Pilot 2 - Requirements Analysis
Work Package Reference 3.2a
Document E

Scope

This document outlines the requirement analysis for the Pilot 2 project, it specifically covers the definition and analysis of the work flows required in the pilot, the data sharing issues and Quality Assurance (QA) requirements.

Pilot 2 is of the 'joint venturing with local firms' type and it was intended that the pilot be conducted in two phases The first phase addressed the issues of outsourcing work on a new construction project, a swimming pool constructed in the UK. The second phase reverses this situation; the project being built in the Developing Country (DC) and the local firm sub-contracts to the European office to provide 'local presence' and DC specific knowledge.

The involved partners UNINEW, UNIGUY, FB and DK assumed different roles during the two pilot phases and thus develop different communication patterns and styles. Emphasis is on sharing product information, visualisation (phase 1), and partnering styles and sharing 'local presence' information (phase 2) in the design phase and production of CAD drawings.

Overview and Methodology

The methodology adopted to define the requirements is defined in the document http://www.funredes.org/caribcad/private/library/reqan.html. There were several initial discussions with the two commercial partners, FaulknerBrown and Klautky that resulted in a broad outline of their requirements and their methods of working. These were captured and transformed into a model of how information flowed within the context of a project. This initial model was considered and rejected at the Delft workshop in (June 1998) where it was decided that this direction would have been too involved and cumbersome and could not be easily decomposed into tasks. It was agreed that the Pilot 2 group change their view to look at how information crosses the boundaries of the CAD organisations. It was also agreed that the group would take a small part of the design process, dealing strictly with CAD documents. This shift was also taken against a background of the emergent workflow modelling theories and it was decided to move to the "Language Action Approach" from the original "Input Output Approach". This document gives the details of this process and the final workflow model that resulted.

Scenario and Roles

A design scenario was defined centred on the construction a new swimming pool within the grounds of the University of Guyana. This pool had previously been designed and built by FB and there existed a complete set of paper and electronic documentation upon which to base the pilot project. The following roles were defined:

- UNIGUY would act as client for the project allowing them to have a supervisory role on all information flows

- FB would act as the design consultants, responsible for the overall form and function of the building, their responsibility would be to define, initiate and manage the outsourcing of the structural aspects of the pool design.
- DK would act as structural consultants partnering with FB to design and detail specific structural components for FB's acceptance
- UNINEW would play a general role of co-ordination and monitoring.

The specific task to be outsourced to DK was the design and detailing of the pool tank, a major component of the pool building that encompassed the range of technical and operational challenges required for the pilot.

Although it was originally intended to execute the pilot in two phases it became clear that this was not practical within the available resource envelope. It was decided to merge the goals of the two phases into one storyboard outlined as follows

1. A ground survey (borehole report) would be provided to DK to produce a foundation analysis, outlining the design considerations to FB. Simulating the typical local presence of the DC partner.
2. Based upon this FB would provide to DK an outline design with a proposed profile for the pool tank.
3. DK would produce a structural design and concrete detailing and specification for the tank for FBs acceptance, simulating design partnering.
4. During this process above, it would be discovered that the water table was higher than anticipated causing a redesign of certain structural considerations, simulating a reasonable (typical) negotiation and amendment cycle.

Base upon this partnering/outsourcing scenario a set of basic requirements was identified.

Partnering Requirements

Partnering of the form described so far was typically of the way in which both of the CAD bureaus operated in their normal commercial environments. They both had existing frameworks for setting up and managing these kinds of collaborations. When analysed it was realised that these frameworks were based upon the following assumptions

1. A shared/implicit view of the legal framework, roles, responsibilities and liabilities of each partner.
2. An agreed/implicit understanding of the interfaces between each partner and the method of communication over those interfaces.
3. A common/implicit model of the process that each partner undertook, the general sequence of these processes and the "touch points" between the organisations.

It was clear that the way this implicit framework was agreed and managed was through regular "face to face" ad-hoc discussion as the project work evolved. It was initially decided by the University teams that for remote collaboration to be successful this framework needed to be formalised and made explicit so that each partner could understand the modus operandi prior to entering into the partnering relationship.

The main focus of these attempts was on communication interfaces and process models as our primary goal was to define the workflow models to be used in the pilot.

General Communication

Both bureaus were actively engaged in partnering using electronic media and were familiar with the many of the issues of exchanging information electronically. However,

it was clear that their approach to the Internet was to perceive it as an alternative media through which they could perform their normal business processes, the "business as usual" perspective. In essence email was perceived as, a quicker way to send a letter than the postal service, an easier way to send a drawing than the fax. This led two schools of thought within the project, one centred upon communication and communication styles required to work effectively through the Internet, the other on information exchange and support for existing business process. This debate can be found in the FUNREDES document http://www.funredes.org/caribcad/private/methodology the UNINEW document http://www.funredes.org/caribcad/private/methodology.
This document focuses on the requirements as identified by the CAD bureaus, the first of these concerns the purpose and seriousness of any communication.

Communication Control

It is clear that from the CAD bureau perspective any communication carries a legal liability and can be used at anytime in the future to prove or disprove the organisation's culpability. The most significant consequence of this is the degree of control and supervision required over email and electronic data leaving the boundaries of the organisation. Support is required to specify who could issue documents and instructions and who could accept them from other partners. In addition there is a need for any outgoing message to be passed through some notion of higher level control (typically a senior member of the practice) who will have the option, and be deemed to have, check the message before it is dispatched.

Project Centric Communication

All existing communications are stored and managed from a project centric perspective rather than individual centric. It is important that all incoming messages ultimately reside in a project repository rather than the individuals that dealt with the message. Individulas work on several projects so the identity of the project must be clear and the status of the message i.e. For Your Information, As Requested etc.

Roles and Responsibilities

Whilst roles and responsibilities within the context of a project are typically quite well defined, the organisations want to retain control over these with time and to change them as required without necessarily exposing this to external agencies. They require all incoming messages to be clearly associated with a project and a role or an individual within that project.
There are clear roles and hierarchies existing in the organisations (see figure x) and these could be built into future workflows. However, it should be noted that these are fluid, project specific and relate more to an individuals status within the organisation rather than the tasks they perform.

Task and Message Exchange

Speed of transmission is not an issue providing it does not require a CAD operatives time throughout the upload and download process. However, it is required that the operative is aware of the successfulness or otherwise of any transmission. It is unacceptable to send a message and to be unaware that it has not been received for several days. Nor does the operative have to be required to manage the interaction between the organisations. If one party has not responded to a request in the required time frame the reminder should be automatically sent and the operative who requested the action should be notified that the response has not been received and a reminder has been sent.

CAD File Exchange

The key issues relating to the exchange of CAD file types are

- Integrity of the information
- Ownership of the information

The CAD bureaus are already experiencing problems with CAD file integrity, the primary requirement is that the same information content (meaning) that leaves one practice is transmitted to the other. This can go wrong for several reasons

- Data loss due to incompatibilities between CAD applications
- Loss or corruption in transmission
- Misinterpretation or human error

FB use Microstation and DK use AutoCAD, neither wishes to change, and it is a requirement that the graphical information that is transmitted is identical at each end regardless of the packages used. No graphical entities may be lost or have their semantic altered during exchange. The measure of integrity that is applied by the CAD offices is the printed drawing. It is required that the drawing that is transmitted when plotted displays the same information content in both organisations.

Both organisations have experienced problems with data loss during Internet based communication. This can either be total loss due to the large CAD files being rejected by Internet intermediary hosts or partial loss due to file truncation. The latter is a particular problem with text based formats like DXF where the recipient may not notice this partial loss. No information must be lost in transmission.

Misinterpretation can typically occurs due to aspects such as the understanding of hatching conventions, use of English, symbology, different layer management, cultural differences, different construction technology. Clear and agreed definitions of conventions are required.

Control and awareness of the ownership of the information is a key requirement. Neither partner should be able to change the output of the other partner. Whilst both partners saw the validity of exchanging CAD data with the objective of the other partner reusing it, the concerns of liability were perceived to outweigh the resource savings. Where information is reused in this way it must be clear that the provider of such information is not liable for errors in the CAD drawing. For example if a drawing contains a doorway which is drawn as 800mm wide but has a textual dimension of 900mm then the textual dimension will be deemed to be correct not the actual CAD drawing. This clearly reflects current practice where the plotted output is used in arbitration rather than the electronic representation. It raises the question as to when this bridge will be crossed by industry.

Process Synchronisation

This proved to the most difficult set of requirements to assess. Both organisations notionally work to a “plan of work” similar to the RIBA Plan of work. However, neither applied this with rigour, rather they used it as a palette from which they “pick and mix”, even change the order of, items on a project specific basis.

The requirement is that points of synchronisation are identified and agreed by both parties before the work is executed. These synchronisation points form the basis by which each partner programmes their work and allocates their resources. The objective is to ensure that whilst they are working concurrently they can attain points in the project where their contributions are coherent and synchronised.

These initial points of synchronisation are very general and as the work becomes better understood during the execution of the project further definition is given to them.

Based on the pilot scenario a simplified model for the tasks involved and the documents exchanged was proposed (figure x). This shows, at a broad level, the points of synchronisation anticipated by the CAD bureaus that they would expect to agree at the outset of the project.

The University partners initially attempted to build a workflow model based upon this approach by requiring the CAD bureaus to anticipate how they might add further levels of detail to this model. This approach was strongly rejected by the CAD offices who were convinced that this level of detail only arose “through doing” and could not be anticipated.

At the workshop in Delft (June 98) it was determined that this approach to defining workflow models through existing processes and practice was not viable. An alternative approach was proposed based upon the synchronisation of project work through the documents and drawings that were being exchanged and the states that those documents attained.

At the Newcastle workshop(July 1998) this new direction was developed, mapping the lifecycle of a CAD file throughout its usage in a project. In keeping with the directions given at the Delft meeting, these processes were then abstracted into five models as listed below:

1. Create Drawing/Document
2. Edit Drawing/Document
3. Review Drawing/Document
4. Issue Drawing/Document

The developed informal models of CAD centric communication are detailed below.

1. Create Drawing/Document

a. Specify project
b. Identify drawing/document type
c. Identify reference drawing/documents
d. Prepare drawing/document meta data
e. Nominate editors
f. Nominate readers
g. Nominate reviewers
h. Nominate owner(s)
i. Invoke the create operation
j. Receive confirmation of creation
k. Notify owner(s) of its existence

3. Review Drawing/Document

a. Receive instruction that drawing is ready for review
b. Obtain project and drawing requirements (what is needed, brief, etc.)
c. Redline and comment on drawing (This and the next three are not necessarily sequential)
d. Raise queries with editors
e. Issue drawing (make it public) or
f. Invoke a “Edit Drawing “ session

4. Issue CAD Drawing/Document

a. Identify recipient
b. Prepare transmittal advice with notes on previous review, if applicable
c. Transmit package to “public”area
d. Notify recipients of its availability
e. Recipients acknowledge receipt (auto response is desirable)
f. Recipients invoke “Review drawing/document” session
g. If review requires changes the sender invokes another “Edit drawing/document”session.
h. If recipient approves drawing, then Issue for construction.

This proposal was taken to CAD bureaus and compared with their procedures for document management both internally and externally with other partners. This resulted in the high level workflow model described in document H and implemented by work package 2.