

# Electronic services and library performance measurement: A definitional challenge

Peter R. Young

Library of Congress, USA

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## Abstract

Recent global advances in communications infrastructure, digital media, network services, and electronic commerce present transformational opportunities and fundamental challenges for libraries. Developments in these areas appear to offer opportunities for increasing and enhancing library service offerings, reducing costs, and for improving organizational performance. But the transformation to an integrated digital future is also generating uncertainty for libraries. New electronic services challenge libraries to differentiate transient developments from those with lasting impact. The ability to discern these transformational changes and to respond to changing requirements depends, in large part, on the concepts, tools, and structures needed for measuring these changes over time. Library statistics and measurements provide a framework for planning and tracking change.

Over the past several decades, American libraries have developed and refined procedures for reporting descriptive statistics collected by census and survey at the state and national levels. These efforts include development of common data elements with standard definitions and uniform data collection/reporting procedures required to assure reliable and comparable data. In conjunction with these developments, library managers are increasingly called on to demonstrate organizational performance through standard measurement techniques. Development of standard definitions and terms, procedures, and measurement methodologies related to library performance requires that librarians rethink how to describe and demonstrate value. Performance measurement of libraries requires librarians to transform quantitative input and output data collection concepts and structures into a qualitative outcome assessment framework. This complex transition is central to understanding the rapid pace of library change within the commercial realm of Web/network services development.

The digital services commercial marketplace is developing standards and procedures for defining, characterizing, and measuring digital media and electronic services. At the same time, libraries are also evolving language, definitions, terminology, and methods for characterizing and describing the impact of network-based services and digital media in performance-based terms, often with reference to customer relationship management. This effort requires a re-con-

ceptualization of the way libraries define, collect, and apply management information. It requires the development of a performance measurement perspective from which standard indicators, operational definitions, procedures, and methodologies can develop and evolve. As an initial component of this development, standard definitions are required for new terms such as: electronic resource, digital library collection, computer file, database, page view, web site, web resource, web page, web collection, online service session, portal, aggregator, gateway, remote login, download, etc. Until standard definitions for these terms are available, refined, and generally adopted, progress in measuring library involvement with digital media and electronic services within a standard performance measurement context will be limited.

Based on recent developments, libraries face opportunities to define and develop new criteria for measuring performance through the development of indicators related to network services and electronic media. The development of these performance indicator criteria requires that libraries focus on metrics and performance indicators related to the following categories:

- **Network technology infrastructure:** the component hardware, equipment, software, communication conduit, network resources, and associated technical aspects related to electronic network media and services;
- **Information resource content:** networked electronic information resources accessible and preserved locally or remotely, and the means by which search, retrieval, and activation is achieved through administrative, descriptive, and structural metadata and coding;
- **Extensiveness:** extent of network provided services as measured by standards such as the number of Web page accesses, number of remote logins and sessions, etc.;
- **Efficiency:** those resources required to provide or access networked information services and digital media resources as measured by standards such as peak-hour connections to servers, bandwidth, etc.

These general categories provide a framework for considering the different ways that libraries are developing indicators for measuring performance based on

electronic service offerings. It is likely that future work in the development of performance indicators for library implementation of electronic media and network services will focus on demonstrating and justifying the technology investments required for libraries to provide these services to patrons. Standard definitions are needed to provide context for customer performance measurement in an increasingly network library context. The development of basic definitions for terms related to these services is intended to facilitate progress in these areas.

This article is based on a Keynote presentation at the Fourth Northumbria International Conference on Performance Measurement in Libraries and Information Services: "Meaningful Measures for Emerging Realities". Pittsburgh, PA - 13 August 2001. The views and opinions expressed in this paper are those of the author and do not necessarily reflect the policies or positions of the Library of Congress or the U.S. federal government.

## Introduction

### ISSUES AND TRENDS

Electronic service measurement and network statistics for libraries are topics of increasing interest as evidenced by presentations at the Fourth Northumbria International Conference on Performance Measurement in Libraries and Information Services held 12-16 August 2001 in Pittsburgh, PA. This increasing interest in library performance measurement is evidenced by a series of rapidly changing developments and a series of recent international initiatives. This paper summarizes the central issues emerging from an interest in measuring the performance of libraries through the application of statistical and other qualitative techniques. It frames the quantitative aspects of library statistics, reviews qualitative issues, and itemizes concerns, challenges, problems, questions, directions related to the development of performance measures and indicators for libraries. Finally, the paper concludes with a brief view of the development of customer-centered performance measurement tools.

An assumption underlying these topics is that there is no one "right" correct method for collecting, reporting, and using statistics in developing performance indicators for libraries. Rather, it is the intent of this paper to provide a context and to clarify a direction for evolving new approaches to library management needed to assist libraries in the conduct of business in a networked environment.

A draft glossary of library statistics and performance measurement terms is included as an appendix. This draft consists of terms and definitions drawn from multiple sources. This draft glossary was developed in conjunction with colleagues engaged in planning for an invitational National Information Standards Organization

(NISO) Forum on Performance Measures and Statistics for Libraries: Issues for Libraries in Measuring the Information Age which was held 15-16 February 2001 in Washington, DC. The NISO Forum planning group consisted of: Pat Harris/NISO, Martha Kyrrillidou/ARL, Karen Motylewski/IMLS, Michael Gorrell/Ebsco, Denise Davis/NCLIS, Barbara Perry/World Bank, Pat Wand/American Univ., and J.D. Waggoner/WVALibrary Commission.

The initial draft glossary was amplified and extended by the inclusion of definitions drawn from standard reference sources, including several outside the scope of the library statistics and performance measurement fields, including those in the areas of digital library standards, metadata framework development, network services, intellectual property ownership, computer science, and descriptive cataloging rules. Inclusion of definitions from multi-disciplinary sources reflects a conviction that electronic services and digital media present transformational opportunities for re-framing library missions. From a variety of perspectives, progress in library statistics and performance measurement requires that the library community participate in multi-disciplinary efforts involved with transitioning from cataloging to metadata, moving from traditional reference to digital reference services, and evolving traditional library research tools such as indexes, bibliographies, guides, and abstracts to Web portals.

### CONTEXT OF CHANGE

The forces of change affecting libraries are the focus of a recent National Academy of Science study, *LC21: A Digital Strategy for the Library of Congress*. This landmark report begins with the following statement:

"No stereotype of libraries as quiet, uneventful places could survive the 1990s. Whatever stability and predictability libraries once had as ordered storehouses of the treasures of the printed word were shattered by the digital revolution. The intellectual function of libraries - to acquire, arrange, and make accessible the creative work of humankind - is being transformed by the explosion in the production and dissemination of information in digital form, especially over global networks." (Library of Congress, 2000)

Nowhere are the consequences of this digital revolution and transformational explosion more succinctly stated than in Clayton Christensen's *The Innovator's Dilemma*, which explores why even good corporate managers may find their companies losing market dominance with the adoption of new technology. Christensen outlines the concept of disruptive technologies in the following passage:

"Most new technologies foster improved product performance. I call these *sustaining technologies*."

Some sustaining technologies can be discontinuous or radical in character.... Most technological advances in a given industry are sustaining in character.... Occasionally, however, disruptive technologies emerge.... [These] *disruptive technologies* bring to market a very different value proposition.... In the future, "Internet appliances" may become disruptive technologies to suppliers of personal computer hardware and software." (Christensen, 1997)

Just as certain new emergent technologies can disrupt a corporation or industry by introducing a new value proposition, so the introduction of networked electronic services and digital media present challenges for libraries to differentiate transient trends from technology-related developments of lasting impact. This situation of constant change challenges the operational stability of information-intensive organizations. For libraries, transforming change is equivalent to 'permanent white water' where:

- Stable and predictable *operations* no longer appear possible
- Increasingly *complex systems* produce novel problems
- Issues become *increasingly messy, ambiguous, and ill-structured*
- Management encounters constant unplanned *surprises*
- Unexpected surprises result in significant *costs*
- The *recurrence of problem issues* present significant continuing challenges

The situation reflects a dramatic change in priorities and organizational goals that reflects a shift from an industrial era to a postmodern era. This shift is exemplified by the following contrasts and trends:

<b>Industrial Era</b>	<b>Postmodern Era</b>
Hierarchical chain of command with multiple management levels	Self-governing teams/networks with few management layers
Competitive advantage	Collaborative advantage
- Control	- Commitment
Managers maintain stability	Managers coach and lead
- Decisions announced	- Performance systems
- Bureaucratic rules/policies	- Few rules and policies
- Power exercised over others	- Power shared with others
- Information held by a few	- Information widely available
Emphasis on repetition	Emphasis on problem solving
Risk averse	Risk tolerant
Focus on short-term gains & interests	Focus on long-term gains & continuous improvement

#### LIBRARY STATISTICS

Traditionally, descriptive statistics about libraries represent information about inputs and outputs that can be characterized by the following:

Consistent Timely Comparable Uniform Reliable  
 Relevant Accurate Useful Standard Reportable

Although descriptive statistics relating to library activities have not always reflected these features, these characteristics have served as standard goals to which various data collection and reporting programs have aspired over the last several decades. In similar fashion, descriptive library statistics are traditionally collected and reported for the following four purposes and applications:

- 1) Managerial and administrative - data used for measuring economic efficiency, productivity, and change;
- 2) Research and analysis - statistics used to perform trend analysis, testing, model formulation, research and development, and identifying innovation;
- 3) Policy planning and development - statistical information and analysis used to plan for improvement, to determine grant allocation and support, to support advocacy, to justify legal reforms;
- 4) Market analysis and planning - data used to analyze demand, to identify, segment, and develop markets, for use in determining licensing contractual terms.

#### EVOLVING LIBRARY POLICY ISSUES AND CONCERNS

Over the last several decades, digital technology and networked systems have been integrated into the core operations of libraries. These developments are intended to improve library effectiveness and functional productivity. However, digital networks are affecting library missions and policies, as well as transforming specific functional capabilities within libraries. The adoption of digital technologies by libraries has not, as yet, generated standard measurement techniques that uniformly and systematically chart changes in library accomplishment and operational effectiveness. Facing increased pressure to demonstrate effectiveness by measuring performance, however, library managers are looking to information technology as a means for measurement of institutional effectiveness. This trend responds to the need for libraries to justify increased capital investments in technology-related systems and to respond to library patron demand for electronic service increases. Library managers are also interested in the development of performance measurements of the impact of digital media and network services in order to manage these new technologies effectively.

Increasingly, libraries are offering new services based on digital and network technologies in response to patron demand. These include patron requests for access to electronic media, technology support, training, and for access to network-based services. Patron expectations for access to digital content and electronic services raise a host of policy issues centering on remote access to resources not owned by the

library. Such patron demands are requiring libraries to adjust activities related to collection development, preservation, archiving, and access policies and procedures. By offering new value-added services, libraries are required to adopt standards relating to digital identifiers and digital repositories. At a fundamental level, these new services challenge library involvement with complex intellectual property and rights management issues related to content licensing agreement terms. Additionally, patron demand for custom-mediated digital-reference guidance support require libraries to address needs for new interpretative tools to perform selection, evaluation, analysis, technology, training, and support function, as well as for policies related to the integration of print and digital media services and resources. In a very rapid fashion, issues and policies that challenge existing paradigms and procedures have attracted the attention of library managers and governing officials. In summary, libraries are encountering transformational adjustments in facing the challenges of a new digital reality.

This transformational challenge is clarified by reviewing attributes of traditional library catalog and index functions with the functions of a dynamic WWW portal in the following comparison:

Library Catalog – Index	Web Portal
Selective	Comprehensive/inclusive
Consistent	Semantic interoperability
Predictable	Heterogeneous domains
Trustworthy	Self-correcting
Credible	Multidimensional
Familiar – Conventional	Integrative topology
Linear	Distributed
Historically derived	Fluid-Evolving-Relational
Syndetic	Ontological taxonomic
Static-Fixed-Dependable	Incrementally dynamic

### Electronic Services and Network Technology

The recent rapid adoption, incorporation, and support of digital media and network services into the library environment have few precedents. The rate of change within libraries reflects similar growth trends in the broader electronic services industry as projected in the following comparison:

2001	2003 (projected)
205 M Internet Users	290 M Internet Users
\$43B Net Commerce	\$7.3 Trillion e-commerce (revised to \$6 Trillion by Gardner Group March 2001)
15 Terabytes online	180 Terabytes online
4.7 M Web Sites	7.1 M Web Sites
25 M Domain Names	60 M Domain Names
2.5 B Documents	30 B Documents
800 M Web pages	1.2 B Web pages
4 B IP Addresses	>4 B IP addresses (?)
10 B e-mails/day	35 B e-mails/day
70 day site life	<1 Month site life (?)
44% dead IP links	>44% dead IP links (?)

This projected rate of development and rapid pace of digital media and network service deployment is background for clarifying the challenge libraries and other information intensive organization face in developing strategies for managing future challenges. This strategic challenge involves the adaptation of descriptive statistics into relevant standard measures that will reflect the scope and scale of electronic services within the context of institutional performance.

#### STATISTICAL MEASUREMENT QUESTIONS AND APPROACHES

Difficult questions arise from library adoption of electronic media and digital services. The issues reflect the conceptual basis for library operations. They include the following:

- Why should libraries measure electronic services and networked resources?
- How should libraries measure electronic service access, media content collections, costs, support requirements, and Web usage?
- What standard defines an electronic session? Should libraries count patron “hits”, “clicks”, “downloads”, and “visits”?
- What statistics should a library collect for access to remote electronic services and digital content?
- Can electronic service measurements facilitate development of library output measures and performance indicators?
- Can electronic services be added to existing library statistical categories or are new measures needed?

In addressing the issues arising from these questions, a variety of approaches are possible. Each of these traditional distinct approaches to measurement reflects a slightly different approach to electronic service measurement, as can be seen from the following, it is possible to use:

- Transaction-based measures that measure such things as interactive sessions, downloads, hits, terminals/patron, domain and host addresses, images, or files by sampling or transaction logs
- Time-based measures that measure such things as available service hours, session length/duration, system/server peak levels
- Cost-based measures that measure such things as cost/expenditures for telecommunication bandwidth, terminal workstation equipment, staff, training, maintenance, site licenses
- Use-based measures that measure such things as user activities, anticipated demand, simultaneous users, group use, hits/patron, user satisfaction, local or remote resource usage

Regardless of the measurement approach selected, however, there is fundamental need to adapt and rethink measurement issues related to library involvement with new electronic media and network technology. In order to address new service measurement issues adequately, libraries require standard terms and definitions that can be applied consistently and uniformly to describe electronic services and resources. The need for carefully devised and developed language, terminology, and definitions related to these services is illustrated in the host of digital library challenges appearing in the traditional library research literature. While the Digital Library Federation has offered a clear standard definition of a digital library, the community lacks agreement on definitions detailed the specific meanings of associated terms and definitions for those functions and services offered in the digital realm." Digital libraries are organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically available for use by a defined community or set of communities." (CLIR, 1999)

#### STANDARDS, TERMS, AND DEFINITIONS

Definitional challenges related to standard terminology for digital library measurements do not admit of easy solutions. The current state of library technology infrastructure development reflects complex configurations in which service mix, patron demand/use, and system implementation vary widely. These varying conditions make it extremely difficult to set standard structures and definitions. These variances and differences also make it difficult to collect comparable data from different libraries using traditional mechanisms and instruments. Libraries recognize the lack of clarity in collecting and reporting information related to electronic services. There is broad agreement about the:

- Lack of common accepted conceptual framework;
- Lack of clear, standard, and unambiguous definitions;
- Lack of standard procedures and methods for gathering data in the same way under similar conditions;
- Lack of integrated set of fully developed network infrastructure design principles; and
- Lack of tools that respond to rapid pace of change in networking technologies.

These challenges are also reflected in the difficulties encountered for development of standards related to measurement of electronic resources and services. The rapid pace of change and development in this area

makes it difficult to keep current with rapid and fluid developments in Web services expansion. A lack of agreement on standard definitions of electronic data element service measures, or for a "unit" count presents particularly difficult challenges. When terms such as "document" or "Web site" do not carry the same definitional foundation and agreement of terms like "title" or "item" in a more traditional library environment, problems arise. In addition, there is need for libraries to work cooperatively with network service vendors and commercial electronic service suppliers to provide consistent and reliable transaction usage log information related to library and patron use. The need for generalized software tools to automatically record meaningful standard data regarding usage requires sophisticated programming competence that is not readily available within the library community. Extensive collaboration with aggregators, network service providers, and electronic publishers is critical to progress in this area. In general, a complex mix of interests and concerns presently cloud agreement about how to proceed in developing standards in this area. Also, with the pace of change and development continuing, it is likely that standards for network service measures will follow an evolutionary and developmental approach. In any event, these efforts require the careful development of language, terminology, and definitions appropriate for the new electronic realm.

#### CONCEPTUAL MODEL FOR LIBRARY STATISTICS

Drawing on developments in a host of allied areas helps clarify library measurement concepts and terminology. Such an approach allows library statistical concerns to build on the progress achieved in areas related to metadata standards development. One such area of development involves preliminary concepts and definitions emerging from the World Wide Web Coalition (W3C). Definitions from this global industry-research group working on standards include the following terms:

**Web resource (Uniform Resource Identifier/URI specification):** the manifestation of a retrievable network object characterized by consistent conceptual mapping (e.g., electronic document, image, or service).

**User:** the principal using a client to interactively retrieve and render resources or resource manifestations.

**User session:** a delimited set of user clicks across one or more Web servers. An episode is a subset of related user clicks within a user session.

**Web page:** a collection of information, consisting of one or more.

**Web resources:** intended to be rendered simultaneously and identified by a single URI. A page view is a visual

rendering of a Web page in a specific client environment at a specific point in time.

**Web site:** a collection of interlinked Web pages residing at the same network location.

Similarly, developments in developing standards for the Open Archival Information System (OAIS) have generated preliminary concepts and definitions for the following terms that can be considered in developing standard terms and definitions for library measurement of digital media and electronic services:

**Digital object:** an object composed of a set of bit sequences.

**Search session:** a session initiated by the consumer with the archive during which the consumer will use the archive Finding Aids to identify and investigate potential holdings of interest.

**Representation information:** information that maps data into more meaningful concepts.

**Data dissemination session:** a delivered set of media or a single telecommunications session that provides data to a consumer. The dds format/contents is based on a data model identifying logical constructs used and represented on each media delivery.

**Information package:** content and packaging information used to delimit and identify digital objects.

Finally, another effort at the Library of Congress in developing core standard metadata elements for electronic media offers further preliminary concepts and definitions that may have application for statistical and measurement development:

**Set:** set-level metadata applies to a digital collection formed from aggregates that group digital items by content type.

**Aggregate:** an aggregate organizes digital objects by digital type and by digital custodial responsibility.

**Primary object:** the specific item identified by the online collection access aid as a coherent whole.

**Intermediate object:** a view of component of the primary object. Metadata for an intermediate object allows the gathering of digital files and metadata for the creation of presentations.

**Terminal object:** the digital content file or files that form the object.

Terminal object metadata provides structural information about digital attributes (file size, extension, bit-depth, etc.).

Borrowing the definitions for terms such as these from a variety of different areas, the appendix to this paper offers preliminary language used in the study,

description, and analysis of library involvement with digital information resources, electronic services, and network applications. Similarly, terminology related to performance measurement and development of performance indicators is included in this draft glossary. Hopefully, this draft will provide motivation and guidance in the development of concepts and definitions for describing and framing these critical areas of library services.

Applying the terms and definitions to library statistics, the following four measures may serve as a reasonable starting-point, despite the fact that each measure identified may not adhere to strict requirements for meaningfulness, relevance, and comparability:

**Interactive Transaction-based Measure** - measure total annual interactive simultaneous network user sessions as recorded by transaction activity-logs or by sampling techniques

**Time-based Measure** - measure total annual network service hours available from public access workstations providing interactive simultaneous user sessions as recorded by transaction activity-logs

**Cost-based Measure** - measure total annual costs/expenditures required to provide network services (including costs of telecommunication/bandwidth, terminal workstation equipment, staff, training, maintenance, site licenses, etc.)

**Use-based Measure** - measure total annual aggregate digital web resource objects/sets delivered from user initiated search sessions involving archived digital resources during which users employ Finding Aids to identify and investigate potential holdings of interest

## Library Performance Indicators

### LIBRARY PERFORMANCE MEASUREMENT

Indicators of library performance measurement differ from descriptive statistics related to libraries in emphasizing the following attributes:

Validity	Goals	Objective	Quality	Impact
Outcomes	Priorities	Accountability	Results	Oversight

Library performance indicators focus on the evaluation of library performance by measuring effectiveness and organizational performance, by assessing needs, testing, identifying gaps & high-risk areas, improving accountability, and by establishing benchmarks and baselines. Performance indicators focus on management using unbiased information to improve decision making, to reduce risks, and to solve problems. The emphasis of performance measurement includes drawing comparisons that are useful to coordinate, prevent duplication, to perform stakeholder consultations, and to focus on outputs and outcomes. Finally, performance measure-

ment enables managers to do comparisons, to plan strategy, to formulate budgets, to plan and evaluate program results, and to set goals required to achieve success.

While overlapping concerns affect each area, a useful comparison of the different emphasis of descriptive statistics and performance indicators is seen in the following:

Descriptive statistics	Performance indicators
Consistent	Valid
Timely	Objective
Comparable	Quality
Uniform	Outcomes
Reliable	Goals
Relevant	Priorities
Accurate	Impact
Useful	Results
Standard	Accountability
Reportable	Effectiveness

Similarly, the application of library statistics and performance measurement for libraries can be contrasted as in the following:

Library Statistics	Performance Measures
Management & Administration: measure economic efficiency, productivity, change	Evaluate: Measure effectiveness, organizational performance, identify baselines, test, identify gaps & high-risk areas, improve accountability
Research & analysis: trend analysis, testing, model formulation, R&D innovation	Manage: unbiased information, improve decisions, reduce risk, solve problems, assess needs
Policy planning & development: improvement, grant support, advocacy, legal reform	Compare: Coordinate, prevent duplication, stakeholder consultations, outputs, outcomes
Market analysis & planning: demand analysis, market development, license contract terms	Plan Strategy: formulate budget, plan program results, set goals & assure achievement terms

Performing this type of comparison as a meta-analysis of these two areas of concentration helps to highlight the different approaches of statistics and performance measurement for libraries. The attributes and methodologies developed for library statistics collection, reporting, and analysis do not translate directly to performance measurement. Rather, comparison of the questions and perspectives for each area reveal differences in emphasis and approach.

#### PERFORMANCE QUESTIONS AND APPROACHES

Library performance measurement focus raises the following concerns:

- Why define a new framework for describing library performance and criteria for successful service?
- How should these new success criteria be developed?

- What performance indicator standards exist at the national and international levels?
- What performance indicators can be recommended?
- What are the future developments that will affect development of library performance measurements?
- Are performance-based indicators related to customer relationship management?

In many ways, development of an evaluative framework for measuring success is required in response to the dynamic, unstable, uncertain, and unpredictable changes occurring in libraries. Performance measures are needed to demonstrate value and to respond to changes in demand brought on by the introduction of new services that require the flexibility to create organic learning organizations that are: self-accountable and self-renewing, that involve continuous learning, and that are increasingly adopting team management principles. Libraries and researchers are beginning to focus on identifying what measures to collect and report, what indicators to recommend, and on what procedures to define, approve, collect, and what data elements to report. Developing standard terms and definitions presents challenges for understanding the various categories involved including the following:

*Network Technology Infrastructure:* the component hardware, software, communications conduit, network resources, and associated technological aspects related to electronic network media and service offerings

*Information Resource Content:* networked electronic information resources accessible and preserved locally or remotely, and the means by which search, retrieval, and activation is achieved through administrative, descriptive, and structural metadata and coding

*Extensiveness:* extent of network provided services as measured by standards such as the number of Web page accesses, number of remote logins and sessions, etc.

*Efficiency:* those resources required to provide or access networked information services and digital media resources as measured by standards such as peak-hour connections to servers, bandwidth, etc.

The Equinox (Telematics for Libraries Programme of the European Commission) project that is working on developing library performance measurement and quality management system has developed the following approach to performance Indicators:

- % target population reached by electronic services
- # electronic library services logins/capita/month  
local>> remote
- # electronic documents delivered/capita/month
- cost/login/electronic service
- cost/electronic document delivered/electronic library service
- reference enquiries submitted electronically/month
- library computer workstation use rate  
# /capita >> hours used/capita/month
- Rejected logins as % of total logins
- Systems availability
- Mean waiting time for access to library computer workstations
- IT expenditure as % of total library expenditure

In addition, McClure/Bertot IMLS1999 have proposed performance measures of capacity, use, and impact to describe the ability to make use of a network resource or deliver an network service. These include the following:

- Capacity measures:
  - Internet workstations/some amount of legal service population
  - Speed of public access Internet workstations
  - % annual operating budget for electronic resources
  - Use measures describe the utilization of the library
  - Electronic reference transactions per reference transactions
  - Virtual visits per month. Virtual visits excluding in library use per month
  - Virtual visits as percentage of total visits
  - Database sessions per month
- Impact measures describe the effects of library use:
  - Training
  - Public technology training per month
  - Staff training sessions per month

Transaction-based Measures  
• Measure interactive sessions, downloads, hits, terminals/patron, domain and host addresses, images, or files by sampling or transaction logs

Time-based Measures  
• Measure available service hours, session length/duration, system server peak levels

Cost-based Measures  
• Measure cost/expenditures for telecommunication/bandwidth, terminal workstation equipment, staff, training, maintenance, site licenses

Use-based Measures  
• Measure user activities, anticipated demand, simultaneous users, group use, hits/patron, user satisfaction, local or remote resource usage

Network Technology Infrastructure  
• The hardware, software, communications conduit, and associated technology related to electronic network media and service offerings

Information Resource Content  
• Networked electronic information resources accessible and preserved locally or remotely, and the means by which search, retrieval, and activation is achieved through administrative, descriptive, and structural metadata

Extensiveness  
• Extent of network provided services as measured by standards (number of Web page accesses, number of remote logins and sessions, etc.)

Efficiency  
• Resources required to provide or access networked information services and digital media resources as measured by standards such as peak-hour connections to servers, bandwidth, etc.

A conceptual model of library performance measurement can be constructed for each category of indicator in the following manner:

- Transaction-based Indicator - measure total annual interactive simultaneous network **user sessions** as percentage of total annual users
- Time-based Indicator - measure total annual network **service hours** available through public access workstations providing interactive simultaneous **user sessions** as recorded by transaction logs as a percentage of total annual hours open
- Cost-based Indicator - measure **total annual operating costs/expenditures** for network services (including: library materials, site licenses access fees, telecommunication/bandwidth, terminal workstations, maintenance, staff, training, etc.) as a percentage of total annual operating expenditures
- Use-based Performance Indicator - total annual **aggregate digital web resource objects/sets** delivered from **user search sessions** as a percentage of total annual interactive simultaneous network **user sessions** as recorded by transaction activity-logs or sampling

#### CONCEPTUAL MODEL FOR LIBRARY PERFORMANCE MEASUREMENT

Combining the different perspectives into a conceptual model of performance measurement categories provides the following comparison which illustrates the differences between the various approaches:

A growing emphasis on the need to measure library performance, especially in those areas impacted by electronic services, requires the development of standard definitions, procedures, and instruments. The trend forces librarians rethink the forms of data used to describe and demonstrate what specific value libraries provide to individual patrons, customers, and to society at large. Development of a library performance measurement perspective has significant public policy implications for library managers, governing officials, and for citizens.

Digital network services and electronic media offer promises of unprecedented potential to supplant or supplement print-based communication modalities. The disruption potential of new technology challenge libraries to reframe concepts of organizational performance. For academic institutions, technological innovation and changing information economics threaten radical changes in knowledge communication processes, access to resources, and the nature of learning. More broadly, rapid growth in interactive global networking promises new opportunities for all types of libraries, as well as for a full spectrum of knowledge institutions involved with learning, information transfer, and the preservation of resources. Together, these challenges present opportunities to rethink the library's role in support of the evolving knowledge needs of an increasingly networked global community.

## Customer Relationship Management

### CUSTOMER PERFORMANCE MANAGEMENT FOR A NETWORKED ENVIRONMENT

In today's world of e-business management, there is growing recognition of the need to measure customer satisfaction through Customer Relationship Management (CRM). This rapidly developing area focuses on developing, improving, and maintaining relationships with customers. CRM enables a company to protect against customer infidelity in light of the expanded range of competitive choices that are available to consumers. This is particularly important for those companies opening e-commerce channels for meeting customer requirements. The CRM field is expected to grow to \$150 billion annually within the next decade. (Chartrand, 2001) Driven by the rapid pace of change and innovation within an increasingly competitive global e-marketplace, customer preferences and priorities are increasingly determined by loyalty. CRM concentrates on managing, strengthening, and enhancing relationships with customers. Such customer-focused enterprise program activity requires a comprehensive technological and organizational reorientation which acknowledges that knowledge of customer preferences, priorities, and potentials are essential for managing customer relationships through multiple channels. Much of the CRM movement is depend-

ent on rapid prototyping and ongoing performance testing common in Web-networking communities.

Adaptation of CRM techniques and approach to the library environment could shift concentration from a more traditional *collection-centered* view to a *customer-service* perspective reflecting a performance management transition. The increasingly networked library environment can adapt the CRM tools needed to facilitate, mediate, and integrate customer access to electronic services and networked resources. These customer-centered services can form the basis for value-added selective dissemination capabilities that are increasingly common for commercial network services like Amazon.com. However, it is particularly important for libraries, as non-commercial service providers offering unbiased network access free of advertising, to examine the application of customer relationship management tools and techniques to those services provided by publicly supported institutions. Adjustments are required to address concerns related to patron privacy and confidentiality. But, nevertheless, the potential for libraries to adapt CRM techniques to amplify and increase the value of non-threatening learning spaces to their communities is great. These services are especially important for the "technology-challenged" and disadvantaged patron segments.

In offering patrons training in use of network technologies and guidance services for searching, evaluating, and interpreting multi-format resources, libraries have the potential for offering customers additional value. Managing relationships with specialized categories of patrons could provide customers with CRM-type services. Similarly important are the evaluation and interpretation services libraries provide patrons, especially since only 16% of Web resources are indexed by any single Web-browser and in light of the fact that 83% of sites indexed contain commercial content 6% of Web sites are educational or scientific in nature. With this situation, many commercial search engines are biased toward popular sites. In some instances, it is only through library-mediated customer-centered services that patrons are provided with relevant information. Application of CRM techniques by libraries could reposition their services in relation to the needs of the public community market segment served by these institutions.

In short, networked and electronic services are extending & enhancing libraries. But providing both traditional and digital space for patrons is essential:

- To aggregate, integrate, interpret, and preserve analog, digital, and digitized content resources
- To support system infrastructure migration, generation, and evolution
- To maintain content and collection conversion, maintenance, and integrity

- To continue to provide “open” community information resources and services
- Integration of traditional resources and electronic media services are essential
- To respond to demand access, value-added services, interpretative tools, technology support, and training
- To focus on establishing patron relationships
- To redefine the relationship between libraries, content providers, and “authors”

The historic gifts of power, talent, and energy that characterize librarianship over the last century are evidence that libraries will continue to evolve in response to the challenges of the global digital age. These traditional values offer perspective for librarians to use the potential of network technologies to build global learning communities and knowledge institutions. Peter R. Lyman writes that:

“Digitized documents may lower the costs of reproduction and distribution of print journals, and perhaps some first copy costs, but they also create new kinds of value in faster models of access to information, new techniques for searching, and more customized content. And in the long run, true digital documents will produce new genres of scholarly discourse, new kinds of information markets, and perhaps, new kinds of educational institutions to use them.” (Lyman, 1997)

The library of the future is emerging. The missions and policies of these newly reframed institutions are consistent with those of the last century; but libraries of the 21st century will also be involved with the evolution of new genres and new services. Their development presents new opportunities to evolve in the directions that patrons and communities require. The value these postmodern libraries contribute to knowledge and learning must be measurable for these reframed institutions to carry out the evolving historic mission of society’s greatest gift to humanity. Our history of cooperation requires that librarians address the strategic and global opportunities of the future by constructing standard language for addressing a culture dominated by the need for measuring institutional performance.

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## Appendix 1

### Draft Glossary of Library Statistics and Performance Measurement Terms

*Peter R. Young*

#### Library of Congress

Prepared for

#### Electronic Services and Library Performance Measurement:

#### A Definitional Challenge

At the

#### 4th Northumbria International Conference on Performance Measurement in Libraries and Information Services

*This draft glossary of library statistics and performance measurement terms responds to the need for development of appropriate standard definitions for terms used in the study, description, and analysis of library involvement with digital information resources, electronic services, and network applications. Initial work on this draft glossary of terms was done for the National Information Standards Organization (NISO) Forum on Performance Measures and Statistics for Libraries: Issues for Libraries in Measuring the Information Age which was held 15-16 February 2001 in Washington, D.C.*

**Access:** to seek, retrieve, and use information and the successful fulfillment of this act. Access often means to read data from or write data to a mass storage device or to a network resource. Sustained access is the objective of continued usability of a digital resource, retaining qualities of authenticity, accuracy and functionality deemed essential by a custodial entity or designated community.

**Access aids:** Catalogs, finding aids, or indexes that allow patrons/consumers to discover and retrieve archival information packages of interest. These may take the form of software, databases, or documents, and may be external to the repository in which the package is stored, referring to the package by an identifier. Examples include a library catalog (OPAC) and finding aid documents marked up according to the Encoded Archival Description DTD.

**Aggregator:** 1) a commercial or non-commercial service that gathers together electronic information resources (e.g., in the form of electronic journal titles) into a single assemblage massed together to facilitate access; 2) an aggregate organizes digital objects by digital type and by digital custodial responsibility.

**Archival information package:** From a physical perspective the AIP consists of three components: metadata, data, and packaging. Each component consists of one or more files. The metadata component consists of XML Schema containing information describing the archival object. The data component consists of all the data files (essence bit streams) that comprise the archival object. The packaging component encapsulates the metadata and data components, creating a single entity or a self-extracting archive that is the AIP. An AIP contains both data files (essence bit streams) and metadata. Once transmitted, an AIP may be de-constructed or otherwise treated to meet the needs of data management and the user community. (see Digital object)

**Authentication:** the process of identifying an individual, usually based on a username and password. In security systems, authentication is distinct from authorization, which is the process of giving individuals access to system objects based on their identity. Authentication merely ensures that the individual is who he or she claims to be but says nothing about the access rights of the individual. Authentication verifies that a user is who he claims to be or a client computer system is what it represents itself as. Combined with authorization to support access management. Authentication is also a mechanism that attempts to establish the authenticity of digital materials at a particular point in time. For example, creation and verification of digital signatures to establish that files or bit streams have not been modified.

**Author:** the individual, organization, or other entity chiefly responsible for creation of the intellectual or artistic content of a work or other expression.

**Authorization:** the process of granting or denying access to a network resource. The first step in security assurance is authentication to ensure a user is who he or she claims to be and the second stage is authorization that allows the user access to various resources based on the user's identity.

**Bandwidth:** 1) the transmission capacity of an electronic medium, such as network wiring, fiber-optic cable, or microwave links; 2) the amount of data that can be transmitted in a fixed amount of time. For digital devices, the bandwidth is usually expressed in bits per second (bps) or bytes per second. For analog devices, the bandwidth is expressed in cycles per second, or Hertz (Hz).

**Born digital:** Describes digital materials with no analog equivalent. Used to differentiate them from 1) digital materials which have been created as a result of converting analog originals; and 2) materials that may have originated from a digital source but have been printed to paper.

**Browser:** (short for Web Browser): a client software application that enables a user to view HTML documents on the World Wide Web, another network, or on the user's computer; follow the hyperlinks among them, and transfer files. Browsers are used to search, locate, and display information on a server. They require a connection that can handle IP packets but will also display graphics that are in the document, play audio and video files, and execute small programs such as Java applets, that can be embedded in HTML documents. The two most popular universal browser applications are Netscape Navigator and Microsoft Internet Explorer. Both are graphical browsers that can display graphics as well as text. In addition, most browsers can present multimedia information, including sound and video, though they require plug-ins for some formats.

**Catalog:** A list of library materials contained in a collection, a library, or a group of libraries, arranged according to some definite plan.

**Computer files:** digital encoded works that exist in media such as CD-ROM's, magnetic tapes, and magnetic disks that are encoded and designed to be processed and manipulated by a computer. Examples are U.S. Census data tapes and reference tools on CD-ROM, tape, or disk. This definition excludes library systems software and associated files used to manage the collection. (NISO Z39.7-1995)

**Container:** Any housing or vehicle for an object or item, group of object or items, or part of an object or item that is separable from the content which facilitates identification and use of the object or item(s) by users.

**Copies:** material objects, other than phonorecords, in which a work is fixed by any method now known or later developed, and from which the work can be perceived, reproduced, or otherwise communicated, either directly or with the aid of a machine or device. The term "copies" includes the material object, other than a phonorecord, in which the work is first fixed.

**CD-ROM:** abbreviation for Compact Disk-Read Only Memory; a type of optical disk capable of storing large amounts of data (from 650 MB to 1 GB) from which information may be read but not written. CD-ROM's are stamped by the vendor and cannot be erased and used to store new data.

**Click:** the pressing down and rapid release of a graphical user interface mouse button. The effectiveness of WWW sites can be measured by their click-through rate - how often people who see the site click on it.

**Collection:** three or more independent works or parts of works by one author published together. Two or more independent works or parts of works by more than one author published together and not written for the same occasion or for the publication in hand.

**Computer file:** a digital file (data and/or programs) encoded for manipulation by computer or similar equipment. Direct access computer files indicate the use of computer files via carriers (e.g., disks, cassettes, cartridges) designed to be inserted into a computer or its auxiliary equipment by the user. Remote access computer files indicates the use of computer files via input/output devices connected electronically to a computer.

**Data:** The OAIS model distinguishes between data and information. Data is a representation of information in a form suitable for communication, interpretation, or processing. When combined with representation information, data becomes information. More particularly, the OAIS model indicates that an Information Object consists of a Data Object together with its Representation Information. An example is a sequence of bits (the data) accompanied by a description of how to interpret a sequence of bits as displayable or printable characters (representation information). In this instance, the representation information would document the character set and encoding used.

**Database:** a collection or file of information assembled and organized in such a way that a program can record, manipulate, select, and retrieve desired data. A hypertext database is a database designed so that any object, whether text, image, or graphic can be linked to any other object. Hypertext databases are particularly useful for organizing large amounts of disparate information.

**Digital:** 1) describes anything that uses a set of discrete numerical values to represent data or signals, as opposed to a continuously fluctuating flow of current or voltage, which is analogous to the data it represents; 2) computer processes digital data that may represent text, sound, pictures, animations, or video content.

**Digital image:** an electronic version of a bit-mapped image of a document or other information format that

allows text to be searched at the character level; "digitize" is to encode images or sound in a format that may be processed by a computer; to convert analog information into data. To "digitalize" means the process and accompanying technologies required to effect the conversion from bit-mapped (e.g., a fax) to searchable format.

**Digital library:** digital libraries are organizations that provide the resources, including the specialized staff, to select, structure, offer intellectual access to, interpret, distribute, preserve the integrity of, and ensure the persistence over time of collections of digital works so that they are readily and economically for use by a defined community or set of communities.

**Digital object:** 1) an object composed of a set of bit sequences. 2) Set-level metadata applies to a digital collection formed from aggregates that group digital items by content type. 3) An aggregate organized digital objects by digital type and by digital custodial responsibility. 4) a primary object is the specific item identified by the online collection access aid as a coherent whole. 5) an intermediate object is a view of component of the primary object. Metadata for an intermediate object allows the gathering of digital files and metadata for the creation of presentations. 6) A terminal object is the digital content file or files that form the object. Terminal object metadata provides structural information about digital attributes (file size, extension, bit-depth, etc.). A generic, abstract concept, it is used to designate a single unit of digital content, which may have been acquired by a library in digital form or which may be the digital reproduction of a physical original. It will often correspond to a unit at the level at which intellectual access or bibliographic description would be normal or desirable, or at the level at which selection or acquisition would occur. Examples are books and maps. For digital reproductions, it may correspond to a unit at the level at which physical control of the source item is managed, for example, a folder of correspondence. Conceptually, a digital object consists of content and the metadata necessary to support its storage, management, and access, now and in the long term. A digital need not be manifested as an object in the object-oriented sense (incorporating its own methods to support access and presentation). The term does imply that a digital object can be instantiated, represented, and transmitted as a complete and self-describing package. In the OAIS model, the digital object is manifested as an archival information package.

**Digital repository:** an organization responsible for digital preservation activities which may be a separate, independent organization or one managed by a library or archive which engages in preservation activities for managing long-term maintenance of a digital byte stream and the continued accessibility of its contents.

**Digital resource:** A generic term for digital content, reflecting the viewpoint of the user looking for resources relevant to a particular task. A resource may be a single digital object or a group or collection of related digital objects.

**Digital transmission:** a transmission in whole or part in a digital or other non-analog format.

**Digitization:** The process of creating digital files by scanning or otherwise converting analog materials. The resulting digital copy, or digital surrogate, would then be classed as digital material and then subject to the same broad challenges involved in sustaining access to it, as “born-digital” materials.

**Dial-up Internet connection:** Internet connection using a modem and a phone line.

**Direct Internet connection:** Internet connection using a dedicated connection such as a leased line (e.g., T-1, 56 kbps, ISDN, DSL) or cable.

**Dissemination:** The process of delivering digital objects or metadata through an Access Subsystem to a Consumer. Examples of disseminations include rendering individual objects for end users and batch exports to other repositories (including any repository built to replace the current repository).

**Document:** 1) a file of data containing, text, graphics, images, and/or other objects. 2) any file produced by an application.

**Document delivery:** the provision of copies of journal articles or other documents or works by digital or analog means to a patron in response to a specific request. Document delivery and interlibrary loan activities may involve fees paid for photocopies, costs of telefacsimile transmission, royalties, and access fees paid to bibliographic utilities, networks, or commercial service providers, including aggregators.

**Domain:** in an Internet address, the part of the naming hierarchy that consists of a sequence of characters separated by dots. A group of computers and devices on a network that are administered as a unit with common rules and procedures. Within the Internet, domains are defined by the IP address. All devices sharing a common part of the IP address are said to be in the same domain. A domain name identifies one or more IP addresses and is used in URL's to identify particular Web pages. A domain name service (DNS) is an Internet service that translates domain names into IP addresses.

**Download:** to copy data (usually an entire file) from a main source to a peripheral device. The term is often used to describe the process of copying a file from an online service to a local computer. Downloading can

also refer to copying a file from a network file server to a computer on the network.

**DVD:** Digital Versatile or Video Disc DVD is a type of CD-ROM that holds a minimum of 4.7 Gb of data.

**Economic measures:** the measurement of library and information services that concentrate on the relationship between investments and the resulting value of library services. Economic measures involve the documentation of costs and assignment of dollar value to library products and services. Quantitative economic measures include measurements of transaction costs, costs per use, costs per category of service, relative costs of analogous electronic and on site/in person services or transactions, etc. Qualitative economic measures include willingness to pay, projected costs of analogous services or products (when available) in the commercial sector, projected economic implications of unavailable service or resource, etc.

**Edition:** All copies embodying essentially the same content or produced from the same master copy and issued by the same entity.

**Editor:** One who prepares for publication an item not his or her own. The editorial work may be limited to the preparation of the item for the manufacturer, or it may include supervision of the manufacturing, revision (restitution), or elucidation of the content of the item, and the addition of introduction, notes, and other critical matter. In some cases, it may involve the technical direction of a staff of persons engaged in creating or compiling the content of the item.

**Efficiency:** those resources required to provide or access networked information services and digital media resources as measured by standards such as peak-hour connections to servers, bandwidth, etc.

**Electronic journal:** a serialized electronic publication.

**Electronic resources:** digital or digitized resources that are accessible locally or remotely to library patrons.

**Electronic services:** services provided to library users based on access to electronic resources held locally or accessed remotely.

**Extensiveness:** extent of network provided services as measured by standards such as the number of Web page accesses, number of remote logins, and sessions, etc.

**Format:** a particular physical presentation of an item or work. Also, the manner in which data, documents, graphics, images, video, animation, or text is organized, structured, named and described in order to prepare the information for use.

**FTP (File Transfer/Transport Protocol):** the protocol based upon which digital files are transferred via the Internet.

**Graphical workstation:** A workstation and/or computer that is capable of displaying graphical images, pictorial representations, or other multi-media formats.

**Information package:** content and packaging information used to delimit and identify digital objects.

**Information resource content:** networked electronic information resources accessible and preserved locally or remotely, and the means by which search, retrieval, and activation is achieved through administrative, descriptive, and structural metadata and coding.

**Internet:** 1) a global composite decentralized communications infrastructure network composed of tens of thousands of individually owned and operated interconnected networks. The Internet is based on a common architecture and protocol standards governing the interchange of data. The Transmission Control Protocol/Internet Protocol (TC/IP) standard Internet suite of route host messaging connecting millions of computers to one another around the world gives the user the illusion that they using are a single network; 2) the Internet can be accessed through an Internet Service Provider (ISP) offering Internet services by connecting to this network of networks; 3) the networks that make up the Internet are composed of communications links, which carry data from one point to another, and routers, which direct the communications flow between links and thus, ultimately, from senders to receivers.

**Interlibrary loan:** a transaction in which library material, or a copy of the material (including materials sent by telefacsimile or other form of electronic transmission) is made available by one library to another upon request. It includes both lending and borrowing. The libraries involved in interlibrary loan are not under the same administration or on the same campus. Interlibrary loan also includes transactions for materials obtained through the interlibrary loan process that are supplied from non-library sources. (NISO Z39.7-1985)

**Issue:** Copies of an edition forming a distinct group that is distinguished from other copies of that edition by minor but well-defined variations.

**Item:** A document or set of documents in any physical or digital form, published, issued, or treated as an entity, and as such forming the basis for a single bibliographic description.

**License database subscription:** a subscription to a commercial (or non-commercial) database service provider that allows library users to access digital resources and works (e.g., article index/abstract infor-

mation, full published texts, numerical data sets, etc.) under specified terms and conditions typically contained in an annual license.

**Library:** an entity that provides all of the following: a) an organized collection of printed or other library materials, or a combination thereof; b) a staff to provide and interpret such materials as required to meet the informational, cultural, recreational, and educational needs of a clientele; c) an established schedule in which services of the staff are available to the clientele; and d) the facilities necessary to support such a collection, staff, and schedule. (NISO Z39.7-1985)

**Logon:** the process of identifying a user to a computer after connecting over communications lines. During the procedure, the computer usually requires the user's name and password.

**Metadata:** structured information about information. Metadata describes how and when and by whom a particular set of data was collected, and how the data is formatted. Metadata is essential for understanding and using information stored in data warehouses. A general term for information needed to support repository system administration and digital object management, consistent with an organization's policies, programs, and practices for content management, including preservation. This includes (but is not limited to) information about the creation or acquisition of the digital object, about ownership and rights, about past transformation or reformatting activities, current storage details; and information deemed important to support future preservation decisions or actions.

**Descriptive metadata** is used in the discovery and identification of an object. Examples include MARC and Dublin Core records. A content metadata standard is defined as an open specification that itemizes a set of elements and their meanings. Each element is tagged with an identifier (e.g., "Title", "Author") that distinguishes the element from other elements within the standard. Descriptive metadata provides basic identifying information including author, title, subjects, etc. Information that primarily describes content in intellectual terms and principally exists to support content discovery, sometimes synonymous with bibliographic information. Some descriptive metadata will be stored with each digital object in a repository. However, descriptive metadata to support discovery (through searching, browsing, and navigation) may also be held in finding aids or catalog records stored elsewhere. Links from those access aids to the digital resources they describe will be through persistent identifiers.

**Structural metadata** describes layout and organization of data to provide guidance on how to use an information work. It defines the object's internal organization and is needed for display and navigation of that object. Structural metadata is used to display and navi-

gate a particular object for a user and includes the information on the internal organization of that object. Structural metadata could exist in various levels of complexity.

**Administrative metadata** provides information about a work's ownership and production. Administrative metadata represents the management information for an object that is needed to keep the object over time and identify artifacts that might have been introduced during its production and management (e.g., the date it was created or digitized, at what resolution, its content file format (JPEG, JTIF, etc.), who can use it, rights information, etc.

**Network:** 1) a specialized type of library cooperative organized established for the centralized development of cooperative programs and services, including use of computers and telecommunications. It requires the establishment of a central office and a staff to accomplish, rather than merely coordinate, network programs. (NISO Z39.7-1985); 2) a group of two or more computer systems linked together using a common protocol to communicate with one another. Computers on a network are called nodes, while computers and devices that allocate resources for a network are servers.

**Network technology infrastructure:** the component hardware, software, communications conduit, network resources, and associated technological aspects related to electronic network media and service offerings.

**Online service:** a business service that provides subscribers with a variety of data transmitted via networks. Online services provide an infrastructure that allows subscribers to communicate with one another and to connect with third-party information providers.

**Outlet:** A library facility. In the case of some public libraries, there is only one facility or outlet. Other public libraries have several outlets or facilities sometimes referred to as branches.

**Outcome measure:** an assessment of the results of a program activity compared to its intended purpose. Outcome/impact measures relate to observable benefits provided to individuals or groups, in the originating human services and education fields, "changes in knowledge, skills, behavior, attitudes, status, or life condition." Quantitative outcomes are measured by grade-based performance on standardized tests, quantifiable changes in performance on pre- and post-service tests, records of behavioral change (crime rates, school attendance, etc.), records of status change (school drop-out, graduations, employment, income, etc.), type of examples are performance on academic and literacy instruments. Qualitative outcomes are measured by observa-

tion of indicative behaviors (e.g., ability to locate high-quality, pertinent information for a query, self-reports of level of skill, knowledge, behavior, attitude surveys (interest in a specific discipline, relative valuation of targeted phenomena such as reading, etc.

**Output measure:** the tabulation, calculation, or recording of activity or effort that can be expressed in a quantitative or qualitative manner. The quantitative measurement of services resulting from library activities such as ILL, items circulated, titles cataloged, volumes added, titles held, reference queries, gate counts, users in legal service area, database searches, FTE staff, etc. Includes e-Metrics, for which meaningful data elements are beginning to be established.

**Page:** a fixed amount of data or information, arranged in bytes recognized by the operating system. A page is equal to the amount of data that can be displayed on a screen.

**Performance indicator:** a particular value or characteristic used to measure output or outcome. Measures of service quality, performance efficiency and customer satisfaction. Quantitative performance indicators may include volume of backlogs, processing time, reference response time, ILL delivery cycle, FTE to user ration, availability of information needed, etc. Qualitative performance indicators include user perception of service quality, user satisfaction with reference response, types or levels of service available, etc.

**Portal:** 1) usually used as a marketing term to describe a Web site that is or is intended to be the first place people see when using the Web. Typically, a Portal Site has a catalog of web sites, a search engine, or both. A Portal site may also offer email and other services to entice users to the site as their main point of entry (e.g., portal) to the Web; 2) a Portal maintains data access and retrieval structures that facilitate access for specific research or user communities by locating, gathering, and maintaining Web content resource addresses according to specified criteria and organizes these resources for easy user search, access, retrieval, interpretation, and use. Portals provide selectivity and functionality at a different level than Web Browsers and search engines, which do not offer the specificity and evaluative details available through a portal. A portal site can attract visitors by offering free information, or free services on a regular basis. Some portals provide indices of Web pages that are maintained by editors that manually classify web documents into a tree-like taxonomy of topics or categories, and provide rich links between sites, works, and citations. The best know portals are available through the major search engines: AltaVista, Excite, HotBot, Lycos, InfoSeek, and Yahoo!.

**Public access workstation:** 1) a single-user computer consisting of a personal general-purpose processor linked to a communications device that allows data transmission; 2) a public access workstation is one made available for a member of the public to use; 3) those library outlet graphical workstations that provide public access to the Internet, including those that provide access to a limited set of Internet-based services such as online databases.

**Publication:** the distribution of copies or phonorecords of a work to the public by sale or other transfer of ownership, by rental, lease, or lending. The offering to distribute copies or phonorecords to a group of persons for purposes of further distribution, public performance, or public display, constitutes publication. A public performance or display of a work does not of itself constitute publication.

**Representation information:** information that maps data into more meaningful concepts.

**Serial:** a publication in any medium issued in successive parts bearing numerical or chronological designations and intended to be continued indefinitely. This definition includes periodicals, newspapers, and annuals (reports, yearbooks, etc.); the journals, memoirs, proceedings, transactions, etc. of societies; and numbered monographic series. (NISO Z39.7-1985)

**Session:** 1) the time during which a program is running for a user. In most interactive programs, a session is the time during which the program accepts input and processes information. In communications, the time during which two computers maintain a connection. 2) A user session is a delimited set of user clicks across one or more Web servers. An episode is a subset of related user clicks within a user session. 3) A search session is initiated by the consumer with the archive during which the consumer will use the archive finding aids to identify and investigate potential holdings of interest. 4) A data dissemination session is a delivered set of media or a single telecommunications session that provides data to a consumer. The dds format/contents is based on a data model identifying logical constructs used and represented on each media delivery.

**Statistics (metrics):** the mathematics of the collection, organization, and interpretation of numerical data as in descriptive statistics. Examples of library statistics include collecting statistics for data elements that quantify library material resources, services, staff, operations, and users.

**URL (Uniform Resource Locator):** the global address of documents and other resources on the WWW. The first part of the address indicates what protocol to use, and the second part specifies the IP address or the domain name where the resource is located.

**URN (Uniform Resource Name):** a scheme for uniquely identifying resources that may be available on the Internet by name, without regard to where they are located. The specifications for the format of URNs are under development by the IETF.

**User:** the principal using a client to interactively retrieve and render resources or resource manifestations.

**Virtual reference transaction:** a reference interaction involving an external patron or user who transmits a query electronically and for whom a response is returned electronically using a variety of formats, including email attachments, URLs, etc.

**Web browser:** see Browser.

**Web page:** 1) a document on the WWW. Each web page is identified by a unique URL; 2) a web page is a collection of information consisting of one or more Web resources, intended to be rendered simultaneously and identified by a single URI; 3) a page view is a visual rendering of a Web page in a specific client environment at a specific point in time.

**Web resource:** the manifestation of a retrievable network object characterized by consistent conceptual mapping (e.g., electronic document, image, or service).

**Web site:** 1) a group of related HTML documents and associated files, scripts, and databases that are served up by an HTTP server on the WWW. Also, a site location on the WWW. Each Web site contains a home page, which is the first document users see when they enter the site. The site might also contain additional documents and files. Each site is owned and managed by an individual, company, or organization; 2) a web site is a collection of interlinked Web pages residing at the same network location.

**Work:** A work is fixed in a tangible medium of expression when its embodiment in a copy or phonorecord, by or under the authority of the author, is sufficiently permanent or stable to permit it to be perceived, reproduced, or otherwise communicated for a period of more than transitory duration. A work consisting of sounds, images, or both, that are being transmitted, is fixed if a fixation of the work is being made simultaneously with its transmission.

**World Wide Web:** The total set of interlinked hypertext document residing on HTTP servers all around the world. Documents on the WWW, called pages or Web pages, are written in HTML, identified by URLs that specify the particular machine and pathname by which a file can be accessed, and transmitted from node to node to the end user under HTTP. Also, the WWW is system of Internet servers that support HTML formatted documents that are linked to other documents, including graphics.