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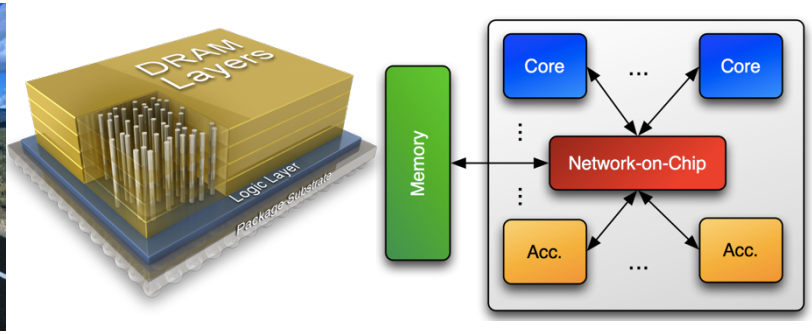

Impact of ECI on DOE Co-design Strategies

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Scalable Computer Architectures

The Salishan Conference on High Speed Computing
Gleneden Beach, OR
Random Access Talk, April 29, 2015

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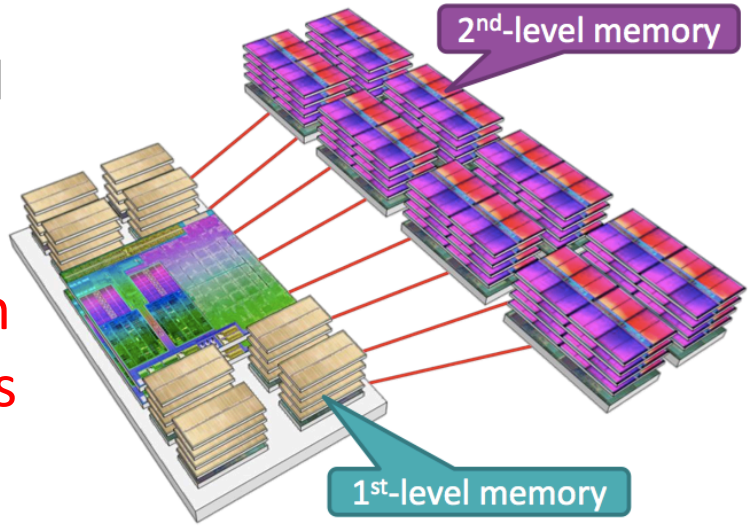
ECI Provides DOE a Key Opportunity

- Time frame and funding to:
  - Design hardware and system architectures
  - Modernize DOE's legacy applications portfolio
- ECI can support two complementary Co-design strategies
  - *Clean sheet* development of applications/algorithms with largely predetermined Hardware and System Architectures
  - *Clean sheet* development of hardware/system architectures with largely predetermined Applications and Algorithms

Clean Sheet development of Application/Algorithms with *a priori* defined HW/System Architectures

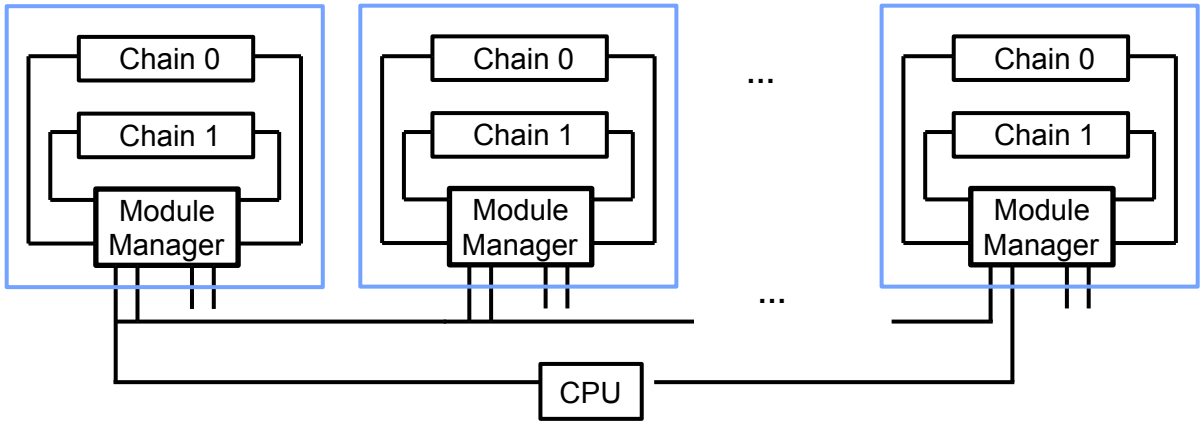
- This maps to an *Application-centric Proactive* Co-design path
- This approach has synergy with DOE/SC applications that are un-encumbered by a large legacy code base
- Note: Even if there were enough ECI budget to scale this strategy to the entire portfolio of DOE Legacy Applications, we do not have enough application and algorithm developers to rely solely on this strategy



e.g. AMD Two Level Memory Concept

Clean Sheet development of HW/System Architectures with *a priori* defined Applications/Algorithms

- ECI provides an opportunity to pursue a complementary strategy. This is an *Architecture-centric Proactive* Co-design path with a required "bridge" to DOE's portfolio of legacy applications.
- This strategy complements *Application-centric* by focusing Computer Industry R&D efforts on designs that reduce DOE application and algorithm developer efforts



e.g. Advanced Concept: *Modules of Chains of HMCs*

Fully Funded ECI is Required to Pursue these Strategies

- These two strategies, while *distinct*
  are not necessarily *independent*
- Progress in the strategies can inform each other,
  i.e., *Holistic* Co-design
- Both strategies require System Software R&D, but needed System Software capabilities may differ due to Application and Architecture differences

Final Thoughts about ECI Impact

- Despite misperceptions,
  ECI is not about reaching 10^{18} floating point operations per second
- We should not squander our ECI opportunity
- Prioritization criteria for DOE Exascale Co-design:
  - All Architecture R&D is not equal. Should prioritize efforts that ease the Application/algorithm developer burden.
  - All Application Development is not equal. Should prioritize approaches that can "bridge" to our legacy code base.
  - System Software Investments that support *these priorities* are critical to DOE Exascale Co-design