Title of proposed presentation: A Modeling Framework to Evaluate Energy, Transportation, and Communication Interdependence in Smart and Connected Communities

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Body of extended abstract:

Public infrastructure in future smart and connected communities is envisioned as a complex intertwined system of services such as energy, transportation, and communication. Few prior studies have examined the interdependencies among these services and quantified their impacts even though their inherent linkages may significantly influence the design and operation of each system. To change this way of design, we propose an open-source, integrated modeling framework to gauge the impact of energy, transportation, and communication systems on public infrastructure operation. An innovative multi-level, multi-layer, multi-agent approach is proposed to model the interconnections between these systems. Individual component and system level models of energy, transportation, and communication systems are designed using Modelica. Three case studies of increasing complexity are examined (energy, energy + transportation, energy + transportation + communication) to evaluate the impacts of the interdependencies. The proof of concept results show that the power draw from the grid can differ by 7% during peak commute time with or without considering the transportation and communication systems. This shows an inherent interdependence even when all of the systems are not considered. Additionally, the velocity on the road can decrease by up to 10.5%, also during peak commute times. This framework can and will be applied to more modeling scenarios such as dynamic modeling and optimization, resilience analysis, and integrated decision making.

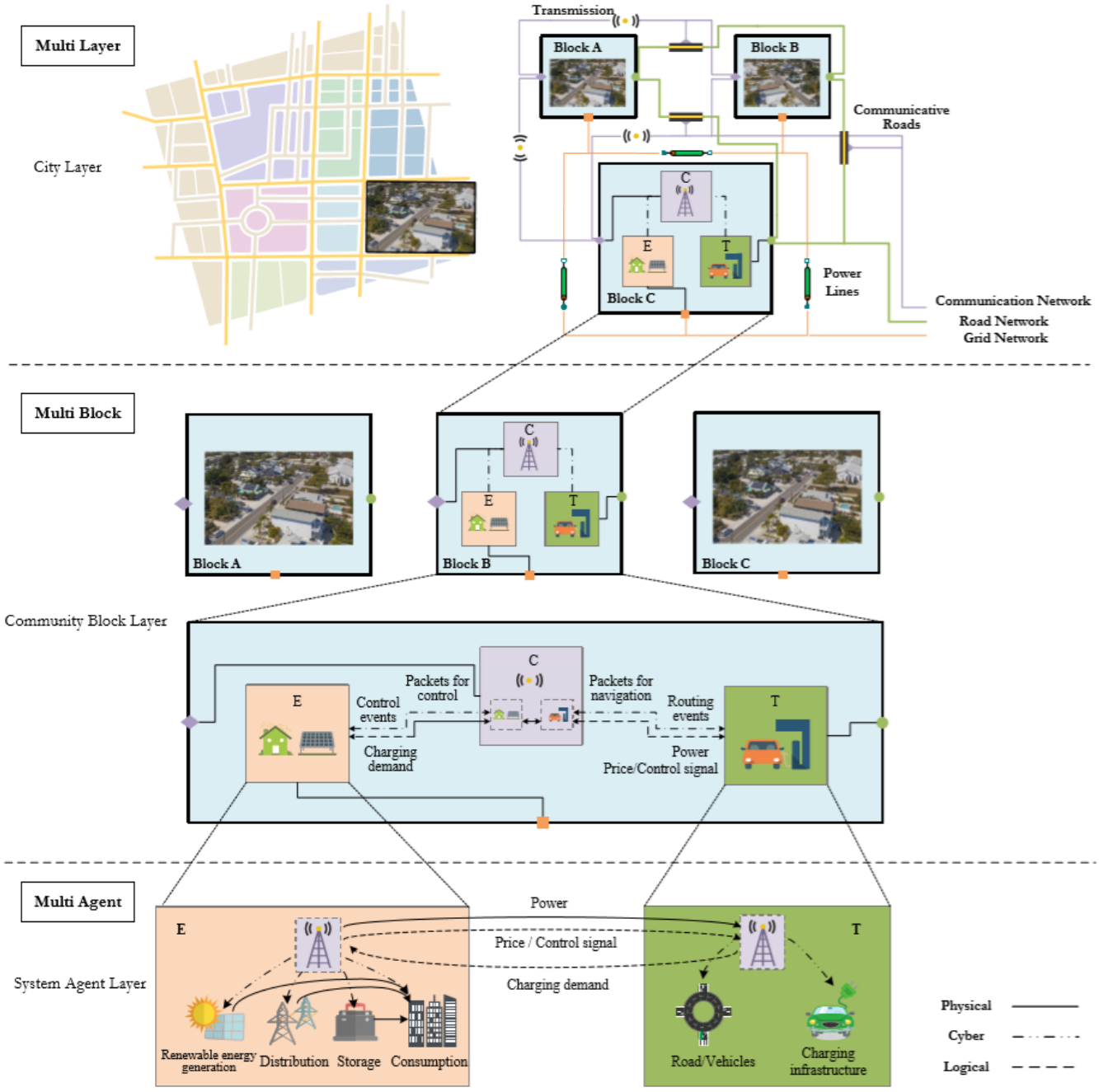

Figure 1 3M schematic of approach for modeling the three coupled systems, type of interdependency shown by line