GWD-I
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Rute Sofia, UniBwM
Sheng Jiang, UCL
Christos Bouras, CTI
Dimitris Primpas, CTI
Kostas Stamos, CTI

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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 from IPv4 to IPv6.

Contents

sofia@informatil.unibw-muenchen.de

1. Introduction

The GGF specifications represent a series of documents created in the context of the Global Grid Forum (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 standards process [GFD-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 become IP-version independent. To achieve this, it is necessary to fulfil several tasks. One key task 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.

1.1 Methodology

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 the same purpose in mind, all current GGF specifications were read and analysed. The analysis took into consideration the understanding of all 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 in the GGF document repository.

1.2 Scope

Possible IPv4 dependencies were surveyed on GGF specifications that are dated earlier than 11th December 2003. This added up to surveying exactly 88 documents, from all GGF areas. The survey required the authors to be familiar not only with IPv6 mechanisms, but also 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 addresses, or the use of the Flow Label field. These and other IPv6 architectural issues are aside of the purpose of this document, but addressed in [GGFv6-2].

1.3 Document 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.

2.1 Applications, Programming Models and Environments (APME) Area

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

This specification has no IPv4 dependencies.

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

This specification has no IPv4 dependencies.

2.2 Architecture (ARCH) Area

2.2.1 GFD-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 [RFC2732], 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 [RFC2732], whenever an URL is used.

2.3 Data (DATA) Area

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

This specification has no IPv4 dependencies.

2.3.2 GFD-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 [RFC2732].

2.4 Information Systems and Performance (ISP) Area

2.4.1 GFD-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 [RFC2732] must be supported.

2.4.2 GFD-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 [RFC2732].

2.5 Grid Security (SEC) Area

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

This specification has no IPv4 dependencies.

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

This specification has no IPv4 dependencies.

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

This specification has no IPv4 dependencies.

2.5.4 GDF-I.18: An Analysis of the UNICORE Security Model

This specification has no IPv4 dependencies.

2.6 Scheduling and Resource Management (SRM) Area

2.6.1 GFD-I.4: Ten Actions When Superscheduling

This specification has no IPv4 dependencies.

2.6.2 GFD-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.

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

This specification has no IPv4 dependencies.

2.6.4 GFD-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).

3.1 GWD-C

3.1.1 Global Grid Forum Certificate Policy Model

This specification has already been analysed in section 2.5.2 of this document. This specification has no IPv4 dependencies.

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

This specification has already been analysed in section 2.5.3 of this document. This specification has no IPv4 dependencies.

3.1.3 A Hierarchy of Network Performance Characteristics for Grid Applications and Services

In the specification, section 3.5 of contains the following paragraph, which explicitely refers to the TCP/IP stack:

“This paper follows the OSI network reference model in defining the layers [32]:

Layer 1 is the physical medium - encoding and bits on the wire
Layer 2 is the link layer dealing with framing e.g. Ethernet or SDH/Sonet
Layer 3 is the network layer (IP)
Layer 4 is the transport layer (UDP, UDP+RTP, TCP etc.)”

For clarity purposes, Layer 3 should also mention IPv6.
Later, in section 6.1.1:

“Because routers use different IP addresses for each port, and those IP addresses typically resolve to different names, it is frequently difficult to identify the individual routers uniquely. For example, traceroute identifies only the receiving interface of each router.

Measurements based on traceroute, therefore, do not provide a useful source-destination pair, but only a series of destination interfaces, where each indicates a single hop. Combining traceroute measurements with those from other tools, may be difficult because different names or IP addresses may be used to refer to the same router.”

Even though there is no explicit dependency on IPv4, a caveat to the above paragraph should be added, mentioning that by IP addresses the authors mean either IPv4 or IPv6 addresses.

3.2 GWD-I

3.2.1 An Analysis of the UNICORE Security Working Mode

This specification has no IPv4 dependencies.

3.2.2 Grid Database Access and Integration: Requirements and Functionalities

This specification has already been analysed in section 2.3.1 of this document. This specification has no IPv4 dependencies.

3.2.3 Services for Data Access and Data Processing on Grids

This specification has no IPv4 dependencies.

3.2.4 Working Experience with the Grid FTP Protocol v1.0: Areas of Protocol Improvements

This specification has no IPv4 dependencies.

3.3 GWD-R

3.3.1 Open Grid Services Infrastructure

This document has already been analysed in section 2.2.1 of this document and contains IPv4 dependencies.

3.3.2 Distributed Resource Management Application API Specification 1.0

This specification has no IPv4 dependencies.

3.3.3 GridFTP: Protocol Extensions to FTP for the Grid

Given that Grid FTP extends the FTP protocol defined by [RFC959], it is necessary to address dependency issues related to the FTP protocol itself. Such issues have already been described and can be found in [v6ops-apps].

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 reviewing by the GGF community.

4.1 APME Area

4.1.1 A Grid RPC Model and API

This specification has no IPv4 dependencies.

4.1.2 Trouble Ticket Exchange Specification

This specification has no IPv4 dependencies.

4.1.3 Support Services and Tools Requirements

This specification has no IPv4 dependencies.

4.1.4 Grid Constitution

This specification has no IPv4 dependencies.

4.1.5 Security Requirements of Advanced Collaborative Environments (ACEs)

This specification has no IPv4 dependencies.

4.2 ARCH Area

4.2.1 The Open Grid Service Architecture Platform

This specification has no IPv4 dependencies.

4.2.2 Abstraction of Functions for Resource Brokers

This specification has no IPv4 dependencies.

4.2.3 A Generic Model for the OGSA Platform

This specification has no IPv4 dependencies.

4.2.4 Agreement 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 [RFC2732].

4.2.5 GWSDL 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 [RFC2732]. Hence, whenever a reference is made to [RFC2396], a reference to [RFC2732] should be added.

4.2.6 Open Grid Service Infrastructure Primer

This specification has no IPv4 dependencies.

4.2.7 Grid Service Architecture Use Cases

This specification has no IPv4 dependencies.

4.2.8 Grid Policy Framework Mapping

This specification has no IPv4 dependencies.

4.2.9 Policy Use Cases for Grid Systems

This specification has no IPv4 dependencies.

4.3 DATA Area

4.3.1 Data Format Description Language Structural Description

This specification has no IPv4 dependencies.

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

This specification has no IPv4 dependencies.

4.3.3 Grid 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 [RFC2732]. Hence, this section should have a reference both to [RFC2396] and [RFC2732].

4.3.4 Grid 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.

4.3.5 Wireless Grid Issues

This specification has no IPv4 dependencies.

4.3.6 Local Replica Catalog Service Specification

The document mentions the use of URLs to reference “physical locations” (see page 4, section *1 Introduction*). To become IP neutral, there must be a reference to the possible use of IP literal addresses, i.e., to [RFC2396] and [RFC2732].

4.3.7 Networking 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 explicitly made. Also, there should be a paragraph related to the use of NAT and IPv6, or at least a reference to NAT-PT [RFC2766].

4.3.8 A Survey of Grid File Systems

This specification has no IPv4 dependencies.

4.3.9 Data Format Description Languages (DFDL) - Primer

This specification has no IPv4 dependencies.

4.3.10 DFDL - Primitive type Ontology

This specification has no IPv4 dependencies.

4.3.11 DFDL – Structural Description

This specification has no IPv4 dependencies.

4.3.12 DFDL – Basic Structures Ontology

This specification has no IPv4 dependencies.

4.3.13 DFDL - XML Representation

This specification has no IPv4 dependencies.

4.3.14 OGSA Data Services

This specification has no IPv4 dependencies.

4.3.15 Data Distribution in the Grid Environment

This specification has no IPv4 dependencies.

4.3.16 Data Access and Integration Services (DAIS) - File Access

This specification describes the design and implementation of a prototype that uses the Globus GSI (Grid Security Infrastructure). It may be an IPv4 dependency if this version of Globus GSI does not work on IPv6 environment.

4.3.17 Grid Data Service Specification – the Relational Realisation

This specification has no IPv4 dependencies.

4.3.18 Grid Data Services – Transformation service

This specification has no IPv4 dependencies.

4.3.19 Data Services Specification – the XML realisation

This specification has no IPv4 dependencies.

4.3.20 Optical Network Infrastructure for Grid

This draft provides information in the area of high performance networking. It contains references to several protocols like GMPLS or mechanisms like IPsec. Therefore, references for interoperability with IPv6 for each of those protocols and mechanisms should be added.

4.3.21 OGSA Replica Location Services

This specification has no IPv4 dependencies.

4.3.22 Transport Operations on Remote Data

This specification has no IPv4 dependencies.

4.3.23 Grid Issues with Network Infrastructure

This specification has no IPv4 dependencies.

4.4 Information Systems and Performance (ISP) Area

4.4.1 An 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.

4.4.2 Batch Jobs Submission and Processing

This specification has no IPv4 dependencies.

4.4.3 Common 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 [RFC2732].

4.4.4 Grid Information Retrieval Architecture

This specification has no IPv4 dependencies.

4.4.5 Grid Information Retrieval Requirements

This specification has no IPv4 dependencies.

4.4.6 Job Submission Information Model, version 1.0

This specification has no IPv4 dependencies.

4.5 Peer-to-Peer (P2P) Area

4.5.1 Appliance Aggregation Architecture Terminology Survey and Scenarios

This specification has no IPv4 dependencies.

4.5.2 Peer 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, which 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.

4.6 SEC Area

4.6.1 Use of SAML for OGSA Authorization

URIs [RFC2396] (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 [RFC2732].

4.6.2 Grid PKI Disclosure Statements

This specification has no IPv4 dependencies.

4.6.3 Conceptual Grid Authorization Framework and Classification

This specification has no IPv4 dependencies.

4.6.4 Grid 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:
- IP address
- ...”

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.

4.6.5 OGSA Authorization Requirements

This specification has no IPv4 dependencies.

4.6.6 Authority Recognition

This specification has no IPv4 dependencies.

4.6.7 OGSA Attributes: Requirements, Definitions, and SAML Profile

This specification has no IPv4 dependencies.

4.7 SRM Area

4.7.1 Advance Reservations: State of the Art

This specification has no IPv4 dependencies.

4.7.2 Usage Scenarios for a Grid Resource Allocation Agreement Protocol

This specification has no IPv4 dependencies.

4.7.3 Grid Economic Services

This specification has no IPv4 dependencies.

4.7.4 GESA Use Cases

This specification has no IPv4 dependencies.

4.7.5 Distributed Resource Management Application API C Bindings, version 0.9

This specification has no IPv4 dependencies.

4.7.6 Grid Resource Allocation Agreement Protocol Operations

This specification has no IPv4 dependencies.

4.7.7 Resource Usage Service

This specification has no IPv4 dependencies.

4.7.8 Usage 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 [RFC2732].

4.7.9 Agreement Based Service Management

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 [RFC2732]. Therefore, a reference to the latter should be added.

4.7.10 Distributed Resource Management Application API JavaTM Language Bindings 0.1

This specification has no IPv4 dependencies.

4.7.11 Standard Terms for Specifying Computational Jobs (Proposal)

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 [RFC2732]. Therefore, a reference to the latter should be added.

5. Summary

Out of the 88 documents analysed, 24 had some form of IPv4 dependency. This corresponds to approximately 27.27% of the documents. The following table details these results.

Specifications	***Total***	***Dependent***
Final	15	6
Public Comment		
GWD-C	3	1
GWD-I	4	0
GWD-R	3	1
Current Drafts		
APME	5	0
ARCH	9	2
DATA	23	6
ISP	6	2
P2P	2	1
SEC	7	2
SRM	11	3
Total	**88**	**24**

6. Security Considerations

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

Author Information

Rute Sofia
Universitaet der Bundeswehr, Muenchen
D-85577 Neubiberg, Muenchen
Email: sofia@informatik.unibw-muenchen.de
Phone: +49 89 6004 3445

Sheng Jiang
University College London
Gower Street
London WC1E 6BT
United Kingdom
Email: s.jiang@cs.ucl.ac.uk
Phone: +44 20 7679 3670

Christos J. Bouras
Computer Engineering and Informatics Department, University Of Patras

Research Academic Computer Technology Institute
Riga Feraiou 61, Patras
Greece
Email: bouras@cti.gr
Phone: +30 2610 960375

Dimitris Primpas
Computer Engineering and Informatics Department, University Of Patras
Research Academic Computer Technology Institute
Riga Feraiou 61, Patras
Greece
Email: primpas@cti.gr
Phone: +30 2610 996954

Kostas Stamos
Computer Engineering and Informatics Department, University Of Patras
Research Academic Computer Technology Institute
Riga Feraiou 61, Patras
Greece
Email: stamos@cti.gr
Phone: +30 2610 960316

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References

[GFD-C.1] C. Cattlet. Global Grid Forum *Documents and Recommendations: Process and Requirements*. Revised June 2002
[GGFv6-2] T. Chown, J. Bound, S. Jiang, P. O'Hanlon, *Guidelines for IPv6 version independency of GGF Specifications*. September 2003.
[GRID] *The Grid*. Available at http://www.grid.org/.
[RFC 2766] G. Tsirtsis, P. Srisuresh, *Network Address Translation – Protocol Translation (NAT-PT)*. February 2000.
[RFC2026] S. Bradner, *The Internet Standards Process - revision 3*. October 1996.
[RFC2396] T. Berners-Lee, R. Fielding, L. Masinter, *Uniform Resource Identifiers (URI): Generic Syntax*. August 1998.
[RFC2732] R. Hinden, B. Carpenter, L. Masinter, *Format for Literal Addresses in URL's*. December 1999
[RFC959[J. Postel, J. Reynolds. *File Transfer Protocol*. October 1985.
[v6ops-apps] R. Sofia, P. Nesser II, *Survey of IPv4 Addresses in Currently Deployed IETF Application Area Standards*. IETF draft (work in progress). September 2003.
[v6ops] *IETF v6ops charter*. Available at http://www.ief.org/html.charters/v6ops-charter.html.