

# Do You Need a Virtual Machine?

## ROS Installation Challenges and Concerns

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# Introduction

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The aim of this project was to identify some of the challenges faced installing ROS on Windows and macOS.



## ROS Noetic installation instructions

These instructions will install **ROS Noetic Ninjemys**, which is available for Ubuntu Focal (20.04), Debian Buster (10), and [other platform options](#).



To install our previous long-term support release, **ROS Melodic Morenia**, please see the [ROS Melodic installation instructions](#).

### Select Your Platform

**Supported:**

-  **Ubuntu** Focal amd64 armhf arm64
-  **Debian** Buster amd64 arm64
- [Source installation](#)

**Experimental:**

-  **Windows** 10 amd64
-  **Arch Linux** Any amd64 i686 arm armv6h armv7h aarch64

## ROS Kinetic installation instructions

These instructions will install the **ROS Kinetic Kame** distribution, which is available for Ubuntu Wily (15.10) and Ubuntu Xenial (16.04 LTS), among other platform options.


To install our previous release, **ROS Jade Turtle**, please see the [Jade installation instructions](#).

The previous long-term support release, **ROS Indigo Igloo**, is available for Ubuntu Trusty (14.04 LTS) and many other platforms. Please refer to the [Indigo installation instructions](#) if you need to use this version due to robot or platform compatibility reasons.





The links below contain instructions for installing **ROS Kinetic Kame** on various operating systems. You may also wish to look at robot-specific installation options instead.

### Select Your Platform


**Supported:**

-  **Ubuntu** Wily amd64 i386  
Xenial amd64 i386 armhf arm64
- [Source installation](#)

**Experimental:**

-  **OS X (Homebrew)**
-  **Gentoo**
-  **OpenEmbedded/Yocto**
-  **Debian** Jessie amd64 arm64

**Unofficial Installation Alternatives:**

-  **Single line install** A single line command to install ROS Kinetic on Ubuntu

### Or, Select your robot

**Robots:**  
See all robots supported here: [Robots](#)

# Main Contributions

- An examination of the issues that arise during installation of ROS on macOS and Windows resulting in seven categories.
- Identifying some shortcomings in official ROS installation documentation that hinder support for installation on non-Linux machines.
- An artifact of our original terminal output available on github.

# Methodology

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1. Create new user accounts on Windows 10 and macOS machines to have fresh installations with no prior configurations.
2. Follow ROS installation instructions for Noetic, Melodic, and Kinetic found on the official [ros.org](https://www.ros.org) website.
3. Document the issues through a log.
4. Use open coding to assign categories to the issues.

# Results: 7 Categories

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## Category 1: Dependency Issues

- Installing packages that have dependencies that fail to install
- MacOS: Melodic

```
ros-install-project@John-Pauls-MacBook-Pro ~ % sudo -H pip install -U wxPython
Collecting wxPython
  Downloading https://files.pythonhosted.org/packages/d9/33/b616c7ed4742be6e0d11ca375b4
100% |#####| 71.0MB 366kB/s
Complete output from command python setup.py egg_info:
Traceback (most recent call last):
  File "<string>", line 1, in <module>
  File "/private/tmp/pip-install-G4Cou8/wxPython/setup.py", line 27, in <module>
    from buildtools.config import Config, msg, opj, runcmd, canGetSOName, getSOName
  File "buildtools/config.py", line 30, in <module>
    from attrdict import AttrDict
ImportError: No module named attrdict

-----
Command "python setup.py egg_info" failed with error code 1 in /private/tmp/pip-install-
You are using pip version 18.1, however version 20.3.4 is available.
You should consider upgrading via the 'pip install --upgrade pip' command.
ros-install-project@John-Pauls-MacBook-Pro ~ %
```

## Category 2: Syntax Errors

- Syntax errors that stop the installation of a package
- MacOS: Melodic and Kinetic

```
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"/Library/Frameworks/Python.framework/Versions/2.7/Resources/Python.app/Contents/MacOS/Python" -u build.py build
File "build.py", line 885
  msg(f"CL.exe: {CL}")
  ^
SyntaxError: invalid syntax
Command "/Library/Frameworks/Python.framework/Versions/2.7/Resources/Python.app/Contents/MacOS/Python" -u build
-----
Command "/Library/Frameworks/Python.framework/Versions/2.7/Resources/Python.app/Contents/MacOS/Python -u -c 'import
te/tmp/pip-build-wVPDud/wxPython/setup.py';f=getattr(tokenize, 'open', open)(__file__);code=f.read().replace('\r\n',
'file_', exec'))" install --record /tmp/pip-BjFKR0-record/install-record.txt --single-version-externally-managed --c
/private/tmp/pip-build-wVPDud/wxPython/
You are using pip version 9.0.3, however version 23.0.1 is available.
You should consider upgrading via the 'pip install --upgrade pip' command.
```



## Category 3: Deprecated Packages

- Packages have been moved from their original location or do not exist anymore
- MacOS: Kinetic

```
ros-install-project-2@John-Pauls-MacBook-Pro ~ % brew tap homebrew/science
Running 'brew update --auto-update'...
==> Auto-updated Homebrew!
Updated 2 taps (osrf/simulation and homebrew/core).
==> New Formulae
meta-package-manager

You have 7 outdated formulae installed.

Error: homebrew/science was deprecated. This tap is now empty and all its contents were either deleted or migrated.
ros-install-project-2@John-Pauls-MacBook-Pro ~ %
```

## Category 4: SSL Library Issues

- SSL Library error, SSL module not available
- MacOS: Kinetic

```
ros-install-project-2@John-Pauls-MacBook-Pro ~ % sudo -H python3 -m pip install wxPython
Password:
WARNING: pip is configured with locations that require TLS/SSL, however the ssl module in Python is not available.
Requirement already satisfied: wxPython in /usr/local/lib/python3.11/site-packages (4.2.0)
Requirement already satisfied: pillow in /usr/local/lib/python3.11/site-packages (from wxPython) (9.4.0)
Requirement already satisfied: six in /usr/local/lib/python3.11/site-packages (from wxPython) (1.16.0)
Requirement already satisfied: numpy in /usr/local/lib/python3.11/site-packages (from wxPython) (1.24.2)
WARNING: Running pip as the 'root' user can result in broken permissions and conflicting behaviour with the system package manager. It is recommended to use a virtual environment instead: https://pip.pypa.io/warnings/venv
WARNING: pip is configured with locations that require TLS/SSL, however the ssl module in Python is not available.
Could not fetch URL https://pypi.org/simple/pip/: There was a problem confirming the ssl certificate: HTTPSPoolConnectionPool(host='pypi.org', port=443): Max retries exceeded with url: /simple/pip/ (Caused by SSLError("Can't connect to HTTPS URL because the SSL module is not available.")) - skipping
ros-install-project-2@John-Pauls-MacBook-Pro ~ %
```

## Category 5: DNE Install Guide

- ROS installation guide for the OS and ROS distribution does not exist
- MacOS: Noetic
- Windows: Kinetic

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### Select Your Platform

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 **Ubuntu** Focal amd64 armhf arm64

 **Debian** Buster amd64 arm64

[Source installation](#)

Experimental:

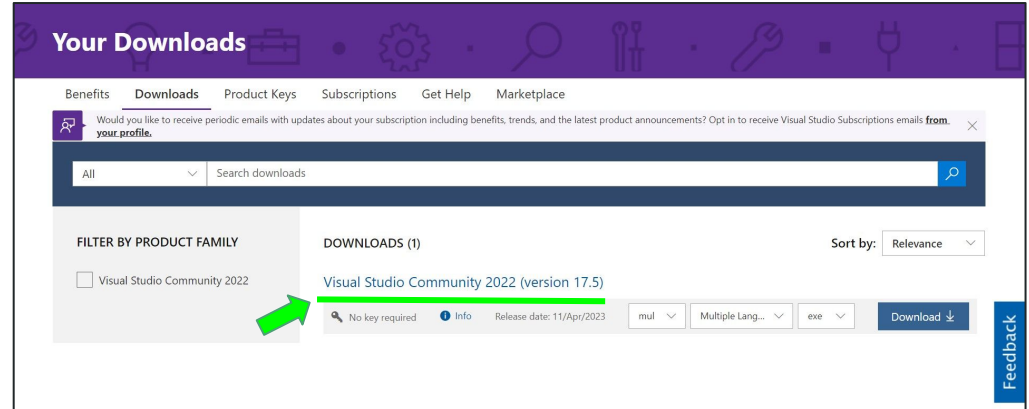
 **Windows** 10 amd64

 **Arch Linux** Any amd64 i686 arm armv6h armv7h aarch64

[1]

## Category 6: Software Install Issues

- Issues with installing software
- Windows: Noetic and Melodic

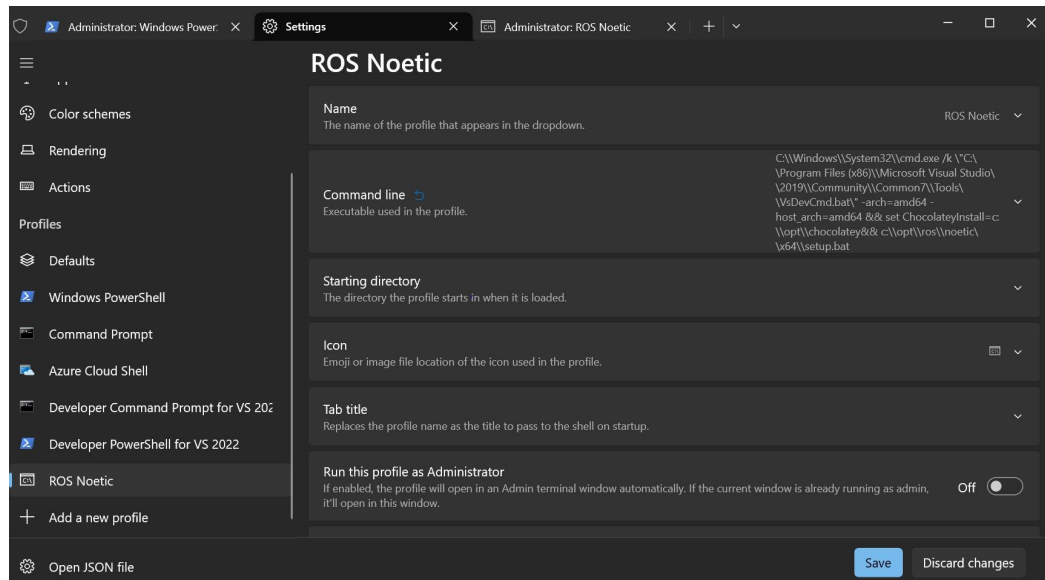


The screenshot shows the 'Your Downloads' page on the Visual Studio website. The page has a purple header with navigation links: Benefits, Downloads, Product Keys, Subscriptions, Get Help, and Marketplace. Below the header is a search bar and a filter section. The 'Downloads (1)' section shows a single entry: 'Visual Studio Community 2022 (version 17.5)'. A green arrow points to this entry. The entry details include 'No key required', 'Info', 'Release date: 11/Apr/2023', and file format options: 'mul', 'Multiple Lang...', and 'exe'. A 'Download' button is visible next to the entry. A 'Feedback' button is located at the bottom right of the page.

[2]

# Category 7: Custom Configuration Issues

- Issues with configuring custom settings
- Windows: Noetic and Melodic



# Aggregated Results

- Majority of issues in Category 1 and 6
- Each distro has about the same number of issues
- MacOS has a greater total number of issues
- MacOS has a greater range of issues

TABLE I.

Number of Issues Per Category						
<i>Category 1</i>	<i>Category 2</i>	<i>Category 3</i>	<i>Category 4</i>	<i>Category 5</i>	<i>Category 6</i>	<i>Category 7</i>
3	2	1	1	2	3	2

Fig. 4. Issues Per Category

TABLE II.

Number of Issues Per Distribution		
<i>Melodic: 5 Issues</i>	<i>Kinetic: 4 Issues</i>	<i>Noetic: 5 Issues</i>
C1, C2, C6	C2, C3, C4, C5	C5, C6, C7

Fig. 5. Issues Per Category

TABLE III.

Category Types Per OS	
<i>macOS: 8 Issues</i>	<i>Windows: 6 Issues</i>
C1, C2, C3, C4, C5	C5, C6, C7

Fig. 6. Issues Per Category

# Key Findings

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# Most and Least Ideal OS for ROS

- Ubuntu had the least issues - successful installation and ROS running
- Windows had a few issues - main issue is the compatibility of Visual Studios (2019 version requirement)
- macOS had the most issues - mainly with package installation issues in the terminal

# Conclusion

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# Lessons Learned

- As of now, virtual machines and docker are the best tools for a non-ideal computing environment
- Documenting installation processes is important
- Learning where to find support and advice for challenges faced during the process



# Closing Remarks and Future Research

- We ran installations of ROS on three different operating systems, documenting issues encountered during the process
- Future research suggestions:
  - How to improve installation instructions (updating outdated links, providing clearer instructions, etc.)
  - Better alternatives to using a virtual machine for ROS if using a non-ideal device
  - Try looking into other operating systems to see if similar issues persist

# References

- [1] <http://wiki.ros.org/noetic/Installation>
- [2] <https://visualstudio.microsoft.com/vs/older-downloads/>