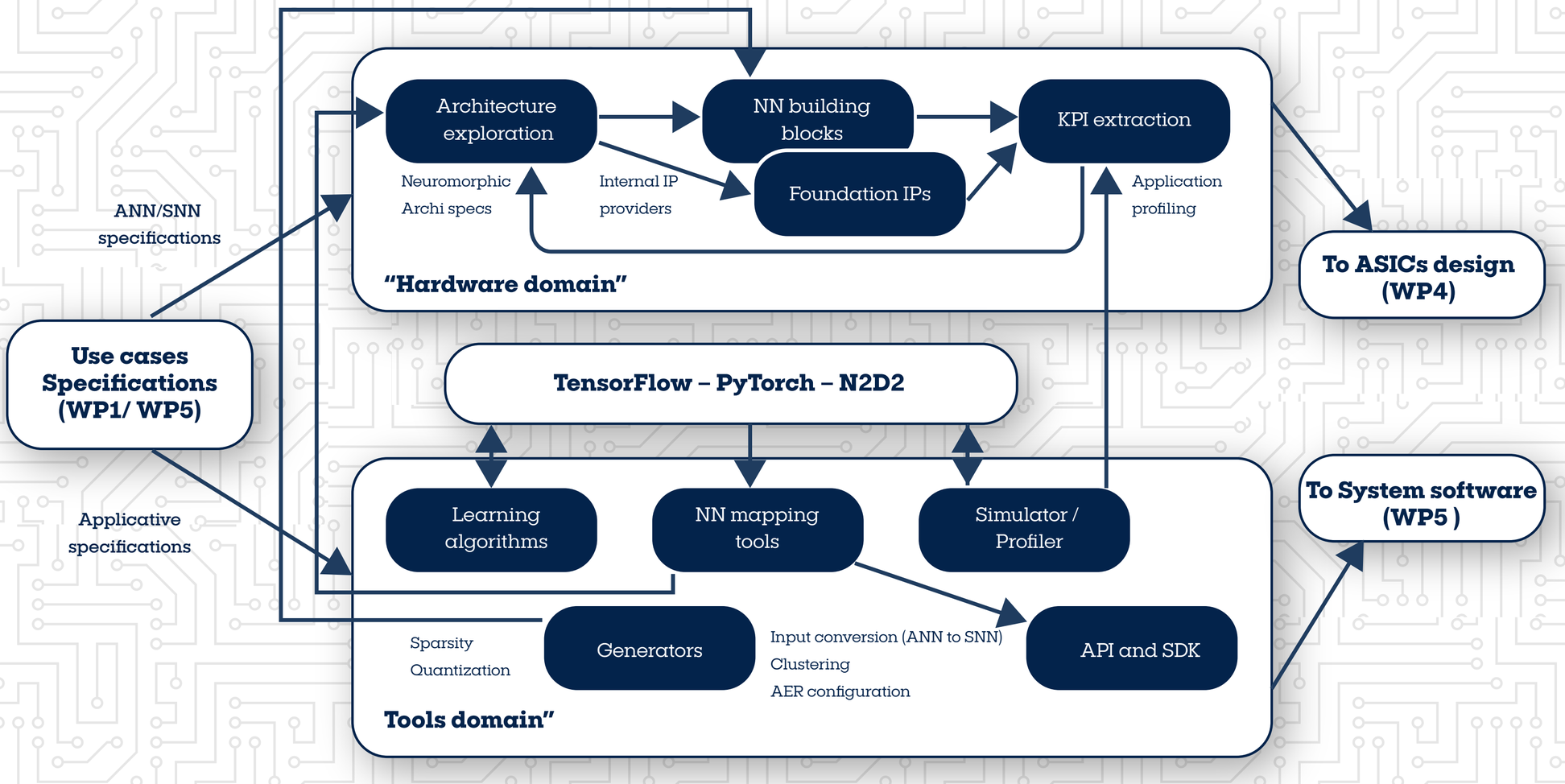
ANDANTE

Tools and methodologies for training, profiling and mapping a neural network on a hardware target

ANDANTE

Design Challenges

Edge AI processors need novel architecture solutions implementing deep neural networks (ANN, SNN, aNN) for data analytics at very low-power consumption.
The efficient design of these processors requires tools and methodologies to facilitate the training, simulation and deployment of neural network models on the targeted processors / HW accelerators. Next Figure depicts the software-hardware co-design methodology pursued in ANDANTE.



Software-hardware co-design workflow

Tools needed to:

- Pursue different coding strategies, either classical coding or spike coding
- Implement various design strategies (digital, mixed-signal)

Next Table lists the tools considered in ANDANTE co-design workflow

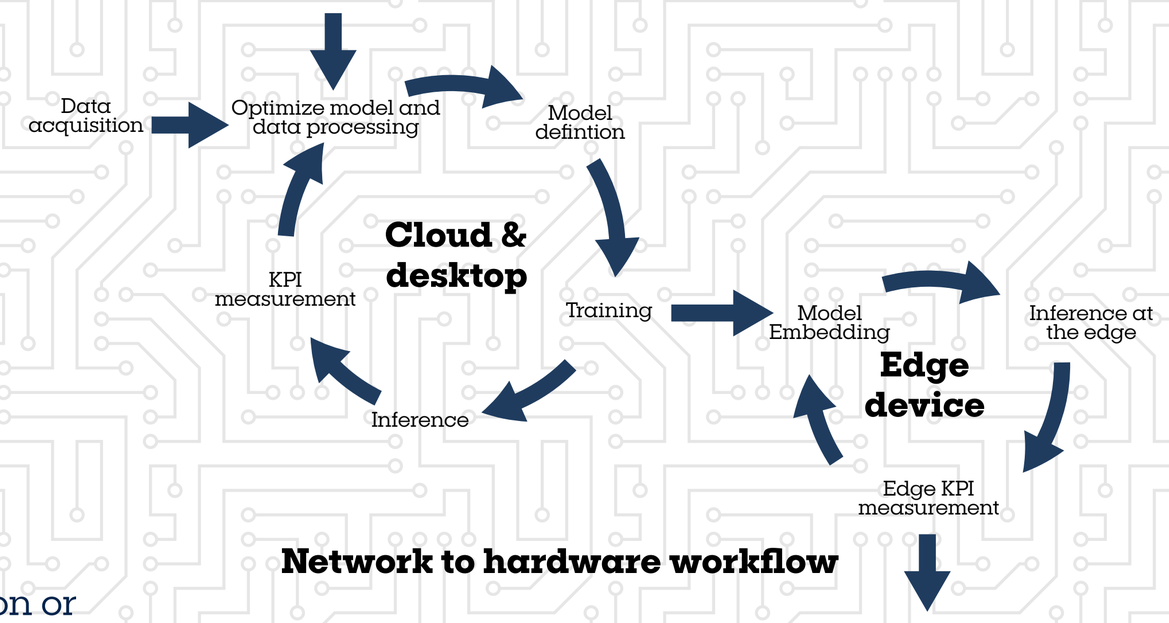
Partner	Tools to be developed	Tools to be updated	Third party tools from another partner
CEA	• Unified framework for algorithm / hardware co-design (Python wrapper for transfer learning, code generation) • Jinja based VDHL templating	N2D2 (quantization aware training, supporting mixed precision)	
CSEM	• Mapping Tool • Benchmarking Tool		• Rockpool (Synsense) • Sinabs (Synsense)
FHG	• FHG training and inference tools • Power estimation tool • Compiler • Deployment and run-time API tool	• NN HW generator tool • Script for Test benches generation	
IFAG	• ANN Design Simulator • ANN Trainings Framework	• NN Design Simulator • SNN Trainings Framework	none
IMEC-NL	• DeltaDNN framework • SNN simulator • Hardware aware simulator • Hardware mapper • Hardware compiler	none	none

Workflow for Embedded neural network

- The deployment of neuromorphic hardware requires several steps whose number, duration and difficulty must be reduced to a minimum.
- These steps must be as independent as possible from the model. They must only require few adaptations to be deployed in several types of neuromorphic hardware

.

Next Figure illustrates the general workflow to embed neural networks on the hardware



Network to hardware workflow

First year achievements

- Several tools are already completed, such as ANN-SNN conversion or SNN-specific training methods and simulators.
- The actual tools development progress is around 50% after the first year.

Next Steps

In the Short-Term, the workflow implementation and development completion of the tools needed for the project. This step is of special importance to ensure that the trained neural networks can be deployed in the neuromorphic hardware to match the use cases requirements defined in WP1 and implemented in WP5.
In the Longer run, ensure that the different tools (contribute to a common ANDANTE workflow, more complete supporting complementary features. This final flow could constitute a starting point for standardization activity at the European level, for coming up as a reference flow for the industry and academia.