Protecting Privacy in Sensor-Enriched Internet Services

Presenter:

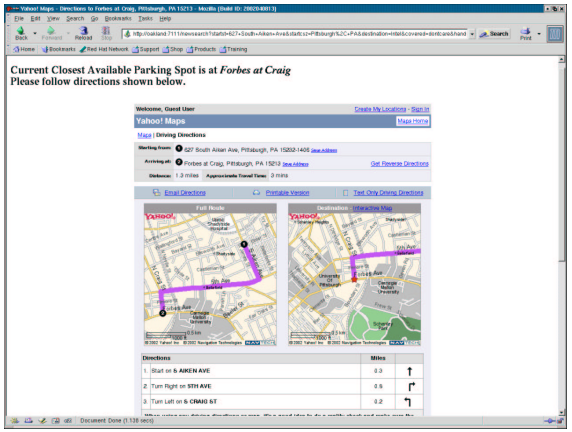
Yan Ke, CMU

In collaboration with:
Phillip B. Gibbons, Brad Karp, Rahul Sukthankar, Intel
Srinivasan Seshan, Suman Nath, CMU

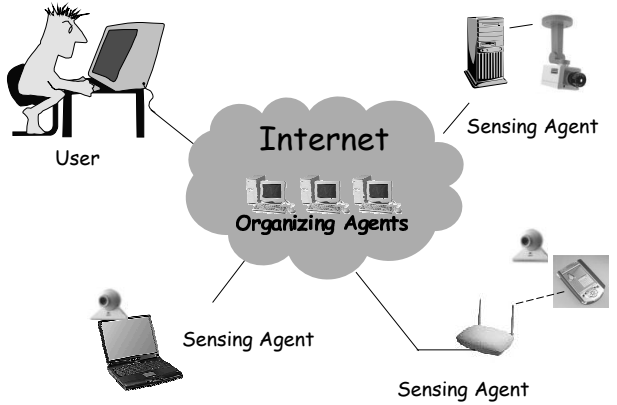
March 28, 2003 CMU Aladdin Data Privacy Workshop

Parking Space Finder Service

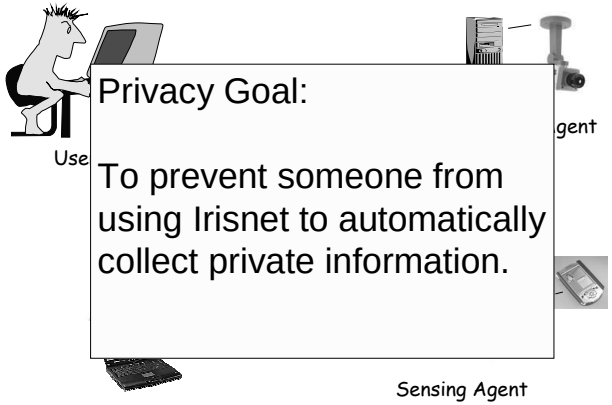
Parking Space Finder Service



Irisnet: The Big Picture



Irisnet: The Big Picture



Example Webcam Services

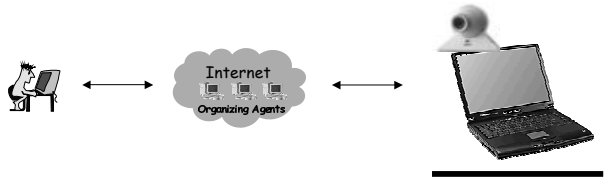
- Parking Space Finder
  - Find me the cheapest available parking spot within 2 blocks of CMU
- Waiting time monitors
  - Which restaurants have the shortest long lines?
- Historical camera views
  - I left my umbrella somewhere today. Show all views of me from today.
- Silent witness
  - Who hit my parked car?
- Triggered event monitor
  - Notify me when the 61C bus is coming down the street

Organizing Agents (OA)

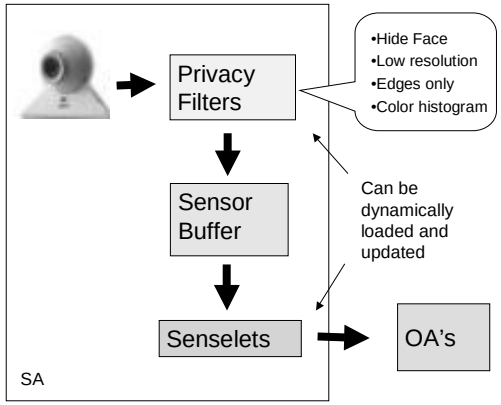
- Distributed XML Database
- Distributed Query Processing (XPath)
- Caching to improve performance
- Redundancy to reduce failures

Intelligent Sensing Agents (SA)

- PC-class machines, running Linux
- Shared by different services.
- Collect data from attached sensor(s)
- Filter sensor data to protect privacy
- Execute senselets (code) uploaded by OAs
- Send gathered data back to OAs

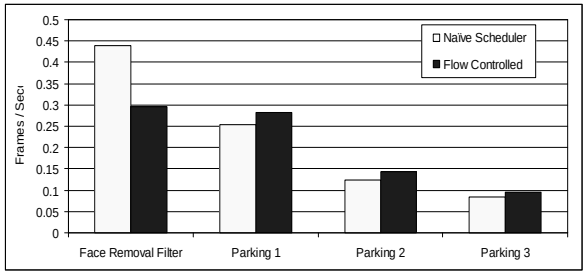


Current SA Implementation



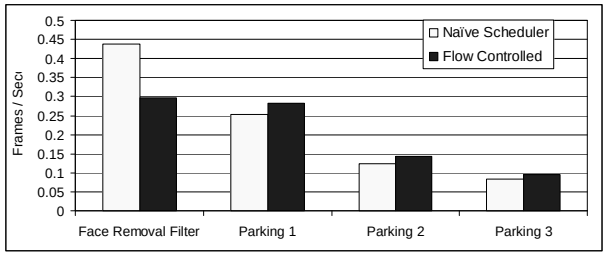
System Issues – Example Problem

- CPU is fully loaded.
- Filter produces frames faster than any of the senselets can consume them.
- Default Linux process scheduler produces suboptimal scheduling of filter and senselets.



Flow Control

- Rate matching of privacy filter to fastest senselet.
- Coalesce requests from senselets, preferring already used frames.



Demo

Future Work

- Privacy checks at other places of infrastructure

•Authentication
•Access Control

•Low data rate output
•Check conformance to XML Schema

•Multiple filter types
•Senselets with different levels of privacy certification

Ability to recover hidden information for post mortem analysis.

Conclusions

- Protecting privacy without degrading performance and utility in real sensor deployments is a challenging problem.
- We built initial privacy protection mechanisms into Irisnet.
- Ability to download arbitrary privacy filters, leveraging the latest image processing algorithms.
- Open to suggestions to other potential problems and solutions…