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Survey of IPv4 Dependencies in Global Grid Forum Specifications

This memo provides information to the Grid community regarding IPv4 dependencies in current specifications. It does not define any standards or technical recommendations. Distribution of this memo is unlimited.

Abstract

This document is a survey of IPv4 dependencies on current Global Grid Forum (GGF) specifications. It is an informational document, intended to be used as a checklist for planning future specification revisions. Its motivation is to aid in the creation of IP-version independent specifications and consequently, in the transition of IPv4 to IPv6.

Contents

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1.Introduction

The GGF specifications represent a series of documents created in the context of the Global Grid Forum (GGF) [GGF] community. The GGF involves approximately 5000 researchers working in distributed computing, and aims at promoting the development and deployment of Grid [GRID] technologies and applications. GGF specifications provide technical and implementation guidelines, as well as user experiences for a generalised Grid deployment.
GGF specifications go through a selection and maturation process [GED-C.1] similar to the *Internet Standards Track Process* [RFC2026] that the Internet Engineering Task Force (IETF) created for the Request for Comments (RFC) series.
One of the key aspects necessary to achieve a broad GRID deployment is to ensure that current and future GRID technologies and applications can easily be IP-version independent. To achieve this, it is necessary to fulfill several tasks. One of such tasks is to survey and document GGF specifications in terms of their possible IPv4 dependencies, so that the surveyed specifications can become IP neutral. Thus, this is an informational document, presenting a first survey of IPv4 dependencies on current GGF specifications.

1.1Methodology

The methodology followed in this document is similar to the one used within the context of the IETF v6ops [v6ops] working group, to survey possible IPv4 dependencies in RFCs. Having that the same purpose in mind, all current GGF specifications were read and analysed. The analysis took into consideration the understanding of possible IP implications not only in terms of concept, but also in terms of implementing the proposed models.
To provide the current survey with the best readability, the specifications were grouped according to their status, namely, Final , Public comment, and Current Draft specifications. For each of these groups, specifications were again grouped according to their area (Applications and Programming Models Environments; Architecture; Data; Grid Security; Peer-to-Peer; Information Systems and Performance; Scheduling and Resource Management). Each GGF specification is then presented according to the order it appears the GGF document repository.

1.2Scope

Possible IPv4 dependencies were surveyed on GGF specifications up to the date of this document. This added up to surveying exactly 73 documents, from all GGF areas. The survey required the authors to be familiar not only with IPv6 mechanisms, but also up to some extent with GRID concepts and technologies.
In terms of possible dependencies, the main purpose of the survey is to help specifications to become IP-version independent. This means surveying explicit dependencies, i.e., dependencies that have direct impact on the specification, but also implicit dependencies, i.e., dependencies that may impact on implementations. Hence, the scope of this document is related to references made to the IPv4 addressing scheme, either explicit or implicit. This implied checking address length and format, or the use of literal IP addresses in URLs and URIs [RFC2396] and [RFC2732]. This document does not provide guidelines on how to solve such issues, and does not explore IPv6 issues such as the deprecation of site-local, or the use of Flow Label. These and other IPv6 architectural issues are aside of the purpose of this document, but addressed in [GGFv6-2].

1.3Document Organization

The remainder sections are organised as follows. Sections 2, 3, and 4 present the survey of IPv4 dependencies on GGF specifications, respectively, on Final, Public Comment and Draft specifications. Section 5 presents a summary containing detailed results, and in Section 6 we present security considerations of this document.

2.Final Specifications (GFD-X)

Final (or Approved) specifications are documents that have completed successfully the GGF reviewing process, and that are given the nomenclature of GFD.
Each GFD specification categorized according to their contribution, i.e., Informational (GFD-I), Experimental (GFD-E), Community Practice (GFD-P), or Recommendations track (GFD-R), and provide "best-practice" guidelines to the Grid community.

2.1Applications, Programming Models and Environments (APME) Area

2.1.1GFD-I.9: Overview of Grid Computing Environments

This specification has no IPv4 dependencies.

2.1.2GFD-I.10: Grid User Services Common Practices

This specification has no IPv4 dependencies.

2.2Architecture (ARCH) Area

2.2.1GFD-R-P.15: Open Grid Services Infrastructure

In section 2. *Notation and Conventions*, there is the following paragraph:

"Namespace names of the general form "http://example.org/..." and "http://example.com/..." represent application or context-dependent URIs."

To become IP-version independent, it is necessary to add a reference to RFC 2732, which defines the format for literal IPv6 addresses in URLs.
There are also several references to the use of either URLs or URIs along the specification. Even though the reference above will suffice to provide IP-version independence to the specification, special care should be taken in implementations, regarding the format specified in RFC 2732, whenever an URL is used.

2.3Data (DATA) Area

2.3.1GFD-I.13: Grid Database Access and Integration: Requirements and Functionalities

This specification has no IPv4 dependencies.

2.3.2GFD-I.14: Services for Data Access and Data Processing on Grids

This specification includes the following text, in section *4.1.3, Data Transport and Replication* (page 20):

" We intend to support replication of files and metadata in a unified manner by storing URLs in the database (see the appendix for details)."

To avoid implementation dependencies, there should be a reference to the eventual support of literal IPv6 addresses in URLs, as stated in RFC 2732.

2.4Grid Security (GRID SEC) Area

2.4.1GFD-I.12: Security Implications of Typical Grid Computing Usage Scenarios

This specification has no IPv4 dependencies.

2.4.2GFD-C.16: Global Grid Forum Certificate Policy Model

This specification has no IPv4 dependencies.

2.4.3GFD-I.17: CA-based Trust Issues for Grid Authentication and Identity Delegation

This specification has no IPv4 dependencies.

2.5Information Systems and Performance (ISP) Area

2.5.1GFD-I.7: A Grid Monitoring Architecture

There are some implicit IPv4 dependencies in this specification. In section 3.2. *Producer/Consumer Interactions* (page 5), there is the following paragraph:

"Protocols for control and event data channel are not specified by the GMA. Moreover, the wire protocol used to communicate control information between produced and consumer and the wire protocol used to transfer performance events (data) may be completely independent. System implementers may support one or more wire protocols, for example SOAP/HTTP, LDAP, or XML/BXXP, choosing those best suited to heir own requirements."

To become IP-version independent, there should be a remark stating that even though the use of literal IPv6 addresses should be avoided, in case they are used the format specified in RFC 2732 must be supported.

2.5.2GFD-I.8: A Simple Case Study of a Grid Performance System
There are some IPv4 dependencies on this specification. In section *4.2 Event Producer Directory* (page 7, Figure 2), an Event Producer Entry contains several fields, among them a Producer_URL, defined as:

"srvr:portXX"
Later, in section 4.3. Even Consumer Directory (page 8, Figure 3), a Consumer_URL is defined as:
"archsys:portYYYY"

To avoid IPv4 implementation dependencies, the text should include a reference to the eventual use of literal IPv6 addresses , as stated in RFC 2732.

2.6Scheduling and Resource Management (SRM) Area

2.6.1GFD-I.4: Ten Actions When Superscheduling

This specification has no IPv4 dependencies.

2.6.2GFD-E.5: Advanced Reservation API

There are IPv4 dependencies in this document. Section *3.2., Describing a Reservation Request* (page 6), contains the following:

“An example RSL string for requesting a network reservation for 150Kbps between a source IP address of 140.221.48.146 and a destination address of 140.221.48.106 looks like the following.
&(resource-type=network)
(start-time=953158862)
(duration=3600)
(endpoint-a=140.221.48.146)
(endpoint-b=140.221.48.106)
(bandwidth=150)”

This is a clear reference to the use of IPv4 addresses, and it will have a clear impact on implementations. Later, there are other references to attributes *endpoint-a* and *endpoint-b* in terms of IPv4 address format. Hence, similar representative examples for IPv6 addresses should be added.

2.6.3GFD-I.6: Attributes for Communication between Scheduling Instances

This specification has no IPv4 dependencies.

2.6.4GFD-I.11: Grid Scheduling Dictionary of Terms and Keywords

This specification presents some IPv4 dependencies. In section 2. *List of Terms and Definitions* (page 3), there is a clear reference to an IP address as:

“Internet Protocol Address. Every system within a network using TCP/IP (Transmission Control Protocol/Internet Protocol, also called Internet protocol family) has an unambiguous IP address assigned.”

To avoid ambiguity, a clear reference to both versions 4 and 6 of IP should be stated.

3.Public Comment Draft Specifications (GWD-X)

Public Comment Drafts are specifications that have been approved by the GGF editor and the relevant area directors, and that are within a 30-day public comment period. Issues raised during this period and corresponding authors' actions will direct whether the document will be published as a GFD or not.
These drafts fall into four categories, according to their contribution, namely, Community Practice Drafts (GWD-C), Experimental Drafts (GWD-E), Informational Drafts (GWD-I), and Recommendations Track Drafts (GWD-R).

3.1GWD-C

3.1.1Global Grid Forum Certificate Policy Model

See section 2.4.2.

3.1.2CA-based Trust Issues for Grid Authentication and Identity Delegation

See section 2.4.3.

3.2GWD-I

3.2.1An Analysis of the UNICORE Security Working Mode

This specification has no IPv4 dependencies.

3.2.2Grid Database Access and Integration: Requirements and Functionalities

See section 2.3.1.

3.2.3Services for Data Access and Data Processing on Grids

This specification has no IPv4 dependencies.

3.3GWD-R

3.3.1Open Grid Services Infrastructure

This document has already been analysed in section 2.2.1.

3.3.2Distributed Resource Management Application API Specification 1.0

This document has already been analysed in section 2.3.1.

4.Current Draft Specifications (GWD-X)

Draft specifications, also known as Working Drafts, are documents that are being proposed to the GGF series tracking process. These are stable documents created either by individuals, or working groups, that await general revieweing by the GGF community.

4.1APME Area

4.1.1An Architecture for Grid Checkpoint Recovery Services and a Grid CPR API

This specification has no IPv4 dependencies.

4.1.2Trouble Ticket Exchange Specification

This specification has no IPv4 dependencies.

4.1.3Support Services and Tools Requirements

This specification has no IPv4 dependencies.

4.1.4Grid Constitution

This specification has no IPv4 dependencies.

4.1.5Grid Computing Environment Shells

In page 7, Section 2, it is mentioned that URIs should be taken as argument to shell commands. If a literal IPv6 address is used, it must conform to the syntax specified in RFC 2732.

4.2ARCH Area

4.2.1Java OGSI Hosting Environment Design – A Portable Grid Service Container Framework

This specification has no IPv4 dependencies.

4.2.2The Open Grid Services Architecture Platform

This specification has no IPv4 dependencies.

4.2.3Reporting Grid Services (ReGS) Specification

URIs are used as resource elements and namespaces in this document. If an IPv6 address is used, it must follow the syntax specified in RFC 2732. Hence, whenever a reference to RFC2396 is made, RFC 2732 must be added.

4.2.4Abstraction of Functions for Resource Brokers

This specification has no IPv4 dependencies.

4.2.5Core Grid Functions: A Minimal Architecture for Grids - Working Draft, version 3.1

This specification has no IPv4 dependencies.

4.2.6Common Consistency Requirements for Data Grids, Digital Libraries, and Persistent Archives

URIs are used as references to digital libraries and namespaces in this document. If an IPv6 address is used, it must follow the syntax specified in RFC 2732. Hence, whenever a reference is made to RFC 2396, a reference to RFC 2732 should be added.

4.2.7A Generic Model for the OGSA Platform

This specification has no IPv4 dependencies.

4.2.8Agreement Based Grid Service Management OGSI Agreement

URIs (see page 6, *section 2. Notational Conventions*) are used in this document as namespaces and references. If a literal IPv6 address is used, it must conform to the syntax specified in RFC 2732.

4.2.9GWSDL to WDSL Transformation

URIs (see page 3, *section 2. Notational Conventions*) are used in this document as namespaces and references. If a literal IPv6 address is used, it must conform to the syntax specified in RFC 2732. Hence, whenever a reference is made to RFC 2396, a reference to RFC 2732 should be added.

4.2.10Open Grid Service Infrastructure Primer

This specification has no IPv4 dependencies.

4.2.11Open Grid Services Architecture Use Cases

This specification has no IPv4 dependencies.

4.3DATA Area

4.3.1Grid Database Service Specifications

In page 19, A URI is taken in an XML attribute using specific format. If literal IP addresses are used, they must conform to the syntax specified in RFC 2732.

4.3.2Persistent Archive Basic Components

This specification has no IPv4 dependencies.

4.3.3Data Format Description Language Structural Description

This specification has no IPv4 dependencies.

4.3.4Evolution of the Replica Location Service Specification to Represent Datasets as Grid Services

This specification has no IPv4 dependencies.

4.3.5Grid Data Service Specification

URIs (see page 4, *section 2. Notational Conventions*) are used in this document as namespaces and references. If a literal IPv6 address is used, it must conform to the syntax specified in RFC 2732. Hence, this section should have a reference both to RFC2396 and RFC2732.

4.3.6Grid Namespace for Files

In page 6, section *3.1. Directory Structure and Junctions,* there is the following paragraph:

“A file system target that is a file or a directory can be represented in the form of a URL.”

To become IP version independent, a reference to the use of literal addresses (RFC2396 and RFC2732) must be added here.

4.3.7Wireless Grid Issues

This specification has no IPv4 dependencies.

4.3.8Local Replica Catalog Service Specification

The document mentions the use of URLs to reference “physical locations” (see page 4, section *1. Introdution*). To become IP neutral, there must be a reference to the possible use of IP literal addresses, i.e., to RFC 2396 and RFC 2732.

4.3.9Networking Issues of Grid Infrastructures

In page 11., section *4.2. Network Address Translators*, there is a reference to an IP address. A reference to both IPv4 and IPv6 addresses should be explicitely made. Also, there should be a paragraph related to the use of NAT and IPv6, or at least a reference to NAT-PT [RFC2766].

4.4Information Systems and Performance Area

4.4.1An Analysis of “Top N” Event Descriptions

In page 6, sections 4.1. *Target Type Schema* and sections *4.2. Target Schema*, there are several explicit references to the use of IPv4 addresses,e.g., definition of host, of network link.
Later, in section *5. Examples , a Target* object is represented using IPv4 addressing schemes.
To become IP neutral, these definitions will have to take into consideration the use of IPv6 addresses.

4.4.2Batch Jobs Submission and Processing

This specification has no IPv4 dependencies.

4.4.3Common Resource Model

URIs are used as resource elements and namespaces in this document. If an IPv6 address is used, it must follow the syntax specified in RFC 2732.

4.4.4Grid Information Retrieval Architecture

This specification has no IPv4 dependencies.

4.4.5Grid Information Retrieval Requirements

This specification has no IPv4 dependencies.

4.4.6Job Submission Information Model

This specification has no IPv4 dependencies.

4.5Peer-to-Peer (P2P) Area

4.5.1Appliance Aggregation Architecture Terminology Survey and Scenarios

This specification has no IPv4 dependencies.

4.5.2Peer To Peer Requirements On The Open Grid Services Architecture Framework

In pages 6, section 5.1. Network Address Translators (NATs), there are several examples using IPv4 addresses, e.g.:

“The ISP allocates one public IP address for use (132.235.95.202).”

In this section, there are also references to the use of private IPv4 addresses:

“When a client in the private network (say 192.168.1.102)...”

This section contains other examples, including figures, that rely on specific IPv4 examples. Therefore, this section must be re-written considering IPv6 scenarios.
Section *5.3. DHCP* (pages 9, 10) again uses explicit examples of IPv4 addressing. It has to be re-written considering IPv6 scenarios also.
Also, section *5.4. IP mobility* (page 10) will only become IP neutral, if IPv6 mobility issues are addressed.

4.6GRID SEC Area

4.6.1Use of SAML for OGSA Authorization

URIs RFC 2396 (see section *5.1.3. Action Elements*, page 11) are used as resource elements and namespaces. Thus, if a literal IPv6 address is used, it must conform to the syntax specified in RFC 2732.

4.6.2A GSSAPI Profile for Security Context Establishment and Message Protection using WS-SecureConversation and WS-Trust

URIs (see *section 3.2. Namespace*, page 2) are used in this document as namespaces and references. If a literal IPv6 address is used, it must conform to the syntax specified in RFC 2732.

4.6.3Security Architecture for Open Grid Services

This specification has no IPv4 dependencies.

4.6.4An Analysis of the UNICORE Security Model

This specification has no IPv4 dependencies.

4.6.5CA-based Trust Model for Grid Authentication and Identity Delegation

This specification has no IPv4 dependencies.

4.6.6Machine Assisted Trust Mechanisms for Grids

This specification has no IPv4 dependencies.

4.6.7Grid Certificate Extensions Profile

The specification references [RFC2459] (obsoleted by [RFC3280]) and RFC 3280 (see section *References*, page 4). Within these RFCs, IP addresses and URIs have been allowed to be *subjectAltName* extensions, as additional identities to be bound to the subject of the certificate. RFC 3280 addresses explicitely the use of both IPv4 and IPv6 addresses. However, as a recommendation, literal IP addresses, should not appear as themselves or part of URIs.

4.6.8Grid PKI Disclosure Statements

This specification has no IPv4 dependencies.

4.6.9Common Grid Certificate Authority Names and Naming

Throughout this specification, there are several references to the use of LDAP URLs (see section *2.5.1. LDAP* and subsections) and to regular URLs (see section *2.5.2 HTTP* and subsections). If a literal IPv6 address is used in normal URL [RFC1738], URIs or LDAP URL [RFC1959], it must conform to the syntax specified in RFC 2732.
Later, in section References, the specification addresses RFC 3280 (which obsoletes RFC 2459, also referenced). As mentioned in the previous section, within these RFCs, IP addresses and URIs have been allowed to be *subjectAltName* extensions, as additional identities to be bound to the subject of the certificate. RFC 3280 addresses explicitely the use of both IPv4 and IPv6 addresses. However, as a recommendation, literal IP addresses, should not appear as themselves , or as part of URIs.

4.6.10Certificates for Automated Clients

This specification has no IPv4 dependencies.

4.6.11Conceptual Grid Authorization framework and Classification

This specification has no IPv4 dependencies.

4.6.12Accounting Section

Section *Resource Identification* contains the following paragraph:

“The resource identity can be layered or accumulative or onion fashioned. This identification may be any or all of the following and more:
➓IP address
➓...”

Here, “IP address” is acceptable , given that in terms of specification, this is a neutral statement. However, IPv4 dependency may occur in terms of implementation, given that the specification does not detail how to store and how to create network connections.

4.6.13Grid Authentication Authorization and Accounting Requirements Research Document

Section *Resource Identification* contains the following paragraph:

“The resource identity can be layered or accumulative or onion fashioned. This identification may be any or all of the following and more:
➓IP address
➓...”

Here, “IP address” is acceptable , given that in terms of specification, this is a neutral statement. However, IPv4 dependency may occur in terms of implementation, given that the specification does not detail how to store and how to create network connections.

4.6.14OGSA Authorization Requirements

This specification has no IPv4 dependencies.

4.7SRM Area

4.7.1Advance Reservations: State of the Art

This specification has no IPv4 dependencies.

4.7.2Usage Scenarios for a Grid Resource Allocation Agreement Protocol

This specification has no IPv4 dependencies.

4.7.3Grid Economics Service Architecture

This specification has no IPv4 dependencies.

4.7.4GESA Use Cases

This specification has no IPv4 dependencies.

4.7.5Accounting Interchange Natural Language Description (Requirements)

This specification has no IPv4 dependencies.

4.7.6Distributed Resource Management Application API Specification

This specification has no IPv4 dependencies.

4.7.7Grid Resource Allocation Agreement Protocol Operations

This specification has no IPv4 dependencies.

4.7.8Resource Usage Service

This specification has no IPv4 dependencies.

4.7.9Usage Record XML Format

URLs are used in this document as namespaces and references. If a literal IPv6 address is used, it must conform to the syntax specified in RFC 2732.

5.Summary

Out of the 73 documents analysed, 25 had some form of IPv4 dependency. This corresponds to approximately 34% of the documents. The next table details these results.

Specifications	***Total***	***Dependent***
Final	14	5
Public Comment		
GWD-C	2	0
GWD-I	2	0
GWD-R	1	0
Current Drafts		
APME	5	1
ARCH	11	4
DATA	9	5
ISP	6	2
P2P	2	1
SEC	14	6
SRM	9	1
Total	**73**	**25**

6.Security Considerations

This document provides an exhaustive documentation of current GGF specifications, in terms of possible IPv4 dependencies. It does not in itself have any security implications.

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