ForestEdge

Unobtrusive Mechanism Interception in Environmental Monitoring

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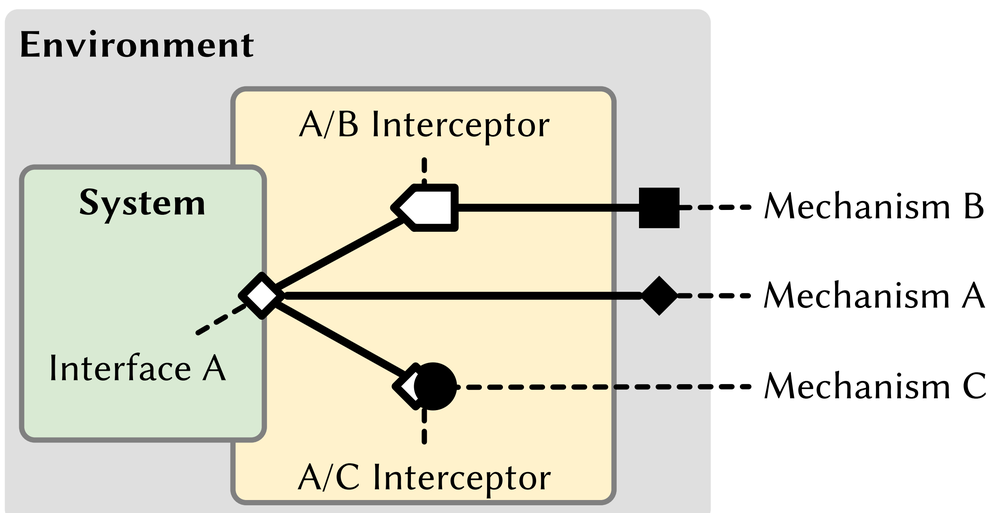
Mechanism Interception

- *System* cannot be upgraded
  - May be an application, operating system, or entire hardware platform
- *Environment* controlled by the developer
  - If system is an app, control OS
  - If system is OS, control platform
  - If system is platform, control network
- Introduce *interceptor* which captures data at the system's *interface*
- Interceptor redirects data over new communication channels



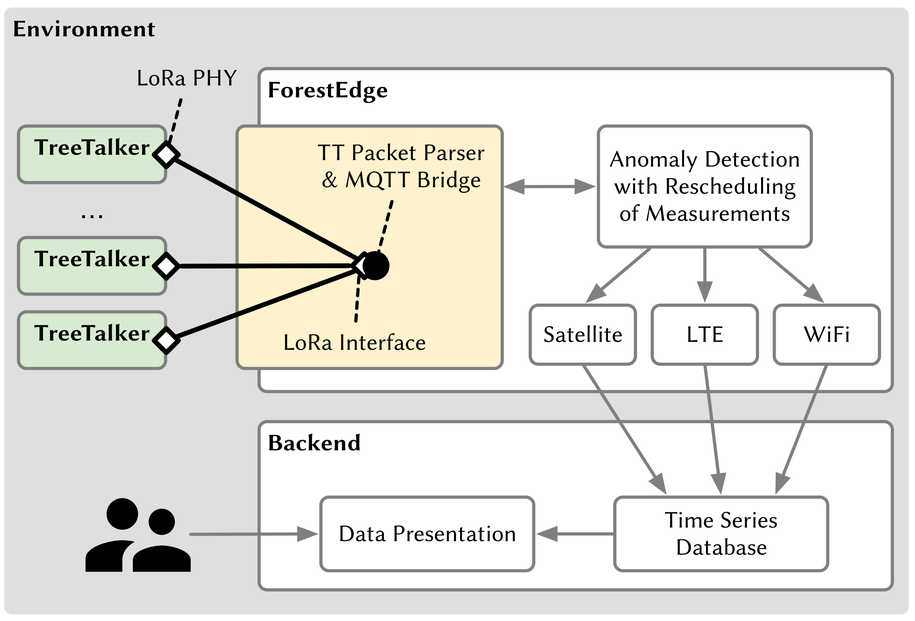
Treetalker

TreeTalker System

- *TreeTalker* is a proprietary hardware platform
- Communicates with proprietary *TTCloud* via LoRa
  - Uses LoRa PHY rather than LoRa WAN
- TTCloud uploads data to vendors' cloud infrastructure
  - Uses operator-provided mobile data plan
- Operator downloads CSV from vendor's website

Issues with the existing system

- System is entirely static; data only available after delay
- Configurability lacking; stations configured statically on startup
  - Remote interaction only possible via SMS



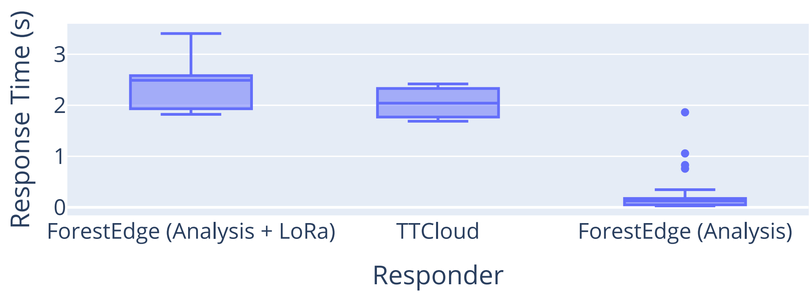
ForestEdge System

- Combines local on-site component with a remote backend
- Local component intercepts LoRa traffic, bypasses TTCloud
  - A single station can serve all TreeTalkers in an area
- Backend aggregates measurements from multiple local components
  - The local interceptor can use arbitrary communication technologies

Advantages

- Dynamically re-provision TreeTalkers during operation
- Live-view of all collected data on the backend
- Recognize anomalous measurements and react
  - Trigger immediate remeasurement, alert operator, etc.

Deployment

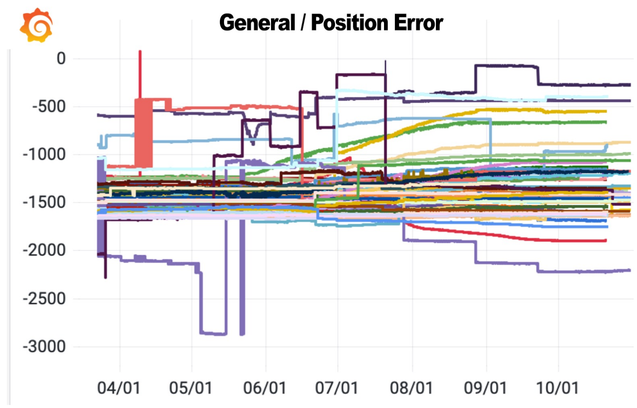


Performance Evaluation

- Same response times as proprietary gateway
- Data gathering, analysis, and transmission to the backend very fast
- The vast majority of response time is due to time on air of LoRa

Historical Data

- Analyzed historical data from real-world deployment
- 100 TreeTaklers deployed for two years
- Discovered major flaw with accelerometer



References

P. Lampe, M. Sommer, A. Sterz, J. Höchst, C. Uhl and B. Freisleben, *"Unobtrusive Mechanism Interception,"* 2022 IEEE 47th Conference on Local Computer Networks (LCN), 2022, pp. 303-306, doi: 10.1109/LCN53696.2022.9843536.

P. Lampe, M. Sommer, A. Sterz, J. Höchst, C. Uhl and B. Freisleben, *"ForestEdge: Unobtrusive Mechanism Interception in Environmental Monitoring,"* 2022 IEEE 47th Conference on Local Computer Networks (LCN), 2022, pp. 264-266, doi: 10.1109/LCN53696.2022.9843426.

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