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A PATH FOR HORIZING YOUR INNOVATIVE WORK

IDU FOR MOBILE COMPUTING

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Abstract

Technology is moving rapidly to the point where computing will be available everywhere, fully mobile, and will provide access to widely distributed resources. This trend to itinerant, distributed, and ubiquitous computing is the latest in a long series of major architectural changes, with associated implications for where computing is performed. Production of geographic data is similarly moving to a new set of arrangements focused on local agencies and individuals. These changes are placed within an economic framework, as a basis for development of a new set of theoretical principles regarding the location of computing, and its implications for

1. INTRODUCTION

Over the past few years, a large no. Of advances in computing and communications technology have made it possible for computing to occur virtually anywhere . Battery powered laptops were one of the first of these , beginning in mid 1980's and further advances in miniaturization and battery technology have reduced the size of a full powered but portable PC dramatically. The evolution of new operating systems (MS Windows CE and Java Soft Java OS) and software components (MS COM and Java Soft Java Beans are the main standards) have also had major impacts.Wireless communication technologies,both ground and satellite based,makes it possible to connect from places that have no conventional connectivity in the form of copper or fibre. New devices and methods of communication suggest the need for a fundamental re-thinking of the principles of geographic information systems design. Computers are likely to be used in new kinds of places that are very different from the conventional office; to communicate information using new modes of interaction, such as the pen and to require much better use of restricted displays and computing power.

2. IDU COMPUTING

2.1 GENERIC NATURE : IDU computing is by its nature generic. The two arguments seem especially compelling in this regard. First, all the three characteristics of IDU Computing – ability to be itinerant, distributed and ubiquitous are inherently geographic. Mobility specifically means with respect to spatial location , there are clear advantages to being able to integrate computing functions across many locations; and being able to compute anywhere in space is clearly an advantage. It is implicit in this chapter, therefore, that IDU refers to capabilities in space, rather than to capabilities in time or in any other framing dimensions. IDU computing is a geographic problem, and part of this chapter is devoted to the associated question: if computing can occur anywhere, where should it occur ? Answers to this question are likely to have profound influence on the geographic organization of society and its activities as we enter the information age.

Second, GIS analysis is focused on geographic location, and the ability to distribute computing across geographic locations is clearly valuable. It helps to make better decisions if the associated computing can occur where it is most helpful. Effective emergency management, for example, is likely to require that decisions be made at or close to the emergency, rather than in places more traditionally associated with computing, such as the desktop or the computer centre.

2.2 THE LOCATION OF COMPUTING: In the early days of computing there were no communication networks, and there were very strict limitations on the possible distance between the input and output peripherals, typically card readers and printers, and the central processing unit. Today, Computing has become so ubiquitous and cheap that delays are rarely experienced, and one expects to be able to connect to significant computing resources from almost anywhere. The locational pattern of computing has changed substantially in thirty years. Nevertheless, every bit of information and every operation in a central processing unit has a well-defined location. It is clear where the user is located, where bits are located on hard drives, where communications networks run, and where transformations of data occur as a result of the operation of software. From the perspective of communication, the important locations include :

1. The location of the user, where information finally resides as a result of computing;

2. The location of the user's workstation, which may travel with the user or may be fixed at some defined location such as an office desk;

3. The locations of the network used to transmit information to and from the user's Workstation;

4. The locations where information is transformed or processed into the form requested by the user;

5. The locations where the necessary data are stored, etc.

3. THE LOCATIONAL HISTORY OF COMPUTING

IDU is the latest of a series of forms of computing technology that have followed each other in rapid succession since the early days of computing in the 1940s. In this section three phases of development are identified, each with a distinct set of locational imperatives.

3.1 PHASE I: THE SINGLE-USER MAINFRAME

From the 1940s through the mid 1960s computing technology was limited to mainframes, each costing upwards of $1 million, and financed by heavy charges on users based on the number of cycles consumed. Each user would define a number of instructions, to be executed in a batch during an interval while the user had been granted control of the machine.

High-speed communication was expensive and limited to very short distances. In essence, then, the locations of computers were determined by the distributions of their users in patterns that are readily understood within the theoretical framework of

Central facilities location theory. (Lösch, 1954) and its more recent extensions, a central facility exists to serve a dispersed population if the demand for the service within its service area is sufficient to support the operation of the service. The minimum level of demand needed for operation is termed the

Threshold, measured in terms of sales for commercial services or size of population served for public services. The distance consumers are willing to travel to obtain the service or good is termed its range.

In summary, the characteristics of Phase I were:

- very high fixed costs of computers;
- a highly clustered pattern of users;
- Costs of travel for those users not located in large clusters that were low in relation to costs of computing.

3.2 PHASE II: THE TIMESHARING ERA

By the mid 1960s, developments in operating systems had made it possible for computers to handle many users simultaneously, through the process known as time-sharing. Although very large numbers of instructions could be executed per second, only a fraction of these would be the instructions issued by one user. As a result, it became possible for users to issue instructions and receive results over an extended period of time, without being constrained to batch operation. This mode of operation required only relatively slow communication speeds between users and computers, speeds that could be supported by existing teletype technology over standard telephone lines. *Terminals,* consisting initially of simple teletype machines and evolving into combinations of keyboards and cathode ray tube displays, provided for local input and output. More sophisticated displays appeared in the 1970s that could display simple graphics.

Time-sharing changed the locational criteria of computing substantially. Computers were still massive mainframes, representing very large investments with high thresholds. But the range of their services increased dramatically. Users were no longer required to pay the costs of travel, but could obtain computing service through a terminal and a simple telephone line connection.

3.3 PHASE III: THE WORKSTATION ERA

The early computers of the 1940s used vacuum-tube technology, required massive cooling, and were highly unreliable because of limited tube life. Very high costs were incurred because every component required manual assembly. Reliability improved substantially with the introduction of solid-state devices in the 1950s, but costs remained high until the invention of integrated components, and their widespread adoption beginning in the 1970s. Today, of course, millions of individual components are packaged on a single chip, and chips are manufactured at costs comparable to those of a single component of the 1950s.

Nevertheless the mainframe computer survived well into this era. Early workstations had much less power than their mainframe contemporaries, could store and process relatively small amounts of data, and had limited software.

3.4 PHASE IV: THE NETWORKED ERA

Computer applications evolved quickly to take advantage of the development of networking. *Client-server* architectures emerged to divide computing tasks between simple client systems owned by users, and more powerful servers owned by a range of providers. For many applications, software and data could reside with the server, while instructions were provided by the client and results returned. The World Wide Web represents the current state of evolution of client-server technology, with powerful servers providing services that range from sales of airline tickets and information about movies to geo coding and mapping.

In summary, four phases of evolution of computing have completed a transition from a location pattern based on provision of service from point-like central facilities of high fixed cost, to a pattern of almost ubiquitous, low-cost facilities located with respect to a fixed communications network. In Phase I, computers established themselves wherever a sufficient number of users existed; in Phase IV it is connectivity, rather than the existence of users, that provides the most important economic determinant of location, along with a large number of less tangible factors. Over the forty-year interval the costs of computing have fallen steadily; in the context of GIS, the cost of hardware and software to support a single user has fallen from around $100,000 to $100 in today's dollars.

4. AN ECONOMIC FRAMEWORK

The previous section on locational history has already hinted at how the location of computing might be placed within an economic framework. This section expands on that theme, and presents a basis for research on the costs, benefits, and economic value of distributed and mobile computing.

From the communications perspective established earlier, computing is seen as a process of information transfer from one person, group, or agency to another. Locations are associated with both sender and receiver, since the human intelligence associated with both must be located somewhere.

4.1 TRANSPORT COSTS

Various costs are associated with the need to overcome the separation between the locations of sender and receiver, and with other separations such as that between the location of geographic ground truth and that of the sender. In classical location theory these costs are tangible, being determined by the costs of moving people or goods from place to place. In the case of information, however, there are both tangible costs, related to renting communication links and the fixed costs of establishing them, and intangible costs related to delay and unreliability.

When costs exist, they begin to influence locational decisions, and either the sender or receiver may choose to relocate, other locations needed for the communication of information may be affected, or communication links may be chosen, to minimize transport costs.

4.2 FACILITY COSTS

Various facilities are needed for communication to occur between sender and receiver. Computer processing may be needed to modify or transform data, or to provide analysis or modelling. Processing will also be needed at the locations of servers, and at other nodes in the communications network. As in the previous section, many of these processing resources are available free because they are part of the Internet, or provided through other arrangements to the sender or receiver. Others must be covered by the users through rental or fixed cost charges. Locational decisions may be involved if there is the possibility of selection among alternative processing locations, or alternative computing resources. Costs may be tangible, when processing power must be rented or purchased, but they may also be intangible, as when choices exist between the computing resources of different agencies, and issues such as security, privacy, or intellectual property are important.

4.3 HUMAN INTELLIGENCE AS A LOCATIONAL FACTOR

Finally, the locational decision will be influenced by the need to consider the locations of human actors in the system. If GIS is a communication problem, as suggested here, then the locations of sender and receiver are both important. Other human factors may also be involved, as interpreters, custodians of ancillary data, or developers of software.

The decision to compute in the office rather than the field may also be an instance of moving human intelligence to the location of computing resources, rather than the reverse. As computing becomes cheaper and the costs of communication lower, it will be increasingly common to move computing to human intelligence, rather than the opposite; and arguably that process is already almost complete with respect to locations provided with power supplies and Internet connections. Changing economics of computing and emerging field technologies will have substantial influence on the locational decisions made by GIS users.

5. RESEARCH ISSUES:

Many research issues have been identified in the previous discussion. This section summarizes them, as a series of priority areas for research.

• Examine the status and compatibility of standards across the full domain of distributed computing architectures and geographic information at national and international levels; identify important gaps, examine the adaptability of standards to rapid technological change, evaluate the degree to which geographic information standards and architectures are compliant with and embedded in such emerging frameworks as Java, CORBA, and COM/OLE; recommend appropriate actions.

• Build models of GIS activities as collections of special services in distributed object environments to support their integration into much broader modelling frameworks. This will help promote the longer-term objective of making GIS services readily accessible

within the general computing environments of the future.

• Develop an economic model of the distributed processing of geographic information; include various assumptions about the distribution of costs, and use the economic model to develop a model of distributed GIS computing.

• Data integration will help to integrate geographic information into the mainstream of future information technologies.

Distributed custodianship: The National Spatial Data Infrastructure (NSDI) calls for a system of partnerships to produce a future national framework for data as a patchwork quilt collected at different scales and produced and maintained by different governments and agencies. NSDI will require novel arrangements for framework management, area integration, and data distribution. Research on distributed and mobile computing will examine the basic feasibility and likely effects of such distributed custodianship in the context of distributed computing architectures, and will determine the institutional structures that must evolve to support such custodianship

6. CONCLUSION

Following are the various conclusions drawn from Mobile Computing . It basically concerns about the usages of mobile devices across the globe. It also maintains some certain criteria regarding cost of computing , access mechanisms etc.

• Access: By decentralizing control, distributed computing offers the potential for significant increases in the accessibility of information technology, and associated benefits. There have been many examples in recent years of the power of the Internet, wireless communication, and other information technologies to bypass the control of central governments, linking citizens in one country with those with common interests around the world. Wireless communication avoids the restrictions central governments impose through control over the installation of copper and fibre; digital communication avoids many of the restrictions imposed over the use of mail.

• Cost reductions: Modern software architectures, with their emphasis on modularity and interoperability, work to reduce the cost of GIS by increased competition and sharing, and by making modules more affordable than monolithic packages.

• Improved decision making: Current technologies virtually require decisions that rely on computing support to be made at the desktop, where powerful hardware and connectivity are concentrated. IDU computing offers the prospect of computing anywhere, resulting in more timely and more accurate data and decisions.

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