

## NFSv4 Test Matrix - 1.2

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

Email [nfsv4@linux-nfs.org](mailto: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 four 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

	<b>New</b>	<b>Open</b>	<b>In Progress</b>	<b>Near Done</b>	<b>Done</b>
<b><u>Functional Testing</u></b>					
<i>Current</i>	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
<b><u>Interoperability Testing</u></b>					
<i>Current</i>	9	6	0	0	1
03/07/05	4	6	0	0	1
02/28/05	4	6	0	0	1

## Intro

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
03/07/05	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
03/07/05	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
03/07/05	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

own

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Intro

Functional Testing

PRI	ID	FUNCTIONAL TESTING	Tools / Tests	Status	Organization	Notes
	I.	<b>Standards compliance/conformance verification (server)</b>				
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	<b>Regression testing</b>				
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	<b>Installability</b>				
L	I.C.1	Test installation on various Linux distro releases		New		Only distros with kernel 2.6.x are valid to test on
	I.C.2	Test default configuration for NFS installations		New		
	I.C.3	Test common non-default configuration options		New		
	I.D	<b>Integration testing</b>				<a href="http://www.eitoolkit.com/tools/implementation/system_integ_test_overview.ppt">http://www.eitoolkit.com/tools/implementation/system_integ_test_overview.ppt</a>
	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	<b>Serviceability</b>				<a href="http://nfsv4.bullopen-source.org/doc/nfsv4_admin.frs.v03.html">http://nfsv4.bullopen-source.org/doc/nfsv4_admin.frs.v03.html</a>
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/ntop)		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	<b>State transitions</b>				
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		
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		
	I.F.8	Locking		New		
L		Blocking locks - fair queing				
H		Non-blocking locks				

Functional Testing

L		Mandatory locks			
	I.G	<b>Portability to target architectures/platforms</b>			TODO: zSeries?
M	I.G.1	Test compilation and functionality on UP systems	New		
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	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	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	<b>Ecosystem compatibility</b>			
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		
	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	<b>Static code analysis</b>			
		Lint, calltree, gcov, fenris, etc.			<a href="http://testingfaqs.org/t-static.html">http://testingfaqs.org/t-static.html</a>
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	<b>Localization/Internationalization testing</b>	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	<b>Documentation update verification</b>			
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	<b>Network transport protocols compatibility</b>			iSCSI? x25?
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 recoNew		Requires the RPC transport switch be implemented first
L	I.M.4	Test compatibility with RDMA/DAPL protocol	Ask Steve for idNew		Requires the RPC transport switch be implemented first
M	I.M.5	Test compatibility with UDP for NFS 2/3 backwards compatibility	Fallover 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		

Functional Testing

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	<b>Automounter functionality - amd</b>			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	<b>Automounter functionality - autofs4</b>			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	<b>Automounter functionality - autog</b>			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	<b>Use Case Scenarios</b>			
H	I.Q.1	Database functionality on NFS	New		
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	<b>ID mapping schemes</b>			
M	I.R.1	LDAP – ID mapping, authenticating users	New		
L	I.R.2	NIS	New		

## Interop Testing

<u>PRI</u>	<u>ID</u>		<u>Tools / Tests</u>	<u>Status</u>
	II	<b>INTEROPERABILITY</b>		
	II.A	<b>Interoperability with other protocols</b>		
	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 pr	Unknown	
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	<b>Interoperability with target architectures/platforms</b>		
	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
H	II.B.3	Testing interoperability of platforms w/ full Linux support		Bull
		Linux IA-32 client – Solaris 10 server		
		Linux IA-32 client – NetApp Filer server		
		Linux IA-32 client – EMC Filer server		
		Linux IA-32 client – AIX 5.3 server		
		Linux IA-32 client – AMD server		
		Linux IA-32 client – PolyServe clustered products		
M	II.B.4	Testing interoperability of platforms w/ partial Linux support		
		HP		
		SGI		
L	II.B.5	Testing interoperability of platforms w/ no Linux support		

## Interop Testing

		<b>File systems</b>	
		cachefs	New
		<b>ACL</b>	
	II.E	<b>Automounter interoperability</b>	
M	II.E.1	Verify amd will work as a drop-in automounter service with nfsv4	New
M	II.E.2	Verify autong will work as a drop-in automounter service with nfsv4	New
M	II.E.3	Verify autofs4 will work as a drop-in automounter service with nfsv4	New
L	II.E.4	Verify interoperability of nfsv4 and automounter with various map sources:	New
		- Flat file	Connectathon
		- Program file	Connectathon
		- NIS	Connectathon
		- NIS+	
		- LDAP using NIS style maps (RFC2307)	
		- LDAP using Linux style automounter maps	
		- LDAP using Yet-Another schema	

## Interop Testing

### Notes

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 Connectathon and NFSv4 Bakeathon

Need to define how to do interoperability testing – need more than just connectathon  
Testing on two platforms will be sufficient  
Bull can do this  
Bull can do this

Bull plans to do Linux/AIX 5.3 in 2005

## Interop Testing

Bull plans to do in 2005

(RFC2307bis, deleted, but used by solaris 9 last I checked)

## Robustness Testing

<u>PRI</u>	<u>ID</u>		<u>Tools / Tests</u>	<u>Status</u>
	III	<b>ROBUSTNESS TESTING</b>		
		<b>Basic stability assessments</b>		
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	<b>Volume testing</b>		
	III.B.1	Test under high activity on std config with no errors over a long period of time		New
		<b>Resource limit testing</b>		
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	<b>Stress load testing</b>		
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	<b>Scalability (robustness)</b>		
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	<b>Recovery from problems while under light/normal/heavy loads</b>		
	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	<b>Race conditions</b>		
	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	<b>Sparse test</b>		
H?	III.H.1	Test functionality with random writes to a very large (sparse) file	New	
M?	III.I	<b>Automounter robustness</b>		
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](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

L?	<i>Measure speed when operating under Robustness/Stress scenarios</i> See :III.D.5	New HPC or visualization workload
H?	<b>IV.F Scalability (performance)</b>	
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	<b>Performance with other protocols</b> <i>Measure speed when operating under Robustness/Protocol Interoperability scenarios</i> See section III.G	New
H?	IV.H <b>Identify best practices for performance tuning</b>	Open
H?	IV.I <b>Performance Non-Regression Testing</b>	In Progress
H?	IV.J <b>Performance effects of security features</b>	
	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](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	<b>SECURITY TESTING</b>		
	V.A	<b>Security inspection tools</b>		
	V.A.1	Stanford/Coverity Checker(?)		New
	V.A.2	SMATCH	<a href="http://freshmeal">http://freshmeal</a>	New
	V.A.3	FlawFinder	<a href="http://www.dwh">http://www.dwh</a>	New
	V.B	<b>Security feature review</b>		
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	<b>Interface input inspection</b>		New
		TODO: Needs clarification		
	V.D	<b>Packet inspection</b>		New
		TODO: Needs clarification		
M?	V.E	<b>Code audit</b>		
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	<b>Data integrity validation</b>		New
	V.G	<b>Privacy validation</b>		New
	V.H	<b>Attack and penetration security review</b>		
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

<b><u>New v4 Feature</u></b>	<b><u>Avail in kernel version</u></b>
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