

Open Source Development Labs

Carrier Grade Linux Serviceability Requirements Definition

Version 4.0

Prepared by the Carrier Grade Linux
Working Group

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1 Introduction to CGL Serviceability Requirements

Serviceability requirements define the tools and methods used by system administrators to manage, install, maintain, upgrade, and monitor a carrier grade system.

Requirements described in the *Standards* and *Availability* sections often are used to facilitate Serviceability.

Serviceability requirements *do not* include off-target development tools such as IDEs (Integrated Development Environments) or compilers. However, requirements *may* include on-target system services that are used in conjunction with off-target analysis tools, such as off-target debuggers and analysis tools.

2 Document Organization

This document is a section of the *OSDL Carrier Grade Linux Requirements Definition Version 4.0*, which is organized into the separately published sections listed below:

Overview of Requirements Version 4.0

Availability Requirements Definition Version 4.0

Clustering Requirements Definition Version 4.0

Hardware Requirements Definition Version 4.0

Performance Requirements Definition Version 4.0

Security Requirements Definition Version 4.0

Serviceability Requirements Definition Version 4.0

Standards Requirements Definition Version 4.0

Released versions of these sections can be found at

http://www.osdl.org/lab_activities/carrier_grade_linux/requirements.html/document_view

3 Requirements Definitions

Requirements are included in each section of the *OSDL Carrier Grade Linux Requirements Definition Version 4.0*. Each requirement is described as follows:

ID	<p>A unique identification number including:</p> <ul style="list-style-type: none"> • An acronym identifying a category for the requirement (first field). • An ID number for the requirement (second field) • An ID number for a sub-requirement (third field). A “0” in this field indicates the requirement is a stand-alone requirement. An empty field indicates the requirement is a summary requirement with sub-requirements. A number in this field indicates this requirement is a sequentially numbered sub-requirement <p>A summary requirement is indicated by bolding the header of the requirement.</p>						
Name	Short description of the requirement						
Category	<p>The category to which the requirement is assigned. The categories for <i>Serviceability</i> are:</p> <table style="margin-left: 40px; border: none;"> <tr> <td style="padding-right: 20px;">SMM.x.x</td> <td>Serviceability – Management and Monitoring</td> </tr> <tr> <td>SPM.x.x</td> <td>Serviceability – Software Package Management</td> </tr> <tr> <td>SFA.x.x</td> <td>Serviceability – Failure Analysis</td> </tr> </table>	SMM.x.x	Serviceability – Management and Monitoring	SPM.x.x	Serviceability – Software Package Management	SFA.x.x	Serviceability – Failure Analysis
SMM.x.x	Serviceability – Management and Monitoring						
SPM.x.x	Serviceability – Software Package Management						
SFA.x.x	Serviceability – Failure Analysis						
Priority	<p><i>P1</i> – The requirement is mandatory and required for registration. The PoC must be fully disclosed</p> <p><i>P2</i> – The requirement is optional, but the registration process must disclose whether or not the distribution is compliant with the requirement. If so, a reference PoC is required.</p> <p><i>P3</i> – The requirement is a roadmap item and not necessary for registration. A PoC is not required and compliance does not apply.</p>						
Description	Detailed description of the requirement.						

4 Serviceability Requirements

4.1 Management and Monitoring

ID	Name	Category	Priority
SMM.1.0	Remote Management Standards	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for the following remote management APIs as defined by the following requirements described in the <i>Standards</i> document:</p> <ul style="list-style-type: none"> • STD.7 SNMP (for IPv4 and IPv6) and STD.7.2 SNMP MIBs for IPv6 <p>This protocol and management standard is used in remote management tools for querying and monitoring a system.</p>			

ID	Name	Category	Priority
SMM.2.0	IPMI Local Management APIs	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for local management using Intelligent Platform Management Interface APIs as defined by the following requirement, described in the <i>Standards</i> and <i>Hardware</i> documents:</p> <ul style="list-style-type: none"> • STD.9.0 IPMI Intelligent Platform Management Interface (IPMI) 			

ID	Name	Category	Priority
SMM.2.1	HPI Local Management APIs	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for local management via SA Forum Hardware Platform Interface APIs as defined by the following requirement described in the <i>Standards</i> and <i>Hardware</i> documents:</p> <ul style="list-style-type: none"> • STD.8.8 SA Forum SA Forum Hardware Platform Interface (HPI) 			

SMM.3 deprecated in CGL 4.0

ID	Name	Category	Priority
SMM.3.1	Serial Console Operation	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for a connection to a system console via a serial port on the system where a serial port exists. All output that would appear on a local console must appear on the remote console.</p>			

ID	Name	Category	Priority
SMM.3.2	Network Console Operation	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that Linux shall provide support for a management console connection via a network port in addition to providing the standard support for a management console connection via a serial port.</p>			

ID	Name	Category	Priority
SMM.4.0	Persistent Device Naming	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide consistent device naming functionality. The user-space system name of the device shall be maintained when the device is removed and reinstalled even if the device is plugged into a different bus, slot, or adapter.</p> <p>A device name shall be assigned, based on hardware identification information using policies set by the administrator.</p>			

ID	Name	Category	Priority
SMM.5.0	Kernel Profiling	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that Linux shall support profiling of a running kernel and applications to identify bottlenecks and other kernel and application statistics.</p>			

ID	Name	Category	Priority
SMM.5.1	Application Profiler (was AVL.19.0)	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a mechanism to profile critical resources of the kernel and applications. The critical resources that are profiled by this mechanism shall include (but are not limited to):</p> <ul style="list-style-type: none"> • Time used • Memory used • Number of semaphores, mutexes, sockets, and threads/child processes in use • Number of open files. <p>Monitoring shall happen at configurable, periodic intervals or as initiated by the user.</p>			

ID	Name	Category	Priority
SMM.6.0	Boot Cycle Detection	Management and Monitoring	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for detecting a repeating reboot cycle due to recurring failures. This detection should happen in user space before system services are started.</p> <p>This type of failure requires a response due to the negative impact of repeatedly bringing up and taking down services. A configurable policy is needed to set thresholds of cycling and desired shutdown actions, such as exponential back off, shutdown, or notifying administrators.</p>			

ID	Name	Category	Priority
SMM.6.1	Early Boot Cycle Detection	Management and Monitoring	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for detecting a repeating reboot cycle due to recurring failures. This detection should happen before the first process is started.</p> <p>Since this is a limited environment, reporting is the most important step.</p>			

SMM.7 deprecated in CGL 4.0

ID	Name	Category	Priority
SMM.7.1	Temperature Monitoring	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a capability that supports the monitoring of system temperature settings and conditions.</p>			

ID	Name	Category	Priority
SMM.7.2	Fan Monitoring	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a capability that supports the monitoring of system fan settings and conditions.</p>			

ID	Name	Category	Priority
SMM.7.3	Power Monitoring	Serviceability - Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a capability that supports the monitoring of system power settings and conditions.</p>			

ID	Name	Category	Priority
SMM.7.4	Media Monitoring	Serviceability - Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a capability that supports the monitoring of media settings and conditions for system media, such as hard disks or hardware specific disk sub-systems.</p>			

ID	Name	Category	Priority
SMM.7.5	Network Monitoring	Serviceability - Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a capability that supports the monitoring of system network settings and conditions.</p>			

ID	Name	Category	Priority
SMM.7.6	CPU Monitoring	Serviceability - Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a capability that supports the monitoring of CPU settings and conditions, such as current utilization totals, per process totals and trends, and current speed settings.</p>			

ID	Name	Category	Priority
SMM.7.7	Memory Monitoring	Serviceability - Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a capability that supports the monitoring of memory conditions, such as current utilization totals, and per process totals and trends.</p>			

ID	Name	Category	Priority
SMM.7.8	Support for User Locked Page Reporting	Management and Monitoring	P3
<p>Description: OSDL CGL specifies that in addition to current memory usage reporting, the OS shall report the count of mlocked pages to accurately determine how much memory may be reclaimed by the page frame reclaim algorithm. Based on mlocked page count and current memory usage reporting, a more accurate amount of free physical memory may be determined. In addition current overcommit policies shall take mlocked pages into account to accurately enforce memory overcommit policies for which the count of mlocked pages is applicable.</p>			

ID	Name	Category	Priority
SMM.7.9	Support for Precise Process Accounting	Serviceability - Management and Monitoring	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall support precise process accounting of CPU usage. This shall be accomplished by time stamping various kernel execution paths using the native platform high resolution counter. This accounting activity shall be run-time configurable, including partial or total disabling, via the proc file system. When totally disabled no additional overhead will be measurable. Disabling or enabling precise accounting shall not affect Linux native tick accounting. All data shall be accessible from the proc file system. For task per-CPU metrics, a range of 1 through N rows may be configured such that each row accrues metrics for one CPU, a range in between 1 and N CPUs (all metrics summed together). Where N is the number of logical CPUs. Additional Sub-requirements follow.</p> <p><i>Sub-requirement 1:</i> The following metrics shall be accrued on per-CPU basis:</p> <ul style="list-style-type: none"> • Per task CPU usage – user, system, interrupt (in tasks context), and time spent on run queue • System wide CPU usage – idle, user, system, interrupt, softirq • Per task occurrence counts of system calls, signals, reschedules, voluntary blocks, preemption due to higher priority task and preemptions due to time slice expirations. • System wide occurrence counts of interrupts, system calls, signals, and softirqs, with softirqs grouped by types. <p><i>Sub-requirement 2:</i> A per task table of schedule latency counts shall be implemented such that a schedule latency value is indexed into predetermined ranges, and the count for that range is incremented. For example a table size of three will correspond to three scheduling latency ranges such as:</p> <p>index 0: 0-10 mili-seconds</p> <p>index 1: 10-100 mili-seconds</p> <p>index 2: greater then 100 mili-seconds</p> <p>The table size and ranges may be build time configurable</p> <p><i>Sub-requirement 3:</i> Certain OS timers and CPU caps may be configured to increment or expire precisely with the initial list being – SIGXCPU, SIGVTALARM, SIGPROF.</p>			

SMM.8 deprecated in CGL 4.0

ID	Name	Category	Priority
SMM.8.1	Kernel Message Structuring	Serviceability - Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support that allows the structuring of kernel messages using an event log format to provide more information to identify the problem and its severity, and to allow client applications registered for the fault event to take policy-based corrective action.</p>			

ID	Name	Category	Priority
SMM.8.2	Platform Signal Handler	Serviceability - Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide an infrastructure to allow interrupts generated by “hardware errors” to be logged using the event logging mechanism. A default handler shall be provided.</p>			

ID	Name	Category	Priority
SMM.8.3	Remote Access to Event Log	Serviceability - Management and Monitoring	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for a remote access capability that allows a centralized system to access the Linux OS event log information of a remote system.</p>			

ID	Name	Category	Priority
SMM.9.0	Disk and Volume Management	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for the installation of a subsystem that supports hard disks to be managed without incurring downtime:</p> <ul style="list-style-type: none"> Physical disks can be grouped into volumes and the volume definitions can be modified without downtime. Filesystems that are defined within volumes can be enlarged without requiring unmounting. Support can be configured out if desired. 			

ID	Name	Category	Priority
SMM.10.0	System Initialization Error Handling Enhancements	Management and Monitoring	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a mechanism to detect errors during system initialization. When such an initialization error occurs, this mechanism shall be able to report the event to a remote system over the network.</p> <p>OSDL CGL further specifies the following error conditions shall apply to this requirement:</p> <ul style="list-style-type: none"> The kernel image fails before init is started The init process fails to fully complete the startup initialization to the point where the conventional error reporting mechanisms are available 			

ID	Name	Category	Priority
SMM.11.0	PCI Express Device Hot Plug (was PIC.1.3)	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall support the plugging and unplugging of PCI Express devices without affecting the system, properly handling the disconnection of a PCI Express device and the probing and connection of a new device.</p>			

ID	Name	Category	Priority
SMM.12.0	Remote Boot Support (was PMT.2.0)	Management and Monitoring	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for remote booting across common LAN and WAN communication media to support diskless systems.</p>			

ID	Name	Category	Priority
SMM.13.0	Diskless Systems (was PMS.4.0)	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide for Linux on diskless systems.</p>			

ID	Name	Category	Priority
SMM.14.1	Kernel Resources Expansion for Threads (was AVL.20.0)	Management and Monitoring	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall expand available kernel resources to provide additional support for threads. The existing thread model is defined as a lightweight process model; therefore some thread kernel resources are missing. Threads are widely used in carrier grade level applications, so at least the following additional kernel resource functionality shall be provided to support threads:</p> <ul style="list-style-type: none"> • Full SIGNAL support – The SIGNAL should be sent to each thread. 			

ID	Name	Category	Priority
SMM.14.2	Kernel Resources Limits for Threads (was AVL.20.0)	Management and Monitoring	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall expand available kernel resources to provide additional support for threads. The existing thread model is defined as a lightweight process model; therefore some thread kernel resources are missing. Threads are widely used in carrier grade level applications, so at least the following additional kernel resource functionality shall be provided to support threads:</p> <ul style="list-style-type: none"> • Full <i>rlimit</i> support – The <i>rlimit</i> parameter should be supported for each thread. 			

4.2 Software Package Management

A software package management system is required for carrier grade Linux systems. These requirements outline capabilities and expectations for remote software installation over a network.

ID	Name	Category	Priority
SPM.1.0	Remote Package Update and Installation	Serviceability - Software Package Management	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a remote software package update feature. The package shall include functions that allow kernel modules and application software to be installed or upgraded remotely, while minimizing downtime of the system.</p> <p>The use of the term “remotely” does not imply a central package management platform, nor does it preclude such a system. This requirement only necessitates that a single device may be upgraded without requiring the administrator to be physically at the device.</p> <p>Note: Due to the wide range of platforms and applications in use, CGL does not specify a specific downtime limit metric. Downtime targets will vary based on the system application.</p>			

ID	Name	Category	Priority
SPM.2.0	No System Reboot for Upgrade of Kernel Modules	Serviceability - Software Package Management	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide remote software installation and upgrade mechanisms that requiring no system reboots:</p> <ul style="list-style-type: none"> • No reboot shall be required to upgrade kernel modules. • Remote software installation and upgrade mechanisms will not require more reboots than the same upgrade done using the console. 			

ID	Name	Category	Priority
SPM.2.1	No System Reboot for Application Package Update	Serviceability – Software Package Management	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide remote software installation and upgrade mechanisms that require no system reboots:</p> <ul style="list-style-type: none"> • No reboot shall be required to upgrade user-space applications provided by CGL system software. 			

ID	Name	Category	Priority
SPM.3.0	Version and Dependency Checking via Package Management	Serviceability - Software Package Management	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide remote software installation and upgrade capabilities that include provisions for version compatibility and dependency checking at the package level.</p>			

ID	Name	Category	Priority
SPM.4.0	Upgrade Log	Serviceability - Software Package Management	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide remote software installation and upgrade mechanisms that perform transaction logging of dates, times, changes, and the identity of the user performing a change.</p>			

ID	Name	Category	Priority
SPM.5.0	Manual Software Rollback	Software Package Management	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide mechanisms that allow manual rollback to a previous version of software without having to reinstall the previous version.</p>			

ID	Name	Category	Priority
SPM.6.0	Automatic Software Rollback	Serviceability - Software Package Management	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide mechanisms that allow automatic rollback with configurable triggers to a previous version of software without having to reinstall the previous version.</p>			

ID	Name	Category	Priority
SPM.7.0	Fine-Grain Software Version Checking	Serviceability - Software Package Management	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide remote software upgrade mechanisms that include provisions for version compatibility and dependency checking at a fine-grain file or application level. The upgrade process shall allow the coexistence of new and old executables, shared libraries, configuration files, and data.</p> <p>The capability must be provided to identify the versions of specific binaries and files. A version inventory mechanism shall be provided that records version, dependency, and compatibility for software packages currently installed.</p>			

ID	Name	Category	Priority
SPM.8.0	Idempotent Package Installation Recovery Procedure	Software Package Management	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide idempotent packaging. In this case, idempotent shall mean that if a script is run successfully, and then it is called again, it doesn't fail or cause any harm, but just verifies that everything is the way it ought to be.</p> <p>If the first call failed, or aborted part way through for some reason, the second call should merely do the things that were left undone the first time, if any, and exit with a success status if everything completes successfully.</p>			

4.3 Failure Analysis

Enhanced capabilities for analyzing software failures are a requirement for a carrier grade system.

ID	Name	Category	Priority
SFA.1.0	Kernel Panic Handler Enhancements	Serviceability - Failure Analysis	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide enriched capabilities in response to a system panic. Currently the default system panic behavior is to print a short message to the console and halt the system. CGL systems shall provide a set of configurable functions, including:</p> <ul style="list-style-type: none"> • Logging the panic event to the system event log • Cycling power (rebooting) or powering off • Forcing a crash dump <p>CGL shall support enhanced kernel panic reporting, at a minimum supporting proper resolution of in-kernel symbols. This will make kernel panic reports useful to administrators that do not have access to the kernel for which the report was generated.</p>			

SFA.2 deprecated in CGL 4.0

ID	Name	Category	Priority
SFA.2.1	Live Kernel Remote Debugger	Serviceability - Failure Analysis	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for remote debugging of a live kernel. This shall include support over serial and/or local Ethernet.</p>			

ID	Name	Category	Priority
SFA.2.2	Dynamic Probe Insertion	Serviceability - Failure Analysis	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for the ability to dynamically insert software instrumentation into a running system in the kernel or applications.</p> <ul style="list-style-type: none"> • The instrumentation must be insertable to any part of the kernel. • The instrumentation should allow control to be passed to a user-provided module. • The instrumentation should not require interactive direction, i.e., no user sitting at the kernel debugger. • The user-provided modules should have access to data the kernel would normally be expected to have access to, e.g., hardware registers, kernel 			

ID	Name	Category	Priority
SFA.2.3	User Space Debug Support for Threads	Serviceability - Failure Analysis	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support to fully enable debugging of multi-threaded programs. This support should allow any actions available for debugging a single-threaded (non-threaded) process be extended to be available for every thread in a multi-threaded process. OSDL CGL shall provide specific additional debugging capabilities that are unique to multi-threaded applications:</p> <ul style="list-style-type: none"> • Automatic notification of a new thread. • List of threads and the ability to switch among them. • Apply specific debug commands to a list of threads. 			

ID	Name	Category	Priority
SFA.2.4	Multithreaded Core Dump Support for Threaded Applications	Serviceability - Failure Analysis	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for correctly storing core dumps of multi-threaded user-space applications.</p>			

ID	Name	Category	Priority
SFA.3.0	Kernel Dump: Analysis	Serviceability - Failure Analysis	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for tools to enable enhanced analysis of kernel dumps. These enhancements must include, but not be limited to, the following capabilities:</p> <ul style="list-style-type: none"> • Access to kernel structures • Virtual-to-physical address translation • Module access • Preserve all tools and CPU states 			

ID	Name	Category	Priority
SFA.3.1	Kernel Dump: Contents	Serviceability – Failure Analysis	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide the ability to create kernel dumps that include, but not be limited to, the following capabilities:</p> <ul style="list-style-type: none"> • Access to kernel structures • Virtual-to-physical address translation • Module access • Preserve all tools and CPU states <p>A kernel dump shall provide the ability to capture enough of the kernel state to permit post-crash analysis of the conditions that led to a server problem, which may be a hardware, software, resources, or configuration issue.</p>			

ID	Name	Category	Priority
SFA.4.0	Kernel Dump: Limit Scope	Serviceability - Failure Analysis	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for configuring the amount of system information that is retained. The minimum type of configuration would be only kernel memory or all system memory. A way must be provided for a system administrator to specify which type of system dump should be performed.</p>			

ID	Name	Category	Priority
SFA.5.0	Live Application Dump Trigger	Serviceability - Failure Analysis	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide mechanisms to trigger application dump procedures. Standard triggers include:</p> <ul style="list-style-type: none"> • Memory thresholds • CPU thresholds 			

ID	Name	Category	Priority
SFA.6.0	System Snapshot	Failure Analysis	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide mechanisms to allow a snapshot image to be taken of an entire running system. The system must be frozen during the snapshot to ensure a consistent image is stored. When the system is frozen, it will not be able to respond to external events. This capability can be used both for analysis and for restoring an arbitrary system state. (This feature may also be known as “live system dump” or “memory image save”).</p>			

ID	Name	Category	Priority
SFA.7.0	Application Snapshot	Serviceability - Failure Analysis	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a mechanism to allow a snapshot image to be taken of a single running application or process. For threaded applications, all child threads and thread contexts should be included in the snapshot. This mechanism must be able to capture images from multiple applications running concurrently.</p> <p>While this capability would typically be used during a system debugging session, it must also be possible to use it during production. It is expected that the snapshot would affect application performance as follows:</p> <ul style="list-style-type: none"> • The application must be frozen during the time the snapshot is being created to ensure that a consistent image is stored. • While the application is frozen, it will not be able to respond to system events like messages or signals. <p>This capability is important for situations like the following:</p> <ul style="list-style-type: none"> • If an application crashes that relies heavily on another application, the state of the other application may be needed to debug the problem. • When problems need to be debugged that do not impact service, such as memory leaks. 			

ID	Name	Category	Priority
SFA.8.0	Kernel Flat/Graph Execution Profiling	Serviceability - Failure Analysis	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for profiling of the running kernel using a <i>prof</i> or <i>gprof</i> style of recording trace information during system execution.</p>			

ID	Name	Category	Priority
SFA.9.0	Kernel Sampling for Profiling	Serviceability - Failure Analysis	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for profiling of the running kernel by providing profiling based on interrupt sampling as follows:</p> <ol style="list-style-type: none"> 1. Take an interrupt. 2. Record an execution point. 3. Record additional execution points at configurable intervals based on HW timers. 4. Analyze to build a profile of the execution history of the system. 			

ID	Name	Category	Priority
SFA.10.0	Kernel Dump: Configurable Destinations	Serviceability - Failure Analysis	P1
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide support for producing and storing kernel dumps as follows:</p> <ul style="list-style-type: none"> • It must be possible to store kernel dumps to disk and across a network. • Regardless of the specific dump target, dumps must be preserved across the next system boot. 			

SFA.11.0 deprecated in CGL 4.0**SFA.12.0 deprecated in CGL 4.0**

ID	Name	Category	Priority
SFA.13.0	Live Application Dump with no Affect on System or Process	Serviceability - Failure Analysis	P2
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a mechanism to enable a live dump image of an application without adversely affecting the application's ability to perform its intended functionality. The dump mechanism must not stop the application, or must minimize the time the application or its components are stopped, during a dump operation. An application can be one or more "processes" with zero or more threads.</p>			

ID	Name	Category	Priority
SFA.14.0	Per Thread CPU Time Limits and Signaling	Serviceability - Failure Analysis	P3
<p>Description: OSDL CGL specifies that carrier grade Linux shall provide a method to accurately track CPU time consumed by an individual thread. It shall also provide a method to set CPU threshold time used by an individual thread. This method shall also include the ability to send a signal to an individual thread if its CPU threshold time is exceeded.</p>			