SYS7: CENS Systems-Infrastructure Overview

https://escholarship.org/uc/item/0pt39141

Richard Guy
Mohammad Rahimi
Karen Weeks
et al.

2005
Effective ENS requires end-to-end systems

- Sensor, sensor host, gateway, database, user interface
  - some COTS, some research, some reusable, some missing
- Development requirements different from deployment needs
- More complex than domain scientist is prepared to construct

Effective ENS requires end-to-end systems

- What software is common to all/most/some/few domains?
- What is reusable from previous distributed systems work?
- What is unique to embedded networked sensing?
  - What deployment management tools are required?

Accomplishments: Significant development/deployment in three domains + core foundation

- Effective ENS requires end-to-end systems
- String of 50 hard-to-access sensor stations
  - Wither, forest, RF noise
- Limited power at each station
- Limited per-station storage capacity
- 40 stations/day available

Solution: Hop-by-hop transport with end-to-end acks

- Capture/package raw sensor data, 3MB/hour

The Need: A software framework for design, development, deployment, and operation of heterogeneous ESNs

- Sensor network software tends to be monolithic
  - Need more component re-usability, without inflexible layered stack
- Sensor network systems tend to be language-specific
  - Difficult to leverage components from other ENS software systems
- Integration of binary images not generally supported
- Sensor networks are notoriously invisible
  - Very difficult to "see" inside an operational in-situ ESN

The Solution: The Emstar family of extensible/reusable tools, services, and libraries

- Tools (simulation, emulation, visibility)
  - EmSim/EmCas, EmRun, EmView/EmProxy
- Services (network, time, IPC)
  - Link/neighborhood estimation, time synchronization, routing, IPC device abstractions, Host/Mote/MoteNIC
- Libraries
  - General purpose utility routines; domain-specific routines

Status: Emstar is maturing from a single lab tool, to a widely-adopted development environment.

- Used by >100 active users (support list e-mail)
  - 21 universities, 11 companies, 13 countries
  - > 1,000 downloads April 1-June 15, 2005
- Major effort to improve documentation
  - Better how-to documents, tutorials, class materials
- Workshops at UCLA, ESN conferences
  - CS113; EE206; NSF u-grad internships; SECON05

Visualization tools examples

- Can easily collect node-by-node data of various metrics
- Can easily display in 3-D graphical form the ESN layout/metrics

Above: display of Boelter Hall ceiling testbed
Right: James Reserve systems research transect

Emstar