RT_PREEMPT Patch Installation

- It is assumed that you have already installed Xubuntu to your PC and connected to the internet.
- 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 -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 kernel and RT patch source, as a good practice download all sources into one folder.
- Note: In this guide document, I chose kernel version 5.9.1 and corresponding RT patch. If you want to download 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 for now, options above will be sufficient.

After you finished configuration press ESC to exit from configuration and save configuration:
Once you see 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 modified config file. After this we're ready to compile RT patched kernel source. Next step will take quite 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 make and install process. If you face any error during make process, just read the error carefully, probably the solution will be in the explanation of the error.
After reboot, if you see 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.

Note: If your system doesn't start after building check this thread and apply solution below:
https://stackoverflow.com/questions/51669724/install-rt-linux-patch-for-ubuntu

After installing the new kernel, I got into a kernel panic. The problem was that the initrd image was too big. I solved that with:

Restart your computer start with 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 COMPRESS option and change it to xz, after change 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
```

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