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Understanding Public Service: An Ontological Characterization of E- Government

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Abstract . With the development of electronic technology and amount of shortcomings of traditional Public Administration (PA) have been exposed nowadays, E-government start to be being used extensively. In this paper, we analyzed the documents provided by a certain government based on the OntoClean methodology. Public service was divided into four social properties, and 17 categories. These definitions of taxonomy are contributive to the establishment and development of E-government and this ontology-based methodology can be applied in different scenarios, like commercial services, applying the same method.

Keywords - ontoloy; PublicService; e-government; social roles; OntoClean;

1. Introduction

The emergence of the Internet and developments in processing capacity and data storage over the 1990s has significantly altered the environment for Information Communication Technology (ICT) use across society and in government."Public Administration (PA) can be broadly described as the development, implementation and study of branches of government policy." [1] Public Administration is often regarded as including some responsibility for determining the policies and programs of governments. However, PA faces a multitude of daunting challenges in achieving economic development and growth. Many drawbacks exist in its system, such as remoteness between government and citizen, and opaque decision-making processes. A meaningful and efficient instrument is needed for tackling both traditional challenges - such as institutional reform, civil service reform and an efficient public sector – and more recent threats produced by the globalization and new technologies in everyday life. E-government is recognized the use of technologies to facilitate the operation of government and the disbursement of government information and services. It's a powerful tool for human development and essential to the achievement of the internationally agreed development goals. The transformative power which try to revitalize PA transform government machinery, operation processes and improve the quality of government services – improve the managerial effectiveness, promotion of democratic mechanisms, and operational efficiency of public services.

The service of PA is the social affairs which related to state, community, common interest of individual accompanied by social development. It includes the production and supply of public goods and to establish and implement of public services. The basic duty of a country is to manage these affairs which individuals cannot or unwilling to complete, in other word, it is public affairs. The service which provided by PA include both political public affairs and social public affairs. Political public affairs are closely related to the construction of state power, involved in the stability of the regime and the development of political and need to rely on state power to address the public affairs, such as military, diplomatic, judicial, maintain public safety; social public affairs don't need rely on state power to address public affairs, such as education, science and technology, public transport, medicine and health and so on. With the emergence of public affairs, there are two different social divisions of labor: one is product public goods directly, provide public services, its

subject is various social welfare organizations. The other one is the subject of public administration in order to solve public problems, achieve the public interest and manage the public affairs using public power.

This paper is based on a project cooperated with a certain country (To maintain secrecy, we use country X instead of the name of that country).

We have to collect the information in their documents and sum up the different classifications. In section two, we will describe the service terminology about public service.

2. Service Terminology

The OntoClean methodology which was first introduced in a series of conference-length papers by Guarino and Welty OntoClean [2, 3, 4, 5] received much attention and has been largely used in recent years. Essence, identity, rigidity and unity which are highly general ontological notions drawn from philosophy impose several constraints on the taxonomic structure of an ontology. As what Alan Rector said of the OntoClean methodology, "…what you have done is reduce the amount of time I spend arguing with doctors that the way I want to model the world is right…"[6], OntoClean provides an effective method helping in arguing against the most common modeling pitfalls. In the following statement, we will explicitly refer to *rigid* (+R) and *dependence* (+D).

1) rigid

First of all, Guarino advanced the definition of essential in 2001 [7]: "A property of an entity is essential to that entity if it must be true of it in every possible world." For instance, water is essential of ocean, as we all know, there won't be an ocean exist without water. The definition of rigid is based on essential, "a property is rigid if it is essential to all its possible instances." [7] It means that an instance of a rigid property will stop being an instance of that property. On the contrary, there will be some property isn't essential to entities. It is called 'anti-rigid'(~R) which defined as follows, "A concept is anti-rigid if, for any time an entity is classified under it, there exists a time at which the entity is present but not classified under the concept." [7]

2) dependence

Dependence means that if there are some instances take one property, there must be some instances take another property, and there is an entity classified by the latter property is external to the former one. In [8], "A concept x is dependence if its definition involves (at least) another concept y (definitional dependence) such that for each entity classified by x, there is an entity classified by y which is external to it (generic existential dependence on external properties)" Such as student, it dependence on teacher. Obviously, there are some property don't dependence on anything, such as book.

As we stated above, public service is complex, it related with education, science and technology, public transport, medicine and health and so on. In this paper, four social properties are used to classify amounts of service objects.

2.1. Social Roles

Masolo et al. proposed that social roles have to satisfy the anti-rigidity property and also characterized by the dependence property in [9]. Obviously, anyone should exist without playing a social role. It's a position in the whole social structure. The other feather is dependence we can figure out each role need to match with another property. Such as student, there should be teacher match it.

Take foreigner as an example: foreigner can be people who are stateless or non-European citizens, once people change his nationality to EU country, he isn't a foreigner. So to be a foreigner is anti-rigid. Besides, it depends on his nationality, so it's dependence. According to the definition of social roles, we can learn that foreigner is a social role.

2.2. Socially Determined Historical Property

Take physically disabled as an example: in our domain, we consider that physical disabled won't be cued in the future. A certificate is necessary to reveal the diagnosis issued by competent health authorities since the officers in service department don't have the right to give diagnosis. A person may be a physical disabled when he was born or become physical disabled after a tragic accident. No matter the time and the reason, once

he is physical disabled he will remain physical disabled throughout his life. We called this property as socially determined historical property.

In our domain, there is another category belongs to this classification – victim of trafficking. We consider that victim of trafficking are people who were transfer from other place and were forced work in CountryX. We can't identify a person is a victim of trafficking when he is forced working. Think in most cases, when people try to apply the service for victim of trafficking, he have already rid of this situation. Therefore, in our domain, victim of trafficking is people who have this kind of experience. So victim of trafficking is socially determined historical property. From this typical case, we can learn that Socially Determined Historical Property can be recognized by the fact that they are supply identity criteria, anti-rigid and dependent on some certificate to prove his disease or his experience in OntoClean methodology (+I~R+D).

2.3. Phased Sortal and Social Phase

The notion of a phased sortal was originally introduced by Wiggins [10]. "A phased sortal is a property whose instances are allowed to change certain of their identity criteria during their existence, while remaining the same entity." As we all know that tadpole will change into a frog whexn it grow up, even though it is still the same entity, however, something fundamental which can make it recognized has changed. According to the sortal individuation principle, phased sortals come in clusters of at least two properties: one is an instance of a phased sortal (e.g., tadpole) should be able to "phase" into another one (e.g., frog); the other is these clusters should have a common subsuming property providing an identity criterion across phases.

According to the statement about phased sortal, let's discuss about social phases. Social phases are different life spans of people based on culture and law in the society. The life spans aren't divided by people themselves but society. In our case, Minor, Adult and Elderly, as different life spans, which is similar to phased sortal. Since minor, adult and elderly share different rights and obligations and those different right and obligations are entitled by law. In most countries, the age which legally demarcates childhood from adulthood is 18. However, there won't be a huge change physically or mental on the day before his 18th birthday and later. Unlike the difference between tadpole and frog, we can't tell a clear difference for a person who becomes from minor to adult within one day. The person who is discussed here is a (legal) person in society but a human being.

In OntoClean methodology, social phases are changeable and dependent on culture and law in the society (~R+D). Social phases are also a specification of social roles. In a nutshell, social phases connect to a precise duration. Differently from roles, once that the duration period has been (socially) fixed (like for minor, you fix that it holds for 18 years), the property that determines whether an individual is in that social phase is just connected to time, however, for roles it can be connected to whatever.

2.4. Essential property

Essential property means that the proper is *essential* to every entity in the possible world. We can learn that the entity which is essential doesn't depend on anything but belong to this category whenever it exists. In our case, Gypsy is essential. We all know that to be a Gypsy is fixed as a kind of ethnic groups and is invariable as soon as one was born. It's essential so it's rigid and independence. (+R-D)

3. Definition and Taxonomy

This is some contest from the documents (translation in English): "The service area consists of two dimensions: the age group (children, adults, elderly) and condition (foreigners, disabled, etc.). While age is a feature unique and irreplaceable, the condition is an attribute or a set of attributes that are dependent on subjective or objective life situations of the user. If a user can be assigned a single age group, the condition is non-exclusive, then to the same user can be assigned multiple conditions simultaneously. This means that statistically the amount of users by age, given a population of 100, will always be 100, while the sum of users by type of condition is most likely different from 100.

Folder in each user will therefore always associate with age, but not always and not necessarily to one or more conditions."

We can notice that the documents are very ambiguous. After four social properties were discussed above, we will go work on some deeper. The service object can be divided more detailed gradually. The categories will be advanced in this section.

3.1. definitions of classification

3) Minor

The term minor is used to refer to a person under a certain age. The age of majority, which legally demarcates childhood from adulthood, is 18 in country A. Minor, Adult and Elderly, as different life spans, are social phases as discussed in Section 2.

Minor is person under 18 years of age.

(D1) **Minor**(x, t) ≡ **Person**(x) ∧**Date**(t) ∧**Alive**(x,t)∧ (**Birthyear**(x) > **year**(t) - 18) ∨ ((**Birthyear**(x) = **year**(t) - 18) ∧ **Birthmonth**(x) < **month**(t)) ∨ ((**Birthyear**(x) = **year**(t) - 18) ∧ **Birthmonth**(x) = **month**(t) ∧ **Birthday**(x) < **day**(t))

4) Elderly

Old people have limited regenerative abilities and are more prone to disease, syndromes, and sickness than other adults. The medical study of the aging process is gerontology, and the study of diseases that afflict the elderly is geriatrics. So elderly need more attention and more services. That's why elderly is classified as one of the most important category. Here is the definition:

Elderly is person aged 65 or older.

(D2) **Elderly**(x, t) ≡ **Person**(x) ∧**Date**(t) ∧**Alive**(x,t) ∧ (**Birthyear**(x) < **year**(t) - 65) ∨ ((**Birthyear**(x) = **year**(t) - 65) ∧ **Birthmonth**(x) > **month**(t)) ∨((**Birthyear**(x) = **year**(t) - 65) ∧ **Birthmonth**(x) = **month**(t) ∧ **Birthday**(x) ≧ **day**(t))

5) Adult

Adult is a person who attains the age of majority with all the attendant rights and responsibilities of adulthood. These may include entering into a binding contract, buying stocks, voting, buying and/or consuming alcoholic beverages, driving motor vehicles on public roads, and marrying without obtaining consent of others.

Adult is person whose age is between 18 and 64 (included).

(D3) **Adult**(x, t) ≡ **Person**(x) ∧**Date**(t) ∧**Alive**(x,t)∧ ¬**Elderly**(x, t) ∧ ¬**Minor**(x, t)

6) Foreigner

Foreigner usually means a person from a foreign country or from outside a particular group or community. In our domain, foreigner means people who are nationals of a state outside the European Union and stateless persons.

Foreigner: Stateless people or non-EU citizens.

(D4) **Foreigner**(x, t) ≡∀y (**Person**(x) ∧ ¬**EU**(x, y, t) ∨¬**Citizen**(x, y, t))

(D5) **EU**(x, y, t) ≡ **Person**(x) ∧ **Citizen**(x, y, t) ∧ **EUCountry**(y, t)

(A1) **Citizen**(x, y, t) → **Country**(y) ∧ **TL**(t)

7) Gypsy

Gypsy, as a kind of ethnic group, is determined when people was born. It's essential. Its definition is as follows:

Gypsy is person belonging to one of the ethnic groups popularly referred to as Roma and Sinti.

(D6) **Gypsy**(x, t) ≡ **Person**(x) ∧(**Roma**(x, t)∨**Sinti**(x, t))

8) Disabled

According to World Health Organization (WHO), "Disabilities are an umbrella term, covering impairments, activity limitations, and participation restrictions. Impairment is a problem in body function or structure; an activity limitation is a difficulty encountered by an individual in executing a task or action; while a participation restriction is a problem experienced by an individual in involvement in life situations. Thus disability is a complex phenomenon, reflecting an interaction between features of a person's body and features of the society in which he or she lives." [11]

A disability may be physical, cognitive, mental, sensory, emotional, and developmental or some combination of these. However, in our thesis we just mentioned physically disabled and mental disordered.

Disabled is physically disabled or mental disordered person.

(D7) **Disabled** (x, t) ≡ **Physicallydisabled** (x, t)∨**Mentaldisordered** (x, t)

9) Physically disabled

The physically disability which we mentioned here is relative to people who are invalids, blind or deaf, disabled workers, war invalids and so on, moreover they cannot be cured. Just because of that, physically disabled is Socially Determined Historical Property rather than social role.

According to our definition we can learn that one who is blind still isn't a physical disabled if he doesn't have a certification of disability or assessment of handicap issued by the committees of investigation of disability and disabling cases. Because the officers in government don't have any right to judge whether people can see or not, we need an authoritative organization to check this. The same as Mental disordered, Drug Addict and Alcoholic. Therefore, physically disabled is defined in this way:

Physically disabled is person who holds a certificate of disability issued by competent health authorities.

(D8) **Physicaldisabled**(x,t) ≡**Person**(x) ∧**Date**(t) ∧∃t' (**Certified**(x, P, t') ∧ (t' ≦ t))

(A2)**Certified**(x, y, t) →**Person**(x) ∧ ((y=P) ∨ (y=M) ∨ (y=D) ∨ (y=A)) ∧ **TL**(t)

In order to judge mental disorders, drug addiction and alcoholism the certificate of diagnosis is required made by the competent health service. Unlike physical disabled, drug addictions, alcoholism and metal disorder is medically defined as a treatable disease, so there is a period of validity for their certificates.

10) Mental disordered

"A mental disorder or mental illness is a psychological or behavioral pattern generally associated with subjective distress or disability that occurs in an individual, and which is not a part of normal development or culture." [12] In our domain, Mental disordered is defined as followed:

Mental disordered is adults with recent psychiatric diagnosis and children with neuropsychiatric diagnosis issued by competent health authorities.

It's not hard to see mental disordered is a social role. Besides, the reason we didn't distinguish the certificate between adult and children is we consider the certificate will display the type of diagnosis according to the time and age of holder.

(D9) **Mentaldisordered**(x, t) ≡**Person**(x) ∧**Date**(t) ∧∃t' (**ValidlyCertified**(x, M, t') ∧t'<t **))**

(A3) **ValidlyCertified**(x,y,t)→**Person**(x) ∧**Date**(t) ∧ ∧ ((y=M) ∨ (y=D) ∨ (y=A))

(A4) ((x=M) ∨ (x=D) ∨ (x=A)) →**Time**(**ExpiryDate**(x))

(A5) **ValidlyCertified**(x,y,t) →∃ t' (**Certified**(x,y,t') ∧t'+ **ExpiryDate**(y) > t)

11) Alcoholic and Drug Addict

Alcoholic and drug addict are quite similar in our thesis, so we decide to write them together. They are both people with disabling addictive disorder a characterized by uncontrolled consumption of alcohol or drug despite its negative effects on the addiction's health, relationships, and social standing. Like disabled, alcoholic and drug addict also need certificates. Their definition is based on the following statement:

Alcoholic is person with a diagnosis of abuse or alcohol dependence formulated by competent health authorities.

(D10) **Alcoholic** (x, t) ≡ **Person**(x) ∧**Date**(t) ∧∃t' (**ValidlyCertified**(x, A, t') ∧t'<t **))**

Drug Addict is person with a diagnosis of abuse or addiction to drugs formulated by competent health authorities.

(D11) **Drugaddict** (x, t)≡ **Person**(x)∧**Date**(t) ∧∃t' (**ValidlyCertified**(x, D, t') ∧t'<t **))**

12) Family of minor

Some service is offer to family member of minor, but it's not true that any family member can benefit from social interventions. The family member must live with the minor. Try to imagine that a minor whose parents have divorced and the father didn't live with the child for many years. This father will lose the right to benefit from the social intervention as family member of the child.

Family of minor is person who benefits from one or more social interventions as family members of minor.

(D12) **FamilyofMinor**(x, t) ≡**Person**(x) ∧**Date**(t) ∧ ∃y ((**Adult**(x, t) ∨ **Elderly**(x, t)) ∧**Minor**(y, t) ∧ **benefitfrom**(x, y, t) ∧ **Familymember**(x, y))

(A6)**benefitfrom**(x, y, t) → **livetogether**(x, y, t)

(D13)**Familymember**(x,y) ≡ **Grandfather**(x,y) ∨ **GrandMother**(x,y) ∨ **Father**(x,y) ∨ **Mother**(x,y) ∨ **Uncle**(x,y) ∨ **Aunt**(x,y) ∨ **Brother**(x,y) ∨ **Sister**(x,y) ∨ **Nephew** (x,y) ∨ **Cousin**(x, y) ∨ **Niece** (x,y)

13) Unaccompanied foreign minor

Since we consider minor is an individual who doesn't completely bear the ability of civil act, they need a tutor to stay with him, especially foreign minors. So as soon as government found that there isn't a tutor who companies a foreign minor they will assign him one in order to supervise his life in Country X.

Unaccompanied foreign minor: Foreigner minor who aren't accompanied by their parents or legal tutor.

(D14) **UnaccompaniedForeignMinor**(x, t) ≡ **Foreigner**(x, t) ∧ **Minor**(x, t) ∧ ¬∃y (**Tutor**(x, y, t))

14) Victim of Trafficking

In this thesis, we advance two points, if a person satisfied both of them, then he is a victim of trafficking in our domain. One of them is people must be transfer from one place to another and the second place which he was transfer to can't be the place he come from, the other is he must be ever forced work. Based on those two points, the definition can be given as follows:

Victim of trafficking is Non-Italian people, victims of recruitment, abduction, transport, sale, transfer, through threats or violence, deceit, coercion, kept in a state of involuntary slavery, forced labor or submission, in a community other than the one they come from.

(D15) **VictimofTrafficking**(x, t) ≡**Person**(x) ∧**Date**(t) ∧ Alive(x, t) ∧ ∃y, t', t'' (¬**CitizenofA**(x, T) ∧T=[t'',t] ∧**Date**(t') ∧**Date**(t'') ∧ **forcedtransfer**(x, p, Italy, t'') ∧(t' ≥ t'') ∧ **forcedwork**(x, CountryX, t') ∧**SL**(p) ∧¬**Part**(p, CountryX) ∧(t ≥ t'))

(A7) **CitizenofX**(x,t)→**Citizen**(x,y,t)∧ **Country**(CountryX)

15) Asylum seeker

An asylum seeker is someone who asks for international protection but whose claim for refugee status has not yet been determined.

Asylum seeker: foreign citizens who are legally in CountryX on a temporary basis because they requested the status of "refugees" before they receive the result of the procedure for recognition of refugee status.

(D16) **Asylumseeker**(x, t) ≡∃y (**Citizen**(x, y, t)) ∧¬ **CitizenofX**(x, t) ∧∃t' (**RefugeeRequester**(x, t') ∧(t>t') ∧¬**Refugee**(x, t))

16) Detainee

Detainee is a term used by certain governments and their military to refer to individuals held in custody, such as those it does not classify and treat as either prisoners of war or suspects in criminal cases. The person must be judged guilty and then be put in jail. For example, a shoplifter being pursued and restrained, but not yet informed he/she is under arrest or read his rights can't be classed as 'detainee'.

Detainee is person who is serving a sentence in a jail or prison.

(D17) **Detainee**(x, t) ≡**Person**(x) ∧**Date**(t) ∧ ∃t' (**ForcedInJail**(x, t', t) ∧(t' < t))

(A8) **ForcedInJail**(x, t', t) →∀t'' (t' <t'' <t → **ForcedInJail**(x, t', t'')

17) Ex-detainee

Unlike ex-president, once one was a president and no matter what kind of reason he leave this position he still is an ex-president. For ex-detainee, as what we stated in last Section, is a social role. Once a person have rehabilitated he lose the right to have the service for an ex-detainee. The definition of ex-detainee in our domain is as followed:

Ex-detainee is person who underwent one or more period of detention. (Excluded people who have rehabilitated)

(D18) **Ex-detainee**(x, t) ≡∃t' (**Detainee**(x, t') ∧ (t>t') ∧ ¬**rehabilitated**(x, t))

18) Low-income

Since we work on the Public Administration it's necessary to relative to low-income people. These people who do not have enough money to live on will be benefit paid. Low-income people can get many kinds of service such as Council Tax Benefit, Cold Weather Payment, Income Support, Budgeting Loans, Community Care Grants, Energy Efficiency grants and Christmas Bonus.

Low-income is person whose income is below the minimum subsistence.

(D19) **Low-income**(x, t) ≡ **Person**(x) ∧∃y (**income**(x, y, t) ∧ (y < **IncomeThreshold**(t)))

19) Extra area

Since those categories can't include all the types of people, we advance the last category—Extra area.

Extra area is person who doesn't fit into any categories listed above.

3.2. Relations between terms

The taxonomy of this paper is showed in figure 1, the categories belong to different social properties. It's not difficult to find that the position of each category in the taxonomy according the definition of them and social properties.

In the meantime, we can find from the figure that homeless is subclass of low-income. Since "the pursuit of the public good by enhancing civil society, ensuring a well-run, fair, and effective public service is some of the goals of the field."[1], service is provided to people who really need it. So in our domain, low-income is requirement of homeless. In case, there is a millionaire who doesn't have a domicile. Here, low-income is requirement of homeless. Each homeless in our domain must be low-income.

4. Conclusion

We have already analyzed the classification of the population access to services from public administration. In this paper we use the ontology-based methodology applied to social services. Learn from the ambiguous document, we classify the service object into four classifications and 17 categories are proposed in this paper. The relation between social properties is found using OntoClean. In fact, this ontology-based methodology can be applied in different scenarios, like commercial services, applying the same method.

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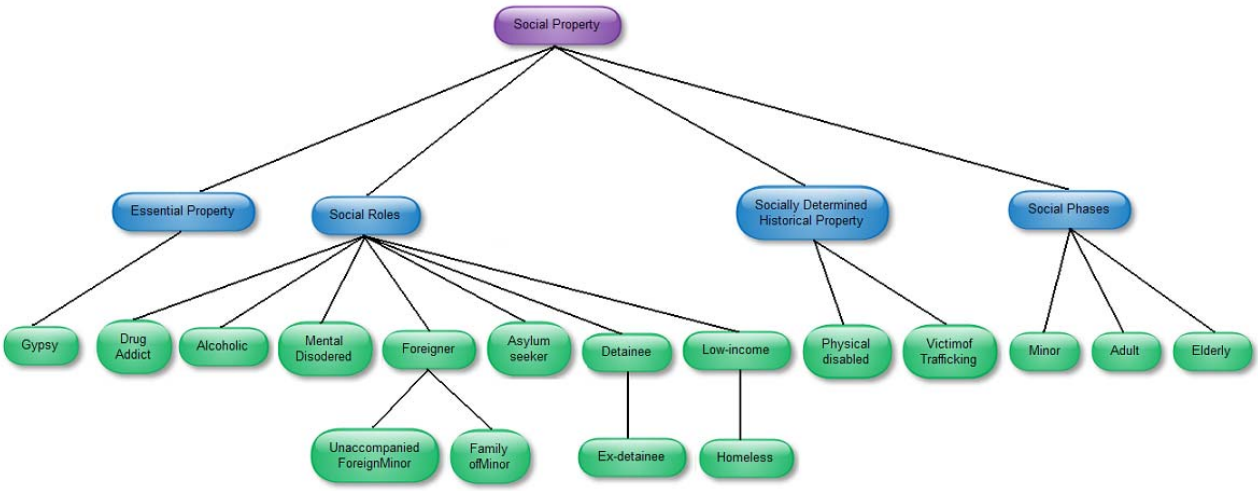

Figure 1. Taxonomy