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IANA Considerations for Remote Procedure Call (RPC) Network Identifiers and Universal Address Formats

Abstract

This document lists IANA Considerations for Remote Procedure Call (RPC) Network Identifiers (netids) and RPC Universal Network Addresses (uaddrs). This document updates, but does not replace, RFC 1833.

Status of This Memo

This is an Internet Standards Track document.

This document is a product of the Internet Engineering Task Force (IETF). It represents the consensus of the IETF community. It has received public review and has been approved for publication by the Internet Engineering Steering Group (IESG). Further information on Internet Standards is available in Section 2 of RFC 5741.

Information about the current status of this document, any errata, and how to provide feedback on it may be obtained at http://www.rfc-editor.org/info/rfc5665.

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1. Introduction and Motivation

The concepts of an RPC (defined in RFC 5531 [4]) Network Identifier (netid) and an RPC Universal Address (uaddr) were introduced in RFC 1833 [1] for distinguishing network addresses of multiple protocols and representing those addresses in a canonical form. RFC 1833 states that a netid "is defined by a system administrator based on local conventions, and cannot be depended on to have the same value on every system". (The netid is contained in the field r_netid of the data type rpcb_entry, and the uaddr is contained in the field r_addr of the same data type, where rpcb_entry is defined in RFC 1833.) Since the publication of RFC 1833, it has been found that protocols like Network File System version 4 (NFSv4.0) [5] and RPC/RDMA (Remote Direct Memory Access) [6] depend on consistent values of netids and representations of uaddrs. Current practices tend to ensure this consistency. Thus, this document identifies the considerations for IANA to establish registries of netids and uaddr formats for RPC and specifies the initial content of the two registries.

2. Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119 [2].

3. Considerations for the Netid of the Stream Control Transmission Protocol

The Stream Control Transmission Protocol (SCTP) (described in RFC 4960 [7]) is a connection-oriented protocol that supports both byte-streamed and record-oriented data transfer. When the "sctp" and "sctp6" netids are used, the Open Network Computing (ONC) RPC Record Marking standard (see Section 11 of RFC 5531 [4]) is not used; instead, SCTP’s native record-oriented data transfer is used.

4. Security Considerations

Since this document is only concerned with the IANA management of the Network Identifier (netid) and Universal Network Addresses (uaddrs) format registry, it raises no new security issues.

5. IANA Considerations

This section uses terms that are defined in RFC 5226 [8].

5.1. IANA Considerations for Netids

IANA has created a registry called "ONC RPC Netids". The remainder of this section describes the registry.

All assignments to the ONC RPC Netids registry are made on one of two bases:

- A First Come First Served basis subregistry per Section 4.1 of RFC 5226.
- A Standards Action basis subregistry per Section 4.1 of RFC 5226.

The eXternal Data Representation (XDR) encoding allows netids to be up to 2^32 - 1 octets in length, but the registry will only allow a much shorter length. Assignments made on a Standards Action basis should be assigned netids 1 to 8 octets long. Assignments made on a First Come First Served basis should be assigned netids 9 to 128 octets long. Some exceptions are listed in Table 2.

Some portion of the netid name space is Reserved:

- All netids, regardless of length, that start with the prefixes "STDS" or "FCFS" are Reserved, in order to extend the name space of either Standards Action or First Come First Served bases.
- To give the IESG the flexibility in the future to permit Private and Experimental Uses, all netids with the prefixes "PRIV" or "EXPE" are Reserved.
- To prevent confusion with the control protocol by the same name [9], netids with the prefix "ICMP" are Reserved.
- Since netids are not constructed in an explicit hierarchical manner, this document does not provide for Hierarchical Allocation of netids. Nonetheless, all netids containing the octet "." are Reserved for future possible provision of Hierarchical Allocation.
- The zero length netid is Reserved.

A recommended convention for netids corresponding to transports that work over the IPv6 protocol is to have "6" as the last character in the netid’s name.

There are two subregistries of netids: one for Standards Action assignments and one for First Come First Served assignments. Each registry of netids is a list of assignments, each containing five fields for each assignment.

1. A US-ASCII string name that is the actual netid. The netid should be 1 to 8 octets long for the Standards Action subregistry, and 9 to 128 octets long for the First Come First Served subregistry. The netid MUST NOT conflict with any other registered netid. Despite the fact that netids are case sensitive, the netid, when mapped to all upper case, MUST NOT conflict with the value of any other registered netid after the registered netid is mapped to upper case. In addition, when mapped to upper case, the prefix of the netid MUST NOT be equal to a Reserved prefix.

2. A constant name that can be used for software programs that wish to use the transport protocol associated with the netid. The name of the constant typically has the prefix "NC_", and a suffix equal to the upper-case version of the netid. This constant name should be a constant that is valid in the 'C' programming language. This constant name MUST NOT conflict with any other netid constant name. Constant names with the prefix "NC_STDS", "NC_FCFS", "NC_PRIV", "NC_EXPE", and "NC_ICMP" are Reserved. Constant names with a prefix of "NC_" and a total length of 11 characters or less should be for assignments made on the Standards Action basis. The constant "NC_" is Reserved. The constant name can be 1 to 131 octets long.

   Given the typical derivation of the constant name from the netid, the registration of the constant might be considered redundant. This is not always true. For example, a netid might use a character that is not valid in the programming language. The first entry of Table 1 provides such an example.

3. A description and/or a reference to a description of how the netid will be used. For assignments made on a First Come First Served basis, the description should include, if applicable, a reference to the transport and network protocols corresponding to the netid. For assignments made on a Standards Action basis, the description field must include the RFC numbers of the protocol associated with the netid, including, if applicable, RFC numbers of the transport and network protocols.

4. A point of contact of the registrant. For assignments made on a First Come First Served basis:

   * the point of contact should include an email address.

   * subject to authorization by a Designated Expert, the point of contact may be omitted for extraordinary situations, such as the registration of a commonly used netid where the owner is unknown.

For assignments made on a Standards Action basis, the point of contact is always determined by IESG.

5. A numerical value, used to cross reference the netid assignment with an assignment in the uaddr format registry (see Section 5.2). If the registrant is registering a netid that cross references an existing assignment in the uaddr format registry, then the registrant provides the actual value of the cross reference along with the date the registrant retrieved the cross reference value from the uaddr format registry. If the registrant is registering both a new netid and new uaddr format, then the registrant provides a value of TBD1 in the netid request, and uses TBD1 in the uaddr format request. IANA will then substitute TBD1 for the cross reference number IANA allocates. Note that if a document requests multiple netid and uaddr assignments, each additional uaddr format cross reference will be identified as TBD2, TBD3, ..., etc.

5.1.1. Initial Registry

The initial list of netids is broken into two subregistries: those assigned on a First Come First Served basis in Table 1 and those assigned on a Standards Action basis in Table 2. These lists will change as IANA registers additional netids as needed, and the authoritative list of registered netids will always live with IANA.

Netid	Constant Name	Description and/or Reference	PoC	CR
"-"	NC_NOPROTO	RFC1833 [1], Section 5.2.3.2 of RFC 5665		1
"ticlts"	NC_TICLTS	The loop back connectionless transport used in System V Release 4 and other operating systems. Although this assignment is made on a First Come First Served basis and is fewer than nine characters long, the exception is authorized. See [10].		0
"ticots"	NC_TICOTS	The loop back connection-oriented transport used in System V Release 4 and other operating systems. See [10]. Although this assignment is made on a First Come First Served basis and is fewer than nine characters long, the exception is authorized.		0
"ticotsord"	NC_TICOTSORD	The loop back connection-oriented with orderly-release transport used in System V Release 4 and other operating systems. See [10].		0

Table 1: Initial First Come First Served Netid Assignments

PoC: Point of Contact.

CR: Cross Reference to the Uaddr Format Registry.

Netid	Constant Name	RFC(s) and Description (if needed)	PoC	CR
"rdma"	NC_RDMA	RFC 5666 [6], RFC 791 [11]	IESG	2
"rdma6"	NC_RDMA6	RFC 5666 [6], RFC 2460 [12]	IESG	3
"sctp"	NC_SCTP	RFC 4960 [7], RFC 791 [11], Section 3 of RFC 5665	IESG	2
"sctp6"	NC_SCTP6	RFC 4960 [7], RFC 2460 [12], Section 3 of RFC 5665	IESG	3
"tcp"	NC_TCP	RFC 793 [13], RFC 791 [11], Section 11 of RFC 5531 [4]	IESG	2
"tcp6"	NC_TCP6	RFC 793 [13], RFC 2460 [12], Section 11 of RFC 5531 [4]	IESG	3
"udp"	NC_UDP	RFC 768 [14], RFC 791 [11]	IESG	2
"udp6"	NC_UDP6	RFC 768 [14], RFC 2460 [12]	IESG	3

Table 2: Initial Standards Action Netid Assignments

5.1.2. Updating Registrations

Per Section 5.2 of RFC 5226, the registrant is always permitted to update a registration made on a First Come First Served basis "subject to the same constraints and review as with new registrations". The IESG or a Designated Expert is permitted to update any registration made on a First Come First Served basis, which normally is done when the PoC cannot be reached in order to make necessary updates. Examples where an update would be needed include, but are not limited to: the email address or other contact information becomes invalid; the reference to the corresponding protocol becomes obsolete or unavailable; RFC 1833 is updated or replaced in such a way that the scope of netids changes, requiring additional fields in the assignment.

Only the IESG, on the advice of a Designated Expert, can update a registration made on a Standards Action basis.

5.2. IANA Considerations for Uaddr Formats

IANA has created a registry called "ONC RPC Uaddr Format Registry" (called the "format registry" for the remainder of this document). The remainder of this section describes the registry.

All assignments to the format registry are made on one of two bases:

- First Come First Served basis per Section 4.1 of RFC 5226.
- Standards Action per Section 4.1 of RFC 5226.

The registry of formats is a list of assignments, each containing four fields for each assignment.

1. The basis for the assignment, which can be either FCFS for First Come First Served assignments or STDS for Standards Action assignments.

2. A description and/or reference to a description of the actual uaddr format. Assignments made on a Standards Action basis always have a reference to an RFC.

3. For assignments made on a First Come First Served basis, a point of contact, including an email address. Subject to authorization by a Designated Expert, the point of contact may be omitted for extraordinary situations, such as the registration of a commonly used format where the owner is unknown. For assignments made on a Standards Action basis, the point of contact is always determined by the IESG.

4. A numerical value, used to cross reference the format assignment with an assignment in the netid registry. The registrant provides a value of TBD1 for the cross reference field when requesting an assignment. IANA will assign TBD1 to a real value. Note that if a document requests multiple uaddr assignments, each additional uaddr format cross reference will be identified as TBD2, TBD3, ..., etc.

All requests for assignments to the format registry on a Standards Action basis are only for Standards Track RFCs approved by the IESG.

5.2.1. Initial Registry

The initial list of formats is in Table 3. This list will change as IANA registers additional formats as needed, and the authoritative list of registered formats will always live with IANA.

Basis	Description and/or Reference	PoC	CR
FCFS	System V Release 4 loopback transport uaddr format. Section 5.2.3.1 of RFC 5665		0
FCFS	Uaddr format for NC_NOPROTO. Section 5.2.3.2 of RFC 5665		1
STDS	Uaddr format for IPv4 transports. Section 5.2.3.3 of RFC 5665	IESG	2
STDS	Uaddr format for IPv6 transports. Section 5.2.3.4 of RFC 5665	IESG	3

Table 3: Initial Format Assignments

5.2.2. Updating Registrations

The registrant is always permitted to update a registration made on a First Come First Served basis "subject to the same constraints and review as with new registrations." The IESG is permitted to update any registration made on a First Come First Served basis, which normally is done when the PoC cannot be reached in order to make necessary updates. Examples where an update would be needed include, but are not limited to: the email address or other contact information becomes invalid; the reference to the format description becomes obsolete or unavailable; RFC 1833 is updated or replaced in such a way that the scope of uaddr formats changes, requiring additional fields in the assignment.

Only the IESG, on the advice of a Designated Expert, can update a registration made on a Standards Action basis.

5.2.3. Uaddr Formats

5.2.3.1. Uaddr Format for System V Release 4 Loopback Transports

Although RFC 1833 specifies the uaddr as the XDR data type string (hence, limited to US-ASCII), implementations of the System V Release 4 loopback transports will use an opaque string of octets. Thus, the format of a loopback transport address is any non-zero length array of octets.

5.2.3.2. Uaddr Format for Netid "-"

There is no address format for netid "-". This netid is apparently for internal use for supporting some implementations of RFC 1833.

5.2.3.3. Uaddr Format for Most IPv4 Transports

Most transport protocols that operate over IPv4 use 16-bit port numbers, including RDMA [6], SCTP [7], TCP [13], and UDP [14]. The format of the uaddr for the above 16-bit port transports (when used over IPv4) is the US-ASCII string:

```
h1.h2.h3.h4.p1.p2
```

The prefix "h1.h2.h3.h4" is the standard textual form for representing an IPv4 address, which is always four octets long. Assuming big-endian ordering, h1, h2, h3, and h4 are, respectively, the first through fourth octets each converted to ASCII-decimal. The suffix "p1.p2" is a textual form for representing a service port. Assuming big-endian ordering, p1 and p2 are, respectively, the first and second octets each converted to ASCII-decimal. For example, if a host, in big-endian order, has an address in hexadecimal of 0xC0000207 and there is a service listening on, in big-endian order, port 0xCB51 (decimal 52049), then the complete uaddr is "192.0.2.7.203.81".

5.2.3.4. Uaddr Format for Most IPv6 Transports

Most transport protocols that operate over IPv6 use 16-bit port numbers, including RDMA [6], SCTP [7], TCP [13], and UDP [14]. The format of the uaddr for the above 16-bit port transports (when used over IPv6) is the US-ASCII string:

```
x1:x2:x3:x4:x5:x6:x7:x8.p1.p2
```

The suffix "p1.p2" is the service port, and is computed the same way as with uaddrs for transports over IPv4 (see Section 5.2.3.3). The prefix "x1:x2:x3:x4:x5:x6:x7:x8" is the preferred textual form for representing an IPv6 address as defined in Section 2.2 of RFC 4291 [3]. Additionally, the two alternative forms specified in Section 2.2 of RFC 4291 are also acceptable.

5.2.3.5. Uaddr Format for ICMP over IPv4 and IPv6

As ICMP is not a true transport, there is no uaddr format for ICMP. The netid assignments "icmp" and "icmp6" and their shared uaddr "format" are listed to prevent any registrant from allocating the netids "icmp" and "icmp6" for a purpose that would likely cause confusion.

5.3. Cross Referencing between the Netid and Format Registry

The last field of the netids registry is used to cross reference with the last field of the format registry. IANA is under no obligation to maintain the same numeric values in cross references when updating each registry; i.e., IANA is free to "re-number" these corresponding fields. However, if IANA does so, both the netid and format registries must be updated atomically.

5.4. Port Assignment for NFS over SCTP

Port 2049 is assigned to NFS over SCTP for the sctp and sctp6 netids.

6. References

6.1. Normative References

[1] Srinivasan, R., "Binding Protocols for ONC RPC Version 2", RFC 1833, August 1995.

[2] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", BCP 14, RFC 2119, March 1997.

[3] Hinden, R. and S. Deering, "IP Version 6 Addressing Architecture", RFC 4291, February 2006.

6.2. Informative References

[4] Thurlow, R., "RPC: Remote Procedure Call Protocol Specification Version 2", RFC 5531, May 2009.

[5] Shepler, S., Callaghan, B., Robinson, D., Thurlow, R., Beame, C., Eisler, M., and D. Noveck, "Network File System (NFS) version 4 Protocol", RFC 3530, April 2003.

[6] Talpey, T. and B. Callaghan, "Remote Direct Memory Access Transport for Remote Procedure Call", RFC 5666, January 2010.

[7] Stewart, R., Ed., "Stream Control Transmission Protocol", RFC 4960, September 2007.

[8] Narten, T. and H. Alvestrand, "Guidelines for Writing an IANA Considerations Section in RFCs", BCP 26, RFC 5226, May 2008.

[9] Postel, J., "Internet Control Message Protocol", STD 5, RFC 792, September 1981.

[10] American Telephone and Telegraph Company, "UNIX System V, Release 4 Programmer's Guide: Networking Interfaces, ISBN 0139470786", 1990.

[11] Postel, J., "Internet Protocol", STD 5, RFC 791, September 1981.

[12] Deering, S. and R. Hinden, "Internet Protocol, Version 6 (IPv6) Specification", RFC 2460, December 1998.

[13] Postel, J., "Transmission Control Protocol", STD 7, RFC 793, September 1981.

[14] Postel, J., "User Datagram Protocol", STD 6, RFC 768, August 1980.

Appendix A. Acknowledgments

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