



Overview

The CI Rainbow research project is a framework for establishing a wireless sensor network (WSN) supporting real-time and long-term environmental studies on Santa Rosa Island in the Channel Islands of California archipelago. The CI Rainbow system is an open framework designed to incorporate a variety of sensors into the system in a generalized manner. The sensor nodes are supported by an infrastructure utilizing communication links and protocols, database storage, and OAM&P. Access tools have been designed and deployed on an exploratory solar-powered self-sustainable WiMAX and WiFi network.

Motivation

With the rise in interest in big data and data mining, including data analytics and visualization tools in the CI Rainbow system will allow researchers to easily apply these techniques to all the data collected within the system.

Goals

- Our goals for this research project are the following:
- Provide capability to analyze data at their source without the need for transferring the data anywhere.
- Provide tools to visually explore the data.
- Enable private, secure, and customizable analytical environments.
- Allow for saving and restoring analytical sessions.
- Create and share analytical and visualization tools.

Future Work

- Develop notebooks to visualize and analyze the data in the system.
- Provide real world examples using the data already in the system and using the latest data mining techniques.

Implementation Components

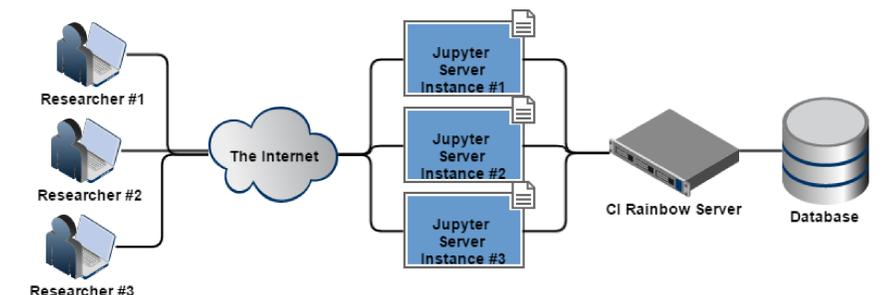
The project goals are achieved by incorporating the following systems together:

- **Jupyter Notebook**
 - These are interactive notebook kernels that spawn a server on the CI Rainbow data server and may be accessed through a web-based client.
- **Python Virtual Environments**
 - The virtual environments allow for researchers to use custom modules that need only be included in their research notebooks.
- **Python Scientific Modules**
 - The scientific modules: NumPy, SciPy, scikit-learn, matplotlib, and neurolab are automatically included.
- **CI Rainbow Web Application**
 - The web application provides user and group based policies to allow for researchers to create their own notebooks and share with others.

Python ENVs and Modules

Python virtual environments provide a solution for having different python environments for many users on the same system. Since all researchers will have different requirements, we utilize this python feature so researchers may:

- Use a custom version of Python.
- Install modules required to accomplish a task.



CI Rainbow Web Application

The web application brings all of the technologies together and allows for researchers to create **workspaces**.

- User requests Jupyter instance.
 - Web application launches jupyter server on a custom port.
 - A directory and virtual environment is created on the server for the user. This is referred to as the **users workspace**.
 - Jupyter client is presented to user on specified port.
- User requests data from CI Rainbow.
 - Data is collected and placed in users notebook directory for analysis.
- User requests to save/restore notebook.
 - The notebook is automatically saved in the users workspace.
 - When restoring the notebook, a new jupyter server is created and the users workspace directory is specified as the working directory.

Jupyter Notebook

Jupyter notebook is a web-based python notebook that provides an interactive environment for python code to be run and presented as a paper.

Each users notebook is a separate client-server application spawned on the CI Rainbow database server.

