

CLINT: A Prototype Logistics Collaboratory

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Abstract

This paper discusses the domain of Army logistics planning at the level of the ODSLOG (Office of the Deputy Chief of Staff for Logistics) and describes tools to assist in this planning. In particular, we have developed a prototype collaboratory (CLINT) for logistics planning that relies on Microsoft NetMeeting™ as the collaborative infrastructure, and a tool named THREADS to support logistics problem solving. THREADS is a "visual simulation" of logistics routes that allows planners to quickly identify bottlenecks and compare alternative plans.

1 Introduction

The demand for efficiency has driven most organizations to utilize powerful tools of computing and communication. The Armed Forces are no different. Drastic cutbacks in funding have forced the Department of Defense to look for ways to maintain readiness while decreasing number of troops and new equipment purchases. Decreasing ammunition stocks, crumbling barracks, and aging equipment are only a glimpse of the results of Congress's cutbacks. [4] "Last fall, Army General Henry Shelton, chairman of the Joint Chiefs of Staff, came before the Senate Armed Services Committee seeking budget increases to prevent 'a continuation of downward trends in readiness.'"

The logistics division of the US military has a massive task to decrease deployment time and increase unit effectiveness, with only a very limited amount of funding. This dilemma applies to many domains, where multiple improvement possibilities exist but funding is limited. This study proposes the use of a collaborative toolkit to help logistics officers decide which improvements would have the greatest positive impact on deployment. Instead of the traditional telephone and paper process, communication via computer will be paired with domain-specific applications. Although issues exist, this application of a collaboratory can improve the efficiency of this type of process.

2 Groups, Groupware, and The Collaboratory Concept

At the core of this type of activity is a group of people collaboratively forming a logistics plan. Many theories

exist about group organization, behavior, and dynamics, and the relative effects of different kinds of collaborative technologies ("groupware") on group processes. McGrath offers a general definition of groups: "Groups are assumed to be complex, intact social systems that engage in multiple, interdependent functions, on multiple, concurrent projects, while partially nested within, and loosely coupled to, surrounding systems." [7] Groups can be analyzed from many points of view: as information-processing systems, social networks, knowledge networks, or distributed cognitive systems. [5][8]

In the last 15 years, a great deal of technology development has been in the area of collaborative computing or "groupware". A variety of genres exist such as email, chat, shared drawing, and workflow applications. One concept that has been explored is that of the "collaboratory" [e.g., 3]. As the name implies, a collaboratory is a "collaborative laboratory" – an infrastructure that supports multiple applications for collaborative inquiry, hypothesis generation, and discussion. Typical components include a digital library, generic collaborative communication mechanisms, and domain-specific tools.

Adding a collaboratory will change the way a group works. And changing their processes can be a good or a bad thing. Defined by Davenport [2] as "a structured, measured set of activities designed to produce a specified output for a particular customer or market," altered processes can lead to more efficient output, when correctly combined with the communication and calculation capacity of computers. Tools within a collaboratory that extend functionality and performance are called groupware. According to Coleman, [1] groupware is "computer-mediated collaboration that increases the productivity or functionality of person-to-person processes" when used correctly, of course. With increasing computer connectivity and global organizations, efficiency can be improved by using the speed and cost-effectiveness of groupware. Email is a good example- with the ease email provides messaging, groups can be contacted without resorting to mass mailings or telephone calls. A group of people using groupware can also more easily share resources to achieve common goals. With relation to the military, a computerized collaboratory could provide a framework to house specialized applications. Communication could be facilitated by viewing a graph, diagram, or report with others in real-time, instead of stumbling over a phone.

And calculation could be facilitated by generating visual simulations and scenarios too complicated for a person to produce effectively.

3 The Logistics Planning Domain

A division of the Army, the Office of the Deputy Chief of Staff for Logistics (ODCSLOG) is in charge of improving Army transportation infrastructure for deployment. Through their leadership, money from Congress may be secured to improve roads and upgrade equipment.

The following process describes the central role that the liaison staff officer follows to support an area of mobility. Separate staff officers are proponents for areas such as watercraft, air, pre-positioning, and troop support. Each staff officer contributes to creating a collection of proposals that improve deployment.

- Receive goal. Every few years, an Army Strategic Logistics Plan (ASLP) is put into action, which typically demands decreased deployment time to certain areas of the world, such as east Asia or the Baltics.
- Collect proposals from the field. The staff officer receives ideas for improving strategic mobility from others. The ideas must be sorted and previewed.
- Subset of proposals chosen, and effect on world viewed. In a lengthy process, the officer forms a collection of proposals, possibly modifying them to work best together.
- Collection of proposals chosen. The officer picks a set of proposals that has the best chance of being accepted by Congress (or his or her superiors) and which helps the field of his or her specialty.
- Presenting and publishing results.

Personnel involved in collecting and choosing proposals engage in the following activities:

- Sort- Review proposals received. Some may be thrown out immediately, some may need clarification, and some may generate a positive or negative first opinion in the staff officer's mind.
- Model- Turn the proposals into computerized models. For example, a proposal to increase number of rail cars at a location could be modeled as "Throughput rate of location increased." The main relevant effect of adding rail cars is to increase rate of throughput.
- Select subset- A group of proposals is chosen, and its effects are viewed upon the whole world. Constraints like least possible dollars and largest positive effect will play a role.
- Revise- The subset can be revised to form a better subset. Also, proposals can be adjusted to be compatible with others. The officer will need to speak with the person who submitted the proposal to discuss modifications.

- Select: After all modifications, a final group of proposals are chosen.

The main topic focused on by this study is the interaction between a manager (staff officer) and multiple people in the field. This is step 4 in the sample model (Revise). The manager wishes to accomplish a goal, within parameters. He or she manages information gathering, negotiating, planning, problem solving, and computation, all among persons in the field. Each person in the field, meanwhile, is driven by an agenda that may differ. This agenda is usually for self-interest. Such a paradigm is an example of the Judge-Advisor group decision making [e.g., 11][10]

In an attempt to improve the communication between the manager and the field personnel, tools will be deployed for discretionary use. A scenario will be given to volunteers, and the effects of the tools will be analyzed. The proposed system design follows.

4 System Design

This chapter describes the proposed design of the Collaborative Logistics Improvements Negotiation Toolkit (CLINT), a group of technologies for choosing the best set of improvements in a distributed logistics infrastructure. CLINT uses Microsoft NetMeeting™ to establish a connection between computers connected via LAN. Once people are connected, they can open up a chat window, a whiteboard, and share applications. The core application is the Java tool Threads, a what-if scenario tool that allows users to compare the effect of improvements on transportation results. The discretionary use of these applications could facilitate collaboration.

The first part of the toolkit is the meeting software. NetMeeting is Microsoft's "Windows real-time collaboration and conferencing client," a "tool for corporate productivity." [9] Meeting participants can use features such as audio and video conferencing, a chat box, a whiteboard, and sharing of programs. Sharing is a powerful tool- "You can share an application with others, even if they don't have it installed on their systems." [6]

The second part of this toolkit harnesses the computational power of the computer. A domain-specific application included in this collaborative becomes more powerful because of the additional communication allowed by the rest of the toolkit. With relation to Army logistics, Threads is a Java tool capable of displaying what-if scenarios in military mobility. Officers can enter data about facilities and ports, transit routes, paths, and mobility assets, and watch the cargo be transported through the route. This research will use Threads as an example of a computational and visual aid. Only a small

portion of Threads will actually be used in this experiment.

Threads is a Java tool created by Michael Dorneich [3] and debugged and extended by Scott Schwemin. In this experiment, the Tweak page was used by participants. In the tweak page, the users load data about the current scenario. Below this, they can change the rates and capacities and run this altered route to see how fast it completes, versus the original route. This single-user domain-specific application is designed to help someone visualize the effect of a localized change on the big picture. But in CLINT, users can take advantage of NetMeeting's Share Application feature. A program running on one computer can be shared to all other participants in the meeting. Everyone can view what the application owner is doing, and can even request control of the program.

4.1 Tweak Page Description

The Tweak Page is the portion of Threads that participants will use to test changes to the deployment route. A sample screen shot is shown below in Figure 1.

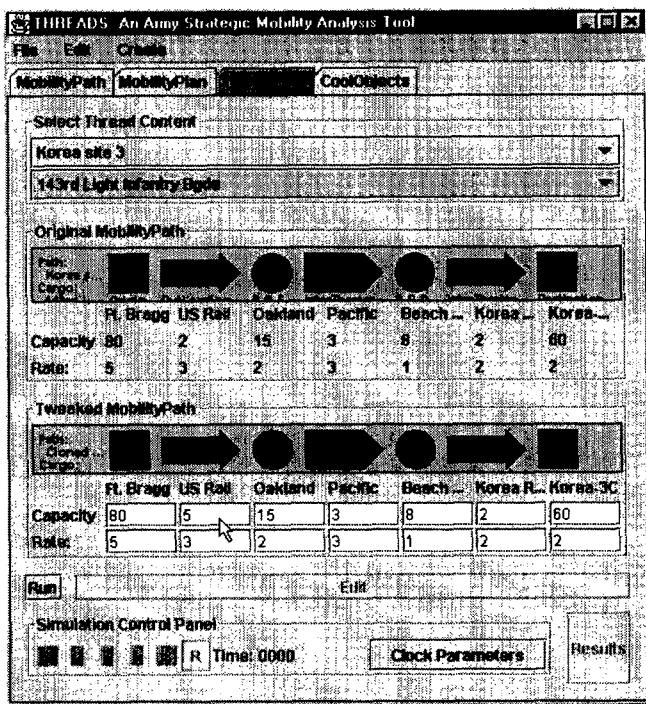


Figure 1: Tweak Page

The original deployment route is depicted on top. Cargo progresses from the origin on the left to the destination on the right, displayed as red boxes moving through the shapes in succession. The numbers below the path describe the vital attributes Capacity and Rate for each of the locations. These values can be changed in the "Tweaked MobilityPath" below. In this example, a change has been made in the capacity of one of the sites, "US Rail." Once

the change is complete, the user presses the Run button in the bottom left. This button freezes the tweaked values, and enables a series of buttons to control the simulation, as displayed below in Figure 2.

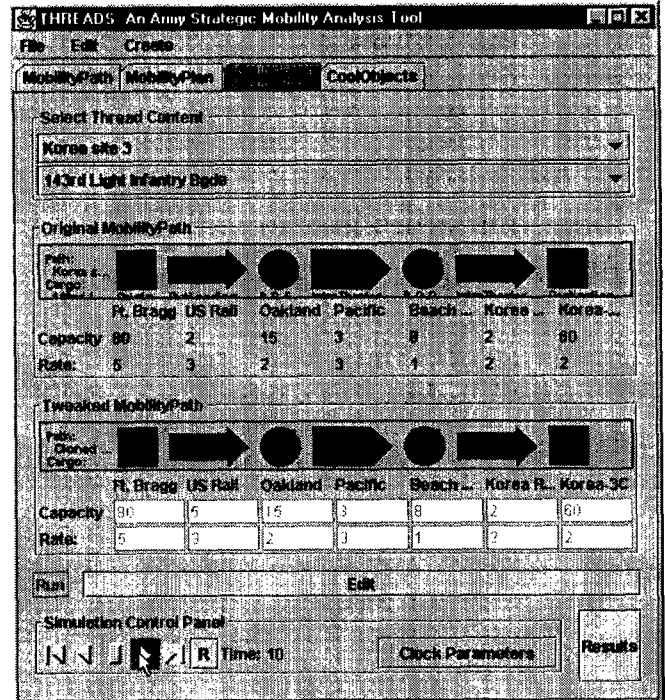


Figure 2: Tweak Page Example

In this short example, the user has just pressed the Play button and let the simulation run for ten seconds. The two routes show different behavior, reflecting the change made to the tweaked path. Using this method, participants will be able to view the effect of one or more changes on the deployment route. In CLINT, the sharing of Threads may provide a valuable communication aid between participants, possibly leading to improved results.

5 Evaluation Study

Like much research in the computer-mediated communication field, team performance is compared with and without the use of CLINT.

Two groups of participants each performed two decision making tasks. In each task, the group is given a scenario, consisting of a deployment route from origin to destination. Each of the field personnel are given a number of improvement ideas for the capacities and rates along this route. Their goal is to get their ideas accepted by the logistics officer. These ideas are not shared between field personnel.

The officer is charged with compiling a plan of improvements that speed the deployment route the most. He or she is provided with target figures and funding, such as "20% improvement: \$2 million." In this case, if the logistics officer's final plan speeds up the route by 20% and costs \$2 million or less, it will be a success. If not, then the result will be a failure: none of the ideas get funded, and no one gains anything. It is to everyone's advantage to get something accomplished.

Each participant is also trying to "make money". This secondary goal impedes the primary goal, but it is an example of a real situation. The field personnel can quote a price to the logistics officer that is higher than actual. If an idea with a raised price is accepted by the officer, and the overall plan is successful, then the field personnel have just "made money." Similarly, if the logistics officer constructs a plan that costs less than the maximum amount allowed, he or she has just "made money." This profit does not actually line that person's pockets, but it would provide some benefit to the person who saved an organization money, or who was allocated more funds than necessary for a project.

The three performance measures of interest are time, money, and length of the plan.

- **Time:** It is better for a group to finish early than late, with one hour being the time limit for each task.
- **Money:** Each participant is associated with a monetary result. The staff officer can beat the monetary requirement for passing a plan, and the field personnel can quote prices higher than the actual. The more money they "make", the better.
- **Length:** An accepted plan that contains only one improvement idea is not very successful. The more ideas accepted while under budget, the better.

Qualitative measures can also be utilized. Surveys, computer logs, and voice recordings identify barriers to communication, difficulties with the technology, and the like. Improved results visible through these qualitative and quantitative measures would support the utilization of a toolkit such as CLINT for a logistics collaboratory.

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