HealthEdge: Task Scheduling for Edge Computing with Health Emergency and Human Behavior Consideration in Smart Homes

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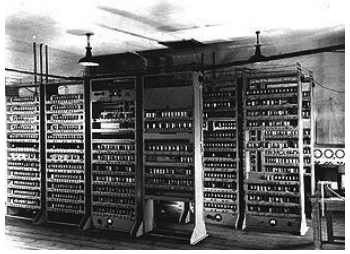
Outline

- Introduction
- Approach description
- Evaluation
- Conclusion

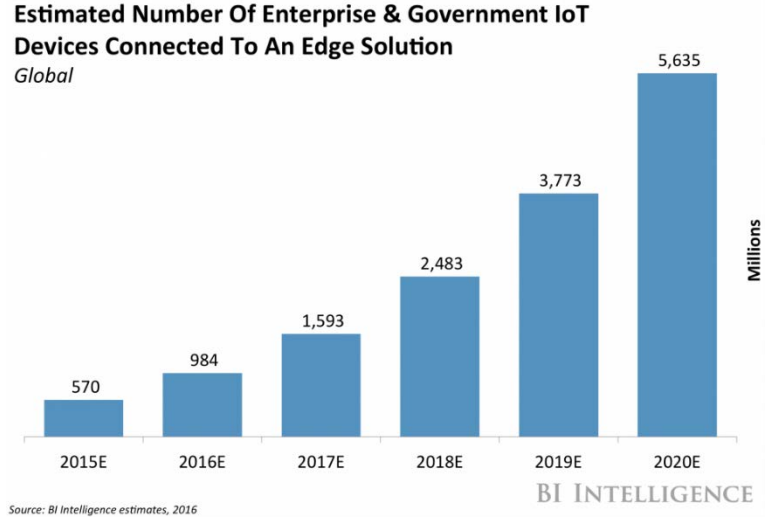
The Future

Mainframe
Centralized
1960-1970

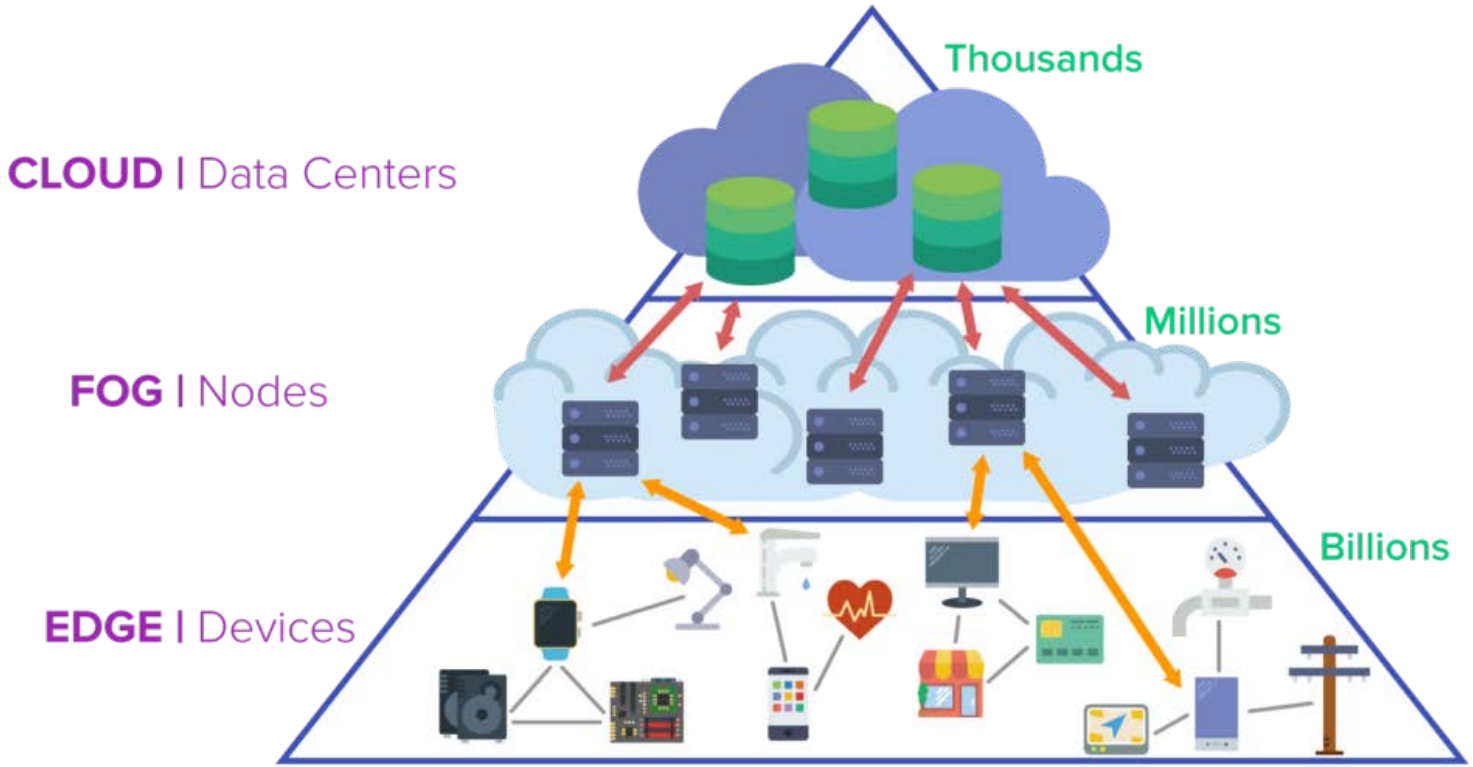


Client-Server
Distributed
1980-2000

Mobile-Cloud
Centralized
2005-2020



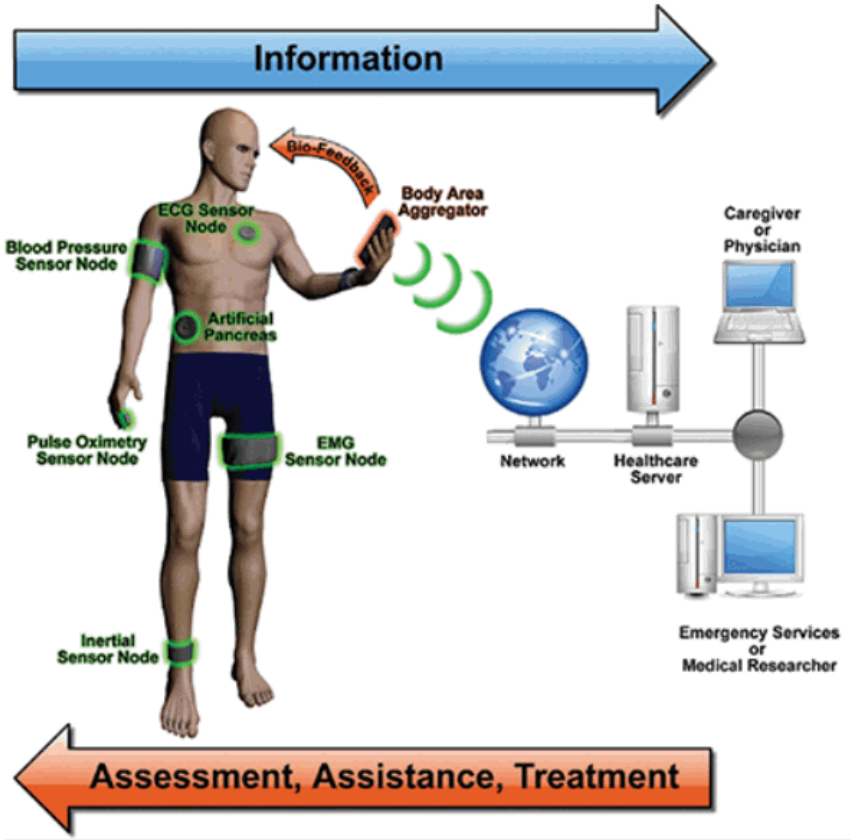
Edge Computing
Distributed
2020-Future


CLOUD | Data Centers
FOG | Nodes
EDGE | Devices
Thousands
Millions
Billions

Monitor patients critically

Better response time

Aids in patient mobility



Sensors connected on a patient for Remote Health Monitoring

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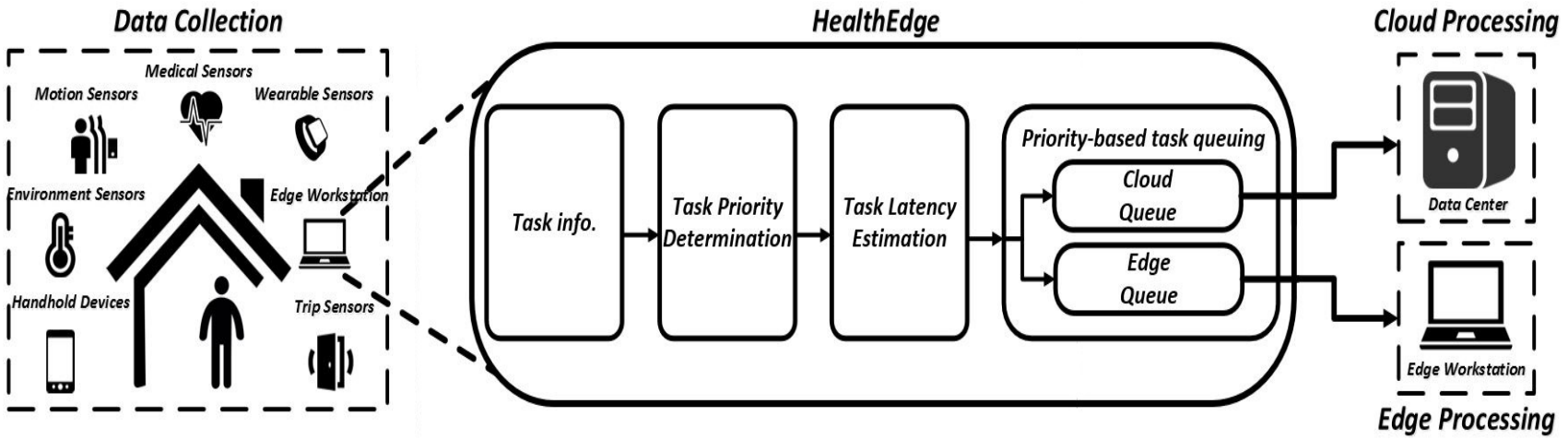
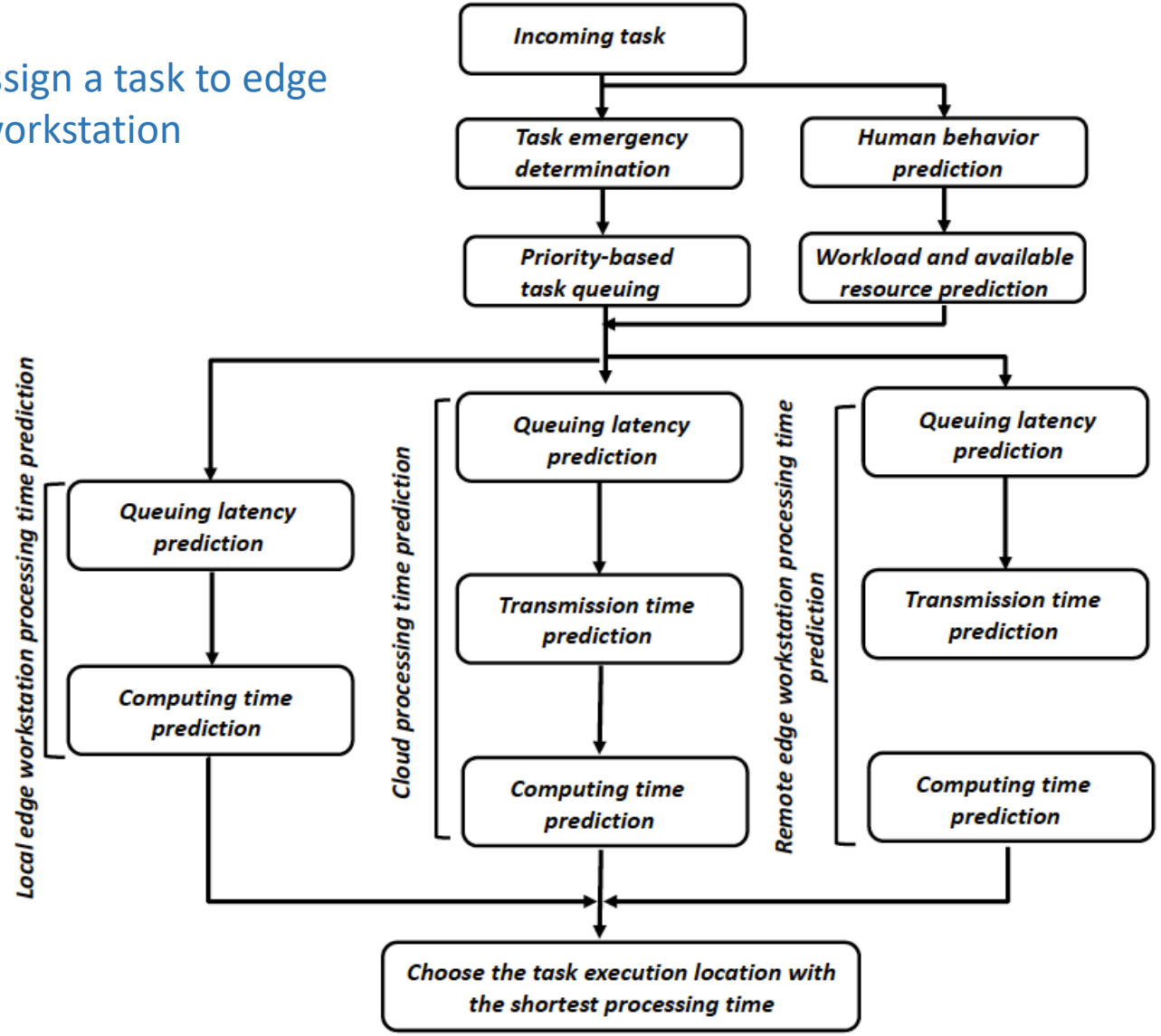


Overview of HealthEdge

Aim to schedule task by considering task emergency and human behavior for resource management

How to assign a task to edge workstation



Task Emergency Determination

$$\Gamma = \left| \frac{(v_u - v_t)^2 - (v_l - v_t)^2}{(v_u - v_l)^2} \right|$$

Priority-based Task Queuing

$$P_{t_k} = \frac{\Gamma^{\alpha} \cdot (T_{t_k})^{\beta}}{D^{t_k}},$$

$$P_{t_k} = \Gamma^{\alpha} \cdot (T_{t_k})^{\beta},$$

Task Latency Estimation and Task Scheduling

$$T_{t_n}^{p} = T_{t_n}^{que} + T_{t_n}^{tran} + T_{t_n}^{cmp}.$$

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Experiment Setup

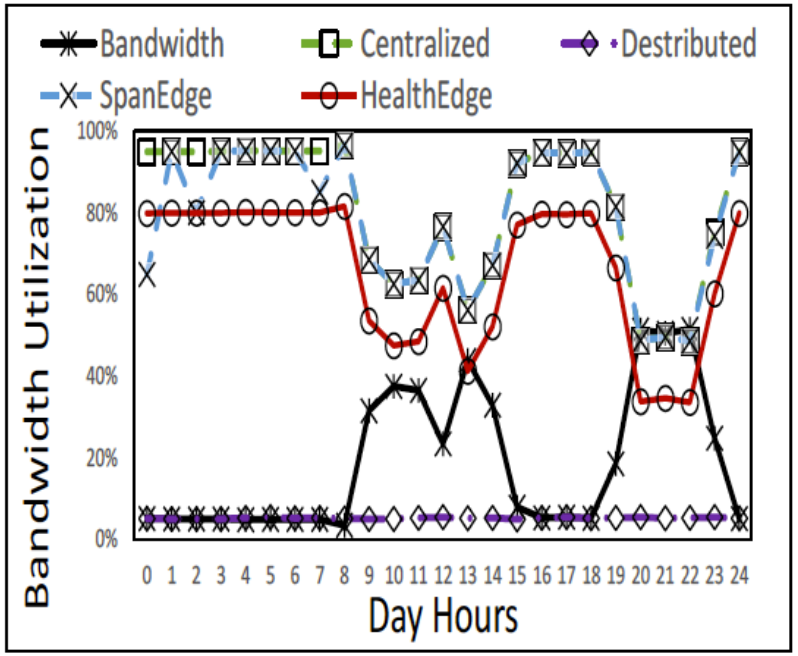
Up to 300 workstations

5 sensors: Temperature sensor, Glucose monitor, ECG sensor, Accelerator and gyroscope sensor, and Pulse oximeter sensor.

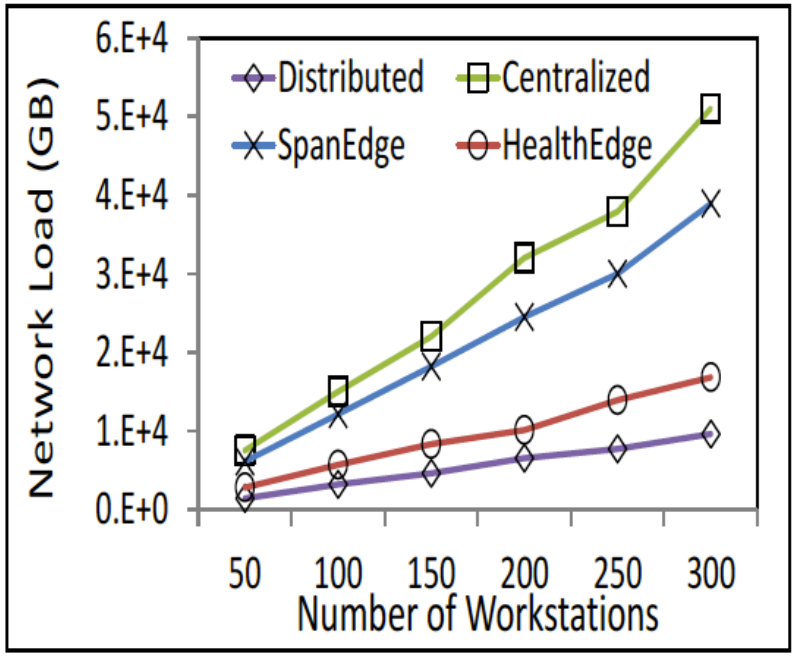
Private Data Center
60 nodes

Workload Description

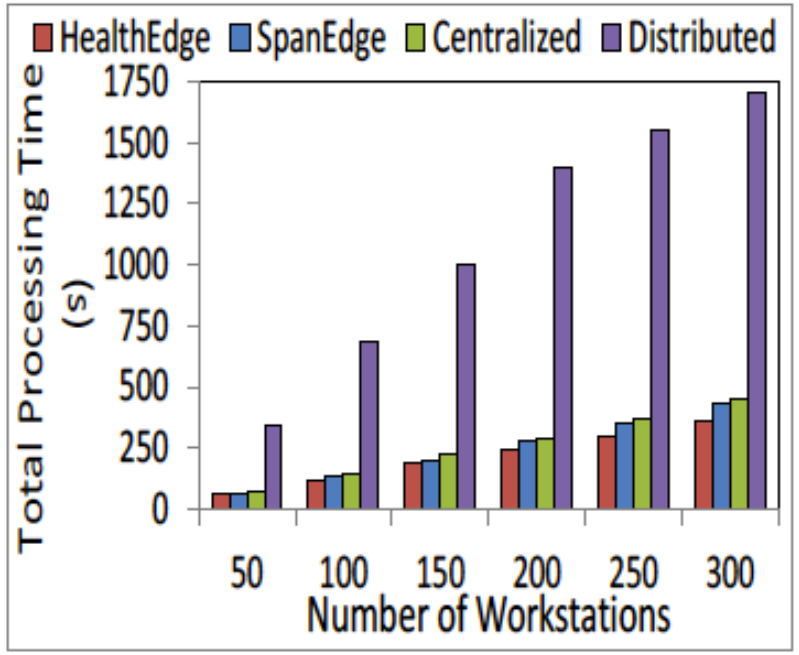
One-month (from Dec. 1 to Dec. 31 in 2016) dataset consists of the human behavior dataset (e.g., physiological signal and activity datasets) and environment datasets (e.g., temperature, humidity, light, and noise datasets).



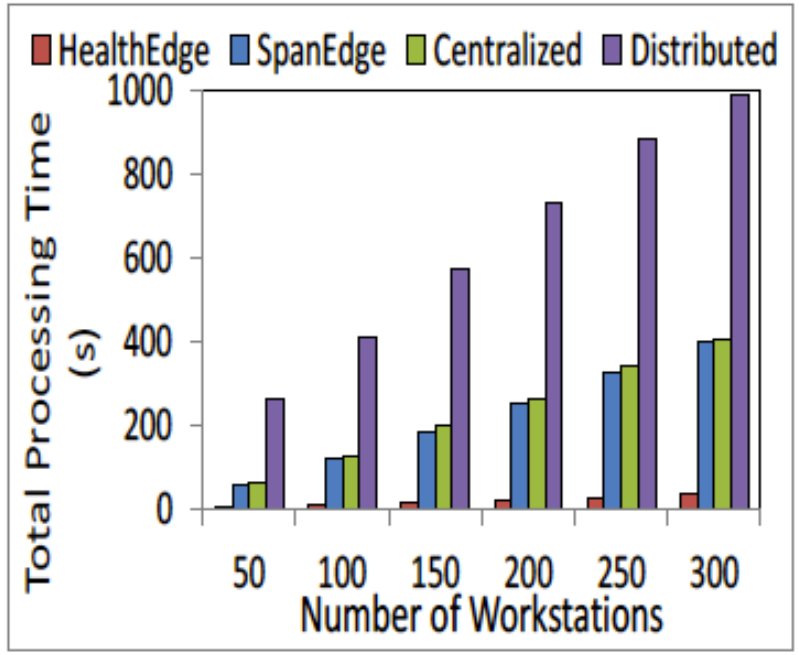
Bandwidth Utilization



Network Load



Processing Time on All Tasks



Processing Time on Emergency Tasks

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Conclusion

1) We first formulate the task scheduling resource management problem and then prove that it is an NP-hard problem.

2) We propose a heuristic resource management HealthEdge that sets different priorities for different tasks based on the human health status

3) We construct a trace-driven simulation to evaluate the performance of HealthEdge

Thank you!

Questions?