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LSN Design Management Plan for Alternative Five

1.0 Introduction

This document presents a description of Alternative Five for the potential design of the Licensing Support Network (LSN) home site and participant sites. It is based on work done by the LSN Advisory Review Panel (LSNARP) Technical Working Group (TWG) during the months of October through December 1999. A total of five potential LSN designs were evaluated. Of these, two (Alternatives One and Two) were discarded. The other two designs, Alternative Three, the “distributed storage,” and Alternative Four, the “LSN campus” approaches are discussed in separate documents.

The three final design alternatives share many characteristics but differ in important ways, most significantly in the areas of the ability of the LSN Administrator (LSNA) to exert management control over the overall LSN, the burden placed on participants to fund, create, and manage their sites, and the overall cost to the NRC for the “home site.” How Alternative Five impacts these factors is discussed below.

The LSN can be regarded as consisting of three functional components. Specifically, these are:

- A component that aids the LSNA in auditing participant compliance with the LSN Rule.
- A component that presents LSN information to participants, other interested parties, and the general public.
- A component that stores LSN documentary information for the use of components one and two.

The alternative designs validated by the TWG differ primarily in the details of the third component; specifically, in how and where LSN materials are stored. The design of the first and second component will not be materially affected by the alternative selected for the third component, although there are differences in the details of implementation and operation.

The following sections will describe the Alternative Five, the “consolidated storage” alternative, the details of its components, how they “fit” together, the hardware and software used in the design, and an approximation of the component life-cycle costs.

2.0 Description of Alternative Five

Alternative Five has been named the “consolidated storage” alternative by the members of the TWG. This terminology focuses on a key characteristic of the design - that each participant, assemble, prepare, and publish their own collections of documents on a WWW server that they control and place at a site of their choosing, and that their information is replicated at a single central storage facility maintained by the LSNA. This approach is essentially identical to the design originally conceived in the early conceptual development of the LSN, with additional storage capability included, effectively used as a 100% cache of participant documentary materials. This functionality allows improved performance, reliability, ease of implementation, and lessens the operational burden on participants.

2.1 Compliance Component

This component is a "front-end" component (one with which end-users interact) with a small set of users who require specific information at specific times. It is intended to address the in-house needs of the LSNA.

2.1.1 Intended functionality

The purpose of this component is two-fold. First, this component ensures that the LSN is functioning as intended and assures this functioning to the intended user base. Second, it provides the necessary reports on LSN functionality that enable the LSNA to ascertain participant compliance with the LSN Rule and that aid in determining whether remedial action is required.

The primary method of following the operation and evolution of the LSN is through a reporting mechanism. Reports will be generated automatically by the system on a periodic basis, when exceptional conditions arise, and on-demand.

2.1.1.1 Periodic reports

The full array of required reports is yet to be determined. However, the following types of reports have been identified at this time:

- A listing of changes in participant document collections, i.e. additions, deletions, and modifications.
- A report on the "health" of the LSN, component and sub-component uptime and performance data (e.g. web server hits, average response times, number of users, etc.)

2.1.1.2 Exception reports

Exception reports will be generated when anomalous conditions are noted. Candidates for this type of report include:

- When auditing software detects a possible compliance problem with a participant collection.
- When a component of the LSN itself is determined to be malfunctioning, e.g. due to a computer or network error.
- When a security exception is noted.

2.1.1.3 On-demand reports

It is anticipated that reports may need to be generated from time-to-time to respond to an exception or to "drill down" to garner additional information on a perceived compliance problem. A facility will be provided to expedite this process. It is anticipated that HTML forms will be designed to allow individuals to design and generate most reports on demand. However, it is likely that some reports may need to be developed by systems personnel from time-to-time.

2.1.2 Intended user base

The intended user base for the compliance component is the LSNA, his designees and the ASLBP (Atomic Safety and Licensing Board Panel).

2.1.3 Access to functionality/information delivery

2.1.3.1 Web browser

Certain functions of the system are best accessed through a WWW browser (e.g. Netscape, Internet Explorer, etc.) through the standard HTTP/HTML mechanism bolstered by CGI programs that interact with the data stores. Most commercial and open source network management software currently employ a web-based interface. Specifically, those aspects of the monitoring function that change rapidly can best be monitored through a browser. Examples of these are troubleshooting on-going problems and ascertaining the status of a particular sub-component at a particular time. Historical trends will be maintained both in HTML tables and graphically.

A web browser is also anticipated as the normal interface to generate reports on demand, with an HTML forms interface providing the report and data selection, as well as the formatting function.

2.1.3.2 Hard-copy delivery

It is anticipated that certain reports, especially periodic reports "for the record," will be automatically printed and physically delivered to their intended recipient(s).

2.1.3.3 E-mail delivery

E-mail is an alternative method of delivery most appropriate for exception reports, but is useful for all report types.

2.1.3.4 Interactive login

Interactive access to the system will be required to produce on-demand reports that have not been anticipated in the design of the web-based, on-demand facility described above.

2.1.3.5 File system access

File system access is required for ready availability of system logs and other source data for off-line processing and archival.

2.1.3.6 Pager notification

Certain types of exception reports, e.g. notifications of system unavailability, mandate a more aggressive notification. In these instances, the system administrator will be paged automatically with a description of the exception in order to expedite repair.

2.1.4 Component elements and their functionality

2.1.4.1 Data retrieval element

This element will consist of one or more programs which will routinely "rove" participant sites, fetching participant data (documents, statistics, and other) and storing this data pending processing. The exact nature of the data retrieval element will depend on the details of the alternative selected for the storage component, but it is analogous to a "web spider." A web spider, when presented with a starting URL, will traverse all hyperlinks within the body of documents "under" the URL. Through this methodology, it is possible to retrieve and replicate the entire static structure of a web site for further processing.

2.1.4.2 Data storage

This element is responsible for storing both data to be processed and the results of that processing. Both file system storage and database storage will be accommodated. The database will be a network-capable SQL relational database that will provide structured data to both front ends, i.e. the

compliance and presentation components.

2.1.4.3 Data processing

This element will process the data retrieved, store the results of the processing, and generate the required reports.

2.1.4.4 Data presentation and reporting tool

This element consists of several programs that process report outputs into formats appropriate for the delivery mechanisms described above, and assist a user in specification of on-demand reports.

2.1.4.5 System assuredness with further sub-elements

This element provides a level of assuredness that the systems the LSN is housed on are functioning as required. There are several main sub-elements:

- **Security mechanisms.** Security sub-elements include a firewall or firewall software, secure remote administration software, and intrusion detection software.
- **Network monitoring and management.** This sub-element monitors hardware and software and reports outages or sub-optimal operation. It also gathers low-level statistics on network operation for trend and throughput analysis.
- **Physical plant and reliability mechanisms.** This sub-element provides appropriate environmental and power conditioning and implements disaster recovery mechanisms, e.g. a backup/restore capability.

2.1.5 Hardware and software required

No attempt is made to specify make and model of hardware and software at this time. Where appropriate, examples of products will be provided, but these are not intended to represent a comprehensive list of alternatives or preferred selections. Since there is a competitive market for these products, they will be used to develop ballpark pricing estimates, but this should not be construed as an attempt to preselect a vendor or product.

2.1.5.1 Computer system hardware

A single computer system of the workstation class is adequate for this functionality. The security sub-element mandates that the system be separate from and more restricted than the computer system (described below) that provides general access. The system should be equipped with the standard components, a graphical display, and a device appropriate for backup. Examples of this type of system include an i386-architecture workstation (e.g. Pentium III "PC") running open-source Unix (e.g. FreeBSD or Linux), or Microsoft NT, a Sun workstation running Solaris, or a Compaq/DEC Alpha running VMS. The primary selection criteria for the specific hardware and operating system should be based on security objectives, with specific functionality a secondary (but important) consideration.

2.1.5.2 Computer system software

The following software components will be required: a web server (e.g. Apache, Netscape Enterprise, MS IIS), a database with accompanying report generation software (e.g. PostgreSQL, Oracle, MS SQL Server), firewall software (e.g. IPFW, ipfilter, Firewall-1), network monitoring and management software (e.g. Big Brother, SunNet Manager, HP OpenView), and a web spider (e.g. MoMspider, BRS/Search, Fulcrum Search Server). Note that the web server, database, and web spider are also part of the presentation component (described in Section 2.2, below). The same software can be used for both purposes. In addition, it is anticipated that this component will require some custom software, scripts and CGI's rather than full-blown applications.

2.2 Presentation Component

This component is a "front-end" with a large set of users who require access to a wide range of information at arbitrary times. It is intended to fulfill the requirement to provide information to interested parties through WWW technology.

2.2.1 Intended functionality

It will be a WWW presentation interface with additional sub-components that consist of:

- Introductory and overview documentation.
- Training / tutorial materials on how to use the site to obtain LSN-related information, and the other aspects of the site, and how to submit to the docket.
- Portal software that allows user customization of user interfaces and user document search and access strategies.

- A search facility that allows LSN-wide searching of participant materials, including individual user custom searching strategies.
- Publication of statistical information on LSN participant sites, including site content and performance.
- Aggregation and publication of overall LSN access and usage statistics, e.g., number of hits.
- A web-based interactive forum in which interested parties can discuss or exchange information regarding LSN matters.
- Help-desk assistance (with escalation) for participants and public users.
- A LISTSERV (e-mail list manager) to allow participants to easily send electronic mail to all interested parties. A number of mailing lists will be created as needed for discussion of specific subjects, including a list with the e-mail addresses of all participants for notification purposes. The LISTSERV software will allow each participant to manage their own subscriptions to interest lists and archive messages to the lists. The LSN is not intended to provide a public LISTSERV function.

2.2.2 Intended user base

The intended user base includes all participants and potential participants, the LSNA and his designees, the press, and the general public.

2.2.3 Access to functionality/information delivery

2.2.3.1 Web browser

Web browsers will be the predominant access method to this component. It is anticipated that this will be the sole access method for the majority of users. Browsers will be used to gain access to general information, participant documentary collections, and to discussion forums.

2.2.3.2 E-mail

E-mail will be used for notification to participants by the LSNA or designee, and interaction with the LISTSERV described above.

2.2.4 Hardware and software required

No attempt is made to specify make and model of hardware and software at this time. Where appropriate, examples of products will be provided but these are not intended to represent a comprehensive list of alternatives or preferred selections. Since there is a competitive market for these products, they will be used to develop ballpark pricing estimates, but this should not be construed as an attempt to preselect a vendor or product.

2.2.4.1 Computer system hardware

A single computer system of the server class will be required for this functionality. Examples are as in Section 2.1.5.1, but this component will require more processing power and capacity, i.e. a faster CPU or multi-CPU machine, more RAM, bigger disk storage, etc. The primary selection criteria for the hardware is that it should be supported by the portal software selected (the most critical software component).

2.2.4.2 Computer system software

The following software components will be required: a web server (e.g. Apache, Netscape Enterprise, MS IIS), a database with accompanying report generation software (e.g. PostgreSQL, Oracle, MS SQL Server), firewall software (e.g. IPFW, ipfilter, Firewall-1), a web forum (e.g. UltimateBulletinBoard, WWWboard), and a LISTSERV (e.g. MailMan, majordomo, LISTPROC), and portal software (e.g. Plumtree, Excalibur, Knowledge Center). Note that the web server, database, and web spider are also part of the compliance component described in Section 2.1. The same software can be used for both purposes.

2.2.5 Participant activities and responsibilities

None except as end-users. This component is the responsibility of the LSNA.

2.3 Storage Component

The storage component represents the "back-end" functionality serving the needs of the front-end components rather than the end-users directly. The data it contains consists of documents required to be published by participants in accordance with the LSN Rule, and accompanying required information.

2.3.1 Participant systems

Each participant will assemble, prepare, and publish their own collections of documents on a WWW server. The compliance component and the presentation component will access these collections as WWW clients and perform the necessary operations routinely through participant sites.

2.3.2 Consolidated storage server

A server intended to aggregate all LSN data will be implemented in close network proximity to the compliance and presentation components. It will act as a 100% cache for participant sites, loading itself from their sites and then supplying the front-end components with data. This will allow a less rigorous design in participant sites, because they will not be required to provide high levels of performance and operational characteristics. The consolidated server can access participant sites at a slow rate of speed and at convenient times (for the participants), and then provide this data at high rates of speed and at all times to the presentation and compliance components.

2.3.3 Intended functionality

Participants will make their documentary collections available on a web server located at the site of their choosing and attached to the Internet. Participants are free to establish their own web server, collaborate on a community web server, procure commercial web service, or employ any other provisioning method they choose. The storage server will load itself from the participant web sites and subsequently be accessed by the compliance and presentation components.

2.3.4 Intended user base

The intended user base of participant sites is primarily the LSN consolidated storage server described above. The user base of the storage server are the compliance and presentation front-ends components.

It is anticipated that participants may choose to make their document collections (and ancillary information) generally accessible on the Internet, (i.e., other than through the LSN portal site). However, any documents intended to be filed in the licensing process will have to be obtained or cross-referenced through the LSN portal site to ensure the uniqueness, consistency, and traceability of document identification (accession) numbers.

2.3.5 Access to functionality/information delivery

2.3.5.1 Web access

This will be the primary method by which participant materials are accessed. Access will be by batch (e.g. the storage server will fetch all materials from the web site, the portal will index them, and retain references to their location on the storage server for subsequent presentation in response to end-user queries).

2.3.5.2 File system access

It is expected that the presentation component will access the consolidated storage component directly through a file system rather than through a web server for greater efficiency in data transfer.

2.3.5.3 SNMP access

For obtaining network usage statistics and performing monitoring activities, the compliance component will also require SNMP (Simple Network Management Protocol) access to participant web servers and network interface equipment.

2.3.5.4 Interactive login

The consolidated storage server will support interactive login for administration.

2.3.6 Participant activities and responsibilities

Participants are required to make available all documents subject to discovery in standard, LSNA-approved formats on a web site. This consists of the following activities.

2.3.6.1 Document identification and assembly

This is simply identifying and assembling the documents. This function will provide a reasonably accurate estimate of the storage space and preparation effort required.

2.3.6.2 Document preparation

Documents are to be converted to a format that includes an image representation (TIFF/CCITT or TIFF/JPEG), a searchable text file, and a bibliographic header containing metadata about the document. In many cases, this will require scanning and OCR conversion of a paper document. However, if a document exists in electronic format, it may be preferred to perform a more accurate conversion with appropriate software.

The LSNA may allow participants to provide their documentary collections in alternative page-representation formats such as PDF and proprietary word processor formats like Microsoft Word. This will depend on whether the data retrieval software selected for the front-end components is capable of indexing, searching, and otherwise processing these formats. The requirement to provide a bibliographic header for each document will remain regardless of the documents' formats. The bibliographic header is subject to the same retrieval requirements as the source document, e.g. provided as a searchable text file by the web server, as HTTP headers, or from within a database. Document preparation is potentially the most labor-intensive and costly aspect of building the LSN, due to the large number of documents included. Therefore, the burden on a participant is more closely correlated to the number of documents they must prepare than any other factor.

2.3.6.3 Document publication

Under this alternative, participants will place their documents on the web server of their choice through whatever file transfer mechanism is supported by the web server. This web server must be connected full-time to the Internet through a communications circuit of adequate speed (to be determined by the LSNA) and have a unique IP address and domain name. The domain name and root URL for the documentary collection, and a list of documents, must be provided to the LSNA. For consistency in retrieval by the storage server described above, participants may be required to follow a standard format in layout of the web pages that provide access to the documents themselves and accompanying bibliographic header information. Note that many web servers provide a standard way to publish meta information on web-served documents (e.g. by including this information in a file of the same name as the source document in a meta sub-directory). Use of this function may be required by the data retrieval elements of the front-end components.

2.3.6.4 Coordination/Integration

Access from the storage server site to the participant sites will be performed by software with fixed expectations of participant site structure and content. This will require that participants coordinate their site design and operations with the LSNA, which is expected to be a significant on-going operational requirement.

2.3.7 Hardware and software required

It is difficult to determine the exact hardware and software components due to the possibility of collaboration and the differences in the size of the documentary collections of the participants. Foreseeable alternatives for setting up a web server include a dedicated resource at the participant's site, sharing a server with other participants or non-LSN-related web sites, "co-location" of a participant-owned machine at an IPP (Internet Presence Provider) or outsourcing the entire site to an IPP. Each of these alternatives have a wide range of cost, convenience, assuredness, and administrative issues associated with them.

If a participant adopts a strategy of provisioning a dedicated web server, the size of this machine will, again, depend on the size of the document collection the participant is required to make available. Participants with an extremely small document collection will probably choose to lease web space on an IPP machine or "piggy-back" on another participant's site rather than implement their own web server. The cost of this facility depends on the amount of data published, the bandwidth the site requires, and other metrics. Typical costs for web sites that are appropriate for small participants range from free (of incremental cost over maintaining a basic Internet-access capability) to several hundreds of dollars per month.

For those who choose to implement their own dedicated resource, a fairly modest machine may be fully satisfactory. An example of this would be an i386 architecture "PC" (e.g. 166MHz Pentium, 128MB RAM, 4GB disk) running an open-source Unix-like operating system (FreeBSD or Linux)

and the open-source Apache web server. The total cost (hardware and software) of such a machine at current (4th quarter 1999) market prices is under \$1,000, and it would accommodate as many as 10,000 documents (at an estimated 250KB per document). Note that operational requirements, especially the disaster recovery aspects (regular backups with off-site storage), and data communications costs are far less critical under this alternative due to the intercession of the storage server.

Participants with larger document collections will, naturally, require a more powerful computer system, and operational costs will scale as well. Due to the considerable resources of these participants and the likelihood of their already possessing significant computer system infrastructure, no attempt has been made to develop a cost for these facilities.

The storage server will be a high-capacity, high-performance computer capable of housing a fairly large amount of data (approximately double the size of the entire documentary collections of all the participants), estimated to be in the four terabyte range. An example of a system in this class is a Sun Microsystems model 10000 in an appropriate configuration. The software to provide the file sharing capability is generally included with the base system and the software mentioned in the description of the portal system above will be used to populate the storage server so there is no additional software component.

3.0 Implications of this Design Alternative

Selection of this alternative for the final design of the LSN will have implications in several key areas. These represent tradeoffs of functionality and/or cost factors compared to the other remaining alternative designs. Appendix 1, *General Attributes of Alternatives*, presents a tabular comparison of each Alternative considered by the TWG, highlighting these tradeoffs. Note that Alternatives One and Two were considered not viable technical solutions by the TWG, and were discarded.

3.1 Administrator management control

Compared to Alternative Three, this design allows the LSNA more control over the ultimate presentation of LSN materials. Compared to Alternative Four, this design allows the LSNA slightly less control. Because the participants are in control of the design and management of their individual web sites, and because those sites are not topologically close together, the LSNA can only influence the content and management of those sites indirectly through established requirements. However, the LSNA controls a resource, the storage server, that will preclude untoward events at participant sites from affecting the ability of the LSN to provide information to end-users.

3.2 Participant responsibilities

Participants are responsible for publication of their documentary collections under all alternative designs, including creating and operating a web site. Participants will have more freedom to select the technologies for site implementation and will have a decreased burden for maintaining its

operation at a high level of availability and performance. This will decrease the participant's operational cost and lower the requirement to acquire and maintain high levels of computer expertise compared to Alternatives Three and Four.

3.3 Cost

The aggregate cost (to both the LSNA and the participants) of this design is significantly higher than Alternatives Three and Four. This design has the characteristic that each participant's implementation costs are a function of the size of their documentary collections. Because participants are free to select technologies of their choice with their own cost factors included in the selection process, this will probably result in cost savings on their behalf. Due to the decreased demand on the participant sites for operational readiness and performance, it is likely that the overall life-cycle cost components will be lower, specifically in site maintenance and communications costs. However, it is estimated that the overall cost to the participants (excluding their individual document preparation costs) will only vary by about ten percent (10%) among the three alternatives.

The cost to the NRC to build and maintain its portion of the LSN is estimated to be significantly higher than under Alternatives Three and Four due to the need to acquire and maintain the storage server. Such systems are well within the capabilities of modern computing systems but the raw storage needed, and the processing power to manage that much data can be costly. Appendix 2, *LSN Costs for Alternative Five*, outlines a rough estimate of the cost to the NRC, based on currently available information.

3.4 Implementation Schedule

The preliminary LSN implementation schedule represented by the Gantt chart (Appendix 3) does not appear to be materially affected by the Alternative selected. This is somewhat due to the lack of detail in the schedule appropriate to this stage of the planning process. It will be useful to expand the level of detail in the areas of procurement, design, and implementation of each component for planning purposes but it doesn't appear to be a useful way to differentiate among alternatives.

Lack of schedule differentiation between alternatives arises from the fact that the differences between alternatives are only in one of the three major components, i.e. the storage component, and that implementation of this component will take comparatively little time. The more time-intensive aspects of overall LSN implementation, specifically document conversion and site integration, are, essentially, identical across alternatives. The other activities common to all three alternatives, specifically, the development and implementation of the compliance and presentation components, have potentially more impact on the schedule and staffing than the development and implementation of the storage component.

One area of potentially significant impact on how selection of a particular alternative will affect the schedule is in the procurement of the storage server for Alternative Five. This is the one component among all the alternatives that cannot be considered an "off-the-shelf" item and timely delivery after

ordering cannot be assumed. Generally, systems of this nature are built to customer specification and delivery schedules can vary significantly depending on what item is ordered and when the item is ordered. Delays of three to six months are not uncommon. Efforts should be made to eliminate procurement delays associated with this item from the critical path of the project plan, if at all possible.