Maintaining user satisfaction with performance of an online system

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ABSTRACT

This paper discusses the experience of OCLC, Online Computer Library Center, Inc., with maintaining user satisfaction with performance of its online system. OCLC is an innovator in the field of automated library services. Because it is a service organization, user satisfaction with its online services of cataloging, inter-library loan, serials control, and acquisitions is a major concern. An important component of that satisfaction is online system performance, primarily measured by response time and system availability.

This paper also discusses the considerable effort that has been devoted to system support activities to address response time and availability improvement. Among the system support activities discussed are creation of an internal problem reporting and monitoring system, organizing to more clearly delineate responsibility and authority, and communication of system support activities to the user. These activities have had a positive effect on user satisfaction with OCLC’s online system.
INTRODUCTION

OCLC, Online Computer Library Center Inc., a privately funded, not-for-profit corporation, was founded in 1967 to help libraries improve patron access to the ever-expanding body of worldwide knowledge and information. The first online service in support of that corporate purpose was the OCLC Shared Cataloging subsystem originally designed for 54 academic libraries in the state of Ohio. As libraries’ recognition of cost savings and service enhancement possible with this system grew, the OCLC computer system, the complexity of software, and the need for corrective, adaptive, and perfective maintenance also grew. OCLC’s current system of custom manufactured terminals, dedicated telecommunications lines, front end minicomputers, network supervisor, host computers, and back-end database processors provides cataloging, serials control, acquisitions, and interlibrary loan services to approximately 3,500 member institutions serving over 6,000 libraries internationally via more than 5,000 terminals.

Our physical facility, located in Dublin, Ohio, contains over 44,000 square feet of secure, environmentally controlled computer floor space, a dramatic change from the space rented from Ohio State University little more than a decade before. More dramatic, however, is the change in the people who support and use the system.

OCLC was founded by the Ohio College Association, a group of university presidents, to increase availability of library resources and reduce costs among the academic institutions in the state. That founding resulted in an initial computer-based system that was designed, developed, and modified almost experimentally by a few dedicated people committed to making dramatic—at the time, revolutionary—changes in the library community. From that foundation evolved the current OCLC organization of over 670 staff and a customer base of over 6,000 libraries of all types—not just college libraries, but public, governmental, school, medical, law, and corporate libraries, serviced through a multiple-tier distribution channel.

Associated with the internal change of OCLC is a change in user expectations. System performance expectations continue to grow with increased user sophistication regarding online systems use. Additionally, as the OCLC system becomes the backbone of operations in a growing number of customers’ libraries, high expectations of maintaining adequate online system performance are not unreasonable.

THE PROBLEM

The problem of maintaining user satisfaction with performance in an online system entails a complex system of external and internal perceptions and constraints that vary over time. Key factors of perceptions and constraints are interrelated and seem to be part of a zero-sum game in informal systems such as ours; if one area of performance is satisfactory, another area is perceived less so by some measure. Therefore, one element of a solution is more formal measures of acceptable performance for each component that affects user perceived system performance.

Users’ perceptions of performance areas for interactive systems include response time, system availability, and reliability measures as well as expectations of database integrity, completeness, currency, and high expectations of new systems development and responsive maintenance. As is only proper, failure to meet formal performance standards results in unacceptable performance from the users’ perspective. However, if performance is measured informally, even what at one time was satisfactory performance may no longer be so; change takes place in the level of user expectations of adequate performance to target the lowest area of performance as unacceptable. This change in level of expectation seems to be natural; and systems performance expectations seem to vary with use sophistication, which in the OCLC system has grown substantially during the last decade.

The key aspects of this increasing demand for maintaining user satisfaction with performance in an online system are understood measures of performance consistent over time; development of new systems; and adequate system maintenance in terms of its adaptive, perfective, and corrective aspects. It is because of the universality and typical symptomatic treatment of those needs that OCLC’s approach may be appropriate to other interactive environments.

SYMPTOMATIC TREATMENT

Using internally defined measures of response time and availability and using informal, individually conceptualized measures of other performance factors mentioned above, OCLC staff have had their hands full chasing the illusion of satisfactory performance; users continued to be dissatisfied. The effects of this lack of measurability have materially affected system support activities where patchwork maintenance and damage control have been consuming activities to keep the system available in the short term to the exclusion of addressing other user-perceived performance criteria for a longer term. Attaining the right mix of performance levels in an informal system may be harder than finding the pot of gold at the end of the rainbow, but it has the same allure.

To help understand the shifting nature of priorities and the long-term effects of looking only at short-term system performance, we must understand our online environment. OCLC online is a dynamic system that accommodates growth of
accessibility for added terminals and new functions. Barbara Taute calls this type of environment unstable, and that is certainly the case. Users and OCLC staff agree that growth has typically been followed by periods of unacceptable reliability, availability, and response time. Growth demands have taken their toll on maintainability. The environment is not a desirable one, because induced periods of instability have caused wholesale shifts of staff for support at the expense of new development. The result of these shifts is conflicting performance criteria: new development vs. current system stability. This unacceptable trade of performance issues highlighted our need to address internal problems requiring immediate remedy as longer-term remedies were formulated.

INTERNAL PROBLEM

The OCLC online system is growing: over 600 user terminals and over a million new records are added per year. The result of this growth is a continuing imbalance of staff need and availability. Reactive approaches to this imbalance included cutbacks in training, increases in Band-Aid problem fixing, and redirecting staff from other areas to help. We did all of these things we knew were harmful in the long term but that we could easily justify in the short term. The result was a temporary increase in system stability, but at a heavy cost, akin to running faster to keep from falling; it only works for awhile.

As if things weren't bad enough, there were role perception difficulties regarding software maintenance. What is it? Who does it? When and how is it done? How is it regarded in the company? The diversity of answers to these questions adversely affected even short-term maintenance activities. Meanwhile, users were demanding that we do something to improve performance.

DOING SOMETHING

We isolated four areas to address: user expectations, system problems, procedures, and the organization. As we were thinking about how to manage our problems, we focused on time to repair as a critical element in user-perceived performance in an online system.

Doing Something About User Expectations

Although user expectations have always been considered by OCLC staff, it is increasingly important to address those expectations formally in the development and operation of a system, and it is acutely important in interactive systems. Developing understood measures of system performance, improving communications about system aberration and expected resumption of normal service, improving problem-call handling, and increasing availability of problem-call staff, in addition to the Herculean task of improving system performance, are the activities we felt most important to bring user expectations and actual performance closer together.

Developing commonly understood measures of performance that relate well to user experience at a terminal, and yet can be monitored and controlled at a central site, is a nontrivial task in an online environment. In addition, user-perceived measures of performance in an online system of transaction response time, system availability, and system reliability are made even more complex by potential misinterpretation of the statistics necessary to describe these performance measures.

To explore the complexity of communicating online system performance characteristics, let's look at response time. Certainly we should be able to agree that user-perceived system response time can be measured as the interval of time between the SEND/DO IT key stroke of the terminal user and the full screen display of the system's response. Figure 1 shows the components of our system a transaction may exercise; however, not all components are used for every transaction. Add human-related variables, and it should be obvious that a statement of an average response time of 8 seconds can mean many different things to many people.

Other complicating factors are the nonhomogeneous resource requirements for different ways of requesting the same information, cyclical use of the system by season, week within season, day within week, and hour within day, continuing
change in system environment, and lack of monitoring tools for understanding those changes better. A system person’s approach is to make various assumptions concerning unmeasured activities and add that to monitored activities to calculate an average over time. A user’s approach is to time activities at the terminal, whether with a clock or not. Our experience indicates that the system person and the user have difficulty communicating performance measurements with such disparate baselines of measurement. Therefore, developing common measures is precisely what must be done for effective communication.

OCLC is currently conducting investigations to determine how best to characterize user-perceived online system performance in order to relate it to our characterization of performance; the first step is to come to a common definition. The first investigation consisted of 14 user institutions that manually timed specific transactions at a predetermined time of day and reported their observed response times and system availability to OCLC for summarization. This manual approach was meant only to give us a feeling of users’ experience. The other study involves a hardware device attached to a user’s terminal to directly measure and calculate response time statistics over a period of terminal use. The user reported statistics are then correlated to OCLC-measured computer system response times. Figure 2 shows user vs. OCLC measures for response times and system availability over a 41-week period. This has dramatically improved our ability to communicate response time and availability performance measures with the user.

Other activities to promote user satisfaction with system performance are to increase communication about system activity, increase the use of meaningful broadcast messages via the users’ terminals, and increase responsiveness to trouble calls by providing a hierarchy of user-call handling.

The entry level of our hierarchy of problem-call handling is the OCLC reception staff, which discriminates between informational and assistance calls and transfers calls that require more attention to a second level. At the second level, the Marketing and User Services Division of OCLC staffs a trouble call function where further discrimination among user-, application-, and system-caused problems is made. Only computer system problems are then passed on to network operation technicians for further diagnosis and resolution. Network operation technicians dispatch field service aid for terminal and modem problems and deal with the telephone companies for telecommunications problems; computer hardware and software problems are passed to system support personnel for resolution, the final level of the problem resolution hierarchy. The severity of the problem coupled with the estimated time to repair determines the mechanics of problem resolution.

**Doing Something About the System**

Although terminal and telecommunications are components of our online system, it is our computer environment that is the subject of this section. Our computer hardware is stable at over 99% availability for each major component on a regular basis. Although 99% component availability seems more than adequate, the number of components and the number of terminals can produce over 5,000 terminal hours outage per week. That much outage translates into user dissatisfaction and lost revenue for the period. OCLC from the beginning adopted a philosophy of self-reliance. It currently has 24-hour-a-day, seven-day-a-week computer maintenance support to provide immediate reaction to any hardware malfunction to try to reduce the mean time to repair and hence increase system availability. A substantial investment in spares inventory, test equipment, staff, and staff training help keep our computer hardware running at that relatively high availability. The software component is not as stable as the hardware, nor is the environment as straightforward.

Dealing with software has resulted in major changes to our existing environment. Some of those changes are further identified in the following sections on procedures and organization. The main change to be identified here is a recognition by the corporation of the primary importance of user perception of performance and a recognition that maintenance of adequate performance had failed. As part of an overall effort, OCLC temporarily redirected the work of our development staff from installing additional software to an already unstable system to attending to medium-term-problem resolution. The support group, which has primary responsibility for restoring the system after a failure, necessarily operates in the short
term, often allowing only symptomatic treatment and leaving the real problem unresolved. Recovery vs. resolution is a resource problem intensified by online systems. OCLC recognized the unmet need for problem resolution as an activity simultaneous with the requirement to recover on a day-to-day basis.

The significance of this recognition of time between recovery and medium-term resolution resulted in new procedures for problem solving. It also allowed system support staff's significant expertise to be more productively employed in resolving problems rather than continuing symptomatic treatment, a result of sufficient resources to use innovative methods to combat long-neglected problems. We call the system support activities of resolving maintenance hot spots system manageability.

**Doing Something About Procedures**

The most significant result of dealing with procedures was the creation of a problem reporting and monitoring system that is itself an online application. Previous attempts at prob-

![Figure 3—Problem report](From the collection of the Computer History Museum (www.computerhistory.org))
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and providers. System performance measures of response time, availability, and reliability have improved significantly since these activities have started. This improvement has allowed us to resume scheduling system enhancements to increase users' satisfaction with online system performance in the area of system enhancements.

Although not as amenable to measurement as external ones, internal effects such as staff morale and productivity have improved also.

A program of systems manageability is under way to ensure maintaining user satisfaction with the OCLC Online System by improving response time and availability. It includes refinement of the above activities of formalizing and communicating system performance measures, increasing the quality of software maintenance, and improving the systems environment, as well as showing progress in new feature development with engineered maintainability improvements.

REFERENCES