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Title: IoGET: Internet of Geophysical and Environmental Things

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IoGET: Internet of Geophysical and Environmental Things

Los Alamos NATIONAL LABORATORY EST. 1943

Towards a low-cost, energy-efficient, and near real-time monitoring of earth and environmental processes

LDRD innovation for our nation

BACKGROUND & MOTIVATION

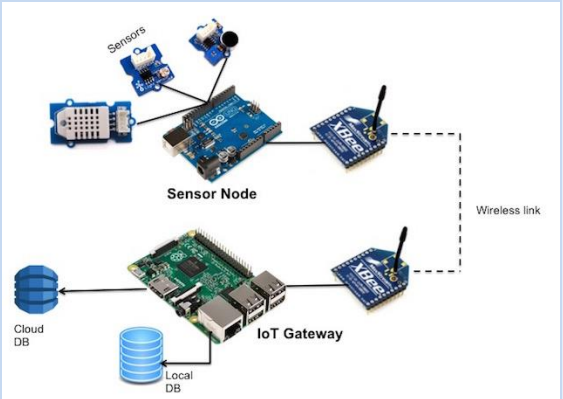
Current monitoring status:
- **Manual, expensive, and**
- **High-power requirements**

Messy/Manual data collection

Expert data analysis

INNOVATION

Automated and Smart Monitoring

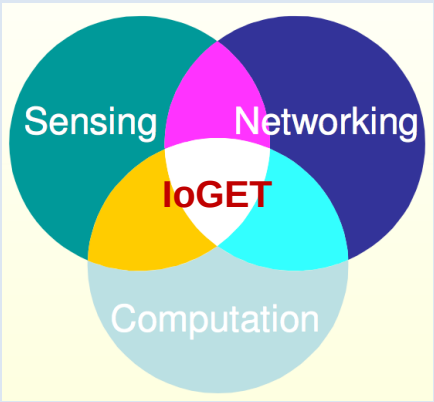


- *Improved monitoring with low-cost equipment*
- *High resolution of coverage areas*
- *Improved characterization based on fusing multiple data streams*

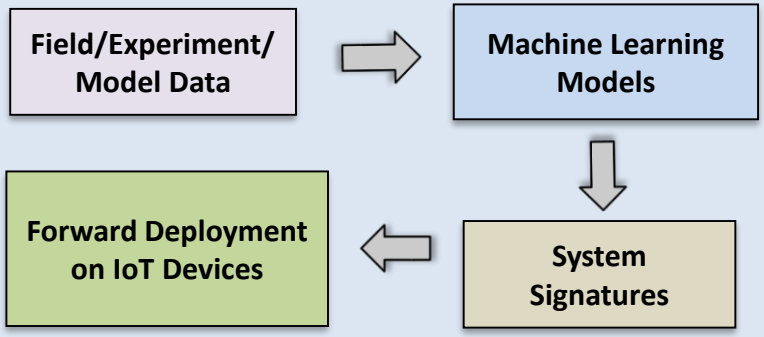
DESCRIPTION

Novel and fast reduced-order models for onboard computation at sensor nodes for real-time analysis

Approach (**Computation Part**):
- *Perform high-fidelity numerical simulations*
- *Construct simple reduced-order models (ROMs) using machine learning and signal processing algorithms*
- *ROMs and compressive sensing at sensor nodes (Raspberry Pi, Arduino, etc) for real-time data analysis*



Preliminary Computational Analytics (High-Fidelity Simulations):
•Regression Tests using LANL HPC simulator PFLOTRAN
•**Laptop** (16GB RAM, i7-dual core, 3.1GHz): Time taken 3 to 5 sec
•**Raspberry Pi** (1GB RAM, quad-core ARMv8, 1.2GHz): Time taken 35 to 40 sec

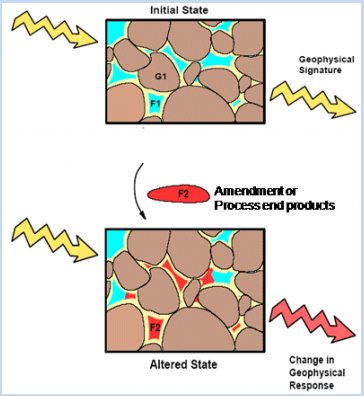


Current Progress and Path Forward:
•**Testing and validating the machine learning models based on experimental data from MPA-11 collaborators.**

TRL 2: New and fast computing methods for real-time data analysis at sensor node are developed and proof-of-concept is demonstrated

ANTICIPATED IMPACT

A real-time warning system to prevent and mitigate disasters



- **Low-power, low-cost, scalable**
- **Smart and fast on-board computing**
- **Very fast risk assessment**

PATH FORWARD

Investigations

•Test ROMs and data processing algorithms on Raspberry Pi Sensor node in real-time

Demonstrations

•Extend technology to dynamic sensing applications

•Prototype and develop a smart sensing system for government & commercial use

Potential End Users:

•Oil & Gas, Electrical Power/Grids, Structural Health Monitoring, and Nuclear Industries

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