The Role of ENG in DDDAS

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Dynamic Data Driven Applications Systems (DDDAS)

• DDDAS is a promising concept in which the computational and measurement aspects of a real-time simulation are dynamically integrated, creating new capabilities for analysis and prediction in complex systems.

• The DDDAS concept holds the promise for accurate and reliable analysis and prediction capabilities that will enable decision making in complex systems.

• Many areas of national importance are likely to benefit from DDDAS.
DDDAS Basic Building Blocks

• A hierarchy of heterogeneous simulation models
• A system to gather data from archival and dynamic sources
• Algorithms to analyze/predict system behavior by blending simulation models and data
• Algorithms to steer and control the data gathering and model validation processes
• The software infrastructure supporting model execution, data gathering, analysis/prediction and control algorithms
Engineering in DDDAS

• Engineering investigators and students possess
  – Imagination and domain knowledge to help identify applications with societal impact
  – Domain knowledge to conceive and develop the appropriate simulation models
  – Experience with sophisticated measurement systems and sensor networks
  – Experience with elaborate strategies and algorithms for prediction, optimization, and control

• Partnerships with computer science colleagues are necessary for success
Examples of Areas of Impact

• Hazard prevention, mitigation and response
  – Earthquakes, hurricanes, tornados, wild fires, floods, landslides, tsunamis, terrorist attacks

• Critical infrastructure systems
  – Condition monitoring and prediction of future capability

• Transportation of humans and goods
  – Safe, speedy, and cost effective transportation networks and vehicles (air, ground, space)

• Energy and environment
  – Safe and efficient power grids, safe and efficient operation of regional collections of buildings
Examples of Areas of Impact

• Health
  – Reliable and cost effective health care systems with improved outcomes

• Enterprise-wide decision making
  – Coordination of dynamic distributed decisions for supply chains under uncertainty

• Next generation communication systems
  – Reliable wireless networks for homes and businesses