

DISTRIBUTED COLLABORATION IN MOBILE CONTEXT-AWARE SYSTEMS

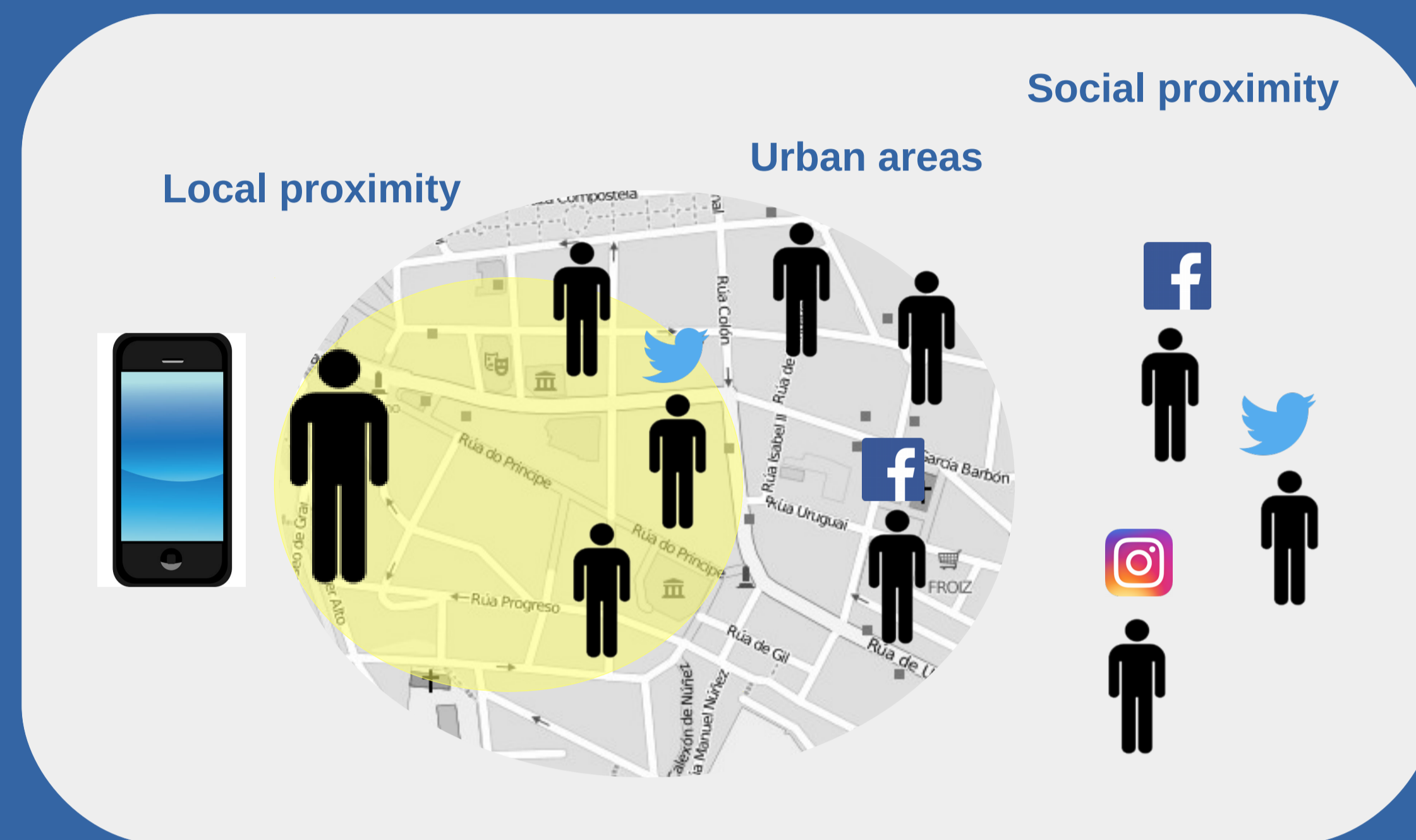
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Motivation

The proliferation of embedded sensors has enabled mobile devices to be aware of their changing circumstances and adapt their behavior accordingly. This adaptation should be performed as transparently as possible in order to ensure minimal disturbance to users [1]. Current research on context-dependent behavior focuses on routine inference through training [2]. This thesis aims to study the possibilities of collaborative strategies for this task [3]. These strategies will allow not to limit adaptation to everyday activities, but to expand it to unusual situations. Cooperation may include both socially [4] and physically close devices [5]. In the latter case, the area to be considered may vary from local proximity, where direct communication between devices can be performed, to bigger urban areas where information is exchanged through distributed ad hoc networks. Additionally, local cooperation will be studied not only as an end in itself but also as a means to assess context-related data that will be disseminated further away.

Objectives

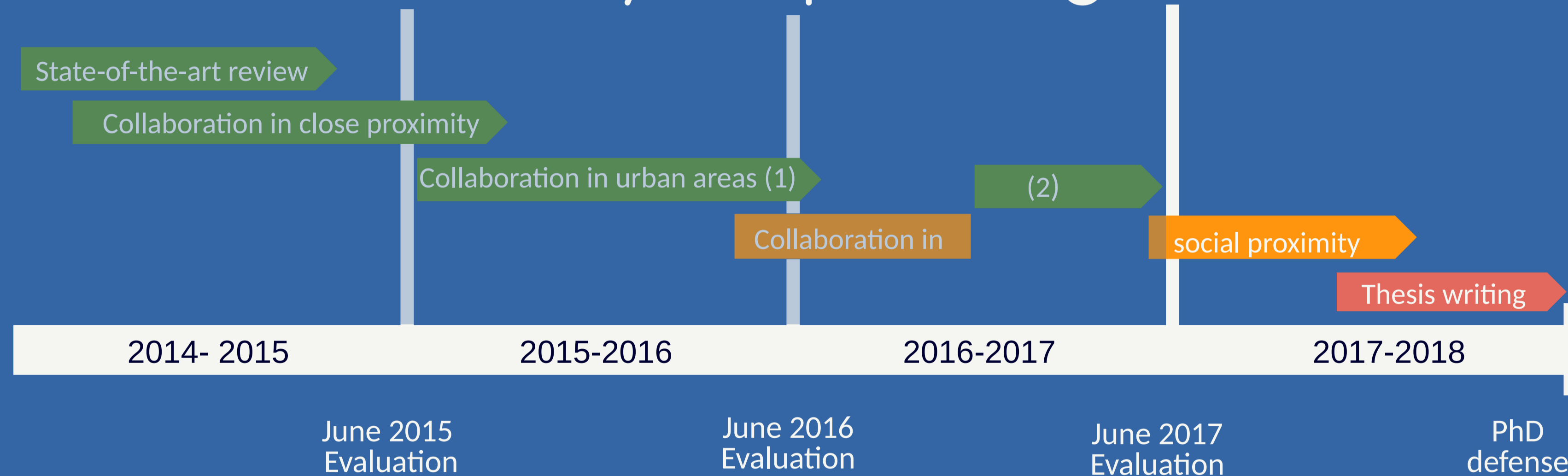
Design, development and evaluation of collaborative strategies in context monitoring and management. Information from physically and socially close devices will be combined to support autonomous decision-making and improve adaptation to unusual situations. Moreover, proximity information will be employed to increase trust in a mobile system and the data it shares. Research areas: distributed and proximity-based communications, ad hoc networks, context inference, decision strategies, information dissemination, social networks.



Research plan

- State of the art review:
 - Comprehensive literature review in context detection, context-aware adaptation, device collaboration and ad hoc networks.
- Collaboration in close proximity:
 - Gathering of real data on users' context changes.
 - Design of communication strategies to enable collaboration between nearby context-aware systems.
- Collaboration in urban areas:
 - 1) Application of collaborative assessment strategies to data dissemination in participatory sensing schemes.
 - 2) Design of fog-based architectures to assess mobile sensor location in proximity (Research stay at Télécom SudParis).
- Collaboration in social proximity:
 - Application of the collaborative strategies designed in the previous stages to socially close devices (Collaboration with Universidad Politécnica de Cataluña (UPC))
- Evaluation of the proposed communication strategies employing network and urban mobility simulations based on real data.
- Result dissemination through publications in international conferences, workshops and journals.

Next year planning



Results & Discussion

Collaboration in close proximity: Exchange of data on appropriate behavior in room-size areas. Assessed by simulation using real data on people movement in indoor scenarios.

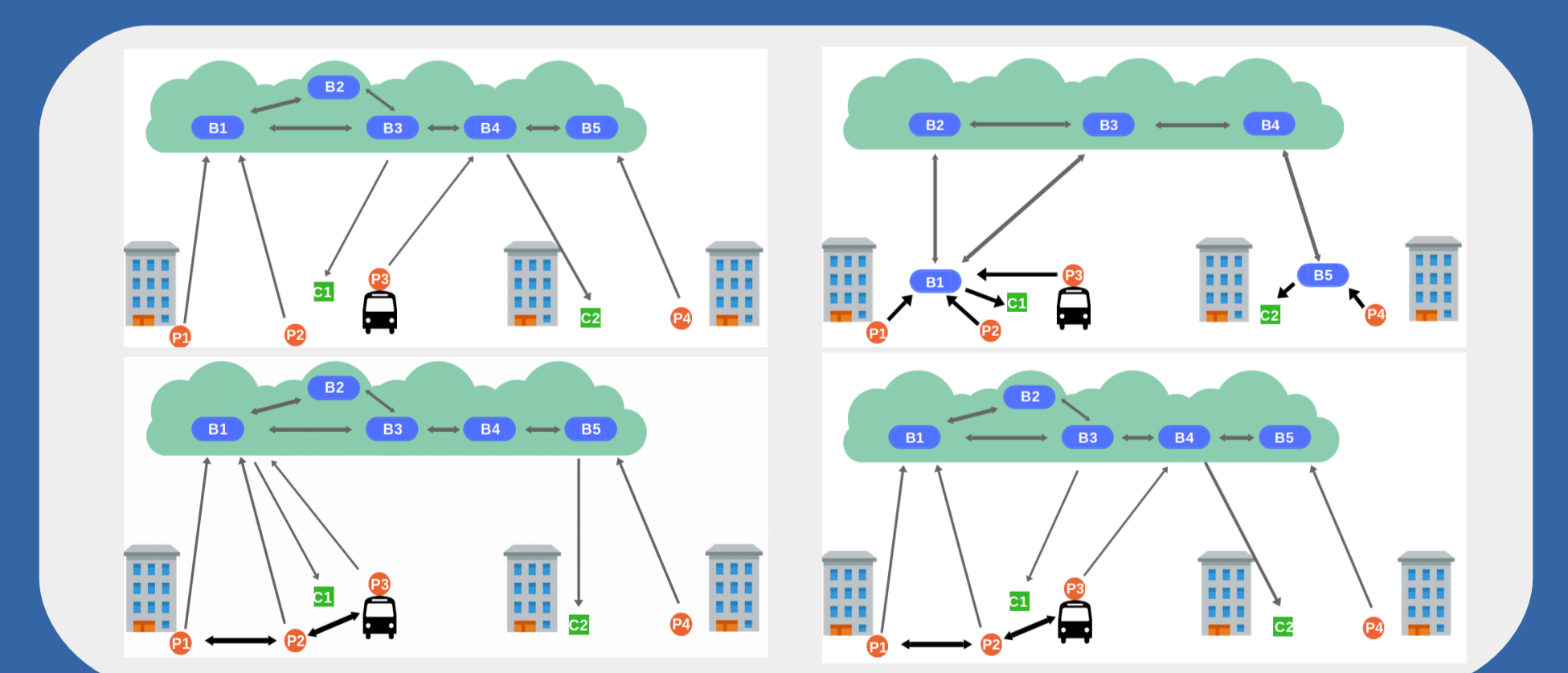
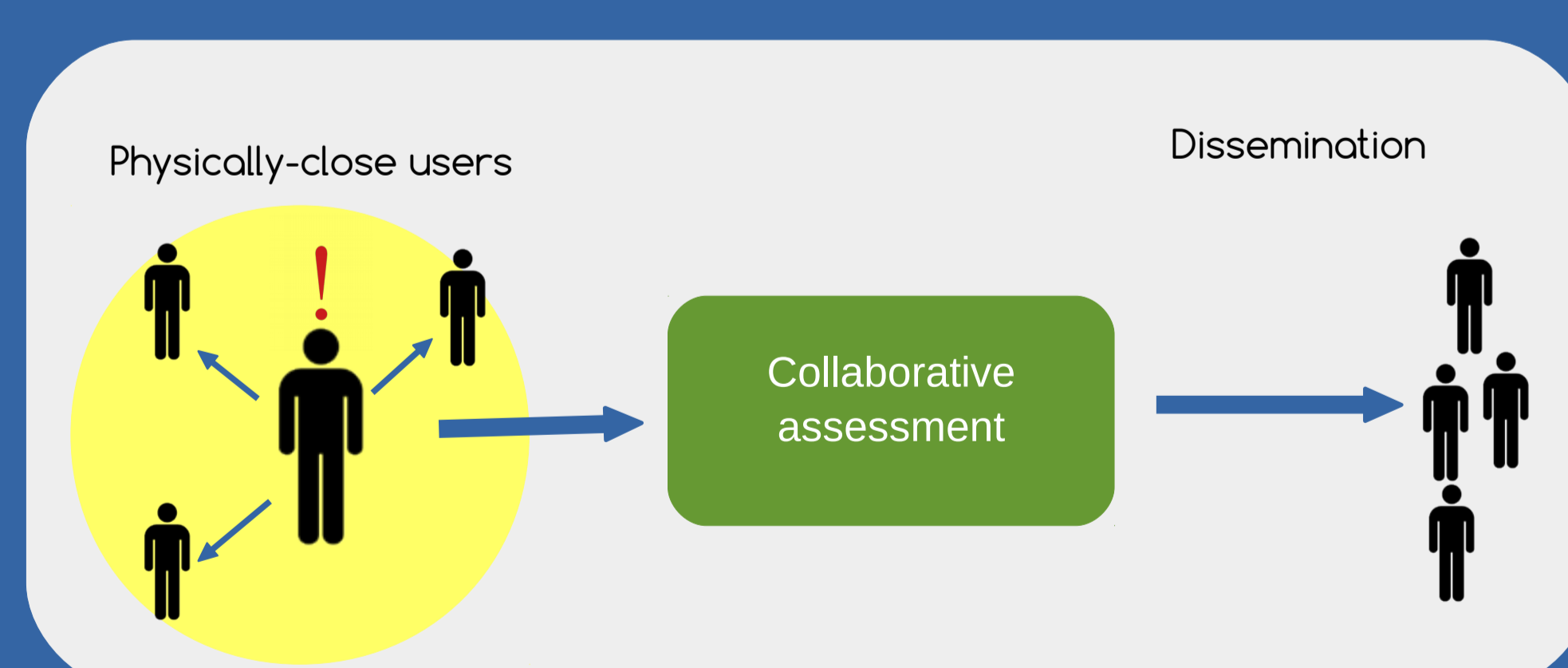
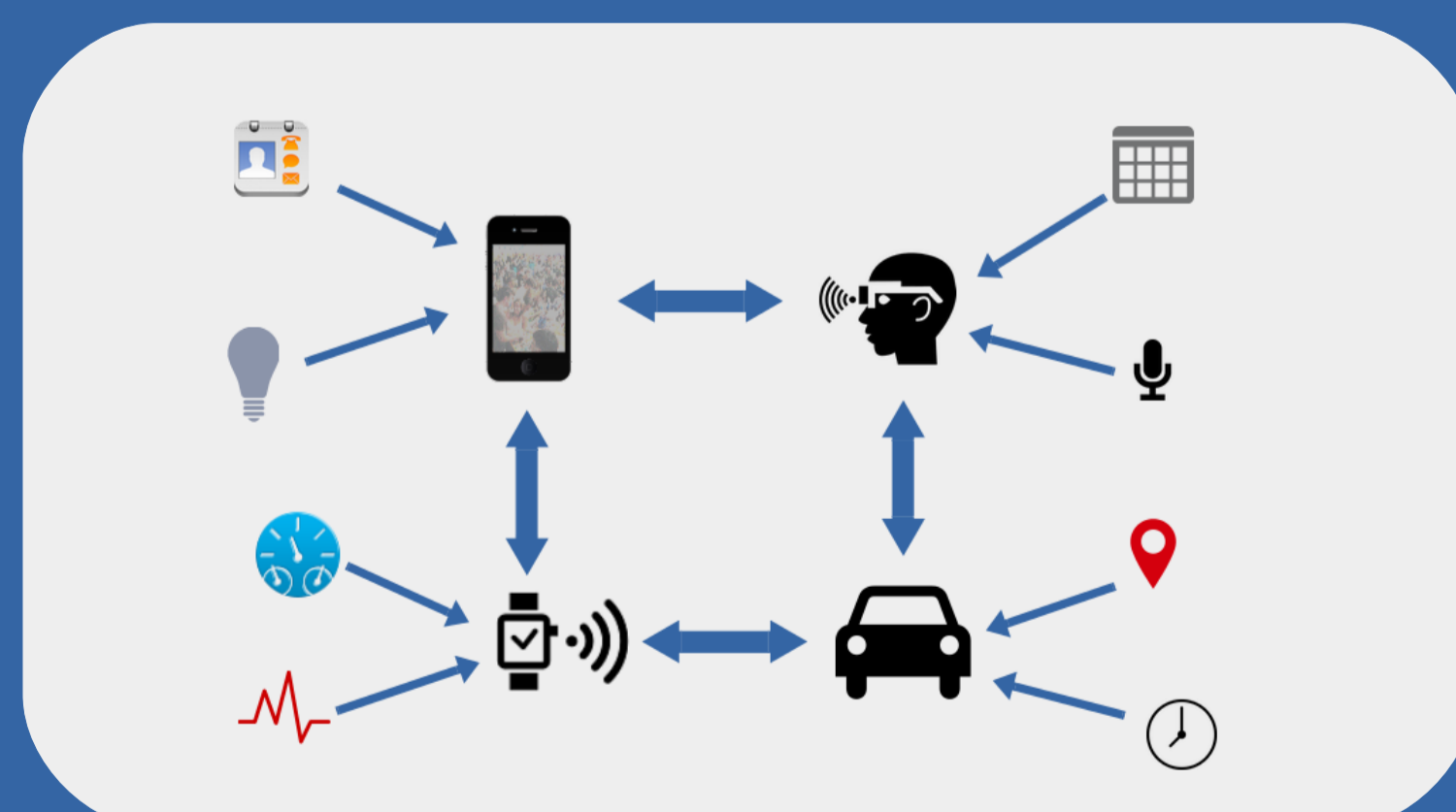
- F. Castro Jul, A. Fernández Vilas and R. Díaz Redondo. "How should my device behave now? Applying consensus protocols for autonomous context management?" *Journal of Computers* vol. 12, no. 3, pp. 200-211, 2017

Collaboration in urban areas (1): Application of collaborative assessment strategies to alert dissemination in order to reduce irrelevant and duplicate messages.

- F. Castro Jul, R. Díaz Redondo and A. Fernández Vilas. "Have you also seen that? Collaborative alert assessment in ad hoc participatory sensing" *UCAml 2016, Part II 10* (pp. 125-130). Springer International Publishing.
- F. Castro Jul, A. Fernández Vilas and R. Díaz Redondo. "Collaboratively filtering alerts in ad hoc networks", *Computer Networks* (In review)

Collaboration in urban areas (2): Fog architecture for sensor location certification combining proximity-based and cloud communication.

- F. Castro Jul, D. Conan, S. Chabridon, R. Díaz Redondo, A. Fernández Vilas, C. Taconet. "Combining Fog Architectures and Distributed Event-Based Systems for Mobile Sensor Location Certification". *UCAml 2017* (In review)
- F. Castro Jul, D. Conan, S. Chabridon, R. Díaz Redondo, A. Fernández Vilas, C. Taconet. "Fog Architectures for Mobile Sensor Location Certification". (Ongoing)



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- [5] D. Christin, P. Sánchez López, A. Reinhardt, M. Hollick, and M. Kauer, "Share with strangers: Privacy bubbles as user-centered privacy control for mobile content sharing applications," *Information Security Technical Report*, vol. 17, no. 3, pp. 105-116, 2013.