Real Time BoF ELC 2012

This session provides a forum to discuss Real Time Linux, share how you are using it, and learn from the experiences of others.

Please come prepared to discuss your experiences with and hear about:
- fields of use (for example: stock market, audio, robotics, industrial automation, consumer products)
- what works well
- what needs to improve
- what is missing and needs to be implemented
- experiences using real time, both successes and failures
- where the future Preempt RT patchset is heading
- status of mainlining, what is left to mainline
- possible future areas of development such as scheduler improvements, a deadline scheduler, resource allocation
- benchmarking tools and techniques
- performance measurement tools and techniques
- any other topic of interest to the attendees

Frank Rowand, Sony Network Entertainment
Birds of a Feather (computing)

In computing, BoF (Birds of a Feather) can refer to:

A BoF session, an informal meet-up at conferences, where the attendees group together based on a shared interest and carry out discussions without any pre-planned agenda.

Session Format

I would like for this to be an interactive session.

I would prefer to listen to other people talk.

But if no one else wants to talk, I can.....
What to talk about

PREEMPT_RT patch size
Current PREEMPT_RT Versions
Stable Tree
What events are coming up?
Lightning talks
Who are we? How are we using RT Linux?
Various RT Features
How can you contribute?
Contents of RT patches

*******  What Else?  *******
PREEMPT_RT Patch Size

The recent trajectory

- Number of files modified
- Number of lines added
- Number of lines deleted

For example:

2.6.15-rt21            806      27449    9372
green: files

from 2.6.15–rt21 to 3.2.5–rt12
green: files  pink: deletions  blue: insertions

from 2.6.15–rt21 to 3.2.5–rt12
green: files
EXCLUDE: 2.6.29.*

from 2.6.15–rt21 to 3.2.5–rt12
green: files  pink: deletions  blue: insertions
EXCLUDE: 2.6.29.*
## PREEMPT_RT Patch Size

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Contents of 3.2.5 RT Patches

# UPSTREAM changes queued for 3.2 or in 3.1
2 patches

# Stuff broken upstream, patches submitted
1 patch

# Stuff which needs addressing upstream, but requires
# more information
1 patch

# Submitted on LKML, mips ML, ARM ML, ppc-devel
8 patches
Contents of 3.2.5 RT Patches

# Pending in peterz's scheduler queue
2 patches

# Stuff which should go upstream ASAP
49 patches

# Stuff which should go mainline, but wants some care
4 patches

# REAL RT STUFF starts here
182 patches
Current PREEMPT_RT Versions

OSADL latest stable: 2.6.33.7.2-rt30
    https://www.osadl.org/Latest-Stable-Realtime.latest-stable-realtime-linux.0.html

    Paul Gortmaker created a broken out version
    http://marc.info/?l=linux-rt-users&m=129588844818236&w=2

    2.6.34.8     from Paul (_not_ stable, best effort)

    3.0.20-rt36   stable, from Steve Rostedt

    3.2.5-rt12    top of tree from Thomas Gleixner
Stable Tree

Maintained by Steve Rostedt

Same type of policy as the Greg KH stable trees
- Fixes only (no new features)
- Patch must first be in one of:
  - more recent tglx RT_PREEMPT patch
  - Linux mainline
  - Linux stable

To nominate a patch for stable:
Cc: stable-rt@vger.kernel.org
Stable Tree

Typical release cycle is a multi-stage process

1. Move existing RT patches to a new Greg KH stable version [ release ]
2.a Add additional RT fix patches [ -rc ]
2.b Add additional RT fix patches [ release ]

All announced on lkml and linux-rt-users
Stable Tree

Patches can be downloaded from
ftp://www.kernel.org/pub/linux/kernel/projects/rt/3.0/

Split out patches (quilt model) through 3.0.14-rt31.
Unified patch for all versions.

Maintained in a git repository
- Most recent description:
  https://lkml.org/lkml/2012/1/24/222
Stable Tree git Repository

git://git.kernel.org/pub/scm/linux/kernel/git/rt/linux-stable-rt.git

v3.0-rt branch

- will never rebase
- should be what users develop git repositories with
Stable Tree git Repository

v3.0-rt-rebase branch

- will rebase at every -rt version
- should *not* be used by other developmental git repositories.
- will allow pulling out the commits that will apply to the stable tree

At each version, the rebase branch will be tagged with a "-rebase" name after it.
Stable Tree git Repository Tags

- v3.0.10-rt27
- v3.0.10-rt27-rebase
- v3.0.11-rt28
- v3.0.11-rt28-rebase
- v3.0.12-rt29
- v3.0.12-rt29-rebase
- v3.0.12-rt30
- v3.0.12-rt30-rebase
- v3.0.14-rt31
- v3.0.14-rt31-rebase
- v3.0.14-rt32
- v3.0.14-rt32-rebase
- v3.0.17-rt33
- v3.0.17-rt33-rebase

- v3.0.18-rt34
- v3.0.20-rt35
- v3.0.20-rt35-rebase
- v3.0.20-rt36
- v3.0.20-rt36-rebase
Stable Tree git Repository

“IMPORTANT NOTE: The rebase branch and tags are very low priority.
If it becomes too time consuming to maintain, I *will* stop adding them.
They will be created when I have time to do so.
This rebase branch is a convenience for people that may want it.
It may be discontinued at any time without notice!”
## Stable Tree 3.0.x History

**DELTA:** patches, files, insertions, deletions

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What events are coming up?

14th real time linux workshop
   October 18 - 20, 2012
   University of North Carolina at Chapel Hill

Linux Kernel Summit, LinuxCon North America, Linux Plumbers Conference
   August 27 - 29, August 29 - 31

LinuxCon Europe / Embedded Linux Conference Europe
   November 5 - 7
Lightning Talks

Random current RT topics of interest...

Who are we?

How are we using RT Linux?

How would we like to use RT?

What is missing or needs to improve?

What works well already?
Various RT Features
Deadline Scheduler

Juri Lelli has taken over from Dario:

> Is there any news on the possible integration of the EDF scheduling class (SCHED_DEADLINE) in the RT branch?

Cannot speak about "the integration" :-P, but I can tell you that I'm currently taking over Dario's work (he has a new job now, and I started working at his previous lab), even if he remains behind the scenes.

We focused on the RT branch (3.2-rc1-rtx) for the next release and I'm quite close to post it (hope before the end of November).

http://marc.info/?l=linux-rt-users&m=132135121824549&w=2
CPU Isolation

[git pull] CPU isolation extensions
From: Max Krasnyansky
https://lkml.org/lkml/2008/2/7/1

Linus, please pull CPU isolation extensions from ...

The patchset consist of 4 patches.
- Make cpu isolation configurable and export isolated map
- Do not route IRQs to the CPUs isolated at boot
- Do not schedule workqueues on the isolated CPUs
- Do not halt isolated CPUs with Stop Machine
CPU Isolation - In Progress

[PATCH v7 0/8] Reduce cross CPU IPI interference
From: Gilad Ben-Yossef
https://lkml.org/lkml/2012/1/8/109
https://lkml.org/lkml/2012/1/26/70
CPU Isolation - In Progress

From: Frederic Weisbecker

[RFC PATCH 00/32] Nohz cpusets (was: Nohz Tasks)
https://lkml.org/lkml/2011/8/15/245

Status of Nohz cpusets (adaptive tickless kernel) for January 2012
https://lkml.org/lkml/2012/1/17/486

May include tick avoidance when there is a single userland process running.

https://tglx.de/~fweisbec/TODO-nohz-cpusets
CPU Isolation

One further suggestion for moving solutions forward:

- create a partition using cpuset
- run a while(1); userspace in it, and trace the thing
- Work up patches that remove all useless permutations
Real-Time virtualisation

Real-Time Linux Failure
Frank Rowand
From ELC 2010

Using KVM as a Real-Time Hypervisor
Jan Kiszka
From KVM Forum 2011
Xenomai / ipipe vs. PREEMPT_RT

???
Tools:
What has changed since ELC 2008 BoF?

ftrace, KernelShark
perf
cyclictest enhancements
lpptest no longer in RT patch set
RealFeel-ETRI
  Jung: ELC 2010 Measuring Responsiveness ...
Woerner test (serial port interrupt latency test)
  web site gone
Senoner test (audio)
What has not changed?

LRTB
Hourglass
Other Topics?
How can you contribute?

OSADL.org

mainline RT_PREEMPT

test new RT releases

rt.wiki.kernel.org

elinux.org
  http://elinux.org/Real_Time
  http://elinux.org/Realtime_Testing_Best_Practices

linux-rt-users
  http://vger.kernel.org/vger-lists.html#linux-rt-users
And yeah, I still think the hard-RT people are mostly crazy.

So I can work with crazy people, that's not the problem. They just need to _sell_ their crazy stuff to me using non-crazy arguments, and in small and well-defined pieces. When I ask for killer features, I want them to lull me into a safe and cozy world where the stuff they are pushing is actually useful to mainline people _first_.

In other words, every new crazy feature should be hidden in a nice solid "Trojan Horse" gift: something that looks _obviously_ good at first sight.
Resources

Status of Preempt-RT and why there is no roadmap
Thomas Gleixner, ELC 2011
https://lwn.net/Articles/440064/

Trojan Horses
http://lkml.indiana.edu/hypermail/linux/kernel/1001.3/00384.html
http://lkml.indiana.edu/hypermail/linux/kernel/1001.3/00389.html

14th Real Time Linux Workshop 2012
https://www.osadl.org/RTLWS-2012.rtlws-2012.0.html
Resources

Using KSM as a Real-Time Hypervisor
Jan Kiszka, KVM Forum 2011
http://www.linux-kvm.org/wiki/images/0/03/
KVM-Forum-2011-RT-KVM.pdf

Real Time Wiki
https://rt.wiki.kernel.org

Embedded Linux Wiki
http://elinux.org

Open Source Automation Development Lab
http://www.osadl.org/
How to get a copy of the slides

1) leave a business card with me
2) frank.rowand@am.sony.com