



Collectives: a Framework for Self-Adaptive P2P Applications

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Motivation



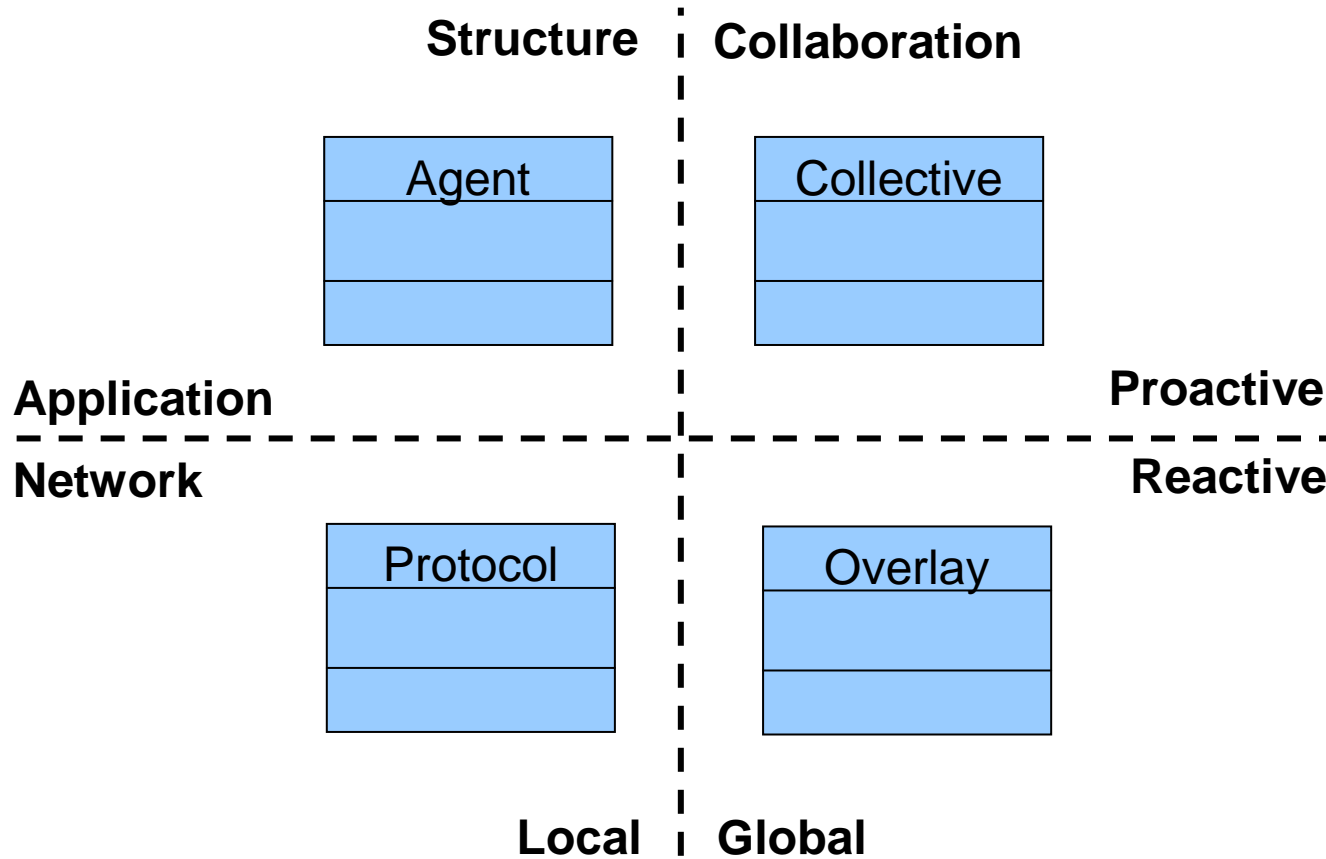
- P2P Applications has many sources of complexity and variability
 - Open environments with varying functionalities and users
 - Changing application level network topologies
 - Complex communication flows depending on usage patterns
 - Diversity of network infrastructures with different properties (Jxta, Gnutella, Chord, etc.)
- As a consequence, the process of designing and implementing P2P applications should consider its static and dynamic adaptation by means of parametric and structural changes at different levels of abstractions and during different stages of development

Objectives and Approach

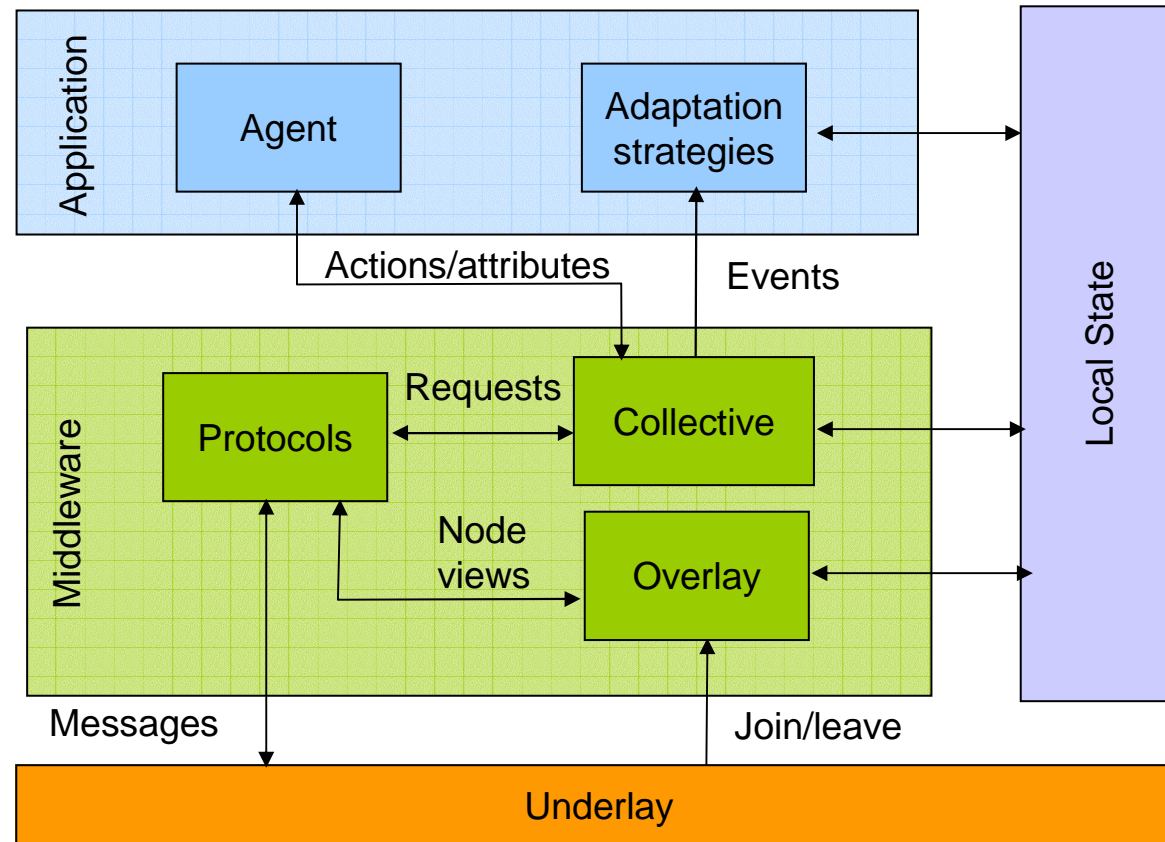


- Objectives
 - Offer a framework to support the study and development of self-adaptive applications
 - Support a progressive transition from a high-level modeling to the detailed design and the actual implementation
 - Allow reasoning about adaptation at each level
- Approach
 - Formulate abstractions that encapsulate these diverse adaptation concerns.
 - Realized abstractions in a flexible architecture that allows plugging the components responsible for diverse adaptation policies
 - Identify patterns for self-adaptation that guide the design and implementation process (future work)

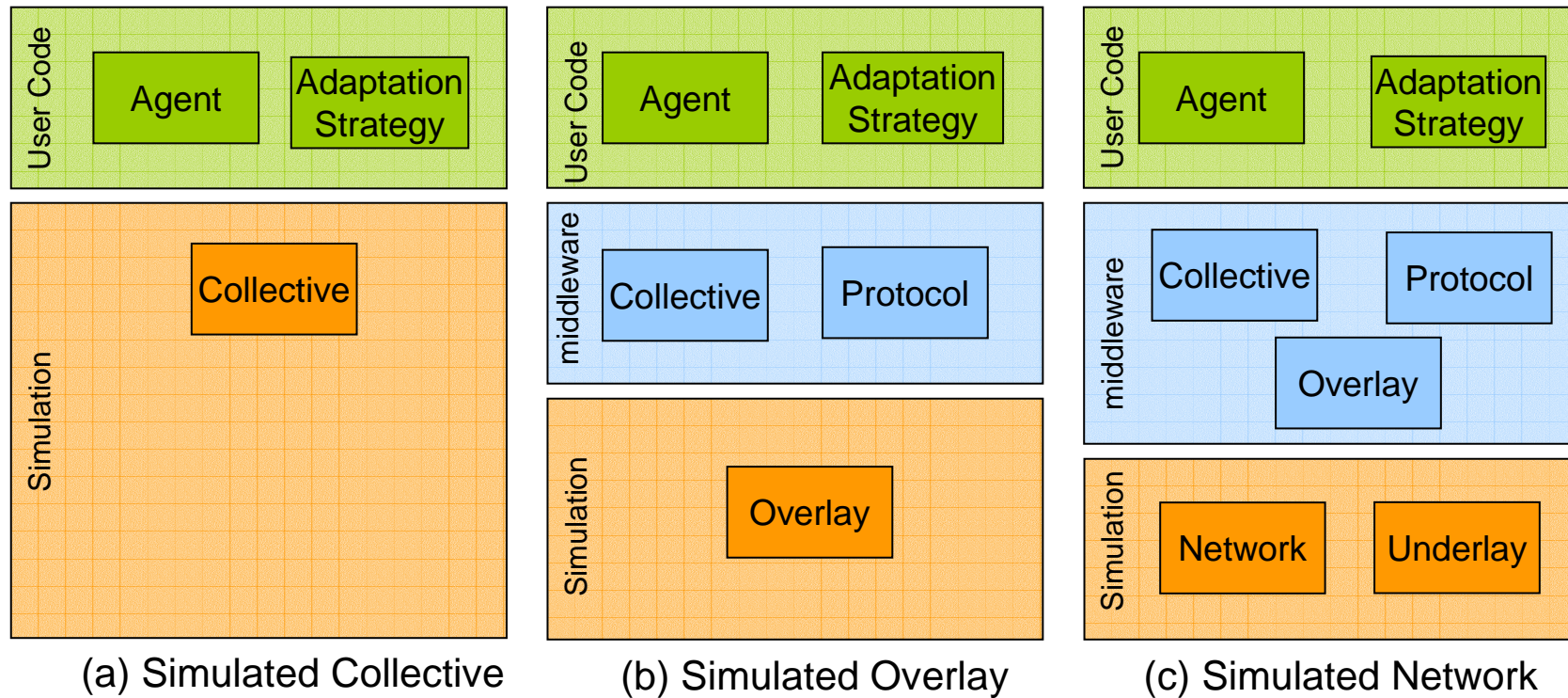
Basic Abstractions



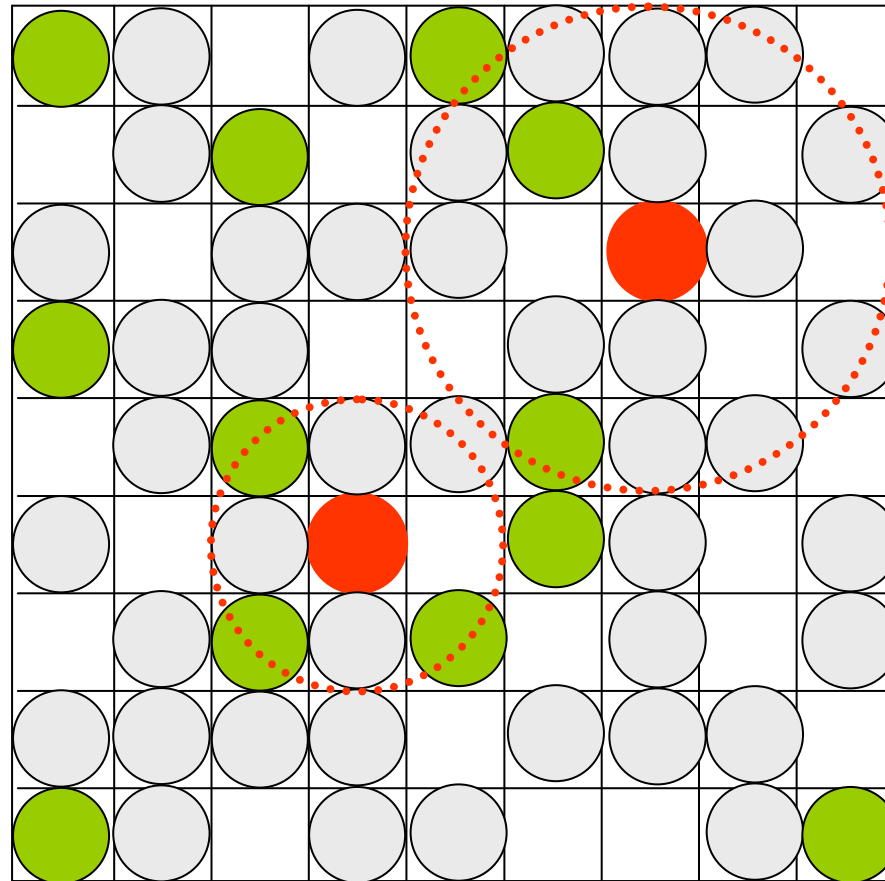
Architecture Overview



Analysis of Application Properties



Case Study scenario

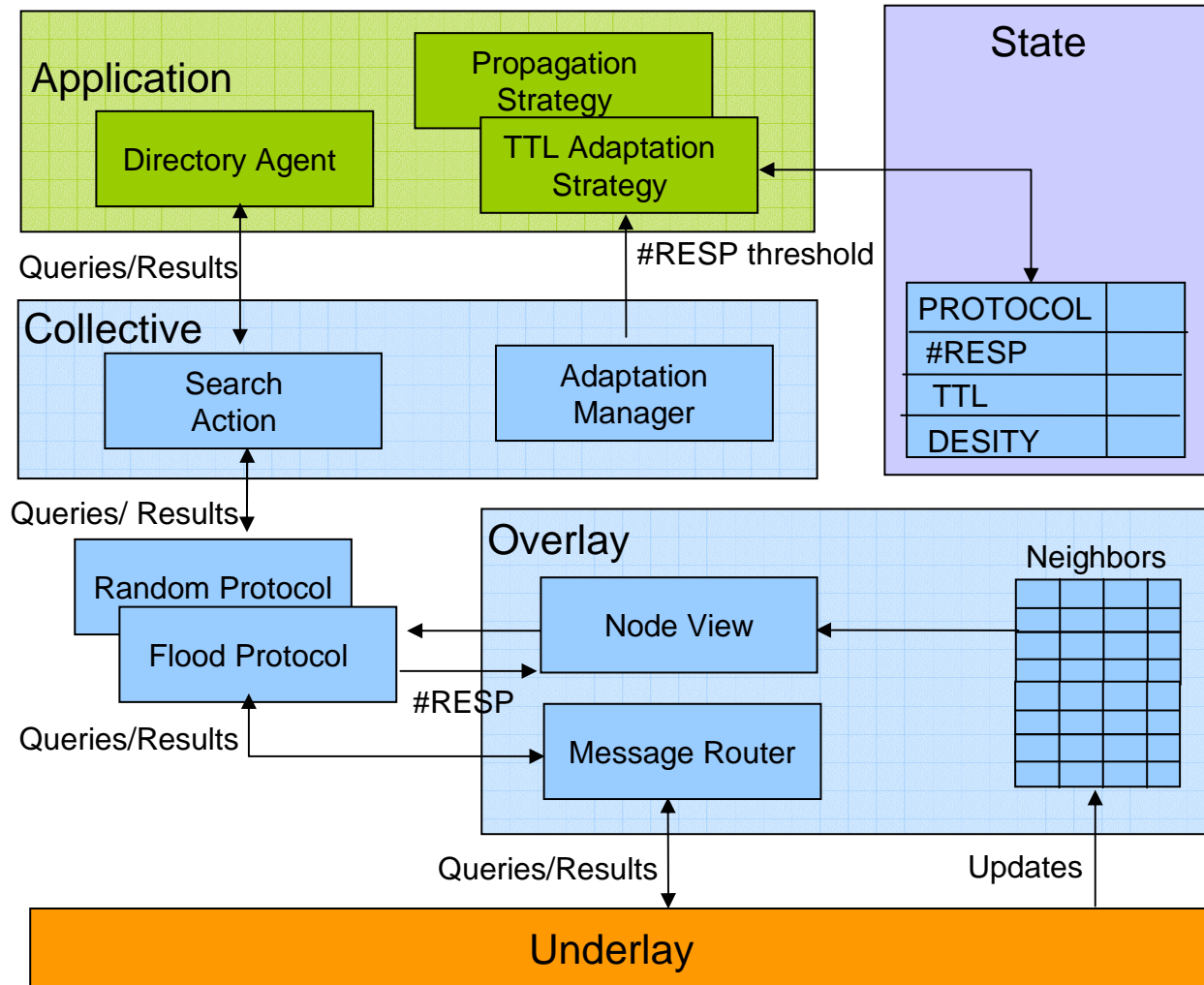


Adaptation options



- Adjust the TTL at the origin to extend/restrict the search radius depending on the number of responses received in previous requests.
- Adjust the TTL at each intermediary node to allow spatial adaptation, to local resource density
- Select the propagation algorithms (flood, random walk) depending on the global density of resources
- Sort neighbour nodes depending of different criteria (number of responses received, availability, load, etc.)
- Use different strategies for caching results (no caching, depending on demand, most recently requested, etc.)

Case Study architecture



Concluding Remarks



- Collectives offers a comprehensive framework to reason about the diverse adaptation concerns for P2P applications, providing the modeling abstractions and the implementation architecture to address them.
- This is an ongoing effort with a prototype in its initial stages and some open issues:
 - Composition of protocols
 - Coordination of self-adaptation actions
 - Explore symmetries between Agent-Collective and Protocol-Overlay
- We are analyzing diverse application domains (search, resource allocation, fault tolerance) to study the applicability of the model and generalize our conclusions
- We believe that developing Adaptation Patterns is a crucial element for the wide spread adoption of self-adaptation into the software engineering practice.



Questions?

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Further comments or questions

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