AdaPNet: Adapting Process Networks in Response to Resource Variations

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Motivation
- If multiple applications share a system, the computing resources that an application can use depend on the overall workload of the system.
- The programmer does not know the available computing resources at design time.
- Applications must seamlessly adapt on-line to dynamic resource changes for increased efficiency – performance, memory usage.

AdaPNet Highlights
AdaPNet is a runtime system that efficiently executes streaming applications, on platforms with dynamic resource allocation.
AdaPNet responds to changes in the available resources:
1. It calculates a process network that maximizes the performance on the new resources.
2. It transparently transforms the application into the alternative network without discarding the program state.
AdaPNet outperforms comparable run-time systems, in terms of speed-up and memory usage.

Design Flow
1. Application(s)
2. Mapping optimization
3. Architecture
4. Mapping storage
5. Run-time manager
6. Behavioral events
7. Fault events

Design Transformations
- Expandable Process Networks (EPN)
- Specification
  - Only behavioral description
  - Behavioral description
  - Structural description
  - Behavioral description & structural description

Experimental Results
- Can AdaPNet outperform run-time systems that do not adapt the application's degree of parallelism?
- How expensive is the transformation into an alternative process network?

AdaPNet Runtime Strategy
- Application
  - Network 1
  - Network 2
- Mapping
  - Mapping 1
  - Mapping 2
- Transform
- Calculate new network/mapping

Experimental Setup
- Vary number of available cores
- Intel Xeon Phi

AdaPNet is an adaptive run-time system that enables the efficient execution of streaming applications specified as stateful process networks, on multi-processor platforms with dynamic resource allocation.