

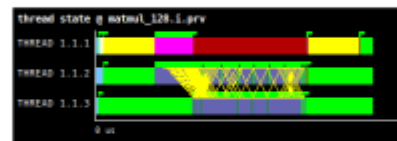
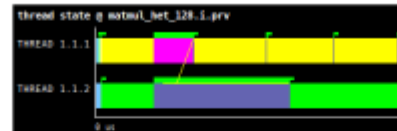
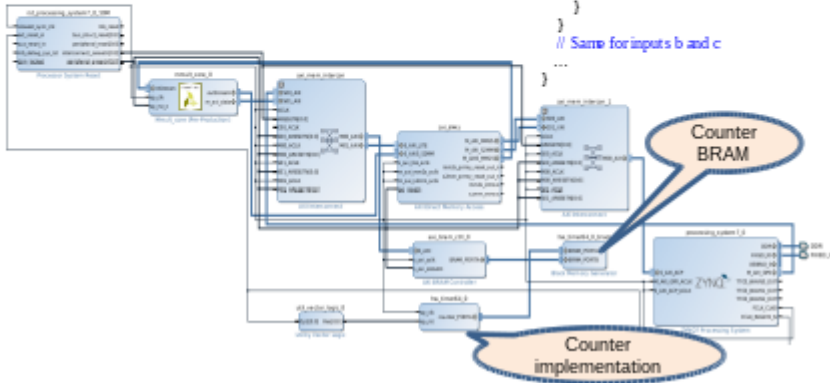
Cyber-Physical Computing Systems

```

#pragma omp target device(fpga, smp) copy_deps
#pragma omp task in(a[@:BS*BS-1], b[@:BS*BS-1]) \
  inout(c[@:BS*BS-1])
void matrix_multiply(int BS, t a[BS][BS], t b[BS][BS],
  t c[BS][BS]) {
  for (int ia = 0; ia < BS; ++ia) {
    for (int ib = 0; ib < BS; ++ib) {
      t sum = 0;
      for (int id = 0; id < BS; ++id)
        sum += a[ia][id] * b[id][ib];
      c[ia][ib] += sum;
    }
  }
}
  
```

```

void mmult_core_kernel (inStream axiData -> SrcStream,
  SrcStream axiData -> SoutStream)
{
  #pragma HLS interface ap_ctrl_none port=stream
  #pragma HLS interface axis port=inStream
  #pragma HLS interface axis port=outStream
  union { float f; int i; } Eoi;
  // stream inStream first matrix
  float a[64][64];
  for (int i = 0; i < 64; i++) {
    for (int j = 0; j < 64; j++) {
      #pragma HLS pipeline II=1
      Eoi.i = inStream.read().data;
      a[i][j] = Eoi.f;
    }
  }
  // Same for inputs b and c
}
  
```



Cyber-Physical Systems are getting spread, as more and more devices are connected to the Internet. From TV streaming to alarm control, and from automatic delivery of home supplies to video processing, there are a lot of services that demand a connection to the Internet.

Summary

Can we drive Cyber-Physical Systems with OmpSs? This is the topic we are dealing with in this research line at BSC.

Cyber-Physical Systems are getting spread, as more and more devices are connected to the Internet. From TV streaming to alarm control, and from automatic delivery of home supplies to video processing, there are a lot of services that demand a connection to the Internet and some CPU cycles to process the information they get from the environment. CPU demand can vary from simple analysis and collection of some samples every second, to high demand of video processing.

Objectives

We are investigating the use of the OmpSs Programming Model to serve as the basic programming tool for these Cyber-Physical Systems. OmpSs is being deployed on systems with small processing capabilities and

memory capacity, as well as on clustered environments based on small boards. In these systems, acceleration is also a requirement. Heterogeneous OmpSs with support for FPGAs, OpenCL and CUDA is key to exploit all systems features.

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