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R. Thurlow
Sun Microsystems

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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:

- 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
- Addition of an "IANA Considerations" section that describes past number assignment policy and how IANA is intended to assign them in the future
- Clarification of the RPC Language Specification to match current usage
- Enhancement of the "Security Considerations" section to reflect experience with strong security flavors
- Specification of new authentication errors that are in common use in modern RPC implementations
- 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.

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

- 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.

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

- 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:

- Unique specification of a procedure to be called
- Provisions for matching response messages to request messages
- 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:

- RPC protocol mismatches
- Remote program protocol version mismatches
- Protocol errors (such as misspecification of a procedure's parameters)
- Reasons why remote authentication failed
- 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:

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

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

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

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

- 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 - 0x7efffffff	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

- The following keywords are added and cannot be used as identifiers: "program" and "version".
- 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.
- 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.
- Program identifiers are in the same name space as constant and type identifiers.
- Only unsigned constants can be assigned to programs, versions, and procedures.
- 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:

- The short description of purpose and use
- The program number(s) assigned
- 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:

- The short identifier string(s)
- The auth number(s) assigned
- 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:

- The short identifier string(s)
- The auth_stat number(s) assigned
- 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:

- The type of number(s) (program number or authentication flavor number or authentication status number) sought
- How many numbers are sought
- The name of the person or company that will use the number
- An "identifier string" that associates the number with a service
- Email address of the contact person for the service that will be using the number
- A short description of the purpose and use of the number
- 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	csscltprog
	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