

Morphable Multithreaded Memory Tiles (M3T)*

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Impact

- Influenced IBM CyclopsE chip with polymorphic support
- Sped up Sphinx speech processing about 2.5x through polymorphism
- Estimated 60x reduction in size, weight, and power per speech channel
- Estimated 20x reduction in cost per speech channel

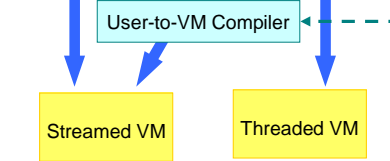
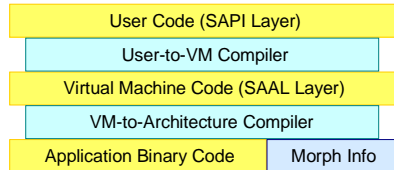
Templates

- Provide routines required by application
- Use
 - generic: threads, C, C++,...
 - specialized – (possibly architecture specific): Brook, StreamIt, StreamC/KernelC, assembly - MPI?, Corba?



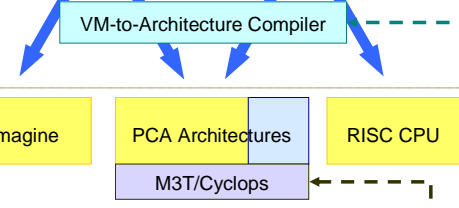
New Ideas

- M3T morphs into VLIW, MIMD and TaskScalar templates
- Polymorphism at every stage of the system
- M3T morphs on demand within application



Streaming

- Native mode for M3T/Cyclops
- GNU -- C/C++/Fortran
- Augmentation with superscalar possible
- MPI, Corba possible (not currently supported)

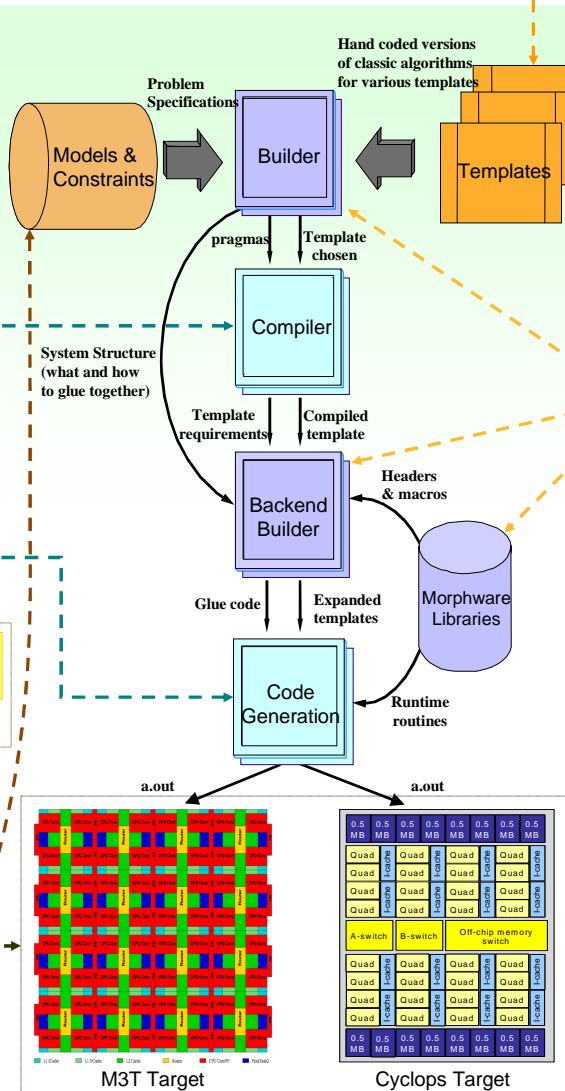


Threaded

- Use cache interest group coding as routing network
- Support SIMD via fast barrier
- Utilize thread units as imagine clusters
- Compiler/macro/template support needed

Model

- Architecture specific details:
 - ALU, memory, etc.
- Template constraints
- Application requirements
- Optimization goals
- System constraints
- Tool choice structure



Builder/Runtime

- Search design space based on models/templates
- Generate application framework (glue code) and configuration files within MSI constraints
- Utilize existing
 - Compilers/linkers based on template choice
 - Hardware specific morphware

Compiler

- Transformation based on three templates
 - MIMD, TaskScalar, VLIW
- Target to two morphable architectures
 - M3T, Cyclops
- Support automatic and manual parallelization



* Some parts adapted from: "The Stanford Smart Memory Compiler Framework", Ben Black, François Labonte, Lance Hammond, Stanford University, Morphware Forum 04, April 2002

