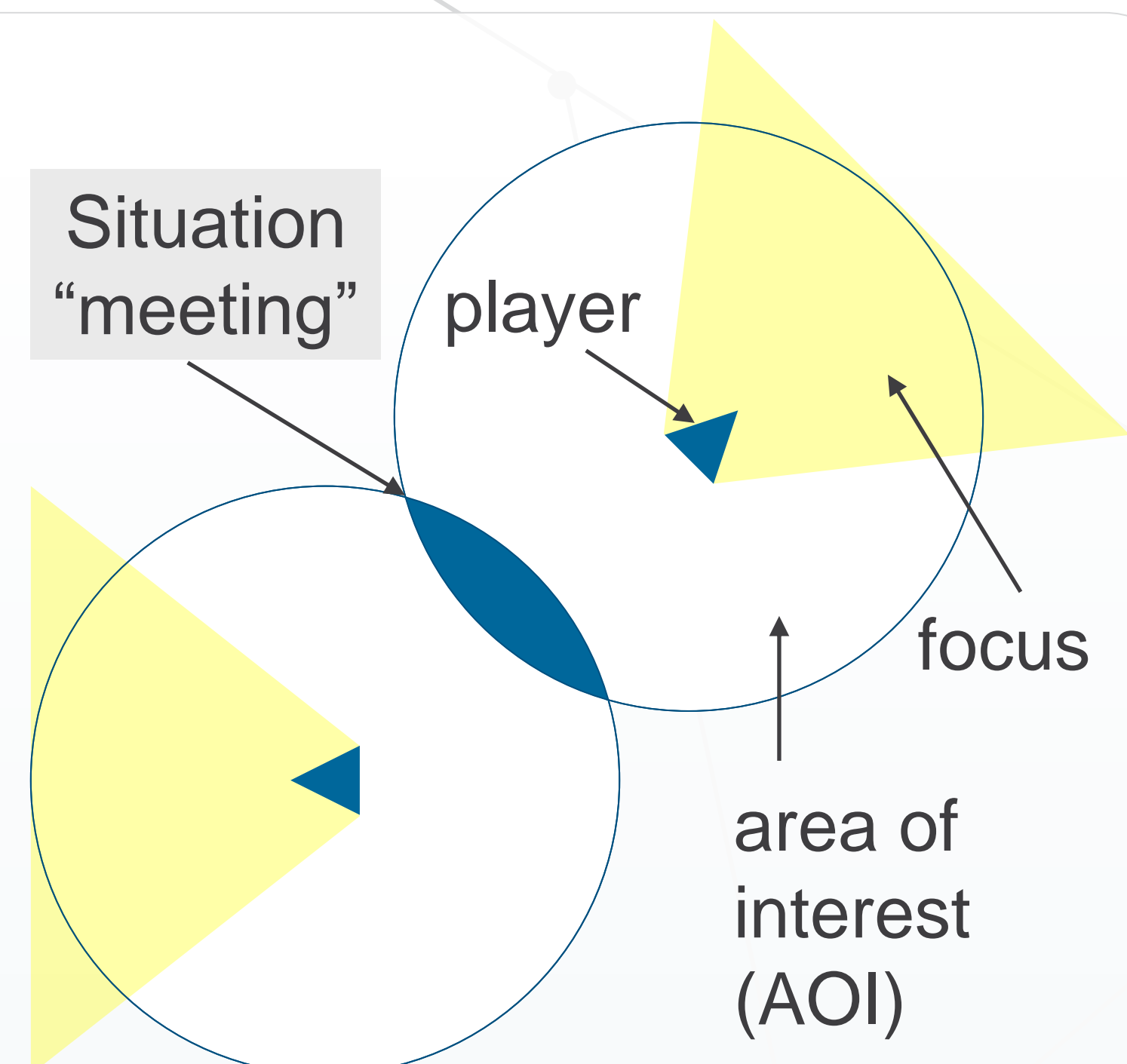


Event processing for large-scale distributed games

Motivation

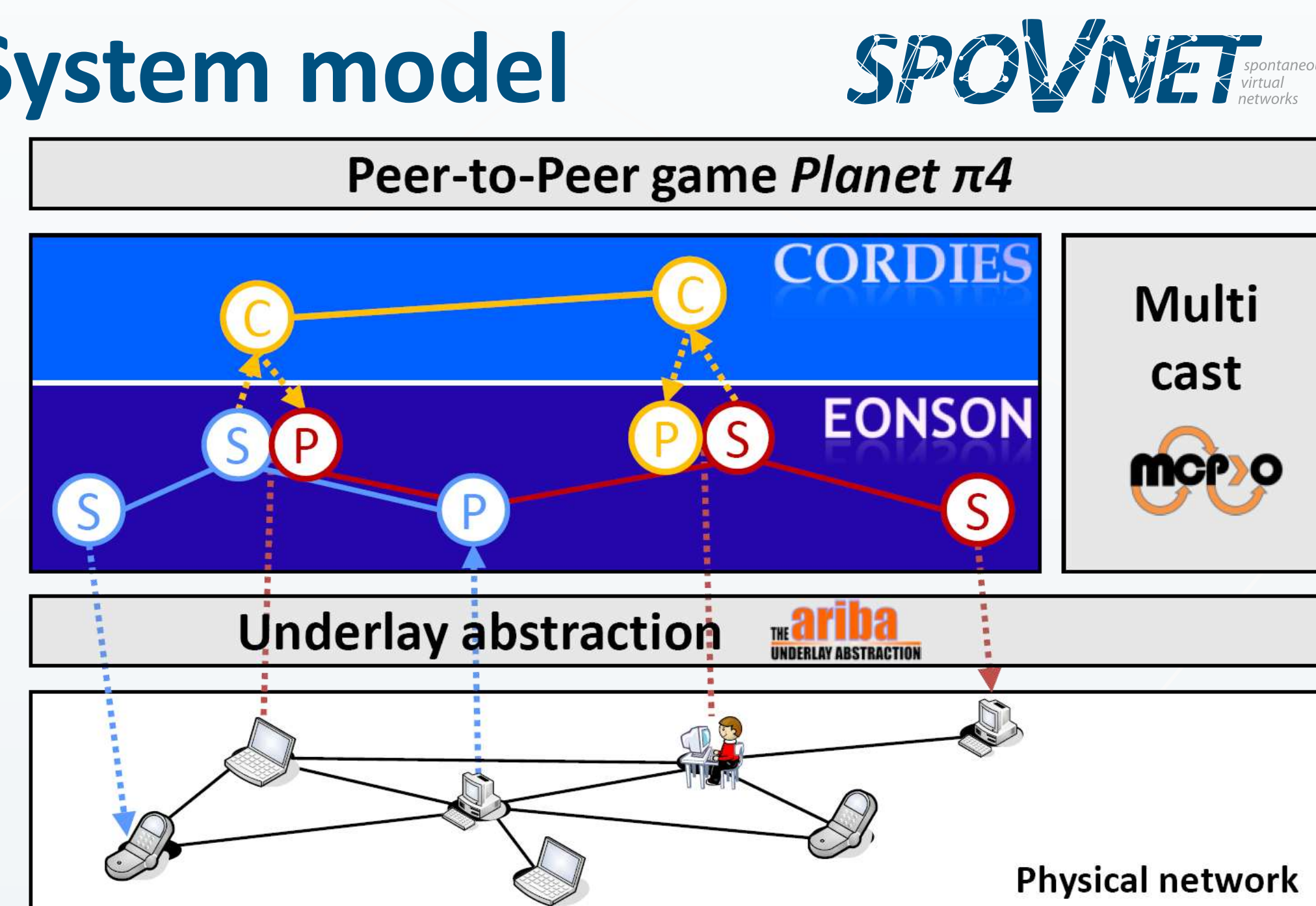
- Peer-to-peer architecture
 - Ad-hoc instantiation
 - Distributed games state
 - Low-latency communication required
 - Exchange of all state information that affects the player and its focus
- Main challenges
 - Responsiveness: Equal relative latency for all players
 - Consistency: Equal view for all players
 - Efficiency: Bandwidth consumption, computation of situations
- Solution's required properties
 - Scalable for Massively Multiplayer Online Game
 - Capable of the responsiveness-consistency trade-off despite dynamic behaviour



Approach

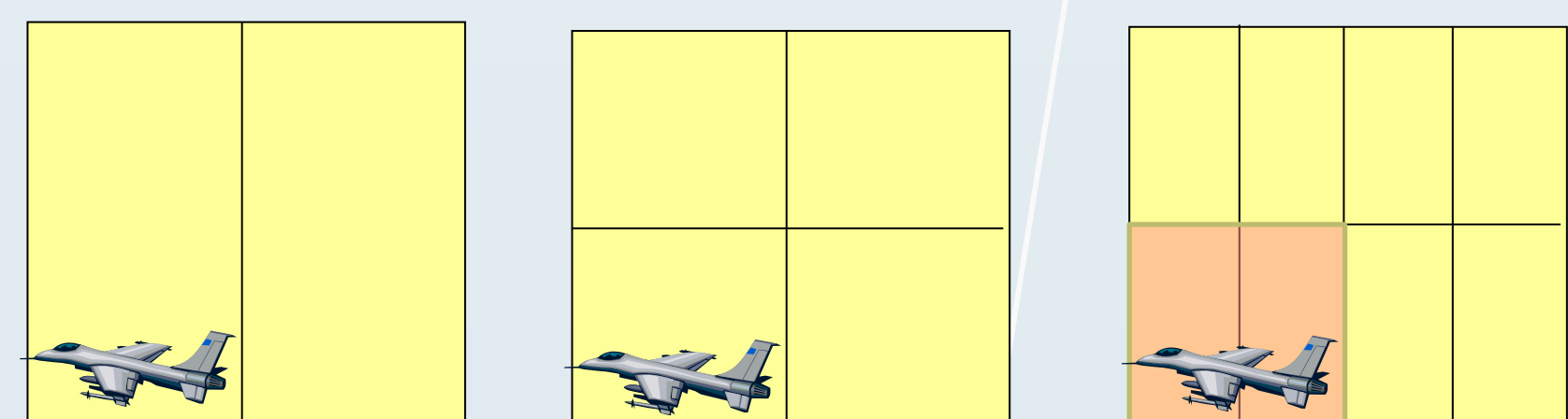
- Use of two communication services
 - Content-based **event communication** and complex **situation detection**
 - Multicast**: efficient game state communication between close objects

System model

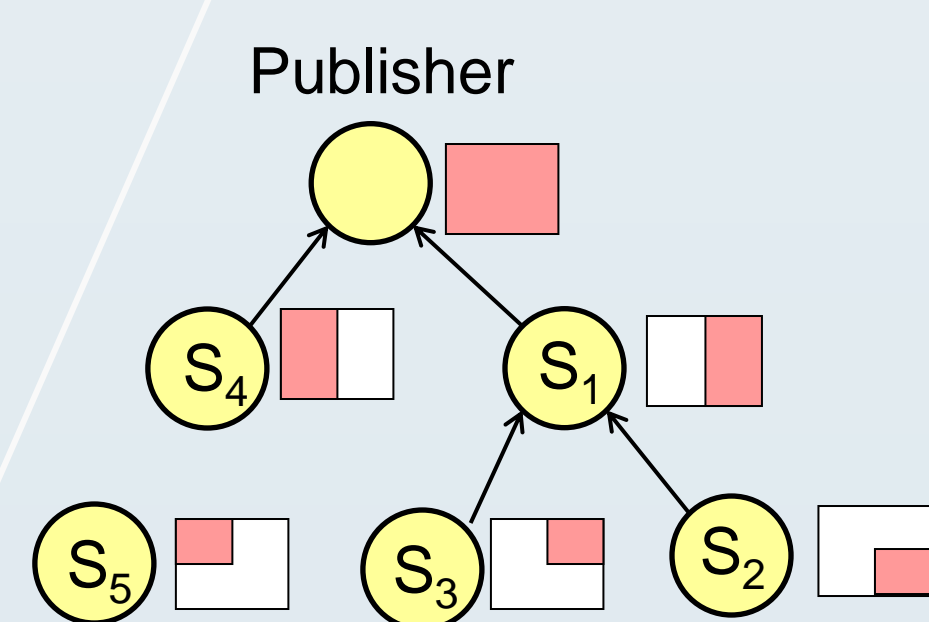


Demonstration Scenario

- Efficiency by introducing game semantics in services
- Employed semantics: area of interest (AOI)
- Cordies**
 - Distributed in-network detection of situations (*movement, meet, depart*), thus reducing bandwidth consumption
 - Distributed CORDIES instances detect situations occurring in separate AOIs, thus ensuring scalability
- EONSON**
 - Overlay topology is dynamically restructured to reflect the **inclusion relationship** between the AOIs of game instances
 - Ensures that only the peers interested in an area participate in forwarding and filtering the corresponding events

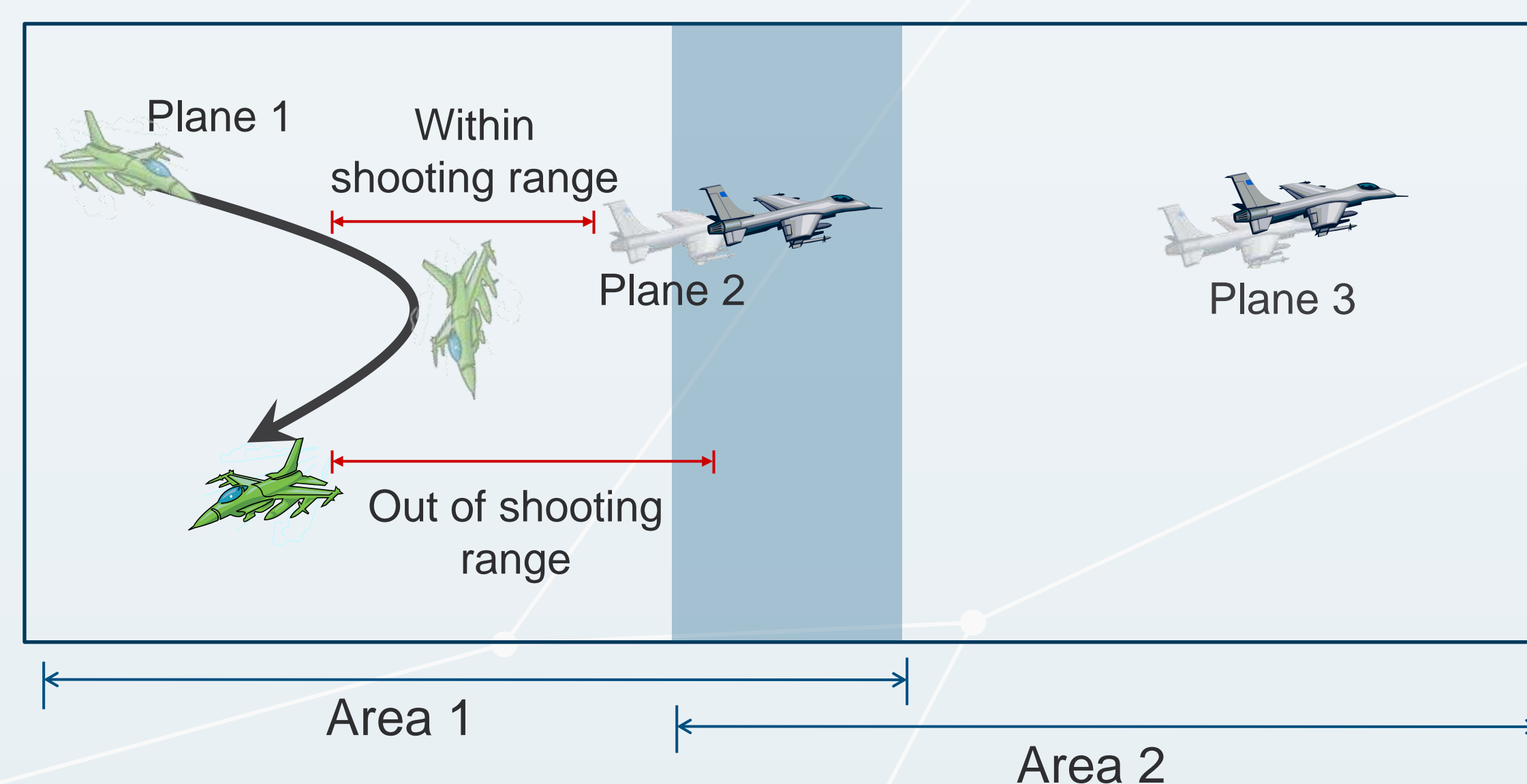


Exemplary spatial subscription notation

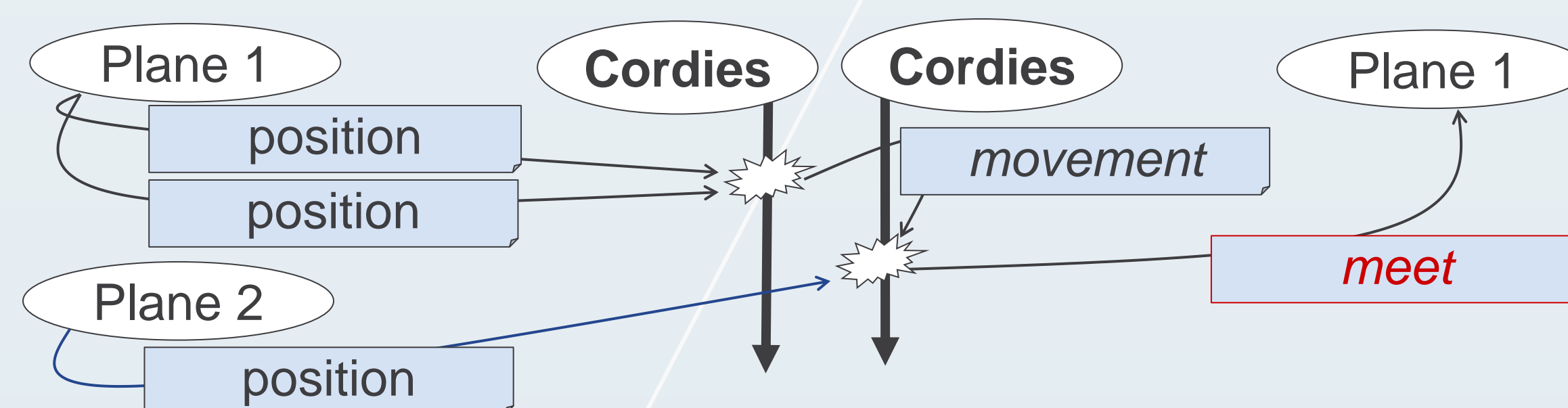


Dissemination structure

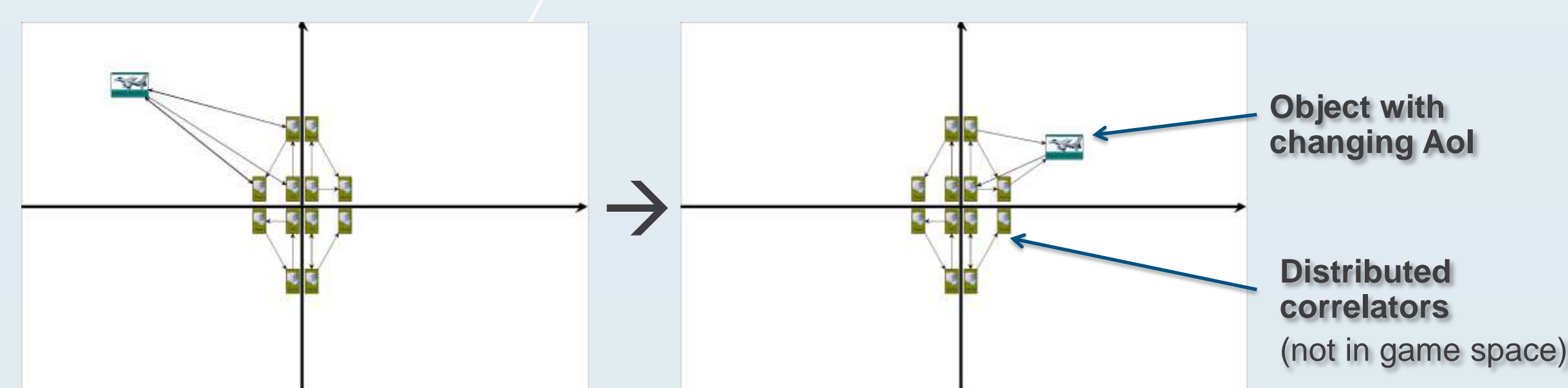
Demonstration scenario



Cordies – distributed situation detection



EONSON – adaptation of dissemination structure



Additional contributions

- QoS:
 - Event communication to fulfill latency requirements, individual bandwidth restrictions
 - Correlation detection to measure confidence in detected situations
- Security:
 - Authentication, authorization and weak confidentiality for content-based publish/subscribe

Gerald G. Koch et al.: *Higher confidence in event correlation using uncertainty restrictions* (ICDCSW'08)

M. Adnan Tariq et al.: *Providing basic security mechanisms in broker-less publish/subscribe systems* (DEBS'10)

References

- Cordies** — Gerald G. Koch et al.: *Cordies: Expressive event correlation in distributed systems* (DEBS'10)
- EONSON** — M. Adnan Tariq et al.: *Dynamic publish/subscribe to meet subscriber-defined delay and bandwidth constraints* (Euro-Par'10 – to appear)
- Planet π4** — Tonio Triebel et al.: *Peer-to-peer voice communication for massively multiplayer online games* (CCNC'09)
- ariba** — Christian Hübsch et al.: *Reconnecting the Internet with ariba - Self-Organizing Provisioning of End-to-End Connectivity in Heterogeneous Networks*, ACM SIGCOMM Comp. Comm. Rev 40:1, p. 131–132
- MCPO** — Christian Hübsch et al.: *On Runtime Adaptation of Application-Layer Multicast Protocol Parameters* (EUNICE'10 – to appear)