USC University of Southern California

USC Viterbi School of Engineering

Ming Hsieh Department of Electrical Engineering

# Noctua: A Publish/Subscribe Framework For In-Network Processing

Kwame-Lante Wright, Bhaskar Krishnamachari, Fan Bai

## Motivation

**Efficient networked applications for the Internet of Things**

•Developing high-performance applications for low-power wireless networks requires domain expertise

- *Challenges*: Energy consumption, link quality, memory capacity, processing speed, and device mobility

•**Goal:** A macroprogramming framework that dynamically optimizes an application by leveraging the shared resources of devices on its network

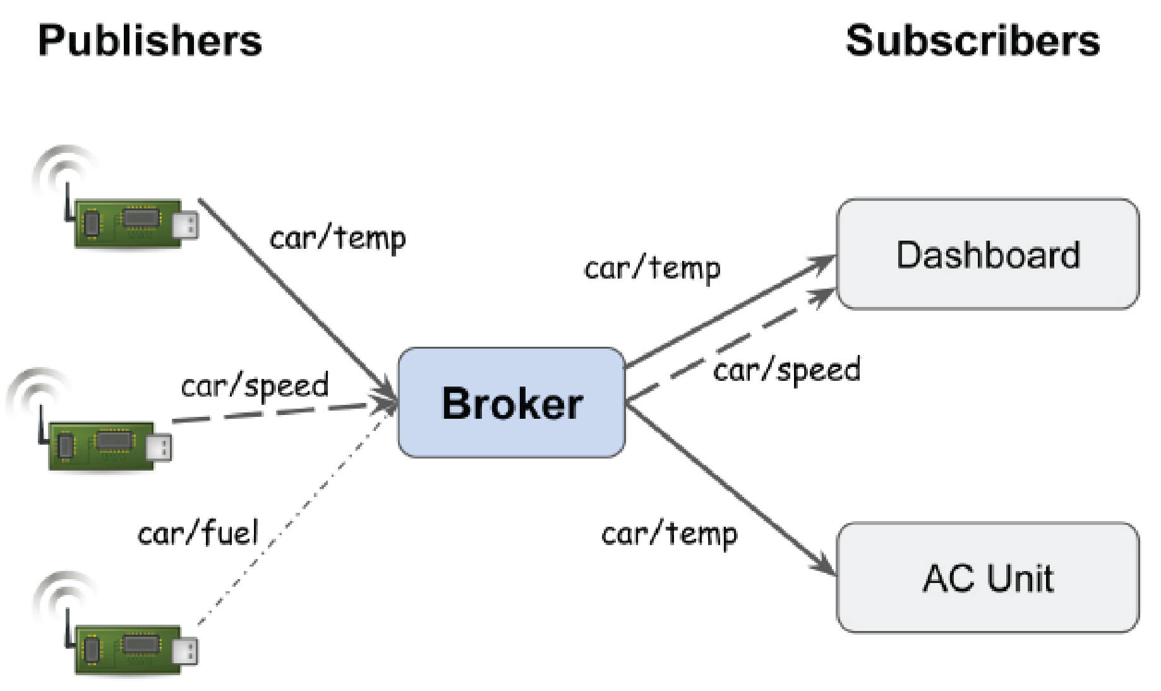
## Computation

- Data-centric networking allows data to be identified by names or topics, and for computations to be requested on-the-fly.
- For example, a subscription to `avg(temp1,temp2)+2` automatically generates subscriptions to temp1 and temp2, and allocates a resource to compute the result

| Type | Examples |
|---|---|
| Literals: ints, floats | 5, 8, 2.7 |
| Operators: − * \ ˆ | 10 − 3, 2 ∗ 6, 12\4, 2ˆ5 |
| Parentheses: () | (47 − 5) ∗ 8 |
| Identifiers | temp, speed, x1, y1 |
| Static Routines | avg(), min(), max() |

Expression Grammar for Subscription Topics

## Communication

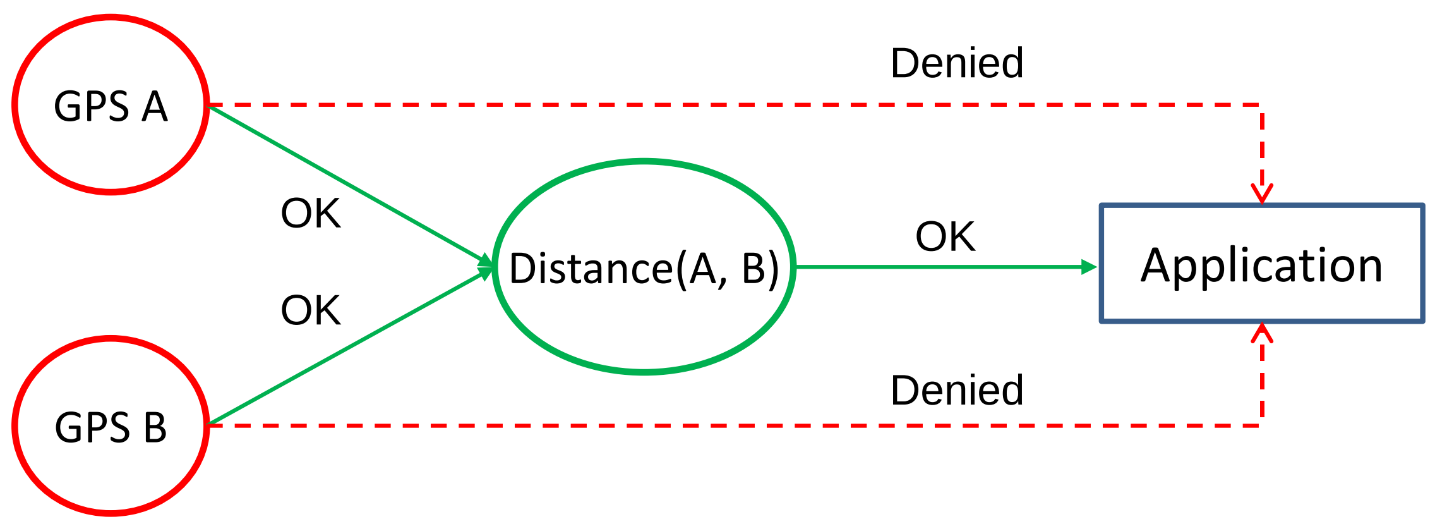


MQTT Protocol Example

- Publish/subscribe messaging paradigm
  - Data sources (publishers) and sinks (subscribers) are decoupled in both time and space

## Privacy

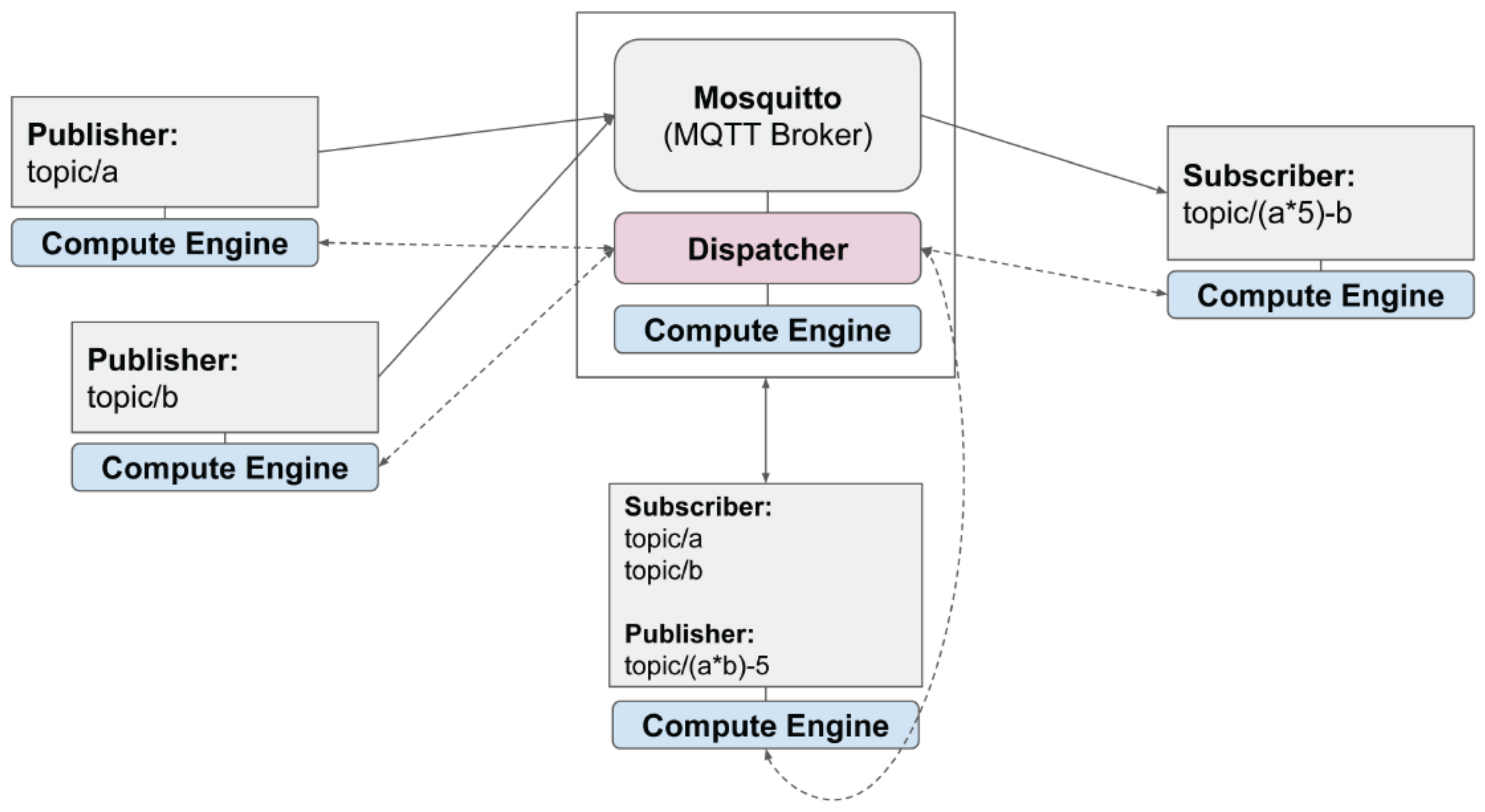
- Through access controls, subscriptions can be limited to aggregated forms of data
- This protects sensitive information without severely limiting flexibility in application development



Privacy Protection

## System Architecture

- Noctua is built on **Mosquitto**, an open-source MQTT broker
- The **Dispatcher** dynamically schedules requests for computation based on available network resources
- **Compute Engine** runs on all devices with shared resources; performs computations when resources are available and a task has been allocated by the Dispatcher



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GM

*Kwame Wright <kwamelaw@usc.edu>*

Ming Hsieh Institute

Ming Hsieh Department of Electrical Engineering