Dataflow Programming For Near-Sensor Signal Processing And Machine Learning Specific Architecture

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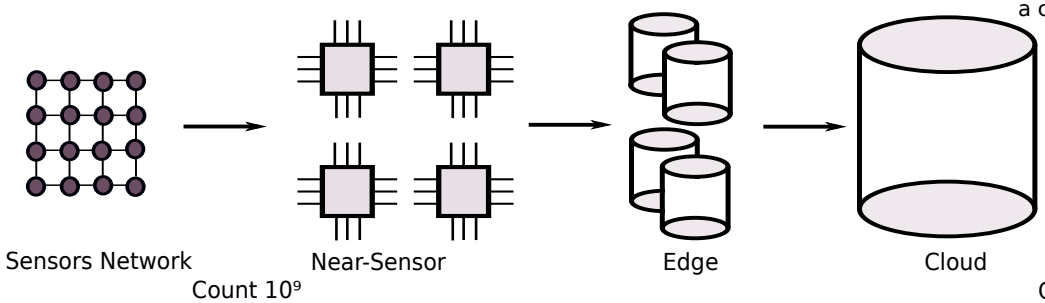
Context



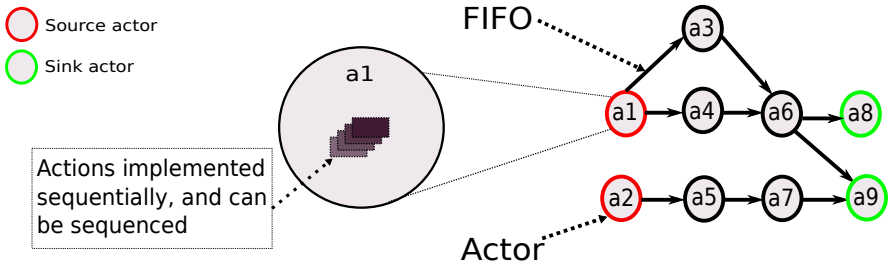
The accelerating growth of IoT devices and data that systems capture has spurred the industry to reconsiderwhere to compute data andembraces a computing continuum.

Cloud: relatively centralized and offers big data storage and high computing power.

Edge: In this context, it refers to where endpoint devices plug into the network and ending at the cloud.

Near-Sensor: Where data is firstly computed. Nowadays it covers a large set of applications,such as signal processing and machine-learning applications.

The Dataflow Model of Computation

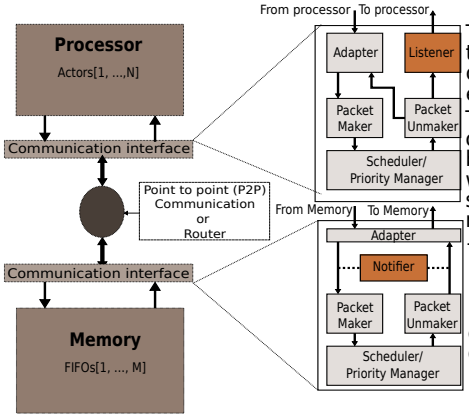


The stream processing nature of SPML workloads make it possible to exploit data, tasks, and pipeline parallelism to optimize the usage of memory and computation hardware resources.

The Dataflow Models of Computation have been proven useful to formalize the aforementioned applicative properties and feed automated optimization processes.

This opens reflection to new specialized architecture taking advantage of the possible latency analysis and knowledge of data movements.

Notifying Memories

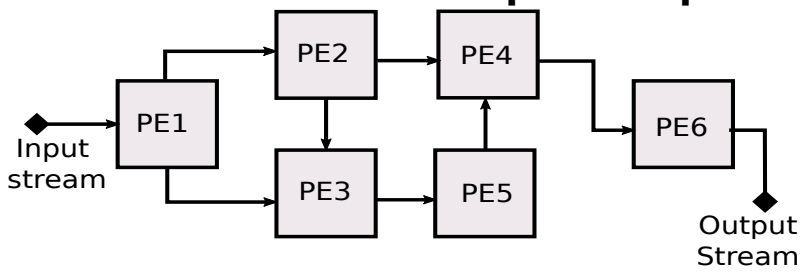


The notifying memory concept takes advantage of the observer pattern in software engineering.

This pattern defines a one-to-many dependency between objects so that, when one objects changes states, all its dependents are notified and update.

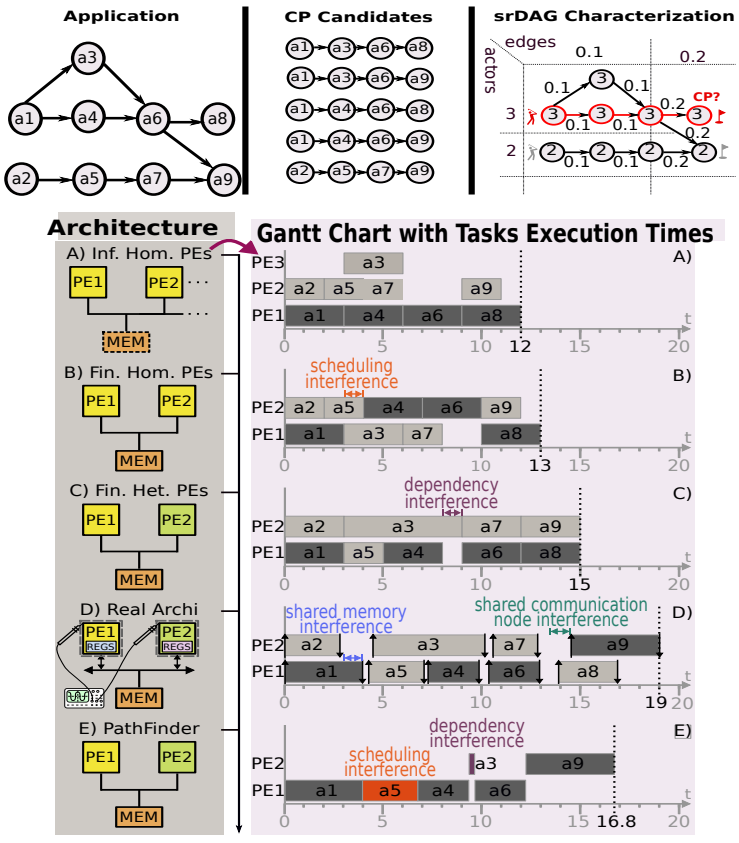
The main purpose of this method is to reduce the number of useless memory requests and then, reduce the communication latency overhead.

Coarse Grain Anisotropic Datapath



Early works of this Ph.D. thesis are investigating custom coarse grain datapath using the PathTracing latency analysis for design space exploration and the notifying memory concept to optimize memory usage. The work will use the dataflow prototyping framework PREESM and the open-source SoC builder LiteX.

PathTracing Analysis



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