below

Interactive resource monitor for modern linux systems

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Facebook

Overview

- Background
- Features
- Tour of the UI
- Comparison
- Demo

Background

- Resource/system monitor
- Designed to replace atop (https://www.atoptool.nl/)
  - No cgroup awareness
  - May suffer priority inversions while host is under resource contention
  - On-disk data has custom delta compression and is easily corrupted
  - Unintuitive UX
- Developed by and for resource control team @ FB
  - Designed for post-mortem investigations
  - With input from major production atop users, cgroup/mm kernel developers, and container runtime developers
  - Completeness, reliability, and ease of use are core goals

Features

- Information regarding hardware resource utilization
- Viewing the cgroup hierarchy
  - Shortcuts for mapping cgroup -> processes
  - Pressure Stall Information (PSI)
- Modes
  - record mode to record system data (daemon mode)
    - Records _all_ processes in interval period, even those that have exited (using eBPF)
  - replay mode to replay historical system data (client mode)
  - live mode to view live system data (daemon + client mode)
  - dump subcommand to report script-friendly information (eg json and csv) (client mode)

Tour of the UI

```
05/14/2021 16:32:16 UTC+00:00      Elapsed: 5s    8bda5b7cb0c3    0.1.0     replay

CPU              Usage    42.14%          User    23.24%          System  18.49%
Mem              Total    15.4 GB         Free    1.1 GB          Anon    9.4 GB           File     3.9 GB
VM               Page In  0.0 B/s         Page Out 3.2 MB/s       Swap In 0.0 B/s          Swap Out 0.0 B/s
I/O   (Rd|Wr)  dm-0       0.0 B/s    |819.2 B/s nvme0n1 0.0 B/s   |819.2 B/s
Iface (Rx|Tx)  eth0       35.6 B     |0.0 B     lo      0.0 B     |0.0 B


General    CPU    Mem    I/O    Pressure

Name                                                     CPU       Memory      CPU Pressure   Mem Pressure   I/O Pressure   Reads      Writes

<root>                                                   161.44%   13.8 GB     7.23%          0.00%          0.00%          ?          ?
└ user.slice                                             176.00%   9.5 GB      6.90%          0.00%          0.00%          ?          ?
  └ user-1001.slice                                      176.00%   9.4 GB      6.95%          0.00%          0.00%          ?          ?
    ↳ user@1001.service                                  176.01%   9.4 GB      6.94%          0.00%          0.00%          ?          ?
    └ session-3.scope                                    0.00%     6 MB        0.00%          0.00%          0.00%          ?          ?
    └ user-runtime-dir@1001.service                      0.00%     0.0 B       0.00%          0.00%          0.00%          ?          ?
↳ system.slice                                           0.49%     4.2 GB      0.20%          0.00%          0.00%          ?          ?
└ hostcritical.slice                                     0.01%     105.7 MB    0.00%          0.00%          0.00%          ?          ?
  └ systemd-journald.service                             0.01%     91.4 MB     0.00%          0.00%          0.00%          ?          ?
  └ dbus-broker.service                                  0.01%     13.4 MB     0.00%          0.00%          0.00%          ?          ?
  └ sshd.service                                         0.00%     816 KB      0.00%          0.00%          0.00%          ?          ?
↳ init.scope                                             0.00%     90.9 MB     0.00%          0.00%          0.00%          ?          ?
└ machine.slice                                          1.46%     19.1 MB     0.00%          0.00%          0.00%          ?          ?
  └ libpod-8bda5b7cb0c34022cec6cbb44b6107552c1c6         1.46%     19.1 MB     0.00%          0.00%          0.00%          ?          ?
    └ container                                          1.48%     19.1 MB     0.00%          0.00%          0.00%          ?          ?















/user.slice/user-1001.slice/user@1001.service
```

```
05/14/2021 16:32:16 UTC+00:00     Elapsed: 5s     8bda5b7cb0c3     0.1.0     replay
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VM            Page In  0.0 B/s       Page Out 3.2 MB/s       Swap In  0.0 B/s            Swap Out 0.0 B/s
I/O  (Rd|Wr)  dm-0     0.0 B/s  |819.2 B/s nvme0n1 0.0 B/s  |819.2 B/s
Iface (Rx|Tx) eth0     35.6 B   |0.0 B     lo      0.0 B    |0.0 B

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    └ user@1001.service                           176.01%  9.4 GB    6.94%         0.00%         0.00%         ?        ?
      └ session-3.scope                           0.00%    6 MB      0.00%         0.00%         0.00%         ?        ?
      └ user-runtime-dir@1001.service             0.00%    0.0 B     0.00%         0.00%         0.00%         ?        ?
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    └ container                                   1.48%    19.1 MB   0.00%         0.00%         0.00%         ?        ?




/user.slice/user-1001.slice/user@1001.service
```

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Iface (Rx|Tx)  eth0    35.6 B   |0.0 B     lo        0.0 B    |0.0 B

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   └ user-1001.slice                                    176.00%   9.4 GB      6.95%          0.00%          0.00%          ?          ?
      └ user@1001.service                               176.01%   9.4 GB      6.94%          0.00%          0.00%          ?          ?
         └ session-3.scope                              0.00%     6 MB        0.00%          0.00%          0.00%          ?          ?
            └ user-runtime-dir@1001.service             0.00%     0.0 B       0.00%          0.00%          0.00%          ?          ?
└ system.slice                                          0.49%     4.2 GB      0.20%          0.00%          0.00%          ?          ?
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      └ container                                       1.48%     19.1 MB     0.00%          0.00%          0.00%          ?          ?

/user.slice/user-1001.slice/user@1001.service
```

System overview

```
05/14/2021 16:32:16 UTC+00:00      Elapsed: 5s      8bda5b7cb0c3      0.1.0      replay

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Iface (Rx|Tx) eth0     35.6 B   |0.0 B    lo       0.0 B    |0.0 B

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      └ session-3.scope                      0.00%    6 MB       0.00%          0.00%          0.00%          ?       ?
      └ user-runtime-dir@1001.service        0.00%    0.0 B      0.00%          0.00%          0.00%          ?       ?
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/user.slice/user-1001.slice/user@1001.service
```

cgroup
view

```
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/user.slice/user-1001.slice/user@1001.service
```

Resource tabs

```
05/14/2021 16:32:16 UTC+00:00     Elapsed: 5s     8bda5b7cb0c3     0.1.0     replay

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I/O  (Rd|Wr) dm-0     0.0 B/s  |819.2 B/s nvme0n1 0.0 B/s  |819.2 B/s
Iface (Rx|Tx) eth0    35.6 B   |0.0 B    lo       0.0 B    |0.0 B

General  CPU  Mem  I/O  Pressure

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      └ session-3.scope                        0.00%   6 MB      0.00%         0.00%         0.00%         ?       ?
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  ↳ init.scope                                 0.00%   90.9 MB   0.00%         0.00%         0.00%         ?       ?
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      └ container                              1.48%   19.1 MB   0.00%         0.00%         0.00%         ?       ?

/user.slice/user-1001.slice/user@1001.service
```

Data in tab

Scrollable

```
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    user-1001.slice                              176.00%   9.4 GB    6.95%          0.00%          0.00%          ?        ?
    └ user@1001.service                          176.01%   9.4 GB    6.94%          0.00%          0.00%          ?        ?
      session-5.scope                            0.00%     0 MB      0.00%          0.00%          0.00%          ?        ?
      └ user-runtime-dir@1001.service            0.00%     0.0 B     0.00%          0.00%          0.00%          ?        ?
└ system.slice                                   0.49%     4.2 GB    0.20%          0.00%          0.00%          ?        ?
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      └ container                                1.48%     19.1 MB   0.00%          0.00%          0.00%          ?        ?

/user.slice/user-1001.slice/user@1001.service
```

Collapsed cgroup

```
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Iface (Rx|Tx) eth0     35.6 B   |0.0 B    lo       0.0 B    |0.0 B

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    └ session-3.scope                             0.00%     6 MB      0.00%          0.00%          0.00%          ?        ?
      └ user-runtime-dir@1001.service             0.00%     0.0 B     0.00%          0.00%          0.00%          ?        ?
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    └ sshd.service                                0.00%     816 KB    0.00%          0.00%          0.00%          ?        ?
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    └ container                                   1.48%     19.1 MB   0.00%          0.00%          0.00%          ?        ?

/user.slice/user-1001.slice/user@1001.service
```

Expanded cgroup

```
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Iface (Rx|Tx) eth0    35.6 B    |0.0 B      lo      0.0 B   |0.0 B

General   CPU   Mem   I/O

Comm                  Cgroup                                           Pid       Ppid      State      CPU      CPU User
Web Content           /...e/gnome-launched-firefox.desktop-2046603.scope 2048151 2046603   SLEEPING   4.40%    3.40%
firefox               /...e/gnome-launched-firefox.desktop-2046603.scope 2046603 3631      SLEEPING   64.40%   30.20%
packagekitd           /system.slice/packagekit.service                 2521      1         SLEEPING   0.00%    0.00%
element-desktop       /...1.service/app-flatpak-im.riot.Riot-54267.scope 54331   54283     SLEEPING   0.80%    0.60%
Web Content           /...e/gnome-launched-firefox.desktop-2046603.scope 2048129 2046603   SLEEPING   2.80%    2.80%
WebExtensions         /...e/gnome-launched-firefox.desktop-2046603.scope 2046806 2046603   SLEEPING   0.20%    0.20%
Web Content           /...e/gnome-launched-firefox.desktop-2046603.scope 2048242 2046603   SLEEPING   0.00%    0.00%
Web Content           /...e/gnome-launched-firefox.desktop-2046603.scope 2046781 2046603   SLEEPING   0.20%    0.20%
Web Content           /...e/gnome-launched-firefox.desktop-2046603.scope 2048300 2046603   RUNNING    98.40%   58.20%
dropbox               /...vice/gnome-launched-dropbox.desktop-4266.scope 3728781 3307      SLEEPING   0.20%    0.20%
Web Content           /...e/gnome-launched-firefox.desktop-2046603.scope 2057416 2046603   SLEEPING   0.20%    0.20%
Web Content           /...e/gnome-launched-firefox.desktop-2046603.scope 2644171 2046603   SLEEPING   0.00%    0.00%
gnome-software        /...ched-gnome-software-service.desktop-4252.scope 4252   3596      SLEEPING   0.00%    0.00%
gnome-shell           /.../user@1001.service/gnome-shell-wayland.service 3631   3307      SLEEPING   0.00%    0.00%
Web Content           /...e/gnome-launched-firefox.desktop-2046603.scope 2787743 2046603   SLEEPING   0.00%    0.00%
systemd-journal       /hostcritical.slice/systemd-journald.service     1529      1         SLEEPING   0.00%    0.00%
Privileged Cont       /...e/gnome-launched-firefox.desktop-2046603.scope 2046970 2046603   SLEEPING   0.00%    0.00%
systemd               /init.scope                                      1         0         SLEEPING   0.00%    0.00%
alacritty             /...d-home-dlxu-.cargo-bin-alacritty-4131527.scope 4131527 3307      SLEEPING   0.00%    0.00%
gnome-control-c       /...ched-gnome-network-panel.desktop-2954586.scope 2954586 3631      SLEEPING   0.00%    0.00%
podman                /system.slice/below.service                      4137616   1         SLEEPING   0.00%    0.00%
gsd-media-keys        /...slice/user@1001.service/gsd-media-keys.service 4129    3307      SLEEPING   0.00%    0.00%
element-desktop       /...1.service/app-flatpak-im.riot.Riot-54148.scope 54250   54249     SLEEPING   0.20%    0.20%
element-desktop       /...1.service/app-flatpak-im.riot.Riot-54148.scope 54310   54263     SLEEPING   0.00%    0.00%

/usr/lib64/firefox/firefox -contentproc -childID 9 -isForBrowser -prefsLen 5839 -prefMapSize 252334 -parentBuildID 20210422145831 -appd
r /usr/lib64/firefox/browser 2046603 true tab
```

Process view

Comparison

	Terminal interface	Host level stats	cgroup support	Record/replay	Scriptable	Web interface
atop	Yes	Yes	No	Yes	Yes	No
cAdvisor	No	No	cgroup1 only	Yes	Yes	Yes
htop	Yes	Yes	No	No	No	No
below	Yes	Yes	cgroup2 only	Yes	Yes	No

By no means complete!

Demo

Thanks bye

Repository:

https://github.com/facebookincubator/resctl