Unlocking the Power of OpenMP

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The talk aims to discuss and illustrate by practical examples the power of OpenMP on current, cache-based processors. It will also highlight the (potentially) relative simplicity of OpenMP with respect to other multi-threading techniques. Some comments about the potential importance of OpenMP for hybrid parallelism (i.e. clusters of SMP nodes) will be made. Finally, by means of case studies, the need to revise current algorithms will be addressed.

- The Nature of OpenMP
- Memory access issues
  - Cache
  - Some comments on the relationship between no. ops and no. memory references
- Serial and quasi-serial bottlenecks.
  - Reducible and Irreducible bottlenecks
  - "Look –ahead" algorithms
  - "Hiding" vs. parallelising serial bottlenecks
- Practical Example: LU Factorisation
  - Existing algorithms, their characteristics and performances
    - The serial line algorithm
    - The blocked LAPACK algorithm
  - Parallelisation
    - Forming queues of (locally asynchronous) tasks
    - Parallelising existing codes
- OpenMP and Hybrid Parallelism
  - Importance of node-level multi-threading
  - OpenMP as a latency-busting device
- Extension to other algorithms, two case studies:
  - Orthogonal reductions
  - Iterative solution of Sparse systems of equations