The ARTEMIS JU Annual Work Programme 2008

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1 Introduction

Embedded Systems are everywhere, built into cars, roads, bridges and tunnels, into medical instruments and surgical robots, into homes, offices and factories, into aeroplanes and airports, into mobile phones and communication and virtual reality glasses, and even into our clothes. They are interconnected into networks of many devices - the car to the fixed road infrastructure, the smart card to the banking systems. Embedded Systems technologies are deployed in all relevant market sectors for Europe. Consequently Embedded Systems have a major impact on the way these sectors work and collaborate, how they will develop, how they are perceived by both professionals and the public, and how successful their products will be on the world market.

ARTEMIS (ETP) -“Advanced Research and Technology for Embedded Intelligence and Systems”- is the European Technology Platform for Embedded Computing Systems.

This ARTEMIS Annual Work Programme for 2008 is the first Annual Work Programme for the ARTEMIS Joint Undertaking (JU).

This Work Programme has been derived from extensive consultation with the research and application community, first to establish the ARTEMIS Strategic Research Agenda (SRA), then the Joint Undertaking Multi-Annual Strategic Plan including the Research Agenda (RA).

2 Context

The structure of the ARTEMIS Joint Undertaking (JU) is laid down in the Council Regulation no 74/2008 which states that the Joint Undertaking will develop its own ARTEMIS Research Agenda (RA). The Research Agenda closely follows the recommendations of the ARTEMIS Strategic Research Agenda (SRA) of the ARTEMIS Technology Platform and addresses the design, development and deployment of ubiquitous, interoperable and cost-effective, powerful, safe and secure electronic and software systems.

However, the ARTEMIS RA is a subset of the ARTEMIS SRA since on the one hand European and national programmes other than the ARTEMIS Joint Undertaking also contribute to the goals of the ARTEMIS SRA, and on the other hand the contribution of the ARTEMIS JU must be tailored to the boundary conditions within which the ARTEMIS JU can operate.

In particular, the ARTEMIS RA focuses on downstream-oriented research that can deliver prototype or demonstrator solutions with high cross-domain applicability to address specific and important societal needs. It may also be enriched on specific topics that are not described in detail in the ARTEMIS SRA.

ARTEMIS also maintains a Multi-Annual Strategic Plan (MASP), which defines the strategy that the JU, will follow to ensure that the RA can be executed in the most favourable conditions, how this can be supported, how it will be financed, and how it will be managed.

Each year, the specific objectives for R&D to be achieved through Calls for Proposals will be detailed in an Annual Work Programme. There will be one Call for Proposals to address those requirements during each year.

This present document is the Annual Work Programme for 2008. It defines the content and scope of the Call for Proposals focusing on downstream-oriented research to be launched in 2008.

The text of the Call for Proposals will further detail the available budget and the eligibility criteria, taking into account the requirements of both the European Commission and Member States.

2.1 Technical context

The ARTEMIS JU strategy is conceived to overcome fragmentation in the Embedded Systems markets so as to increase the efficiency of technological development and, at the same time, facilitate the

establishment of a competitive market in the supply of Embedded Systems technologies.

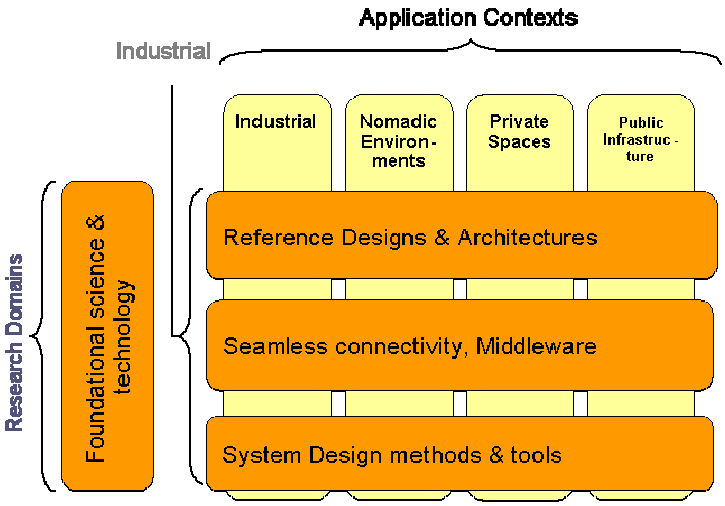
Specific barriers to progress have been identified that have common characteristics across the different application contexts. These fall into three main Research Domains:

"Reference Designs and Architectures"
"Seamless Connectivity and Middleware"
"Design Methods and Tools"

While the ARTEMIS JU will seek maximum commonality across application sectors, it is recognised that different application domains impose differing demands on the technology to be developed. The ARTEMIS SRA therefore identified a number of representative 'Application Contexts' in which sets of applications can share common domain expertise, design characteristics and requirements so that they can, in turn, share methods, tools, technologies and skills. These are:

"Industrial systems"
"Nomadic Environments"
"Private Spaces"
"Public Infrastructure"

The ARTEMIS strategy therefore takes a two-dimensional matrix approach: on one side the four clusters of Application Contexts, and on the other the three Research Domains.



The three Research Domains form the core of the research strategy of the Joint Undertaking.

In addition to the cross-domain strategy, the outcome of the research within the Work Programme is expected to fulfil concrete targets for the ARTEMIS JU that are set out in the MASP (see *References,* section 6).

2.2 Structural context

The industrial partners within ARTEMIS stress the importance of application-oriented research that supports the development of sophisticated prototypes of embedded systems so as to provide proofs of concepts for novel embedded systems in specific domains. These implementation developments are needed to empirically validate design requirements and allow for real-time performance evaluation of novel designs and architectures.

In order to focus the research, eight sub-programmes have therefore been defined in the ARTEMIS RA as building blocks:

SP1. Methods and processes for safety-relevant embedded systems
SP2. Person-centric health management
SP3. Smart environments and scalable digital services
SP4. Efficient manufacturing and logistics
SP5. Computing environments for embedded systems
SP6. Security, privacy and dependability
SP7. Embedded technology for sustainable urban life
SP8. Human-centric design of embedded systems

These eight sub-programmes are detailed in the Research Agenda. They address research into both technologies and applications. This is necessary to ensure that cross-domain re-usability of technological developments is attained.

However, while all sub-programmes place requirements on and draw upon results from all three of the Research Domains, the focus of research differs among the sub-programmes. Sub-programmes 1, 3 and 5 are specifically aligned with the Research Domains: sub-programme 1 with the Design Methods and Tools domain: sub-programme 3 with the Seamless Connectivity and Middleware domain: and sub-programme 5 with the Reference Designs and Architectures domain.

One of the major characteristics of the new research approach promoted by the ARTEMIS JU is the promotion of cross-fertilization and reuse of technology results in different applications domain. The structure in the 8 subprograms is coherent with such view. To obtain valuable results the implementation will be managed by tightly coordinating and synchronizing the research performed in the sub-programmes.

3 Content and Objectives of 2008 Call

Each proposal should address at least one Industrial Priority (see Section 3.1) and one sub-programme (see Section 3.2) and clearly identify which have been addressed.

3.1 Industrial Priorities

The ARTEMIS JTI on Embedded Computing Systems should address the design, development and deployment of ubiquitous, interoperable and cost-effective, powerful, safe and secure electronics and software systems. It should deliver on 3 industrial priorities:

3.1.1 Reference designs and architectures

Reference designs and architectures that offer common architectural approaches for given ranges of applications. It includes topics such as:

- composability: the ability to derive instantiations of architecture from a generic platform that support the constructive composition of large systems out of components and sub-systems without uncontrolled emergent behaviour or side effects.
- architectural dependability, to ensure secure, reliable and timely system services despite accidental failure of system components and/or the activity of malicious intruders.
- design for safety by means of architectures instantiated from a generic platform that enable the implementation of safety critical systems and the concurrent construction of dependability models. In addition to the required dependability and functionality of the provided services, emphasis is put on architectural support for certification, and the establishment of a safety case.

3.1.2 Seamless connectivity and middleware

Middleware that allows seamless connectivity and interoperability. It includes topics such as:

- cross domain connectivity and communication capabilities, necessary to realise the seamless interoperability between the ‘Ambient Intelligent Environments’ envisaged for the European citizen (at home, travelling, at work, in public spaces,…)
- resource management to insure seamless connectivity between ES in a physical and logical

environment more and more subject to changes, and to dynamically adapt to such changes. Resource management should ensure high utilization of the system resources such as CPU, memory, network, and energy, and guarantee operation within resource reserves or budgets.

3.1.3 Design methods and tools

Integrated system design methods and tools for rapid development and prototyping. It includes topics such as:

- establishment of an integrated chain of European-sourced tools, based on ARTEMIS JU results, to support a complete process flow of development of Embedded Systems from user requirements, through system design, to system-on-chip production.
- system-level model-based tools and design processes that contribute, in an integrated fashion, to elevating the abstraction level for architecture exploration and product design.
- test, validation and verification tools to support compositional design that can be integrated into the complete process flow to support concurrent verification and validation at the product level as an integral part of the design process.

3.2 Sub-programmes

The specific sub-programme priorities for 2008 are indicated below. These are set in the context of the sub-programme definitions contained in the ARTEMIS Multi-Annual Strategic Plan and the Artemis (JU) Research Agenda.

A research project should specifically address the Main Goals and Approach, the Applications Relevance, and the Cross-domains aspects of the sub-programmes, as described below.

In addition, all projects are required to satisfy general requirements, not specific to any of the sub-programmes. These general requirements are set out in Section 4.

3.2.1 SP1. Methods and processes for safety-relevant embedded systems

Main Goals and Approach

The overall aim of this sub-programme is to enhance the quality of services and products in strategic European industrial sectors and to decrease fatalities and injuries by building cost-efficient processes and methods supporting the development and operation of safety enabling embedded systems.

The aim is to achieve technological breakthroughs in four research areas:

- Requirement Management
- Architecture Modelling and Exploration
- Analysis Methods
- Component Based Design

These breakthroughs will contribute to progress in several transverse processes, e.g. Design for Safety, Design for Maintainability, Design for Reuse, Considerations for Certification aspects...

Application relevance & impact

Embedded systems with high safety requirements contribute more and more in the total costs and value creation in a large variety of equipment serving application areas such as:

- Transportation applications (automotive, aerospace, rail)
- Industrial applications (process control)
- Public infrastructures (electricity, gas, water) and utilities
- Medical applications (surgical equipment, diagnostic equipment, imaging equipment, sensors devices, ..
- Energy generation applications

The competitiveness of European Industry in these areas will rely on the fulfilment of top level objectives to maintain the leading edge position, to reduce the time to market despite the increase of systems and software (size and complexity), to increase the quality and reliability of products and services with novel functionalities to the user, and improve cross-domain fertilisation.

Projects should contribute to one or more of the following:

- A European Standard Reference Technology Platform, embodying meta-models, methods, and tools for safety-critical hard-real-time system development supported by European tool vendors.
- A model-driven process for the compositional development of safety and security critical systems. This should enable model-based compositional development and qualification, supporting reasoning about non-functional properties (including but not limited to safety) and is should provide a basis for rapid qualification or certification of compositionally designed systems and especially rapid re-qualification or re-certification after change.
- An analysis methodology to establish an industrially applicable methodology for exploration of design spaces and multi-criteria constraint satisfaction and design and development decision-making, with particular regard to safety properties.
- The design and prototype implementation of a cross-domain embedded systems architecture that addresses the requirements and constraints of the ARTEMIS RA for composability, Networking and Security, Robustness, Diagnosis and Maintenance, Integrated Resource Management, Evolvability and Self-Organization.

Cross-domain aspects

The development of safety critical systems will mainly rely on:

- Development of cross-domain S/W tools with multi-objective consideration (cost, time, energy, memory, safety, design distribution, standards compliance)
- Design space exploration and architecture assessment
- Component based design for better composability
- Safety assessment metrics and tools
- (Co-)Modelling, (co-) simulation (HW/SW), (validated) code generation

- Automatic testing, formal techniques
- Interoperability analysis and verification
- Ad-hoc communication protocols, devices and HW/SW infrastructure for multi-system architectures

Systems of systems specific requirements, if needed, (e.g. self-assembly in manufacture, and intermodality, formation flying or driving in transport) should be addressed in conjunction with the relevant application-oriented sub-programmes.

Synergy will be sought with SP6 in view of the similar objectives.

Synergy will be sought with SP8 since usability is a main concern for early and smooth adoption in projects.

3.2.2 SP2. Person-centric health management

Main Goals and Approach

This sub-programme will establish an overall system approach for person centric health management based on an integrated system concept of seamless integration of interoperable components (devices as well as services). This will offer personalized prevention and treatment strategies by taking advantage of the opportunities offered by new technology, such as:

- gathering data by a large variety of sensors and controlling treatment by various actuators in relevant situations: at home, on the move, at work, in health centres, clinics and hospitals;
- analysis of the gathered data, from historical as well as parallel care cycles, and present the relevant information in adequate way to persons related to their task and situation;
- ubiquitous access to a citizens health data, by all partners in an inter-disciplinary care team under the conditions of proper privacy enforcements;
- adequate communication between partners in inter-disciplinary care teams using collaboration technology, including secure messaging, instant messaging, audio and video communication and even remote sharing of applications at any place and time on the device of choice.

An essential part in this eHealth approach relates to embedded systems technology: communicating sensors and actuators, improvements in genetic, molecular and imaging equipment for diagnostics, advanced treatment technology in surgery, chemical and radiation therapy and guidance based on tele-monitoring in post event care; facilities for diagnostic and epidemiological analysis, remote management of implanted drug delivery, tele-surgery.

Application relevance & impact

The aim of this sub-programme is move away from ‘health care’ to health management’ - i.e. from “how to treat patients” to “how to keep people healthy”. In this way Europe may optimise the use of its expenditure on healthcare, which is at present steadily rising from a recent figure of about 8% of GDP - or about 600 billion Euro p.a.

Projects should contribute to one or more of the following:

- A reference architecture to support integrated care cycles
- Interoperability guidelines and selected standards
- Portable and stationary, compliant to interoperability standards, sensors and actuators
- Standards to build applications that cover the full path from sensor and actuators up to the backend infrastructure to make the information available to other health services
- Implementations that can be validated
- Possible controllable licensing model for medical data
- Stable, robust and extendable standard format for medical data (the data should and have to be readable more or less indefinitely, or at least over a human life time)
- Reduction of effort and time required for certification/qualification upon changes and during system development, implementation and evolution

Cross-domain aspects

Solutions for the health management must operate in contexts varying from near body close loop systems, home centric systems and fully end-to-end solutions involving back-end services and several alternatives to implement the required connectivity. This programme must therefore share research and results with other sub-programmes operating in private spaces, nomadic environments and transportation to enable this connectivity.
Interface to public infrastructures will be important since in many countries regional or national Health Information Exchange infrastructures are or will be implemented and even European ideas in the context of eHealth are on the agenda (eHealth card and Patient Summary Records).
With respect to the development of devices and systems collaboration with the sub-programme “Methods and Processes for Safety-enabling Embedded Systems” will be organized.
An important issue is the interaction with people, the citizen/patient as well a professionals using the system in the context and situation of their task, this relates to the sub-programme concerned with

“advanced cognitive modelling and HMI design”.
The dynamics of several services involved from device level up to data management, processing and interacting with persons could benefit from the work of the sub programme “Smart Environments Eco-Systems and Scalable Digital Services incl. Mobile Media”. In the context of the Person Centric Health Management sub-programme account must be taken of specific healthcare requirements like the development of medical profiles for connectivity on top of Bluetooth, USB and Zigbee, …
Security and privacy is another topic that relates to the sub-programme “Security, Privacy and Dependability in Embedded Systems”. Within PCHM the base technologies developped by the other sub-programmes will be used to implement the specific needs of this sub-programme, like bi-directional authentication between sensor and actuator devices with other parts of an end-to-end system as well as identification of these devices e.g. to check their certification as medical device.
Since senior citizens are an important target group and likely also need more support in managing their health this sub-programme has also relations to Ambient Assisted living.

3.2.3 SP3. Smart environments and scalable digital services

Main Goals and Approach

The overall goal of SP3 is to provide methods, tools, technology and models with which developers will be able to build “smart environments”, i.e. ecosystems of smart and heterogeneous devices interacting with each other and with the environment, and cooperating together to provide a foundation for rapid local applications and service innovations.

This will be achieved by building an interoperable infrastructure for service innovation and identifying vertical service cases with relevant business models. The requirements of all stakeholders must be accommodated - SMEs, corporations, research institutes and public authorities willing to enter the innovative market of smart environment applications.

Application scenarios for smart environments that have been identified already include:

- Smart locations (smart city, smart home, smart public space, ...)
- Smart physical objects (objects equipped with identification mechanisms such as RFID tags, smart multi-media content storage, smart communications objects such as wireless grids and co-operative networks)
- Smart virtual spaces (Mixed mode Physical and 3D-Virtual spaces, community spaces)
- Private mobile social networks ('PMSNs')

The vertical and horizontal approaches are strictly related. Systems for vertical scenarios must be designed taking into account interoperability and extensibility: common service platforms must be able to cope with the needs of the most relevant applications. In order to narrow down the possible choices, a dual approach will be taken:

1. identify a common architecture and build a horizontal interoperable infrastructure for service innovation
2. identify a set of domain specific services, “vertical cases”, with relevant business models

Application relevance & impact

The potential for reaching across application domains is expected to provide growth opportunities beyond what is possible with domain specific solutions, since the same smart environment can be used for multiple purposes by multiple classes of users. This should enable novel possibilities for service aggregation and service composition.

In the medium to long term, the deployment of smart environments should lead to more local, personal control, less reliance on manufacturers and corporate service providers, less stress, less overhead and increased comfort and safety in everyday life.

Projects should contribute to one or more of the following:

- Interaction model between horizontal and vertical activities, to assure proper tackling of the interoperability and cross-domain issues
- Understanding infrastructure requirements to support new interaction and interface concepts (e.g. goal based user-environment interaction, automatic triggering of services with non-explicit requests)
- Environment representation language to support interoperability and reasoning
- Validation of SP3 vision on one vertical case that can be generalized
- Semantic platform specification

Cross-domain aspects

One of the central notions of the smart environment applications is their ability to benefit from information in different domains.

Projects will demonstrate that smart environments connectivity and interaction technologies may provide strategic input to enhance the potential of all Artemis application-oriented Sub-programmes, particularly

“Methods and Processes for Safety Enabling Embedded Systems” (focused on transportation systems), “Person Centric Health Management”, “Embedded Technology for Sustainable Urban Life” and “Human Centered Design of Embedded Systems”. The latter is especially important as a “space” which will most likely cover several different entities and in which there is a need for interaction with the aggregate system.

In return, the common architecture (embracing seamless connectivity and middleware) supporting the expected horizontal and interoperable infrastructure will certainly have the potential to highly benefit from the incorporation and exploitation of input from all of the transversal Sub-programmes, namely “Computing Environments for Embedded Systems”, “Information Security, Privacy and Dependability”.

3.2.4 SP4. Efficient manufacturing and logistics

Main Goals and Approach

The main ambitions of this sub-programme are to improve time-to-market, productivity, and efficiency in manufacturing and logistics, recognising that the boundaries between manufacturing and logistics will become blurred as manufacturing operations are carried out closer to the customer and in-transit manufacture blurs the boundaries between production and distribution.

The approach is therefore the establishment of an embedded systems' architecture, together with supporting methodologies and tools that enables holistic lifecycle management for manufacturing, distribution, recycling and disposal of goods.

The architecture should enable the interoperation and reconfiguration of embedded devices and systems in both products and processing equipment so as to build complete plant solutions that enable owners and operators to save energy and achieve greater transparency of operation, greater predictability, reduced safety risks, enhanced security, and cost efficiency.

The architecture should be supported by all the necessary systems and tools to support development and implementation of systems conforming with the architecture.

Application relevance & impact

The industry employs around 35 million people in Europe making it by far the largest sector. Productivity improvements in this sector will have major impact for European economy and competitiveness. Manufacturing efficiency will improve quality and shorten time-to-market while cutting social, economic and environmental costs.

Increased usage of technology, and particularly automation can also improve safety and working conditions, reducing the need for tedious or heavy manual work, in turn opening the prospect for distance maintenance, monitoring, control and industrial services in which SMEs may participate more easily.

Projects should contribute to one or more of the following:

- development of a complete plant solution concept in which production machines and equipment are connected via an optimized platform of heterogeneous wireless and cabled networks.
- real-time asset monitoring for large-scale distributed production processes, linked to automatic scheduling of maintenance activities and automatic reaction to malfunctions.
- continuous tracking of material flow from raw material to final deployed products based on RFIDs and sensors network technologies.
- new multi-disciplinary coordination and control principles for large-scale, wireless sensor and actuator networks, including combined Control, Computing and Communication (C3) strategies.
- new tools for managing uncertainty and risk in distributed and networked systems;
- new tools for visualization of plant operations

Cross-domain aspects

Low-power solutions and future wireless sensor networks, as required by instruments, for example, have much in common with nomadic applications.

Safety technology used to prevent industrial accidents has much in common with safety technology in transportation domains such as rail, automotive and aviation.

Manufacturing has less advanced solutions for cyber security than available for other IT dependent industries such as Web commerce and financial applications etc. and it would be highly advantageous to utilize the cyber security technology from such sectors, though with adjustment of focus to availability of the production system (e.g. uninterrupted energy supply).

3.2.5 SP5. Computing environments for embedded systems

Main Goals and Approach

A main goal of this sub-programme is to enable transition from separate sectoral, vertically structured markets to a horizontally structured market.

A second goal is to enable massive real-time data-processing in multiple domains (image processing, signal processing, computational fluid flow, ...).

A third goal is to enable composition of platform independent software over highly concurrent, fault-tolerant systems with a variety of communication schemes, types of core, etc. Run-time adaptability is required so as to optimise performance and resource usage - particularly extremely low power consumption.

Application relevance & impact

The transition from a vertically structured to a horizontally structured market will allow easier IP reuse across applications and domains, create new market opportunities, and stimulate the emergence of new innovation ecosystems, in particular supporting SMEs. In particular, the modularity, reuse, scalability, and portability that are anticipated as part of this transition will enable the development of low cost solutions for high volume market development.

Some specific application domain clusters in which fundamental requirements for computing environments are similar are particularly important. The Transportation and Manufacturing cluster, and the Nomadic and consumer electronics cluster are considered as priority targets for this sub-programme.

Projects should contribute to one or more of the following:

- establishment of a common multi-domain architecture, APIs, and design tool platform for advanced multi-core hardware and middleware solutions
- establishment of heterogeneous multi-domain architectures and integrable and interoperable tool suites to support massive real-time data-processing
- definition of a new programming model & new types of API to support platform-independent composition
- definition of performance & resource management models, meta-data and system layers in order to achieve global performance and resource optimization and management.
- development of design tools and associated runtime support to enable composability, predictability, parallelisation, aggregation and management of systems according to a service-driven or data-centric approach, performance and energy modelling and analysis, verification, scalability … while preserving system-level predictability and appropriate levels of safety.

Project results must be demonstrated with application use cases derived from one or several application domains, such as advanced road vehicle management; data intensive multi-sensor applications (vision, radar, lidar, …); adaptive nomadic context-sensitive multimedia service provision; adaptable/evolvable autonomous systems; robotic control systems.

Cross-domain aspects

This need for multi-domain and cross-domain application is central to this sub-programme.

Nevertheless, there is most probably no “one-fits-all” global solution for all types of systems and applications. Effective solutions to the often conflicting demands on applications - and on the computing platform - will require domain-specific trade-off analysis. At the same time, some strong cross-domain studies and exchanges should be undertaken so as to achieve conceptual and technological sharing between domain specific solutions.

3.2.6 SP6. Security, privacy and dependability in Embedded Systems for applications, networks and services

Main Goals and Approach

The main goal of this sub-programme is to ensure that security, privacy and dependability (SPD) can be ensured in the context of integrated and interoperating heterogeneous services, applications, systems and devices. Systems and services must be robust in the sense that an acceptable level of service is available despite the occurrence of transient and permanent perturbations such as hardware faults, design faults, imprecise specifications, and accidental operational faults.

The approach is to establish a common conceptual framework - and thereafter conformant methods and tools for design and implementation - to assure security, privacy and dependability in three classes of systems. These three classes are differentiated on the basis of the difference between 'managed systems' where the security attributes are centrally defined by the provider managing the system and 'unmanaged systems' built on the top of a set of independent and dynamic managed systems, where the security attributes cannot be defined by a single provider. The three classes are:

- interconnected embedded systems employing heterogeneous devices and standard communication technologies working in managed and trusted environments.
- interconnected embedded systems, employing heterogeneous devices and advanced communication technologies (including securing on demand 'instant' networks) working in unmanaged and non-trusted environments. This will require definition of security schemes spanning different dynamic domains, assurance of end-to-end security, and adaptive, context and information dependent security.
- interconnected embedded systems in a framework characterized by an efficient combination of managed and unmanaged systems, where each embedded system builds its own trust and security model, whichever communication technologies or media channels will be adopted. This will also include adaptive trust based on the provenance of the information used by each embedded system.

Application relevance & impact

Enhanced security, privacy and dependability will increase people's confidence in applications, systems, devices and infrastructures that were considered vulnerable or untrustworthy in the past. Knowledge, for example, that their cell phone is more difficult to be tampered with or that secure network access is fully guaranteed during an interaction with a system or application, will reduce their fear or reluctance in using them. The feeling and knowledge of complete protection from crime and violent "supporter riots" will, for example, make public events more enjoyable and will augment the willingness of people to socialize while decreasing risks for public disorder. This will enable industrial actors and service providers to offer new features or services with minimal additional cost to the customer.

Projects should contribute to one or more of the following:

- definition of a common conceptual framework to address the requirements for security, privacy and dependability in one or more of the three classes of systems identified above, with a particular focus on compositional design and development. Research should take into account the interplay between system properties such as safety, reliability, availability, maintainability, security, and survivability, and should work with certification and qualification authorities to establish new approaches to certification and qualification required to accommodate the new technology.
- instantiation of this framework with architectures, components, methods, interfaces and communications, tools and tool chains, to enable the design, development, analysis, validation, and deployment, as well as certification (or qualification).
- test beds and field trial set-ups, including prototypes, in order to prove the advanced security, privacy and dependability concepts.

Cross-domain aspects

The results of research on ES security and privacy in this sub-program will be applicable beyond the traditional fields of pervasive computing applications and services and public infrastructure protections in,

for instance:

- Wide deployment of m-commerce transactions and other financial services as well as trusted multimedia distribution on mobile – Internet based networks.
- Remote (i.e. Internet-based) control of home, office and industrial processes.
- Decentralized and interconnected utilities productions, storage and transmission systems.

At the same time this sub-program will monitor security, privacy and dependability conditions and requirements and use technological results obtained by other Sub-programs (for instance those concerned with “nomadic environment”, “safety” and “energy management”) that will present security and privacy features for ES boards and appliances, ES networks, ES firmware/middleware or will influence the implementation technologies for security provision.

In particular, this sub-programme will specifically focus on the interplay of security and safety in fault-tolerant (redundant and/or diverse) configurations. This has up to now not been resolved only in special domains or applications, and is not well-addressed in standards for either safety or security.

3.2.7 SP7. Embedded technology for sustainable urban life

Main Goals and Approach

The main goal of this sub-programme is to enable sustainable urban life through rationalisation in the use of resources while increasing comfort and security in urban environments by means of embedded intelligence and integration technology.

The approach is to achieve greater efficiency in use of resources, more flexibility in the provision of resources and better situation awareness for the citizen and for service and infrastructure owners. This should be achieved through the deployment and inter-operation of embedded systems throughout the environment.

Therefore, the main outcome of application should be improved energy efficiency in residential and non-residential buildings as a first priority, while efficiency in the management of other resources in more extensive urban and sub-urban areas are to be addressed in subsequent years.

Application relevance & impact

Three main market sectors are especially relevant: public infrastructures and utilities; residential and non-residential buildings; and domestic electronics and appliances.

Public infrastructures and utilities span all kinds of urban buildings and infrastructures from power generation and distribution, to water supply and waste management, public health, education and leisure, security services, transport systems in urban areas, etc. The already huge market may grow even further, since the sub-programme will stimulate the creation of new business models - from conceptualisation to maintenance and operation of urban systems.

Appliances are no longer independent entities, but part of a larger system connected through a residential gateway, with intelligent smart capabilities. Energy efficiency is a driver for purchase and renovation of domestic brown and white goods.

Projects should contribute to one or more of the following:

- definition and initial instantiation of architectures and communication platforms to enable the flexible and evolvable interoperation of systems, including sensors, actuators, information systems, control systems and commercial systems across multiple domains and multiple vendors and service providers.
- development of reference designs to achieve energy efficient HW/SW architectures (e.g. reference mobile handset, reference tiny communicating device)
- definition of a standard HW and SW modelling framework and of development tools based on common industry driven meta-models, for high-level analysis and validation of resource usage, emphasizing composability and reuse
- design and realization of design-time energy exploration and optimization tools and methods
- development of models to enable energy efficient topology management in distributed systems, with emphasis on dynamic reconfiguration capabilities of resource management devices as key non-functional capability to cope with the legacy challenge

Projects may be focused by addressing a variety of application challenges associated with eco-efficiency, eco-sufficiency, eco-sustainability and/or improved comfort and security.

Cross-domain aspects

Safety aspects of transport systems, addressed in SP1, will complement work in this sub-programme on the use of embedded systems for transport system optimisation in urban areas.

Comfort and security services aimed at eco-efficiency and eco-sufficiency addressed in this sub-programme constitute one specific aspect of the Smart Environments and Scalable Digital Services. domain (SP3).

In addition, there are cross-domain problems that are addressed in technology-oriented domains and applicable in developments and systems for sustainable urban life. This is the case particularly for computing environments and energy management in embedded systems, security, privacy and dependability, and user interfaces.

This sub-programme will also draw on developments from these other areas, focusing on development and/or adaptation of specific aspects of the technology, such as surveillance systems, access control, and accessibility.

3.2.8 SP8. Human-centric design of embedded systems

Main Goals and Approach

This sub-programme aims to automate tasks which are today fully under human control (e.g., driver assistance in the automotive domain) and to extend automation in tasks which are today highly assisted (e.g., pilot assistance systems in the avionics domain). The HMI determines how these systems are perceived by the users. It is the mediator between new functionalities or services and the user, mediating human intervention (like configuration, adjusting or overriding) and machine intervention (like preventing hazardous manoeuvres).

The approach is to establish a methodology for design and development of human-in-the-loop adaptive control systems suitable for application in multiple safety critical domains and sectors, taking into account not just explicit interactions between human and machine, but also the cognitive state of the human.

Application relevance & impact

Human centred design (HCD) is a key enabler for embedded systems advancement and deployment in *all* ARTEMIS application contexts, and especially in safety critical domains. In *Industrial Systems* HCD enables Advanced Driver Assistance Systems for road and rail vehicles and Advanced Multidimensional Cockpit Displays and Flight Management Systems in the aircraft. In *Nomadic Environments* HCD is at the heart of the seamless integration of information management in personal information spaces. In Private Spaces HCD informs the design of products with innovative user interfaces, for instance to ease access for aging or disabled persons. In Public Infrastructure applications, HCD is critical to the design and operation of safe and efficient power plants, communication systems, emergency infrastructures, and health monitoring, care and treatment systems.

Projects should contribute to one or more of the following:

- understanding and modelling of human performance in the context of ever-increasing and ever-changing automation,
- the extension of model-based design approaches to the design and analysis of human machine interaction.
- the development of cross-domain reusable technology to synthesize “intelligent” multi-modal HMI.
- the development of cross-domain technologies to analyse the effectiveness and economy of interaction with “intelligent” multi modal HMI designs by predicting human behaviour.
- agile model-based HMI prototyping taking into account multi-modal interfaces and the need for allocation of capabilities between “presentation layer” and “data management layer”,
- methodologies for building cognitive user models taking into account perceptual, cognitive and psychomotor capabilities as well as emotional state and attitude,
- technologies for intelligent multi-modal interactive systems especially addressing the user’s inter-working with adaptive context-aware systems.

Cross-domain aspects

In all domains addressed by ARTEMIS, interfaces of automated systems are used to interact with the environment, but also to interact with the user (e.g. to give him advice, to prevent hazardous manoeuvres) and furthermore to allow the user to influence the automated system itself (e.g. to configure its rules and behaviour). In all ARTEMIS domains systems are becoming more and more autonomous. In spite of differences in time-to-market, time-on-market, and certification requirements of automation and assistive technology in the different domains, cross-domain reuse of design methodologies, devices, processing hardware, and software components is achievable.

The sub-programme envisions cross-domain sharing of concepts, methods and tools in synthesis as well as analysis of HMI and cross-domain clusters can be defined based on the interaction patterns between human and machine:

1. one human, one complex system (avionics, complex infrastructure monitoring, nomadic with "all in one" device, automotive, ..)

2. one human, many "not so complex systems" (home, automotive, ..)
3. several humans, one complex system (surgical team around a patient, satellite launch infrastructure, ...)
4. several humans, several complex systems (e.g. air traffic management, catastrophic situations management, systems of systems with human at different levels of responsibility, ...)

4 Requirements

The proposal should satisfy the following requirements.

4.1 General

Each proposal should address at least one Industrial Priority (see Section 3.1) and one sub-programme (see Section 3.2) and clearly identify which have been addressed.

Each proposal should include demonstration of core technological developments in order to achieve the empirical validation expected (see Section 2.2).

Proposers are encouraged to address sub-programmes SP1, SP3 and SP5 as a matter of priority because they are thought to be the most urgent for implementation. Large projects in the order of 150 MY (or roughly 50 MY/Y) are also encouraged in each of these 3 sub-programmes.

4.2 Contribution to the Artemis targets

Artemis has an over-arching objective to close the design productivity gap between potential and capability. The results arising from Projects responding to this call will be expected to:

- reduce the cost of the system design from 2005 levels by 15% by 2013.
- achieve 15% reduction in development cycles - especially in sectors requiring qualification or certification - by 2013,
- manage a complexity increase of 25% with 10% effort reduction by 2013,
- reduce the effort and time required for re-validation and recertification after change by 15% by 2013.
- achieve cross-sectoral reusability of Embedded Systems devices for example, interoperable components (hardware and software) for automotive, aerospace and manufacturing) that will be developed using the ARTEMIS JU results.

All projects to be supported will be expected to identify, at proposal stage, their intended contribution to achievement of these targets. Proposals should describe how projects would measure their contribution and how they would establish a baseline and thereafter monitor their progress compared with the baseline.

4.3 Technology vis-à-vis Application

All projects are expected to have a strong application focus in order to present a realistic context for industrially relevant, short to medium term research and technology development, and to enable its validation. However, all projects in all sub-programmes must make explicit contributions to the technological ambitions of ARTEMIS for Embedded Systems development. Clear expression of the technical approach to the research objectives will be essential.

4.4 Co-operation

All projects to be supported will be expected to share requirements and emerging results, during project execution, so as to achieve the coherent, synergistic progress sought by the ARTEMIS JU

4.5 Evolution of markets and market environment

All projects to be supported will be expected to maintain a ‘market watch’ to ensure the continuing relevance of their work to the evolving market, and to contribute to programme-level monitoring of the market for the purpose of evolving the Research Agenda and the Multi-Annual Strategic Plan.

4.6 Standards & Regulations

ARTEMIS has a Strategic Agenda for Standardisation (see *References* section 6.). Its principle mission is to support the ARTEMIS ambitions for cross-domain synergies, composability, reusability, reliability, interoperability, verification and certification. This entails overcoming the present domain-orientation of many standards and standardisation groups. Projects will be expected to contribute to this aim, engaging

where appropriate with the relevant standardisation, regulation and certification bodies.

Specifically, proposals must make explicit their intended contribution to:
- standard development and harmonisation, as the basis of any integration and inter-operation;
- open source reference implementations of standards, in order to facilitate their take-up in the market.

4.7 Innovation environment

To fulfil the ARTEMIS SRA target for having *50% more European SMEs within the aegis of ARTEMIS JU engaged in the Embedded Systems supply chain, from concept through design and manufacture, delivery and support, than there were in 2005,* project consortia must be balanced, considering explicitly the involvement of SMEs and favouring clustering of SMEs in innovation eco-systems.
.
ARTEMIS also supports the consistent grouping, on a permanent basis and at European scale, of industry and research in *Innovation Clusters* to foster the *Innovation Environment*.

4.8 Project duration

In view of the downstream research focus of the ARTEMIS Joint Undertaking and the targets described in this document, projects with duration longer than 3 years must provide adequate justification for their duration, relative to the application demonstrators and expected impact they describe.

5 Implementation of Call in 2008

5.1 Call 1: JU-ARTEMIS-2008

- Indicative date of publication: 8th May 2008
- Indicative closure date: 3rd September 2008, at 17.00 h Brussels local time.
- Indicative ARTEMIS JU contribution to Call: 35.1 M€[1]
- Evaluation procedure: A one-stage submission procedure will be followed. The evaluation and selection procedure is described in the document: "ARTEMIS Joint Undertaking selection and evaluation procedures related to Calls for proposals". The general eligibility criteria as well as evaluation criteria and sub-criteria are set out in chapter 6 of this work programme. Further eligibility criteria for funding (national and JU) will be published in the Call.
- Indicative evaluation and contractual timetable: It is expected that the contract negotiations for the selected proposals will start as of November 2008
- Project agreements: Participants in all actions resulting from this call are required to conclude a project agreement.
- The grant which will be offered by the JU will be specified in the Grant Agreement applicable to ARTEMIS.

[1] 55% of the amount of 63.78 M€ committed by ARTEMIS Member States to the budget of the ARTEMIS Call 2008.

6 Eligibility and Evaluation Criteria for Proposals

6.1 Eligibility Criteria for Proposals

A proposal will only be considered eligible if it meets all of the following conditions:

- It is received by the ARTEMIS JU before the deadline given in the call text.
- It involves at least 3 non-affiliated legal entities established in at least 3 ARTEMIS Member States (Belgium, Denmark, Germany, Estonia, Ireland, Greece, Spain, France, Italy, Hungary, the Netherlands, Austria, Portugal, Romania, Slovenia, Finland, Sweden, the United Kingdom, Czech Republic and Norway). The final list of ARTEMIS member states will be published in the Call.
- It is complete (i.e. both the requested administrative forms and the proposal description are present).
- The proposal is submitted in English.
- The content of the proposal relates to the topic(s) described in this work programme.

6.2 Eligibility Criteria for JU funding of individual participants

A participant will only be considered eligible for JU funding if the following criteria are met:

- The participant has its location in an EU Member State or in an Associated Country to the Seventh Framework Programme.

- Grants may not be awarded to applicants who are, at the time of the grant award procedure, in one of the following situations:
  - they are bankrupt or in the state of being wound up, are having their affairs administered by the courts, have entered into an arrangement with creditors, have suspended business activities, are the subject of proceedings concerning those matters, or are in any analogous situation arising from a similar procedure provided for in national legislation or regulations;
  - they have been convicted of an offence concerning their professional conduct by a judgment which has the force of res judicata;
  - they have been guilty of grave professional misconduct proven by any means which the Joint Undertaking can justify;
  - they have not fulfilled obligations relating to the payment of social security contributions or the payment of taxes in accordance with the legal provisions of the country in which they are established or with those of the country of the Joint Undertaking or those of the country where the contract is to be performed;
  - they have been the subject of a judgment which has the force of res judicata for fraud, corruption, involvement in a criminal organization or any other illegal activity detrimental to the Communities' financial interests;
  - they are currently subject to an administrative penalty imposed by the Community institutions as referred to in the general Financial Regulation.
  - are subject to a conflict of interest;
  - are guilty of misrepresentation in supplying the information required by the Joint Undertaking as a condition of participation in the grant award procedure or fail to supply this information;

6.3 Evaluation criteria

Evaluation scores will be awarded for each of the five criteria, and not for the sub-criteria. Each criterion will be scored out of 10. No weightings will apply. The threshold for the individual criteria (1), (2), (3), (4) will be 6. There is no threshold for the individual criterion (5). The overall threshold, applying to the sum of the five individual scores, will be 35.

The evaluation criteria against which proposals will be judged are:

1. Relevance and contributions to the content and objectives of the Call.
    - Relevance will be considered in relation to the work programme open in a given call (see section 3 of this work programme).

2. R&D innovation and technical excellence.
    - Soundness of the concept and quality of the scientific and technological objectives.
    - Progress beyond the state-of-the-art.

3. S&T approach and work plan
    - Quality and effectiveness of the S&T methodology and associated work plan.

4. Market innovation and impact
    - Contribution, at the European and/or international level, to the expected impacts listed in the work programme under the relevant sub-programme (see section 3.2) and to the general ARTEMIS targets in section 4.2.
    - Appropriateness of measures for the dissemination and exploitation of project results.
    - Contribution to standards (see section 4.6).
    - Management of intellectual property.

5. Quality of consortium and management[2].
    - Appropriateness of the management structure and procedures
    - Quality and relevant experience of the individual participants
    - Quality of the consortium as a whole including complementarities, balance and involvement of SMEs
    - Appropriateness of the allocation and justification of the resources to be committed (budget, staff, equipment)

7 How to submit a proposal

Proposals should be submitted in accordance with the terms set out in the call for proposals. In order to submit a proposal, applicants should consult the following documents:

- The text of the call for proposals, as announced in the Official Journal of the European Union and published on the webpage of the ARTEMIS Joint Undertaking
- This work programme
- The guide for Applicants

[2] This evaluation criterion corresponds to the **selection criteria** in the meaning of the general financial regulation (article 115) [in footnote: OJ L 248, 16.09.2002, p. 1] and its implementing rules (article 176 and 177) [footnote: OJ L 357, 31.12.2002, p.1] and of the financial rules of the Joint Undertaking. It will also be the basis for assessing the 'operational capacity' of participants. The other four evaluation criteria (1-4) correspond to the **award criteria**.

There are also a number of other useful texts which applicants could refer to:

Document	Document / Web site
ARTEMIS SRA Introduction	http://www.artemis-sra.eu/downloads/SRA_MARS_2006.pdf
Reference Design & Architecture SRA	http://www.artemis-sra.eu/downloads/RAPPORT_RDA.pdf
Seamless Connectivity and Middleware SRA	http://www.artemis-sra.eu/downloads/RAPPORT_SCM.pdf
System Design Methods and Tools SRA	http://www.artemis-sra.eu/downloads/RAPPORT_DMT.pdf
ARTEMIS-JU MASP (including the ARTEMIS-JU Research Agenda)	https://www.artemisi-ju/publications/MASP.pdf
STANDARDISATION SA	https://www.artemisia-association.eu/publications/STANDARDS.pdf