AGENTLINK II:
Continuation of a Network of Excellence for Agent-based Computing

Coordinating proposer:

Michael Wooldridge

Department of Computer Science
University of Liverpool
Liverpool L69 7ZF
United Kingdom

Email   `M.J.Wooldridge@csc.liv.ac.uk`
Tel   (+44 151) 794 3670
Fax   (+44 181) 794 3715

B1 Title Page

Part B

Proposal full title   AGENTLINK II: Continuation of a Network of Excellence for Agent-Based Computing

Proposal Acronym   AGENTLINK II

Date of Preparation   November 1999

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B3 Objectives

AGENTLINK II is proposed as a follow-on to AGENTLINK, the ESPRIT-funded Network of Excellence for agent-based systems that was established in May 1998. Agent-based systems are one of the most vibrant and important areas of research and development to have emerged in information technology in the 1990s. An agent is a computer system that is capable of flexible autonomous action in dynamic, unpredictable, typically multi-agent domains. Many observers believe that agents represent the most important new paradigm for software development since object-orientation. The concept of an intelligent agent has found currency in a diverse range of sub-disciplines of information technology, including computer networks, software engineering, object-oriented programming, artificial intelligence, human-computer interaction, distributed and concurrent systems, telematics, computer-supported cooperative work, control systems, and electronic commerce.

AGENTLINK II will act as a unifying focus for agent-based activities in these different domains. As with AGENTLINK, the long-term goal of AGENTLINK II is to put Europe at the leading edge of international competitiveness in this increasingly important area. The medium term goals of the network are:

- to gain competitive advantage for European industry by promoting and raising awareness of agent systems technology;

- to facilitate improvement in the quality, profile, and industrial relevance of European research in the area of agent-based computer systems;

- to promote excellence of teaching and training in the area of agent-based systems;

- to provide a widely known, high-quality European forum in which current issues, problems, and solutions in the research and development of agent-based computer systems may be debated, discussed, and resolved.

To achieve these goals, AGENTLINK II will:

- actively promote awareness of agent research and development activities within European industry by means of an industrial awareness programme, drawing attention to the potential advantages of agent-based solutions and describing the scope of agent-systems technology;

- encourage technology transfer from academia to industry, by supporting industrial-academic meetings and pump-priming technology transfer collaborations, particularly with respect to the IST programme;

- promote the adoption of standards and the awareness of standardisation activities in the area of agent technology;

- provide support for innovative, high-quality conferences and workshops related to agent systems research, technology, and applications;

- create a pan-European infrastructure for teaching and training in the area of agent-based systems, disseminating curricula, reading lists, courses, and teaching materials;

- establish and maintain databases that map agent-based system research and development skills to researchers and practitioners across Europe;

- establish high-quality channels of communication on research, technology, and application aspects of agent-based systems, including a dedicated World-Wide Web (WWW) site, email list, and printed newsletter.

Experience with AGENTLINK demonstrates that this programme will clearly achieve the medium term goals of AGENTLINK II, and represents a sound and pragmatic first step towards the long term network goals. As with AGENTLINK, every effort will be made to encourage AGENTLINK II members to be as fully involved as possible both in the activities and the decision-making aspects of the network.

AGENTLINK II will focus on the *application* aspects of agent systems. Thus AGENTLINK II will not directly support research. Instead, AGENTLINK II will encourage and wherever possible facilitate industrial-academic collaborations, and will enable the flow of results, technologies, problems, and skills in both directions. In addition, AGENTLINK II will focus agent development and application efforts in European industry on areas of strategic importance and mutual strength, as well as on promising new application domains for exploitation.

AGENTLINK defined the scope of its activities via a classification scheme, which proved to be effective in determining how and where network resources can and should be applied. AGENTLINK II will initially adopt this classification scheme, and extend it over time — see Tables 1 and 2.

Emphasis in the research actions of AGENTLINK II will be placed on best practice (e.g., methodologies for agent system design), and on bringing theory closer to practice. The industrial/application areas to be addressed by AGENTLINK II are summarised in Table 2. A major focus of AGENTLINK II industrial action will be the use of agents in internet and electronic commerce applications (DA1–DA5) , as well as agents in telecommunications applications (DA7).

A key success of AGENTLINK has been to establish a high-quality communications infrastructure for communicating the results of the network. The key aspect of this infrastructure is a WWW site: the domain name `AgentLink.org` has been registered, and all the network's public documents and activities are accessible via this regularly maintained site. The intention is to establish `www.AgentLink.org` as a "portal" site for international agent-related activities. In addition, AGENTLINK established a printed newsletter. As well as carrying news about AGENTLINK itself, this newsletter carries "feature" articles of general interest to the agent community, keeping members up-to-date with the main developments in the field. The newsletter is distributed to all AGENTLINK members, and is also freely available via the AGENTLINK WWW site. Finally, a regular monthly email digest has been established, (currently with nearly 500 subscribers), through which the activities of AGENTLINK are communicated to members. AGENTLINK II will continue all of these infrastructure activities, and will work towards the goal of becoming recognised as the first point of contact for agent activities in the European region.

The success of AGENTLINK II will be assessed primarily by measuring:

- the number of sites becoming or applying to become members of AGENTLINK II;

- the number of new collaborations established between AGENTLINK II nodes;

- the number of research and training activities established through AGENTLINK II, and the volume of interest in these activities; and finally

- the general level of interest in agent technology in European industry and academia.

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Research Areas
    RA1: Micro/agent-level issues in agent technology
        1.1: Agent control architectures
            1.1.1: deliberative/cognitive agent control architectures & planning
            1.1.2: reactive/behavioural agent control architectures
            1.1.3: hybrid agent control architectures
            1.1.4: layered agent control architectures
        1.2: Foundations of agency
            1.2.1: practical reasoning/planning and acting
            1.2.2: rational action & agency
            1.2.3: decision making, decision theory, & agency
            1.2.4: agent representation & specification formalisms
            1.2.5: semantics of agency & logics of agency
            1.2.6: computational/complexity issues of agency
    RA2: Macro/society level issues in agent technology
        2.1: cooperation
            2.1.1: cooperation protocols
            2.1.2: models and formalisms for cooperation
            2.1.3: game/economic theoretic models of cooperation
            2.1.4: conflict detection & resolution in multi-agent systems
            2.1.5: coalitions & coalition formation
        2.2: coordination
            2.2.1: coordination techniques and protocols
            2.2.2: coordination languages & systems
        2.3: computational market systems
            2.3.1: market-based control
            2.3.3: market-oriented programming
        2.4: communication
            2.4.1: agent communication languages
            2.4.2: speech acts
        2.5: negotiation, bidding, and argumentation
        2.6: foundations of multi-agent systems
            2.6.1: emergence of cooperation and social action
            2.6.2: sociology, ethology, and their relationship to multi-agent systems
            2.6.3: emergent functionality and swarm behaviour in multi-agent systems
            2.6.4: semantics of multi-agent systems & logics of multi-agent systems
            2.6.5: computational/complexity issues of multi-agent systems
    RA3: Agent system implementation issues
        3.1: environments & testbeds for agent system development
        3.2: programming languages, tools, & libraries for agent system development
        3.3: relationship of agents to objects and other paradigms (e.g., logic programming)
        3.4: evaluating agent systems
    RA4: Best-practice in agent system development
        4.1: standards for (multi-) agent systems
        4.2: analysis, specification, design, & verification techniques for agent systems
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Table 1: Research areas within the scope of AGENTLINK II.

B4 Contribution to programme/key action objectives

Like key action four of the IST programme itself (*Essential technologies and infrastructures*), AGENTLINK II can be seen as a horizontal activity. Agent technology is not restricted to one specific computing or communications domain. Rather, it is likely to play a key role in many aspects of the IST programme. In this section, we identify those areas of the IST programme that are most closely related to agent technology, and therefore most closely related to AGENTLINK II.

Development/Application Areas
  DA1: Electronic commerce
  DA2: Information gathering, management, and retrieval
  DA3: Internet and World-Wide-Web agents
  DA4: Expert assistants & human computer interfaces
  DA5: Business process control, workflow, emergency management
  DA6: Industrial control & scheduling, embedded systems
  DA7: Telecomms network management and control
  DA8: Simulation
  DA9: Entertainment & virtual environments
  DA10: Education
  DA11: Robotics
  DA12: Mobile computing
  DA13: Intelligent home & office
  DA14: Advanced services

Table 2: Application/development areas within the scope of AGENTLINK II.

- *Key action I*: Systems and services for the citizen.

  - I.1.1: New models for providing services to citizens.
  - I.3.1: Systems and services for independent living.
  - I.4.1: Systems enhancing the efficiency and user-friendliness of organisations.
  - I.6.2: Systems for intelligent vehicles.

- *Key action II*: New methods of work and electronic commerce.

  - II.1.1: New perspectives for work and business.
  - II.1.2: Corporate knowledge management.
  - II.2.2: Team work.
  - II.2.3: Dynamic networked organisations.
  - II.3.2: New market mediation mechanisms.
  - II.3.3: Enhanced consumer-supplier relationships.

- *Key action III*: Multimedia content and tools.

  - III.2.2: Content management and personalisation.
  - III.3.1: Open platforms and tools for personalised learning.
  - III.3.3: Advanced training systems.
  - III.4.2: Natural interactivity.

- *Key action IV*: Essential technologies and infrastructures.

  - IV.1.1: Convergence and integration: scenarios and analyses.
  - IV.2: Technologies for the management of information processing.
  - IV.2.1: Concurrent systems.
  - IV.2.4: Technologies for network management.
  - IV.3.1: Component-based software engineering.
  - IV.3.2: Engineering of intelligent systems.
  - IV.3.3: Methods and tools for intelligence and knowledge sharing.
  - IV.3.4: Information management methods.

B5 Membership

It is the intention that, as with AGENTLINK, AGENTLINK II will be an *open* network, in that any site which satisfies the European Commission rules for membership of a Network of Excellence, and that is in addition carrying out work relevant to AGENTLINK II, should be both encouraged and permitted to join. Openness to new members and new directions will be central to the ethos of AGENTLINK II. In this section, we describe how new members will be made aware of and attracted to AGENTLINK II, how membership requests will be dealt with, and how nodes will be encouraged to participate in AGENTLINK II.

Attracting New Members

In order to attract new members to AGENTLINK, an awareness programme was initiated. This awareness programme consisted of initial emails to established public email lists, followed by regular updates on AGENTLINK activities, printed leaflets distributed at major international conferences of relevance to agent technology, and AGENTLINK sponsored events at other meetings (such as the FIPA standardisation meetings). This programme proved highly successful in attracting new members; from the 37 initial members, AGENTLINK grew to 103 members within its first year, and 123 members within 18 months. This awareness programme will be continued within AGENTLINK II. Particular emphasis will be placed on attracting industrial members, through the program of visits to industrially-oriented conferences, and notices in industrially-focussed magazines and newsletters.

Applying for Membership

In order to apply for membership, a site will be required to complete a short application form, detailing their agent-related research and/or development activities. Membership requests will be batched up and considered by the management committee approximately every three to four months. AGENTLINK II will use two rules to determine whether or not academic or industrial partners should be granted membership:

- *Industrial nodes.*

  The only requirement placed on industrial nodes is that they can demonstrate a genuine interest in agent systems, typically through projects or suchlike. The rationale behind these criteria is that a key goal of AGENTLINK II is to pump-prime industrial activity in agent technology. Encouraging industry to participate at an early stage of involvement in agent activities is therefore essential.

- *Academic nodes.*

  For academic (i.e., university) nodes, the entry requirements for AGENTLINK II are somewhat stricter. Such nodes are required to demonstrate some degree of quality in agent research and development. There are several ways in which such excellence might be demonstrated. Research publications in respected journals, conferences, or workshops are the most obvious way. The development of agent software or participation in European agent projects is another. Each case will be considered on its individual merits, but the overriding intention is that the academic membership of AGENTLINK II should signify a certain standard of *excellence* in agent technology.

The proposed application form for AGENTLINK II membership is available on the AGENTLINK WWW site (`http://www.AgentLink.org/`).

Participation of Members

Members will have the opportunity to participate in AGENTLINK II activities in many ways, for example by serving on one of the various workpackage committees, taking part in SIGs, participating in inter-node meetings, writing reports for the newsletter, and so on.

Crucial to the success of AGENTLINK II is the participation of *industrial* nodes in the activities of the network. It was recognised early on in the life of AGENTLINK that a key obstacle to the successful participation of industrial members in various meetings was simply lack of time. To this end, a key principle in the organisation of many AGENTLINK events was *co-location* — it was decided that wherever possible, AGENTLINK II events should be co-located with existing events, so that both events could benefit from the reduced overhead in travel. This theme will continue in AGENTLINK II, with events being located wherever possible around industrially-oriented conferences and workshops.

B6   Project Workplan

The workplan of AGENTLINK II is similar to the AGENTLINK workplan. The division of activities into five workpackages is closely based on that of AGENTLINK, and the division of these workpackages into tasks is broadly the same. However, AGENTLINK II will also carry out some additional activities.

The five work packages are:

- *WP1 — Industrial action*.

  Focussing primarily on the transfer of agent technology from academia to industry, the transfer of user requirements from industry to academia, and promoting best practice in agent systems development.

- *WP2 — Research coordination*.

  Focussing primarily on the promotion of excellence in European agent research, and establishing new research communities in promising, valuable areas of research.

- *WP3 — Education and training*.

  Focussing on building agent technology development and research skills in students and researchers, and providing an infrastructure for teaching and research in agent-based systems.

- *WP4 — Special Interest Groups (SIGs)*.

  Special interest groups are one of the key activity areas of AGENTLINK II, and provide the main conduit through which strategic direction for the network will be determined, and the technological roadmap generated.

- *WP5 —* AGENTLINK II *Management & Information Infrastructure*.

  Focussing primarily on the creation of a management and communication infrastructure through which the work of AGENTLINK II can be efficiently carried out.

In the subsections that follow, these workpackages are described in detail. For each workpackage, we describe its *aims*, and then a detailed specification of the specific *tasks* of the work package.

Each workpackage will last three years (the duration of the proposed funding). As with AGENTLINK, each work package is managed by a *coordinator*.

B6.1   Work Package 1: Industrial Action

Coordinator: Jörg P. Müller (Siemens AG, D)

The main aim of this workpackage is to put European industry at the leading edge of international competitiveness in the agent area, by:

- raising awareness within industry of the value and appropriateness of agent-based computing techniques and solutions, and demonstrating the potential of this technology for solving real industrial problems;

- facilitating the transfer of agent technology, skills, standards, and best-practice from academia to industry; and finally

- focussing European research on agent-based systems on industrial problems, by facilitating the transfer of user requirements from industry to agent researchers.

In order to realise these aims, the following programme of work will be carried out:

- *Task T1.1*: Industrial awareness programme.

  The industrial awareness programme established in AGENTLINK will be continued in AGENTLINK II. The aim will be: (i) to bring the activities of AGENTLINK II to the attention of an industrial audience, and (ii) to promote awareness of agent research and development activities in the European region. Typically, these meetings involve taking a stall at an industrially-oriented conference, distributing leaflets and other promotional material, and giving presentations on aspects of agents and agent technology.

- *Task T1.2*: Agent systems & technology database.

  A database of developed agent systems, technologies, and products was established in AGENTLINK, and is available via the network's WWW site. In addition, a database has been developed of agent-related expertise available within AGENTLINK II. This database is freely available via the AGENTLINK WWW site. In AGENTLINK II, we will continue to build upon this activity, ensuring that it is kept up-to-date and accurate, and we will develop and expand the database to cover new areas of agent technology as they emerge.

- *Task T1.3*: Standardisation support & awareness initiatives.

  The lack of appropriate communication, cooperation, and negotiation standards is one of the main obstacles in the way of wider deployment of agent systems technology. The aim of this task will be to promote the development, dissemination, and adoption of such standards within the European region. AGENTLINK II will do this by providing hardware support for AGENTLINK II members upon which they can test and evaluate implementations of standards, and by disseminating news about current standardisation activities to members of the network. Resources will be made available for AGENTLINK II members to attend and report upon standardisation initiatives.

Criteria for success: The success of this workpackage will be assessed by measuring:

- the number of industrial nodes taking part in AGENTLINK II;

- the level of European interest in and takeup of agent-related standards;

- the number of collaborative activities between academic and industrial nodes in AGENTLINK II.

B6.2   Work Package 2: Research Coordination

Coordinator: Yves Demazeau (Univ. Joseph Fourier/LEIBNIZ, F)

The main aim of this work package is to promote excellence in European agent systems research, by:

- encouraging the development of research communities in new and promising areas;

- providing a high-quality infrastructure for disseminating research results, issues, datasets, and software; and

- encouraging cross fertilisation of research skills across the European region.

In order to realise these aims, the following programme of work will be carried out:

- *Task T2.1*: Research database.

  AGENTLINK established a research database, mapping areas of research in the scope of AGENTLINK (see Table 1) to AGENTLINK nodes with expertise in these areas. This database is available via the AGENTLINK WWW site, and provides at-a-glance information on the major areas of strength within AGENTLINK. In AGENTLINK II, this activity will be consolidated by ensuring that the database is kept up-to-date, and by expanding it with new areas of research and development activity as they emerge.

- *Task T2.2*: Clearinghouse for agent-related papers, articles, datasets, & software.

  Currently, there are no central repositories (in the world) where students and researchers can expect to find pre-prints or reprints of agent-related research material, datasets, electronic bibliographies, freely available research software, and so on — despite the fact that all of these are available in one form or another across the WWW. AGENTLINK II will create an online clearinghouse that allows researchers to keep such materials in a single, central place. Materials will be obtained both by actively searching for it and obtaining the relevant permissions, and by researchers submitting it electronically. Materials will be indexed wherever possible using the AGENTLINK II research classification (see Table 1), with the goal of allowing users rapid, easy access to relevant materials. The database will be made available via the AGENTLINK II WWW site (T5.1).

- *Task T2.3*: Support for agent workshops & conferences.

  Financial support will be provided for workshops and conferences that explicitly cover areas of interest to AGENTLINK II. The goal of this support is to pump-prime research in strategically important areas of agent R&D, as indicated in AGENTLINK II's primary objectives. Support will be provided primarily for innovative, novel areas, with clear potential for the development of strong research communities within Europe. Support will not be provided for new workshops or conferences that relate to areas already covered by established events. Requests for support of conferences and workshops will be directed to the workpackage coordinator, who will make recommendations to the management committee. Events supported by AGENTLINK II will be required, as a condition of funding, to write a report on the event for subsequent inclusion in the AGENTLINK II newsletter (T5.3) and the AGENTLINK II WWW site (T5.1).

Criteria for success: The success of this workpackage will be assessed by measuring:

- the number of active researchers joining AGENTLINK II;

- the number of collaborations established and project proposals submitted as a result of AGENTLINK II;

- the number of new research areas investigated as a result of AGENTLINK II.

B6.3 Work Package 3: Education and Training

Coordinator: Gerhard Weiß (Technical University of Munich, D)

The main aim of this workpackage is to promote excellence in the teaching and training of agent-related issues throughout the European region. In order to realise this aim, the following programme of work will be carried out:

- *Task T3.1*: Agent systems summer school.

  A centerpiece of AGENTLINK's teaching and training activities was the establishment of a summer school. This first of these summer schools took place in Utrecht, The Netherlands, in July 1999, and offered 18 courses on all aspects of agent technology, delivered by the very best international lecturers. About 40 AGENTLINK members were funded to attend, and no less than 120 other paid registrations were received, from both industry and academia. This made the 1999 summer school easily the largest agent teaching event ever, and AGENTLINK II will continue to build on this success by developing annual summer schools with the same model. Courses will be presented by international experts, from both inside and outside Europe. Support will be provided to fund travel, accommodation, and subsistence for both lecturers and a limited number of students. As with the 1999 summer school, additional attendance will be encouraged, and a fee charged for such attendees, with the ultimate goal of making the summer schools self-financing. Where possible, lecture materials will subsequently be made available via the AGENTLINK II WWW site (T5.1).

- *Task T3.2*: Curricula database for agent-related teaching.

  To encourage the teaching of agent-based computing, AGENTLINK established a WWW-based database of agent teaching materials and curricula, covering all aspects of agent-based computing. Each curriculum summarises the teaching aims of the course, teaching plans, and pointers to reading material. Curricula are classified with reference to the AGENTLINK II research and development areas (see Table 1). AGENTLINK II will continue to build and refine this database.

Criteria for success: The success of this workpackage will be assessed by measuring:

- the level of participation in the AGENTLINK II summer school;

- the number of universities offering agent-related courses;

- the number of curricula for agent-related teaching that are developed and disseminated by AGENTLINK II.

B6.4 Work Package 4: Special Interest Groups (SIGs)

One of the main activities in the first year of AGENTLINK was to establish a number of *special interest groups* (SIGs). A SIG is a group of researchers and developers sharing an interest in a specific sub-area of agent technology. SIGs are funded to meet between 2 and 3 times per year; so far, AGENTLINK has been able to fund about 15 AGENTLINK members to attend each SIG

meeting, and typically, the same number fund themselves to attend. SIGs are not established in a top-down manner: they are formed as a result of unsolicited, refereed proposals made by AGENTLINK II members. AGENTLINK II will continue this activity, with the aims being:

- to facilitate the development of communities around specific areas of strategic importance for European agent R&D, enabling them to share common problems, issues, and results in a manner that other forums (e.g., academic workshops and conferences) do not allow;

- to develop the technological roadmap;

- to provide the AGENTLINK II management committee with "bottom-up" input to its decision-making process, and hence ensure that the strategic direction of the network is reactive to the needs of its members.

In order to realise these aims, the following programme of work will be carried out:

- *Task T4.1*: Application area special interest groups.

  Application area SIGs are intended to focus on promising application areas for agent technology. Such SIGs formed so far within AGENTLINK include

  - agent-mediated electronic commerce;
  - intelligent information agents; and
  - agents for telecomms applications.

  AGENTLINK II will continue to expand upon AGENTLINK's programme of application area SIGs. In addition, SIGs will be encouraged to find support from other (national and European) sources in addition to AGENTLINK II, and to form collaborations for projects, particularly with respect to the IST programme.

- *Task T4.2*: Research area special interest groups.

  As in task T4.1 (Application area special interest groups), one of the key activities of AGENTLINK was the instigation of a number of *research SIGs*. These SIGs are collections of nodes of AGENTLINK II, working on closely related underlying technologies. Such SIGs established in AGENTLINK include:

  - software engineering and design methodologies;
  - agent-based simulation; and
  - coordination and control.

  As in AGENTLINK, the SIG infrastructure will (indirectly) promote collaborative projects by putting groups with related interests in touch with one-another, providing information about national and international project support for these areas of interest, workshops and conferences of interest, and so on. Other support will be provided in the form of funding to support meetings of the SIGs and dissemination of information. Requests for support of research SIGs will be directed to the workpackage coordinator, who will make recommendations to the management team. Preference will be given to groups in new and promising areas of development, and to SIGs that form new collaborations. Information on research SIGs will be made available via the AGENTLINK II WWW site, and in hardcopy format to nodes within AGENTLINK II on an annual basis. Research

SIGs supported by AGENTLINK II will be required, as a condition of funding, to write an annual report on the SIGs activities, for subsequent inclusion in the AGENTLINK II newsletter (T5.3) and the AGENTLINK II WWW site (T5.1). Each SIG will have a chair person, responsible for liaising with AGENTLINK II and managing the activities of the SIG. The chair of each SIG will sit on the AGENTLINK II management committee (see section C5).

- *Task T4.3*: Inter-network SIGs

  One aspect of AGENTLINK's activities that proved to be of great interest to the wider IT and telecomms communities was a number of meetings held in cooperation with other networks of excellence — in particular, COMPULOG (the network of excellence for computational logic) and I³NET (the network of excellence for intelligent information interfaces). These meetings provided researchers and developers working in both communities with the opportunity to meet, exchange ideas, and identify issues of common interest. This activity area will be continued and expanded in AGENTLINK II.

- *Task T4.4*: The Technological Roadmap.

  The key deliverable of workpackage 4 will be the *technological roadmap*. The aim of the AGENTLINK II technological roadmap is to provide a focussed, up-to-date assessment of how the agent field can and should develop. In so doing, it will specify:

  1. briefly, the background to agent technology - where it came from, what it is all about;

  2. the state of the art in agent technology - where we are today, in terms of technology and applications, including commercial success stories and failures;

  3. a long-term vision for the field - where will we be if agent technology succeeds? what is the long term problem (or whatever) that agents are trying to solve? what commercial opportunities can be expected from this success? what social impact (if any) will the success of agent technology have? what other impact will the success of agent technology have?

  4. what the technology gaps are, between the state of the art and the long-term vision; what problems do we need to solve in order to realise the long-term vision? what different techniques are being applied in order to bridge these gaps? what are the most promising of these, and what are their drawbacks?

  5. a discussion of the implications of the study in specific terms for each set of stakeholders, for example:
     - what regulatory implications are there?
     - what are the implications for research (e.g., content gaps, funding gaps, etc)?
     - what are the implications for industry (e.g., skills gaps, collaboration opportunities, etc)?

  Implications analysis should also include the consequences of not implementing the recommendations.

  The roadmap document will be read by three groups of individuals:

  (a) R&D policy makers at the European Commission;
  (b) industrial members of AGENTLINK II (typically technology-aware managers);
  (c) academic members of AGENTLINK II.

  Each of these will cite the document in order to support claims with respect to directions that agent technology can/should go, and the important issues facing the field.

B6.5   Work Package 5: AGENTLINK II **Information Infrastructure**

Coordinator: Michael Wooldridge (University of Liverpool, UK)
The success of AGENTLINK II, like its predecessor, will critically depend on the provision of a high-quality communications infrastructure. Therefore, the main aims of this workpackage are:

- to provide a communication infrastructure through which both members of AGENTLINK II and other interested parties can communicate on aspects of AGENTLINK II; and

- to provide a management infrastructure through which the work of the network can be effectively and efficiently carried out.

In order to realise these aims, the following programme of work will be carried out:

- *Task T5.1*: Dedicated WWW site for AGENTLINK II.

  The most important single communication mechanism for AGENTLINK II is a WWW site. The domain name `AgentLink.org` was registered under AGENTLINK for this purpose. The WWW site provides information both about all aspects of AGENTLINK II: its purpose, mandate, organisation, mechanisms for entry to the network, work areas, reports, points of contact, and so on. In addition, it is the conduit though which all tasks intended to communicate information will flow (e.g., T1.2, T2.1, . . .). All network-specific documents for AGENTLINK are available via the WWW site, as is the newsletter (T5.3), and a collection of maintained resources of value to the community. As indicated earlier, the goal is for `http://www.AgentLink.org/` to become a "portal" site for agent-related activities. In order to provide an up-to-date, high-quality WWW site, it will be essential to appoint a dedicated WWW site manager.

- *Task T5.2*: Moderated, edited email list for AGENTLINK II.

  An email list for AGENTLINK was established, providing moderated, edited information about all issues relevant to the network. This email list, which is free to join, currently has nearly 500 subscribers. The list regularly provides up-to-date information on all aspects of AGENTLINK's activities. This activity will be continued in AGENTLINK II.

- *Task T5.3*: Newsletter.

  Electronic methods for dissemination, while they are both cheap and fast, are not appropriate for some audiences. In particular, electronic formats are not appropriate for dissemination at conferences, trade fairs, and so on, and can create an unprofessional impression in industry. For these reasons, AGENTLINK established a professionally typeset and printed newsletter, published at four-month intervals throughout the life of the project (up to issue 4 by November 1999). In addition to containing details of what's happening in the network, the newsletter carries a range of articles including features, reports on conferences and workshops, informal descriptions of research results and new software, book reviews, short descriptions of projects, labs, and companies, and so on. The newsletter is distributed free to all members of AGENTLINK, and is also distributed by way of promotion at conferences, workshops, and industrial events. This activity will be continued in AGENTLINK II.

- *Task T5.4*: Annual report.

  As in AGENTLINK, an annual report will be prepared by the management committee of AGENTLINK II, summarising the activities of AGENTLINK II (including financial and

organisational matters, as well as reports on inter-node visits, SIGs, workshops and conferences supported, and projects in progress) throughout the preceding year. The report is expected to be formal, but will not require the professional typesetting and printing services required by the newsletter.

- *Task T5.5*: External and inter-network coordination.

  In order to both encourage cross-fertilisation of research and development activities and make the most efficient possible use of available resources, AGENTLINK II will actively coordinate its activities with those of other relevant networks of excellence (such as COMPULOG-NET and ERUDIT). In addition, AGENTLINK II will coordinate its activities with external professional and academic organisations at both national and pan-European levels, as well as with relevant journals, seminars, conferences, and workshops (such as the *International Conference on Multi-Agent Systems*, the *International Conference on Autonomous Agents*, the *International Conference on Practical Application of Agents and Multi-Agent Systems*, and the many other established AI, HCI, and software engineering conferences). Finally, AGENTLINK II will also coordinate with relevant funding bodies outside Europe: the most obvious example is the National Science Foundation (NSF) in the USA, who are initiating a major programme of agent research, and who have expressed an interest in coordinating their activities with AGENTLINK II, to support, for example, researcher exchange programmes.

- *Task T5.6*: Administrative support.

  The work of AGENTLINK II cannot be carried out effectively without dedicated, full time administrative support. A qualified administrator will therefore be appointed, to be resident at the site of the coordinating proposer, in order to provide this support. The administrator will manage the communication infrastructure of AGENTLINK II on a day-to-day basis, ensure that enquiries are directed to the appropriate persons, keep track of finances, and so on. The administrator will not have executive power within AGENTLINK II, but will primarily assist the network and workpackage coordinators, and deal with any issues that do not require management input. The administrator will also provide support to the various SIGs and workpackages active within the network, by providing help and advice on organising meetings, issuing meeting calls to the appropriate parties, and so on.

- *Task T5.7*: Openness.

  It is intended that AGENTLINK II will be an open network, in that any group sufficiently qualified should be able to join (see section B5). This task will be directed at encouraging appropriate nodes to join; such encouragement will be given in part through industrial meetings (see T1.1), in part through awareness-raising activities (T5.5), and in part by encouraging all members of AGENTLINK II to actively promote the network at conferences, workshops, industrial events, and so on.

- *Task 5.8*: Development of AGENTLINK II.

  As AGENTLINK II develops, new problems and opportunities will arise for the communities it creates. This task will focus on ensuring that any problems which may arise are dealt with effectively (perhaps by modifications to the management or infrastructure), and that any opportunities are fully exploited.

Criteria for success: The success of this workpackage will be assessed by measuring:

- the number of hits on the AGENTLINK II WWW site;

- the number of sites joining the AGENTLINK II email list;

- the number of copies of the newsletter distributed;

- the number of requests for the annual report;

- the number of extra-AGENTLINK II collaborations formed, e.g., with other networks;

- the number of requests to join AGENTLINK II.

C1   Title Page

Part C

Proposal full title   AGENTLINK II: Continuation of a Network of Excellence
for Agent-Based Computing

Proposal Acronym   AGENTLINK II

Date of Preparation   November 1999

C2   Content List

- C1   Title page

- C2   Content list

- C3   Community added value

- C4   Contribution to Community Social Objectives

- C5   Management

- C6   Description of Consortium

- C7   Description of Participants

- C8   Economic Development and Prospects

C3　Community Added Value

A recurrent theme in the information technology and telecommunications sectors over at least the past decade has been the *convergence* of communication and computation technologies. The impact of this convergence is being felt throughout the telecomms and IT sectors, and will be perhaps the defining characteristic of information technology in the early 21st century. As this convergence progresses, enormous opportunities will arise for new markets, services, and industries. It is crucial for European industry and academia to be at the leading edge of any technologies with the potential to play a part in this new field. *Agents are widely recognised as precisely such a technology.* They have a role to play at the client-side of such systems, providing customers with personalised, pro-active interfaces to new services and products. They have a role to play as middleware, putting users in contact with the goods and services that best suit their needs. And they have a role to play as servers, cooperating and negotiating on behalf of organisations and other end users.

There is a significant imperative for agent research and development to have coordination at a European level. The most obvious reason for this is that the issue of agent inter-operability will be central to the success of agent technology. It will clearly be to the advantage of European industry if such inter-operability issues are addressed by a coordinating organisation at the European level, rather than at the national or organisational level. In addition, it is worth noting that European industry is still moving up the learning curve with respect to agent technology: industrial-strength agent technology skills are only very thinly distributed throughout the region. The existence of an organisation providing the fledgling European agent technology industry with information about best practice, current practice, technology consumers, and so on, will have a significant positive effect.

European research in agent systems also has a strong international reputation. Despite these European strengths in aspects of agent technology, until AGENTLINK there was no central coordination or communication infrastructure for European activities, and as such, agent technology in Europe was developing in a number of separate directions. AGENTLINK provided these different communities with a single point of contact through which they could communicate issues and results. AGENTLINK II will build on this success.

C4   Contribution to Community Social Objectives

One of the primary stated aims of the IST Programme, contributing to the Community's social objectives, is to

> "help create a user-friendly information society by building a global knowledge, media and computing space which is universally and seamlessly accessible to all through interoperable, dependable and affordable products and services".
>
> (IST 1999 Workprogramme, p4).

In order to realise this vision, new technologies are required, which cut across traditional R&D boundaries and go beyond existing software and communications paradigms. Agents are currently regarded as the best candidate for such technologies — hence the enormous interest in agent technology throughout the software and telecomms industries.

As stated in B3, B6, and C8, AGENTLINK II will address a range of issues and problems facing the European agent community, in order to enhance the effectiveness of agent R&D activities and to help diffuse results, problems, techniques, and experiences among the relevant communities. In so doing, AGENTLINK II will make a clear positive contribution to the aims of the IST programme and the social objectives it supports.

AGENTLINK II will have both a *primary* and *secondary* contribution to the Community's social objectives. The primary contributions of AGENTLINK II will be in the short term (less than five years), and are likely to be:

- the delivery of new and improved (agent-based) goods and services to citizens and organisations within the community;

- the development of new economic activities in the IT and telecomms sectors, (recognised as being crucial to the future success of European industry);

- wealth creation through the exploitation of new goods and services;

- improvements in the profile, industrial relevance, and quality of European agent research, with obvious positive benefits for creation and exploitation of new technologies, industries, and services; and

- the dissemination of advanced IT and telecomms skills throughout the European region, with the obvious social benefits such training brings.

The secondary contributions of AGENTLINK II to community social objectives will be more long term, and perhaps less tangible. These will include the development of a coherent European R&D community working in the agent area, as well as new European collaborations in the agent area.

C5   Management

The management structure of AGENTLINK II has been designed with the following goals in mind:

- AGENTLINK II should be flexible and responsive to the needs of the community it serves;

- decision making should, wherever possible, be distributed across the members nodes of AGENTLINK II, and not lie with a small group of individuals;

- as many nodes as possible should be involved in carrying out the actions of AGENTLINK II, in order to prevent bottlenecks and to ensure that nodes recognise that AGENTLINK II is a network in which they play an active part.

In summary, the intention is that AGENTLINK II will engage *the entire community*, and *not* simply serve the interests of an elite few. Experience with AGENTLINK indicates that a distributed management structure can achieve this goal while at the same time dynamically meeting the needs of the community, as these needs arise. In the subsections that follow, the makeup and role of the various management committees are described in detail. The management structure of AGENTLINK II is illustrated in Figure 1.
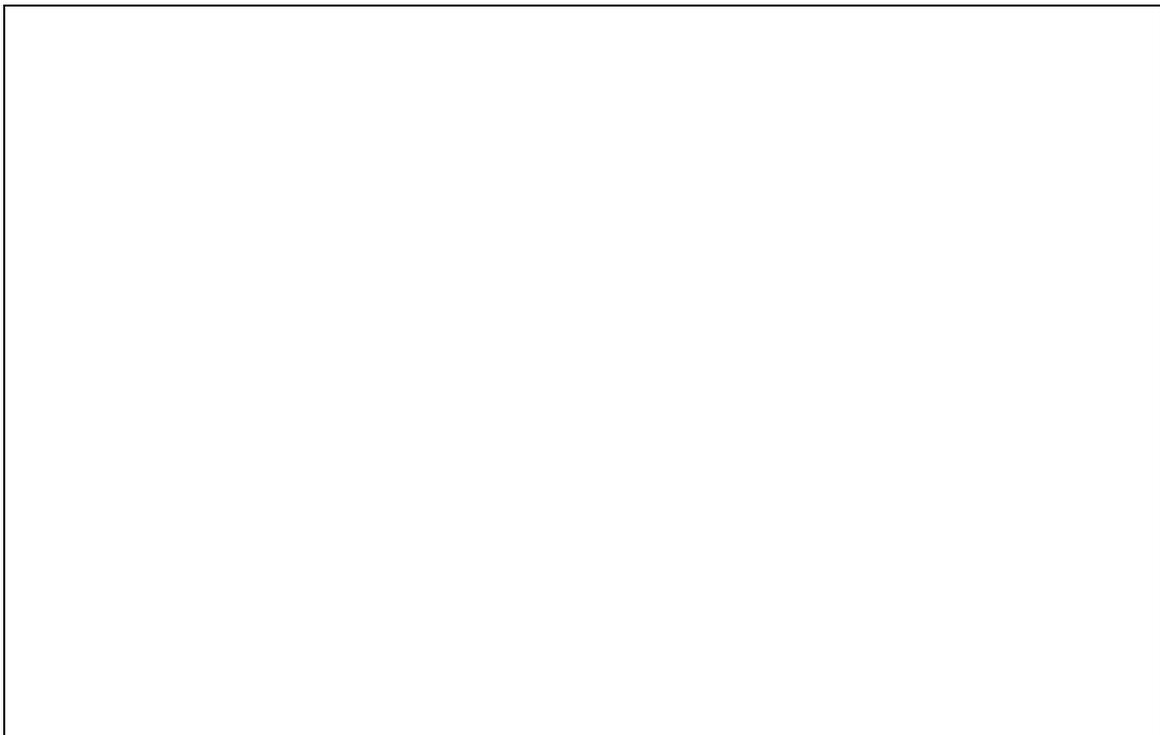
Figure 1: Management Structure

C5.1   The Management Committee

Overall management of AGENTLINK II will be achieved through the *management committee*, which will meet approximately two to three times annually throughout the life of the project. The basic goal of the management committee is to make major policy and strategic decisions

for the network, and to approve large funding requests. The management committee will not be responsible for the day-to-day running of the network, which will fall to the network coordinator and network administrator. The management committee has overall responsibility for ensuring that the work of the network is carried out efficiently, effectively, and in the best interests of the community, and for taking whatever action is required to ensure that this remains the case.

Meetings of the management committee will be called by the *chair* of the committee (the network coordinator). The agenda of each management committee meeting will be set and distributed by the committee chair at least one month in advance of the meeting. Agenda items may be requested (at least a month in advance of the meeting) by AGENTLINK II members, and where possible will be scheduled for discussion. In addition to requested agenda items, the management committee will also normally discuss the following items:

- report on membership, status, progress, finances, and issues arising from management committee chair;

- report on status, progress, and issues arising from each workpackage coordinator;

- report on status, progress, and issues arising from each SIG chair.

Decisions on the allocation of resources over 2K Euro by the network must be made by the management committee. For such a decision to be resolved by the committee, a majority will be required from a quoral meeting; a meeting will be considered quoral if no less than $\frac{2}{3}$ of those eligible to attend are present.

Decisions not related to finance, the organisation of the network, or membership of the network will be made by the relevant workpackage coordinator, and will be reported at the following management committee meeting. If no workpackage is deemed appropriate for a particular decision, then decision making will fall to the management committee.

The general coordinator of AGENTLINK II will reserve the right to take executive action on decisions in extraordinary circumstances (when a quoral vote or meeting cannot be arranged, where the relevant coordinator is for some reason unavailable, or where the decision must be made before feedback can be obtained from the remainder of the management committee). Such decisions will be reported at the following management committee meeting, and will be ratified by a European Commission representative.

The management committee will be made up of:

- the AGENTLINK II coordinator;

- the coordinators for each workpackage, and members of each workpackage committee;

- the chair of each industrial and research SIG;

- a European Commission representative, where possible.

The makeup of the management committee may be extended, by vote of the committee, as and when required. All management committee members will be expected to attend committee meeting unless extraordinary circumstances arise to prevent them doing so. Where committee members regularly fail to meet this commitment, the committee will reserve the right to ask them to stand down, and vote a replacement.

The AGENTLINK II **Coordinator**

The network coordinator will have overall responsibility for ensuring that the activities of AGENTLINK II are carried out. In particular, day-to-day management of the project, maintenance and provision of the communication infrastructure (WP5), and overall coordination between sites will be the responsibility of the network coordinator. The AGENTLINK II coordinator will be helped in this respect by the administrative assistant.

Workpackage Coordinators and Committees

Each workpackage coordinator will have overall responsibility for ensuring that the activities of their respective workpackage are carried out. Workpackage coordinators will each convene a *workpackage committee* to carry out the actions of their workpackage. Where problems arise, the workpackage coordinator will have immediate responsibility for rectifying the situation, typically by reallocating responsibilities within the committee. In the case of problems that cannot be resolved within the workpackage (for example, requiring resources not available to the committee), the workpackage coordinator shall report this to the management committee, who will take such action as is necessary to resolve the problem.

Industrial and Research SIGs

Industrial and research SIGs (see T4.1 and T4.2) will meet at regular intervals (at least twice annually), and will report their activities to the appropriate workpackage coordinator (industrial or research). Such SIGs will have a chairperson, who will be eligible to sit on management committee meetings.

Country	Number of Members
UK	28 (27%)
Germany	21 (21%)
France	11 (11%)
Italy	7 (7%)
Spain	6 (6%)
Netherlands	5 (5%)
Portugal	4 (4%)
Belgium	3 (3%)
Norway	3 (3%)
Sweden	3 (3%)
Finland	2 (2%)
Greece	2 (2%)
Israel	2 (2%)
Switzerland	2 (2%)
Austria	1 (1%)
Denmark	1 (1%)
Ireland	1 (1%)
Total	102

Table 3: Breakdown of proposers by country of origin, as at 1 April 1999. Figures in brackets show percentage of total.

C6   Description of Consortium

The AGENTLINK II consortium consists of 123 members, and includes every centre of competence for agent R&D in the European region. As the consortium is so large, it would be impractical to list every member here; full lists of consortium members are given in Appendix A and Appendix B.

In this section, we present a breakdown of AGENTLINK members, as of 1 April 1999. These members are indicative of the makeup of the consortium. In particular, we provide:

- a breakdown of proposers by country of affiliation (see Table 3);

- a breakdown of proposers by member type, (i.e., industry, academic, research etc. — see Table 4); and

- a breakdown of proposers by industry area, where appropriate (see Table 5).

Note that the original membership of AGENTLINK was 37. The AGENTLINK network has thus *tripled* in size since May 1998. The consortium believes this is a good indication of the competence and quality of the network.

Table 4 gives a breakdown of members by organisation type. Note that 45% of members are non-university, giving a healthy division between industry and academia.

Table 5 gives a breakdown of industrial members by industry type. (Note that some members classified themselves in terms of multiple industry types.) Not surprisingly, software and telecommunications in one form or another account for nearly 70% of the total membership.

Organisation Type	Number of Members
University	55 (54%)
Industry	25 (25%)
Research institute	19 (19%)
Public administration	2 (2%)
Other	1 (1%)
Total	102

Table 4: Breakdown of proposers by organisation type, as at 1 April 1999. Figures in brackets show percentage of total.

Industry Type	Number of Members
Software consultancy & supply, …	18 (37%)
Telecom products	11 (23%)
Post & telecommunications	4 (8%)
Information not provided	5 (11%)
Electronic engineering & related	2 (5%)
Aircraft & spacecraft	1 (2%)
Audiovisual consumer electronics	1 (2%)
Pharmaceuticals …	1 (2%)
Vehicles for land transportation	1 (2%)
Office machinery & computing	1 (2%)
Electronic components	1 (2%)
Health & social work	1 (2%)
Electrical engineering & related	1 (2%)
Total	43

Table 5: Breakdown of industrial members by industrial type, as at 1 April 1999. Figures in brackets show percentage of total.

C7 Description of the Participants

Given the size of the proposing consortium, (123 members), it would be infeasible to present a CV and background for every proposer. For this reason, we simply give a CV of the four main coordinators of the network.

Dept of Computer Science, University of Liverpool, UK

The University of Liverpool was founded in 1881. Today, the University has more than 13,000 full time students, around 1,000 of whom are from overseas, in faculties covering a wide spread of academic disciplines: Medicine, Arts, Law, Science, Engineering, Veterinary Science and Social and Environmental Studies. Research plays a major role in the University, and, as just one example of that, the University obtained more than Euro 57M by way of research grants in 1998. The University has consistently been one of the top research universities in the UK, and has developed major research interests across all subject areas in the University.

   The Department of Computer Science is one of the most active and popular Departments in the University. With 22 academic staff, the Department has two main research groups: complexity theory and algorithms (headed by Prof Alan Gibbons), and agent-based computing (headed by Prof Michael Wooldridge). The agent-based computing group, containing 8 academic staff (faculty), has particular expertise in the theory and semantics of multi-agent systems, and negotiation and argumentation technologies.

   Michael Wooldridge is Professor of Computer Science in the Department of Computer Science at the University of Liverpool, UK. He has been active in the research and development of multi-agent systems for ten years, gaining his PhD for work in the theoretical foundations of multi-agent systems from the University of Manchester, UK in 1992. Prof Wooldridge has published many articles in the theory and practice of agent-based systems, and has edited eight books in the area. He has served on many program committees for conferences and workshops in the area, and is a director of the International Foundation for Multi-Agent Systems (IFMAS). He also serves as an associate editor of the International Journal of Autonomous Agents and Multi-Agent Systems (Kluwer), and an editorial board member for the Journal of Applied AI (Taylor & Francis). He is coordinator of AGENTLINK, the ESPRIT-funded European network of excellence in the area of agent-based computing (see `http://www.AgentLink.org/`).

Siemens Corporate Research, Germany

The Autonomous Intelligent Systems department within Siemens Corporate Research has been a driver of industrial research on intelligent agents for almost a decade, starting with the European project IMAGINE in 1990. The lab is a technology provider for the Siemens business units. It focuses on the development of concepts, methods, components, and applications of agent technology in various application domains, such as traffic telematics, telecommunications, and electronic commerce. Members of the group are active in all major agents conferences (ICMAS, Autonomous Agents, ATAL, PAAM) and in the FIPA agent technology standardization effort. Amongst many other activities, the Autonomous Intelligent Systems department at Siemens has contributed the underlying agent platform, the design, and the implementation to one of the world's largest implemented industrial multiagent systems developed in the German MOTIV-PTA project (Personal Travel Assistance).

   Jörg P. Müller is currently a senior project scientist in the Software Agents group at Siemens AG, Munich, Germany, where he is developing innovative agent-based technologies and applications for e-commerce, traffic telematics, and mobility. From 1996 to 1999 he was Principal

Software Engineer for Zuno Ltd., a spin-off of Mitsubishi Electric in London, and for John Wiley & Sons, Ltd., where he developed architectures, services, and solutions for agent-based digital libraries and e-commerce. From 1991 to 1996, he was a scientist in the multiagent systems research group at the German Artificial Intelligence Research Centre (DFKI GmbH), Saarbrücken, Germany. He holds a Ph.D. in Computer Science from the Universität des Saarlandes in Saarbrücken, and a M.S. in Computer Science from the Universität Kaiserslautern. Dr. Müller has published one monograph, has co-edited four books, and has written more than 70 peer-reviewed research papers on Intelligent Agents.

LEIBNIZ Laboratory, Grenoble, France

LEIBNIZ laboratory is a French public research laboratory, jointly established and supported in Grenoble by CNRS (Centre National de la Recherche Scientifique), INPG (Institut National Polytechnique de Grenoble) and UJF (Université Joseph Fourier). Research at LEIBNIZ laboratory ranges from the foundations of computer science in discrete maths, logics and programming (combinatorics; graph theory; algorithms; optimisation; automated inferencing in classical and non classical logics and interactive theorem proving; semantics of logic and functional languages), to exploring and implementing ideas, experiments and applications pertaining to a long term vision, where computers are aimed at mechanising or interacting with human cognitive activities (automated learning and reasoning with neural nets; system autonomy for sensory-motor learning and behaviour, with applications to robotics; theory, experiments and applications in multi-agent systems; computer environments for human learning and didactics of mathematics). The scientific policy of LEIBNIZ laboratory aims at maintaining a stimulating balance between theory, experiments, industrial applications and developments towards commercial products based on research results. Around 120 people are part of the LEIBNIZ laboratory, of which 40 are full time researchers or faculty members from CNRS, INPG and UJF, and 50 PhD students. In addition to institutional academic funding, the main resources of LEIBNIZ laboratory are contract research and royalties from marketed products.

Yves Demazeau received his Ph.D. in Computer Science, at INPG Grenoble in 1986. He is currently CNRS Research Fellow since 1988, and has been Visiting Professor at VUB Brussels in 1989 and Odense University in 1994. He is co-ordinator of the MAGMA research group on Multi-Agent Systems (MAS) at LEIBNIZ laboratory in Grenoble since 1990. He has been active in the research and development of MAS for 13 years. He has edited 5 books, authored over 70 papers and has given more 29 invited lectures, 65 seminars, and 14 tutorials in this research area. He has taught MAS extensively in Western Europe and South America for more than 7 years. His main research contributions are the introduction of interaction protocols for agent communication languages, the introduction of organisations as a ground component of MAS, the development of large-scale applications, and most recently, the overall VOWELS multi-agent oriented framework. He was the originator of the successful MAAMAW workshop series held regularly year since 1989 (currently chairing its advisory committee, program chair for its 10th issue in 2001), and co-founder of the ICMAS conference series (European Program Chair for the 1st one, General Chair for the 3rd one in Summer 1998). In addition to serving on the program committees of many conferences and workshops, he is an editorial board member for the Journals of AAMAS (Kluwer), RIA (Hermes), CIA (SAS). He is research co-ordinator of AgentLink, the European Network of Excellence in the area of multi-agent and agent-based computing, and member of the Board of the IFMAS foundation since its creation in 1998.

Research Group AI/Cognition, Technical University of Munich, Germany

The Research Group AI/Cognition is part of Prof Brauer's "Theoretical Informatics and Foundations of AI" unit, which is one of the 15 units of the Computer Science Department of Technical University of Munich. The Research Group AI/Cognition was created in 1986, and has been lead by Gerhard Weiss since 1997. The group currently consists of 10 junior scientists and adminstrative/technical staff. The group's primary research interests are centered around agent-based computing, knowledge representation, and artificial neural networks.

Dr Gerhard Weiss obtained a PhD in computer science from TUM in 1994 for work on distributed machine learning. Since 1997 he has lead the Research Group AI/Cognition at the computer science chair of Prof Dr W. Brauer at Technical University of Munich. His research and teaching mainly focuses on agent-based computing, distributed artificial intelligence, and machine learning. He is the co-editor or author of five books and the co/author of a number of articles in refereed conferences and journals. He is in the editorial board of the International Journal on *Autonomous Agents and Multi-Agent Systems*, and is the series editor of the International Book Series on *Multiagent Systems, Artificial Societies, and Simulated Organizations* published by Kluwer. He has served as the Agentlink WP3 coordinator since 1998, and recently became a member of the Board of Directors of the International Foundation for Multiagent Systems (IFMAS).

C8   Economic Development and Scientific/Technological Prospects

The potential economic impact of AGENTLINK II is enormous. Agents are recognised as an important technology for complex systems development by most major software and information technology companies across the world. This interest is evidenced by the fact that agent research and technology groups have been established by such companies as, (in the USA), Microsoft, IBM, Sun Microsystems, AT&T, and Netscape. Many other large US companies with an information technology interest are also actively engaged in agent projects. Examples include Andersen Consulting, Charles River Analytics, US West, and Xerox. In Europe, interest has been particularly strong within the telecommunications sector, with British Telecom, France Telecom, Deutsche Telecom, Nortel (UK), Broadcom (IR) and other telcos all establishing highly-active agent groups. Many industrial players in Europe have some of the longest-established agents research and development groups in the world, and are members of AGENTLINK II. Many SMEs and start-up companies specifically created to develop and exploit agent technology (such as Living Systems, D) have also benefitted from AGENTLINK activities over the past 18 months.

The main application/development areas in which agent systems are currently having an impact are summarised in Table 2. In electronic commerce (DA1), multi-agent negotiation, bidding, and argumentation techniques are found appropriate for second generation electronic commerce systems, in which computer systems will autonomously engage in transacting business across the Internet. More generally, agents are seen as a method for exploiting the Internet and World-Wide-Web (DA3) by companies who wish to exploit the agent metaphor in providing personalised, adaptive expert assistants & human computer interfaces (DA4). Business process control and workflow systems (DA5) are naturally represented as societies of cooperating agents, with agents corresponding to either individuals or organisations. Agent-based industrial control & scheduling systems (DA6) have been pioneered in Europe. Telecomms network management and control systems (DA7) have been investigated by many telecomms companies. More recent but promising development activities also fall within the scope of AGENTLINK II, including simulation (DA8), entertainment & virtual environments (DA9) and education (DA10). Even minor advances in the these application areas will prove to have dramatic impacts on profitability and competitiveness for the organisations involved. For example, with respect to electronic commerce, there is enormous commercial and competitive advantage to be gained by the first companies that provide effective autonomous negotiation or bidding techniques.

While these very different application domains have widely varying properties, certain common themes emerge that will be the focus of AGENTLINK II activities. In single agent applications, the design of systems that are capable of flexible, timely autonomous action becomes paramount. When considering multi-agent applications, the design of societies that are capable of effective cooperation become more important. The research areas of AGENTLINK II are focussed on understanding the principles behind both of these areas.

Finally, like all advances in software, the wider use of agent-technology is likely to have a positive effect in the range and complexity of software systems that can be successfully implemented. This in turn is likely to lead to areas of research and development that can currently only be guessed at.

Dissemination

The effective dissemination of AGENTLINK II results will be vital to the effectiveness of the project. The primary mechanism for dissemination of AGENTLINK II results will be electronic: as described in section B6, a dedicated World-Wide Web site will be established for

AGENTLINK II, where all public AGENTLINK II documents, reports, databases, teaching materials, and software will be made available. Email will be used wherever possible to facilitate communication and decision making within the network (including a dedicated, edited email newsletter). A regular printed newsletter will be established to communicate news and other relevant information throughout the network. Industrial/technology databases, and research databases will also be printed annually, and distributed both within AGENTLINK II and to other interested parties.

AGENTLINK II will also take advantage of many academic lines of communication in order to contact potentially interested parties. Examples include the many open electronic mailing lists dedicated to agent-based activities, the various established and respected conferences in the area of agent systems (which many AGENTLINK II nodes have been involved in organising), and journals in the area (which many AGENTLINK II members have editorial representation on).

Finally, the various industrial and research SIGs (T1.3, T2.2) and inter-node visits (T1.4, T2.5) will ensure the flow of expertise and results between nodes of the network, and in particular, will facilitate technology transfer from research to industry. These activities will create tightly focussed communication channels that simply would not exist otherwise.

Appendix C: Budget Breakdown

In this Appendix, we provide a brief breakdown and justification of the proposed AGENTLINK II budget.

- *Personnel Costs*

  Will fund one administrator (clerical officer grade 3 stage 5), and one WWW manager (experimental officer grade 2 stage 6) full-time throughout the life of the project.

  Experience with AGENTLINK indicates that a significant amount of time is required to deal with network member expense claims, preparing the newsletter, dealing with applications for membership and general enquiries, and other administrative duties. The appointment of a full-time administrator is therefore essential to provide an professional network service.

  A full-time WWW manager is also required in order to provide a professional, high-quality, up-to-date WWW site. Without such support, it is impossible to maintain the WWW site.

- *Travel and Subsistence*

  Budgeting 10 meetings per year (of SIGs and other activities), each attended by 10 people, funded to an average of 600 Euro per meeting. In addition provides support for 2 management/other meetings per year, each with 6 delegates, funded to a total of 500 Euro per meeting. Experience with AGENTLINK indicates that this will be adequate to maintain a high-level of activity.

- *Computing Costs*

  Provides for 3 PCs in the first year of the project, together with networking and printing costs, and 3000 Euro per year thereafter for miscellaneous computing costs.

- *Subcontracting*

  Will provide for an average 6 months labour per year to be sub-contracted, for such tasks as creating online databases, professional editing of the newsletter, organising meetings, and so on.

- *Other Costs*

  Provides for:

  - 20000 Euro support per annum for the summer school;
  - 9000 Euro support per annum for newsletter;
  - 2000 Euro support per annum for leaflets, advertising materials, and suchlike; and
  - 15000 Euro per annum for conference/workshop support.

- *Overheads*

  Are charged at the standard rate on every category except subcontracting costs.