Design, Proposal and Experiments of a Wireless Sensor Network Architecture for Urgent Information Transmission

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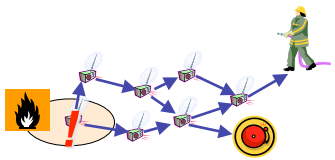
1. INTRODUCTION

A WSN as a social infrastructure

- Building automation, public surveillance, disaster detection, ...
- Need to prioritize urgent information over non-urgent information
- Need to mitigate congestion in case of a large scale event *e.g.* earthquake attack

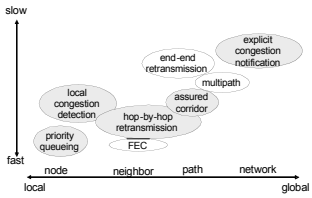


Our design objectives of a WSN architecture

- High reliability and low latency
- Self-organizing and localized behavior
- Simplicity

Design Policy

Combine several simple distributed mechanisms which function in different spatial and temporal levels to adapt to the scale of an emergency



2. UMIUSI ARCHITECTURE

(aUtonomous Mechanisms Integrated for Urgent Sensor Information)

Three traffic classes

- Critical class — most urgent and important information
- Important class — urgent but tolerate delay and loss to some extent in case of congestion
- Normal class — non-urgent information

Mechanisms leveraged in UMIUSI

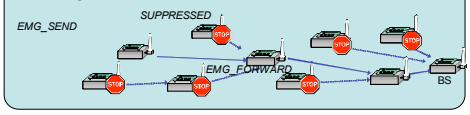
local & quick

Priority queueing
Important class packets are served only when there is no critical packets queued.

Rate control by local congestion detection
Sending rate of important class packets is reduced when the node reporting the event detects local congestion.

Hop-by-hop scheduled retransmission
The backoff for retransmission of the critical class is scheduled earlier than that of the important class.

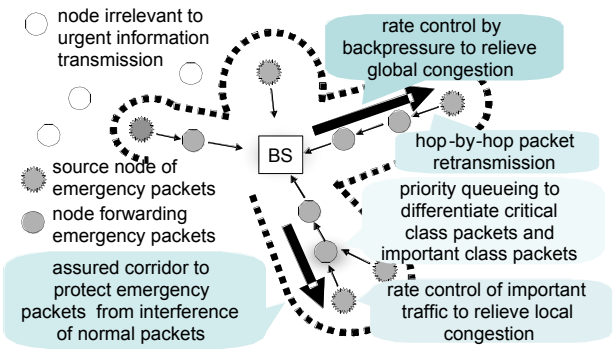
Assured corridor mechanism (ACM)
Nodes surrounding the path of emergency packets from the source to the BS refrain from sending normal class packets.



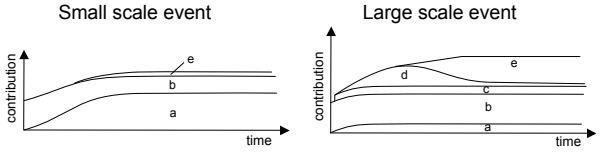
global & slow

Rate control by backpressure
Explicit Congestion Notification is sent back from congested points to the source of important class packets by piggybacking.

How does UMIUSI work?



Contribution of each mechanism

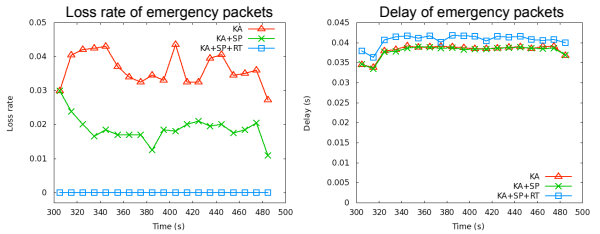


a. assured corridor
b. scheduled retransmission
c. priority queueing
d. rate control by local congestion detection
e. rate control by backpressure

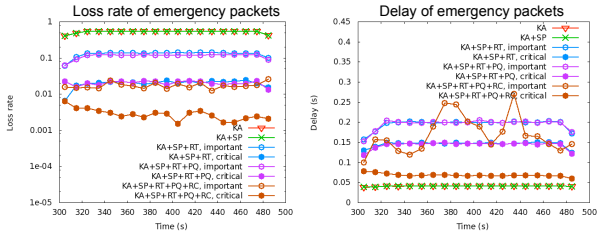
With the mechanisms working in different spatial and temporal levels, UMIUSI enables distributed QoS control adapting to the scale of an emergency

3. SIMULATION

Small scale event



Large scale event



4. DEMONSTRATION