

IT Operations and Cyber Infrastructure

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Overview

- User Training
- IT Infrastructure and Equipment
- Hybrid Simulation
- Data Management



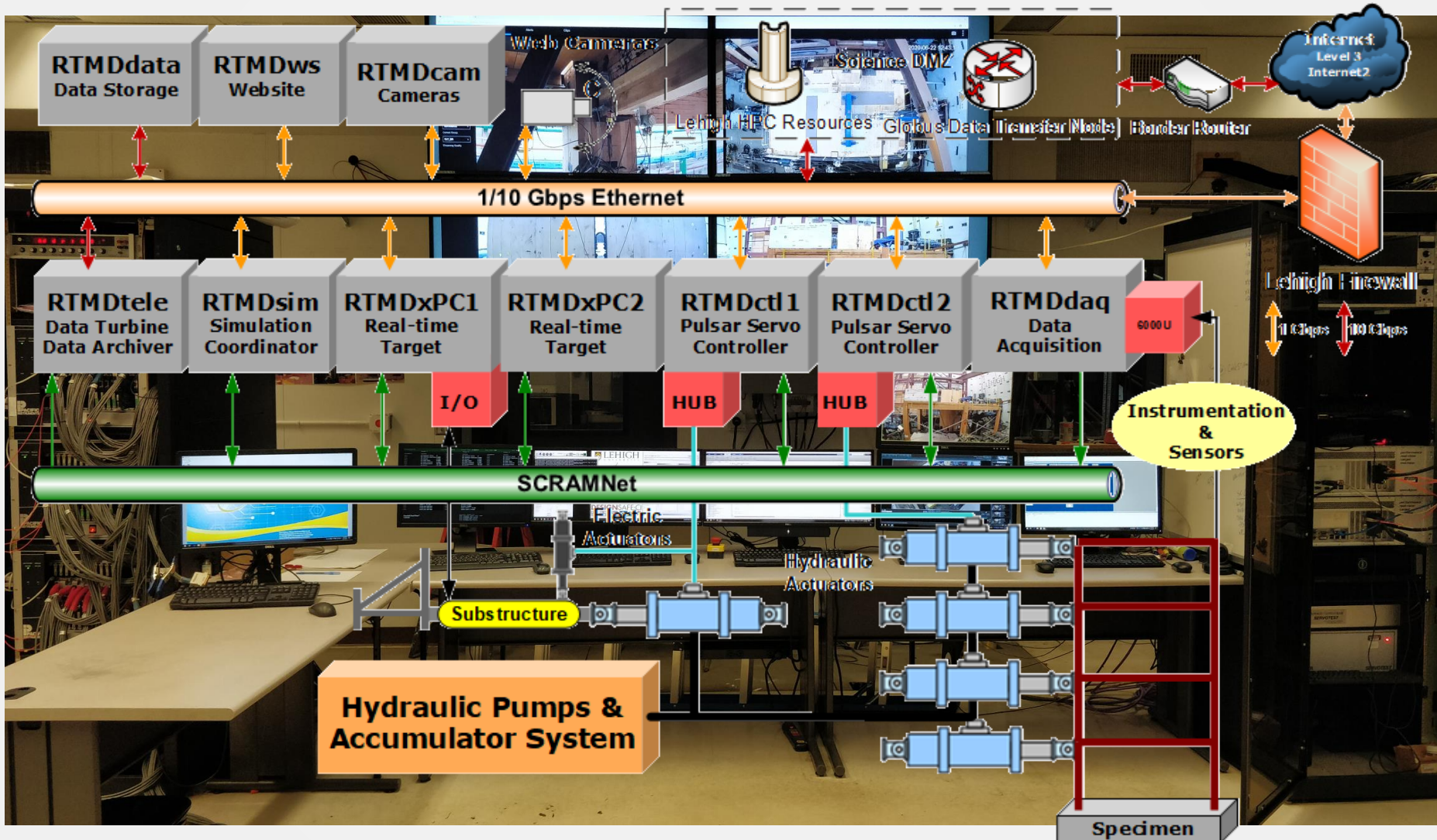
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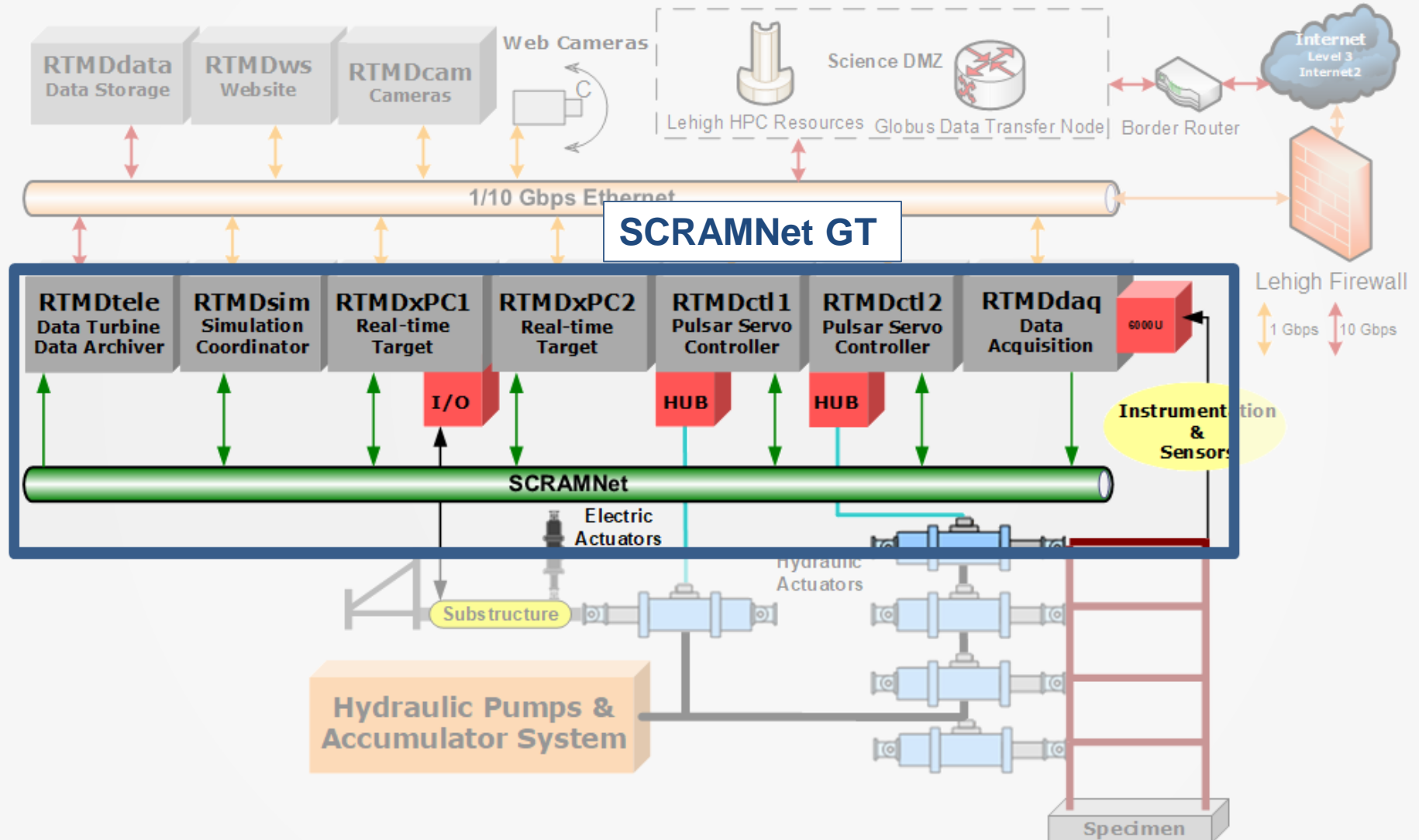
Researcher Training and Experiment Support

1. Researchers and NHERI Lehigh team work together on training, development of experimental protocols, instrumentation, control and safety plans
2. Create Project Workspace for future curation and publication on DesignSafe-CI Data Depot
3. On-site laboratory walk through and identification of IT systems with demonstrations
4. Validate control configuration through numerical and hydraulics off simulations
5. Configure data acquisition system for sensor equipment
6. Configure video acquisition system for cameras
7. Configure data streaming for local and remote data viewing
8. Determine safety protocols for equipment and specimen
9. Conduct experiments
10. Data is locally archived and synced with DesignSafe Project Warehouse
11. Research team processes data locally and stored in Data Depot at DesignSafe-CI into data model. Tools available to process data available locally and on DesignSafe-CI

IT Infrastructure



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SCRAMNet GT

- Fiber-optic based
High-Speed, Low-Latency
Industrial Protocol for
Real-time data control



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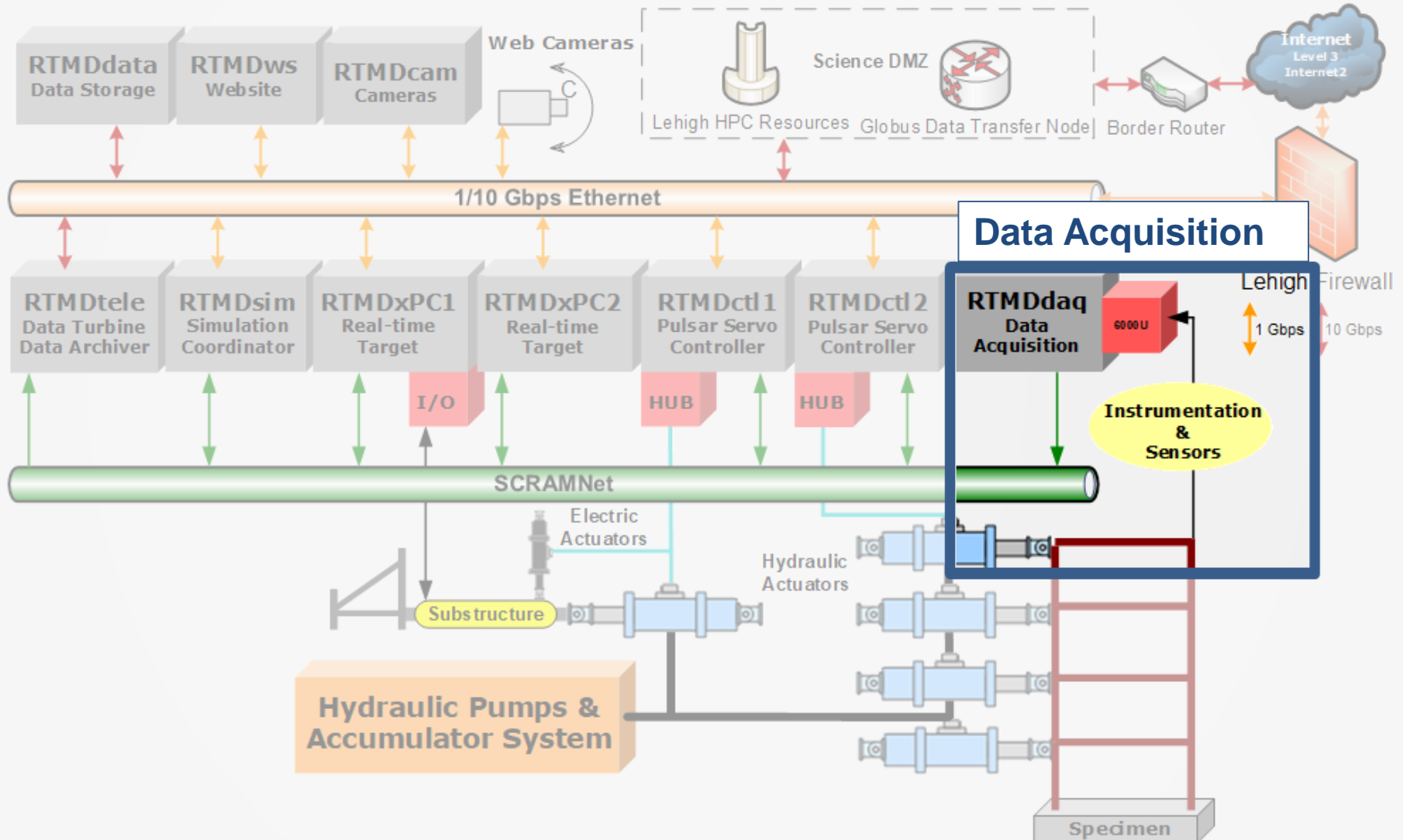


REAL-TIME MULTI-DIRECTIONAL SIMULATION
NATURAL HAZARDS ENGINEERING RESEARCH INFRASTRUCTURE



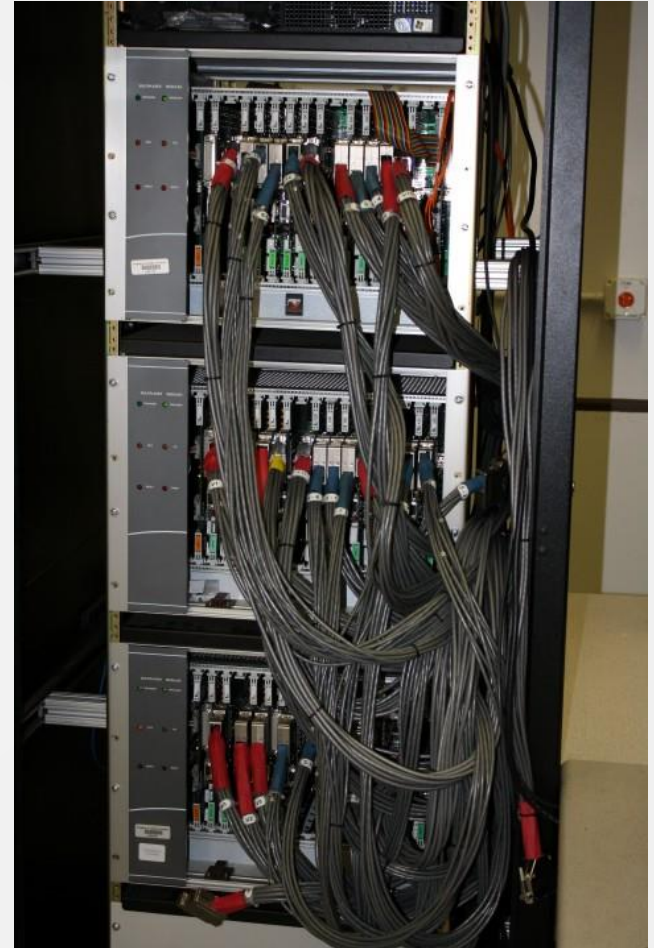
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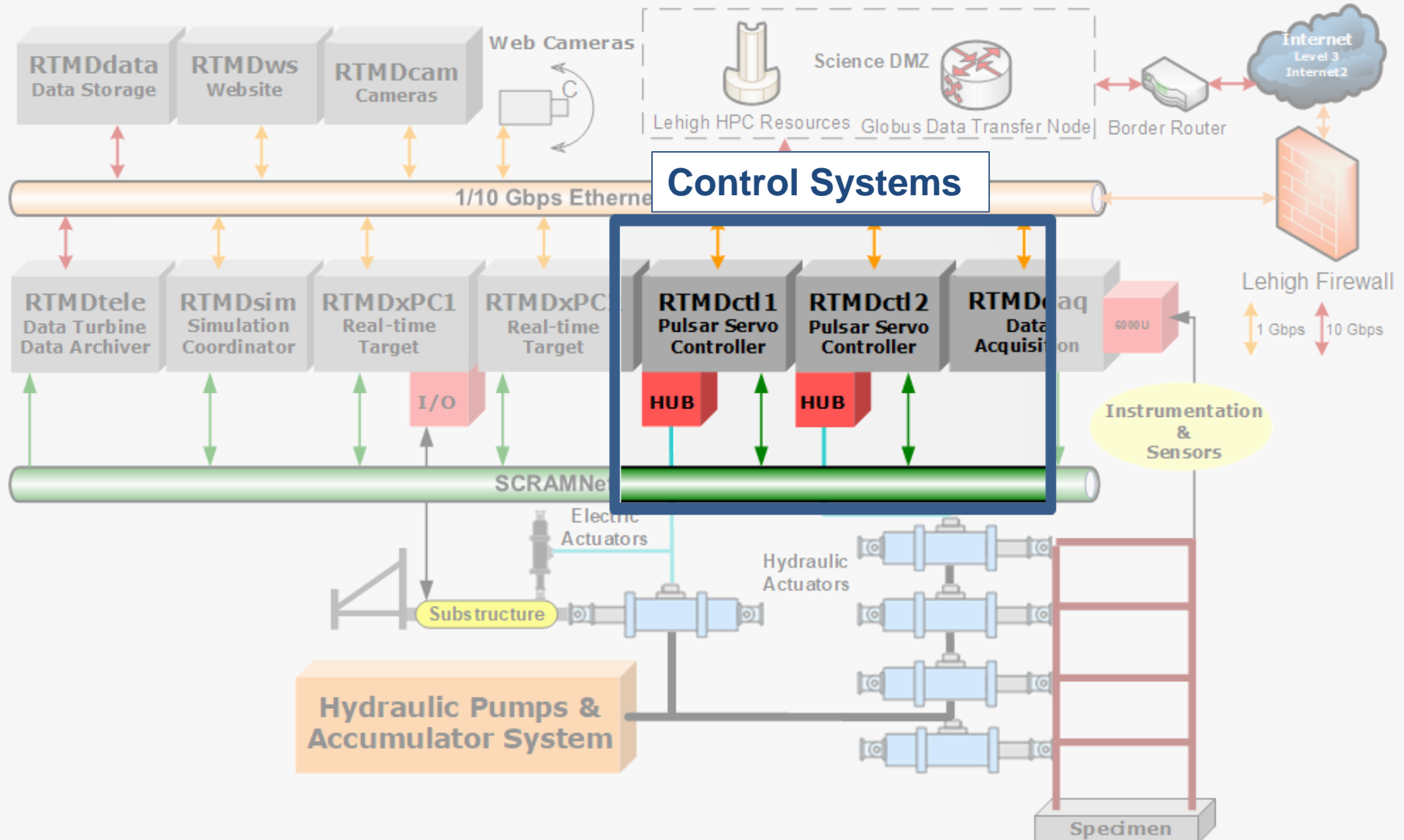


RTMDdaq

- Pacific Instruments 6000 Data Acquisition System
 - 304 channels, 384 expandable
 - Voltage, Strain, Thermocouple
 - Variable sampling rates
 - 4 kHz for Real-time Testing

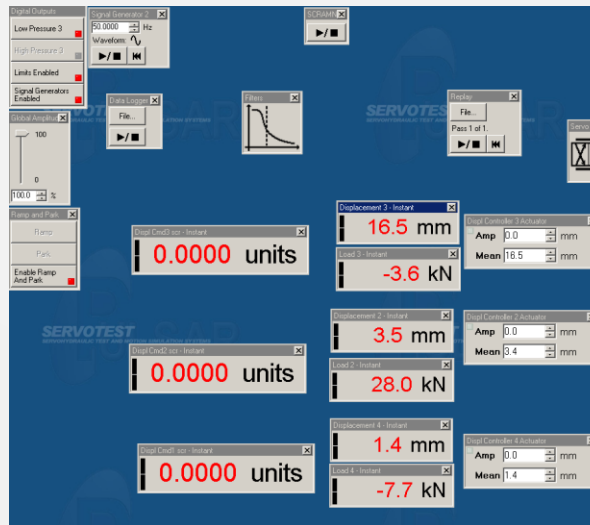


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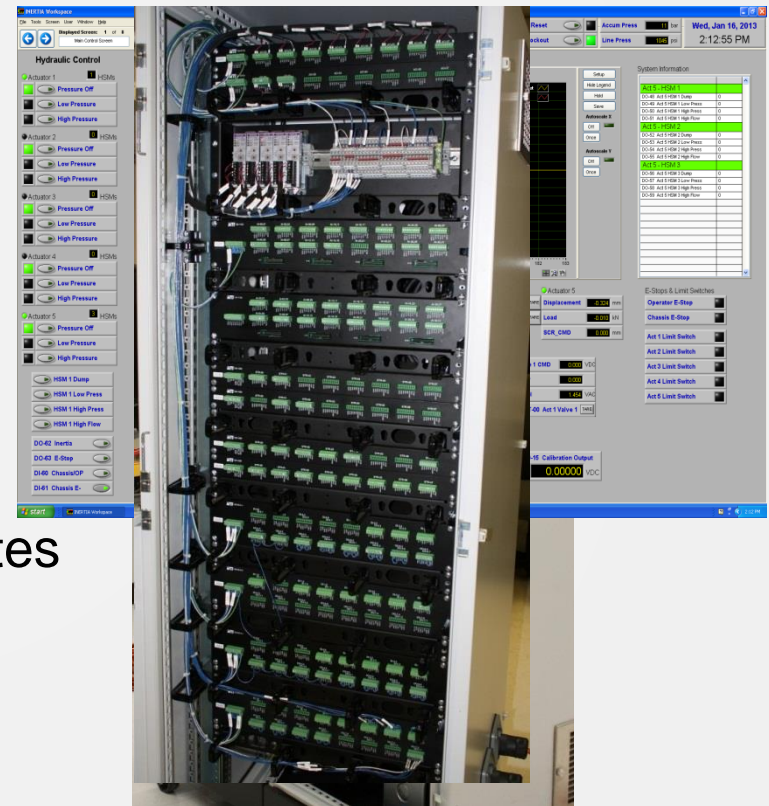
RTMDctrl

- Servotest Pulsar Hub Control System
 - Configurable servo-control system for hydraulics actuator PID control
 - 2048Hz or higher control rate
 - Wide vendor support
 - Customizable interface



RTMDctrl

- Wineman INERTIA Control System
 - Unlimited multi-mode closed-loop control
 - Integrated test editor
 - Integrated with various NI modules
 - Integrated PID control loop tuning
 - Complete access to tuning system variables
 - Programmable control and DAQ rates

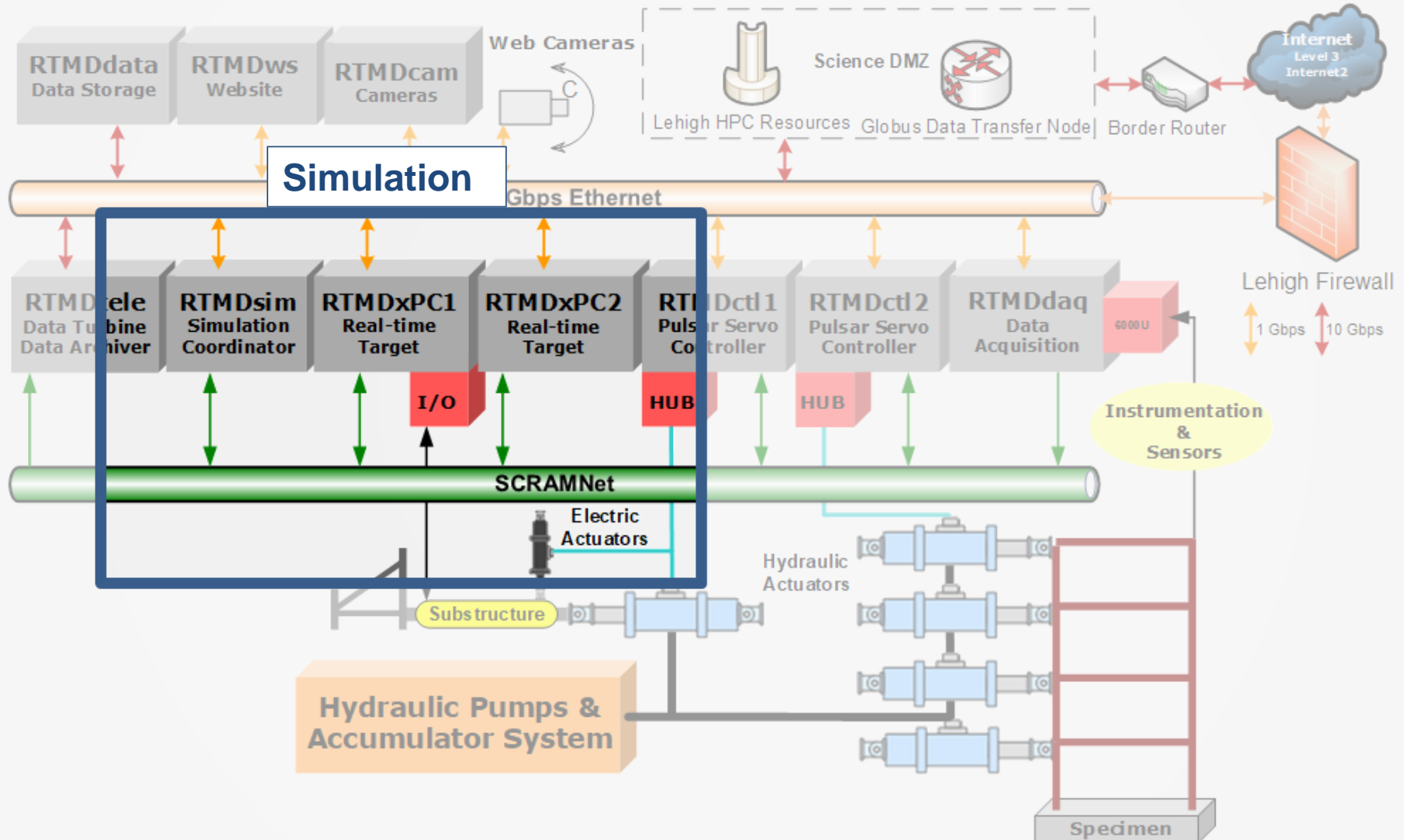


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Simulation – RTMDsim/RTMDxPC

- Host-Target configuration
 - Real-time and custom applications
- Dell i7 Precision Workstation
 - High power workstation for execution and processing
- Speedgoat Targets (Simulink Real-time)
 - Dedicated Intel i7 4Ghz real-time systems
- Multiple Targets
 - Defined roles
 - Parallel processing for larger, more complex models



RTMDsim

Simulation Coordinator

- Host Workstation
 - MATLAB/Simulink Interface
 - Coordinator of synchronized control and data acquisition
 - Hydraulics on/off testing – numerical simulation for safety, validation & training
 - Process and analyze data



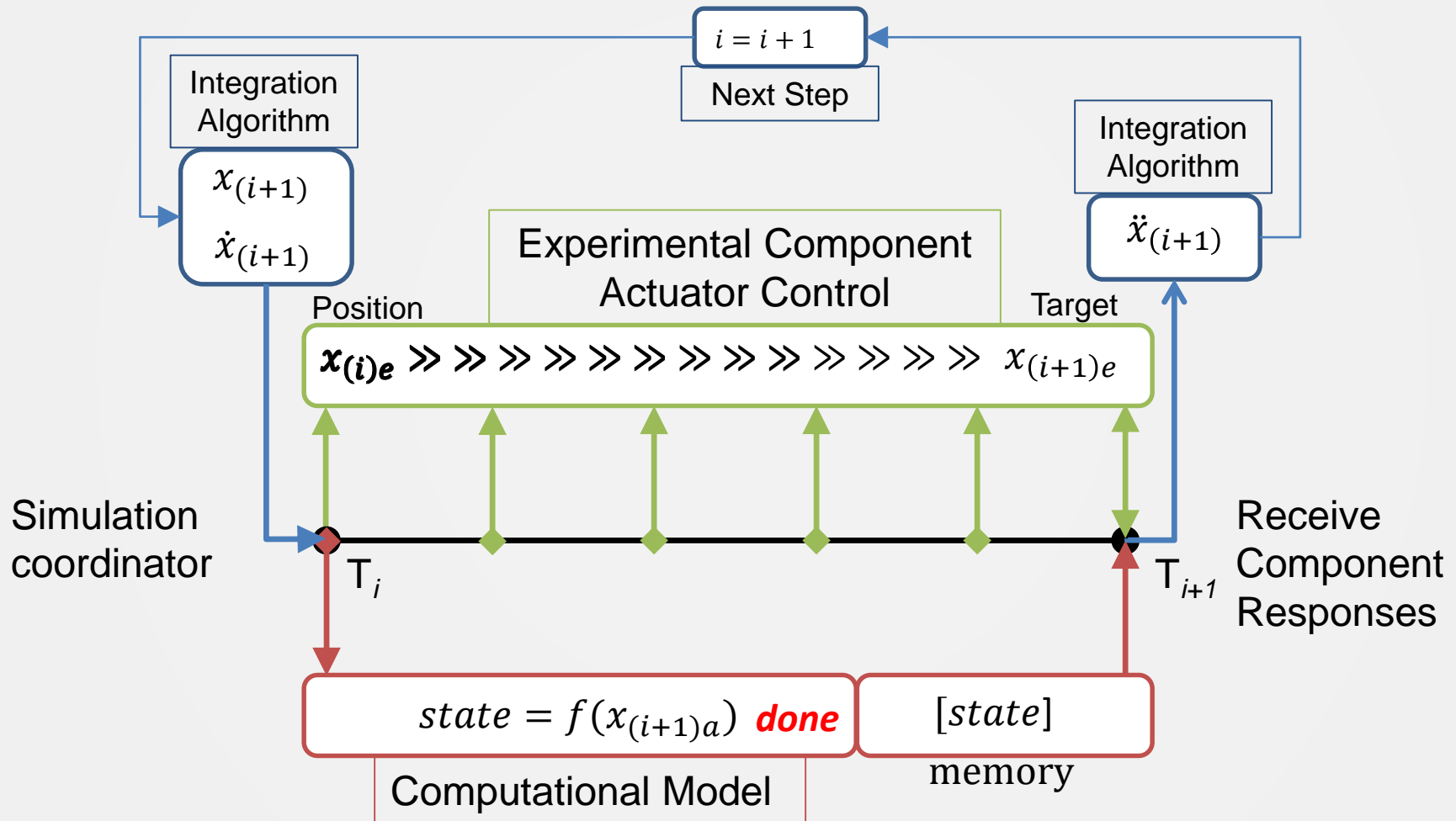
RTMDxPC

Real-Time Targets

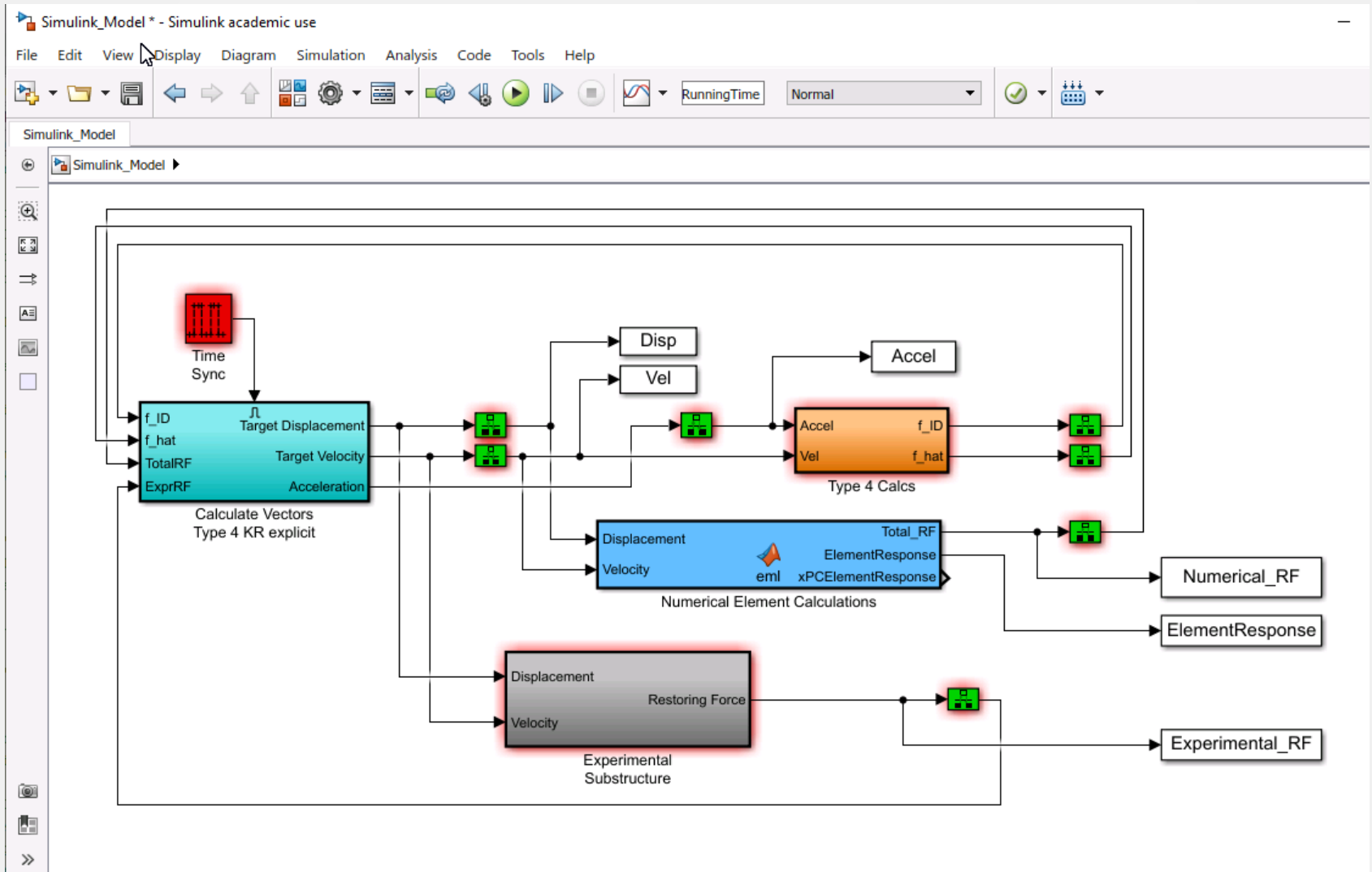
- Speedgoat systems, CPU performance up to 4 GHz
- Industrial quality design for robustness
- Multi-core support for parallel processing
- Synchronized Multi-system execution
- Built-in modules for data acquisition and control
- “Bring your own model” infrastructure for researchers



RTHS: Model Flow through Simulink Simulation

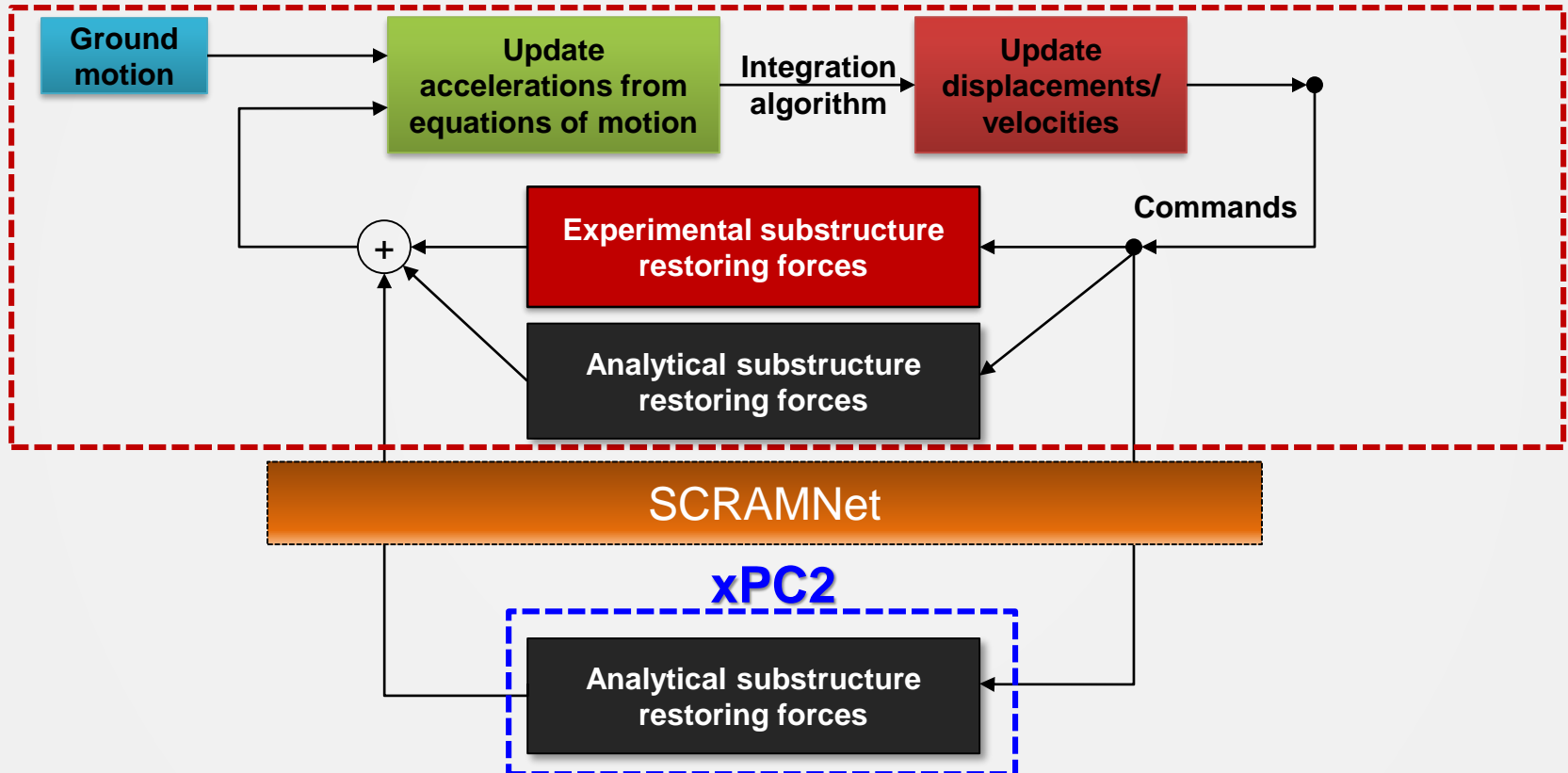


RTHS: Simulink



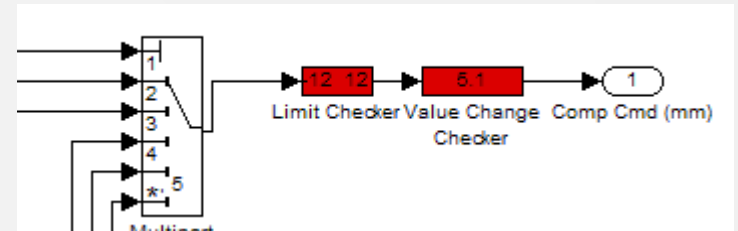
RTHS: Multiple Targets

xPC1

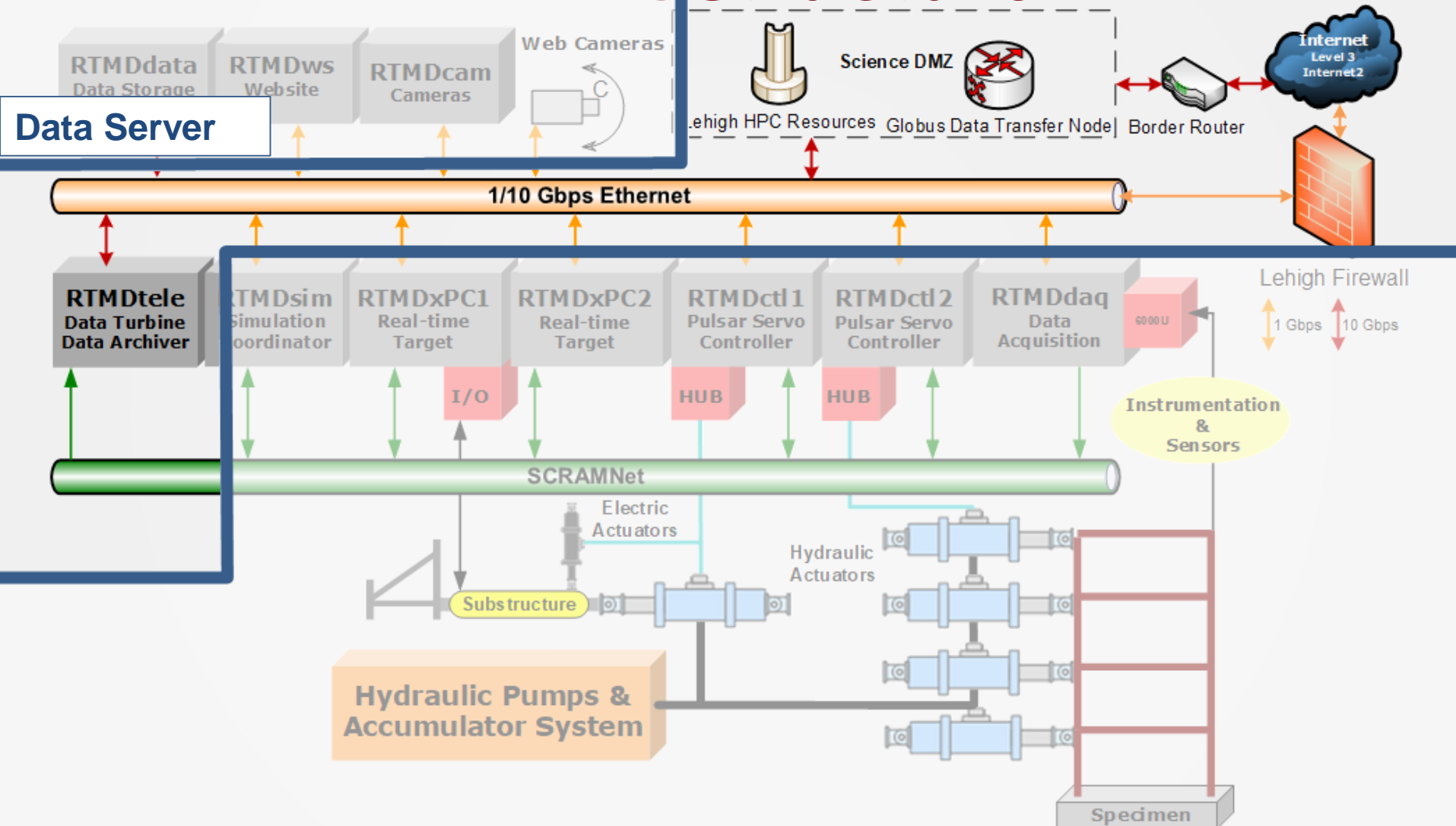


Simulation Safety

- Command software limits
 - Bound and rate limits
- Controller software limits
 - System trip and shutdown
- Hardware displacement limit switches
- E-Stop buttons



IT Infrastructure



Data Streaming

- Data Turbine (RBNB) (dataturbine.org)
 - Aggregates data from systems integrated on SCRAMNet GT ring
 - Storage archive of test data based on timestamps
- Real-Time Data Viewer (RDV)
 - Plot-based and numerical observation of data locally and remotely
 - Time-controlled playback

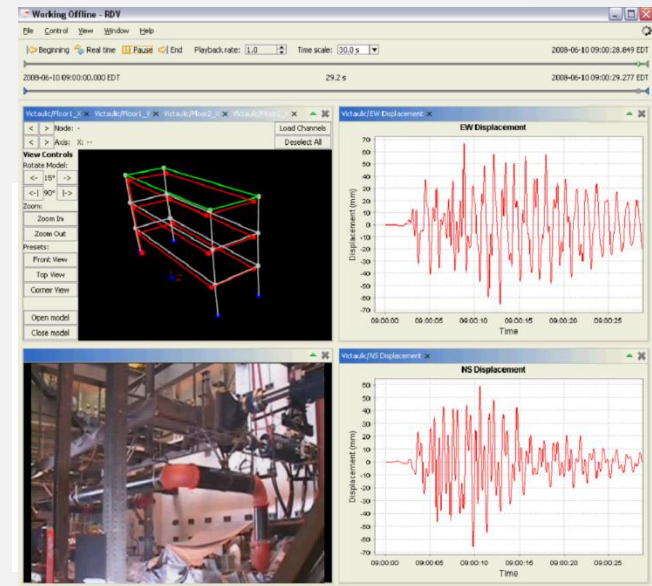
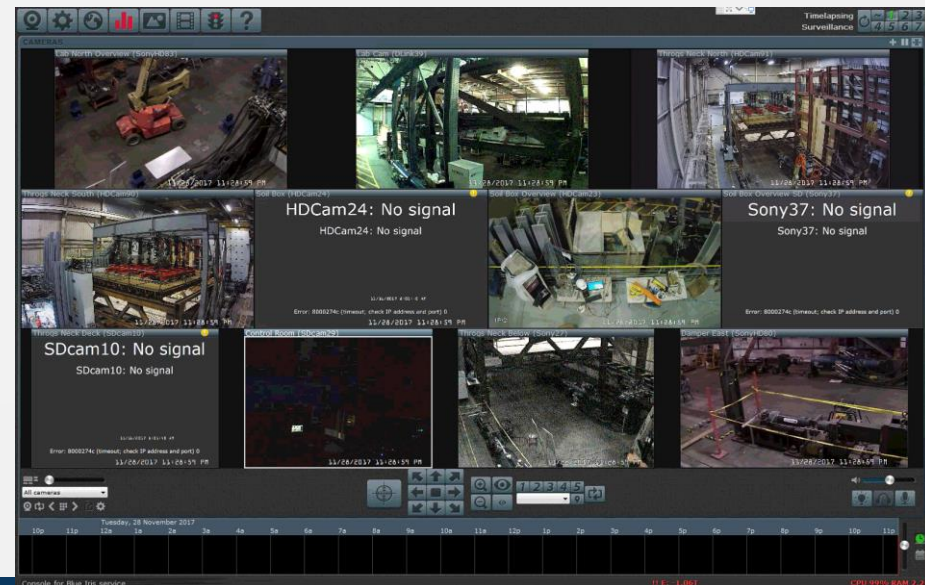
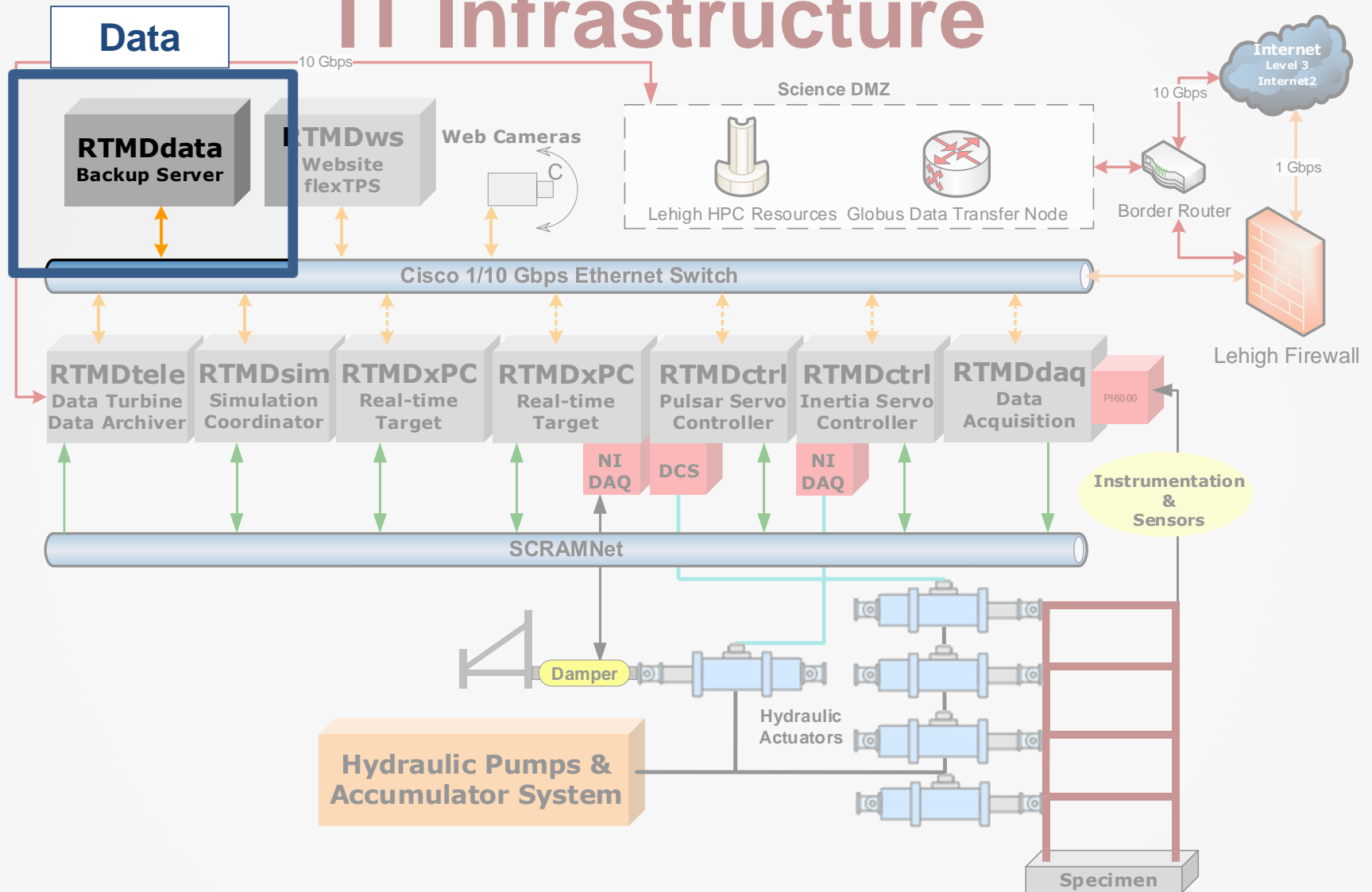


Photo and Video Capabilities

- Video/Imaging systems
 - (24) Amcrest Bullet/PTZ IP Cameras (up to 8k)
 - (4) Sony SNC-EP550 HD (720p HD)
 - (9) GoPro Hero 3 Black camcorders (1080p60 HD)
 - (8) Sony SNC-RZ30N network cameras (SD Security)
 - Nikon D70 D-SLR camera
 - Additional camera equipment upon request through LU Media
- Blue Iris Servers
 - Portal for all users to access and control web cameras
 - Archived video available for previous experiments



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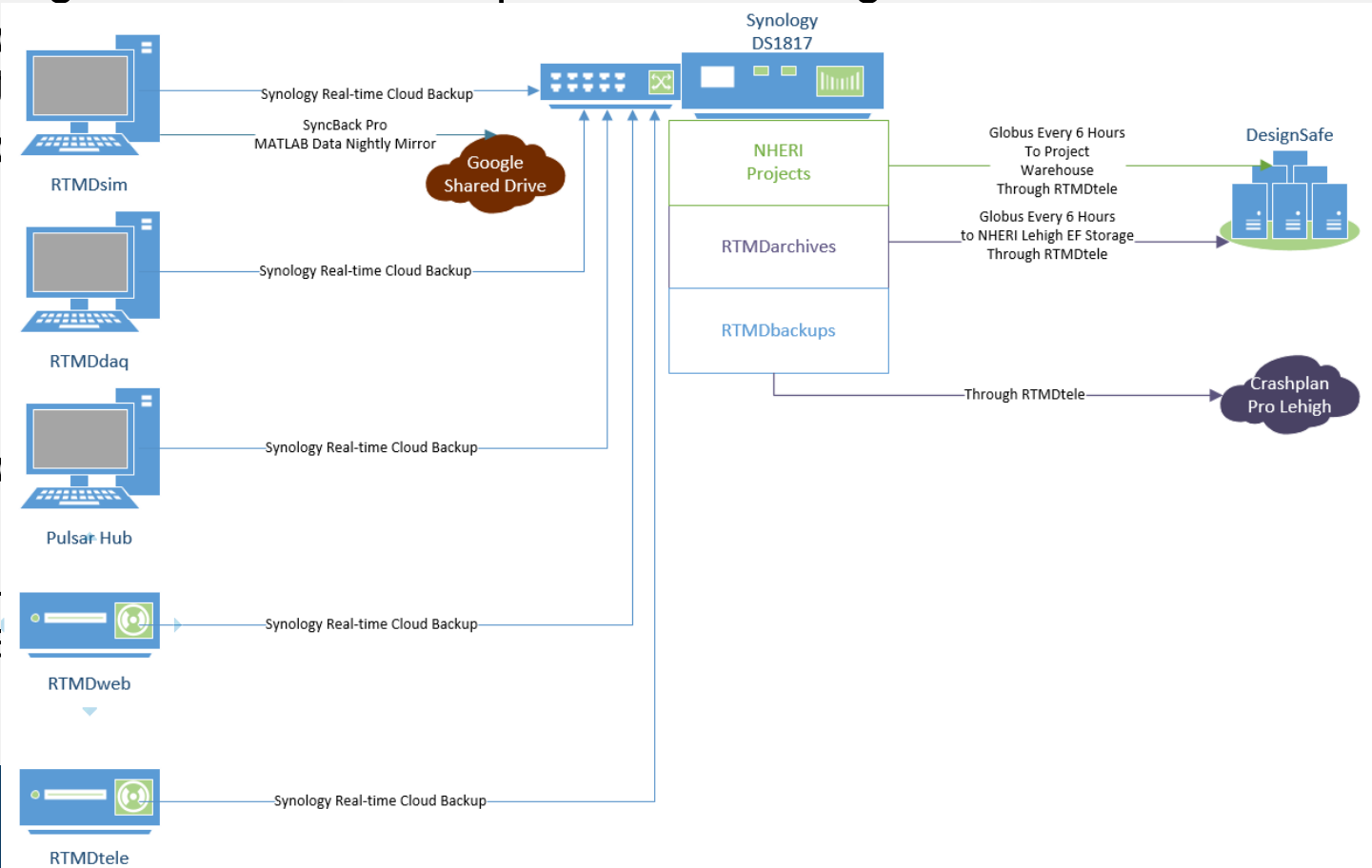
RTMDdata

- Synology DS 1817
 - 50TB Expandable
 - 10Gb Connection
- Dual-disk Redundancy
- Network Attached Storage
- Mirrored to DesignSafe through Globus



Data Management Plan

- Local repository for data storage managed by NHERI Lehigh with offsite backup risk mitigation through DesignSafe-CI
- Google Drive and Crashplan cloud storage



Q&A

Questions?



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