HiPAS

Requirements and Design Presentation
CEC EPC-17-047

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GISMO Grid Integration Systems and Mobility
"100% Clean Energy for All"

SLAC NATIONAL ACCELERATOR LABORATORY

Deliverables

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This presentation covers the products of Task 2:

- HIPAS GridLAB-D Release Requirements Presentation
- Performance and Baseline Analysis Presentation
- Software Upgrade Design Presentation
- Performance Specifications Presentation
- Testing Plan Presentation
- Software Design Presentation

Overview

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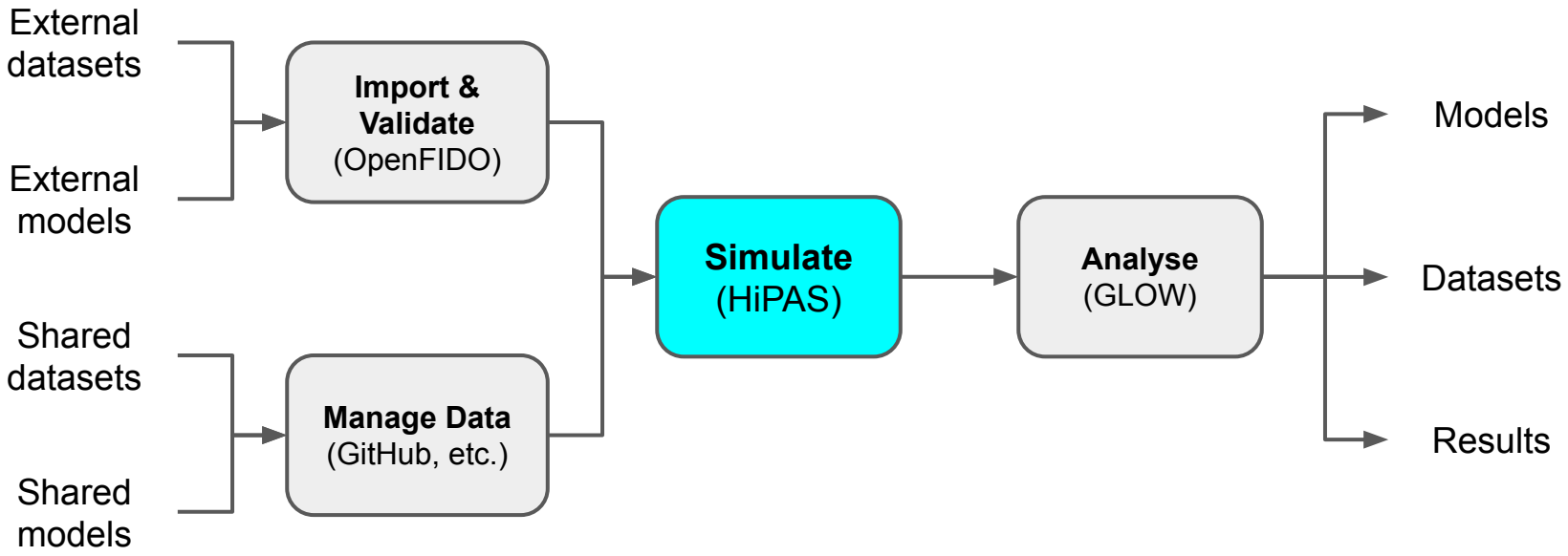
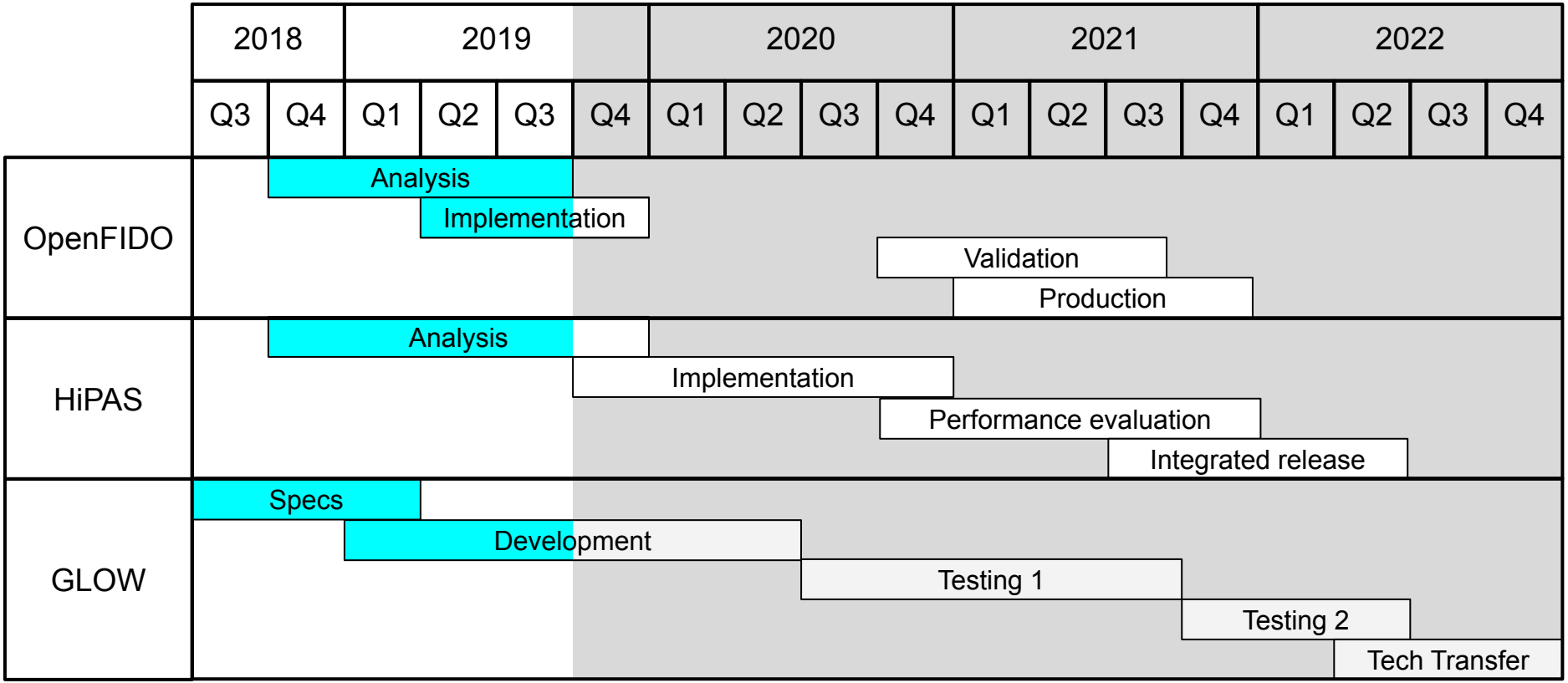
Scope of requirements and design analysis

- Current GridLAB-D use-cases studied
- Requirement and design analysis
  - Module design analysis
  - Core system requirements
- Summary

Overview: Advanced Simulation Program workflow



Overview: Project timelines and status



Use-Cases

VADER (DOE/SETO in collaboration with SCE)

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Visualization & Analysis for Distributed Energy Resources

Real-time simulation of hardware-in-the-loop

- Based on IEEE-123

DSO simulation for "smart-grid" controls

- Feeder switch and voltage control coordination

Distributed energy resource integration

- Includes solar PV, battery, and load control

PowerNET with Markets (SLAC/CEC EPC 15-047)

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Market-based “smart-grid” distribution systems operation

Behind-the-meter voltage control resources

- Simulate impact of voltage control in appliances

Cloud-based distribution system operations

- Simulate impact of cloud coordination and optimization

Retail real-time price simulation

- Compute costs under different pricing mechanisms
- Estimate revenue potential from wholesale markets

GRIP (DOE/GMLC in collaboration with SCE & NRECA)

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Grid Resilience Intelligence Platform

***Anticipate* rare/large events**

- Prepare for emergency operations

***Absorb* the impact of rare/large events**

- Ride-through an emergency event

***Adapt* to changes in the wake of rare/large events**

- Recover from an emergency event

GLOW (Hitachi/CEC EPC 17-043)

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GridLAB-D Open Workspace

- **UI/UX for workflow-based GridLAB-D simulation**
  - Focus on ICA use case
- **Integration requirements for GridLAB-D core**
  - UI API (model control, etc.)
  - OpenFIDO API (data control, etc.)
  - UX API (server control, etc.)

OpenFIDO (SLAC/CEC EPC 17-046)

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Open Framework for Integrated Data Operations

- **Enable multi-org sharing of models and data**
  - Import, curate, and export network models and data
  - Supprt weather data, model templates, data libraries
- **Support multiple model and data formats**
  - Provide UI to directly manage models and data
  - Provide API for applications to access models and data

Requirements and Design Analysis

Commercial buildings module

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Physical models for key commercial building types

- Focus on office, retail, and major building systems

Data-driven models (e.g., support for CEUS data)

- Enable use of measured data to support simulations

Support for composite load model

- Incorporate modern load models into GridLAB-D

Residential buildings module

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Data-driven model (e.g., RBSA)

- Use measurement data to drive residential load models

Composite load model support expansion

- Support modern load models in GridLAB-D

Simplified physical building models

- Reduce model complexity to increase speed

Enhanced physical appliance models

- Enable appliance control model to simulate DER/DR

Markets module

Tariff model to support general tariff evaluation

- Expand support for new/prospective CPUC tariffs

Transactive model is based on one technology only

- Enable study of transactive energy systems
- Add simulation of settlement infrastructure(s)

Database module

High-performance access

- Support for parallel initialization & progressive queries

Alternate data storage/access systems

- Postgres
- MariaDB
- Python pandas dataframes (local only)
- AWS boto support (e.g., S3 buckets)

Powerflow module

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Support for re-entrant/parallel simulations

- Enable multiple/concurrent runs per job

Support for machine-learning based solver(s)

- Enable fast powerflow solvers when appropriate

Equipment/environmental vulnerability analysis

- Impacts from wind, fire, and ice on equipment
- Impact of equipment failure on vegetation

Core system requirements

Cloud development and distribution support

- Docker (with mysql, apache2)
- Code integration & release management
  (e.g., GitHub, CircleCI)

Subcommands to manage simulation environment

- Runtime environment configuration management
- Weather/climate data manager (download, info)
- Templates/libraries (download, create, submit, review)

Workflow Requirements

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Full access to core capabilities

- Modeling interface at runtime using JSON and CIM
- Full and direct control of simulation environment
- Access using high level languages (e.g. python)

Access to all subcommands through both CLI and API

- Configuration manager for simulation system
- Management of weather and climate data
- Management of model templates
- Control of containers and servers

Format Support Requirements

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Commercial building data and models

- Support data-driven building simulation
- Support physics-based commercial building simulation

Residential building data and models

- Support data-driven home simulation
- Simplify physics-based residential building simulation

General support for automatic file conversion

- Support for {JSON,XML}← GLM → {XML,JSON}
- Direct support for CIM ← GLM → CIM

Validation

Augmented validation testing for new capabilities

- Upgrade validation procedures to detect new issues
- Improve performance of validation test
- Add new tests for new capabilities

Multi-environment validation (host, docker, cloud)

- Allow scaling of simulation deployment

Template model validation and review

- Support community of users who create/share models

Training and documentation

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Online documentation

- Separate user, modeler, and developer wikis
- Automatic version matching of documentation

Training

- Short topical tutorial videos (links from wiki pages)
- Revise structured training courses for communities

Summary of requirements identified

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	VADER	PowerNET	GRIP	GLOW	OpenFIDO
Commercial				Libraries Templates Weather	CEUS
Residential		DER			RBSA
Markets		RTP			Tariffs
Database		MySQL			MySQL, S3
Powerflow	IEEE-123, Controls, & DER		Pole vulnerability		
GLD Core				Solvers	GitHub
Validation				Docker	Docker
Workflows				CircleCI	CircleCI
Formats				API	JSON, CIM
Training				Videos	Videos
Documentation				github.io	github.io

Contact Information

Principal Investigator:

David P. Chassin, PhD

dchassin@slac.stanford.edu

GridLAB-D Project Repository:

https://github.com/dchassin/gridlabd

SLAC Project Team

David P. Chassin

Marie-Louise Arlt

Lily Buechler

Velvet Gaston

Jonathan Goncalves

Alyona Ivanova

Siobhan Powell

Mikaela Quintos

Berk Serbetcioglu

Nani Sarosa

Karen Schooler

Subcontractors and Partners

Gridworks

Matt Tisdale

Andrew Spreen

Mac Roche

National Grid

Pedram Jahangiri

PNNL

Tom McDermott

Jason Fuller

Frank Tuffner