

NFSv4  
Internet-Draft  
Intended status: Standards Track  
Expires: June 18, 2009

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December 15, 2008

NFSv4 Minor Version 1 XDR Description  
draft-ietf-nfsv4-minorversion1-dot-x-12.txt

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### Abstract

This Internet-Draft provides the XDR description for NFSv4 minor

Internet-Draft

NFSv4.1 XDR Description

December 2008

version one.

Requirements Language

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC 2119](#) [1].

Table of Contents

- [1.](#) Code Components Licensing Notice . . . . . [3](#)
- [2.](#) XDR Description of NFSv4.1 . . . . . [3](#)
- [3.](#) Security Considerations . . . . . [71](#)
- [4.](#) IANA Considerations . . . . . [72](#)
- [5.](#) Normative References . . . . . [72](#)
- [Appendix A.](#) Acknowledgements . . . . . [72](#)
- [Appendix B.](#) RFC Editor Notes . . . . . [72](#)
- Authors' Addresses . . . . . [73](#)

## 1. Code Components Licensing Notice

The XDR description and scripts for extracting the XDR description are Code Components as described in [Section 4](#) of "Legal Provisions Relating to IETF Documents" [\[2\]](#).

## 2. XDR Description of NFSv4.1

This document contains the XDR ([\[3\]](#)) description of NFSv4.1 protocol ([\[4\]](#)). In order to facilitate implementations that support both NFSv4.0 and NFSv4.1, the description includes operations, and other features of NFSv4.0 that do not apply to NFSv4.1.

The XDR description is provided in this document in a way that makes it simple for the reader to extract into ready to compile form. The reader can feed this document in the following shell script to produce the machine readable XDR description of NFSv4.1:

```
<CODE BEGINS>
```

```
#!/bin/sh
grep '^ *///' | sed 's?^ */// ??' | sed 's?^ *///$??'
```

```
<CODE ENDS>
```

I.e. if the above script is stored in a file called "extract.sh", and this document is in a file called "spec.txt", then the reader can do:

```
<CODE BEGINS>
```

```
sh extract.sh < spec.txt > nfs4_prot.x
```

```
<CODE ENDS>
```

The effect of the script is to remove leading white space from each line, plus a sentinel sequence of "///

The XDR description, with the sentinel sequence follows:

<CODE BEGINS>

```
///  
/// /*  
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/// * as the document authors. All rights reserved.  
/// *
```

Shepler, et al.

Expires June 18, 2009

[Page 3]

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Internet-Draft

NFSv4.1 XDR Description

December 2008

```
///  
/// * The document authors are identified in [RFC3530] and  
/// * [draft-ietf-nfsv4-minorversion1-xx.txt].  
/// *  
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/// * EXEMPLARY, OR CONSEQUENTIAL DAMAGES (INCLUDING, BUT
```

```

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/// * LIABILITY, WHETHER IN CONTRACT, STRICT LIABILITY,
/// * OR TORT (INCLUDING NEGLIGENCE OR OTHERWISE) ARISING
/// * IN ANY WAY OUT OF THE USE OF THIS SOFTWARE, EVEN IF
/// * ADVISED OF THE POSSIBILITY OF SUCH DAMAGE.
/// */
/// /*
/// * This code was derived from [RFC3530]. Please
/// * reproduce this note if possible.
/// *
/// * This file was machine generated for
/// * draft-ietf-nfsv4-minorversion1-29
/// * Last updated Mon Dec 15 11:26:38 PST 2008
/// */
/// /*
/// *      nfs4_prot.x
/// */

```

```

///
/// #ifndef _AUTH_SYS_DEFINE_FOR_NFSv41
/// #define _AUTH_SYS_DEFINE_FOR_NFSv41
/// #include <rpc/auth_sys.h>
/// #typedef struct authsys_parms authsys_parms;
/// #endif _AUTH_SYS_DEFINE_FOR_NFSv41
///
/// /*
/// * Basic typedefs for RFC 1832 data type definitions
/// */
///
/// /*
/// * typedef int          int32_t;
/// * typedef unsigned int  uint32_t;
/// * typedef hyper        int64_t;
/// * typedef unsigned hyper uint64_t;
/// */
///
/// /*
/// * Sizes
/// */
/// const NFS4_FHSIZE      = 128;

```

```

/// const NFS4_VERIFIER_SIZE      = 8;
/// const NFS4_OPAQUE_LIMIT       = 1024;
/// const NFS4_SESSIONID_SIZE     = 16;
///
/// const NFS4_INT64_MAX          = 0x7fffffffffffffff;
/// const NFS4_UINT64_MAX         = 0xfffffffffffffff;
/// const NFS4_INT32_MAX          = 0x7fffffff;
/// const NFS4_UINT32_MAX         = 0xffffffff;
///
/// const NFS4_MAXFILELEN         = 0xfffffffffffffff;
/// const NFS4_MAXFILEOFF         = 0xfffffffffffffe;
///
///
/// /*
///  * File types
///  */
/// enum nfs_ftype4 {
///     NF4REG    = 1,    /* Regular File */
///     NF4DIR    = 2,    /* Directory */
///     NF4BLK    = 3,    /* Special File - block device */
///     NF4CHR    = 4,    /* Special File - character device */
///     NF4LNK    = 5,    /* Symbolic Link */
///     NF4SOCK   = 6,    /* Special File - socket */
///     NF4FIFO   = 7,    /* Special File - fifo */
///     NF4ATTRDIR = 8,    /* Attribute Directory */

```

```

///     NF4NAMEDATTR
///     = 9    /* Named Attribute */
/// };
///
/// /*
///  * Error status
///  */
/// enum nfsstat4 {
///     NFS4_OK           = 0,    /* everything is okay */
///     NFS4ERR_PERM      = 1,    /* caller not privileged */
///     NFS4ERR_NOENT     = 2,    /* no such file/directory */
///     NFS4ERR_IO        = 5,    /* hard I/O error */
///     NFS4ERR_NXIO      = 6,    /* no such device */
///     NFS4ERR_ACCESS    = 13,   /* access denied */
///     NFS4ERR_EXIST     = 17,   /* file already exists */

```

```

/// NFS4ERR_XDEV          = 18,    /* different filesystems */
///
/// /*
///  * Please do not allocate value 19; it was used in NFSv3
///  * and we do not want a value in NFSv3 to have a different
///  * meaning in NFSv4.x.
///  */
///
/// NFS4ERR_NOTDIR        = 20,    /* should be a directory */
/// NFS4ERR_ISDIR         = 21,    /* should not be directory */
/// NFS4ERR_INVAL         = 22,    /* invalid argument */
/// NFS4ERR_FBIG          = 27,    /* file exceeds server max */
/// NFS4ERR_NOSPC         = 28,    /* no space on filesystem */
/// NFS4ERR_ROFS          = 30,    /* read-only filesystem */
/// NFS4ERR_MLINK         = 31,    /* too many hard links */
/// NFS4ERR_NAMETOOLONG   = 63,    /* name exceeds server max */
/// NFS4ERR_NOTEMPTY      = 66,    /* directory not empty */
/// NFS4ERR_DQUOT         = 69,    /* hard quota limit reached*/
/// NFS4ERR_STALE         = 70,    /* file no longer exists */
/// NFS4ERR_BADHANDLE     = 10001, /* Illegal filehandle */
/// NFS4ERR_BAD_COOKIE    = 10003, /* READDIR cookie is stale */
/// NFS4ERR_NOTSUPP       = 10004, /* operation not supported */
/// NFS4ERR_TOOSMALL      = 10005, /* response limit exceeded */
/// NFS4ERR_SERVERFAULT   = 10006, /* undefined server error */
/// NFS4ERR_BADTYPE       = 10007, /* type invalid for CREATE */
/// NFS4ERR_DELAY         = 10008, /* file "busy" - retry */
/// NFS4ERR_SAME          = 10009, /* nverify says attrs same */
/// NFS4ERR_DENIED        = 10010, /* lock unavailable */
/// NFS4ERR_EXPIRED       = 10011, /* lock lease expired */
/// NFS4ERR_LOCKED        = 10012, /* I/O failed due to lock */
/// NFS4ERR_GRACE         = 10013, /* in grace period */
/// NFS4ERR_FHEXPIRED     = 10014, /* filehandle expired */
/// NFS4ERR_SHARE_DENIED  = 10015, /* share reserve denied */

```

```

/// NFS4ERR_WRONGSEC     = 10016, /* wrong security flavor */
/// NFS4ERR_CLID_INUSE   = 10017, /* clientid in use */
///
/// /* NFS4ERR_RESOURCE is not a valid error in NFSv4.1 */
/// NFS4ERR_RESOURCE     = 10018, /* resource exhaustion */
///
/// NFS4ERR_MOVED         = 10019, /* filesystem relocated */
/// NFS4ERR_NOFILEHANDLE = 10020, /* current FH is not set */

```

```

/// NFS4ERR_MINOR_VERS_MISMATCH= 10021,/* minor vers not supp */
/// NFS4ERR_STALE_CLIENTID = 10022,/* server has rebooted */
/// NFS4ERR_STALE_STATEID = 10023,/* server has rebooted */
/// NFS4ERR_OLD_STATEID = 10024,/* state is out of sync */
/// NFS4ERR_BAD_STATEID = 10025,/* incorrect stateid */
/// NFS4ERR_BAD_SEQID = 10026,/* request is out of seq. */
/// NFS4ERR_NOT_SAME = 10027,/* verify - attrs not same */
/// NFS4ERR_LOCK_RANGE = 10028,/* overlapping lock range */
/// NFS4ERR_SYMLINK = 10029,/* should be file/directory*/
/// NFS4ERR_RESTOREFH = 10030,/* no saved filehandle */
/// NFS4ERR_LEASE_MOVED = 10031,/* some filesystem moved */
/// NFS4ERR_ATTRNOTSUPP = 10032,/* recommended attr not sup*/
/// NFS4ERR_NO_GRACE = 10033,/* reclaim outside of grace*/
/// NFS4ERR_RECLAIM_BAD = 10034,/* reclaim error at server */
/// NFS4ERR_RECLAIM_CONFLICT= 10035,/* conflict on reclaim */
/// NFS4ERR_BADXDR = 10036,/* XDR decode failed */
/// NFS4ERR_LOCKS_HELD = 10037,/* file locks held at CLOSE*/
/// NFS4ERR_OPENMODE = 10038,/* conflict in OPEN and I/O*/
/// NFS4ERR_BADOWNER = 10039,/* owner translation bad */
/// NFS4ERR_BADCHAR = 10040,/* utf-8 char not supported*/
/// NFS4ERR_BADNAME = 10041,/* name not supported */
/// NFS4ERR_BAD_RANGE = 10042,/* lock range not supported*/
/// NFS4ERR_LOCK_NOTSUPP = 10043,/* no atomic up/downgrade */
/// NFS4ERR_OP_ILLEGAL = 10044,/* undefined operation */
/// NFS4ERR_DEADLOCK = 10045,/* file locking deadlock */
/// NFS4ERR_FILE_OPEN = 10046,/* open file blocks op. */
/// NFS4ERR_ADMIN_REVOKED = 10047,/* lockowner state revoked */
/// NFS4ERR_CB_PATH_DOWN = 10048,/* callback path down */
///
/// /* NFSv4.1 errors start here. */
///
/// NFS4ERR_BADIOMODE = 10049,
/// NFS4ERR_BADLAYOUT = 10050,
/// NFS4ERR_BAD_SESSION_DIGEST = 10051,
/// NFS4ERR_BADSESSION = 10052,
/// NFS4ERR_BADSLOT = 10053,
/// NFS4ERR_COMPLETE_ALREADY = 10054,
/// NFS4ERR_CONN_NOT_BOUND_TO_SESSION = 10055,
/// NFS4ERR_DELEG_ALREADY_WANTED = 10056,
/// NFS4ERR_BACK_CHAN_BUSY = 10057,/*backchan reqs outstanding*/

```

```

/// NFS4ERR_LAYOUTTRYLATER = 10058,

```



```

/// NFS4ERR_LAYOUTUNAVAILABLE = 10059,
/// NFS4ERR_NOMATCHING_LAYOUT = 10060,
/// NFS4ERR_RECALLCONFLICT = 10061,
/// NFS4ERR_UNKNOWN_LAYOUTTYPE = 10062,
/// NFS4ERR_SEQ_MISORDERED = 10063,/* unexpected seq.ID in req*/
/// NFS4ERR_SEQUENCE_POS = 10064,/* [CB_]SEQ. op not 1st op */
/// NFS4ERR_REQ_TOO_BIG = 10065,/* request too big */
/// NFS4ERR_REP_TOO_BIG = 10066,/* reply too big */
/// NFS4ERR_REP_TOO_BIG_TO_CACHE =10067,/* rep. not all cached*/
/// NFS4ERR_RETRY_UNCACHED_REP =10068,/* retry & rep. uncached*/
/// NFS4ERR_UNSAFE_COMPOUND =10069,/* retry/recovery too hard */
/// NFS4ERR_TOO_MANY_OPS = 10070,/*too many ops in [CB_]COMP*/
/// NFS4ERR_OP_NOT_IN_SESSION =10071,/* op needs [CB_]SEQ. op */
/// NFS4ERR_HASH_ALG_UNSUPP = 10072, /* hash alg. not supp. */
/// /* Error 10073 is unused. */
/// NFS4ERR_CLIENTID_BUSY = 10074,/* clientid has state */
/// NFS4ERR_PNFS_IO_HOLE = 10075,/* IO to _SPARSE file hole */
/// NFS4ERR_SEQ_FALSE_RETRY= 10076,/* Retry != original req. */
/// NFS4ERR_BAD_HIGH_SLOT = 10077,/* req has bad highest_slot*/
/// NFS4ERR_DEADSESSION = 10078,/*new req sent to dead sess*/
/// NFS4ERR_ENCR_ALG_UNSUPP= 10079,/* encr alg. not supp. */
/// NFS4ERR_PNFS_NO_LAYOUT = 10080,/* I/O without a layout */
/// NFS4ERR_NOT_ONLY_OP = 10081,/* addl ops not allowed */
/// NFS4ERR_WRONG_CRED = 10082,/* op done by wrong cred */
/// NFS4ERR_WRONG_TYPE = 10083,/* op on wrong type object */
/// NFS4ERR_DIRDELEG_UNAVAIL=10084,/* delegation not avail. */
/// NFS4ERR_REJECT_DELEG = 10085,/* cb rejected delegation */
/// NFS4ERR_RETURNCONFLICT = 10086,/* layout get before return*/
/// NFS4ERR_DELEG_REVOKED = 10087 /* deleg./layout revoked */
/// };
///
/// /*
/// * Basic data types
/// */
/// typedef opaque attrlist4<>;
/// typedef uint32_t bitmap4<>;
/// typedef uint64_t changeid4;
/// typedef uint64_t clientid4;
/// typedef uint32_t count4;
/// typedef uint64_t length4;
/// typedef uint32_t mode4;
/// typedef uint64_t nfs_cookie4;
/// typedef opaque nfs_fh4<NFS4_FHSIZE>;
/// typedef uint64_t offset4;
/// typedef uint32_t qop4;
/// typedef opaque sec_oid4<>;
/// typedef uint32_t sequenceid4;

```

---

```
/// typedef uint32_t      seqid4;
/// typedef opaque  sessionid4[NFS4_SESSIONID_SIZE];
/// typedef uint32_t      slotid4;
/// typedef opaque  utf8string<>;
/// typedef utf8string    utf8str_cis;
/// typedef utf8string    utf8str_cs;
/// typedef utf8string    utf8str_mixed;
/// typedef utf8str_cs     component4;
/// typedef utf8str_cs     linktext4;
/// typedef component4     pathname4<>;
/// typedef opaque  verifier4[NFS4_VERIFIER_SIZE];
///
/// /*
///  * Timeval
///  */
/// struct nfstime4 {
///     int64_t      seconds;
///     uint32_t     nseconds;
/// };
///
/// enum time_how4 {
///     SET_TO_SERVER_TIME4 = 0,
///     SET_TO_CLIENT_TIME4 = 1
/// };
///
/// union settime4 switch (time_how4 set_it) {
///     case SET_TO_CLIENT_TIME4:
///         nfstime4      time;
///     default:
///         void;
/// };
///
/// typedef uint32_t nfs_lease4;
///
/// /*
///  * File attribute definitions
///  */
///
/// /*
///  * FSID structure for major/minor
///  */
/// struct fsid4 {
///     uint64_t      major;
///     uint64_t      minor;
/// };
```

```
///  
/**
```

```
/// * Filesystem locations attribute  
/// * for relocation/migration and  
/// * related attributes.  
/// */  
/// struct change_policy4 {  
///     uint64_t      cp_major;  
///     uint64_t      cp_minor;  
/// };  
///  
/// struct fs_location4 {  
///     utf8str_cis   server<>;  
///     pathname4     rootpath;  
/// };  
///  
/// struct fs_locations4 {  
///     pathname4     fs_root;  
///     fs_location4 locations<>;  
/// };  
///  
/// /**  
/// * Various Access Control Entry definitions  
/// */  
///  
/// /**  
/// * Mask that indicates which  
/// * Access Control Entries are supported.  
/// * Values for the fattr4_aclsupport attribute.  
/// */  
/// const ACL4_SUPPORT_ALLOW_ACL    = 0x00000001;  
/// const ACL4_SUPPORT_DENY_ACL     = 0x00000002;  
/// const ACL4_SUPPORT_AUDIT_ACL    = 0x00000004;  
/// const ACL4_SUPPORT_ALARM_ACL    = 0x00000008;  
///  
///  
/// typedef uint32_t      acetype4;  
///  
///  
/// /**  
/// * acetype4 values, others can be added as needed.
```

```
/// */
/// const ACE4_ACCESS_ALLOWED_ACE_TYPE      = 0x00000000;
/// const ACE4_ACCESS_DENIED_ACE_TYPE       = 0x00000001;
/// const ACE4_SYSTEM_AUDIT_ACE_TYPE        = 0x00000002;
/// const ACE4_SYSTEM_ALARM_ACE_TYPE        = 0x00000003;
///
///
///
/// /*
```

```
/// * ACE flag
/// */
/// typedef uint32_t aceflag4;
///
///
/// /*
/// * ACE flag values
/// */
/// const ACE4_FILE_INHERIT_ACE              = 0x00000001;
/// const ACE4_DIRECTORY_INHERIT_ACE        = 0x00000002;
/// const ACE4_NO_PROPAGATE_INHERIT_ACE     = 0x00000004;
/// const ACE4_INHERIT_ONLY_ACE             = 0x00000008;
/// const ACE4_SUCCESSFUL_ACCESS_ACE_FLAG   = 0x00000010;
/// const ACE4_FAILED_ACCESS_ACE_FLAG       = 0x00000020;
/// const ACE4_IDENTIFIER_GROUP             = 0x00000040;
/// const ACE4_INHERITED_ACE                = 0x00000080;
///
///
///
/// /*
/// * ACE mask
/// */
/// typedef uint32_t          acemask4;
///
///
///
/// /*
/// * ACE mask values
/// */
/// const ACE4_READ_DATA                    = 0x00000001;
/// const ACE4_LIST_DIRECTORY               = 0x00000001;
/// const ACE4_WRITE_DATA                   = 0x00000002;
/// const ACE4_ADD_FILE                      = 0x00000002;
```

```
/// const ACE4_APPEND_DATA          = 0x00000004;
/// const ACE4_ADD_SUBDIRECTORY      = 0x00000004;
/// const ACE4_READ_NAMED_ATTRS     = 0x00000008;
/// const ACE4_WRITE_NAMED_ATTRS    = 0x00000010;
/// const ACE4_EXECUTE               = 0x00000020;
/// const ACE4_DELETE_CHILD          = 0x00000040;
/// const ACE4_READ_ATTRIBUTES       = 0x00000080;
/// const ACE4_WRITE_ATTRIBUTES      = 0x00000100;
/// const ACE4_WRITE_RETENTION       = 0x00000200;
/// const ACE4_WRITE_RETENTION_HOLD = 0x00000400;
///
/// const ACE4_DELETE                 = 0x00010000;
/// const ACE4_READ_ACL               = 0x00020000;
/// const ACE4_WRITE_ACL              = 0x00040000;
/// const ACE4_WRITE_OWNER            = 0x00080000;
/// const ACE4_SYNCHRONIZE            = 0x00100000;
```

```
///
///
/// /*
/// * ACE4_GENERIC_READ -- defined as combination of
/// *   ACE4_READ_ACL |
/// *   ACE4_READ_DATA |
/// *   ACE4_READ_ATTRIBUTES |
/// *   ACE4_SYNCHRONIZE
/// */
///
/// const ACE4_GENERIC_READ = 0x00120081;
///
/// /*
/// * ACE4_GENERIC_WRITE -- defined as combination of
/// *   ACE4_READ_ACL |
/// *   ACE4_WRITE_DATA |
/// *   ACE4_WRITE_ATTRIBUTES |
/// *   ACE4_WRITE_ACL |
/// *   ACE4_APPEND_DATA |
/// *   ACE4_SYNCHRONIZE
/// */
/// const ACE4_GENERIC_WRITE = 0x00160106;
///
///
/// /*
```

```

/// * ACE4_GENERIC_EXECUTE -- defined as combination of
/// *     ACE4_READ_ACL
/// *     ACE4_READ_ATTRIBUTES
/// *     ACE4_EXECUTE
/// *     ACE4_SYNCHRONIZE
/// */
/// const ACE4_GENERIC_EXECUTE = 0x001200A0;
///
///
/// /*
/// * Access Control Entry definition
/// */
/// struct nfsace4 {
///     acetype4         type;
///     aceflag4         flag;
///     acemask4         access_mask;
///     utf8str_mixed    who;
/// };
///
///
/// /*
/// * ACL flag
/// */

```

```

///
/// typedef uint32_t aclflag4;
///
/// /*
/// * ACL flag values
/// */
/// const ACL4_AUTO_INHERIT         = 0x00000001;
/// const ACL4_PROTECTED             = 0x00000002;
/// const ACL4_DEFAULTED             = 0x00000004;
///
///
/// /*
/// * Version 4.1 Access Control List definition
/// */
/// struct nfsacl41 {
///     aclflag4         na41_flag;
///     nfsace4         na41_aces<>;
/// };

```

```

///
///
/// /*
/// * Field definitions for the fattr4_mode
/// * and fattr4_mode_set_masked attributes.
/// */
/// const MODE4_SUID = 0x800; /* set user id on execution */
/// const MODE4_SGID = 0x400; /* set group id on execution */
/// const MODE4_SVTX = 0x200; /* save text even after use */
/// const MODE4_RUSR = 0x100; /* read permission: owner */
/// const MODE4_WUSR = 0x080; /* write permission: owner */
/// const MODE4_XUSR = 0x040; /* execute permission: owner */
/// const MODE4_RGRP = 0x020; /* read permission: group */
/// const MODE4_WGRP = 0x010; /* write permission: group */
/// const MODE4_XGRP = 0x008; /* execute permission: group */
/// const MODE4_ROTH = 0x004; /* read permission: other */
/// const MODE4_WOTH = 0x002; /* write permission: other */
/// const MODE4_XOTH = 0x001; /* execute permission: other */
///
///
/// /*
/// * Masked mode for the mode_set_masked attribute.
/// */
/// struct mode_masked4 {
///     mode4 mm_value_to_set; /* Values of bits
///                             to set or reset
///                             in mode. */
///
///     mode4 mm_mask_bits; /* Mask of bits to
///                          set or reset

```

```

///                                     in mode. */
/// };
///
/// /*
/// * Special data/attribute associated with
/// * file types NF4BLK and NF4CHR.
/// */
/// struct specdata4 {
///     uint32_t specdata1; /* major device number */
///     uint32_t specdata2; /* minor device number */
/// };

```

```

///
/// /*
/// * Values for fattr4_fh_expire_type
/// */
/// const   FH4_PERSISTENT           = 0x00000000;
/// const   FH4_NOEXPIRE_WITH_OPEN  = 0x00000001;
/// const   FH4_VOLATILE_ANY         = 0x00000002;
/// const   FH4_VOL_MIGRATION        = 0x00000004;
/// const   FH4_VOL_RENAME           = 0x00000008;
///
///
/// struct netaddr4 {
///     /* see struct rpcb in RFC 1833 */
///     string na_r_netid<>;    /* network id */
///     string na_r_addr<>;    /* universal address */
/// };
///
/// /*
/// * data structures new to NFSv4.1
/// */
///
/// struct nfs_impl_id4 {
///     utf8str_cis   nii_domain;
///     utf8str_cs    nii_name;
///     nfstime4     nii_date;
/// };
///
///
/// /*
/// * Stateid
/// */
/// struct stateid4 {
///     uint32_t     seqid;
///     opaque       other[12];
/// };
///
/// enum layouttype4 {

```

```

///     LAYOUT4_NFSV4_1_FILES       = 0x1,
///     LAYOUT4_OSD2_OBJECTS        = 0x2,
///     LAYOUT4_BLOCK_VOLUME        = 0x3
/// };

```



```

///
/// struct layout_content4 {
///     layouttype4 loc_type;
///     opaque      loc_body<>;
/// };
///
///
/// /*
/// /* LAYOUT4 OSD2 OBJECTS loc_body description
/// % * is in a separate .x file
/// % */
/// %
/// /*
/// /* LAYOUT4_BLOCK_VOLUME loc_body description
/// % * is in a separate .x file
/// % */
///
/// struct layouthint4 {
///     layouttype4      loh_type;
///     opaque           loh_body<>;
/// };
///
/// enum layoutiomode4 {
///     LAYOUTIOMODE4_READ      = 1,
///     LAYOUTIOMODE4_RW       = 2,
///     LAYOUTIOMODE4_ANY      = 3
/// };
///
/// struct layout4 {
///     offset4           lo_offset;
///     length4          lo_length;
///     layoutiomode4    lo_iomode;
///     layout_content4  lo_content;
/// };
///
/// const NFS4_DEVICEID4_SIZE = 16;
///
/// typedef opaque deviceid4[NFS4_DEVICEID4_SIZE];
///
/// struct device_addr4 {
///     layouttype4      da_layout_type;
///     opaque           da_addr_body<>;
/// };
///

```

```
///
/// struct layoutupdate4 {
///     layouttype4          lou_type;
///     opaque                lou_body<>;
/// };
///
/// %
/// /* Constants used for LAYOUTRETURN and CB_LAYOUTRECALL */
/// const LAYOUT4_RET_REC_FILE      = 1;
/// const LAYOUT4_RET_REC_FSID      = 2;
/// const LAYOUT4_RET_REC_ALL       = 3;
/// %
/// enum layoutreturn_type4 {
///     LAYOUTRETURN4_FILE = LAYOUT4_RET_REC_FILE,
///     LAYOUTRETURN4_FSID = LAYOUT4_RET_REC_FSID,
///     LAYOUTRETURN4_ALL  = LAYOUT4_RET_REC_ALL
/// };
///
/// struct layoutreturn_file4 {
///     offset4          lrf_offset;
///     length4          lrf_length;
///     stateid4         lrf_stateid;
///     /* layouttype4 specific data */
///     opaque           lrf_body<>;
/// };
///
/// union layoutreturn4 switch(layoutreturn_type4 lr_returntype) {
///     case LAYOUTRETURN4_FILE:
///         layoutreturn_file4      lr_layout;
///     default:
///         void;
/// };
/// %
///
/// enum fs4_status_type {
///     STATUS4_FIXED = 1,
///     STATUS4_UPDATED = 2,
///     STATUS4_VERSIONED = 3,
///     STATUS4_WRITABLE = 4,
///     STATUS4_REFERRAL = 5
/// };
///
/// struct fs4_status {
///     bool          fss_absent;
///     fs4_status_type fss_type;
///     utf8str_cs    fss_source;
///     utf8str_cs    fss_current;
```

```
///          int32_t          fss_age;
```

```
///          nfstime4          fss_version;
/// };
///
///
/// const TH4_READ_SIZE      = 0;
/// const TH4_WRITE_SIZE     = 1;
/// const TH4_READ_IOSIZE    = 2;
/// const TH4_WRITE_IOSIZE   = 3;
///
/// typedef length4 threshold4_read_size;
/// typedef length4 threshold4_write_size;
/// typedef length4 threshold4_read_iosize;
/// typedef length4 threshold4_write_iosize;
///
/// struct threshold_item4 {
///     layouttype4      thi_layout_type;
///     bitmap4          thi_hintset;
///     opaque           thi_hintlist<>;
/// };
///
/// struct mdsthreshold4 {
///     threshold_item4 mth_hints<>;
/// };
///
/// const RET4_DURATION_INFINITE = 0xffffffffffffffff;
/// struct retention_get4 {
///     uint64_t         rg_duration;
///     nfstime4         rg_begin_time<1>;
/// };
///
/// struct retention_set4 {
///     bool             rs_enable;
///     uint64_t         rs_duration<1>;
/// };
///
/// const FSCHARSET_CAP4_CONTAINS_NON_UTF8 = 0x1;
/// const FSCHARSET_CAP4_ALLOWS_ONLY_UTF8  = 0x2;
///
/// typedef uint32_t     fs_charset_cap4;
///
```

```

///
/// /*
///  * NFSv4.1 attributes
///  */
/// typedef bitmap4          fattr4_supported_attrs;
/// typedef bitmap4          fattr4_suppattnr_exclcreat;
/// typedef nfs_ftype4        fattr4_type;
/// typedef uint32_t          fattr4_fh_expire_type;

```

```

/// typedef changeid4        fattr4_change;
/// typedef uint64_t          fattr4_size;
/// typedef bool              fattr4_link_support;
/// typedef bool              fattr4_symlink_support;
/// typedef bool              fattr4_named_attr;
/// typedef fsid4             fattr4_fsid;
/// typedef bool              fattr4_unique_handles;
/// typedef nfs_lease4        fattr4_lease_time;
/// typedef nfsstat4          fattr4_rdattnr_error;
/// typedef nfsace4           fattr4_acl<>;
/// typedef uint32_t          fattr4_aclsupport;
/// typedef bool              fattr4_archive;
/// typedef bool              fattr4_cansetttime;
/// typedef bool              fattr4_case_insensitive;
/// typedef bool              fattr4_case_preserving;
/// typedef bool              fattr4_chown_restricted;
/// typedef uint64_t          fattr4_fileid;
/// typedef uint64_t          fattr4_files_avail;
/// typedef nfs_fh4           fattr4_filehandle;
/// typedef uint64_t          fattr4_files_free;
/// typedef uint64_t          fattr4_files_total;
/// typedef fs_locations4     fattr4_fs_locations;
/// typedef bool              fattr4_hidden;
/// typedef bool              fattr4_homogeneous;
/// typedef uint64_t          fattr4_maxfilesize;
/// typedef uint32_t          fattr4_maxlink;
/// typedef uint32_t          fattr4_maxname;
/// typedef uint64_t          fattr4_maxread;
/// typedef uint64_t          fattr4_maxwrite;
/// typedef utf8str_cs        fattr4_mimetype;
/// typedef mode4             fattr4_mode;
/// typedef mode_masked4      fattr4_mode_set_masked;
/// typedef uint64_t          fattr4_mounted_on_fileid;

```

```

/// typedef bool          fattr4_no_trunc;
/// typedef uint32_t      fattr4_numlinks;
/// typedef utf8str_mixed fattr4_owner;
/// typedef utf8str_mixed fattr4_owner_group;
/// typedef uint64_t      fattr4_quota_avail_hard;
/// typedef uint64_t      fattr4_quota_avail_soft;
/// typedef uint64_t      fattr4_quota_used;
/// typedef specdata4     fattr4_rawdev;
/// typedef uint64_t      fattr4_space_avail;
/// typedef uint64_t      fattr4_space_free;
/// typedef uint64_t      fattr4_space_total;
/// typedef uint64_t      fattr4_space_used;
/// typedef bool          fattr4_system;
/// typedef nfstime4      fattr4_time_access;
/// typedef settime4      fattr4_time_access_set;

```

```

/// typedef nfstime4      fattr4_time_backup;
/// typedef nfstime4      fattr4_time_create;
/// typedef nfstime4      fattr4_time_delta;
/// typedef nfstime4      fattr4_time_metadata;
/// typedef nfstime4      fattr4_time_modify;
/// typedef settime4      fattr4_time_modify_set;
/// /*
///  * attributes new to NFSv4.1
///  */
/// typedef nfstime4      fattr4_dir_notif_delay;
/// typedef nfstime4      fattr4_dirent_notif_delay;
/// typedef bool          fattr4_absent;
/// typedef layouttype4   fattr4_fs_layout_types<>;
/// typedef fs4_status    fattr4_fs_status;
/// typedef fs_charset_cap4 fattr4_fs_charset_cap4;
/// typedef uint32_t      fattr4_layout_alignment;
/// typedef uint32_t      fattr4_layout_blksize;
/// typedef layouthint4   fattr4_layout_hint;
/// typedef layouttype4   fattr4_layout_types<>;
/// typedef mdsthreshold4 fattr4_mdsthreshold;
/// typedef retention_get4 fattr4_retention_get;
/// typedef retention_set4 fattr4_retention_set;
/// typedef retention_get4 fattr4_retentevt_get;
/// typedef retention_set4 fattr4_retentevt_set;
/// typedef uint64_t      fattr4_retention_hold;
/// typedef nfsacl41      fattr4_dacl;

```

```

/// typedef nfsacl41      fattr4_sacl;
///
///
/// /*
///  * Mandatory Attributes
///  */
/// const FATTR4_SUPPORTED_ATTRS = 0;
/// const FATTR4_TYPE = 1;
/// const FATTR4_FH_EXPIRE_TYPE = 2;
/// const FATTR4_CHANGE = 3;
/// const FATTR4_SIZE = 4;
/// const FATTR4_LINK_SUPPORT = 5;
/// const FATTR4_SYMLINK_SUPPORT = 6;
/// const FATTR4_NAMED_ATTR = 7;
/// const FATTR4_FSID = 8;
/// const FATTR4_UNIQUE_HANDLES = 9;
/// const FATTR4_LEASE_TIME = 10;
/// const FATTR4_RDATTR_ERROR = 11;
/// const FATTR4_FILEHANDLE = 19;
/// const FATTR4_SUPPATTR_EXCLCREAT = 75;
///
/// /*

```

```

///  * Recommended Attributes
///  */
/// const FATTR4_ACL = 12;
/// const FATTR4_ACLSUPPORT = 13;
/// const FATTR4_ARCHIVE = 14;
/// const FATTR4_CANSETTIME = 15;
/// const FATTR4_CASE_INSENSITIVE = 16;
/// const FATTR4_CASE_PRESERVING = 17;
/// const FATTR4_CHOWN_RESTRICTED = 18;
/// const FATTR4_FILEID = 20;
/// const FATTR4_FILES_AVAIL = 21;
/// const FATTR4_FILES_FREE = 22;
/// const FATTR4_FILES_TOTAL = 23;
/// const FATTR4_FS_LOCATIONS = 24;
/// const FATTR4_HIDDEN = 25;
/// const FATTR4_HOMOGENEOUS = 26;
/// const FATTR4_MAXFILESIZE = 27;
/// const FATTR4_MAXLINK = 28;
/// const FATTR4_MAXNAME = 29;

```

```
/// const FATTR4_MAXREAD           = 30;
/// const FATTR4_MAXWRITE          = 31;
/// const FATTR4_MIMETYPE           = 32;
/// const FATTR4_MODE                = 33;
/// const FATTR4_NO_TRUNC            = 34;
/// const FATTR4_NUMLINKS           = 35;
/// const FATTR4_OWNER               = 36;
/// const FATTR4_OWNER_GROUP        = 37;
/// const FATTR4_QUOTA_AVAIL_HARD    = 38;
/// const FATTR4_QUOTA_AVAIL_SOFT    = 39;
/// const FATTR4_QUOTA_USED          = 40;
/// const FATTR4_RAWDEV              = 41;
/// const FATTR4_SPACE_AVAIL         = 42;
/// const FATTR4_SPACE_FREE          = 43;
/// const FATTR4_SPACE_TOTAL         = 44;
/// const FATTR4_SPACE_USED          = 45;
/// const FATTR4_SYSTEM              = 46;
/// const FATTR4_TIME_ACCESS         = 47;
/// const FATTR4_TIME_ACCESS_SET     = 48;
/// const FATTR4_TIME_BACKUP         = 49;
/// const FATTR4_TIME_CREATE         = 50;
/// const FATTR4_TIME_DELTA          = 51;
/// const FATTR4_TIME_METADATA       = 52;
/// const FATTR4_TIME_MODIFY         = 53;
/// const FATTR4_TIME_MODIFY_SET     = 54;
/// const FATTR4_MOUNTED_ON_FILEID   = 55;
/// const FATTR4_DIR_NOTIF_DELAY     = 56;
/// const FATTR4_DIRENT_NOTIF_DELAY  = 57;
/// const FATTR4_DACL                = 58;
```

```
/// const FATTR4_SACL               = 59;
/// const FATTR4_CHANGE_POLICY       = 60;
/// const FATTR4_FS_STATUS            = 61;
/// const FATTR4_FS_LAYOUT_TYPE      = 62;
/// const FATTR4_LAYOUT_HINT         = 63;
/// const FATTR4_LAYOUT_TYPE         = 64;
/// const FATTR4_LAYOUT_BLKSIZE      = 65;
/// const FATTR4_LAYOUT_ALIGNMENT    = 66;
/// const FATTR4_FS_LOCATIONS_INFO   = 67;
/// const FATTR4_MDSTHRESHOLD        = 68;
/// const FATTR4_RETENTION_GET        = 69;
/// const FATTR4_RETENTION_SET        = 70;
```

```

/// const FATTR4_RETENDEV_T_GET      = 71;
/// const FATTR4_RETENDEV_T_SET      = 72;
/// const FATTR4_RETENTION_HOLD     = 73;
/// const FATTR4_MODE_SET_MASKED    = 74;
/// const FATTR4_FS_CHARSET_CAP     = 76;
///
/// /*
///  * File attribute container
///  */
/// struct fattr4 {
///     bitmap4      attrmask;
///     attrlist4    attr_vals;
/// };
///
/// /*
///  * Change info for the client
///  */
/// struct change_info4 {
///     bool          atomic;
///     changeid4     before;
///     changeid4     after;
/// };
///
/// typedef netaddr4 clientaddr4;
///
/// /*
///  * Callback program info as provided by the client
///  */
/// struct cb_client4 {
///     uint32_t      cb_program;
///     netaddr4      cb_location;
/// };
///
/// /*
///  * NFSv4.0 Long Hand Client ID
///  */

```

```

/// struct nfs_client_id4 {
///     verifier4     verifier;
///     opaque        id<NFS4_OPAQUE_LIMIT>;
/// };
///

```



```

/// /*
///  * NFSv4.1 Client Owner (aka long hand client ID)
///  */
/// struct client_owner4 {
///     verifier4      co_verifier;
///     opaque          co_ownerid<NFS4_OPAQUE_LIMIT>;
/// };
///
///
/// /*
///  * NFSv4.1 server Owner
///  */
/// struct server_owner4 {
///     uint64_t        so_minor_id;
///     opaque          so_major_id<NFS4_OPAQUE_LIMIT>;
/// };
///
///
/// struct state_owner4 {
///     clientid4       clientid;
///     opaque          owner<NFS4_OPAQUE_LIMIT>;
/// };
///
/// typedef state_owner4 open_owner4;
/// typedef state_owner4 lock_owner4;
///
///
/// enum nfs_lock_type4 {
///     READ_LT         = 1,
///     WRITE_LT        = 2,
///     READW_LT        = 3,    /* blocking read */
///     WRITEW_LT       = 4    /* blocking write */
/// };
///
///
/// %
/// %/* Input for computing subkeys */
/// enum ssv_subkey4 {
///     SSV4_SUBKEY_MIC_I2T    = 1,
///     SSV4_SUBKEY_MIC_T2I    = 2,
///     SSV4_SUBKEY_SEAL_I2T   = 3,
///     SSV4_SUBKEY_SEAL_T2I   = 4
/// };

```

```

/// %
///
/// %
/// /* Input for computing smt_hmac */
/// struct ssv_mic_plain_tkn4 {
///     uint32_t      smpt_ssv_seq;
///     opaque        smpt_orig_plain<>;
/// };
/// %
///
/// %
/// /* SSV GSS PerMsgToken token */
/// struct ssv_mic_tkn4 {
///     uint32_t      smt_ssv_seq;
///     opaque        smt_hmac<>;
/// };
/// %
///
/// %
/// /* Input for computing ssct_encr_data and ssct_hmac */
/// struct ssv_seal_plain_tkn4 {
///     opaque        sspt_confounder<>;
///     uint32_t      sspt_ssv_seq;
///     opaque        sspt_orig_plain<>;
///     opaque        sspt_pad<>;
/// };
/// %
///
/// %
/// /* SSV GSS SealedMessage token */
/// struct ssv_seal_cipher_tkn4 {
///     uint32_t      ssct_ssv_seq;
///     opaque        ssct_iv<>;
///     opaque        ssct_encr_data<>;
///     opaque        ssct_hmac<>;
/// };
/// %
///
/// /*
///  * Defines an individual server replica
///  */
/// struct fs_locations_server4 {
///     int32_t      fls_currency;
///     opaque        fls_info<>;
///     utf8str_cis   fls_server;
/// };
///
/// /*

```

Internet-Draft

NFSv4.1 XDR Description

December 2008

```
/// * Byte indices of items within
/// * fls_info: flag fields, class numbers,
/// * bytes indicating ranks and orders.
/// */
/// const FSLI4BX_GFLAGS           = 0;
/// const FSLI4BX_TFLAGS           = 1;
///
/// const FSLI4BX_CLSIMUL           = 2;
/// const FSLI4BX_CLHANDLE          = 3;
/// const FSLI4BX_CLFILEID          = 4;
/// const FSLI4BX_CLWRITEVER        = 5;
/// const FSLI4BX_CLCHANGE          = 6;
/// const FSLI4BX_CLREADDIR         = 7;
///
/// const FSLI4BX_READRANK          = 8;
/// const FSLI4BX_WRITERANK         = 9;
/// const FSLI4BX_READORDER         = 10;
/// const FSLI4BX_WRITEORDER        = 11;
///
/// /*
/// * Bits defined within the general flag byte.
/// */
/// const FSLI4GF_WRITABLE           = 0x01;
/// const FSLI4GF_CUR_REQ            = 0x02;
/// const FSLI4GF_ABSENT             = 0x04;
/// const FSLI4GF_GOING              = 0x08;
/// const FSLI4GF_SPLIT              = 0x10;
///
/// /*
/// * Bits defined within the transport flag byte.
/// */
/// const FSLI4TF_RDMA               = 0x01;
///
/// /*
/// * Defines a set of replicas sharing
/// * a common value of the root path
/// * with in the corresponding
/// * single-server namespaces.
/// */
/// struct fs_locations_item4 {
///     fs_locations_server4    fli_entries<>;
///     pathname4               fli_rootpath;
```

```
/// };
///
/// /*
///  * Defines the overall structure of
///  * the fs_locations_info attribute.
///  */
```

```
/// struct fs_locations_info4 {
///     uint32_t          fli_flags;
///     int32_t          fli_valid_for;
///     pathname4        fli_fs_root;
///     fs_locations_item4 fli_items<>;
/// };
///
/// /*
///  * Flag bits in fli_flags.
///  */
/// const FSLI4IF_VAR_SUB          = 0x00000001;
///
/// typedef fs_locations_info4 fattr4_fs_locations_info;
///
/// const NFL4_UFLG_MASK          = 0x0000003F;
/// const NFL4_UFLG_DENSE        = 0x00000001;
/// const NFL4_UFLG_COMMIT_THRU_MDS = 0x00000002;
/// const NFL4_UFLG_STRIPE_UNIT_SIZE_MASK
///                               = 0xFFFFF0;
///
/// typedef uint32_t nfl_util4;
///
/// %
///
/// enum filelayout_hint_care4 {
///     NFLH4_CARE_DENSE          = NFL4_UFLG_DENSE,
///
///     NFLH4_CARE_COMMIT_THRU_MDS
///                               = NFL4_UFLG_COMMIT_THRU_MDS,
///
///     NFLH4_CARE_STRIPE_UNIT_SIZE
///                               = 0x00000040,
///
///     NFLH4_CARE_STRIPE_COUNT = 0x00000080
/// };
```

```

/// %
/// %/* Encoded in the loh_body field of type layouthint4: */
/// %
/// struct nfsv4_1_file_layouthint4 {
///     uint32_t      nflh_care;
///     nfl_util4     nflh_util;
///     count4        nflh_stripe_count;
/// };
///
/// %
///
/// %
/// typedef netaddr4 multipath_list4<>;

```

```

/// %
/// %/* Encoded in the da_addr_body field of type device_addr4: */
/// struct nfsv4_1_file_layout_ds_addr4 {
///     uint32_t      nflda_stripe_indices<>;
///     multipath_list4 nflda_multipath_ds_list<>;
/// };
///
/// %
///
/// %
/// %/* Encoded in the loc_body field of type layout_content4: */
/// struct nfsv4_1_file_layout4 {
///     deviceid4     nfl_deviceid;
///     nfl_util4     nfl_util;
///     uint32_t      nfl_first_stripe_index;
///     offset4       nfl_pattern_offset;
///     nfs_fh4       nfl_fh_list<>;
/// };
///
/// %
///
/// %/*
/// % * Encoded in the lou_body field of type layoutupdate4:
/// % *      Nothing. lou_body is a zero length array of octets.
/// % */
/// %
///
///

```

```

///
/// const ACCESS4_READ      = 0x00000001;
/// const ACCESS4_LOOKUP    = 0x00000002;
/// const ACCESS4_MODIFY    = 0x00000004;
/// const ACCESS4_EXTEND    = 0x00000008;
/// const ACCESS4_DELETE    = 0x00000010;
/// const ACCESS4_EXECUTE   = 0x00000020;
///
/// struct ACCESS4args {
///     /* CURRENT_FH: object */
///     uint32_t      access;
/// };
///
/// struct ACCESS4resok {
///     uint32_t      supported;
///     uint32_t      access;
/// };
///
/// union ACCESS4res switch (nfsstat4 status) {
///     case NFS4_OK:

```

```

///     ACCESS4resok      resok4;
///     default:
///     void;
/// };
///
/// struct CLOSE4args {
///     /* CURRENT_FH: object */
///     seqid4      seqid;
///     stateid4    open_stateid;
/// };
///
/// union CLOSE4res switch (nfsstat4 status) {
///     case NFS4_OK:
///     stateid4    open_stateid;
///     default:
///     void;
/// };
///
/// struct COMMIT4args {
///     /* CURRENT_FH: file */
///     offset4     offset;

```

```

///         count4         count;
/// };
///
/// struct COMMIT4resok {
///         verifier4         writeverf;
/// };
///
/// union COMMIT4res switch (nfsstat4 status) {
/// case NFS4_OK:
///         COMMIT4resok         resok4;
/// default:
///         void;
/// };
///
/// union createtype4 switch (nfs_ftype4 type) {
/// case NF4LNK:
///         linktext4 linkdata;
/// case NF4BLK:
/// case NF4CHR:
///         specdata4 devdata;
/// case NF4SOCK:
/// case NF4FIFO:
/// case NF4DIR:
///         void;
/// default:
///         void; /* server should return NFS4ERR_BADTYPE */
/// };

```

```

///
/// struct CREATE4args {
///         /* CURRENT_FH: directory for creation */
///         createtype4         objtype;
///         component4         objname;
///         fattr4         createattrs;
/// };
///
/// struct CREATE4resok {
///         change_info4         cinfo;
///         bitmap4         attrset; /* attributes set */
/// };
///
/// union CREATE4res switch (nfsstat4 status) {

```

```

/// case NFS4_OK:
///     /* new CURRENTFH: created object */
///     CREATE4resok resok4;
/// default:
///     void;
/// };
///
/// struct DELEGPURGE4args {
///     clientid4      clientid;
/// };
///
/// struct DELEGPURGE4res {
///     nfsstat4      status;
/// };
///
/// struct DELEGRETURN4args {
///     /* CURRENT_FH: delegated object */
///     stateid4      deleg_stateid;
/// };
///
/// struct DELEGRETURN4res {
///     nfsstat4      status;
/// };
///
/// struct GETATTR4args {
///     /* CURRENT_FH: object */
///     bitmap4      attr_request;
/// };
///
/// struct GETATTR4resok {
///     fattr4      obj_attributes;
/// };
///
/// union GETATTR4res switch (nfsstat4 status) {

```

```

/// case NFS4_OK:
///     GETATTR4resok resok4;
/// default:
///     void;
/// };
///
/// struct GETFH4resok {

```



```

    ///         nfs_fh4         object;
    /// };
    ///
    /// union GETFH4res switch (nfsstat4 status) {
    ///     case NFS4_OK:
    ///         GETFH4resok         resok4;
    ///     default:
    ///         void;
    /// };
    ///
    /// struct LINK4args {
    ///     /* SAVED_FH: source object */
    ///     /* CURRENT_FH: target directory */
    ///     component4         newname;
    /// };
    ///
    /// struct LINK4resok {
    ///     change_info4         cinfo;
    /// };
    ///
    /// union LINK4res switch (nfsstat4 status) {
    ///     case NFS4_OK:
    ///         LINK4resok resok4;
    ///     default:
    ///         void;
    /// };
    ///
    /// /*
    ///  * For LOCK, transition from open_stateid and lock_owner
    ///  * to a lock stateid.
    ///  */
    /// struct open_to_lock_owner4 {
    ///     seqid4         open_seqid;
    ///     stateid4         open_stateid;
    ///     seqid4         lock_seqid;
    ///     lock_owner4         lock_owner;
    /// };
    ///
    /// /*
    ///  * For LOCK, existing lock stateid continues to request new
    ///  * file lock for the same lock_owner and open_stateid.

```

```

/// */
/// struct exist_lock_owner4 {
///     stateid4      lock_stateid;
///     seqid4        lock_seqid;
/// };
///
/// union locker4 switch (bool new_lock_owner) {
///     case TRUE:
///         open_to_lock_owner4    open_owner;
///     case FALSE:
///         exist_lock_owner4      lock_owner;
/// };
///
/// /*
///  * LOCK/LOCKT/LOCKU: Record lock management
///  */
/// struct LOCK4args {
///     /* CURRENT_FH: file */
///     nfs_lock_type4  locktype;
///     bool            reclaim;
///     offset4        offset;
///     length4         length;
///     locker4        locker;
/// };
///
/// struct LOCK4denied {
///     offset4        offset;
///     length4         length;
///     nfs_lock_type4  locktype;
///     lock_owner4    owner;
/// };
///
/// struct LOCK4resok {
///     stateid4      lock_stateid;
/// };
///
/// union LOCK4res switch (nfsstat4 status) {
///     case NFS4_OK:
///         LOCK4resok    resok4;
///     case NFS4ERR_DENIED:
///         LOCK4denied    denied;
///     default:
///         void;
/// };
///
/// struct LOCKT4args {
///     /* CURRENT_FH: file */
///     nfs_lock_type4  locktype;

```

Internet-Draft

NFSv4.1 XDR Description

December 2008

```
///         offset4         offset;
///         length4         length;
///         lock_owner4     owner;
/// };
///
/// union LOCKT4res switch (nfsstat4 status) {
///   case NFS4ERR_DENIED:
///     LOCK4denied     denied;
///   case NFS4_OK:
///     void;
///   default:
///     void;
/// };
///
/// struct LOCKU4args {
///   /* CURRENT_FH: file */
///   nfs_lock_type4   locktype;
///   seqid4           seqid;
///   stateid4         lock_stateid;
///   offset4          offset;
///   length4          length;
/// };
///
/// union LOCKU4res switch (nfsstat4 status) {
///   case NFS4_OK:
///     stateid4        lock_stateid;
///   default:
///     void;
/// };
///
/// struct LOOKUP4args {
///   /* CURRENT_FH: directory */
///   component4       objname;
/// };
///
/// struct LOOKUP4res {
///   /* New CURRENT_FH: object */
///   nfsstat4         status;
/// };
///
/// struct LOOKUPP4res {
///   /* new CURRENT_FH: parent directory */
///   nfsstat4         status;
```

```
/// };
///
/// struct NVERIFY4args {
///     /* CURRENT_FH: object */
///     fattr4         obj_attributes;
```

```
/// };
///
/// struct NVERIFY4res {
///     nfsstat4         status;
/// };
///
/// /*
///  * Various definitions for OPEN
///  */
/// enum createmode4 {
///     UNCHECKED4         = 0,
///     GUARDED4           = 1,
///     /* Deprecated in NFSv4.1. */
///     EXCLUSIVE4         = 2,
///     /*
///      * New to NFSv4.1. If session is persistent,
///      * GUARDED4 MUST be used. Otherwise, use
///      * EXCLUSIVE4_1 instead of EXCLUSIVE4.
///      */
///     EXCLUSIVE4_1       = 3
/// };
///
/// struct creatverfattr {
///     verifier4         cva_verf;
///     fattr4             cva_attrs;
/// };
///
/// union createhow4 switch (createmode4 mode) {
///     case UNCHECKED4:
///     case GUARDED4:
///         fattr4         createattrs;
///     case EXCLUSIVE4:
///         verifier4     createverf;
///     case EXCLUSIVE4_1:
///         creatverfattr ch_createboth;
/// };
```

```

///
/// enum opentype4 {
///     OPEN4_NOCREATE = 0,
///     OPEN4_CREATE   = 1
/// };
///
/// union openflag4 switch (opentype4 opentype) {
///     case OPEN4_CREATE:
///         createhow4    how;
///     default:
///         void;
/// };

```

```

///
/// /* Next definitions used for OPEN delegation */
/// enum limit_by4 {
///     NFS_LIMIT_SIZE           = 1,
///     NFS_LIMIT_BLOCKS        = 2
///     /* others as needed */
/// };
///
/// struct nfs_modified_limit4 {
///     uint32_t    num_blocks;
///     uint32_t    bytes_per_block;
/// };
///
/// union nfs_space_limit4 switch (limit_by4 limitby) {
///     /* limit specified as file size */
///     case NFS_LIMIT_SIZE:
///         uint64_t    filesize;
///     /* limit specified by number of blocks */
///     case NFS_LIMIT_BLOCKS:
///         nfs_modified_limit4    mod_blocks;
/// } ;
///
/// /*
///  * Share Access and Deny constants for open argument
///  */
/// const OPEN4_SHARE_ACCESS_READ    = 0x00000001;
/// const OPEN4_SHARE_ACCESS_WRITE   = 0x00000002;
/// const OPEN4_SHARE_ACCESS_BOTH    = 0x00000003;
///

```

```

/// const OPEN4_SHARE_DENY_NONE      = 0x00000000;
/// const OPEN4_SHARE_DENY_READ      = 0x00000001;
/// const OPEN4_SHARE_DENY_WRITE     = 0x00000002;
/// const OPEN4_SHARE_DENY_BOTH      = 0x00000003;
///
///
/// /* new flags for share_access field of OPEN4args */
/// const OPEN4_SHARE_ACCESS_WANT_DELEG_MASK      = 0xFF00;
/// const OPEN4_SHARE_ACCESS_WANT_NO_PREFERENCE   = 0x0000;
/// const OPEN4_SHARE_ACCESS_WANT_READ_DELEG      = 0x0100;
/// const OPEN4_SHARE_ACCESS_WANT_WRITE_DELEG     = 0x0200;
/// const OPEN4_SHARE_ACCESS_WANT_ANY_DELEG      = 0x0300;
/// const OPEN4_SHARE_ACCESS_WANT_NO_DELEG       = 0x0400;
/// const OPEN4_SHARE_ACCESS_WANT_CANCEL        = 0x0500;
///
/// const
/// OPEN4_SHARE_ACCESS_WANT_SIGNAL_DELEG_WHEN_RESRC_AVAIL
/// = 0x10000;
///

```

```

/// const
/// OPEN4_SHARE_ACCESS_WANT_PUSH_DELEG_WHEN_UNCONTENDED
/// = 0x20000;
///
/// enum open_delegation_type4 {
///     OPEN_DELEGATE_NONE      = 0,
///     OPEN_DELEGATE_READ      = 1,
///     OPEN_DELEGATE_WRITE     = 2,
///     OPEN_DELEGATE_NONE_EXT  = 3 /* new to v4.1 */
/// };
///
/// enum open_claim_type4 {
///     /*
///      * Not a reclaim.
///      */
///     CLAIM_NULL              = 0,
///
///     CLAIM_PREVIOUS          = 1,
///     CLAIM_DELEGATE_CUR      = 2,
///     CLAIM_DELEGATE_PREV     = 3,
///
///     /*

```

```

///      * Not a reclaim.
///      *
///      * Like CLAIM_NULL, but object identified
///      * by the current filehandle.
///      */
///      CLAIM_FH          = 4, /* new to v4.1 */
///
///      /*
///      * Like CLAIM_DELEGATE_CUR, but object identified
///      * by current filehandle.
///      */
///      CLAIM_DELEG_CUR_FH      = 5, /* new to v4.1 */
///
///      /*
///      * Like CLAIM_DELEGATE_PREV, but object identified
///      * by current filehandle.
///      */
///      CLAIM_DELEG_PREV_FH    = 6 /* new to v4.1 */
/// };
///
/// struct open_claim_delegate_cur4 {
///     stateid4      delegate_stateid;
///     component4    file;
/// };
///
/// union open_claim4 switch (open_claim_type4 claim) {

```

```

/// /*
/// * No special rights to file.
/// * Ordinary OPEN of the specified file.
/// */
/// case CLAIM_NULL:
///     /* CURRENT_FH: directory */
///     component4    file;
/// /*
/// * Right to the file established by an
/// * open previous to server reboot. File
/// * identified by filehandle obtained at
/// * that time rather than by name.
/// */
/// case CLAIM_PREVIOUS:
///     /* CURRENT_FH: file being reclaimed */

```

```

///         open_delegation_type4    delegate_type;
///
/// /*
///  * Right to file based on a delegation
///  * granted by the server. File is
///  * specified by name.
///  */
/// case CLAIM_DELEGATE_CUR:
///     /* CURRENT_FH: directory */
///     open_claim_delegate_cur4      delegate_cur_info;
///
/// /*
///  * Right to file based on a delegation
///  * granted to a previous boot instance
///  * of the client. File is specified by name.
///  */
/// case CLAIM_DELEGATE_PREV:
///     /* CURRENT_FH: directory */
///     component4                    file_delegate_prev;
///
/// /*
///  * Like CLAIM_NULL. No special rights
///  * to file. Ordinary OPEN of the
///  * specified file by current filehandle.
///  */
/// case CLAIM_FH: /* new to v4.1 */
///     /* CURRENT_FH: regular file to open */
///     void;
///
/// /*
///  * Like CLAIM_DELEGATE_PREV. Right to file based on a
///  * delegation granted to a previous boot
///  * instance of the client. File is identified by

```

```

///  * by filehandle.
///  */
/// case CLAIM_DELEG_PREV_FH: /* new to v4.1 */
///     /* CURRENT_FH: file being opened */
///     void;
///
/// /*
///  * Like CLAIM_DELEGATE_CUR. Right to file based on

```



```

/// * a delegation granted by the server.
/// * File is identified by filehandle.
/// */
/// case CLAIM_DELEG_CUR_FH: /* new to v4.1 */
///     /* CURRENT_FH: file being opened */
///     stateid4         oc_delegate_stateid;
///
/// };
///
/// /*
/// * OPEN: Open a file, potentially receiving an open delegation
/// */
/// struct OPEN4args {
///     seqid4             seqid;
///     uint32_t          share_access;
///     uint32_t          share_deny;
///     open_owner4       owner;
///     openflag4         openhow;
///     open_claim4       claim;
/// };
///
/// struct open_read_delegation4 {
///     stateid4 stateid; /* Stateid for delegation*/
///     bool      recall; /* Pre-recalled flag for
///                       delegations obtained
///                       by reclaim (CLAIM_PREVIOUS) */
///
///     nfsace4 permissions; /* Defines users who don't
///                           need an ACCESS call to
///                           open for read */
/// };
///
/// struct open_write_delegation4 {
///     stateid4 stateid; /* Stateid for delegation */
///     bool      recall; /* Pre-recalled flag for
///                       delegations obtained
///                       by reclaim
///                       (CLAIM_PREVIOUS) */
///
///     nfs_space_limit4

```

```

///     space_limit; /* Defines condition that

```

```

///
///
///
///
///
///
/// nfsace4 permissions; /* Defines users who don't
///
///
///
///
/// };
///
///
///
/// enum why_no_delegation4 { /* new to v4.1 */
///     WND4_NOT_WANTED           = 0,
///     WND4_CONTENTION           = 1,
///     WND4_RESOURCE             = 2,
///     WND4_NOT_SUPP_FTYPE       = 3,
///     WND4_WRITE_DELEG_NOT_SUPP_FTYPE = 4,
///     WND4_NOT_SUPP_UPGRADE     = 5,
///     WND4_NOT_SUPP_DOWNGRADE  = 6,
///     WND4_CANCELED             = 7,
///     WND4_IS_DIR               = 8
/// };
///
///
/// union open_none_delegation4 /* new to v4.1 */
/// switch (why_no_delegation4 ond_why) {
///     case WND4_CONTENTION:
///         bool ond_server_will_push_deleg;
///     case WND4_RESOURCE:
///         bool ond_server_will_signal_avail;
///     default:
///         void;
/// };
///
///
/// union open_delegation4
/// switch (open_delegation_type4 delegation_type) {
///     case OPEN_DELEGATE_NONE:
///         void;
///     case OPEN_DELEGATE_READ:
///         open_read_delegation4 read;
///     case OPEN_DELEGATE_WRITE:
///         open_write_delegation4 write;
///     case OPEN_DELEGATE_NONE_EXT: /* new to v4.1 */
///         open_none_delegation4 od_whynone;
/// };
///
///
/// /*

```

---

```
/// * Result flags
/// */
///
/// /* Client must confirm open */
/// const OPEN4_RESULT_CONFIRM      = 0x00000002;
/// /* Type of file locking behavior at the server */
/// const OPEN4_RESULT_LOCKTYPE_POSIX = 0x00000004;
/// /* Server will preserve file if removed while open */
/// const OPEN4_RESULT_PRESERVE_UNLINKED = 0x00000008;
///
/// /*
/// * Server may use CB_NOTIFY_LOCK on locks
/// * derived from this open
/// */
/// const OPEN4_RESULT_MAY_NOTIFY_LOCK = 0x00000020;
///
/// struct OPEN4resok {
///     stateid4      stateid;      /* Stateid for open */
///     change_info4  cinfo;        /* Directory Change Info */
///     uint32_t      rflags;        /* Result flags */
///     bitmap4       attrset;       /* attribute set for create*/
///     open_delegation4 delegation; /* Info on any open
///                                     delegation */
/// };
///
/// union OPEN4res switch (nfsstat4 status) {
///     case NFS4_OK:
///         /* New CURRENT_FH: opened file */
///         OPEN4resok      resok4;
///     default:
///         void;
/// };
///
/// struct OPENATTR4args {
///     /* CURRENT_FH: object */
///     bool      createdir;
/// };
///
/// struct OPENATTR4res {
///     /*
///     * If status is NFS4_OK,
///     * new CURRENT_FH: named attribute
///     * directory
///     */
///     nfsstat4      status;
/// };
```

```
///  
/// /* obsolete in NFSv4.1 */
```

```
/// struct OPEN_CONFIRM4args {  
///     /* CURRENT_FH: opened file */  
///     stateid4        open_stateid;  
///     seqid4          seqid;  
/// };  
///  
/// struct OPEN_CONFIRM4resok {  
///     stateid4        open_stateid;  
/// };  
///  
/// union OPEN_CONFIRM4res switch (nfsstat4 status) {  
///     case NFS4_OK:  
///         OPEN_CONFIRM4resok      resok4;  
///     default:  
///         void;  
/// };  
///  
/// struct OPEN_DOWNGRADE4args {  
///     /* CURRENT_FH: opened file */  
///     stateid4        open_stateid;  
///     seqid4          seqid;  
///     uint32_t        share_access;  
///     uint32_t        share_deny;  
/// };  
///  
/// struct OPEN_DOWNGRADE4resok {  
///     stateid4        open_stateid;  
/// };  
///  
/// union OPEN_DOWNGRADE4res switch(nfsstat4 status) {  
///     case NFS4_OK:  
///         OPEN_DOWNGRADE4resok    resok4;  
///     default:  
///         void;  
/// };  
///  
/// struct PUTFH4args {  
///     nfs_fh4         object;  
/// };
```

```

///
/// struct PUTFH4res {
///     /*
///     * If status is NFS4_OK,
///     *   new CURRENT_FH: argument to PUTFH
///     */
///     nfsstat4      status;
/// };
///

```

```

/// struct PUTPUBFH4res {
///     /*
///     * If status is NFS4_OK,
///     *   new CURRENT_FH: public fh
///     */
///     nfsstat4      status;
/// };
///
/// struct PUTROOTFH4res {
///     /*
///     * If status is NFS4_OK,
///     *   new CURRENT_FH: root fh
///     */
///     nfsstat4      status;
/// };
///
/// struct READ4args {
///     /* CURRENT_FH: file */
///     stateid4      stateid;
///     offset4       offset;
///     count4        count;
/// };
///
/// struct READ4resok {
///     bool          eof;
///     opaque        data<>;
/// };
///
/// union READ4res switch (nfsstat4 status) {
///     case NFS4_OK:
///         READ4resok      resok4;
///     default:

```

```

///         void;
/// };
///
/// struct READDIR4args {
///     /* CURRENT_FH: directory */
///     nfs_cookie4      cookie;
///     verifier4        cookieverf;
///     count4           dircount;
///     count4           maxcount;
///     bitmap4          attr_request;
/// };
///
/// struct entry4 {
///     nfs_cookie4      cookie;
///     component4       name;
///     fattr4           attrs;

```

```

///     entry4          *nextentry;
/// };
///
/// struct dirlist4 {
///     entry4           *entries;
///     bool             eof;
/// };
///
/// struct READDIR4resok {
///     verifier4        cookieverf;
///     dirlist4         reply;
/// };
///
///
/// union READDIR4res switch (nfsstat4 status) {
///     case NFS4_OK:
///         READDIR4resok  resok4;
///     default:
///         void;
/// };
///
///
/// struct READLINK4resok {
///     linktext4        link;
/// };

```

```

///
/// union READLINK4res switch (nfsstat4 status) {
///   case NFS4_OK:
///       READLINK4resok  resok4;
///   default:
///       void;
/// };
///
/// struct REMOVE4args {
///     /* CURRENT_FH: directory */
///     component4      target;
/// };
///
/// struct REMOVE4resok {
///     change_info4    cinfo;
/// };
///
/// union REMOVE4res switch (nfsstat4 status) {
///   case NFS4_OK:
///       REMOVE4resok  resok4;
///   default:
///       void;
/// };

```

```

///
/// struct RENAME4args {
///     /* SAVED_FH: source directory */
///     component4      oldname;
///     /* CURRENT_FH: target directory */
///     component4      newname;
/// };
///
/// struct RENAME4resok {
///     change_info4    source_cinfo;
///     change_info4    target_cinfo;
/// };
///
/// union RENAME4res switch (nfsstat4 status) {
///   case NFS4_OK:
///       RENAME4resok  resok4;
///   default:
///       void;
/// };

```

```

/// };
///
/// /* Obsolete in NFSv4.1 */
/// struct RENEW4args {
///     clientid4      clientid;
/// };
///
/// struct RENEW4res {
///     nfsstat4      status;
/// };
///
/// struct RESTOREFH4res {
///     /*
///      * If status is NFS4_OK,
///      *   new CURRENT_FH: value of saved fh
///      */
///     nfsstat4      status;
/// };
///
/// struct SAVEFH4res {
///     /*
///      * If status is NFS4_OK,
///      *   new SAVED_FH: value of current fh
///      */
///     nfsstat4      status;
/// };
///
/// struct SECINF04args {
///     /* CURRENT_FH: directory */
///     component4    name;

```

```

/// };
///
/// /*
///  * From RFC 2203
///  */
/// enum rpc_gss_svc_t {
///     RPC_GSS_SVC_NONE      = 1,
///     RPC_GSS_SVC_INTEGRITY = 2,
///     RPC_GSS_SVC_PRIVACY   = 3
/// };
///

```



```

/// struct rpcsec_gss_info {
///     sec_oid4      oid;
///     qop4          qop;
///     rpc_gss_svc_t service;
/// };
///
/// /* RPCSEC_GSS has a value of '6' - See RFC 2203 */
/// union secinfo4 switch (uint32_t flavor) {
///     case RPCSEC_GSS:
///         rpcsec_gss_info      flavor_info;
///     default:
///         void;
/// };
///
/// typedef secinfo4 SECINFO4resok<>;
///
/// union SECINFO4res switch (nfsstat4 status) {
///     case NFS4_OK:
///         /* CURRENTFH: consumed */
///         SECINFO4resok resok4;
///     default:
///         void;
/// };
///
/// struct SETATTR4args {
///     /* CURRENT_FH: target object */
///     stateid4      stateid;
///     fattr4        obj_attributes;
/// };
///
/// struct SETATTR4res {
///     nfsstat4      status;
///     bitmap4       attrsset;
/// };
///
/// /* Obsolete in NFSv4.1 */
/// struct SETCLIENTID4args {

```

```

///     nfs_client_id4 client;
///     cb_client4     callback;
///     uint32_t       callback_ident;
/// };

```

```

///
/// struct SETCLIENTID4resok {
///     clientid4      clientid;
///     verifier4      setclientid_confirm;
/// };
///
/// union SETCLIENTID4res switch (nfsstat4 status) {
///     case NFS4_OK:
///         SETCLIENTID4resok      resok4;
///     case NFS4ERR_CLID_INUSE:
///         clientaddr4      client_using;
///     default:
///         void;
/// };
///
/// /* Obsolete in NFSv4.1 */
/// struct SETCLIENTID_CONFIRM4args {
///     clientid4      clientid;
///     verifier4      setclientid_confirm;
/// };
///
/// struct SETCLIENTID_CONFIRM4res {
///     nfsstat4      status;
/// };
///
/// struct VERIFY4args {
///     /* CURRENT_FH: object */
///     fattr4      obj_attributes;
/// };
///
/// struct VERIFY4res {
///     nfsstat4      status;
/// };
///
/// enum stable_how4 {
///     UNSTABLE4      = 0,
///     DATA_SYNC4    = 1,
///     FILE_SYNC4     = 2
/// };
///
/// struct WRITE4args {
///     /* CURRENT_FH: file */
///     stateid4      stateid;
///     offset4      offset;

```

```
///         stable_how4      stable;
///         opaque           data<>;
/// };
///
/// struct WRITE4resok {
///         count4            count;
///         stable_how4      committed;
///         verifier4        writeverf;
/// };
///
/// union WRITE4res switch (nfsstat4 status) {
///     case NFS4_OK:
///         WRITE4resok      resok4;
///     default:
///         void;
/// };
///
/// /* Obsolete in NFSv4.1 */
/// struct RELEASE_LOCKOWNER4args {
///         lock_owner4      lock_owner;
/// };
///
/// struct RELEASE_LOCKOWNER4res {
///         nfsstat4         status;
/// };
///
/// struct ILLEGAL4res {
///         nfsstat4         status;
/// };
///
/// typedef opaque gsshandle4_t<>;
///
/// struct gss_cb_handles4 {
///         rpc_gss_svc_t    gcbp_service; /* RFC 2203 */
///         gsshandle4_t     gcbp_handle_from_server;
///         gsshandle4_t     gcbp_handle_from_client;
/// };
///
/// union callback_sec_parms4 switch (uint32_t cb_secflavor) {
///     case AUTH_NONE:
///         void;
///     case AUTH_SYS:
///         authsys_parms    cbsp_sys_cred; /* RFC 1831 */
///     case RPCSEC_GSS:
///         gss_cb_handles4 cbsp_gss_handles;
/// };
///
```

```
/// struct BACKCHANNEL_CTL4args {
```

```
///         uint32_t          bca_cb_program;
///         callback_sec_parms4  bca_sec_parms<>;
///     };
///
/// struct BACKCHANNEL_CTL4res {
///     nfsstat4          bcr_status;
/// };
///
/// enum channel_dir_from_client4 {
///     CDFC4_FORE          = 0x1,
///     CDFC4_BACK          = 0x2,
///     CDFC4_FORE_OR_BOTH  = 0x3,
///     CDFC4_BACK_OR_BOTH  = 0x7
/// };
///
/// struct BIND_CONN_TO_SESSION4args {
///     sessionid4      bctsa_sessid;
///
///     channel_dir_from_client4
///         bctsa_dir;
///
///     bool            bctsa_use_conn_in_rdma_mode;
/// };
///
/// enum channel_dir_from_server4 {
///     CDFS4_FORE          = 0x1,
///     CDFS4_BACK          = 0x2,
///     CDFS4_BOTH          = 0x3
/// };
///
/// struct BIND_CONN_TO_SESSION4resok {
///     sessionid4      bctsr_sessid;
///
///     channel_dir_from_server4
///         bctsr_dir;
///
///     bool            bctsr_use_conn_in_rdma_mode;
/// };
///
/// union BIND_CONN_TO_SESSION4res
```

```

/// switch (nfsstat4 bctsr_status) {
///
/// case NFS4_OK:
///     BIND_CONN_TO_SESSION4resok
///         bctsr_resok4;
///
/// default:
///     void;
/// };

```

```

///
/// const EXCHGID4_FLAG_SUPP_MOVED_REFERER = 0x00000001;
/// const EXCHGID4_FLAG_SUPP_MOVED_MIGR  = 0x00000002;
///
/// const EXCHGID4_FLAG_BIND_PRINC_STATEID = 0x00000100;
///
/// const EXCHGID4_FLAG_USE_NON_PNFS      = 0x00010000;
/// const EXCHGID4_FLAG_USE_PNFS_MDS     = 0x00020000;
/// const EXCHGID4_FLAG_USE_PNFS_DS      = 0x00040000;
///
/// const EXCHGID4_FLAG_MASK_PNFS        = 0x00070000;
///
/// const EXCHGID4_FLAG_UPD_CONFIRMED_REC_A = 0x40000000;
/// const EXCHGID4_FLAG_CONFIRMED_R      = 0x80000000;
///
/// struct state_protect_ops4 {
///     bitmap4 spo_must_enforce;
///     bitmap4 spo_must_allow;
/// };
///
/// struct ssv_sp_parms4 {
///     state_protect_ops4    ssp_ops;
///     sec_oid4              ssp_hash_algs<>;
///     sec_oid4              ssp_encr_algs<>;
///     uint32_t              ssp_window;
///     uint32_t              ssp_num_gss_handles;
/// };
///
/// enum state_protect_how4 {
///     SP4_NONE = 0,
///     SP4_MACH_CRED = 1,
///     SP4_SSV = 2
/// };

```

```

///
/// union state_protect4_a switch(state_protect_how4 spa_how) {
///     case SP4_NONE:
///         void;
///     case SP4_MACH_CRED:
///         state_protect_ops4        spa_mach_ops;
///     case SP4_SSV:
///         ssv_sp_parms4            spa_ssv_parms;
/// };
///
/// struct EXCHANGE_ID4args {
///     client_owner4                eia_clientowner;
///     uint32_t                     eia_flags;
///     state_protect4_a             eia_state_protect;
///     nfs_impl_id4                 eia_client_impl_id<1>;

```

```

/// };
///
/// struct ssv_prot_info4 {
///     state_protect_ops4        spi_ops;
///     uint32_t                  spi_hash_alg;
///     uint32_t                  spi_encr_alg;
///     uint32_t                  spi_ssv_len;
///     uint32_t                  spi_window;
///     gsshandle4_t              spi_handles<>;
/// };
///
/// union state_protect4_r switch(state_protect_how4 spr_how) {
///     case SP4_NONE:
///         void;
///     case SP4_MACH_CRED:
///         state_protect_ops4        spr_mach_ops;
///     case SP4_SSV:
///         ssv_prot_info4            spr_ssv_info;
/// };
///
/// struct EXCHANGE_ID4resok {
///     clientid4                  eir_clientid;
///     sequenceid4                eir_sequenceid;
///     uint32_t                    eir_flags;
///     state_protect4_r            eir_state_protect;
///     server_owner4              eir_server_owner;

```

```

/// opaque          eir_server_scope<NFS4_OPAQUE_LIMIT>;
/// nfs_impl_id4    eir_server_impl_id<1>;
/// };
///
/// union EXCHANGE_ID4res switch (nfsstat4 eir_status) {
/// case NFS4_OK:
///   EXCHANGE_ID4resok      eir_resok4;
///
/// default:
///   void;
/// };
///
/// struct channel_attrs4 {
///     count4                ca_headerpadsize;
///     count4                ca_maxrequestsize;
///     count4                ca_maxresponsesize;
///     count4                ca_maxresponsesize_cached;
///     count4                ca_maxoperations;
///     count4                ca_maxrequests;
///     uint32_t              ca_rdma_ird<1>;
/// };
///

```

```

/// const CREATE_SESSION4_FLAG_PERSIST          = 0x00000001;
/// const CREATE_SESSION4_FLAG_CONN_BACK_CHAN   = 0x00000002;
/// const CREATE_SESSION4_FLAG_CONN_RDMA       = 0x00000004;
///
/// struct CREATE_SESSION4args {
///     clientid4                csa_clientid;
///     sequenceid4              csa_sequence;
///
///     uint32_t                  csa_flags;
///
///     channel_attrs4            csa_fore_chan_attrs;
///     channel_attrs4            csa_back_chan_attrs;
///
///     uint32_t                  csa_cb_program;
///     callback_sec_parms4       csa_sec_parms<>;
/// };
///
/// struct CREATE_SESSION4resok {
///     sessionid4                csr_sessionid;

```

```

///         sequenceid4          csr_sequence;
///
///         uint32_t             csr_flags;
///
///         channel_attrs4       csr_fore_chan_attrs;
///         channel_attrs4       csr_back_chan_attrs;
/// };
///
/// union CREATE_SESSION4res switch (nfsstat4 csr_status) {
/// case NFS4_OK:
///         CREATE_SESSION4resok   csr_resok4;
/// default:
///         void;
/// };
///
/// struct DESTROY_SESSION4args {
///         sessionid4             dsa_sessionid;
/// };
///
/// struct DESTROY_SESSION4res {
///         nfsstat4               dsr_status;
/// };
///
/// struct FREE_STATEID4args {
///         stateid4               fsa_stateid;
/// };
///
/// struct FREE_STATEID4res {
///         nfsstat4               fsr_status;

```

```

/// };
///
///
/// typedef nfstime4 attr_notice4;
///
/// struct GET_DIR_DELEGATION4args {
///         /* CURRENT_FH: delegated directory */
///         bool                gdda_signal_deleg_avail;
///         bitmap4             gdda_notification_types;
///         attr_notice4        gdda_child_attr_delay;
///         attr_notice4        gdda_dir_attr_delay;
///         bitmap4             gdda_child_attributes;

```



```

    ///         bitmap4          gdda_dir_attributes;
    /// };
    /// struct GET_DIR_DELEGATION4resok {
    ///         verifier4          gddr_cookieverf;
    ///         /* Stateid for get_dir_delegation */
    ///         stateid4           gddr_stateid;
    ///         /* Which notifications can the server support */
    ///         bitmap4            gddr_notification;
    ///         bitmap4            gddr_child_attributes;
    ///         bitmap4            gddr_dir_attributes;
    /// };
    ///
    /// enum gddrnf4_status {
    ///         GDD4_OK              = 0,
    ///         GDD4_UNAVAIL         = 1
    /// };
    ///
    /// union GET_DIR_DELEGATION4res_non_fatal
    /// switch (gddrnf4_status gddrnf_status) {
    /// case GDD4_OK:
    ///     GET_DIR_DELEGATION4resok          gddrnf_resok4;
    /// case GDD4_UNAVAIL:
    ///     bool                               gddrnf_will_signal_deleg_avail;
    /// };
    ///
    /// union GET_DIR_DELEGATION4res
    /// switch (nfsstat4 gddr_status) {
    /// case NFS4_OK:
    ///     GET_DIR_DELEGATION4res_non_fatal    gddr_res_non_fatal4;
    /// default:
    ///     void;
    /// };
    ///
    /// struct GETDEVICEINF04args {
    ///         deviceid4           gdia_device_id;
    ///         layouttype4         gdia_layout_type;

```

```

    ///         count4            gdia_maxcount;
    ///         bitmap4            gdia_notify_types;
    /// };
    ///
    /// struct GETDEVICEINF04resok {

```

```

    ///         device_addr4      gdir_device_addr;
    ///         bitmap4           gdir_notification;
    /// };
    ///
    /// union GETDEVICEINF04res switch (nfsstat4 gdir_status) {
    /// case NFS4_OK:
    ///         GETDEVICEINF04resok      gdir_resok4;
    /// case NFS4ERR_T00SMALL:
    ///         count4                    gdir_mincount;
    /// default:
    ///         void;
    /// };
    ///
    /// struct GETDEVICELIST4args {
    ///         /* CURRENT_FH: object belonging to the file system */
    ///         layouttype4      gdla_layout_type;
    ///
    ///         /* number of deviceIDs to return */
    ///         count4           gdla_maxdevices;
    ///
    ///         nfs_cookie4      gdla_cookie;
    ///         verifier4        gdla_cookieverf;
    /// };
    ///
    /// struct GETDEVICELIST4resok {
    ///         nfs_cookie4      gdlr_cookie;
    ///         verifier4        gdlr_cookieverf;
    ///         deviceid4        gdlr_deviceid_list<>;
    ///         bool              gdlr_eof;
    /// };
    ///
    /// union GETDEVICELIST4res switch (nfsstat4 gdlr_status) {
    /// case NFS4_OK:
    ///         GETDEVICELIST4resok      gdlr_resok4;
    /// default:
    ///         void;
    /// };
    ///
    /// union newtime4 switch (bool nt_timechanged) {
    /// case TRUE:
    ///         nfstime4           nt_time;
    /// case FALSE:
    ///         void;

```

```

/// };
///
/// union newoffset4 switch (bool no_newoffset) {
/// case TRUE:
///     offset4          no_offset;
/// case FALSE:
///     void;
/// };
///
/// struct LAYOUTCOMMIT4args {
///     /* CURRENT_FH: file */
///     offset4          loca_offset;
///     length4         loca_length;
///     bool             loca_reclaim;
///     stateid4        loca_stateid;
///     newoffset4      loca_last_write_offset;
///     newtime4        loca_time_modify;
///     layoutupdate4   loca_layoutupdate;
/// };
/// union newsize4 switch (bool ns_sizechanged) {
/// case TRUE:
///     length4         ns_size;
/// case FALSE:
///     void;
/// };
///
/// struct LAYOUTCOMMIT4resok {
///     newsize4        locr_newsize;
/// };
///
/// union LAYOUTCOMMIT4res switch (nfsstat4 locr_status) {
/// case NFS4_OK:
///     LAYOUTCOMMIT4resok    locr_resok4;
/// default:
///     void;
/// };
///
/// struct LAYOUTGET4args {
///     /* CURRENT_FH: file */
///     bool             loga_signal_layout_avail;
///     layouttype4     loga_layout_type;
///     layoutiomode4   loga_iomode;
///     offset4         loga_offset;
///     length4         loga_length;
///     length4         loga_minlength;
///     stateid4        loga_stateid;
///     count4          loga_maxcount;
/// };

```

Internet-Draft

NFSv4.1 XDR Description

December 2008

```
/// struct LAYOUTGET4resok {
///     bool                logr_return_on_close;
///     stateid4            logr_stateid;
///     layout4             logr_layout<>;
/// };
///
/// union LAYOUTGET4res switch (nfsstat4 logr_status) {
/// case NFS4_OK:
///     LAYOUTGET4resok    logr_resok4;
/// case NFS4ERR_LAYOUTTRYLATER:
///     bool                logr_will_signal_layout_avail;
/// default:
///     void;
/// };
///
///
/// struct LAYOUTRETURN4args {
///     /* CURRENT_FH: file */
///     bool                lora_reclaim;
///     layouttype4         lora_layout_type;
///     layoutiomode4       lora_iomode;
///     layoutreturn4       lora_layoutreturn;
/// };
///
///
/// union layoutreturn_stateid switch (bool lrs_present) {
/// case TRUE:
///     stateid4            lrs_stateid;
/// case FALSE:
///     void;
/// };
///
/// union LAYOUTRETURN4res switch (nfsstat4 lorr_status) {
/// case NFS4_OK:
///     layoutreturn_stateid    lorr_stateid;
/// default:
///     void;
/// };
///
/// enum secinfo_style4 {
///     SECINFO_STYLE4_CURRENT_FH    = 0,
///     SECINFO_STYLE4_PARENT        = 1
```

```

/// };
///
/// /* CURRENT_FH: object or child directory */
/// typedef secinfo_style4 SECINFO_NO_NAME4args;
///
/// /* CURRENTFH: consumed if status is NFS4_OK */

```

```

/// typedef SECINFO4res SECINFO_NO_NAME4res;
///
/// struct SEQUENCE4args {
///     sessionid4    sa_sessionid;
///     sequenceid4   sa_sequenceid;
///     slotid4       sa_slotid;
///     slotid4       sa_highest_slotid;
///     bool          sa_cachethis;
/// };
///
/// const SEQ4_STATUS_CB_PATH_DOWN           = 0x00000001;
/// const SEQ4_STATUS_CB_GSS_CONTEXTS_EXPIRING = 0x00000002;
/// const SEQ4_STATUS_CB_GSS_CONTEXTS_EXPIRED  = 0x00000004;
/// const SEQ4_STATUS_EXPIRED_ALL_STATE_REVOKED = 0x00000008;
/// const SEQ4_STATUS_EXPIRED_SOME_STATE_REVOKED = 0x00000010;
/// const SEQ4_STATUS_ADMIN_STATE_REVOKED      = 0x00000020;
/// const SEQ4_STATUS_RECALLABLE_STATE_REVOKED = 0x00000040;
/// const SEQ4_STATUS_LEASE_MOVED              = 0x00000080;
/// const SEQ4_STATUS_RESTART_RECLAIM_NEEDED  = 0x00000100;
/// const SEQ4_STATUS_CB_PATH_DOWN_SESSION    = 0x00000200;
/// const SEQ4_STATUS_BACKCHANNEL_FAULT       = 0x00000400;
/// const SEQ4_STATUS_DEVID_CHANGED          = 0x00000800;
/// const SEQ4_STATUS_DEVID_DELETED          = 0x00001000;
///
/// struct SEQUENCE4resok {
///     sessionid4    sr_sessionid;
///     sequenceid4   sr_sequenceid;
///     slotid4       sr_slotid;
///     slotid4       sr_highest_slotid;
///     slotid4       sr_target_highest_slotid;
///     uint32_t      sr_status_flags;
/// };
///
/// union SEQUENCE4res switch (nfsstat4 sr_status) {
/// case NFS4_OK:

```

```

///      SEQUENCE4resok  sr_resok4;
/// default:
///      void;
/// };
///
/// struct ssa_digest_input4 {
///      SEQUENCE4args sdi_seqargs;
/// };
///
/// struct SET_SSV4args {
///      opaque          ssa_ssv<>;
///      opaque          ssa_digest<>;
/// };

```

```

///
/// struct ssr_digest_input4 {
///      SEQUENCE4res sdi_seqres;
/// };
///
/// struct SET_SSV4resok {
///      opaque          ssr_digest<>;
/// };
///
/// union SET_SSV4res switch (nfsstat4 ssr_status) {
/// case NFS4_OK:
///      SET_SSV4resok  ssr_resok4;
/// default:
///      void;
/// };
///
/// struct TEST_STATEID4args {
///      stateid4        ts_stateids<>;
/// };
///
/// struct TEST_STATEID4resok {
///      nfsstat4        tsr_status_codes<>;
/// };
///
/// union TEST_STATEID4res switch (nfsstat4 tsr_status) {
/// case NFS4_OK:
///      TEST_STATEID4resok tsr_resok4;
/// default:

```

```

    ///         void;
    /// };
    ///
    /// union deleg_claim4 switch (open_claim_type4 dc_claim) {
    /// /*
    ///  * No special rights to object. Ordinary delegation
    ///  * request of the specified object. Object identified
    ///  * by filehandle.
    ///  */
    /// case CLAIM_FH: /* new to v4.1 */
    ///         /* CURRENT_FH: object being delegated */
    ///         void;
    ///
    /// /*
    ///  * Right to file based on a delegation granted
    ///  * to a previous boot instance of the client.
    ///  * File is specified by filehandle.
    ///  */
    /// case CLAIM_DELEG_PREV_FH: /* new to v4.1 */
    ///         /* CURRENT_FH: object being delegated */

```

```

    ///         void;
    ///
    /// /*
    ///  * Right to the file established by an open previous
    ///  * to server reboot. File identified by filehandle.
    ///  * Used during server reclaim grace period.
    ///  */
    /// case CLAIM_PREVIOUS:
    ///         /* CURRENT_FH: object being reclaimed */
    ///         open_delegation_type4    dc_delegate_type;
    /// };
    ///
    /// struct WANT_DELEGATION4args {
    ///         uint32_t        wda_want;
    ///         deleg_claim4    wda_claim;
    /// };
    ///
    /// union WANT_DELEGATION4res switch (nfsstat4 wdr_status) {
    /// case NFS4_OK:
    ///         open_delegation4 wdr_resok4;
    /// default:

```

```

    ///         void;
    /// };
    ///
    /// struct DESTROY_CLIENTID4args {
    ///         clientid4         dca_clientid;
    /// };
    ///
    /// struct DESTROY_CLIENTID4res {
    ///         nfsstat4         dcr_status;
    /// };
    ///
    /// struct RECLAIM_COMPLETE4args {
    ///         /*
    ///         * If rca_one_fs TRUE,
    ///         *
    ///         *     CURRENT_FH: object in
    ///         *     filesystem reclaim is
    ///         *     complete for.
    ///         */
    ///         bool         rca_one_fs;
    /// };
    ///
    /// struct RECLAIM_COMPLETE4res {
    ///         nfsstat4         rcr_status;
    /// };
    ///
    /// /*

```

```

    /// * Operation arrays
    /// */
    ///
    /// enum nfs_opnum4 {
    ///     OP_ACCESS           = 3,
    ///     OP_CLOSE            = 4,
    ///     OP_COMMIT           = 5,
    ///     OP_CREATE           = 6,
    ///     OP_DELEGPURGE       = 7,
    ///     OP_DELEGRETURN      = 8,
    ///     OP_GETATTR          = 9,
    ///     OP_GETFH            = 10,
    ///     OP_LINK              = 11,
    ///     OP_LOCK              = 12,

```



```

/// OP_LOCKT           = 13,
/// OP_LOCKU           = 14,
/// OP_LOOKUP          = 15,
/// OP_LOOKUPP        = 16,
/// OP_NVERIFY        = 17,
/// OP_OPEN            = 18,
/// OP_OPENATTR       = 19,
/// OP_OPEN_CONFIRM   = 20, /* Mandatory not-to-implement */
/// OP_OPEN_DOWNGRADE = 21,
/// OP_PUTFH          = 22,
/// OP_PUTPUBFH       = 23,
/// OP_PUTROOTFH      = 24,
/// OP_READ           = 25,
/// OP_READDIR        = 26,
/// OP_READLINK       = 27,
/// OP_REMOVE         = 28,
/// OP_RENAME         = 29,
/// OP_RENEW          = 30, /* Mandatory not-to-implement */
/// OP_RESTOREFH      = 31,
/// OP_SAVEFH         = 32,
/// OP_SECINFO        = 33,
/// OP_SETATTR        = 34,
/// OP_SETCLIENTID    = 35, /* Mandatory not-to-implement */
/// OP_SETCLIENTID_CONFIRM = 36, /* Mandatory not-to-implement */
/// OP_VERIFY         = 37,
/// OP_WRITE          = 38,
/// OP_RELEASE_LOCKOWNER = 39, /* Mandatory not-to-implement */
/// %
/// %/* new operations for NFSv4.1 */
/// %
/// OP_BACKCHANNEL_CTL = 40,
/// OP_BIND_CONN_TO_SESSION = 41,
/// OP_EXCHANGE_ID     = 42,
/// OP_CREATE_SESSION  = 43,

```

```

/// OP_DESTROY_SESSION = 44,
/// OP_FREE_STATEID    = 45,
/// OP_GET_DIR_DELEGATION = 46,
/// OP_GETDEVICEINFO    = 47,
/// OP_GETDEVICELIST    = 48,
/// OP_LAYOUTCOMMIT     = 49,
/// OP_LAYOUTGET        = 50,

```

```

/// OP_LAYOUTRETURN          = 51,
/// OP_SECINFO_NO_NAME       = 52,
/// OP_SEQUENCE              = 53,
/// OP_SET_SSV               = 54,
/// OP_TEST_STATEID         = 55,
/// OP_WANT_DELEGATION       = 56,
/// OP_DESTROY_CLIENTID     = 57,
/// OP_RECLAIM_COMPLETE     = 58,
/// OP_ILLEGAL               = 10044
/// };
///
/// union nfs_argop4 switch (nfs_opnum4 argop) {
/// case OP_ACCESS:          ACCESS4args opaccess;
/// case OP_CLOSE:          CLOSE4args opclose;
/// case OP_COMMIT:         COMMIT4args opcommit;
/// case OP_CREATE:         CREATE4args opcreate;
/// case OP_DELEGPURGE:     DELEGPURGE4args opdeleGPurge;
/// case OP_DELEGRETURN:    DELEGRETURN4args opdelegreturn;
/// case OP_GETATTR:        GETATTR4args opgetattr;
/// case OP_GETFH:          void;
/// case OP_LINK:           LINK4args oplink;
/// case OP_LOCK:           LOCK4args oplock;
/// case OP_LOCKT:          LOCKT4args oplockt;
/// case OP_LOCKU:          LOCKU4args oplocku;
/// case OP_LOOKUP:         LOOKUP4args opllookup;
/// case OP_LOOKUPP:        void;
/// case OP_NVERIFY:        NVERIFY4args opnverify;
/// case OP_OPEN:           OPEN4args opopen;
/// case OP_OPENATTR:       OPENATTR4args opopenattr;
///
/// /* Not for NFSv4.1 */
/// case OP_OPEN_CONFIRM:   OPEN_CONFIRM4args opopen_confirm;
///
/// case OP_OPEN_DOWNGRADE:
///
///     OPEN_DOWNGRADE4args opopen_downgrade;
///
/// case OP_PUTFH:          PUTFH4args opputfh;
/// case OP_PUTPUBFH:       void;
/// case OP_PUTROOTFH:      void;
/// case OP_READ:           READ4args opread;
/// case OP_READDIR:        READDIR4args opreaddir;

```



Internet-Draft

NFSv4.1 XDR Description

December 2008

```
/// case OP_GETDEVICEINFO: GETDEVICEINFO4args opgetdeviceinfo;
/// case OP_GETDEVICELIST: GETDEVICELIST4args opgetdevicelist;
/// case OP_LAYOUTCOMMIT: LAYOUTCOMMIT4args oplayoutcommit;
/// case OP_LAYOUTGET: LAYOUTGET4args oplayoutget;
/// case OP_LAYOUTRETURN: LAYOUTRETURN4args oplayoutreturn;
///
/// case OP_SECINFO_NO_NAME:
///     SECINFO_NO_NAME4args opsecinfo_no_name;
///
/// case OP_SEQUENCE: SEQUENCE4args opsequence;
/// case OP_SET_SSV: SET_SSV4args opset_ssv;
/// case OP_TEST_STATEID: TEST_STATEID4args optest_stateid;
///
/// case OP_WANT_DELEGATION:
///     WANT_DELEGATION4args opwant_delegation;
///
/// case OP_DESTROY_CLIENTID:
///     DESTROY_CLIENTID4args
///         opdestroy_clientid;
///
/// case OP_RECLAIM_COMPLETE:
///     RECLAIM_COMPLETE4args
///         opreclaim_complete;
///
/// /* Operations not new to NFSv4.1 */
/// case OP_ILLEGAL: void;
/// };
///
/// union nfs_resop4 switch (nfs_opnum4 resop) {
/// case OP_ACCESS: ACCESS4res opaccess;
/// case OP_CLOSE: CLOSE4res opclose;
/// case OP_COMMIT: COMMIT4res opcommit;
/// case OP_CREATE: CREATE4res opcreate;
/// case OP_DELEGPURGE: DELEGPURGE4res opdelegpurge;
/// case OP_DELEGRETURN: DELEGRETURN4res opdelegreturn;
/// case OP_GETATTR: GETATTR4res opgetattr;
/// case OP_GETFH: GETFH4res opgetfh;
/// case OP_LINK: LINK4res oplink;
/// case OP_LOCK: LOCK4res oplock;
/// case OP_LOCKT: LOCKT4res oplockt;
/// case OP_LOCKU: LOCKU4res oplocku;
/// case OP_LOOKUP: LOOKUP4res oplookup;
/// case OP_LOOKUPP: LOOKUPP4res oplookupp;
```

```
/// case OP_NVERIFY:      NVERIFY4res opnverify;
/// case OP_OPEN:        OPEN4res oopen;
/// case OP_OPENATTR:    OPENATTR4res oopenattr;
/// /* Not for NFSv4.1 */
/// case OP_OPEN_CONFIRM: OPEN_CONFIRM4res oopen_confirm;
```

```
///
/// case OP_OPEN_DOWNGRADE:
///         OPEN_DOWNGRADE4res
///         oopen_downgrade;
///
/// case OP_PUTFH:      PUTFH4res oputfh;
/// case OP_PUTPUBFH:   PUTPUBFH4res oputpubfh;
/// case OP_PUTROOTFH:  PUTROOTFH4res oputrootfh;
/// case OP_READ:       READ4res oread;
/// case OP_READDIR:    READDIR4res oreaddir;
/// case OP_READLINK:   READLINK4res oreadlink;
/// case OP_REMOVE:     REMOVE4res oremove;
/// case OP_RENAME:     RENAME4res orename;
/// /* Not for NFSv4.1 */
/// case OP_RENEW:      RENEW4res orenew;
/// case OP_RESTOREFH:  RESTOREFH4res orestorefh;
/// case OP_SAVEFH:     SAVEFH4res opsavefh;
/// case OP_SECINFO:    SECINFO4res opsecinfo;
/// case OP_SETATTR:    SETATTR4res opsetattr;
/// /* Not for NFSv4.1 */
/// case OP_SETCLIENTID: SETCLIENTID4res opsetclientid;
///
/// /* Not for NFSv4.1 */
/// case OP_SETCLIENTID_CONFIRM:
///         SETCLIENTID_CONFIRM4res
///         opsetclientid_confirm;
/// case OP_VERIFY:     VERIFY4res opverify;
/// case OP_WRITE:      WRITE4res opwrite;
///
/// /* Not for NFSv4.1 */
/// case OP_RELEASE_LOCKOWNER:
///         RELEASE_LOCKOWNER4res
///         orelease_lockowner;
///
/// /* Operations new to NFSv4.1 */
/// case OP_BACKCHANNEL_CTL:
```

```
///          BACKCHANNEL_CTL4res
///          opbackchannel_ctl;
///
/// case OP_BIND_CONN_TO_SESSION:
///          BIND_CONN_TO_SESSION4res
///          opbind_conn_to_session;
///
/// case OP_EXCHANGE_ID:    EXCHANGE_ID4res opexchange_id;
///
/// case OP_CREATE_SESSION:
///          CREATE_SESSION4res
///          opcreate_session;
```

```
///
/// case OP_DESTROY_SESSION:
///          DESTROY_SESSION4res
///          opdestroy_session;
///
/// case OP_FREE_STATEID:   FREE_STATEID4res
///          opfree_stateid;
///
/// case OP_GET_DIR_DELEGATION:
///          GET_DIR_DELEGATION4res
///          opget_dir_delegation;
///
/// case OP_GETDEVICEINFO:  GETDEVICEINFO4res
///          opgetdeviceinfo;
///
/// case OP_GETDEVICELIST:  GETDEVICELIST4res
///          opgetdevicelist;
///
/// case OP_LAYOUTCOMMIT:   LAYOUTCOMMIT4res oplayoutcommit;
/// case OP_LAYOUTGET:      LAYOUTGET4res oplayoutget;
/// case OP_LAYOUTRETURN:   LAYOUTRETURN4res oplayoutreturn;
///
/// case OP_SECINFO_NO_NAME:
///          SECINFO_NO_NAME4res
///          opsecinfo_no_name;
///
/// case OP_SEQUENCE:       SEQUENCE4res opsequence;
/// case OP_SET_SSV:        SET_SSV4res opset_ssv;
/// case OP_TEST_STATEID:   TEST_STATEID4res optest_stateid;
```

```

///
/// case OP_WANT_DELEGATION:
///             WANT_DELEGATION4res
///             opwant_delegation;
///
/// case OP_DESTROY_CLIENTID:
///             DESTROY_CLIENTID4res
///             opdestroy_clientid;
///
/// case OP_RECLAIM_COMPLETE:
///             RECLAIM_COMPLETE4res
///             opreclaim_complete;
///
/// /* Operations not new to NFSv4.1 */
/// case OP_ILLEGAL:      ILLEGAL4res opillegal;
/// };
///
/// struct COMPOUND4args {
///     utf8str_cs      tag;

```

```

///     uint32_t      minorversion;
///     nfs_argop4    argarray<>;
/// };
///
/// struct COMPOUND4res {
///     nfsstat4      status;
///     utf8str_cs    tag;
///     nfs_resop4    resarray<>;
/// };
///
///
/// /*
///  * Remote file service routines
///  */
/// program NFS4_PROGRAM {
///     version NFS_V4 {
///         void
///         NFSPROC4_NULL(void) = 0;
///
///         COMPOUND4res
///         NFSPROC4_COMPOUND(COMPOUND4args) = 1;
///     }

```

```

///         } = 4;
/// } = 100003;
///
/// /*
///  * NFS4 Callback Procedure Definitions and Program
///  */
/// struct CB_GETATTR4args {
///     nfs_fh4 fh;
///     bitmap4 attr_request;
/// };
///
/// struct CB_GETATTR4resok {
///     fattr4 obj_attributes;
/// };
///
/// union CB_GETATTR4res switch (nfsstat4 status) {
///     case NFS4_OK:
///         CB_GETATTR4resok      resok4;
///     default:
///         void;
/// };
///
/// struct CB_RECALL4args {
///     stateid4      stateid;
///     bool          truncate;
///     nfs_fh4      fh;

```

```

/// };
///
/// struct CB_RECALL4res {
///     nfsstat4      status;
/// };
///
/// /*
///  * CB_ILLEGAL: Response for illegal operation numbers
///  */
/// struct CB_ILLEGAL4res {
///     nfsstat4      status;
/// };
///
/// /*
///  * NFSv4.1 callback arguments and results

```



```

/// */
///
/// enum layoutrecall_type4 {
///     LAYOUTRECALL4_FILE = LAYOUT4_RET_REC_FILE,
///     LAYOUTRECALL4_FSID = LAYOUT4_RET_REC_FSID,
///     LAYOUTRECALL4_ALL = LAYOUT4_RET_REC_ALL
/// };
///
/// struct layoutrecall_file4 {
///     nfs_fh4         lor_fh;
///     offset4        lor_offset;
///     length4         lor_length;
///     stateid4        lor_stateid;
/// };
///
/// union layoutrecall4 switch(layoutrecall_type4 lor_recalltype) {
/// case LAYOUTRECALL4_FILE:
///     layoutrecall_file4 lor_layout;
/// case LAYOUTRECALL4_FSID:
///     fsid4             lor_fsid;
/// case LAYOUTRECALL4_ALL:
///     void;
/// };
///
/// struct CB_LAYOUTRECALL4args {
///     layouttype4      clora_type;
///     layoutiomode4    clora_iomode;
///     bool             clora_changed;
///     layoutrecall4    clora_recall;
/// };
/// struct CB_LAYOUTRECALL4res {
///     nfsstat4         clorr_status;
/// };

```

```

///
/// /*
///  * Directory notification types.
///  */
/// enum notify_type4 {
///     NOTIFY4_CHANGE_CHILD_ATTRS = 0,
///     NOTIFY4_CHANGE_DIR_ATTRS = 1,
///     NOTIFY4_REMOVE_ENTRY = 2,

```

```

    ///          NOTIFY4_ADD_ENTRY = 3,
    ///          NOTIFY4_RENAME_ENTRY = 4,
    ///          NOTIFY4_CHANGE_COOKIE_VERIFIER = 5
    /// };
    ///
    /// /* Changed entry information. */
    /// struct notify_entry4 {
    ///     component4      ne_file;
    ///     fattr4          ne_attrs;
    /// };
    ///
    /// /* Previous entry information */
    /// struct prev_entry4 {
    ///     notify_entry4    pe_prev_entry;
    ///     /* what READDIR returned for this entry */
    ///     nfs_cookie4     pe_prev_entry_cookie;
    /// };
    ///
    /// struct notify_remove4 {
    ///     notify_entry4    nrm_old_entry;
    ///     nfs_cookie4     nrm_old_entry_cookie;
    /// };
    ///
    /// struct notify_add4 {
    ///     /*
    ///     * Information on object
    ///     * possibly renamed over.
    ///     */
    ///     notify_remove4    nad_old_entry<1>;
    ///     notify_entry4    nad_new_entry;
    ///     /* what READDIR would have returned for this entry */
    ///     nfs_cookie4      nad_new_entry_cookie<1>;
    ///     prev_entry4     nad_prev_entry<1>;
    ///     bool             nad_last_entry;
    /// };
    ///
    /// struct notify_attr4 {
    ///     notify_entry4    na_changed_entry;
    /// };
    ///

```

```

    /// struct notify_rename4 {

```

```

///         notify_remove4  nrn_old_entry;
///         notify_add4    nrn_new_entry;
/// };
///
/// struct notify_verifier4 {
///         verifier4      nv_old_cookieverf;
///         verifier4      nv_new_cookieverf;
/// };
///
/// /*
///  * Objects of type notify_<>4 and
///  * notify_device_<>4 are encoded in this.
///  */
/// typedef opaque notifylist4<>;
///
/// struct notify4 {
///         /* composed from notify_type4 or notify_deviceid_type4 */
///         bitmap4        notify_mask;
///         notifylist4    notify_vals;
/// };
///
/// struct CB_NOTIFY4args {
///         stateid4      cna_stateid;
///         nfs_fh4       cna_fh;
///         notify4       cna_changes<>;
/// };
///
/// struct CB_NOTIFY4res {
///         nfsstat4      cnr_status;
/// };
///
/// struct CB_PUSH_DELEG4args {
///         nfs_fh4       cpda_fh;
///         open_delegation4 cpda_delegation;
/// };
///
/// struct CB_PUSH_DELEG4res {
///         nfsstat4      cpdr_status;
/// };
///
/// const RCA4_TYPE_MASK_RDATA_DLG          = 0;
/// const RCA4_TYPE_MASK_WDATA_DLG         = 1;
/// const RCA4_TYPE_MASK_DIR_DLG           = 2;
/// const RCA4_TYPE_MASK_FILE_LAYOUT       = 3;
/// const RCA4_TYPE_MASK_BLK_LAYOUT        = 4;
/// const RCA4_TYPE_MASK_OBJ_LAYOUT_MIN    = 8;

```

---

```
/// const RCA4_TYPE_MASK_OBJ_LAYOUT_MAX      = 9;
/// const RCA4_TYPE_MASK_OTHER_LAYOUT_MIN     = 12;
/// const RCA4_TYPE_MASK_OTHER_LAYOUT_MAX     = 15;
///
/// struct CB_RECALL_ANY4args {
///     uint32_t      craa_objects_to_keep;
///     bitmap4      craa_type_mask;
/// };
///
/// struct CB_RECALL_ANY4res {
///     nfsstat4     crar_status;
/// };
///
/// typedef CB_RECALL_ANY4args CB_RECALLABLE_OBJ_AVAIL4args;
///
/// struct CB_RECALLABLE_OBJ_AVAIL4res {
///     nfsstat4     croa_status;
/// };
///
/// struct CB_RECALL_SLOT4args {
///     slotid4      rsa_target_highest_slotid;
/// };
///
/// struct CB_RECALL_SLOT4res {
///     nfsstat4     rsr_status;
/// };
///
/// struct referring_call4 {
///     sequenceid4  rc_sequenceid;
///     slotid4      rc_slotid;
/// };
///
/// struct referring_call_list4 {
///     sessionid4   rcl_sessionid;
///     referring_call4 rcl_referring_calls<>;
/// };
///
/// struct CB_SEQUENCE4args {
///     sessionid4   csa_sessionid;
///     sequenceid4  csa_sequenceid;
///     slotid4      csa_slotid;
///     slotid4      csa_highest_slotid;
///     bool         csa_cachethis;
///     referring_call_list4 csa_referring_call_lists<>;
/// };
///
```

```
/// struct CB_SEQUENCE4resok {
///     sessionid4      csr_sessionid;
```

```
///     sequenceid4    csr_sequenceid;
///     slotid4        csr_slotid;
///     slotid4        csr_highest_slotid;
///     slotid4        csr_target_highest_slotid;
/// };
///
/// union CB_SEQUENCE4res switch (nfsstat4 csr_status) {
/// case NFS4_OK:
///     CB_SEQUENCE4resok  csr_resok4;
/// default:
///     void;
/// };
///
/// struct CB_WANTS_CANCELLED4args {
///     bool cwca_contended_wants_cancelled;
///     bool cwca_resourced_wants_cancelled;
/// };
///
/// struct CB_WANTS_CANCELLED4res {
///     nfsstat4      cwcr_status;
/// };
///
/// struct CB_NOTIFY_LOCK4args {
///     nfs_fh4      cnla_fh;
///     lock_owner4 cnla_lock_owner;
/// };
///
/// struct CB_NOTIFY_LOCK4res {
///     nfsstat4      cnlr_status;
/// };
///
/// /*
///  * Device notification types.
///  */
/// enum notify_deviceid_type4 {
///     NOTIFY_DEVICEID4_CHANGE = 1,
///     NOTIFY_DEVICEID4_DELETE = 2
/// };
///
```

```

/// /* For NOTIFY4_DEVICEID4_DELETE */
/// struct notify_deviceid_delete4 {
///     layouttype4    ndd_layouttype;
///     deviceid4      ndd_deviceid;
/// };
///
/// /* For NOTIFY4_DEVICEID4_CHANGE */
/// struct notify_deviceid_change4 {
///     layouttype4    ndc_layouttype;

```

```

///     deviceid4      ndc_deviceid;
///     bool            ndc_immediate;
/// };
///
/// struct CB_NOTIFY_DEVICEID4args {
///     notify4 cnda_changes<>;
/// };
///
/// struct CB_NOTIFY_DEVICEID4res {
///     nfsstat4        cndr_status;
/// };
///
/// /*
///  * Various definitions for CB_COMPOUND
///  */
/// %
/// enum nfs_cb_opnum4 {
///     OP_CB_GETATTR          = 3,
///     OP_CB_RECALL           = 4,
///     /* Callback operations new to NFSv4.1 */
///     OP_CB_LAYOUTRECALL     = 5,
///     OP_CB_NOTIFY           = 6,
///     OP_CB_PUSH_DELEG       = 7,
///     OP_CB_RECALL_ANY       = 8,
///     OP_CB_RECALLABLE_OBJ_AVAIL = 9,
///     OP_CB_RECALL_SLOT      = 10,
///     OP_CB_SEQUENCE         = 11,
///     OP_CB_WANTS_CANCELLED  = 12,
///     OP_CB_NOTIFY_LOCK      = 13,
///     OP_CB_NOTIFY_DEVICEID  = 14,
///
///     OP_CB_ILLEGAL          = 10044

```

```

/// };
///
/// union nfs_cb_argop4 switch (unsigned argop) {
///   case OP_CB_GETATTR:
///     CB_GETATTR4args          opcbgetattr;
///   case OP_CB_RECALL:
///     CB_RECALL4args           opcbrecall;
///   case OP_CB_LAYOUTRECALL:
///     CB_LAYOUTRECALL4args     opcblayoutrecall;
///   case OP_CB_NOTIFY:
///     CB_NOTIFY4args           opcbnotify;
///   case OP_CB_PUSH_DELEG:
///     CB_PUSH_DELEG4args       opcbpush_deleg;
///   case OP_CB_RECALL_ANY:
///     CB_RECALL_ANY4args       opcbrecall_any;
///   case OP_CB_RECALLABLE_OBJ_AVAIL:

```

```

///     CB_RECALLABLE_OBJ_AVAIL4args opcbrecallable_obj_avail;
///   case OP_CB_RECALL_SLOT:
///     CB_RECALL_SLOT4args         opcbrecall_slot;
///   case OP_CB_SEQUENCE:
///     CB_SEQUENCE4args            opcbsequence;
///   case OP_CB_WANTS_CANCELLED:
///     CB_WANTS_CANCELLED4args     opcbwants_cancelled;
///   case OP_CB_NOTIFY_LOCK:
///     CB_NOTIFY_LOCK4args         opcbnotify_lock;
///   case OP_CB_NOTIFY_DEVICEID:
///     CB_NOTIFY_DEVICEID4args     opcbnotify_deviceid;
///   case OP_CB_ILLEGAL:
///     void;
/// };
///
/// union nfs_cb_resop4 switch (unsigned resop) {
///   case OP_CB_GETATTR:   CB_GETATTR4res  opcbgetattr;
///   case OP_CB_RECALL:    CB_RECALL4res   opcbrecall;
///
///   /* new NFSv4.1 operations */
///   case OP_CB_LAYOUTRECALL:
///     CB_LAYOUTRECALL4res
///     opcblayoutrecall;
///
///   case OP_CB_NOTIFY:    CB_NOTIFY4res   opcbnotify;
///

```

```

/// case OP_CB_PUSH_DELEG: CB_PUSH_DELEG4res
///                               opcbpush_deleg;
///
/// case OP_CB_RECALL_ANY: CB_RECALL_ANY4res
///                               opcbrecall_any;
///
/// case OP_CB_RECALLABLE_OBJ_AVAIL:
///                               CB_RECALLABLE_OBJ_AVAIL4res
///                               opcbrecallable_obj_avail;
///
/// case OP_CB_RECALL_SLOT:
///                               CB_RECALL_SLOT4res
///                               opcbrecall_slot;
///
/// case OP_CB_SEQUENCE:   CB_SEQUENCE4res opcbsequence;
///
/// case OP_CB_WANTS_CANCELLED:
///                               CB_WANTS_CANCELLED4res
///                               opcbwants_cancelled;
///
/// case OP_CB_NOTIFY_LOCK:
///                               CB_NOTIFY_LOCK4res
///                               opcbnotify_lock;

```

```

///
/// case OP_CB_NOTIFY_DEVICEID:
///                               CB_NOTIFY_DEVICEID4res
///                               opcbnotify_deviceid;
///
/// /* Not new operation */
/// case OP_CB_ILLEGAL:   CB_ILLEGAL4res  opcbillegal;
/// };
///
///
/// struct CB_COMPOUND4args {
///     utf8str_cs      tag;
///     uint32_t        minorversion;
///     uint32_t        callback_ident;
///     nfs_cb_argop4   argarray<>;
/// };
///
/// struct CB_COMPOUND4res {

```



```

///      nfsstat4 status;
///      utf8str_cs      tag;
///      nfs_cb_resop4  resarray<>;
/// };
///
///
///
/// /*
///  * Program number is in the transient range since the client
///  * will assign the exact transient program number and provide
///  * that to the server via the SETCLIENTID operation.
///  */
/// program NFS4_CALLBACK {
///     version NFS_CB {
///         void
///         CB_NULL(void) = 0;
///         CB_COMPOUND4res
///         CB_COMPOUND(CB_COMPOUND4args) = 1;
///     } = 1;
/// } = 0x40000000;

<CODE ENDS>

```

### 3. Security Considerations

See the Security Considerations section of [\[4\]](#).

### 4. IANA Considerations

See the IANA Considerations section of [\[4\]](#).

### 5. Normative References

- [1] Bradner, S., "Key words for use in RFCs to Indicate Requirement Levels", March 1997.
- [2] IETF Trust, "Legal Provisions Relating to IETF Documents",

November 2008.

- [3] Eisler, M., "XDR: External Data Representation Standard", STD 67, [RFC 4506](#), May 2006.
- [4] Shepler, S., Eisler, M., and D. Noveck, "NFS Version 4 Minor Version 1", [draft-ietf-nfsv4-minorversion1-29](#) (work in progress), Dec 2008.

#### [Appendix A](#). Acknowledgements

The authors are grateful to Lars Eggert for navigating the intellectual property issues of this document.

#### [Appendix B](#). RFC Editor Notes

- o [RFC Editor: please delete this section before publishing]
- o [RFC Editor: after the appearance of,
  - \* This code was derived from [\[RFC3530\]](#). Please
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please add this text with the three leading forward slashes on each line of text (so that the text shows up in the self-extracting Code Component):

- \* This code was derived from [\[RFCTBD1\]](#). Please
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where TBD1 is replaced with the number of the RFC that will replace [draft-ietf-nfsv4-minorversion1-xx.txt](#) [\[4\]](#).)

- o [RFC Editor: please replace these lines,

- \* This file was machine generated for
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- o [RFC Editor: please replace the entry in the "Normative References" section that identifies [draft-ietf-nfsv4-minorversion1-xx.txt](#) with an entry that describes RFCTBD1, where TBD1 is replaced with the number of the RFC that will replace [draft-ietf-nfsv4-minorversion1-xx.txt](#). ]
- o [RFC Editor: please replace all appearances of [draft-ietf-nfsv4-minorversion1-xx.txt](#) with RFCTBD1, where TBD1 is the number of the RFC that will replace [draft-ietf-nfsv4-minorversion1-xx.txt](#).]

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