

NFSv4 Test Matrix – 1.4

This spreadsheet summarizes testing efforts for NFSv4, and identify testing gaps.

Email nfsv4@linux-nfs.org with feedback or to take ownership of a task.

If you are doing NFSv4 testing, please let us know!

The matrix is divided into five categories, each on its own page in this spreadsheet. Priorities are listed where there is a rough consensus. Ones still pending consensus are marked with a ?.

Category

| | |
|--------------------|---|
| <i>Functional</i> | Ability to do what it's supposed to do. Standards compliance, regression, compatibility, static code analysis, etc. |
| <i>Interop</i> | Ability to work with other versions of nfs, other operating systems and other software/filesystems/etc. generally associated with NFS |
| <i>Robustness</i> | Remains stable and recovers even in extreme situations Stability, interoperability, error recovery, race conditions, etc. |
| <i>Performance</i> | Able to perform well under real and theoretical workloads Load, stress, destruction, scalability, etc. |
| <i>Security</i> | Resistant to being compromised and difficult to attack |

Status Summary

Definitions

| | |
|--------------------|--|
| <i>New</i> | An owner has not been identified for the item and work has not started on it |
| <i>Open</i> | The task has been adopted, but either has not been started, or progress is not yet known |
| <i>In Progress</i> | Some work has been completed on the task |
| <i>Near Done</i> | The principle essence of the task has been finished, but there are some loose ends left |
| <i>Done</i> | The task has been fully completed |

| | New | Open | In Progress | Near Done | Done |
|--|------------|-------------|--------------------|------------------|-------------|
| <u>Functional Testing</u> | | | | | |
| <i>Current</i> | 121 | 6 | 1 | 1 | 3 |
| 03/14/05 | 117 | 6 | 1 | 0 | 0 |
| 03/07/05 | 115 | 6 | 1 | 0 | 0 |
| 02/28/05 | 115 | 6 | 1 | 0 | 0 |
| 02/21/05 | 115 | 6 | 1 | 0 | 0 |
| 02/14/05 | 73 | 5 | 1 | 0 | 0 |
| 02/07/05 | 74 | 4 | 1 | 0 | 0 |
| 01/31/05 | 58 | 4 | 1 | 0 | 0 |
| 01/24/05 | 62 | 4 | 1 | 0 | 0 |
| 01/17/05 | 62 | 4 | 1 | 0 | 0 |
| 01/10/05 | 55 | 4 | 1 | 0 | 0 |
| 01/03/05 | 60 | 0 | 0 | 0 | 0 |
| <u>Interoperability Testing</u> | | | | | |
| <i>Current</i> | 59 | 8 | 0 | 0 | 1 |
| 03/14/05 | 9 | 6 | 0 | 0 | 1 |

Intro

| | | | | | |
|----------|---|---|---|---|---|
| 03/07/05 | 4 | 6 | 0 | 0 | 1 |
| 02/28/05 | 4 | 6 | 0 | 0 | 1 |
| 02/21/05 | 4 | 6 | 0 | 0 | 1 |
| 02/14/05 | 4 | 6 | 0 | 0 | 1 |
| 02/07/05 | 4 | 6 | 0 | 0 | 1 |
| 01/31/05 | 4 | 6 | 0 | 0 | 1 |
| 01/24/05 | 4 | 6 | 0 | 0 | 1 |

Robustness Testing

| | | | | | |
|----------------|----|---|---|---|---|
| <i>Current</i> | 40 | 1 | 1 | 0 | 0 |
| 03/14/05 | 40 | 1 | 1 | 0 | 0 |
| 03/07/05 | 40 | 1 | 1 | 0 | 0 |
| 02/28/05 | 40 | 1 | 1 | 0 | 0 |
| 02/21/05 | 40 | 1 | 1 | 0 | 0 |
| 02/14/05 | 39 | 1 | 1 | 0 | 0 |
| 02/07/05 | 39 | 1 | 1 | 0 | 0 |
| 01/31/05 | 36 | 1 | 1 | 0 | 0 |
| 01/24/05 | 36 | 1 | 1 | 0 | 0 |
| 01/17/05 | 40 | 7 | 1 | 0 | 1 |
| 01/10/05 | 30 | 7 | 1 | 0 | 0 |
| 01/03/05 | 38 | 0 | 0 | 0 | 0 |

Performance Testing

| | | | | | |
|----------------|----|---|---|---|---|
| <i>Current</i> | 25 | 2 | 1 | 0 | 6 |
| 03/14/05 | 25 | 2 | 1 | 0 | 6 |
| 03/07/05 | 25 | 2 | 1 | 0 | 6 |
| 02/28/05 | 25 | 2 | 1 | 0 | 6 |
| 02/21/05 | 25 | 2 | 1 | 0 | 6 |
| 02/14/05 | 25 | 2 | 1 | 0 | 6 |
| 02/07/05 | 25 | 2 | 1 | 0 | 6 |
| 01/31/05 | 21 | 2 | 1 | 0 | 6 |
| 01/24/05 | 21 | 2 | 1 | 0 | 6 |
| 01/17/05 | 21 | 2 | 1 | 0 | 6 |
| 01/10/05 | 12 | 0 | 0 | 0 | 0 |
| 01/03/05 | 12 | 0 | 0 | 0 | 0 |

Security Testing

| | | | | | |
|----------------|----|---|---|---|---|
| <i>Current</i> | 15 | 3 | 0 | 0 | 0 |
| 03/14/05 | 15 | 3 | 0 | 0 | 0 |
| 03/07/05 | 15 | 3 | 0 | 0 | 0 |
| 02/28/05 | 15 | 3 | 0 | 0 | 0 |
| 02/21/05 | 15 | 3 | 0 | 0 | 0 |
| 02/14/05 | 15 | 3 | 0 | 0 | 0 |
| 02/07/05 | 15 | 3 | 0 | 0 | 0 |
| 01/31/05 | 13 | 3 | 0 | 0 | 0 |
| 01/24/05 | 13 | 3 | 0 | 0 | 0 |
| 01/17/05 | 13 | 3 | 0 | 0 | 0 |
| 01/10/05 | 15 | 0 | 0 | 0 | 0 |
| 01/03/05 | 15 | 0 | 0 | 0 | 0 |

Intro

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Intro

Functional Testing

| PRI | ID | FUNCTIONAL TESTING | Tools / Tests | Status | Organization | Notes |
|-----|--------|---|---------------------|-------------|--------------|---|
| | I. | FUNCTIONAL TESTING | | | | |
| | I.A | Standards compliance/conformance verification (server) | | | | |
| H | I.A.1 | Test POSIX conformance | POSIX testsuite | New | | |
| L | I.A.2 | Test protocol compliance/conformance against NFSv2 spec | Connectathon | New | | |
| H | I.A.3 | Test protocol compliance/conformance against NFSv3 spec | Connectathon | New | | Quotas |
| H | I.A.4 | Test protocol compliance/conformance against NFSv4 spec (RFC 3530) | Pynfs, POSIX cOpen | | Bull | Bull has interest in pynfs for conformance verification |
| H | I.A.5 | Protocol implementation interoperability between Linux server and client | Connectathon | New | | |
| | I.B | Regression testing | | | | |
| H | I.B.1 | Run applicable existing functionality tests on codebase periodically | Connectathon, iOpen | | Bull | Bull has interest in doing regression testing |
| L | I.B.2 | Review common faults reported with NFSv3 and check if they still exist | New | | OSDL | |
| | I.C | Installability | | | | |
| H | I.C.1 | Test install on Debian unstable of NFSv4 server & client, krb5, ldap, et al | | DONE | CITI | |
| H | I.C.2 | Test install on Fedora Core of NFSv4 server & client, krb5, ldap, et al | | New | | |
| H | I.C.3 | Test install on SuSE of NFSv4 server & client, krb5, ldap, et al | | DONE | OSDL | |
| H | I.C.4 | Test install on Gentoo of NFSv4 server & client, krb5, ldap, et al | | Near Done | OSDL | |
| H | I.C.5 | Test install on SLES of NFSv4 server & client, krb5, ldap, et al | | New | | |
| H | I.C.6 | Test install on RHEL of NFSv4 server & client, krb5, ldap, et al | | New | | |
| M | I.C.7 | Test install on Ubuntu of NFSv4 server & client, krb5, ldap, et al | | New | | |
| M | I.C.8 | Test install on Mandrake of NFSv4 server & client, krb5, ldap, et al | | New | | |
| M | I.C.9 | Test install on Turbolinux of NFSv4 server & client, krb5, ldap, et al | | New | | |
| H | I.C.10 | Test installation of heimdal vs. MIT krb5 implementations | | DONE | OSDL | |
| | I.D | Integration testing | | | | http://www.eitoolkit.com/tools/implementation/system_integ_test_overview.ppt |
| | I.D.1 | Verify functional requirements met for NFSv4 server / RPC | | New | | |
| | I.D.2 | Verify functional requirements met for NFSv4 server / Transport Switch | | New | | |
| | I.D.3 | Verify functional requirements met for NFSv4 server / GSS | | New | | |
| | I.D.4 | Verify functional requirements met for NFSv4 server / GSS / Kerberos | | New | | |
| | I.D.5 | Verify functional requirements met for NFSv4 server / GSS / SPKM | | New | | |
| | I.D.6 | Verify functional requirements met for NFSv4 server / ACLs | | New | | |
| | I.D.7 | Verify functional requirements met for NFSv4 client / NFSv4 server | | New | | |
| | I.D.8 | Verify functional requirements met for NFSv4 client / GSS | | New | | |
| | I.D.9 | Verify functional requirements met for NFSv4 client / GSS / Kerberos | | New | | |
| | I.D.10 | Verify functional requirements met for NFSv4 client / GSS / SPKM | | New | | |
| | I.D.11 | Verify functional requirements met for NFSv4 client / ACLs | | New | | |
| | I.D.12 | Verify functional requirements met for NFSv4 client / mount | | New | | |
| | I.D.13 | Verify functional requirements met for NFSv4 client / IDMAP | | New | | |
| | I.E | Serviceability | | | | http://nfsv4.bullopensource.org/doc/nfsv4.admin.frs.v03.html |
| H? | I.E.1 | Verify NFSv4 administrative functionality within Webmin | | In Progress | Bull | Verification has been done by Bull in 2004. Code has been done and delivered. ACL to be studied. |
| H? | I.E.2 | Verify NFSv4 debugging functionality within nfsdebug, et al | | New | | |
| H? | I.E.3 | Verify NFSv4 monitoring functionality within nagios | | Open | Bull | Verification (and code) will be done by Bull in 2005 |
| H? | I.E.4 | Verify informativeness of error/trace messages | | New | | |
| | I.E.5 | Verify sufficient monitoring functionality within Ethereal | | New | | |
| | | Parse delegation callbacks (CB_NULL, CB_RECALL, CB_GETATTR) | | | | Unimplemented functionality |
| | | Parse OPEN repy's with a granted READ or WRITE delegation | | | | Unimplemented functionality |
| | I.E.6 | Verify ability to get detailed state info from service | | New | | |
| | I.E.7 | Verify ability to list who has open/locked files (ala lsof) | | New | | |
| | I.E.8 | Verify ability to list active mount points and who has them open | | New | | Showmount? |
| | I.E.9 | Verify ability to force operations (close files, change states, unmount) | | New | | e.g. Umount -f |
| L? | I.E.10 | Verify ability for global visualization of mounts/locks/traffic (like top/intop) | | New | | An SNMP interface? |
| | I.E.11 | Verify ability to trace NFS activity (like strace) | | New | | |
| | I.E.12 | Verify ability to trace security rules (e.g., why did user X get auth'd) | | New | | |
| | I.E.13 | Verify admin access to session encryption key (so can e.g. decode protocol in Ethereal) | | New | | |
| | I.F | State transitions | | | | |
| H | I.F.1 | Client notification to server of locking, write, read, etc. | | New | | |
| H | I.F.2 | Reboot recovery | | New | | |
| M | I.F.3 | Delegation / delegation callbacks | | New | | |

| Priority | Item ID | Description | Status | Notes |
|---|---------|---|--------|---|
| Functional Testing | | | | |
| H | I.F.4 | Open with shares / deny | New | |
| H | I.F.5 | Bumping a sequence ID | New | |
| H | I.F.6 | Network partition recovery | New | |
| M | I.F.7 | Sharing file local accessors and remote accessors | New | |
| L | I.F.8 | Locking | New | |
| L | | Blocking locks - fair queuing | | |
| H | | Non-blocking locks | | |
| L | | Mandatory locks | | |
| I.G. Portability to target architectures/platforms | | | | |
| M | I.G.1 | Test compilation and functionality on UP systems | New | TODO: zSeries? |
| L | I.G.2 | Test compilation and functionality on SMP (2, 4, 8, 16, +) systems | New | |
| M | I.G.3 | Test compilation and functionality on cluster system(s) | New | |
| L | I.G.4 | Test compilation and functionality on IA-32 (2, 4, 8-way systems) | New | |
| H | I.G.5 | Test compilation and functionality on IA-64 | Open | Bull planning on contributing this in 2005 (Out of date) |
| L | I.G.6 | Test compilation and functionality on PPC-64 with Linux in 32-bit mode | New | |
| H | I.G.7 | Test compilation and functionality on PPC-64 | Open | Bull planning on contributing this in 2005 |
| L | I.G.8 | Test compilation and functionality on IA-32e, and if there are differences from IA-32 | New | |
| L | I.G.9 | Test compilation and functionality on Sparc | New | |
| I.I. Ecosystem compatibility | | | | |
| H | I.I.1 | Verify compatibility with glibc | New | |
| M | I.I.2 | Verify compatibility with NLM/NSM and NFSv3 locking | New | |
| H | I.I.3 | Verify compatibility with Kerberos | New | |
| H | I.I.4 | Verify compatibility with Ipsec | New | |
| H | I.I.5 | Verify compatibility with POSIX ACLs | New | |
| H | I.I.6 | Verify compatibility with NFS ACLs | New | |
| M | I.I.7 | Verify compatibility with LDAP | New | |
| M | I.I.8 | Verify compatibility with NIS | New | |
| H | I.I.9 | Verify compatibility with automounter | New | |
| L | I.I.10 | Verify compatibility with pNFS | New | Development work required - leave on TODO list for now |
| H | I.I.11 | Verify compatibility with basic system tools (file utils, core utils, util-linux, mount, sar, iostat) | New | |
| L | I.I.12 | Verify compatibility with Active Directory | New | |
| M | I.I.13 | Verify compatibility with Samba (CIFS Server) | New | |
| I.J. Static code analysis | | | | |
| | | Lint, calltree, gcov, fenris, etc. | | http://testingfaqs.org/t-static.html |
| M | I.J.1 | Syntax | New | |
| M | I.J.2 | Unreachable code, unconditional branches into loops | New | |
| M | I.J.3 | Undeclared or uninitialized variables | New | |
| M | I.J.4 | Parameter type mismatches | New | |
| L | I.J.5 | Uncalled functions and procedures | New | |
| L | I.J.6 | Non-usage of function results | New | |
| H | I.J.7 | Possible array bound errors | New | |
| H | I.J.8 | Misuse of pointers | New | |
| M | I.J.9 | Sparse testing | New | |
| L? | I.K | Localization/Internationalization testing | New | |
| | | Need to gather info on what people need | | |
| | | Tests that could point out possible problems? | | |
| | | Alerting people to the issue | | |
| | | Localization of error messages(?) | | |
| | | nfs-utils - general problem | | |
| I.L. Documentation update verification | | | | |
| M | I.L.1 | Check that web content at nfs.sf.net has updated nfsv4 info | New | |
| H | I.L.2 | Check that NFS HOWTO is updated with sufficient nfsv4 info | New | |
| M | I.L.3 | Check that all NFS man pages are updated with nfsv4 info | New | |
| H | I.L.4 | Check that Network Admin Guide at tldp.org is updated for nfsv4 | New | |
| M | I.L.5 | Check that NFS docs for main distros are updated for nfsv4 | New | |
| M | I.L.6 | Check that an NFSv4 Security Best Practices document available | New | |
| H | I.L.7 | Check the nfs performance section in howto | Open | Chuck |
| M | I.L.8 | Make sure section RPCGSS, set up kerberos explanations, etc. exist | New | is in FAQ but not HOWTO |
| M | I.L.9 | List to check system for kerberos config's to make sure it's set up correctly | New | |
| M | I.L.10 | Interoperability considerations - known issues, things to test | New | |
| I.M | | Network transport protocols compatibility | | iSCSI? x25? |

Functional Testing

| | | | | | | |
|---|--------|---|------------------|-----|--|---|
| H | I.M.1 | Test compatibility with TCP protocol | Need to define | New | | |
| L | I.M.2 | Test compatibility with SCTP protocol | How rpc, rdma, | New | | Requires the RPC transport switch be implemented first |
| M | I.M.3 | Test compatibility with BIC-TCP protocol | Issues like reco | New | | Requires the RPC transport switch be implemented first |
| L | I.M.4 | Test compatibility with RDMA/DAPL protocol | Ask Steve for id | New | | Requires the RPC transport switch be implemented first |
| M | I.M.5 | Test compatibility with UDP for NFS 2/3 backwards compatibility | Failover works | New | | |
| L | I.M.6 | Test basic NFS functionality under IPv6 | | New | | |
| L | I.M.7 | Test ecosystem under IPv6 (see section I.I) | | New | | |
| L | I.M.8 | Test compatibility with other network transport protocols (see section I.M) | | New | | |
| L | I.M.9 | Test NFSv2/3 with Ipv6 | | New | | |
| | I.N | Automounter functionality - amd | | | | amd not actively developed, but required for legacy support |
| H | I.N.1 | Verify functionality of direct map support | Connectathon | New | | |
| M | I.N.2 | Verify functionality of indirect map support | Connectathon | New | | |
| M | I.N.3 | Verify functionality of multimount support, including hierarchical mounts | Connectathon | New | | |
| M | I.N.4 | Verify functionality of nested map support | Connectathon | New | | Not implemented yet |
| M | I.N.5 | Verify functionality of /net (-hosts) support | Connectathon | New | | |
| M | I.N.6 | Verify functionality of browse (ghosting) support | Connectathon | New | | |
| | I.O | Automounter functionality - autofs4 | Connectathon | New | | actively developed; not full featured but is robust |
| H | I.O.1 | Verify functionality of direct map support | Connectathon | New | | |
| M | I.O.2 | Verify functionality of indirect map support | Connectathon | New | | |
| M | I.O.3 | Verify functionality of multimount support, including hierarchical mounts | Connectathon | New | | |
| M | I.O.4 | Verify functionality of nested map support | Connectathon | New | | Not implemented yet |
| M | I.O.5 | Verify functionality of /net (-hosts) support | Connectathon | New | | |
| M | I.O.6 | Verify functionality of browse (ghosting) support | Connectathon | New | | |
| | I.P | Automounter functionality - autong | | | | actively developed; has good support for newer features |
| H | I.P.1 | Verify functionality of direct map support | Connectathon | New | | |
| M | I.P.2 | Verify functionality of indirect map support | Connectathon | New | | |
| M | I.P.3 | Verify functionality of multimount support, including hierarchical mounts | Connectathon | New | | |
| M | I.P.4 | Verify functionality of nested map support | Connectathon | New | | Not implemented yet |
| M | I.P.5 | Verify functionality of /net (-hosts) support | Connectathon | New | | |
| M | I.P.6 | Verify functionality of browse (ghosting) support | Connectathon | New | | |
| | I.Q | Use Case Scenarios | | | | |
| H | I.Q.1 | Database functionality on NFS | | New | | Netapp may be interested "The Factory" |
| L | I.Q.2 | Diskless boot functionality on NFS (going away) | | New | | |
| H | I.Q.3 | Clusters / migration / replication functionality (multiple clients) | | New | | |
| M | I.Q.4 | Functionality on Async I/O interface to file systems on client | | New | | |
| H | I.Q.5 | Web server | | New | | |
| M | I.Q.6 | User filesystem environment | | New | | |
| M | I.Q.7 | Mail spooling | | New | | |
| M | I.Q.8 | Wide area clustering | | New | | |
| M | I.Q.9 | Single client high performance computing | | New | | |
| M | I.Q.10 | Clustering servers to provide higher reliability | | New | | |
| | I.R | ID mapping | | | | |
| M | I.R.1 | LDAP – ID mapping, authenticating users | | New | | |
| L | I.R.2 | NIS | | New | | |
| H | I.R.3 | Cross realm mapping | NEED TEST | New | | |

Interop Testing

| <u>PRI</u> | <u>ID</u> | | <u>Tools / Tests</u> | <u>Status</u> | <u>Notes</u> |
|------------|-----------|--|----------------------|---------------|--------------|
| | II | INTEROPERABILITY | | | |
| | II.A | Interoperability with other protocols | | | |
| | II.A.1 | Kerberos – verify basic functionality. Mount w/ krb5, etc. | | | |
| H | | MIT implementation | | Open | Bull |
| M | | Heimdal implementation | | Open | Bull |
| L | II.A.2 | Active Directory | | New | |
| | II.A.3 | IpSec – basic functionality w/ various VPNs, establishment, policies, best prUnknown | | | |
| H | | IpSec v4 | | Open | Bull |
| M | | IpSec v6 | | New | |
| L | | CCM – very new, low priority | | New | |
| L | II.A.4 | SPKM – Interoperability with key management | | New | |
| H | II.A.5 | Interoperability of RPCSEC_GSS in general | | Done | CITI |
| | II.B | Specific architectural/platform interoperability issues | | | |
| | II.B.1 | Interoperability between 32-bit and 64-bit for client and server | | | |
| H | | Linux IA-32 client – AIX PPC server | | Open | Bull |
| H | | Linux IA-32 client – Linux PPC server | | Open | Bull |
| L | | Linux IA-32 client – Linux AMD server | | | |
| L | | Linux IA-32 client – Linux IA-64 server | | | |
| H | II.B.2 | Interoperability between little endian and big endian | | Open | Bull |
| | II.C | Client Interoperability with target architectures/platforms | | | |
| H | II.C.1 | Interoperability for Linux IA-32 client – Solaris 10 server | | Open | Bull |
| H | II.C.2 | Interoperability for Linux IA-32 client – NetApp Filer server | | New | |
| H | II.C.3 | Interoperability for Linux IA-32 client – EMC Filer server | | New | |
| H | II.C.4 | Interoperability for Linux IA-32 client – AIX 5.3 server | | Open | Bull |
| H | II.C.5 | Interoperability for Linux IA-32 client – AMD server | | New | |
| H | II.C.6 | Interoperability for Linux IA-32 client – PolyServe clustered products | | New | |
| M | II.C.7 | Interoperability for Linux IA-32 client – Hummingbird server | | New | |
| L | II.C.9 | Interoperability for Linux IA-32 client – HP server | | New | |
| L | II.C.10 | Interoperability for Linux IA-32 client – SGI server | | New | |
| L | II.C.11 | Interoperability for Linux IA-32 client – Spinniker server | | New | |
| | II.D | Server Interoperability with target architectures/platforms | | | |
| L | II.D.1 | Interoperability for Solaris 10 client – Linux IA-32 server | | New | |
| L | II.D.2 | Interoperability for NetApp client – Linux IA-32 server | | New | |
| L | II.D.3 | Interoperability for EMC client – Linux IA-32 server | | New | |
| L | II.D.4 | Interoperability for AIX 5.3 client – Linux IA-32 server | | New | |
| L | II.D.5 | Interoperability for AMD client – Linux IA-32 server | | New | |
| L | II.D.6 | Interoperability for Polyserve client – Linux IA-32 server | | New | |
| L | II.D.7 | Interoperability for Hummingbird client – Linux IA-32 server | | New | |
| L | II.D.8 | Interoperability for HP client – Linux IA-32 server | | New | |
| L | II.D.9 | Interoperability for SGI client – Linux IA-32 server | | New | |
| L | II.D.10 | Interoperability for Spinniker client – Linux IA-32 server | | New | |
| | II.C | File systems | | | |
| M | II.C.1 | Verify features of cachefs for NFSv4 | | New | |

Bull plans to do in 2005

Bull plans to do in 2005

Bull plans to do in 2005

Not clear who will be using it

Very new, low priority

Trond and Bruce have tested this at Connectat

Testing on two platforms will be sufficient

Optional

Optional

Bull plans to do Linux/AIX 5.3 in 2005

Need to define how to do interoperability testing

Need to define how to do interoperability testing

Not currently NFSv4 ready; needs additional de

Interop Testing

| | | | | |
|---|---------|---|-----|--|
| H | II.C.2 | Verify features of the Ext3 file system work under NFSv4 | New | |
| M | II.C.3 | Verify features of the XFS file system work under NFSv4 | New | |
| M | II.C.4 | Verify features of the Reiser file system work under NFSv4 | New | |
| M | II.C.5 | Verify features of the GFS file system work under NFSv4 | New | |
| M | II.C.6 | Verify features of cluster file systems (e.g. GFS) work under NFSv4 | New | |
| L | II.C.7 | Verify features of the Luster file system work under NFSv4 | New | |
| L | II.C.8 | Verify features of the GPFS file system work under NFSv4 | New | |
| L | II.C.9 | Verify features of the Sanfs file system work under NFSv4 | New | |
| L | II.C.10 | Verify features of the Polyserve file system work under NFSv4 | New | |
| L | II.C.11 | Verify features of the Netcache file system work under NFSv4 | New | |
| L | II.C.12 | Verify features of the Rainfinity file system work under NFSv4 | New | |
| M | II.C.13 | Analyze file system configuration issues, such as: Logical volume manager behind server RAID-5 problem with small write workloads (may be performance issue?) Compiling POSIX ACL's in and out | New | |

II.D

Test ACL interoperability of Linux client for non-Linux servers

| | | | | |
|---|---------|---|-----|----------------------|
| H | II.D.1 | ACL compatibility for Linux IA-32 client - Solaris 10 client | New | See I.R.3; need test |
| H | II.D.2 | ACL compatibility for Linux IA-32 client - NetApp server | New | |
| H | II.D.3 | ACL compatibility for Linux IA-32 client - EMC server | New | |
| H | II.D.4 | ACL compatibility for Linux IA-32 client - AIX 5.3 server | New | |
| H | II.D.5 | ACL compatibility for Linux IA-32 client - AMD server | New | |
| H | II.D.6 | ACL compatibility for Linux IA-32 client - Polyserve server | New | |
| H | II.D.7 | ACL compatibility for Linux IA-32 client - Hummingbird server | New | |
| H | II.D.8 | ACL compatibility for Linux IA-32 client - HP server | New | |
| H | II.D.9 | ACL compatibility for Linux IA-32 client - SGI server | New | |
| H | II.D.10 | ACL compatibility for Linux IA-32 client - Spinnaker server | New | |

II.E

Test ACL interoperability of Linux server with non-Linux clients

| | | | | |
|---|---------|---|-----|----------------------|
| H | II.E.1 | ACL compatibility for Solaris 10 client - Linux IA-32 server | New | See I.R.3; need test |
| H | II.E.2 | ACL compatibility for NetApp client - Linux IA-32 server | New | |
| H | II.E.3 | ACL compatibility for EMC client - Linux IA-32 server | New | |
| H | II.E.4 | ACL compatibility for AIX 5.3 client - Linux IA-32 server | New | |
| H | II.E.5 | ACL compatibility for AMD client - Linux IA-32 server | New | |
| H | II.E.6 | ACL compatibility for Polyserve client - Linux IA-32 server | New | |
| H | II.E.7 | ACL compatibility for Hummingbird client - Linux IA-32 server | New | |
| H | II.E.8 | ACL compatibility for HP client - Linux IA-32 server | New | |
| H | II.E.9 | ACL compatibility for SGI client - Linux IA-32 server | New | |
| H | II.E.10 | ACL compatibility for Spinnaker client - Linux IA-32 server | New | |

II.F

Automounter interoperability

| | | | | |
|---|--------|---|---|--|
| M | II.F.1 | Verify amd will work as a drop-in automounter service with nfsv4 | New | |
| M | II.F.2 | Verify autong will work as a drop-in automounter service with nfsv4 | New | |
| M | II.F.3 | Verify autofs4 will work as a drop-in automounter service with nfsv4 | New | |
| L | II.F.4 | Verify interoperability of nfsv4 and automounter with various map sources: - Flat file - Program file - NIS - NIS+ - LDAP using NIS style maps (RFC2307) - LDAP using Linux style automounter maps - LDAP using Yet-Another schema | New New New New New New New | |

(RFC2307bis, deleted, but used by solaris 9 la

hon and NFSv4 Bakeathon

g – need more than just connectathon

g – need more than just connectathon

velopment

Interop Testing

ist | checked)

Robustness Testing

| <u>PRI</u> | <u>ID</u> | | <u>Tools / Tests</u> | <u>Status</u> |
|------------|-----------|--|----------------------|---------------|
| | III | ROBUSTNESS TESTING | | |
| | | Basic stability assessments | | |
| H? | III.A | | | |
| H? | III.A.1 | Verify basic stability in a std config of each release | | New |
| H? | III.A.2 | Verify stability of valid use cases over long period | | New |
| H? | III.A.3 | Verify stability within "ecosystem" situations over long period | | New |
| | III.A.4 | Verify stability with random inputs | Crashme | New |
| | III.B | Volume testing | | |
| | III.B.1 | Test under high activity on std config with no errors over a long period of time | | New |
| | | Resource limit testing | | |
| H? | III.C | | | |
| L? | III.C.1 | Test stability of client in out of pid situation | | New |
| H? | III.C.2 | Test stability of client in out of memory situation | valgrind | New |
| L? | III.C.3 | Test stability of client in out of disk space situation | | New |
| L? | III.C.4 | Test stability of client in out of inode situation | | New |
| H? | III.C.5 | Test stability of server in out of pid situation | | New |
| H? | III.C.6 | Test stability of server in out of memory situation | valgrind | New |
| H? | III.C.7 | Test stability of server in out of disk space situation | | New |
| H? | III.C.8 | Test stability of server in out of inode situation | | New |
| | III.D | Stress load testing | | |
| H? | III.D.1 | Run LTP NFS fstress in a std config on each release | | In Progress |
| | III.D.2 | Run under other stress loads (TBD) | | New |
| | III.D.3 | Destructive testing by measuring point of failure for various loads | | New |
| | III.D.4 | Use Tool: fsstress | | Open |
| | III.E | Scalability (robustness) | | |
| H? | III.E.1 | Find maximum number of connections | | New |
| L? | III.E.2 | Find maximum number of files | | New |
| L? | III.E.3 | Find maximum file size | | New |
| H? | III.E.4 | Find maximum size of an on-the-wire NFS read or write operation | | New |

Robustness Testing

| | | | | |
|----|----------|--|-----|--|
| L? | III.E.5 | Find maximum number of mounted file systems | New | |
| | III.E.6 | Use Tool: fsstress, fsx | New | |
| | III.E.7 | Test robustness on NUMA when scaling CPU, mem, NIC, or disk count | New | |
| | III.E.8 | Test use of large (>100GB) local caches per node in cluster system | New | |
| M? | III.F | Recovery from problems while under light/normal/heavy loads | | |
| | III.F.1 | Test LAN loss | New | |
| | III.F.2 | Test behavior during crash of client with open delegations and locks | New | |
| | III.F.3 | Test behavior during crash/reboot of server with clients holding various states | New | |
| | III.F.4 | Test multiple clients using, locking, etc. same files | New | |
| | III.F.5 | Test behavior of server with failed storage device | New | |
| | III.F.6 | Test behavior when client's switch port is disabled | New | |
| | III.F.7 | Test recovery from denied permission | New | |
| | III.F.8 | Test recovery from JUKEBOX/DELAY | New | |
| | III.F.9 | Test recovery from ESTATE | New | |
| | III.F.10 | Test recovery from network partitioning events | New | |
| | | Failure of transport level | | |
| H? | III.G | Race conditions | | |
| | III.G.1 | Test for race conditions and locking bugs on PPC64 | New | |
| | III.G.2 | Test for race conditions on new architectures | New | |
| M? | III.H | Sparse test | | |
| H? | III.H.1 | Test functionality with random writes to a very large (sparse) file | New | |
| M? | III.I | Automounter robustness | | |
| L | III.I.1 | Test interruptible automounting in the following cases - indirect mount - direct mount - browsed mount - multimount offset | New | |
| H | III.I.2 | Test concurrent access tests for races - Have multiple threads working in parallel | New | |
| H | III.I.3 | Test replicated file system selection | New | |
| H | III.I.4 | Test remounting after expire corner cases - Something (a process) sitting in the scaffolding - Common case for /net | New | |

Robustness Testing

Notes

Multi-client cache coherency, locking, etc.
May be easiest to get from customer use
Automounter, etc.
<http://people.delphiforums.com/gjc/crashme.html>

IA-32

IA-32

Bull: "Actual tests does not end" http://nfsv4.bullopensource.org/tools/tests/NFSv4_tests.html

Bull planning to contribute testing on this tool in 2005

Bull may be doing some scalability testing

Robustness Testing

Several versions of fsx exist; need to identify canonical version & url

See <ftp.cis.uoguelph.ca/pub/nfsv4/testing-stuff>

Polyserve is interested in this

Olaf Kirch says PPC64 is good at exposing problems because of its weak CPU cache coherency semantics
Faster CPU, memory, and buses can expose race conditions

For more info about Automounter, see notes in nfsv4 list archive for 2/16/05

Needs to be supported at nfs level

Performance Testing

| <u>PRI</u> | <u>ID</u> | | <u>Tools / Tests</u> | <u>Status</u> |
|------------|-----------|---|----------------------|---------------|
| | IV. | PERFORMANCE TESTING | | |
| H? | IV.A | Comparison of NFSv4 vs. NFSv3 for common use cases | | |
| | IV.A.1 | Time to perform sequence of unique read/write operations | lozone | DONE Bull |
| | IV.A.2 | Time to perform sequence of cacheable read/write operations | lozone | DONE Bull |
| | IV.A.3 | Random reads/writes/opens from many clients to one server | lozone | DONE Bull |
| | IV.A.4 | Industry standard loads | SpecSFS, Spec | N/A |
| H? | IV.A.5 | Time to scan file from beginning to end and then rewrite it | | New |
| H? | IV.A.6 | Time for appending large amounts of info to a log file | | New |
| M? | IV.B | Compare latency, throughput, etc. of NFSv4 on TCP vs. other protocols | | New |
| H? | IV.C | Test performance on different local filesystems | | |
| | IV.C.1 | Test performance with ext3 on server | lozone | DONE Bull |
| | IV.C.2 | Test performance with Reiser3 on server | lozone | DONE Bull |
| | IV.C.3 | Test performance with xfs on server | lozone | DONE Bull |
| | IV.C.4 | Test performance with jfs on server | | New |
| | IV.C.5 | Test performance with Reiser4 on server | | New |
| H? | IV.D | Evaluation in various load scenarios | | |
| H? | IV.D.1 | Test performance with large numbers of small (<4k) files | | New |
| L? | IV.D.2 | Test performance with a few very large (>1G) files | | New |
| | IV.D.3 | 2000-5000 clients on 5-10 servers in production environment | NetApp | New |
| | IV.D.4 | Measure memory/network/CPU efficiency of client for fixed workload | lozone or fsx | N/A |
| M | IV.D.5 | Cluster scenario with 1000+ clients and several servers | HPC or visualiz | New |
| | | - Ensure overloaded server handles load gracefully | | |
| | | - Are there resource problems with thousands of idle clients? | | |
| | | - How many mountpoints can client handle? | | |
| | | - How many exports can a single server provide? | | |
| | | - If clients use 1 socket per server, does multiple servers help scalability? | | |
| | IV.E | Evaluation in stress scenarios | | |

Performance Testing

| | | |
|------|--|--------------------------------------|
| L? | <i>Measure speed when operating under Robustness/Stress scenarios</i> See :III.D.5 | New HPC or visualization workload |
| | | |
| H? | IV.F Scalability (performance) | |
| H? | IV.F.1 Impact of Security Protocols to overall performance | Open |
| H? | IV.F.2 Verify server scalability with clients generating various basic requests (ACCESS, GETATTF | New |
| H? | IV.F.3 Verify server scalability with clients using compound requests | New |
| | IV.F.4 Use Tool: fsstress, fsx | New |
| H? | IV.F.5 Measure effects of scaling up number of connections | New |
| H? | IV.F.6 Measure effects of increasing number of files | New |
| H? | IV.F.7 Measure effects of increasing file size | New |
| H? | IV.F.8 Measure effects when increasing size of on-the-wire NFS read or write operations | New |
| | IV.F.9 Measure effects of increased numbers of mounted file systems | New |
| L? | IV.F.10 Measure performance when scaling CPU count per node on NUMA | New |
| L? | IV.F.11 Measure performance when scaling memory per node on NUMA | New |
| L? | IV.F.12 Measure performance when scaling NIC count per node on NUMA | New |
| L? | IV.F.13 Measure performance when scaling disk count per node on NUMA | New |
| | | |
| IV.G | Performance with other protocols <i>Measure speed when operating under Robustness/Protocol Interoperability scenarios</i> See section III.G | New |
| | | |
| H? | IV.H Identify best practices for performance tuning | Open |
| | | |
| H? | IV.I Performance Non-Regression Testing | In Progress |
| | | |
| H? | IV.J Performance effects of security features | |
| | IV.J.1 Measure performance when operating with IPSec integrity and privacy | New |
| H? | IV.J.2 Measure performance when operating with Kerberos 5 integrity and privacy | New |

Performance Testing

Last Updated Notes

There are currently no existing NFSv4 performance benchmarks, due to the robust features inherent in the protocol.

2004 Done by Bull in 2004

2004 Done by Bull in 2004

2004 Done by Bull in 2004

No support is planned for NFSv4 in SpecSFS at this time

V. Roqueta has found that filesystem performance affects NFS in a constant manner

http://nfsv4.bullopen-source.org/tools/tests/NFSv4_tests.html

http://nfsv4.bullopen-source.org/tools/tests/NFSv4_tests.html

http://nfsv4.bullopen-source.org/tools/tests/NFSv4_tests.html

Goal needs clarification for Bull

Goal needs clarification for Bull

32-bit

Performance Testing

Cluster scenario with 1000+ clients and several servers

Bull plans to do this in 2005

SMP
SMP
SMP
SMP
SMP
NUMA
NUMA
NUMA
NUMA

Another Bull project will work on a Tunables Framework and GUI

Bull is doing this 2004,2005

Security Testing

| <u>PRI</u> | <u>ID</u> | | <u>Tools / Tests</u> | <u>Status</u> |
|------------|-----------|---|---|---------------|
| | V.A | SECURITY TESTING | | |
| | V.A | Security inspection tools | | |
| | V.A.1 | Stanford/Coverity Checker(?) | | New |
| | V.A.2 | SMATCH | http://freshmeal | New |
| | V.A.3 | FlawFinder | http://www.dwh | New |
| | V.B | Security feature review | | |
| H? | V.B.1 | Review Authentication/ACL | | New |
| H? | V.B.2 | Review each security flavor | | New |
| H? | V.B.3 | Trust assumptions on LAN vs. WAN | | New |
| | V.C | Interface input inspection | | New |
| | | TODO: Needs clarification | | |
| | V.D | Packet inspection | | New |
| | | TODO: Needs clarification | | |
| M? | V.E | Code audit | | |
| H? | V.E.1 | 32-bit overflows, underflows, integer ranges, pointer analysis, etc. | Lint, splint, gcc | New |
| H? | V.E.2 | 64-bit overflows, underflows, integer ranges, pointer analysis, etc. | | New |
| H? | V.E.3 | Logic holes | | New |
| | V.F | Data integrity validation | | New |
| | V.G | Privacy validation | | New |
| | V.H | Attack and penetration security review | | |
| H? | V.H.1 | Review security assuming attack from client-side | | Open |
| H? | V.H.2 | Review security assuming attack from server-side | | Open |
| L? | V.H.3 | Review security/privacy assuming listening by third party | | Open |
| L? | V.H.4 | Review security assuming penetration of the client-side tools (mount, etc.) | | New |

Security Testing

H? V.H.5

Review security assuming penetration of the server

New

Cross realm

Two v4 domains; kerberos, ACLs in one realm; file system in another

Security Testing

Notes

Look at writings from John Viega

<http://opensourcetesting.org/security.php>

U Mich has done some NFS2/3 ACL testing 10/04

Esp. sunrpc_gss

TODO: How is this done?

Bull planning on working on this in 2005

Bull planning on working on this in 2005

Bull planning on working on this in 2005

Security Testing

Features

| <u>New v4 Feature</u> | <u>Avail in kernel version</u> |
|---|---------------------------------------|
| Basic file operations | 2.6.4 |
| Compound RPCs | ? |
| Locking | 2.6.4 |
| Locks propagation from applications | |
| krb5 | 2.6.4 |
| krb5i | 2.6.6-rc1 |
| krb5p | 2.6.7-rc2-CITI_NFS4_ALL-1 |
| Server reboot recovery (client) | 2.6.4 |
| Server reboot recovery (server) | ? |
| POSIX ACLs (client) | 2.6.4-CITI-NFS4_ALL-1 |
| POSIX ACLs (server) | 2.6.9-rc1 |
| Full NFSv4 ACLs (client) | 2.6.4-CITI-NFS4_ALL-1 |
| Full NFSv4 ACLs (server) | ? |
| Delegations (client) | 2.6.9-rc1 |
| Delegations (server) | 2.6.4-CITI-NFS4_ALL-1 |
| Timeout of client leases | |
| Named attributes (client) | ? |
| Named attributes (server) | ? |
| Security negotiation | ? |
| AUTH_SYS security mechanism | |
| SPKM3 security mechanism | |
| Automounting on fsid change | ? |
| RPC over streaming network protocols such as TCP | |
| Legacy support for RPC via datagrams | |
| File migration and replication | |
| UTF-8 encoding | |
| Delegation support integration with Cluster filesystems | |
| Delegation support integration with Local Access | |
| Share reservations support for cluster file systems | |
| Data migration and replication support | |
| Single protocol spec | |
| Internationalization | |
| File handles | |
| Error definitions | |
| Minor versioning | |
| NFSv4 Requests | |

Features

NFSv4 Procedures

NFSv4 Callback Procedures

Features

Notes

reading, writing, etc.

allows combining several basic NFS ops (LOOKUP, OPEN, READ, etc.) into a single complex RPC operation

advisory/lease-based byte-range locking using fcntl; in nfsv4 this is done by the nfsv4 protocol itself rather than a separate protocol.

For cluster file systems, byte-range locks can be propagated to underlying file systems for better granularity

Authentication only: The header of each request and response is signed. You know who sent you this thing but you don't really know for sure what's in it.

Integrity: The header and body of each request and response is signed. So you know who sent this thing and what was in it.

Privacy: The header of each request is signed, and the body is encrypted, so you know everything you knew with krb5i, but everyone else knows less.

Client apps should continue running after server reboots and maintain consistent states

Standardized use of ACLs across POSIX and Windows environments

Client notifies server of file state intentions

Server can delegate local ops on a file to a client; improves latency and increases use of client-side caching

Clients must continue extending open and lock leases.

Allows client to associate app-specific data with a regular file or directory

Allow automatic negotiation of security flavor using SECINFO and the WRONGSEC error

Client should automatically create new mountpoints when fsid changes

UTF-8 encoding of ACLs, user/group names, and named attributes

Support end-to-end delegation with cluster file systems for Linux

Integrate correctly with local file access, while remaining consistent with cluster file system

Grants client access to open a file and exclude open to others

Supports transparent data migration and replication across applications

Combines various protocols (stat, NLM, mount, ACL, and NFS) into single protocol spec

Features