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Yet Another Definition on Name, Address, ID, and Locator (YANAIL)

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Abstract

This paper proposes a new definition on names, addresses, identifiers, and locators based on a different framework. Starting with observation of the patterns how those terms are used, a new definition for the terms and their relations are presented. First, name and address are defined based on assignment, where a name denotes an entity itself and an address denotes a point to which the entity is attached. On the other hand identifier and locator are defined based on their use, where identifier is used for identifying an entity from others without ambiguity and locator is used for locating an entity within a given space. Next, the relationship among those four terms is presented. Finally, we show how communication is performed with respect to the new definition.

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1. Introduction

Many definitions for name, address along with identifier and locator have been proposed, but the exact relation among those concepts is still vague. One of early and most often referred definitions is proposed by J. Shoch [1], where three distinct concepts are defined as follows:

A name indicates what we want,
An address indicates where it is
A route indicates how to get there

Shock's definitions have the advantage of being simple and intuitively comprehensible. However, going on one step further in detail, ambiguities may arise with regard to interpretation. [2] One example is an Ethernet (MAC) address which is a 48-bit number assigned to the controller of the Ethernet, so called factory-set address. Obviously, the Ethernet address cannot tell any information concerning on "where it is" since the address is fixed before installing on some position in the network. Can we still call it an address? Probably not, then, do we have to call that a name rather than an address? Maybe yes, but once being installed in a local area network, the Ethernet address is used for communication in the same way as other types of addresses. This shows why we have to define those concepts more clearly.

Recently, in addition to the previous definition, the terms, identifier and locator, are widely used. [3,4] Separation of ID and locator is proposed on retrospect on duplicated roles of an IP address: as the identifier of host and also as the locator indicating where the host is attached. Those proposals introduce two separate name spaces: one for identifier and the other for locator. But none of the proposals clearly defines the relation between name and ID, address and locator.

Similar issues can be found in the area of W3C where URL (Uniform Resource Locator), URN (Uniform Resource Name), and URI (Uniform Resource Identifier) are defined. The term URL refers to the subset of URI that identify resources via a representation of their primary access mechanism (e.g., their network "location"), rather than identifying the resource by name or by some other attribute(s) of that resource. The term URN refers to the subset of URI that are required to remain globally unique and persistent even when the resource ceases to exist or becomes unavailable. While [5] attempts to address the distinction between URIs URLs, and URBs, it has not been successful in clearing up the confusions. [6]

This paper proposes a new definition on names, addresses, identifiers, and locators based on a different framework. In section 2, we observe the patterns how those terms are used, and a new definition for the term and their relations are presented in section3. The major contributions of the new definition and some further issues are given in conclusions.

2. Observation on the usage of the terms

2.1. Postal System

One of the earliest communication networks is the postal system that utilises address corresponding geographical locations such as street number, street name, city, zip code, and so on. Practically the postal system has no name concept, but has address concept only. Addresses in the postal system have hierarchical structure generally corresponding geographic or administrative regions.

2.2. Telephone network

The telephone systems, in early days, have similar structure as the postal system. Phone numbers consists of exchange number, area code, and country code. Later, some location-independent numbers, such as toll-free 800 numbers, are introduced. According to previous definition on address, the toll-free phone number is not an address but looks like a name.

2.3. Internet (IP and TCP/UDP)

Original Internet is based on IP address which consists of network address and host identifier in the network. Later, the network address parts and the host identifier parts in IP addresses become flexible in Classless Inter-

Domain Routing (CIDR). In the sense that the network address parts are used in routers in the network and host identifiers are used for pointing hosts in the network, IP addresses are used as locators. At the same time IP addresses are used to denote host itself. This duplicated semantic of IP address causes serious problems in mobile IP and multi-homing situations. To solve these problems, Identifiers and locators separation approaches are recently proposed. [3,4] Those papers use terminology, identifiers and locators, but don't explain any differences with the traditional terminology, names and addresses.

2.4. Application such as Web, Email, and SIP

In early days of the Internet, an application is identified by the IP address of the host and the port number of the application. The notations are formalized by W3C in the form of Uniform Resource Identifier (URI) which includes location-dependent Uniform Resource Locator (URL) and location-independent Uniform Resource Name (URN). However, people, even experts, tend to be confused and use the term, URI, URL, URN interchangeably. [6] Thus, it is natural to wonder how they are related and attempt to clear up the confusion.

3. Yet Another Definitions on Name, Address, Identifier, and Locator (YANAIL)

Based on the observation, we can define names and addresses, identifiers and locators. First, names and addresses are defined based on where the symbols are assigned. Then, identifiers and locators can be classified based on for what purposes the symbols are used.

3.1. Definition of Name and Address

A name is a symbol that denotes an entity itself and an address is a symbol assigned to the position where entities can be placed. Note that the position itself may be an entity which has its own name. For example, when we refer "Seoul" as the capital city of Korea, the symbol "Seoul" is the name of the city. But when we refer the same symbol "Seoul" as a citizen of the city, the symbol "Seoul" is viewed as an address. Thus, the same symbol can be either name or address with respect to the referrer. We can find many similar situations in the Internet as well. In the host view point, one of the IP addresses assigned to its interfaces can be used as the name of the host, and also the host name is the address for the services and applications running on the host.

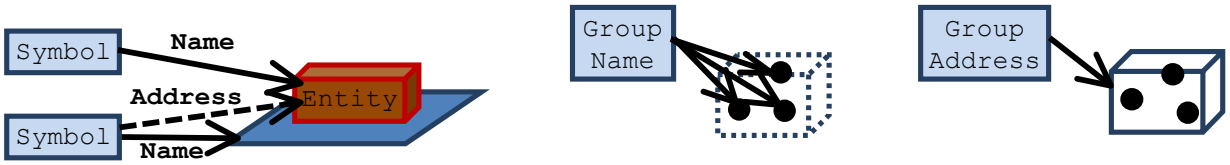

Figure 1. Name, Address, and group name, address

A symbol can be either name or address with respect to an entity. As defined in ISO/OSI Reference Model and PNA [7], names and addresses can be defined in the recursive manner such that (N)-address is composed of (N-1)-name and (N)-selector. Similarly, the address of a site is the name of the attachment point to the core network. Now let's define addresses and names as follows;

Definition 1) A name denotes entity itself, and an address denotes position where an entity can be placed (or attached)

3.2. Definition of identifiers and locator

In contrast to the definition of names and addresses, which is based on where the symbols are assigned, either to the entities or the position, the definition of identifiers and locators are based on their roles. Now let's define identifiers and locators as follows;

Definition 2) A symbols used for unambiguously identifying entities from others are called identifiers and the symbols used for pointing specific positions on a given space are called locators.

Of course, a name is often used as an identifier of the entity that the name denotes. To be used as an identifier, a name must be unique in a given scope but this is not always guaranteed. For non-unique names to be used as identifiers their scopes may be limited or the names could/must be qualified. For instance, two entities with the same name, say N, may belong to separate scopes, say S1 an S2, can be identified by "N@S1" and "N@S2".

Similarly, addresses are often used as locators since addresses are the name of specific positions in a given space. Path names of the file system in UNIX operating system are typical examples of locators, where the path name of the directory containing a file is the address of the file, and it can be used as the locator for the file. As in the case of name, addresses, to be used as locators, must be defined in a specific space. Typical examples can be found in Uniform Resource Locators (URL), where a locator consists of access method, address of the host, and path name, i.e., http://www.etri.re.kr/future_internet/doc/YANAIL.doc. In the sense that the URL denotes the document itself, it can be viewed as name rather than address. In other word, name, if it is location-specific also used as a locator. On the other hand, addresses sometimes used as identifiers when a specific entity is associate with that position. For example, the Email address of a person can be used as login ID or the phone number of a person can be used as a key to identifying him. The relationship among them is depicted in figure 2 and further explained in Section 3.4.

3.3. Group names and group addresses

One of the controversial issues in naming and addressing is how to define group names and group address. According to the traditional definition of address where an address indicates the location, a group address cannot directly indicate locations. A group name is also problematic in the sense whether it indicates a collection of entities or the collection itself. This is analogous with the difference between a "box of apples" and an "apple box". Expanding the new definition on names and addresses, let's define group name and address as follows;

Definition 3) A group name denotes a set of entities collectively, so the group name can be converted into a list of names, and A group address is the address assigned in the position (or container) where multiple entities can be placed (or contained), so the group address cannot be expanded into a list of entities.

By definition, a symbol denoting the "box of apples" is a group name and a symbol denoting the "apple box" is a group address. In the context of the Internet, multicast IP addresses or multicast MAC addresses can be viewed as group addresses and a group Email address can be viewed as group name. Since a group Email address is a collection addresses, it may sound strange that a group Email address is a name. But remember that an Email address is also the name of entity (mail box in this case) so the group name is collectively denoting the mail boxes. And the Email group name is used as an address for the mail sender and receiver.

Now, do we need a definition on group identifiers and group locators? As defined in Section 3.2, group name as well as group addresses can be used as identifiers as long as they can unambiguously separate a group of entities from others. Also, they can be used as locators with appropriate access mechanisms such as expanding a group name into a list or checking the membership of a group address. Note that choosing one members in a group name/address is called “anycast”, and referring all members in a group is called “multicast”.

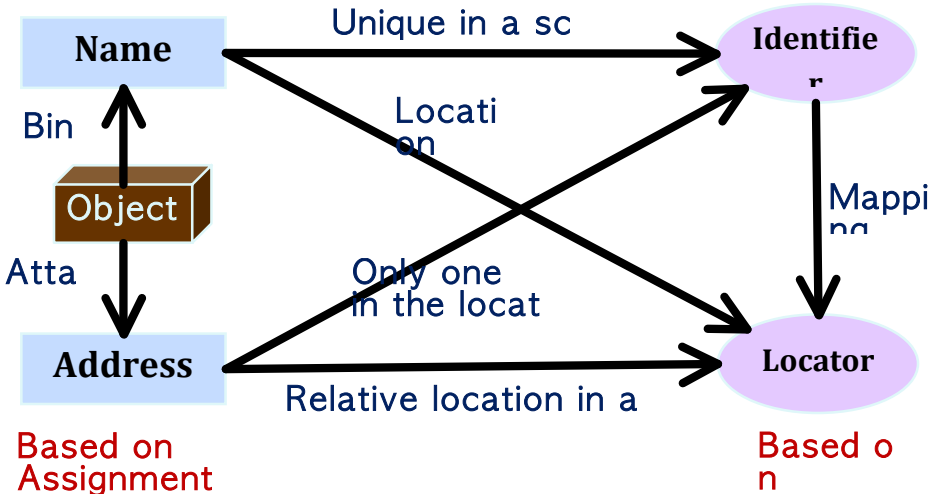

Figure 2. Relationship among Name, Address, and group name, address

3.4. Relations and Process

The relationship among concept on names, addresses, identifiers, and locators are depicted as in Figure 2. With respect to an entity, a name denotes the entity itself, and the name of position where the entity is associated is defined as the address. The entity name can be used as an identifier in case that the name is unique within a given domain. An address also may be used as an identifier as long as the address is unique and the entity (entities) associated with that position can be unambiguously determined. To be used as a locator, addresses or name must have their relative positions within a space, that is, from a specific position in a space one locator can be said to be near/close to another. For example, Two IP addresses sharing with the same network portion are said to be closer than two IP addresses with different network potions.

Concerning on the process of identifying and locating, distinguishing concept are ‘scope” and “space”. An identifier must be unique within a scope and a locator must point a specific position in a space. Let’s define “scope (identifying scope, to be specific)” and “space (locating space, to be specific)” as follows;

Definition 4) The scope of an identifier is the domain in that the identifier is recognized as being valid, that is, the identifier denotes an entity (entities) without ambiguity. The space of a locator is the set of all possible positions that the locator can take, that is, an entity can be placed any position in the space.

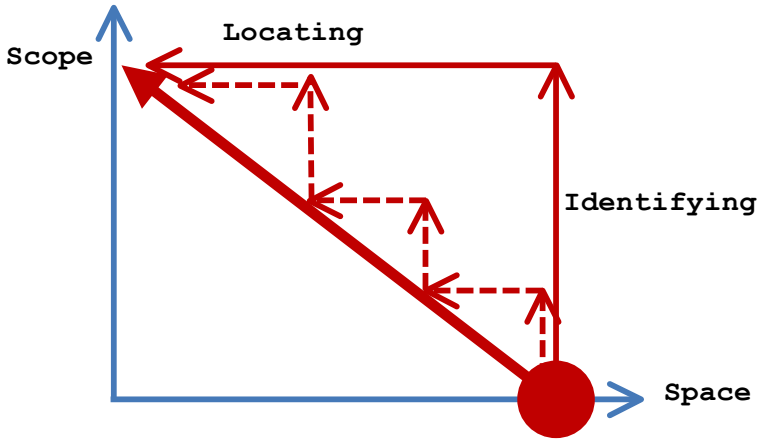

Figure 3. Process of Identifying and Locating

Let's assume a company, for instance, where 4 digit number for employee identifier. The 4 digit number itself has no meaning, but it can be recognized only in the company scope. Assume that the 4 digit numbers are used as locators (i.e., the phone extension number for each employee). Then, the set of all possible values (i.e., 0000 ~ 9999) can be defined as the space of the locators. In reality, scope and space are often used interchangeably such that the company defines the scope and the space of the 4 digit number in the above example. To be specific, the scope is a matter of recognisability and the space is the matter of confinability.

In any given scope, you can use an identifier for only one purpose. An exception to this rule is caused by separate spaces. Different spaces allow the same identifier to be *overloaded* within the same scope. For example, an identifier within the same scope, "server.etri.re.kr" might reference a different system when it is used in the different spaces, such as a web service space or an email service space.

By definition, the identifying process is characterized as uniqueness checking by expanding the scope, and locating process is characterized as finding a point by narrowing the space. For example, in order to communicate, we have to identify what entity we actually want to communicate with, and then locate the entity in the communicating network. Starting with the narrow scope of the initiator, identifying process is performed by expanding the scope gradually until the entity is proved as being unique in the scope in that both initiator and responder share. On the other hand locating process is started with a wide space, and narrows down the space by limiting or transforming the space. As in Figure 3, the identifying and locating processes are done in sequential (solid line) or alternative (dashed line) ways.

4. Conclusions

One of the major contributions of YANAIL is providing consistent definition on names, addresses, identifiers, and locations, which have been long problematic and inconsistent. This paper proposes a new framework for names and addresses based on where the symbols are assigned and identifiers and locators based on how they are used. Along with the definition, group names and group addresses are also defined in the same framework.

The relationship among those concepts is shown, and general steps for identifying and locating process are suggested.

Based on new frameworks, we hope the existing definitions and mechanisms can be interpreted in consistent ways. Moreover, various identifying and locating processes can be developed in more comprehensible way than ever before.

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