RPC: Remote Procedure Call Protocol Specification Version 2

Status of This Memo

This document specifies an Internet standards track protocol for the
Internet community, and requests discussion and suggestions for
improvements. Please refer to the current edition of the "Internet
Official Protocol Standards" (STD 1) for the standardization state
and status of this protocol. Distribution of this memo is unlimited.

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Abstract

This document describes the Open Network Computing (ONC) Remote
Procedure Call (RPC) version 2 protocol as it is currently deployed
and accepted. This document obsoletes RFC 1831.

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1. Introduction

   This document specifies version 2 of the message protocol used in ONC
   Remote Procedure Call (RPC). The message protocol is specified with
   the eXternal Data Representation (XDR) language [RFC4506]. This
   document assumes that the reader is familiar with XDR. It does not
   attempt to justify remote procedure call systems or describe their
   use. The paper by Birrell and Nelson [XRPC] is recommended as an
   excellent background for the remote procedure call concept.

1.1. 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 [RFC2119].

2. Changes since RFC 1831

   This document obsoletes [RFC1831] as the authoritative document
   describing RPC, without introducing any over-the-wire protocol
   changes. The main changes from RFC 1831 are:

   o Addition of an Appendix that describes how an implementor can
      request new RPC program numbers, authentication flavor numbers,
      and authentication status numbers from IANA, rather than from Sun
      Microsystems

   o Addition of an "IANA Considerations" section that describes past
      number assignment policy and how IANA is intended to assign them
      in the future

   o Clarification of the RPC Language Specification to match current
      usage

   o Enhancement of the "Security Considerations" section to reflect
      experience with strong security flavors

   o Specification of new authentication errors that are in common use
      in modern RPC implementations

   o Updates for the latest IETF intellectual property statements

3. Terminology

   This document discusses clients, calls, servers, replies, services,
   programs, procedures, and versions. Each remote procedure call has
   two sides: an active client side that makes the call to a server
   side, which sends back a reply. A network service is a collection of

one or more remote programs. A remote program implements one or more
remote procedures; the procedures, their parameters, and results are
documented in the specific program's protocol specification. A
server may support more than one version of a remote program in order
to be compatible with changing protocols.

For example, a network file service may be composed of two programs.
One program may deal with high-level applications such as file system
access control and locking. The other may deal with low-level file
input and output and have procedures like "read" and "write". A
client of the network file service would call the procedures
associated with the two programs of the service on behalf of the
client.

The terms "client" and "server" only apply to a particular
transaction; a particular hardware entity (host) or software entity
(process or program) could operate in both roles at different times.
For example, a program that supplies remote execution service could
also be a client of a network file service.

4. The RPC Model

The ONC RPC protocol is based on the remote procedure call model,
which is similar to the local procedure call model. In the local
case, the caller places arguments to a procedure in some well-
specified location (such as a register window). It then transfers
control to the procedure, and eventually regains control. At that
point, the results of the procedure are extracted from the well-
specified location, and the caller continues execution.

The remote procedure call model is similar. One thread of control
logically winds through two processes: the caller's process and a
server's process. The caller first sends a call message to the
server process and waits (blocks) for a reply message. The call
message includes the procedure's parameters, and the reply message
includes the procedure's results. Once the reply message is
received, the results of the procedure are extracted, and the
caller's execution is resumed.

On the server side, a process is dormant awaiting the arrival of a
call message. When one arrives, the server process extracts the
procedure's parameters, computes the results, sends a reply message,
and then awaits the next call message.

In this model, only one of the two processes is active at any given
time. However, this model is only given as an example. The ONC RPC
protocol makes no restrictions on the concurrency model implemented,
and others are possible. For example, an implementation may choose

to have RPC calls be asynchronous so that the client may do useful
work while waiting for the reply from the server. Another
possibility is to have the server create a separate task to process
an incoming call so that the original server can be free to receive
other requests.

There are a few important ways in which remote procedure calls differ
from local procedure calls.

o Error handling: failures of the remote server or network must be
   handled when using remote procedure calls.

o Global variables and side effects: since the server does not have
   access to the client's address space, hidden arguments cannot be
   passed as global variables or returned as side effects.

o Performance: remote procedures usually operate at one or more
   orders of magnitude slower than local procedure calls.

o Authentication: since remote procedure calls can be transported
   over unsecured networks, authentication may be necessary.
   Authentication prevents one entity from masquerading as some other
   entity.

The conclusion is that even though there are tools to automatically
generate client and server libraries for a given service, protocols
must still be designed carefully.

5. Transports and Semantics

   The RPC protocol can be implemented on several different transport
   protocols. The scope of the definition of the RPC protocol excludes
   how a message is passed from one process to another, and includes
   only the specification and interpretation of messages. However, the
   application may wish to obtain information about (and perhaps control
   over) the transport layer through an interface not specified in this
   document. For example, the transport protocol may impose a
   restriction on the maximum size of RPC messages, or it may be
   stream-oriented like TCP [RFC0793] with no size limit. The client
   and server must agree on their transport protocol choices.

   It is important to point out that RPC does not try to implement any
   kind of reliability and that the application may need to be aware of
   the type of transport protocol underneath RPC. If it knows it is
   running on top of a reliable transport such as TCP, then most of the
   work is already done for it. On the other hand, if it is running on

top of an unreliable transport such as UDP [RFC0768], it must
implement its own time-out, retransmission, and duplicate detection
policies as the RPC protocol does not provide these services.

Because of transport independence, the RPC protocol does not attach
specific semantics to the remote procedures or their execution
requirements. Semantics can be inferred from (but should be
explicitly specified by) the underlying transport protocol. For
example, consider RPC running on top of an unreliable transport such
as UDP. If an application retransmits RPC call messages after time-
outs, and does not receive a reply, it cannot infer anything about
the number of times the procedure was executed. If it does receive a
reply, then it can infer that the procedure was executed at least
once.

A server may wish to remember previously granted requests from a
client and not regrant them, in order to insure some degree of
execute-at-most-once semantics. A server can do this by taking
advantage of the transaction ID that is packaged with every RPC
message. The main use of this transaction ID is by the client RPC
entity in matching replies to calls. However, a client application
may choose to reuse its previous transaction ID when retransmitting a
call. The server may choose to remember this ID after executing a
call and not execute calls with the same ID, in order to achieve some
degree of execute-at-most-once semantics. The server is not allowed
to examine this ID in any other way except as a test for equality.

On the other hand, if using a "reliable" transport such as TCP, the
application can infer from a reply message that the procedure was
executed exactly once, but if it receives no reply message, it cannot
assume that the remote procedure was not executed. Note that even if
a connection-oriented protocol like TCP is used, an application still
needs time-outs and reconnections to handle server crashes.

There are other possibilities for transports besides datagram- or
connection-oriented protocols. For example, a request-reply protocol
such as [VMTP] is perhaps a natural transport for RPC. ONC RPC
currently uses both TCP and UDP transport protocols. Section 11
("Record Marking Standard") describes the mechanism employed by ONC
RPC to utilize a connection-oriented, stream-oriented transport such
as TCP. The mechanism by which future transports having different
structural characteristics should be used to transfer ONC RPC
messages should be specified by means of a Standards Track RFC, once
such additional transports are defined.

6. Binding and Rendezvous Independence

The act of binding a particular client to a particular service and
transport parameters is NOT part of this RPC protocol specification.
This important and necessary function is left up to some higher-level
software.

Implementors could think of the RPC protocol as the jump-subroutine
instruction (JSR) of a network; the loader (binder) makes JSR useful,
and the loader itself uses JSR to accomplish its task. Likewise, the
binding software makes RPC useful, possibly using RPC to accomplish
this task.

7. Authentication

The RPC protocol provides the fields necessary for a client to
identify itself to a service, and vice-versa, in each call and reply
message. Security and access control mechanisms can be built on top
of this message authentication. Several different authentication
protocols can be supported. A field in the RPC header indicates
which protocol is being used. More information on specific
authentication protocols is in Section 8.2, "Authentication,
Integrity and Privacy".

8. RPC Protocol Requirements

The RPC protocol must provide for the following:

o Unique specification of a procedure to be called

o Provisions for matching response messages to request messages

o Provisions for authenticating the caller to service and vice-versa

Besides these requirements, features that detect the following are
worth supporting because of protocol roll-over errors, implementation
bugs, user error, and network administration:

o RPC protocol mismatches

o Remote program protocol version mismatches

o Protocol errors (such as misspecification of a procedure's
   parameters)

o Reasons why remote authentication failed

o Any other reasons why the desired procedure was not called

8.1. RPC Programs and Procedures

   The RPC call message has three unsigned-integer fields -- remote
   program number, remote program version number, and remote procedure
   number -- that uniquely identify the procedure to be called. Program
   numbers are administered by a central authority (IANA). Once
   implementors have a program number, they can implement their remote
   program; the first implementation would most likely have the version
   number 1 but MUST NOT be the number zero. Because most new protocols
   evolve, a "version" field of the call message identifies which
   version of the protocol the caller is using. Version numbers enable
   support of both old and new protocols through the same server
   process.

   The procedure number identifies the procedure to be called. These
   numbers are documented in the specific program's protocol
   specification. For example, a file service's protocol specification
   may state that its procedure number 5 is "read" and procedure number
   12 is "write".

   Just as remote program protocols may change over several versions,
   the actual RPC message protocol could also change. Therefore, the
   call message also has in it the RPC version number, which is always
   equal to 2 for the version of RPC described here.

   The reply message to a request message has enough information to
   distinguish the following error conditions:

   o The remote implementation of RPC does not support protocol version
      2. The lowest and highest supported RPC version numbers are
      returned.

   o The remote program is not available on the remote system.

   o The remote program does not support the requested version number.
      The lowest and highest supported remote program version numbers
      are returned.

   o The requested procedure number does not exist. (This is usually a
      client-side protocol or programming error.)

   o The parameters to the remote procedure appear to be garbage from
      the server's point of view. (Again, this is usually caused by a
      disagreement about the protocol between client and service.)

8.2. Authentication, Integrity, and Privacy

   Provisions for authentication of caller to service and vice-versa are
   provided as a part of the RPC protocol. The call message has two
   authentication fields: the credential and the verifier. The reply
   message has one authentication field: the response verifier. The RPC
   protocol specification defines all three fields to be the following
   opaque type (in the eXternal Data Representation (XDR) language
   [RFC4506]):

```
enum auth_flavor {
    AUTH_NONE       = 0,
    AUTH_SYS        = 1,
    AUTH_SHORT      = 2,
    AUTH_DH         = 3,
    RPCSEC_GSS      = 6
    /* and more to be defined */
};

struct opaque_auth {
    auth_flavor flavor;
    opaque body<400>;
};
```

   In other words, any "opaque_auth" structure is an "auth_flavor"
   enumeration followed by up to 400 bytes that are opaque to
   (uninterpreted by) the RPC protocol implementation.

   The interpretation and semantics of the data contained within the
   authentication fields are specified by individual, independent
   authentication protocol specifications.

   If authentication parameters were rejected, the reply message
   contains information stating why they were rejected.

   As demonstrated by RPCSEC_GSS, it is possible for an "auth_flavor" to
   also support integrity and privacy.

8.3. Program Number Assignment

Program numbers are given out in groups according to the following
chart:

```
0x00000000                  Reserved
0x00000001 - 0x1fffffff     To be assigned by IANA
0x20000000 - 0x3fffffff     Defined by local administrator
                            (some blocks assigned here)
0x40000000 - 0x5fffffff     Transient
0x60000000 - 0x7effffff     Reserved
0x7f000000 - 0x7fffffff     Assignment outstanding
0x80000000 - 0xffffffff     Reserved
```

The first group is a range of numbers administered by IANA and should
be identical for all sites. The second range is for applications
peculiar to a particular site. This range is intended primarily for
debugging new programs. When a site develops an application that
might be of general interest, that application should be given an
assigned number in the first range. Application developers may apply
for blocks of RPC program numbers in the first range by methods
described in Appendix B. The third group is for applications that
generate program numbers dynamically. The final groups are reserved
for future use, and should not be used.

8.4. Other Uses of the RPC Protocol

The intended use of this protocol is for calling remote procedures.
Normally, each call message is matched with a reply message.
However, the protocol itself is a message-passing protocol with which
other (non-procedure-call) protocols can be implemented.

8.4.1. Batching

Batching is useful when a client wishes to send an arbitrarily large
sequence of call messages to a server. Batching typically uses
reliable byte stream protocols (like TCP) for its transport. In the
case of batching, the client never waits for a reply from the server,
and the server does not send replies to batch calls. A sequence of
batch calls is usually terminated by a legitimate remote procedure
call operation in order to flush the pipeline and get positive
acknowledgement.

8.4.2. Broadcast Remote Procedure Calls

   In broadcast protocols, the client sends a broadcast call to the
   network and waits for numerous replies. This requires the use of
   packet-based protocols (like UDP) as its transport protocol. Servers
   that support broadcast protocols usually respond only when the call
   is successfully processed and are silent in the face of errors, but
   this varies with the application.

   The principles of broadcast RPC also apply to multicasting -- an RPC
   request can be sent to a multicast address.

9. The RPC Message Protocol

   This section defines the RPC message protocol in the XDR data
   description language [RFC4506].

```
     enum msg_type {
        CALL  = 0,
        REPLY = 1
     };
```

   A reply to a call message can take on two forms: the message was
   either accepted or rejected.

```
     enum reply_stat {
        MSG_ACCEPTED = 0,
        MSG_DENIED   = 1
     };
```

   Given that a call message was accepted, the following is the status
   of an attempt to call a remote procedure.

```
     enum accept_stat {
        SUCCESS       = 0, /* RPC executed successfully      */
        PROG_UNAVAIL  = 1, /* remote hasn't exported program */
        PROG_MISMATCH = 2, /* remote can't support version # */
        PROC_UNAVAIL  = 3, /* program can't support procedure */
        GARBAGE_ARGS  = 4, /* procedure can't decode params  */
        SYSTEM_ERR    = 5  /* e.g. memory allocation failure */
     };
```

   Reasons why a call message was rejected:

```
     enum reject_stat {
        RPC_MISMATCH = 0, /* RPC version number != 2       */
        AUTH_ERROR = 1    /* remote can't authenticate caller */
     };
```

Why authentication failed:

```
enum auth_stat {
    AUTH_OK          = 0,  /* success                           */
    /*
     * failed at remote end
     */
    AUTH_BADCRED     = 1,  /* bad credential (seal broken)   */
    AUTH_REJECTEDCRED = 2,  /* client must begin new session  */
    AUTH_BADVERF     = 3,  /* bad verifier (seal broken)     */
    AUTH_REJECTEDVERF = 4,  /* verifier expired or replayed   */
    AUTH_TOOWEAK     = 5,  /* rejected for security reasons  */
    /*
     * failed locally
     */
    AUTH_INVALIDRESP = 6,  /* bogus response verifier        */
    AUTH_FAILED      = 7,  /* reason unknown                 */
    /*
     * AUTH_KERB errors; deprecated.  See [RFC2695]
     */
    AUTH_KERB_GENERIC = 8,  /* kerberos generic error */
    AUTH_TIMEEXPIRE = 9,    /* time of credential expired */
    AUTH_TKT_FILE = 10,     /* problem with ticket file */
    AUTH_DECODE = 11,       /* can't decode authenticator */
    AUTH_NET_ADDR = 12,     /* wrong net address in ticket */
    /*
     * RPCSEC_GSS GSS related errors
     */
    RPCSEC_GSS_CREDPROBLEM = 13, /* no credentials for user */
    RPCSEC_GSS_CTXPROBLEM = 14   /* problem with context */
};
```

As new authentication mechanisms are added, there may be a need for
more status codes to support them. IANA will hand out new auth_stat
numbers on a simple First Come First Served basis as defined in the
"IANA Considerations" and Appendix B.

The RPC message:

All messages start with a transaction identifier, xid, followed by a
two-armed discriminated union. The union's discriminant is a
msg_type that switches to one of the two types of the message. The
xid of a REPLY message always matches that of the initiating CALL
message. NB: The "xid" field is only used for clients matching reply
messages with call messages or for servers detecting retransmissions;
the service side cannot treat this id as any type of sequence number.

```
struct rpc_msg {
   unsigned int xid;
   union switch (msg_type mtype) {
   case CALL:
      call_body cbody;
   case REPLY:
      reply_body rbody;
   } body;
};
```

Body of an RPC call:

In version 2 of the RPC protocol specification, rpcvers MUST be equal
to 2. The fields "prog", "vers", and "proc" specify the remote
program, its version number, and the procedure within the remote
program to be called. After these fields are two authentication
parameters: cred (authentication credential) and verf (authentication
verifier). The two authentication parameters are followed by the
parameters to the remote procedure, which are specified by the
specific program protocol.

The purpose of the authentication verifier is to validate the
authentication credential. Note that these two items are
historically separate, but are always used together as one logical
entity.

```
struct call_body {
   unsigned int rpcvers;        /* must be equal to two (2) */
   unsigned int prog;
   unsigned int vers;
   unsigned int proc;
   opaque_auth cred;
   opaque_auth verf;
   /* procedure-specific parameters start here */
};
```

Body of a reply to an RPC call:

```
union reply_body switch (reply_stat stat) {
case MSG_ACCEPTED:
   accepted_reply areply;
case MSG_DENIED:
   rejected_reply rreply;
} reply;
```

Reply to an RPC call that was accepted by the server:

There could be an error even though the call was accepted. The first
field is an authentication verifier that the server generates in
order to validate itself to the client. It is followed by a union
whose discriminant is an enum accept_stat. The SUCCESS arm of the
union is protocol-specific. The PROG_UNAVAIL, PROC_UNAVAIL,
GARBAGE_ARGS, and SYSTEM_ERR arms of the union are void. The
PROG_MISMATCH arm specifies the lowest and highest version numbers of
the remote program supported by the server.

```
struct accepted_reply {
    opaque_auth verf;
    union switch (accept_stat stat) {
    case SUCCESS:
        opaque results[0];
       /*
        * procedure-specific results start here
        */
     case PROG_MISMATCH:
        struct {
            unsigned int low;
            unsigned int high;
        } mismatch_info;
     default:
        /*
         * Void.  Cases include PROG_UNAVAIL, PROC_UNAVAIL,
         * GARBAGE_ARGS, and SYSTEM_ERR.
         */
        void;
    } reply_data;
};
```

Reply to an RPC call that was rejected by the server:

The call can be rejected for two reasons: either the server is not
running a compatible version of the RPC protocol (RPC_MISMATCH) or
the server rejects the identity of the caller (AUTH_ERROR). In case
of an RPC version mismatch, the server returns the lowest and highest
supported RPC version numbers. In case of invalid authentication,
failure status is returned.

```
        union rejected_reply switch (reject_stat stat) {
        case RPC_MISMATCH:
           struct {
              unsigned int low;
              unsigned int high;
           } mismatch_info;
        case AUTH_ERROR:
           auth_stat stat;
        };
```

10. Authentication Protocols

   As previously stated, authentication parameters are opaque, but
   open-ended to the rest of the RPC protocol. This section defines two
   standard flavors of authentication. Implementors are free to invent
   new authentication types, with the same rules of flavor number
   assignment as there are for program number assignment. The flavor of
   a credential or verifier refers to the value of the "flavor" field in
   the opaque_auth structure. Flavor numbers, like RPC program numbers,
   are also administered centrally, and developers may assign new flavor
   numbers by methods described in Appendix B. Credentials and
   verifiers are represented as variable-length opaque data (the "body"
   field in the opaque_auth structure).

   In this document, two flavors of authentication are described. Of
   these, Null authentication (described in the next subsection) is
   mandatory -- it MUST be available in all implementations. System
   authentication (AUTH_SYS) is described in Appendix A. Implementors
   MAY include AUTH_SYS in their implementations to support existing
   applications. See "Security Considerations" for information about
   other, more secure, authentication flavors.

10.1. Null Authentication

   Often, calls must be made where the client does not care about its
   identity or the server does not care who the client is. In this
   case, the flavor of the RPC message's credential, verifier, and reply
   verifier is "AUTH_NONE". Opaque data associated with "AUTH_NONE" is
   undefined. It is recommended that the length of the opaque data be
   zero.

11. Record Marking Standard

When RPC messages are passed on top of a byte stream transport
protocol (like TCP), it is necessary to delimit one message from
another in order to detect and possibly recover from protocol errors.
This is called record marking (RM). One RPC message fits into one RM
record.

A record is composed of one or more record fragments. A record
fragment is a four-byte header followed by 0 to (2**31) - 1 bytes of
fragment data. The bytes encode an unsigned binary number; as with
XDR integers, the byte order is from highest to lowest. The number
encodes two values -- a boolean that indicates whether the fragment
is the last fragment of the record (bit value 1 implies the fragment
is the last fragment) and a 31-bit unsigned binary value that is the
length in bytes of the fragment's data. The boolean value is the
highest-order bit of the header; the length is the 31 low-order bits.
(Note that this record specification is NOT in XDR standard form!)

12. The RPC Language

Just as there was a need to describe the XDR data-types in a formal
language, there is also need to describe the procedures that operate
on these XDR data-types in a formal language as well. The RPC
language is an extension to the XDR language, with the addition of
"program", "procedure", and "version" declarations. The keywords
"program" and "version" are reserved in the RPC language, and
implementations of XDR compilers MAY reserve these keywords even when
provided with pure XDR, non-RPC, descriptions. The following example
is used to describe the essence of the language.

12.1. An Example Service Described in the RPC Language

   Here is an example of the specification of a simple ping program.

```
     program PING_PROG {
           /*
            * Latest and greatest version
            */
           version PING_VERS_PINGBACK {
              void
              PINGPROC_NULL(void) = 0;
              /*
               * Ping the client, return the round-trip time
               * (in microseconds).  Returns -1 if the operation
               * timed out.
               */
              int
              PINGPROC_PINGBACK(void) = 1;
           } = 2;

           /*
            * Original version
            */
           version PING_VERS_ORIG {
              void
              PINGPROC_NULL(void) = 0;
           } = 1;
        } = 1;

        const PING_VERS = 2;      /* latest version */
```

   The first version described is PING_VERS_PINGBACK with two
   procedures: PINGPROC_NULL and PINGPROC_PINGBACK. PINGPROC_NULL takes
   no arguments and returns no results, but it is useful for computing
   round-trip times from the client to the server and back again. By
   convention, procedure 0 of any RPC protocol should have the same
   semantics and never require any kind of authentication. The second
   procedure is used for the client to have the server do a reverse ping
   operation back to the client, and it returns the amount of time (in
   microseconds) that the operation used. The next version,
   PING_VERS_ORIG, is the original version of the protocol, and it does
   not contain the PINGPROC_PINGBACK procedure. It is useful for
   compatibility with old client programs, and as this program matures,
   it may be dropped from the protocol entirely.

12.2. The RPC Language Specification

   The RPC language is identical to the XDR language defined in RFC
   4506, except for the added definition of a "program-def", described
   below.

      program-def:
         "program" identifier "{"
            version-def
            version-def *
      "}" "=" constant ";"

      version-def:
         "version" identifier "{"
            procedure-def
            procedure-def *
      "}" "=" constant ";"

      procedure-def:
         proc-return identifier "(" proc-firstarg
            ("," type-specifier)* ")" "=" constant ";"

      proc-return: "void" | type-specifier

      proc-firstarg: "void" | type-specifier

12.3. Syntax Notes

   o The following keywords are added and cannot be used as
      identifiers: "program" and "version".

   o A version name cannot occur more than once within the scope of a
      program definition. Neither can a version number occur more than
      once within the scope of a program definition.

   o A procedure name cannot occur more than once within the scope of a
      version definition. Neither can a procedure number occur more
      than once within the scope of version definition.

   o Program identifiers are in the same name space as constant and
      type identifiers.

   o Only unsigned constants can be assigned to programs, versions, and
      procedures.

   o Current RPC language compilers do not generally support more than
      one type-specifier in procedure argument lists; the usual practice
      is to wrap arguments into a structure.

13. IANA Considerations

   The assignment of RPC program numbers, authentication flavor numbers,
   and authentication status numbers has in the past been performed by
   Sun Microsystems, Inc (Sun). This is inappropriate for an IETF
   Standards Track protocol, as such work is done well by the Internet
   Assigned Numbers Authority (IANA). This document proposes the
   transfer of authority over RPC program numbers, authentication flavor
   numbers, and authentication status numbers described here from Sun
   Microsystems, Inc. to IANA and describes how IANA will maintain and
   assign these numbers. Users of RPC protocols will benefit by having
   an independent body responsible for these number assignments.

13.1. Numbering Requests to IANA

   Appendix B of this document describes the information to be sent to
   IANA to request one or more RPC numbers and the rules that apply.
   IANA will store the request for documentary purposes and put the
   following information into the public registry:

   o The short description of purpose and use

   o The program number(s) assigned

   o The short identifier string(s)

13.2. Protecting Past Assignments

   Sun has made assignments in both the RPC program number space and the
   RPC authentication flavor number space since the original deployment
   of RPC. The assignments made by Sun Microsystems are still valid,
   and will be preserved. Sun has communicated all current assignments
   in both number spaces to IANA and final handoff of number assignment
   is complete. Current program and auth number assignments are
   provided in Appendix C. Current authentication status numbers are
   listed in Section 9 of this document in the "enum auth_stat"
   definition.

13.3. RPC Number Assignment

   Future IANA practice will deal with the following partitioning of the
   32-bit number space as listed in Section 8.3. Detailed information
   for the administration of the partitioned blocks in Section 8.3 is
   given below.

13.3.1. To Be Assigned By IANA

The first block will be administered by IANA, with previous
assignments by Sun protected. Previous assignments were restricted
to the range decimal 100000-399999 (0x000186a0 to 0x00061a7f);
therefore, IANA will begin assignments at decimal 400000. Individual
numbers should be grated on a First Come First Served basis, and
blocks should be granted under rules related to the size of the
block.

13.3.2. Defined by Local Administrator

The "Defined by local administrator" block is available for any local
administrative domain to use, in a similar manner to IP address
ranges reserved for private use. The expected use would be through
the establishment of a local domain "authority" for assigning numbers
from this range. This authority would establish any policies or
procedures to be used within that local domain for use or assignment
of RPC numbers from the range. The local domain should be
sufficiently isolated that it would be unlikely that RPC applications
developed by other local domains could communicate with the domain.
This could result in RPC number contention, which would cause one of
the applications to fail. In the absence of a local administrator,
this block can be utilized in a "Private Use" manner per [RFC5226].

13.3.3. Transient Block

The "Transient" block can be used by any RPC application on an "as
available" basis. This range is intended for services that can
communicate a dynamically selected RPC program number to clients of
the service. Any mechanism can be used to communicate the number.
For example, either shared memory when the client and server are
located on the same system or a network message (either RPC or
otherwise) that disseminates the selected number can be used.

The transient block is not administered. An RPC service uses this
range by selecting a number in the transient range and attempting to
register that number with the local system's RPC bindery (see the
RPCBPROC_SET or PMAPPROC_SET procedures in "Binding Protocols for ONC
RPC Version 2", [RFC1833]). If successful, no other RPC service was
using that number and the RPC Bindery has assigned that number to the
requesting RPC application. The registration is valid until the RPC
Bindery terminates, which normally would only happen if the system
reboots, causing all applications, including the RPC service using
the transient number, to terminate. If the transient number
registration fails, another RPC application is using the number and

the requestor must select another number and try again. To avoid
conflicts, the recommended method is to select a number randomly from
the transient range.

13.3.4. Reserved Block

The "Reserved" blocks are available for future use. RPC applications
must not use numbers in these ranges unless their use is allowed by
future action by the IESG.

13.3.5. RPC Number Sub-Blocks

RPC numbers are usually assigned for specific RPC services. Some
applications, however, require multiple RPC numbers for a service.
The most common example is an RPC service that needs to have multiple
instances of the service active simultaneously at a specific site.
RPC does not have an "instance identifier" in the protocol, so either
a mechanism must be implemented to multiplex RPC requests amongst
various instances of the service or unique RPC numbers must be used
by each instance.

In these cases, the RPC protocol used with the various numbers may be
different or the same. The numbers may either be assigned
dynamically by the application, or as part of a site-specific
administrative decision. If possible, RPC services that dynamically
assign RPC numbers should use the "Transient" RPC number block
defined in Section 13.3.3. If not possible, RPC number sub-blocks
may be requested.

Assignment of RPC Number Sub-Blocks is controlled by the size of the
sub-block being requested. "Specification Required" and "IESG
Approval" are used as defined by Section 4.1 of [RFC5226].

Size of sub-block	Assignment Method	Authority
Up to 100 numbers	First Come First Served	IANA
Up to 1000 numbers	Specification Required	IANA
More than 1000 numbers	IESG Approval required	IESG

Note: sub-blocks can be any size. The limits given above are
maximums, and smaller size sub-blocks are allowed.

Sub-blocks sized up to 100 numbers may be assigned by IANA on a First
Come First Served basis. The RPC Service Description included in the
range must include an indication of how the sub-block is managed. At
a minimum, the statement should indicate whether the sub-block is

used with a single RPC protocol or multiple RPC protocols, and
whether the numbers are dynamically assigned or statically (through
administrative action) assigned.

Sub-blocks of up to 1000 numbers must be documented in detail. The
documentation must describe the RPC protocol or protocols that are to
be used in the range. It must also describe how the numbers within
the sub-block are to be assigned or used.

Sub-blocks sized over 1000 numbers must be documented as described
above, and the assignment must be approved by the IESG. It is
expected that this will be rare.

In order to avoid multiple requests of large blocks of numbers, the
following rule is proposed.

Requests up to and including 100 RPC numbers are handled via the
First Come First Served assignment method. This 100 number threshold
applies to the total number of RPC numbers assigned to an individual
or entity. For example, if an individual or entity first requests,
say, 70 numbers, and then later requests 40 numbers, then the request
for the 40 numbers will be assigned via the Specification Required
method. As long as the total number of numbers assigned does not
exceed 1000, IANA is free to waive the Specification Required
assignment for incremental requests of less than 100 numbers.

If an individual or entity has under 1000 numbers and later requests
an additional set of numbers such that the individual or entity would
be granted over 1000 numbers, then the additional request will
require IESG Approval.

13.4. RPC Authentication Flavor Number Assignment

The second number space is the authentication mechanism identifier,
or "flavor", number. This number is used to distinguish between
various authentication mechanisms that can be optionally used with an
RPC message. An authentication identifier is used in the "flavor"
field of the "opaque_auth" structure.

13.4.1. Assignment Policy

Appendix B of this document describes the information to be sent to
IANA to request one or more RPC auth numbers and the rules that
apply. IANA will store the request for documentary purposes and put
the following information into the public registry:

o The short identifier string(s)

o The auth number(s) assigned

o The short description of purpose and use

13.4.2. Auth Flavors vs. Pseudo-Flavors

   Recent progress in RPC security has moved away from new auth flavors
   as used by AUTH_DH [DH], and has focused on using the existing
   RPCSEC_GSS [RFC2203] flavor and inventing novel GSS-API (Generic
   Security Services Application Programming Interface) mechanisms that
   can be used with it. Even though RPCSEC_GSS is an assigned
   authentication flavor, use of a new RPCSEC_GSS mechanism with the
   Network File System (NFS) ([RFC1094] [RFC1813], and [RFC3530]) will
   require the registration of 'pseudo-flavors' that are used to
   negotiate security mechanisms in an unambiguous way, as defined by
   [RFC2623]. Existing pseudo-flavors have been granted in the decimal
   range 390000-390255. New pseudo-flavor requests will be granted by
   IANA within this block on a First Come First Served basis.

   For non-pseudo-flavor requests, IANA will begin granting RPC
   authentication flavor numbers at 400000 on a First Come First Served
   basis to avoid conflicts with currently granted numbers.

   For authentication flavors or RPCSEC_GSS mechanisms to be used on the
   Internet, it is strongly advised that an Informational or Standards
   Track RFC be published describing the authentication mechanism
   behaviour and parameters.

13.5. Authentication Status Number Assignment

   The final number space is the authentication status or "auth_stat"
   values that describe the nature of a problem found during an attempt
   to authenticate or validate authentication. The complete initial
   list of these values is found in Section 9 of this document, in the
   "auth_stat" enum listing. It is expected that it will be rare to add
   values, but that a small number of new values may be added from time
   to time as new authentication flavors introduce new possibilities.
   Numbers should be granted on a First Come First Served basis to avoid
   conflicts with currently granted numbers.

13.5.1. Assignment Policy

   Appendix B of this document describes the information to be sent to
   IANA to request one or more auth_stat values and the rules that
   apply. IANA will store the request for documentary purposes, and put
   the following information into the public registry:

   o The short identifier string(s)

   o The auth_stat number(s) assigned

   o The short description of purpose and use

14. Security Considerations

   AUTH_SYS as described in Appendix A is known to be insecure due to
   the lack of a verifier to permit the credential to be validated.
   AUTH_SYS SHOULD NOT be used for services that permit clients to
   modify data. AUTH_SYS MUST NOT be specified as RECOMMENDED or
   REQUIRED for any Standards Track RPC service.

   AUTH_DH as mentioned in Sections 8.2 and 13.4.2 is considered
   obsolete and insecure; see [RFC2695]. AUTH_DH SHOULD NOT be used for
   services that permit clients to modify data. AUTH_DH MUST NOT be
   specified as RECOMMENDED or REQUIRED for any Standards Track RPC
   service.

   [RFC2203] defines a new security flavor, RPCSEC_GSS, which permits
   GSS-API [RFC2743] mechanisms to be used for securing RPC. All non-
   trivial RPC programs developed in the future should implement
   RPCSEC_GSS-based security appropriately. [RFC2623] describes how
   this was done for a widely deployed RPC program.

   Standards Track RPC services MUST mandate support for RPCSEC_GSS, and
   MUST mandate support for an authentication pseudo-flavor with
   appropriate levels of security, depending on the need for simple
   authentication, integrity (a.k.a. non-repudiation), or data privacy.

Appendix A: System Authentication

   The client may wish to identify itself, for example, as it is
   identified on a UNIX(tm) system. The flavor of the client credential
   is "AUTH_SYS". The opaque data constituting the credential encodes
   the following structure:

```
         struct authsys_parms {
            unsigned int stamp;
            string machinename<255>;
            unsigned int uid;
            unsigned int gid;
            unsigned int gids<16>;
         };
```

   The "stamp" is an arbitrary ID that the caller machine may generate.
   The "machinename" is the name of the caller's machine (like
   "krypton"). The "uid" is the caller's effective user ID. The "gid"
   is the caller's effective group ID. "gids" are a counted array of
   groups that contain the caller as a member. The verifier
   accompanying the credential should have "AUTH_NONE" flavor value
   (defined above). Note that this credential is only unique within a
   particular domain of machine names, uids, and gids.

   The flavor value of the verifier received in the reply message from
   the server may be "AUTH_NONE" or "AUTH_SHORT". In the case of
   "AUTH_SHORT", the bytes of the reply verifier's string encode an
   opaque structure. This new opaque structure may now be passed to the
   server instead of the original "AUTH_SYS" flavor credential. The
   server may keep a cache that maps shorthand opaque structures (passed
   back by way of an "AUTH_SHORT" style reply verifier) to the original
   credentials of the caller. The caller can save network bandwidth and
   server cpu cycles by using the shorthand credential.

   The server may flush the shorthand opaque structure at any time. If
   this happens, the remote procedure call message will be rejected due
   to an authentication error. The reason for the failure will be
   "AUTH_REJECTEDCRED". At this point, the client may wish to try the
   original "AUTH_SYS" style of credential.

   It should be noted that use of this flavor of authentication does not
   guarantee any security for the users or providers of a service, in
   itself. The authentication provided by this scheme can be considered
   legitimate only when applications using this scheme and the network
   can be secured externally, and privileged transport addresses are
   used for the communicating end-points (an example of this is the use
   of privileged TCP/UDP ports in UNIX systems -- note that not all
   systems enforce privileged transport address mechanisms).

Appendix B: Requesting RPC-Related Numbers from IANA

   RPC program numbers, authentication flavor numbers, and
   authentication status numbers that must be unique across all networks
   are assigned by the Internet Assigned Number Authority. To apply for
   a single number or a block of numbers, electronic mail must be sent
   to IANA <iana@iana.org> with the following information:

   o The type of number(s) (program number or authentication flavor
      number or authentication status number) sought

   o How many numbers are sought

   o The name of the person or company that will use the number

   o An "identifier string" that associates the number with a service

   o Email address of the contact person for the service that will be
      using the number

   o A short description of the purpose and use of the number

   o If an authentication flavor number is sought, and the number will
      be a 'pseudo-flavor' intended for use with RPCSEC_GSS and NFS,
      mappings analogous to those in Section 4.2 of [RFC2623]

   Specific numbers cannot be requested. Numbers are assigned on a
   First Come First Served basis.

   For all RPC authentication flavor and authentication status numbers
   to be used on the Internet, it is strongly advised that an
   Informational or Standards Track RFC be published describing the
   authentication mechanism behaviour and parameters.

Appendix C: Current Number Assignments

```
    #
    # Sun-assigned RPC numbers
    #
    # Description/Owner         RPC Program Number         Short Name
    # --------------------------------------------------------------------
    portmapper                      100000      pmapprog portmap rpcbind
    remote stats                    100001      rstatprog
    remote users                    100002      rusersprog
    nfs                             100003      nfs
    yellow pages (NIS)              100004      ypprog ypserv
    mount demon                     100005      mountprog
    remote dbx                      100006      dbxprog
    yp binder (NIS)                 100007      ypbindprog ypbind
    shutdown msg                    100008      wall
    yppasswd server                 100009      yppasswdprog yppasswdd
    ether stats                     100010      etherstatprog
    disk quotas                     100011      rquota
    spray packets                   100012      spray
    3270 mapper                     100013      ibm3270prog
    RJE mapper                      100014      ibmrjeprog
    selection service               100015      selnsvcprog
    remote database access          100016      rdatabaseprog
    remote execution                100017      rexec
    Alice Office Automation         100018      aliceprog
    scheduling service              100019      schedprog
    local lock manager              100020      lockprog llockmgr
    network lock manager            100021      netlockprog nlockmgr
    x.25 inr protocol               100022      x25prog
    status monitor 1                100023      statmon1
    status monitor 2                100024      statmon2
    selection library               100025      selnlibprog
    boot parameters service         100026      bootparam
    mazewars game                   100027      mazeprog
    yp update (NIS)                 100028      ypupdateprog ypupdate
    key server                      100029      keyserveprog
    secure login                    100030      securecmdprog
    nfs net forwarder init          100031      netfwdiprog
    nfs net forwarder trans         100032      netfwdtprog
    sunlink MAP                     100033      sunlinkmap
    network monitor                 100034      netmonprog
    lightweight database            100035      dbaseprog
    password authorization          100036      pwdauthprog
    translucent file svc            100037      tfsprog
    nse server                      100038      nseprog
    nse activate daemon             100039      nse_activate_prog
    sunview help                    100040      sunview_help_prog
```

```
   pnp install                          100041    pnp_prog
   ip addr allocator                    100042    ipaddr_alloc_prog
   show filehandle                      100043    filehandle
   MVS NFS mount                        100044    mvsnfsprog
   remote user file operations          100045    rem_fileop_user_prog
   batched ypupdate                     100046    batch_ypupdateprog
   network execution mgr                100047    nem_prog
   raytrace/mandelbrot remote daemon    100048    raytrace_rd_prog
   raytrace/mandelbrot local daemon     100049    raytrace_ld_prog
   remote group file operations         100050    rem_fileop_group_prog
   remote system file operations        100051    rem_fileop_system_prog
   remote system role operations        100052    rem_system_role_prog
   gpd lego fb simulator                100053    [unknown]
   gpd simulator interface              100054    [unknown]
   ioadmd                               100055    ioadmd
   filemerge                            100056    filemerge_prog
   Name Binding Program                 100057    namebind_prog
   sunlink NJE                          100058    njeprog
   MVSNFS get attribute service         100059    mvsattrprog
   SunAccess/SunLink resource manager   100060    rmgrprog
   UID allocation service               100061    uidallocprog
   license broker                       100062    lbserverprog
   NETlicense client binder             100063    lbbinderprog
   GID allocation service               100064    gidallocprog
   SunIsam                              100065    sunisamprog
   Remote Debug Server                  100066    rdbsrvprog
   Network Directory Daemon             100067    [unknown]
   Network Calendar Program             100068    cmsd cm
   ypxfrd                               100069    ypxfrd
   rpc.timed                            100070    timedprog
   bugtraqd                             100071    bugtraqd
                                        100072    [unknown]

   Connectathon Billboard - NFS         100073    [unknown]
   Connectathon Billboard - X           100074    [unknown]
   Sun tool for scheduling rooms        100075    schedroom
   Authentication Negotiation           100076    authnegotiate_prog
   Database manipulation                100077    attribute_prog
   Kerberos authentication daemon       100078    kerbprog
   Internal testing product (no name)   100079    [unknown]
   Sun Consulting Special               100080    autodump_prog
   Event protocol                       100081    event_svc
   bugtraq_qd                           100082    bugtraq_qd
   ToolTalk and Link Service Project    100083    database_service
   Consulting Services                  100084    [unknown]
   Consulting Services                  100085    [unknown]
   Consulting Services                  100086    [unknown]
   Jupiter Administration               100087    adm_agent admind
                                        100088    [unknown]
```

```
                                     100089    [unknown]
   Dual Disk support                 100090    libdsd/dsd
   DocViewer 1.1                     100091    [unknown]
   ToolTalk                          100092    remote_activation_svc
   Consulting Services               100093    host_checking
   SNA peer-to-peer                  100094    [unknown]
   Roger Riggs                       100095    searchit
   Robert Allen                      100096    mesgtool
   SNA                               100097    [unknown]
   SISU                              100098    networked version of CS5
   NFS Automount File System         100099    autofs
                                     100100    msgboard
   event dispatching agent [eventd]  100101    netmgt_eventd_prog
   statistics/event logger [netlogd] 100102    netmgt_netlogd_prog
   topology display manager [topology]100103   netmgt_topology_prog
   syncstat agent [syncstatd]        100104    netmgt_syncstatd_prog
   ip packet stats agent [ippktd]    100105    netmgt_ippktd_prog
   netmgt config agent [configd]     100106    netmgt_configd_prog
   restat agent [restatd]            100107    netmgt_restatd_prog
   lpq agent [lprstatd]              100108    netmgt_lprstatd_prog
   netmgt activity agent [mgtlogd]   100109    netmgt_mgtlogd_prog
   proxy DECnet NCP agent [proxydni] 100110    netmgt_proxydni_prog
   topology mapper agent [mapperd]   100111    netmgt_mapperd_prog
   netstat agent [netstatd]          100112    netmgt_netstatd_prog
   sample netmgt agent [sampled]     100113    netmgt_sampled_prog
   X.25 statistics agent [vcstatd]   100114    netmgt_vcstatd_prog
   Frame Relay                       100128    [unknown]
   PPP agent                         100129    [unknown]
   localhad                          100130    rpc.localhad
   layers2                           100131    na.layers2
   token ring agent                  100132    na.tr
   related to lockd and statd        100133    nsm_addr
   Kerberos project                  100134    kwarn
   ertherif2                         100135    na.etherif2
   hostmem2                          100136    na.hostmem2
   iostat2                           100137    na.iostat2
   snmpv2                            100138    na.snmpv2
   Cooperative Console               100139    cc_sender
   na.cpustat                        100140    na.cpustat
   Sun Cluster SC3.0                 100141    rgmd_receptionist
                                     100142    fed
   Network Storage                   100143    rdc
   Sun Cluster products              100144    nafo
   SunCluster 3.0                    100145    scadmd
   ASN.1                             100146    amiserv
                                     100147    amiaux # BER and DER
                                                encode and decode
   Delegate Management Server        100148    dm
```

```
                                      100149     rkstat
                                      100150     ocfserv
                                      100151     sccheckd
                                      100152     autoclientd
                                      100153     sunvts
                                      100154     ssmond
                                      100155     smserverd
                                      100156     test1
                                      100157     test2
                                      100158     test3
                                      100159     test4
                                      100160     test5
                                      100161     test6
                                      100162     test7
                                      100163     test8
                                      100164     test9
                                      100165     test10
                                      100166     nfsmapid
                                      100167     SUN_WBEM_C_CIMON_HANDLE
                                      100168     sacmmd
                                      100169     fmd_adm
                                      100170     fmd_api
                                      100171     [unknown]
                                      100172     idmapd
      unassigned                      100173 - 100174
      snmptrap                        100175     na.snmptrap
      unassigned                      100176-100199

      unassigned                      100200
      MVS/NFS Memory usage stats server 100201   [unknown]
      Netapp                          100202-100207
      unassigned                      100208-100210
      8.0 SunLink SNA RJE             100211     [unknown]
      8.0 SunLink SNA RJE             100212     [unknown]
                                      100213     ShowMe
                                      100214     [unknown]
                                      100215     [unknown]
      AUTH_RSA Key service            100216     keyrsa
      SunSelect PC license service    100217     [unknown]
      WWCS (Corporate)                100218     sunsolve
                                      100219     cstatd
      X/Open Federated Naming         100220     xfn_server_prog
      Kodak Color Management System   100221     kcs_network_io kcs
      HA-DBMS                         100222     ha_dbms_serv
                                      100223-100225   [unknown]
                                      100226     hafaultd
      NFS ACL Service                 100227     nfs_acl
      distributed lock manager        100228     dlmd
```

```
                       100229    metad
                       100230    metamhd
                       100231    nfsauth
                       100232    sadmind
                       100233    ufsd
                       100234    grpservd
                       100235    cachefsd
                       100236    msmprog Media_Server
                       100237    ihnamed
                       100238    ihnetd
                       100239    ihsecured
                       100240    ihclassmgrd
                       100241    ihrepositoryd
                       100242    metamedd rpc.metamedd
                       100243    contentmanager cm
                       100244    symon
                       100245    pld genesil
                       100246    ctid
                            cluster_transport_interface
                       100247    ccd
                            cluster_configuration_db
                       100248    pmfd
                       100249    dmi2_client
                       100250    mfs_admin
                       100251    ndshared_unlink
                       100252    ndshared_touch
                       100253    ndshared_slink
                       100254    cbs control_board_server
                       100255    skiserv
                       100256    nfsxa nfsxattr
                       100257    ndshared_disable
                       100258    ndshared_enable
                       100259    sms_account_admin
                       100260    sms_modem_admin
                       100261    sms_r_login
                       100262    sms_r_subaccount_mgt
                       100263    sms_service_admin
                       100264    session_admin
                       100265    canci_ancs_program
                       100266    canci_sms_program
                       100267    msmp
                       100268    halck
                       100269    halogmsg
                       100270    nfs_id_map
                       100271    ncall
                       100272    hmip
                       100273    repl_mig
                       100274    repl_mig_cb
```

```
   NIS+                                 100300    nisplus
   NIS+                                 100301    nis_cachemgr
   NIS+ call back protocol              100302    [unknown]
   NIS+ Password Update Daemon          100303    nispasswdd
   FNS context update in NIS            100304    fnsypd
                                        100305    [unknown]
                                        100306    [unknown]
                                        100307    [unknown]
                                        100308    [unknown]
                                        100309    [unknown]
   unassigned                           100310 - 100398
   nfscksum                             100399    nfscksum
   network utilization agent            100400    netmgt_netu_prog
   network rpc ping agent               100401    netmgt_rping_prog
                                        100402    na.shell
   picsprint                            100403    na.picslp
                                        100404    traps
                                        100405 - 100409 [unknown]
                                        100410    jdsagent
                                        100411    na.haconfig
                                        100412    na.halhost
                                        100413    na.hadtsrvc
                                        100414    na.hamdstat
                                        100415    na.neoadmin
                                        100416    ex1048prog
   rdmaconfig                           100417    rpc.rdmaconfig
   IETF NFSv4 Working Group - FedFS     100418 - 100421
                                        100422    mdcommd
                                        100423    kiprop krb5_iprop
                                        100424    stsf
   unassigned                           100425 - 100499
   Sun Microsystems                     100500 - 100531 [unknown]
                                        100532    ucmmstate
                                        100533    scrcmd
   unassigned                           100534 - 100999
   nse link daemon                      101002    nselinktool
   nse link application                 101003    nselinkapp
   unassigned                           101004 - 101900
                                        101901    [unknown]
   unassigned                           101902 - 101999
   AssetLite                            102000    [unknown]
   PagerTool                            102001    [unknown]
   Discover                             102002    [unknown]
   unassigned                           102003 - 105000
   ShowMe                               105001    sharedapp
   Registry                             105002    REGISTRY_PROG
   Print-server                         105003    print-server
   Proto-server                         105004    proto-server
```

```
   Notification-server               105005    notification-server
   Transfer-agent-server             105006    transfer-agent-server
   unassigned                        105007 - 110000
                                     110001    tsolrpcb
                                     110002    tsolpeerinfo
                                     110003    tsolboot
                                     120001    cmip na.cmip
                                     120002    na.osidiscover
                                     120003    cmiptrap
   unassigned                        120004 - 120099
                                     120100    eserver
                                     120101    repserver
                                     120102    swserver
                                     120103    dmd
                                     120104    ca
   unassigned                        120105 - 120125
                                     120126    nf_fddi
                                     120127    nf_fddismt7_2
   unassigned                        120128 - 150000
   pc passwd authorization           150001    pcnfsdprog
   TOPS name mapping                 150002    [unknown]
   TOPS external attribute storage   150003    [unknown]
   TOPS hierarchical file system     150004    [unknown]
   TOPS NFS transparency extensions  150005    [unknown]
   PC NFS License                    150006    pcnfslicense
   RDA                               150007    rdaprog
   WabiServer                        150008    wsprog
   WabiServer                        150009    wsrlprog
   unassigned                        150010 - 160000
                                     160001    nihon-cm
                                     160002    nihon-ce
   unassigned                        160003 - 170099
                                     170100    domf_daemon0
                                     170101    domf_daemon1
                                     170102    domf_daemon2
                                     170103    domf_daemon3
                                     170104    domf_daemon4
                                     170105    domf_daemon5
   unassigned                        170106 - 179999
                                     180000    cecprog
                                     180001    cecsysprog
                                     180002    cec2cecprog
                                     180003    cesprog
                                     180004    ces2cesprog
                                     180005    cet2cetprog
                                     180006    cet2cetdoneprog
                                     180007    cetcomprog
                                     180008    cetsysprog
```

```
                         180009      cghapresenceprog
                         180010      cgdmsyncprog
                         180011      cgdmcnscliprog
                         180012      cgdmcrcscliprog
                         180013      cgdmcrcssvcproG
                         180014      chmprog
                         180015      chmsysprog
                         180016      crcsapiprog
                         180017      ckptmprog
                         180018      crimcomponentprog
                         180019      crimqueryprog
                         180020      crimsecondaryprog
                         180021      crimservicesprog
                         180022      crimsyscomponentprog
                         180023      crimsysservicesprog
                         180024      csmagtapiprog
                         180025      csmagtcallbackprog
                         180026      csmreplicaprog
                         180027      csmsrvprog
                         180028      cssccltprog
                         180029      csscsvrprog
                         180030      csscopresultprog
         unassigned      180031 - 199999
                         200000      pyramid_nfs
                         200001      pyramid_reserved
                         200002      cadds_image
                         200003      stellar_name_prog
                         200004      [unknown]
                         200005      [unknown]
                         200006      pacl
                         200007      lookupids
                         200008      ax_statd_prog
                         200009      ax_statd2_prog
                         200010      edm
                         200011      dtedirwd
                         200012      [unknown]
                         200013      [unknown]
                         200014      [unknown]
                         200015      [unknown]
                         200016      easerpcd
                         200017      rlxnfs
                         200018      sascuiddprog
                         200019      knfsd
                         200020      ftnfsd ftnfsd_program
                         200021      ftsyncd ftsyncd_program
                         200022      ftstatd ftstatd_program
                         200023      exportmap
                         200024      nfs_metadata
```

```
   unassigned                           200025 - 200200
                                        200201    ecoad
                                        200202    eamon
                                        200203    ecolic
                                        200204    cs_printstatus_svr
                                        200205    ecodisc
   unassigned                           200206 - 300000
                                        300001    adt_rflockprog
                                        300002    columbine1
                                        300003    system33_prog
                                        300004    frame_prog1
                                        300005    uimxprog
                                        300006    rvd
                                        300007    entombing daemon
                                        300008    account mgmt system
                                        300009    frame_prog2
                                        300010    beeper access
                                        300011    dptuprog
                                        300012    mx-bcp
                                        300013    instrument-file-access
                                        300014    file-system-statistics
                                        300015    unify-database-server
                                        300016    tmd_msg
                                        300017    [unknown]
                                        300018    [unknown]
                                        300019    automounter access
                                        300020    lock server
                                        300021    [unknown]
                                        300022    office-automation-1
                                        300023    office-automation-2
                                        300024    office-automation-3
                                        300025    office-automation-4
                                        300026    office-automation-5
                                        300027    office-automation-6
                                        300028    office-automation-7
                                        300029    local-data-manager
                                        300030    chide
                                        300031    csi_program
                                        300032    [unknown]
                                        300033    online-help
                                        300034    case-tool
                                        300035    delta
                                        300036    rgi
                                        300037    instrument-config-server
                                        300038    [unknown]
                                        300039    [unknown]
                                        300040    dtia-rpc-server
                                        300041    cms
```

```
                        300042     viewer
                        300043     aqm
                        300044     exclaim
                        300045     masterplan
                        300046     fig_tool
                        300047     [unknown]
                        300048     [unknown]
                        300049     [unknown]
                        300050     remote-lock-manager
                        300051     [unknown]
                        300052     gdebug
                        300053     ldebug
                        300054     rscanner
                        300055     [unknown]
                        300056     [unknown]
                        300057     [unknown]
                        300058     [unknown]
                        300059     [unknown]
                        300060     [unknown]
                        300061     [unknown]
                        300062     [unknown]
                        300063     [unknown]
                        300064     [unknown]
                        300065     [unknown]
                        300066     nSERVER
                        300067     [unknown]
                        300068     [unknown]
                        300069     [unknown]
                        300070     [unknown]
                        300071     BioStation
                        300072     [unknown]
                        300073     NetProb
                        300074     Logging
                        300075     Logging
                        300076     [unknown]
                        300077     [unknown]
                        300078     [unknown]
                        300079     [unknown]
                        300080     [unknown]
                        300081     [unknown]
                        300082     sw_twin
                        300083     remote_get_login
                        300084     odcprog
                        300085     [unknown]
                        300086     [unknown]
                        300087     [unknown]
                        300088     [unknown]
                        300089     [unknown]
```

```
                            300090     [unknown]
                            300091     smartdoc
                            300092     superping
                            300093     distributed-chembench
                            300094     uacman/alfil-uacman
                            300095     ait_rcagent_prog
                            300096     ait_rcagent_appl_prog
                            300097     smart
                            300098     ecoprog
                            300099     leonardo
                            300100     [unknown]
                            300101     [unknown]
                            300102     [unknown]
                            300103     [unknown]
                            300104     [unknown]
                            300105     [unknown]
                            300106     [unknown]
                            300107     [unknown]
                            300108     wingz
                            300109     teidan
                            300110     [unknown]
                            300111     [unknown]
                            300112     [unknown]
                            300113     [unknown]
                            300114     [unknown]
                            300115     [unknown]
                            300116     cadc_fhlockprog
                            300117     highscan
                            300118     [unknown]
                            300119     [unknown]
                            300120     [unknown]
                            300121     opennavigator
                            300122     aarpcxfer
                            300123     [unknown]
                            300124     [unknown]
                            300125     [unknown]
                            300126     groggs
                            300127     licsrv
                            300128     issdemon
                            300129     [unknown]
                            300130     maximize
                            300131     cgm_server
                            300132     [unknown]
                            300133     agent_rpc
                            300134     docmaker
                            300135     docmaker
                            300136     [unknown]
                            300137     [unknown]
```

```
                              300138    [unknown]
                              300139    iesx
                              300140    [unknown]
                              300141    [unknown]
                              300142    [unknown]
                              300143    [unknown]
                              300144    smart-mbs
                              300145    [unknown]
                              300146    [unknown]
                              300147    docimage
                              300148    [unknown]
                              300149    dmc-interface
                              300150    [unknown]
                              300151    jss
                              300152    [unknown]
                              300153    arimage
                              300154    xdb-workbench
                              300155    frontdesk
                              300156    dmc
                              300157    expressight-6000
                              300158    graph service program
                              300159    [unknown]
                              300160    [unknown]
                              300161    [unknown]
                              300162    [unknown]
                              300163    [unknown]
                              300164    [unknown]
                              300165    [unknown]
                              300166    [unknown]
                              300167    [unknown]
                              300168    [unknown]
                              300169    [unknown]
                              300170    [unknown]
                              300171    [unknown]
                              300172    [unknown]
                              300173    [unknown]
                              300174    [unknown]
                              300175    [unknown]
                              300176    rlpr
                              300177    nx_hostdprog
                              300178    netuser-x
                              300179    rmntprog
                              300180    [unknown]
                              300181    mipe
                              300182    [unknown]
                              300183    collectorprog
                              300184    uslookup_PROG
                              300185    viewstation
```

```
                         300186    iate
                         300187    [unknown]
                         300188    [unknown]
                         300189    [unknown]
                         300190    imsvtprog
                         300191    [unknown]
                         300192    [unknown]
                         300193    [unknown]
                         300194    pmdb
                         300195    pmda
                         300196    [unknown]
                         300197    [unknown]
                         300198    trend_idbd
                         300199    rres
                         300200    sd.masterd
                         300201    sd.executiond
                         300202    sd.listend
                         300203    sd.reserve1
                         300204    sd.reserve2
                         300205    msbd
                         300206    stagedprog
                         300207    mountprog
                         300208    watchdprog
                         300209    pms
                         300210    [unknown]
                         300211    session_server_program
                         300212    session_program
                         300213    debug_serverprog
                         300214    [unknown]
                         300215    [unknown]
                         300216    paceprog
                         300217    [unknown]
                         300218    mbus
                         300219    aframes2ps
                         300220    npartprog
                         300221    cm1server
                         300222    cm1bridge
                         300223    sailfrogfaxprog
                         300224    sailfrogphoneprog
                         300225    sailfrogvmailprog
                         300226    wserviceprog arcstorm
                         300227    hld
                         300228    alive
                         300229    radsp
                         300230    radavx
                         300231    radview
                         300232    rsys_prog
                         300233    rsys_prog
```

```
                    300234    fm_rpc_prog
                    300235    aries
                    300236    uapman
                    300237    ddman
                    300238    top
                    300239    [unknown]
                    300240    trendlink
                    300241    licenseprog
                    300242    statuslicenseprog
                    300243    oema_rmpf_svc
                    300244    oema_smpf_svc
                    300245    oema_rmsg_svc
                    300246    grapes-sd
                    300247    ds_master
                    300248    ds_transfer
                    300249    ds_logger
                    300250    ds_query
                    300251    [unknown]
                    300252    [unknown]
                    300253    nsd_prog
                    300254    browser
                    300255    epoch
                    300256    floorplanner
                    300257    reach
                    300258    tactic
                    300259    cachescientific1
                    300260    cachescientific2
                    300261    desksrc_prog
                    300262    photo3d1
                    300263    photo3d2
                    300264    [unknown]
                    300265    soundmgr
                    300266    s6k
                    300267    aims_referenced_
                              text_processor
                    300268    xess
                    300269    ds_queue
                    300270    [unknown]
                    300271    orionscanplus
                    300272    openlink-xx
                    300273    kbmsprog
                    300274    [unknown]
                    300275    futuresource
                    300276    the_xprt
                    300277    cmg_srvprog
                    300278    [unknown]
                    300279    [unknown]
                    300280    front
```

```
                              300281     [unknown]
                              300282     [unknown]
                              300283     [unknown]
                              300284     conmanprog
                              300285     jincv2
                              300286     isls
                              300287     systemstatprog
                              300288     fxpsprog
                              300289     callpath
                              300290     axess
                              300291     armor_rpcd
                              300292     armor_dictionary_rpcd
                              300293     armor_miscd
                              300294     filetransfer_prog
                              300295     bl_swda
                              300296     bl_hwda
                              300297     [unknown]
                              300298     [unknown]
                              300299     [unknown]
                              300300     filemon
                              300301     acunetprog
                              300302     rbuild
                              300303     assistprog
                              300304     tog
                              300305     [unknown]
                              300306     sns7000
                              300307     igprog
                              300308     tgprog
                              300309     plc
                              300310     pxman pxlsprog
                              300311     hde_server hdeserver
                              300312     tsslicenseprog
                              300313     rpc.explorerd
                              300314     chrd
                              300315     tbisam
                              300316     tbis
                              300317     adsprog
                              300318     sponsorprog
                              300319     querycmprog
                              300320     [unknown]
                              300321     [unknown]
                              300322     mobil1
                              300323     sld
                                         service_locator_daemon
                              300324     linkprog
                              300325     codexdaemonprog
                              300326     drprog
                              300327     ressys_commands
```

```
                    300328    stamp
                    300329    matlab
                    300330    sched1d
                    300331    upcprog
                    300332    xferbkch
                    300333    xfer
                    300334    qbthd
                    300335    qbabort
                    300336    lsd
                    300337    geomgrd
                    300338    generic_fts
                    300339    ft_ack
                    300340    lymb
                    300341    vantage
                    300342    cltstd clooptstdprog
                    300343    clui clui_prog
                    300344    testerd tstdprog
                    300345    extsim
                    300346    cmd_dispatch maxm_ems
                    300347    callpath_receive_program
                    300348    x3270prog
                    300349    sbc_lag
                    300350    sbc_frsa
                    300351    sbc_frs
                    300352    atommgr
                    300353    geostrat
                    300354    dbvialu6.2
                    300355    [unknown]
                    300356    fxncprog
                    300357    infopolic
                    300358    [unknown]
                    300359    aagns
                    300360    aagms
                    300361    [unknown]
                    300362    clariion_mgr
                    300363    setcimrpc
                    300364    virtual_protocol_adapter
                    300365    unibart
                    300366    uniarch
                    300367    unifile
                    300368    unisrex
                    300369    uniscmd
                    300370    rsc
                    300371    set
                    300372    desaf-ws/key
                    300373    reeldb
                    300374    nl
                    300375    rmd
```

```
                300376    agcd
                300377    rsynd
                300378    rcnlib
                300379    rcnlib_attach
                300380    evergreen_mgmt_agent
                300381    fx104prog
                300382    rui
                          remote_user_interface
                300383    ovomd
                300384    [unknown]
                300385    [unknown]
                300386    system_server
                300387    pipecs cs_pipeprog
                          ppktrpc
                300388    uv-net univision
                300389    auexe
                300390    audip
                300391    mqi
                300392    eva
                300393    eeei_reserved_1
                300394    eeei_reserved_2
                300395    eeei_reserved_3
                300396    eeei_reserved_4
                300397    eeei_reserved_5
                300398    eeei_reserved_6
                300399    eeei_reserved_7
                300400    eeei_reserved_8
                300401    cprlm
                300402    wg_idms_manager
                300403    timequota
                300404    spiff
                300405-300414        ov_oem_svc
                300415    ov_msg_ctlg_svc
                300416    ov_advt_reg_svc
                300417-300424   showkron
                300425    daatd
                300426    swiftnet
                300427    ovomdel
                300428    ovomreq
                300429    msg_dispatcher
                300430    pcshare server
                300431    rcvs
                300432    fdfserver
                300433    bssd
                300434    drdd
                300435    mif_gutsprog
                300436    mif_guiprog
                300437    twolfd
```

```
                              300438      twscd
                              300439      nwsbumv
                              300440      dgux_mgr
                              300441      pfxd
                              300442      tds
                              300443      ovomadmind
                              300444      ovomgate
                              300445      omadmind
                              300446      nps
                              300447      npd
                              300448      tsa
                              300449      cdaimc
          unassigned          300450-300452
                              300453      ckt_implementation
                              300454      mda-tactical
          unassigned          300455-300458
                              300459      atrrun
                              300460      RoadRunner
                              300461      nas
                              300462      undelete
                              300463      ovacadd
                              300464      tbdesmai
                              300465      arguslm
                              300466      dmd
                              300467      drd
                              300468      fm_help
                              300469      ftransrpc_prog
                              300470      finrisk
                              300471      dg_pc_idisched
                              300472      dg_pc_idiserv
                              300473      apd
                              300474      ap_sspd
                              300475      callpatheventrecorder
                              300476      flc
                              300477      dg_osm
                              300478      dspnamed
                              300479      iqddsrv
                              300480      iqjobsrv
                              300481      tacosxx
                              300482      wheeldbmg
                              300483      cnxmgr_nm_prog
                              300484      cnxmgr_cfg_prog
                              300485      3dsmapper
                              300486      ids
                              300487      imagine_rpc_svc
                              300488      lfn
                              300489      salesnet
                              300490      defaxo
```

```
                         300491    dbqtsd
                         300492    kms
                         300493    rpc.iced
                         300494    calc2s
                         300495    ptouidprog
                         300496    docsls
                         300497    new
                         300498    collagebdg
                         300499    ars_server
                         300500    ars_client
                         300501    vr_catalog
                         300502    vr_tdb
                         300503    ama
                         300504    evama
                         300505    conama
                         300506    service_process
                         300507    reuse_proxy
                         300508    mars_ctrl
                         300509    mars_db
                         300510    mars_com
                         300511    mars_admch
                         300512    tbpipcip
                         300513    top_acs_svc
                         300514    inout_svc
                         300515    csoft_wp
                         300516    mcfs
                         300517    eventprog
                         300518    dg_pc_idimsg
                         300519    dg_pc_idiaux
                         300520    atsr_gc
                         300521    alarm alarm_prog
                         300522    fts_prog
                         300523    dcs_prog
                         300524    ihb_prog
                         300525    [unknown]
                         300526    [unknown]
                         300527    clu_info_prog
                         300528    rmfm
                         300529    c2sdocd
                         300530    interahelp
                         300531    callpathasyncmsghandler
                         300532    optix_arc
                         300533    optix_ts
                         300534    optix_wf
                         300535    maxopenc
                         300536    cev cev_server
                         300537    sitewideprog
                         300538    drs
```

```
              300539    drsdm
              300540    dasgate
              300541    dcdbd
              300542    dcpsd
              300543    supportlink_prog
              300544    broker
              300545    listner
              300546    multiaccess
              300547    spai_interface
              300548    spai_adaption
              300549    chimera_ci
                        chimera_clientinterface
              300550    chimera_pi
                        chimera_processinvoker
              300551    teamware_fl
                        teamware_foundationlevel
              300552    teamware_sl
                        teamware_systemlevel
              300553    teamware_ui
                        teamware_userinterface
              300554    lprm
              300555    mpsprog
                        Mensuration_Proxy_Server
              300556    mo_symdis
              300557    retsideprog
              300558    slp
              300559    slm-api
              300560    im_rpc teamconference
              300561    license_prog license
              300562    stuple stuple_prog
              300563    upasswd_prog
              300564    gentranmentorsecurity
              300565    gentranmentorprovider
              300566    latituded
                        latitude_license_server
              300567    gentranmentorreq1
              300568    gentranmentorreq2
              300569    gentranmentorreq3
              300570    rj_server
              300571    gws-rdb
              300572    gws-mpmd
              300573    gws-spmd
              300574    vwcalcd
              300575    vworad
              300576    vwsybd
              300577    vwave
              300578    online_assistant
              300579    internet_assistant
```

```
               300580    spawnd
               300581    procmgrg
               300582    cfgdbd
               300583    logutild
               300584    ibis
               300585    ibisaux
               300586    aapi
               300587    rstrt
               300588    hbeat
               300589    pcspu
               300590    empress
               300591    sched_server
                         LiveScheduler
               300592    path_server
                         LiveScheduler
               300593    c2sdmd
               300594    c2scf
               300595    btsas
               300596    sdtas
               300597    appie
               300598    dmi
               300599    pscd
                      panther software corp daemon
               300600    sisd
               300601    cpwebserver
               300602    wwcommo
               300603    mx-mie
               300604    mx-mie-debug
               300605    idmn
               300606    ssrv
               300607    vpnserver
               300608    samserver
               300609    sams_server
               300610    chrysalis
               300611    ddm
               300612    ddm-is
               300613    mx-bcp-debug
               300614    upmrd
               300615    upmdsd
               300616    res
               300617    colortron
               300618    zrs
               300619    afpsrv
               300620    apxft
               300621    nrp
               300622    hpid
               300623    mailwatch
               300624    fos bc_fcrb_receiver
```

```
                300625     cs_sysadmin_svr
                300626     cs_controller_svr
                300627     nokia_nms_eai
                300628     dbg
                300629     remex
                300630     cs_bind
                300631     idm
                300632     prpasswd
                300633     iw-pw
                300634     starrb
                300635     Impress_Server
                300636     colorstar
                300637     gwugui
                300638     gwsgui
                300639     dai_command_proxy
                300640     dai_alarm_server
                300641     dai_fui_proxy
                300642     spai_command_proxy
                300643     spai_alarm_server
                300644     iris
                300645     hcxttp
                300646     updatedb rsched
                300647     urnd urn
                300648     iqwpsrv
                300649     dskutild
                300650     online
                300651     nlserv
                300652     acsm
                300653     dg_clar_sormsg
                300654     wwpollerrpc
                300655     wwmodelrpc
                300656     nsprofd
                300657     nsdistd
                300658     recollect
                300659     lssexecd lss_res
                300660     lssagend lss_rea
                300661     cdinfo
                300662     sninsr_addon
                300663     mm-sap
                300664     ks
                300665     psched
                300666     tekdvfs
                300667     storxll
                300668     nisse
                300669     lbadvise
                300670     atcinstaller
                300671     atntstarter
                300672     NetML
```

```
300673     tdmesmge
300674     tdmesmgd
300675     tdmesmgt
300676     olm
300677     mediamanagement
300678     rdbprog fieldowsrv
300679     rpwdprog rpwd
300680     sapi-trace
300681     sapi-master-daemon
300682     omdcuprog om-dcu
300683     wwprocmon
300684     tndidprog
300685     rkey_setsecretprog
300686     asdu_server_prog
300687     pwrcntrl
300688     siunixd
300689     wmapi
300690     cross_reference_ole
300691     rtc
300692     disp
300693     sql_compilation_agent
300694     tnsysprog
300695     ius-sapimd
300696     apteam-dx
300697     rmsrpc
300698     seismic_system
300699     remote
300700     tt1_ts_event nokia_nms
300701     fxrs
300702     onlicense
300703     vxkey
300704     dinis
300705     sched2d schedule-2
300706     sched3d schedule-3
300707     sched4d schedule-4
300708     sched5d schedule-5
300709     sched6d schedule-6
300710     sched7d schedule-7
300711     sched8d schedule-8
300712     sched9d schedule-9
300713     adtsqry
300714     adserv
300715     adrepserv
300716     [unknown]
300717     caad
300718     caaui
300719     cescda
300720     vcapiadmin
```

```
              300721    vcapi20
              300722    tcfs
              300723    csed
              300724    nothand
              300725    hacb
              300726    nfauth
              300727    imlm
              300728    bestcomm
              300729    lprpasswd
              300730    rprpasswd
              300731    proplistd
              300732    mikomomc
              300733    arepa-cas
              300734    [unknown]
              300735    [unknown]
              300736    ando_ts
              300737    intermezzo
              300738    ftel-sdh-request
              300739    ftel-sdh-response
              300740    [unknown]
              300741    [unknown]
              300742    [unknown]
              300743    [unknown]
              300744    [unknown]
              300745    vrc_abb
              300746    vrc_comau
              300747    vrc_fanuc
              300748    vrc_kuka
              300749    vrc_reis
              300750    hp_sv6d
              300751    correntmgr01
              300752    correntike
              300753    [unknown]
              300754    [unknown]
              300755    intransa_location
              300756    intransa_management
              300757    intransa_federation
              300758    portprot
              300759    ipmiprot
              300760    aceapi
              300761    f6000pss
              300762    vsmapi_program
              300763    ubertuple
              300764    ctconcrpcif
              300765    mfuadmin
              300766    aiols
              300767    dsmrootd
              300768    htdl
```

```
                                       300769    caba
                                       300770    vrc_cosimir
                                       300771    cmhelmd
                                       300772    polynsm
                                       300773    [unknown]
                                       300774    [unknown]
                                       300775    [unknown]
                                       300776    [unknown]
                                       300777    [unknown]
                                       300778    [unknown]
                                       300779    [unknown]
                                       300780    [unknown]
                                       300781    dsmrecalld
                                       300782    [unknown]
                                       300783    [unknown]
                                       300784    twrgcontrol
                                       300785    twrled
                                       300786    twrcfgdb
BMC software                           300787-300886
unassigned                             300887 - 300999
Sun Microsystems                       301000-302000 [ 2000 numbers ]
unassigned                             302001-349999
American Airlines                      350000 - 350999
Acucobol Inc.                          351000 - 351099
The Bristol Group                      351100 - 351249
Amteva Technologies                    351250 - 351349
                                       351350    wfmMgmtApp
                                       351351    wfmMgmtDataSrv
                                       351352    wfmMgmtFut1
                                       351353    wfmMgmtFut1
                                       351354    wfmAPM
                                       351355    wfmIAMgr
                                       351356    wfmECMgr
                                       351357    wfmLookOut
                                       351358    wfmAgentFut1
                                       351359    wfmAgentFut2
unassigned                             351360 - 351406
Sterling Software ITD                  351407    csed
                                       351360    sched10d
                                       351361    sched11d
                                       351362    sched12d
                                       351363    sched13d
                                       351364    sched14d
                                       351365    sched15d
                                       351366    sched16d
                                       351367    sched17d
                                       351368    sched18d
                                       351369    sched19d
```

```
351370     sched20d
351371     sched21d
351372     sched22d
351373     sched23d
351374     sched24d
351375     sched25d
351376     sched26d
351377     sched27d
351378     sched28d
351379     sched29d
351380     sched30d
351381     sched31d
351382     sched32d
351383     sched33d
351384     sched34d
351385     sched35d
351386     sched36d
351387     sched37d
351388     sched38d
351389     sched39d
351390     consoleserver
351391     scheduleserver
351392     RDELIVER
351393     REVENTPROG
351394     RSENDEVENTPROG
351395     snapp
351396     snapad
351397     sdsoodb
351398     sdsmain
351399     sdssrv
351400     sdsclnt
351401     sdsreg
351402     fsbatch
351403     fsmonitor
351404     fsdisp
351405     fssession
351406     fslog
351407     svdpappserv
351408     gns
351409     [unkonwn]
351410     [unkonwn]
351411     [unkonwn]
351412     axi
351413     rpcxfr
351414     slm
351415     smbpasswdd
351416     tbdbserv
351417     tbprojserv
```

```
                         351418    genericserver
                         351419    dynarc_ds
                         351420    dnscmdr
                         351421    ipcmdr
                         351422    faild
                         351423    failmon
                         351424    faildebug
                         351425    [unknown]
                         351426    [unknown]
                         351427    siemens_srs
                         351428    bsproxy
                         351429    ifsrpc
                         351430    CesPvcSm
                         351431    FrPvcSm
                         351432    AtmPvcSm
                         351433    radius
                         351434    auditor
                         351435    sft
                         351436    voicemail
                         351437    kis
                         351438    SOFTSERV_NOTIFY
                         351439    dynarpc
                         351440    hc
                         351441    iopas
                         351442    iopcs
                         351443    iopss
                         351444    spcnfs
                         351445    spcvss
                         351446    matilda_sms
                         351447    matilda_brs
                         351448    matilda_dbs
                         351449    matilda_sps
                         351450    matilda_svs
                         351451    matilda_sds
                         351452    matilda_vvs
                         351453    matilda_stats
                         351454    xtrade
                         351455    mapsvr
                         351456    hp_graphicsd
                         351457    berkeley_db
                                   berkeley_db_svc
                         351458    io_server
                         351459    rpc.niod
                         351460    rpc.kill
                         351461    hmdisproxy
                         351462    smdisproxy
                         351463    avatard
                         351464    namu
```

```
                              351465     BMCSess
                              351466     FENS_Sport
                              351467     EM_CONFIG
                              351468     EM_CONFIG_RESP
                              351469     lodge_proof
                              351470     ARCserveIT-Queue
                              351471     ARCserveIT-Device
                              351472     ARCserveIT-Discover
                              351473     ARCserveIT-Alert
                              351474     ARCserveIT-Database
                              351475     scand1
                              351476     scand2
                              351477     scand3
                              351478     scand4
                              351479     scand5
                              351480     dscv
                              351481     cb_svc
                              351482     [unknown]
                              351483     iprobe
                              351484     omniconf
                              351485     isan
          BG Partners         351486 - 351500
                              351501     mond
                              351502     iqlremote
                              351503     iqlalarm
          unassigned          351504 - 351599
          Orion Multisystems  351600-351855
          unassigned          351856 - 351899
          NSP lab             351900 - 351999
          unassigned          351999 - 352232
                              352233     asautostart
                              352234     asmediad1
                              352235     asmediad2
                              352236     asmediad3
                              352237     asmediad4
                              352238     asmediad5
                              352239     asmediad6
                              352240     asmediad7
                              352241     asmediad8
                              352242     asmediad9
                              352243     asmediad10
                              352244     asmediad11
                              352245     asmediad12
                              352246     asmediad13
                              352247     asmediad14
                              352248     asmediad15
                              352249     asmediad16
                              352250     waruser
```

```
                          352251      warlogd
                          352252      warsvrmgr
                          352253      warvfsysd
                          352254      warftpd
                          352255      warnfsd
                          352256      bofproxyc0
                          352257      bofproxys0
                          352258      bofproxyc1
                          352259      bofproxys1
                          352260      bofproxyc2
                          352261      bofproxys2
                          352262      bofproxyc3
                          352263      bofproxys3
                          352264      bofproxyc4
                          352265      bofproxys4
                          352266      bofproxyc5
                          352267      bofproxys5
                          352268      bofproxyc6
                          352269      bofproxys6
                          352270      bofproxyc7
                          352271      bofproxys7
                          352272      bofproxyc8
                          352273      bofproxys8
                          352274      bofproxyc9
                          352275      bofproxys9
                          352276      bofproxyca
                          352277      bofproxysa
                          352278      bofproxycb
                          352279      bofproxysb
                          352280      bofproxycc
                          352281      bofproxysc
                          352282      bofproxycd
                          352283      bofproxysd
                          352284      bofproxyce
                          352285      bofproxyse
                          352286      bofproxycf
                          352287      bofproxysf
                          352288      bofproxypo0
                          352289      bofproxypo1
                          352290      bofproxypo2
                          352291      bofproxypo3
                          352292      bofproxypo4
          unassigned      352293-370000
                          370001      [unknown]
                          370002      [unknown]
                          370003      [unknown]
                          370004      [unknown]
                          370005      [unknown]
```

```
                                  370006     [unknown]
                                  370007     [unknown]
                                  370008     [unknown]
                                  370009     [unknown]
                                  370010     [unknown]
                                  370011     [unknown]
                                  370012     [unknown]
                                  370013     [unknown]
                                  370014     [unknown]
                                  370015     [unknown]
                                  370016     [unknown]
                                  370017     [unknown]
                                  370018     [unknown]
                                  370019     [unknown]
                                  370020     [unknown]
                                  370021     [unknown]
                                  370022     [unknown]
                                  370023     [unknown]
                                  370024     [unknown]
                                  370025     [unknown]
                                  370026     [unknown]
                                  370027     [unknown]
        unassigned                370028 - 379999
                                  380000     opensna
                                  380001     probenet
                                  380002     [unknown]
                                  380003     license
                                  380004     na.3com-remote
                                  380005     na.ntp
                                  380006     probeutil
                                  380007     na.vlb
                                  380008     cds_mhs_agent
                                  380009     cds_x500_agent
                                  380010     cds_mailhub_agent
                                  380011     codex_6500_proxy
                                  380012     codex_6500_trapd
                                  380013     na.nm212
                                  380014     cds_mta_metrics_agent
                                  380015     [unkonwn]
                                  380016     na.caple
                                  380017     codexcapletrap
        Swiss Re                  380018-380028
                                  380029     ncstat
                                  380030     ncnfsstat
                                  380031     ftams
                                  380032     na.isotp
                                  380033     na.rfc1006
        unassigned                380034 - 389999
```

```
    Epoch Systems                         390000 - 390049
    Quickturn Systems                     390050 - 390065
    Team One Systems                      390066 - 390075
    General Electric CRD                  390076 - 390085
    TSIG NFS subcommittee                 390086 - 390089
    SoftLab ab                            390090 - 390099
    Legato Network Services               390100 - 390115
                                          390116    cdsmonitor
                                          390117    cdslock
                                          390118    cdslicense
                                          390119    shm
                                          390120    rws
                                          390121    cdc
    Data General                          390122 - 390141
    Perfect Byte                          390142 - 390171
    JTS Computer Systems                  390172 - 390181
    Parametric Technology                 390182 - 390191
    Voxem                                 390192 - 390199
    Effix Systems                         390200 - 390299
    Motorola                              390300 - 390309
    Mobile Data Intl.                     390310 - 390325
    Physikalisches Institut               390326 - 390330
    Ergon Informatik AG                   390331 - 390340
    Analog Devices Inc.                   390341 - 390348
    Interphase Corporation                390349 - 390358
    NeWsware                              390359 - 390374
    Qualix Group                          390375 - 390379
    Xerox Imaging Systems                 390380 - 390389
    Noble Net                             390390 - 390399
    Legato Network Services               390400 - 390499
    Client Server Tech.                   390500 - 390511
    Atria                                 390512 - 390517
    GE NMR Instruments                    390518 - 390525
    Harris Corp.                          390526 - 390530
    Unisys                                390531 - 390562
    Aggregate Computing                   390563 - 390572
    Interactive Data                      390573 - 390580
    OKG AB                                390581 - 390589
    K2 Software                           390591 - 390594
    Collier Jackson                       390595 - 390599
    Remedy Corporation                    390600 - 390699
    Mentor Graphics                       390700 - 390799
    AT&T Bell Labs (Lucent)               390800 - 390899
    Xerox                                 390900 - 390999
    Silicon Graphics                      391000 - 391063
    Data General                          391064 - 391095
    Computer Support Corp.                391096 - 391099
    Quorum Software Systems               391100 - 391199
```

```
     InterLinear Technology        391200 - 391209
     Highland Software             391210 - 391229
     Boeing Comp. Svcs.            391230 - 391249
     IBM Sweden                    391250 - 391259
     Signature Authority Svc       391260 - 391271
     ZUMTOBEL Licht GmbH           391272 - 391283
     NOAA/ERL                      391284 - 391299
     NCR Corp.                     391300 - 391399
     FTP Software                  391400 - 391409
     Cadre Technologies            391410 - 391433
     Visionware Ltd (UK)           391434 - 391439
     IBR-Partner AG                391440 - 391449
     CAP Programator AB            391450 - 391459
     Reichle+De-Massari AG         391460 - 391474
     Swiss Bank Corp (London)      391475 - 391484
     Unisys Enterprise Svr         391485 - 391489
     Intel - Test Dev. Tech.       391490 - 391499
     Ampex                         391500 - 391755
                                   391756    naas-spare
                                   391757    naas-admin
                                   391758    isps
                                   391759    isps-admin
                                   391760    mars
                                   391761    mars-admin
                                   391762    attcis_spare0
                                   391763    attcis_spare1
                                   391764    mail-server
                                   391765    mail-server-spare
                                   391766    attcis_spare2
                                   391767    attcis_spare3
                                   391768    attcis_spare4
                                   391769    attcis_spare5
                                   391770    attcis_spare6
                                   391771    attcis_spare7
     Integrated Systems, Inc.      391772 - 391779
     Parametric Tech., Inc.        391780 - 391789
     Ericsson Telecom AB           391790 - 391799
     SLAC                          391800 - 391849
                                   391850    qhrdata
                                   391851    qhrbackup
                                   391852    minutedata
                                   391853    prefecture
                                   391854    supc
                                   391855    suadmincrw
                                   391856    suadminotas
                                   391857    sumessage
                                   391858    sublock
                                   391859    sumotd
```

```
        staffware dev. (uk)            391860 - 391869
        Staffware Dev. (UK)            391870 - 391879
                                       391880    namesrvr
                                       391881    disksrvr
                                       391882    tapesrvr
                                       391883    migsrvr
                                       391884    pdmsrvr
                                       391885    pvrsrvr
                                       391886    repacksrvr
                                       391887    [unknown]
        Convex Computer Corp.          391888 - 391951
                                       391952    lookoutsrv
                                       391953    lookoutagnt
                                       391954    lookoutprxy
                                       391955    lookoutsnmp
                                       391956    lookoutrmon
                                       391957    lookoutfut1
                                       391958    lookoutfut2
        windward                       391959 - 391967
                                       391968    sra_legato
                                       391969    sra_legato_imgsvr
                                       391970    sra_legato_0
                                       391971    sra_legato_1
                                       391972    sra_legato_2
                                       391973    sra_legato_3
                                       391974    sra_legato_4
                                       391975    sra_legato_5
                                       391976    sra_legato_6
                                       391977    sra_legato_7
                                       391978    sra_legato_8
                                       391979    sra_legato_9
        Brooktree Corp.                391980 - 391989
        Cadence      Design Systems    391990 - 391999
        J. Frank & Associates          392000 - 392999
        Cooperative Solutions          393000 - 393999
        Xerox Corp.                    394000 - 395023
                                       395024    odbc_sqlretriever
        3M                             395025 - 395091
        Digital Zone Intl.             395092 - 395099
        Software Professionals         395100 - 395159
        Del Mar Solutions              395160 - 395164
                                       395165    ife-es
                                       395166    ife-resmgr
                                       395167    ife-aes
                                       395168    ife-bite
                                       395169    ife-loader
                                       395170    ife-satcom
                                       395171    ife-seat
```

```
                                        395172      ife-dbmgr
                                        395173      ife-testmgr
                                        395174      atrium_server
                                        395175      ase_director
                                        395176      ase_agent
                                        395177      ase_hsm
                                        395178      ase_mgr
                                        395179      ase_sim
        Hewlett-Packard                 395180 - 395194
        XES, Inc.                       395195 - 395199
        Unitech Products                395200 - 395249
        TransSys                        395250 - 395505
        Unisys Govt Systems             395506 - 395519
        Bellcore                        395520 - 395529
        IBM                             395530 - 395561
        AT&T Network Services           395562 - 395571
        Data General                    395572 - 395577
        Swiss Bank Corp                 395578 - 395597
        Swiss Bank Corp                 395598 - 395637
        Novell                          395638 - 395643
        Computer Associates             395644 - 395650
        Omneon Video Networks           395651 - 395656
        unassigned                      395657 - 395908
        UK Post Office                  395909 - 395924
        AEROSPATIALE                    395925 - 395944
        Result d.o.o.                   395945 - 395964
        DataTools, Inc.                 395965 - 395980
        CADIS, Inc.                     395981 - 395990
        Cummings Group, Inc.            395991 - 395994
        Cadre Technologies              395995 - 395999
        American Airlines               396000 - 396999
        Ericsson Telecom TM Div         397000 - 398023
        IBM                             398024 - 398028
        Toshiba OME Works               398029 - 398033
        TUSC Computer Systems           398034 - 398289
        AT&T                            398290 - 398320
        Ontario Hydro                   398321 - 398346
        Micrion Corporation             398347 - 398364
        unassigned                      398365 - 398591
        Pegasystems, Inc.               398592 - 399616
        Spectra Securities Soft         399617 - 399850
        QualCom                         399851 - 399866
        unassigned                      399867 - 399884
        Altris Software Ltd.            399885 - 399899
        ISO/IEC WG11                    399900 - 399919
        Parametric Technology           399920 - 399949
        Dolby Laboratories              399950 - 399981
        unassigned                      399982 - 399991
```

```
   Xerox PARC                               399992 - 399999
   #
   Next Inc.                                200100000 - 200199999
   Netwise (RPCtool)                        200200000
   Concurrent Computer Corp                 200200001 - 200200007
   AIM Technology                           200300000 - 200399999
   TGV                                      200400000 - 200499999
   #
   # Sun-assigned authentication flavor numbers
   #
   AUTH_NONE       0                 /* no authentication, see RFC 1831 */
                                     /* a.k.a. AUTH_NULL */
   AUTH_SYS        1                 /* unix style (uid+gids), RFC 1831 */
                                     /* a.k.a. AUTH_UNIX */
   AUTH_SHORT      2                 /* short hand unix style, RFC 1831 */
   AUTH_DH         3                 /* des style (encrypted timestamp) */
                                     /* a.k.a. AUTH_DES, see RFC 2695 */
   AUTH_KERB       4                 /* kerberos auth, see RFC 2695 */
   AUTH_RSA        5                 /* RSA authentication */
   RPCSEC_GSS      6                 /* GSS-based RPC security for auth,
                                        integrity and privacy, RPC 5403 */

   AUTH_NW        30001              NETWARE
   AUTH_SEC       200000             TSIG NFS subcommittee
   AUTH_ESV       200004             SVr4 ES

   AUTH_NQNFS     300000             Univ. of Guelph - Not Quite NFS
   AUTH_GSSAPI    300001             OpenVision <john.linn@ov.com>
   AUTH_ILU_UGEN  300002             Xerox <janssen@parc.xerox.com>
                                       - ILU Unsecured Generic Identity
   #
   #  Small blocks are assigned out of the 39xxxx series of numbers
   #
   AUTH_SPNEGO    390000
                  390000 - 390255 NFS 'pseudo' flavors for RPCSEC_GSS
                  390003 - kerberos_v5 authentication, RFC 2623
                  390004 - kerberos_v5 with data integrity, RFC 2623
                  390005 - kerberos_v5 with data privacy, RFC 2623

                  200000000         Reserved
                  200100000         NeXT Inc.
```

Normative References

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Author's Address

   Robert Thurlow
   Sun Microsystems, Inc.
   500 Eldorado Boulevard, UBRM05-171
   Broomfield, CO 80021

   Phone: 877-718-3419
   EMail: robert.thurlow@sun.com