
USGv6 Testing Program User's Guide

National Institute of Standards and Technology

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USGv6 Testing Program User's Guide
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Executive Summary

OMB Memorandum M-05-22 directed the National Institute of Standards and Technology (NIST) to develop the technical infrastructure (standards and testing) necessary to support wide scale adoption of IPv6 in the US Government (USG). Upon detailed inspection of the state of the industry and the scope of IPv6 technology, it was felt prudent to develop the USGv6 standards profile [2] to assist agencies in the development of acquisition requirements for IPv6 products and the USGv6 Test Program to provide the means to assess product compliance to such requirements.

This document outlines the form and function of the USGv6 Test Program. In particular, it defines the components of the test program, their implementation and use. This guide also defines the management process that will govern the future evolution of the test program and how it will address and accommodate ever changing requirement sets and product offerings.

The guide is expected to be of general use to all those interested in understanding the USGv6 Test program, but in particular, to:

- IPv6 product developers aiming to document capabilities that comply with requirements expressed in terms of the USGv6 profile;
- USG Agencies acquiring IT products that require USGv6 capabilities; and,
- USGv6 Test Labs that will provide testing services to support the above.

This document explains the technical infrastructure provided by the USGv6 Test Program and how it is to be used by each of the groups above.

1 Introduction

This document has been prepared for use in conjunction with NIST SP 500-267 A Profile for IPv6 in the U.S. Government [2] and NIST SP 500-273 USGv6 Test Methods: General Description and Validation [3]. It can be used by nongovernmental organizations on a voluntary basis and is not subject to copyright, though attribution is desired.

Nothing in this document is intended to contradict standards and guidelines made mandatory and binding on Federal agencies by the Secretary of Commerce under statutory authority, nor ought it be interpreted as altering or superseding the existing authorities of the Secretary of Commerce, Director of the Office of Management and Budget, or any other Federal official.

1.1 USGv6 Testing Program

The USGv6 profile was published in July 2008 with the intention of seeking compliant products after a two year period to allow for product implementation and tailoring. The profile specifies selections from over 150 IPv6-related RFCs and other standards, to facilitate the definition of requirements for a variety of hosts, routers and network protection products.

NIST has established the USGv6 testing program as a way to document products' compliance with USGv6 requirements. The test program makes use of a set of abstract test specifications, each validated against the respective protocol specifications. To be documented as USGv6-compliant, products must be tested against tools validated to these tests, in accredited laboratories. Having implemented and tested their products, developers must make their claims of USGv6 compliance in a systematic and standardized way. The Supplier's Declaration of Conformity (SDOC) [4,5] is a tool that offers a flexible means of constructing these claims, and will be used to document compliance with USGv6 requirements.

USGv6 contains a wide range of elements, and the testing program includes components that are subject to enhancement and revision over time. Hence it is necessary to have in place a scheme to manage the evolution and maintenance of these components that includes collaboration with the stakeholders.

1.2 Purpose, Scope and Document Structure

This document provides a user's guide to the USGv6 testing program. It gives an overview of the elements of the program. It offers guidance to Agencies on what to look for in "USGv6-compliant" products, and to IPv6 product suppliers on how to make their products USGv6-compliant.

Some consequences of putting together a technical recommendation that is a compendium of large numbers of different, informal standards include:

- 1) Tests derived from natural language, rather than formal, specifications are not formally derived, thereby increasing the potential for bugs; and
- 2) Changes to several of the standards spread over time may lead to complex interoperability issues and potential compatibility problems.

A corollary of (1) is that informally derived tests have the characteristic of software, that they need debugging over several iterations of use. Where tests are lacking in coverage, conformance bugs and interoperability difficulties in USGv6 products can go undetected. A systematic review and revision process for tests will result in progressively increased accuracy and optimized coverage over time, with the ultimate goal of increasing confidence in product interoperability.

The document gives an analysis of the lifecycles of standards, tests and IPv6 products, and establishes schedules for systematic change in the selection and update of these items. It also explains the requirements for Supplier's Declaration of Conformity (SDOC), used by vendors to document the test results for the USGv6 capabilities supported by their product. The USGv6 testing program attempts to provide the flexibility necessary to avoid redundant retesting of IPv6 implementations that are used, unmodified, across multiple distinct product offerings. This document addresses the scenarios and specific testing and reporting requirements for products that may inherit the test results of previously tested implementations.

Following this introduction, Section 2 introduces the elements of the testing program, including artifacts, processes and stakeholders involved in the USGv6 testing program. The interaction between stakeholders and processes is fundamental to the operation of the testing program. The lifecycles of the artifacts, and their impacts on interoperability, are explored in Section 3, and management of the testing program is discussed in Section 4. Section 5 is devoted to the definition and operation of SDOC.

1.3 Constituencies

While a more complete list of stakeholders is given in Section 2.3 below, this section identifies how Federal Agencies, USGv6 product suppliers and accredited test laboratories should use the USGv6 testing program, including their particular uses of: the USGv6 profile [2], the USGv6 testing website [6], and NIST SP 500-273 the test methods document [3], together with this document.

1.3.1 Federal Agencies

A USG Federal Agency's objectives with respect to USGv6 may include (1) specifying networking requirements through RFPs, or published enterprise network architecture goals, and (2) evaluating IT product supplier offerings through examination and comparison of completed SDOCs.

- (1) The USGv6 profile [2] recommends a set of USGv6 compliant configurations for Host, Router and network protection product. In addition it provides a vocabulary wherein each agency can select configuration options appropriate to its networking requirements and adapt the configuration checklist from the profile [2, Appendix 1]. Or if more detail is required, they can adapt the node requirements table [2, Section 8].
- (2) Section 5 of this document discusses claims of product compliance and what are the recommendations to the product supplier in completing the SDOC based on hardware and software combinations and on what testing was performed. The SDOC contains claims of tested capabilities and can be compared against requirements in the capabilities checklist ([2, Appendix 1]) as recommended by NIST, or as modified for Agency needs.

Should an Agency wish to keep active track of, and participate in, events in the USGv testing program, they are invited to have a representative sign up to the USGv6-testing@nist.gov mailgroup.

1.3.2 USGv6 Product Vendors

Neworking product suppliers develop products with particular capability sets for sale to computer buyers including the Federal Government. So as to meet Federal conformance and interoperability requirements they use the USGv6 profile [2] to craft capability sets. When bulk or custom RFPs require it, products can be tailored to specific Agency requirements. Having developed and refined the product it is submitted for testing to an accredited testing laboratory, per the list at the website [6]. On successful completion of testing, the product supplier completes a Supplier's Declaration of Conformity (Appendix 1 here, and USGv6 testing website [6]) summarizing the testing done. Per Appendix 1, the SDOC denotes conformance and interoperability testing done to designated tests, as attested by the accredited test laboratory. The SDOC captures the complexity of bundling combinations of capabilities, different hardware and software combinations, composite products and product families. For capabilities where no test currently exists, the product supplier attests that the capability is implemented, and was tested in-house. The gaps in testing provision are filled by adding quality checked and bugfixed test specifications in 6 monthly cycles. Product vendors who claim a capability through self-declaration must formally test it by six months after effective inclusion of the new tests.

Should a product supplier wish to keep active track of, and participate in, events in the USGv testing program, they are invited to have a representative sign up to the USGv6-testing@nist.gov mailgroup.

1.3.3 Accredited Test Laboratories

The objective of a test laboratory is to get USGv6 accreditation, test Host, Router or network protection products for conformance and/or interoperability, and produce a test report. While it is the product supplier's responsibility to generate the SDOC, in practice we expect test laboratories to have the greater body of knowledge about the testing program and the profile, and to offer SDOC production assistance.

As part of the USGv6 quality process the test laboratory participates in interlaboratory comparisons as discussed in NIST SP 500-273 [3] and cooperates in test interpretation resolution. This is facilitated through discussion at the test laboratories mailgroup, USGv6-labs@nist.gov.

2 USGv6 Testing Program Elements

The principle elements of the USGv6 Testing Program are test specifications and processes necessary to enable an open market for product testing while insuring consistency of results. Each of these elements is governed by a process and is subject to change in managed stages. For each element and its process a subgroup of stakeholders have a direct interest. In this section the set of artifacts is identified in Section 2.1. The processes associated with particular artifacts are explained in Section 2.2, and the stakeholders interested in these artifacts and processes are introduced in Section 2.3.

2.1 Artifacts

The **USGv6 profile, NIST SP 500-267** is the document that selects and organizes the IPv6 networking standards for Federal Government use. Initially published in July 2008, it is subject to annual revision. The profile is a compendium of networking standards, mostly RFCs published by the IETF. The USGv6 profile brings change slowly, to allow the industry time to make their products ready. The profile cites only final standards. Future versions introduce new standards as SHOULD+ with upgrade to MUST after 12 months or more. When a new MUST appears in the profile it is not required to test in a product that claims support of that capability until 24 months after its elevation to MUST. Deprecated standards will be indicated as SHOULD- for at least 12 months before removal from the profile.

The USGv6 **Supplier's Declaration of Conformity (SDOC)** is based on ISO/IEC 17050. SDOC stands as representative of the device supplier's claims of compliance for a host, router or network protection product. It contains a summarization of the functional categories supported with respect to the profile, and their tested status. Changes to SDOC arise from retesting and repackaging products.

Moving in to the testing infrastructure, **Abstract Test Specifications** are needed for conformance and for interoperability tests. Typically, a single test specification is based on an individual RFC, and individual tests are created with purposes specific to functions in the RFC. Test purposes differ for conformance and interoperability. Conformance tests are usually run against independent testing devices, and the object is to make sure that the product under test exhibits the specified behavior for each function tested. Interoperability tests are run in a configuration with two or more implementations under test, and the object is to make sure that every product pair interoperates – in the case where they implement complementary and compatible protocols. The test specifications in use for both conformance and interoperability are largely the product of the IPv6 Ready Logo program [10]. They have been under development over many revisions for several years. Memoranda of Understanding have been signed between NIST and the developers of these test specifications to allow the USGv6 testing program to make free use of them. But since these tests were developed to meet the IPv6 Ready Logo profile, they differ somewhat from the requirements of the USGv6 profile. For this reason NIST has developed a set of **Test Selection Tables**, accessible from the USGv6 testing website [6], to select from the Ready Logo specifications' tests applicable to the USGv6 profile. In regard to their accuracy and reliability, since these tables simply make a selection of tests, their complexity is not great, and they should converge on the correct values after a very few iterations. Test specifications are also needed for network protection. The functional specifications are embodied within the profile, and tests have been provided by ICSA Labs. These tests are new, and it is reasonable to expect some iterations of test and revise until their reliability is established.

It is expected that the set of applicable USGv6 test specifications will be reviewed and updated on a 6 monthly cycle. After public review, each fall a set of test specifications will be published and declared in effect for the USGv6 test program. Each spring, a public meeting will be held to resolve issues and

update the test specifications. The details of the the test system management plan are provided in subsequent sections.

2.2 Processes

The operation of the USGv6 Testing Program is defined by its testing processes and management processes. These processes regulate the development of the artifacts, given above. They are discussed here as testing processes in Section 2.2.1, management processes in 2.2.2 and other processes in section 2.2.3.

2.2.1 Testing Processes

All testing is conducted using the published USGv6 test specifications, distinct and different for conformance, interoperability and network protection. All tests are derived from the published standards. Testing finds bugs in products under tests, but also finds bugs in the tests themselves. The tests must be shaken out thoroughly and converged on single interpretations for each test purpose.

Conformance Testing is conducted between the product under test and a special purpose test system. The test system executes tests that implement the purposes and procedures of the USGv6 abstract test specifications. Abstract tests are periodically corrected and updated, so executable tests and test systems must also be modified to maintain equivalence. There is a process of validation (see below) that reconciles abstract and executable test specifications. The standard taxonomy for conformance testing architectures describes combinations of protocol layer, and levels of control and coordination, and is given in ISO 9646 [7].

Interoperability Testing is conducted among several host or router products under test, according to abstract tests that include a detailed configuration section, and procedures typically conducted manually. These tests, too, are periodically corrected and updated. Where such tests are implemented manually, “validation” is accomplished through proficiency testing of the laboratory’s procedures. The issue of equivalence is focused on how different test laboratories conduct the interoperability tests.

Network Protection Testing is conducted in conjunction with internal and public networks, according to published abstract test specifications. In consonance with the other tests, these tests are updated every six months, to eliminate bugs and also to account for newly arisen attack vectors. The issue of equivalence is focused on how different network protection testing laboratories conduct the tests.

2.2.2 Management Processes

The artifacts described earlier are used in the testing process described above. There is a set of management processes associated with these artifacts and the testing processes. These management processes are described here.

Abstract Test Development Abstract tests are used as the basis for testing compliance with USGv6 requirements, that are in turn based upon RFCs pertaining to IPv6. These are procedural descriptions each having a test purpose applicable to exercising some functions of one or more RFCs. Our intention has

been to leverage wherever possible established tests and testing infrastructure. Most of the initial tests have been developed under the auspices of the IPv6Ready Logo. Some tests have been privately developed, e.g network protection tests by ICSA Labs, some by open source organizations such as Tahi, some by test labs such as UNH InterOperability Laboratory, some by collaboration with other organizations such as OSPFv3 by Taiwan Telecommunications Laboratories and some through USG funding. Tests once developed are released to the community of labs for a review period, corrected, agreed, and published with a revision number.

USGv6 Test Selection Adopted abstract test specifications often refer to the broadest range of functions in an RFC. USGv6 requirements sometimes choose to subset and/or augment the requirements of a stock RFC. Test selection tables are developed by the USGv6 program, to identify a base test specification and list the abstract tests that comprise the USGv6 test, and any modifications or additions necessary to adapt the test to USGv6 requirements. For completeness sake, the test selection tables also list the set of tests from the referenced test suite that do not apply to USGv6. The test selections are also subject to the USGv6 open review process.

Laboratory Accreditation Each test laboratory that wants its results recognized as part of the USGv6 program must seek accreditation to ISO/IEC 17025 in general, and the USGv6 testing program in particular. Such accreditation is achieved through an ILAC recognized accreditation body that offers accreditation to the USGv6 testing program. A list of accredited test laboratories is maintained at the USGv6 testing website [6].

Test Method Validation The abstract test specifications are written procedures. For conformance testing these need to be translated to executable form. The resulting test methods have to be equivalent to the abstracts. The assessment of this activity is part of the on-site assessment leading to accreditation for the USGv6 test methods. Additionally, it is necessary to ensure that all test methods in use for each protocol generate identical results when testing the same implementation. This equivalence is ensured through the processes of interlaboratory comparisons.

Interlaboratory Comparisons These ensure that test methods for the same protocol functionality across all different laboratories generate identical results. NIST will designate a single organization to perform interlaboratory comparisons, and distribute results to test laboratories and accreditors as appropriate. This avoids the problem of multiple accreditors having different schemes that may not harmonize. The results of interlaboratory comparison are posted to the USGv6 testing website [6].

Revision Management From the outset we anticipate changes to RFCs, USG profile versions and tests, all leading to the need for IPv6 product changes. For example the USGv6 profile is subject to annual revision. Test specifications are also subject to change, based on bug fixing and extending test coverage. These changes occur no more frequently than every 6 months. Specific cases for USGv6 testing program revision management are detailed later in Section 3, Lifecycles.

2.2.3 Other Processes

SDOC Production. After testing products in an accredited laboratory, product vendors develop a Suppliers Declaration of Conformity in compliance with ISO/IEC 17050:2004 [4,5] serving as indication to purchasers that required testing has taken place. Whether a test laboratory wants to offer the service of SDOC creation after testing is a matter between the lab and its customer. SDOC production is fully discussed in Section 5.

2.3 Stakeholders

The producers and consumers of the artifacts and processes constitute the stakeholders in the USGv6 testing system. These are identified here.

USG Agencies have a primary interest in making sure that IT products with IPv6 capabilities are available to meet their acquisition requirements.

Testing Laboratories are central to the USGv6 testing process. Each such laboratory seeks accreditation from an accreditor who offers USGv6 testing methods. Test laboratories may conduct any of conformance, interoperability or network protection testing. 1st, 2nd and 3rd party labs are recognized: a 1st party lab is associated with the product developer. A 2nd party lab is associated with a USG agency. A 3rd party lab is independent.

Test Method Developers including open source suppliers such as Tahj and commercial developers, who develop IPv6 test methods for conformance and interoperability, based on the abstract test specifications. In conjunction with test laboratories, test method developers take part in interlaboratory comparisons to make sure that test results for the same test using different methods in different labs are equivalent.

Accreditors - The role of an accreditor is to assess test laboratories for their compliance with ISO/IEC 17025 [8]. These are the quality provisions for testing. All assessors develop programs that build in technical test methods and assess technical competence. In the case of USGv6 the technical requirements are based on NIST SP 500-273 [3].

IPv6 Product Developers develop hosts, routers and network protection products which, when claiming compliance with USGv6 requirements, shall be tested according to the criteria described here and in NIST SP 500-273.

NIST and the USG test program - NIST is a technology agency of the US government charged with creating a standard for IPv6 products, and a means of determining compliance to that standard. The USGv6 Profile (NIST SP 500-267) is that standard. The USGv6 Testing Program (see this document and NIST SP 500-273) is the means of establishing compliance to USGv6 Profile requirements.

3 USGv6 Element Lifecycles

The USGv6 program exists in an environment in which technical requirements, product capabilities and test methods are constantly evolving. It is important that the test program and the interpretation of its results accommodate graceful forward evolution while maintaining appropriate control on the quality of its results.

USG Agencies procuring products with USGv6 requirements are advised to consider first those with up to date test results, based on the test specifications currently applicable, as published at the USGv6 testing website [6]. The following table itemizes the changes to artifacts that can impact interoperability in the Agency's installed base. Acquisitions based on USGv6 profile version 1.0 will establish that installed base, so subsequent versions should be incremental, not revolutionary, and highly conservative.

Changes to test specifications may have an effect on interoperability to the extent that functions previously not tested, or insufficiently tested, are in unknown status with respect to their conformance or interoperability. The subsequent test change can highlight latent conformance or interoperability problems already in the installed base. Buyers may want to write in specific interoperability requirements, to help ensure interoperability with their installed base. The USGv6 profile is a procurement profile, it does not require post-acquisition testing. However in Section 5 of the document, the conditions for declaring SDOC do describe conditions for the validity of a supplier's declaration.

The USGv6 profile includes upwards of 100 RFCs and other standards. Full coverage entails tests for each, but due to the complexity of the problem, test specification development lags protocol specification and implementation development considerably. The situation is that there is a core of protocols for which tests are mature, a further range for which they are under active development, and yet more protocols for which test development has not yet started. For those specifications for which no public consensus test suite is available, we rely on vendors to "self test" by what ever means they deem appropriate to support their claim of compliance with a given USGv6 requirement. This situation is reflected in the testing and reportage requirements as verified by the SDOC provisions in Section 5.

The table below takes account of the variations in test maturity: where mature tests exist, they are required to be passed if claimed in SDOC; where tests are undergoing periodic major revisions, **suppliers are required to test against the new tests and improved tests by 6 months after the revision.** Where only minor test revisions are published, suppliers with products already tested are not obliged to retest.

Item	Conditions and Events	Impact on Vendor	Impact on USG Agencies
1	Event: USGv6 Profile version 1.0 published (July 2008)	Signal to IPv6 suppliers to implement MUST capabilities.	Plan for IPv6 compliant product acquisition, with a 2 year time horizon.
-	Condition: Conditional MUST functions (C(M)) in the profile.	Implemented by suppliers who elect to support identified USGv6 product configuration options (See the Node Requirements Table in the profile).	-

Comment [dougml]: Not clear why this is called a "condition".

-	Condition: SHOULD and SHOULD+ functions in the profile.	Not required for USGv6 compliance, but implemented by vendor choice. Some Agencies may seek these functions.	-
2	Event: Profile revision published (e.g. Version 2.0 and later).	Signal to vendors to start planning for new SHOULD+s, and start implementing new MUSTs.	IPv6 plans can include the new revision's capabilities but specific procurement requirements for new capabilities should not be cited until 24 months after its publication.
3	Event: Accredited test laboratories open for business	Accredited test laboratories open for business. Product vendors can test their USGv6 stacks.	Agencies should not broadly cite USGv6-v1.0 requirements yet, but instead work with vendors to define agency specific IPv6 requirements .
4	Event: USGv6 Profile version 1.0 requirements in force from July 2010	Vendors issue SDOC with claims of supported and tested USGv6 capabilities, citing test results in accredited labs.	From this point forward, agencies should express their requirements for IPv6 capabilities in terms of the USGv6 profile and should expect vendors to supply SDOCs traceable through the USGv6 Testing program to document compliance with such requirements.
5	Condition: Post July 2010 test provision as below.	-----	-----
6	Condition: No test selections exists for USGv6 requirements.	Claims of support can be made in SDOC, only subject to local testing outside the scope of this program.	Test results for these capabilities are not traceable through the accreditation structure of this program. Agencies may specify their own verification requirements.
7	Condition: Test selections exist for specific USGv6 capabilities within the profile.	SDOC claims of support for a given USGv6 capability MUST be supported by results from accredited test laboratories.	Test results for these capabilities are traceable through the accreditation structure of this program. Agencies may verify by contacting the accredited test laboratory.
8	Event: New test selections become effective or new major version number of test specification is published.	Products claiming the related USGv6 capabilities in SDOC must test by 6 months after publication.	USG agencies may seek IPv6 products with SDOC that specifies compliance to the profile based on the new tests, by 6 months after their publication

			date.
10	Event: New minor version number change of test specification	No requirement for retest of products already claiming SDOC for these functions.	USG agencies continue to seek IPv6 products with SDOC that specifies the current major version of the tests (e.g v.1.x, v.2.x).

3.1 Narrative Description of Lifecycle Table

Changes to the USGv6 profile and the testing infrastructure have impacts on all the stakeholders. The above table highlights the effect of these changes on product vendors and their customers, the USG Agencies in particular. Items 1 and 2 concern the impact of introducing and upgrading the profile, which goes through yearly revisions. Version 1.0 of the profile has no immediate impact on the agencies, but is a signal to product vendors to implement the mandatory capabilities. Conditional MUSTS and SHOULDs are only implemented if chosen by the vendor, or in response to individual agency/procurement specific requirements. The annual revision of the profile signals what capabilities are required in the future, but will not become effective sooner than 2 years if new MUSTs, 3 or more years if new SHOULD+s.

Items 3 and 4 denote timing events. We expect the USGv6 testing program to be operational with accredited laboratories open for business from approximately January 2010 onwards. Version 1.0 of the profile recommended that its requirements not be cited in procurements until July 2010. After that point we expect Agencies to express their IPv6 procurement requirements in terms of the USGv6 profile and to require vendors to document their compliance with those requirements, through the provisions of the USGv6 test program

Items 6 through 10 of the table are concerned with the provision of tests for conformance, interoperability and network protection, for the compendium of capabilities in the profile. There are some capabilities for which tests exist at the outset, and some capabilities for which tests do not yet exist. The USGv6 testing website [6] gives up to date details of test status and contains also the tests. For some capability implemented, where no test exists as yet, the supplier can claim this in their SDOC, subject to in-house testing only. Where a test specification is already in existence at the launch of the testing program, products claiming support must be tested, and evidence of testing in an accredited laboratory, must be included in the declaration. When a new test specification is introduced after the launch of the testing program, the supplier has a 6 month grace period before claims of implementation must be tested against that specification and recorded in the SDOC. If a test specification is revised with only minor changes, no retest is required.

4 Management

Publication of NIST SP 500-273 USGv6 Test Methods: General Description and Validation [3] was the signal to interested accreditors to develop accreditation programs. Test laboratories are free to choose test methods from Section 5 of that document and prepare for accreditation. With the formal designation of test specifications as “Version 1.0” in November 2009, the pieces are in place for laboratories to get accredited.

Ongoing management of the testing program includes:

- Maintaining the testing program website [6] to keep the list of accreditors and test laboratories up to date.
- Promoting dialogue and agreement on interpretation and editing of the test selection tables and test specifications. These are also published at the website.
- Publishing new test specifications for USGv6 capabilities where such tests are not available at the outset.
- Hosting mailgroups: usgv6-testing@nist.gov for vendors and users interested in test management activities, and usgv6-labs@nist.gov for the use of participating laboratories, accreditors and test developers. Discussions and decisions of the mailgroup are archived for reference as necessary.
- Hosting an annual meeting at NIST to resolve test specification issues, interoperability issues, and at the same time review the effectiveness of the testing program.
- Continuing to promote harmonization activities with other IPv6 testing programs around the world in good standing.

Management of the USGv6 testing program is conducted through the mailgroup, the website and in occasional face-to-face meetings.

5 Claims of Product Compliance

USG agencies seeking to buy products with USGv6-compliant capabilities are advised to require submission of the Supplier's Declaration of Conformity (SDOC) [4,5] as documentation of compliance to requirements. The details of what is included in SDOC are given in Sections 5.1 and 5.2. The question of what products can be claimed as equivalent to the tested version and included in the same SDOC is discussed in Section 5.3. Finally, the vendor's test process culminating in the production of SDOC is given in Section 5.4. A template for the SDOC is given in Appendix 1.

5.1 Preliminary Requirements

Product vendors are advised to use the USGv6 Node Requirements Table given as an appendix in the USGv6 profile [2] as a means to document the capabilities implemented in their host, router or network protection product. The product identified by these capabilities is submitted to an accredited test laboratory to test its compliance. A list of accredited test laboratories and supporting accreditors is given at the USGv6 testing website [6].

5.2 Test Selection Requirements

The tests for conformance, interoperability and network protection are published on the USGv6 website [6]. The USGv6 profile includes 12 functional areas, with over 150 RFCs and standards in total. 100% coverage is an ambitious long term goal, but for the foreseeable future there will be gaps in coverage, test suites missing. In making claims of conformance, a vendor must pass the tests where they exist. Where tests do not exist, vendors must rely on their own testing and quality assurance techniques to verify that their product meets the specified USGv6 requirements. Note that the lack of a published USGv6 test for a given capability does not lessen or alter the underlying USGv6 technical requirements for a given capability. Vendors should not knowingly claim support for a USGv6 capability when their product does not conform to the published requirements.

In the situation where a new test suite is added to the USGv6 test program for the first time, vendors claiming that capability are required to pass the tests within 6 months of their publication date, and record the outcome in their SDOC.

The basic set of tests derive from the IPv6 Ready Logo, ICSA Labs, and other sources, and constitute a superset of possible USGv6 tests, per RFC covered. The USGv6 website contains test selection tables that identify from the published test specifications those tests applicable to USGv6 profile testing.

5.3 Test Pass Requirements

The profile defines a set of capabilities of IPv6 related functions that can be grouped together in very flexible ways. For example, capabilities can be grouped to identify host or router roles, or to provide network protection. The minimal mandatory set of IPv6 capabilities for each product type (host, router and network protection product) is defined by the corresponding unconditional MUSTs in the Node Requirements Table. This set of requirements defines the minimal capabilities of a host, router or network protection product that claims to be "USGv6-Capable".

Compliance to this profile is defined in terms of all of the capabilities claimed or required. That is, compliance is required, tested and reported to the set of unconditional MUST requirements, plus those MUSTs that are conditional on options required for a particular procurement request or claimed for a

specific product. Hence, being “USGv6-Compliant” is only meaningful with respect to a specific set of conditions and configuration options. The conditions and configuration options are defined in the Host, Router and NPD profile templates in the Node Requirements Table of the profile and further explained in Sections 3, 4 and 5.

While these recommendations above define USGv6-Compliant networking products, this does not preclude more flexible uses of the profile to accommodate individual Agency requirements. Agencies are strongly urged to analyse this profile in the light of their own Enterprise Network Architectures, specify and acquire solutions on a case-by-case basis.

5.4 Composite Products

Composite products (i.e. products whose USGv6 capabilities are provided by the application or integration of one or more distinct components) can inherit the USGv6 test results of their individual component parts. To do so the precise component parts and their test specific test results must be documented. The USGv6 testing program recognizes three cases of composite product:

1. Application of a single USGv6 Component - A vendor bundles a composite product in which all the capabilities within the scope of the USGv6 profile are provided by a single, independent product (e.g., stock OEM operating system on commodity hardware), that itself has completed testing. In this case, the vendor of the composite product does not need to repeat conformance or interoperability testing. The composite product vendor must still complete an SDOC for the final product; in particular the product description and declaration (pages 1 and 2). Note that this declaration requires that the composite product vendor attest to the following.

- "All of the USGv6 capabilities of the products cited this SDOC are provided by a single, unmodified, component referenced above. The conformance and interoperability test results for the USGv6 capabilities of this component are documented in the attached document. This SDOC attests to the fact that these USGv6 capabilities are unmodified in their use in the products cited above."

A copy of OEM vendor's SDOC must be attached so as to detail the complete set of USGv6 capabilities declared and tested for the product.

This case is primarily intended to address the OEM operating system on commodity hardware scenario. It should be noted that though, that this scenario is equally applicable to a single vendor that employs the same distinct IPv6 components in a series of products.

2. Integration of multiple USGv6 components - A vendor bundles a composite product who's USGv6 capabilities are provided by the integration of two or distinct products that have been (at least) conformance tested in isolation. The composite product vendor must complete unique interoperability testing of the entire integrated product, but may reference the conformance test results of the individual components. Note that this declaration requires that the composite vendor attest to the following:

- "The USGv6 capabilities of the products cited in this SDOC are provided by the integration of two or more unmodified components cited above. The results of conformance tests of these independent components are documented by attaching their SDOCs and identifying the appropriate component for each USGv6 capability they provide in the composite product. The interoperability testing results are unique, referenced in this original SDOC and attested here"

In this scenario, the composite product vendor provides copies of the SDOCs for each distinct component and a unique SDOC for the composite product. For each USGv6 capability claimed for the composite

product, a distinct interoperability test result must be cited. If conformance test results are to be inherited from a previous component test, the composite product SDOC must clearly state which component is providing each capability and conformance test result.

3. Opaque application or integration of USGv6 components - A vendor supplies a product for which he does not wish to disclose whether all or parts of the stack derive from another product or supplier. In this scenario the vendor must complete both conformance and interoperability testing of the complete product offering as if it is a wholly unique implementation. The SDOC must be completed in full by the final product vendor.

5.5 Product Families

A single vendor may identify “product families”, as a set of distinct product offerings (e.g., unique product name, version and configuration) that have identical and unmodified USGv6 capabilities. That is, the products only vary in ways that do not impact the capabilities within the scope of the USGv6 profile.

In this scenario, the product family can inherit the test results of one of its members. The vendor must supply an SDOC that identifies the specific product configuration that was tested, but can then list additional product configurations that are declared within the same family, and thus share the same test results. Note that the declaration of a product family requires that the vendor attest to the following.

- "All of the products listed in this product family are implemented such that their USGv6 capabilities are identical in form and function across the entire product family. The specific conformance and interoperability test results for the USGv6 capabilities of an identified member of this product family are provided in this SDOC. This SDOC attests to the fact that these tested USGv6 capabilities are identical in form and function for all the products cited above."

5.6 Traceability and Applicability of Test Results

The concepts of composite products and product families have been developed to ease the vendor’s burden for duplicative testing, while maintaining an acceptable level of product assurance and traceability of results within the USGv6 test program. We rely on the test lab / vendor relationship to establish and document the scenarios in which product families and composite products may inherit a prior test result. It is expected that all such vendor claims of inherited test results can, and will be, explicitly affirmed by the cited test labs should a user decide to verify the test results claimed in any given SDOC.

Each lab may establish the procedures by which composite products and product families are identified, as long as they meet the requirements and guidelines provided by the USGv6 program. In the end, we rely on the natural tension between a lab’s desire to maintain its reputation and accreditation in the USGv6 test program and its desire to avoid duplicative testing for its customers, the product vendors. A given lab, for example, might require sample testing of two or more product configurations before being willing to attest to inherited results for an entire family or a composite product. All claims and reports of test results should always explicitly indicate what product configurations were actually tested and which additional configurations those results are deemed applicable to. The SDOC is designed to facilitate this identification and feedback through the usgv6-testing@nist.gov mailgroup is encouraged.

Note also, that should a lab determine that at some point that there is reason to suspect that the validity of previously identified and agreed upon inherited test results, the lab is free to request further tests from the vendor and/or modify the set of products for which it is willing to affirm test results for. It is expected that it is in all parties best interests (i.e., vendors, test labs, accreditors, and users) to efficiently identify and resolve such issues.

5.7 USGv6 Product Supplier's Process

This section describes the process that suppliers of IPv6 products will go through, from specification, through development, testing, to USG acquisition via SDOC production.

- Initial product development.
- USGv6 adaptation:
 - Develop to default recommendations as “USGv6-Capable” per the USGv6 profile, OR
 - Develop to Agency specific requirements per contract or the Agency’s Enterprise Network Architecture.
- In house testing:
 - Testing using open source or proprietary tools.
- Contract with accredited test laboratory:
 - Specify capabilities to determine what testing is required.
 - Get conformance testing with current test selections (TSTs).
 - Get interoperability testing with selected partners and test selections (TSTs).
- Develop and publish Supplier’s Declaration of Conformity (SDOC):
 - Subject to constraints for:
 - Tested hardware and software combinations (Section 5.3).
 - Composite products (Section 5.4).
 - Product families (Section 5.5).
 - Self-declared testing where no published test exists yet.
- Submit SDOC in response to RFPs.
- Annually/periodically:
 - Major release testing.
 - Formal testing to newly sanctioned test specifications, where previously self-declared.
 - Revise SDOC and re-publish.

6 Bibliography and References

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- [6] USGv6 Testing Website, <http://www.antd.nist.gov/usgv6/testing.html>.
- [7] ISO 9646-2:1994 Information technology – Open Systems Interconnection – Conformance testing methodology and framework – Part 2: Abstract Test Suite specification. <http://www.iso.org/iso/>
- [8] ISO/IEC 17025:2004 General requirements for the competence of testing and calibration laboratories. <http://www.iso.org/iso/>
- [9] The RFC-Editor homepage, <http://www.rfc-editor.org/>.
- [10] Pv6 Ready Logo Program, <http://www.ipv6ready.org/>.

7 Terms

Application Firewall a firewall that operates using application data filtering.

Conformance Testing Testing to determine if a product satisfies the criteria specified in a controlling document, such as an RFC.

Firewall A product that acts as a barrier to prevent unauthorized or unwanted communications between sections of a computer network.

Host Any node that is not a Router. In general this profile is limited to discussions of general purpose computers, and not highly specialized devices.

Interoperability Testing Testing to ensure that two or more communications products can interwork and exchange data.

Network Protection Device A product such as a Firewall or Intrusion Detection device that selectively blocks packet traffic based on configurable and emergent criteria.

Network Protection Testing Testing that is applicable to network protection devices.

Request for Comment (RFC) – an Internet standard, developed and published by the Internet Engineering Task Force.

Router a Node that interconnects subnetworks by packet forwarding.

USG The United States Government, comprising the Federal Agencies.

8 Appendix 1: Supplier's Declaration of Conformity: Template

The template for the Supplier's Declaration of Conformity is included here on the adjacent page. Some notes on the template are given below.

- Test Suite column where a test suite is identified by name, tests should be run in an accredited laboratory and passed. Where the cell is marked Self Test, no official test suite is yet available. The supplier performs in-house testing and may claim support of those capabilities..
- The SDOC comprises a high-level summary of the functional areas supported. It does not identify a 'blow-by-blow' account of all protocols tested within that functional area. Tested support can only be claimed if all the mandatory lines from the Node Requirements Table of the USGv6 profile, within a functional area are also tested and passed.
- The test version numbers given in this template are listed with a major and a minor version number. Agencies and buyers are urged to compare product results against the currently in force major number, without regard to the minor number. Hence, '1.*' implies that 1.1, 1.2, 1.3 and so on are all valid results.