Tracing in the Real World

Julien Desfossez <julien.desfossez@polymtl.ca>

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Tracing

- Monitor and record operations of a system
- Pretty much like logging for the entire OS
- Sysadmins love logs
- Why only (some) developers use tracing?
Debugging for developers

- Developers work in their own environment
- Developers can take time to understand why a problem is happening
- Developers don't necessarily care about the efficiency of the tracer (printf, strace)... they should, but that's another story...
Debugging for sysadmins

- Sysadmins like text log files
- Sysadmins like console tools
- Sysadmins work remotely
- Sysadmins work on production systems
- Sysadmins work under pressure
Solving problems as a sysadmin

- Easy:
  - Most of load related problems can be found with `top`, `vmstat`, `iotop`, `tcpdump`, etc.

- Hard:
  - What about problems happening “sometimes”?
  - How do you fix a “the server feels slow” symptom when nothing is obvious?
Can non-kernel developers use kernel tracing?

- Kernel level tracers give a lot of useful information
- Most of the time it is too detailed when you don't want to read the kernel source code
- Most of the time it is too much for a production environment
- Need for an external tool to analyse the recorded data
- Too many tracers doing different but complementary things in their own format, how do you choose?
What is LTTng?

- Highly efficient full system tracing solution
- Kernel and Userspace tracing
- Tools to analyse offline and live traces
- Trace streaming infrastructure
- Unified trace format
- GPLv2, LGPLv2.1 and MIT licensed
- Tested on x86, x86_64, PPC, ARM, Sparc
- But: used to be hard to use, needed to patch the kernel, complex GUI to read traces with nanoseconds accuracy
Introducing LTTng 2.0

• Same purpose as LTTng but:
  • Generic file format (Common Trace Format)
  • Module based (for 2.6.35+)
  • Secure and unified control tools (lttng-tools)
  • Easy to install on Ubuntu, Debian, Fedora and others (without reboot !)
• Tracing group
• Currently 2.0 pre-8, final 2.0 really soon
LTTng 2.0 kernel data sources

- Tracepoints
- Function tracer (aka ftrace)
- CPU Performance Monitoring Unit counters (aka perf)
- Kprobes
- Kretprobes
Installation on Ubuntu

apt-add-repository ppa:lttng
apt-get install lttng-modules-dkms lttng-tools babeltrace
Record a trace

# lttng create mysession
# lttng enable-event -k -a
# lttng add-context -k -t pid -t comm -t tid -t ppid
# lttng start
...do stuff...
# lttng stop
# lttng destroy
# babeltrace -n /path/to/trace
Introducing lttnngtop

- A top-like application to read traces
- Ncurses
- GPLv2
- Browse through recorded traces
- Display various statistics
- Demo
Solving “weird” sysadmin problems with common tools

- “Sometimes at random time the server slows down”
  - `while true; do d=$(date +%s); uptime > log-$d; vmstat 2 5 >> log-$d; ps aux >> log-$d; sleep 10; done`
- Log files
- Cacti, nagios, munin, ganglia, collectd...
Solving “weird” sysadmin problems with tracing

• Sometimes at random time the server “slows down”
  • Record as much information possible
  • Make sure the tracing itself does not impact the server too much
  • Wait the amount of time necessary until the problem reappears
  • Play back the interesting part of the trace
Using performance counters to solve Real World problems

- I have a server that does a lot of disk I/O and runs my Apache server, it is just a simple HTML site, it should be in cache and the disk activity should not have an impact on it right?
Live tracing?

• Early beta demo?
Tracing in the Real World

- Kernel tracing is not limited to kernel developers.
- System administrators can benefit from this amount of information if it is presented in a useful way.
- For solving complex problems, we can benefit from this information to track the problem back to kernel bug:
  - To get precise statistics, use the performance counter on the event you suspect.
  - Once you know where the problem is happening, use the function tracer to identify the culprit.
  - Once you know which function is posing the problem, use kprobe to identify which instruction is problematic.
Tracing in the Real World: tracing for end users?

- Replace polling by tracing:
  - Wakeup when trace data is available
  - Read and process buffers directly in memory, absolutely no I/O
- Example applications:
  - Various load monitoring applet score really high in CPU wakeup (look at powertop) and generate a lot of I/O
  - Monitoring on embedded devices (Linux based smartphones...
Informations

- LTTng: http://lttng.org/lttng2.0
- lttngetop: http://git.dorsal.polymtl.ca/?p=lttngetop.git;a=summary