Computational Technologies Workshop Charter

ESTO
Earth Science Technology Office

- Identify the Earth Science Enterprise computing capabilities required to achieve the Earth System Prediction Goals and applications strategy for 2010 and beyond.
- Evaluate current ESE computing capabilities against these requirements.
- Determine and quantify what gaps in capabilities exist.
- Determine which gaps can be addressed by advances in computational technologies
- Identify and quantify the advancements in computational technology capabilities that require NASA investment in order to bridge these gaps.
- Prioritize these capability advancements in terms of their likelihood to enable the Earth System Prediction Goals for 2010.
- Create a roadmap for each unique capability advancement.
- Create a final report.

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- Identify the Earth Science Enterprise computing capabilities required to achieve the Earth System Prediction Goals and applications strategy for 2010 and beyond.
  - **What will achievement of the prediction goals require? I.e., imagine what the community infrastructure would look like to enable these goals …**
    - **Rate of observational data ingestion?**
    - **Real-time, simultaneous, multi-satellite data availability?**
    - **Model resolution?**
    - **Number of model runs? (I.e., computing infrastructure throughput?)**
    - **Data volume being stored, processed, and transfer rate?**
  - **Show stoppers? I.e., is development of new modeling and/or analysis techniques the pacing item here? Do we even know how to achieve these prediction goals?**
  - **Software Development/Programming Environment - does this need to change from how you work today?**

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- Evaluate current ESE computing capabilities against these requirements.
  - How do you do business today?
  - **Rate of observational data ingestion?**
  - **Model resolution?**
  - **Number of model runs? (I.e., current throughput?)**
  - **Data volume being stored, processed, and transfer rate?**
  - **Model complexity?**
  - **Software Development process?**
  - **Software portability?**
  - **Adequate platforms?**

  - What needs to change in this decade and beyond?

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- Determine and quantify what gaps in capabilities exist.
  - **Model Complexity - Limited by science understanding or ability to engineer and implement software? Both?**
  - **Model validation process?**
  - **Data management?**
  - **Data movement?**
  - **Computing throughput?**
  - **Human interface to the analysis?**
  - **Visualization?**
  - **Other gaps?**
  - **Make a list of the capability gaps and describe each in sufficient detail, e.g.**

    Random access to petabytes of sensor data products

    Automatic generation and execution of ensembles of models

    Plug and play modeling infrastructure
  - **Try to stay away from implementation solutions at this point**

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- Determine which gaps can be addressed by advances in computational technologies
  - **Are any of the gaps identified not dependent on advances in computational technology? I.e., those that are fundamental physics modeling issues should be separated from implementation advancements required**

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- Identify and quantify the advancements in computational technology capabilities that require NASA investment in order to bridge these gaps.
  - We are looking for a break down into more specific technology areas. Some possible examples:
  - **Algorithms - faster, more scalable, etc.**
  - **Applications software engineering - Code development and testing tools, programming models, …**
  - **System software - …**
  - **Computing Platforms & networks - …**

  - Identify any items where advancements are required - but NASA investment would not be productive or it is not unique to NASA- I.e.:
  - **Industry will do it**
  - **Another agency is already the leader is this area**
  - **Other reasons?**

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- Prioritize these capability advancements in terms of their likelihood to enable the Earth System Prediction Goals for 2010.
  - Given the list of capabilities needed, assign a priority (high, medium, low) that indicates how important a capability will be in enabling a prediction. This could also be interpreted as
  - **Must Have - Can't do prediction without it**
  - **Important - work will be harder without it**
  - **Nice to have - goals are achievable without it**

First type of Roadmap

- Create a roadmap for each prediction/science capability goal.

  Start with each prediction/application scientific knowledge base against enabling computational technology needed, as a function of time:

  - **Current state of knowledge base**
  - **Current computing technology base**
  - **Science-based milestones for achieving each prediction goal.**
  - **Milestone for a technology development activity to enable prediction goal (with success criteria and date required)**
  - **Major development milestones and test cases along the way with desired completion dates**
  - **Think of what other science capabilities might be dependent on these intermediate technology milestones?**

Second type of Roadmap

- Create a roadmap for each unique computing capability advancement.
  - **Current state**
  - **Current development activities (who, what)**
  - **End goal milestone for a technology development activity to address this capability (with success criteria and date required)**
  - **Major development milestones and test cases along the way with desired completion dates**
  - **Indicate science capabilities that might be dependent on these intermediate milestones?**
  - **Are there any external dependencies with other technology developments?**