control of a production process for instance and other examples are used elsewhere in this specification.

The system comprises a set of classes (in the object-oriented technology sense) implemented in the Java programming language, allowing it to run on a variety of hardware platforms. Java is a good choice of language for developing multi-agent applications because it is object-oriented and multi-threaded, and each agent may consist of many objects and several threads. It also has the advantage of being portable across operating systems, as well as providing a rich set of class libraries that include excellent network communication facilities.

The classes of the system can be categorised into three primary functional groups - an agent component library, an agent building tool and an agent visualisation tool.

The agent component library comprises Java classes that form the "building blocks" of individual agents. These together implement the "agent-level" functionality required for a collaborative agent. Thus for instance for communications, reasoning, inter-agent co-operation and the ability to participate in goal-driven interactions between agents, the system provides:

- A performative-based inter-agent communication language
- Knowledge representation and storage using ontologies
- An asynchronous socket-based message passing system
- A planning and scheduling system
- An event model together with an applications programming interface (API) that allows programmers to monitor changes in the internal state of an agent, and to control its behaviour externally
- A co-ordination engine
- A library of predefined co-ordination protocols
- A library of predefined organisational relationships

It further provides support agents of known general type such as name-servers, facilitators (classified directories), and visualisers.

Preferably, components of the system use standard technologies wherever possible, such as communicating through TCP/IP sockets using a language based on the Knowledge Query Management Language (KQML).

Further descriptions of these aspects can be found below.