Introducing

ITEA Technology Roadmap for Software-Intensive Systems

2nd EDITION

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Σ!2023

ITEA

ITEA Strategy

- Change the battleground to software in products (embedded and distributed systems) building on key European strengths and industries
- Mount an industry-driven strategic pre-competitive R&D initiative for a sustained build-up of European software capabilities
- Maximize and leverage integration of SMEs and Academia / Research institutes

... best available instrument: EUREKA Framework

ITEA

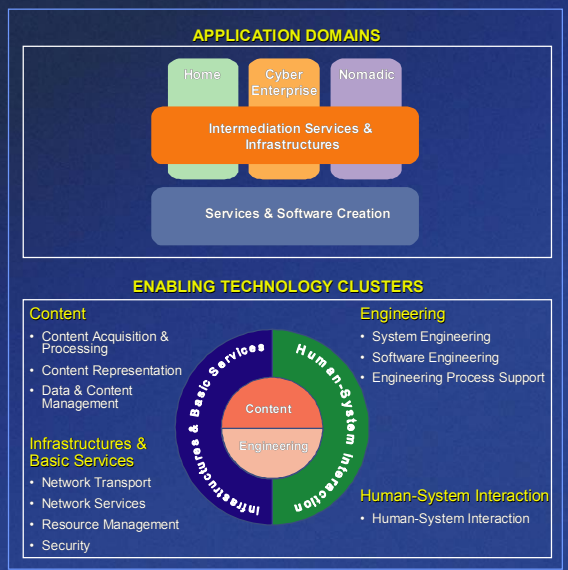
Technology Road Mapping (TRM)
Purpose

- TRM has over the last decade gained a major interest as a tool for technology planning in industry but also within broader sectorial and public innovation policies.
- TRM is a powerful tool to bring actors together and provide guidelines for the future.
- TRM exercises provide strategic vision not only for big firms but, very importantly, for SMEs, that were said to be increasingly involved in such exercises.

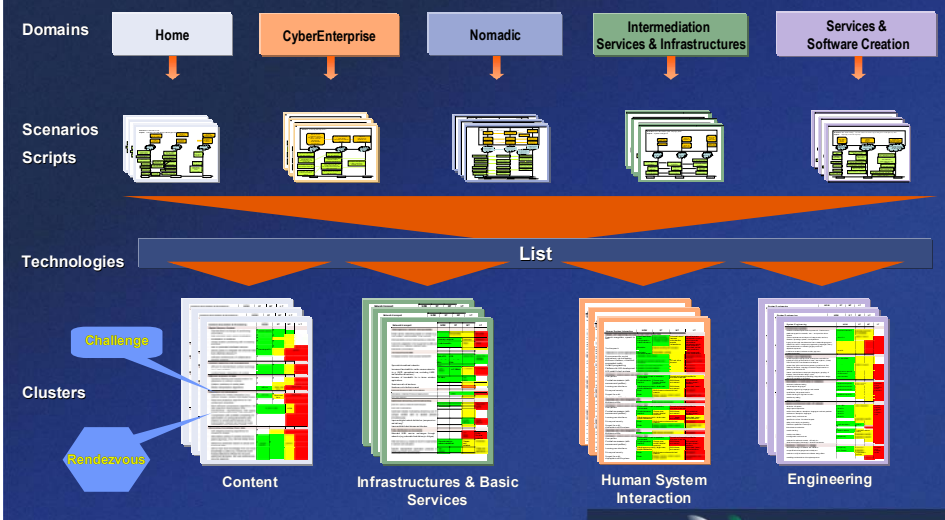
*From: **The effectiveness of Technology Roadmapping**; Bastiaan de Laat, Shonie Mc Kibbin; The Dutch Ministry of Economic Affairs, Pub.nummer 03I18*

Purpose for ITEA: technical guidance for the programme

ITEA Roadmap



Methodology

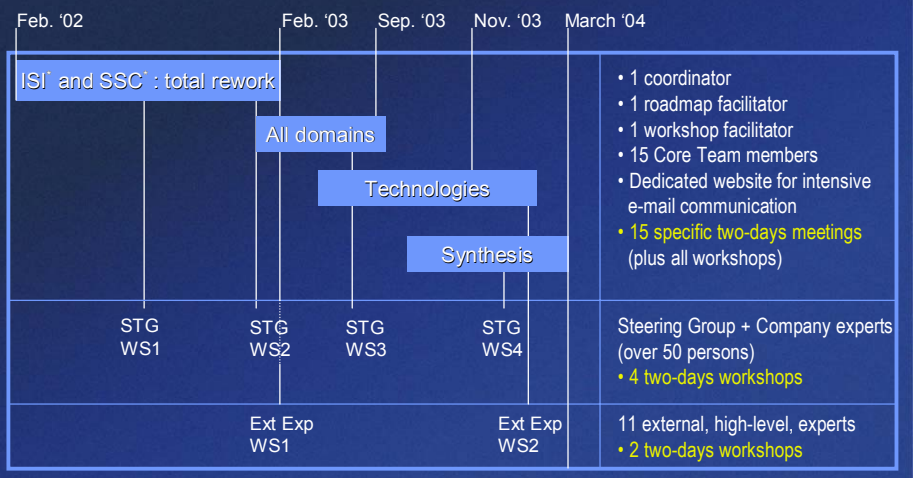


Methodology

- No change to the proven methodology of the 1st edition; only minor adaptations.
- Key concepts:
  - Basis: "Application Domains" as cross-business sectors
  - Technologies/Technology Clusters and their evolution derived from scenarios for the Application Domains
  - Time horizon: *10 years*; sub-divided in three principal frames: Short-term: 2004 - 2006; Medium-term: 2007 - 2009; Long-term: 2010+
  - "Rendezvous concept" for sequencing of events

Team process driven by Core Team supported by multi-level review and consensus loop (industry; academia/research)

Process, schedule and effort

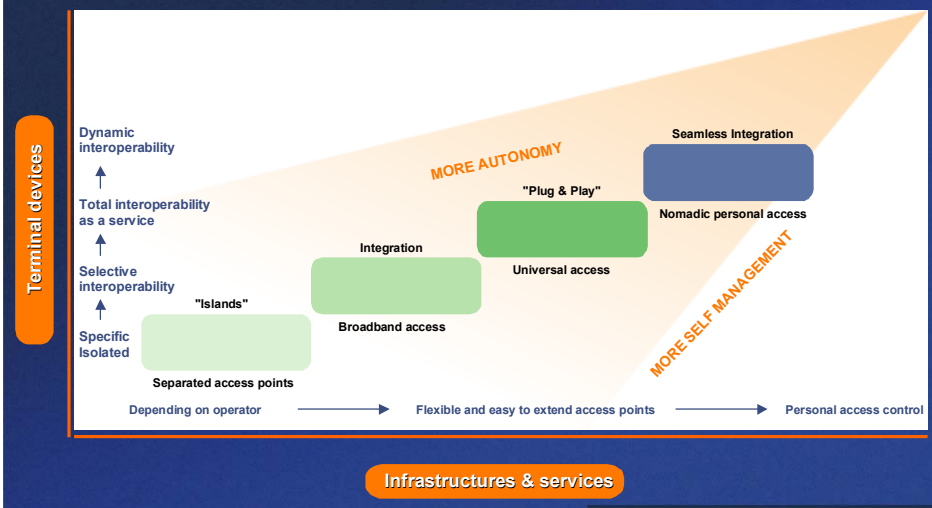


*) ISI = Intermediation Services & Infrastructures
SSC = Services & Software Creation

Main results
Wrap-up

- This 2nd edition confirms and underpins in more depth the findings of the 1st edition; in particular confirming the ITEA core bet on "*digital convergence*"
- It defines the *basic features* of "software-intensive systems" for the years to come and the *principal drivers*
- It identifies as the *overarching issue* for the future of software-intensive systems "*Design for change (DFC)*" and "*Open-middleware*" as key

The road towards convergence



Wrap-up of main results
Basic system features

Software-intensive systems of the years to come will incorporate mainly four basic features as compared to their present status:

- They will be dynamic evolutionary systems
- They will exhibit adaptive and anticipatory behaviour
- They will process knowledge and not only data
- They will allow the user to stay in control

Note: These "high-level conclusions" are thoroughly developed and discussed in the Roadmap

Wrap-up of main results
Keys for development and deployment

The keys for development and deployment of these systems are of two kinds:

- Key drivers for acceptance are:
  - Interoperability of products, systems, applications
  - "-ilities": security, usability, testability, reliability, safety, etc.
- Key issues for implementation are:
  - technical: mastering of the size, complexity, adaptiveness, etc…
  - economic: middleware business models, cost

Wrap-up of main results
Overarching issues

- The overarching issue for the future of software-intensive systems is *design for change (DFC)*
  - Its "Always on" SYSTEMS
  - Continuous modifications in the systems (technology, services,…) and around them (terminals, usage,…)
- The key: *open middleware (APIs)*
  - Interoperability
  - Cost of development, time-to-market, market size

Conclusion

- This 2nd edition of the ITEA Roadmap is the culmination of a large scale strategic ITEA effort, involving more than 70 high-level experts
- We believe that it is a solid foundation to build on for years to come

Roadmap availability

- Executive summary, freely downloadable from ITEA website
- WEB version with low resolution graphics & tables, free of charge downloadable with registration
- Print version: high-quality print + CD (also incl. IRIS Book, ITEA Brochure, etc.)

Available on www.itea-office.org

Thank you for your attention

The ITEA application domains
Definitions (1)

HOME

All activities that may be required by actors/people/agents in their private environment in order to exchange information inside and outside the home (using all types of appliances) and perform the corresponding tasks.

CYBER ENTERPRISE

All activities that may be required by a set of people or machines, which communicate and interact with each other as well as with the outside "environment" in order to achieve a common goal (technical or economic) and/or perform a task together, independent of the organisational and/or geographical location of these people or machines.

NOMADIC (was Mobile)

All activities that may be required by nomadic actors/people/agents away from their home or workplace and on the move to exchange information and perform corresponding tasks. It also includes all mobile and transportation applications.

The ITEA application domains
Definitions (2)

INTERMEDIATION SERVICES & INFRASTRUCTURES

All kinds of activities that may be required to support the different actors/people/agents who need to access and manage networks and network services (incl. design, implementation, sales, maintenance and billing services).

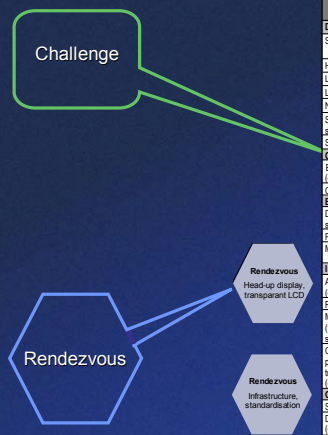
SERVICES & SOFTWARE CREATION
(was Complex Systems Engineering)

All activities that may be required to help the different actors/people/agents engaged in designing, implementing, verifying, maintaining and modifying software-intensive products, systems or services.

An example
Content

Content categories	Category definition	Major challenges
Content Acquisition & Processing	Technologies that are relevant to acquiring, transforming and modifying content.	Digital sensory system; capturing and managing contexts; efficient analysis of data, integration of information.
Content Representation	Technologies for representing and structuring data while at the same time making the most appropriate and efficient use of resources.	Generic structuring of data; integrated multimedia streams; distinction between content and presentation of data; semantic data; semantic classification of content; virtual re presentation of real-world items; virtual/augmented reality; cyber representation of active entities.
Data & Content Management	Technologies for managing and retrieving content while ensuring data integrity in dispersed and heterogeneous environments.	Guaranteeing the integrity of data, intellectual property management and protection; certification of content; offering unique virtual identity capabilities and management of the context; personal or professional content management and intelligent search.

An example
Content Acquisition & Processing



	Now	ST	MT	LT
Digital Sensory System				
Standardised exchange of positioning information	domain-specific		generic	
High-precision open-space localisation				
Localisation in buildings				
Low-cost location positioning with increasing precision				
New or extended intelligent sensors				
Sensor fusion to integrate raw physical data from different sensors to information/knowledge	domain-specific		generic	
Software architectures of collaborative sensory systems				
Context capturing and management				
Efficient & standardised context exchange (e.g. user profiles)				
Context fusion: integration of context				
Efficient analysis of data				
Dynamic filtering and transformation for adaptation to session context				
Pattern matching of media data				
Media interpretation algorithms	off-line	near real-time	real-time	
Integration of information				
Algorithms for media integration (e.g. camera images, position and digital maps)	off-line	near real-time	real-time	
Real-time projection algorithms for full windscreen projection				
More efficient compression algorithms / bit-rate reduction (transmission time (isochronous – asynchronous), cost, space, quality (perceived quality - full integrity)	H.261/H.263		H.264	
Compression with scalable complexity for optimising coding parameters with respect to overall performances of the transmission channel and terminal node capabilities (e.g. CPU resources, and power)				
Generating knowledge from data				
Self-adapting learning algorithms for content & context				
Descriptive coding of context evolution in space and time (e.g. derived delay times from traffic data				
Behaviour prediction based on actual and historical data	domain-specific		generic	
Derive high-level from low-level knowledge or data (e.g. enhanced route-finding algorithms, taking into account additional attributes such as user preferences and security aspects)				