Parallel EDA,

A user's perspective

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User's View of Parallel EDA

- Tool(s) that run for a long time
- Access to a farm of machines usually managed by lsf or something similar
- Fair share concept allocating machines across users
  - Exclusive access to machines is discouraged
  - Access to large memory machines requires long waits
- Hoping to use fair share of the farm to get the job done faster
- Cloud EDA is not yet in the mindset

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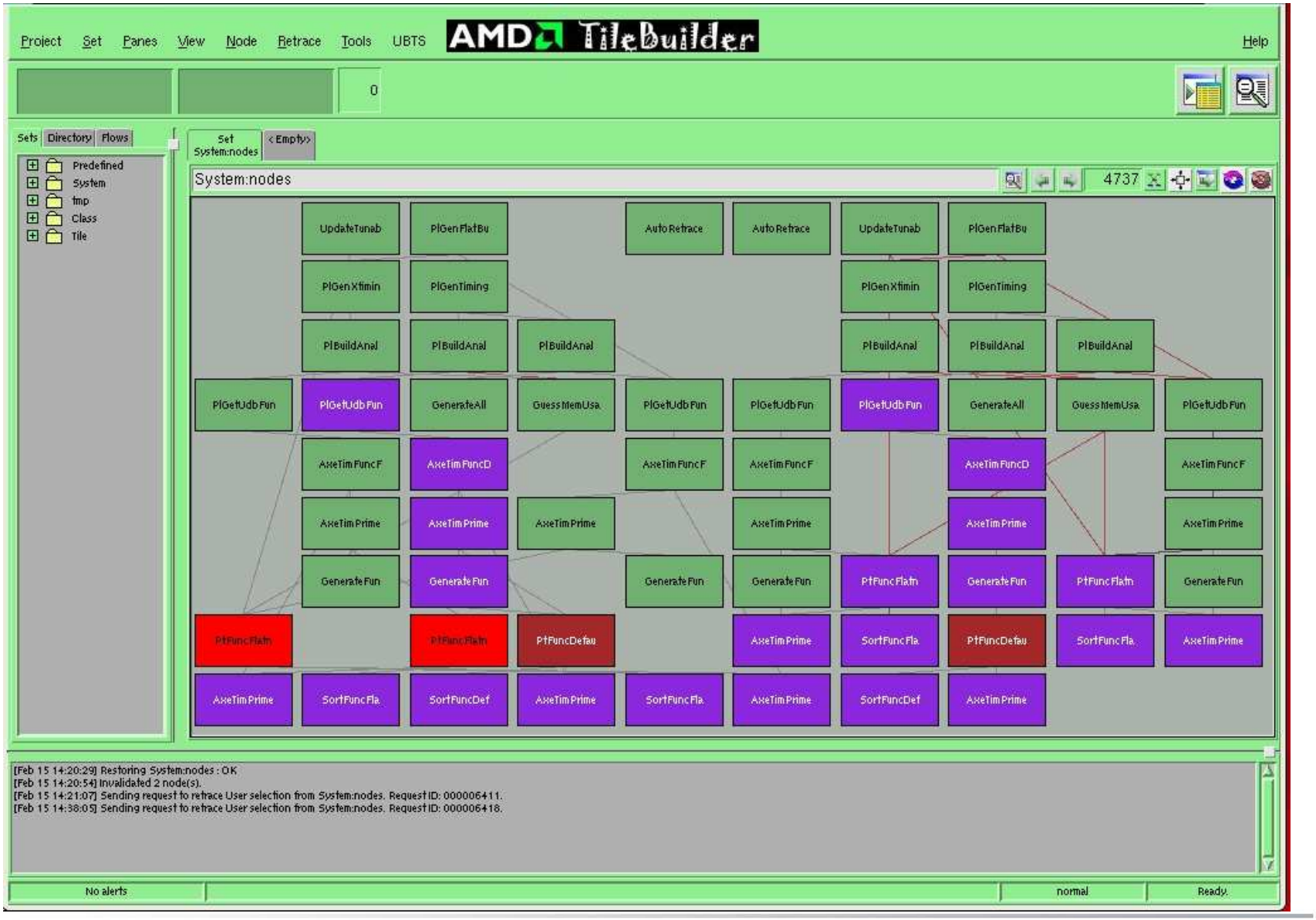

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Given the User's view these are the trade-offs

- Requiring multiple machines simultaneously does not work well.
- For example in Timing Analysis, MMMC distributed, where all timing views are needed at the same time is not feasible.
- Machines need to be used effectively as they come up, no waiting for all machines requested before starting
- If multiple machines are used and there is high memory duplication this is not efficient
- Multi-threading with minimal memory increase per thread is preferred but there is a usability issue

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Usability of multi-threading and LSF/others

- Tool asks user to set number of threads
- User must make sure bsub call asks for that number of threads.
- If there is a good machine with n-1 processors available it won't be chosen
- If resource managers and tool developers could coordinate it would be helpful.
  - Ask for machine with X memory and most available cpus from LSF. Tell App how many it can use via envi variable

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Fair Share example

- A user cannot have more than 8 machines with running jobs at the same time
- 8-way machines are the most available
- 64 cpus
- Easy to get machines with 64Gig RAM
- Hard but possible to get machines with 128Gig Ram
- Bigger requires special approval / process

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Using parallel processing to reduce Machine Size

- Split job into pieces where each uses less memory
- MMMC Timing analysis
- Routing
- DRC

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What about the Cloud

- Possible benefits
  - Peak access to machines when needed
  - **Solve the application / resource manager coordination**
  - Shared cache contention
  - **EDA Vendor easy access to data**
    - **Quick debugging of actual issue, like internal CAD**
- Questions
  - Data security real and perceived
- Cost predictability
  - Time based versus usage based model

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Methodology for deciding if and how much parallel programming to use

- When answering this question we need to look at :
  - Technical issues
  - ROI issues for the expert resources usually needed to write parallel programs and make them scale

- List of questions that form a decision diagram starting at the simplest solution moving to the most complex

- I may not have the decision points right for everyone but I feel strongly about the general methodology of trying to start simple and adding complexity when there is ROI.

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Methodology for deciding if and how much parallel programming to use

- Can non-shared memory, coarse grained with separate processes give the needed scalability?
  - Use only processes and keep it simple when possible
  - Coarseness defined as compute time >> data transfer time
  - My Blog Post discusses pushing this to the limit :
    - http://software.intel.com/en-us/blogs/2009/09/02/parallelizing-legacy-code-using-fine-grained-distributed-processing/

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Methodology for deciding if and how much parallel programming to use

- If shared memory is required does the task tend to share a lot of memory for read and then generate a smaller amount of data?
  - Use copy on write fork() and keep it simple when possible
  - Generate all data before fork(). Compute generates new data versus updating existing data.
  - My blog post discusses this in detail :
    - http://software.intel.com/en-us/blogs/2009/09/25/parallelizing-legacy-unixlinux-code-using-copy-on-write-fork/

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Methodology for deciding if and how much parallel programming to use

- If shared memory is required for both reading and writing at a fine grained level then we need threads that share memory.
  - Can you get the needed scalability with X86 threads including using SSE?
  - Stay with X86 threads, if SSE use openCL if not use the pthread library since more people are trained on it.

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Methodology for deciding if and how much parallel programming to use

- Is the cost of the run in terms of number of cpu's needed too high, or is the bottleneck access to cpu's instead of scalability of the algorithm?
  - Use openCL to access GPU hardware and see if the compute power there can be utilized. Save on X86 hosts.
  - If X86 based threads won't scale, there is either a bottleneck in the divisibility of the work or the data transfer.
    - If this is the case it probably won't scale on GPU's either

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