University of Basel

Custom Linux Task Manager - Process Monitoring and Management

Project Presentation

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Operating Systems Lecture Spring Semester 2025

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Problem Statement

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- Our goal was to develop a custom task manager that enables real-time process monitoring and management.

General Approach

- collect the data with C

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- refine the data when needed in C
- display the data in a web UI
- invoke resource management calls from the UI
- handle the resource management calls correctly in C

Approach

- collect data from /proc folder

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- General Stats

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- General Stats
- Processes

System Architecture

- C core module

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- web front end

Team organization

We split our group of four into two teams.
Note that Both teams had tasks that occasionally overlapped with the other team.

- Backend team responsible for the c-core and the maintenance of the c-daemon composed of `[Jiri|Fabian]`

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- Backend team responsible for the c-core and the maintenance of the c-daemon composed of `[Jiri|Fabian]`
- Frontend team responsible for the web frontend UI and the Java API composed of `[Manuel|Valerio]`.

General Stats

- CPU

General Stats

- CPU
- Memory

General Stats

- CPU
- Memory
- Disk

General Stats

- CPU
- Memory
- Disk
- Network

General Stats

- CPU
- Memory
- Disk
- Network
- GPU(NVIDIA)

Processes Info

- State

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- CPU

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- State
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- RAM

Processes Info

- State
- CPU
- RAM
- Priority

Processes Info

- State
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- Priority
- Sleeper Detection

Background c-daemon

Http server running in the background handing frontend requests
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- POST */api/processes/pid/signal will kill the process with PID

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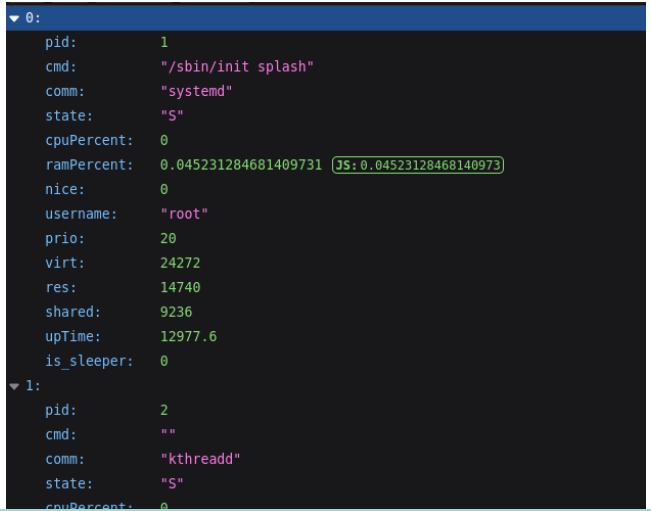
- `[limit|process|stats]_routes.c` contain the handles for the functionalities that are called by `routes.c`
- These handles then rely on the c-core for final execution.

Example for process data sent from c-daemon



Web API and Front End structure

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- Java Spring Boot

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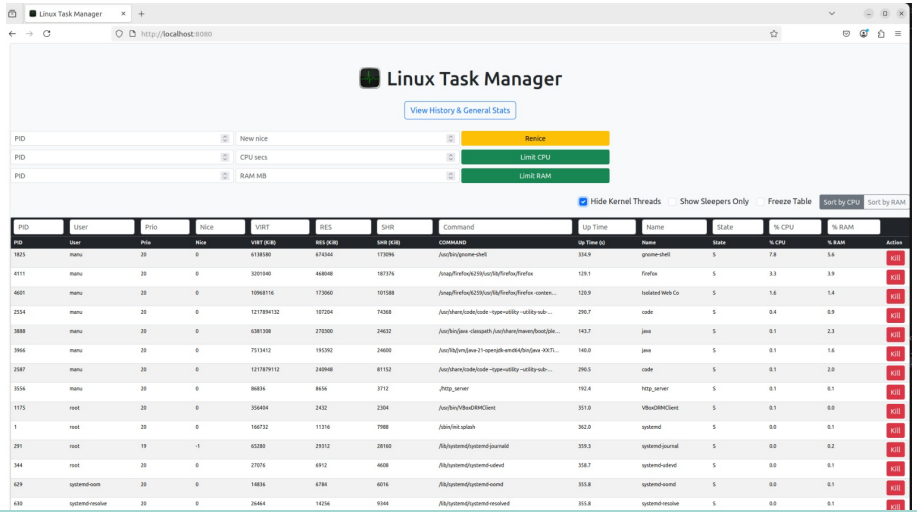
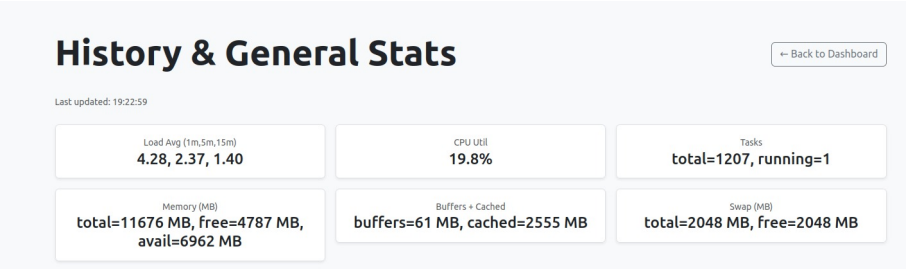
- Thymeleaf

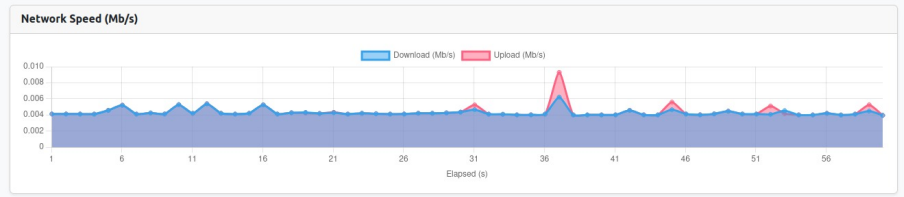
Web API and Front End Main page

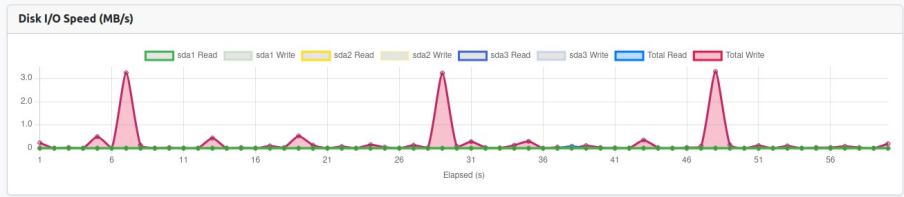


Web API and Front End System statistic page



Web API and Front End System statistic page





Web API and Front End System statistic page

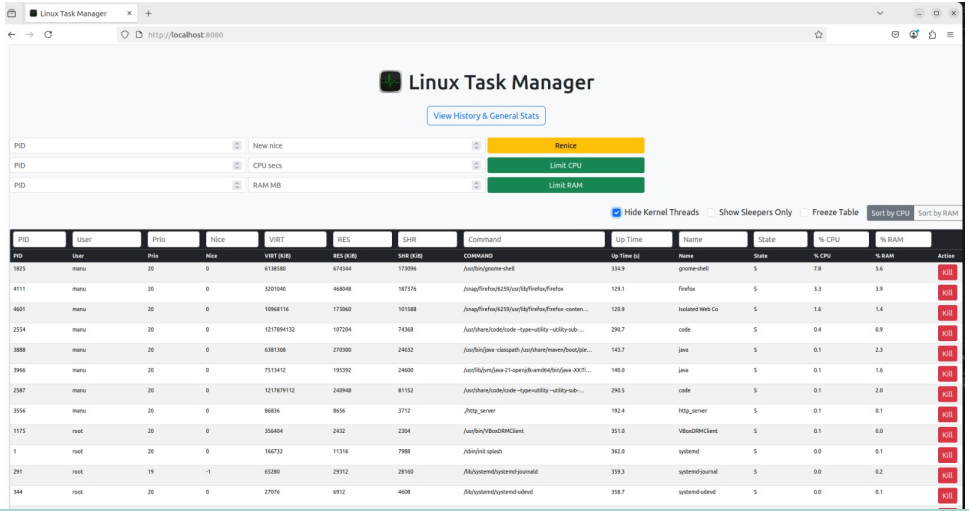
C Dependencies

- standard C
- libmicrohttpd
- libcjson

Java / Spring Dependencies

- maven
- REST API
- Thymeleaf
- Jackson

Demo


Linux Task Manager
http://localhost:8080
Linux Task Manager
View History & General Stats
PID
New nice
Renice
PID
CPU secs
Limit CPU
PID
RAM MB
Limit RAM
Hide Kernel Threads
Show Sleepers Only
Freeze Table
Sort by CPU
Sort by RAM
PID
User
Prio
Nice
VIRT
RES
SHR
Command
Up Time
Name
State
% CPU
% RAM
PID User Prio Nice VIRT (KiB) RES (KiB) SHR (KiB) COMMAND Up Time (s) Name State % CPU % RAM Action
1825 manu 20 0 6138580 674344 173096 /usr/bin/gnome-shell 334.9 gnome-shell S 7.8 5.6 Kill
4111 manu 20 0 3201040 468048 187376 /snap/firefox/6259/usr/lib/firefox/firefox 129.1 Firefox S 3.3 3.9 Kill
4601 manu 20 0 10968116 173060 101588 /snap/firefox/6259/usr/lib/firefox/firefox -conten... 120.9 Isolated Web Co S 1.6 1.4 Kill
2554 manu 20 0 1217894132 107204 74368 /usr/share/code/code --type=utility --utility-sub-... 290.7 code S 0.4 0.9 Kill
3888 manu 20 0 6381308 270300 24632 /usr/bin/java -classpath /usr/share/maven/boot/plc... 143.7 java S 0.1 2.3 Kill
3966 manu 20 0 7513412 195392 24600 /usr/lib/jvm/java-21-openjdk-amd64/bin/java -XX:I... 140.0 java S 0.1 1.6 Kill
2587 manu 20 0 1217879112 240948 81152 /usr/share/code/code --type=utility --utility-sub-... 290.5 code S 0.1 2.0 Kill
3556 manu 20 0 86836 8656 3712 ./http_server 192.4 http_server S 0.1 0.1 Kill
1175 root 20 0 356404 2432 2304 /usr/bin/VBoxDRMClient 351.0 VBoxDRMClient S 0.1 0.0 Kill
1 root 20 0 166732 11316 7988 /sbin/init splash 362.0 systemd S 0.0 0.1 Kill
291 root 19 -1 65280 29312 28160 /lib/systemd/systemd-journald 359.3 systemd-journal S 0.0 0.2 Kill
344 root 20 0 27076 6912 4608 /lib/systemd/systemd-udevd 358.7 systemd-udevd S 0.0 0.1 Kill

What We Achieved

- task manager with C
- sleeper detection
- commands for process management
- web UI instead of terminal based UI
- stable communication between frontend and backend

Improvements

What could be added extra:

- more info per Process

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- remote monitoring
- clean up
- full Disk support
- Windows support
- full GPU support

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- how to build an API in C and Java
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- how to run a Java Spring Boot web application