End-to-End Reconfigurability (E²R II) Management and Control of Adaptive Communications Systems

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ETSI Workshop
09.02.07 – Sophia Antipolis
Presentation Outline

✓ E²R II Enabler of Seamless Experience

✓ E²R II in a Nutshell

✓ E²R II Website

✓ E²R II Technical Highlights
Beyond 3G (B3G) Systems

End-to-End Reconfigurability is the key enabler for providing a seamless experience to the end-user and the operators:

- Managing and increasing resilience of growingly complex architectures
- Reducing costs of deployment, evolution and operation of large communication systems
- Providing opportunities to develop and experiment rapidly new services and applications
E²R Definitions

✓ **End-to-End Reconfigurability** means adaptability of the nodes along the complete communication path between communicating entities. This encompasses configuration and reconfiguration of equipment (terminals, base-stations, access points, gateways) and potentially impacts all OSI layers.

✓ The **End-to-End Reconfigurability Project** develops concepts and solutions to enable, manage and control End-to-End Connectivity in B3G Heterogeneous Environment (Cellular, 802.xx, Broadcast...)}
**E²R II in a Nutshell (1/7)**

**E²R II Highlights**

- **Phase 2 Duration**
  - Jan. 06 – Dec. 07
- **Consortium**
  - 32 Organizations
  - 14 Countries
- **Budget**
  - 19.0 MEuros
- **EU Budget**
  - 11.6 MEuros
- **Resources**
  - Around 67 PY/Y
- **Contractual Outcomes:** **38 Deliverables and 45 Milestones**


**E²R II Project Research**

Matricial Structure: Research Challenges (WP1 → WP5) & Research Domain Skills (WP6 → WP8)

Enabling seamless access to communications and services in B3G context: Developing methods and tools for managing complex architectures (Network management, equipment management, resource and spectrum management, security management, autonomies...)

- WP0: Project and Technical Management
  - WP1: E²R Sustainable Business Development and Project Exploitation
    - Validation of Business Models
  - WP2: End-to-End Reconfiguration Management and Control Architecture
    - Validation of System Architecture
  - WP3: Efficiency Enhancements for Radio Resource and Spectrum Usage
    - Validation of Radio Resource and Spectrum Efficiency
  - WP4: Unified Robust Reconfigurable Connectivity
    - Validation of Reconfigurable Connectivity
  - WP5: E²R European Reference Prototyping Environment
    - Demonstrations and Trials
  - WP6: Cognitive Networks
  - WP7: Reconfigurable Equipment
  - WP8: Proof-of-concept
E²R II – Building on E²R I “Golden Nuggets” (Final Audit - March 06)

- Unified Business Model (UBM)
- Responsibility Chain Concept
- R&TTE Directive Extension for Reconfigurable Equipment
- End-to-End Reconfigurability System Architecture (SA)
- Reconfiguration Management Plane (RMP)
- Network Support Architecture for Reconfiguration
- Functional Architecture (FA) for Resource Efficiency
- Cognitive Pilot Channel (CPC)
- Equipment Management and Control (EMC) Architecture
- Functional Description Language (FDL) for Physical Layer Processing
E²R II and WWI

WWI Steering Board

WWI Coordination Team

User Acceptance

Business Models

System Interfaces

Validation

Migration

Phase I WWI Integrated Projects

Phase II WWI Integrated Projects

Liaisons

MobiLife  AN  WINNER  E²R  SPICE

Phase I WWI Integrated Projects

MOCCA

S4ALL

Phase II WWI Integrated Projects
E²R II in a Nutshell (5/7)

E²R II – EC Clusters Context

Project Clustering - Mobile

B3G System Architecture and Control

Mobile Service Platforms

Advanced Radio Network Topologies (Ad Hoc, Relay, Sensors, Mesh)

Spectrum and Resource Management (Spectrum, RRM, SDR)

Instruments:

- Integrated Project (IP)
- Network of Excellence (NoE)
- Specific Targeted Research Project (STREP)
- Specific Support Action (SSA)
- Coordination Action (CA)
E²R II – Next Steps…

E³ IP Proposal

- E³ is an ambitious FP7 IP Proposal
- Introducing Cognitive Wireless Systems in the B3G World
- E³ is building on several Key Achievements from E²R
- E³ is developing the very successful Approach of E²R to cover Technical, Business and Regulatory Perspectives
- E³ is teaming sub-set of E²R Consortium and non- E²R Partners
E²R II – Standardization Framework

Controlled by a single operator or a Meta-Operator regrouping several Operators

Vendor-Specific (not standardized [yet])

ETSI

3GPP

OMG (Interfaces, HW Architecture)

SDR Forum (SDR HW)

IEEE P1900.4

802.xx/3GPP/etc. (air interface)

Next Generation WiFi (IEEE 802.11n or similar)

WiMAX

3GPP (IEEE 802.11a or similar)

Legacy Handset

Network Management

Radio Enabler of Reconfiguration Management

Terminal Reconfiguration Management
Welcome to the End-to-End Reconfigurability - Phase 2 (E2R II) website! E2R is an Integrated Project (IP) of the 6th Framework Programme of the European Commission, addressing the core of the strategic objective “Mobile and wireless systems and platforms beyond 3G”. E2R II is the second phase of the project, starting on 01.01.06.

E2R II Website: First information on the E2R II project starting on 01.01.06. All E2R I information and documents are accessible through this website.

Visit the different sections of E2R website to learn more about this research project:
- Project Overview
- Deliverables
- Press Releases
- Related Links
- Impacts
- Key Challenges
- Schedule
- Approach
- Workpackages
- Partner News
- Workshops
- Dissemination
- Training/Tutorials
- Achievements
- Glossary
- IST Summits
- White Papers

Log in
- Name
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[Click here to enlarge]

Do not hesitate to contact and meet E2R partners for more information on this project!
E²R II – Towards Distributed Decision Making and Autonomics Principles:

High-Level System Architecture Definition

A particular focus is given to
- self-learning (e.g., modulation detection, etc.),
- self-configuring (e.g., distributed selection of RAT selection strategies, etc.) and
- self-managing attributes (e.g., protocol stack reconfiguration, etc.)
E²R II – Technical Highlights (II/X)

**E²R II – SA Mapping onto 3GPP ➔ Network Architecture**

**End-to-end Reconfiguration Management and Control Network Architecture**

- **Reconfiguration related:**
  - T-Mobile 3GPP
  - CSA 3GPP
  - LMM 3GPP
  - RBC 3GPP
  - PM 3GPP
  - NAM 3GPP

- **E-UTRAN:**
  - UMTS
  - LTE
  - WiMax

- **Mapping to 3GPP SAE for Autonomously Reconfigurable UE:**
  - Candidate AN profile parameters

- **UE monitoring:**
  - Traffic flow balancing or traffic split between ANs & QoS enforcement

- **Packet Core:**
  - BSS
  - RNC
  - RNC

- **BSS:**
  - LMM
  - 3GPP
  - PM
  - NAM

- **BSS:**
  - 3GPP
  - PM
  - NAM

- **PCF:**
  - CPDC
  - RCC

- **PCF:**
  - CPDC
  - RCC

- **PS:**
  - Key
  - RBK

- **PS:**
  - Key
  - RBK

- **Translation of application specific QoS parameters received from external servers to network level reconfiguration policy rules:**

- **UE new entity for reconfiguration & download sessions:**
  - Authorization to access RS

- **UE new entity for reconfiguration & download sessions:**
  - Discovery of RS through RA

- **Performance reports for NW-initiated QoS reconfiguration:**

- **Download switching mode:**
  - Service adaptation to reconfiguration events

- **Discovery of RS through MMS:**
  - Session negotiation for service adaptation

**E²R II – ETSI Workshop (09.02.07 – Sophia Antipolis)**
E²R II – Technical Highlights (III/X)

E²R II – Implementation Architecture:

- **Reconfigurable Equipment PIM (REP)** (from Logical View)
  - 1 - Reconfiguration Management
  - 2 - Reconfiguration Control
  - 3 - Reconfigurable Elements

The REP is composed of three Architecture Areas: Reconfiguration Management, Reconfiguration Control and Reconfigurable Elements.

Diagram showing the implementation architecture with various components and arrows indicating the flow.
**E²R II – A framework for DNPM, ASM & JRRM:**

### Dynamic Network Planning & Management:

Framework dealing with planning and managing a reconfigurable network. During the initial planning phase, feasibility of setting radio interfaces, location of base stations, antenna patterns, coupling structure among sub-networks, policy of Joint Radio Resource Management (JRRM) and statistic values of required spectrum with available RATs are developed.

### Advanced Spectrum Management

Responsible for all spectrum resource management. It includes a number of sub modules such as Global Spectrum Allocation Manager (GSAM), Local Spectrum Economic Management (LSEM) and local Spectrum Allocation Manager (LSAM) to support spectrum management functionalities.

### Joint Radio Resource Management:

Primary function of the JRRM module is to optimize the overall performance of the heterogeneous radio network. This includes offering service to the users based on the QoS needs of their applications and subscriptions, and distributing radio resources throughout the network to satisfy as much as mobile users ("always connected").
E²R II – Technical Highlights (V/X)

E²R II – Spectrum Measurements during Football Worldcup:

E²R II – Technical Highlights (VI/X)

E²R II – Cognitive Pilot Channel Demo:

- Laptop
- Handset
- DNS/CPC
- GGSN/DHCP
- HSDPA
E²R II – IEEE P1900.4 Working Group on Cohabitation of Heterogeneous Wireless Systems:

Baseline Proposal: Network Reconfiguration Management
E²R II – IEEE P1900.4 Working Group on Cohabitation of Heterogeneous Wireless Systems:

Baseline Proposal: Reconfiguration Enabler

Baseline Proposal: Terminal Reconfiguration Management
IEEE P1900.4 Meeting Planning:

- **February**: Madrid 6-8th
- **March**: London 27-29th
- **April**: Paris 5-7th
- **June**: Boulder CL 23-26th
- **July**: St Petersburg 2-4th
- **October**: London/Berlin 4-6th
- **November**: Intel or Alcatel-Lucent??
- **December**: KPCL/Ofcom

For meetings:
- **P1900 Plenary + 1900.1, .2, .3**
- **P1900.4 only**
- **P1900 Plenary + all WGs**
- **P1900.2 & .3**
Q & A