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Collaboration Environments Instantiation Process through Interoperable Platforms[i]

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Abstract: This paper describes the "instantiation process" in Collaboration Environments (CE) through interoperable platforms. Nowadays CE use is distributed and heterogeneous, therefore it needs complex platforms, hardware and software with complex instantiation models. One single application through one network and using one service platform will not be an acceptable solution anymore. In this paper, It's defined the basic concepts needed to perform CE Instantiation Processes (CEIP) in order to provide a proposal of the CEIP and a specific scenario that illustrates the instantiation process steps. The CEIP works in the current platforms with manual and not formal mechanism. This situation decreases enormously the collaboration possibilities and interoperable capabilities of those platforms. The wider scope that could be considered by the CEIP should be the environment and the granularity should be each component, service, terminal or device and each user or community. This work was financed by the EU C@R Project (www.c-rural.eu)

1. Introduction

Collaboration Platforms are designed for providing collaborative services to end-users. Main Collaboration Platforms have being designed, but interoperability between single services and between platforms is still a missing point. Forrester has evaluated in 2006 five leading Collaboration Platform vendors across 98 criteria and found that IBM and Microsoft are still the leaders in this market [1].

The definition of a Reference Architecture is the goal of several EU projects, and the unification of them into a single Reference Architecture is driven by the EU Commission through the OCA WG "Open Collaborative Architecture Working Group"[2][3].
C@R: "A Collaboration Platform for working and living in rural areas"[4], EU project with reference FP6-2005-IST-5-03492 is developing its own reference architecture [see Fig. 1]. This collaboration reference architecture is composed of the following elements:

- *CCS* (Collaborative Core Services Layer): Defines one or more Services Components encapsulated into a predefined API and integrated into the C@R OSOA through a uniforming interlayer. CCS brings together all basic resources -devices, technologies or software components- which will be orchestrated to build high level collaborative functions into the environment.
- *SCT* (Software Collaborative Tools Layer): Define complex system architectures composed by Collaborative Applications and Service Components which allows the end user to carry out complex collaboration activities. SCT is the C@R Service Architecture Upper layer, which includes three main functions: Uniforming Middleware, Orchestration Capabilities and Software Tools.

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- Uniforming Middleware: Define a conceptual inter-layer space, which includes a set of predefined Collaboration Enablers supporting the C@R Architecture.

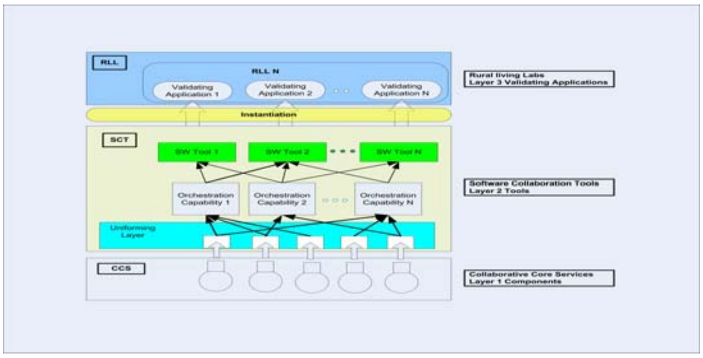

Figure 1: C@R Collaborative Architecture

- Orchestration Capabilities: the set of three predefined Collaboration features integrated into the C@R Architecture to facilitate the definition of new Collaborative Services.
- Validating Applications: The high-level software tools available to end-users to perform their job or leisure activities taking advantage of the combination of Software Collaborative Tools.

This reference architecture includes the definition of one Instantiation Process. The Instantiation Process deals with the problems related to the deployment, tuning and operation of Collaboration Platforms and services over distributed and heterogeneous hardware, software and communications infrastructures using complex interaction models. The main goal of the Instantiation Process is to create flexible, dynamically adaptable and customizable CE over the available infrastructure in order to support present and future requirements of collaboration between the end users and devices.

The paper is organized as follows: Section 2 provides definitions and collaboration models. Section 3 presents the definitions for the main elements involved in the instantiation process of Collaboration Environments. Section 4 discusses summarized description of the instantiation process defined. Section 5 provides a specific example of the instantiation process applied in the fishing sector. At the end, Section 6 presents the conclusions obtained and the future work.

2. Definitions and Collaborative Models

In C@R Project [4] CE Instantiation Process is being defined as follows:

"Collaborative capabilities unattended composition, at real/virtual environments, through one or several Collaboration Platforms, using all necessary interoperability layers for a full cooperation among people, devices and services that could be available in the environment".

Collaboration Platforms should include pre-existing infrastructure mainly in distributed locations. This process should be bi-directional and therefore able to modify instantiation information into all CE platforms.

A key concept that we could also see in this definition is that "*Instantiation*" is a continuous process that could happen the first time one CE platform is deployed in one environment and that is essential in their evolution in terms of members or services, data or capabilities upgrades.

"Environment" refers to a complex of surrounding circumstances, conditions, or influences in which a thing is situated or is developed [6]. Some how the instantiation process should be consider at environment level.

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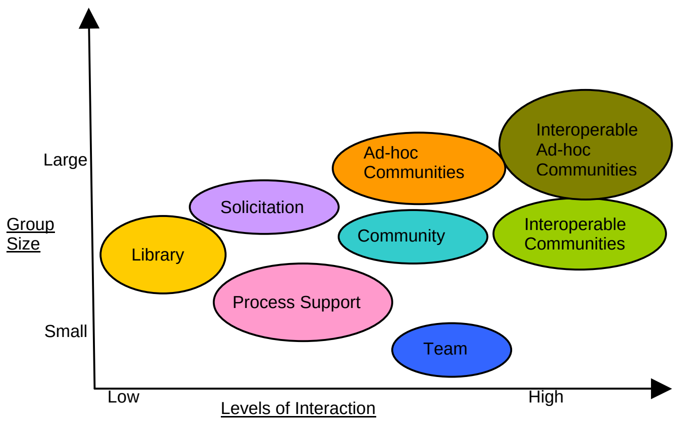

Figure 2: Collaboration Models Based on [7]

It is clear that the CEIP should take care on the collaborative models that could be adopted. Timothy Butler and David Coleman (2003), suggest five fundamental models of collaboration (see Figure 2)

In Figure 2 you can see that community model is the more interaction degree level plus the more people involved. In this article it has extended this figure including different community groups that will increase the level of interaction and the group size. CEIP should be aware of them.

In the same year Clay Shirky (2003), suggests three types of collaboration base on communication patterns: point-to-point two-way (as in phone calls), one-to-many outbound (as in newsletters) many-to-many two-way (as in a group discussion)

Again in 2003 George Siemens suggested a typology based on spaces:

- A space for gurus and beginners to connect (provide mentorship)
- A space for self-expression (blog)
- A space for debate and dialogue (discussion forum/listserv)
- A space to search for archived knowledge
- A space to learn in a structured manner (tutorials)

Another important aspect is the privacy. If someone needs or wants to collaborate, he/she has to share something, i.e.: information, data, localization, etc. It means that this one should choose a privacy model and catalogue all the information.

Could it be shared with everybody?; with the community?; with the platform only? Who takes care and guarantees the access rights and privacy?

Finally, taken into account the wider scope of the CEIP i.e.: “The Environment”, collaboration could happen:

- Between people or communities @work, @life and @leisure.
- On a direct P2P communication or through a Collaboration Platform
- Sharing one or many services thanks to interoperability capabilities
- With self management of collaboration or delegating it choosing specific collaboration models
- With synchronous and/or asynchronous access to people, devices and content

3. Concepts Related to the Instantiation Process

In order to present properly a Process to Instantiate Collaboration Environments through Interoperable Platforms, it is necessary to define the concepts that have to be managed during the execution of the process proposed in the Section 4.

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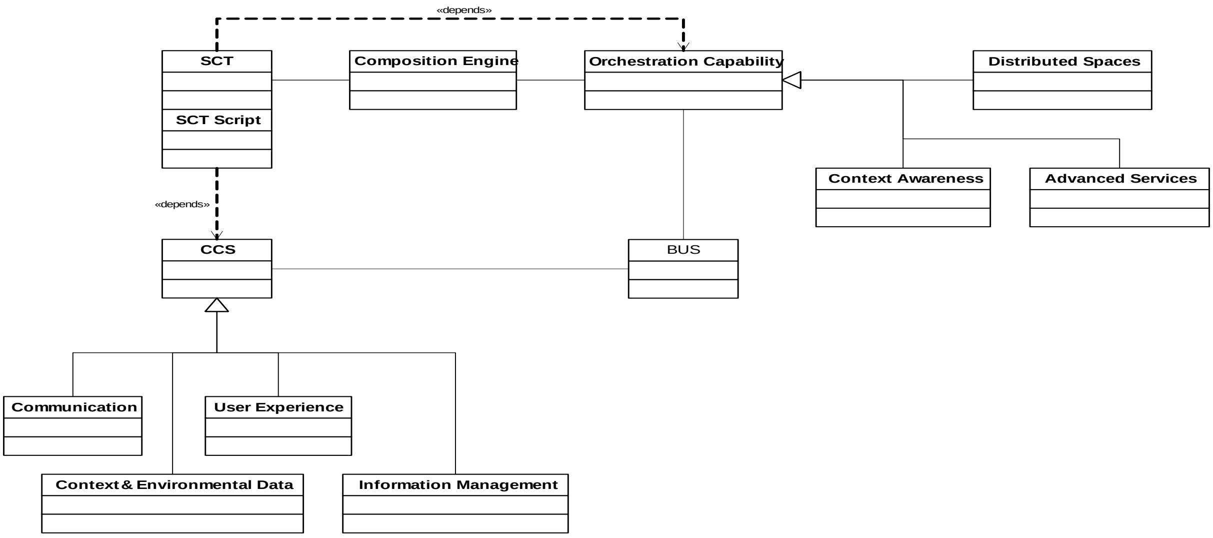

These components are:

- Software Collaboration Tool (SCT). A SCT is a composition of services (CCS's and OC's) built as a result of the instantiation process. The LL applications are built by writing scripts, which describe the necessary elements (CCS's) interactions and calls to the collaborative functions and libraries provided by the core OC's.
- SCTs are the result of running a script defining the interactions of the platform elements (CCS, OCs Functions), which are necessary to establish the service framework. An instantiated SCT constitutes a final user application.
- SCT Script. A script defines an application. An application description contains the specification of all the needed components, connections, relations, and work flow descriptions and so, form the final user application. The SCT script is written following Business Process Specification Language (BPEL) standard.
- Composition Engine. The composition engine is the specific component that interprets scripts to instantiate SCTs as a result.
- Core Collaborative Service (CCS). CCS are basic or low level services and resources (networks, sensors, devices, software modules, localization sources and other context data capture resources, GIS components, grids, web services, notification services, etc.) encapsulated in reusable software components. CCS components will follow a standardized architecture. This comprises their software primitives, data objects, interoperation protocols and APIs.
- Orchestration Capability (OC). The orchestration capabilities will define components for providing common services for all the SCTs. Each orchestration capability will harmonize and integrate into a single model all the information related to a specific subject, providing to the Software Tools a uniform and transparent way for using this information.
- BUS. The bus is the control middleware of the broker-based architecture. This element acts as a resource broker, enabling the system to search for resources and managing their interconnection

4. Specification of Collaboration Environments Instantiation Process

The Collaboration Environments Instantiation Process (CEIP) main goal is the autonomous and spontaneous deployment or upgrade of all required collaborative capabilities in the environment joined by each user or device. The actors involved in the CEIP are introduced in Figure 4.

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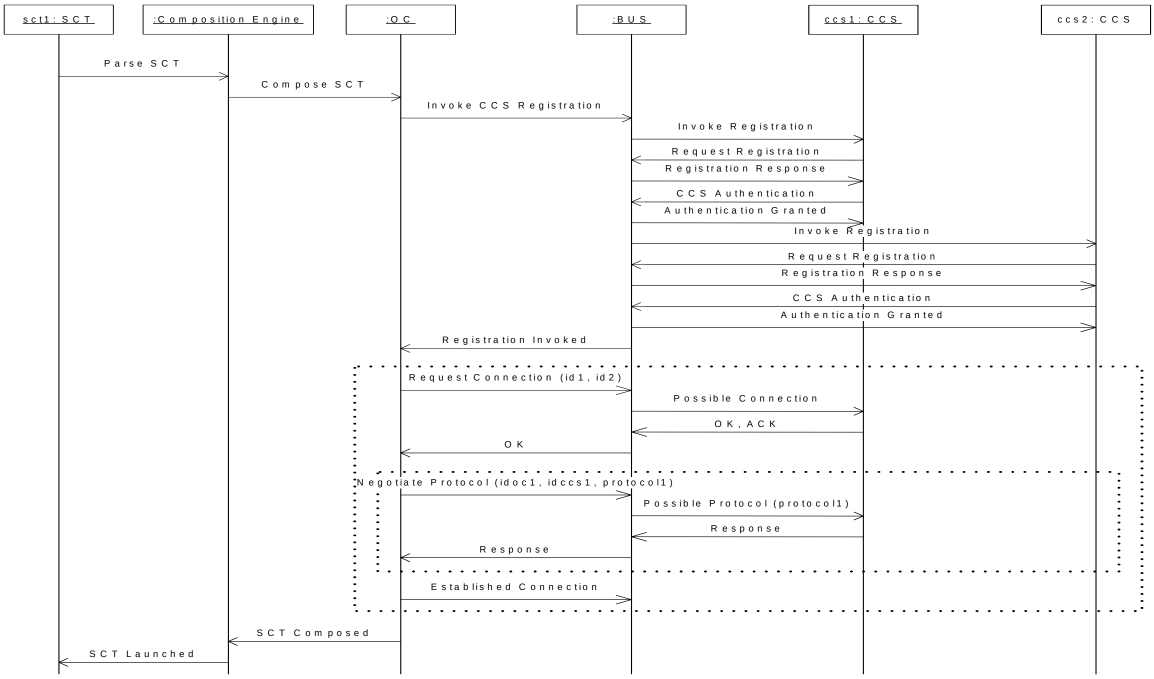

Figure 4: CE Instantiation Process

This process has to be initiated the first time a user joins a new environment, or if new collaborative capabilities are required, when the environment suffers any change in terms of actors or services, or when the user wants or needs to change the profile.

The main benefits of the CEIP are: any joined user can instantiate all collaborative capabilities available in the environment, even those that have not collaborative interfaces, the joined user and their new capabilities and tools could be available for others, even for those that have not collaborative interfaces, users should be able to chose between different providers and self-configure their preferences in terms of quality, cost, availability and privacy.

The steps required to compose a software collaboration tool are (See Figure 4):

1. First of all, the composition engine loads the script that specifies the SCT.
2. The composition engine requires the functionality of an orchestration capability that is in charge of registering and connects all the CCS required by a specific SCT.
3. Then the orchestration capability is in charge of registration (in a passive way) of all the CCS required.
4. If an OC or a CCS with id=ID1 needs to connect to another CCS with id=ID2, it must call requestConnection, Connector module of the BUS with parameters id1 and id2. The BUS informs ID2 that ID1 wants to connect calling possible Connection on ID2.

If all goes right the two CCS must start a negotiation to decide which protocol they must use. The ID1 calls the Connector negotiateProtocol function. The connector receives from the ID1 the information of the preferred protocol for the communication with ID2. The connector uses the service in CCS (possibleProtocol) to inform to the ID2 about this protocol chosen by ID1.

If all goes right the connection is prepared. The connector is informed by the ID1 that the connection has been correctly established calling establishedConnection.

After the negotiation process, if the two CCS don’t agree about the connection protocol and the connection cannot be performed, the connector is informed by the ID1 that the connection couldn’t be established correctly calling notEstablishedConnection function and the composition process finishes unsuccessfully.

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At this moment, the SCT is successfully composed. During the SCT use, a monitoring process is rung. This monitoring process is continuously checking the state of the connections registered in the bus.

Finally, the disconnection process is usually started by the component, but if it is necessary, the connector could order the end of the connections, in case there is any problem in the bus or the domain

5. CE Instantiation in a Fishing Scenario

C@R collaborative platform is being developed for their applications to the specific scenarios. One of them is the “hake fished by hook” art. In this kind of fishery, several small vessels are concentrated in the same fishing grounds. The fishing art relies on small boats (less than 15 meters long) with small interior often occupied by the tackles. Some of these boats don’t even have generators on board and their communications infrastructure is based on mobile points. Such a specific scenario is of significant interest because of the high transferability of the solutions to be developed to a large diversity of fishing arts that are routinely performed in small vessels in playgrounds near the shore.

In order to introduce origin certificates or quality labels specifically for the hake fished by hook, fishing scenario has been working on an end user application for the catches information and GPS location sending to guarantee the hake traceability from the origin. This application relies on communication infrastructures as ad-hoc rural networks (ARN) with GPRS/UMTS available in fishing grounds and on a Wimax deployment plan. Basing on this end user application the community is working on the guidelines and the regulation for the quality label establishment so is looking for certification authorities, promoting this quality label and guaranteeing its visibility in the fisher’s community and creating learning platforms for people in this sector. C@R fishing Living Lab, like the others, addresses different target groups, all stakeholders mainly, but in this case the fishers will gain the most benefit getting a clear hake fished by hook price increase.

Other important issue, on which the Living Lab community is working, is the ARN or the Ad-hoc Rural Network mentioned above. This scenario represents a good solution for the communications infrastructure in the area in case of inadequate communications coverage. An example of this scenario should be the following: A fishing boat tries to connect to the port to send catches data or GPS positioning, but GPRS is not available in this area. So the fishing boat would try to connect through WiMax to a nearby boat which has satellite connection to the port. Therefore the ARN would detect that in the WiMax coverage area of the first boat there is a fishing boat with satellite connection to the port. The network would act as a router looking for neighbouring communication services.

An important obstacle has been found during this cycle to experiment this intelligent network. Although an ARN model is going on studying for fisher’s community, nowadays there isn’t a commercial technology that allows using vessels on the path to the seashore as a relay station in order to reach a base station on the seashore. WiMax represents a good solution but this Ad-hoc solution is revolutionary; it is not widely available today as a commercial of the shelf solution from vendors of WiMax products. The topic “Ad-hoc Network” is very popular in Universities and other academic institutes. It is also used for building tactical radio communications for military applications. Typically the application of ad-hoc networks is for providing connectivity to terminals that suddenly appear in the area and must immediately be admitted and allowed to communicate in a flat (non hierarchical) manner with other terminals in the network (under the same coverage area).

Fishing Living Lab community has been working on the end user application for the catches information and GPS location sending to guarantee the hake traceability from the moment. It’s been catch: through several forms fishermen are able to send the catches data before arriving in port. Through these forms fishermen can also voluntarily send their GPS

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position. Once in the auction centre located at the port, the officers can consult the information sent by the fishing boats. They can also certify the hake origin with the information about the GPS location sent by each boat at the moment in which the hake was catch. Fishermen are sending their position of their own three times during their daily journey, sending also their departure and arrival time. This is a first step to get a quality label. On the other hand this allows the auction centre officers to speed up their production processes.

Fishing LL community count on GPRS/UMTS available in fishing grounds but a good service cannot be guaranteed. A solution based on WiMax has been studied as a fixed and mobile technological alternative to provide with an added value in a mixed environment in the coast where there are services for both the fishing grounds and the inland. This first design includes one sitting near the port to provide with coverage up to 5 miles in the sea covering the fishing grounds and other sitting near the urban centre to provide with coverage to official buildings and to give the connection services to the port.

For the first collaborative service basic software components were identified:

1. In the fishing boat sub domain: MQS – Messages Queuing Service, GPSS – GPS, SRS – Speech Recognition Service to allow fishermen to fill in the reports through their voice, MDLS – Multilanguage Data Loading Service, etc.
2. In the fishery sub domain: AAAS – Authentication Authorization and Audit Service, DMS – Data Management Service, DSS – Data Storage Service, SMS_S – SMS Service, EM_S – Email Service, MDLS – Multilanguage Data Loading Service, These software components has been identified as Collaborative Core Services (CCSs) except the AAAS that acts as a transversal service that need to be preregistered in the bus to let the rest of CCSs to be authenticated to the C@R platform.
3. Two special CCSs were distinguished in each sub domain: CDS App – Catches Data Sending Application and FIS App – Fishery Information System Application.
   These specific CCSs (CCS applications) consist of the graphic user interfaces and the service framework. These are main threads that use and orchestrate the basic services (rest of CCSs) to compose end user applications.

This application operates in a main domain and two sub domains were distinguished: the fishing boats sub domain and the fishery sub domain. Each sub domain relies on the bus. Different sub domains are registered in the Fishing domain through the bus internetworking capability.

In order to make each identified CCS available to the C@R platform, a homogeneous layer is needed to register and connect them to the C@R bus. During last three months the first draft of this homogeneous layer has been concluded and integrated with some CCSs. Moreover some enhancements on the CCS applications have been done in order to optimize the user application for first experimentation.

Besides, the fishers' community guild web site has been developed and tested by the users. Through this web site, different users will be able to access to available online services. So far the only available service allows fishers and wholesalers to get information about the catches and to configure their user profiles

6. Conclusions and Future Work

Interoperability is therefore a key functionality that has to be strongly considered by Collaboration Platforms. In relation with the instantiation process, this paper establishes:

- Basic concepts required to perform an effective CEIP.
- A proposal of the specification of a CEIP
- A scenario that illustrates the steps of the CEIP proposed in this paper.

Moreover, a set of basic interfaces has been defined. They should be supported by Collaboration Platforms and included as a part of OCA results.

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As shown in the fishing scenario key aspects for a better CEIP definition are: rapid ad-hoc, self-configuration based on local resources availability, dynamic on-line environment awareness and heterogeneous interoperability capabilities.

Then all objectives related to internal instantiation have been achieved and those related to interoperability capabilities needs further research in case studies.

The future work related to this research line will be centred in:

- Specification of more complex CEIP scenarios to find more detailed requirements to be addressed in a much more detailed definition.
- Definition of a Collaboration Environment Description Language CEDL
- Detailed Modelling of the CE instantiation concepts and activities using Model Driven Architectures (MDA).
- Detailed definition of the interfaces to be provided by specific CE to support the CEIP which has been proposed in this paper, including them as a part of OCA results. It is planned to OCA token pass to another portfolio project during next ICE 2008 in Lisbon.

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