Waterford Institute *of* Technology
INSTITIÚID TEICNEOLAÍOCHTA PHORT LÁIRGE

TSSG

Waterford Institute of Technology R&D

Who We Are

The Waterford Institute of Technology (WIT) is based in the South East of Ireland. Within WIT, ICT R&D is handled by the Telecommunications Software & Systems Group (TSSG). TSSG are one of the largest integrated information communications technologies (ICT) research and innovation centres in Ireland and has been recognised as one of the top 10 European institutes driving the specification of the Future Internet, and is the founder of the Irish Future Internet Forum. Founded in 1996 by Dr. Willie Donnelly, the TSSG is part of the Waterford Institute of Technology (WIT), and is based at the Carriganore Campus in Waterford, Ireland.

Our Mission

Our mission is to build an unrivaled research and innovation centre that shapes the future of communications technologies, ensuring all our research outputs can be translated into products and services that benefit society. As an academic institution, the TSSG's goal has always been to add value and generate new knowledge in the ICT domain for economic and social progress, and to establish long lasting collaborative relationships with leading academic and industrial global leaders.

What We Do

The TSSG R&D group of WIT has grown into a large research centre, with over 150 staff and students, working across a broad project portfolio consisting of 117 projects. The TSSG is at the forefront of Communications Management for networks and services in Europe, and is engaged in a critical mass of activity that addresses the transformation of the telecommunications industry. The basic and applied research challenges currently addressed by TSSG's portfolio of projects include:

- Autonomic Network management.
- Ubiquitous Network Connectivity through mobility.
- Security through trust and dependability.
- Pervasive Service Creation & Deployment.
- Accounting for Networked Services and Billing.
- Context and Location, IMS/NGN platforms and services.
- Testbed Activities and Experimentally Driven Research.

This is a position paper which focuses on the issues and open questions to be addressed during the EFII PPP Architecture Workshop of June 9th 2010.

TSSG Critical analysis of the proposed architecture

The TSSG has taken stock of the provided position paper on the core platform needed to support the Future Internet PPP projects and have the following comments for consideration

Core Platform Architecture and Basic Architectural Principles
The paper takes a position that the Future Internet Core Platform must have means to support different applications and business processes and given a set of Generic Enablers should support interoperable and portable applications.

Recommendation: In order for the FI Core platform to support differing requirements the project must have a mechanism for Dynamic Requirements Gathering and implementation. With the FI Core Platform needing to be flexible and capable of evolving over time as new requirements are discovered and new technologies become available the requirements gathering mechanism will be essential. We also see a need for Usage Area Application developers to be able to visualise the resources, services and interfaces being made available by the FI Core Platform and from this visualisation tool be able to create the initial configuration of a FI Core Platform Instance which would suit their needs. Additionally it will be essential to involve the usage area application developers in the requirements cycle for the PPP Core, as they will be the first instance users of the platform.

Generic Enablers (GE's) and their development
The paper lays out an initial set of 13 GE's which the FI Core platform would be composed of.

Recommendation: It appears that one GE not considered at this point is one which links the FI Core Platform to legacy implementations of the Usage Area applications. While we can see that the point of the FI Core Platform is to facilitate future application & services, it can be seen that users will already have existing applications in place and that at some point they will fully transition to a FI Core Platform Instance. However experience from existing large communication systems, such as the transitions from analogue mobile to digital (GSM) and from GSM to 3G there has always been a place in the architecture for supporting legacy platform until the full transition is complete. The FI Core Platform should also factor this into their thinking of their architecture.

As to the purposed 13 GE's here are some comments to consider.

4.1 End-user access, adaptation and composition of Resources
Recommendation: Other functionality to be considered here would be recommender systems – to be used to provide resource and service recommendations to users and integrated systems based on past usage patterns. This would significantly reduce the time required for resource/service discovery/selection and composition. Another aspect related to the users, and groups of users (crowd-sourcing is mentioned) is that of integrating social networks with the PPP to provide a means to group, and categorise groups, of users with common interests, common system requirements, and so on (as is currently being implemented in the PERSIST and soon SOCIETIES projects).

4.2 Service Handling and SOA Support
Recommendation: Another functionality to consider in this GE could be: Service usage observation. Business and Telco services will have differing transaction execution types (short-running and long-running). In order measure the service effectiveness the usage of the service will need to be observed and compared against a common set of criteria. Additionally with mobility of users and service providers being a reality in the vision of the FI, there will be requirements to ensure stability,

availability and dependability of provided services – in order to instil user confidence in provided offerings.

4.5 Preferences, profiling and context

Recommendation: It will be important to integrate a user's personal preferences with context information in order to provide a richer contextual framework for the provision of value-added services. I.e. personalisation of context information is equally, if not more, important than personalisation of services provided to the users. With such functionality included the services provided to a user would be personalised based not only on a user's preferences, but dynamically based on context changes. Additionally it will be important to understand how groups of users can share service preferences/resources, and act as context sources themselves.

4.6 Identity, Privacy, Confidentiality

Recommendation: Additional confidentiality functionalities to consider could include the allowing of diverse data content providers to contribute to a large collective content base without having to relinquish control over how their content is protected with N-tier security, which would enable textual description tracks to be decrypted using a widely- distributed key for search indexing purposes, while keeping the remainder of the content protected.

4.10 Connectivity

Recommendation: An additional connectivity requirements could include End-to-End traffic monitoring and analysis. While this may fit under the End-to-end Quality control requirement, it must be noted that traffic analysis should be consider in real-time and non- real-time.

4.11 Developers Community and Tools

Recommendation: The complexity of the proposed FI-CP open interfaces and software API's will require innovative and different approaches to the existing testing processes and tools available in SDK's. Automated tools will be essential in order to conduct robust and repeatable testing and experimental analysis. An end-to-end robust, adaptive and scalable testing process could be of benefit across all the usage areas identified. Certification and standardisation of the development and testing methodologies will be a key enabler in the API definition process. There may be an opportunity here to develop a new test maturity model – this could be entirely new or based on existing models such as the CMMi, TMMi but adaptive and fluid enough to evolve and meet the specific challenges that the innovation of the Future Internet Core Platform could bring.

4.13 Lifecycle management, traceability and accountability

Recommendation: The area of self-managed systems could be applied in this GE. Identifying the ways of integrating self-managed systems into the network provisioning lifecycle developing management solutions incorporating semantic analysis, that can be applied to build federated network and service management systems that understand changes in the environment and coordinate their actions to effectively deliver services on an end-to-end basis.
The importance of reliable self-management is necessary to enhance the operation of other management systems (legacy or self-managed) and can recover from failure situations exhibited from these systems efficiently and limit disturbances to its network services.

TSSG Relevant assets to contribute.

The following table lists relevant developed technology of the TSSG, which can be contributed to the Generic Enablers of the FI Core Platform.

Project	Relevant Assets / R&D
Daidalos I & II (FP6)	Mechanisms for service discovery, composition,

	context awareness, service lifecycle management, test and verification, security
PERSIST (FP7)	Mechanisms for context aware personalisation of services, creating user groups within which resources are accessed and shared, integration of multiple device technologies and development frameworks. Provision of a context broker enabling module
4WARD (FP7)	The Component-Based Architecture (CBA) platform implementing a software component infrastructure for flexible development of network protocols. The protocol components are written in Java but conform to the requirements of a CBA architecture within the Open Services Gateway Initiative (OSGi) framework. Also we have a DSL for composition of Management Objectives(exposed by underlying embedded Management Capabilities). The DSL allows for subscription to management objectives which are running in the network and semantics for comparison of the outputs of these objectives which can in turn be consolidated into a more high level composite objective.
EFIPSANS (FP7)	A Path Based Monitoring function that supports hop-by-hop performance metrics collection utilising Router Alert mechanism. Implemented in the Linux Kernal and therefore experimental with limited re-use potential in its current form – this is still at the development phase. Shim6 implementation is also implemented in the Linux kernel. Currently planning to utilise MBT from AutoI to develop the GANA defined Managed Entities for collecting performance metrics for a node. This is currently at the design phase.
AUTOI (FP7)	Model Based Translator - a mediation function translates technology neutral Information Model derived from DEN-ng and realised as an XML schema to technology specific protocols and data models. A core component of a multi-vendor management system capable of loose coupling with network elements and dynamic customisation in runtime.
SOCIETIES (FP7 – forthcoming)	Creating of dynamic communities of users, integration of social networks as context sources in order to create user communities, which in turn share data, resources, information, services etc
IMS- ARCS	Provision of a context enabler module for NGN network services
MORE (FP6)	Service oriented middleware for distributed communication

	Service group management facilitated by DSL driven policies, i.e. management of groups of services through the use of policies. The policies are defined using a DSL which is integrated with Eclipse IDE .

TSSG Relevant experimentation facilities available.

NGN Testbed and Centre: TSSG have recently set up a new international Next Generation Networks (NGN) test centre (http://www.ngntestcentre.com/) for services and infrastructure, using carrier-grade telecommunications equipment. The NGN solution provides IMS core nodes to enable and deliver multimedia services for fixed and mobile access. The ICT infrastructure is maintained and scheduled by a Test Manager and is enhanced by a testing and experimental facilities group to support the challenges of experimentally driven research. This group has extensive experience in being integration and testbed managers for a number of National and EU projects, some of which are part of the Future Internet Research and Experimentation (FIRE) initiative.

The group have expertise and capabilities in the following areas:

- Verification of software processes and practices.
- Validation of developed products through test case design and test case execution, using unit, functional, performance, scalability and integration testing.
- Coordination of requirements gathering, definition and documentation.
- Project Planning and scheduling.
- Promoting and supporting a collaborative approach in building quality into services and products from an early stage of the products lifecycle.
- Promoting techniques such as test driven development, continuous integration, iterative work cycle, pair programming, code reviews and code refactoring.
- Usage of open source project management and testing tools.

In addition the TSSG has integrated a testbed for generating, collecting, aggregating, fusing and delivering of location and context information in Pervasive and Ubiquitous Computing and Communication scenarios. It provides a software framework for Redundant Positioning and a context database. The different tiers are accessible individually to cater for investigation of specific research questions, such as processing and fusion algorithms, machine learning strategies and context inference.

On the sensor side, it is open for plugging-in any hardware supporting heterogeneous physical and logical principles of sensing, indoors and outdoors, and currently supports GPS, RFID, 2-D barcode (Semacode), Ubisense (Ultrawideband radio location), Acceleration/Inertia/Gyro sensors, and manual registration.

Pluggable fusion algorithms include Baysian and Particle filters, a history function supports time-based evaluation of point-by-point sightings. Applications are supported via an API and graphical visualisations, a mechanism for cross-domain information exchange and consideration of privacy aspects.

The group brings its experience in software, services and processes methodologies and improvements to testing in large-scale environments across a number of testbeds to ensure the verifiability, reliability, repeatability, and reproducibility of the experimental results achieved. Supporting our test infrastruture and research efforts, the TSSG has a dedicated professional Verification and Validation (V&V) team which currently consists of 4 Research Engineers who have several years industrial experience in the Telecoms and Internet domains working for such companies as Ericsson, Logica and

Openet, as well as several years experience working on Research and Commercialisation projects in the TSSG. This team would be highly relevant for requirements management, software intergration and software process / practice verification and so on.

Related Projects in TSSG

FP7 4WARD	http://www.4ward-project.eu/
FP7 EFIPSANS	http://www.efipsans.org/
FP7 AutoI	http://ist-autoi.eu/autoi/
FP7 PERIMETER	http://www.ict-perimeter.eu/
FP7 PERSIST	http://www.ict-persist.eu/
FP7 VITAL++	http://www.ict-vitalpp.upatras.gr/
FP7 Panlab II	http://www.panlab.net/
FP7 Comifin:	http://www.comifin.eu/
FP6 DAIDALOS	http://www.ist-daidalos.org/
FP6 MORE	http://www.ist-more.org/
FP6 ENABLE	http://www.ist-enable.com
Celtic Eureka GenesisX	http://kristal-priv.ita.es/genesisX/
Celtic Eureka Madeira	http://www.celtic-madeira.org/
IMS ARCS	http://www.ims-arcs.com

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