PROPOSAL OF AN ARCHITECTURE FOR DIGITAL CITIES CREATION

Proposal of an Architecture P2P for Digital Cities Creation

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Abstract: The term digital cities do not have a precise definition. The number of digital cities, whose development started from the 90s, is constantly growing. Motivated by the increase of these cities, this paper describes architecture for digital cities environment as a proposal to create a middleware for the interconnection of the various segments of society. This middleware is structured in a Platform for P2P networks, also known as DHT, with emphasis in the JXTA modified protocol.

1 INTRODUCTION

Also known as Virtual City, Digital City, Intelligent City and other names, digital cities represent a kind of projection of a city in the digital world and emerge as one of the forces that may contribute to space organization (Silvia, 2002).

The digital cities can have many definitions. In (Silvia, 2002), it is defined that digital cities are people, systems and institutions that remain connected through a digital communication infrastructure. In digital cities, one uses real cities as reference for their digital counterpart, aiming at developing social relations of different purposes. These include one or more of the items cited below.

- Creation of political and cultural spaces for people and groups manifestation;

- Creation of communication channels between individuals and groups;

- Creation of communication and negotiation channels between municipal government and citizens;

- Favoring a greater identification from the visitors with the reference city;

- Creation of a collection of information from many different species and easily accessible on the reference city.

Digital Cities, as defined by Graham (Graham, 2007), can serve as a tool to improve communication between citizens and local government, stimulating many activities that promote new opportunities to the citizens, as we identify below.

"... virtual cities are electronic spaces, generally based on the World Wide Web, which were developed to connect, in an explicit way, the development schedules of each city. These virtual cities are working as political tool for a variety of urban plans and objectives: global urban marketing, stimulus to business and consumption, improving communications between citizens and local governments, increase the local enterprise competitiveness, greater local economies integration and the rebirth of civic and local culture." (Graham, 2007)

Motivated by the increased number of digital cities developed during the 90s, this article presents an architecture for digital cities environments and a proposal to create a middleware based on a DHT structure to people, groups and services (public and private) interconnections for this proposed environment.

2 DIGITAL CITIES ARCHITECTURE

In (Yamaoka, 2006) it is defined a minimal set of assumptions, policies and technical specifications that rules the use of Information and Communication Technologies (ICT) by the government, establishing the conditions for interaction. This middleware emphasizes the JXTA modified protocol, extending the interoperability traditional models in government for other society segments as citizens, companies and the third sector. Our proposition is developed based on these minimal premises.
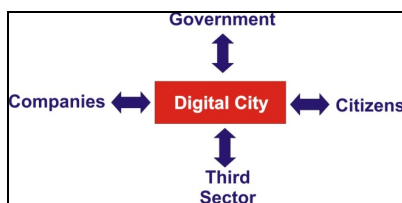

Figure 1: Interaction with digital cities and segments society.

The proposed architecture establishes rules on the following areas responsible for the interoperability of various society segments, Interconnection, Security, Access Media and organization and Information exchange.

For each of these areas we specify components, for which standards are established.

2.1 Interconnection

The segment "Interconnection" establishes the rules for enterprises (such as service or commercial companies) and governments to interconnect themselves upon the local network, which can be a metropolitan network, a community network, or even the Internet. This segment also treats the interoperation rules of enterprises and governments with the citizen. In this segment are defined Electronics Message Transport, Electronics Message Safely Content, Intercommunication LAN/ WAN and Transportation.

2.2 Security

This segment deals with the proposed architecture ICT security aspects that should be considered for Digital Cities creation. We treat in this segment security IP patterns, encryption, System Development and Network Services.

2.3 Access Media

In the segment Access Media one explains issues relating to devices standards, which are used to access the services offered by Digital Cities. We also define how devices must be treated. Some of these devices are computers, mobile phones, hand-helds and digital television, for example.

2.4 Organization and Information Exchange

This segment deals with aspects related to the processing and transfer of information among services offered by Digital Cities. It includes components for data exchange, data processing, data definition and Standards Database Catalogue (SDC). Information distribution for these situations requires the construction of suitable metadata structures for each of the cases above.

Clearly defined policies and specifications for interoperability and information management are key issues for providing the enterprise connection among citizen, enterprise, government and service providers. The Digital City is designed as a basic structure for the government strategy and business in the several business scenarios (B2B, B2C, B2G, G2G, G2C and C2C). This approach allows the rationalization of investments in ICT, through the sharing, reuse and exchange of technology resources.

Enterprises, government and services providers information resources are valuable economic assets. By ensuring that information or service can be quickly located and exchanged between the public and private sectors, keeping the privacy obligations and security, one encourages and stimulates local economy.

Nowadays, most of the countries of world recognize the needs for high investments in developing universal access to multiservice networks for all citizens. Economic analyses show that universal services cause a direct and almost immediate increase in GNP. Its also understood that universal access to services, particularly when we talk about e-Gov services, can only be achieved through the creation of virtual (and, sometimes, real) local networks (or Digital Cities). In creating the Digital Cities one is primarily concerned with establishing policies development, procedures and standards for ICT, mounting dedicated structures to reach local interoperability and seeking better quality provision services at reduced costs. The existence of a middleware as a foundation for

electronic services creation is a pre-requisite for better services provision at a reduced cost for all the actors of the Digital City.
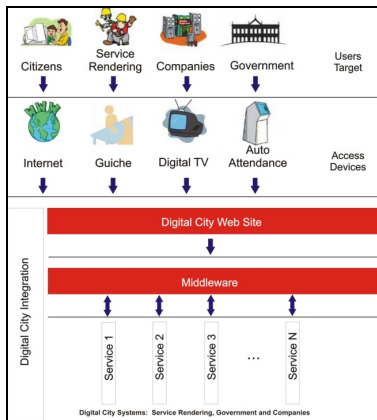

Figure 2: Proposal of Architecture for Digital Cities.

A modern knowledge society requires the development of integrated and interoperable intelligent systems, which must work in a safe and consistent environment. These requirements cannot be attained unless a common interoperable standardized environment is established. The middleware, whose architecture is shown in Figure 3, is also the solution for this exigency. This architecture covers the information exchange between the services offered by all society segments.

3 MIDDLEWARE

To create the Middleware, we propose to add an abstract slice on JXTA architecture. This slice will be acting as an access control to digital cities network.

3.1 Structure

The basic structure to the proposed middleware is based on the JXTA overlay network topology as can be seen in Théodoloz (2004), or in Traversat (2003). This model creates a network of Randezvous servers to establish interconnection links among these, and forming a complete graph, where each server is a vertex and the connections are the edges.

In a JXTA network each server has a complete and updated list of connected peers. Therefore, it is possible that the search for a service in the network be performed in a linear order when the network servers are consistent. Otherwise, when an inconsistency is found in the server's network,

another mechanism must be activated to return the identifier of a peer in time n.

Figure 3 represent the proposed architecture for middleware model described in this paper. In this architecture the *Rx* peers provide routing, the *Ex* peers services and the *Px* peers access to the interaction portal of Digital City.
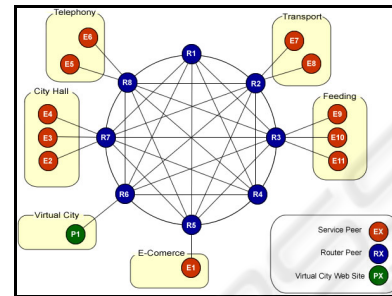

Figure 3: Proposal of Architecture for Middleware.

Another relevant element to build a Digital City is the creation of a protocol of multiple connections to the peers connected to the network. In order to use the multi-connection resources already available in the JXTA architecture and seeking to make an efficient use of the network and maintain its workload low, it is proposed the creation of an abstraction layer that keeps the peer connected to only one Digital City. However, the protocol allows the peer to make connections to other peers and other Digital Cities without loosing the main connection. This resource allows that the peer uses services from other digital cities and, at the same time, allows other digital cities to access its services.

To provide this resource, the abstraction layer cannot treat the peer identifier like it is treated in the JXTA architecture. In the proposed abstraction layer, the peer identification must be done using a pair of identifiers (GPID, PRID), where GPID is the group identifier and PRID is the peer identifier.

3.2 Security

In a corporative or government communication environment, data security is an extremely important issue both in storage and transport of information.

To provide security in the operations of data applications and transactions, one can use resources offered by the JXTA API. This resource has a set of algorithms that provide a base to security control in the applications developed using this API.

3.3 Digital City Directory

To maintain a consistent identifier services list in the digital cities network, one can create agents associated to the digital city portals and systems interfaces. These agents can perform periodic searches in the network to look for active services and to map these services with an appropriate description. With this map, the creation, ordering and availability of data are responsibility of the respective digital city through their portals and access interfaces.

4 USE CASE

The concept of Digital City can be easily explained how a user makes use of the digital city environment to plan and contract a travel to a congress in another city.

The citizen enters in the portal a make authentication. Authentication done, the citizen makes them registration and makes a payment with a credit card. As the bank system also was developed within digital city architecture, the congress page makes a request to the bank system with totally transparent to the user.

After registration, the citizen chooses a hotel in the city of the congress, buy the airplanes tickets and rent a car, paying all of this in the same bank systems

Although these actions performed by the citizen are familiar to the common user of the Internet, the Internet users are not able to follow, and even interfere in the process. In the Digital City, the user is able to perform all these activities by accessing only one page and yet follows all the process that happening behind the scenes.

5 CONCLUSIONS

The creation of digital cities provides communication channels to facilitate and improve the relations between citizens and government, citizen and enterprises, and enterprises and government. This communication environment is suitable to head these relationships because the sophisticated identification, authentication and security offered by the digital city middleware. For the authenticated user, the digital city can provide an environment rich in information and services.

The DHTs proposed in this work has as one of its main characteristics the separation between identifier and locator. This feature provides superior mobility and improves security. Another important feature of this DHT is the service doesn't have mapped in a physical address. The service can be mapped in a simple name, allowing an improved transparency with respect to migration.

To provide interoperability among different digital cities without creating inconsistency or service address replication, the creation of the abstraction layer proposed in this paper is indispensable.

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