

# The Disappearing Computer

Draft



Information Document, IST Call for proposals, February 2000.

## **Mission Statement**

To see how information technology can be diffused into everyday objects and settings, and to see how this can lead to new ways of supporting and enhancing people's lives that go above and beyond what is possible with the computer today.

Specifically, the initiative will look at how to make 'information artefacts' based on new software and hardware architectures that are integrated into everyday objects. It will look at how collections of artefacts can act together, so as to produce new behaviour and new functionality. It will investigate the new approaches for designing for collections of artefacts in everyday settings, and how to ensure that people's experience in these new environments is coherent and engaging.

## **A vision of the future**

A vision of the future is one in which our world of everyday objects and places becomes infused and augmented with information processing and exchange. In this vision, the technology providing these capabilities is unobtrusively merged with real world objects and places, so that in a sense it disappears into the background, taking on a role more similar to electricity - an invisible pervasive medium.

As a consequence, human-centred notions, such as real objects and everyday settings, can come into foreground, rather than the computer-centric ones which have determined the evolution of the computer-as-we-know it. It offers the opportunity of seeing how objects can become augmented with new properties and qualities and how these can be designed to enrich everyday living in completely different ways.

Artefacts will be able to adapt and change, not just in a random fashion but based on how people use and interact with them. Together, new functionalities and new forms of use will emerge that will enrich everyday life, resulting in an everyday world that is more 'alive' and 'deeply interconnected' than our current day understanding.



A vision of the future

## Moving towards the vision

As much of the above represents un-charted territory, the aim of the disappearing computer will be to explore the underlying concepts and methods that will 'set the trends' for future development. In this spirit, the initiative will focus on three inter-linked objectives:

- 1) Create artefacts
- 2) Emerging functionality
- 3) People's experience

A detailed description of these objectives is given in Annex I.

The initiative will address these three objectives by launching a number of independent research projects that will be selected from the current call for proposals. Individually, projects will address specific topics; collectively they will address the three objectives as a whole. In addition, promising and complementary work that emerges from the various projects will be able to be integrated by new projects that can be created throughout the duration of the initiative. Annex II details how this will be done.

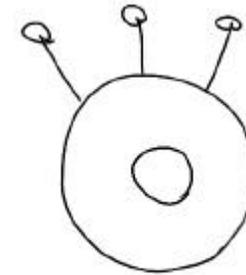
In order to maintain a sense of direction and coherence across all the projects, a number of support activities will be put into motion. A network made up of a representation of all project partners will run these activities. Details are given in Annex III.

## Submitting a proposal

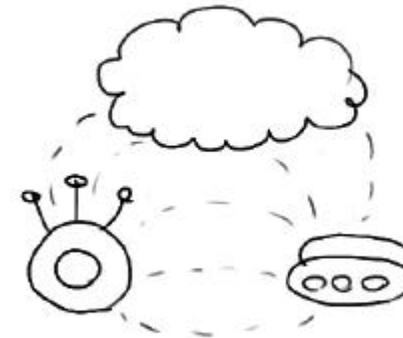
The Call for Proposals of February 8<sup>th</sup> 2000, solicits proposals on the disappearing computer. The deadline for receipt of proposals is tentatively May 10<sup>th</sup> 2000. For more information on the details of how to submit a proposal, see the Guide for Proposers, <http://www.cordis.lu/ist/guide.htm>.

## What proposals should address

Annex I details each of the three objectives with an indicative set of research topics. A



Create artefacts



Emerging functionality

project proposal can address one or more research topics within one objective, or alternatively, chose to address research topics across objectives.

Proposals should take the description of these objectives as a springboard for their own ideas, building on current developments in wireless communication, small-scale devices, embedded computing and innovative design approaches, in ways that are imaginative and not bound by today's thinking.

A project proposal should try to remain focused, and it should try not to address too many topics. At the same time, proposers should remain open to the overall goals of the initiative and open to working with others in it.

### Pre-proposals

On a voluntary basis, proposers are invited to submit pre-proposals. The purpose is to check the eligibility of the consortium, and to give advice on the suitability of the proposed ideas with respect to the scope and objectives of the call. Full proposals will be evaluated independently of any comments given on pre-proposals.

A pre-proposal should be clear and succinct. Ideas should be expressed in no more than one page of text.

Pre-proposals are receivable at any time up to 31<sup>st</sup> March 2000.

Pre-proposals should be sent by email or fax to the attention of Jakub Wejchert:

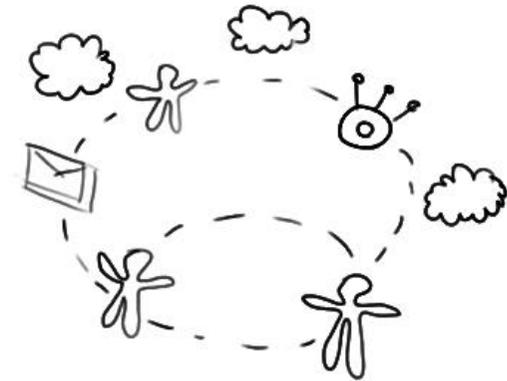
Email: [istfet@cec.eu.int](mailto:istfet@cec.eu.int)

fax: 32-2-2968390

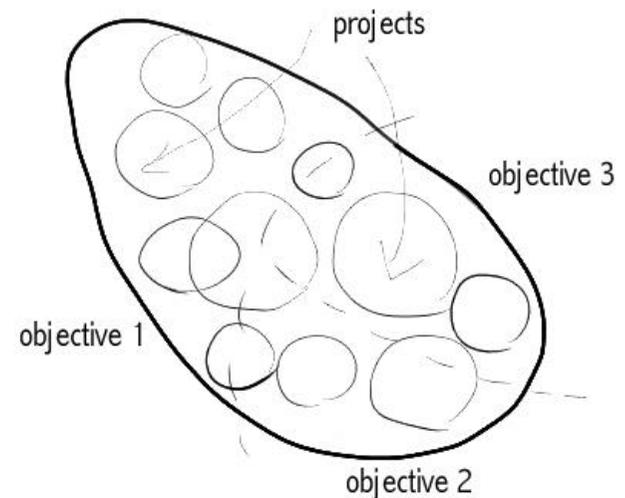
### Information workshops

Two information workshops will be held on 1<sup>st</sup> February and 28<sup>th</sup> March 2000. These workshops will give proposers the opportunity to make specific inquires about the call and to met other potential partners. For registration and further information see:

<http://www.cordis.lu/ist/fetdc.htm>



People's experience



The initiative as a cluster of interacting projects

## **ANNEX I**

### **Objective 1): Create artefacts.**

In the vision of the 'disappearing computer', information artefacts are future forms of everyday objects that represent a merging of current everyday objects (tools, appliances, clothing, etc) with the capabilities of information processing and exchange (based on sensors, actuators, processors, microsystems, etc).

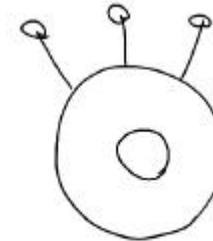
These artefacts have the capability of communicating with other artefacts based on local (typically wireless) networks, as well as accessing or exchanging information at a distance via global networks. In this way, these artefacts possess the capability of both local and global inter-working.

Individually, artefacts may have a small range of capabilities but together can exhibit a much broader range of behaviours. Alternatively, in certain cases, they may be designed to individually have a wider range of functions, but still working within an ensemble.

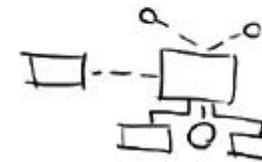
This objective focuses on how to create individual artefacts, particularly ones that will have the attributes of openness and connectivity, so that together they can form an open and adaptable system. How they can work together using this as a basis, is taken up in objective 2.

### **New architectures**

The creation of artefacts will require research on new software and hardware



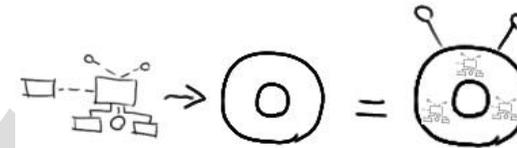
Create an artefact



A new architecture

architectures, particularly ones that:

- Accommodate trade-offs between networking, computing, and power consumption.
- Form part of an open system that allows for wireless communication with other artefacts, for example to connect with global networks.
- Allow for adaptive behaviour, for example through the design of adaptive software architectures, or re-configurable hardware.
- Allow for an awareness of their context, for example with a system of sensors.
- Enable an artefact to be modular, either from the software or hardware points of view.



### Embedding into everyday objects

In order to make information artefacts, the IT components will have to fit them unobtrusively. This will require research into ways of merging information technology with objects and materials, including for example:

- Methods and techniques for adding-on or embedding IT components.
- Techniques for miniaturising components so as to allow easy embedding
- Coating, or sticking components onto objects, or interweaving them with their constituent materials.

Research could also consider approaches that would make it easy for people to embed IT components into everyday objects themselves, for example, with 'do-it-yourself' toolkits.

Embed into an object



A DIY artefact toolkit

## Objective 2): Emerging functionality

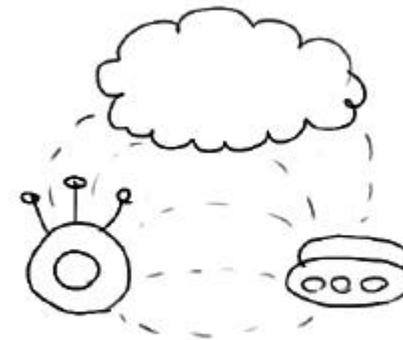
The functionality of an artefact corresponds to the range of functions it exhibits or the experience it provides. In reality we may expect a range of different kinds of artefacts, some general purpose and some quite specific. Even if an individual artefact has limited functionality, it can have more advanced behaviour when grouped with others. The aim is to look at how collections of artefacts can be made to work together, and in particular how they provide behaviour or functionality that exceeds the sum of their parts.

The basis for new functionality to emerge is due to the fact that artefacts have properties as described in the first objective, for instance:

- They are Modular
- They can Communicate with others
- They can adapt and learn from previous events
- They can be placed in various locations

These properties lay the basis for collections of artefacts to be able to behave as a complex interacting system. The main aim of this objective to see how to take advantage of this inherent complexity so as to allow for the behaviours and functionalities of collections artefacts to be changeable and emergent.

Because artefacts can be re-configured, or recombined by people and because they can adapt and evolve, their collective behaviour is not static, and collections of artefacts can evolve to produce new behaviours. This is not just a random behaviour, but one that is guided by how artefacts are used or configured by people. As a



A cloud representing an emerging functionality

consequence, people are given 'things' with which to make 'new things', rather than only being supplying with fixed and un-changeable tools. This requires a 're-think' about the ways in which tools should be conceived of and designed, and this is taken up further in objective 3.

In order to lay the foundations for new functionality to emerge from collections of artefacts, this objective considers two main topics:

### Working together

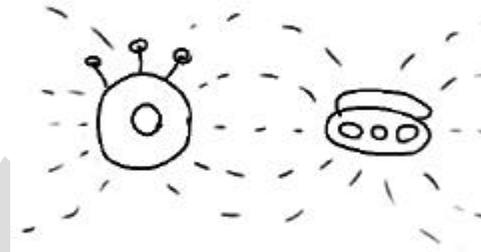
Artefacts will have to be able to work together in order to allow new 'collective' functions to emerge. As a basis for this, research will be needed into:

- The ways in which artefacts communicate with other artefacts or other information sources (either globally or locally) and the protocols they should use.
- The structuring of different kinds of artefacts into collections or 'families', each with a different role and level of influence.
- The design of new forms of 'adaptive operating systems' that would provide a platform for more general software across a range of artefacts.

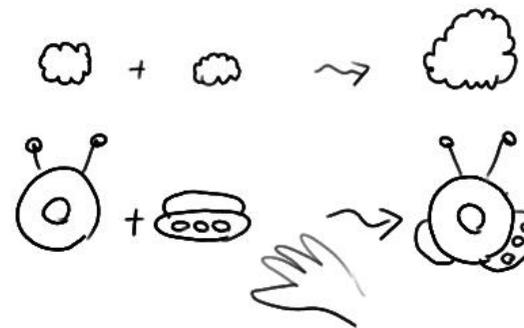
### Emerging Functionality

Given that artefacts can communicate, adapt and are modular, the specific ways in which functionality can be designed for collections of artefacts have to be researched. This should consider the ways in which functionality can be constructed and the specific ways or conditions for new functionality to emerge. Some indications are outlined below:

- Because artefacts are modular means that parts of them (either from the software, hardware or physical aspects) can be constructed, deconstructed or mixed, or added on to other artefacts. These kinds of changes would in turn create a new hybrid artefact with a new functionality. Combinations or various artefacts would lead to new functionality that would go beyond what individual artefacts could do.
- The fact that artefacts can communicate and can be aware of other artefacts,



Artefacts working together



Combining artefacts to get new functionalities

means that under certain conditions, artefacts could 'synergize' to produce new properties and behaviour that they otherwise they would not exhibit. For example, the proximity of a group of artefacts could trigger an interaction between them and a new functionality would become possible. This principle 'non-linear addition' or synergy could also be applied to certain groups of artefacts interacting over a distance.

- The fact that an artefact can learn or adapt from a history of past events, means that this knowledge can trigger new functionality that for example, emerges with time. An individually adaptive artefact may also communicate with other adaptive artefacts so that a group would produce a more complex behaviour.

### Objective 3): People's experience

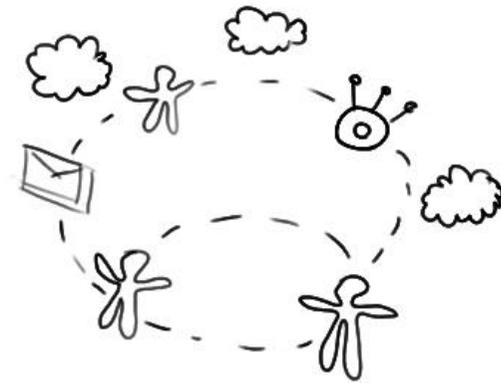
As described in the previous two objectives, collections of artefacts will represent a 'radical distribution' of computing and information processing that can inter-work to deliver new functionality and lead to new patterns of behaviour. It is the integration of these concepts with real-world settings and with real objects, that offers opportunities for new ways of supporting people's everyday activities - ways that go above and beyond what the pc can offer today. In this respect, one can imagine groupings of artefacts could substitute some of the functions that the personal computer (pc) can perform today, however in a more distributed fashion and based a more natural form of interaction. In other cases, one can imagine groupings of artefacts designed to take advantage of the new context and support people's activities in a completely different ways.

It is therefore necessary to address ways in which people's activities can be supported or enhanced in such new environments. The basis for this is to consider how to design artefacts or how to design for collections of them. Furthermore it is important to see how they can lead to coherent experience in real world settings and how people can participate in them.

#### Designing and prototyping artefacts

The nature of information artefacts, as described in objectives 1 and 2, pose a number of challenges as regards how artefacts should be designed. This includes for example:

- How to design an individual artefact, and how to integrate utility design with software/hardware constraints.
- The design of the functionality of an individual artefact and how this can be combined with that of others.
- Research on how to design for collections of interacting artefacts and how to



People's experience



Iterative design of an artefact and its functionality

design in the context of a collective and emerging functionality.

- The use of iterative prototyping and new evaluation methods.

### Coherence

A world full of interacting artefacts could easily confuse people. Research will be needed in order to make sure that environments will be coherent and understandable.

This could include for example:

- Ways to integrate artefacts with real places and locations.
- The use of metaphors, cognitive or semantic models, to guide the design of environments.
- Approaches that ensure 'seamless interaction', for example, for an activity that takes place across different locations and different stages in time.

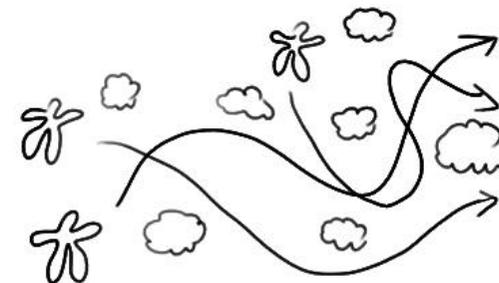
### Engagement

In contrast to concentrated engagement in one location (as with a pc), the distributed nature of a collection of artefacts in real locations leads to a range of research issues on how to support people's activities in this context, for example:

- The ways in which both individuals and groups of people can participate in such environments.
- The design of engagement that is appropriate to an activity. This includes active engagement that requires concentration, through to relaxed participation that is 'laid-back', enjoyable or fun.
- The ways in which sequences of interaction and experience can be structured. For example, the use of 'interactive narratives', that can guide or engage people in space and time, and the ways in which such narratives can encompass pre-scripted elements as well as emergent, or unexpected events.



Coherence in space and time



Interactive narratives

## **ANNEX II**

The majority of projects will be launched directly in response to this call of February 2000. In addition, a select set of projects may be newly created during the course of the initiative.

### **Newly created projects**

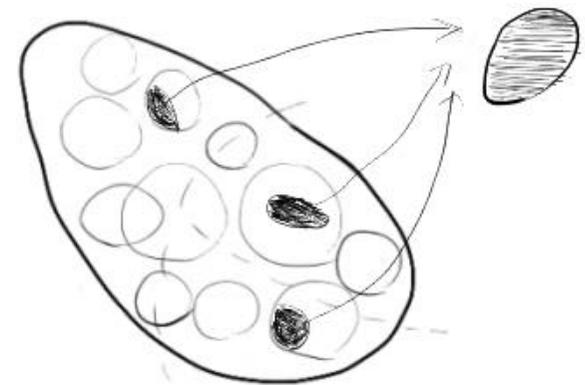
The aim is to bring together some of the most promising, but complementary, pieces of work from the on-going projects (i.e. the ones launched directly from this call) to form a small number of select projects. These newly created projects will forge new technologies, or approaches, that emerge from the work of the projects as a whole. They will exploit new opportunities for integrating components into coherent systems or architectures, or will aim to achieve an inter-working between them. Newly created projects will run in parallel with the on-going projects and will involve appropriate combinations of partners from these.

### **How newly created projects will be selected**

The selection of newly created projects will follow the advice of independent experts. It will also be done in consultation with the network coordinating the initiative. The selection would take place at regular intervals, such as at the annual jamboree where project reviews will take place (see Annex III). A panel of independent experts would recommend opportunities for new projects, following an appraisal of the work of individual projects, as well as an appraisal of the initiative as a whole. Following this, a specification of the new projects and their partnerships would be formulated, and a selection of these would be launched by the Commission through a due decision process.

### **The budget for newly created projects**

The total budget for newly created projects will not exceed 30% of the budget for projects selected directly from this call.



A newly created project

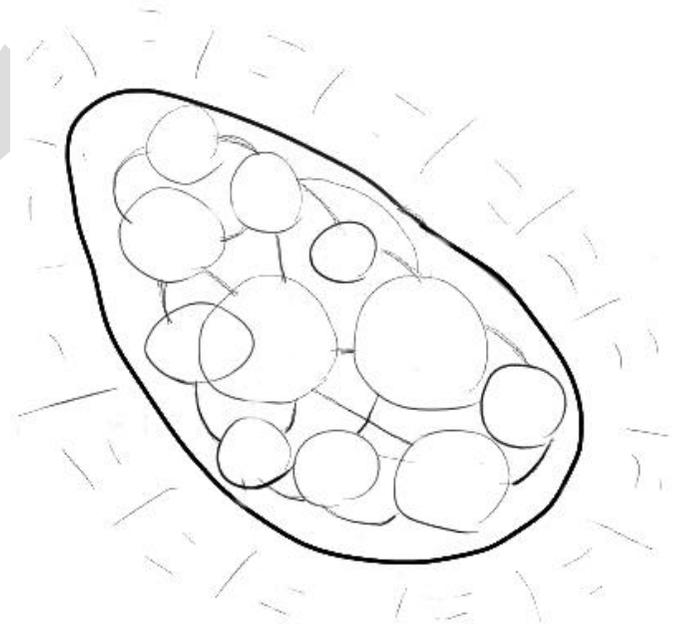
## **ANNEX III**

The purpose of the network will be to sustain the disappearing computer initiative as a whole. In particular, it will run activities aimed to make the resultant 'whole' much greater than the sum of the individual projects. Any partner in a selected project will automatically become a member of this network and will be able to actively contribute towards its work. Specifically, the aims of the network will be to:

- Encourage and facilitate synergy across projects. (For example by funding partners across projects to carry out activities on a common theme, or by maintaining an effective website that many partners can jointly use).
- Foster a research culture that is dynamic and open. (For example, by organising stimulating annual events open to all).
- Contribute towards the development of a European strategy in the area.
- Offer membership or association to appropriate researchers in Europe who are not involved in selected projects.

Once it is known which projects are selected, the network will be set up based on proposals made at that time. The network will have a managing board made up of elected representations of projects partners. It will be run and execute tasks in a flexible and dynamic manner. An independent review board will monitor its progress.

Apart from running standard support activities (such as maintaining a web-site, producing a magazine or newsletters) the network will organise activities such as the ones listed below. These are aimed at allowing new opportunities to emerge, and to prepare a 'fertile ground' for the integration of different parts of projects, as described in Annex II. Other activities may be proposed at stages throughout the running of the

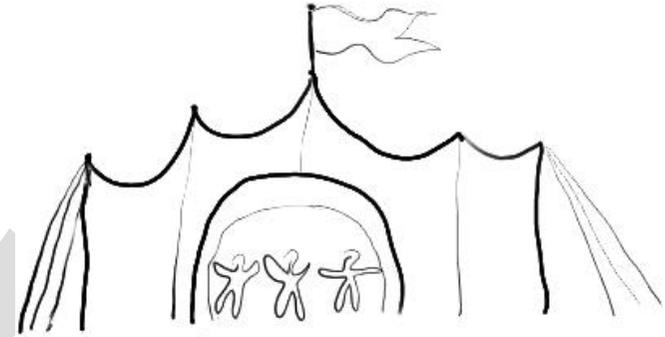


A network interlinking all projects

initiative.

### **Annual jamboree**

The annual jamboree will be designed to act as the focal point for the initiative. It will bring all projects together in one large collective event, so as to demonstrate results and to facilitate discussion and exchange. It will focus on activities that help the formation of a community of researchers, and in particular, on activities that are not available at traditional conferences. The annual jamboree will also be open to the public and will provide open access events to encourage this. It will also provide the setting for the annual reviews of projects and the initiative as a whole.



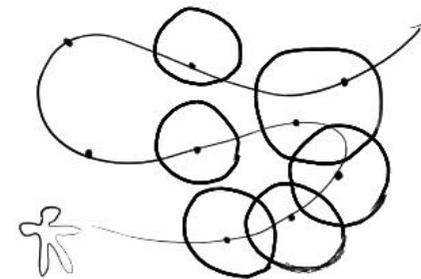
### **Research Ateliers**

Collaborative research at a distance does not 'just happen' – it needs a range of activities to help bring people closer together. Traditionally, project meetings and workshops have played a main role in this respect. However, research at a distance could be further enhanced by allowing people to work together in one location on specific tasks for short periods of time. 'Research ateliers' would be designed to allow researchers to come together for periods of time (a week or a month) to work on a specific topic. In such ateliers, people from a range of projects could construct and experiment with technologies together, thus laying the foundation for integrating components into more coherent systems. Projects would be able to apply for funding for ateliers from the network, either individually or on a cross-project basis.

### **Troubadours grants**

Borrowing from the idea of the travelling musician of the middle ages, a troubadour would be a 'travelling researcher' who presents their ideas to others, gains from the feedback of others, or makes their skills available to others, both in within and outside of the initiative. A troubadour could visit a range of project sites or other locations over a period of months. In particular, the aim of a troubadour would be see how their work could be relate to that of others in the initiative so as to lay the basis for the possible future 'piecing together' of work. Projects or individual partners would be able to apply for grants from the network that would give researchers a budget to carry out such a role.

The annual jamboree



A troubadour visits various projects

**Draft**