Cyberinfrastructure-enabled Spatial Decision Making *

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Spatial decision making involves finding high-quality solutions to problems that contains various spatial components.[1] Solving these problems, however, are often difficult, thanks to the following main reasons. First, the solution space of such a problem may be so large that it is impractical to evaluate all feasible solutions in a reasonable time frame. Second, these problems often have multiple, conflicting objectives that make finding a single optimal solution impossible because there may exist many optimal solutions that are desirable when all objectives must be considered. Third, a number of social, economic, and political factors may be difficult to incorporate in the problem formulation. Such a semi-structured feature often makes second best or near-optimal solutions appeal to decision makers because these solutions may be more robust in real-world situations. Fourth, decision makers and stakeholders of these problems often come from different background and have different preferences about the solutions. Spatial and temporal constraints may not allow them to discuss and negotiate potential solutions in a physical meeting environment. Fifth, many problems may involve the interests of the general public who desire to participate in the decision process. Finally, solving some of these problems may required expensive software packages that may not be affordable to some stakeholders.

The cyberinfrastructure vision sheds light on creating a cohesive problem-solving environment that addresses all of the above challenges. Such a cyberinfrastructure-enabled approach is different from existing problem-solving techniques that are often designed to tackle a subset (often one) of these issues. In a cyberinfrastructure approach, high-performance computing can be utilized to efficiently generate solutions to the decision problems using exact or heuristic methods. Virtual organizations can be formed so that decision makers and stakeholders can share their knowledge about the problem and discuss interesting solutions through a web-based environment. Decision tools can be implemented in an online fashion that does not require acquiring commercial software and therefore relieve the monetary burden for the general public to participate.

Though the bright potential seems to be straightforward, it is important to realize that implementing these techniques for the purpose of spatial decision making is a major undertaking for the GIScience community. This workshop could serve as a forum for the participants to focus on some prominent case studies and discuss collaborations.

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[1] Examples of spatial decision problems include location-allocation analysis where facilities must be located to maximize service, school or political redistricting where space is partitioned into contiguous districts in order to provide equal opportunity to residents, and routing where a path is to be determined so that the transportation cost is minimized.