A snap-stabilizing termination detection algorithm for non-diffusing computation

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Outline

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- Background
- Approach
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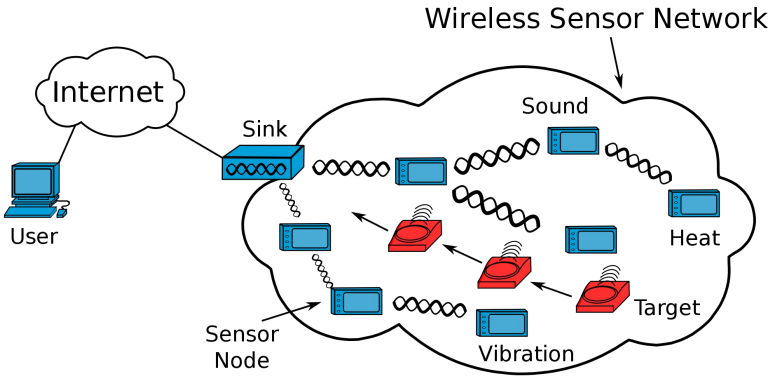
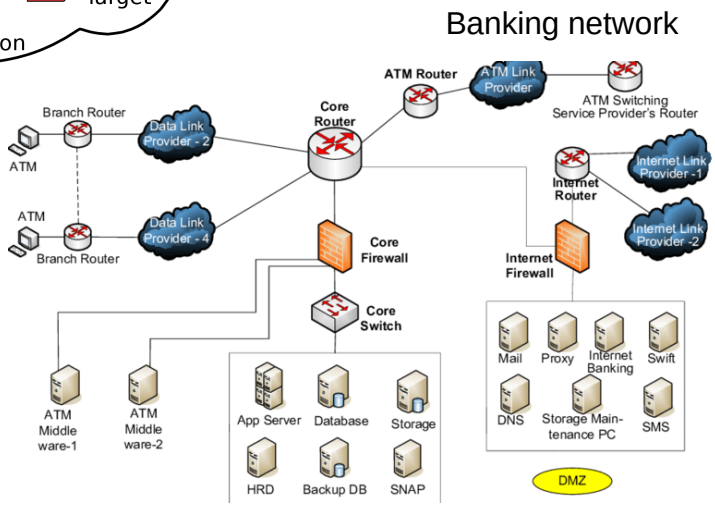
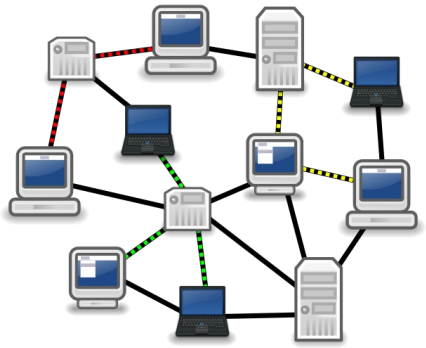
Motivation



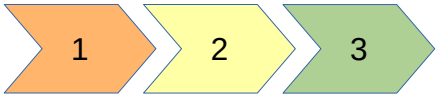


Motivation

- Processes are connected through network
  - No global knowledge

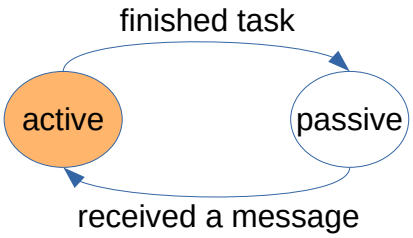


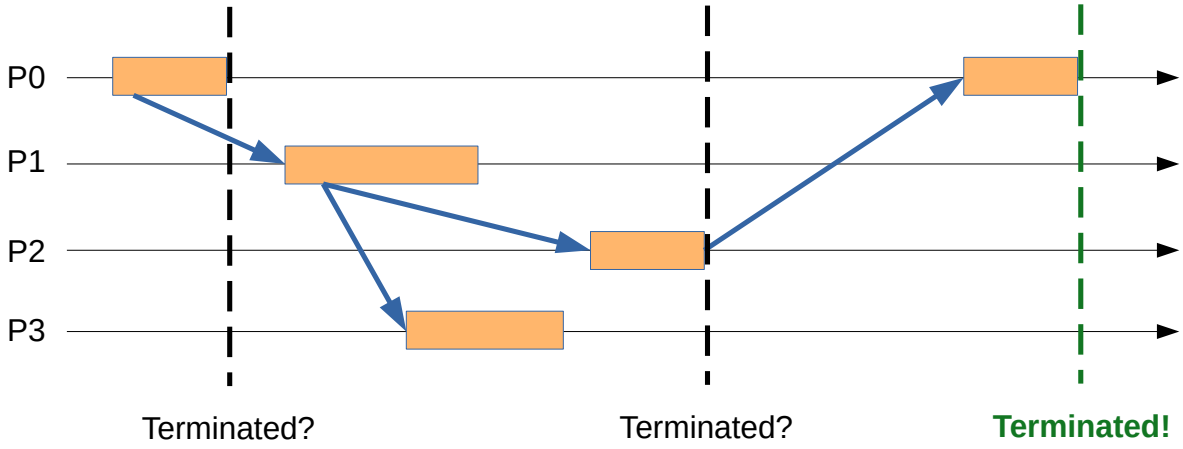
- Round-based computation



Global termination detection

- Termination conditions:
  - No message in transit
  - All processes are passive

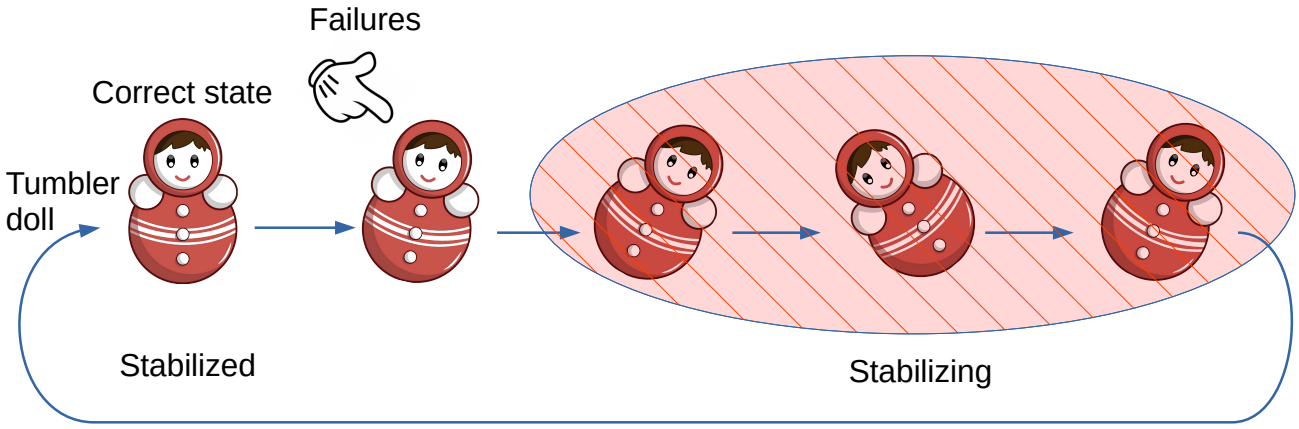




~~Self-~~Snap-stabilization

1. Zero configuration
Initialization is not necessary

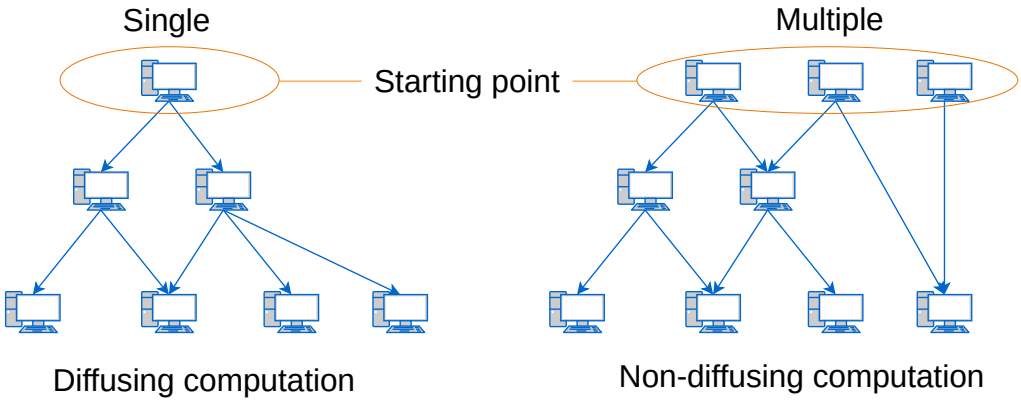
3. Automatic fault handling
~~But effects of the faults are visible~~
Could expect correct result right away



2. Always end up in correct states
After some finite time

Related work

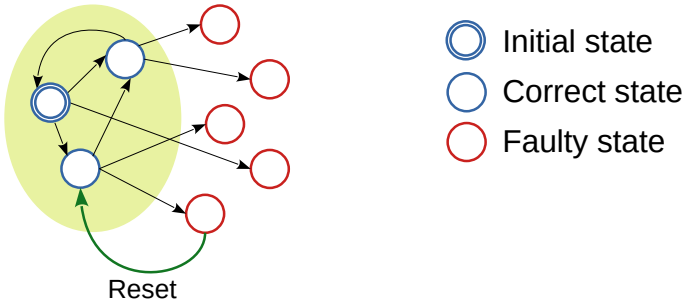
- Recent related work[1], derived from Dijkstra-Scholten termination detection algorithm[2]
  - Does not work with non-diffusing computation.



1) Anaïs Durand, Shay Kutten, Reducing the Number of Messages in Self-stabilizing Protocols. SSS 2019: 133-148
2) Dijkstra, Edsger W., and Carel S. Scholten. "Termination detection for diffusing computations." Information Processing Letters 11.1 (1980): 1-4.

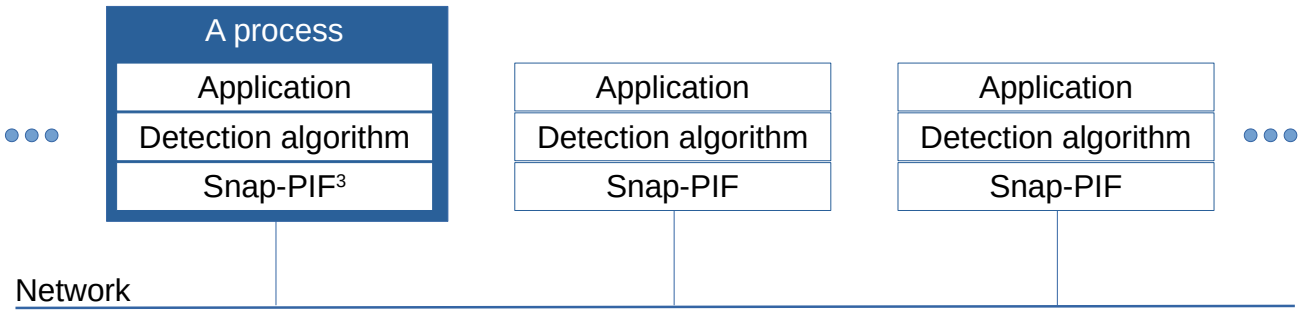
Challenges

- Self-stabilizing algorithm cannot totally rely on its memory
  - Does not even remember its initial state



  - Message counter is not usable.
- Snap-stabilizing algorithm:
  - User's request is "initialization".

Approach

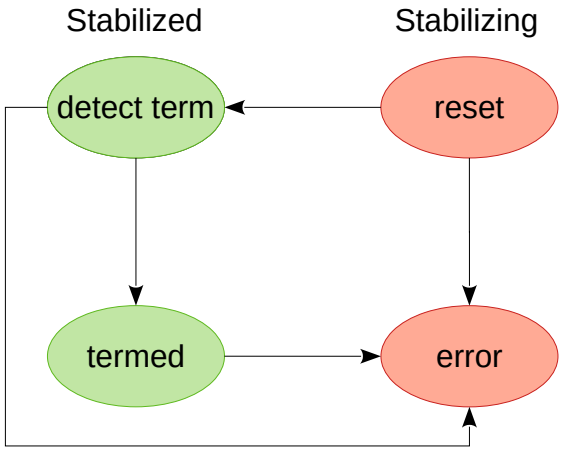


- Multi-layered structure: agumenting the existing system
  - Detection algorithm: adapted from Safra's termination detection algorithm[1]
- Layers are fairly composed[2]

1) Broy, M., and R. Steinbrüggen. "Shmuel Safra's version of termination detection." Calculational System Design 173, 1999.
2) Dolev, Shlomi. Self-stabilization. MIT press, 2000.
3) Delaët, Sylvie, et al. "Snap-stabilization in message-passing systems." Journal of Parallel and Distributed Computing 70.12 (2010): 1220-1230.

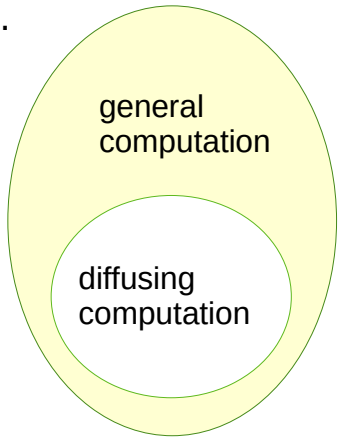
Approach

- Life cycle of the algorithm



Conclusion

- Derived an snap-stabilizing algorithm for detecting global termination in message passing systems.
  - Applicable to general computation



- Future work:
  - Extends to general dynamic networks.
  - Reset mechanism