

Dynamic Domains for Applications

User's Guide

NOVASCALe



NOVASCALE

Dynamic Domains for Applications

User's Guide

Software

September 2006

BULL CEDOC
357 AVENUE PATTON
B.P.20845
49008 ANGERS CEDEX 01
FRANCE

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86 A2 63ER 01

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1. Introduction

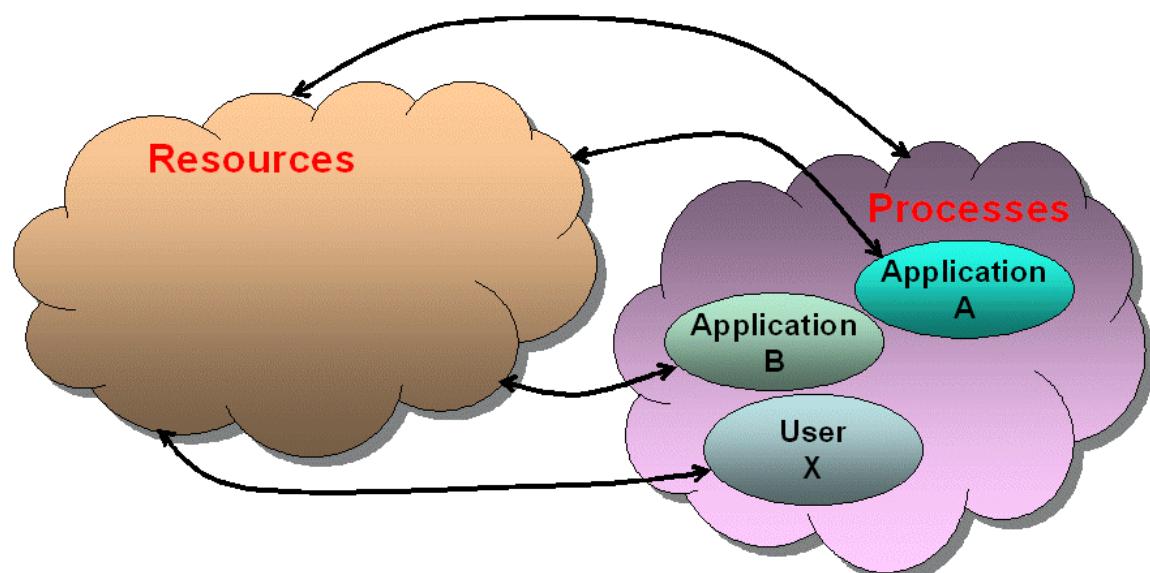
The "Dynamic Domains For Applications" software (simply referred to as "Dynamic Domains" in this manual) is a tool that can be used on the Linux operating system for simulating the partitioning of a multi-CPU machine at application level. "Dynamic Domains" can be used with the standard distributions (Red Hat RHEL 4, Suse SLES 9, Bull BAS 4, etc.). "Dynamic Domains" can be managed using the Webmin standard administration tool.

Description

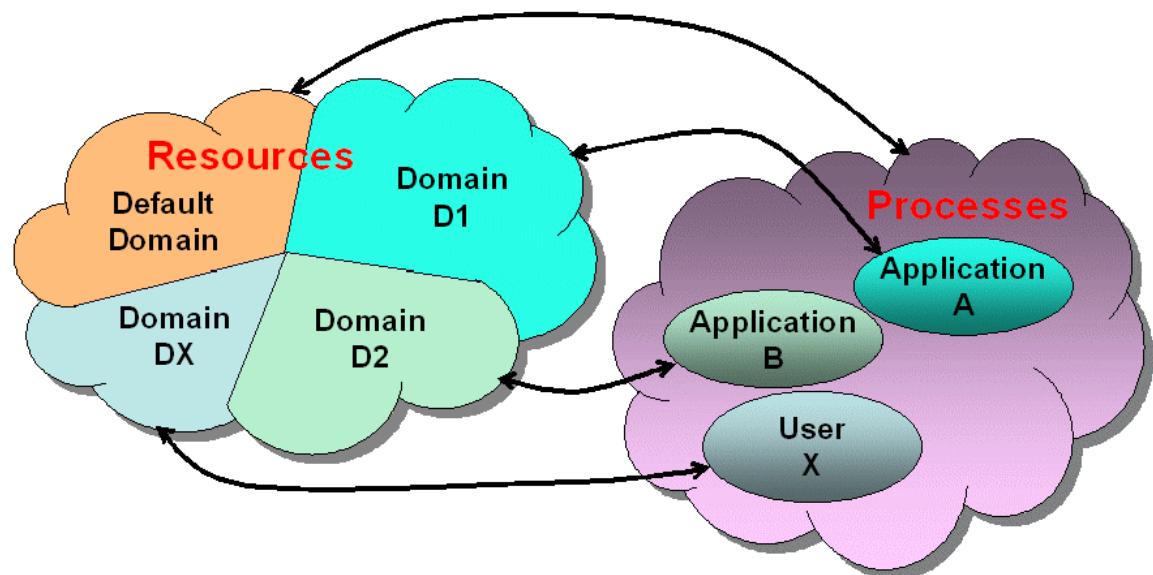
"Dynamic Domains" correspond to a breakdown of the resources available on a machine. A given domain is composed of a set of resources (one or more CPUs). On installation of the "Dynamic Domains" software, a default domain is automatically created. This domain will use all the machine's resources and all the machine's CPUs will be assigned to it. When a domain is created, the various resources required at domain level are recovered from the default domain.

Principle

The "Dynamic Domains" software enables resources to be reserved for a given application, user, etc., with resources usable by lower priority tasks being limited. In the example below, without domain, all resources will be shared among the various processes.

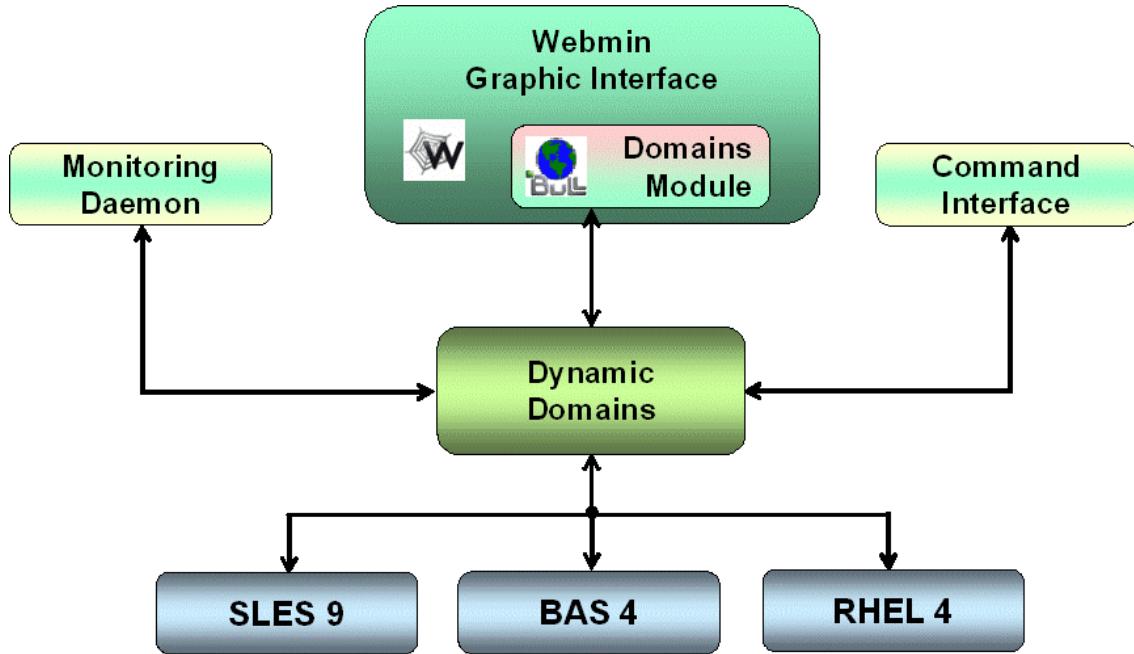


With domains, lower priority processes will share the resources of domain "default" while domain "D1" resources will be reserved for application "A", application "B" will be assigned to domain "D2", etc.



Resources can be dynamically assigned to the domains according to the usage level ("dynamic domains" notion). The dynamic management of domains is carried out by the [monitoring daemon](#) (see Appendix C: [Simulation of dynamic domains](#)).

Architecture



The graphic interface on Webmin enables the user to create new domains and assign processes to these domains by user name, task name or more sophisticated criteria in advanced mode. This interface can be accessed from a new Webmin module, via the "System" category.

This module includes three submodules, either in [Normal](#) mode (default configuration) or in [Advanced](#) mode (use of all software functions):

- "Domains Management" : Creation, edition, deletion of a domain.
- "Tasks Assignment" : Assignment of processes to the domains.
- "Configuration" : Configuration of "Dynamic Domains" module.

The monitoring daemon and the control interface are based on a set of tools installed by the product:

- [ddadd](#) : utility for creating a new domain.
- [ddchg](#) : utility for changing the characteristics of a domain.
- [ddflt](#) : utility for assigning processes to the domains using the multicriterion filter file.
- [ddload](#) : utility for simulating the load of a domain.
- [ddls](#) : utility for displaying the domains configuration and the processes assignment to domains.
- [ddmon](#) : dynamic domain management and domain monitoring daemon.
- [ddrm](#) : utility for destroying a domain.
- [ddstat](#) : utility for displaying the domains load status.
- [ddtask](#) : utility for assigning processes to the domains (equivalent to "taskset")

- **[ddtop](#)** : utility for displaying the CPUs loads and machine's processes (equivalent to commands "top" or "ps").
- **[ddtopd](#)** : daemon for periodically displaying the CPUs loads and machine's processes (daemon for the "ddtop" command).

See Chapter 5: "[Commands](#)"

Installation

The "Dynamic Domains" software is delivered in the form of an rpm file to be found on the following CD-ROM:

- Bull Extension Pack for RHEL4.

See Chapter 2: "[Installation](#)".

Checking the Installation

Once the prerequisites and "Dynamic Domains" software are installed, it is recommended to check the following:

- presence of domain "default",
- proper operation of the monitoring daemon,
- access to the graphic interface.

See Appendix A: "[Check of installation](#)".

Configuration and Use

The "Dynamic Domains" software is configured or administered using the "Webmin" tool ("System" category) via a browser (URL: <http://<hostname>:10000/> or <https://<hostname>:10000/>).

See Chapter 3: "[Configuration and use in Normal mode](#)", Chapter 4 "[Configuration and use in Advanced mode](#)" and Appendix B "[Example of use](#)".

2. Installation

General

The "Dynamic Domains for Applications" software is delivered on the following CD-ROM:

- Bull Extension Pack for RHEL4.

This software requires a Linux Red Hat RHEL4 or Suse SLES9 distribution to be installed with the following prerequisites:

- shell sh,
- Webmin administration tool (rpm to be found on above CD-ROMs, in tools directory).

Installation of "Dynamic Domains" Software

- Install the prerequisites.
- Install the "Dynamic Domains" software rpm (example: ddomains-[vv.rr-cc].ia64.rpm), to be found on above CD-ROMs, in tools/ddfa directory:

```
rpm -ivh ddomains-[vv.rr-cc].ia64.rpm
```

The rpm installation checks that the required prerequisites are properly installed and prepares the software operating environment (configuration of Webmin administration tool).

Example

```
rpm -ivh ddomains-[vv.rr-cc].ia64.rpm
Preparing...                                          #####
1:ddomains                                         #####
Stopping Webmin server in /usr/libexec/Webmin
Starting ddmon  OK
```


3. Configuration and use in Normal mode

General

The "Dynamic Domains" software is configured or administered using the "Webmin" tool ("System" category) via a browser (URL: <http://<hostname>:10000> or <https://<hostname>:10000>).

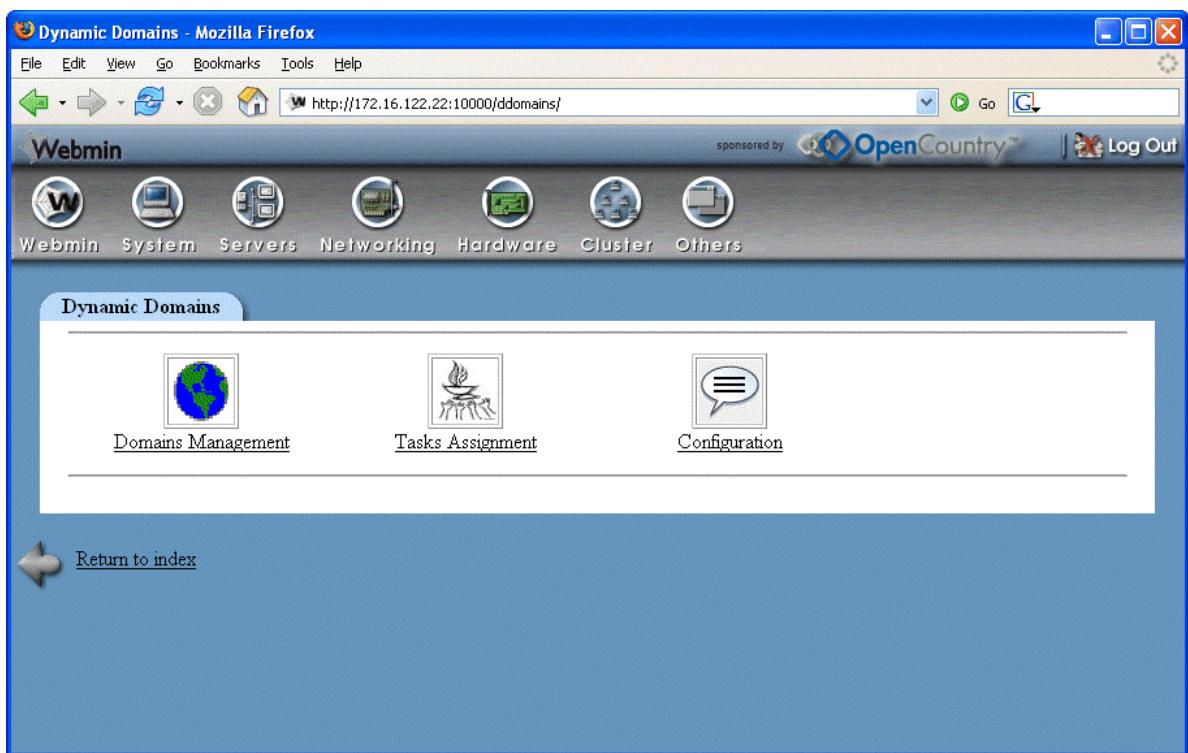
The administration tool can be used in two operating modes:

- a "Normal" mode (default configuration),
- an "[Advanced](#)" mode (giving access to all software functions).

The screens below give examples of software implementation.

Home page

Access with Webmin after software installation: System->Dynamic Domains.



Managing a domain

Click "Domains Management" to add, edit or delete a domain:

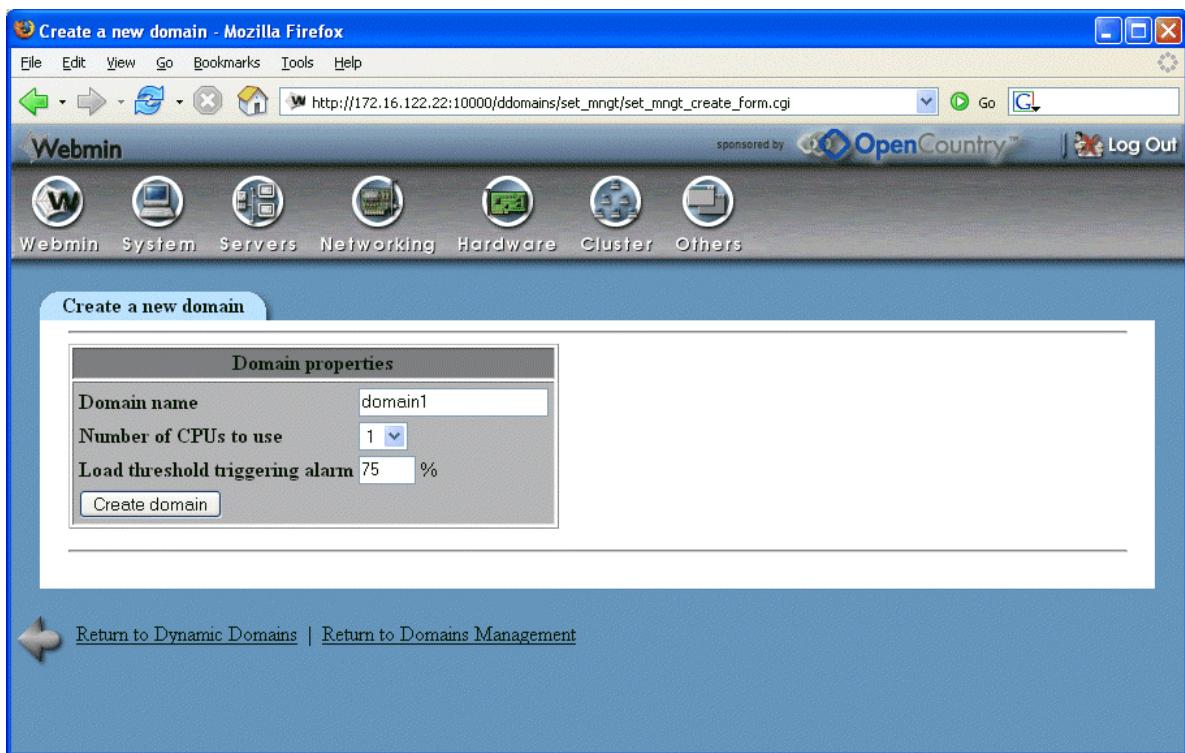
The screenshot shows a Mozilla Firefox browser window with the title "Domains Management - Mozilla Firefox". The address bar displays the URL "http://172.16.122.22:10000/ddomains/set_mngt/set_mngt.cgi". The main content area is titled "Domains Management" and shows a table titled "Domains on the system". The table has columns: Domain name, Type, Nb CPUs, CPUs, Load, Mem, and Nb tasks. A single row is present for the "default" domain, which is of type "Default" and uses 4 CPUs (0-3). The "Load" column shows 0.1 %, and the "Mem" column shows 14.78 %. The "Nb tasks" column shows 70. Below the table are links for "Create a new domain" and "View machine's topology". At the bottom left is a "Return to Dynamic Domains" link.

Domain name	Type	Nb CPUs	CPUs	Load	Mem	Nb tasks					
default	Default	4	0-3	0.1 %	View	14.78 %	70	Edit domain	Add a cpu	Remove a cpu	Delete

In the above example, domain "**default**" created on software installation uses all machine's CPUs (number of CPUs: **Nb CPUs = 4**, list of CPUs used: **CPUs = 0 to 3**), all tasks are assigned to it and its CPUs are not loaded (**Load ~ 0%**), the memory used by the domain (resident process memory) represents ~ 15% of total memory. No action (edition, deletion, etc.) is possible on this domain.

Creating a new domain

Click "Create a new domain" to create a new domain.



- Enter the domain name (example: **domain1**).
- Select the number of CPUs for the domain (example: **1**),
- Select the alarm threshold for the domain (default: **75%**). When the domain load exceeds this threshold, an alarm message is issued by the monitoring daemon (see command [ddmon](#)).
- Click "**Create domain**".

The screenshot shows the 'Domains Management' section of the Webmin interface. At the top, there's a navigation bar with links for File, Edit, View, Go, Bookmarks, Tools, and Help. Below that is a toolbar with icons for Back, Forward, Stop, Home, and Refresh, along with a URL field showing 'http://172.16.122.22:10000/ddomains/set_mngt/set_mngt.cgi'. A banner for 'OpenCountry™' is visible, along with a 'Log Out' link.

The main content area has a title 'Domains Management' and a sub-section 'Domains on the system'. It displays a table with the following data:

Domain name	Type	Nb CPUs	CPUs	Load	Mem	Nb tasks	
default	Default	3	1-3	0.1 % View	14.78 %	70	Edit domain Add a cpu Remove a cpu Delete
domain1	Static	1	0	0.0 % View	0.00 %	0	Edit domain Add a cpu Remove a cpu Delete

Below the table are two links: [Create a new domain](#) and [View machine's topology](#).

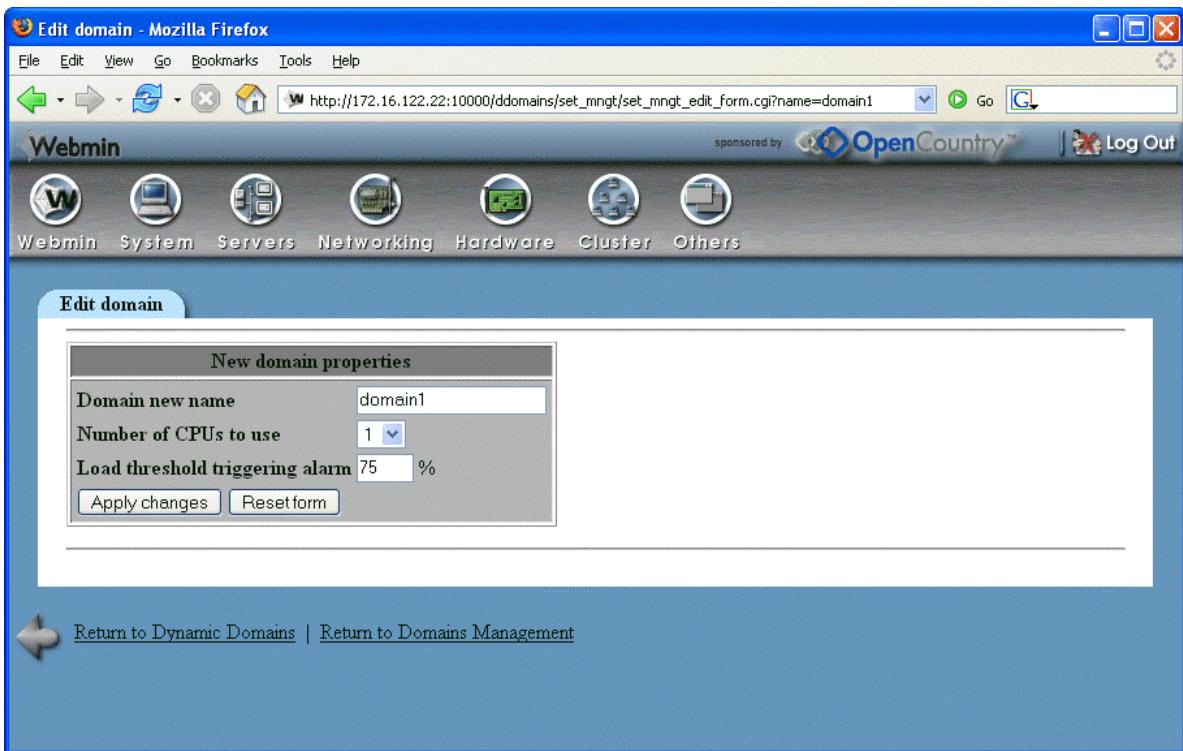
A blue footer bar at the bottom left contains a back arrow icon and the text [Return to Dynamic Domains](#).

A new static domain has been created. This domain uses one CPU (CPU 0) and no task is assigned to it. The CPU used by this new domain has been taken from domain "**default**". Only three CPUs are now left to domain "**default**" (CPUs 1 to 3).

- Click on the following as applicable:
 - **"Add a cpu"** to add a CPU to the domain (this option is deactivated if no CPU is left). The added CPU is taken from domain "**default**".
 - **"Remove a cpu"** to remove a CPU from the domain (this option is deactivated if only one CPU is left to the domain). The removed CPU is added to domain "**default**".
 - **"Delete"** to delete the domain.
 - **"View"** in column "**Load**" to view the load of the domain CPUs.
 - **"Edit domain"** to edit the domain configuration.

Editing a domain

Click "Edit domain" for domain "domain1" in order to change its configuration.



From this screen, the user can change the domain name, the number of CPUs used by the domain and the alarm threshold for the domain.

- Click "Apply changes" for changes to be taken into account or click "Return to Domains Management" to ignore the changes and return to domains management.

Viewing the new domain's topology

Click "View machine's topology" to view the domain's topology.

The screenshot shows a Mozilla Firefox browser window with the title "Machine's topology - Mozilla Firefox". The address bar displays the URL "http://172.16.122.22:10000/ddomains/set_mngt/set_mngt_view_topology.cgi". The page content is from the Webmin interface, specifically the "Machine's topology" section. It shows a tree structure under "Module 0" with "Node 0" expanded, listing four CPUs: CPU 0 (domain1), CPU 1 (default), CPU 2 (default), and CPU 3 (default). Below this, under "Distances between elements", it lists: CPU-memory distance inside a node: 10, CPU-memory distance between nodes of a same module: 30, and CPU-memory distance between nodes of different modules: 50. At the bottom left, there is a back arrow icon followed by the text "Return to Dynamic Domains | Return to Domains Management".

The machine consists in a single node including four CPUs. Domain "**domain1**" uses CPU 0. The distance between elements is provided by the Linux core. This distance represents the time required for accessing the memory of the same node, another node of the same module or another node for a given CPU (the NUMA [Non-Uniform Memory Access] factor). The CPUs used by a domain are selected with this distance being taken into account. The "**default**" domain uses the free CPUs (CPUs 1 to 3).

- Click "**Return to Dynamic Domains**" to return to the main screen.

Adding or removing tasks for a domain

Click "Tasks Assignment" to add or remove a process from the domain.

The screenshot shows the "Tasks Assignment" page within the Webmin interface. At the top, there's a menu bar with File, Edit, View, Go, Bookmarks, Tools, and Help. Below the menu is a toolbar with icons for Back, Forward, Stop, Home, and Search, along with a URL field showing http://172.16.122.22:10000/ddomains/proc_mngt/proc_mngt.cgi. A banner for "OpenCountry" is visible. The main navigation bar includes links for Webmin, System, Servers, Networking, Hardware, Cluster, and Others. The "Tasks Assignment" tab is active. A table titled "Domains on the system" lists two entries: "default" and "domain1". The "default" row shows 3 Nb CPUs, 1.0 % Load, 14.78 % Mem, and 70 Nb tasks. The "domain1" row shows 1 Nb CPUs, 0.0 % Load, 0.00 % Mem, and 0 Nb tasks. Each row has "View", "Assign users", and "Assign by command" buttons. Below the table is a link to "View tasks running on the machine". At the bottom left is a "Return to Dynamic Domains" button with a back arrow icon.

Domain name	Nb CPUs	Load	Mem	Nb tasks				
default	3	1.0 %	View	14.78 %	70	View	Assign users	Assign by command
domain1	1	0.0 %	View	0.00 %	0	View	Assign users	Assign by command

Assigning users

Click "Assign users" for domain "domain1" to assign one or more users' tasks to the domain.

The screenshot shows a Mozilla Firefox browser window with the title "Assign tasks by user name - Mozilla Firefox". The address bar displays the URL "http://172.16.122.22:10000/ddomains/proc_mngt/proc_mngt_assign_users_form.cgi?name=dc". The main content is a table with the following data:

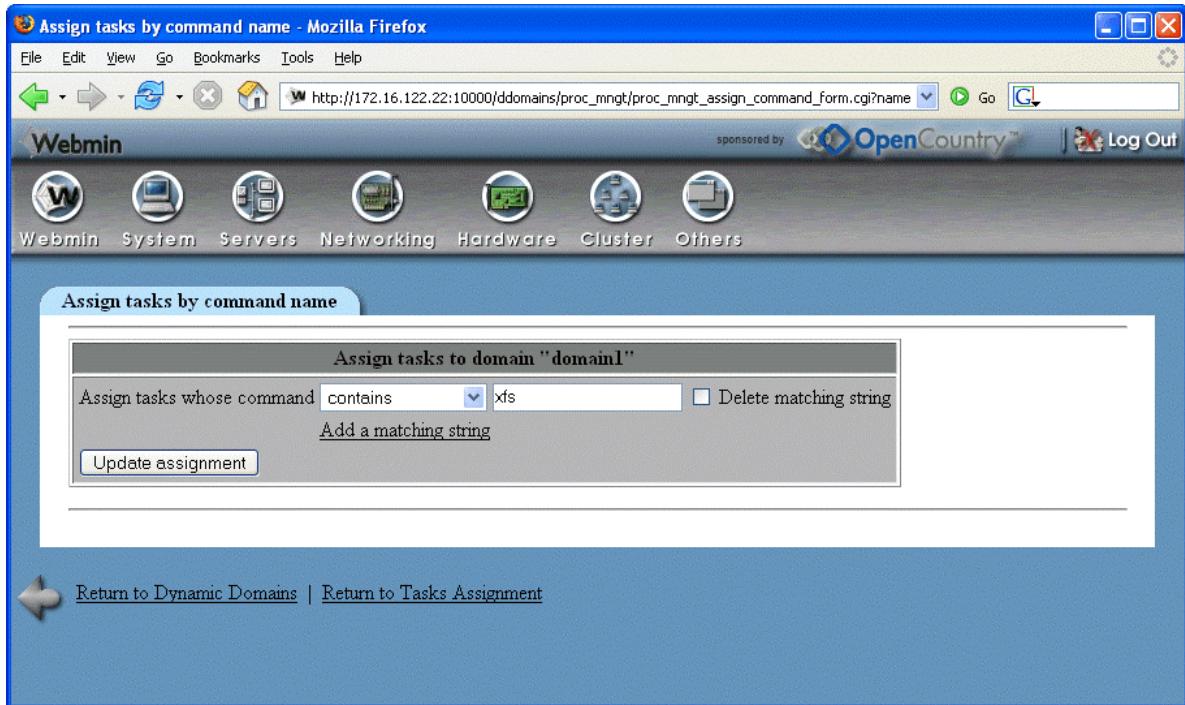
User	ID	Description	
pcap	77		
apache	48	Apache	
squid	23		
webalizer	67	Webalizer	
xfs	43	X Font Server	
ntp	38		
gdm	42		
pegasus	100	tog-pegasus OpenPegasus WBEM/CIM services	
<input checked="" type="checkbox"/> htt	101	IIMF Htt	
pvm	24		

Below the table are two buttons: "Select all users" and "Deselect all users". A large blue button labeled "Update assignment" is positioned below these buttons. At the bottom left, there are links to "Return to Dynamic Domains" and "Return to Tasks Assignment".

- Check users whose tasks are to be assigned to the current domain (example: user "htt").
- Click "Update assignment" to validate the selections.

Assigning tasks by command name

Click "Assign by command" for domain "domain1" to assign tasks with a given character string in the associated command.



- Select the test mode and the content (example: assign tasks whose command name contains "xfs").
- Click "Update assignment" to validate the selections.

For assigning several tasks with different command names, use "**More matching strings**" to specify several character strings to be searched for.

Caution: With the graphic interface being used in "normal" mode, all tasks that do not meet at least one assignment criterion by user name or command name will be assigned to domain "default" when clicking on "Update assignment".

Click "**View tasks running on the machine**" to view the tasks assigned to the various domains. Click "**View**" to view the domains loads or the list of tasks assigned to the domains.

Viewing the tasks assigned to a domain

Click "View" in the "Nb tasks" column for domain "domain1" to view the list of tasks assigned to this domain.

The screenshot shows a Mozilla Firefox browser window displaying the Webmin interface. The title bar reads "Assigned tasks - Mozilla Firefox". The address bar shows the URL: "http://172.16.122.22:10000/ddomains/proc_mngt/proc_mngt_view_assigned_tasks.cgi?name=". The main content area is titled "Assigned tasks" and displays a table of tasks assigned to domain "domain1". The table has columns: Process ID, Owner, Size, Domain Usage, and Command. The data is as follows:

Process ID	Owner	Size	Domain Usage	Command
2950	htt	3056 KB	0.0 %	/usr/sbin/htt -retryonerror 0
2951	htt	19328 KB	0.0 %	htt_server -nodaemon
3013	xfs	9504 KB	0.0 %	xfs -droppriv -daemon
Total		63776 KB	0.0 %	3 task(s)

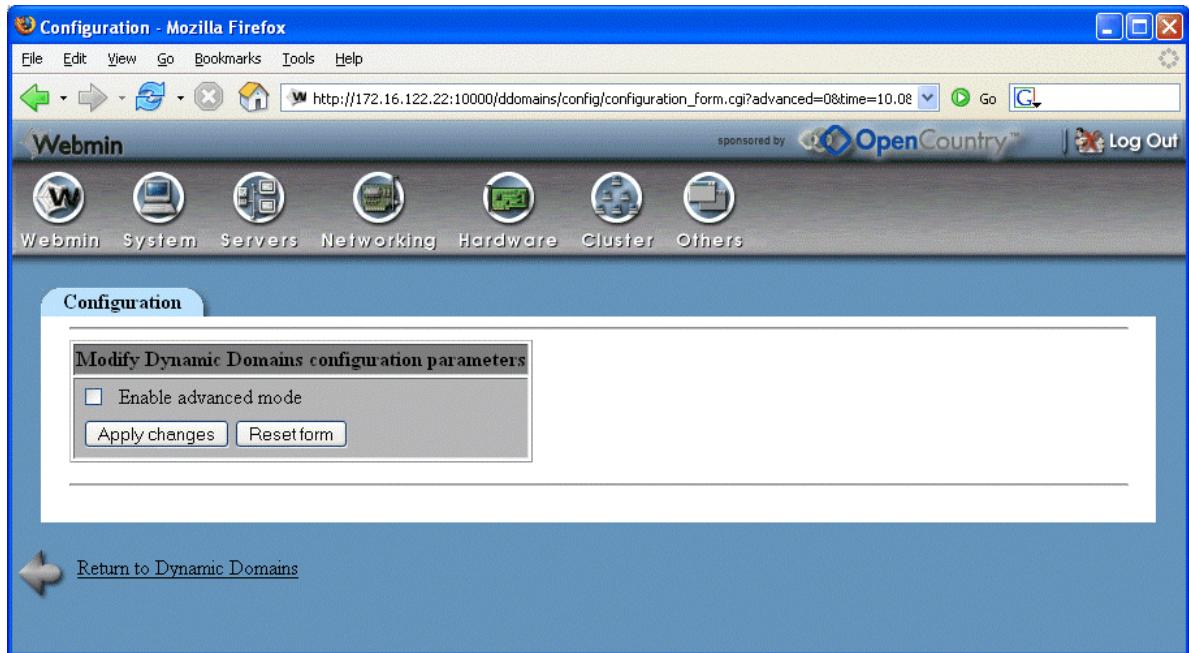
At the bottom left, there is a back arrow icon and two links: "Return to Dynamic Domains" and "Return to Tasks Assignment".

In the example above, two tasks of user "htt" and one task containing "xfs" in its command name are assigned to domain "domain1".

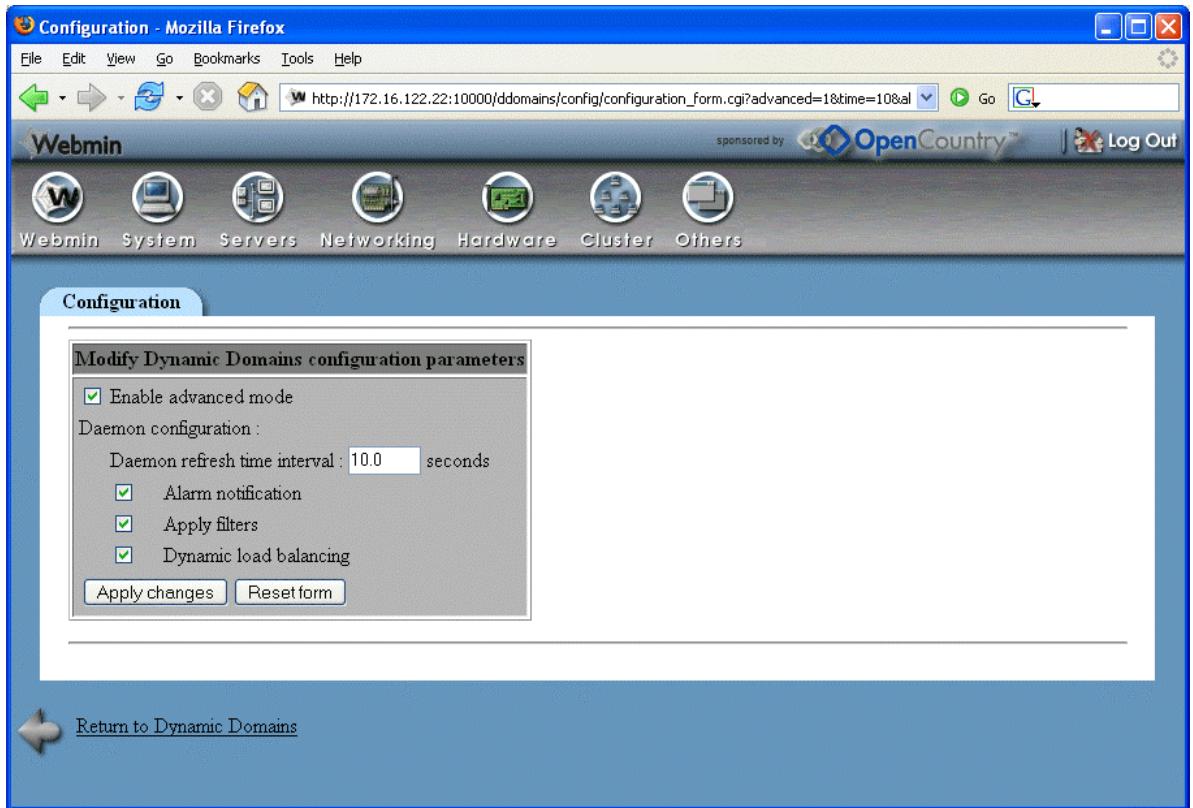
- Click "Return to Dynamic Domains" to return to the main screen.

Changing the interface operating mode

Click "Configuration" to change the operating mode of the graphic interface.



- Check the "Enable advanced mode" box to validate the advanced mode.



- If required, define the daemon parameters (polling period, whether or not alarm, filter and dynamic management are validated) or uncheck the "**Enable advanced mode**" box to validate the normal mode.
- Click the "**Apply changes**" button for changes to be taken into account or click "**Return to Dynamic Domains**" to ignore the changes and return to the main screen.

4. Configuration and Use in Advanced Mode

General

The "Dynamic Domains" software is configured or administered using the "Webmin" tool ("System" category) via a browser (URL: <http://<hostname>:10000> or <https://<hostname>:10000>).

The administration tool can be used in two operating modes:

- a "[Normal](#)" mode (default configuration),
- an "Advanced" mode (giving access to all software functions).

Access with Webmin after software installation and "Advanced" mode validation from the configuration screen: System->Dynamic Domains.

Managing a domain

Click "[Domains Management](#)" to add, edit or delete a domain.

The screenshot shows the "Domains Management" page within the Webmin interface. At the top, there's a navigation bar with links for File, Edit, View, Go, Bookmarks, Tools, Help, and a search bar. Below that is the Webmin header with links for Webmin, System, Servers, Networking, Hardware, Cluster, and Others. The main content area has a title "Domains Management". Underneath, a table titled "Domains on the system" lists two entries:

Domain name	Type	Nb CPUs	CPU	Load	Mem	Priority	Nb tasks				
default	Default	3	1-3	0.1 % View	14.41 %	255	67	Edit domain	Add a cpu	Remove a cpu	Delete
domain1	Static	1	0	0.0 % View	0.38 %	25	3	Edit domain	Add a cpu	Remove a cpu	Delete

Below the table are two buttons: "Create a new domain" and "View machine's topology". At the bottom left, there's a "Return to Dynamic Domains" link with a back arrow icon.

In advanced mode, domains management involves an additional notion: priority.

Changing a domain configuration

Click "Edit domain" for domain "domain1" in order to change its configuration.

The screenshot shows a Mozilla Firefox browser window with the title 'Edit domain - Mozilla Firefox'. The address bar displays 'http://172.16.122.22:10000/ddomains/set_mngt/set_mngt_edit_form.cgi?name=domain1'. The page header includes the Webmin logo and navigation links for 'File', 'Edit', 'View', 'Go', 'Bookmarks', 'Tools', and 'Help'. A banner for 'OpenCountry' is visible. The main menu bar has 'Webmin' selected, with other options like 'System', 'Servers', 'Networking', 'Hardware', 'Cluster', and 'Others'. Below the menu is a toolbar with icons for each category. The central content area is titled 'Edit domain' and contains a form titled 'New domain properties'. The form fields are as follows:

Domain new name	domain1
Domain type	<input checked="" type="radio"/> Static <input type="radio"/> Dynamic
Number of CPUs to use	1
Load threshold for grabbing new cpus	75 %
Priority	25
Choose CPUs implantation	<input checked="" type="radio"/> Automatically <input type="radio"/> Manually

At the bottom of the form are two buttons: 'Apply changes' and 'Reset form'. Below the form is a horizontal line and a link to 'Return to Dynamic Domains'.

From this screen, the user can change the domain name, the number of CPUs used, the alarm threshold, the priority, the CPUs used or the domain type (dynamic management).

Dynamic management of a domain

Click "Dynamic" for dynamic domain management to be enabled.

The screenshot shows a Mozilla Firefox browser window with the title 'Edit domain - Mozilla Firefox'. The address bar displays the URL http://172.16.122.22:10000/ddomains/set_mngt/set_mngt_edit_form.cgi?name=domain1&new_name. The page header includes the 'Webmin' logo and navigation links for 'Webmin', 'System', 'Servers', 'Networking', 'Hardware', 'Cluster', and 'Others'. A banner for 'OpenCountry™' and a 'Log Out' link are also present. The main content area is titled 'Edit domain' and contains a form titled 'New domain properties'. The form fields are as follows:

Domain new name	domain1
Domain type	<input type="radio"/> Static <input checked="" type="radio"/> Dynamic
Minimum number of usable CPUs	1
Maximum number of usable CPUs	4
Load threshold for grabbing new cpus	75 %
Load threshold for releasing cpus	25 %
Priority	25
Choose CPUs implantation	<input checked="" type="radio"/> Automatically <input type="radio"/> Manually

At the bottom of the form are two buttons: 'Apply changes' and 'Reset form'. Below the form, there are links: 'Return to Dynamic Domains' and 'Return to Domains Management'.

From this screen, the user can change the domain name, the minimum number of CPUs used, the maximum number of usable CPUs, the alarm threshold or CPU load threshold, the CPU release threshold, the priority and the CPUs used, or return to static domain management.

- Change the "**Maximum number of usable CPUs**" (example: **4**).
- Click "**Apply changes**" for changes to be taken into account.

The screenshot shows the 'Domains Management' section of the Webmin interface. At the top, there's a navigation bar with links for 'File', 'Edit', 'View', 'Go', 'Bookmarks', 'Tools', and 'Help'. Below that is a toolbar with icons for 'Webmin', 'System', 'Servers', 'Networking', 'Hardware', 'Cluster', and 'Others'. The main content area has a title 'Domains Management' and a sub-section 'Domains on the system'. A table lists two domains: 'default' (Default type) and 'domain1' (Dynamic type). The table columns include 'Domain name', 'Type', 'Nb CPUs', 'CPUs', 'Load', 'Mem', 'Priority', and 'Nb tasks'. For each domain, there are buttons for 'Edit domain', 'Add a cpu', 'Remove a cpu', and 'Delete'. Below the table are links for 'Create a new domain' and 'View machine's topology'. At the bottom left is a 'Return to Dynamic Domains' link with a back arrow icon.

Domain name	Type	Nb CPUs	CPUs	Load	Mem	Priority	Nb tasks	
default	Default	3	1-3	0.0 % View	14.41 %	255	67	Edit domain Add a cpu Remove a cpu Delete
domain1	Dynamic	1	0	0.0 % View	0.38 %	25	3	Edit domain Add a cpu Remove a cpu Delete

Domain "**domain1**" is now a dynamic domain. The daemon will add CPUs to this domain if its load happens to exceed the associated alarm threshold.

- Click on the following as applicable:
 - "Add a cpu" to add a CPU to the domain (for a dynamic domain, this option is deactivated if no CPU is left or if the domain has reached its maximum size).
 - "Remove a cpu" to remove a CPU from the domain (for a dynamic domain, this option is deactivated if the domain has reached its minimum size).
 - "Delete" to delete the domain.
 - "Edit domain" to edit the domain configuration.
 - "View" in column "Load" to view the load of the domain CPUs.
 - "View machine's topology" to check the domain's topology.
- Click "**Return to Dynamic Domains**" to return to the main screen.

Adding or removing tasks for a domain

Click "Tasks Assignment" to add or remove a process from the domain.

The screenshot shows the 'Tasks Assignment' page within the Webmin interface. At the top, there's a navigation bar with links like File, Edit, View, Go, Bookmarks, Tools, Help, and a search bar. Below the navigation is a banner for 'OpenCountry' with a 'Log Out' link. The main menu has icons for Webmin, System, Servers, Networking, Hardware, Cluster, and Others. The 'Tasks Assignment' tab is active. The page displays a table titled 'Domains on the system' with columns: Domain name, Nb CPUs, Load, Mem, and Nb tasks. It lists two domains: 'default' (3 CPUs, 0.0% load, 14.41% mem, 67 tasks) and 'domain1' (1 CPU, 0.0% load, 0.38% mem, 3 tasks). For each domain, there are buttons for 'View', 'Assign by PID', 'Run command', and 'Clean'. Below the table are links for 'Modify tasks assignment through filters' and 'View tasks running on the machine'. At the bottom left is a 'Return to Dynamic Domains' button.

Domain name	Nb CPUs	Load	Mem	Nb tasks
default	3	0.0 %	View	14.41 % 67 View Assign by PID Run command Clean
domain1	1	0.0 %	View	0.38 % 3 View Assign by PID Run command Clean

Tasks management in advanced mode can be used for assigning tasks by process number (**Assign by PID**), running a command in a given domain (**Run command**), cleaning a domain (**Clean**) and managing multicriterion filters (**Modify tasks assignment through filters**).

- Click on the following as applicable:
 - "Clean" to assign to domain "**default**" any tasks in the domain that do not meet the filters criteria.
 - "**Run command**" to run a task in the domain.
 - "**Assign by PID**" to assign tasks to the domain by process number.
 - "**View**" to view the domains loads or the list of tasks assigned to the domains.
 - "**Modify tasks assignment through filters**" to define or modify the multicriterion filters.
 - "**View tasks running on the machine**" to view the tasks assigned to the various domains.

Running a command in a domain

Click "Run command" of domain "domain1" to run a command in the domain.

The screenshot shows a Mozilla Firefox browser window with the title 'Run command into a domain - Mozilla Firefox'. The address bar displays the URL 'http://172.16.122.22:10000/ddomains/proc_mngt/proc_mngt_run_form.cgi?name=domain1'. The page header includes the Webmin logo and navigation links for File, Edit, View, Go, Bookmarks, Tools, and Help. A banner for 'OpenCountry' is visible. The main menu bar has links for Webmin, System, Servers, Networking, Hardware, Cluster, and Others. Below the menu is a toolbar with icons for each category. The main content area is titled 'Run command into a domain' and contains a form with a label 'Run command into domain "domain1"' and a text input field containing 'sleep 1000'. A 'Run command' button is next to the input field. At the bottom left is a back arrow icon and links to 'Return to Dynamic Domains' and 'Return to Tasks Assignment'.

- Enter the name of the command to be run (example "**sleep 1000**").
- Click "**Run command**" to run this command in domain "**domain1**".

An additional task must be assigned to domain "**domain1**".

- Click "**Clean**".
Task "**sleep 1000**" should have been assigned to domain "**default**" (no filter specifies that this task should be assigned to domain "**domain1**").

Assigning a task by process number

Click "Assign by PID" to reassign task "sleep 1000" to domain "domain1".

	PID	User	Size	CPU	Command	Domain	
<input type="checkbox"/>	17200	root	55376 Kb	0.0 %	-bash	default	
<input type="checkbox"/>	17379	root	3472 Kb	0.0 %	/usr/bin/ddmon --ini...	default	
<input type="checkbox"/>	17389	root	14432 Kb	0.0 %	/usr/bin/perl /usr/l...	default	
<input type="checkbox"/>	18095	root	14560 Kb	0.0 %	sshd: root@pts/2	default	
<input type="checkbox"/>	18097	root	55360 Kb	0.0 %	-bash	default	
<input type="checkbox"/>	19621	root	22080 Kb	0.0 %	/usr/libexec/webmin/...	default	
<input type="checkbox"/>	19622	root	4832 Kb	0.0 %	/bin/sh -c (ddtask d...	default	
<input checked="" type="checkbox"/>	19623	root	4176 Kb	0.0 %	sleep 1000	default	
<input type="checkbox"/>	19653	root	22240 Kb	0.0 %	/usr/libexec/webmin/...	default	
<input type="checkbox"/>	19664	root	4832 Kb	0.0 %	/bin/sh -c (ddtop -P...	default	
<input type="checkbox"/>	19665	root	3520 Kb	0.4 %	ddtop -PD -i -g -a -...	default	

Select all tasks [Deselect all tasks](#)

[Update assignment](#)

[Return to Dynamic Domains](#) | [Return to Tasks Assignment](#)

- Check the line corresponding to command "sleep 1000".
- Click "**Update assignment**" to validate the selection.

Task "sleep 1000" should now be assigned to domain "domain1".

- Click "**Clean**" and check that task "sleep 1000" is still assigned to domain "domain1".

Assigning a task by multicriterion filters

Click "Modify tasks assignment through filters" to define or modify the multicriterion filters.

The screenshot shows the Webmin interface for managing process filters. The top navigation bar includes File, Edit, View, Go, Bookmarks, Tools, and Help. Below the bar, there are standard browser controls (Back, Forward, Stop, Home) and a URL field showing http://172.16.122.22:10000/ddomains/proc_mngt/proc_mngt_filter.cgi. The main header says "Webmin" and "Process filters". A banner for "OpenCountry™" is visible. The menu bar below the header includes Webmin, System, Servers, Networking, Hardware, Cluster, and Others. The "Process filters" tab is selected. The main content area displays a table titled "Filters" with three rows:

Filter name	Priority	Enabled	Target domain	Edit	Inc Priority	Dec Priority	Delete
domain1_pid	1	Yes	domain1	Edit	Inc Priority	Dec Priority	Delete
domain1_command	2	Yes	domain1	Edit	Inc Priority	Dec Priority	Delete
domain1_user	3	Yes	domain1	Edit	Inc Priority	Dec Priority	Delete

A link "Create a new filter" is located below the table. At the bottom left, there is a back arrow icon and links to "Return to Dynamic Domains" and "Return to Tasks Assignment".

These filters have been automatically created on the previous operations. The user can edit each of these filters (**Edit**), change its priority (**Inc[crease] Priority** or **Dec[crease] Priority**), disable it (**Enabled = Yes**) or delete it (**Delete**). The user can also add new filters (**Create a new filter**).

Modifying a filter

Click "Edit" for filter "domain1_pid", for example.

The screenshot shows a Mozilla Firefox browser window with the title 'Edit filter - Mozilla Firefox'. The address bar displays the URL http://172.16.122.22:10000/ddomains/proc_mngt/proc_mngt_filter_edit_form.cgi?name=domain1%pid. The page header includes the Webmin logo and navigation links for 'File', 'Edit', 'View', 'Go', 'Bookmarks', 'Tools', and 'Help'. A banner for 'OpenCountry™' and a 'Log Out' link are also present. The main menu bar has icons for 'Webmin', 'System', 'Servers', 'Networking', 'Hardware', 'Cluster', and 'Others'. Below the menu is a toolbar with a 'Edit filter' button. The central content area is titled 'Edit filter' and contains a form for 'New properties for filter "domain1_pid"'. The form fields include:

- Filter new name:** domain1_pid
- For processes that:** Match all of the following Match any of the following
- PID**: is 19623 [Delete condition](#)
- [Add a condition](#)
- Assign children of processes matching conditions
- Assign to domain:** domain1
- Buttons:** [Update filter](#), [Preview filter >>](#)

At the bottom of the page, there are links: [Return to Dynamic Domains](#), [Return to Tasks Assignment](#), and [Return to Filters management](#).

This is the filter defined when assigning tasks by process number (PID). The user can modify, add or delete matching conditions for this filter.

- Click "**Update filter**" for changes to be taken into account or click "**Return to Filters management**" to ignore the changes and return to filters management.

Disabling a filter

Click "Yes" in the "Enabled" column for filter "domain1_pid" in order to disable this filter.

The screenshot shows a Mozilla Firefox browser window with the title 'Disable filter - Mozilla Firefox'. The address bar displays the URL 'http://172.16.122.22:10000/ddomains/proc_mngt/proc_mngt_filter_disable_form.cgi?name=domain1'. The page is titled 'Disable filter' and contains a form for managing tasks assigned to domain 'domain1' through the 'domain1_pid' filter. The form has two radio button options: 'Assign tasks to domain "default"' (selected) and 'Keep tasks in domain "domain1"'. A 'Disable filter' button is at the bottom. Below the form, there are links to 'Return to Dynamic Domains', 'Return to Tasks Assignment', and 'Return to Filters management'. The top navigation bar includes 'File', 'Edit', 'View', 'Go', 'Bookmarks', 'Tools', and 'Help'. The toolbar below the menu bar includes icons for Back, Forward, Stop, Refresh, Home, and Search. The main menu bar shows 'Webmin' and other system-related options.

- Choose whether the tasks assigned by the filter will be left in domain "**domain1**" or assigned to domain "**default**".
- Click "**Disable filter**" to disable the filter or click "**Return to Filters management**" to ignore the changes and return to filters management.
- Click "**Return to Dynamic Domains**" to return to the main screen.

5. Commands

The "Dynamic Domains" software installs the following commands:

- **ddadd** : utility for creating a new domain.
- **ddchg** : utility for changing the characteristics of a domain.
- **ddfilt** : utility for assigning processes to the domains using the multicriterion filter file.
- **ddload** : utility for simulating the load of a domain.
- **ddls** : utility for displaying the domains configuration and the processes assigned to domains.
- **ddmon** : dynamic domain management and domain monitoring daemon.
- **ddrm** : utility for destroying a domain.
- **ddstat** : utility for displaying the domains load status.
- **ddtask** : utility for assigning processes to the domains (equivalent to "taskset" command for domains).
- **ddtop** : utility for displaying the CPUs loads and machine's processes (equivalent to commands "top" or "ps").
- **ddtopd** : daemon for periodically displaying the CPUs loads and machine's processes (daemon for the "ddtop" command).

Description

The "ddadd" utility is used for creating a new domain and defining its characteristics (size, priority, thresholds, etc.). The names "-" and "all_cpus" are reserved and domain "default" has specific characteristics. Defining the [characteristics of a domain](#) comes to specifying its behaviour (static domain or dynamic domain).

Syntax

General format

```
/usr/bin/ddadd [[-d|--domain] domain] [[-u|--nbused] nbused] [[-n|--nbmin] nbmin]
[[[-m|--nbmax] nbmax] [[-p|--priority] priority]
[[[-t|--threshold] threshold] [[-s|--nbshar] nbshar]
[[[-M|--maxcpus] maxcpus] [[-U|--usedcpus] usedcpus]
[[[-S|--shareeven] shareeven] [-a] [-dc cnf] [-v]
```

Parameters

[-d] domain	Name of the domain to be created (by default: display of domains configuration).
[-u] nbused	Number of CPUs used (by default: 0 for domain "default", 1 for the other domains; 0 for using all usable CPUs).
[-n] nbmin	Minimum number of CPUs (by default: 1 or nbused).
[-m] nbmax	Maximum number of CPUs (by default: all CPUs for domain "default" and 1 for all other domains; 0 for all CPUs). [-p] priority
[-p] priority	Priority of the domain (by default: 255 for domain "default" and 25 for the other domains).
[-t] threshold	Alarm threshold for the domain's load (by default: 100 for domain "default" and 75 for the other domains).
[-s] nbshar	Number of sharable CPUs (by default: 0),
[-M] maxcpus	List of CPUs usable by the domain (by default: all CPUs).
[-U] usedcpus	List of CPUs used by the domain (by default: automatic selection).
[-S] shareeven	Threshold for enabling the domain's CPUs to be released or shared (by default: 1/3 Threshold).
[-a]	In case of display, display of domains "all_cpus" and "other_cpus".
[-dc cnf]	Domains configuration file (by default: /var/ddomains/ddomains).
[-v]	Addition of traces.

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Examples

Creating the domain "default"

```
ddadd default
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default     1       4       4      255      100        33    0-3       0      39      43
```

Creating a dynamic domain with a size of 1 to 4 CPUs

```
ddadd domain1 1 1 4
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default     1       3       4      255      100        33    1-3       0      39      43
domain1    1       1       4       25       75        25       0       0       0       0
```

Description

The "ddchg" utility is used for changing the characteristics of a domain (size, priority, thresholds, etc.). The names "-" and "all_cpus" are reserved and domain "default" has specific characteristics. Changing the [characteristics of a domain](#) may result in a change in its behaviour (a static domain may become a dynamic domain and vice versa).

Syntax

General format

```
/usr/bin/ddchg [[-d|--domain] domain] [[-u|--nbused] nbused] [[-n|--nbmin] nbmin]
[[[-m|--nbmax] nbmax] [[-p|--priority] priority]
[[[-t|--threshold] threshold] [[-s|--nbshar] nbshar]
[[[-S|--shareven] shareven] [[-A|--add] addcpus]
[[[-R|--release] release] [[-N|--newname] newname]
[[[-M|--maxcpus] maxcpus] [[-U|--usedcpus] usedcpus]
[-a] [-dc cnf] [-v]
```

Parameters

[-d] domain	Name of the domain to be changed (by default: display of domains configuration).
[-u] nbused	Number of CPUs used (by default: no change; 0 for all usable CPUs).
[-n] nbmin	Minimum number of CPUs (by default: no change).
[-m] nbmax	Maximum number of CPUs (by default: no change; 0 for all CPUs). [-p] priority
[-p] priority	Priority of the domain (by default: no change).
[-t] threshold	Alarm threshold for the domain's load (by default: no change).
[-s] nbshar	Number of sharable CPUs (by default: no change).
[-S] shareven	Threshold for enabling the domain's CPUs to be released or shared (by default: no change).
[-A] addcpus	Number of CPUs to be added to the domain (by default: 0),
[-R] release	Number of CPUs to be removed from the domain (by default: 0),
[-N] newname	New name of the domain (by default: no change).
[-M] maxcpus	List of CPUs usable by the domain (by default: no change).
[-U] usedcpus	List of CPUs used by the domain (by default: no change).
[-a]	In case of display, display of domains "all_cpus" and "other_cpus".
[-dc cnf]	Domains configuration file (by default: /var/ddomains/ddomains).
[-v]	Addition of traces.

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Example

Changing domain "domain1" (addition of a CPU)

```
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default    1      3      4      255      100      33      1-3      0      39      43
domain1    1      1      4      25       75      25       0       0       0       0

ddchg domain1 -A 1
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default    1      2      4      255      100      33      2-3      0      39      43
domain1    1      2      4      25       75      25      0-1      0       0       0
```

Description

[Multicriterion filters](#) are used for assigning tasks (processes or threads) to the domains as per conditions described in the filters configuration file. This file is read by the "ddflt" utility with the following results, as applicable:

- The enabled filters are interpreted and processes or threads that do not meet each filter's criteria are assigned to the domain specified by the filter.
- Tasks already assigned to domains that do not meet the filters' criteria are assigned to domain "default" (option: -default) or to all CPUs (option: -all_cpus).
- Tasks already assigned to a domain (option: -d domain) and that do not meet the filters' criteria are assigned to domain "default" (option: -default) or to all CPUs (option: -all_cpus).
- Tasks that meet the criteria of a filter (option : -F filter) are assigned to domain "default" (option: -default) or to all CPUs (option: -all_cpus).
- List the tasks that can be assigned by a filter (option -p filter).

By default, processes or threads that meet the filters' criteria will be assigned to the respective domains with no change in the assignment of tasks (processes and threads) that fail to meet such criteria.

Syntax

General format

```
/usr/bin/ddflt [-d domain domain] [-F filter filter] [-p|--preview filter]
[-f fmt] [+f fmt] [-dc cnf] [-fc cnf] [-U] [-v] [-i|--noid]
[-v] [--default] [--all_cpus]
```

Parameters

[-d domain]	Name of the domain whose tasks not taken into account by the filters will be assigned to domain "default" or to all CPUs (by default: all domains).
[-F filter]	Name of the filter whose relevant tasks will be assigned to domain "default" or to all CPUs.
[-p filter]	List the tasks that can be assigned by the "filter" filter,
[-f fmt]	Definition of parameters edited for the list of tasks listed by the "-p filter" parameter,
[+f fmt]	Add parameters edited for the list of tasks listed by the "-p filter" parameter, (format: pid[,...], type "ddls -format" for more details),
[-dc cnf]	Domains configuration file (by default: /var/ddomains/ddomains).

[-fc cnf]	Filter configuration file (by default: /var/ddomains/filters),
[-U]	Edit parameters with units.
[-i]	or [-noid]: No edit of parameter meanings.
[-v]	Addition of traces.
[--default]	Without parameter [-F filter]: tasks assigned to domain [-domain] or to all domains and not taken into account by the filters are assigned to domain "default"; with parameter [-F filter]: tasks taken into account by the filter are assigned to domain "default".
[--all_cpus]	Without parameter [-F filter]: tasks not taken into account by the filters are assigned to all CPUs; with parameter [-F filter]: tasks taken into account by the filter are assigned to all CPUs.

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Examples

For tasks taken into account by the filters to be assigned to respective domains

ddflt

For tasks taken into account by the filters to be assigned to respective domains and for the other tasks to be assigned to domain "default"

ddflt --default

For tasks taken into account by the filters to be assigned to respective domains and for the other tasks of domain "domain1" to be assigned to domain "default"

ddflt domain1 --default

Multicriterion filters

Parameters

Multicriterion filters are used for conditioning the assignment of tasks (processes or threads) to domains. A filter is characterized by a set of parameters used for defining its name, the associated domain, its validity, its priority, its matching conditions, etc. The matching conditions of a filter will define criteria for assigning such or such tasks to such or such domain. Multiple conditions can be used.

Characteristics

Name	Name of the filter.
Domain	Name of the domain associated with the filter.
Enabled	Filter processing validity (0: disabled, 1: enabled).
Priority	Filter processing priority or processing order (1: highest priority).
Matching	Filter matching conditions (any: one of the conditions must be met, all: all conditions must be met).
Thread	Applicability to the process specified and to its threads (0: process only, 1: process + threads).
Children	Applicability to the process specified and to its children (0: process only, 1: process + children).
Daemon	Validity of filter processing by the daemon (0: disabled, 1: enabled).

Matching conditions

Field	Name of the field involved in the condition:
pid	Process number,
tid	Thread number,
ppid	Children process number,
user	Name of task user,
group	Name of task group,
size	Memory size used by the task,
args	Arguments for the task command,
Condition	Test condition:
eq	The field is equal to the value,
ne	The field is different from the value,
co	The field contains the value,
nc	The field does not contain the value,
be	The beginning of the field is equal to the value,
en	The end of the field is equal to the value,
lt	The field is lower than the value,
le	The field is lower than or equal to the value,
gt	The field is higher than the value,
ge	The field is higher than or equal to the value.
Value	Expected value.

Example

For domain "domain1" to be assigned tasks that belong to user "bin", that use at least 512 K of memory and whose command contains the string "test", the filter defined must be associated with domain "domain" (domain = domain1, matching = all) with three conditions (user eq bin, size ge 512, and args co test).

ddload

Description

The "ddload" utility allows the load of a domain to be simulated.

Syntax

General format

```
/usr/bin/ddload [-i|--ident ident] [-d|-ld|--domain domain] [-t|--time time]
[-l|--load load] [-p|--proc proc] [-m|--mem mem]
[-dc cnf] [-v]
```

Parameters

[-i ident]	Name for identifying the programme (by default: no special identification),
[-d domain]	Name of the domain to be loaded (by default: no special assignment),
[-t time]	Duration of processing (by default: 10 seconds),
[-l load]	Load for each process (by default: 75% of the CPU used),
[-p proc]	Number of CPUs run (by default: 1 process),
[-m mem]	Size of memory used in bytes (by default: no special use of memory),
[-dc cnf]	Domains configuration file (by default: /var/ddomains/ddomains).
[-v]	Addition of traces.

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Examples

Running 4 processes in the domain "domain1" each using 20% of a CPU

```
ddload -d domain1 -l 20 -p 4 &
ddtop -s ddload -f domain,pid,%cpu,cmd
  Domain   Pid   %Cpu Command
domain1  9242  19.41 "ddload -d domain1 -l 20 -p 4"
domain1  9243  20.38 "ddload -d domain1 -l 20 -p 4"
domain1  9244  20.38 "ddload -d domain1 -l 20 -p 4"
domain1  9245  19.41 "ddload -d domain1 -l 20 -p 4"
```

Running a process in domain "domain1" with an identifier being defined:

```
ddload -i simulation -d domain1 &
ddtop -s simulat -f domain,pid,%cpu,cmd
  Domain   Pid   %Cpu Command
domain1  9254  74.78 simulation
```

Description

The "ddls" utility is used for displaying the domains configuration, the list of processes assigned by domain and the multicriterion filters configuration.

Syntax

General format

```
/usr/bin/ddls [-d|ld [d...]] [-P|-p [p...]] [-s str] [-u user] [-F] [-f fmt]
               [+f fmt] [-z] [-a] [-g] [-dc cnf] [-fc cnf] [-U] [-v] [-i|--noid]
```

Parameters

[-d ld]	Display of the domains configuration.
[d...]	List of domains involved (by default: all domains; format: domain_name1[,domain_name2][,...] or all).
[-P]	Display of processes and threads assigned to the domains.
[-p]	Display of processes (without threads) assigned to the domains.
[p...]	List of processes (PID) or threads (TID) involved (by default: all; format: pid[-pid][,pid[-pid]][,...] or all).
[-s str]	Display of processes containing string str in their command line.
[-u user]	Display of processes belonging to user "user".
[-F]	Display of filters configuration and assignment conditions.
[-f fmt]	Definition of parameters edited for the domains or processes.
[+f fmt]	Addition of parameters edited for the domains or processes (format: pid[,...], type "ddls -format" for more details).
[-z]	Display of processes using no memory.
[-a]	Display of processes not included in a domain.
[-g]	Display of global values of domains.
[-dc cnf]	Name of the domains configuration file (by default: /var/ddomains/ddomains).
[-fc cnf]	Name of the filters configuration file (by default: /var/ddomains/filters),
[-U]	Display of parameters with units.
[-v]	Addition of traces.
[-i] or [--noid]	No display of parameters meaning.

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Examples

Displaying the domains configuration

```
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default    1      2      4      255      100      33      2-3     50      43      47
domain1    1      2      4      25       75      25      0-1     0       3       3
```

Displaying the configuration of domain "domain1"

```
ddls -d domain1
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
domain1    1      2      4      25       75      25      0-1     0       3       3
```

Displaying filters configuration

```
ddls -F
Filter   Type Enabled Priority      Domain Matching Threads Children Daemon
filter1  user      1      1      domain1      any      0      0      0
Filter   Field Condition Value
filter1  user      eq      root
```

Displaying threads of domain "oracle"

```
ddls -d domain1 -P
Domain      Filter   Pid   Tid      Uid Command
domain1      -      9325  9325      root simulation
domain1      -      9327  9327      root simulation
domain1      -      9328  9328      root simulation
domain1      -      9329  9329      root simulation
domain1      -      9330  9330      root simulation
domain1      -      9331  9331      root simulation
```

Displaying processes of domain "domain1" with edited parameters being defined

```
ddls -d domain1 -P -f pid,tid,uid,gid,cmd
Pid   Tid      Uid      Gid Command
9327  9327      root      root simulation
9328  9328      root      root simulation
9329  9329      root      root simulation
9330  9330      root      root simulation
9331  9331      root      root simulation
```

Description

The monitoring daemon:

- coherency check between hardware configuration and domain configuration after rebooting of the machine.
- periodically assigns processes to domains according to the content of the multicriterion filters definition file,
- manages the alarms,
- dynamically allots resources to domains according to their load levels.

Coherency check

When the machine reboots, the daemon checks for coherency between the hardware configuration (quantity of CPUs and their numbers) and the domain configuration. If an error occurs in the coherency check and if the **-R** option is set, the daemon attempts to reconfigure the domains automatically.

Periodic assignment

On each daemon processing period, the multicriterion filters definition file is processed. All filters are checked and the various tasks (processes or threads) that are taken into account by filters enabled by the daemon (i.e. with parameter "Daemon" = 1) are assigned to the corresponding domains.

Alarms management

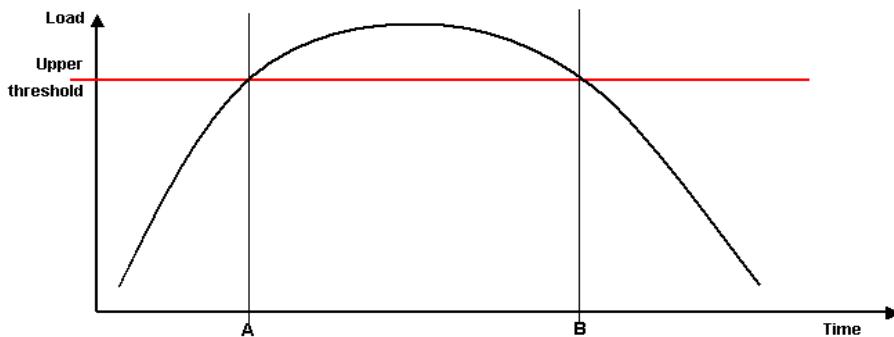
When the load level of a given domain exceeds its upper threshold, an alarm message is edited in the daemon trace file. On return to normal status (end of alarm conditions), an information message is edited in the trace file. The upper threshold value of a domain is defined by the characteristics of this domain.

Example of messages

```
06/01/30 10:07:59 ddmon*2 Domain domain1 : Alarm threshold (>75%)
06/01/30 10:08:09 ddmon*4 Domain domain1 : Normal threshold
```

Principle

Alarms management



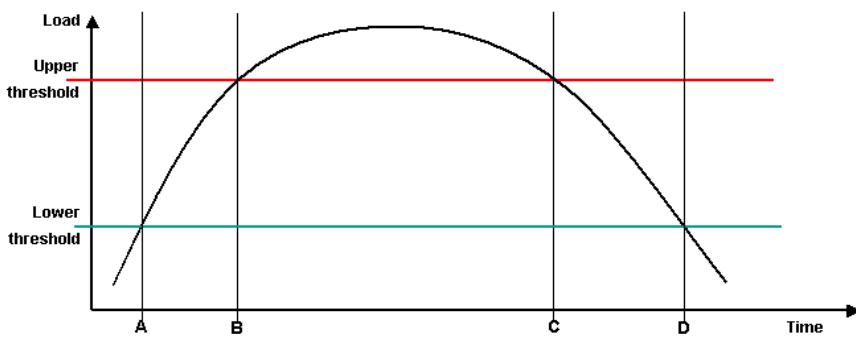
- A. Upper threshold exceeded: beginning of alarm
- B. Upper threshold no longer exceeded: end of alarm

4

Dynamic allotment of resources

Dynamic processing enables resources to be allotted to the domains or released according to the domains load. Only dynamic domains are managed by this feature (see "[Characteristics of domains](#)"). Resources are dynamically managed according to domains thresholds (upper and lower) and priority.

Dynamic management



- A. Lower threshold exceeded: resource pickup no longer authorized
- B. Upper threshold exceeded: additional resources requested
- C. Upper threshold no longer exceeded: no resources added
- D. Lower threshold no longer exceeded: resource pickup authorized

5

See Appendix C: "[Simulation of dynamic domains](#)"

Syntax

General format

```
/usr/bin/ddmon [-t|--time time] [-F|--filters] [-A|--alarms] [-D|--dynamic]
[-dc cnf] [-fc cnf] [-c cnf] [-h his] [-l log] [--init]
[-nc cnf] [-R|--reconfig] [-v]
```

By default, command **ddmon** without parameter (`/usr/bin/ddmon`) is equivalent to
`/usr/bin/ddmon -F -A -D`.

Parameters

<code>[-t time]</code>	Value of the daemon processing period (by default: 10 seconds),
<code>[-F]</code>	Processing of tasks assignment using the multicriterion filters file,
<code>[-A]</code>	Processing of alarms on threshold overshoot.
<code>[-D]</code>	Processing of dynamic domains management.
<code>[-dc cnf]</code>	Domains configuration file (by default: <code>/var/ddomains/ddomains</code>).
<code>[-fc cnf]</code>	Filters configuration file (by default: <code>/var/ddomains/filters</code>),
<code>[-c cnf]</code>	Daemon configuration file (by default: <code>/var/ddtools/ddmon.conf</code>).
<code>[-h his]</code>	Trace file (by default: console).
<code>[-l log]</code>	Trace display level (by default: 4),
<code>--init</code>	Creation of domains configuration file and domain "default", and assignment of tasks to domain "default" (by default: no creation, no assignment).
<code>[-nc cnf]</code>	Node configuration file (by default: <code>/var/ddtools/node.conf</code>).
<code>[-R]</code>	Automatic domain reconfiguration after coherency error (by default: no reconfiguration).
<code>[-v]</code>	Addition of traces.

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Example

Running of daemon with configurations initialized

```
ddmon --init
ddmon : Initialization enabled
ddmon : Assign tasks to domain default
ddmon : Daemon started
ddmon : Time between measures : 10.000s
ddmon : Filters management started
ddmon : Alarms management started
ddmon : Dynamic management started
```

Daemon check service

When the product is installed, the **ddmon** daemon is activated via the **ddmon** service (file: /etc/init.d/ddmon). This service allows the operation of the daemon to be checked (starting it, stopping it or checking its status).

Running the daemon

```
/etc/init.d/ddmon start
Starting ddmon  OK
```

Status of the daemon

```
/etc/init.d/ddmon status
ddmon is running (pid=21264) since 06/06/20 08:25:35
```

Stopping the daemon

```
/etc/init.d/ddmon stop
Stopping ddmon  OK
```

Restarting the daemon (stopping and running)

```
/etc/init.d/ddmon restart
Stopping ddmon  OK
Starting ddmon  OK
```

Daemon configuration file

The configuration file defines the parameters and processing managed by the daemon. When the daemon is run, the configuration file (if it exists) defines the default values for the parameters of the daemon. At any time (daemon stopped or running), the user can edit some of the daemon's processing parameters via the configuration file (change the polling period, enable or disable a process, etc.).

Example of a configuration file

```
cat /var/ddtools/ddmon.conf
ddmon_enable = 1
ddmon_pid = 21264
start_time = 1150784735
log_file = /var/ddtools/ddmon.log
log_level = 4
init = 1
reconfig = 0
loop_time = 10.000
filters = 1
alarms = 1
dynamic = 1
ddmon_status = 1
```

Parameter meanings

ddmon_enable	Whether or not the daemon is enabled (value 0 or 1; 1: daemon enabled),
ddmon_pid	Daemon process number (do not change),
start_time	Daemon run date (in seconds since 01/01/1970; do not change),
log_file	Name of the daemon trace file (by default: /var/ddtools/ddmon.log),
log_level	Trace message edit level (by default: 4).
init	Process initialisation when run (value 0 or 1; 1: initialisation enabled).
reconfig	Process automatic domain reconfiguration when run (value 0 or 1; 1: reconfiguration enabled).
loop_time	Daemon process time in seconds (by default: 10 seconds).
filters	Periodic filter processing (value 0 or 1; 1: processing enabled).
alarms	Periodic alarm processing (value 0 or 1; 1: processing enabled).
dynamic	Periodic dynamic domain processing (value 0 or 1; 1: processing enabled).
ddmon_status	Status of the daemon (0: stopped, 1: running, -1: stopped after an error).

Description

The "ddrm" utility is used for removing a domain in the domains configuration file. By default, a given domain can be removed only if no task (process or thread) is assigned to it. If tasks are still assigned to the domain to be removed, the user can force its removal (parameter: `--remove` or `--rmonly`) and can specify whether or not the assigned tasks will be reassigned to the "default" domain.

Syntax

General format

```
/usr/bin/ddrm [[-d|--domain] domain] [--remove] [--rmonly] [-a] [-dc cnf] [-v]
```

Parameters

<code>[-d] domain</code>	Name of the domain to be removed (by default: display of domains configuration).
<code>[--remove]</code>	Forcing of domain removal when tasks are still assigned to the domain.
<code>--rmonly</code>	Removal of the domain without reassigning its tasks to domain "default".
<code>[-a]</code>	In case of display, display of domains "all_cpus" and "other_cpus".
<code>[-dc cnf]</code>	Domains configuration file (by default: /var/ddomains/ddomains).
<code>[-v]</code>	Addition of traces.

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Example

Removing domain "domain1"

```
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default 1 3 4 255 100 33 1-3 0 39 43
domain1 1 1 4 25 75 25 0 0 0 0

ddrm domain1
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default 1 4 4 255 100 33 0-3 0 39 43
```

ddstat

Description

The "ddstat" utility is used for displaying the domains load status.

Syntax

General format

```
/usr/bin/ddstat [[-d|--domain] domain] [-t|--time time] [-a] [-dc cnf] [-v]
```

Parameters

[-d] domain	Name of the domain to be displayed (by default: all domains except the "default" domain),
[-t] time	Duration of load measurement (by default: 0.333 seconds).
[-a]	Display of domain "default" in addition to other domains, if required.
[-dc cnf]	Domains configuration file (by default: /var/ddomains/ddomains).
[-v]	Addition of traces.

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.
- 3 and above:** one or more domains in alarm condition (number of domains involved = return code - 2).

Example

Displaying the status of domain "domain1"

```
ddstat domain1
ddstat : Domain      domain1 : Load value: 25% - Normal threshold
```

Description

The "ddtask" utility is used for assigning tasks (processes or threads) to a domain. This can be done by list of process numbers (PID), by list of thread numbers (TID), by user name (UID) or by command name (character string contained in the process command line). This utility can also be used for directly running a task in a domain.

Syntax

General format

```
/usr/bin/ddtask domain [-dc cnf] [-v] [[-P|-p [p...]] [-s str] [-u user]]  
| [-c cmd[ args ...]]
```

Parameters

domain	Name of the target domain for assignment or running of the task,
[-dc cnf]	Domains configuration file (by default: /var/ddomains/ddomains).
[-v]	Addition of traces.
[-P]	Assignment of processes and associated threads.
[-p]	Assignment of processes only.
[p...]	List of processes (PID) or threads (TID) (by default: tous (all), format: pid[-pid][,pid[-pid]][,...] or all),
[-s str]	Assigning processes that contain the string "str" in the command, or ^str if the command starts with "str", or str\$ if the command ends with "str", or ^str\$ if the command is equal to "str",
[-u user]	Assignment of processes belonging to user "user".
[-c cmd]	Direct running of command "cmd" in a domain.
[args ...]	Arguments for command "cmd".

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Examples

Assigning a process and its threads by process number

```
ddtask jonas -P 25695
```

Assigning processes and threads of a user

```
ddtask jonas -u invite
```

Running a command in a domain

```
ddtask jonas -c sleep 10
```

Description

The "ddtop" utility is used for displaying various CPUs parameters as well as active nodes and processes of the machine. Parameters are displayed according to the level of detail requested (options: -d and -D) or can be redefined by the user (options: -f and +f). The expected results are displayed in chronological order (options: -C, -L, -P, -PM, -p, -pM, -M) or sorted by domain (options: -CD, -LD, -PD, -PMD, -pD, -pMD, -MD).

Syntax

General format

```
/usr/bin/ddtop [-t time] [-C[D] | -N[C] | -m] [-L[D] | -P[M] [D] | -p[M] [D] | -M[D]]  
[v...] [-ld dom] [-s str] [-u user] [-f fmt] [+f fmt]  
[-g|-G] [-d|-D] [-U] [-z] [-a] [-n cpu] [-r] [-dc cnf]  
[-fc cnf] [-c cnf] [-v] [-i|--noid] [--gbld] [--gb1] [--all]
```

By default, command **ddtop** without parameter (`/usr/bin/ddtop`) is equivalent to `/usr/bin/ddtop -C -D -U`.

Parameters

<code>[-t time]</code>	Interval between two measurements or display (by default: 1.00 seconds).
<code>[-C[D]]</code>	display of CPUs load (CPU number x, y,...). D: sorted by domain name.
<code>[-N[C]]</code>	Display of nodes configuration (node number x, y,...). C: with CPU load.
<code>[-m]</code>	Display of memory used by node (node number x, y,...).
<code>[-L[D]]</code>	Display of list of threads by process (PID x, y,...). D: sorted by domain name.
<code>[-P[M] [D]]</code>	Display of load by process and thread (PID x, y,...). M: addition of used memory. D: sorted by domain name.
<code>[-p[M] [D]]</code>	Display of load by process without threads (PID x, y,...). M: addition of used memory. D: sorted by domain name.
<code>[-M[D]]</code>	Display of list of threads by process (PID x, y,...). D: sorted by domain name.
<code>[v...]</code>	List of CPU, node and process numbers (by default: all; format: a[-b][,c[-d]][,...] or all).
<code>[-ld dom]</code>	Display of parameters for the list of domains "dom" (by default: all; format: domain_name1[,domain_name2][,...] or all).
<code>[-s str]</code>	Display if the command line contains string "str".
<code>[-u user]</code>	Display for user "user".
<code>[-f fmt]</code>	Definition of parameters displayed for nodes, CPUs, etc.

[+f fmt]	Addition of parameters displayed for nodes, CPUs, etc. (format: pid[,...], type "ddtop -format" for more details)
[-g]	Global display of parameters (loads, memory, etc.) by item.
[-G]	Global display of parameters (loads, memory, etc.) for all items.
[-d]	Detailed display of parameters.
[-D]	Display with a maximum of parameters details.
[-U]	Display of parameters with units.
[-z]	Display of processes using no memory.
[-a]	Display of processes not included in a domain.
[-n cpu]	Number of CPUs used for computing loads (by default: 1; cpu = 1 or maximum number of machine's CPUs).
[-r]	Display every "-t time" seconds.
[-dc cnf]	Domains configuration file (by default: /var/ddomains/ddomains).
[-fc cnf]	Domains configuration file (by default: /var/ddomains/ddomains).
[-v]	Addition of traces.
[-i] or [--noid]	No display of parameters meaning.
--gbld	Display of sum for each domain.
--gb1	Display of global sum.
--all	Display of sum for the whole machine.
[stdin]	Value input on standard input (stdin) (same as [v...]).

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Examples

Displaying domain name and load of CPUs 3 to 5

```
ddtop -CD 3-5
  Domain Cpus      Cpu %Used %Idle %Wait
domain4 3           3   0.00 100.00  0.00
domain5 4           4   0.00 100.00  0.00
domain6 5           5   0.00 100.00  0.00
```

Displaying nodes configuration

```
ddtop -NC
Node Cpus      %Cpu %MemU. Distance
  3 12-15     0.09  1.24 30,30,30,10
  2 8-11      0.09  1.76 30,30,10,30
  1 4-7       0.09  0.54 30,10,30,30
  0 0-3       0.09  5.42 10,30,30,30
```

Displaying CPUs 4 to 7 with selection of edited parameters

```
ddtop -CD 4-7 -f domain,cpu,%user,%syst,%idle
  Domain  Cpu %User %Syst %Idle
domain5   4   0.00  0.00 100.00
domain6   5   0.00  0.00 100.00
domain7   6   0.00  0.00 100.00
domain8   7   0.00  0.00 100.00
```

Displaying processes whose command contains "tst", with addition of the command name

```
ddtop -pD -s tst +f cmd
  Domain  Pid %Cpu Command
domain8 18782 0.00 ./tst
domain8 11519 0.00 ./tst
domain8 11521 0.00 ./tst
domain10 11520 0.00 ./tst
```

Displaying processes and associated threads whose command contains "tst", with addition of the command name

```
ddtop -PD -s tst +f cmd
  Domain  Pid  Tid %Cpu Command
domain7 11519 11522 0.00 -
domain7 11521 11525 0.00 -
domain8 18782 18782 0.00 ./tst
domain8 11519 11519 0.00 ./tst
domain8 11519 11524 0.00 -
domain8 11521 11521 0.00 ./tst
domain8 11521 11526 0.00 -
domain9 11520 11523 0.00 -
domain10 11520 11520 0.00 ./tst
domain10 11520 11527 0.00 -
```

Displaying processes and associated threads with selection of PIDs

```
ddtop -PD 11534-11536,18782 +f cmd
  Domain   Pid   Tid   %Cpu Command
domain7 11534 11537  0.00 -
domain7 11536 11540  0.00 -
domain8 18782 18782  0.00 ./tst
domain8 11534 11534  0.00 ./tst
domain8 11534 11539  0.00 -
domain8 11536 11536  0.00 ./tst
domain8 11536 11542  0.00 -
domain9 11535 11538  0.00 -
domain10 11535 11535  0.00 ./tst
domain10 11535 11541  0.00 -
```

Displaying a list of threads for processes whose command contains "tst"

```
ddtop -LD -s tst -g
  Domain   Pid Tid ...
default 18782
default 24612 24617 24618
default 24614 24619 24621
default 24615 24622 24623
```

Description

The "ddtop" daemon allows you to list various parameters for CPUs, nodes and active processes on the machine to the console or in a trace file. Parameters are edited according to the level of detail requested (options: -d and -D) or can be redefined by the user (options: -f and +f). The results are edited in chronological order (options: -C, -L, -P, -PM, -p, -pM, -M) or classified by domain (options: -CD, -LD, -PD, -PMD, -pD, -pMD, -MD).

Syntax

General format

```
/usr/bin/ddtopd [-t time] [-C[D] | -N[C] | -m] [-L[D] | -P[M] [D] | -p[M] [D] | -M[D]]  
[v...] [-ld dom] [-s str] [-u user] [-f fmt] [+f fmt]  
[-g|-G] [-d|-D] [-U] [-z] [-a] [-n cpu] [-dc cnf] [-fc cnf]  
[-c cnf] [-h hist] [-l log] [-i|--noid] [--gbld] [--gb1] [--all]
```

By default, command **ddtopd** without parameter (`/usr/bin/ddtopd`) is equivalent to `/usr/bin/ddtopd -C -D -U`.

Parameters

<code>[-t time]</code>	Interval between two measurements or display (by default: 1.00 seconds).
<code>[-C[D]]</code>	display of CPUs load (CPU number x, y,...). D: sorted by domain name.
<code>[-N[C]]</code>	Display of nodes configuration (node number x, y,...). C: with CPUs load.
<code>[-m]</code>	Display of memory used by node (node number x, y,...).
<code>[-L[D]]</code>	Display of list of threads by process (PID x, y,...). D: sorted by domain name.
<code>[-P[M] [D]]</code>	Display of load by process and thread (PID x, y,...). M: addition of used memory. D: sorted by domain name.
<code>[-p[M] [D]]</code>	Display of load by process without threads (PID x, y,...). M: addition of used memory. D: sorted by domain name.
<code>[-M[D]]</code>	Display of list of threads by process (PID x, y,...). D: sorted by domain name.
<code>[v...]</code>	List of CPU, node and process numbers (by default: all; format: a[-b][,c[-d]][,...] or all).
<code>[-ld dom]</code>	Display of parameters for the list of domains "dom" (by default: all, format: domain_name1[,domain_name2][,...] or all),
<code>[-s str]</code>	Display if the command line contains string "str".
<code>[-u user]</code>	Display for user "user".
<code>[-f fmt]</code>	Definition of parameters edited for nodes, CPUs, etc.

[+f fmt]	Addition of parameters displayed for nodes, CPUs, etc. (format: pid[,...], type "ddtop -format" for more details)
[-g]	Global display of parameters (loads, memory, etc.) by item.
[-G]	Global display of parameters (loads, memory, etc.) for all items.
[-d]	Detailed display of parameters.
[-D]	Display with a maximum of parameter details.
[-U]	Edit parameters with units.
[-z]	Display of processes using no memory.
[-a]	Display of processes not included in a domain.
[-n cpu]	Number of CPUs used for computing loads (by default: 1; cpu = 1 or maximum number of machine's CPUs).
[-dc cnf]	Name of the domains configuration file (by default: /var/ddomains/ddomains).
[-fc cnf]	Domains configuration file (by default: /var/ddomains/ddomains).
[-h hist]	Name of history trace file (by default: console).
[-l log]	Trace message edit level (by default: 4).
[-i] or [--noid]	No edit of parameter meanings.
--gbld	Display of sum for each domain.
--gb1	Display of global sum.
--all	Display of sum for the whole machine.
[stdin]	Value input on standard input (stdin) (same as [v...]).

Return codes

- 0 : Running OK.
- 1 : Access error.
- 2 : Error in a parameter.

Examples

Displaying a domain name and load of CPU 3 to 5 every 10 seconds

```
ddtopd -CD 3-5 -t 10
ddtopd: Daemon started
ddtopd: Time between measures : 10.000s
Domain Cpus Cpu %Used %Idle %Wait
test 3 3 0.00 100.00 0.00
test1 4 4 0.00 100.00 0.00
test2 5 5 0.00 100.00 0.00

Domain Cpus Cpu %Used %Idle %Wait
test 3 3 0.00 100.00 0.00
test1 4 4 0.00 100.00 0.00
test2 5 5 0.00 100.00 0.00
...
...
```

Displaying node configuration every 2 seconds

```
ddtopd -NC -t 2
ddtopd: Daemon started
ddtopd: Time between measures : 2.000s
Node Cpus %Cpu %MemU. Distance
0 0-15 0.23 44.05 10,30
1 16-31 0.00 0.34 30,10

Node Cpus %Cpu %MemU. Distance
0 0-15 0.09 44.05 10,30
1 16-31 0.00 0.34 30,10
...
...
```

Displaying total load for CPUs 0 to 7 every second

```
ddtopd -C 0-7 -g -t 1
ddtopd: Daemon started
ddtopd: Time between measures : 1.000s
cpu0 cpu1 cpu2 cpu3 cpu4 cpu5 cpu6 cpu7
0.00 1.37 0.00 0.00 0.00 0.00 0.10 0.00
0.00 0.58 0.00 0.00 0.00 0.00 0.58 0.00
...
...
```

Displaying the total domain load every second

```
ddtopd -CD -g -t 1
ddtopd: Daemon started
ddtopd: Time between measures : 1.000s
default test test1 test2
0.05 0.15 0.00 0.00
0.08 0.05 0.00 0.00
0.05 0.34 0.00 0.00
...
...
```

List to file for processes and their threads that have "test1" in their command with the addition of the command name

```
ddtopd -PD -s test1 +f cmd -t 1 -h trace.log &
tail -f trace.log
06/06/19 17:15:24 ddtopd: Daemon started
06/06/19 17:15:24 ddtopd: Time between measures : 1.000s
06/06/19 17:15:25 Domain      Pid      Tid      %Cpu  Command
06/06/19 17:15:25 test1      25357    25357    84.02  test1
06/06/19 17:15:26 test1      25357    25357    85.03  test1
06/06/19 17:15:27 test1      25357    25357    84.91  test1
06/06/19 17:15:28 test1      25357    25357    85.04  test1
06/06/19 17:15:29 test1      25357    25357    84.93  test1
...
...
```

Daemon check service

The **ddtopd** service allows the operation of the **ddtopd** daemon to be checked (starting it, stopping it or checking its status). The **ddtopd** daemon is not enabled when the product is installed.

Running the daemon

```
/etc/init.d/ddtopd start
Starting ddtopd  OK
```

Status of the daemon

```
/etc/init.d/ddtopd status
ddtopd is running (pid=21367) since 06/06/20 09:59:47
```

Stopping the daemon

```
/etc/init.d/ddtopd stop
Stopping ddtopd  OK
```

Restarting the daemon (stopping and running)

```
/etc/init.d/ddtopd restart
Stopping ddtopd  OK
Starting ddtopd  OK
```

Daemon configuration file

The configuration file defines the daemon's parameters. When the daemon is run, the configuration file (if it exists) defines the default values for the parameters of the daemon. At any time (daemon stopped or running), the user can edit some of the daemon's processing parameters via the configuration file (change the polling period, enable or disable a process)

Example of a configuration file

```
cat /var/ddtools/ddtopd.conf
ddtopd_enable = 1
ddtopd_pid = 26750
start_time = 1150782757
loop_time = 60.000
```

Parameter meanings

- ddtopd_enable** Whether or not the daemon is enabled (value 0 or 1; 1: daemon enabled),
- ddtopd_pid** Daemon process number (do not change),
- start_time** Daemon run date (in seconds since 01/01/1970; do not change),
- loop_time** Daemon process time in seconds (by default: 60 seconds).

6. Characteristics of domains

Parameters of a domain

A domain is characterized by a set of parameters used for defining its type (static or dynamic), size, priority, etc.

Domain size

- NbMin:** Minimum number of resources guaranteed for the domain.
- NbUsed:** Number of resources used by the domain.
- NbMax:** Maximum number of resources usable by the domain.

Domain priority

- Priority:** Priority in resources allotment to the domain
(1: highest priority, 255: lowest priority).

Domain thresholds

- Threshold:** Upper threshold for alarm management and adding resources.
- SharEven:** Lower threshold for authorizing resources pickup.

CPUs mask

- UsedCpus:** List of CPUs used by the domain.
- MaxCpus:** List of CPUs usable by the domain.

Static domain

A domain is static when its parameters NbMin and NbMax have the same value (no change in its size).

Dynamic domain

A domain is dynamic when its parameters NbMin and NbMax are different. These parameters allow the number of domain resources to be varied. The dynamic aspect of a domain is managed by the daemon (ddmon) in the following conditions:

- The domain load level exceeds its upper threshold.
- The domain size (number of resources) is lower than its maximum size (number of CPUs used < maximum number of CPUs).
- Another domain with lower priority is able to release some resources (number of CPUs used > minimum number of CPUs).
- A domain with an equal or higher priority and with a load level lower than its lower threshold is able to release some resources.

Domain "default"

Domain "default" is similar to the other domains as regards the following characteristics: priorities management, load thresholds management, dynamic management or not. It does not behave like the other domains in the following cases:

- On tasks assignment, it may be automatically assigned tasks that are not taken into account by other domains.
- In case resources are reduced for a given domain (release of a CPU), all released resources are allotted to domain "default".
- If minimum resources are guaranteed for domain "default", no resource is reserved for it (another domain can take any resource from domain "default" within the limit of its guaranteed minimum).

Domain "default" cannot be removed using the graphics interface.

A. Checking the installation

Checking the domain "default"

Once the "Dynamic Domains" software is installed, a domain called "default" should be created automatically. This domain must use all the machine's CPUs.

To check the configuration of domain "default", enter the following:

```
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default      1        4        4      255       100       33     0 - 3       0       68       82
```

Checking the daemon

Once the "Dynamic Domains" software is installed, the monitoring daemon ("[ddmon](#)") must be running.

To display the daemon status, enter the following:

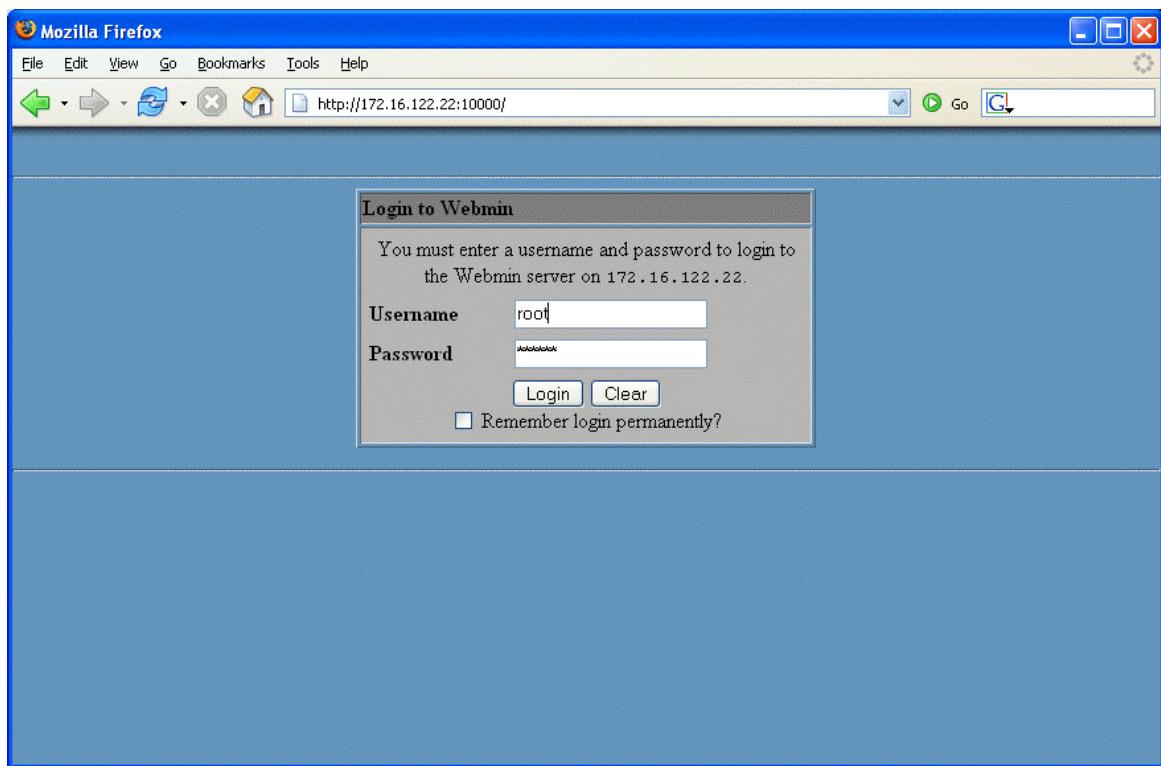
```
/etc/init.d/ddmon status
ddmon is running (pid=17379) since 06/02/07 07:46:18
```

To display the daemon trace file, enter the following:

```
tail /var/ddtools/ddmon.log
06/06/19 07:46:18 ddmon : Initialization enabled
06/06/19 07:46:18 ddmon : Create domains configuration file
                           /var/ddomains/ddomains
06/06/19 07:46:18 ddmon : Create new domain default
06/06/19 07:46:18 ddmon : Assign tasks to domain default
06/06/19 07:46:18 ddmon : Create filters configuration file
                           /var/ddomains/filters
06/06/19 07:46:18 ddmon : Daemon started
06/06/19 07:46:18 ddmon : Time between measures : 10.000s
06/06/19 07:46:18 ddmon : Filters management started
06/06/19 07:46:18 ddmon : Alarms management started
06/06/19 07:46:18 ddmon : Dynamic management started
```

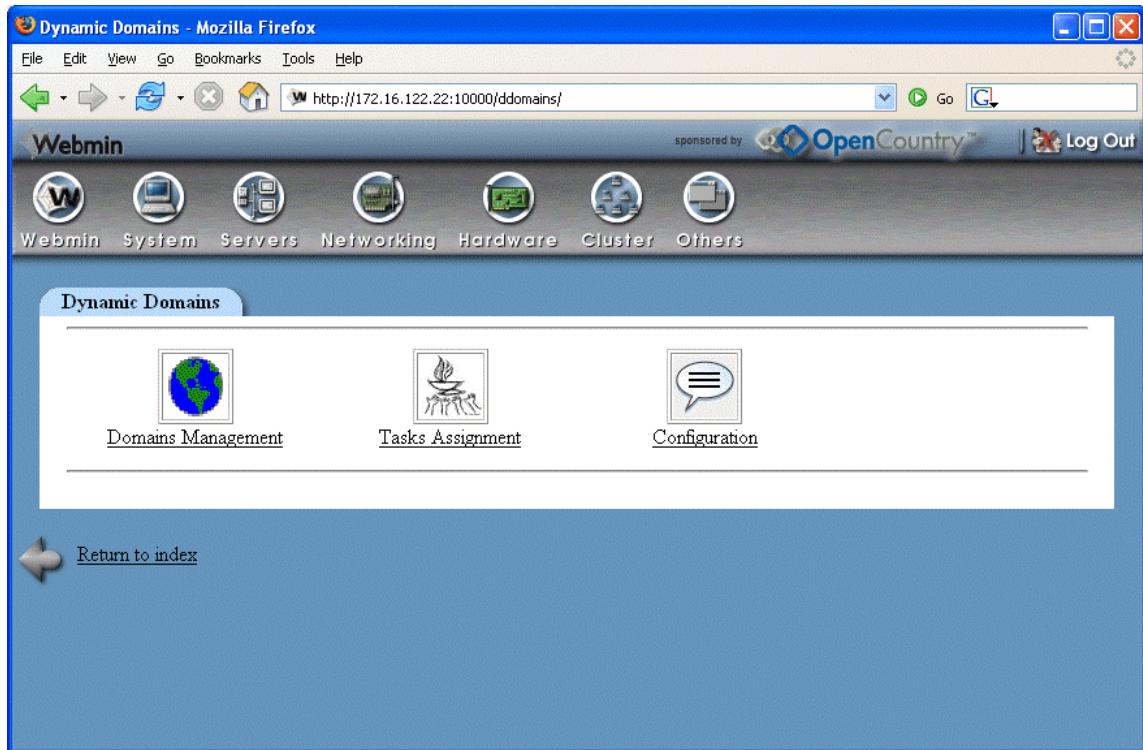
Checking access via Webmin

The "Dynamic Domains" software is configured or administered using the "Webmin" tool ("System" category) via a browser (URL: <http://<nomhote>:10000> or <https://<nomhote>:10000>).

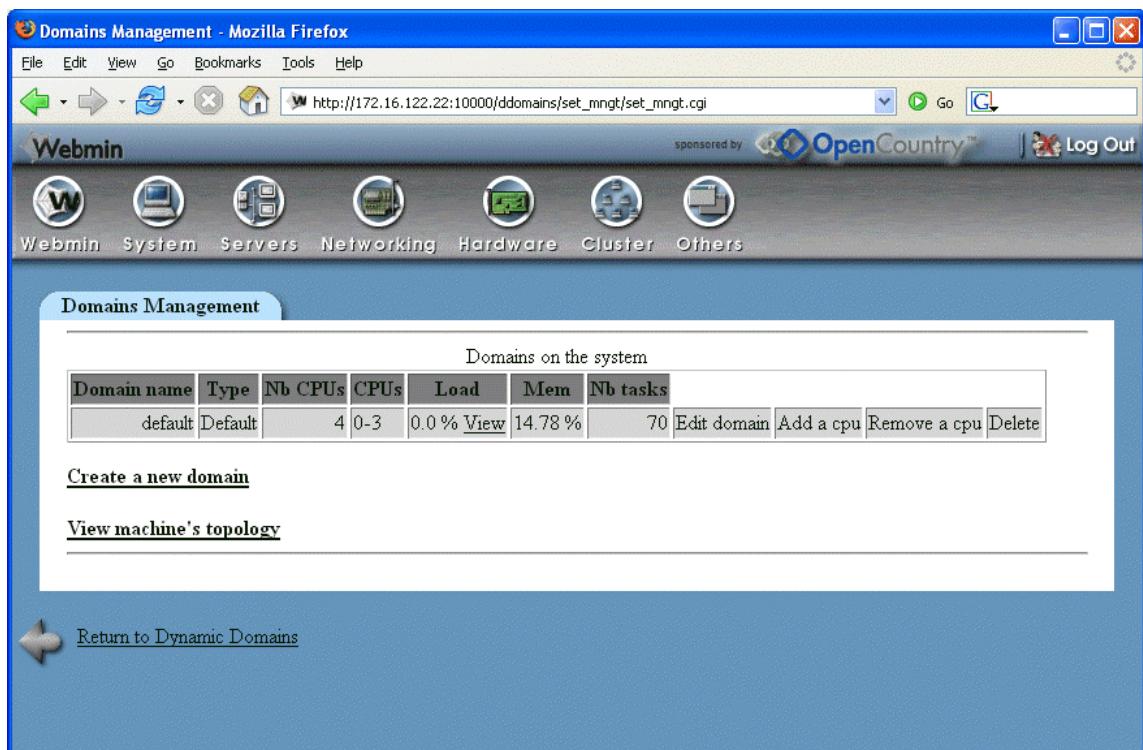


- Enter user name "root" with its password.
- Click "Login" to validate.
- Select group "System".
- Click the icon for the "Dynamic Domains" module.





- Click the "**Domains Management**" icon to check the configuration of domain "default".



Domain "default" must use all the machine's CPUs. No action (edition, deletion, etc.) is possible on this domain. With this screen, the user can create new domains (see chapter 3: "[Configuration et utilisation en mode Normal](#)" or chapter 4 "[Configuration et utilisation en mode Expert](#)").

B. Example of use

Running a process to simulate the load

This involves running programmes that use CPU resource, using the "[ddload](#)" utility. Type:

```
ddload -i load_2x45% -t 3600 -l 45 -p 2 &
ddload -i load_85% -t 3600 -l 85 &
```

Checking operation of the load simulation processes

The "load_xx" must be assigned to domain "default" and can use any machine's CPUs. To check the assignment of the "load_xx" processes, enter the following:

```
ddls -s load_
      Domain      Filter   Pid      Uid Command
      default      - 18046  root  load_2x45%
      default      - 18047  root  load_2x45%
      default      - 18048  root  load_85%
```

The "load_xx" processes can periodically change CPUs. To check any possible change in the CPUs used by the "load_xx" processes, enter the following repeatedly:

```
ddls -s load_-f domain,pid,lcpu,cmd
      Domain  Pid  C Command
      default 18046 3 load_2x45%
      default 18047 2 load_2x45%
      default 18048 3 load_85%
```

where "C" is the number of the last CPU used (*lcpu*).

Each "load_xx" process uses resources from its CPU. To check the CPU load of the "load_xx" processes, enter the following:

```
ddtop -P -s load_ +f cmd
      Pid  Tid  %Cpu Command
      18046 18046 44.49 load_2x45%
      18047 18047 44.68 load_2x45%
      18048 18048 84.55 load_85%
```

Configuring a domain

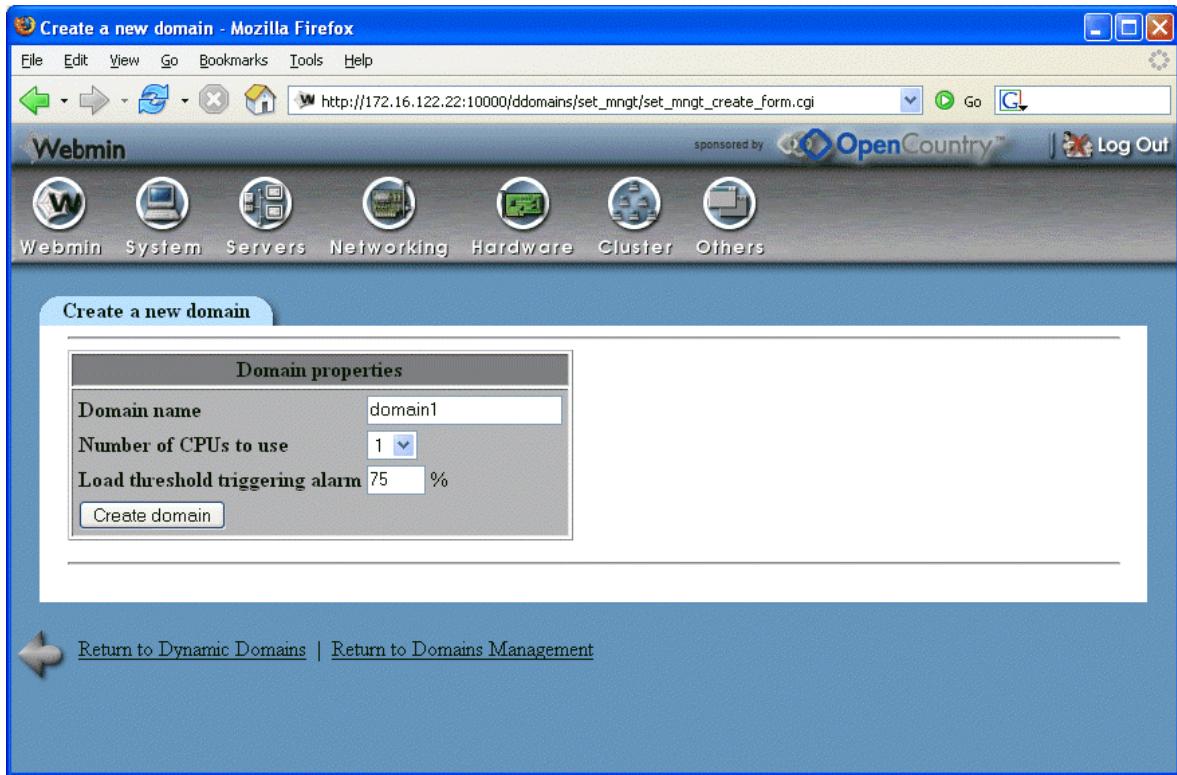
With Webmin: System->Dynamic Domains

- Click "Domains Management" to configure a new domain.

The screenshot shows the 'Domains Management' page of the Webmin interface. At the top, there is a navigation bar with links for 'File', 'Edit', 'View', 'Go', 'Bookmarks', 'Tools', and 'Help'. Below the navigation bar is a toolbar with icons for 'Webmin', 'System', 'Servers', 'Networking', 'Hardware', 'Cluster', and 'Others'. The main content area is titled 'Domains Management' and displays a table titled 'Domains on the system'. The table has columns for 'Domain name', 'Type', 'Nb CPUs', 'CPUs', 'Load', 'Mem', 'Priority', and 'Nb tasks'. A single row is shown for 'default' with values: Type 'Default', Nb CPUs '4', CPUs '0-3', Load '44.6 %', Mem '14.87 %', Priority '255', and Nb tasks '73'. To the right of the table are buttons for 'Edit domain', 'Add a cpu', 'Remove a cpu', and 'Delete'. Below the table are two links: 'Create a new domain' and 'View machine's topology'. At the bottom left, there is a blue arrow pointing left with the text '[Return to Dynamic Domains](#)'.

Domain name	Type	Nb CPUs	CPUs	Load	Mem	Priority	Nb tasks					
default	Default	4	0-3	44.6 %	View	14.87 %	255	73	Edit domain	Add a cpu	Remove a cpu	Delete

- Click "Create a new domain" to create a new domain.



- Define the **Domain Name** (example: "domain1").
- Define the number of CPUs to be reserved for the domain (**Number Of CPUs to use**) (example: "1").
- Define the alarm threshold for the domain (**Load threshold triggering alarm**) (example: "75").
- Click "**Create domain**".

Domain name	Type	Nb CPUs	CPUs	Load	Mem	Nb tasks	
default	Default	3	1-3	57.7 % View	14.87 %	73	Edit domain Add a cpu Remove a cpu Delete
domain1	Static	1	0	5.0 % View	0.00 %	0	Edit domain Add a cpu Remove a cpu Delete

[Create a new domain](#)

[View machine's topology](#)

[Return to Dynamic Domains](#)

Domain "domain1" is added to the list of domains and domain "default" no longer uses all the machine's CPUs.

Check of the new domain configuration:

ddls

Domain	NbMin	NbUsed	NbMax	Priority	Threshold	SharEven	UsedCpus	Load	NbProcs	NbThrds
default	1	3	4	255	100	33	1-3	53	71	85
domain1	1	1	1	25	75	25	0	0	0	0

Adding a process to the domain

With Webmin: System->Dynamic Domains

- Click "Tasks Assignment" to add a process to the domain.

The screenshot shows the 'Tasks Assignment' page in Mozilla Firefox. The URL is http://172.16.122.22:10000/ddomains/proc_mngt/proc_mngt.cgi. The page title is 'Tasks Assignment - Mozilla Firefox'. The top menu bar includes File, Edit, View, Go, Bookmarks, Tools, and Help. Below the menu is a toolbar with icons for Back, Forward, Stop, Home, and Search. The main content area has a header 'Webmin' with a 'Log Out' link. Below the header are navigation links: Webmin, System, Servers, Networking, Hardware, Cluster, and Others. The main content is titled 'Tasks Assignment' and displays 'Domains on the system'. A table lists domains with their CPU usage, load, memory usage, and task counts. For 'domain1', there are links to 'Assign users' and 'Assign by command'. At the bottom, there is a link to 'View tasks running on the machine' and a 'Return to Dynamic Domains' button.

Domain name	Nb CPUs	Load	Mem	Nb tasks
default	3	60.9 %	View	14.87 %
domain1	1	0.0 %	View	0.00 %

- Click "Assign by command" for domain "domain1" in order to add a process to the domain.

Assign tasks by command name

Assign tasks to domain "domain1"

Assign tasks whose command **contains** Delete matching string

[Add a matching string](#)

[Update assignment](#)

[Return to Dynamic Domains](#) | [Return to Tasks Assignment](#)

- Select condition "**contains**" and value "**load_2x**".
- Click "**Update assignment**".

Domains on the system					
Domain name	Nb CPUs	Load	Mem	Nb tasks	
default	3	26.9 %	View	14.81 %	71
domain1	1	89.9 %	View	0.06 %	2

[View tasks running on the machine](#)

[Return to Dynamic Domains](#)

Domain "domain1" has to be loaded (load > 75%).

- Click "**View**" in "**task**" for domain "domain1".

The screenshot shows the 'Assigned tasks' page in the Webmin interface. The URL in the address bar is `http://172.16.122.22:10000/ddomains/proc_mngt/proc_mngt_view_assigned_tasks.cgi?name=domain`. The main content area displays a table of tasks assigned to 'domain1'.

Process ID	Owner	Size	Domain Usage	Command
18046	root	3008 KB	44.5 %	load_2x45%
18047	root	3008 KB	44.5 %	load_2x45%
Total		12032 KB	89.0 %	2 task(s)

Below the table, there are links: 'Return to Dynamic Domains' and 'Return to Tasks Assignment'.

The "load_2x45%" tasks must be in domain "domain1" and load the domain ("Domain Usage" > 75%).

- Click "Return to Dynamic Domains" to return to the main screen.

Check that the processes "load_2x45%" are assigned to domain "domain1", that the CPU used corresponds to the one defined for the domain and that process "load_85%" is still assigned to domain "default".

To check the assignment of the "load_xx" processes, enter the following:

```
ddls -s load_ -f domain,pid,lcpu,cmd
      Domain   Pid  C Command
      default 18048  1 load_85%
      domain1 18046  0 load_2x45%
      domain1 18047  0 load_2x45%
```

If the daemon "ddmon" is active, an alarm message must be added to its trace file (file: /var/ddtools/ddmon.log)

Example:

```
06/06/19 08:49:43 ddmon*2 Domain domain1 : Alarm threshold (>75%)
```

Adding a CPU to a domain

With Webmin: System->Dynamic Domains

- Click "Domains Management" to change a domain.

The screenshot shows the 'Domains Management' page in Mozilla Firefox. The URL is http://172.16.122.22:10000/ddomains/set_mngt/set_mngt.cgi. The page title is 'Domains Management - Mozilla Firefox'. The top menu bar includes File, Edit, View, Go, Bookmarks, Tools, and Help. Below the menu is a toolbar with icons for Back, Forward, Stop, Home, and Search. A banner at the top right says 'sponsored by OpenCountry™' and has a 'Log Out' link. The main navigation bar below the banner includes links for Webmin, System, Servers, Networking, Hardware, Cluster, and Others. The 'Domains Management' tab is selected. The main content area displays a table titled 'Domains on the system'. The table has columns: Domain name, Type, Nb CPUs, CPUs, Load, Mem, and Nb tasks. There are two rows: one for 'default' (Type: Default, Nb CPUs: 3, CPUs: 1-3, Load: 26.9 %, Mem: 14.81 %, Nb tasks: 71) and one for 'domain1' (Type: Static, Nb CPUs: 1, CPUs: 0, Load: 89.8 %, Mem: 0.06 %, Nb tasks: 2). For 'domain1', there are links: 'Edit domain', 'Add a cpu', 'Remove a cpu', and 'Delete'. Below the table are links for 'Create a new domain' and 'View machine's topology'. At the bottom left is a 'Return to Dynamic Domains' button with a left arrow icon.

Domain name	Type	Nb CPUs	CPUs	Load	Mem	Nb tasks
default	Default	3	1-3	26.9 % View	14.81 %	71 Edit domain Add a cpu Remove a cpu Delete
domain1	Static	1	0	89.8 % View	0.06 %	2 Edit domain Add a cpu Remove a cpu Delete

- Click "Add a cpu" of domain "domain1" to add a CPU to the domain.

The screenshot shows the 'Domains Management' section of the Webmin interface. At the top, there's a navigation bar with links for File, Edit, View, Go, Bookmarks, Tools, and Help. Below that is a toolbar with icons for Back, Forward, Stop, Home, and Search, along with a URL field showing 'http://172.16.122.22:10000/ddomains/set_mngt/set_mngt.cgi'. A banner for 'OpenCountry' and a 'Log Out' link are also present.

The main content area has a title 'Domains Management' and a sub-section 'Domains on the system'. It displays a table with the following data:

Domain name	Type	Nb CPUs	CPUs	Load	Mem	Nb tasks				
default	Default	2	2-3	37.5 % View	14.81 %	71	Edit domain	Add a cpu	Remove a cpu	Delete
domain1	Static	2	0-1	45.1 % View	0.06 %	2	Edit domain	Add a cpu	Remove a cpu	Delete

Below the table are two links: [Create a new domain](#) and [View machine's topology](#).

A blue button at the bottom left says 'Return to Dynamic Domains' with a right-pointing arrow.

Domain "domain1" uses 2 CPUs and no longer has an alarm.

- Click "[Return to Dynamic Domains](#)" to return to the main screen.

Check that the "load_2x45%" processes that are assigned to domain "domain1" use one of the domain's CPUs. To check the assignment of the "load_xx" processes, enter the following:

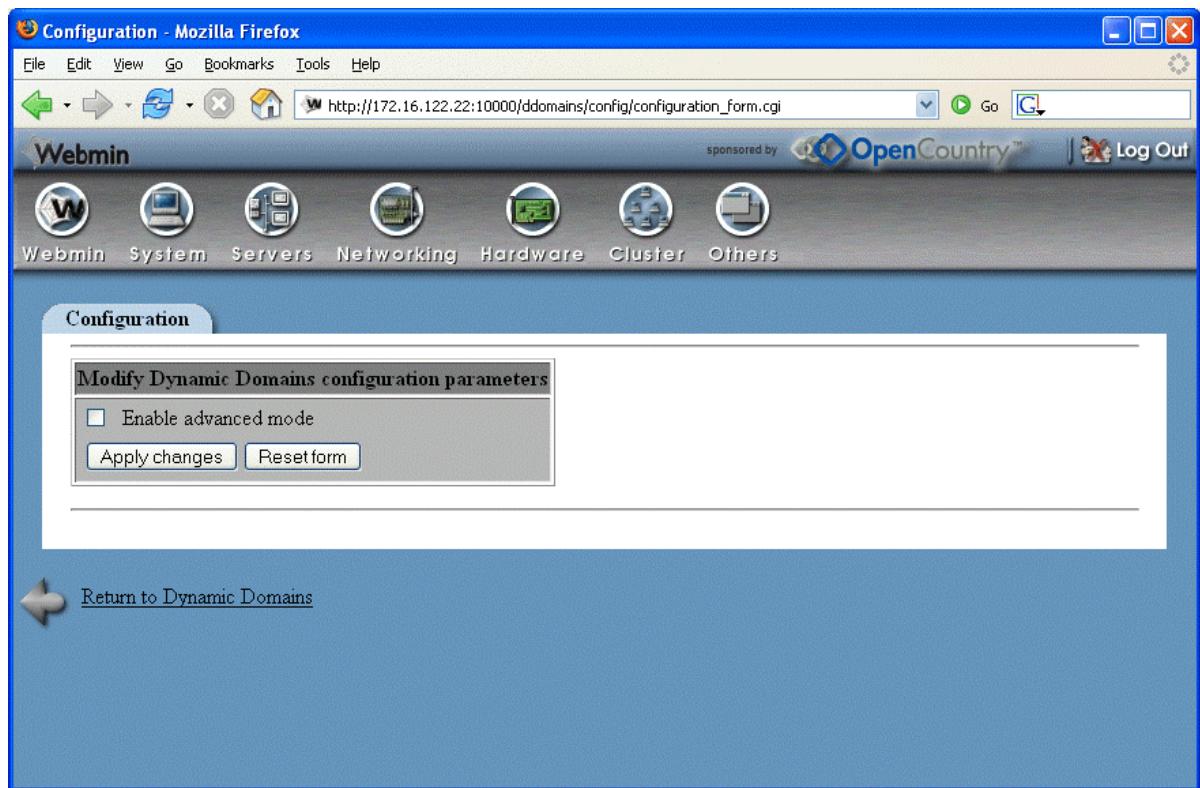
```
ddls -s load_ -f domain,pid,lcpu,cmd
      Domain   Pid   C Command
    default  18487  3 load_85%
  domain1  18485  0 load_2x45%
  domain1  18486  1 load_2x45%
```

Changing a domain (switching to dynamic mode)

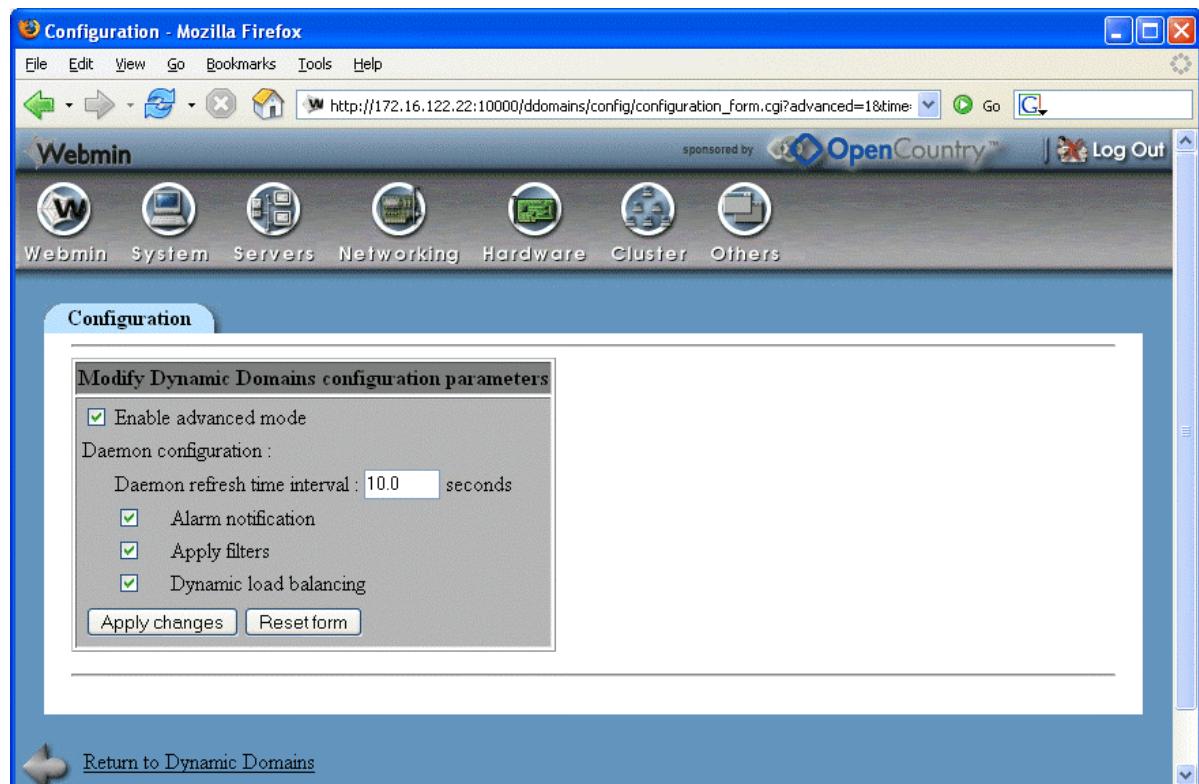
By default, once the "Dynamic Domains" software is installed, the operating interface on Webmin is configured in normal mode (simplified access to software functionalities). For dynamic domains configuration to be possible, the operating interface must be configured in advanced mode (full access to software functionalities).

With: Webmin->System->Dynamic Domains

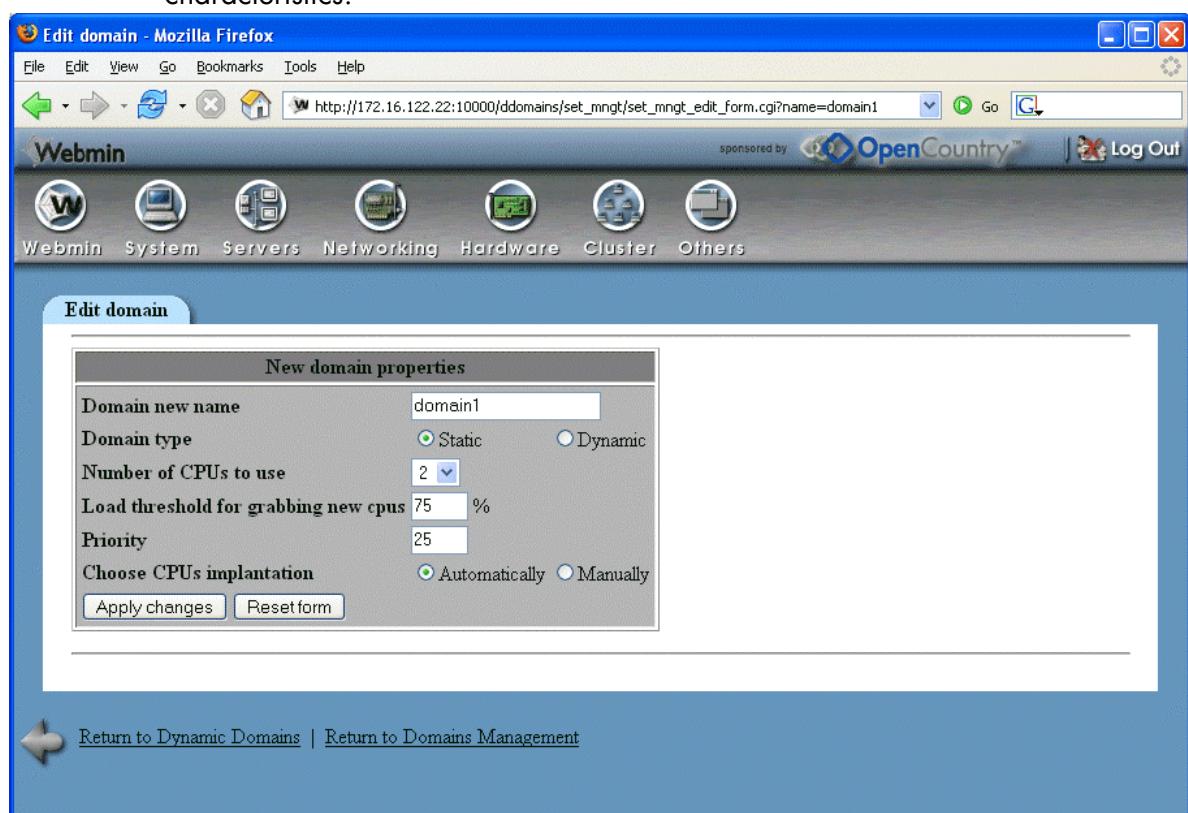
- Clicking on "Configuration" to switch to advanced mode.



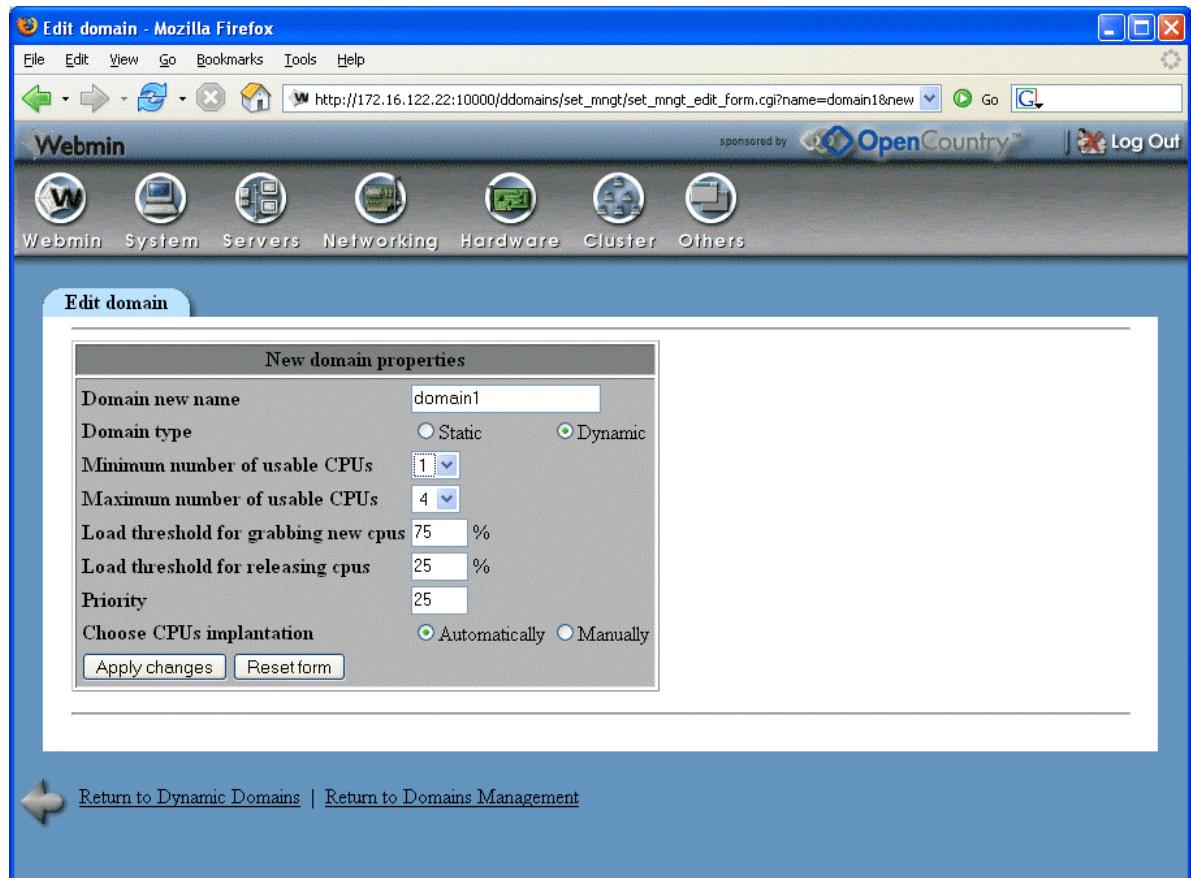
- Check the "Enable advanced mode" box to validate the advanced mode.



- Click "Apply changes".
- Click "Domains Management" to change a domain.
 - Click "Edit domain" for domain "domain1" in order to change its characteristics.



- Click domain type "Dynamic".



- Change the maximum number of CPUs for the domain (**Maximum number of usable CPUs**) example: "1".
- Change the maximum number of CPUs for the domain (**Maximum number of usable CPUs**) (example: "4").
- Click "**Apply changes**".

The screenshot shows the 'Domains Management' section of the Webmin interface. At the top, there's a navigation bar with links for 'File', 'Edit', 'View', 'Go', 'Bookmarks', 'Tools', and 'Help'. Below that is a toolbar with icons for 'Webmin', 'System', 'Servers', 'Networking', 'Hardware', 'Cluster', and 'Others'. The main content area is titled 'Domains Management' and contains a table titled 'Domains on the system'. The table has columns for 'Domain name', 'Type', 'Nb CPUs', 'CPUs', 'Load', 'Mem', 'Priority', and 'Nb tasks'. Two rows are shown: 'default' (Default type, 3 CPUs, 1-3 load, 24.9% load) and 'domain1' (Dynamic type, 1 CPU, 0 CPUs, 89.0% load, 0.06% mem). Below the table are links for 'Create a new domain' and 'View machine's topology'. A 'Return to Dynamic Domains' link is at the bottom left.

Domain name	Type	Nb CPUs	CPUs	Load	Mem	Priority	Nb tasks	
default	Default	3	1-3	24.9 % View	14.81 %	255	71	Edit domain Add a cpu Remove a cpu Delete
domain1	Dynamic	1	0	89.0 % View	0.06 %	25	2	Edit domain Add a cpu Remove a cpu Delete

Domain "domain1" is now a dynamic domain. It uses a single CPU but, as the domain's load exceeds its upper threshold (alarm threshold), the daemon has to automatically add resources to it (add a new CPU to domain "domain1").

- Click "**Reload the page**" to check that CPU has been assigned automatically to domain "domain1".

This screenshot shows the same 'Domains Management' interface after a CPU was added to 'domain1'. The table now shows 'domain1' with 2 CPUs, 0-1 load, and 45.0% load. The other 'default' domain remains at 3 CPUs and 24.9% load.

Domain name	Type	Nb CPUs	CPUs	Load	Mem	Priority	Nb tasks	
default	Default	2	2-3	40.6 % View	14.81 %	255	71	Edit domain Add a cpu Remove a cpu Delete
domain1	Dynamic	2	0-1	45.0 % View	0.06 %	25	2	Edit domain Add a cpu Remove a cpu Delete

- Click "**Return to Dynamic Domains**" to return to the main screen.

To check the addition of a resource (number of CPUs used = 2) using the command interface, enter the following:

```
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default    1      2      4      255      100      33      2-3     42      69      83
domain1    1      2      4      25       75      25      0-1     44      2       2
```

Since domain "domain1" no longer has an alarm, the daemon no longer adds any additional resources to it. To add a resource (CPU) to domain "domain1" using the command interface, enter the following:

```
ddchg domain1 --add 1
```

Check with:

```
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default    1      1      4      255      100      33      3      90      69      83
domain1    1      3      4      25       75      25      0-2     31      2       2
```

The process load for domain "domain1" is badly distributed. To check the load distribution on the domain CPUs, enter the following:

```
ddtop -CD
Domain      Cpus   Cpu   %Used   %Idle   %Wait
default      3      3     87.04  12.96   0.00
domain1      0      0     43.90  56.10   0.00
domain1      1      1     38.05  61.95   0.00
domain1      2      2     0.00  100.00  0.00
```

In this example, CPU 2 of domain "domain1" is not used. The domain resources can be easily limited to the minimum required, for instance by allotting the minimum resources to the domain; the daemon will add new resources as required according to the domain load.
Allotment of minimum resources (domain "domain1": Nbused=1):

```
ddchg domain1 1
```

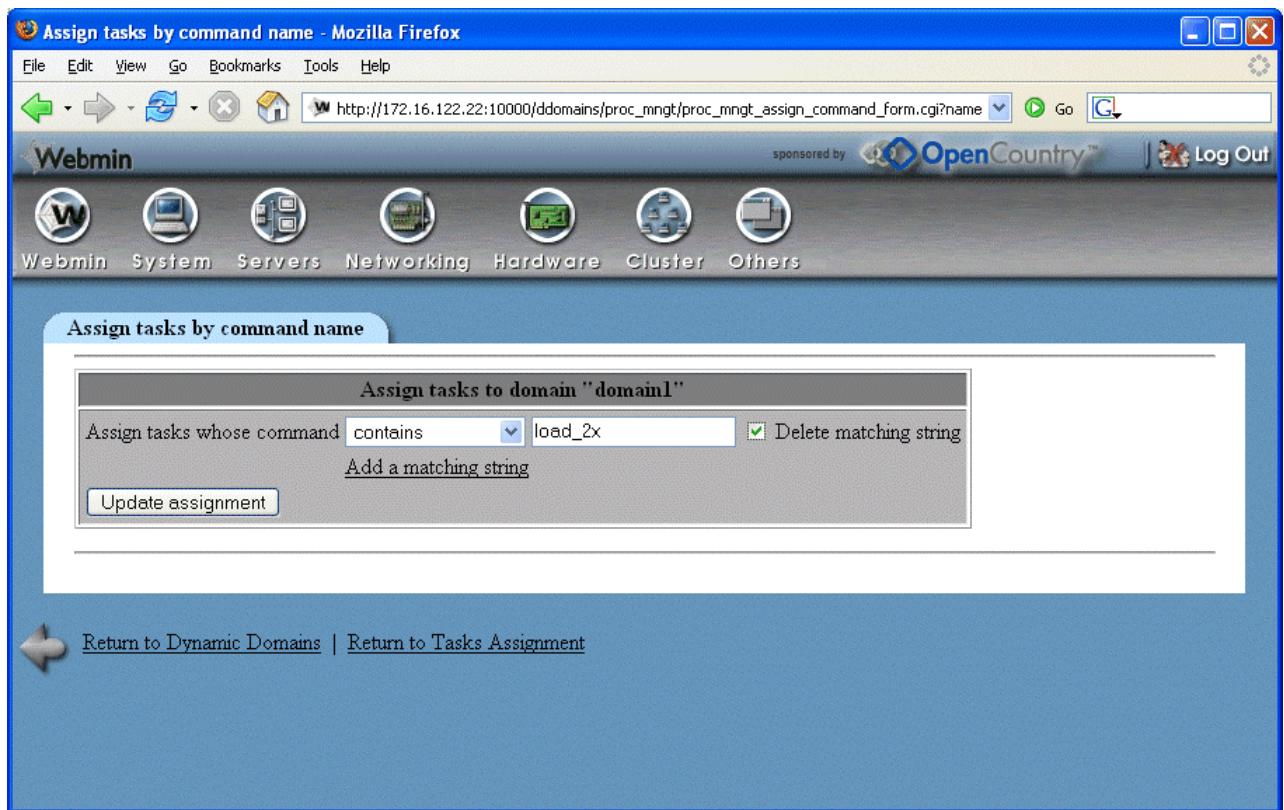
After processing, the daemon must add a CPU to domain "domain1":

```
ddls
Domain NbMin NbUsed NbMax Priority Threshold SharEven UsedCpus Load NbProcs NbThrds
default    1      2      4      255      100      33      2-3     42      69      83
domain1    1      2      4      25       75      25      0-1     36      2       2
```

Resuming normal mode and removing domain "domain1"

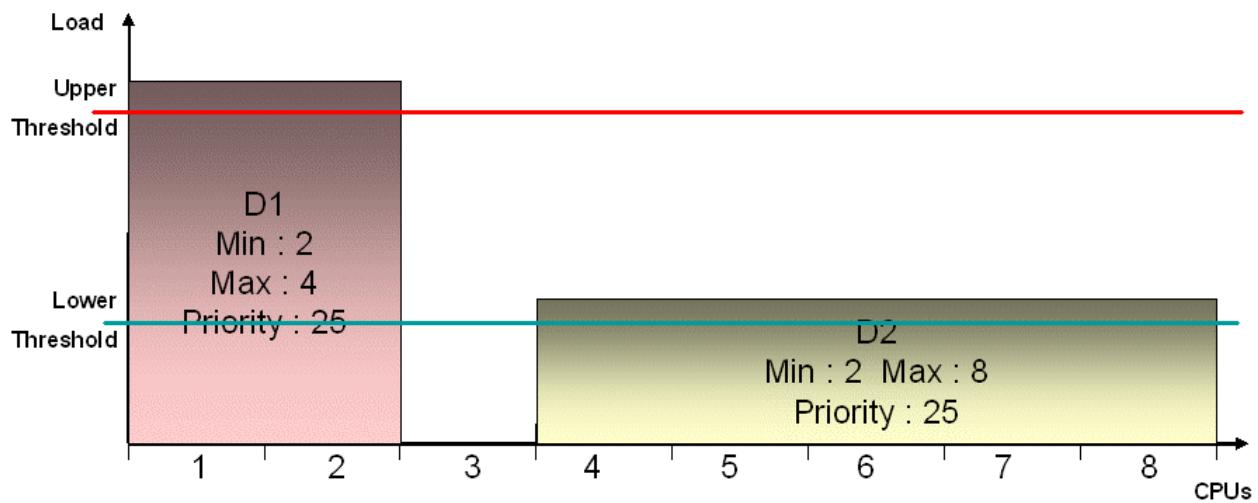
With: Webmin->System->Dynamic Domains

- Click "Configuration" to switch to [advanced](#) mode.
 - Uncheck the "Enable advanced mode" box to disable advanced mode.
 - Click "Apply changes".
- Click "Tasks Assignment" to add a process to the domain.
 - Click "Assign by command" of domain "domain1" to remove task assignment.

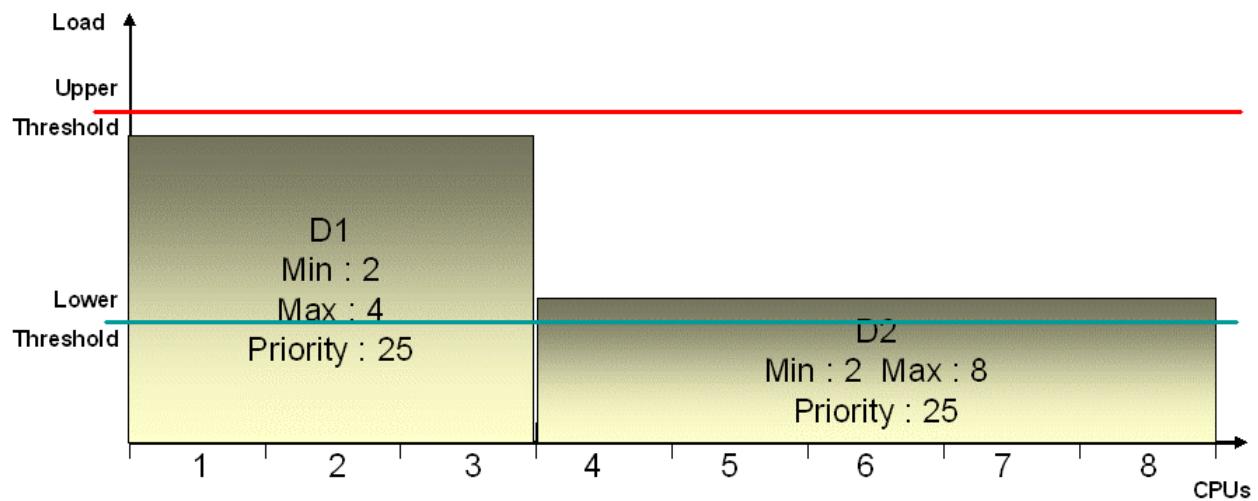


- Check the "Delete matching string" box.
- Click "Update Assignment".
- Click "Return to Dynamic Domains" to return to the main screen.
- Click "Domains Management" to remove domain "domain1".
 - Click "Delete" and confirm the action.
- Click "Return to Dynamic Domains" to return to the main screen.

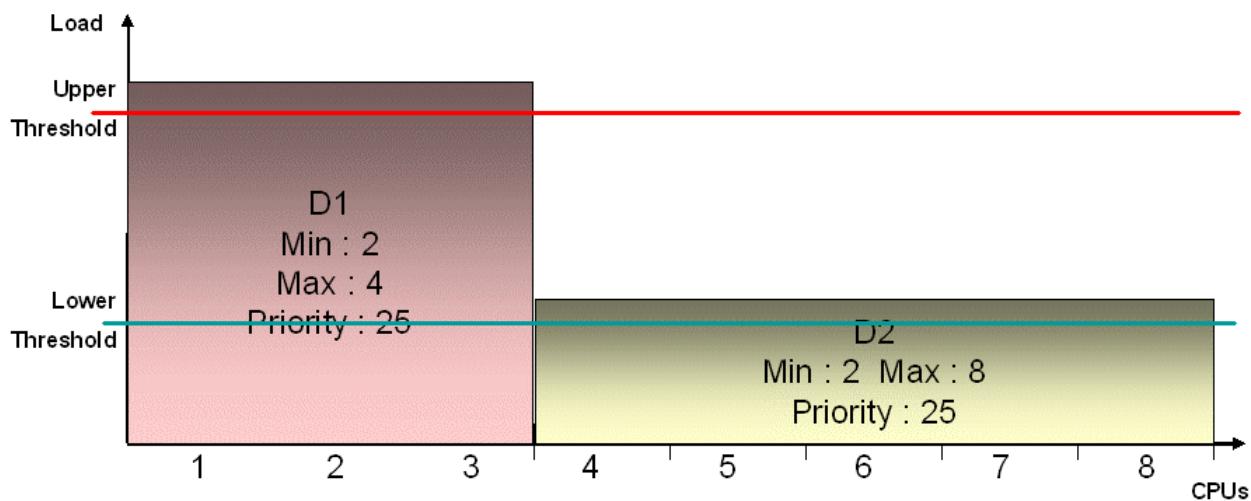
C. Simulating dynamic domains



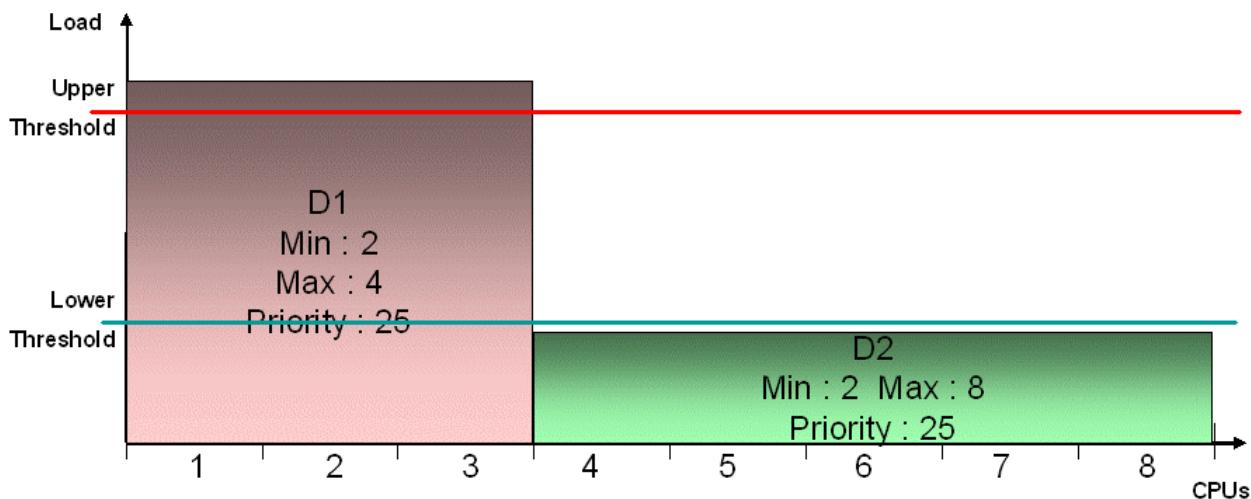
1. 2 domains with domain D1 in Alarm condition



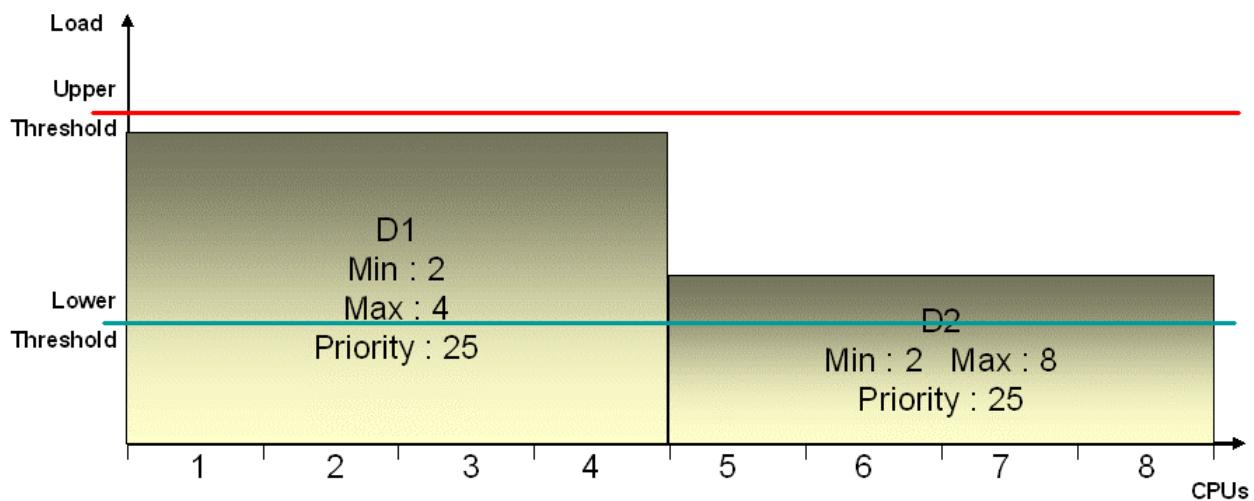
1. 2 domains with domain D1 in Alarm condition
2. Addition of a CPU to domain D1



1. 2 domains with domain D1 in Alarm condition
2. Addition of a CPU to domain D1
3. Alarm condition entered for domain D1



1. 2 domains with domain D1 in Alarm condition
2. Addition of a CPU to domain D1
3. Alarm condition entered for domain D1
4. Passage below the lower threshold for domain D2



1. 2 domains with domain D1 in Alarm condition
2. Addition of a CPU to domain D1
3. Alarm condition entered for domain D1
4. Passage below the lower threshold for domain D2
5. Addition of a CPU (of domain D2) to domain D1

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