Red Hat
Certificate of Expertise
in Performance Tuning

CURRICULUM

» **Elements of Monitoring and Tuning**
- Monitoring vs Profiling
- Whole system view
- Before tuning kernel
- Kernel Tunables
- Using system documentation

» **Simple Network Monitoring**
- SNMP
- Management Information Base
- Installing SNMP
- Using SNMP for queries
- Configuring SNMP client
- Enabling SNMP agents
- Profiling SNMP host access controls

» **Graphical Reporting**
- MRTG
- Configuring MRTG
- Ad-hoc utilities
- iostat and sar
- Awk
- Using Gnuplot
- Creating custom script

» **Kernel Level Profiling**
- Installing OProfile
- Installing kernel-debuginfo
- OProfile Architecture
- System Tap
- System Tap Scripts
- stap command
- staprun command

» **Queuing Theory**
- Introduction to Queuing Theory
- Little's Law
- Queue Length
- Wait Time
- Finding hot spot in codes

- Arrival rate vs completion rate
- Predicting system-wide limits
- Predicting resource limits

» Physical Disk Characteristics
- Physical factors affecting disk IO
- Disk storage density
- Block IO request and cache effect
- Tuning sequential read access
- Tuning the disk queue
- Tuning deadline scheduler
- Tuning anticipatory scheduler
- Tuning noop scheduler
- Tuning cfq scheduler
- Physical block device interface
- Virtual block devices

» Reducing Disk Visit Count
- Virtual File System (VFS)
- Fragmentation
- Viewing fragmentation
- Tuning fragmentation
- Filesystem limits
- Journaling
- Improving journal performance
- Tuning journal performance
- Lock contention
- Chunk size
- Calculating filesystem stride
- Tuning RAID

» Processes and Scheduler
- Types of CPU cache
- Locality of reference
- Improving locality of reference
- Tuning scheduler policy
- Viewing CPU performance data

» Kernel Timing and Process Latency
- Tuning system ticks
- Tuning processor speed
- IRQ balancing
- Tuning IRQ affinity
- Equalizing CPU visit count
- Hot-plugging CPUs
- Virtual CPUs
- Tuning VCPUs at domain creation
- Tuning VCPU affinity

» Memory Addressing and Allocation
- Overview of memory addressing
- Virtual disk space
- Viewing and Tuning process address space
- Physical address space
- Overview of memory allocation
- Improving RAM performance
- Improving MMU performance
- Improving NUMA performance
- Improving TLB performance

- Viewing System calls
- Virtual domain memory
- Recovering unassigned memory

» Memory Cache
- Tuning page allocation
- Tuning overcommit
- Slab cache
- ARP cache
- Tuning ARP cache
- Page cache
- Tuning page cache
- Anonymous pages

» Memory Reclamation
- Page status
- Calculating dirty and clean memory
- Reclaiming dirty pages
- Tuning pdflush
- Out of memory killer
- Tuning OOM policy
- Detecting memory leaks
- Understanding swap
- Improving swap performance
- Tuning swappiness
- Tuning swap size
- Tuning swap for think time
- Tuning swap visit count
- Monitoring memory usage

» Essential Network Tuning
- Calculating per-socket buffer size
- Tuning core buffer size
- Tuning TCP buffer size
- Tuning DMA buffer size
- Tuning fragmentation buffers
- Network interrupt handling
- Network sockets
- TCP sockets
- Tuning TCP socket creation

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