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Title	Systems Engineering of Autonomous Systems and Architectures
Abstract	<p>A significant amount of research is being conducted into increasingly autonomous systems. The prospective benefits of these systems are huge – increased safety for operators, greater adaptability or capability for deployed systems and cheaper operating costs. However, some of the properties of increasingly autonomous systems can challenge current systems engineering practices:</p> <ul style="list-style-type: none"> - Greater adaptability and better decision making by an autonomous system has significant advantages when deployed, but at a cost of increased difficulty in validating during the design cycle. - Autonomous Systems are expected to deal with increasingly complex environments, data and information - Autonomous Systems can exist within complex, distributed architectural structures (both for a particular instance of an autonomous system, and collection of autonomous systems) which can be both dynamic and ad-hoc. <p>Some classes of autonomous systems may be successfully engineered by extending current engineering practices instead of looking at new approaches wholesale. If we can accommodate these additional tools, techniques and representations within our current engineering processes then it may allow us to reason about the additional properties and problems that arise with increasingly autonomous systems.</p> <p>The proposal looks to cover three primary areas with a view to building a systems engineering framework specifically for autonomous systems. This framework would cover:</p>

- The utilisation of Goals and Goal-Based Decomposition to allow decision making by an Autonomous System to be better reflected in the requirements specification phase of a project and to potentially allow the Autonomous System greater flexibility to adapt to changes in goal, configuration and environment. There would be a focus on non-functional goals and requirements, particularly performance.
- The utilisation of richer Architectural Specification to allow additional properties to be captured within a System Architecture and to bring greater formality to Architectural Specification.
- The development of an analytical framework to allow suitably annotated Autonomous System Architectures to be better assessed against the Autonomous Systems goals.

Research has been conducted into these elements – Goals and Goal Based Decomposition, Architectural Definition Languages and Architectural Analysis. However, much less has been conducted in combing these elements into a single process which can be applied to software systems in general, and less still has looked to apply this to Autonomous Systems specifically.

In addition to the above, the project may cover some additional topics which include:

- Runtime validation of architecture against goals, other constraints and the environment – i.e. The moving of the assessment from design-time to run-time, allowing the Autonomous System to assess whether it can achieve the goal it has been set given the current constraints and capabilities.
- Dynamic Architectural Reconfiguration/Generation – The creation or reconfiguration of a system based on whether the current configuration is assessed as being able to achieve the goal.

