# Distributet Concurrent Design

(Process Description)



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# **1** Introduction

This process description for Distributed Concurrent Design (DCD) is result number 4, from work package number 2, in the UnderstandIT project. The UnderstandIT project has financial support from the European Union, it belongs to the Leonardo da Vinci -Transfer of Innovation program and it is a part of the Lifelong Learning Programme (UnderstandIT 2011).

The aim of work package number 2 in the UnderstandIT project is to learn how to use the Concurrent E-Learning Design (CCeD) method and to adapt this method to the aims and objectives of the understand IT project. In the project application we find the following short description of result number 4: A CCeD process description adapted to the UnderstandIT project, included a Mindmap framework to be used to transfer the Vitae results to new user-groups.

The process which is described in this document is in accordance to the project application a continuation of the CCeD method. CCeD is a concurrent design method for design of cooperative e-learning solutions and more information about the CCeD method is to be found in Strand & Staupe (2010).

The main difference between Concurrent E-Learning Design (CCeD) and Distributed Concurrent Design (DCD) is the distribution of the participants. While cooperation sessions in CCeD are conducted with all participants co-located in a specialized facility for cooperation, so are the cooperation sessions in DCD distributed with Internet as a communication platform.

This process description can be viewed as a synthesis of experience with DCD in the UnderstandIT project. The following experiences are considered relevant in this context:

- First the process was defined on an overall level by people with experience in CCeD.
- Then the process was presented for all participants in the UnderstandIT project during a co-located workshop in Trondheim Norway, in December 2010.
- In January 2011 the first technical session was conducted to check technical matters such as video transmission quality, access to common documents, etc.
- In the spring of 2011, three distributed cooperation sessions was conducted, all of which were evaluated afterwards.
- In the same period (spring 2011), several meetings among those involved in describing the DCD process was held, and in addition a partner meeting where all project partners where represented was held in Lisbon Portugal.
- During the summer 2011 this process description was completed. It is prepared as a mind map using the MindManager (R) software from Mindjet (R). Any Microsoft Word (R) or PDF versions are exported from the MindManager version.

Some parts of this process description, mainly the Benefits of Distributed Concurrent Design section, is based on an article currently under peer review. This article is also written by project participants in the Understand IT project. This process description is written by Knut Arne Strand and Tor Atle Hjeltnes, both of which have been involved in facilitating distributed concurrent design in the UnderstandIT project.

# **1.1 Process Description for Distributed Concurrent Design**

This process description contains basic requirements for Distributed Concurrent Design (DCD). We consider DCD as a methodological approach that builds on computer supported cooperative work and concurrent design. On this basis, we put forward the following definition:

Distributed Concurrent Design (DCD) is coordinated and multidisciplinary collaboration where different forms of communication are used to develop knowledge and make decisions regarding products under development. Optimal interactions between involved parties, the processes and the tools they utilize are important for this to work and utilization of workspace awareness is important for optimal cooperation.

Successful DCD has an overall need for communication, coordination, collaboration and workspace awareness to support the needed interactions between involved people, the processes and the tools. When we present the requirements for DCD in this process description we have: (1) this introduction which says something about the background of this work, (2) a section with benefits of distributed concurrent design which is largely based on theoretical considerations, (3) a section about the people involved, (4) a section about the process for DCD- projects, (5) a section about appropriate tools, (6) a section that deals with the project deliveries, and (7) a section containing the referred sources.

# 1.2 Results from the UnderstandIT project

This work is produced as part of the UnderstandIT project, which is a typical EU project where we among other things should specify and test the distributed concurrent design approach. The project belongs to the Leonardo da Vinci - Transfer of Innovation program, it is a part of the Lifelong Learning Programme and it involves19 participants from 6 different countries (UnderstandIT 2011).

One of the work packages (WP2) of the UnderstandIT project aims to utilize distributed concurrent design for further development of existing courses for teachers' use of ICT within vocational education and training. This means that the courses should be adapted to four new countries (Lithuania, Italy, Portugal and Norway). The delivery from this work is twofold. On the one hand, a design document that explains how the courses will be organized in the respective countries should be produced, and on the other hand we should produce a business plan covering how to produce and deliver sustainable courses for the respective countries. This work consist of interdisciplinary tasks since we must take into account the academic content and the kind of knowledge, skills and attitudes the students should acquire, the teaching methods, pedagogical activities or learning events that should be conducted, language and cultural differences from each country and factors that affect the business plan of each respective country. Moreover, much of the work has to be carried out distributed since it is neither economically possible nor practical to meet physically for all activities required to complete the work. This was the underlying motivation in relation to specify and test the distributed concurrent design approach, and from this starting point the concept was defined.

When we started using the distributed concurrent design approach in the UndertsandIT project, we first conducted a traditional face-to-face meeting for all project participants. This meeting served as a preparation for the methodological approach and the tools to be used. Then we made a plan for four distributed concurrent design sessions, all of which should help us reach the goals of this actual work package. After each cooperation session, we conducted an oral evaluation and an online survey in which all session participants were asked questions related to how the preparation and implementation of the session have worked. This investigations have attempted to capture both technological and more interpersonal or social relationships. Furthermore, we have used students writing bachelor thesis in distributed concurrent design as passive session observers. We consider this as a research methodological approach that builds on the principles of ethnography (Blomberg & Burrell & Guest 2003) and the students' observations were immediately written down and distributed to relevant project participants.

# 2 Benefits of Distributed Concurrent Design

Cooperative work is distributed in principle (Schmidt, 2009) and it consists of communication, collaboration, and coordination which are considered three functional aspects of cooperation (Fitzpatrick, 2003). Furthermore, awareness is found to be both important and challenging for cooperative work. It is important when we work co-located and an additional challenge when we work distributed (Gutwin & Greenberg, 2002; Schmidt, 2002; Erickson & Kellogg, 2000). Because communication, collaboration, coordination and awareness also are important for Distributed Concurrent Design (DCD) we choose to focus on these four items in this theoretical section.

# **2.1 Communication**

A central part of Computer Supported Cooperative Work (CSCW) deal with computer-based communication between distributed people and the aim is to design systems that support both deep, coherent, and productive communication (Erickson & Kellogg, 2000). It is also important to support the need for informal and spontaneous communication when groups are geographically distributed (Schmidt, 2002). This is due to the fact that much of the communication is informal and that creativity often flourishes in the informal communication.

A large part of the communication that takes place among knowledge workers are conversations, in which knowledge is created, developed, assessed and shared between the involved parties. This form of communication is also used as a medium for decision making. Through conversation, we establish a common ground, we exchange experiences, we interpret what is being said, check that we have been understood correctly, provide new contributions and make decisions. Furthermore, we should strive for making the knowledge that emerges from conversations reusable. In this way the conversation may be a product that others can use and analyze retrospectively (Erickson & Kellogg, 2000).

It is also important to be aware of implicit versus explicit communication when systems for computer-aided communication are designed (Pipek & Kahler, 2006). Communication is not just a separate activity but also an integrated part of doing the work (Schmidt, 2009). The systems must therefore be designed to support implicit communication, and the participants must utilize the possibilities so that communication becomes a direct contribution to the final product.

Communication is perhaps the most important element of DCD. Formal communication must be supported so that we can convey formal information about ongoing work, while informal communication must be supported so participants can meet by chance and exchange information spontaneously. Synchronous communication must be supported so that participants can converse during the cooperation sessions and work simultaneously on the same product, while asynchronous communication must be supported so that participants can work on tasks over time. Communications in multiple channels must be supported, so that participants can discuss things in common (the whole project team) or in smaller expert groups, whichever is the need. Explicit communication should be supported so that parties directly can exchange information, while implicit communication should be supported to make the communication directly affect the product under development. Implicit communication such as to describe design ideas that occurs, directly in the design document which all work together to develop, is an effective way to communicate. The communication must support both the work that actually lead to a product, and the coordination work which is done to optimize the cooperation.

We need to establish a shared workspace that consists of multiple communication channels to support all these communication needs. The products currently under development must always be available so that participants at any time can contribute to the development and thus communicate implicitly. Moreover, the process itself affords with important communication in relation to coordination and workspace awareness. As part of the process we have tools such as session plans, action lists, decision lists, etc., which also could be

considered boundary objects (Star & Griesemer, 1989), and these objects support shared understanding and coordination of work across the project team. It is important that the experts understand each other and that everyone understands common goals and communication is an important mean to achieve this understanding.

# **2.2 Collaboration**

Collaboration is in accordance to the Oxford Dictionary of English the action of working with someone to produce something. Work that involves several persons and contribute to the products being developed are therefore essential and the central aspect of collaboration. To carry out this work computer tools have to be used so that various experts who are distributed can interact synchronously or asynchronously and produce a joint and comprehensive product. There are a number of computer tools, i.e. collaborative software, which can be used. Some are specific to particular disciplines such as computer-aided design tools for product design or editors for instructional design, while others are general and support activities such as collaborative writing, collaborative mind-mapping, etc. It is important to emphasize that the tools we focus on, under the collaboration umbrella, not necessarily are the ones that will be used for communication and coordination, but rather the tools we use to produce the final product.

Knowledge production takes best place in smaller forums where participants feel safe and want to contribute. On the other hand we also want to share knowledge on a broader level of the organization. "One resolution to this tension between privacy and visibility is to support an organizational space within which semiautonomous knowledge communities can exist, each community exercising control over the ways and means through which its knowledge is shared with the larger organization." (Erickson & Kellogg, 2000, p. 69).

There are many tools that can be candidate tools when we are to cooperate to reach a common target. When specific products are selected they may be implemented, configured and used in very different ways. The process to customize the tools to the current situation is often called tailoring (Pipek & Kahler, 2006). The tools must primarily be adapted to different and changing work context. Moreover, tailoring is an activity that can be made jointly to get the tools to suit a particular situation in the best possible way. Collaborative tailoring can contribute positively in relation to the tools that are used but there is an assumption that tailoring mechanisms are available and that a culture for tailoring is established in the organization (Pipek & Kahler, 2006).

The double level nature of work is a concept used to make a distinction between core work activities and work about the work (Fitzpatrick, 2003), and in this paragraph we have collaboration concerning the core work activities in mind. DCD must facilitate collaboration concerning the core work activities, and this is also the main aim of the cooperation sessions.

During the sessions the experts work together to produce results that will be part of the project deliveries. Collaboration is therefore synonymous with production of results, and we need tools that support both synchronous and asynchronous collaboration to deal with this. Our experience shows that conversations actually are important work in this context and that the tools therefore must have the possibility to store main results of these conversations while the work takes place. The use of Google Docs as a platform for document sharing and collaborative writing turns out to work very well in this context. Especially when session preparation activities are to fill out current issues and topics in the collaborative tool (Google Docs), so that all participants have the opportunity to become best prepared for conversation efforts that will actually take place in the cooperation sessions. Sensible conversation about current topics and challenges are of greatest importance. This should make us able to handle important decisions that take into account the needs of the holistic and all relevant parties.

## **2.3 Coordination**

Coordination is activities that must be performed when several actors work together to perform a job and this is because there are dependencies between the tasks. These tasks are referred to as interdependent tasks and coordination is regarded as articulation work since this work does not contribute to the final product, but is part of the process that must be followed to arrive at the final product (Schmidt & Simonee, 1996).

Coordination work is to determine the order in which different tasks should be performed, who should perform the various tasks, when it needs to be done, etc., and coordination is needed to achieve a flow of work. Coordination is also tightly connected with awareness of the ongoing activities that constitute a cooperative effort. We become aware of what has happened, what happens, what should happen and to what extent this affects us and the tasks we should perform. Actors who are performing interdependent work need to coordinate and integrate their various actions (Schmidt, 2002).

Schmidt (2002) also highlights monitoring and displaying as two complementary aspect of coordination. We monitor our colleagues by observing, listening, etc. so that we get an overview and are able to adjust our own work and make it fit in with the others. In addition we display what we are doing so that our colleagues can become aware of what is being done, how it is done, etc., and use this information to coordinate their own work.

Coordination is very essential in Distributed Concurrent Design (DCD) since interdisciplinary solutions depend on various experts' needs and these needs must be treated coordinated.

The facilitator(s) plays a central role with respect to coordination. Facilitator's most important role is actually to lead cooperation sessions so that relevant discussions are conducted and decisions are made. In practice, this is to coordinate the session participants most effectively through the session. In addition, the facilitator and/or project manager is also involved in the session planning phase. Session planning can be regarded as coordination of all project participants, so that they get the chance to become well-prepared for the sessions, where the actual work should be performed.

The facilitator has an additional role in relation to coordination in DCD, but distributed coordination is generally an important part of cooperative work that all participants must be aware of (Crabtree, Rodden, & Benford, 2005). In DCD, it is particularly important that the various experts are aware of what other experts have produced, so that new solutions can be built on a joint decision and a common platform that takes the overall needs into account.

#### **2.4 Awareness**

The concept of awareness is very central and important in Computer Supported Cooperative Work (CSCW) research and researchers have been concerned with how computer systems can support awareness from the very beginning of the CSCW research field. Today, however, the concept of awareness is both ambiguous and diluted and researchers do often use adjectives in front of awareness to handle this (Schmidt, 2002). In this process description we have also done the same by focusing on workspace awareness (Gutwin & Greenberg, 2002) which concerns awareness among project participants working in a shared environment or a shared workspace.

Some studies of awareness points out that awareness not necessarily consist of passively acquired information, but it is rather the results of active and conscious actions from both the observer and those being observed (Schmidt, 2002). The term "social awareness" is used to describe mechanisms which help people adjust own activities to others who are co-located with them and social awareness is often mediated by the use of social artifacts in a distributed setting (Bardram & Hansen, 2004). This suggests that the acts of contribution to and utilization of workspace awareness are skills that can be learned and developed further to achieve more effective and efficient cooperation. If we do not manage to take advantage of this, we get a lack of workspace

awareness which in turn is a problem since the consequences are that we do not know what to do and the cooperation will therefore suffer.

Constraints in the shared workspace is also a phenomenon it is important to be aware of. This awareness helps us to exploit the situation in the best possible way with the constraints that exist for us as individuals, for other participants and for the whole group. It is neither obvious which constraints that exist in a digital shared workspace, nor how the diverse constraints affects the different participants. Although this might be a matter of course in physical environments (face-to- face) it is not obvious in a shared digital workspace since equipment's and infrastructure can vary between the different sites and participants (Erickson & Kellogg, 2000).

We are particularly interested in workspace awareness in connection with Distributed Concurrent Design (DCD), which means that participants know what is going on and what others contribute, in the shared workspace.

When it comes to gathering workspace awareness we consider part two of the framework of Gutwin & Greenberg (2002) relevant. Our workspace should support consequential and intentional communication by demanding a separate screen dedicated to video conferencing. In addition, the participants need to have the necessary equipment (web camera, headset, etc.), so that they to the greatest extent possible are able to sense what's going on at the different sites. Likewise, feedthrough from the artifacts is found to be an important source for awareness in DCD. The fact that all participants always have the opportunity to see what the others have contributed, through public and shared documents, is perhaps the most important instrument to coordinate activities and arrive at comprehensive solutions.

The facilitator has a special role in relation to awareness since the facilitator's role actually is to be aware of the contributions from the different participants, so that the interaction between plenum discussions and discussions in small groups can be balanced for the benefit of all. The facilitator uses consequential and intentional communication from the participants as a source to determine when work should take place in small groups and when it must be lifted up in the plenary. Furthermore, the participants themselves are dependent on knowing and understanding what others have contributed, so that their own work and contributions can be coordinated with the others. In this context the feedthrough from artifacts, (e.g. Google Docs), is a very important source of awareness.

# **3 The People Involved**

As with other projects people do also play an important role in distributed concurrent design. The goal is that the involved resources should become high performance teams, which are dedicated to the tasks, have common challenging targets, a set of complementary skills (i.e. technical and functional expertise, problem-solving and decision-making skills and interpersonal skills), have mutual accountability and commitment regarding a common approach. "A team is a small group of people (typically fewer than twenty) with complementary skills committed to a common purpose and set of specific performance goals. Its members are committed to working with each other to achieve the team's purpose and hold each other fully and jointly accountable for the team's results." (Katzenbach & Smith, 1993 p. 21).

It's probably extra challenging to become a high performance team if the participants are distributed. This is partly because the informal communication, which is very important when such teams are established, does not work equally well for participants who are distributed. In any case, it is important to identify who should participate in the project and to decide the role they should be responsible for during the distributed cooperation session. The following sub-sections contain more information about typical roles in a distributed concurrent design project.

## **3.1 Project Management**

Project administration will typically involve the project manager and a few selected people from the project team, which are responsible for planning how the project should be accomplished. This involves determining the project deliveries and their composition, and to decide which experts are needed and which roles they should play, so that the expected results could be produced. Furthermore, one must decide when the project participants should meet for cooperation sessions and what the expectations and goals of each session are. Relevant information for these sessions are summed up and collected in a session plan that consequently is important for coordination.

Project administrative activities are very important in the project initiation phase, and it is important to focus on these coordination activities along the way, to adjust the project direction and ensure that we are heading towards the right goals.

## 3.2 Session Management

Something that is a bit special about concurrent design (whether we are co-located or distributed) is the use of highly intensive cooperation sessions. These sessions are led by a facilitator which is often another person than the project manager. The facilitators should be specially trained to facilitate sessions, i.e. to lead the sessions and contribute to the best possible cooperation among all participants. Parts of a cooperation session take place so that all participants are able to converse while other parts only support conversations between participants in a specific group, e.g., the business plan group and the design document group. This balance between collaboration between some experts, and the entire group is very important for the achievement of comprehensive solutions and one of the main challenges for the facilitators is to ensure that this coordination happens in a sensible way.

In addition to using one or more facilitators (one when co-located and several if different groups partly are working in various digital workspaces), one can also consider using both technical and administrative assistance. Technical assistance (i.e. to be responsible for the technology running smoothly for all users) can typically be performed by a technical assistant, and administrative assistance (e.g. to log the actions, decisions, problems, or solutions) can typically be performed by a dedicated administrative secretary. Use of such roles in the cooperation sessions will relieve the facilitators who can then focus on the important task of managing the interaction between involved parties and arrive at the best possible solutions.

#### **3.3 Domain Experts**

A multidisciplinary and multi-functional team, made up of domain experts that represent different areas of expertise is central to concurrent design. The fact that these domain experts work concurrently and in parallel is contributing to an effective way of work, where comprehensive solutions that satisfy everyone's needs are reached. Any distributed concurrent design project must decide which experts are needed, based on what is to be produced in the project. Domian experts for all relevant knowledge areas, which have the authority to take decisions within their respective disciplines, are very central to achieve the desired progress in the cooperation sessions.

To achieve this one must define the knowledge areas that need to be represented, and also define who should be working most closely together, so that the groups are running optimally. In cases where we have designed e-learning solution for cooperate clients we have used four different domain experts (i.e. an instructional designer responsible for instructional strategies and learning activities (pedagogy), a subject matter expert responsible for competencies to be developed, learning needs and subject content (knowledge), a technical delivery expert responsible for technical matters such as selection of technical platforms, infrastructure, solutions and tools, and a business expert who should take care of business related issues and administrative needs), while we in the Understand IT project used two domain expert groups (i.e. one group responsible for pedagogical questions related to the Vitae Course Design Document and one group responsible for business issues related to Vitae Course Business Plan). What domain experts that are needed vary from project to project.

# **3.4 Evaluation**

Towards the end of a session, typically a session evaluation is conducted. This may be an oral evaluation where all participants contribute, followed up with an online questionnaire.

Facilitators are usually responsible for conducting oral evaluation towards the end of a session, while one needs own people to prepare and follow up evaluation surveys. See separate sub-sections for evaluation under "The Process Used" section.

# 4 The Process Used

The customized process of Distributed Concurrent Design (DCD) have a semi-synchronous approach (Dourish & Bellotti, 1992), where a series of planned cooperation sessions are carried out synchronously using video conferencing equipment's, while the work between these cooperation sessions is asynchronous and supported by common document storage tools and communication channels such as e-mail and chat. We can also state that the process is semi- distributed since the work mainly takes place in a distributed form (distributed cooperation sessions), while some articulation work (Schmidt & Simonee, 1996) takes place between people who are co-located.



Figure 1 shows a general description of the process used in the DCD projects. From the figure we can see that the process consists of three phases (i.e. preparation, implementation and termination) and that some activities are asynchronous while other activities are synchronous. Session evaluation is both synchronous and asynchronous since some evaluation takes place at the end of each synchronous session, while the rest of the evaluation can take place as surveys and other evaluation activities in retrospect.) We can also see that there is no predetermined number of sessions to be conducted, and that each session are prepared, implemented and evaluated. Input to the process is typically the application form and related documents, while the output is intermediate results, evaluation notes, until we eventually have the final results available. See the relevant subsection for more information about these process activities.

## 4.1 Project tailoring

What really distinguishes Distributed Concurrent Design (DCD) from other forms of cooperation is the implementation of the cooperation sessions. This is a set of distributed and synchronous interdisciplinary cooperation sessions where the project participants (different experts) are controlled by a process, and uses some selected and customized computer tools, to achieve the best possible cooperation.

Project tailoring are activities going on at the start of the project. In this context it is important to decide what to produce, when this should happen, who should be involved, the infrastructure and the tools that are needed, etc. Project tailoring are normally the responsibility of the project management team (see separate section for this).

As a result of the tailoring process in the UnderstandIT project we choose to divide the experts into two groups with each group working on their respective deliveries, i.e. a business model and a design document for an e-learning course. Furthermore, we choose to use two facilitators with special responsibility for their respective group.

During the project startup phase technological platforms and technological tools to be used in the project must be considered. Once these choices are made, one should define some rules for how the tools are to be used in the project and communicate this to all project participants. In the UnderstandIT project we choose to use the Adobe Connect Pro web conferencing tool as a communication platform, while we selected Google Docs as a platform for document sharing besides both synchronous and asynchronous collaborative writing. In order to encourage maximum participation from all parties involved we required two monitors with extended display, so that the communication platform (Adobe Connect Pro) could run on one monitor whilst the tools for collaborative writing (Google Docs) runs on the other monitor. In addition, we demand a headset with speakers and microphone, and a web camera of good quality to get the best possible audio and video in the sessions. This we consider as tailoring and customisation to get the best possible environment for communication, collaboration, coordination, and workspace awareness.

#### 4.2 Session preparation and planning

Although, the cooperation sessions are what distinguish Distibuted Concurrent Design (DCD) from more traditional Computer Supported Cooperative Work (CSCW) approaches, we must also take into account the work that takes place between these sessions. It is when we are preparing or following up a session that we really are building the foundation for effective collaboration within the session. Sessions should ideally consist of important and interdisciplinary conversations, which lead to decisions that will ensure comprehensive solutions that meet stakeholder needs. To get the correct focus and an adequate level of this cooperation, the

participants must be well prepared and have the opportunity to familiarize themselves with the themes and issues that are on the agenda for the current session. This means that important coordination work takes place between the sessions in DCD, just to be able to exploit the situation when experts actually meet for cooperative sessions.

Objectives for a technical test session: To establish a connection for all project participants, to talk (check that everybody are able to speak, to present (with Adobe connect), to work i.e. collaborate in breakeout sessions, to evaluate (oral evaluation at the end).

# 4.3 Session implementation

A cooperation session lasts for approximately 3 to 4 hours. Before the session starts, the communication platform (video conference) has to be established so that participants can join up and so that all participants can check that everything is working properly. In this context it is also important to check the access to necessary resources in the workspace. When all participants are connected and the session starts, the facilitator typically make an introduction in which the objectives of the current session are conveyed and then the cooperation starts. While this cooperation is in progress the facilitators will ensure a balance between cooperation across the whole group and cooperation within the groups, i.e. common session versus breakout session.



Figure 2 - A presentation of sessions, teams, deliveries and some tools

Figure 2 shows an overview of the sessions to be conducted in the UnderstandIT project. The figure shows that it will be carried out four cooperation sessions (1 - situation analysis, 2 - a study of possibilities, 3 - selection of solutions, and 4 - review of final product). Furthermore, it shows that there are two different teams (The Business Plan Team and The Vitae Course Team) that cooperate towards their respective deliveries (i.e. the Vitae Business Plan and the Vitae Design Document). After the first session, the two teams produces a situation analysis document (i.e. Business Plan Situation Analysis and Vitae Course Situation Analysis) while after the

second session they produces a study of possibilities (i.e. Business Plan Possibilities and Vitae Course Possibilities). In addition, the figure shows that evaluations are carried out in connection with all sessions and that the Decision List, the Action List and the Brainstorming Notes are common tools available throughout the project. Which team that are needed, what they have to produce, what kind of cooperation sessions that needs to be conducted, etc., are typically decided in the early project tailoring phase and described in a plan such as figure 2 shows.

### **4.4 Session evaluation**

Evaluation of ongoing work, particularly in connection with each session, is an important part of distributed concurrent design (DCD). In connection with each session an oral evaluation is normally carried out, in which all the session participants are challenged to explain how the session and the cooperation has worked. Facilitators are usually responsible for managing these evaluation activities, while all session participants are able to contribute with their evaluation comments.

Moreover, one can conduct online surveys with both open and closed questions, so that session participants can contribute to the evaluation in retrospect by answering the survey. In this context, one need at least a person who is responsible for preparing the survey and it will be a great advantage to know what research questions one wants answered, so the survey can be planned accordingly.

There are several reasons why one wants to evaluate the sessions in the DCD:

- The evaluation is used as part of the preparations for the next session, i.e. we consider what we have done until now and what should be done in future (next) sessions.
- Quality assurance, i.e. to evaluate what has been produced so far in the project and to ensure the best possible quality for the project deliverables.
- The evaluation is performed to improve the process, i.e. a focus on how the session generally worked and what should be improved before the next time.

# 4.5 Project evaluation

Project evaluation is something that can take place both during the project and once the project is about to end.

During the project, when data from any surveys or other data produced in the project are available, the project manager and selected participants typically could conduct their own evaluation meetings, which in turn will shape the further direction of the project.

The last cooperation session of a project can typically be a session where the achieved results are presented. This will normally be an important contribution to, and a foundation for, the project's final evaluation.

# **5 The Tools Used**

Our commitment to distributed Concurrent Design (DCD) is a continuation of Concurrent E-Learning Design (CCeD) and one main difference is that we are distributed with participants sitting around in Europe, although we conduct synchronous and work-intensive cooperation sessions. This means that we have a transition from a co-located workspace to a distributed workspace. (Traditional CCeD sessions are implemented as co-located and synchronous sessions in a specialized facility.)

There are some general challenges for distributed workspaces; e.g. communication, collaboration, coordination and awareness, which is also discussed in separate sections (under "Benefits of Distributed Concurrent Design") in this process description. We have to deal with these challenges when DCD is established and this means that challenges concerning communication, collaboration, coordination and awareness must be considered when we choose which tools to use in the shared workspace for distributed concurrent design.

It is in many ways a fluent transition between communication, collaboration, coordination and awareness, and the same tools can sometimes be used to achieve all this. Although we have this fluent transition between these properties we choose to discuss them separately here. The following four sections discuss these respective challenges in relation to suitable tools on a general basis, before we present a section where we show the specific tools used in the UnderstandIT project where DCD is applied.

## **5.1 Communication Tools**

The most important communication channel, when we perform synchronous and work-intensive cooperation sessions, are video conferencing. Today, there are a number of web-based video conferencing tools that can be used in this context and these tools can be a good option if we are to meet for distributed communication across organizations and countries. With Internet access, a webcam, microphone and speakers we have what it takes to establish a communication channel that can work very well. In relation to distributed concurrent design (DCD), we recommend that the session participants use at least two monitors, so that they can have a dedicated monitor for video conference communication. Furthermore, we recommend using a headset with microphone for optimum sound quality. It is also appropriate to split the conference in several parts with their respective participants, meaning that some communication takes place in plenary, while other communication takes place in small groups. These groups are typically expert-groups who have a responsibility for their respective parts of the total delivery from the distributed concurrent design project.

In addition to the video conferencing tool, which is regarded as the main channel for synchronous communication we also use several other communication tools, mostly for asynchronous communication. This can typically be instant messaging, e-mail or web sites for the exchange of information and collaborative writing. We have to define what communication tools that should be used, and in some contexts we also must define how to use them. For example in relation to the use of video conferencing, we might need someone who is responsible to host the service, while the facilitators have an overall responsibility for managing communication between the involved individuals and groups.

# **5.2 Collaboration Tools**

Collaboration is the joint work we are doing to produce our results. Much of this work is going on as conversations and the video conference equipment's could therefore be considered both as collaboration and communication tools.

In addition, it is typically the tools we use to document our results we regard as collaboration tools. These can be subject-specific design tools that support design and modelling in a particular subject (e.g. The ReCourse Learning Design Editor for IMS Learning Design (ReCourse, 2011)), more general tools such as web-based mind mapping tools to co-edit mind maps (e.g. Mindjet Catalyst (MindjetCatalyst, 2011)), simple web-based editors (e.g. EtherPad (EtherPad, 2011)) or slightly more advanced tools for collaborative writing (e.g. Google Docs (Google Docs, 2011)).

An important feature of these tools is that they work for synchronous collaboration with several simultaneous users as well as asynchronous collaboration which typically take place between the cooperation sessions in distributed concurrent design (DCD).

## **5.3 Coordination Tools**

Coordination work is to determine the order in which different tasks should be performed, who should perform the various tasks, when it needs to be done, etc., and coordination is necessary to achieve a flow of work. In distributed concurrent design (DCD) we use several tools to help coordinate our work.

The session plan is one such tool which is used to describe the different sessions that should be perform in the project. A session plan starts with some overall objectives and some general information before each session is described in detail. For each session, the plan typically contains information such as: (1) name of the session (e.g. situation analysis), (2) general information (e.g. that we shall aim at describing what the situation is and what we face in this context), (3) date and time when the session should be performed, (4) URL's to be used to get access to web conferences, shared documents, etc., (5) the people who are going to participate and their respective roles, (6) what kind of preparations that are recommended before the session starts, which documents that are relevant, etc., (7) the objectives for the session and the deliveries that should be produced, and (8) an overview of how the session will be evaluated.

The action list and the decision list are two other examples of tools used to coordinate the work. The action list is used both in and between the working sessions and all actions are registered with id, description, registration date, deadline date, responsible person and status. Status for an action may typically be; R (registered), O (open), C (closed). The decision list contains decisions made in the cooperation sessions and these decisions will normally influence further decisions and the direction of the project. We should register when the decision was made (session), what the decision is about (description), and the status for the decision. Status for decisions may typically be; D (Decided) and TBD (To Be Decided). Both the action list and the decision list are central tools to help gather awareness and coordinate the tasks that must be performed.

In addition to these tools (session plan, action list and decision list) we also have the activities that take place using video conferencing tools, which is also important for coordination. The fact that the participants are discussing matters relating to the project, contains in itself a lot of coordination. In addition, the facilitators have a central coordinative role. In co-located concurrent design (e.g. concurrent e-learning design) we use one facilitator who has a special responsibility to coordinate the participants. In distributed concurrent design, we have chosen to use several facilitators since some conversations are taking place in groups (breakout rooms) and since the same facilitator not are able to simultaneously participate in multiple breakout rooms. The facilitators in DCD coordinate activities by listening to each group, while the facilitators themselves are able to perform mutual communication and thus balance the interaction between group work and plenary work in the best possible way.

#### 5.4 Awareness gathering tools

In accordance to part two of the framework of Gutwin & Greenberg (2002) we could gather workspace awareness from consequential communication, intentional communication and feedthrough from the artifacts.

Consequential communication and intentional communication is primarily achieved through the synchronous communication that takes place using video conferencing equipment's. The fact that we participate in conversations and both see and hear what others contribute is an important source of awareness. Artifact feedthrough could also be gathered from the video conferencing equipment since chat logs, blackboard drawings, etc., which are produced and used during the synchronous cooperation sessions, also are available afterwards.

Furthermore, we are able to achieve artifact feedthrough from tools like the session plan, the action list, and the decision list, besides the collaboration tools, i.e. the tools used for collaborative writing. Tools for collaborative writing, such as Google Docs, often contain a revision history that can be used to see who have contributed to what and when this happened and this could be an important source of awareness.

# 5.5 Specific tools used in the UnderstandIT project

This section refers to specific tools used in the UnderstandIT project. In this project we used Adobe Connect Pro as a video conferencing tool. Adobe Connect Pro was used both for traditional video based project meetings and distributed concurrent design sessions. The distributed concurrent design sessions conducted was hosted from Trondheim (Norway) with the facilitator(s), technical staff and four project participants colocated. The rest of the session participants were distributed and located in six different European countries. All session participants had to join the video conference when a session started, which means that those who were co-located also had their own connection and similar equipment's as the others. The users can be granted three different roles in Adobe Connect Pro. This is:

1. The host - which can specify each attendee's role, set up a meeting, invite guests, add content to the library, share content, and add or edit layouts in a meeting room. The host right is granted to the facilitators when distributed cooperation session are conducted.

2. Presenters - who can share content already loaded into the meeting room from the library. They can share their screen with all attendees, chat, and broadcast live audio and video. Presenters can mute and unmute audio broadcasts on their computers. All participants in our distributed cooperation session, except for the facilitators are set to be presenters.

3. Participants - who can view the content that the presenter is sharing, hear and see the presenter's audio and video broadcast, and use text chat, as well as mute and unmute audio broadcasts on their computers. When we conducted distributed concurrent design sessions we used the facilitators as hosts while the rest were set to be presenters. In distributed cooperation sessions we use this (participant) role only for observers.

In addition to the common video conference room we also established breakout rooms for collaboration in smaller groups. Breakout rooms are a feature of Adobe Connect Pro who turns out to be very useful for distributed concurrent design sessions. With these rooms we can switch from collaboration between all participants to collaboration in smaller groups. Two groups were established in the UnderstandIT project, i.e. the Business Plan Team and the Vitae Course Team, since the final delivery of this project was a business plan for Vitae courses and a design document for new Vitae courses. These two groups were thus responsible for their deliveries and we used two facilitators to achieve the best possible coordination of tasks both within and across these groups.

During a distributed concurrent design session we could claim that we have four different working situations. This is: (1) the startup situation when a connection is established and audio and video is tested, (2) the situation where everybody are able to talk to each other, (3) the situation where slides, documents and other resources are presented to the audience, and (4) the situation where conversations and work is performed in smaller groups. The following figures are intended to illustrate some of this:



Figure 3 - The whole UnderstandIT project team collaborating.



Figure 4 - The Vitae Course team in a breakout session.



Figure 5 - The Business Plan Team presenting some slides in a breakout session.

Google Docs was used both as a platform for a common distributed workspace, i.e. for document sharing, and as a tool for collaborative writing. It was established a project folder, named Understand IT, and several subfolders as needed and there are several advantages associated with this: (1) All working documents are available in one place, (2) it contributes to a structure where everyone can find what they need, (3) everybody can always see and us the contribution from others, (4) both synchronous and asynchronous collaboration (collaborative writing) is possible, and (5) the feedthrough from this artifact, e.g. the revision history, helps us gather workspace awareness.

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Figure 6 – Shared workspace based on Google Docs

Figure 6 shows Google Docs as a common workspace. We can see the project folder Understand IT and several of the sub-folders. In this case, the sub- folder for the cooperative session number three-b (S3b-Selection of solutions second time)) is selected and we can see what documents that is stored in this folder. In this case the session plan is selected. The session plan contains the list of sessions to be conducted and a lot of information concerning each session (see separate section for session preparation and planning under "The Process Used" folder for more information about the session plan).

One can also consider using other tools in the Google Family (i.e. the Google Calendar to provide useful information about the project's activities, the Chat Part for informal communication and as an awareness widget that could be used to indicate whether we are available for the project, Google Sites to provide information which is not stored under the Google Docs folder and to embed information from Google Docs and Google Calendar and have it presented at one centralized place.

In this section, we described how to work with specific tools like Adobe Connect Pro for video conferencing and several tools in the Google Family that together can constitute a shared and distributed workspace. For this to work optimally, we have the following additional recommendations: (1) Use two screens, i.e. one for Adobe Connect Pro and one for Google Docs, (2) a web camera is needed, and (3) use a headset with microphone to get the best possible sound quality.



Figure 7 - Some recommendations regarding equipment for the cooperation sessions

Figure 7 shows some of the project participants in the middle of a cooperation session. We can see that two screens are used: one screen for Adobe Connect Pro (primarily to communicate), and one screen for Google Docs (primarily to collaborate). Furthermore, the participants use a headset (speakers and microphone) and a separate web camera of sufficient quality. This is in accordance to the recommendations we described above.

# **6 Project Deliveries**

To produce project results and deliveries is always very important since these are the very reason why we want to perform the project. Results and deliveries is what we want to produce and they will hopefully remain when the project is finished.

Related to distributed concurrent design (DCD), we talk about two kinds of results. This is intermediate results that typically must be available after a session (different results for different sessions) and the final results or the actual project deliverables which shall be available at the end of the project. These result categories are discussed in the following two sub-sections.

#### **6.1 Intermediate Results**

This is the results that will be available during the project and it is usually in connection with the sessions that they are prepared. By describing fairly detailed requirements for the intermediate results that should be available after a particular session, we can achieve several benefits. Firstly, this will be of great help in the preparation phase, when the session participants make their preparations for the session. Next, it is of great help during the session since knowing what to do and what the expectations are is essential for the best

possible coordination of the cooperative activities. Finally, these intermediate results are of great help later on (later in the project), when the work shall build on previous results and decisions.

Specific examples of intermediate results can typically be: (1) a situation analysis document containing relevant information about the current situation, (2) a study of possibilities document where the purpose is to describe a wide range of possible solutions in relation to the final product which are to be developed, or (3) a selection of solutions document which could contain an evaluation of the possibilities and a selection of solutions which we choose to bring forward and use in the project's final delivery.

#### **6.2 Final Results**

The final result which should be available after a distributed concurrent design (DCD) project, varies from project to project. In some projects we want to produce a design document that describes how a product or a service should be developed, without starting on the real production of the product or service. In other projects it may be that the final deliverables shall be a business plan, a marketing plan, a project plan, a concept study, or perhaps a complete and fully developed product or service.

To determine what actually should be the final results in a project is normally included as part of the project tailoring activities.

As part of the project tailoring activities it is important to decide what to produce, when this should happen, who should be involved, the infrastructure and the tools that are needed, etc. See separate section for "Project tailoring" under "The Process Used" section for more information concerning this.

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