



NSF Campus Cyberinfrastructure PI and Cybersecurity Innovation for Cyberinfrastructure PI Workshop

September 23 – 25, 2019 | Minneapolis, MN

NSF Program (either CC or CICI): CC

Program Area: OAC

Award Number: 1827126

PI: Klara Nahrstedt

co-PIs: John Dallesasse, Roy Campbell, Kenton McHenry, Tracy Smith

**Project Title: SENSELET: Sensory Network Infrastructure for
Scientific Lab Environments**



Name: Klara Nahrstedt

Title: Director of Coordinated
Science Lab (CSL);
Ralph and Catherine Fisher
Professor,

Organization: CSL,
Department of Computer
Science, University of Illinois at
Urbana-Champaign (UIUC)

Email : Klara@Illinois.edu

Name: John Dalesasse

Title: Professor

Organization: Holonyak Micro
& Nano-Technology Lab
(MNTL), Department of ECE,
UIUC

Email : jdallesa@Illinois.edu

Name: Kenton McHenry

Title: Principal Research Scientist

Organization: NCSA@UIUC

Email: mchenry@Illinois.edu

Name: Roy Campbell

Title: Professor (Emeritus)

Organization: CSL & CS @UIUC

Email: rhc@Illinois.edu

Name: Tracy Smith

Title: Director of Research IT and
Innovation

Organization: Campus Research
IT@UIUC

Email: tracys@Illinois.edu



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Quad Chart for:

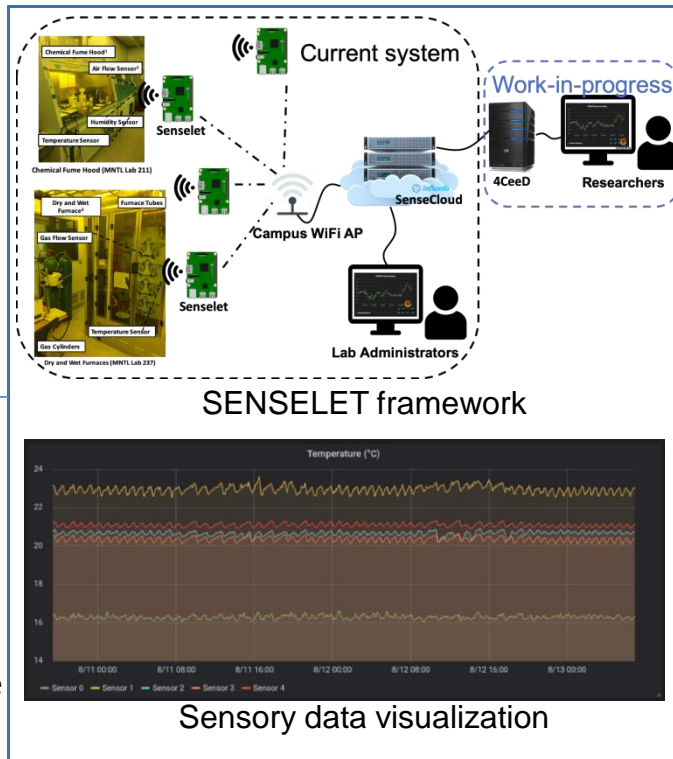
SENSELET: a Sensory Network infrastructure for Scientific Lab Environments

Challenge Project Seeks to Address:

- Materials research and device fabrication are sensitive to their environments, thus lab environments must be carefully monitored.
- Budget limits and cleanroom policies require a low-cost, wireless sensor solution.
- An easy-to-use visualization tool is needed to aide real-time monitoring.

Solutions or Deliverables:

- We have built SENSELET prototypes from Raspberry Pi Zeros interfacing with temperature and humidity sensors Si7021.
- A time series database, InfluxDB, is deployed as the backend data storage engine.
- We have built communication channels between the sensors and database using Mosquitto.
- Real-time monitoring is enabled through data visualization.



Scientific Impact or Broader Impact:

- SENSELET can help lab administrators monitor the real-time status of the lab environment and equipment to be aware of hazardous conditions.
- With the interface to 4CeeD, SENSELET allows researchers to automatically log environmental data during experiments to correlate with experimental data.

Metadata tag:

- <https://t2c2.csl.illinois.edu/senselet>
- Prototypes deployed in cleanroom lab space; integration with 4CeeD being developed.
- Publication: "SENSELET: Sensory Network Infrastructure for Scientific Lab Environments", poster at PEARC19.
- We are looking for other open source sensors to monitor power, vibration,...
- 2 PhD students from CS/CSL and 2 PhD students from ECE/MNTL collaborate on this project, jointly with MNTL clean room lab managers, with CSL/Engineering/Campus IT professional programmers/staff



NSF Campus Cyberinfrastructure PI and Cybersecurity Innovation for Cyberinfrastructure PI Workshop

September 24-25, 2019 | Santa Fe, Arizona

NSF Program: CC*

Program Area: CC*Integration

Award Number: 1659293

PI: Klara Nahrstedt, University of Illinois, Urbana-Champaign (UIUC)

co-PIs: Tracy Smith, John Dallesasse, Paul Braun, Roy Campbell

Project Title: BRACELET: Robust Cloudlet Infrastructure for Scientific Instruments' Lifetime Connectivity



Klara Nahrstedt
Director of CSL
UIUC
klara@illinois.edu



Tracy Smith
Director of Research IT,
Technology Services
UIUC
tracys@illinois.edu



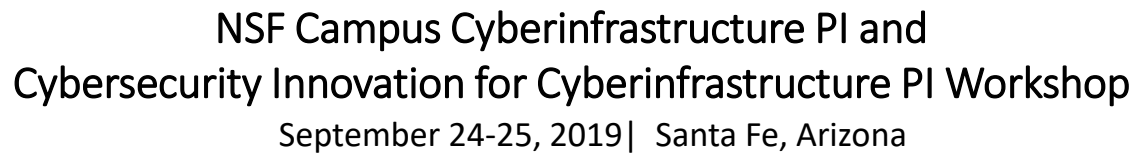
John Dallesasse
Assoc. Professor, ECE/MNTL
UIUC
jdallesa@illinois.edu



Paul Braun
Director of MRL
UIUC
pbraun@illinois.edu



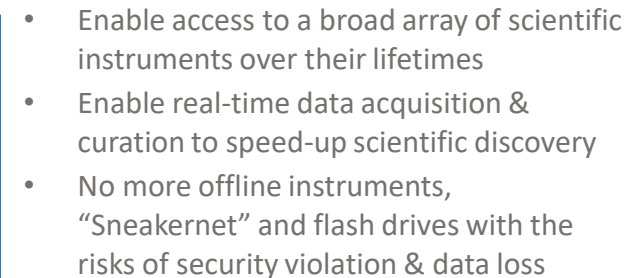
Roy Campbell
Assoc. Dean CoE
UIUC
rhc@illinois.edu



Broader Impact:

- **Performance mismatch:** Older instruments' OSES Windows NT or XP run network protocols at lower bandwidth speeds (10Mbps or 100Mbps)
- **Obsolete security:** Older devices and their OS systems cannot be patched, hence become vulnerable & taken offline

- Cloudlet/edge device, called BRACELET, between older instrument and private cloud
- **Performance component:** Have two network interfaces configured at different speeds, perform traffic shaping from slower to faster network
- **Security component:** User & instrument registration; data encryption during upload; firewall to protect against external threats



- **URL:** <https://t2c2.csl.illinois.edu/bracelet/>
- **Collaboration:** We are interested if other labs face similar problems and are interested in collaboration!
- **Publication:** Phuong Nguyen, et al., "Bracelet: Edge-Cloud Micro-service Infrastructure for Aging Scientific Instruments", **IEEE ICNC 2019**, Hawaii, February 2019
- **Student Engagement:** BRACELET project includes full time CSL PhD student, assisted by two PhD students from MRL (Materials Research Lab) and MNTL (Micro-Nano Technology Lab) working with scientific instruments