

## LA-UR-17-25560

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Title: loGET: Internet of Geophysical and Environmental Things

Author(s): Mudunuru, Maruti Kumar

Intended for: Web

Issued: 2017-07-10

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# IoGET: Internet of Geophysical and Environmental Things

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



## BACKGROUND & MOTIVATION

Current monitoring status:

- Manual, expensive, and
- High-power requirements



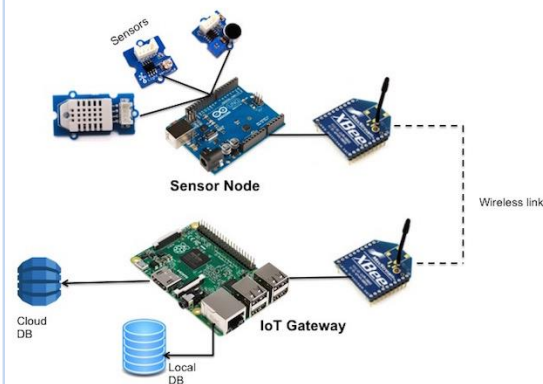
Messy/Manual data collection



Expert data analysis

## INNOVATION

### Automated and Smart Monitoring



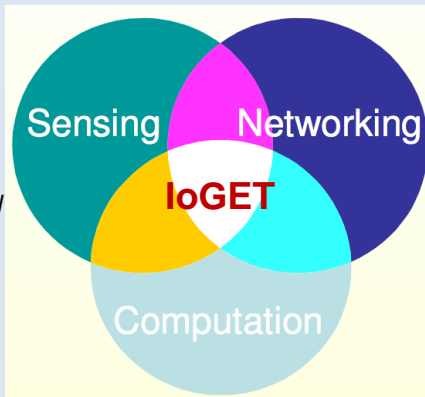
- Improved monitoring with low-cost equipment
- High resolution of coverage areas
- Improved characterization based on fusing multiple data streams

## 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

Field/Experiment/  
Model Data

Machine Learning  
Models

Forward Deployment  
on IoT Devices

System  
Signatures

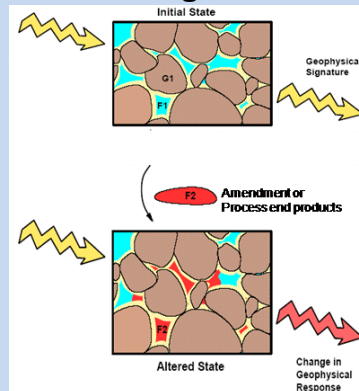
**Current Progress and Path Forward:**

- 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

**Point of Contact:** Maruti Kumar Mudunuru (MKM), EES-16 Group, Phone: 979-571-3841, Email: [maruti@lanl.gov](mailto:maruti@lanl.gov)

**Mentors (EES-16):** Satish Karra, Hari Viswanathan  
**Collaborators (MPA-11):** Vamshi Krishna Chillara, Dipen Sinha (DS), and Cristian Pantea