PARSL & FUNCX FEST 2022

ARGONNE PRIVACY-PRESERVING FEDERATED LEARNING WITH FUNCX

APPFL

funcX

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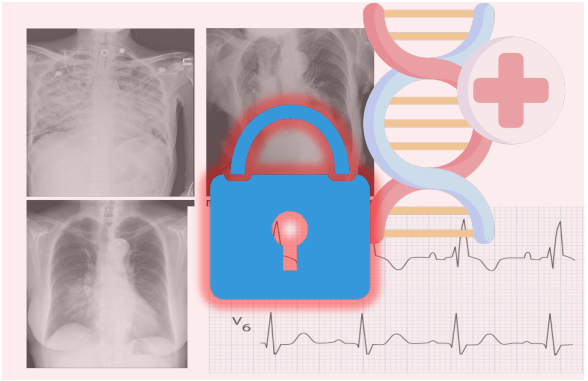
KEY MOTIVATIONS & OBJECTIVES

Data shift in Machine Learning

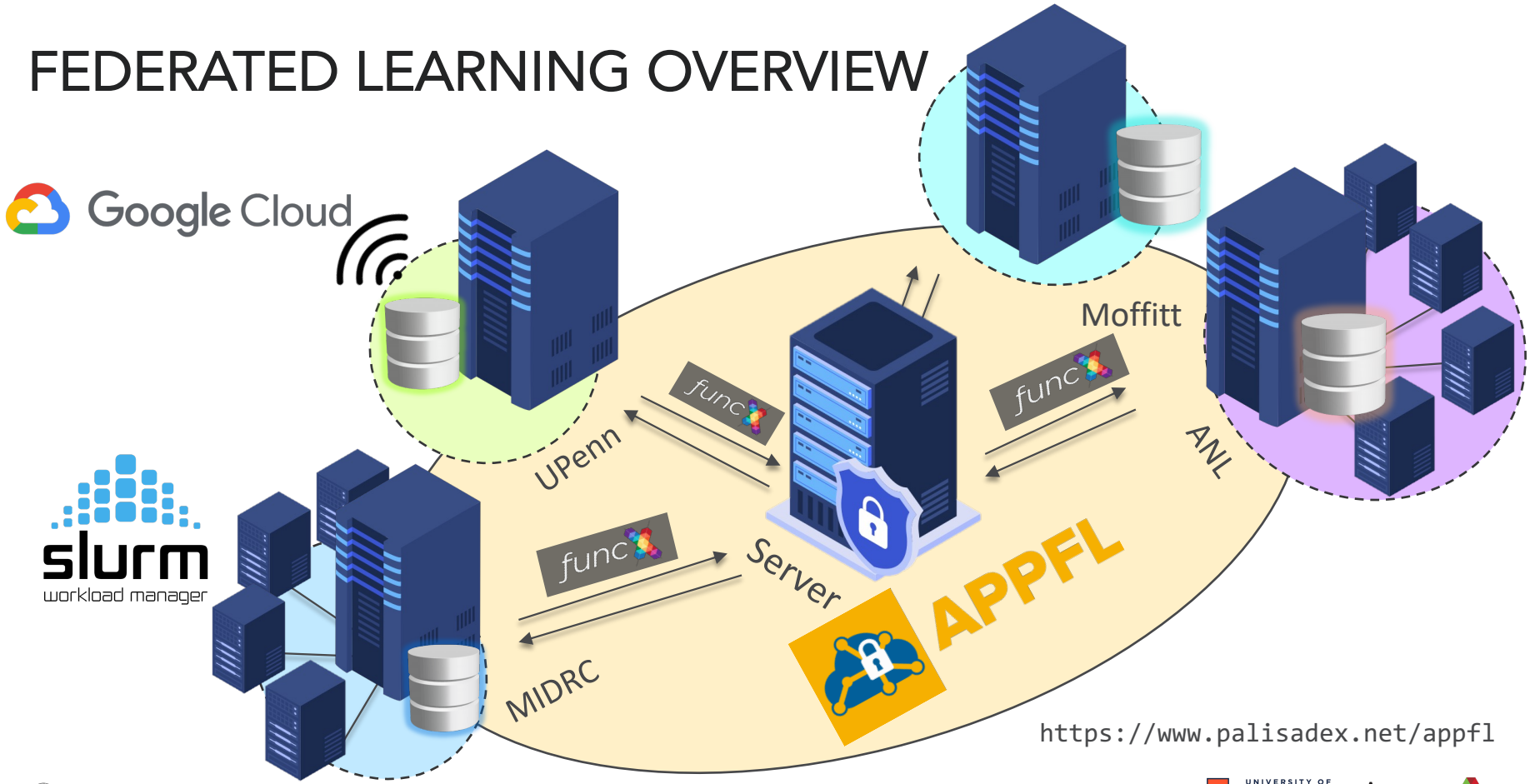


Policy concerns with Biomedicine Data

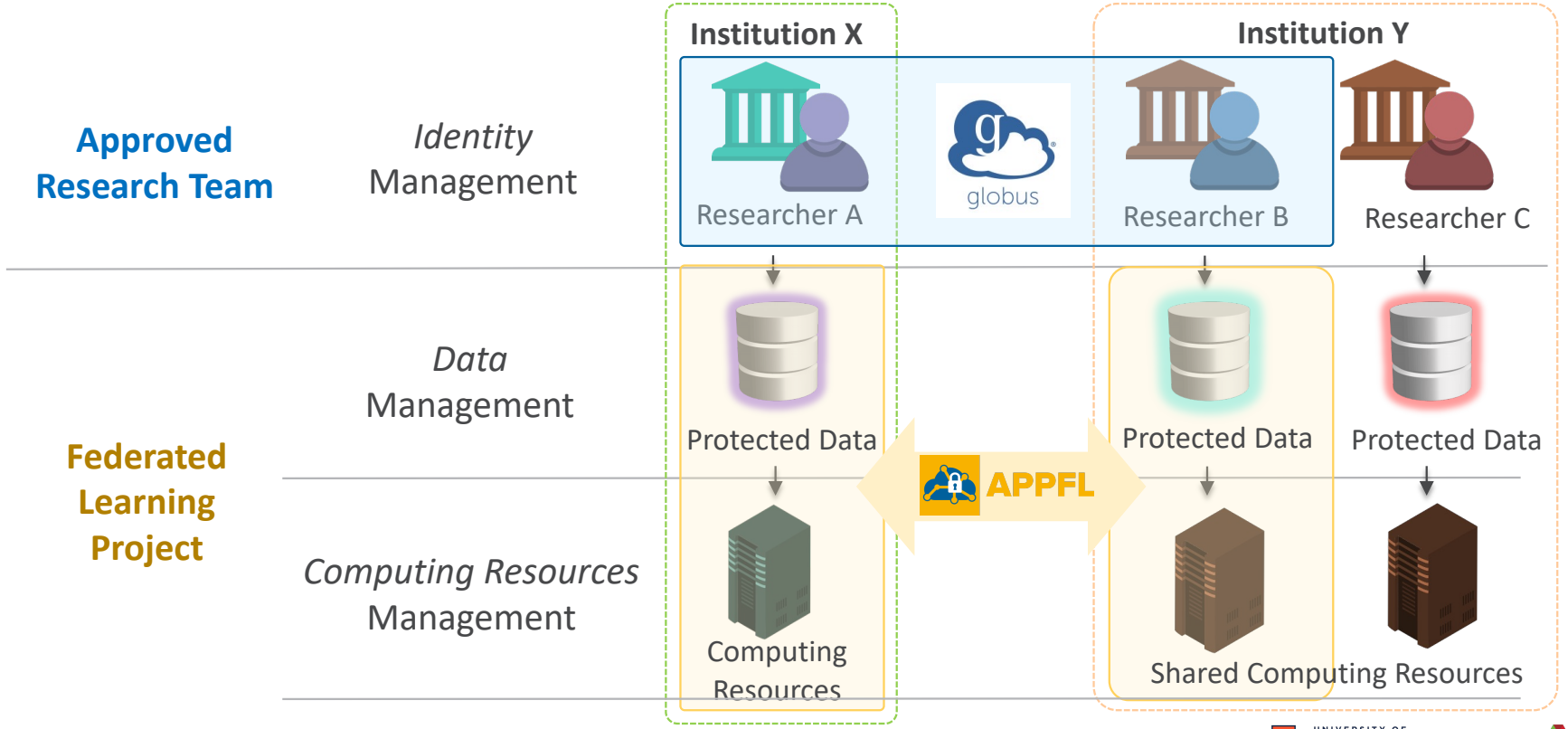
Key objectives

To develop and implement **APPFL (Argonne Privacy-Preserving Federated Learning)** framework that implements **Differential Privacy algorithms** for training **Federated Learning models** with the **biomedical datasets from multiple organizations**

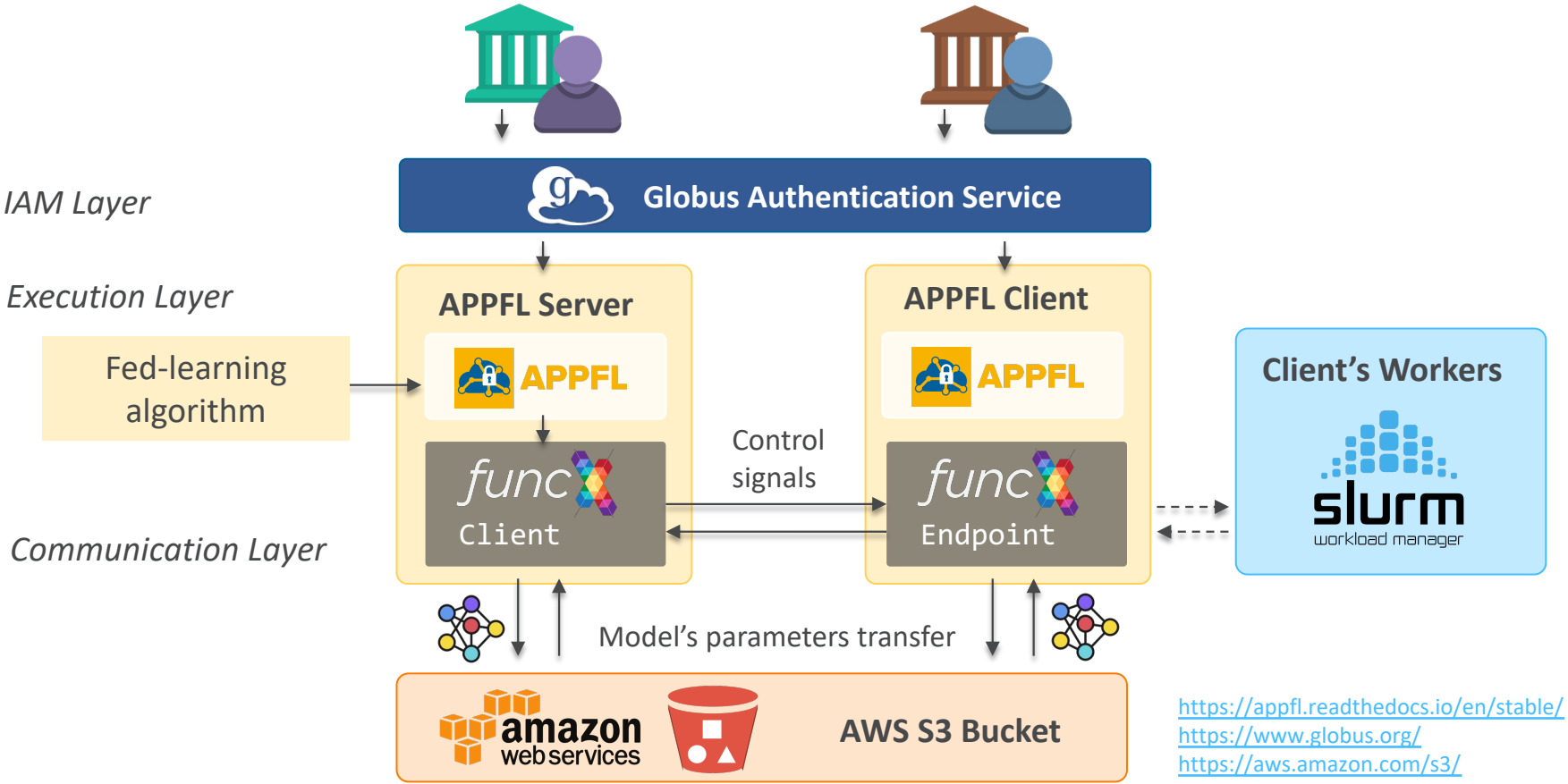
FEDERATED LEARNING OVERVIEW



FEDERATED LEARNING RESOURCES MANAGEMENT



KEY COMPONENTS



https://appfl.readthedocs.io/en/stable/
https://www.globus.org/
https://aws.amazon.com/s3/

SETTING UP AN EXPERIMENT

Users need to define the following files:

User-defined Model & Data-loader

`model.py` `dataloader.py`

Using PyTorch, as regular Python scripts

Client Configuration

`clients.yml`

Parameters, funcX-endpoint IDs and data loaders at all clients

Server Configuration

`server.yml`

Parameters, fed-learning algorithm at server

EXAMPLES – FUNCX TASK EXECUTION LOG

timestamp	task_name	client_name	status	execution_time
8/16/22 9:00 AM	client_validate_data	uiuc-cig-01-gpu-02	success	13.63
8/16/22 9:00 AM	client_validate_data	uchicago-gpu	success	39.04
8/16/22 9:01 AM	client_training	uiuc-cig-01-gpu-02	success	34.95
8/16/22 9:01 AM	client_training	uchicago-gpu	success	65.08
8/16/22 9:02 AM	client_training	uiuc-cig-01-gpu-02	success	31.73
8/16/22 9:02 AM	client_training	uchicago-gpu	success	35.21
8/16/22 9:03 AM	client_training	uiuc-cig-01-gpu-02	success	31.51
8/16/22 9:03 AM	client_training	uchicago-gpu	success	35.42
8/16/22 9:03 AM	client_training	uiuc-cig-01-gpu-02	success	28.75
8/16/22 9:03 AM	client_training	uchicago-gpu	success	35.63


```
- task_name: client_training
endpoint: uiuc-cig-01-gpu-02
start_at: '2022-08-16
09:01:22.433471'
end_at: '2022-08-16 09:01:57.384578'
events:
start_endpoint_execution: '2022-08-16
09:01:22.552091'
stop_endpoint_execution: '2022-08-16
09:01:54.578533'
timing:
load_dataset: 7.529
download_global_state: 0.626
load_global_state_to_device: 3.94
training_client_update: 19.404
epoch_1:
val_before_update_val_set: 0.726
train_one_epoch: 1.849
epoch_2:
train_one_epoch: 1.852
```

TAKEAWAYS

- **APPFL:** An **open-source** framework for **privacy-preserving federated-learning** tasks
- **funcX** helps us to efficiently perform remote task execution at clients **without thinking too much about the underlying computing infrastructure**
- **funcX authentication** via Globus provides a reliable way for **managing data/computing resources access** for teams of cross-institution researchers
- Our project facilitates collaborations on developing machine learning algorithms in many biomedicine researches. **We are actively looking for collaborations in the future!**

`https://appfl.readthedocs.io/en/stable/`

THANKS FOR YOUR ATTENTION

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https://appfl.readthedocs.io/en/stable/

https://github.com/APPFL/APPFL/tree/thoang/funcx