

LXD

Linux Cross Documenter

Software Specification Document

Issue: 1
Revision: 2

Reference: SSD-LXD
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Prepared by: Guillermo López Alejos

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Abstract

The software specification document defines software requirements and system architecture.

Document Status Sheet

1. LXD Linux Cross Documenter. Software Specification Document			
2. Document Reference Number: SSD-LXD			
3. Issue	4. Revision	5. Date	6. Reason for change
1	0	08-05-2006	
1	1	16-07-2006	First revision.
1	2	14-08-2006	End of first lifecycle iteration.

Table 1: Document Status Sheet

Document Change Record

Document Change Record		DCR No.	1
		Date	16-07-2006
		Originator	Guillermo López Alejos
		Approved By	Guillermo López Alejos
1. Doc. Title		Software Specification Document	
2. Doc. Ref. Num.		SSD-LXD	
3. Doc. Issue / Rev. Num.		1 / 1	
4. Page	5. Paragraph	6. Reason for Change	
N.A.	N.A.	Fixed some misspells.	
N.A.	N.A.	Pictures and tables updated.	
N.A.	N.A.	Design required more detail in detailed design phase.	
1	N.A.	List was incorrectly sorted.	
3	N.A.	Section needed further description.	
5	N.A.	Content was not suitable in this section.	
5	6	Clarification example was missing.	
9	N.A.	Component description was needed in detailed design phase.	

Table 2: Document Change Record 1

Document Change Record		DCR No.	2
		Date	14-08-2006
		Originator	Guillermo López Alejos
		Approved By	Guillermo López Alejos
1. Doc. Title		Software Specification Document	
2. Doc. Ref. Num.		SSD-LXD	
3. Doc. Issue / Rev. Num.		1 / 2	
4. Page	5. Paragraph	6. Reason for Change	
1	N.A.	Added copyright and license notices.	
3	1	Updated <i>assumptions made</i> list.	
3	1	Reviewed integrity checks list.	
4	N.A.	Reviewed the static information model.	
3	2	Updated intermediate document types list.	
5	N.A.	Updated example.	
7	N.A.	Updated system diagram.	
7	N.A.	Updated C2 breakdown diagram.	
15	N.A.	Updated entity mappings table.	
15	1	Updated mapping listing.	
16	N.A.	Symbol exploring alternatives table needed re- vision.	
17	N.A.	Added a copy of the GNU Free Documentation License.	

Table 3: Document Change Record 2

Contents

Abstract	I
Document Status Sheet	I
Document Change Record	II
Table of contents	V
List of figures	VI
List of tables	VII
1. Introduction	1
1.1. Purpose	1
1.2. Definitions, acronyms and abbreviations	1
1.2.1. Definitions	1
1.2.2. Acronyms	1
1.2.3. Abbreviations	2
1.3. References	2
1.4. Overview	2
2. Model description	3
2.1. Static information model	3
2.1.1. Asumptions made	3
2.1.2. Integrity Checks	3
2.2. Intermediate documentation model	3
2.3. Symbol source model	5
2.4. Output documentation model	5
3. System design	7
3.1. Component description	9
3.1.1. Controller (C1)	10
3.1.2. Symbol Source Processor Implementation (C2)	11
3.1.3. Documentation tree manager (C3)	12
3.1.4. L ^A T _E X Doc Generator (C4)	13
3.1.5. C Symbol Processor (C2.1)	13
3.1.6. ctags (C2.3)	14
3.2. Symbol source to intermediate document mapping	15
3.2.1. Direct mappings	15
3.2.2. Inferred mappings	15

3.2.3. Unmapped intermediate document elements	16
3.3. Symbol exploring alternatives	16
A. GNU Free Documentation License	17

List of Figures

1.	Static Information Model	4
2.	<i>LXD</i> System Diagram	7
3.	<i>C2</i> component breakdown	7
4.	Symbol source exploring process sequence diagram	8
5.	Intermediate doc. synchronizing process sequence diagram	8
6.	Output documentation generation process sequence diagram	8

List of Tables

1.	Document Status Sheet	I
2.	Document Change Record 1	II
3.	Document Change Record 2	III
4.	Component C1 description	10
5.	Component C2 description	11
6.	Component C3 description	12
7.	Component C4 description	13
8.	Component C2.1 description	13
9.	Component C2.3 description	14
10.	Direct symbol source to intermediate document mappings	15
11.	Symbol exploring alternatives	16

1. Introduction

This section will cope with the aim of both, the software and the document itself, definitions and references that will appear in the document, and a brief overview of the rest of the sections.

1.1. Purpose

The purpose of this document is to state the most important design details for *LXD*.

1.2. Definitions, acronyms and abbreviations

The aim of this section is to state all the definition of key terms, the acronyms and the abbreviations that appear along this document.

1.2.1. Definitions

Documentation tree Directory structure containing intermediate documents

Intermediate documentation See *documentation tree*

Intermediate document Document that can be processed directly by the system in order to obtain the output documentation. It may be generated automatically from source code, written by hand by developers, or both

Output documentation Human readable documentation

Symbol source Resource that contains information about the symbols to process (i.e. source code or index file)

System Synonym of *LXD*. Set of programs that implement *LXD* capabilities

1.2.2. Acronyms

GCC GNU compiler collection

GNU *GNU's Not UNIX*

LXD Linux Cross Documenter

SSD Software Specification Document

UML Unified Modelling Language

XML Extensible Markup Language

1.2.3. Abbreviations

Not applicable.

1.3. References

ctags Index file generator. Homepage: <http://ctags.sourceforge.net/>

GCC The GNU compiler collection. Homepage: <http://gcc.gnu.org/>

MÉTRICA v3 Methodology for Plan, Development and Upkeep of information systems (*Metodología de Planificación, Desarrollo y Mantenimiento de sistemas de información* in spanish). Developed by the Spanish Ministry for Public Administration. Homepage: <http://www.csi.map.es/csi/metrica3/>

LXR Linux Cross Referencer. Homepage: <http://lxr.sourceforge.net/>

1.4. Overview

This document is organized as follows:

Section 2 describes information models that define the *bussines logic* of *LXD*.

Section 3 contains specific details of the solution of the problem.

2. Model description

This section describes the logical model of the system, providing a static view.

2.1. Static information model

Figure 1 shows the *UML* class diagram representing the static information model for *LXD*. This model has been extracted from the *MÉTRICA v.3* methodology.

2.1.1. Assumptions made

The following assumptions have been made on the static information model¹:

- Packages can contain other packages, interfaces or modules.
- Nodes contain components.
- Components can contain other components, modules, data storages or external devices.
- Parameters have associated a data type.

2.1.2. Integrity Checks

The following constraints have to be taken into account to complete the static information model:

- *LXD* has to do the appropriate checks in order to avoid loops when processing reflexive relations.
- Regarding, `Call` and `Callable` classes, *LXD* has to check whether a called operation is being implemented by the target module.

2.2. Intermediate documentation model

Intermediate documentation has to contain the information depicted in figure 1. The different types of intermediate documents are (sorted alphabetically):

- Component
- DataStorage

¹The static information model for *LXD* contains some details that are not explicitly described in *MÉTRICA v.3*.

- Device
- Interface
- Node
- Module
- Operation
- Package
- Project

These intermediate documents types correspond to the classes of the static information model that are independent enough to be entities.

2.3. Symbol source model

This model contains the information that can be extracted from the symbol source. The amount of information that can be extracted depends on the techniques or tools used, that is why this model is described in section 3: component C2 description (page 11) and section 3.3.

2.4. Output documentation model

The output documentation consists in the following information:

- Package map: package listing and contained components
- Component breakdown: interface and component description for each package. Described components contain module, data storage and devices description
- Deployment description: nodes description
- Software reference: alphabetically sorted list of components, data storages, devices, interfaces, nodes, modules, operations and packages

The following listing shows how this information should be presented:

Package map (chapter)

- Package1
- Package1.package1_1

- Package1.package1_2
 - Component1
 - Component1.component1_1

Component description (chapter)

- Package1 (section)
 - Interfaces (subsection, repetitive)
 - Components (subsection, repetitive)

Deployment description (chapter)

- Nodes (section, repetitive)

Software reference (chapter)

- Package list
- Interface list
- Component list
- Data storage list
- External devices list
- Node list
- Module list

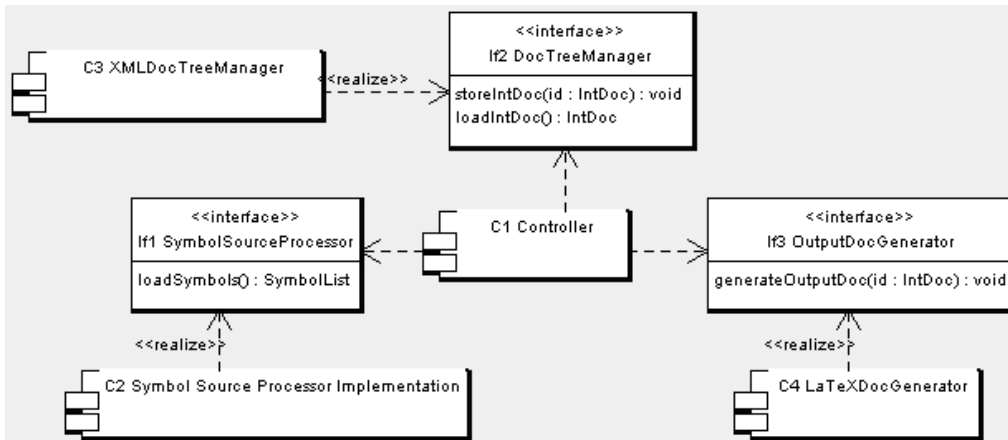


Figure 2: *LXD* System Diagram

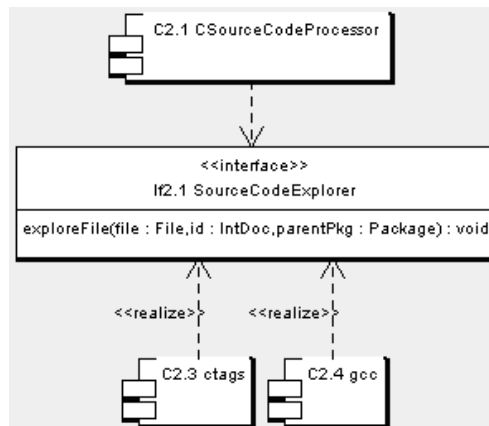


Figure 3: *C2* component breakdown

3. System design

This section provides a description of the main components of *LXD*.

Figure 2 shows components and interfaces at system level (first level). The *C1* component orchestrates the three main processes: symbol source exploring, intermediate documentation synchronizing and output documentation generation. This main processes are implemented by the *C2*, *C3* and *C4* components. Component *C2* breakdown is shown in figure 3.

Figures 4, 5 and 6 describe interaction between components for each process.

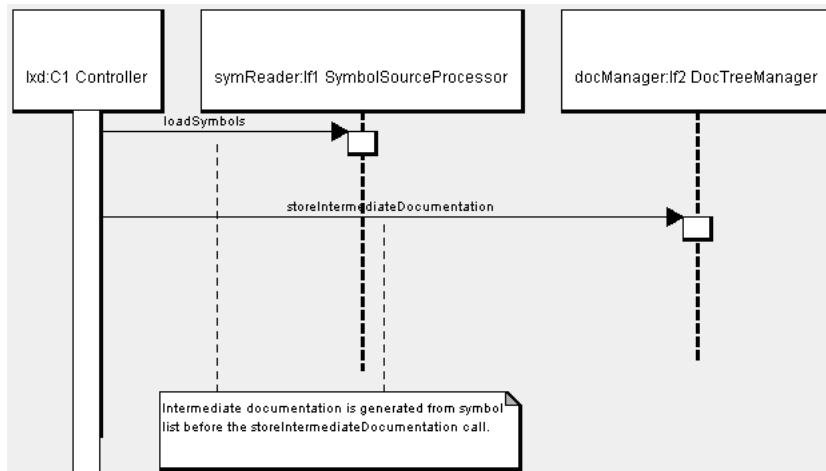


Figure 4: Symbol source exploring process sequence diagram

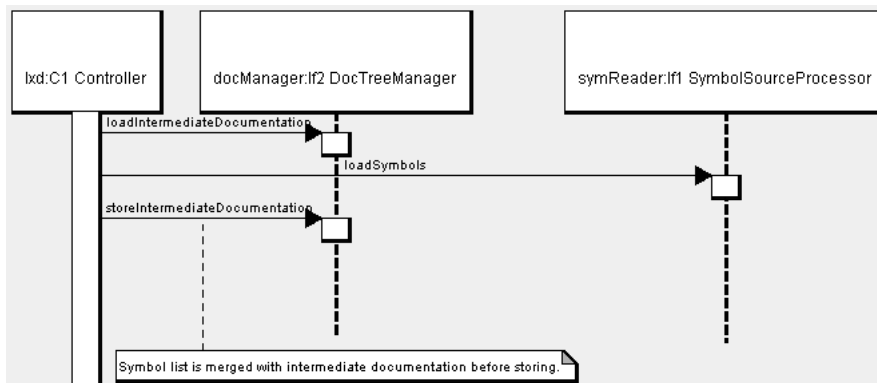


Figure 5: Intermediate doc. synchronizing process sequence diagram

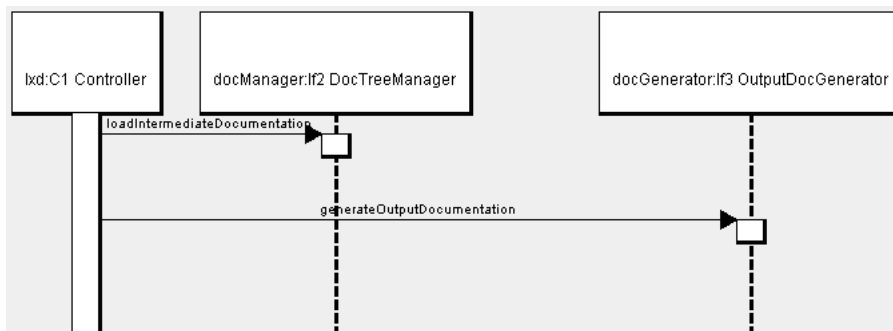


Figure 6: Output documentation generation process sequence diagram

3.1. Component description

Components are described by stating the following information:

Type Kind of the component, such as *system*, *program* or *file*.

Function Purpose of the component.

Provided interfaces Interfaces that the component implements.

Used interfaces Interfaces that the component depends on.

Dependencies Conditions that the environment has to met in order to execute the component.

Processing Control flow description.

Data Information used and generated by the component.

Resources Physical devices needed by the component, such as networks interfaces or display devices.

The following sections details this information for each component.

3.1.1. Controller (C1)

Type	Class
Function	Program entry point. Parses input parameters and links sequentially the different processes.
Provided interfaces	N.A.
Used interfaces	I f1, I f2, I f3
Dependencies	N.A.
Processing	Depending on the use case being executed, this component will execute one of the following sequences: <ul style="list-style-type: none">■ C2 then C3 in generate documentation tree use case (figure 4).■ C3 then C4 in generate output documentation use case (figure 5).■ C3, C2 then C3 again in synchronize documentation tree use case (figure 6).
Data	N.A.
Resources	N.A.

Table 4: Component C1 description

3.1.2. Symbol Source Processor Implementation (C2)

Type	Module
Function	This component is responsible of accessing the symbol source and building the <i>intermediate documentation</i> data structure.
Provided interfaces	I f 1
Used interfaces	N.A.
Dependencies	The symbol source must be available to this component.
Processing	N.A.
Data	This component reads data from the symbol source and builds the <i>intermediate documentation</i> data structure. The information contained by this data structure depends on component C2.1 and components implementing interface If2.1. More information on this data model can be found at section 3.3 .
Resources	N.A.

Table 5: Component C2 description

3.1.3. Documentation tree manager (C3)

Type	Module
Function	This component is responsible of storing the <i>intermediate documentation</i> data structure as a documentation tree, and viceversa.
Provided interfaces	I f 2
Used interfaces	N.A.
Dependencies	The documentation tree location must be readable and writable.
Processing	N.A.
Data	This component stores and restores the <i>intermediate documentation</i> data structure to / from the documentation tree.
Resources	N.A.

Table 6: Component C3 description

3.1.4. \LaTeX Doc Generator (C4)

Type	Class
Function	This component is responsible of generating \LaTeX documents from the <i>intermediate documentation</i> data structure.
Provided interfaces	I f 3
Used interfaces	N.A.
Dependencies	The output documentation location must be writable.
Processing	N.A.
Data	Converts the <i>intermediate documentation</i> data structure to \LaTeX documents.
Resources	N.A.

Table 7: Component C4 description

3.1.5. C Symbol Processor (C2.1)

Type	Class (instance of C2)
Function	This component is responsible of accessing the symbol source and building the <i>intermediate documentation</i> data structure.
Provided interfaces	I f 1
Used interfaces	I f 2 . 1
Dependencies	The symbol source location must be readable.
Processing	N.A.
Data	Converts the symbol source information to the <i>intermediate documentation</i> data structure.
Resources	N.A.

Table 8: Component C2.1 description

3.1.6. ctags (C2.3)

Type	Class
Function	This component is responsible of accessing <i>ctags</i> output files and building the <i>intermediate documentation</i> data structure.
Provided interfaces	I f 2 . 1
Used interfaces	N.A.
Dependencies	The <i>ctags</i> program must be executable by this component, and the <i>ctags</i> output files must be readable.
Processing	N.A.
Data	<p>Converts the <i>ctags</i> output files to the <i>intermediate documentation</i> data structure. This symbol explorer provides the following information:</p> <ul style="list-style-type: none"> ■ Symbol identifier ■ Symbol type ■ Symbol source file ■ Symbol definition string
Resources	<i>ctags</i> program.

Table 9: Component C2.3 description

3.2. Symbol source to intermediate document mapping

This section explains how information read from the symbol source is converted to intermediate documents. Note that here are introduced some C language organizational concepts, such as *directory* of *header file*.

The following assumptions have been made for the symbol source:

- Each header file has a source file that implements it.
- Functions identifiers are unique.

3.2.1. Direct mappings

Here are listed those mappings that do not require special data processing (i.e. the mapping is obvious). Table 10 summarizes this information.

Symbol source element	Mapped to
Directory	Package
Header file	Interface + defined operations
Source code file	Component
Function	Module + operation

Table 10: Direct symbol source to intermediate document mappings

3.2.2. Inferred mappings

Mappings described in this section are based on some assumptions or data processing.

- The *contains* relation (in general) can be inferred during symbol source exploring.
- A component implements an interface if the component contains one or more modules that implements all the operations defined by the interface.
- A component partially implements an interface if the component contains one or more modules that implements some of the operation defined the interface, but not all.
- An operation is internal to a component if the component contains one or more modules implementing the operation and the operation is not defined in any interface.

3.2.3. Unmapped intermediate document elements

There is no map defined for the following intermediate document elements:

- Data storage
- Device
- Node

Most relations are unmapped.

3.3. Symbol exploring alternatives

Table 11 shows the different alternatives for the *Symbol explorer* component.

	Provided information	Problems
<i>LXR</i>	Calculates a lot of relations (variables, macros, functions, types, etc...).	Discards some information provided by <i>ctags</i> that is useful for <i>LXD</i> . The complexity of the integration with <i>LXD</i> is considered moderated.
<i>ctags</i>	Symbol identifiers, symbol type, line numbers, file names.	Function declaration information is not precise.
<i>gcc</i> (with <i>-aux-info</i> option)	Function declaration and definition (.h and .c), parameter list, parameter types, line numbers and file names.	Focuses only in functions. Code must compile.
<i>C</i> source parsed by <i>LXD</i>	All information in the symbol souce.	Complex to implement.

Table 11: Symbol exploring alternatives

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