DOE-COE Breakouts

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OpenMP Futures Breakout

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Topics to cover

- Performance Portability
- Usability
- Memory management
- Execution
- ...
Performance Portability Related

- What is missing in OpenMP for performance portability?
- Is the OpenMP abstract machine adequate to reason about performance?
  - Is it possible to define an adequate abstract machine or do we need to explicitly support/be aware of architectural differences?
- There are different practices for different architectures
- Do you need better support for STL?
Portability Discussion Notes

- Current solutions seem to involve lots of ifs and ifdefs
- More descriptive options might help compiler Do The Right Thing
  - Do you believe in Magic? Does this really work for more complex code examples
- Even portability from compiler to compiler can be problematic
- One view is we only have two platforms, just choose your directives. That is enough.
  - this does tend to limit scope of codes.
- Basic unit of work - then design a separate mapping
- relationships between work units must be defined.
- Hardware can set algorithm preference. Then you're just stuck.
- Need a better stl.
Usability Related

- **Best practices**
  - Does a ‘best practices’ document exist somewhere? Who maintains it?
  - What programming patterns work in OpenMP?
  - What are the characteristics of codes that admit such patterns?
  - Do we now need a new set of practices? Will community adopt it?
  - Different annotations for different architectures

- **What are most important interoperability concerns for OpenMP regarding:**
  - third party libraries?
  - other programming models?
  - other threading systems?
  - MPI?
Usability Discussion Notes

- Appears that we could improve dissemination of best practice information.

- Discussion of classifications of codes
  - Can your code nest? Are the nesting levels self similar?
Interoperability Discussion Notes

- Resource allocation handles to pass to library
  - Like an MPI Communicator
- Task constructs sort of help, but they aren't there yet.
- What might support for "unbound" threads look like?
- Libraries have been typically developer as context free, because there was no context to worry about.
- Support for C++ is can be problematic
- Co-existing with other threading models could be better
Memory Management Discussion Notes

- Is OpenMP adequate to manage the lower levels of the memory hierarchy?
- Do we need additional facilities and what would they look like?
- Could code written with such features ever be considered performance portable?

- Question of memory support applies to any language/model?
- I have read only data, used heavily (descriptive approach)
- Talking about data traits seems useful.
- but we probably don't know where the land mines are
- The fact that directives aren't "sticky" is limited. (Solutions can be imagined)
Execution, Runtime, etc…

- Do you need more control over sequential optimization?
  - Tiling of loops?
  - Automated unrolling?
  - Support for wavefront loops?

- Do we need directives for specifying dependencies between loops?
  - Loop fusion?
  - Pipelining?
  - Intermediate variables?
  - Dependency list?
Execution Discussion Notes

- Tension between portability and performance is once again evident.

- doacross - yes

- collapse non-rectangular loops – yes
  - or non closely nested loops (ugly and hard transformation?)

- tiling - yes, but limited audience

- standardized directives could be a benefit, but feature creep

- Knowing staging and interaction of directives is important.

- examples needed!!

- Explorations of auto-tuning or run time adaptive tuning
Backups in case discussion dies…
Usability Improvements

- Best practices
  - Does a ‘best practices’ document exist somewhere? Who maintains it?
  - Do we now need a new set of practices? Will community adopt it?

- It is hard to do OpenMP well
  - How can I do OpenMP wrong? Let me count the ways…
  - Different annotations for different architectures
  - No heuristics easy to find (see best practices above)

- Should OpenMP be more descriptive?

- Is accelerator support adequate?

- Is support for function pointers needed?
  - Do we need access to function pointers generated by compiler?

- Is support for lambdas needed?

- Do we need API routines to understand how the device works?

- Are OpenMP tasks usable?

- Are overheads too high? What would you give up to get lower overheads?
Memory Management

- Do we need Futures in OpenMP?
  - Easier specification of dependencies

- What memory management improvements do you want to see?
  - Hierarchies?
  - Affinity? (NUMA aware)
  - Deep copies?
  - Allocations? (is target / map enough)

- Should OpenMP infer target directives based on the context?