A Calm GIS: Smart Mobile Applications

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Abstract: Invisible networks have hidden bits flows from human being and become the periphery in the Internet overload; technologies become invisible and everywhere computing. The appearance of the calm environment requires a new relationship between human being and machines and geographic features: a paradigm shift. However no one says what next steps to those environments on details are, a reason why lots of people focus on the endeavors. In this paper, we touch the geographic features on ubiquitous environments and research the transition step of GIS mobile applications in order to achieve a natural integration of connectivity, capability and functionality.
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1. Introduction

Invisible networks have hidden bits flows from human being and become the periphery in the Internet overload. With the recent ubiquitous computing, technologies become invisible and everywhere computing, but are in the woodwork everywhere, a calm technology. The calm technology makes geographic features recede into the well-connected background of our lives. The geographic features become intelligent, do more things in invisible places, and communicate with GIS mobile applications processing ubiquitous information. We focus on the evolution of GIS mobile applications: connectivity, capability, and functionality. They process real-time mobile data, provide various functions, support offline services, and make the network connectivity be invisible from users to achieve the anywhere services. An appearance of the calm environment requires a new relationship between human being and machines and geographic features: a paradigm shift. Thus, this paper researches the transition step of GIS mobile applications in order to achieve a natural integration.

2. Mobile GIS

Mobile computing technology comes from the evolutionary changes of computers since 1990s. Mobile phones, laptop computers and personal digital assistants (PDAs) have set high standards for mobile devices, and offer a myriad of options for improving communication across your organization and with your customers and trading partners. Because of such "go- anywhere" gadgets which enable your employees to access the company network from anywhere and at any time, we're accustomed to getting more done wherever we are and having the latest information available at our fingertips all the time. The Geography Information System (GIS) provides application information in geospatial industries, which collects, stores, analyzes and processes the geographic data on the Earth. It includes road facilities, buildings, electric circuits and water facilities as well as map data or transportation information.

These recent technological advancements in GIS technology, wireless communications and mobile devices have made mobile GIS a reality. Mobile GIS is the use of geographic data in the field on mobile devices. It's an evolution of how the enterprise database is used and managed within an organization. Mobile GIS includes essential components; global positioning system (GPS), mobile devices, wireless networks and GIS applications. A full range of mobile devices can be used for mobile GIS, from mainstream laptop computers with all the computing power of a PC to PDAs or Pocket PCs with smaller screens to cellular telephones with even smaller displays, simpler input devices and limited processing power. Mobile GIS is usually coupled with GPS and wireless communication to facilitate exchanges between the existing spatial server and mobile devices. Moreover, Internet-enabled devices rely on the wireless network to transport information. Performance is a function of the wireless network architectures because different wireless networks have different transmission rates. The GIS application serves data and applications to the user e.g. it offers location information content and information processing services. The type of information and services provided varies depending on the type of application being used. Fig. 1 shows components for mobile GIS systems, and bringing these technologies together makes the enterprise database directly accessible to field based personnel - whenever and wherever it is required.

Fig. 1. Mobile GIS Components.

Mobile GIS is a natural expansion of the business system environment that GIS currently operates in. It provides an entire workforce, from office-based analysts to field-based managers, with immediate access to information. This immediate access to relevant and complete data results in faster solutions and better decisions for the entire organization because it gives field workers the independence to make "on-the-spot" decisions anywhere at any time. Field technicians can edit and update feature and attribute data onsite. As real-time access becomes more of a reality, mobile GIS will use existing data for more sophisticated query and analysis operations.

3. Ubiquitous Computing

The *ubiquitous computing*, where technologies recede into background of our lives, has been researched and expected for the next generation communication environments. With recent ubiquitous computing, technologies become invisible and everywhere computing, but are in the woodwork everywhere: *a calm technology*. With 'a calm technology', the distributed heterogeneous models are supported under the one theme, 'a woodwork everywhere'.

In 1993, Mark Weiser introduces the ubiquitous concept based on an evolution of relationship between computer technologies and human being. In mainframe era, lots of people share a computer. Then one person uses one computer in personal computer era, and having an Internet-widespread distributed computing theme in transition, which we are now in. The next goes into the ubiquitous computing, where hundreds of wireless computing devices are provided per person and per office by forcing the computers to live out here in the world with people. Upon the ubiquitous environment, computing access is going to be everywhere, and users are able to share information through the invisible interfaces and do more things with unrecognizable computer technologies.

Fig. 2. Ubiquitous Computing.

The actualization of the ubiquitous computing can be touched from the view point of relationship between cyber spaces and real world. For the interconnection of those spaces, computer technologies go into neighbors of us, which is expected to overcome the physical limits of desktop PCs and fictitious instance in chatting rooms. The integration, however, requires new technologies and advances of existing technologies. An identity clears the existence of an object in spaces, and object identities are classified and represented by addressing each object to a network-enabling system such as Internet Protocol version 6. Context recognition feels, perceives and understands neighboring contexts, forms and objects. A sensing technology monitors the changes of neighbors, properties and spatial and temporal circumstances, and those transition and variation are continued to have relationship by space connectivity. Communications of their connection are on wired or wireless network infrastructures which are out of sight from human beings, *behind networks*. And a ubiquitous access make variable and different type of mobile devices contact and get ubiquitous information through the behind networks. In order to achieve the above statements, each object should be individually intelligent and self-organizing (Fig. 2).

4. Calm GIS

Invisible networks have hidden bits flows from human being and become the periphery in the Internet overload. If computers are everywhere they better stay out of the way, and that means designing them so that the people being shared by the computers remain serene and in control. Calmness is a new challenge that ubiquitous computing brings to computers. When computers are used behind closed doors by experts, calmness is relevant to only a few. The difference between enraging and encalming is in how they engage our attention, and calm technology engages both the *center* and the *periphery* of our attention, and in fact moves back and forth between the two [7]. The 'periphery' is named what we are attuned to without attending to explicitly; anything but on the fringe or unimportant. What is in the periphery at one moment may in the next moment come to be at the center of our attention and so be crucial. A calm technology would move easily from the center of our attention, to the periphery, and back, which is fundamentally encalming; the enhanced peripheral reach increases our knowledge and so our ability to act without increasing information overload. The calm technology puts us at home, in a familiar place; when our periphery is functioning well we are tuned into what is happening around us. The periphery connects us effortlessly to a myriad of familiar details, which fundamentally gives us *locatedness*, a connection to the world.

The calm technology makes geographic features recede into well-connected background of our lives, which requires a fundamental challenge for all technological design. The geographic features become intelligent, do more things in invisible places, and communicate with GIS mobile applications processing ubiquitous information. When features are all around, so that we want to compute while doing something else and have more time to be more fully human, we must radically rethink the

goals, context and technology of the features and all the other technology crowding into our lives. The geographic features give us *location*, which is encalming connection to fundamentals details of the earth: the *Calm GIS*. They process real-time mobile data, provide various functions, support offline services and make the network connectivity be invisible from users to achieve the anywhere services.

5. Smart Mobile Application

One of the properties of ubiquitous computing is network connectivity, however it is said that the Internet is not going to be the communication platform on ubiquitous computing infrastructures. The ubiquitous entities take advantage of short-range wireless communication technologies such as RF interfaces or Bluetooth, which can implement near field communications and connect to access points toward the Internet. Without regard to the networking infrastructures, from the viewpoint of connection, mobile applications need to notice the linking status to neighbors or servers, and may be responsible for activating their functions. This section describes the evolution of GIS mobile applications: connectivity, capability and functionality.

Access and use of GIS data and functions through mobile and wireless devices is possible in two main ways; online or offline. The online devices support real-time access to service/corporate data. These devices can access and display ubiquitous services in real-time using communication technologies. Users can make requests for data, modify this data and return the results. Using this method, the need to store large amounts of data on the device and to return to the office to synchronies files is eliminated. On the second, offline users download the data they require onto the device. They can then use a GIS application installed on the device to view and manipulate this data in the field. When complete, the user returns to the office, connects the device to a PC and synchronizes the changes. This method eliminates the need to establish live Internet connections in the field.

Regarding to an evolution of the connectivity, the starting point is *a local mobile application* where data is given from remote servers, stored, and used in local mobile devices. A mobile device may disconnect to remote data sources usually, only connect when needed. Instead, it defines, gets and stores information in itself, which is directly called by application programs. The next comes to a*n intermittent mobile application*. It becomes smarter, which should support seamless online/offline mobile services. It monitors and recognizes the connectivity with distributed geographic features, and does self-synchronizing for local-caching interfaces in multiplex network infrastructures. An application program on a mobile device calls ubiquitous data and services from local caches supporting self-synchronizing process or APIs on mobility data layer. *A smart mobile applicatio*n guarantees the connectivity. It does dynamic data processing, error detection of networks, and asynchronous data requests. The appearance of the calm environment requires a new relationship between human being and machines and geographic features: a paradigm shift. An application program on a mobile device calls ubiquitous data and services from the main codes and mobile devices calls the application program with online status.

6. Conclusions

It seems that everything on the Earth goes into the ubiquitous, and there is no doubt for the streams. However no one says what next steps to those environments on detail are, a reason why lots of people focus on the endeavors. In this paper, we touched the geographic features on ubiquitous environments. In order to understand previous works, we reviewed mobile GIS technology and concepts and current status of ubiquitous computing. Then we introduced a calm GIS that was based on the calmness on ubiquitous computing and was expected to give a design paradigm for place of GIS technology on next-coming infrastructures. In the last section, we showed smart mobile application that was the last place on the evolution steps of mobile appliances with regarding to the connectivity to the world having a myriad of ubiquitous information. As we learn calm technology, we will enrich not only our space of artifacts, but also our opportunities for being with other people. When our world is filled with interconnected, imbedded computers, calm technology will play a central role in a more humanly empowered twenty-first century.

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