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From Islands of Automation to Client/Server Architecture

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Abstract

Different terms or buzzwords have existed for the several classes of computers. Should our view of the classes of computers be so complicated and potentially confusing? Based on literature survey, empirical research, and authors' combined accumulated experience in teaching and consulting, this paper recommends that for most situations, a simple dichotomy of computers as CLIENT and SERVER is adequate.

The CLIENT computer is primarily for the use of and under the control of an individual, while the SERVER computer is meant for the use of more than one individual - a group, department, corporation, or government agency. This paper contends that this simple dichotomy facilitates initial learning for all computer users. Based on empirical research, the results were statistically significant to substantiate that -- (a) computer classification confusion exists, (b) the dichotomy works, and (c) the dichotomy is preferred. This paper also proposes a hierarchical classification of computers based on different levels of perspective.

Just as the general view of the classes of computers was technical in the beginning, the view of the computing architecture has been also technical. The technical classifications were based on criteria like network topologies, type of protocol, etc. This paper contends that again the user-oriented view for the classification of computing architecture should prevail. We suggest a simple dichotomy of computing architectures: Server/Client and Client/Server.

The proposed dichotomy is based on end users' view: who is at the center of information processing: Server or Client. In the Server/Client architecture, the server is at the center and the clients revolved around it in the sense that these are dependent on the capacity and capabilities of the server. With the fusion of computer and telecommunication technologies, a new paradigm of Client/Sever architecture has evolved. In this architecture, the client is at the center and there are several local or remote servers catering to the needs of this KING called the client.

INTRODUCTION

Computer literacy has become as important as language literacy. In order to assist everyone to become computer literate, it is extremely important that computer education be comprehensible for not only technical users (computer professionals), but also non-technical users (end users). Simplicity is the best way to make a complex concept comprehensible for the non-technical users. As a rule of thumb, specially in the beginning of the computer era, computer price and physical size have been directly corrected with technical characteristics like CPU speed, RAM capacity, input/output speed, and word length.

Traditionally, computers have been classified according to these technical characteristics. However, with the tremendous proliferation of computers and rapid advances in computer technology, a classification according to the above technical criteria becomes very fuzzy. There can be significant overlaps. A surprisingly powerful machine sold as a personal computer (PC) may have more processing capability than a machine sold as a small minicomputer.

Furthermore, with the rapid advance of computer technology, each new model is facing the prospects of becoming obsolete within a couple of years. The newer models are generally smaller, cost less, and have higher performance (speed and memory).

For the vast majority of potential computer end users, the technical details of the different classes of computers are not relevant. In that sense, exposing high school and college students to traditional classifications may hinder the learning process. This issue first surfaced in an earlier study by Palvia and Chung (1985). According to their empirical study:

- Minicomputers are favored over mainframe computers on the characteristics of user-friendliness, sense of ownership, sense of control, and ease of learning. However, there is hardly any preference when comparing micro and mini computers. Given this evidence and the several taxonomies for computers being used in literature (micro, mini, main, and super; personal, micro, super micro, mini, super mini, main, super main, giant) we recommend a simple one: micro and macro computers.

This paper illustrates in greater depth that the classifications of computers and computing architectures must be simplified for end users and how it could be done.

RESEARCH METHODOLOGY

Literature Survey:
A literature survey of over twenty introductory computer and information system books revealed an abundance of terms used by the authors to classify computers. This abundance is a result of their attempts to deal with the diversity found in computers. However, these classes of computers do overlap each other.

Questionnaire:
A three-page questionnaire was administered to undergraduate and graduate classes in two academic institutions, one in Massachusetts and another in Pennsylvania. The questionnaire is general so that it can be administered to computer users in both academic or non-academic settings.

OBJECTIVES OF THE STUDY

Our study addresses the following six issues.
ISSUE 1: Computer Classification Confusion Exists The research participants were first presented with a list of seven classification terms drawn from the literature. They were asked to indicate which of the terms were useful for classifying computers. They were also invited to mention any other terms they considered valid.

The majority (53%) viewed computers as falling into either three or four classes. Less than one percent of the respondents either did not recognize any of these classes or mentioned other names. Only 4% respondents mentioned other computer classes. This shows that our list of current classification names was fairly adequate and exhaustive in terms of its representation.

Some of the respondents could not even define the classes of computers they indicated that they recognized. Based on short interviews with some participants after the questionnaire was administered, it was discovered that some did not even indicate that they recognized a class because they could not define it. This suggests that, although some of the classes are words that the students have heard of, the term's meaning is not understood. We contend that this problem is largely due to the lack of exposure to an easily recognizable and understandable computer classification scheme. Our contention that significant confusion exists about the way computers are classified is supported by both the literature survey and the analysis of our empirical data.

ISSUE 2: The Dichotomy Works
The respondents were asked to map, if possible, the computer classifications they indicated or mentioned in the previous section into a dichotomy: MICRO or MACRO computers. If any of their classification terms did not fit into the dichotomy, they were to place it in a third category, ``other." The definitions as provided for these two classes in the questionnaire are: [MICRO:] Computers mainly for personal use. Computers which you can own, touch, feel, or move around at ease. [MACRO:] Computers for the use of several people in a department, organization, state, country, or world. Computers which

you can access from distance through terminals. Computers which you probably never own, touch, feel, or move around at ease.

The overwhelming majority (92%) of the participants were able to classify their initial classification into these two groups. The basis for the above dichotomy is obviously user orientation classification and not technical characteristics of computers. Clearly, the simple dichotomy of MICRO and MACRO computers based on user-orientation works.

ISSUE 3: The Dichotomy Is Preferred
Finally, two questions to test whether the dichotomy is preferred were administered to all the participants. It is clear from this study that there is a statistically significant leaning toward the new classification. We contend that this leaning should be considered adequate justification for making the transition to the dichotomy in education as well as for ongoing use among all professionals: end-users as well as computer professionals.

ISSUE 4: Relabel MICRO and MACRO as CLIENT and SERVER The original names given to the dichotomy were MICRO and MACRO; however, it appears that other two words - CLIENT and SERVER - implying the same idea and logic for computer classification have caught on the imagination and have gained acceptance of the computer industry and academia worldwide. If these terms are familiar enough to a large number of people, we strongly recommend that these terms be defacto names for a preferred, clear, unambiguous, and meaningful dichotomy.

ISSUE 5: A Hierarchical Classification To Facilitate Learning For All Users We propose a hierarchy of computer classification for different types of computer users. At the top level, from the perspective of a user rarely exposed to the world of computers, a computer is a computer is a computer. For the general class of users, who are computer literates and the end users, the level of classification of CLIENT and SERVER computers should suffice. This level of classification focuses on the logical perspective of computers (i.e., what kinds of information processing functions can be done by a computer) instead of what are the technical specifications (i.e., processing speed, memory capacity, etc.) of a computer. This fact has been sufficiently validated by our empirical studies.

To a more technical user of computers, we offer a third level of computing classification. CLIENT computers can be further classified into strictly personal computers and workstations connected to several other sources of data and programs. SERVER computers can be classified into supermicro and mini computers, mainframe and super computers. For a real computer expert, these third level classifications can be further subdivided into different categories.

ISSUE 6: The Dichotomy of Computing Architecture Just as the general view of computers was technical in the beginning, the view of the computing architectures was also technical. When probed deeply, the basic rule for communication among computers in a computing architecture is simple: one computer (i.e., the client) gives instructions and the other computer (i.e., the server) receives and processes the instructions. By this simple logic, the traditional computing architecture ought to be called Server/Client

architecture. In the Server/Client architecture, which was generally mainframe based with dumb terminals on its periphery, the server was at the center of the architecture.

Thank to the fusion of computers and communications, there is a paradigm shift to Client/Server architecture. For the Client/Server architecture, the client is the boss. Each individual client has the right to access different servers (e.g., database, computation, network, and printing servers) to obtain the information and share the computation power. Basically, servers are subordinate to the clients, and the onnectivity among clients and servers is dynamic. The client can determine who to connect and when to connect. This paper contends that again the terms: Server/Client and Client/Server work well for classifying computing architectures.