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Hard Partitioning with Oracle VM Server for SPARC

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Introduction

This document describes hard partitioning with Oracle VM Server for SPARC, and how to use it to conform to the [Oracle licensing policies for partitioned environments](#).

CPU Cores and CPU Threads

Oracle VM Server for SPARC software runs on SPARC servers. Each SPARC processor has multiple CPU cores, and each CPU core has multiple CPU threads (virtual CPUs). By default, domains created with Oracle VM Server for SPARC are configured in units of CPU threads. Oracle VM Server for SPARC uses CPU affinity to try to assign each domain's virtual CPUs on its own cores for optimal performance. This can be made mandatory by using the "whole core constraint" to require that CPUs are assigned in units of entire CPU cores. When binding such a domain, the system provisions the specified number of CPU cores and all their CPU threads to the domain.

For a list of supported SPARC systems and more information about CPU whole-core configurations, see the Release Notes and Administration Guide of [Oracle VM Server for SPARC Documentation](#).

Hard Partitioning and CPU Whole Cores

Beginning with the Oracle VM Server for SPARC 2.0 release, hard partitioning is enforced by using CPU whole-core configurations and specifying the maximum number of cores that can be assigned to the domain. In this case, domains are configured with CPU whole cores, instead of the default of individual CPU threads. Using a whole-core configuration and setting a maximum CPU cap limits the number of CPU cores that can be dynamically assigned to a bound or active domain.

Oracle Hard Partition Licensing

To conform to the Oracle hard partition licensing requirement, you must use at least Oracle VM Server for SPARC 2.0 release and must use CPU whole cores as follows:

- If a domain runs applications using Oracle hard partition licensing, that domain must be configured with CPU whole cores, and the CPU cap (maximum number of CPU cores) must be set for the domain. The CPU cap must be the number of CPU cores that is specified by the Oracle software license.
- Live migration of guest domains with whole cores and a CPU cap does not conform to the terms of the hard partition licensing. When live migration is used in an Oracle VM server pool, hard partition licensing is not applicable. You must determine the number of guest domains running the Oracle Software and then license the same number of physical servers (starting with the largest servers based on the CPU core count) up to the total number of the physical servers in the pool. For example, if a customer has a server pool with 32 servers and 20 guest domains running Oracle Software within the server pool, the customer must license the 20 largest physical servers in the pool. If the customer is running 50 guest domains with Oracle Software in a pool of 32 physical servers, they need only to license the 32 physical servers in the pool.
- Live migration of other guest domains with non-Oracle software within the server pool is not relevant to Oracle software hard partitioning or has no impact to how Oracle software license is calculated.
- “Trusted Partitions” allow subset licensing without limitation on live migration, but only available on the approved Oracle Engineered Systems listed on [Oracle licensing policies for partitioned environments](#).

Checking the Configuration of a Domain

To Check Whether a Domain is Configured With CPU Whole Cores and a CPU Cap

1. Obtain the resources management information for the domain.

```
# ldm list -o resmgt domain
```

Verify that the `whole-core` constraint appears in the output and that the `max-cores` keyword specifies the maximum number of CPU cores configured for the domain.

For more information, see the `ldm(1M)` man page of the Reference Manual in the [Oracle VM Server for SPARC Documentation](#).

EXAMPLE – Checking Whether a Domain Is Configured With CPU Whole Cores and a CPU Cap

The following command shows that `ldg1` domain is configured with CPU whole cores and a maximum of five cores:

```
# ldm list -o resmgt ldg1
NAME
ldg1

CONSTRAINT
  whole-core
  max-cores=5
```

To List the CPU Cores That Are Assigned to a Domain

CPU cores are assigned to a domain when a domain is bound.

1. Obtain the list of CPU cores that are assigned to a domain.

```
# ldm list -o core domain
```

EXAMPLE – Listing the CPU Cores That Are Assigned to a Domain

The following command shows the cores that are assigned to domain `ldg1`:

```
# ldm list -o core ldg1
NAME
ldg1

CORE
CID  PCPUSET
1    (8, 9, 10, 11, 12, 13, 14, 15)
2    (16, 17, 18, 19, 20, 21, 22, 23)
```

Configuring a Domain With CPU Whole Cores and a CPU Cap

Use the following commands to configure a domain to use CPU whole cores and set the maximum number of CPU cores (CPU cap) for the domain:

```
ldm set-core number-of-cpu-cores domain
ldm set-domain max-cores=max-number-of-cpu-cores domain
```

If you are using version 2.0 or 2.1 of the Logical Domains Manager to assign whole cores to domains, the `ldm add-core`, `ldm set-core`, `ldm remove-core`, and `ldm set-domain max-core` commands are not available. Instead, you *must* use the `ldm add-vcpu -c`, `ldm set-vcpu -c`, and `ldm remove-vcpu -c` commands. These commands also set the CPU cap for the domain. See the `ldm(1M)` man page of the Reference Manual in the [Oracle VM Server for SPARC Documentation](#).

To Create a New Domain With CPU Whole Cores and a CPU Cap

When creating a new domain, you can configure it to use CPU whole cores.

1. Create the domain.


```
# ldm create domain
```
2. Set the number of CPU whole cores and the CPU cap for the domain.


```
# ldm set-core number-of-cpu-cores domain
# ldm set-domain max-cores=max-number-of-cpu-cores domain
```
3. Configure the domain.

Caution –During this configuration, do *not* use the `ldm add-vcpu`, `ldm set-vcpu` or `ldm rm-vcpu` command. If you do so, the domain is reconfigured with individual CPU threads instead of CPU whole cores. Ensure that you use the `ldm add-core`, `ldm set-core`, or `ldm remove-core` command, or the `-c` option of the `ldm add-vcpu`, `ldm set-vcpu` or `ldm rm-vcpu` command if you use version 2.0 or 2.1 of Logical Domains Manager.

4. Bind and start the domain.


```
# ldm bind domain
# ldm start domain
```

EXAMPLE – Creating a New Domain With Two CPU Whole Cores and a CPU Cap of Two Cores

This example shows how to create a domain, `ldg1`, with two CPU whole cores. The following command creates the `ldg1` domain:

```
# ldm create ldg1
```

The following commands configure the `ldg1` domain with two CPU whole cores and set the CPU cap to two cores:

```
# ldm set-core 2 ldg1
# ldm set-domain max-cores=2 ldg1
```

At this point, you can perform further configuration of the domain subject to the restrictions described in Step 3 of the previous procedure. Before you use the `ldg1` domain, you must bind and start it, which is done by the following commands:

```
# ldm bind ldg1
# ldm start ldg1
```

To Configure an Existing Domain With CPU Whole Cores and a CPU Cap

If a domain already exists and is configured to use CPU threads, you can change its configuration to use CPU whole cores and a CPU cap.

1. Stop and unbind the domain. This step is not needed to configure the domain to use CPU whole cores; it is only needed to set the CPU cap.

```
# ldm stop domain
# ldm unbind domain
```

2. Set the number of CPU whole cores for the domain and set the CPU cap.

```
# ldm set-core number-of-cpu-cores domain
# ldm set-domain max-cores=max-number-of-cpu-cores domain
```

3. Rebind and restart the domain if it was stopped in step 1.

```
# ldm bind domain
# ldm start domain
```

EXAMPLE – Configuring an Existing Domain With Four Whole Cores and a CPU Cap of Eight Cores

This example shows how to update the configuration of an existing domain, `ldg1`. Four CPU whole cores are configured for the domain and the CPU cap is set to eight cores. This enables you to add up to four more whole cores to the domain, if needed.

The following commands stop and unbind the `ldg1` domain:

```
# ldm stop ldg1
# ldm unbind ldg1
```

The following commands configure the `ldg1` domain with four CPU whole cores and set the CPU cap to eight. Note that the `ldm set-core` command can be done while the domain is active.

```
# ldm set-core 4 ldg1
# ldm set-domain max-cores=8 ldg1
```

The following commands bind and restart the `ldg1` command:

```
# ldm bind ldg1
# ldm start ldg1
```

To Configure the Primary Domain With CPU Whole Cores and a CPU Cap

If the `primary` domain is configured to use CPU threads, you can change its configuration to use CPU whole cores and a CPU cap.

1. Set the number of CPU whole cores for the `primary` domain.


```
# ldm set-core number-of-cpu-cores primary
```
2. Put the `primary` domain in delayed reconfiguration mode. This step is not needed to change the domain to use whole cores, but it is needed in order to set a CPU cap.


```
# ldm start-reconf primary
```
3. Set the CPU cap for the `primary` domain.


```
# ldm set-domain max-cores=max-number-of-cpu-cores primary
```
4. Reboot the `primary` domain.

Use the appropriate procedure to reboot the `primary` domain, which depends on the system configuration. See “Rebooting the `primary` Domain” in the Administration Guide of the [Oracle VM Server for SPARC Documentation](#).

EXAMPLE – Configuring the Primary Domain With Two Whole Cores and a CPU Cap of Two Cores

This example shows how to configure CPU whole cores on the `primary` domain. First, the following command specifies the number of CPU whole cores to assign to the `primary` domain:

```
# ldm set-core 2 primary
```

The following command initiates delayed reconfiguration mode on the `primary` domain:

```
# ldm start-reconf primary
```

The following command configures the CPU cap for the `primary` domain to two:

```
# ldm set-domain max-cores=2 primary
```

The following command reboots the `primary` domain:

```
# shutdown -i 6
```

Interaction With Other Features

CPU Dynamic Reconfiguration

You can use CPU dynamic reconfiguration with domains that are configured with CPU whole cores. However, you can only add or remove entire CPU cores, not individual CPU threads. Using CPU dynamic reconfiguration in this way maintains the hard partitioning of the system. In addition, when you dynamically add CPU cores to a domain, the command fails if it exceeds the maximum number of CPU cores for the domain.

Use the following commands to dynamically add, set, or remove CPU whole cores to a bound or active domain:

```
ldm add-core number-of-cpu-cores domain
ldm set-core number-of-cpu-cores domain
ldm remove-core number-of-cpu-cores domain
```

To conform to the Oracle licensing policy requirements, you *must* set the CPU cap by using the following command:

```
ldm set-domain max-cores=max-number-of-cpu-cores domain
```

Or, if you use version 2.0 or 2.1 of Logical Domains Manager, use the `ldm add-vcpu -c`, `ldm set-vcpu -c`, and `ldm remove-vcpu -c` commands for dynamic reconfiguration. These commands also set the CPU cap.

EXAMPLE – Dynamically Adding Two CPU Whole Cores to a Domain

This example shows how to dynamically add two CPU whole cores to domain `ldg1`, which is an active domain configured with CPU whole cores. The first command shows that the `ldg1` domain is active. The second command shows that the `ldg1` domain is configured with CPU whole cores, and a maximum of four CPU cores.

```
# ldm list ldg1
NAME      STATE  FLAGS  CONS  VCPU  MEMORY  UTIL  UPTIME
ldg1     active -n---- 5000   16    2G      0.4%  5d 17h 49m

# ldm list -o resmgt ldg1
NAME
ldg1

CONSTRAINT
  whole-core
  max-cores=4
```


The following command shows the CPU cores assigned to the domain before adding two CPU whole cores:

```
# ldm list -o core ldg1
NAME
ldg1

CORE
CID  PCPUSET
1    (8, 9, 10, 11, 12, 13, 14, 15)
2    (16, 17, 18, 19, 20, 21, 22, 23)
```

The following command dynamically adds two CPU whole cores to the ldg1 domain. This is permitted because the total number of cores does not exceed the maximum of four:

```
# ldm add-core 2 ldg1
```

The following command shows the CPU cores assigned to the domain after adding two CPU whole cores:

```
# ldm list -o core ldg1
NAME
ldg1

CORE
CID  PCPUSET
1    (8, 9, 10, 11, 12, 13, 14, 15)
2    (16, 17, 18, 19, 20, 21, 22, 23)
3    (24, 25, 26, 27, 28, 29, 30, 31)
4    (32, 33, 34, 35, 36, 37, 38, 39)
```

CPU Dynamic Resource Management

If Dynamic Resource Management (DRM) is used to automatically manage CPU resources on some domains, DRM policies do *not* apply to those domains that are configured with CPU whole cores.

A DRM policy can include a domain that is configured with CPU whole cores. However, when such a policy is activated, the DRM policy is automatically disabled for that domain, which remains configured with CPU whole cores. If the domain is later reconfigured with CPU threads instead of CPU whole cores, the DRM policy is automatically re-enabled for that domain.

CPU Power Management

You can use CPU power management on domains that have either the performance or elastic policy set and configure the domains with CPU whole cores. Using CPU power management maintains the hard partitioning of the system.

Domain Reboot or Rebind

A domain that is configured with CPU whole cores remains configured with CPU whole cores when it is restarted, or if the entire platform is restarted. A domain uses the same physical CPU cores for the entire time it remains bound. For example, if a domain is rebooted, it uses the exact same physical CPU cores both before and after the reboot. Or, if the entire platform is powered off while a domain is bound, that domain will be configured with the exact same physical CPU cores when the platform is powered on again. If you unbind a domain and then rebind it, or if the entire platform is restarted with a new configuration, the domain might use different physical CPU cores.

Domain Migration

Starting with Oracle VM Server for SPARC 3.0, CPU whole-core configuration is compatible with domain migration. You can migrate a domain that is configured with CPU whole cores, and whole core allocation is enforced on the target system. Maximum CPU cores, if set, are also enforced on the target system. In prior releases, the whole-core configuration and the maximum number of CPU cores are not preserved by the migration to the target system.

Conclusion

With the Oracle VM Server for SPARC software, you must use the whole-core constraint and the CPU cap constraint to conform to the Oracle hard partition licensing requirement. In such a case, domains are configured with CPU whole cores, instead of the default of individual CPU threads. Using a CPU whole-core configuration with the CPU cap set also adds some restrictions to features, such as CPU dynamic reconfiguration beyond the CPU cap, CPU dynamic resource management, and domain migration.

For more information about Oracle's virtualization solutions, visit oracle.com/virtualization.





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