Thesis Proposal

School of Computer Science
Institute for Software Research
Software Engineering

Hybrid Planning in Self-Adaptive Systems

Ashutosh Pandey

Friday, November 3, 3pm
Gates & Hillman Centers 4405

Self-adaptive software systems determine adaptation plans at run time that seek to change their behavior in response to faults, changing environments and attacks. Therefore, having an appropriate planning approach to find an adaptation plan is critical to successful self-adaptation.

For many realistic systems, ideally one would like to have a planning approach that finds quality plans in a timely manner. However, due to the fundamental trade-off between quality and timeliness of planning, today designers often have to compromise between an approach that is quick to find a plan and an approach that is slow but finds a quality plan.

To deal with this trade-off, we propose a ***hybrid planning*** approach for self-adaptive systems that combines deliberative and reactive planning to find a balance between quality and timeliness. The key idea is to use reactive planning to provide a quick (although potentially a sub-optimal) response, but simultaneously invoke deliberative planning to determine quality plans. Once the deliberative plan is ready, it takes over the execution from the reactive plan to provide a higher quality adaptation thereafter.

The proposed thesis work will demonstrate through case-studies that a combination of reactive and deliberative planning can improve adaptation effectiveness over using either alone as measured by a multi-dimensional utility function capturing different dimensions of a system's goal. In the process, the thesis will make contributions to both the theory and the practice of hybrid planning in self-adaptive systems. Specifically, the thesis will provide: (a) a formal framework defining the problem of hybrid planning; (b) a practical approach (grounded on the formal model) to apply hybrid planning to self-adaptive systems; and (c) concrete examples bridging the gap between theory and practice.

Committee: Dr. David Garlan (chair), Dr. Jonathan Aldrich, Dr. John Dolan, Dr. Hausi Müller (University of Victoria, Canada)