FIPPA Check-in

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Feedback

- Collaboration
  - Very good interaction with Arbor developers through slack chat
  - Thorough handling of bug reports/feature requests via github's issue tracker
- Documentation
  - Overall very good
  - Existing knowledge of NEURON should not be expected $\rightarrow$ towards standalone Arbor
- Functionality
  - Existing examples are OK for getting started
  - Complex networks are difficult to formulate $\rightarrow$ index based (Arbor) vs. "high-level" like pyNN's projections
  - Input/output format/container missing (ongoing discussion within HBP)
  - An LIF (state machine neuron) would ease tests and comparisons to other simulators

Milestones

- **M18 (10/2021) SC3 T5.16**: Extension of Arbor for initial support of plasticity and beta-release of code Arbor running with test plasticity rules.
  - Event based STDP already good enough $\rightarrow$ we will add a small networks (suggestions?) and analysis
- **M27 (07/2022) SC3 T5.16**: Full implementation of plasticity processes in Arbor and integration into upstream Arbor code base

Milestones continued

- **M34 (02/2023) SC3 T5.16**: Simulation of full-scale, learning networks on HPC and release of code
- **M24 (04/2022) MS5.3**: Simulation/analysis workflows for each simulation scale & cosimulation, including integration in EBRAINS infrastructure, documentation, validation, visualization where appropriate, integration testing and user support workflows (SC3). Implementation available in a public repository, CI on appropriate systems where applicable, user and developer documentation available, workflows including example models/data accessible from the web.

Outputs

- **OP5.32**: Open-source software release of ready-to-use blueprints, e.g. code examples, for other scientists to build upon in open standard network description languages compatible with the Arbor simulator
- **OP5.33**: Open-source software release of code, tools and working examples based on the Arbor simulator
- **OP5.34**: Open-source software release of Arbor-based network framework implemented on neuromorphic hardware

FIPPA Roadmap

- Voltage/calcium based plasticity
  - Cf. Clopath (2010) and Graupner/Brunel (2012)
  - A combination of both is suggested in Hiratani/Fukai (2017)
- Calcium (diffusion)
  - Calcium “state” could be shared within a region
  - Diffusion (cf. Yasuda (2017)) needs new functionality
- Dendritic spikes
  - Approximate with HH or via a custom neuron mechanism?