1.3 Mediation Systems

Thomas F. Gordon, Oliver Märker

By "mediation", we mean any moderated conflict resolution discourse, regardless of the procedures, methods or tools applied. Since mediation is a kind of discourse, it seems reasonable to assume that information and communication technology can provide some useful support. This assumption is investigated by analyzing the tasks in the standard mediation procedure and matching them with a broad spectrum of methods, tools and systems provided by information technology. The focus here is on trying to identify the specific requirements of *mediation systems* and discussing whether or to what extent these requirements can be met using general purpose groupware systems.

1. Introduction

Our working definition of "mediation" is any moderated conflict resolution discourse, regardless of the procedures, methods or tools applied. That is, except for the mere presence of a mediator, our definition does not place any requirements on the mediation procedure. Our definition of mediation distinguishes it from other forms of discourse, such as deliberation or argumentation, not on the basis of features of a particular procedure, but rather on the basis of its goal: conflict resolution.[1]

At this level of abstraction it would be quite difficult, if at all possible, to investigate whether and to what extent information technology can provide any useful support for mediation. On the other hand, defining mediation in terms of its goals leaves open the possibility of designing novel kinds of mediation procedures which perhaps make better use of the potential of new information tech-

1 See the definition of computer-supported mediation and online-mediation of Märker/ Trénel in this book.

nology. But we do not want to be so presumptuous as to try to develop a completely new procedure from scratch, without taking into consideration the state of the art in professional mediation practice. Thus, our starting point is an analysis of "standard" mediation procedure, from a software engineering perspective. The goal will be to try to identify so-called "use cases", that is roles and tasks, in each of the phases of the mediation procedure. For each use case we will discuss various ideas, resulting from a kind of brainstorming process, about how information technology might usefully be applied to support the tasks of each of the roles in the mediation process.

In this approach, the requirements of mediation are given higher priority than any particular information technology, let alone particular tools or systems. Our research here is requirements, not technology, driven.

The rest of this paper is organized as follows. The next section is a brief whirlwind tour of relevant information technology. After this survey, we outline the standard mediation procedure and identify use cases for each phase of mediation, discussing possible ways to apply information technology to each case. We close by presenting our conclusions and plans for future work.

2. What Computers Can Do

This section provides a brief whirlwind tour of much that information technology has to offer in the way of formalisms, methods, and systems.[2] Our goal in such a paper of course cannot be to provide encyclopedic coverage. Rather, we just want to refresh our memories about a broad range of information technology, to avoid focusing prematurely on particular technologies, such as the World Wide Web.

Here are some categories of information technology which might prove interesting and relevant for use in mediation systems:

Data Collection and Generation. Data "fusion" from electronic sensing devices, such as cameras or microphones; simulation systems for generating data from models; online polls and surveys, using electronic forms or questionnaires.

Modeling and Analysis. Tools for aggregating, selecting, filtering, sorting, clustering and categorizing data; methods for computing functions or deriving inferences, including methods for statistical analysis; procedural or declarative programming languages, knowledge-based systems, neural networks; formal and semiformal methods for constructing, structuring and visualizing models, such

2 In the following, we will use the term tool to generically cover formalisms, methods and systems.

as Petri Nets, flow charts or the Unified Modeling Language (UML); methods for outlining, diagramming, concept mapping and mind mapping; geographical information systems (GIS) for modeling, analyzing and visualizing spatial information.

Authoring and Design Tools. Text or word processing systems; graphics editors; computer-aided design (CAD) tools for drafting complex technical systems.

Storage, Search and Retrieval. File systems; hierarchical, relational and object-oriented databases; metadata; full text search; query languages such as SQL; hypertext and hypermedia systems, in particular the World Wide Web, where information is retrieved by navigating (surfing) explicit links; standards for exchanging structured data, in particular the Extensible Markup Language (XML).

Networks. Communication protocols for computer networks, in particular the Internet; methods for *pushing* information from senders to receivers, such as e-mail, instant messaging, notification services, or chat; methods for *pulling* information from a server, such as distributed hypertext systems, shared workspaces, discussion forums and bulletin boards.

Security. Methods for encrypting data and restricting access to sensitive data or documents to particular persons or groups; digital signatures for authenticating documents; journals, protocols or logs allowing changes to be traced.

3. Use Cases of the Standard Mediation Procedure

Although any moderated conflict resolution procedure can be considered mediation, we focus here on conventional mediation practice, as articulated by Troja (2001) and others. This standard mediation procedure consists of the following six phases:

1. Preparation and Mediation Agreement,
2. Information and Issue Collection,
3. Interest Clarification,
4. Creative Search for Options and Ideas,
5. Evaluation and Selection of Options,
6. Agreement and Monitoring.

When mediation is used to try to resolve public conflicts, such as city planning or environmental issues, at least four roles can be identified:

– *Mediator.* The person (or persons) who organizes and moderates the mediation process.

- *Inner Circle.* The representatives of the various organizations and interests groups who actively participate in the mediation procedure.
- *Outer Circle.* The organizations and interest groups represented in the procedure; also called the *parties*.
- *Public.* The general public, including but not limited to, the members of the organizations and interest groups participating in the procedure.

It would be possible to further differentiate these roles, for example by distinguishing the members of the represented organizations from other members of the public, such as the press. But we prefer to begin our investigation with this simple model.

In addition to the six mediation phases and four roles, three "levels" of issues or topics can be identified:

- *Interpersonal.* Issues about relationships among the actors involved in the mediation process, in particular interpersonal conflicts among members of the inner circle.[3]
- *Process.* Issues about how to conduct the mediation process itself.[4]
- *Subject.* The issues primarily intended to be resolved by the mediation process, for example issues about the acceptability or appropriateness of a proposed site for a new airport.

3.1. Phase 1. Preparation and Mediation Agreement

The preparation and mediation agreement phase consists of three main tasks: analysis of the conflict, clarification of organizational and procedural issues and negotiation of a mediation agreement. At the beginning of this phase, the persons and organizations with the mediator and outer circle roles have been identified. The events culminating in the conflict, recognition of the need for mediation and selection of the mediator all precede the mediation process per se and are not further elaborated in the standard mediation model.

One of the organizational issues to be resolved in Phase 1 is the selection of the members of the inner circle, i.e. the representatives of the conflicting parties who will be sitting at the roundtable.

Since the usual face-to-face meetings of the inner circle do not yet take place in this phase, critical questions about the suitability of computer facilitated communication for mediation seem less relevant here. On the contrary, since the

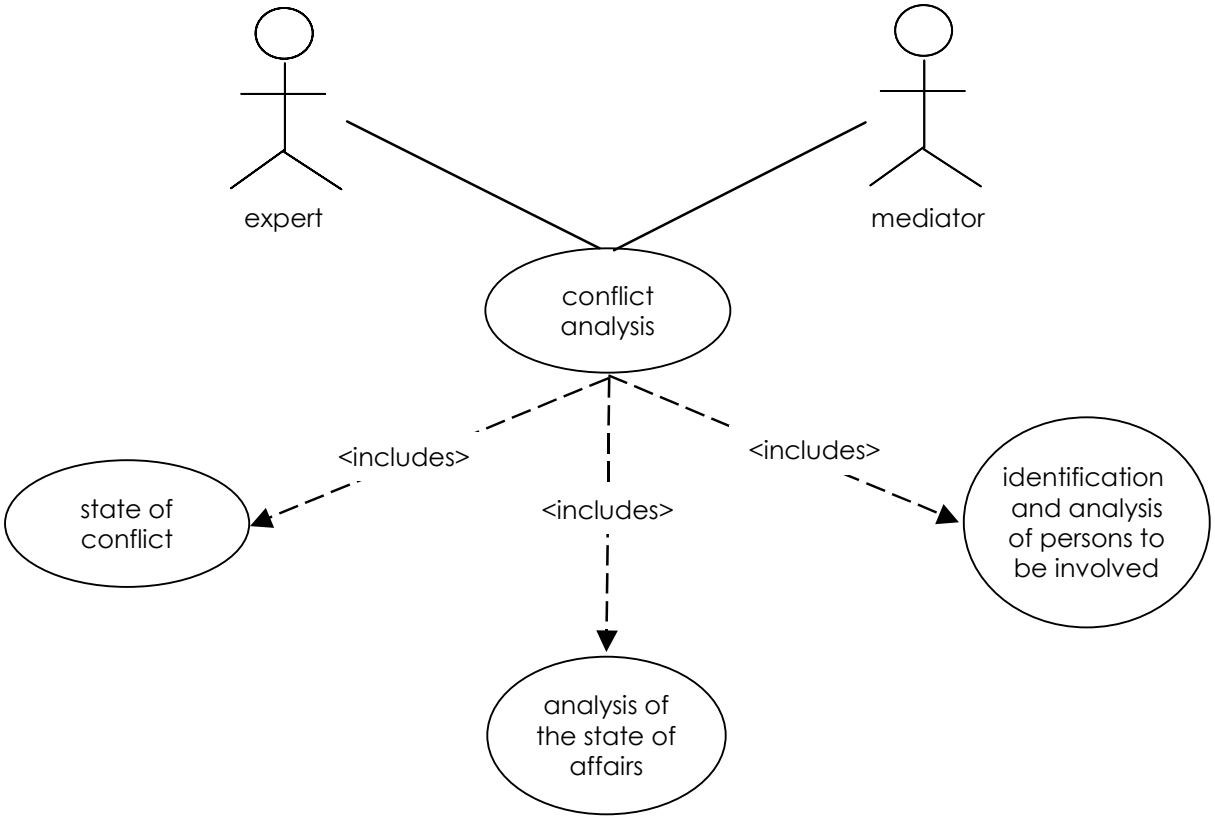
3 See also Fietkau in this book.

4 See also Märker/Poppenborg, Hohberg/Luehrs, or Voss/Röder/Wacker in this book.

communication required in this phase is primarily asynchronous and can involve a fairly large number of members of the conflicting organizations and possibly the general public, computer mediated communication would seem to be especially appropriate.

The first task of Phase 1 is conflict analysis (Troja 2001) – Figure 1. This involves analysis of the situation, the involved persons and organizations, the status of the conflict and development of a detailed plan for the mediation process.

Fig. 1: Conflict Analysis (Phase 1a)



This requires first gathering information about the conflict. If this is a public conflict, some information might be available on the World Wide Web. Discussion forums, online surveys and polls could be used to collect additional information.

After some information has been collected, various modeling and analysis tools could become useful, for structuring and visualizing social relationships, values and value conflicts (Renn/Webler 1998). Popular spreadsheet and charting programs could be useful, especially for working with quantitative data. In

complex cases, packages for statistical analysis might be appropriate. Special purpose authoring programs originally designed for screenwriting might be useful with their support for developing characters and plots.[5]

The next task of Phase 1 is to clarify the organizational and procedural issues of the mediation process. The participating organizations and interest groups will need to select their representatives for the inner circle. Each organization will likely have its own procedure for making this decision. Decision-making processes vary widely among organizations. Although the top-level management of many organizations may decide such issues in a small group, other organizations may want to enable the broad participation of its membership. Online discussion forums and polls could be useful here.

Once the inner circle has been identified, the mediator and the members of the inner circle will need to clarify the subject matter and goals of the mediation process and develop both a set of principles, rules or guidelines for conducting the procedure and a detailed schedule and plan. Since the specific rules for conducting the mediation process are under development at this stage, this process is regulated only by the generally applicable social conventions of the community.

Although some face-to-face meetings may be indispensable at this stage, information technology can be useful for preparing the meetings and documenting their results.

To prepare meetings, shared workspaces can be used to securely exchange documents among members of the inner circle; group calendars and scheduling programs can help to find suitable dates for meetings and to also remind users, by e-mail for example, of upcoming events; online discussion forums can be used to discuss the agenda; mind-mapping software can be used to structure and visualize the options raised in the discussion; decisions can be made using online polling software to conduct a vote; and e-mail can be used for "shuttle diplomacy" between the mediator and individual members of the inner circle.

An online address book can be set up for sharing such information as the names, addresses, telephone numbers and e-mail addresses of the members of the inner circle and could be used as a mailing list, making it easy to send e-mail messages to some or all members of the group. This address book could also be used as a central store for passwords and digital signatures, for authentication and other security purposes.

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5 "Screenwriting" is the writing of scripts for theater, television and film. For examples of screenwriting software, see: http://www.ballisticware.com/storydevelopment.html or http://dir.yahoo.com/Business_and_Economy/Shopping_and_Services/Computers/Software/Writing/Screenwriting/.

In some cases, the meeting itself could take place online, as a video conference. Even when it is deemed preferable to have a conventional face-to-face meeting, information technology can be useful for projecting presentations and interactively structuring and visualizing information, as an alternative to conventional moderation media such as flip charts and pin boards.[6]

Creating the rules, plan and schedule is a negotiation process.[7] Since the negotiation here is about the rules, plan and schedule of the mediation process, several kinds of tools could be useful here:

1. Tools for modeling and visualizing the events and actions of the plan,
2. Tools for modeling and visualizing the rules of the procedure,
3. Tools supporting negotiation discourses.

There are several well-established formalisms for modeling processes, such as Petri Nets and Finite State Machines, which could be applied to the problems of modeling events and actions. Some of these formalisms have been used in so-called "workflow" systems, which are typically used to model and then coordinate the flow of documents through an organization. The development environments for workflow systems often include visualization and, sometimes, simulation tools for these workflows.

Workflow systems typically do not provide a way to model rights and obligations, i.e. the rules of the procedure. This is especially important if violations of the norms are anticipated: The model should continue to apply in the face of violations; it must express how the rights and obligations are modified when violations occur. This is an active area of research. For example, Prakken and Gordon (1999) develop a formal model of Robert's Rules of Order (Robert 1915).

This is possibly one of the most interesting research areas for future mediation systems. The goal would be to develop a formal model and accompanying tools which not only help a group to construct a model of the mediation process, including its guiding rules, but also a monitoring system which helps the group to perform the process in accordance with the agreed-upon rules. The monitor could remind users of their obligations and tasks and handle rule violations, for example by informing the mediator or other members of the group. The monitor might be able to prevent some violations, but keep in mind that an important

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6 See, for example, the moderation software of the Pinking company at http://www.pinking.de/.

7 Mediation processes can use negotiation and other kinds of discourse to handle tasks, even though mediation itself is not defined as a kind of negotiation. Our working definition of negotiation is a deliberation process in which the goal is to try to reach an agreement.

goal is to avoid the inflexibility of workflow systems which require users to act exactly as prescribed by the rules.

Regarding negotiation support, there are systems, some commercial, which support negotiation, but typically these are restricted to rather simple kinds of negotiation tasks, such as finding a compromise value along a quantitative scale which is acceptable to all parties, usually a monetary amount. More complex negotiations with many parameters can presumably benefit from a broad range of tools.

Fig. 2: Mediation Agreement (Phase 1b)

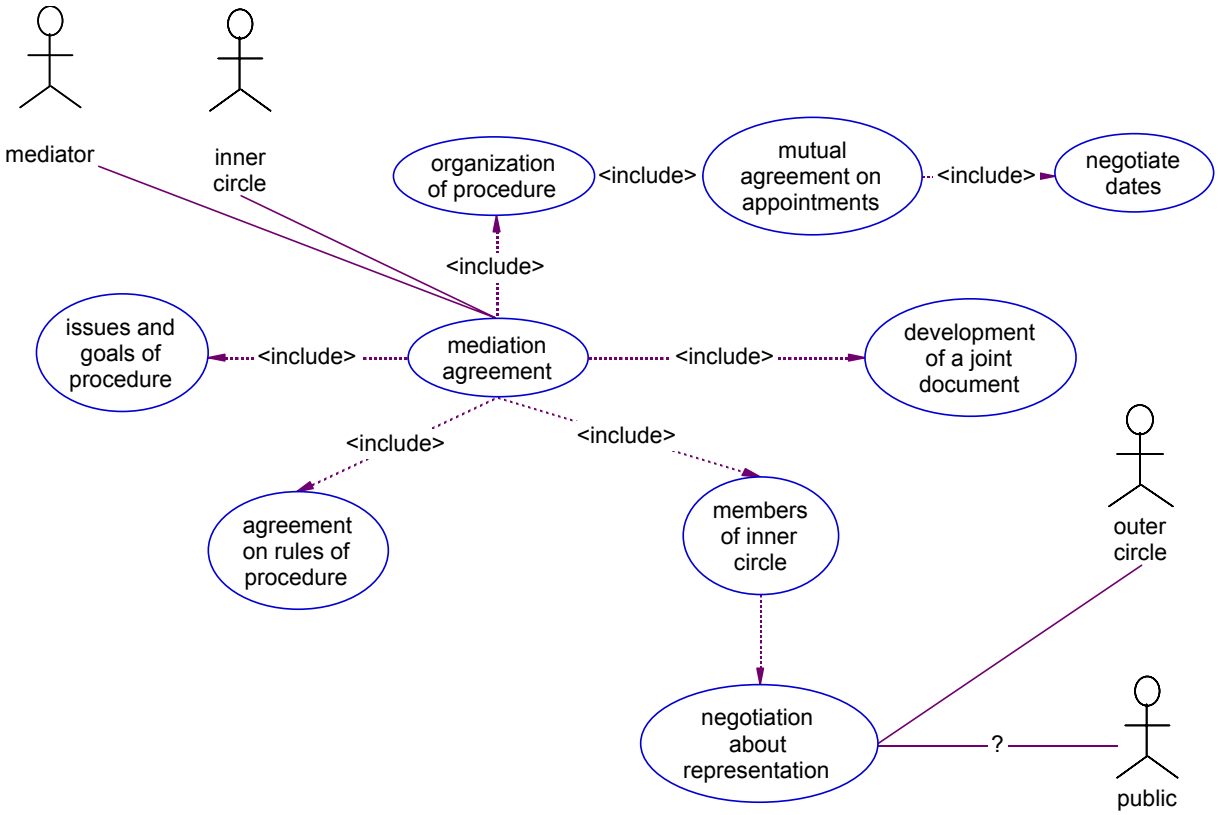


Figure 2 illustrates the final task of Phase 1, formulating the mediation agreement. This is related to, but not the same as the task of negotiating the process norms and plan. Here the job is to put the norms and plan to paper, i.e. to collaboratively author a document.

Document assembly systems have been developed for helping to write legal and other kinds of documents which make frequent use of "boilerplate" or canned text segments (Lauritsen 1992). The most advanced document assembly systems use a knowledge-based system to guide the user through an interactive

dialog to construct the document (Gordon 1992; Branting et al. 1998). Perhaps such a system would be useful for common kinds of mediation cases.

It could be used as the starting point for further editing, using collaborative authoring tools such as the Digital Document Discourse Environment (Sumner/ Shum 1998).[8] Such systems provide convenient ways for a group to view, edit and discuss a document stored in a shared workspace on a network. The comments about the document are linked to the sections commented on, and vice versa, so that it is very convenient to navigate back and forth between the document and the discussion.

3.2 Phase 2. Information and Issue Collection

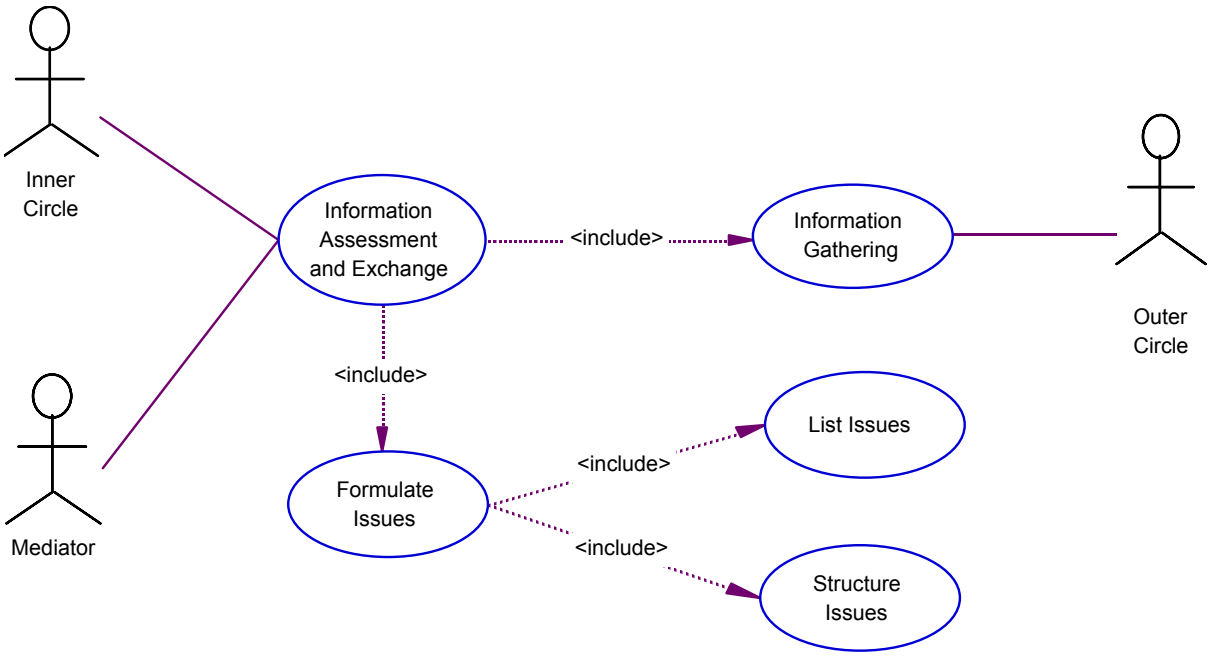
After the mediation agreement has been made, the work of the inner circle on resolving the conflict can begin in earnest. Figure 3 illustrates the use cases (tasks and roles) of the this phase.

The first task is collecting and exchanging information among the members of the inner circle, with the dual purposes of establishing a common basis for an informed solution and resolving as many actual and potential conflicts due to differing sources of information as possible. For this purpose, as in Phase 1, it might be useful to set up a shared workspace, protected by an access control system, to assure that only members of the inner circle can view the documents to be shared. Again, a shared workspace is a kind of file server on a computer network, such as the Internet, which provides convenient ways for a group of users to upload, describe, and search for documents in an area secured by access rights managed by the group itself. Some shared workspaces also provide ways to add information describing the documents, so-called metadata, which can later be used to assist retrieval.

An advantage of shared workspaces is that it is possible and convenient to allow access to the documents to others outside of the inner circle if desired. Selected documents can be made available to members of the outer circle, the press or the general public.

8 http://d3e.open.ac.uk/

Fig. 3: Information Gathering and Exchange (Phase 2)



The next task of Phase 2 is to gather and structure the subjects or issues to be discussed in depth during the proceedings (Troja 2001). An online discussion forum could be used to collect issues, either instead of a face-to-face meeting or as a way to save meeting time by collecting ideas in advance.

The mediator could then use a graphical visualization tool, such as Inspiration,[9] to group or otherwise structure and visualize the issues submitted to the forum. Some of these visualization programs can generate an image map, i.e. a graphic with embedded hypertext links. For example, links can be made to point to the contributions of the forum. If the shared workspace system is Web-based, as most now are, the image map can be made available to the rest of the group by storing it in the workspace. By opening this image map with a Web browser, the user can quickly access and view the documents referenced by the embedded links, just by clicking on figures shown in the image map.

Some discussion forum systems have their own structuring and visualizing features built-in. Typically there is some way to reorganize the tree of articles, to label articles with the names of speech acts and often to associate labels with mnemonic icons. For example, labels can be created for such speech acts as claim, issue, argument, question or answer. These labels are usually created and assigned in an ad hoc manner, but some systems, including our Zeno system[10],

9 http://www.inspiration.com/
10 http://zeno.gmd.de/

have built-in support for one or more speech act grammars, such as the Issue Based Information System (IBIS) model of argumentation (Kunz/Rittel 1970; Gordon/Karacapilidis 1997; Märker/Schmidt 1999; Märker 1999). With these grammars users can define which speech acts are allowed as responses to prior speech acts in a tree of articles. For example, the grammar might specify that a position statement can be followed only by a pro or contra argument.

By agreeing to use such a grammar, a group raises the level of formality of the discussion. Although this may seem somewhat rigid, such conventions can facilitate a more objective, goal-directed, and constructive discourse, helping to discharge and counterbalance the level of emotional response in situations of aggravated conflict.

3.3 Phase 3. Interest Clarification

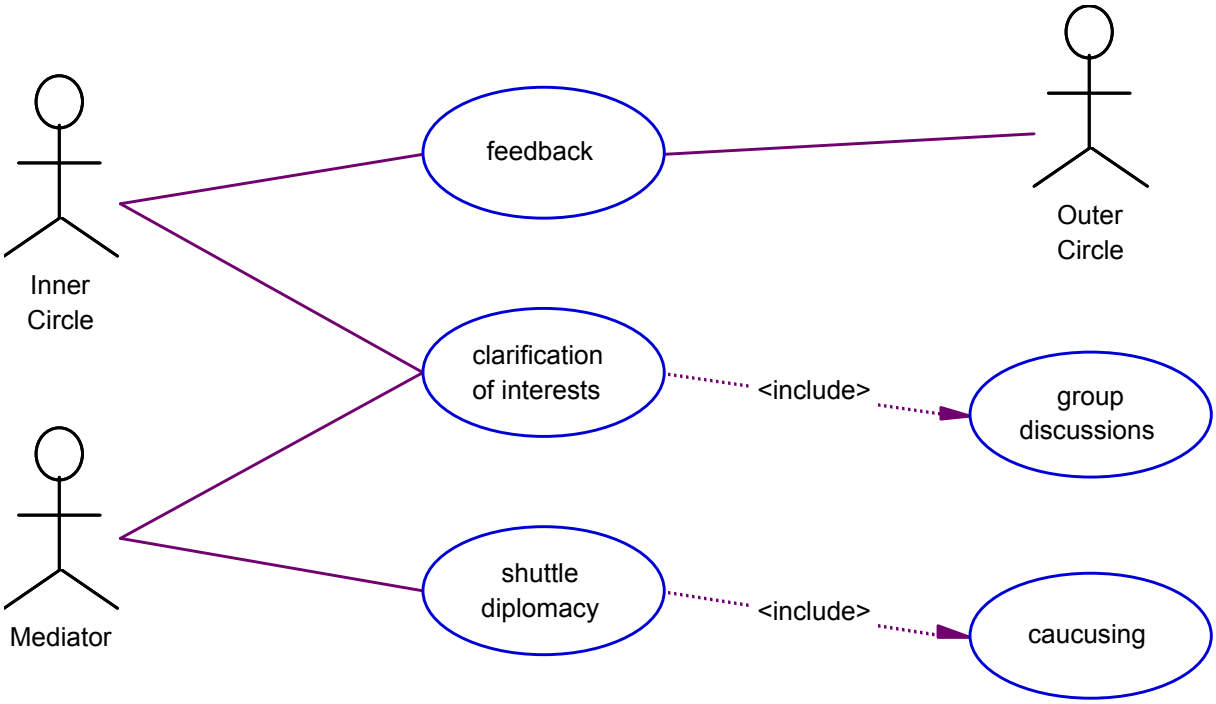
As in the Harvard school of negotiation (Fisher et al. 1983), the standard mediation procedure places a great emphasis on the early recognition and clarification of the interests behind conflicting, or seemingly conflicting, positions. So rather than immediately beginning the search for solutions after collecting issues in Phase 2, the procedure first tries to discover and identify the underlying interests of the parties. Figure 4 illustrates the use cases of Phase 3.

> "The parties describe why the issues which have been collected are important to them, why they are in favor of or against particular actions, and the requirements which should be met by any solution they could find acceptable. In this phase the reasons for the different positions are worked out. These interests are the foundation for the later search for solutions which can be carried by all interested parties" (Troja 2001, p. 15).

Here again an online discussion forum, or perhaps a synchronous chat tool, might be a useful tool. Many chat systems and discussion forums make it possible to take part in the discussion anonymously. One way to illicit frank and open statements about interests might be to set up an anonymous forum in which also members of the outer circle can actively participate. This could increase the number of potential active participants sufficiently to make it difficult or impossible to guess the true identity of each contributor.

Discussion forums typically have the advantage of keeping a protocol or record of the discussion, making it easier for the mediator to later structure the contributions to show related interests.

Fig. 4: Interest Clarification (Phase 3)



A related idea would be to used a computer-based role playing game. In such a game, the mediator could define a set of roles, perhaps real roles from the organizations involved in the conflict, and each member of the inner circle could, possibly anonymously, assume these roles. The rest of the system is much like a chat group or discussion forum; the main difference being that users should try to stay in character when they make contributions.[11]

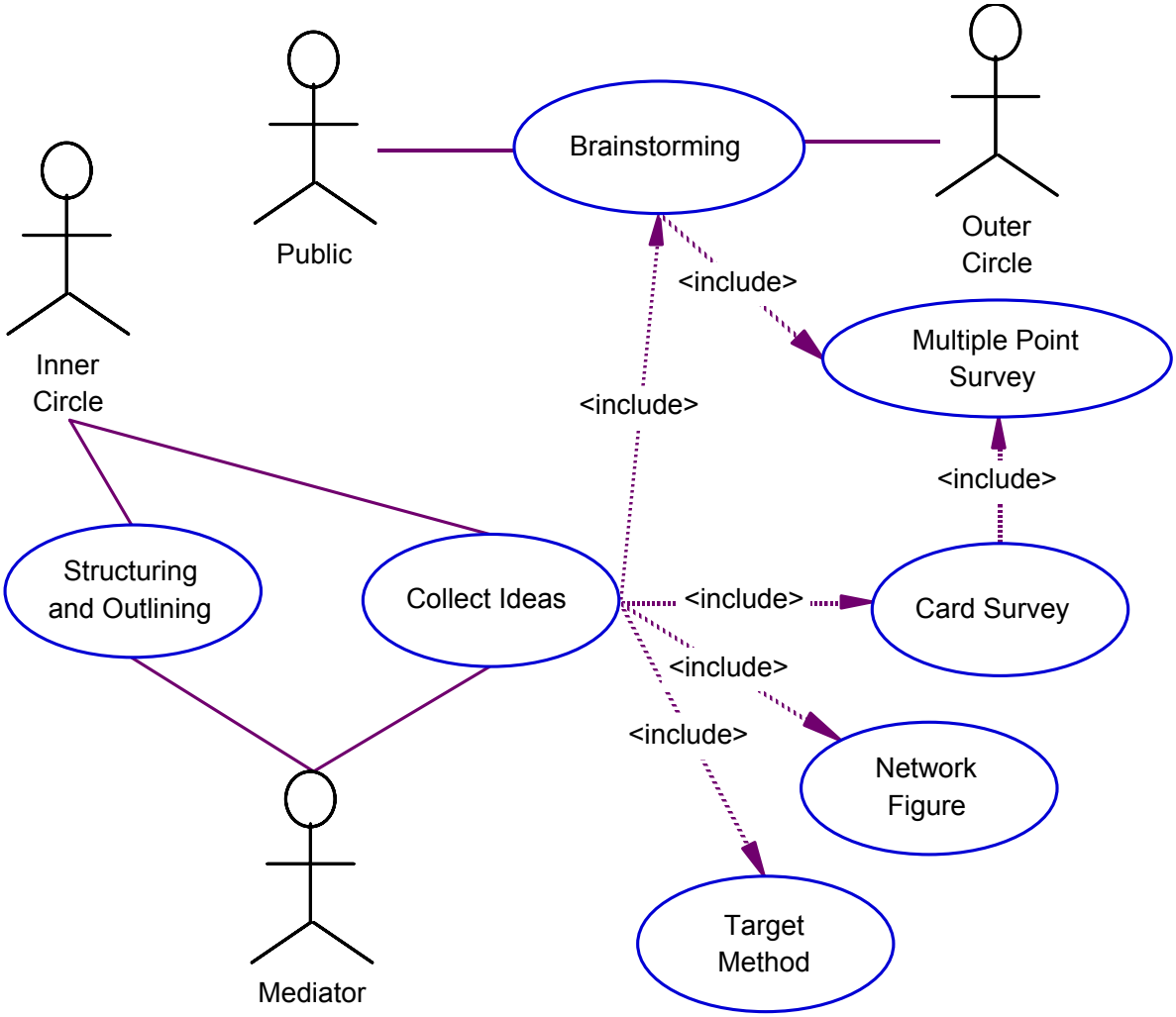
It might also be useful to break up into smaller groups, or to have each representative in the inner circle moderate an online discussion with members of the outer circle from his or her organization with the goal of trying to clearly identify the interests of this organization. The representative could then report back to the inner circle, possibly by submitting an article to an online discussion forum which has been established for this purpose. One can imagine software which helps the mediator to select the members of a subgroup, using information about the interests, background and experience of the members of inner circle and the requirements of the particular task to be handled in the subgroup. But it is doubtful whether there is much need for this kind of support, given the small size of the inner circle.

11 See also Schmidt-Belz and Voss/Röder/Wacker in this book.

3.4 Phase 4. Creative Search for Solutions

In Phase 4 the main task is to creatively open and explore the space of possible solutions. Ideally, an option will be discovered which can be accepted by all parties. Figure 5 shows the use cases of Phase 4.

Fig. 5: Creating and Searching the Solution Space (Phase 4)



As Schenk/Schwabe (2000) and Fietkau et al. (2001) both notice, "divergent communication processes", where the goal is more to expand the space of possible solutions rather than trying to converge towards a single solution, can be usefully supported by computer-facilitated communication systems:

> "The gathering of creative conflict resolution possibilities can be well supported by computers. It has been shown that in this way more and qualitatively better ideas can be

found than in face-to-face communication without computer support" (Fietkau et al. 2001, p. 133).

Various moderation methods for generating ideas have been developed for face-to-face meetings, especially the well-known brainstorming method. Since the goal of brainstorming is to generate as many alternatives as possible, it could make sense to solicit the participation of the outer circle. An online bulletin board could be set up for members to post suggestions, anonymously. A discussion forum could be used for this purpose, but would be less appropriate here, since the goal is to gather many alternatives without much discussion.

After the time period allocated to idea generation has expired, the next task is to cluster and categorize the ideas. The conventional moderation technique for this uses cards posted on a pin board. The participants make suggestions for clustering the cards. If there are objections to some suggestion, reasons for and against the suggestion are collected by the moderator for a brief period of time. If consensus cannot be reached, the moderator notes and visualizes the disagreement. Otherwise silence implies consent. After the clusters have been completed, proposals for naming, i.e. categorizing, are collected. Here again, disagreements are settled by collecting arguments for a brief period, after which the consensus (or disconsensus) is noted and visualized by the moderator.

Information technology might be applied to improve this procedure in several ways. Visualization software can replace cards and the pin board. There are fully automatic methods for clustering texts, however it is not clear whether these would work very well with very brief expressions of solution ideas. Another idea would be to write a kind of online questionnaire which enables each participant to first cluster all of the ideas alone. The software would collect these clusters and then apply some statistical procedure to generate a collective clustering. This could be viewed as a kind of voting procedure.

Perhaps a computer voting, polling and surveying system could be useful for supplementing discussion and argument and to quickly obtain anonymous feedback about the state of opinion of the group, even during face-to-face meetings. For this purpose, a wireless network and small portable computers could be used. So-called personal digital assistants, computers small enough to fit in a pocket, are capable of sending messages over short distances via infrared.

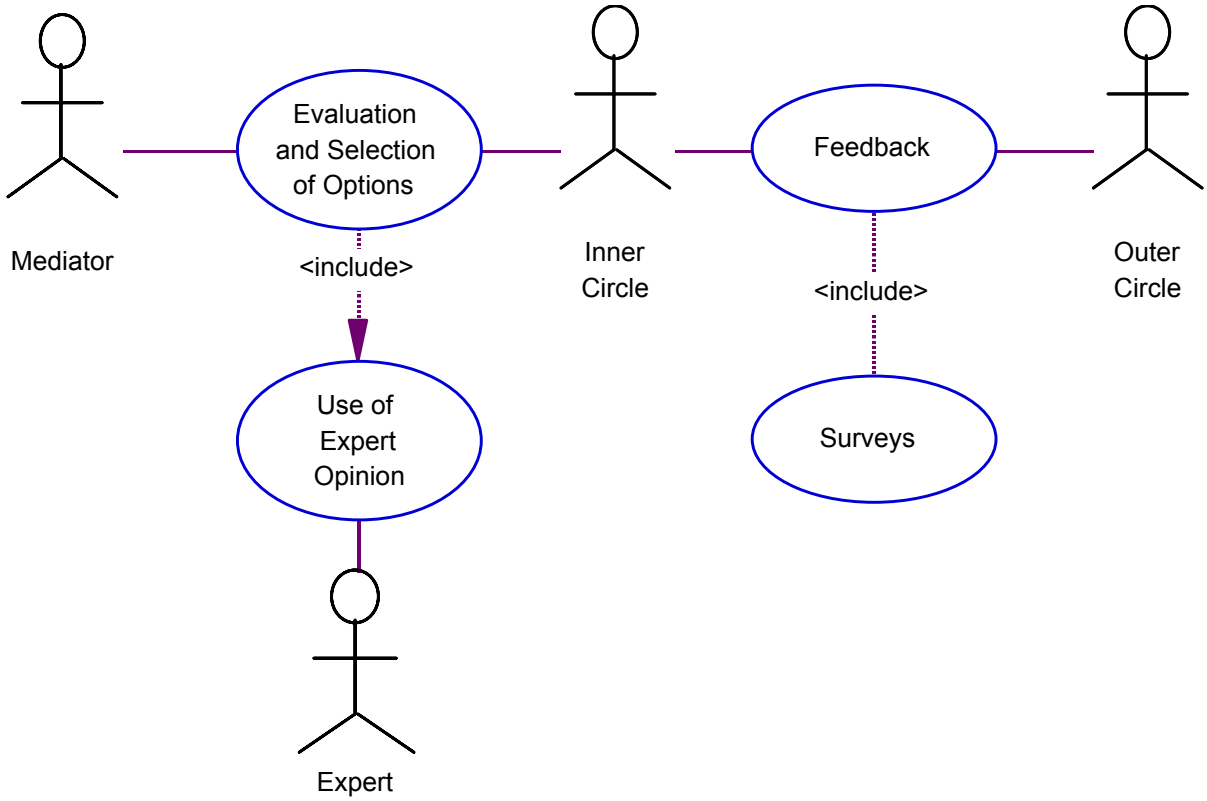
3.5 Phase 5. Evaluation and Selection of Options

The clustering and categorizing in Phase 4 of the alternatives generated during brainstorming was the first step toward reducing the alternatives. This convergence process continues in Phase 5, as illustrated in Figure 5. Here the goal is to

further reduce the alternatives to solutions which, ideally, are acceptable to all of the parties. This is done by evaluating the alternatives.

There are several methods for evaluating options. One is to appeal to the opinion and testimony of experts, using for example the Delphi method. Delphi is an iterative polling method.[12] Experts are submitted a series of questions and have an opportunity to change their answers after seeing the statistical results of the previous poll. Feedback is anonymous to avoid influence on the basis of reputation. The result after a few cycles is an aggregated expert opinion. For evaluation among the members of the inner circle, moderation methods similar to polls, e.g. where participants stick some number of paper points next the cards for the alternatives on a pin board, can be used. Another possibility is to have a moderated discussion, in which participants can argue about the pros and cons of the alternatives.

Fig. 6: Evaluation and Selection of Options (Phase 5)



All of these methods can be supported by information technology. Expert opinion could be gathered using an online discussion forum in which only the se-

12 See also Hohberg/Luehrs in this book.

lected experts have permission to post messages. The Delphi method can be carried out using online questionnaires. In the Ladenburger TeleDelphi experiment, e-mail was successfully used to support a Delphi process (Florian et al. 2000). The results of the polls can be analyzed and visualized using special purpose statistics package or even commonplace spreadsheet programs.

As for argumentation support, a large number of prototype systems have been developed. Ludwig (1997) includes a recent if not comprehensive survey of computer-supported collaborative argumentation systems. Many of these systems, such as our Zeno system, use the simple Issue-Based Information System (IBIS) model of argumentation of Kunz/Rittel (1970). The basic elements of the IBIS model are issues, positions (also called ideas) and pro and con arguments. Notice that IBIS does not model interests. Aside from this limitation, IBIS covers nicely many of the structural elements of the standard mediation process we have been presented here: Phase 2 of the process has the purpose of issue identification; Phase 4 is for generating alternative solution ideas, i.e. positions; and Phase 5 is for evaluating these alternatives, using argumentation among other methods.

In several ways the standard mediation procedure can be viewed as a refinement of the IBIS model. It adds interests to the set of IBIS elements and complements the structural IBIS model, which defines only the relationships between the elements, with a process model controlling the order in which elements are added to the model. For example, insights from Harvard negotiation theory could be applied to identify interests before positions are stated. (In practice, positions are usually stated first and an effort is then made to discover the interests behind them.)

In the Artificial Intelligence and Law community, a great deal of research has been done on developing computational models of legal argumentation (Gordon 1995; see also the special issue on Dialectical Legal Argument in the Artificial Intelligence and Law Journal by Feteris/Prakken 2000). However, there is a fundamental difference between legal argumentation and the kind of argumentation needed in mediation. Legal argumentation is a winner-takes-all "game" between a plaintiff, who has the task and burden of proving his claim, and a defendant, who has the task of attacking the claim in various ways, so as to prevent the plaintiff from succeeding in bearing his burden of proof. Thus, legal argumentation is purely adversarial. In mediation, on the other hand, the goal of argumentation is to collaboratively collect and then weigh the pros and cons of alternative courses of action, with the aim of finding a solution which can be accepted by all the parties. An interesting research task would be to try to

adapt the formal models of legal argumentation to be useful for more collaborative forms of practical reasoning and problem solving.

There are many kinds of Decision Support Systems which might be useful in this phase, depending on the kinds of issues being discussed. For example, Geographical Information Systems would be helpful for evaluating alternatives which have a spatial dimension, such as alternative locations for some new facility. An interesting development in this regard are hybrid systems which tightly integrate modeling and visualization systems such as GIS with structured discussion forums (Pipek et al. 2000). For a limited number of issues, multi-criteria decision-making methods from operations research are applicable as well. These methods require the identification of the features of the problem and the formulation of utility curves for the values of each feature. It is difficult to reach agreement about these elements, which are required by the model before the optimization techniques from operations research can be applied. The parties may not be sufficiently aware of their own interests so as to be able to articulate them in the form of utility curves. Even if this is possible, it is likely to be difficult to reach agreement on these utility curves, since typically the interests of the parties are divergent. Nonetheless, some interesting prototype systems for collaboratively constructing such models have been developed (Jarke et al. 1987).

3.6 Phase 6. Agreement and Monitoring

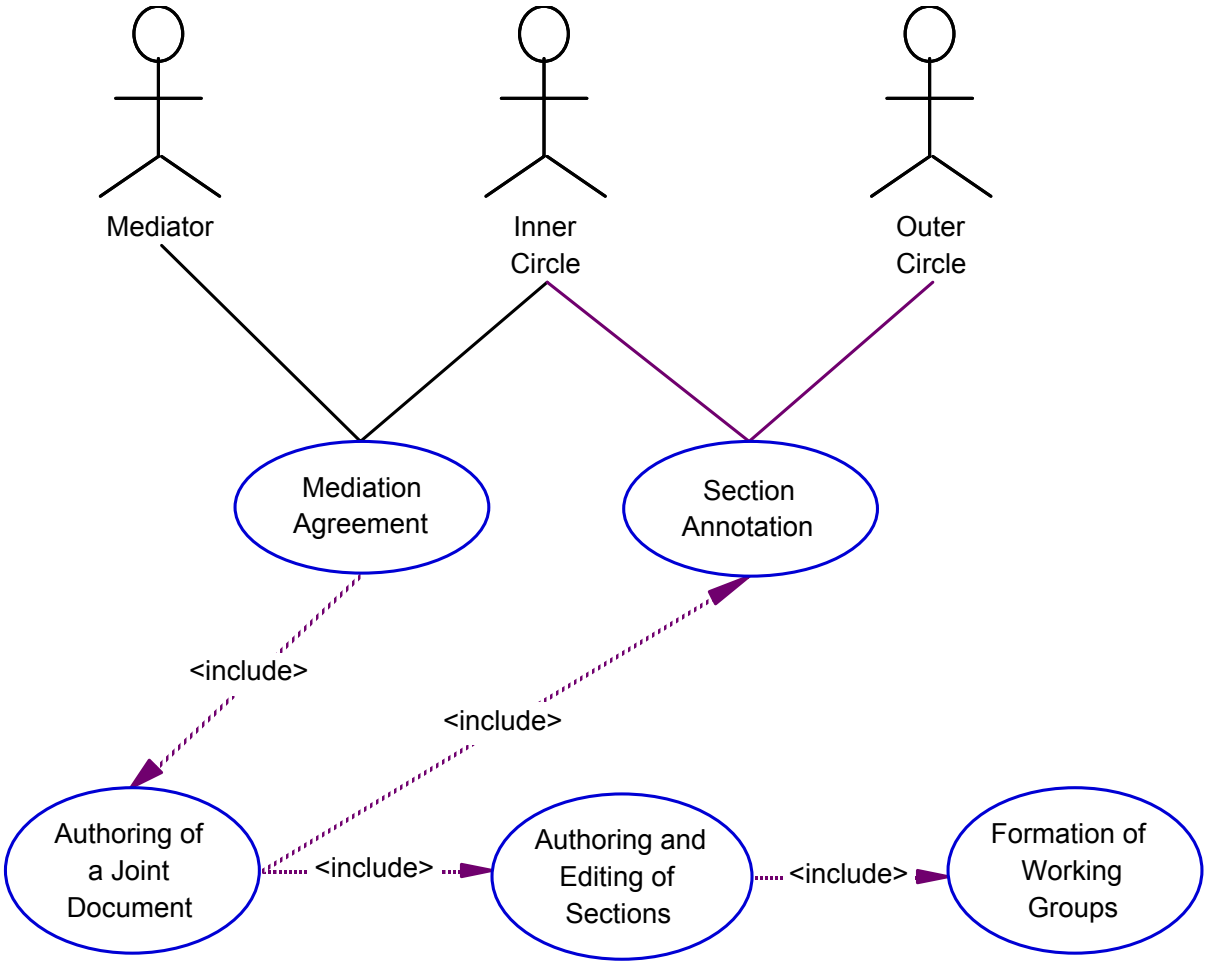
Ideally, by the end of Phase 5 the inner circle will have narrowed down the alternatives to one or more which are acceptable to all the parties. Phase 6 can begin only if the search for acceptable solutions was successful. The standard mediation procedure does not make it clear how the final decision or recommendation is to be made if there is more than one alternative considered acceptable. Perhaps this is one of the things which needs to be clarified in the mediation agreement formulated in Phase 1. Assuming a choice has been made, the first task of Phase 6 is to write a document expressing the agreement of the parties. In some cases the agreement will need to satisfy the requirements of the applicable law of contracts. In other cases the agreement is merely a recommendation to be passed on to the authorities with the power to enter contracts on behalf of the parties. Figure 7 shows the use cases of this phase.

We have already discussed ways of supporting the collaborative authoring of agreements, since one of the tasks of Phase 1 is the construction of the agreement regulating the mediation process. Although a discourse environment for collaboratively authoring documents online seems equally applicable here, we doubt this is also the case for the document assembly system, since these sys-

tems only make sense for routine documents which can make heavy reuse of boilerplate text.

The process of writing the agreement is simplified by having used information technology in the previous mediation phases, since much of the information needed should be readily accessible in the shared workspace constructed during the process. In particular, the use of structured argumentation methods like IBIS makes it easy to extract the design rationale, i.e. the reasons, for the decision. It can be a good idea to keep this design rationale online, even after the mediation process has been completed. This can be useful for several purposes, such as helping to avoid conflicts about how to interpret the agreement and helping to avoid or resolve similar conflicts in the future. This is one of the main ideas behind the currently fashionable subject of knowledge management.

Fig. 7: Agreement and Monitoring (Phase 6)



With the completion of the agreement, the mediation process is almost but not quite complete. The final task is to oversee the performance of the agreement. Here too information technology can offer some useful tools. Project management software can visualize dependencies between tasks, show at a glance which tasks are on schedule or overdue and provide reminders of upcoming due dates. Some of these are multi-user systems which enable each member of the project to obtain, over a network, a status report of all the tasks for which he or she is responsible. There may also be some way to upload deliverable documents upon completion, storing them so that they can be retrieved directly from a view of the task in the project plan. Ideally such a project management system would be integrated with a discussion forum system, so that questions about the plan can be conveniently handled and linked to the appropriate tasks or other elements of the plan, similar to the way the Digital Document Discourse Environment (Sumner/Shum 1998) links documents with discussions.

Systems like the one sketched above facilitate commitment tracking. One question is who should be given access to this information. Presumably the responsible managers of the parties to the agreement will have access. But what about the other members of these organizations, the press or the general public? Probably there is no generally optimal answer to this question. The appropriate answer depends on the particular circumstances of the case. But we cannot help but wonder what effect broad public access to such a system, on the World Wide Web for example, could have on the accountability of public administration and, more generally, our political system.

4. Conclusions and Future Work

In section 3, we walked through each of the phases of the standard mediation procedure and considered various kinds of information technology tools which might be useful for supporting the work to be done in each phase. In this section, we will collect and organize all tools considered, to identify tools which would be generally useful as components of a mediation system. Here is a quick overview of all tools mentioned in the discussion of each phase of the standard mediation procedure:

Phase 1: Preparation and Mediation Agreement. Distributed hypertext (Web), discussion forum, online surveys and polls, spreadsheet and charting, statistics package, screenwriting software, shared workspace, group calendar and scheduling program, mind mapping and other visualization tools, e-mail, shared online address book, mailing list, video conferencing, presentation software,

plan and rule modeling and visualization, negotiation support, document assembly system, collaborative authoring environment.

Phase 2: Information and Issue Gathering. Shared workspace, discussion forum, visualization software, and discourse grammars (e.g. for IBIS).

Phase 3: Interest Clarification. Discussion forum, chat, and possibly a system for supporting subgroup formation.

Phase 4: Creative Search for Solutions. Bulletin board and specialized chat tools (for brainstorming), clustering and categorizing tools, and an online polling or voting system.

Phase 5: Evaluation and Selection of Options. Visualization software, online surveys, discussion forum, argumentation system, and possibly a GIS or multi-criteria decision support system.

Phase 6: Agreement and Monitoring. Collaborative authoring environment, knowledge management system for design rationales, negotiation support systems, project management (for task monitoring and commitment management), and discussion forums.

Phase 1 has the longest list of tools, but some of these are of such obvious general utility that they were mentioned only once: The World Wide Web, calendar, address book, e-mail, mailing list, and the presentation software. The tools which were explicitly mentioned in more than one phase are for shared workspaces, discussion forums, online surveys and polls, visualization, and collaborative document authoring. These observations lead us to propose the following core components for mediation systems:

- Address book,
- Calendar,
- Shared workspace,
- Discussion forum,
- Questionnaires,
- Visualization and presentation tool,
- Group authoring tool.

Distributed hypertext and e-mail are not included, since we presume any reasonable mediation system will make use of standard Internet protocols, so that it can be used in a well integrated way with any standards-based e-mail program or Web browser. The mailing list is also not included, since this can be considered a possible feature of the address book.

In this paper we have taken a requirements-driven approach to mediation systems. Starting from a general (working) definition of mediation as a moderated conflict resolution procedure and an analysis of the standard process model

for mediation, we have identified tasks occurring in each phase of the process. Only then did we begin to look for possibly useful technology.

We have found that standard mediation procedure can be viewed as a refinement of the IBIS model, adding interests to the set of IBIS elements and complementing the structural IBIS model with a particular process model controlling the order in which elements are added to the model.

A definition of a mediation system compatible with this requirements-driven approach is: *An integrated set of tools designed to be generally useful for mediation.* Although we do not want to specify a minimum set of tools in the definition, we hypothesize that any system "generally useful for mediation" will provide most if not all of the core components listed above.

Most of the components in the core set can be used asynchronously over a network such as the Internet. This does not necessarily preclude their use offline, for example to provide support to a face-to-face meeting. An ideal mediation system would be useful anytime and anywhere, online or offline, before, during and after meetings.

Some commentators have been skeptical of the idea of mediation systems, because of the importance of face-to-face communication for effectively resolving many kinds of issues, in particular interpersonal ones. This skepticism is based on the premise that mediation systems are intended as an online alternative to conventional face-to-face mediation. One of our conclusions here is that a good mediation system should be designed to support the requirements of good mediation practice, without trying to promote online communication over face-to-face meetings.

An important insight is that even the standard mediation procedure depends on media-based communication, with or without computer support. Many of the tasks critically depend on some means to represent, store and transmit messages and documents, even if these are just conventional paper and post or cards on pin boards. So the issue of mediated communication vs. face-to-face communication is a red herring: Clearly both kinds of communication are essential. The more important questions are about the kind of communication tools to use for each task, considering all available technology, old and new.

Another conclusion is that a basic mediation system can be quickly put together using widely available applications and systems. There are now quite a few integrated groupware systems which provide many of the desired components, including the ArsDigita Community System (ACS)[13], BSCW[14], eRoom[15],

13 http://www.arsdigita.com
14 http://www.orbiteam.de
15 http://www.instinctive.com

HyperWave[16], LiveLink[17], Webcrossing[18], Lotus QuickPlace[19], and our own Zeno system[20]. Any good vector graphics editor (drawing tool) can be used as a visualization tool. There are also a number of more special purpose tree and graph editors which are well suited for this application. There is a very popular program for presentations which also includes a drawing tool with support for drawing graphs. There are also programs available for group authoring and online questionnaires, even if these are not yet as widely used as the other kinds of tools.

Given this broad base of existing tools, an important question for developers of mediation systems is whether the potential added-value of custom mediation systems can be sufficient to warrant the development effort. This is the subject of our current work, in progress, in which we are comparing and evaluating about 30 groupware systems, both commercial and open-source, focusing on their suitability as a platform for mediation systems.

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16 http://www.hyperwave.com
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19 http://www.lotus.com/home.nsf/welcome/quickplace
20 http://zeno.gmd.de; see also Voss in this book.

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