Engaging Scholars in Cybersecurity Analysis: A Laboratory for Teaching and Education (ESCALATE)

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Challenges

- Cybersecurity training lacks real-world, data-driven experience
- Many cybersecurity programs focus on theories, best practices, and protocols
- Want to expose students to real network measurement data where students can distinguish baseline behavior from sophisticated attacks
- Requires:
  - cutting-edge data science techniques
  - skills in advanced cyberinfrastructure (CI)

Pain points

1. Scalability
2. Complexity

Pain points

1. Scalability
    - Real-world Internet infrastructure datasets are terabyte-scale
    - Often contain sensitive information unsuitable for transfer to personal devices
    - High compute and storage requirements limit access to well-resourced institutions

Pain points

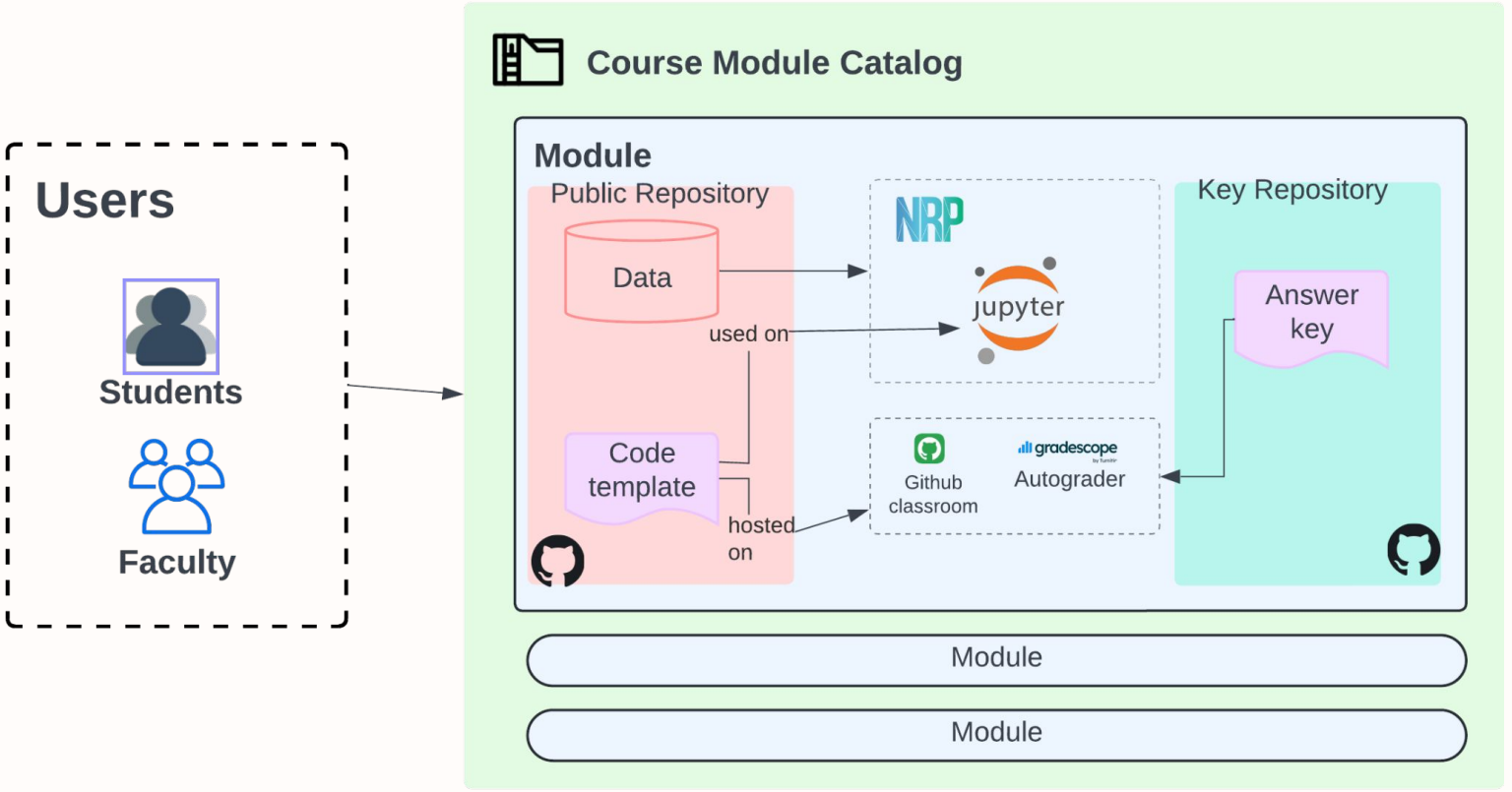
2. Complexity
    - Educators and researchers may lack skills to use advanced cyberinfrastructure (CI)
    - Steep learning curve discourages adoption of CI tools in courses and research
    - No centralized platform to find, share, or build on existing materials

Goals

- Lower the barrier to accessing teaching resources
- Teach internet research with latest tools & datasets
- Remove hardware limitations for data analysis

Our Solution

- **C2Hub (catalog)**: facilitate building, delivering, and sharing resources that support the distribution and analysis of large-scale datasets for educators, students, and researchers.


Users
Students
Faculty
Course Module Catalog
Module
Public Repository
Data
used on
Code template
hosted on
NRP
jupyter
Github classroom
gradescope
Autograder
Key Repository
Answer key
Module
Module

What is a module

- Learning modules (think: homework assignments) are 2 separate repos
  - **Assignment**
    - **Instructions**: Written document of instructions, learning goals and questions
    - **Template**: Jupyter notebook file with helper functions and cells for answers
  - **Answer key**
    - **Autograder**
    - **Completed assignment**

National Research Platform (NRP)

FEATURES

Accelerating Science and Education

Artificial Intelligence

The National Research Platform supports research, education, classes, and workshops, offering modern GPUs, FPGAs, and specialized hardware for advanced AI projects.

Learn more

Resources for Classroom

The NRP provides resources for educators to use in their classrooms, including GPUs, CPUs, and storage accessible through convenient interfaces like JupyterHub and Coder.

Learn more

Network Experiments

The NRP nodes are distributed around the world and allow experiments that are impossible on other clusters.

Learn more

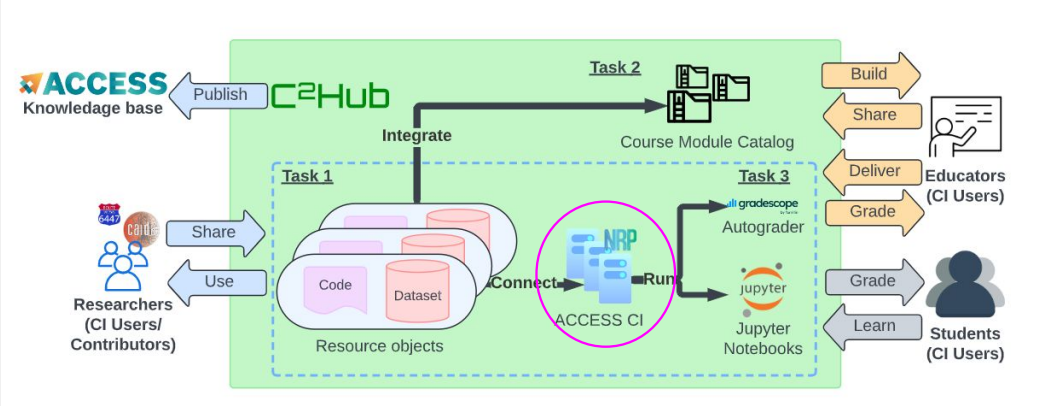
Large Data Pools

Mount your data across the world and use it in your experiments.

Learn how to use storage on the NRP

How are we using NRP

- JupyterHub: NRP hosted Jupyter notebooks
- Data hosting:
  - NRP Object storage



Faculty Workflow

- Find assignments on catalog (C2Hub)
- Github Classroom
  - Make edits to assignment / template (as needed)
  - Give to students
- NRP.ai
  - Make namespace + add students
- [after assignments are done]
  - Grade using key (in key repository)

Student Workflow

- “Accept” the assignment on Github
- Join the namespace on NRP.ai
  - Login using school credentials
- Work on assignment from **template** on JupyterHub on NRP
  - Note: Will need Github access token to clone via JupyterHub

Feedback

- What modules do people want?
  - Content wise
- What flows do folks want
- What concerns do people have

Planned Modules

1. Introduction to Internet infrastructure data science
2. Measuring and defending against IP address spoofing.
3. The business relationships that shape global Internet routing.
4. Threats to global Internet routing: mistakes and hijacks.
5. Active topology measurement with traceroute.
6. The promise and peril of the DNS.
7. TLS essentials: secure communication with public key infrastructure.
8. Distinguishing cybersecurity events from Internet background radiation.
9. Ethically measuring the Internet.

Thank you!