

Objectives

By the year 2020, mobile and wireless communications will play a central role in all aspects of European citizens' lives, not just telephony, and will be a major influence on Europe economy, wirelessly enabling every conceivable business endeavour and personal lifestyle.

The following sentence articulates the essence of the future aims and vision: **“The improvement of the individual's quality of life, achieved through the availability of an environment for instant provision and access to meaningful, multi-sensory information and content”**. Realisation of this vision demands a major shift from the current concept of “anywhere, anytime” to a new paradigm of **“any network, any device, with relevant content and context in a secure and trustworthy manner”**.

The future system will be complex, consisting of a multitude of service and network types ranging across Wireless Sensor Networks (WSN), Personal Area, Local Area, Home Networks, Moving Networks to Wide Area Networks. The increasing dependency of society on such communication infrastructure requires new approaches and an emphasis in European research captured here in a new concept called the **“SET Concept”** that underscores the need for a 3-dimensional vision of research activities that will deliver Simplicity, Efficiency and Trust.

SET Concept

The SET Concept is designed to overcome potential technical, business and psychological barriers to the adoption and acceptance of new technologies and services. It takes into consideration the interests of users, network operators, service providers, and manufacturers, and provides a challenging research agenda for all.

Simplicity- It emphasises research into new solutions for managing complexity seamlessly on behalf of service providers and for hiding complexity from a user in accessing, using and creating services. Complexity is delegated from a user to the communication system which must adapt to the individual's life stage preferences and situation, and a variety of other contexts.

Efficiency- Solutions which result in efficient use of spectrum and network resources, and higher throughputs, through appropriate cooperation and adaptation techniques. The new target is not necessarily higher bit rates as in the past. Autonomous self organisation is needed to continuously operate at the optimum point under dynamically varying conditions, as well as capabilities to easily incorporate (as yet unconceived) future services and requirements.

Trust- Wireless communications will enable an always-connected environment, facilitating services to support private and professional life of individuals, families, and special interest groups. Intelligent services will be based on sensitive personal information, context and profiles traversing different network types, and multiple business and administrative domains. Any successful adoption and use of future services and networks in all walks of life, imposes the creation of a trust environment. This is necessary to overcome possible psychological barriers through building a sense of trust in the integrity, privacy, security of information and networks, as well as to protect society against malicious, criminal or terrorist activity.

Research Challenges

Simplicity

- Ubiquitous connectivity and session continuity through auto-connectivity between legacy and new types of networks: WSN, PAN, LAN, Home Network, Moving Networks, Wide Area Networks and techniques which facilitate self-(configuration, organisation, healing) and management of heterogeneous and dynamic networks and services.
- A network agnostic service execution platform that interacts with networks and terminals and also facilitates the deployment, adaptation and management of services on the various (including mobile) devices.
- Innovative services based on a user's ambient intelligent and streamlined context classifications methodology
- Enabling techniques for user-created content facilitating peer-to-peer communication
- Smart user interfaces and interactions with learning capabilities
- New mobile device form factors, included embedded wireless chip connectivity
- Radically simplified mechanisms and technologies for context capturing, processing, distribution and integration into intelligent services.
- New and efficient search engines with automatic zero-configuration and complexity management (including the management of privacy and trust).
- Intelligent customer care and provision of smart support in real-time in case of technical difficulties.

Efficiency

- Joint optimization of coverage, capacity and quality techniques through cooperation and adaptation techniques
- Efficient mechanisms for joint exploitation and operation of available diversities in time/space/frequency/code/power domains
- Investigation of alternative deployment concepts and system architectures beyond the classical cellular approach
- Efficient cross-layer operation and optimization
- Intelligent resource (frequency, battery, power, hardware, software) discovery and management techniques
- End-to-end content and media adaptation techniques such as time-shifting, intelligent catching, opportunistic transport/transmission, rate/quality adaptation.
- Centralised and de-centralised self-organising network topologies for both operator-based and operator-less radio access network concepts for special application areas (e.g., disaster relief and campus networks)
- Seamless convergence between fixed and mobile at both service and network levels, exploiting broadband optical technologies.
- Innovative transceiver architectures and jointly optimized RF and baseband hardware designs, matching the nano-electronics roadmaps and exhibiting new degrees of scalability, flexibility, security, energy-aware performance, cost efficiency and design productivity.
- Evaluation of Network Information theoretical limits of cooperative and self-organising networks and research into advance coding design and signal processing schemes to achieve these limits.

- Investigation of the impact of new frequency bands for future systems on the radio propagation and specification of appropriate output power levels to ensure compliance with relevant guidelines and regulations related to human exposure to radio frequency electromagnetic fields.
- New methods of frequency usage, coexistence, cooperation and sharing techniques for/between existing and newly identified frequency spectrum and radio access technologies, based on cognitive and spectrum-agile radios to select the most appropriate radio access technology for a given environment.

Trust

- Secure data management, and synchronization and private exchange of user profile and context information
- Efficient encryption and cryptographic mechanisms and algorithms suitable for different types of devices and networks
- Identity management & privacy
- Secure and dependable end-to-end network protocols and applications enabling a simple-to-use trusted transaction environment
- Unified Digital Rights Management
- Transparent and flexible Service Level Agreements
- Combined multi-layered mobility support and authentication/authorization across diverse networks and support of simultaneous use of multiple access technologies.
- Secure software and execution environment including O/S
- Device and network protection against (virus, trojan, DoS attacks) and intrusion detection
- Safe and secure software download enabling networks and device re-configurability

Building on Europe's Strengths

As was achieved with GSM, the SET Concept offers new opportunity for Europe to be the leader in adopting a holistic and balanced approach to realisation of the future mobile/wireless communication system. The SET Concept will result in efficient and usable technologies and was developed taking into great consideration users' interest/needs as well as recognising the important role of wireless communications in Europe's economy. The research programmes will need to be focused on enhancing the axis of research (Simplicity, Efficiency, Trust) in the SET Concept through innovative techniques and technologies and targeted towards a system that comprises multiple network types. The SET framework offers a useful means to measure the relevance and output of research programmes, also facilitating faster standardisation processes and reducing time to market. Supporting measures to evaluate the evolving European policy environment against the SET framework are also needed, if effective and timely research exploitation is to be secured.

As a further step to ensure such exploitation, the most relevant research results should be integrated and demonstrated in an open infrastructure for research and education purposes that facilitates joint optimisation of different sub-systems under the same conditions. These include, for example, use of different and new frequency bands, new spectrum sharing methods, interworking and seamless mobility solutions, new security techniques, cognitive paradigms, ambient intelligence, and new usages and context aware services. This infrastructure is expected to act as a European showroom of advanced mobile technology and services highlighting achievements from leading projects, and an open test-bed to host SMEs and students through partnerships with Universities, research centres and through international cooperation.