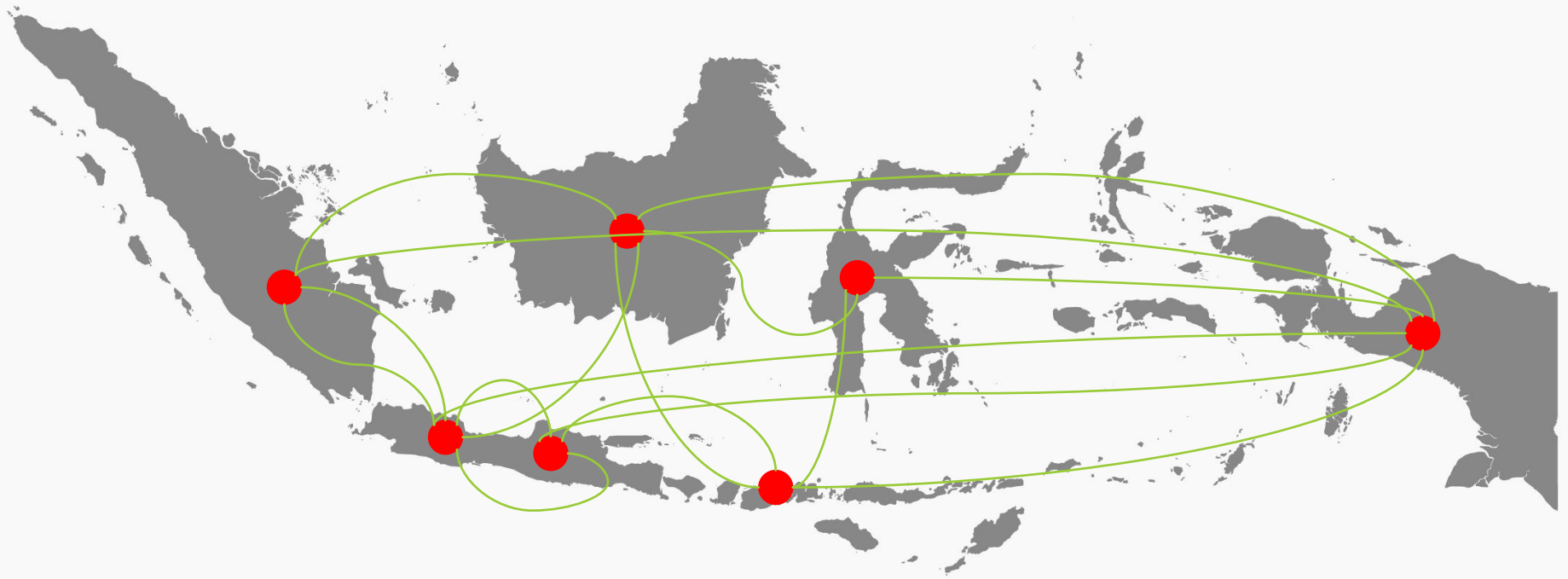
pharmaceutical, and health centers must involve along with universities and Government to develop an e-Health that supports resource sharing. Grid computing has been proven to solve the problem of dynamic resource sharing on different location using open-standard protocols with a set of middleware. The Grid computing system can share data, storage, and processor as well. The use of grid technologies in health areas integrates distributed

IMPLEMENTATION OF E-HEALTH GRID IN INDONESIA
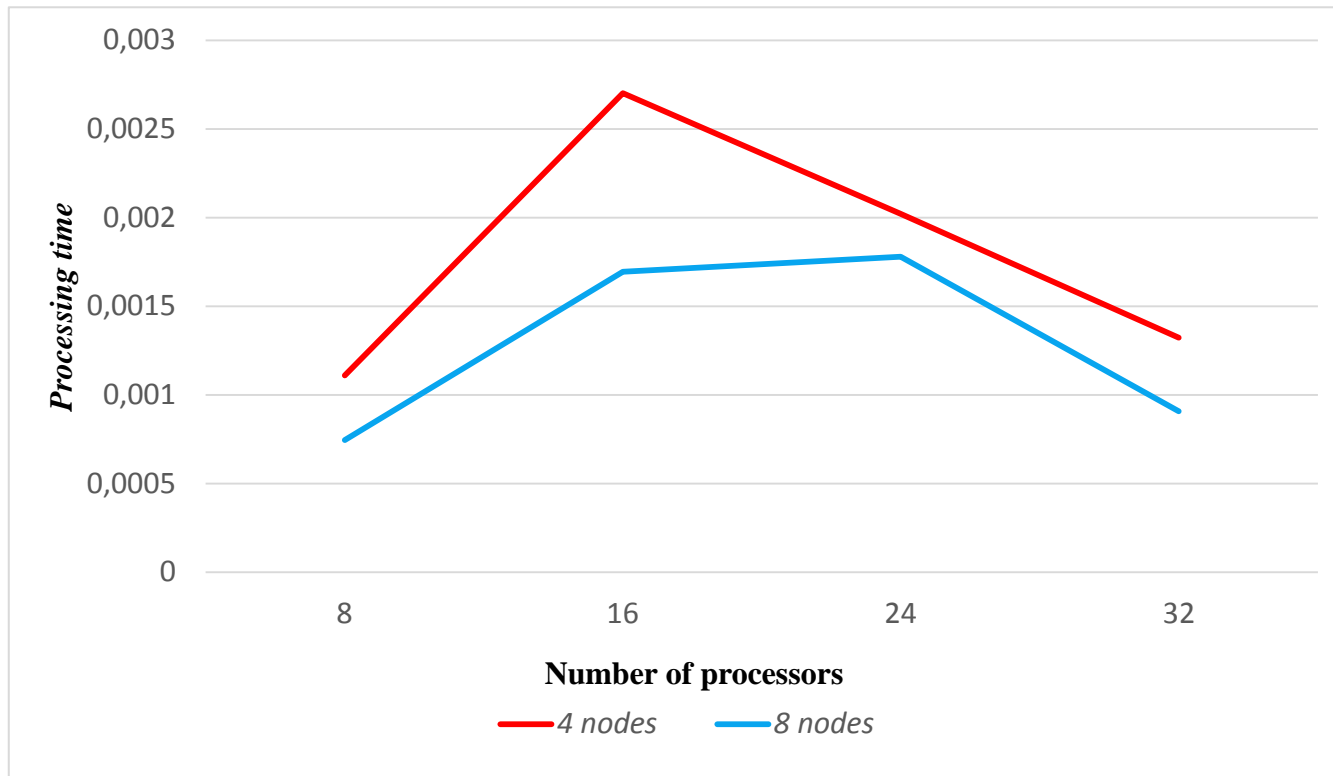USING GRID LIPI

Point-to-point

UA. Rachmawati, et al, "E-Health Grid Network topology based on Province in Indonesia", International Journal of Bio-Science and Bio-Technology, Vol.8, No.2 (2016), pp.307-316.
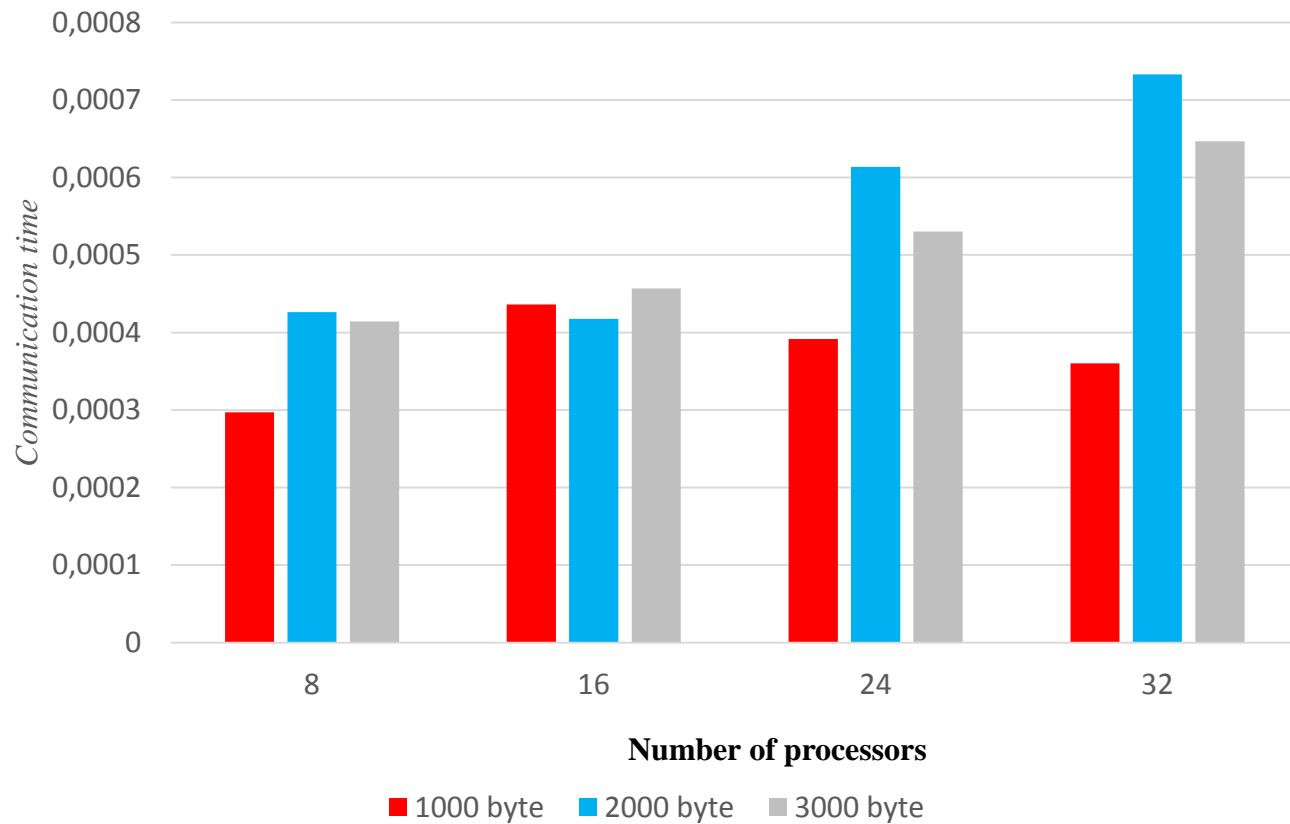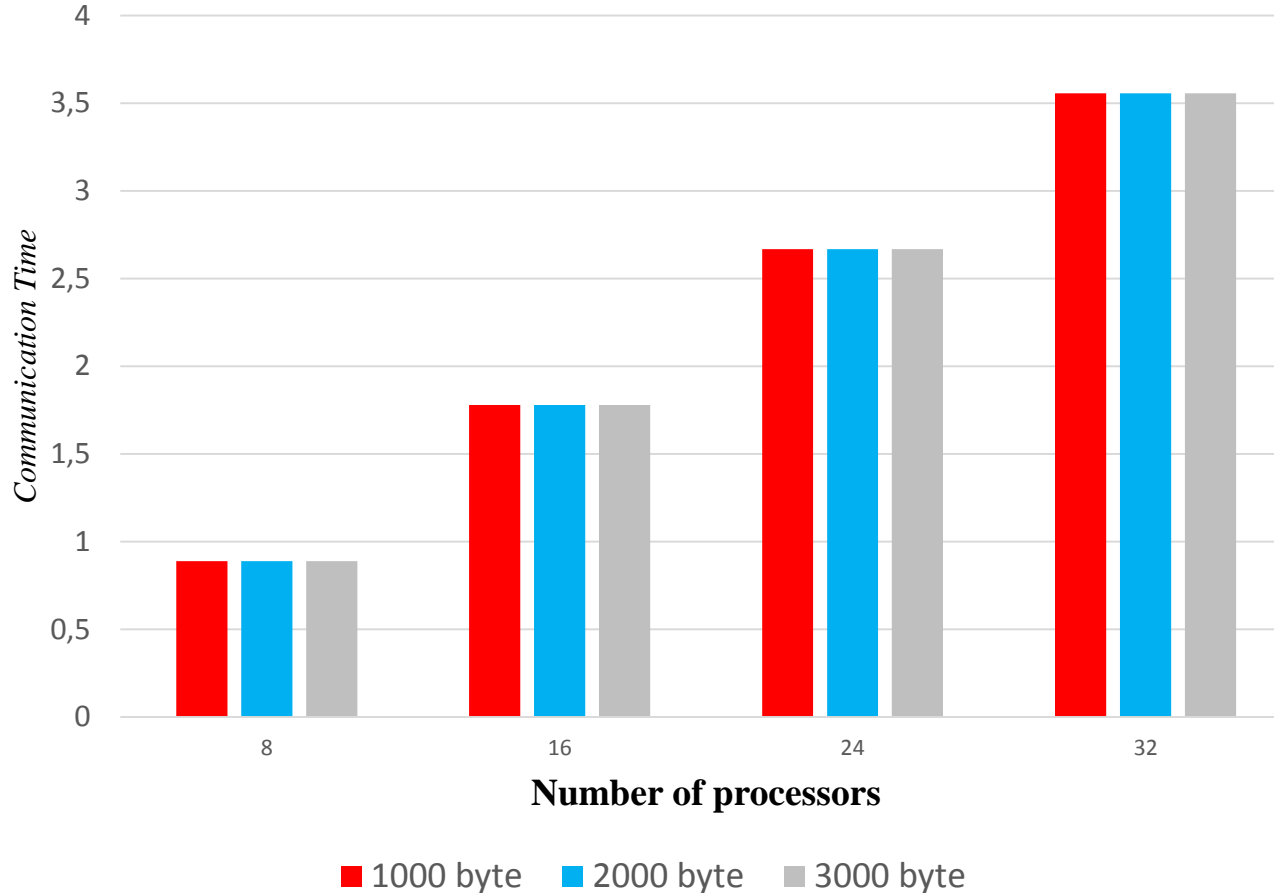
Graph Comparison Processing time for 4 and 8 nodes

The processing time using 4 nodes are longer than 8 nodes

Communication Time 4 Node

The use of 4 nodes indicates that the communication time of data size 2000 bytes is longer than the other data size.
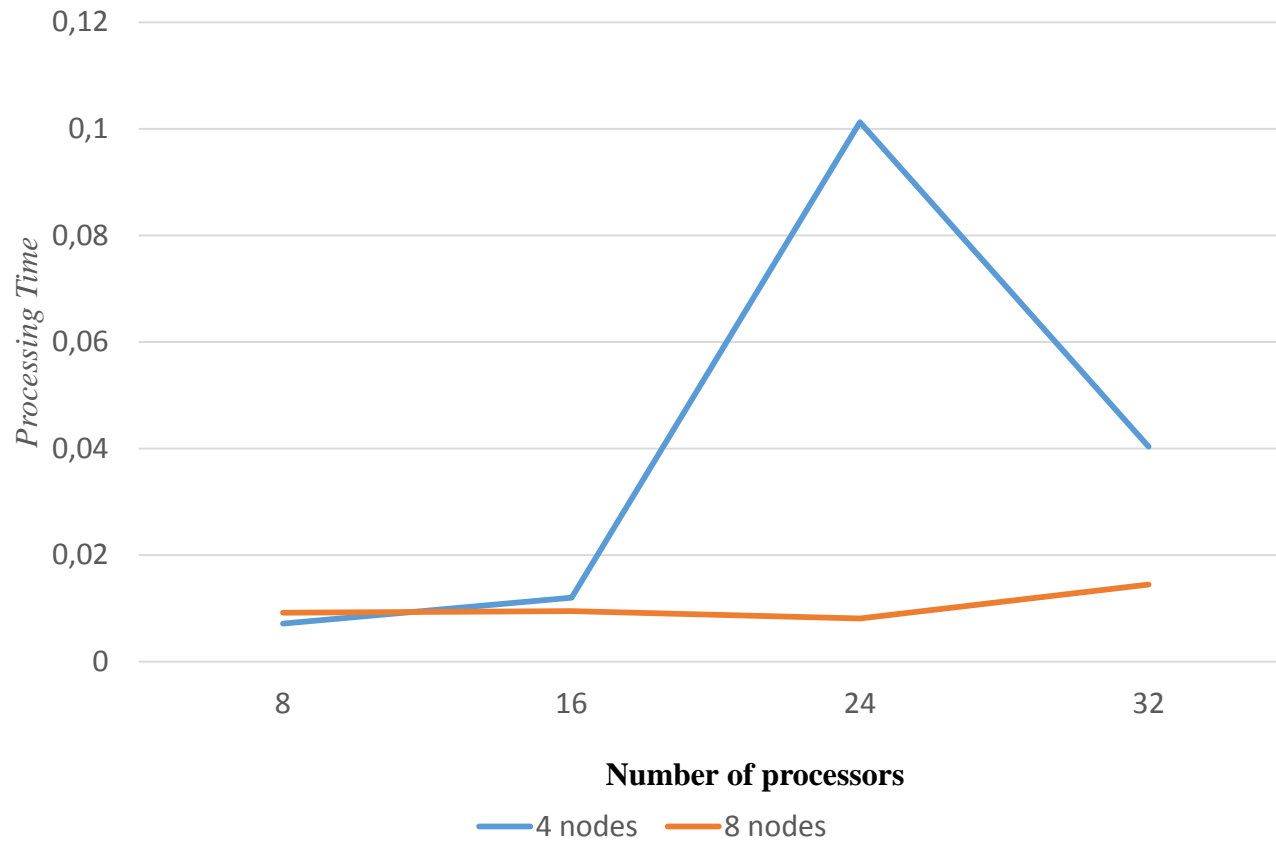
Communication Time 8 Node

The use of 8 nodes shows that the communication time is almost balances on each data size sent.

Communication time using node 4 is very fast compared with node 8.

The larger number of the node used will result in higher communication time process.

# Processing Time between 4 & 8 nodes with horizontal method

The use of 4 nodes results in longer processing time compared to using 8 nodes.

Results Comparison Processing Time between Vertical and Horizontal Methods for 4 node usage
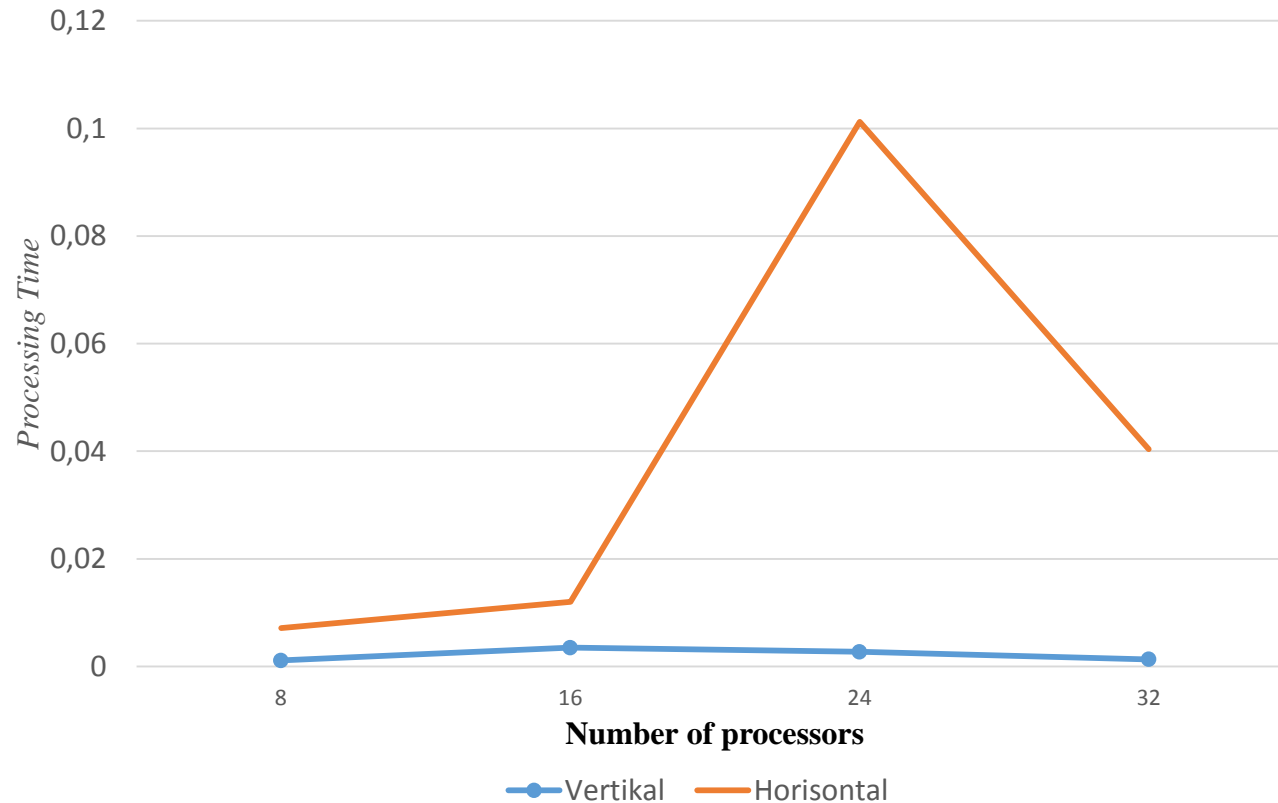
The using of node 4 with horizontal method results in longer processing time than the using of node 4 with the vertical one.
There is no delay time to get the data by the horizontal method.
The vertical method gives a time lag of approximately 1 minute to re-obtain the data.

Results Comparison Processing Time between High Memory Host and Non-GPU / GPU
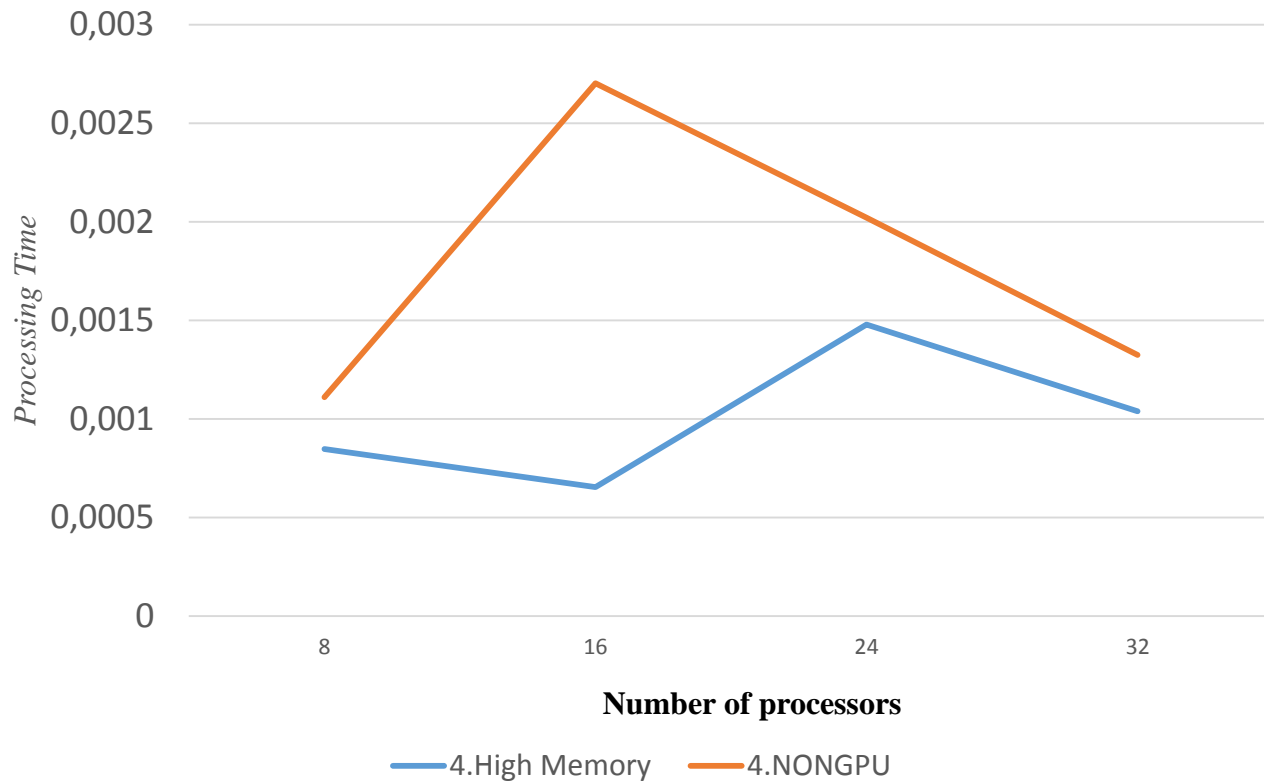
The using of high memory results in faster processing time compared to non-GPU host or GPU

Conclusions

- The processing time and communication time in the Grid system depend on the specifications and network of a server. The number of tasks affecting the performance. The experiment shows that the higher number of nodes used will make the processing time faster. The performance results of 4 nodes are better than 8 nodes.

- This research aims to model an e-Health Grid in Indonesia. The model can be used as a reference when the government decided to develop an e-Health Grid. We will continue this work by involving stakeholders in the country.

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