Software Engineering for Large-scale in silico Neuroscience Research

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Validation Centric Approach is unfortunately very common

- Exercises and proof of concept software
- Reference Implementations
- Private Tools
- Public Tools

→ Not all software developments should lead to a public tool!
→ Public tools have to employ best software engineering practices

Why do we have to change?

• Advent of large-scale in silico neuroscience research

http://bluebrain.epfl.ch

http://humanbrainproject.eu

• Mission-driven science project
• Using modeling for integrating diverse neuroscience data
• Relies on supercomputing
• Single organization with about 50% engineers, 50% scientists

• EU-funded flagship project targeting to build a research infrastructure
• Caters to multiple objectives (strategic data, theory, informatics, sim, HPC, robotics, ..)
• Collaboration of >100 institutions
Learning from others: TriBITS!

Bartlett et al., TriBITS LifeCycle Model v1.0, Sandia National Laboratory, Technical Report
Mapping

TriBITS  Gewaltig & Cannon

- Exercises and proof of concept software
- Reference Implementations
- Private Tools
- Public Tools

- Exploratory
- Research Stable
- Production Growth
- Production Maintenance
BBP Experience

**TriBITS**

- **Exploratory**
- **Research Development**
- **Research Stable**
- **Production Growth**
- **Production Maintenance**

**Gewaltig & Cannon**

- Exercises and proof of concept software
- Reference Implementations
- Private Tools
- Public Tools
- Acceptable modern CSE principles for non-SW experts
- “Staging zone” between scientists and engineers
- Achievable goal for legacy refactoring

EPFL/Blue Brain Project
Summary

• Computational neuroscience traditionally did not have a strong Computational Software Engineering culture
  – On the one hand, lacking behind wrt to CSE discipline
  – On the other hand, can learn from other efforts

• Advent of large-scale in silico neuroscience efforts recently has giving need and opportunity for CSE discipline
  – Different talent mix in teams
  – Ability to provide (suggestive) modern SW development infrastructure

• Adoption of CSE culture easier in single organization than in distributed collaborations (support from funders helps!)