RealSense Linux Computer Guide

NOTE: A docker container should be considered to hold the linux environment.

System Requirements

- See single_board_computer_research for info on CPU/RAM requirements
    - NOTE: Due to the USB 3.0 translation layer between native hardware and virtual machine, the Intel RealSense SDK 2.0 does not support installation in a virtual machine (VM). If a VM is required, Intel recommends using VMware Workstation Player, and not Oracle VirtualBox for proper emulation of the USB3 controller.
- See realsense_to_NUC_connection for practical considerations about assembling a multi-camera RealSense depth camera system
- ROS and ROS2 supported distributions are detailed in Intel's documentation https://dev.intelrealsense.com/docs/ros-wrapper
    - The specific ROS/ROS2 distribution must be matched to the correct Ubuntu Linux release
        - E.G. ROS2 distribution 'Foxy Fitzroy' must be matched to Ubuntu 20.04 Focal (or a sub-version e.g. 20.04.5)
    - For more information about matching the correct Linux kernel to the specific Intel Realsense SDK 2.0 version see [further down].
- The Intel RealSense SDK 2.0 (librealsense) is available on GitHub https://github.com/IntelRealSense/librealsense
    - For info on recent versions (including linux release/kernel compatibility and ros wrapper (realsense-ros) compatibility) see here: https://github.com/IntelRealSense/librealsense/releases
- The ROS/ROS2 wrapper is available on GitHub https://github.com/IntelRealSense/realsense-ros
    - The specific ROS/ROS2 wrapper must be matched to the correct librealsense version
        - E.G. ROS2-Beta wrapper build 4.51.1 must be matched to Intel RealSense SDK 2.0 (librealsense) v2.51.1

Installation of ROS/ROS2 Distribution

- Confirm ROS/ROS2 compatibility with Ubuntu Linux release. See here: https://dev.intelrealsense.com/docs/ros-wrapper
- Confirm ROS/ROS2 compatibility with ROS/ROS2 wrapper (realsense-ros). See the 'Supported ROS Distributions' section of the latest (or desired) realsense-ros release here: https://github.com/IntelRealSense/realsense-ros/releases

- Confirm ROS/ROS2 wrapper (realsense-ros) compatibility with Intel RealSense camera model. See the 'Supported Devices' section of the latest (or desired) realsense-ros release here: https://github.com/IntelRealSense/realsense-ros/releases
- Open ROS documentation and installation instructions here: https://docs.ros.org/
    - Select the chosen ROS/ROS2 distribution
    - Find the installation instructions
        - E.G. the installation instructions for ROS2 Foxy Fitzroy are found here: https://docs.ros.org/en/foxy/Installation/Ubuntu-Install-Debians.html
    - Open a base terminal in Ubuntu Linux and follow the installation instructions
- Information about configuring environments is found in the 'Configuring Environments' tutorial here: https://docs.ros.org/en/foxy/Tutorials/Beginner-CLI-Tools/Configuring-ROS2-Environment.html
    - NOTE: For access to ROS/ROS2 commands, every shell (terminal) must be sourced. This is covered in the 'Configuring Environment' tutorial
        - E.G. for ROS2 Foxy Fitzroy the source command is "source /opt/ros/foxy/setup.bash"
- Information about using colcon to build packages (used when installing ROS/ROS2 wrapper) is found here: https://docs.ros.org/en/foxy/Tutorials/Beginner-Client-Libraries/Colcon-Tutorial.html#
- Information about ROS/ROS workspaces is found here: https://docs.ros.org/en/foxy/Tutorials/Beginner-Client-Libraries/Creating-A-Workspace/Creating-A-Workspace.html

Installation of Intel RealSense SDK 2.0 (librealsense)

- Confirm compatibility of librealsense version and Ubuntu Linux version/kernel
    - Check Linux kernel version by opening a base terminal and entering the command: uname -r
    - Information about the latest librealsense releases is found here: https://github.com/IntelRealSense/librealsense/releases
        - Under the 'Supported Platforms' section of a release info block, is information about compatible Ubuntu Linux distributions and kernel versions
        - E.G. Intel RealSense SDK 2.0 (v2.51.1) is compatible with Ubuntu 18.04/20.04 LTS and is compatible with kernel versions 4.[4, 8,10,13,15], 4.16 , 4.18, 5.[0, 3, 4, 8].
            - Therefore a system running Ubuntu Linux 20.04.5 LTS (Focal Fossa) and kernel version 5.8.10 will be compatible with Intel RealSense SDK 2.0 v2.51.1

    - If the installed Ubuntu Linux release is not compatible with the desired librealsense version, install a compatible Ubuntu Linux release from here: https://www.releases.ubuntu.com/
        - Again, confirm compatibility between librealsense version and ROS/ROS2 wrapper (realsense-ros) version.
    - If the kernel version on the installed Ubuntu Linux is not compatible with the desired librealsense version, change the system's kernel version.
        - Instructions for changing the kernel version on Ubuntu 20.04/22.04 are found here: https://www.how2shout.com/linux/how-to-change-default-kernel-in-ubuntu-22-04-20-04-lts/
        - If issues with accessing the Grub menu at bootup occur (step 7 from the instructions above) try the following advice from here: https://askubuntu.com/questions/16042/how-to-get-to-the-grub-menu-at-boot-time
            - Menu will appear if you press and hold Shift during loading Grub, if you boot using BIOS. When your system boots using UEFI, press Esc.
            - For permanent change you'll need to edit your /etc/default/grub file:
            - Place a # symbol at the start of line GRUB_HIDDEN_TIMEOUT=0 to comment it out. If that line doesn't exist, then you can comment out this line instead: # GRUB_TIMEOUT_STYLE=hidden, and then change GRUB_TIMEOUT=0 to GRUB_TIMEOUT=5, for instance, to give the grub menu a 5 second timeout before it automatically logs you in.
            - Save changes and run sudo update-grub to apply changes.
            - Documentation: https://help.ubuntu.com/community/Grub2
- Confirm kernel version using: uname -r
- Install the desired librealsense version by following the instructions here: https://github.com/IntelRealSense/librealsense/blob/master/doc/installation.md
    - NOTE: In the "Prerequisites" section under subsection "Download/Clone librealsense github repository", download the correct librealsense version by adding '-b [version]' to the end of the 'git clone' command
        - E.G. to install librealsense v2.51.1, use the following command: git clone https://github.com/IntelRealSense/librealsense.git -b v2.51.1
    - NOTE: Make sure to not change the kernel version when following the instructions if the correct kernel version has already been set in the Ubuntu Linux system

Installation of ROS/ROS2 Wrapper (realsense-ros)

- Confirm ROS/ROS2 wrapper (realsense-ros) compatibility with Intel RealSense SDK 2.0 (librealsense). Information about the latest ROS/ROS2 wrapper (realsense-ros) versions is found here: https://github.com/IntelRealSense/realsense-ros/releases
    - Under the 'Supported RealSense SDK' section of a realsense-ros release info block is the supported librealsense version
- Again, confirm ROS/ROS2 distribution and RealSense camera model compatibility
- Install the ROS/ROS2 wrapper
    - For a ROS2 distribution, find the 'Installation Instructions' section and follow the instructions starting with 'Step 3: Install Intel Realsense ROS2 wrapper from sources" at the following link: https://github.com/IntelRealSense/realsense-ros
        - NOTE: when creating a ROS2 workspace, name the workspace something appropriate to the project
            - E.G. to create a workspace named 'glasswing_ws' us the following command: mkdir -p ~/glasswing_ws/src
        - NOTE: if having issues with 'Step 5: Build', refer to the installed ROS2 distribution's tutorial titled "Using colcon to build packages"
            - Find the installed version of ROS2 here: https://docs.ros.org/
            - Find "Tutorials"
            - Under "Beginner: Client libraries" find "Using colcon to build packages"
            - E.G. for ROS2 Foxy Fitzroy the tutorial is found here: https://docs.ros.org/en/foxy/Tutorials/Beginner-Client-Libraries/Colcon-Tutorial.html
    - For a ROS distribution follow similar instructions at the following link: https://github.com/IntelRealSense/realsense-ros/tree/ros1-legacy

Notes for Migration to ROS2 Humble Hawksbill on Intel NUCPAH11i5

- The Hesai Lidar ROS2 driver currently supports ROS2 Dashing
- An updated driver to support ROS2 Humble Hawksbill is expected to be released in the next few weeks (starting at 2/21/2023)
- ISSUE: Humble Hawksbill compatibility
    - Intel ROS/ROS2 wrapper (realsense-ros) v4.51.1 supports Humble Hawksbill
    - realsense-ros v4.51.1 (latest) only supports librealsense v2.51.1
    - librealsense v2.51.1 does **not** support Ubuntu Linux 22.04 (Jammy Jellyfish)
    - ROS2 Humble Hawksbill requires Ubuntu Linux 22.04 (Jammy Jellyfish)
- SOLUTION: The next release of realsense-ros should have support for librealsense v2.53.3 which does support Ubuntu Linux 22.04 (Jammy Jellyfish)

- ROS2 projects list: https://docs.ros.org/en/humble/Related-Projects/Intel-ROS2-Projects.html
    - Relationships among ROS/ROS2 projects
- ROS2 Intel Robot Dev Toolkit: https://intel.github.io/robot_devkit_doc/
-