DESIGNING IOT SYSTEMS FOR SMART COMMUNITIES

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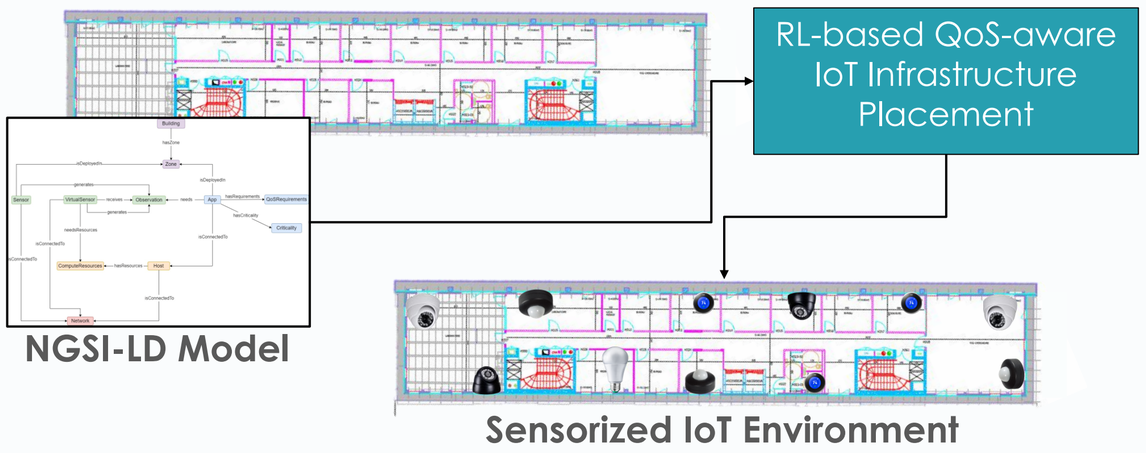
DESIGN TIME: ENABLING AUTOMATED IOT INFRASTRUCTURE PLACEMENT

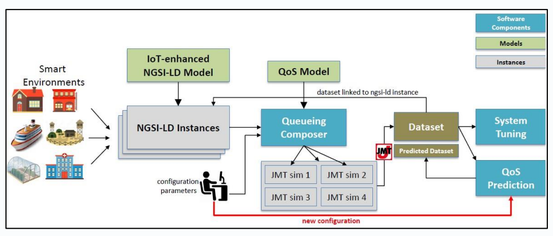


- Currently, IoT designers must place the required IoT infrastructure (sensors, APs, brokers,..) **manually**, which is a **lengthy** and **error-prone** task.
- We propose an **automated approach for IoT infrastructure placement** that considers:
  - the QoS requirements of applications to be deployed.
  - the coverage and accuracy of sensors and IoT devices.
  - the available computing resources.

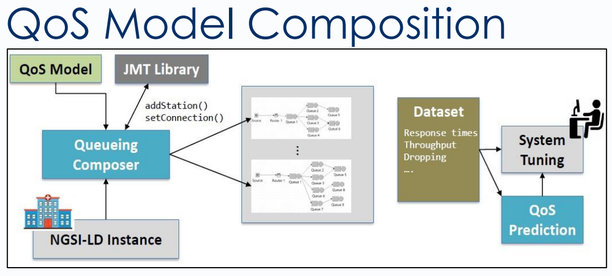
SIMULATION TIME: SIMULATING EDGE INTERACTIONS IN IOT-ENHANCED SPACES[1]

- Applications deployed in a smart environment have different QoS requirements (e.g., thermal comfort vs. emergency application).
- IoT systems designers need to **tune** their systems (e.g., bandwidth allocation, assigning priorities to data flows) to ensure that the QoS requirements of all applications are satisfied.
- However, doing so by deploying and testing the IoT system is a **costly** and **time-consuming** process.
- We propose **EDICT, a simulation tool for evaluating and predicting the performance of Edge interactions in IoT-enhanced environments**.

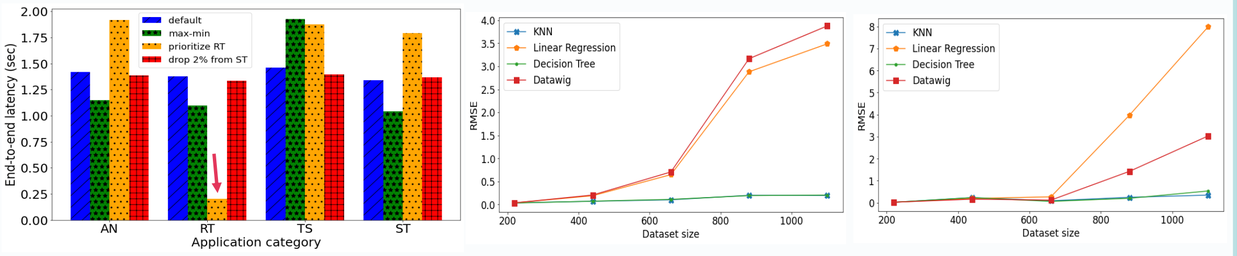
EDICT Architecture



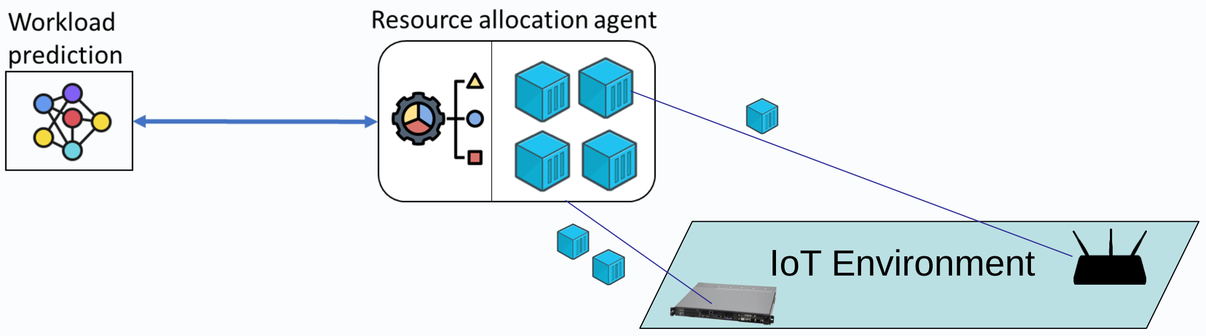
QoS Model Composition



Experimental Evaluation

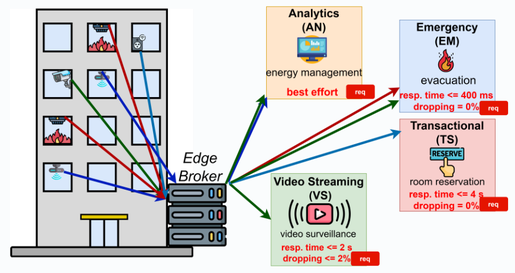


RUNTIME: A WORKLOAD-ADAPTIVE SYSTEM FOR DISTRIBUTED IOT ENVIRONMENTS



DEPLOYMENT TIME: A FRAMEWORK FOR ADAPTIVE DATA FLOW MANAGEMENT

- IoT devices data is highly diverse in nature.
- Smart space applications have diverse QoS requirements.
- **Intersecting applications** receive the same data flows coming from the same IoT devices.



Main challenge: how to satisfy the QoS requirements of different applications sharing the same flows of data?

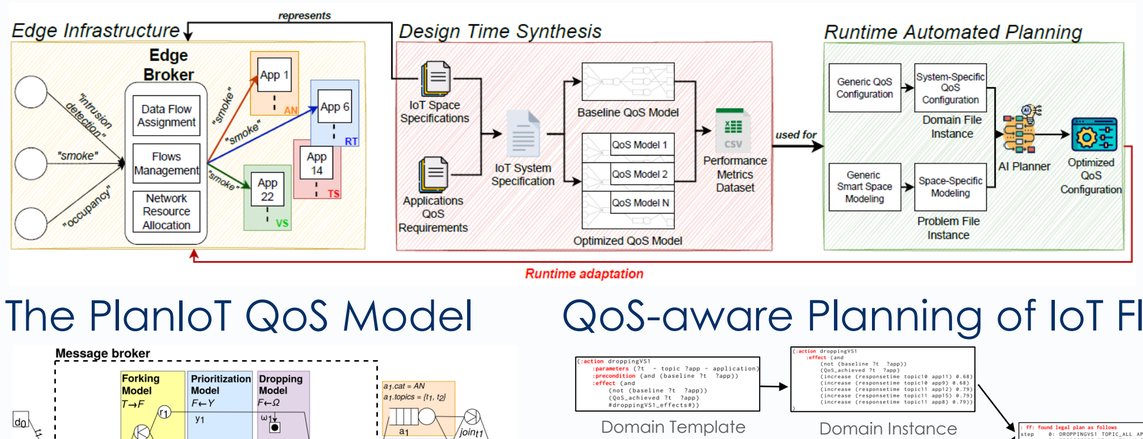
How to support time-critical and bandwidth-sensitive applications?

How to enable Edge infrastructure reconfiguration in an emergency?

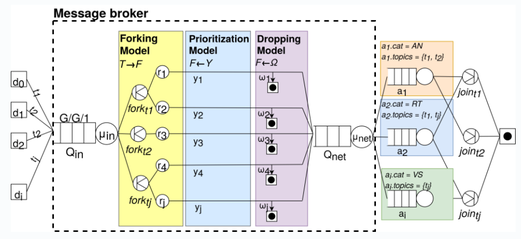
PlanIoT: A Framework For Adaptive Data Flow Management

(to appear in SEAMS'23)

High-Level Architecture

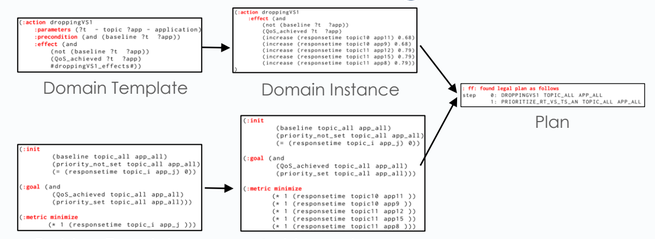


The PlanIoT QoS Model



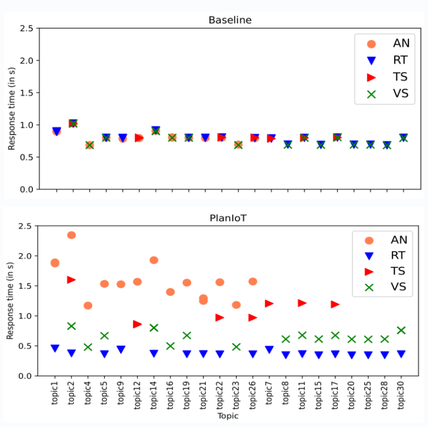
- **Forking Model:** creates flows based on PlanIoT's subscription filters: $r_j = (a_i , t_j) \leftarrow f_i$
- **Prioritization Model:** assigns priorities to flows: $f_i \leftarrow y_i$
- **Dropping Model:** assigns drop rates according to rates identified by PlanIoT: $f_i \leftarrow \omega_i$

QoS-aware Planning of IoT Flows

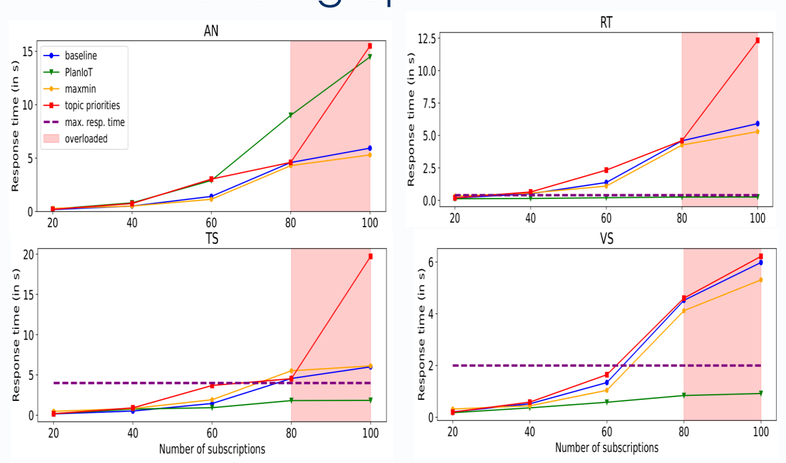


- We rely on generic **domain and problem templates** to represent spaces and QoS models, and to generate **instances** that represent specific IoT environments.
- When the Edge infrastructure changes, new instances are generated and the AI planner automatically reconfigures the Edge infrastructure.

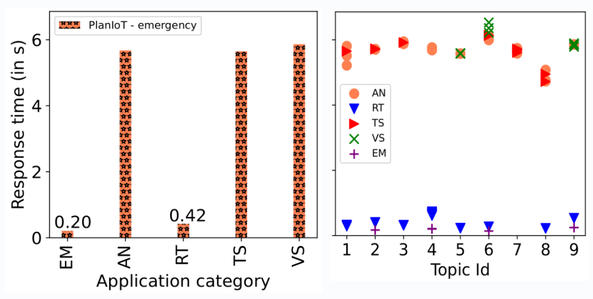
Baseline Evaluation



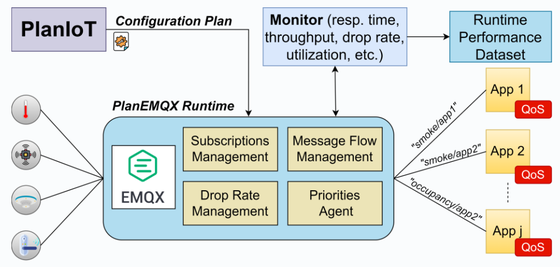
Scaling Up PlanIoT



Adaptation for Emergency Scenarios



Prototype Implementation



1 submitted to DCOSS-IoT'23

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