**Introduction**

**Motivations**
- Scalable and flexible PR base architecture for rapid development of PR embedded systems
- Virtual Architecture for Partially Reconfigurable Embedded Systems (VAPRES)
- Enabling hardware (HW) for research on intelligent HW resource management
- Online HW module placement and scheduling
- Dynamic migration of application tasks from software to HW

**Highlights**
- Integration of MACS inter-module communication architecture
- Integrated VAPRES System Builder (VSB) software
- Develop both partially reconfigurable (PR) SoCs and applications
- Support for both IOMs (static modules) and partially reconfigurable modules (PRMs)
- Impulse C compatible hardware modules
- Implementation on both Virtex-4 and Virtex-5
- Area profile, bitstream size, reconfiguration time

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**Architectural Support for Impulse C**

**VAPRES architecture**
- Scalable and flexible architecture
- Architectural parameters: number of partially reconfigurable regions (PRRs), FIFO depths, PRR width/height, MACS
- Modules run in different clock domains
- Streaming communication
- Asynchronous FSLs
- Inter-module communication via MACS Network-on-chip (NOC)

**Support for high-level synthesis (HLS) of PRMs using Impulse C**
- Transparent integration of Impulse C hardware processes into VAPRES PRRs
- Higher abstraction level reduces development time

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**Experimental Setup**

This experiment demonstrates adaptive target tracking of a ball using a camera and near-seamless filter swapping

**Equipment**
- **Target**
  - Ball on cloth backdrop
- **VAPRES Setup**
  - 3 switches
  - 1 channel left and right

**Adaptive Target Tracking**

**Application development using the VSB**
- KF filters for target tracking
- Tracks targets from noisy measurements
- Highly parallel calculation ideal for FPGA

**Specialized Kalman filters for different targets**

**Proposed algorithm**
- Software application initially loads variable-gain Kalman filter inside a PRR
- Switches to constant-gain Kalman filter if filter gain does not change
- Adaptive clock frequency keeps throughput constant
- Software application adjusts PRR frequency