MICHIGAN STATE UNIVERSITY

Project Plan Presentation

SmartSat™ Software Development Kit & AI Platform

The Capstone Experience

Team Lockheed Martin Space

Tyler Holt
Jackson Haugen
Robert Francis
Kyle Soderlund
Kurt LaBlanc
Maxwell Lu

Department of Computer Science and Engineering
Michigan State University

Spring 2023

From Students…
…to Professionals

Project Sponsor Overview

- Lockheed Martin Space is our project sponsor
- Products include satellites, space probes, missile systems, and components of NASA's Orion spacecraft
- Produce software to be executed on their line of satellites and ground to support the on-orbit satellites

Project Functional Specifications

- SDK manager changes three-format system to a single operating system agnostic format
- Built in tools to handle versioning and dependency chains
- Query functionality
- Users can publish their own SDKs
- Allows deployment of AI/ML models to SmartSat™ applications
- Increases compatibility and speed of SmartSat™ AI services

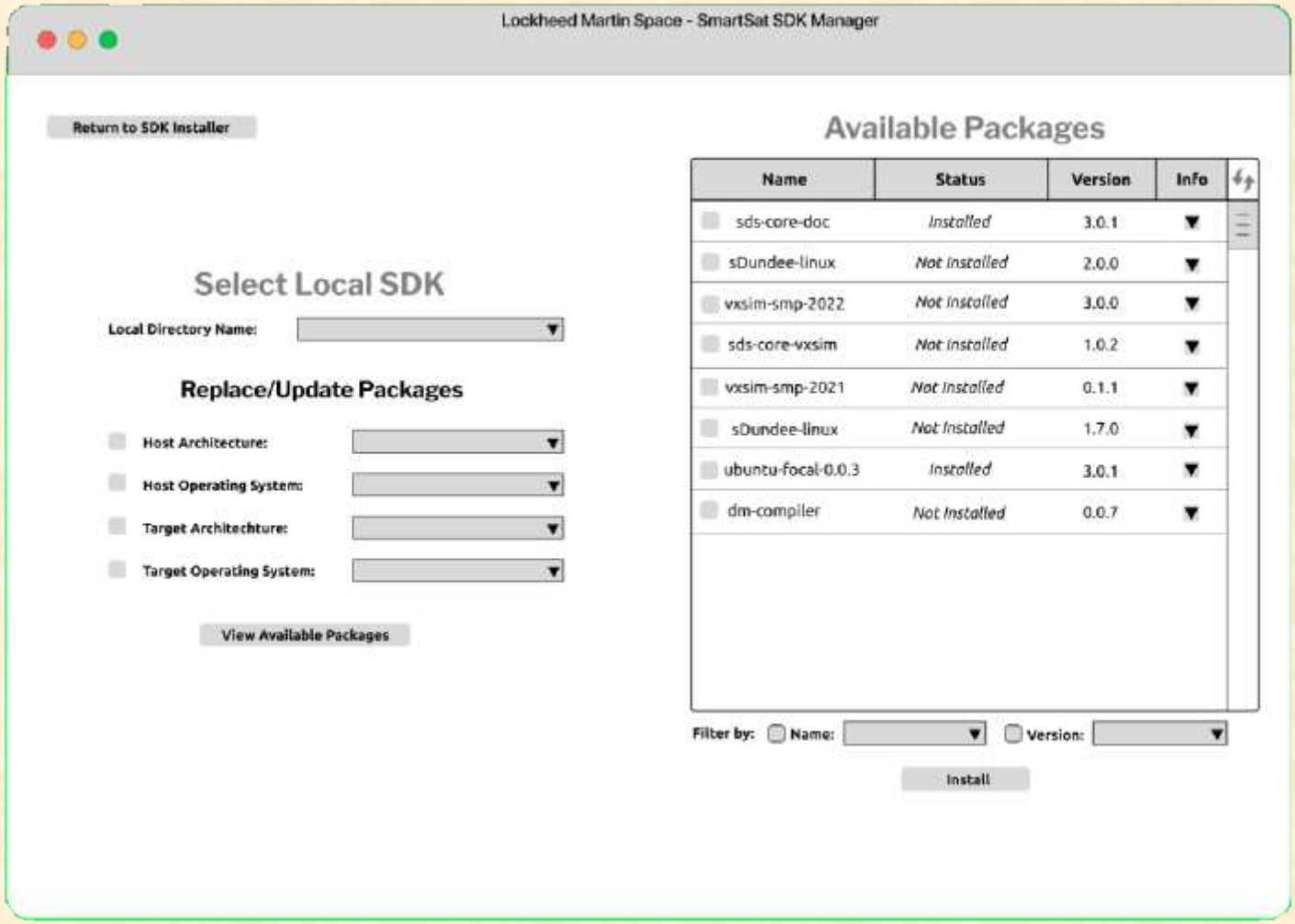
Project Design Specifications

- Users can filter SDKs by properties
- Users can select the directory where they would like to place the SDK
- Users can create and publish their own SDKs
- Users specify the host and target architecture and operating system
- ML model compiled with Python module
- Inference engine runs on SmartSat™ devices

Screen Mockup: SDK Installer/Uploader

Screen Mockup: SDK Installer Pop-up

Screen Mockup: SDK Package Installer



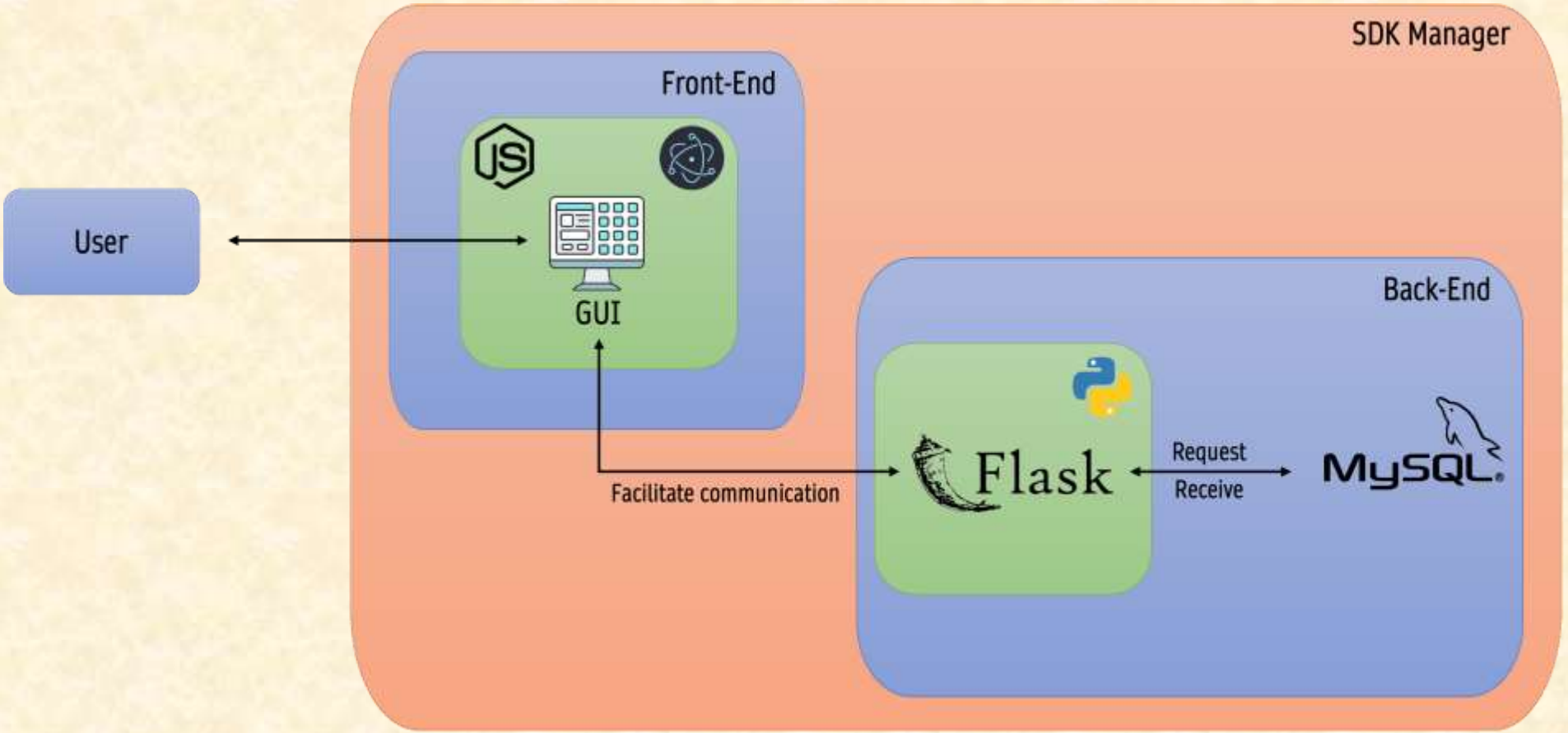
Screen Mockup: Inference Engine Logs

```
lms-user@lms-bolt:~
lms-user@lms-bolt:~$ docker logs -f inference-engine
[2023-22-01 15:19:31,089] INFO in process_message: Prediction: small_civ_ship - Confidence: 0.89124
[2023-22-01 15:19:31,087] INFO in process_message: Inference time: 0.0667334
[2023-22-01 15:19:31,152] INFO in process_message: Prediction: barge - Confidence: 0.68322
[2023-22-01 15:19:31,155] INFO in process_message: Inference time: 0.099357
[2023-22-01 15:19:31,268] INFO in process_message: Prediction: military_ship - Confidence: 0.45519
[2023-22-01 15:19:31,275] INFO in process_message: Inference time: 0.0321565
[2023-22-01 15:19:31,301] INFO in process_message: Prediction: small_civ_ship - Confidence: 0.77821
[2023-22-01 15:19:31,303] INFO in process_message: Inference time: 0.0567299
```

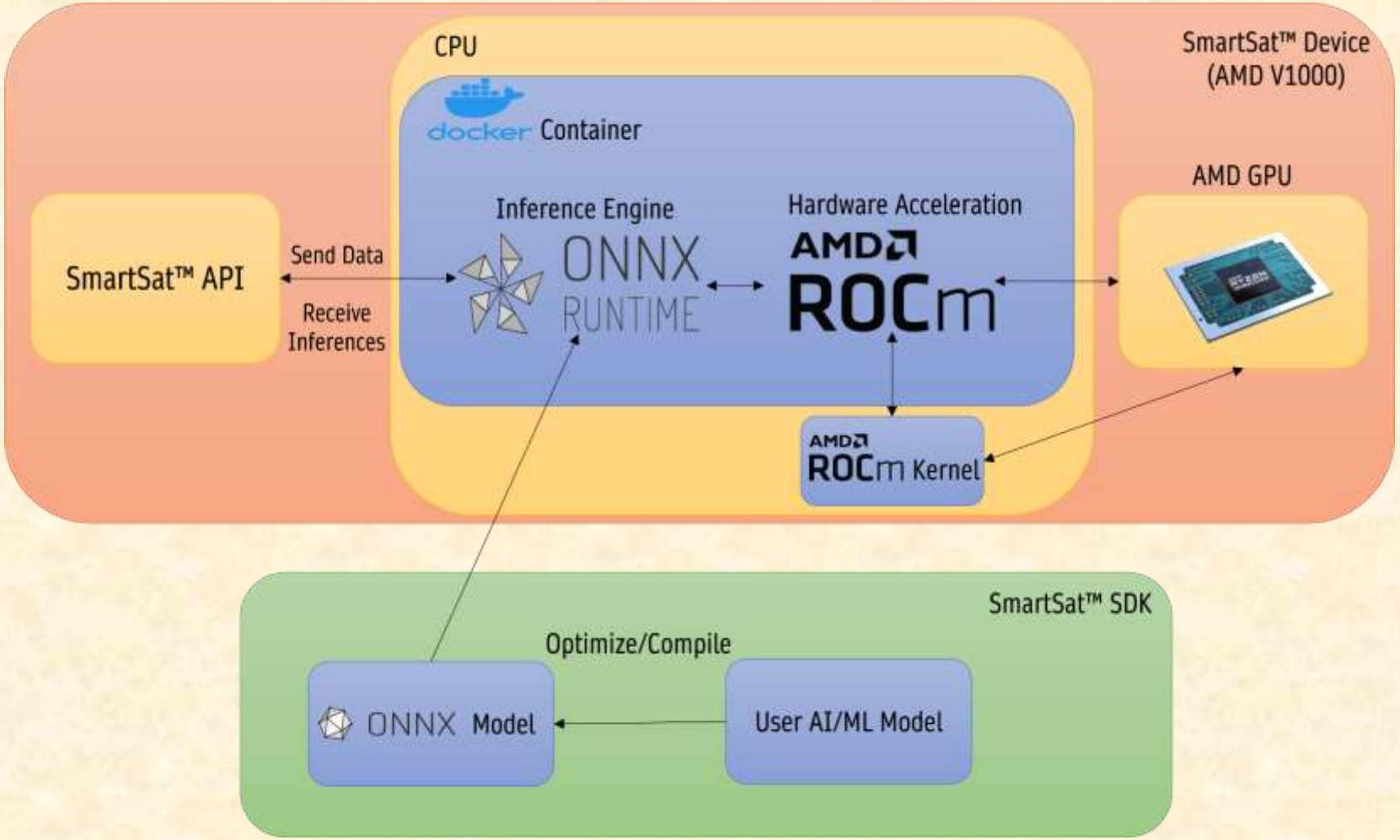
Project Technical Specifications

- Electron
  - Used to create GUI front end
- Flask
  - Used to create an API to interface with the Electron GUI
  - SQLAlchemy is used with Flask to retrieve requests for data from the MySQL database
- MySQL
  - Contains tables of SDK and other related packages along with metadata
- ONNX Runtime
  - ONNX format is used as the standard for models, ONNX Runtime facilitates inferencing on remote hardware

Project Software Architecture



Project System Architecture



Project System Components

- Hardware Platforms
  - UDOO Bolt V8
    - Equipped with an AMD V1000 APU that has Zen CPU and Vega GPU architectures
- Software Platforms / Technologies
  - Electron
  - Flask
  - MySQL
  - ONNX Runtime
  - AMD ROCm

Project Risks

- Risk 1
  - Filtering results in the GUI
  - run conditionals that will check where each file came from
- Risk 2
  - Installing RPM files correctly
  - We will use scripting for each command without the user seeing any code being run.
- Risk 3
  - ROCm versioning and support
  - We see no alternative other than to just push through.
- Risk 4
  - Docker Container
  - We will install Docker Desktop and see what it takes to establish a container on our AMD machine.

Questions?