3-03-20 Improving Workgroup Communications: Requirements for Group Decision Support Systems

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Payoff

Workgroup tools that support decision making and other group work can be applied across a range of applications, including strategic planning, focus groups, and IS systems requirements. A group decision support system (GDSS)is designed to improve the quality of the group decision-making process. The technical, design, and connection requirements for GDSSs presented in this article constitute a detailed and complete list of communications capabilities that may be needed in any GDSS. The choice of which requirements are important must be made by management, users, and designers of the systems.

Introduction

Structured approaches to the dynamics of group interaction—for example, the nominal group technique, the Delphi technique, and computer-based approaches(e.g., electronic mail, teleconferencing, videoconferencing)—have all been implemented either to improve the quality of meetings and the decisions they produce or to reduce the number of meetings. The most recent approach has been the use of Group Decision Support System(GDSSs).

Data communications is a crucial element in the implementation of a group decision support systems. In this article, general communication and behavioral problems common in group interactions are discussed to make apparent the importance of data communications in the successful implementation of a group decision support systems as a workgroup tool. The article scans the technical, design, and connection requirements of a group decision support systems. Finally, the factors that determine the choice of group decision support systems type are used to present a framework for deciding which requirements are most important for a particular group decision support systems.

Group Decision Support Systems: Definition and Types

In general, a Group Decision Support System is a computer-based information system that is used to improve group decision making. The group decision support systems is similar to a Decision Support System in that it supports the three basic functions of data, model, and dialogue management. However, unlike an individual decision support system (DSS), a group decision support systems must interact with two or more users through a communications subsystem.

The factors that may be used to describe a particular system are presented in Exhibit 1. A group decision support systems may involve a mix of:

- Face-to-face or non-face-to-face communication.
- Synchronous or nonsynchronous communications (i.e., communication occurs within a single interactive session or at different times through, for example, E-mail).

- Close or dispersed geography (i.e., decision makers are at the same physical location or at two or more separate locations).

- Cooperative or uncooperative (e.g., a negotiation situation)atmosphere.

Factors That Determine GDSS Typology

Most research on group decision support systems focuses on face-to-face, physically close, synchronous, cooperative decision making, commonly known as a “war room” or “decision room” situation (see Exhibit 2). Two other commonly used types are the linked decision room (dispersed geography, synchronous), wherein two separate rooms similar to the decision room depicted in Exhibit 2 are connected with telecommunications and possibly video links, and local or remote decision networks (either close or dispersed geography, nonsynchronous), in which electronic bulletin boards, E-mail, or other messaging systems are the means used to reach a decision.

An Example of a Decision Room

In reality a group decision support systems may simply be an electronic mail, teleconferencing, or computer conferencing system that members of a decision-making group use to exchange and gather information. The systems studied in this article are actually more complex and narrower in scope and have as their sole purpose the enhancement of the decision-making process.

Improving Group Communications

A Group Decision Support System such as that shown in Exhibit 2 is computer driven and involves multiple decision makers, all with their own computer terminals. Because the terminals are linked together within a network, data communications is a central issue in the successful implementation of a group decision support systems.

The fact that computer support for group decisions has begun to receive so much attention and that organizations have implemented group decision support systems would seem to confirm the notion that groups that communicate better are also able to make better decisions. Some common communication problems experienced by decision-making groups may be alleviated through computer and communications solutions. These problems include:

- Dominance of the discussion by one or more members.

- Low tolerance of minority or controversial opinions.

- An inability to access information during the course of the group meeting because the information is not close at hand.

- Undue attention to social activities as compared with the business task of the group.

Usually all members of a group decision support systems network participate in an initial idea gathering by entering suggestions anonymously on their keyboards. Anonymity

solves the first two problems because all members are allowed to participate freely without fear of reprisals from more powerful group members. A wider range of possible solutions is presented; the greater the choice of alternatives, the more likely the group is to make the best possible choice.

The third problem can easily be solved by establishing links to data bases or files that contain needed information. This solution allows members to make informed decisions based on accurate information and not the facts as someone is forced to remember them.

Finally, social exchanges are minimized because responses are entered using a keyboard and not through group interaction. The meeting should proceed more quickly because group members are more likely to enter only information relevant to the problem. All of these solutions can be seen to have a positive effect on the decision-making process; however, inefficient communication is not the only or maybe even the most important factor affecting group processes.

Reducing Negative Group Behaviors

Behavioral as well as technical aspects of the group decision support systems must be considered. Group behaviors that can adversely affect its individual members include such phenomena as diffusion of responsibility, loss of sense of individuality, pressures for group consensus, and problems of coordination. A group decision support systems, when properly designed, is helpful in reducing these problems.

Diffusion of responsibility causes group members to perform below their potential, possibly because of a lack of uniqueness felt by individuals in a group setting. The result is that group members do not take responsibility for their actions, a situation that leads to decisions that are either riskier or more conservative than might otherwise be made by the individual acting alone.

Loss of individuality is a similar phenomenon that occurs when group members lose their sense of self within the group setting. It is one explanation for irrational group behavior—in extreme situations, mob behavior.

Pressure for group consensus, often referred to as groupthink, causes members of the group to support views or ideas that are perceived to be in accordance with the majority of the members. These pressures limit the reasoning abilities of the group's members so that they are unable to consider all aspects of a problem and concentrate only on evidence that supports the group opinion.

Problems of coordination are structural and logistical concerns that determine how the group will communicate, present ideas, and support ideas—in general, concerns that govern the flow of the meeting. Because of coordination problems, a group takes longer than an individual to arrive at solutions to problems, although it is hoped that the group arrives at better solutions.

Research suggests that computer-mediated communication is helpful in reducing these negative group behaviors. The structured approaches found within the group decision support systems appear to increase group member participation, ease pressures toward group consensus, focus attention on the problem, and keep the group on track. Computer-mediated communication allows for the quick and easy exchange of information in groups. Wide information searches become possible, leading to more informed decisions and more equal participation. Groups that use a computer to communicate are less likely to be influenced by group norms, which may lead to greater innovation but may also lead to higher-risk decisions than might be appropriate.

Requirements for a GDSS

For any type of Group Decision Support System, such issues as user transparency and delays in system response are important. Users of some group decision support systems have reported waiting for up to two minutes for a new screen at the beginning of a session while files are being sent. Some users will not be highly computer literate. The group decision support systems must make it easy for members of the group to communicate with each other; otherwise, users will become frustrated with the system.

If the group decision support systems is to be an acceptable tool in the decision-making process there are several requirements that must be evaluated. Technical, design, and connection requirements must all be satisfactorily determined for the system to facilitate the goal of more productive meetings that result in decisions as good as or better than those resulting from other methods.

The success of the group decision support systems depends largely on how well its capabilities match the tasks encountered by the organization's decision groups. Errors can be made by providing capabilities that are either not cost-effective or not needed or desired. Before an organization implements a group decision support systems, its IS management should evaluate each of the following requirements with those two principles in mind.

Technical Requirements

Data Management.

Data management is what allows members of the group or the group leader to query the organization's data base and display results on the public screen so that facts can be jointly referenced. spreadsheet software can further enable the group to manipulate data in what-if analyses. The ability to quickly manipulate data in this manner allows for the rapid analysis of several scenarios. Calculating the effect of different pricing strategies on cash flows, for example, involves number-handling capability that is unavailable at a typical face-to-face meeting. Text editing could also be included, to edit an extensive list of solutions down to a few alternatives, for example.

Data Security.

Security capabilities may be essential for a dispersed-geography group decision support systems or in an uncooperative group situation. Data encryption may be used to protect sensitive company data transmitted over a Wide Area Network. In a negotiation situation, each party has private information to protect from the other parties, semiprivate information that is shared between a party and the mediator, and public information that is available to all parties involved. The group decision support systems must be able to distinguish between each of these types of data. The integrity of shared data also needs to be protected through shared and exclusive locks when data is accessed by two or more members of the group at the same time.

Compatibility.

An example of the need for compatibility is the experimental computer meeting room, or Colab, at the Xerox PARC facility. Colab's computers are intended to support group interaction and problem solving and so constitute a group decision support systems.

Colab software provides a multiuser interface that allows meeting participants to interact easily and immediately. The computers have a WYSIWYG (what you see is what you get)interface, so what appears on the user's screen can be printed. The interface also has what you see is what I see (WYSIWIS) capabilities, so all meeting participants see exactly the same thing on their screens. A group decision support systems composed of incompatible computer systems would not be able to offer these capabilities.

Data Transferability.

Transferability of data refers to a user's ability to upload and download files—for example, to retrieve information from an individual Decision Support System or data base or to transfer information from one participant's screen to the main viewing screen for all participants to see. The major problem would be the transfer of data between the microcomputer environment and a mainframe environment. It can be accomplished through terminal emulation, file transfer, protocol conversion, use of file servers, or connection through a local area network(LAN).

Accessibility.

Multilocation capabilities are needed in a group decision support systems when its users are geographically dispersed. These requirements may be met if it is possible to quickly establish communication links for data, voice, or video. Dispersed users may also require a distributed data base management system (DBMS) in order to achieve local autonomy and location transparency. Local autonomy enables users at each site to maintain control over their own data. Location transparency relieves users of the task of trying to find the site at which specific data is found.

Reliability.

Technical requirements of a group decision support systems should include reliability and, just as important, maintainability and capabilities for incorporating new technologies. Software and hardware components that are unreliable disrupt and detract from the decision-making process. As users become more adept in the use of the group decision support systems and wish to incorporate new capabilities and technologies or do away with old ones, system requirements will change. A system that is easily maintained by support personnel will better meet these needs. Decisions concerning the backup and redundancy of data will need to be made.

Design Requirements

Meeting design requirements involves choosing among different topologies, access methodologies, and networking architectures. Whereas the type of Group Decision Support System required may be determined through the use of the factors listed in Exhibit 1, the actual design requirements of the data communications components of the Group Decision Support System are primarily determined by the size of the decision-making group and the members' proximity to one another.

As groups get larger, for example, the number of potential information exchanges rises and the frequency, duration, and intimacy of the information exchange all decline. In smaller groups, the anonymity of individual responses may be important to ensure a wide

range of ideas are expressed in a brainstorming session. In a large group, the ability to quickly tabulate votes may be an important consideration.

The design requirements of the group decision support systems as well as their effect on the group also vary, depending on whether the group engages in some face-to-face interaction or all communication is computer mediated. In groups in which all communication is computer mediated, users participate more equally in the decision process, are more uninhibited, and may deviate more from initial conclusions. However, widely dispersed groups also experience less efficient communication, greater interpersonal conflict, and less satisfaction with the group process.

Network Topology.

Topology refers to the physical arrangement of the communications lines and nodes. The best topology for a particular group decision support systems depends on the characteristics of the topology and the number of participants in the decision-making session. The most widely used network topologies are star, hierarchical, bus, and ring.

A star network is usually fairly easy to implement, because all links lead to one central node. There is virtually no limit to the number of circuits that can be added to the network, so it can be easily expanded if the size of the decision-making group increases. During a brainstorming session, however, when all communications must go through a central node , the system can become overloaded. If the central node fails, the whole system goes down.

A hierarchical network is similar in configuration to a corporate organization chart. In this system, several computers are connected to one main computer called the root node. These subordinate computers can continue to operate if the root node fails, although communications between some nodes could be affected. The drawback to this network is long communications paths between lower level nodes , which can slow communications.

A bus or multidrop line network refers to a central communications line (i.e., the bus) to which many nodes are attached. The number of devices that may be attached to a bus network is limited, and it can be implemented only over short distances because of signal loss on the line. This network has the advantage of being highly reliable; the failure of one node will not affect the other components. The problem with a bus network is that only one node at a time can send messages on the line. This is not a problem if the number of terminals on the bus is small. Communication becomes more difficult as more terminals are added.

A ring network is like a bus network in that it usually is implemented over fairly short distances, but because the signal is regenerated as it passes through each of the nodes , it is not as susceptible to attenuation of the signal.

Access Method.

An access method controls the passage of data between nodes. One common network access method is contention. In a contention system, a node checks the circuit to ascertain whether the circuit is busy. If the circuit is busy, the node waits a certain amount of time and then tries again. If the circuit is not busy, the node gains control and begins to send. This system works well in a network with a small number of users but is not suitable for larger systems on which many terminals may need to communicate at once.

Another method is polling. In a roll-call polling system, one node is designated as the master and it controls the other computers. The master station polls each of the other stations. If a station that is being polled has a message, it is sent. If there is no message, the master station moves on to poll the next station and so on down the line.

Hub polling is similar to roll-call polling except that there is no master node. One station begins by polling its neighboring station. This station responds with a message if it has one to send and then passes the polling message down the line to the next station.

Standardized Network Architecture.

The function of the network, broadly defined, is the transport of data and the coordination of communications activities to make the group decision support systems as transparent as possible to its users. The transport function for an optimum group decision support systems is actually more complex than simple data transport. The group decision support systems should be able to analyze, evaluate, and determine the content of the information that is transported.

Open systems interconnection (OSI) standardization of the data communications components of a group decision support systems offers the following advantages:

- It may become profitable and commercially practical to produce a turnkey group decision support systems.
- The group decision support systems could be tailored to meet the needs of a group as its members become more experienced in the use of the group decision support systems.
- The group decision support systems could be modified quickly in order to suit its use by several different groups in the organization. Greater use reduces overall expense.

Connection Requirements

Equipment.

The selection of equipment entails both data terminal and data communications equipment. There are two concerns about the data terminal interface in a Group Decision Support System. First, users must be able to type in responses on a keyboard and then read the screen to gain access to other group members' ideas, which tends to interfere with the decision-making process. Second, a large screen is needed to manipulate and organize data in a brainstorming or evaluation situation. Touch screens, a mouse, or menu-driven programs may circumvent the keyboard problem. The use of screen windows in order to have several ideas represented on-screen at once could further enhance the capabilities of a large screen.

Modems.

When a group decision support systems serves a geographically dispersed workgroup, modems are required. Modem selection criteria include data flow, physical connection, timing of the signal, and the digital coding format. Front-end processors or multiplexers may also be needed if communications links are to be over company-owned, leased, or dial-up digital lines.

Line Selection.

Appropriate communications lines must be chosen if a group decision support systems is to be distributed among two or more widely separated locations. The choice of fiber-optic, satellite, or microwave links depends on the distance between locations, the availability of links from service providers, and the amount of information to be transmitted. Leasing or buying the circuit may also be options.

Error Prevention, Detection and Correction.

Conditioned lines (i.e., lines that have higher specifications for amplitude and distortion) are available from communications service providers to help ensure data integrity. In addition, a user's cabling plant can be shielded to protect the transmitted message from electrical interference.

Error detection and correction are required because errors occur no matter what measures are taken to correct them. Errors are detected through some type of transmission redundancy or through the use of parity bit or checking characters. echo checking is one of the most common forms of redundancy: each character is echoed from the receiver back to the transmitter. More sophisticated methods for identifying errors all use checking characters. The most common methods employed for correcting errors are retransmission of the data, stop-and-wait Automatic Repeat reQuest, and forward error correction.

Matching GDSS Capabilities to Decision Groups' Needs

The technical, design, and connection requirements presented in the preceding section constitute a fairly detailed and complete list of capabilities that might be needed in any Group Decision Support System. In reality, because no single group decision support systems requires all of these capabilities, the choice of which requirements are important for a particular system is a decision that needs to be made by management as well as by users and designers of the system.

The major problem in deciding what requirements are needed for a particular group decision support systems in that users are not able to determine many of their needs before using this technology. Systems that are predefined for a specific application and cannot be changed are impractical. The question still remains as to what requirements are needed for the initial system. These requirements can be determined by linking the factors shown in Exhibit 1 to the technical requirements, as shown in Exhibit 3.

Importance of Data Communication Requirements

	Face-to-Face	Non-Face-to-Face	Synchronous	Nonsynchronous	Close Geography	Dispersed Geography	Cooperative	Uncooperative
Technical Requirements								
--Data Management			X			X		X
--Data Security						X		X
--Compatibility						X		
--Data Transferabilitty	X	X	X	X	X	X	X	X
--Multilocation Capabilities						X		
--Reliability	X	X	X	X	X	X	X	X
Design Requirements								
--Topology			X		X	X		
--Accessing Methods			X					
--Networking Architecture						X		
Connection Rquirements								
--Eqipment		X	X					
--Modems						X		
--Line Selection						X		
--Error Detection		X				X		X
--Error Prevention		X				X		X

In the first column of Exhibit 3 is a list of all of the various technical, design, and connection requirements. The other columns cover the determinants given in Exhibit 1. For each determinant, the requirements that are most important for the implementation of each type of group decision support systems are marked with an X. This does not mean that meeting other requirements is not desirable for that group decision support systems type, but it is of less importance.

Data transferability and system reliability are important regardless of the type of group decision support systems. One of the major advantages of the computer capability in a group decision support systems is the direct access to information through a terminal. Better decisions are made because this information is available during the group decision-making process. To keep a meeting from being disrupted, the reliability of the system is essential. The disruption of the group's work that would result if the system breaks down could lead to the group's abandoning it.

A group decision support systems designed for a non-face-to-face environment also needs appropriate terminal equipment and error prevention and detection, because all communication takes place through the terminal. Users will want a system that makes it easy to enter information and read responses. A large screen, a mouse, or a touch screen will make managers who are not good typists more comfortable with the system and may reduce errors in transmission that would cause frustration with the system.

A group decision support systems for a synchronous group meeting (i.e., all members are meeting together at the same time) requires fast, flexible data management capabilities as well as topology, access method, and equipment that ensure quick response. Workgroup size, along with members' proximity to one another, dictates which of the many choices should be selected. These capabilities are much less important in a nonsynchronous system wherein members leave messages for each other and decisions are made over longer periods.

The greatest challenge to group decision support systems development occurs when group members are at two or more locations. Some requirements for this group decision support systems type have already been mentioned. Dispersed workgroups dictate special consideration for security, compatibility, modem and circuit selection, and network architecture.

For uncooperative groups, data management, security, and error detection and prevention are the most important considerations. The main concern for a group decision support systems in this environment is that it help each of the participating groups better understand the other groups' positions. Incorrect information or the inability to arrange information in a desired manner could lead to a widening of the gap between the two groups. Each group will also have information that it will not wish to share with the other group, a situation that is drastically different from most decision-making groups that want all available information to make a decision. The uncooperative group will wish to assure the safety of its information from the other group.

Conclusion

Determining the data communications needs of a Group Decision Support System represents a new challenge for IS managers and communications specialists that necessitates the integration of technical, design, and connection requirements. These requirements vary according to workgroup size, proximity of members to one another, whether or not they are meeting face-to-face, whether or not they are meeting in a cooperative setting, and whether the meeting is interactive or takes place over some time period. To be useful, the group decision support systems must make a positive contribution to the group decision-making process while at the same time reducing the inconveniences of group tasks. The complexities are enormous, and in most cases the requirements for the system will not be completely known until users have had sufficient time to use the system and provide feedback.

Author Biographies

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Previous screen

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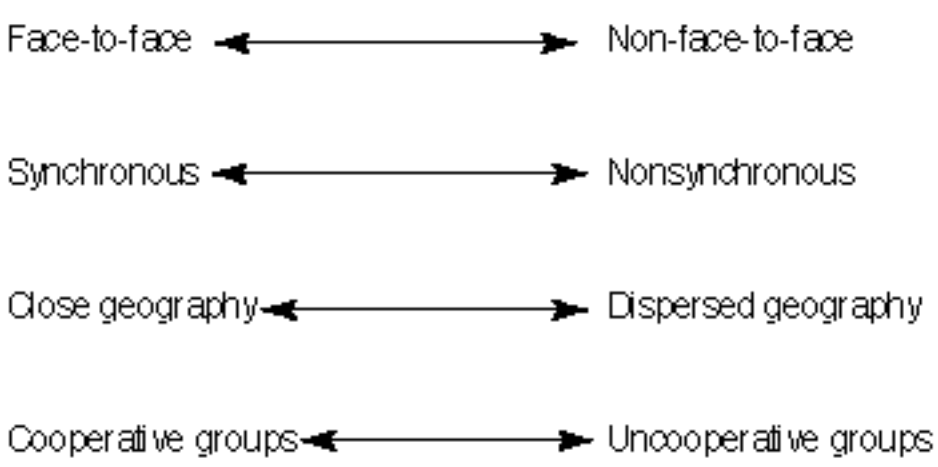
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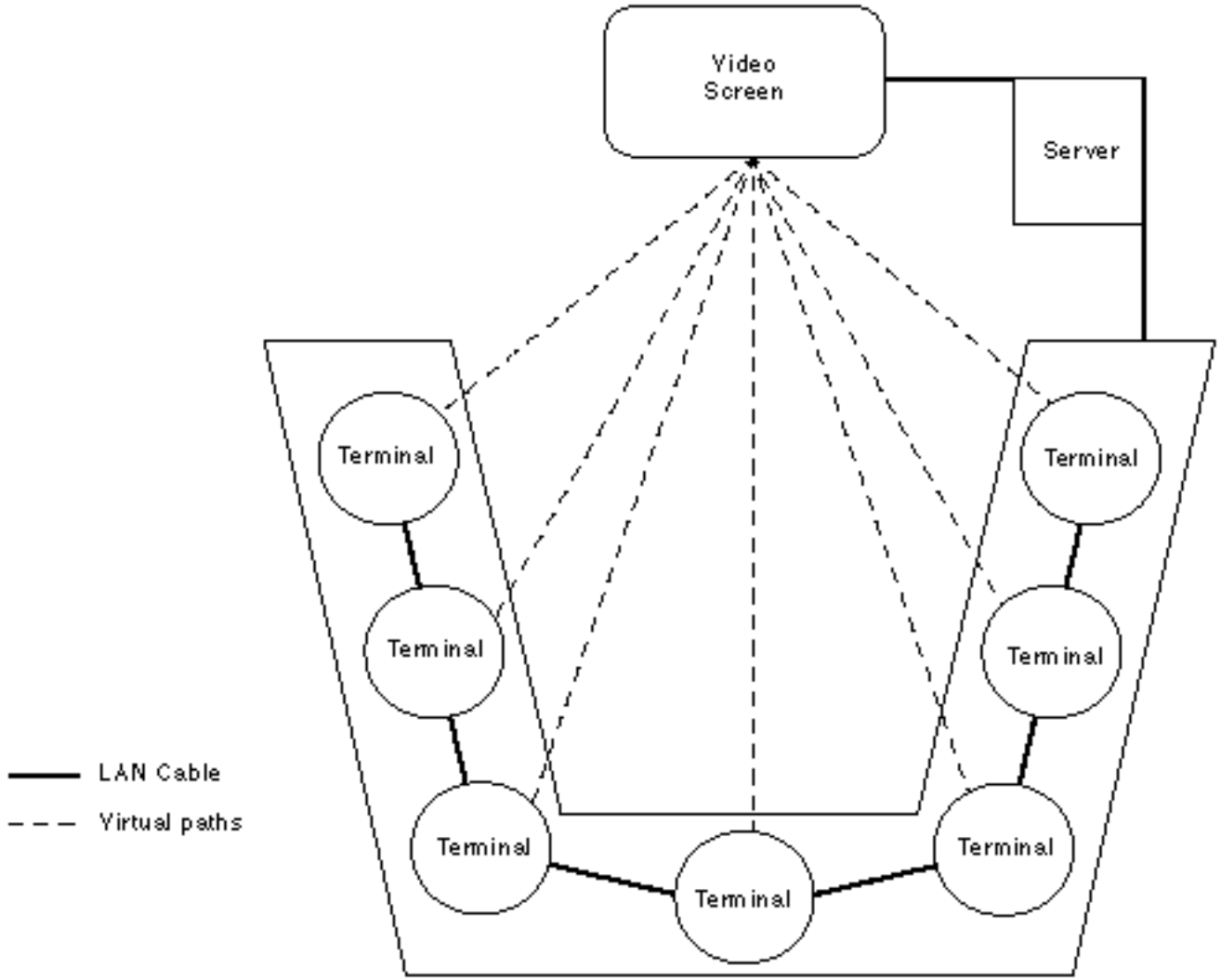
Close geography
Dispersed geography
Cooperative groups
Uncooperative groups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