MacroSwarm
Field-based Compositional Framework for Swarm Programming

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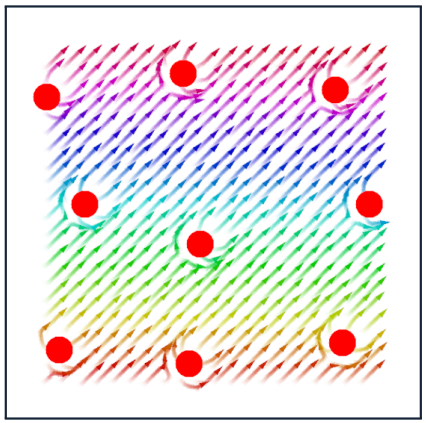
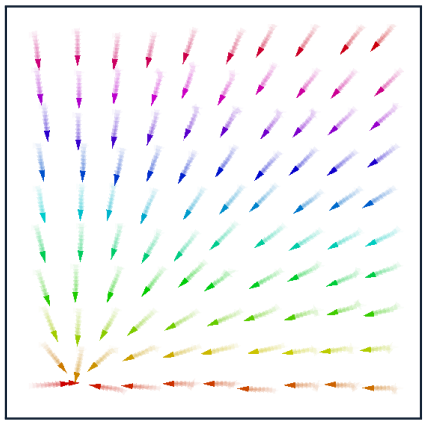
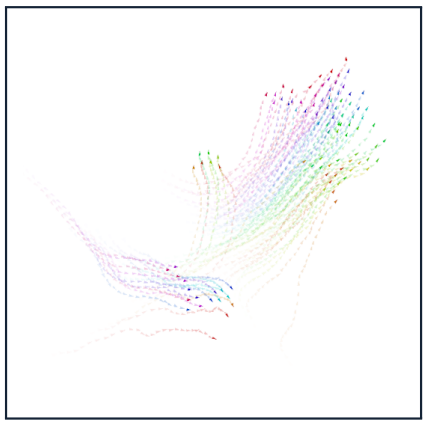
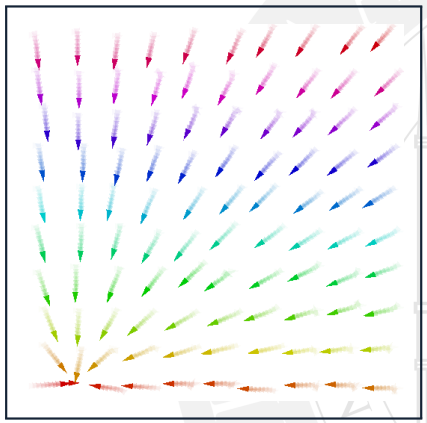
Talk @ COORDINATION 2023

Context

Networked Mobile Nodes + **Collective Behaviours**

Swarm Behaviours

A *swarm behaviour* is a *collective* behaviour that emerges from the *local* interactions of a *population* of *autonomous* entities.

In a nutshell

- *Emergent* ➔ *self-organisation* and *self-adaptation*
- *Decentralised* ➔ *locality* and *scalability*
- *Asynchronous* ➔ *robustness* and *fault-tolerance*

Programming Swarm Behaviours

MacroSwarm

Aggregate Computing

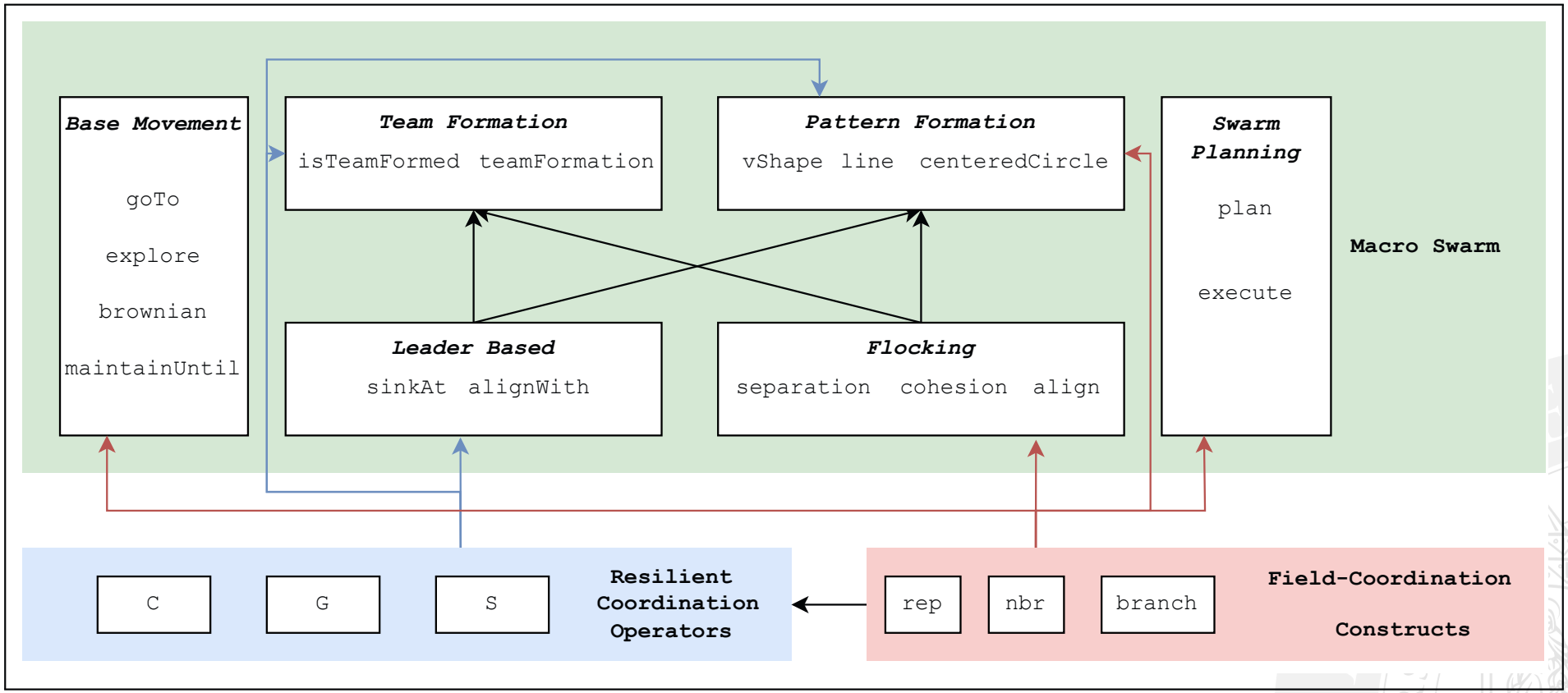
In a nutshell

- *Computational fields* as first-class abstractions
- Programs as field transformations through *field calculus*
- Inspiration from co-fields and artificial pontential fields

Why

- *Top-down behaviour-based design* ➔ *compositionality* and *collective stance* of aggregate computing;
- *Scalability* ➔fully decentralised and asynchronous
- *Formal approach* ➔ based on the field calculus
- *Pragmatism* ➔ witnessed by open-source, maintained, concrete software artefacts like the ScaFi DSL, Alchemist and ScaFi-Web
- *Operational flexibility* ➔ supporting different architectural styles and execution policies.

Architecture



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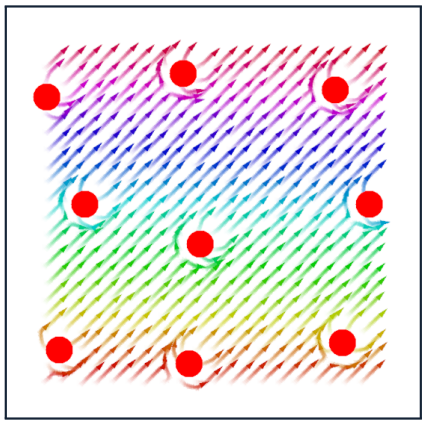
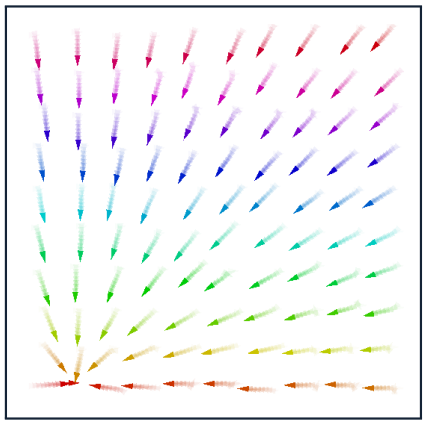
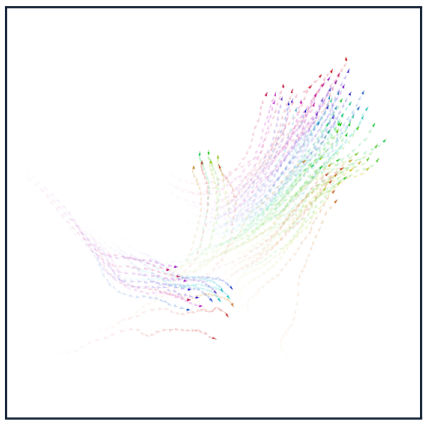
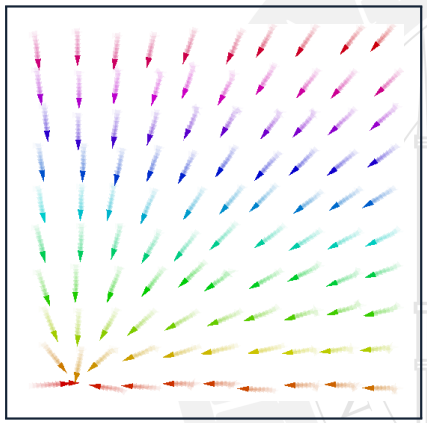

References I