Session 2258

Efficiency and Dynamics of the Client-Server Interaction in the Information Systems: Conceptual Approach

Leonid B. Preiser

Department of Computer Science and Communications Technology
School of Engineering and Technology
National University
11255 North Torrey Pines Road, La Jolla, CA 92037-1011
(858) 642-8483, fax (858) 642-8489
lpreiser@nu.edu

Introduction

Providing service to the user community in the IS environment is a two-way street. The effectiveness of any service, in particular the effort of developing a new IS infrastructure, depends on the effectiveness of interaction between the IS professionals (servers) and the users (clients). The interaction, on the other hand, is based on each player's perception of their own roles and skills needed to make the IS project a success, as well as on mutual perception each player has of each other's roles and skills.

This paper examines the concepts leading to modeling of the dynamics of working relationship between clients and servers in the IS industry.

In what follows, the providers (IS experts, system analysts, IT professionals) will be referred to as servers, **S**, whereas those who are served (users, clients, IT/IS customers) will be referred to as clients, **C**. Also, wherever it deems appropriate, the abbreviations like **R**, **B**, **PE**, **LC** will be used to suggest any link with the **r**ole, **b**ehavior, **p**rofessional **e**xperience or **l**earning **c**urve associated with either **C** or **S**, respectively.

Background for IS Client-Server Interaction Model

The **C'**s who constitute the majority at the marketplace, i.e. the mainstream customers, tend to shy away from the brand-new products and developments because they are uncertain about the IS/IT technology in question or its added value and benefits. Most of those **C**'s, particularly the corporate ones, are actually quite conservative and are unlikely to take chances with the new IS/IT technology until they perceive that the new technology is "stable" as well as examine positive reviews from the customers they trust most (**PE** + **LC**).

The newer the concepts embodied in the product, technology or development, the longer would be that initial period of market penetration. In other words, transforming this phenomenon from the generic to the particular relationship between **C** and **S** in the IS/IT marketplace, one might conclude that the dynamics of the **C** – **S** "gap" tend to follow through the transient phase before establishing the steady-state mode. It seems reasonable to suggest that during this early (transient) period, the primary objective of a (perceived by the **S**) successful marketing strategy is to educate the **C**'s constituency. As trust of the **C**'s awareness builds up, some mainstream **C**'s begin to "buy into" the **S**'s product (**LC**), and, as the word about it spreads out and new applications reach the marketplace, the **C** – **S** gap tends to shrink, thus signaling better match between **C** and **S**.

Eventually, however, the newly formed behavioral element on the part of the **C**'s ("market penetration") trails off. Namely, because of the length of time it takes to gain the confidence of the **C**'s ("market acceptance"), the established (not perceived) confidence of the **C**'s lags the level of developments, products and services offered by the **S**'s. The extent of such lag is proportional to the degree of novelty (originality, competitiveness) of the product (service, development) concept, with the shortest lag presumably associated with the products that appear to be very similar to the ones already on the market (i.e., better recognizable).

What if a new product introduced by the **S** requires of **C** to learn a new usage pattern (**LC**)? For example, **C**'s may be reluctant to buy a document imaging and electronic filing system to manage their hard copy documents because they must learn a new set of skills to handle that product. This behavioral aspect of **C** might inadvertently "feedback" to the perceived role of the **S**. Namely, given the fact that satisfaction of the C ("market acceptance of the new products") is uncertain, and slow at best, it could be a risky decision on the part of **S** to jump from a known profitable services (products, developments) to the unknown (new) ones (feedback from **B** of **C** to **R** of **S**). At this stage, a new mode of the **S** "participation" in the **C** – **S** interactive process might develop: combination of **B** and **LC** leading to the changes in the so far accumulated **PE** of **S**.

In essence, **S** at this stage begin realizing that optimized **B** and change of so far perceived priorities are in order, since "investment" in the current profitable and successful products or services may have to be reduced so that funding would be diverted to the new product. As a subset of the accumulated so far **PE**, this might represent an investment intended to improve current products or to reduce the **S**'s cost of serving the **C**. For example, a manufacturer of the rewritable optical storage devices might be exploring the opportunity of investing in developing the holographic storage systems. Hence, this phenomenon of dynamics involving both perceived **R** and gradually changing **B** as a function of **LE** on the part of **S**.

What if the **S**'s competition decides to invest in business process reengineering leading to decreasing of manufacturing costs for optical storage devices or improving their performance? This would place **S** at a competitive disadvantage since the **S** could be caught up between the time when their current optical disk product is no longer competitive and the time when the new holographic approach has not yet gained market acceptance.

Mathematical Modeling of Client-Server Interactions

Formalization of efficiency and dynamics of the client-server interactions in the IS marketplace is approached here by analyzing the subject of clustering that represents an environment in which we formulate, select, modify, and adjust our frames of reference so that we could relate to a certain structure of **C** – **S** interaction. In particular, we will be considering two spaces of random outcomes, one related to the domain of **S**, and the other one associated with **C**.

A column random vector

$$\mathbf{X} = (X_1, X_2,\dots, X_n)^T$$

where T denotes transpose, in the **S**-space will have scalar random variables X_i, i = 1,…, n, as its elements, whereas a column random vector

$$\mathbf{Y}= (Y_1, Y_2,\dots, Y_n)^T$$

in the **C**-space will have scalar random variables Y_j, j= 1,…, n, as its elements.

For example, each element X_i of the **S**-space might represent particular features of the clustered **S**, such as

- Role
- Behavior
- Professional experience
- Learning curve
- On-the-job-training capability
- Communications skills
- Brainstorming potential
- Team cohesiveness
- Educational background.

Similarly, each Yj might represent certain behavioral, professional, psychological and other features of the **C**.

The suggested above clustering approach implies "static" mode (as it deals with random variables). The further expansion might involve gradual transformation from "statics" to the dynamics (time dependence), so that the respective random variables X_i, Y_j would be replaced with random (stochastic) processes[1].

Returning to the "static" approach, it is suggested to introduce the Efficiency and Dynamics Analysis (EDA) algorithm describing interactions between **C**-space and **S**-space. In particular, with any random variable assigned a range of values on a given scale – say, from 0 to 100 – and assuming that the experiments to be conducted (such as interviews and surveys) will use this specified range for statistical purposes, the general EDA correlation matrix

$$
\mathbf{R} = \begin{matrix} R_{X1X1} & R_{X1X2} & \ldots R_{X1Xn} & R_{X1Y1} & R_{X1Y2} & \ldots R_{X1Yn} & R_{Y1Y1} \ldots & R_{Y1Yn} \\ \ldots & & & & & & & \\ \ldots & & & & & & & \\ \ldots & & & & & & & \\ R_{XnX1} & R_{XnX2} & \ldots R_{XnXn} & R_{XnY1} & R_{XnY2} & \ldots R_{XnYn} & R_{XnY1} \ldots & R_{YnYn} \end{matrix}
$$

where

$$R_{XY} = E \{ X_i Y_j)$$

and E { . } is an expectation (statistical averaging) operator, will describe all possible interactions both within each space and between their respective elements.

In particular, the general EDA correlation matrix may be decomposed into three separate matrices:

S-space autocorrelation matrix

$$
\mathbf{R_{SS}} = \begin{matrix} R_{X1X1} & R_{X1X2} & \ldots R_{X1Xn} \\ \ldots & & \\ \ldots & & \\ \ldots & & \\ R_{XnX1} & R_{XnX2} & \ldots R_{XnXn} \end{matrix} ,
$$

C-space autocorrelation matrix

$$
\mathbf{R_{CC}} = \begin{matrix} R_{Y1Y1} & R_{Y1Y2} & \ldots R_{Y1Yn} \\ \ldots & & \\ \ldots & & \\ \ldots & & \\ R_{YnY1} & R_{YnY2} & \ldots R_{YnYn} \end{matrix}
$$

and **C**-**S** cross-correlation matrix

$$\mathbf{R}_{CS} = \begin{matrix} R_{X1Y1} & R_{X1Y2} & \ldots R_{X1Yn} \\ \ldots & \ldots & \ldots \\ \ldots & \ldots & \ldots \\ \ldots & \ldots & \ldots \\ R_{XnY1} & R_{XnY2} & \ldots R_{XnYn} \end{matrix}$$

Essential in this approach would be the proper interpretation of the elements R_{XY} of such correlation matrix **R**. For example, the particular matrix element might represent correlation between the role of the **S** and the **C**'s learning curve.

Projected Benefits of the **C-S** Interaction Model

Here are several potential applications of the proposed **C** – **S** Interaction Model.

- Based on an established correlation between the behavioral pattern of the **C**'s and perceived role of the **S** as a promoting educator for the **C** (i.e., promoting important features of the products or services), it may become possible not only to design new training strategies for the cadre of the **S**'s, but – even more to the point – develop and promote the new corporate culture.
- Based on an established trend in dynamics (for example, length of transient period, expected number of iterations) of the interactive process convergence to the "local" (in time) equilibriums between **C** and **S**, it seems reasonable to expect better planning process to be embedded into the **S**'s corporate plans.
- The findings regarding an effect created by a gap between perceived and actual **LC** of the **C**'s on their determination to start considering possible trade-offs in dealing with the **S** might help the **S** to regroup their resources, so that the specially trained team would be available on the ad hoc basis to consult the **C** on a much broader spectrum of relevant topics, thus assisting the **C** in the tradition of "one-stop-for-all-needs-service".
- Another opportunity to utilize the proposed model's outcomes would be to apply the results concerning the effect of gap between the perceived and actual roles of the members of the **S** staff on improving effectiveness of their team performance. This type of findings would allow the **S**'s to validate the process of experimenting with the "team design" concept, namely, depending on the scope of a project, some teams would be formed as groups of loosely coherent and functionally autonomous professionals with broad-based backgrounds. It would be expected that the team-design concept might eventually determine effectiveness of **LC** (ability to integrate different experiences into valuable combination of both knowledge and skills), as well as readiness (perceived and actual) and motivation of the **S** team members – all of which would eventually add value to the ongoing interactive **C** – **S** process.

Bibliography

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LEONID B. PREISER

Ph.D. in Electrical Engineering, Senior IEEE member, ASEE member. Since July 2002, Professor and Chair, Department of Computer Science and Communications Technology, National University (NU), La Jolla, CA. 1999-2002: Professor and Chair, Department of Technology and Information Systems, NU. 1997-1999: Director of the Center for Technology, NU. 1995-1997: Dean, School of Engineering and Computer Science, West Coast University, Los Angeles. 1979-1994: research engineer and consultant, Andrew Corporation, Orland Park, IL.