22 October 2004:

PAS (Publicly Available Specification)

Explanatory Report for

LSB-Core (Linux Standard Base V2.0.1)

from FSG (Free Standards Group)

1   Introduction

This Explanatory Report is for the Free Standards Group (FSG) PAS Submission for the Linux Standard Base (LSB[1]) Core Specification.

This submission is being made in accordance with the criteria in JTC 1 N 7364, *ISO/IEC JTC 1 Directives, 5th Edition*, Annex M: "The Transposition of Publicly Available Specifications into International Standards – A Management Guide."

The Linux Standard Base is a development of the Free Standards Group, a California nonprofit, member supported organization devoted to the development of standards based on technology created by the open source community.

1.1   Background

Software developed by the Open Source Community is a growing trend in information technology, especially in the rapidly evolving domains of the internet and the World Wide Web. Between 50% and 75% of internet activity (e.g. web servers, e-mail servers, DNS servers, client systems) utilizes open source software, and Linux[2], an open source operating system, is estimated as having the fastest-growing market rate for server-based platforms. As the global reliance on open source software increases, so does the need for standards for open source community software.

The Free Standards Group was created to address this need through the merger of two open source community efforts, the Linux Standard Base (LSB) and the Open Internationalization Initiative (OpenI18N). These projects comprise the primary effort in FSG specification development, and have created specifications that codify the base foundation of the Linux operating system as it relates to application binary interfaces, and system internationalization. Both LSB and OpenI18N have been widely adopted by the open source community, certification processes have been established, and customers increasingly demand adherence to these specifications.

As the importance, relevance and ubiquity of these specifications has increased, in particular the Linux Standard Base (LSB Specification), so has the need to ensure their stability and international acceptance. FSG has been accepted by ISO/IEC JTC 1 as a PAS (Publicly Available Specification) Submitter with the intent of submitting the LSB for PAS Transposition, and to subsequently submit additional specifications appropriate to becoming International Standards.

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[1]The term "LSB" is used for the entire set of specifications that describe the binary interface to an open-source system, the set of tools, tests and related materials, as well as the name of the project and working group that developed them. Wherever possible in this document the term is qualified to indicate which is appropriate.

[2] Technically the term "Linux" refers only to the operating system kernel itself. When packaged with a variety of other Open Source Software into a complete system, that system should be called "GNU/Linux". However, in common usage, the term "Linux" often means "GNU/Linux". Further information about this terminology can be found at http://www.gnu.org/gnu/linux-and-gnu.html.

1.2 Relationship of Linux and Linux standards to this Specification

This report is for the Linux Standard Base Core Specification, a set of specifications that define the elements necessary for an implementation of a GNU/Linux-like system. The definition of LSB corresponds to the definition for the term adopted by the ISO/IEC JTC 1 Linux Study Group in May 2003, Resolution 2003-05-1:

> Whereas the Linux Study Group recognized many possible interpretations of the scope of Linux-related terms,

> Resolved that, for the purposes of this meeting and the materials arising from it, the following definitions will be used:

> a) "LSB ABI layer": the binary interface of the kernel, C library, I18N functionality and core utilities corresponding to the APIs presented in ISO/IEC 9945: 2003 POSIX;

> b) "LSB": the LSB ABI layer plus those other sections in the Linux Standard Base (LSB) document, namely Packaging, File Hierarchy, User and Groups and System Initialization;

> c) "Linux Distribution": everything on any vendor's Linux release.

The Linux Standard Base Specification is actually a set of specifications:

a. A generic Core specification, common to all architectures and to all conforming implementations

b. A set of architecture-specific supplements that adapt the core specification to a particular architecture

c. Add-on modules that provide additional, application specific functionality; e.g. a Graphics module, a Desktop module, etc. Add-on modules may also be split into generic and architecture-specific parts.

This submission covers the generic LSB Core module and the mature, stable architecture-specific supplements for the core for a number of processor architectures. Future submissions are intended for other modules.

In particular, this submission is comprised of the following parts:

1. LSB-Core: the generic (architecture independent) core specification,

2. LSB-Core-IA32: the architecture specific supplement for Intel® 32 bit processors (also known as x86 family),

3. LSB-Core-IA64: the architecture specific supplement for the Intel® Itanium® processor family,

4. LSB-Core-AMD64: the architecture specific supplement for Advanced Micro Devices 64 bit processors[3],

5. LSB-Core-PPC32: the architecture specific supplement for IBM's 32 bit PowerPC™ family,

6. LSB-Core-PPC64: the architecture specific supplement for IBM's 64 bit PowerPC™ family,

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[3] Note: This architecture also covers select versions of the Intel® Pentium® 4 processor that support Intel® Extended Memory 64 Technology (Intel® EM64T) as an enhancement to Intel's IA-32 architecture on server and workstation platforms..

7. LSB-Core-S390: the architecture specific supplement for IBM's S/390™ processor,

8. LSB-Core-S390X: the architecture specific supplement for IBM's zSeries™ processors.

1.3   Document Organization

The remainder of this Explanatory Report provides the information requested in Clauses M7.4 of JTC 1 7364, Annex M. In addition, Section 2 provides information and proposals on changes to the specification during the transposition process and some comments on the nature and frequency of subsequent revisions.

2   Revisions

2.1   Revisions to the Specification during the Transposition Process

The Free Standards Group believes that SC 22 is the logical entity within JTC 1 to be tasked with the management of the transposition, and in particular handling of comments and the ballot resolution process. The FSG offers Nick Stoughton as project editor for the documents. The FSG is willing to provide his services for comment and ballot resolution, and convener of any ongoing editing group. The FSG has a Category A liaison relationship with SC 22.

The FSG has previously requested that the international community represented in JTC 1 be encouraged to participate in the public review and comment process on the LSB, and notes that SC 22 encouraged its NBs to do so on several occasions. In part because of this participation, it is hoped that by the time the document was approved by the FSG Board and submitted to JTC 1 for Transposition, additional changes would be relatively small and minor. The FSG is willing to work with the National Bodies to resolve any and all comments arising during transposition. However, as the FSG does not want there to be any divergence between an FSG specification and its equivalent International Standard, any changes required due to transposition would also affect the FSG specification. This requires that all changes are developed cooperatively. If major changes are recommended during ballot resolution and are agreed by the process participants, the FSG proposes that these changes be contributed to the FSG for consideration within the next version of the specification.

2.2   Control and Maintenance of the Specification

2.2.1   Ongoing Maintenance

Document JTC 1 N 7364, Annex M provides for flexibility in establishing, between JTC 1 and a PAS Submitter, provisions for ongoing defect correction and maintenance of a document once transposed.

The FSG has in place well-developed processes for defect correction and ongoing maintenance, which are already open to participation by all interested parties. The FSG therefore proposes that JTC 1 and FSG establish an Editor's Group consistent with the JTC 1 Directives. This group should have representation from JTC 1 National Bodies and FSG members, and have the intent of identifying, recording and developing defect corrections and providing maintenance that can readily be applied simultaneously to the FSG specification and the JTC 1 standard.

It is anticipated that defect corrections will be collected into Technical Corrigenda on no more frequently than an annual basis. As a Technical Corrigenda item can change the meaning of the standard, as such all technical corrigenda require formal approval by both JTC 1 and FSG.

2.2.2 Major Revisions of the Specification

It is extremely important that there not be two separate versions of the LSB Core Specification (i.e., the "FSG" Standard" and the "ISO/IEC Standard." To this end the document will be developed within a group comprising experts from any source, as it has been so far (i.e. national body representatives, FSG members, and other experts), balloted by the FSG as a version release of the LSB Core Specification, and finally transposed to JTC 1 via a PAS Transposition ballot.

The Linux and open source community is characterized by rapid technological enhancements, and as such, the FSG might expect a revision cycle shorter than five years. At the same time, while the FSG would like to revise the specification as needed, it notes the need for stability for many of its members and for the Linux development community. To balance these requirements, the FSG anticipates a major revision to the LSB Core Specification approximately every three years.

3 Organization's (FSG) Acceptance Criteria as a PAS Submitter

Clause M7.3 of JTC 1 N 7364, Annex M requests information to determine the acceptability of an organization as a potential PAS Submitter. The conditions for FSG's recognition as a PAS Submitter have not changed. This information is documented in FSG's PAS Submitter Application, document JTC 1 N 7166, *Application from the Free Standards Group to be a Recognized PAS Submitter of Publicly Available Specifications*. The application was approved as documented in JTC 1 N 7277, *Responses to comments on ISO/IEC JTC 1 N 7277, Summary of Voting for JTC 1 N 7166, Application from the Free Standards Group to be a Recognized PAS Submitter of Publicly Available Specifications*. The above documents are all available on the JTC 1 web site at http://www.jtc1.org.

4 Document Related Criteria

The criteria requested in M7.4 of JTC 1 N 7364, Annex M, are addressed in the following subclauses.

4.1 Quality

Within its scope the specification shall completely describe the functionality (in terms of interfaces, protocols, formats, etc.) Necessary for an implementation of the PAS. If it is based on a product, it shall include all the functionality necessary to achieve the stated level of compatibility or interoperability in a product independent *manner.*

4.1.1 Completeness (M)

a)   How well are all interfaces specified?

b)   How easily can implementation take place without need of additional description ?

c)   What proof exists for successful implementation (e.g. availability of test results for media standards)?

The LSB Core Specification fully describes the implementation model of a conforming system and incorporates only established existing practice within the open source community. The LSB is a well-accepted and established specification. It has a substantial certification program, and currently well over twenty successful implementations exist derived from the LSB Specification.

The LSB Specifications are written in OASIS V4.1 Docbook SGML. Portions of the specification are produced from a database (www.linuxbase.org/spec/db.shtml) designed and maintained by the Free Standards group LSB Project. The specification tree includes a file

(www.linuxbase.org/spec/build/lsb20.html) which describes how to build the specification from the CVS Docbook source, which itself may be checked out from the LSB project at (gforge.freestandards.org/scm/?group_id=5).

Where interfaces are fully described in other specifications, they are specified by normative reference only, e.g. "The xxxx function shall behave as described in ISO/IEC 9945 "Portable Operating System Interfaces (POSIX)". They are not further described in the LSB Core Specification, and an implementer may need to have multiple specifications available in order to fully understand all of the interfaces included.

As noted above, the LSB Core Specification as submitted for PAS Transposition consists of the generic LSB Core Specification plus the mature architecture specifications.

4.1.2   Clarity

a)   What means are used to provide definitive descriptions beyond straight text?

b)   What tables, figures, and reference materials are used to remove ambiguity?

c)   What contextual material is provided to educate the reader?

Use of a standard documentation implementation of SGM (Oasis V4.1 Docbook SGML) contributes largely to definitive descriptions. In addition, the use of a database to generate much of the LSB specification (see 3.1.1 above) ensures the precise replication of text, tables or code samples wherever required without the potential for misrepresentation.

Substantial tables and reference materials are provided within the specification and separately as part of the documentation for Linux, the Linux Standard Base, and are generally available at the FSG LSB Project website at www.linuxbase.org.

In addition, numerous presentations that have been written by the LSB Project, including tutorials, are available at www.linuxbase.org.

4.1.3   Testability (M)

The extent, use and availability of conformance/interoperability tests or means of implementation, verification (e.g. availability of reference material for magnetic media) shall be described, as well as the provisions the specification has for testability.

The specification shall have had sufficient review over an extended time period to characterise it as being stable.

An extensive set of test tools, tests and development tools, together with a sample implementation and application battery are provided along with the LSB specification(s) and are available from the LSB Project downloads page at www.linuxbase.org.

The initial LSB specification (LSB 1.0) has been available since 1999 and has received extensive attention from the Linux community and the contributors who are part of the LSB Project, and extensive test tools, a sample implementation and reference models have been developed over the life of the LSB which are available from the Linux Base Project website. As indicated above a substantial number of Linux implementations have been certified by the FSG as conforming to the LSB.

The LSB is evolved through the continuous evaluation of the specification and submittal of bug reports and candidate fixes, which are consolidated together with functional improvements and tested on a

regular basis. Periodically a release candidate is prepared which undergo substantial testing, review and correction before becoming a release, thereby ensuring correctness, testability and stability.

4.1.4   Stability (M)

a)   How long has the specification existed, unchanged, since come form of verification (e.g. prototype testing, paper analysis, full interoperability tests) has been achieved?

b)   To what extent and for how long have products been implemented using the specification?

c)   What mechanisms are in place to track versions, fixes, and addenda?

As indicated above the initial LSB specification has been available since 1999 and has received extensive attention, scrutiny and feedback from the Linux community. The first version that received significant support and included a certification program was version 1.2 in 2001. Version 1.3, released in 2003, saw widespread adoption, with all of the major Linux distributions (i.e. implementations) participating. Major Linux implementations based on the LSB, and certified as conforming to it, have been available for more than two years and are very widely implemented.

The most recent revision, Version 2.0, was published in August 2004. This edition is far better aligned with other ISO standards, especially ISO/IEC 9899 (C) and ISO/IEC 9945 (POSIX), and includes some additional libraries that are required by end user application developers.

The LSB Project uses Bugzilla, a very well-known bug tracking system in the open source community, for identification, reporting and tracking of bug and error reports. The project also uses a formal code management system to maintain the daily test releases and candidate releases and ensure accurate versioning of the LSB specification and related specifications.

A subgroup of the LSB project manages future requirements, tracking candidate interfaces for suitability, and recommending appropriate actions for future revisions. The LSB Futures group is tasked with

$ Creating and maintaining a list of criteria for evaluating and categorizing potential candidates

$ Gathering and publishing a list of potential candidates based on input from the development community and by analyzing the existing body of Linux software. This list is dynamic and reflects the status of candidates at any given time

$ Manages each identified candidate from identification, categorization and investigation through publishing on the World Wide Web, categorization and ultimate presentation to the LSB for inclusion

$ Presents an unambiguous set of candidate specifications

$ Follows a fast track process to build an ABI definition and validation suites

4.1.5   Availability (M)

a)   Where is the specification available (e.g. one source, multinational locations, what types of distributors?)

b)   How long has the specification been available?

c)   Has the distribution been widespread or restricted? (describe situation)

d)   What are the costs associated with specification availability?

The LSB Core Specification is available on the Internet from the LSB Project at www.linuxbase.org. All previous versions of the specification are also available for review at this website. The original LSB specification, LSB 1.0, has been available since mid-2000. The first widely implemented version was LSB 1.2, available in 2001.

The specification is distributed with no restrictions and at no cost from the FSG. The LSB is developed with a copyright to the FSG, subject to the GFDL, as are any textual passages extracted from other copyrighted documents (with permission). The GFDL permits any other interested body to distribute a document to which it applies.

4.2   Consensus (M)

The accompanying report shall describe the extent of (inter)national consensus that the document has already achieved.

4.2.1   Development Consensus

a)   Describe the process by which the specification was developed.

b)   Describe the process by which the specification was approved.

c)   What "levels" of approval have been obtained?

The LSB Core Specification was created and evolved under the open process set forth in the Bylaws of the Free Standards Group and available on the FSG website at www.freestandards.org. The open source community process allows participation from any and all interested parties and is carried out electronically across the internet to ensure ready access and minimal boundaries to participation. A small number of developers are tasked to update the written specification based on the results of discussions and deliberations on submitted material. This ensures a consistent editing style and prevents abuse of the system.

Documents are reviewed publicly and proposed changes are discussed by an open meeting of reviewers. Any rejected changes must have a suitable rationale, and an appeals process exists. The LSB workgroup steering committee (who represent each of the subgroups within the project) must have unanimous approval for any change. Ultimately the FSG Board of Directors must approve any new candidate for release, and has approved the version of the LSB Core Specification (V2.0.1) submitted to JTC 1 for PAS Transposition.

4.2.2   Response to User Requirements:

a)   How and when were user requirements considered and utilised?

b)   To what extent have users demonstrated satisfaction?

Users are involved in the development of the specification at all stages, as are developers, testers, and other contributors. Please note the discussion of the LSB-Futures group under Section 4.1.4 and refer to www.linuxbase.org/futures for more information and the process of collecting user requirements.

User satisfaction is also demonstrated and can be inferred from the large number of successful certified LSB implementations, and the success of the GNU/Linux system in the marketplace.

4.2.3 Market Acceptance:

a)   How widespread is the market acceptance today? Anticipated?

b)   What evidence is there of market acceptance in the literature?

The LSB Core Specification has been implemented widely, and implementations of LSB-conforming systems account for millions of installed systems. A wide variety of papers and books involving GNU/Linux and the Linux Standard Base exist in literature, not only as symposia presentations but as popular documentation, reference and "how-to" manuals for GNU/Linux users and experimenters. IBM Press has recently published a book, "Building Applications with the Linux Standard Base." There were nearly 200 news references related to the recent announcement of LSB 2.0 on the World Wide Web, including the front page of the *Wall Street Journal*.

4.2.4 Credibility:

a)   What is the extent and use of conformance tests or means of implementation verification?

b)   What provisions does the specification have for testability?

The Free Standards Group conducts a formal certification program for the Linux Standard Base to ensure implementation conformance with the specification. Detailed information on the LSB Certification Program is available from the LSB Certification Authority at http://www.opengroup.org/lsb/cert/. The Guide to LSB Certification is available at http://www.opengroup.org/lsb/cert/docs/LSB_Certification_Guide.html, and the LSB Certification Register can be viewed at http://www.opengroup.org/lsb/cert/register.html. The Linux Standard Base project makes extensive test suites available that can be found at http://www.linuxbase.org.

4.3 Alignment

The specification should be aligned with existing JTC 1 standards or ongoing work and thus complement existing standards, architectures and style guides. Any conflicts with existing standards, architectures and style guides should be made clear and justified.

4.3.1 Relationship to Existing Standards:

a)   What international standards are closely related to the specification and how?

b)   To what international standards is the proposed specification a natural extension?

c)   How is the specification related to emerging and ongoing JTC 1 projects?

The POSIX standard, ISO 9945-1 to 9945-4 (2003) form the basis of many of the interfaces specified in the LSB Core Specification, although there are some minor differences between POSIX and the LSB. These differences are being identified in ongoing work being performed under the auspices of ISO/IEC JTC 1 SC 22, specifically DTR 24715, which is expected to be available to SC 22 more or less at the same point as the LSB PAS Transposition is submitted. The LSB Core Specification is also closely tied to ISO/IEC 9899 (1999) Programming Language: C.

It is important to note that the current market share of Linux-based systems exceeds those of strictly conforming POSIX-based systems. It is the intent of the FSG to make as much of the LSB strictly POSIX-conforming as possible. At the same time, the FSG hopes that a future revision of POSIX will recognize that the standard needs to follow established industry practice, and will evolve the POSIX

standard by incorporating the appropriate changes to accommodate the LSB. This would make the LSB strictly POSIX-conformant without changes to the LSB which might adversely affect the large base of LSB conformant systems.

4.3.2   Adaptability and Migration:

a)   What adaptations (migrations) of either the specification or international standards would improve the relationship between the specification and international standards?

An appropriate accommodation of the LSB in the existing POSIX standard, together with the intended evolution of the LSB specification would establish LSB conformant systems as being strictly conformant POSIX-based systems.

b)   How much flexibility do the proponents of the specification have?

The LSB is based on widespread existing practice. While the FSG is prepared to be as flexible as possible, it is usually hard to change such historic practice without losing consensus. Wherever possible, the FSG is prepared to work with upstream software maintainers and with other standards working groups to ensure that differences can be resolved.

c)   What are the longer-range plans for new/evolving specifications?

In the future, the FSG intends to submit additional LSB module specifications including C++ and Graphics, and may also seek to submit specifications from its other workgroups.

4.3.3   Substitution and Replacement:

a)   What needs exist, if any, to replace an existing international standard? Rationale?

There are none known to the FSG.

b)   What is the need and feasibility of using only a portion of the specification as an international standard?

The LSB Core Specification is designed as a coherent single specification and the FSG does not believe it can be usefully subdivided.

c)   What portions, if any, of the specification do not belong in an international standard (e.g. too implementation-specific?)

While the platform-specific architectural specifications such as IA-32 are indeed implementation-specific, this refers to implementation upon a specific hardware architecture, and clearly multiple LSB implementations quite different in many characteristics could still exist upon, for example, the IA-32 architecture. FSG therefore feels that the architecture specifications do belong in the LSB Core Specification.

4.3.4   Document Format and Style

a)   What plans, if any, exist to conform to JTC 1 document style?

The LSB-Core Specification is submitted to JTC 1 for PAS Transposition in two forms. In accordance with current JTC 1 usage the specification is submitted as a set of Word documents; one for the LSB generic Core module and one for each submitted conforming architecture implementation. Additionally, the specifications are provided as a set of hyperlinked HTML files, also one for the LSB generic Core

module and one for each submitted conforming architecture implementation. The Word documents and HTML files contain the same information and have the same paragraph identifications, etc.

The HTML files are submitted as this is the native format the freely available LSB specifications exist in on the LSB website.

While FSG intends to converge with JTC 1 document style in future submissions, FSG also hopes that JTC 1 will consider HTML document styles such as those natively used by LSB as an alternative format for standards in the future.