Programming the STHORM Manycore: τC

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τC: Process Networks over C

Extending C to make parallel programming on Manycores simpler:

• Processes with interfaces, point to point directed communications, stream-oriented
• Hierarchical composition, component model
• Implicit communications, no race conditions
• Full C handling (C99 + GCC extensions) with no changes to algorithmic / C code
• Graceful termination (downstream / upstream)
• Target independent (Oriented towards embedded manycores)

Example

```c
void * minVariance(int width, int height, Pixel * pDiff, Deviation * pDeviation, int * pMean) {
    computeDeviationMacroBlock(width, height, pDiff, 8, pDeviation);
    computeMeanPicture(width, height, pDiff, pMean);
}
```

τC component for C above

```c
typedef iMinVarianceStrip : (Pixel : diffStrip) -> (Deviation : deviation, int : mean);
task MinVarianceStrip(int width, int height) : iMinVarianceStrip {
    void main() : (pDiffStrip[width * height] <- diffStrip, pDeviation <- deviation, pMean <- mean) {
        computeDeviationMacroBlock(width, height, pDiffStrip, 8, &pDeviation);
        computeMeanPicture(width, height, pDiffStrip, &pMean);
    }
}
```

Instanciation in Graph

Front-end, mapping generator and HAL

• Small set of extensions to C (20 productions added to C grammar)
• Three keywords (task, module, next)
• Offline instanciation / Online execution
• Hooks for deadlock freeness checking / buffer sizing
• Targets C as back-end compiler
• HAL Targets: MCAP/STHORM and host, Pthread
• Easily retargetable to another HAL

Related Work

• Aubry, P. et al.: Extended Cyclostatic Dataflow Program Compilation and Execution for an Integrated Manycore Processor, International Conference on Computational Science, ICCS 2013

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