An agent may be described as anything physical, synthetic or coded that is perceived of being capable of interacting upon an environment. A human agent would be seen to have sensors (eyes, ears, and other organs) to create percepts of the environment and effectors (hands, legs, mouth, and other body parts) to act upon the environment. A robotic agent may substitute cameras or other sensors to perceive the current situation, while various mechanised attachments could be used to effect some action within that environment. When defining an agent, researchers describe the properties it should exhibit. The first property is autonomy, which means operating without the direct intervention of humans. Second is social ability which describes the ability to interact with other agents, agent applications and/or even humans. Third is reactivity, which includes a means of perceiving the environment and responding to any changes that occur within it at a given point in time. Finally, pro-activeness means exhibiting goal-directed behavior. There are many architectures domains of influences and technologies that embody agent systems. When implemented as a system, agents are capable of achieving highly sophisticated goals autonomously and if written correctly, will continue to find a solution until the goal is complete. This chapter investigates how agents architectures evolved, the level of control, construction and mobility. Discussion continues to explore communications, how data is passed or concepts merged and the technologies used.

8.1 Developing Agents

Before developing an agent one needs to understand what it is. Agents are generally regarded as software systems and can be associated with an entity, framework, architecture and even languages. Typically agents are piece of program code that
are able to autonomously complete tasks. They may be required to adapt, learn or collaborate with stimuli, sensors and actuators or data flows. This is generally done using some form of communication within or across a distributed systems or networks. The key arguments used to define agent include its context and in many cases, encompasses everything required to solve problems; past, present and future. The taxonomy or classification is important, however the concept of one entity being responsible to solve every goal presented is unrealistic.

### 8.2 Agent Intelligence

A simple study of our environment re-enforces the concept of *survival of the fittest*. Experts confine their efforts to solve problems within very narrow domains, which is an acceptable and efficient method of solving problems. There are associated costs and implications, but these constraints are tolerated. We need to force a paradigm shift to one that distinguishes the perception from the deliverables. The concept of one entity fixes all needs to be addressed and moderated to account for the technology at hand. Interoperable MAS using dynamic teams and functionality need to be considered. In order to achieve a flexible, reliable problem solving system, a multitude of functionality must be accessible to a coordinated and cooperative supervised team of agents or sub-systems. The concept of intelligence used in agents may only be achieved by minimising the human element. In other words, provide software that achieves more than process or monitor without significant direction or control. Machines and production lines are controlled by operators that require specified skills to achieve a goal. When the required stimuli is missing or delayed, that machine or process become disrupted and may fail. The efficiency of attaining a goal, should not be confused with the intelligence of the machine or operator. Automation is the incarnation of a known sequence of series of processes that contribute to a predefined task. This concept should not be interpreted as intelligence, regardless of the level of technology or efficiency it provides.

As discussed, we know that humans are not efficient problem solvers because they suffer from cognitive stress when pressured to achieve. Technologies can be used to personify many modern behaviours or habits. Although agents are generally small and confined to limited functionality, they can be adapted to efficiently process specific tasks. Having a repository of such capabilities enables a collection of skills to be used to solve one or more elements of a decomposed task or goal. Being able to do this dynamically will improve efficiency and reduce complexity. The use of remote transactions or queries also reduce network traffic and improve reliability, especially across an unstable connection.

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1 Intelligence infers the ability to think, postulate or even compose a thesis to a solution. This requires many skills, compliance to lots of rules and a significant level of expert knowledge in the problem Domain. An Intelligence Quotient measures a range of skills using a standardised rating. Psychologist can administer professionally engineered tests, such as the Wechsler Adult Intelligence Scale (WAIS) or the Raven’s Progressive Matrices. What is measured and its relevance is the major issue clouding the terminology. Computers appear to achieve intelligent feats, but they are not intelligent, they are merely doing what they are programmed to do!