

# Semi-Automatic Garbage Collection for Ambient Intelligence

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The recent advances in the field of Ambient Intelligence (AmI) have raised a new generation of distributed applications with sophisticated characteristics. AmI applications are distributed among mobile devices interconnected by wireless communication media that allow them to interact spontaneously with other devices the environment forming mobile ad hoc networks.

Although many distributed garbage collection (DGC) mechanisms have been proposed for stationary networks, such solutions are not well suited for mobile ad hoc networks. This is due to the distinguishing characteristics of mobile ad hoc networks where applications must deal with frequent disconnections and new devices may appear and disappear at any point in time. Traditional DGC mechanisms rely on network connectivity of the nodes to determine reachability of remote objects. However, this becomes impractical in this context because remote objects can become inaccessible for arbitrary periods of time. DGC in mobile ad hoc networks requires other criteria to determine the reachability of objects since semantic and context information are crucial to ascertain whether an object is still remotely referenced. Therefore, reclaiming distributed objects in mobile networks can no longer be tackled in an automatic transparent algorithm. Instead, DGC in the context of Ambient Intelligence requires the developer to guide the collector to ascertain which remote objects can be collected.

This research proposes a novel treatment of distributed memory management to cope with the hardware phenomena of mobile networks. We do not focus on investigating a fully automatic algorithm but, we propose a semi-automatic garbage collection system where developers can explicitly assist the collector. Since developers have semantic knowledge of the object graph and how references are used, they could transmit this meta information to the collector and help it to ascertain whether a remote object can be reclaimed. Our approach is thus an annotation-guided DGC mechanism based on indirect reference counting and network objects augmented with additional semantic information that is annotated in the remote references. Such annotations describe the conditions under which the reference is valuable for the application so that when a reference becomes inaccessible due to a disconnection, both devices interacting know when the reference can be cleared. In conclusion, DGC is considered as a high level concern -rather than an low-level algorithm - that developers must take into consideration when developing software for mobile networks.