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Area of mangrove forests calculated by color image segmentation using k-means clustering and region growing)

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Abstract

The calculation of the area of mangrove forests by conventional methods requires much time and energy. In this study, a tool for calculating the area of mangrove forests in Southeast Sulawesi Province, Indonesia, using satellite imagery is developed on the basis of two segmentation methods, k-means

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Area of Mangrove Forests Calculated by Color Image Segmentation Using *k*-Means Clustering and Region Growing

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***Abstract*— The calculation of the area of mangrove forests by conventional methods requires much time and energy. In this study, a tool for calculating the area of mangrove forests in Southeast Sulawesi Province, Indonesia, using satellite imagery is developed on the basis of two segmentation methods, k-means clustering and region growing. We then compare those two methods to obtain the optimal method to calculate the area of mangrove forests. Before this research, there were no researchers who calculated the area of mangrove forests in Southeast Sulawesi using both methods. We constructed a calculation algorithm using Matlab, which includes different stages of digital image processing. The area of mangrove forests is calculated on the basis of the number of pixels with an area density of 900 m^2/pixel. The accuracy of the two segmentation methods is compared for identical areas obtained by the National Institute of Aviation and Space in Indonesia (LAPAN), i.e., the area obtained by LAPAN is used as a reference in calculating the accuracy. The accuracy of the region growing segmentation method is 33.33%, whereas that by the k-means clustering segmentation method under optimum conditions is 59.26% in the application of 12 clusters.**

Keywords*— *mangrove forest, k-means clustering, region growing, satellite imagery, Southeast Sulawesi Province

I. INTRODUCTION

Mangrove forests grow along tropical beaches or river mouths that are affected by tides. Indonesia is a country that has the largest area of mangrove forests in the world, which is equivalent to 23% of the world's mangrove ecosystem of a total area of 16530000 ha. However, such forests are damaged from year to year. This damage is caused by the conversion of mangrove forests into fishponds, settlements, or mining activities around the coast. In addition, mangrove forests are increasingly threatened owing to the extensive uncontrolled land uses derived from high community preferences to own land and settlements in coastal areas [1].

Satellite image processing has been widely used to identify and analyze changes in the shape, area, and other conditions of a location. One application of satellite image processing is the identification of the area of mangrove forests by image segmentation. The purpose of image segmentation is to segment or separate an image into homogeneous regions on the basis of certain similarity criteria, e.g., to separate the main object from its background.

Image segmentation is used to identify mangrove forests by dividing an image into homogeneous regions on the basis of certain similarity criteria, as in [2–5]. Two examples of algorithms used for segmentation are *k*-means clustering segmentation reported in [3] and [4] and region growing segmentation described in [5]. *k*-Means clustering segmentation divides a number of objects into regions on the basis of existing categories by referring to the given midpoint, whereas region growing segmentation starts from pixel seeds and develops to form regions. The *k*-means clustering segmentation in [3] can eliminate image noise, whereas the region growing segmentation in [4] cannot reduce noise. Although the two methods have different characteristics, they have some similarities. One of the similarities is in determining a pixel to be a region or group, i.e., with one point as the center and forming a region with certain requirements or properties, i.e., the closest distance between pixels. However, these conventional segmentation methods cannot provide sufficiently accurate data to distinguish mangrove forests from non-mangrove forests. Thus, a new system that aims to assist the accurate calculation of the area of mangrove forests needs to be developed. In this research, we used Landsat-8 images of mangrove forests in Southeast Sulawesi Province, Indonesia, to examine the accuracy of the two segmentation methods [6-8].

The calculation of the area of mangrove forests in [7] and [8] is not based on image segmentation using *k*-means clustering nor region growing. In this study, we aim to implement and analyze the *k*-means clustering segmentation and region growing segmentation methods to calculate the area of mangrove forests by using Landsat-8 imagery on the basis of the number of pixels identified. The pixels are then considered as the area of the mangrove forests. The accuracy of the two methods was calculated by using reference data on the mangrove forest area from the National Institute of Aviation and Space in Indonesia (LAPAN) [9]. In this paper, we first describe the two methods for calculating the area of mangrove forests, namely, the *k*-means clustering color image segmentation and region growing segmentation methods. The method with the higher accuracy was determined.

Another research was conducted on the tsunami-affected areas in Aceh using satellite imagery by Solehatin and Melita, who developed a system for identifying tsunami affected areas by the region growing segmentation method [10]. This research provided information on the size of the area affected by the tsunami generated by an earthquake with a magnitude of 8.9 on the Richter scale.

Arief, Prayogo, and Hamzah explained that the segmentation process can be generally done using three approaches, i.e., segmentation based on the boundary approach using the thresholding method, based on the edge approach using mathematical gradient or Laplacian operators, and based on the region approach [11]. The segmentation algorithms adopted in this study are divided

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Comparison of Migration Approaches of ICN/NDN on IP Networks

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***Abstract*—Named-based Internet architecture such as the Named Data Networking (NDN) and the Information-Centric Networking (ICN) have been developed rapidly. The current Internet architecture, TCP/IP, will be replaced by ICN/NDN in the next decades. However, it seems unrealistic to replace all the IP routers to ICN/NDN routers at the same time, so the migration process of the ICN/NDN routers over the Internet is unavoidable. Therefore, we should discuss the migration mechanism to realize the name-based Internet architecture. This paper depicts several mechanisms and approaches that have been written and reported in recent years. The advantages and disadvantages of each approach are also deeply discussed and explained. Finally, this paper gives a big picture and recommendation about the efficient way of migrating ICN/NDN routers on the Internet.**

***Index Terms*—Named Data Networking, Future Internet Architecture, Translation, Migration**

I. Introduction

Current Internet architecture such as TCP/IP was found in the late 1960s by US military projects, and it connects millions of computers around the world now. Many technologies have been implemented to improve the current Internet architecture. The TCP/IP has been evolved from IP version 4 to IP version 6 solving the lack of IP address. In the future, there will be billions of hosts that will be connected to the global network. The TCP/IP uses a host-centric mechanism for sending and receiving a packet. In the packet frame, source and destination addresses are stated to establish a connection between client and server. This kind of communication scheme is called as host-centric communication. Routers forward the packets based on the destination IP addresses indicating the receiving hosts until reaching the destination hosts.

The information-centric networking (ICN) [9] or its promising candidate, named data networking (NDN), was proposed as a future Internet architecture in around 2009. The ICN/NDN replaces the host-centric networking protocol like TCP/IP by the data-centric networking, and the ICN/NDN refines the drawbacks of TCP/IP and enables routers to cache packets for better performance and latency. Two types of packet primitives are introduced namely interest and data packets. In order to make data transactions, the node (consumer) should emit an interest packet in advance with a prefix name to retrieve the content. Every node (producer) that has the content with a designated prefix name will reply to the interest and send the data to the consumer. Since the packet has a prefix name, this type of communication is called an information-centric network protocol.

NDN routers have three components to forward and process the interest and data packet [7], Pending Interest Table (PIT), Forwarding Information Based (FIB), and Content Store (CS). The PIT is used to register prefix names of missed interests and corresponding incoming interfaces if the interest prefix name is not found in the CS. The FIB is used to forward the missed interest packets to other interfaces listed in the table. And finally, the CS is used to store and cache the data of incoming data packets. The migration from host-centric routers to name-centric routers is unavoidable in the future as seen in Figure 1. Smooth and economical transition and migration are indispensable for the success of the future network.

This paper discusses several migrations and transition approaches that have been proposed recently by many researchers. Furthermore, this paper also categorizes the methods and gives some recommendations for future works. This paper is organized into four sections, namely introduction, migration approach, discussion, and conclusions.

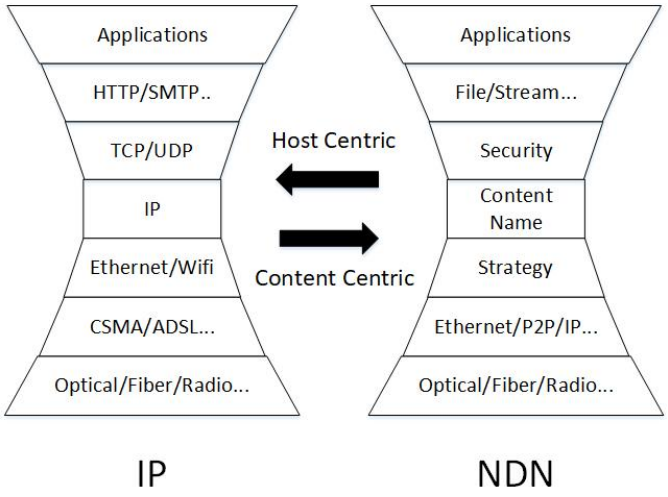

Fig. 1. NDN vs IP stack

II. Migration Approach

In this section, several approaches that have been published to migrate from host-centric to name-centric networking are explained. Some approaches use the translation mechanism for

Drivers and Barriers to IT Service Management Adoption in Indonesian Start-up Based on the Diffusion of Innovation Theory

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***Abstract*—Along with the emergence and trend of startup worldwide, Indonesia, as a developing country, has been supporting startup as a platform for the digital economy. Indonesia has been stated as one of the countries with the most extensive digital industry power. Indonesia has a strong determination in startup development by declaring the vision "Indonesia The Digital Energy of Asia." As a company, a startup relies on information technology (IT) to provide services to customers. Therefore, it is pivotal for the startup to implement IT service management (ITSM) to align IT and business goals. ITSM is not fully implemented yet in a startup because initially, ITSM is designed for large companies only. In other words, it indicates several factors that influence adoption. Therefore, this study aims to fill the gap in this phenomenon by identifying the drivers and barriers to the adoption of ITSM using the Diffusion of Innovation Theory. To sum up, the result of this study reveals that most of the reported drivers for adopting ITSM in Indonesian startups fall under the theme of the effort of change agent and nature of the system, while barriers fall under attributes of innovation and also nature of the system.**

Keywords—information technology service management, startup, adoption, driver, barrier

I. INTRODUCTION

In today's digital era, all organizations depend on information technology (IT) to organize and operate their businesses. One of the biggest challenges in organizations is aligning business needs and the use of IT to achieve organizational goals [1]. Therefore, planning, management, and integration of IT with organization goals are essential. The aligning process of IT services to business goals refers to IT service management. IT services can be in the form of software, hardware, or infrastructure used by organizations that are used for organizing and delivering service or products to customers [2]. Over the last few years, organizations are increasingly aware of the importance of implementing IT service management. In 2014, there were at least 50 countries joined as a member of the IT Service Management Forum (itSMF) with a total membership of 6000 companies and more than 40000 people scattered all over the world [3].

Thus far, IT service management has several frameworks in the form of best practice or standard, such as the Information Technology Infrastructure Library (ITIL), COBIT, ISO/IEC 20000. According to the International Business Machine (IBM), ITIL is the most popular framework for IT service management [4] and the earliest released framework compared to other frameworks. Based on ITIL, IT service management consist of five main processes, namely service strategy, service design, service transition, service operation, and continuous service improvement [4]. Initially, IT service management was intended to be implemented in large-scale companies [5]. This is supported by the assumption that large companies need IT management because they have a large number of IT services to handle. In addition, implementing ITSM requires large and stable resources [6]. Several kinds of research revealed that ITSM was implemented in various types of organizations, such as government institutions [7][8][9], industry [10][11], universities [12], and banking [13]. On the other hand, several studies explained that ITSM adoption is influenced by several factors that could be drivers or barriers. Identifying drivers and barriers was considered one step in designing appropriate policies to increase ITSM adoption [14].

Along with business development, ITSM then began to be implemented in small-scale companies. The adoption of ITSM in small-scale organizations is driven by the belief that ITSM can provide benefits, such as job transparency, workload reduction, and business competition [15]. In small organizations, ITSM is only applied to critical areas. The essential areas refer to the areas that provide the most benefits to organizations such as incident, problem, change, and configuration management [16]. As a developing country, Indonesia certainly realizes the positive impact of ITSM adoption on the organization. Therefore, several companies in Indonesia have implemented the ITSM framework. Lismanto et al. stated that ITIL had been used in several companies in Indonesia that are engaged in various fields, such as marketing, telecommunications, aviation, and education [17]. The companies mentioned in the study were classified as large