



# SOFTWARE BACKGROUNDER

RisingTide brings rich opportunities to OEMs to partner and create added value for their systems, while maximizing IP protection and technology leverage. RisingTide is becoming the standard multiprotocol target in Linux, with support for iSCSI, FCoE, FC and IB, fast virtualization support, a unified cluster manager for highly available and striped SANs, a roadmap to 40/100 GbE, and early access to new Linux technology.

## Standardized SAN Software Platform

The RisingTide multiprotocol target engine is the standard multiprotocol target in Linux, from kernel 2.6.37 (in 4Q10). Our storage abstraction layer (SAL) brings new or novel storage devices into our target engine as raw block devices, so the full Linux stack will “just work”, including complex functionality such as Software RAID, snapshots, virtualization, etc. A SAL module also protects customer IP – by making it a loadable binary module or including it in a commercial RisingTide license.

## Extensible Multiprotocol Target

Our iSCSI fabric module is becoming a Linux standard from kernel 2.6.37. As a next step, we are integrating FC HBA modules, which we will release with Linux 2.6.38, together with our existing FCoE fabric module. We will add Infiniband fabric modules (iWarp, iSER and SRP), and RoCE support further down the road, to drive 1M IOPS and higher. Our fabric abstraction layer (FAL) accommodates novel fabric technology and new requirements, leverages the full Linux functionality, and extends our platform to build complete customer solutions.

## Fast Virtualization

Our tcm\_loop device makes any raw block device (e.g., from a SAL) appear as a fully SPC-4 compliant local SCSI block device. tcm\_loop minimizes overhead – it delivers >12 GB/s (native) and >2 GB/s (KVM, no hardware assist) on modern Intel platforms. This enables VM environments, such as VMware ESX 4.0 or vSphere 4, to use the full advanced SCSI functionality they require.

## Unified Cluster Management

The RTS Director extends the transparency of RTS storage beyond a single node to an entire SAN. It maps all RTS SAN objects into a unified object tree and implements highly available single-system-image management for it. The RTS Director comprises a shell, a single-system-image API, and a distributed SAN library. The shell provides seamless navigation among and operation on all RTS SAN objects, including smart defaults and tab auto-completion. The API and library allow integration into other management tools, and grant transparent access to the entire SAN. We are working to expand the RTS Director to other SAN components, such

## STANDARDS-BASED

RisingTide is becoming the standard Linux target. RTS modules integrate and protect customer IP.

## MULTIPROTOCOL ENGINE

RisingTide provides iSCSI and FCoE, and is adding FC.IB (iSER, SRP) is on the roadmap.

## VIRTUALIZATION

A SCSI SPC-4 emulation module enables VMs to work locally, with near-zero overhead.

## MANAGEMENT

The RTS Director provides fully integrated SAN management, including clustering and HA.

## HIGH AVAILABILITY

The RTS Director makes LUNs and nodes highly available, with a few simple commands.

## CLUSTERING

Unlimited scale-out clustering will be available in Q1 2011.

## ADVANCED TECHNOLOGY

RisingTide provides early access to new Linux core technologies.

## 40 & 100 GBE

RisingTide is partnering with NIC vendors to integrate leading edge fabric technology.

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as switches, in order to create a common SAN management platform, and we will also include a GUI.

## High Availability

The RTS Director manages all objects in the RTS SAN, and can concurrently perform complex operations on one or more of them, thereby creating and managing collections of objects and/or nodes. This currently includes highly available LUNs and/or nodes; more clustering options will become available in the future.

## Scale-Out Clustering

RisingTide continues to push advanced storage technologies, such as SPC-4 referrals. SPC-4 referrals are a novel SCSI feature that we are leveraging to stripe LUNs across SAN nodes, and thereby scale them out to SAN clusters. With SPC-4 referrals logic in our target engine, striping becomes automatically available to all underlying fabrics. This is also an example of advanced SAN technology where we can work together with our customers to create IP that keeps them ahead on the technology curve.

## Advanced Linux Technology

We can provide early access to new Linux core technologies. For instance, together with Intel Labs, we significantly reduced lock contention in the Linux storage subsystem, which improved CPU utilization by 5% and IOPS by 20% in typical tests. We can provide such patches months before they become generally available in the Linux kernel, and quite possibly years before they appear in one of the major distributions.

## 40 GbE and 100 GbE Roadmap

We are working with key NIC vendors to integrate support for their next generation network ASICs, which will include advanced technologies, such as 40/100 GbE, and novel offload and I/O virtualization functionality. Together with our partner ecosystem, we continue to push the performance envelope for SANs, in native and virtualized environments, providing great investment protection and technology leverage for our customers.

## OPERATING ENVIRONMENTS

### Microsoft

Windows Server 2003/2008/R2  
Windows 7 / Vista / XP

### Apple

OS/X (with 3<sup>rd</sup> party initiator)

### Unix

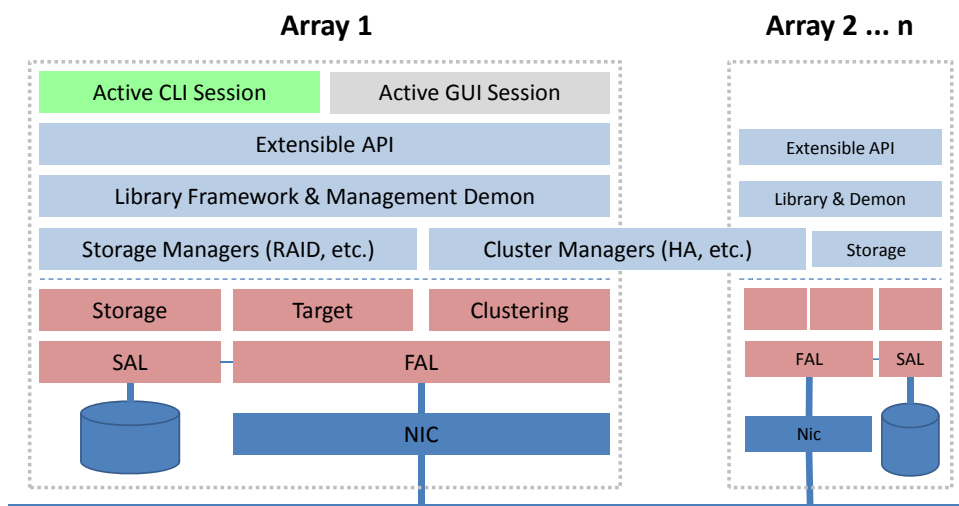
Solaris 10 (x86 / SPARC)  
OpenSolaris  
HP-UX

### Linux

Red Hat RHEL 4.x / 5.x  
SuSe SLES 10.3 / 11  
Red Hat Client

### Virtual Machines

VMware ESX 4.0 / vSphere  
Windows Virtual PC  
KVM / Qemu  
Oracle xVM / VirtualBox  
Xen



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