smartparcels

background info

Google

define smart community

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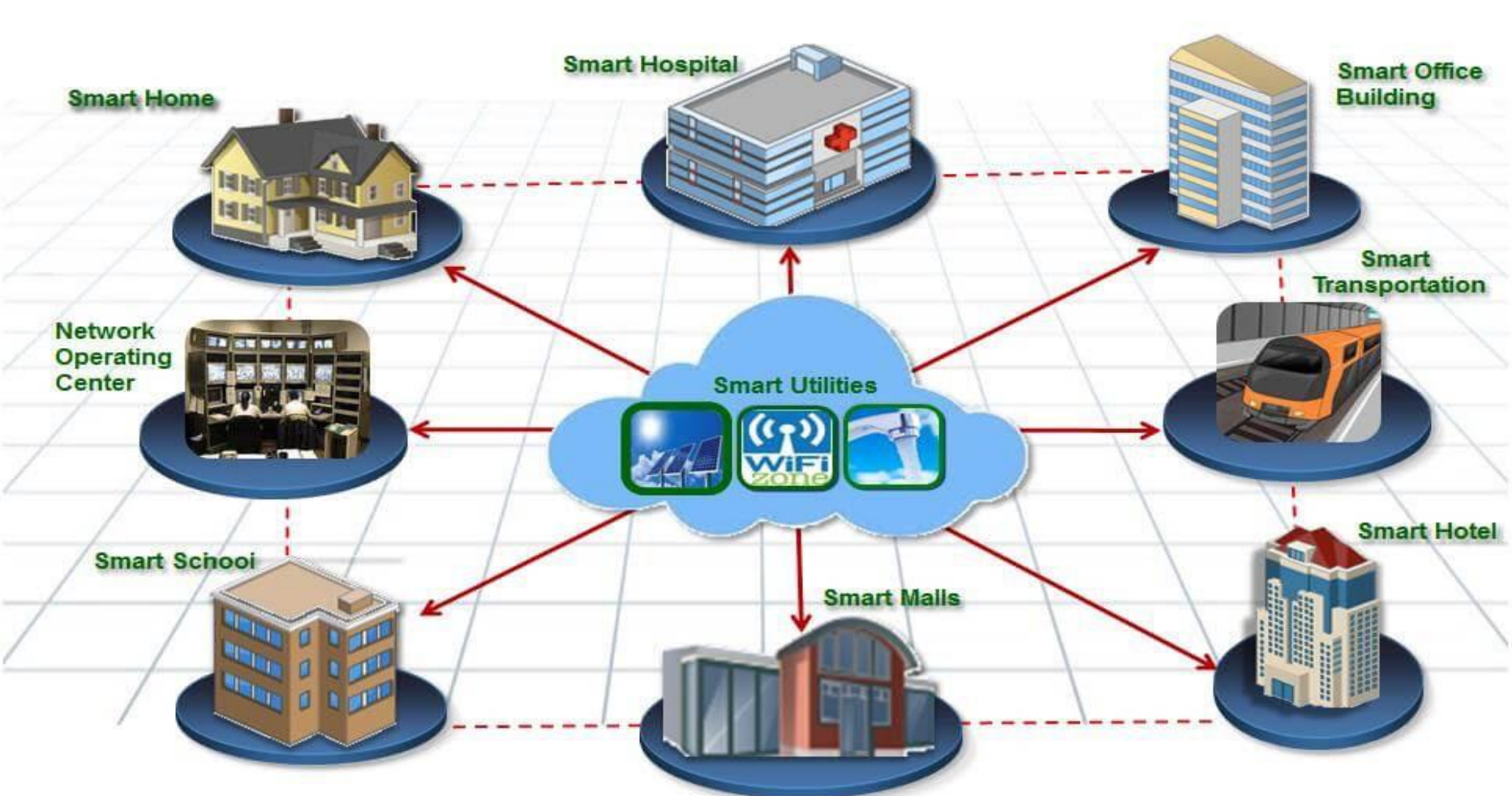
A smart community is **an interconnected city, community, or region that leverages the smart use of technologies to benefit its citizens, businesses, and service organizations for economic growth**, social benefits, and environmental sustainability. ... Smart city services are not just for “cities”.


Smart Home
Smart Hospital
Smart Office Building
Smart Transportation
Network Operating Center
Smart Utilities
WiFi zone
Smart Hotel
Smart Schooi
Smart Malls

applications

smart governance and public safety

environmental monitoring

smart utilities

smart transportation

big market

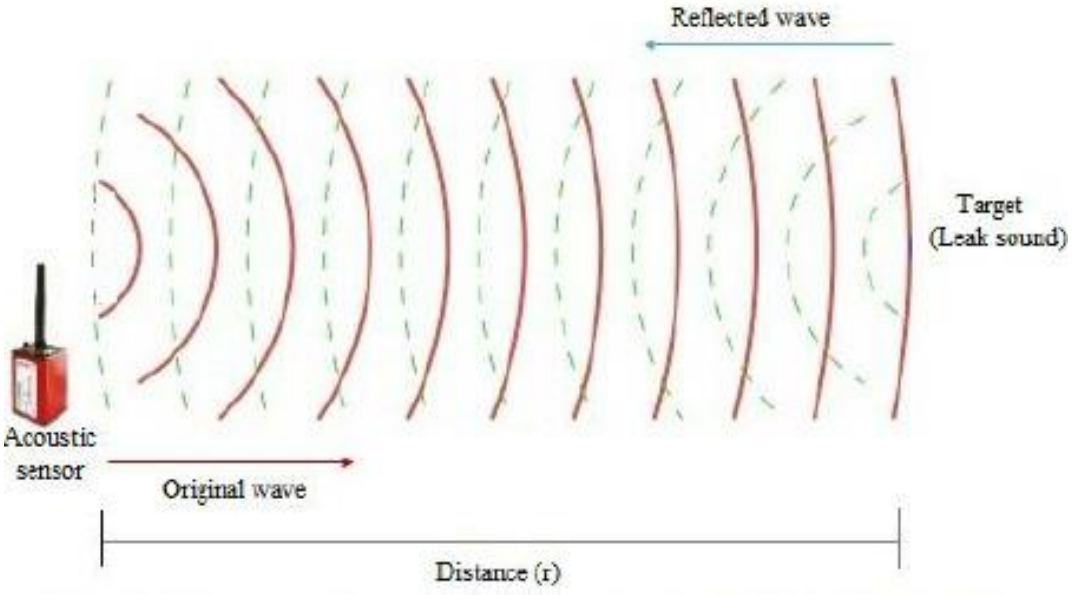
$83.9 billion in 2019

annual growth rate of 24.7% between 2020 and 2027

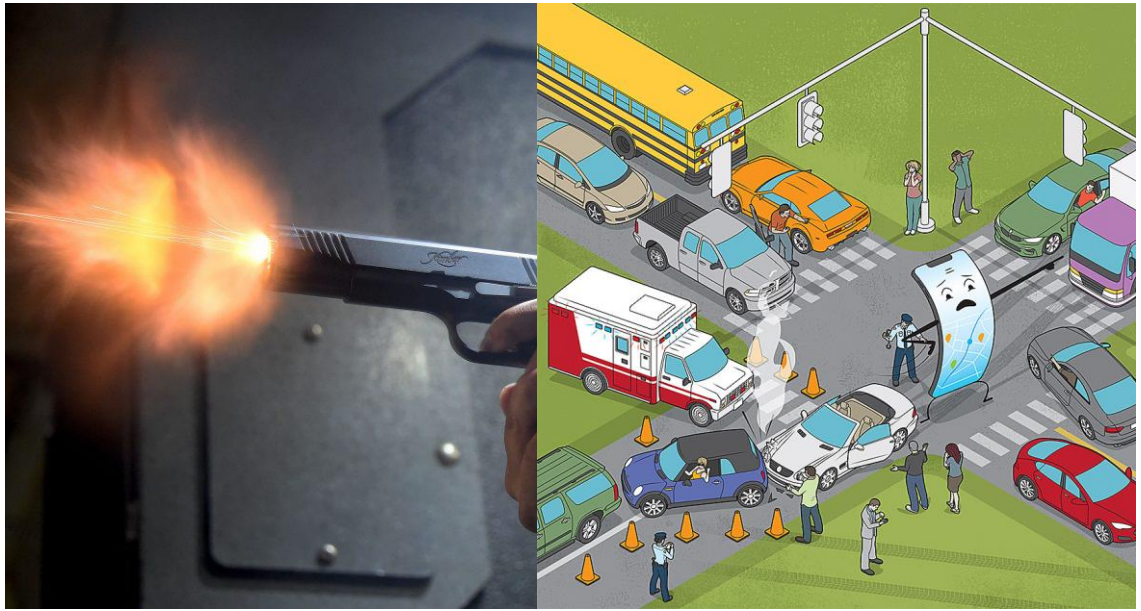
trade-offs

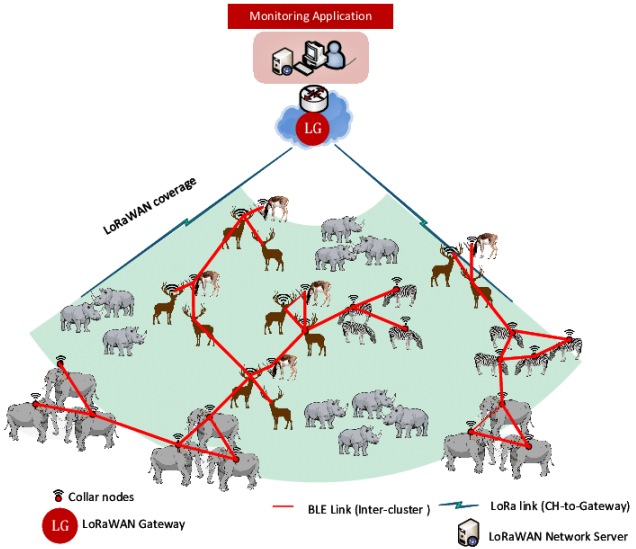
wildfires: gas sensors or drones?

streetlight + acoustic sensors = ?



acoustic sensors





challenges

i) **what** infrastructures and **where** to instrument

ii) how the **data flows** via the infrastructure

iii) how to **reuse** infrastructure under fixed budgets

objective

to develop algorithms to determine:

i) the types and locations of **IoT devices** to deploy

ii) the locations of **computing devices** to deploy

ii) the types and locations of **network components**

‘Parcel’

- from **urban planning** literature
- refer to a **piece of designated land** slated for development with a specific use and purpose
- the **design and instrumentation** to create smart community land parcels

Key Contributions

cross-layer architecture

Need for distinct infrastructure and information layers in order to implement diverse applications

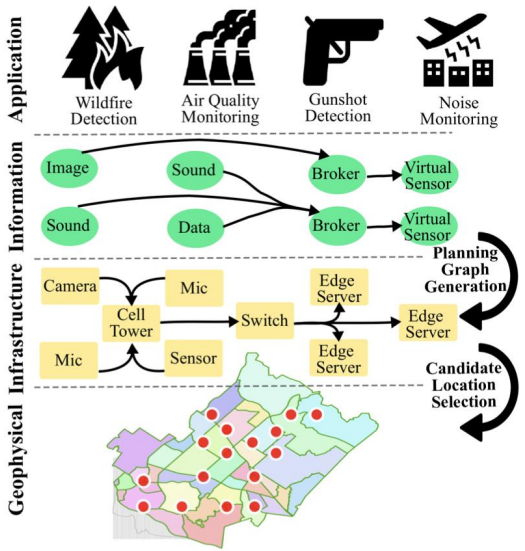


Figure 1: Overview of the IoT planning problem considered in SmartParcels.

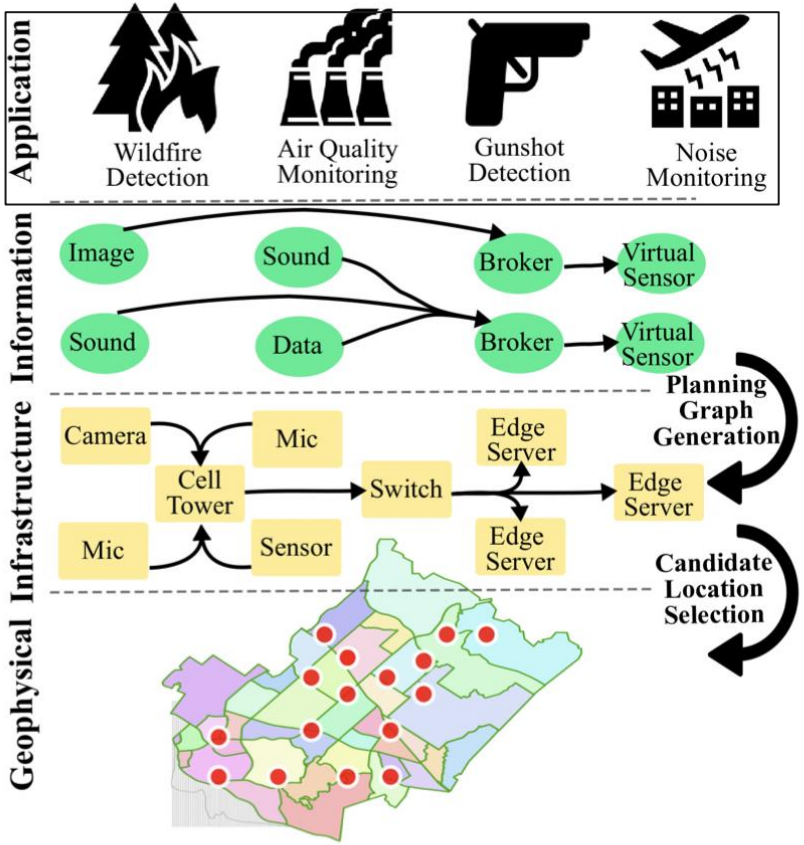


Figure 1: Overview of the IoT planning problem considered in SmartParcels.

Survey the communities for

- Boundaries
- Candidate locations
- Required applications
- Deployment and operational budgets

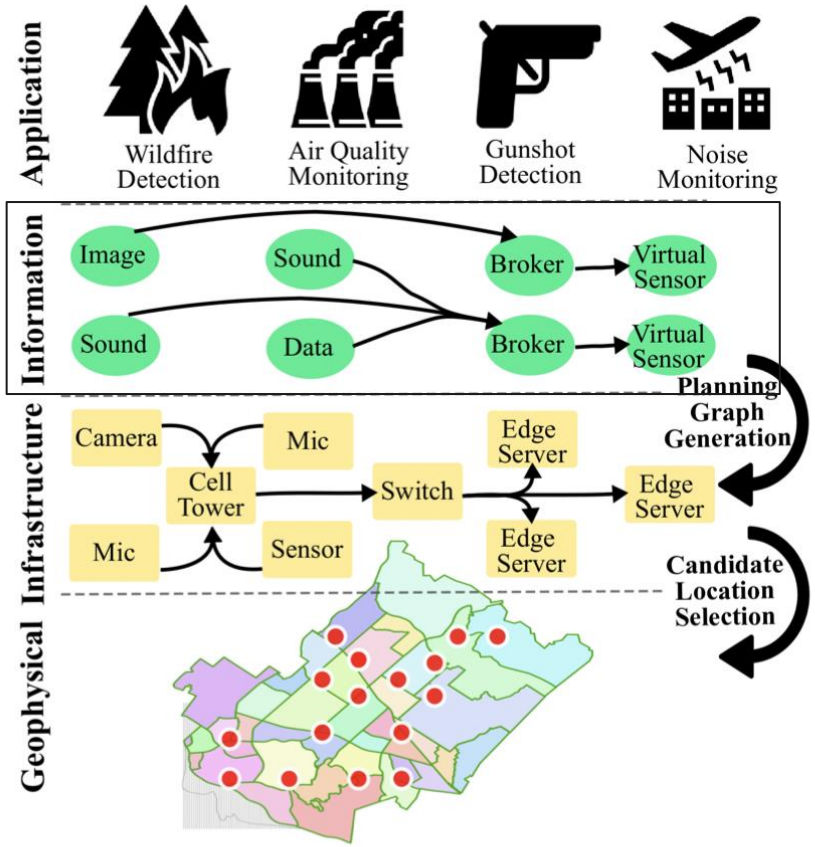


Figure 1: Overview of the IoT planning problem considered in SmartParcels.

Each application can be realized by multiple information flows which consist of multiple software processing units.

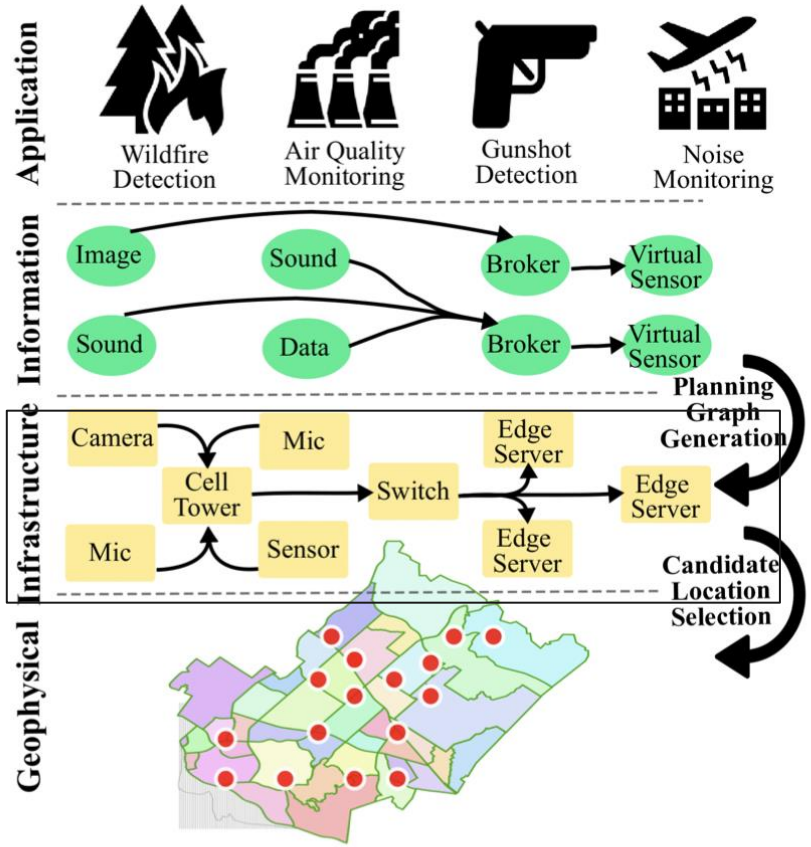


Figure 1: Overview of the IoT planning problem considered in SmartParcels.

each information flow needs to be overlaid on an infrastructure flow, which dictates the hardware devices to install.

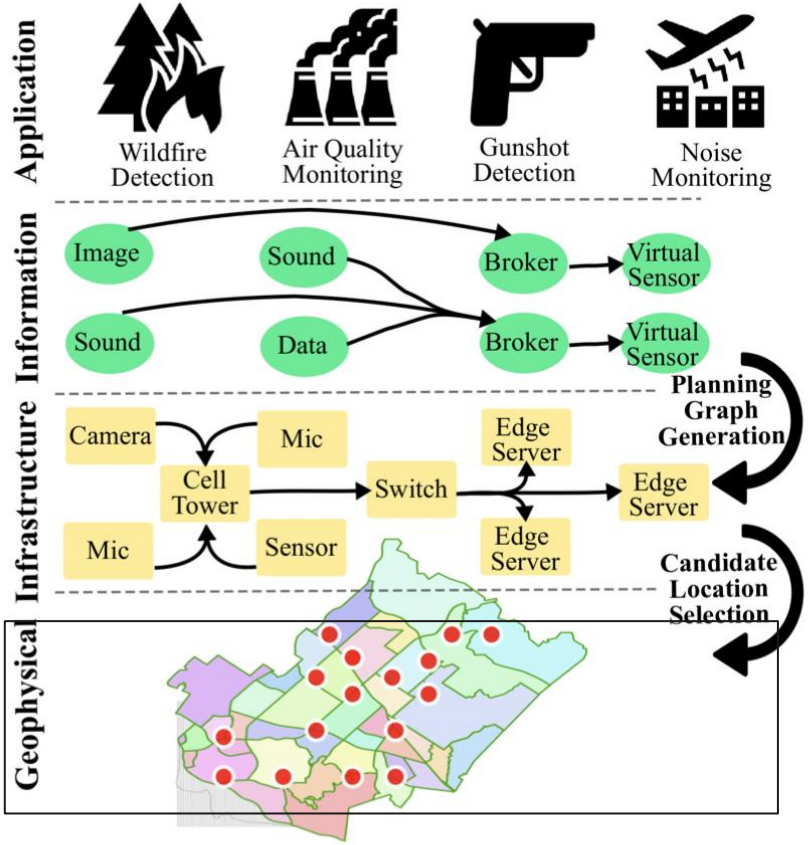


Figure 1: Overview of the IoT planning problem considered in SmartParcels.

compute the optimal mappings across the layers, so as to maximize the service utility without incurring excessive costs.

service utility

service_utility(coverage, accuracy):

coverage -> **geographical area** where events are detected

accuracy -> **probability** an event is correctly detected

algorithms

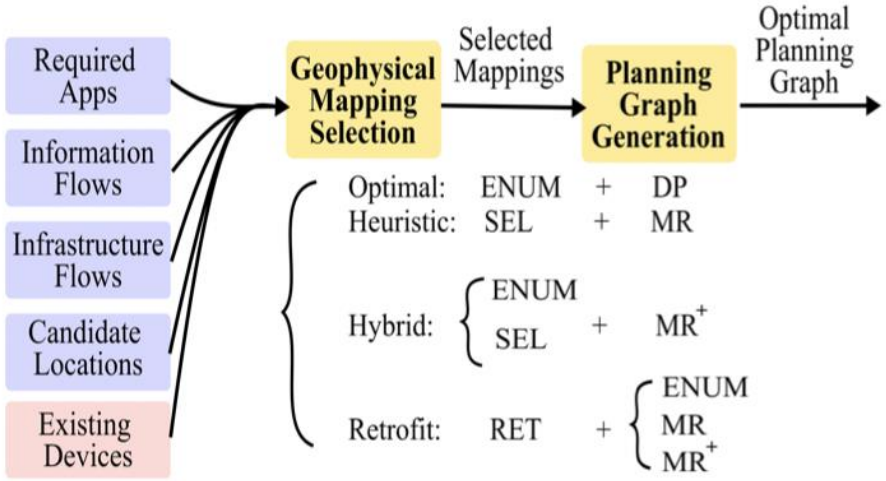
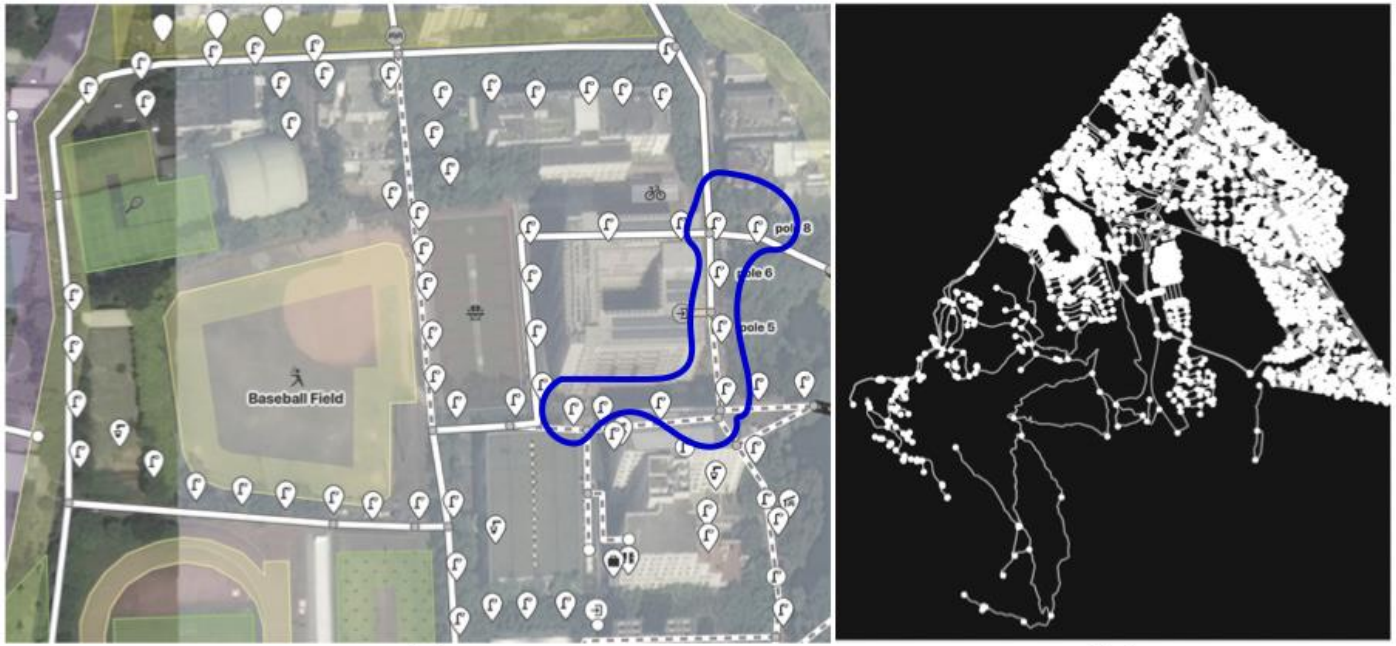


Figure 2: Problem decomposition, key inputs/outputs, and proposed algorithms.

Evaluation

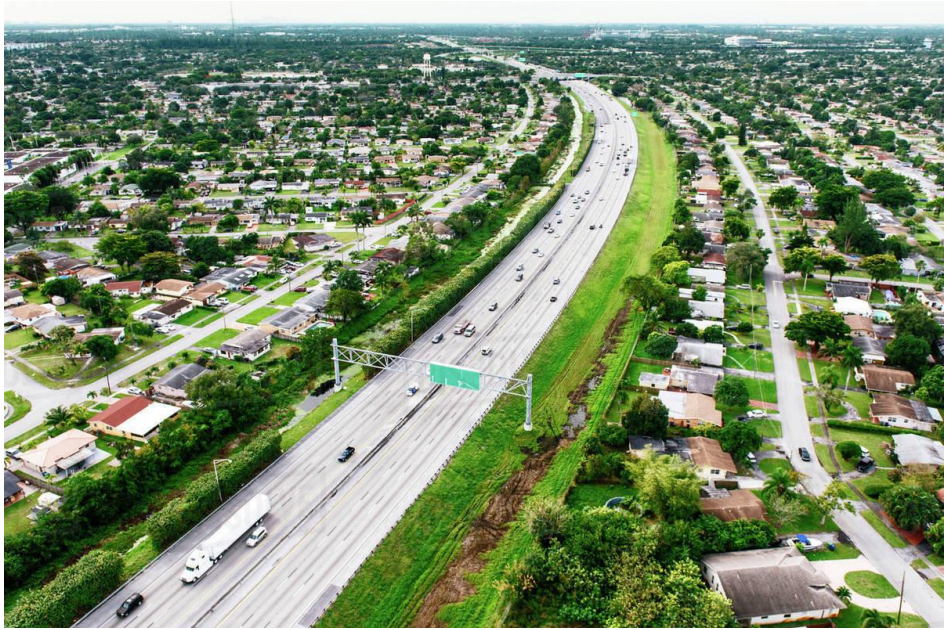


(a) (b)

Figure 3: Two real-world settings: (a) streetlights on a smart campus and (b) road segments in a smart city.

outdoor shopping center

residential area by highway



wildland and residential area next to wildland

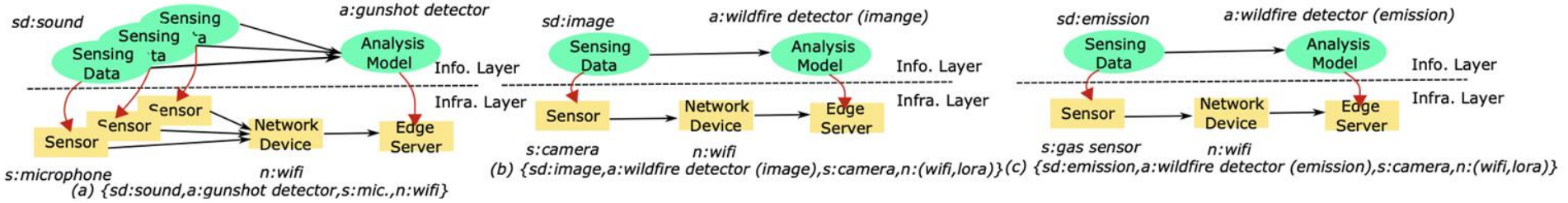


Figure 4: Sample information/infrastructure flows used in our evaluations: (a) gunshot detection and (b), (c) wildfire detection.

key results

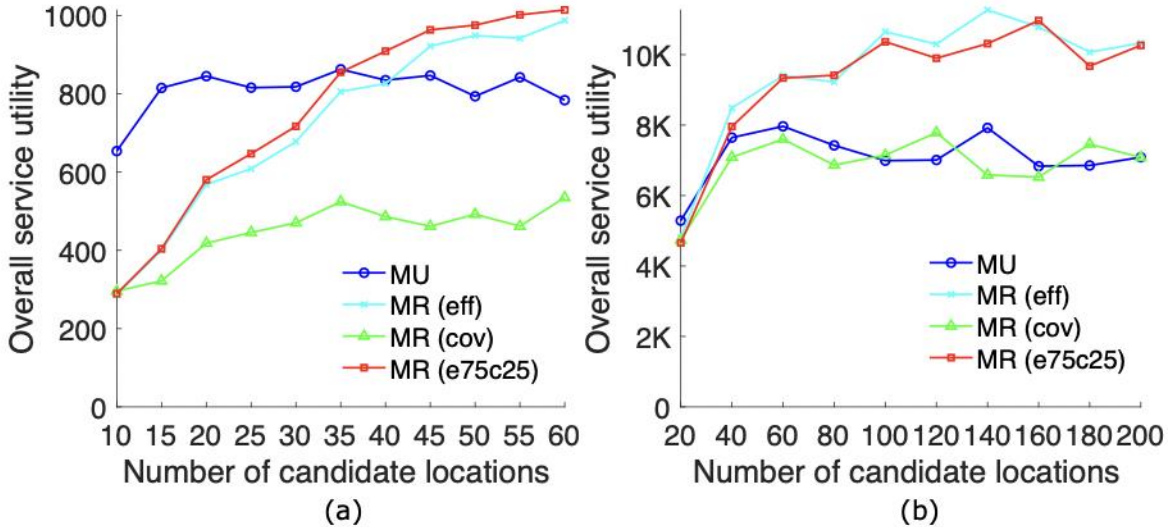


Figure 10: Overall service utility from our event-driven simulator, sample results from the clean-slate problems in: (a) smart campus and (b) smart city.

my pros and cons

+

easy to read

nicely organized and structured

-

unrealized costs?

the maximum reusability algorithm may be too simple to match real life costs of implementation