RT_PREEMPT Patch Installation

- It is assumed that you have already installed Xubuntu on your PC and connected to the internet. Additionally, SAFE-BOOT option must be disabled in your BIOS settings.
- If you want to install Xenomai patch you can check:
    - https://github.com/veysiadn/xenomai-install
- Before starting to build, we need to install several libraries and packages to be able to compile kernel. Run commands below in your terminal (WIN+T) to get required libraries for building/installation.

```
sudo apt-get update

sudo apt-get install git build-essential automake autoconf libtool pkg-config cmake linux-source bc kmod cpio flex -y

sudo apt-get install intltool autoconf-archive libpcre3-dev libglib2.0-dev libgtk-3-dev libxml2-utils zstd dwarves -y

sudo apt-get install libnuma-dev libssl-dev libtool libncurses5 libncurses5-dev autogen libudev-dev libelf-dev stress -y

sudo apt-get install kernel-package fakeroot zlib1g-dev bin86 g++ bison -y
```

- Now that you installed all required packages and libraries, we can download the kernel and RT patch sources, as a good practice download all sources into one folder.
- Note: I chose kernel version 5.9.1 and the corresponding RT patch in this guide document. If you want to download a different version, you can download it from:
    - https://mirrors.edge.kernel.org/pub/linux/kernel/
    - https://mirrors.edge.kernel.org/pub/linux/kernel/projects/rt/
    - Keep in mind that you'll have to download same version of RT patch with kernel version.

```
mkdir sources
cd sources
wget https://mirrors.edge.kernel.org/pub/linux/kernel/v5.x/linux-5.9.1.tar.xz
wget https://mirrors.edge.kernel.org/pub/linux/kernel/projects/rt/5.9/patch-5.9.1-rt20.patch.xz
xz -cd linux-5.9.1.tar.xz | tar xvf -
cd linux-5.9.1
xzcat ../patch-5.9.1-rt20.patch.xz | patch -p1
sudo mv ../linux-5.9.1 /usr/src/ -f
cd /usr/src/linux-5.9.1
sudo make  menuconfig
```

- In menu that will show up, we select:
  General Setup -> Preemption Model -> Fully Preemptible Kernel (RT).
  Processor Type and Features->Timer Frequency->1000Hz

There are more configurations that will improve real-time performance, but the options above will be sufficient for now.
After you finished the configuration press ESC to exit from the configuration and save the configuration:

Once you see the terminal again type:
sudo nano .config

In nano editor find CONFIG_SYSTEM_TRUSTED_KEYS option by pressing CTRL+W for search. And delete parts inside quotation marks. After deletion it should be like this:
CONFIG_SYSTEM_TRUSTED_KEYS=""
Then press CTRL+X and Y and Enter to save the modified config file. After that, we're ready to compile RT patched kernel source. The next step will take a long time, so I recommend you grab a coffee 😊.
sudo -s
make -j4
make && make modules && make modules_install && make install
reboot

Just make sure there is no error during the make and install process. If you face any error during, the make process, just read the error carefully, probably the solution will be in the explanation of the error.
After reboot, if you see the GRUB screen, select Advanced Options for Ubuntu, and select compiled RT kernel version to start.
Once you logged in open the terminal (Win+T) and type:
uname -r
If you see RT patched kernel version, your implementation is successful.
If you don't see the GRUB screen you might need to change the grub file by :
sudo nano /etc/default/grub
Change these two parameters like below, save and exit. (CTRL+X and Y and Enter)
GRUB_TIMEOUT_STYLE =menu
GRUB_TIMEOUT =10
sudo update-grub
sudo reboot
After reboot, you must see the GRUB screen, select Advanced Options for Ubuntu, and select compiled RT kernel version to start.
Note: If your system doesn't start after building check this thread and apply the solution below: https://stackoverflow.com/questions/51669724/install-rt-linux-patch-for-ubuntu

Restart your computer and start with a non-rt kernel. Open your terminal:

Step 1 - Strip the kernel modules

cd /lib/modules/5.9.1-rt20
sudo find . -name *.ko -exec strip --strip-unneeded {} +

Step 2 - Change the initramfs compression

sudo nano /etc/initramfs-tools/initramfs.conf

find the COMPRESS option and change it to xz, after changing, it should be like below:

COMPRESS=xz

save and exit (CTRL+X and Y and Enter).

Step 3 - Update initramfs

```
sudo update-initramfs -u -k 5.9.1-rt20
sudo update-grub2
sudo reboot
```

After reboot, you must see the GRUB screen, select Advanced Options for Ubuntu, and select compiled RT kernel version to start.
Once you logged in open the terminal (Win+T) and type:
uname -r
If you see RT patched kernel version, your implementation is successful.

Additionally, if you face any issues during building/installation you can e-mail: veysi.adin@kist.re.kr
or you can directly come to L8522.
Good Luck ^^.