Dynamic Scheduling of Cover-Sets in Randomly Deployed Wireless Video Sensor Networks for Surveillance Applications

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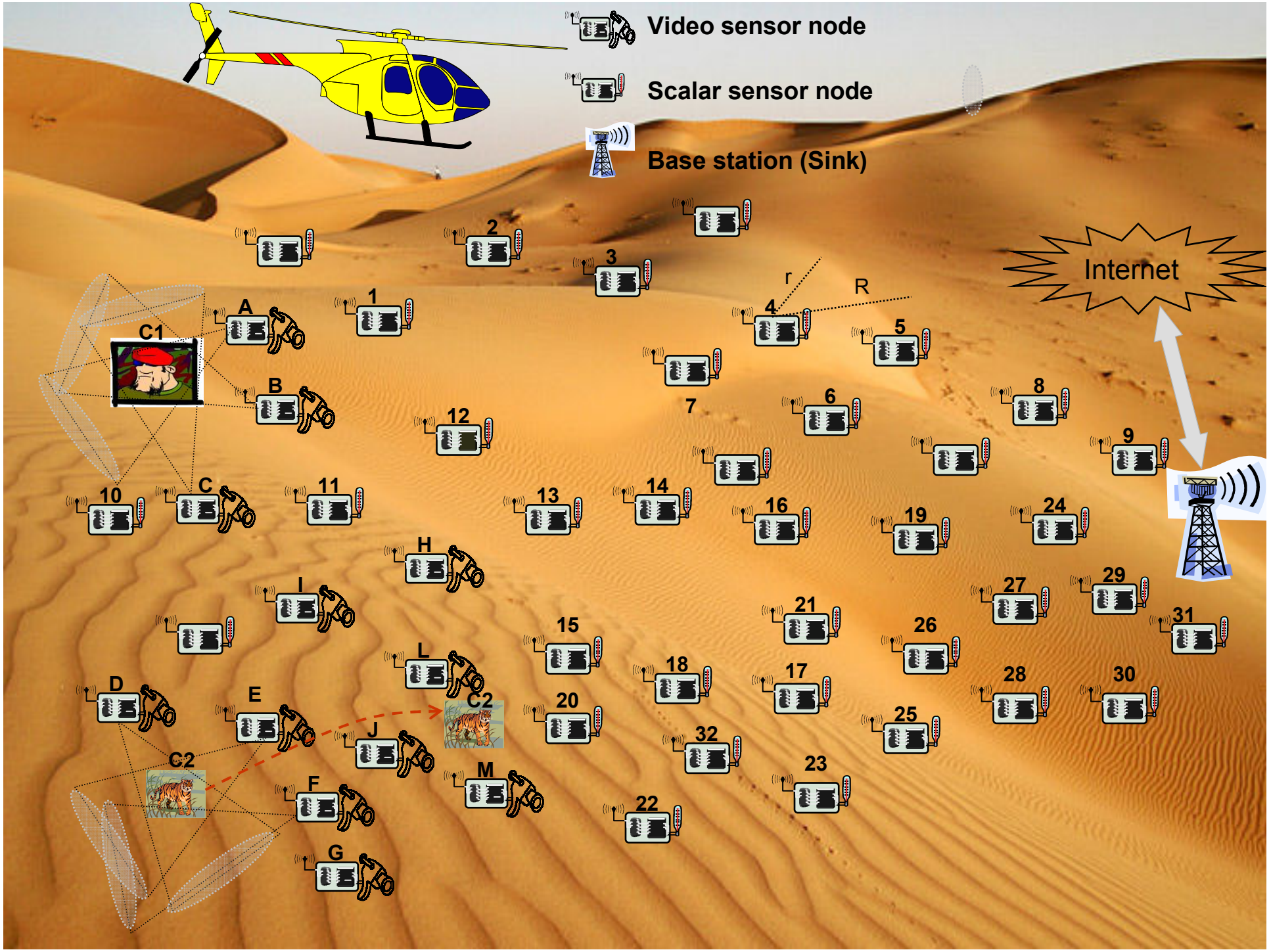
IFIP Wireless days 2009

Paris

December 2009

Overview

- Introduction of wireless video sensor networks
- Coverage and sensor scheduling problem
- Our scheduling algorithm for creating cover sets
- Reducing Ambiguities
- Experimental Results


Video sensor node
Scalar sensor node
Base station (Sink)
Internet
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R
A
B
C
D
E
F
G
H
I
J
L
M
C1
C2
C2
1
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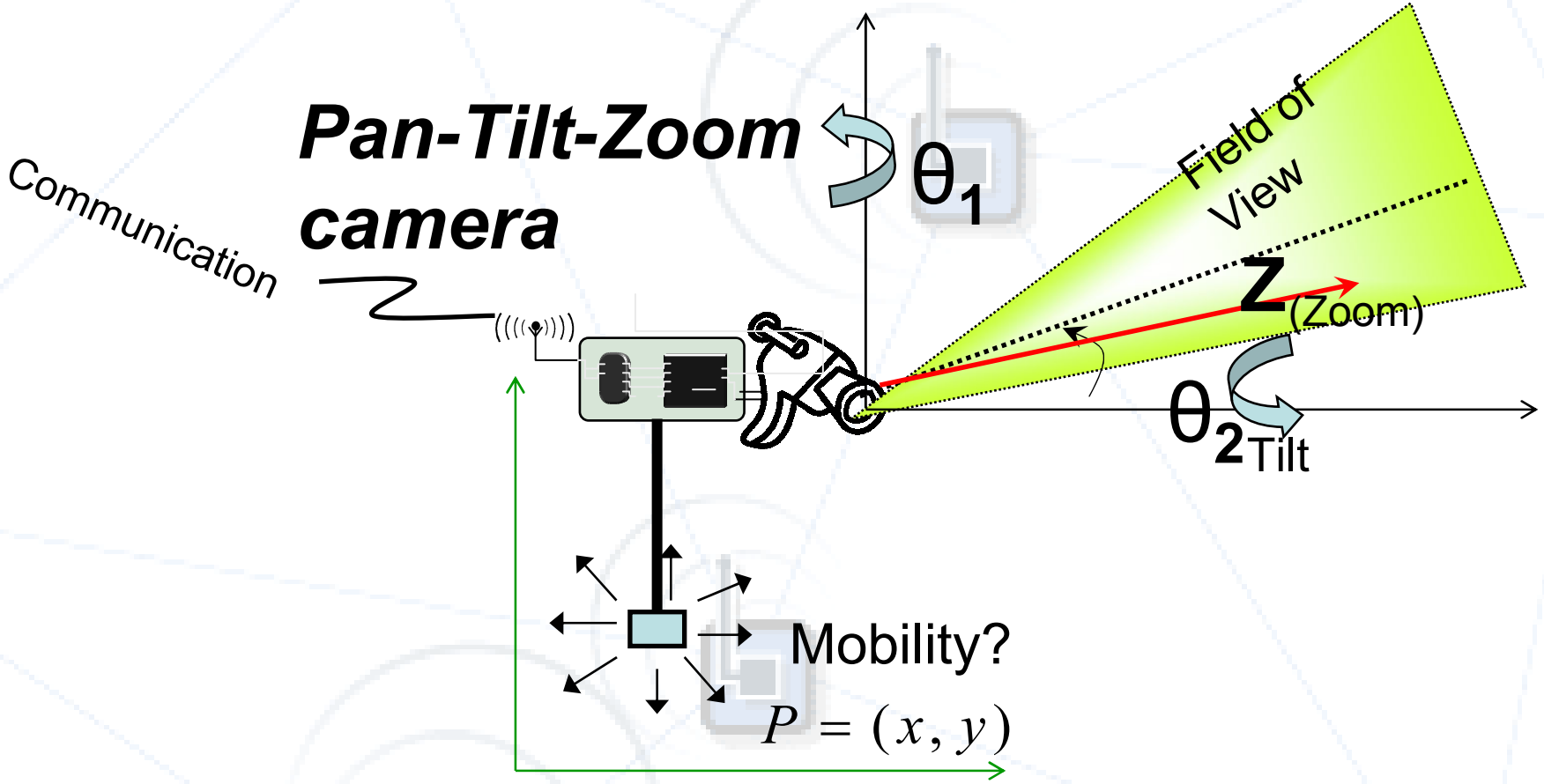
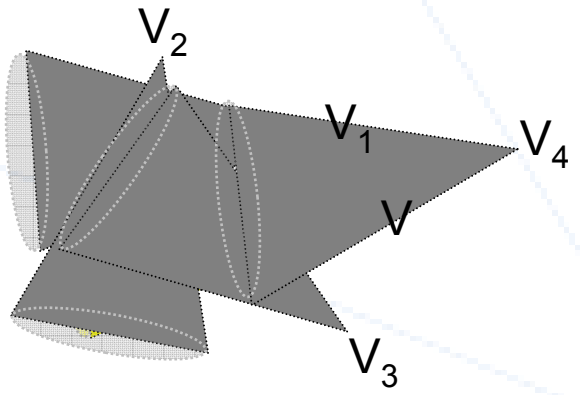
Video Sensor Node



$$N(P, \Theta_1, \Theta_2, Z)$$

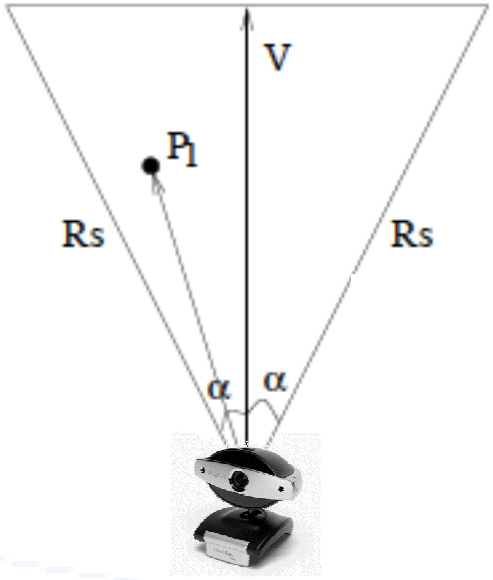
Node's cover set

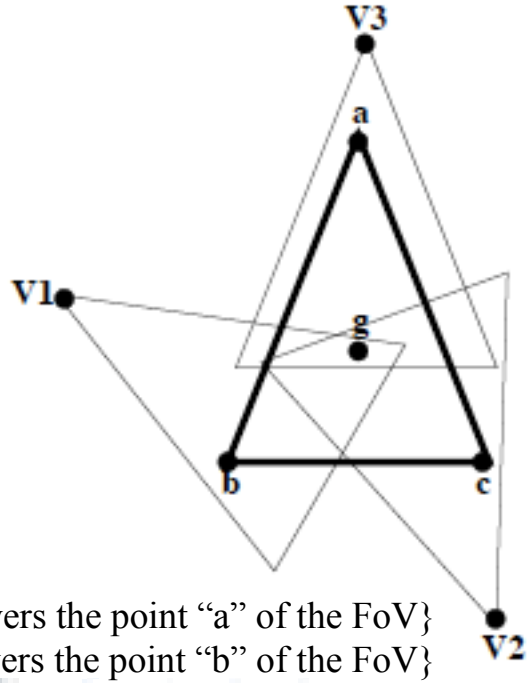
- Each node v has a Field of View, FoV_v
- $Co_i(v)$ = set of nodes v' such as $\cup_{v' \in Coi(v)} FoV_{v'}$ covers FoV_v
- Co(v)= set of $Co_i(v)$



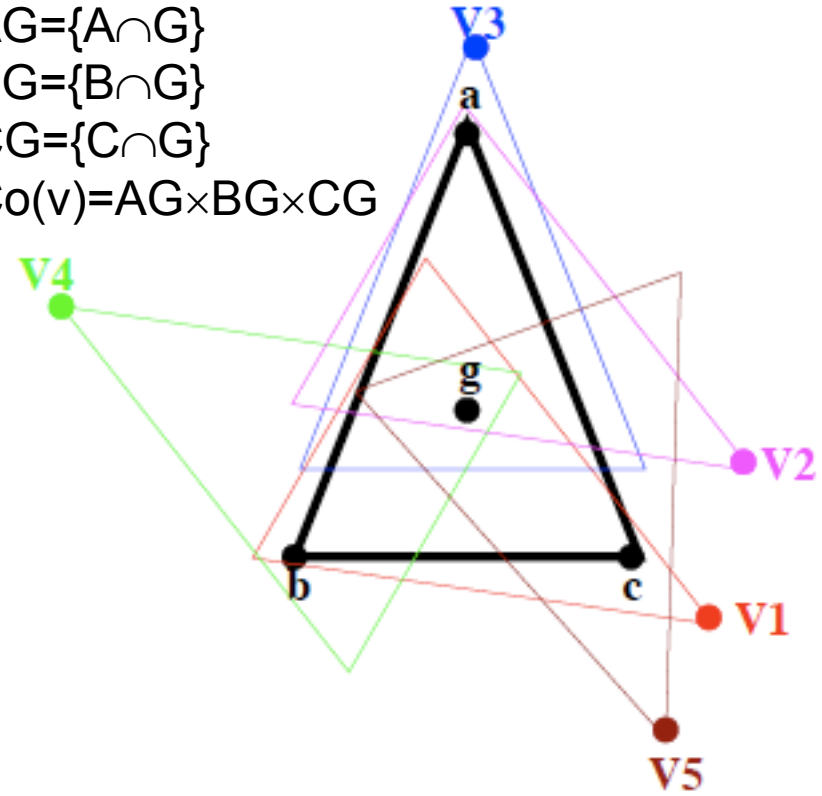
$$Co(v)=\{V_1,V_2,V_3,V_4\}$$

Finding v's cover set





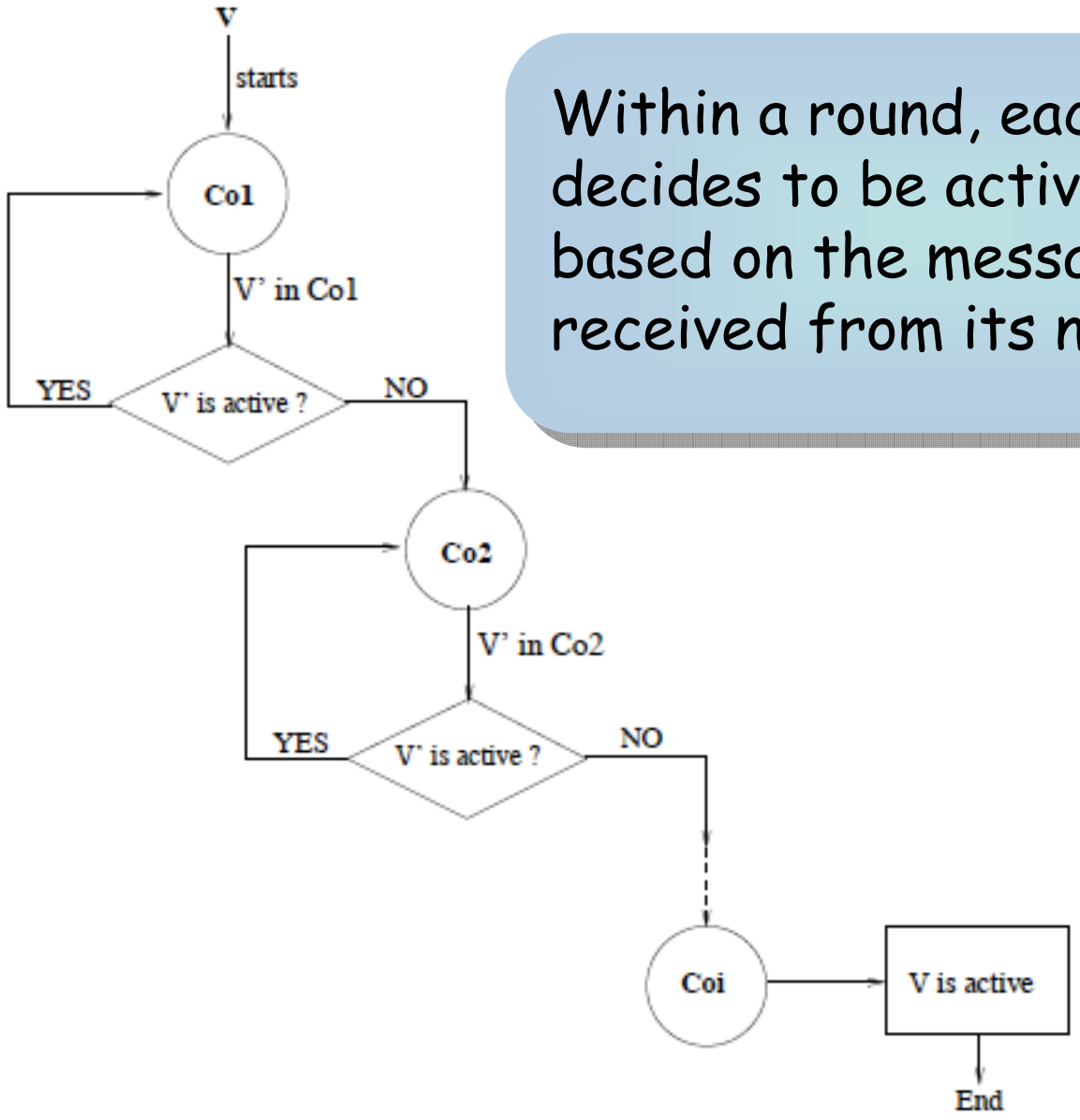
AG={A∩G}
BG={B∩G}
CG={C∩G}
Co(v)=AG×BG×CG



A = {v ∈ N(V) : v covers the point "a" of the FoV}
B = {v ∈ N(V) : v covers the point "b" of the FoV}
C = {v ∈ N(V) : v covers the point "c" of the FoV}
G = {v ∈ N(V) : v covers the point "g" of the FoV}

Co(V)= {
{V },
{V 2, V 1},
{V 3, V 1},
{V 2, V 4, V 5},
{V 3, V 4, V 5}}

Active node selection



Within a round, each node decides to be active or not based on the messages received from its neighbors

Reducing Ambiguities

- Some applications need more comprehensive interpretation of events or gestures
- Multiview has several advantages
  - Help circumvent occlusions
  - Information from multiple views may convey a higher confidence interpretation

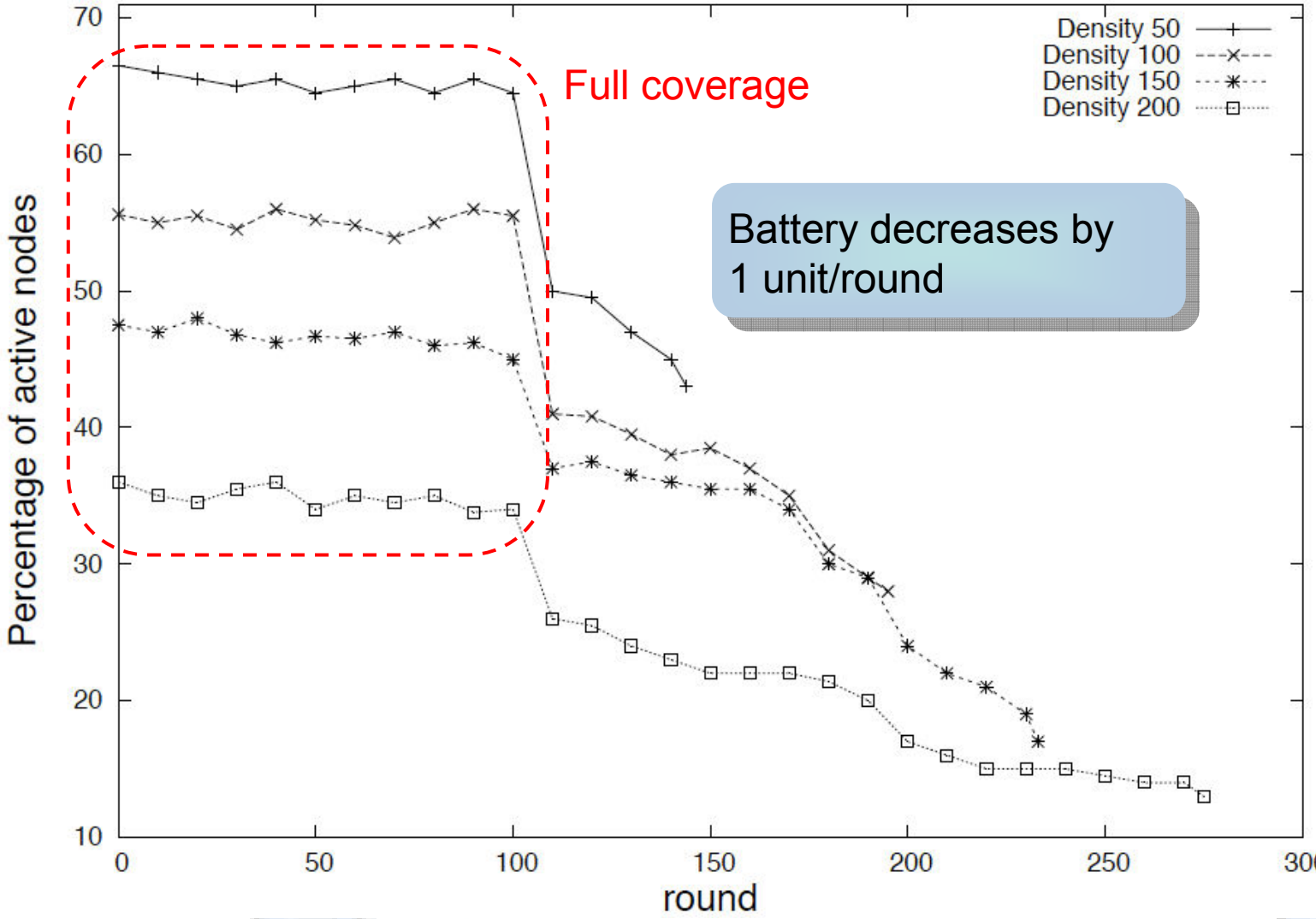
- Collaboration among multiple cameras to reduce ambiguities, by adapting the activity nodes scheduling

- A critical event detected => urgent message to neighbors
  - End the current round and start of a new one
  - The new scheduling must ensure that the target is covered by at least two or more video nodes.

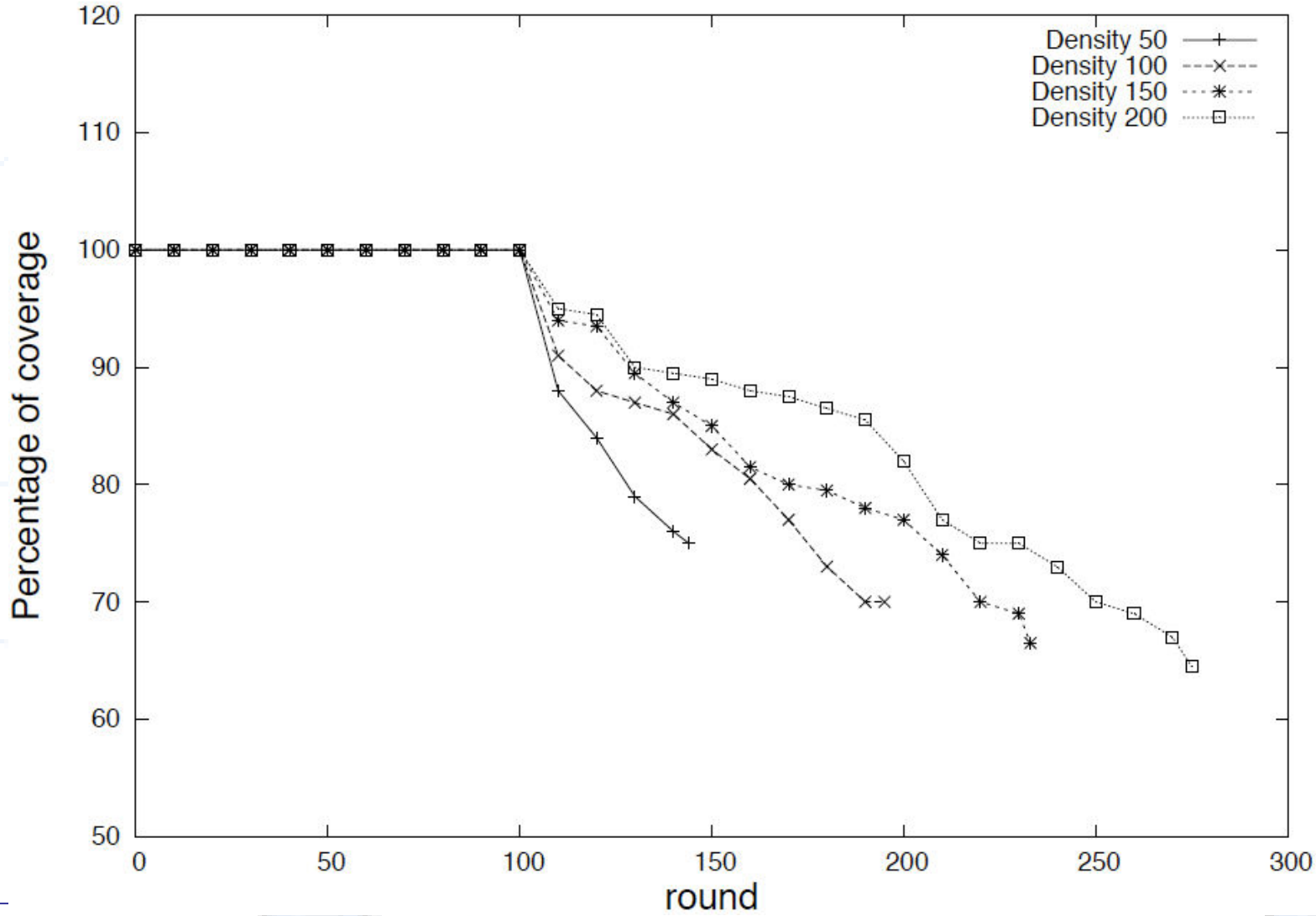
Simulation settings

- OMNET++ simulation model
- Video nodes have communication range of 30m and video sensing range of 25m, FoV is a sector of 60°
- Battery has 100 units
- Full coverage is defined as the region initially covered when all nodes are active

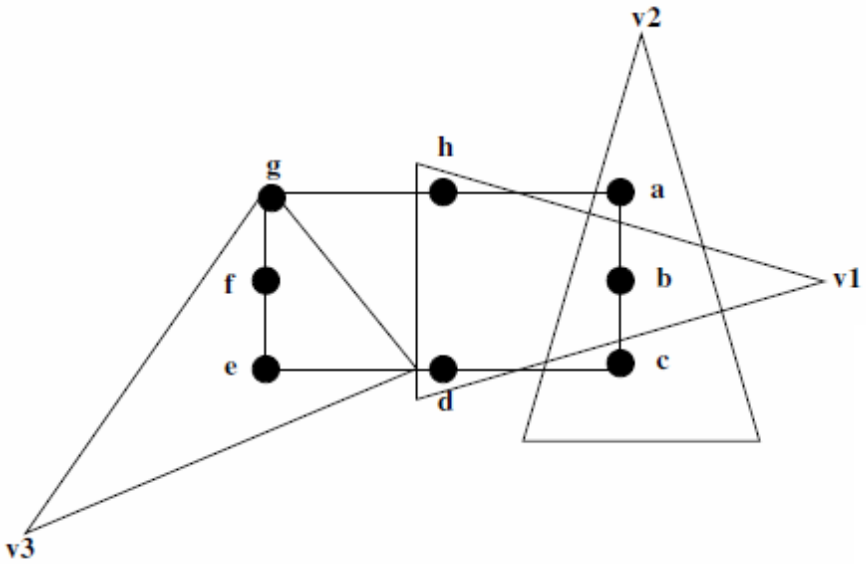
Percentage of active nodes

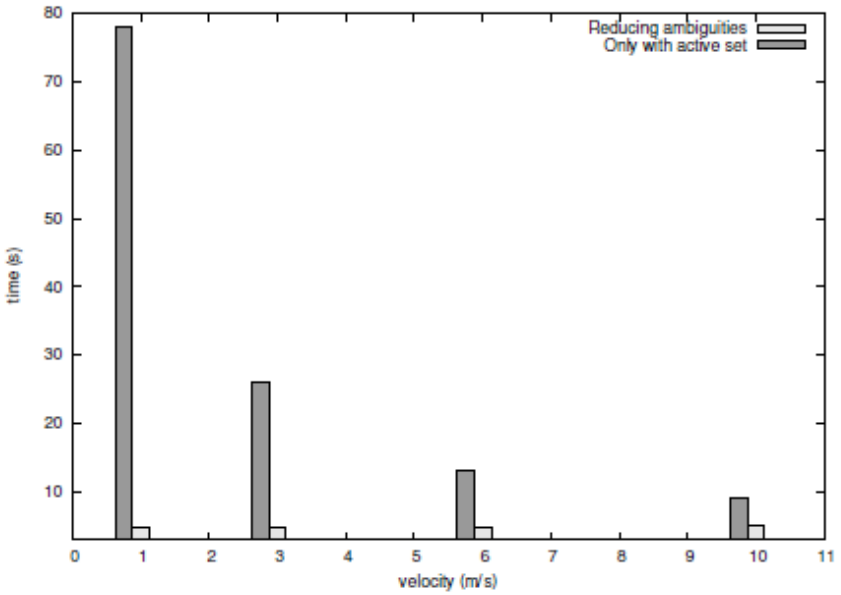


Percentage of Area Coverage



Disambiguation feature





Time of identification

Conclusions & future works

- Distributed algorithm for sensor nodes scheduling in video sensor networks
- Reducing ambiguities of detected objects

- Extension for risk-based scheduling in intrusion detection systems
- Critical applications
- Congestion control