Bootstrapping *Chord* in Ad Hoc Networks: Not Going Anywhere for a While.

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Peer-to-Peer and Ad Hoc Networks

Outline

- Introduction
- Bootstrapping Chord: Problem definition
- Best-case and worst-case time complexity analysis
- Experimental validation
- Discussion and conclusions

Bootstrapping Chord

- Network creation and initial connection
- Sequential *vs.* simultaneous bootstrapping
- Consistency maintenance: *stabilization*

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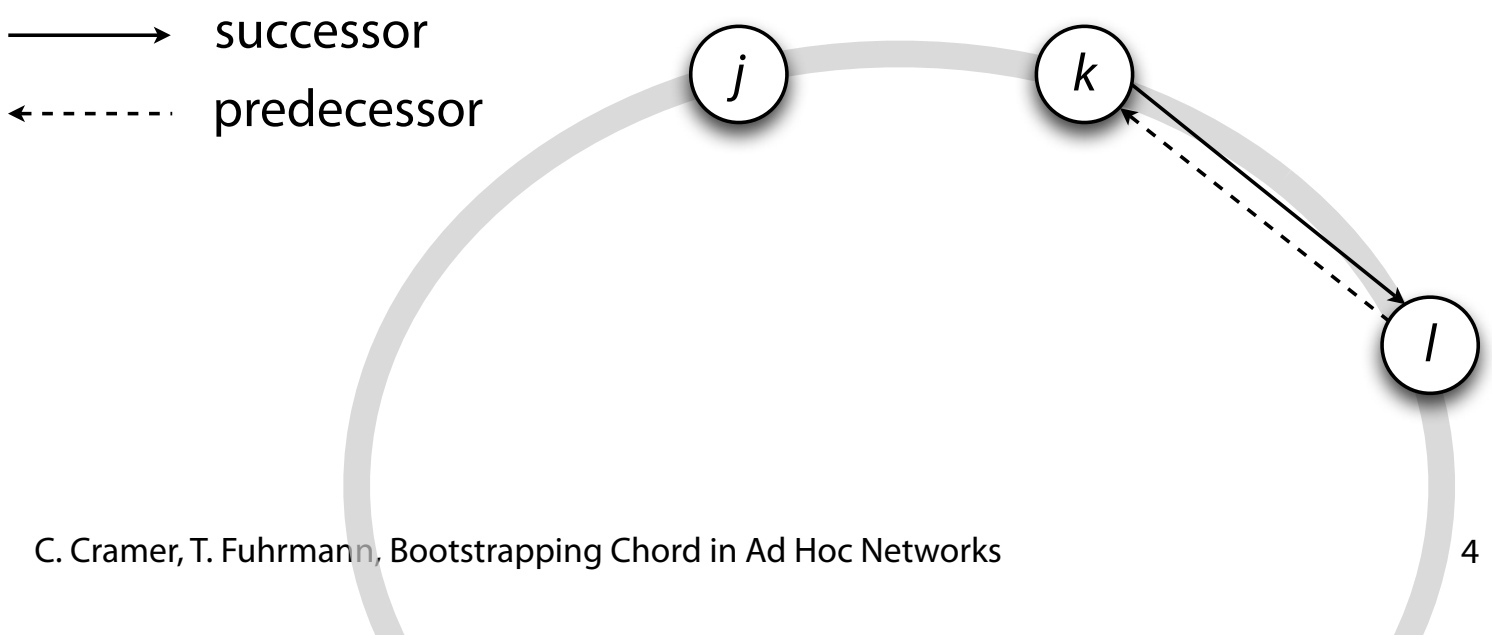

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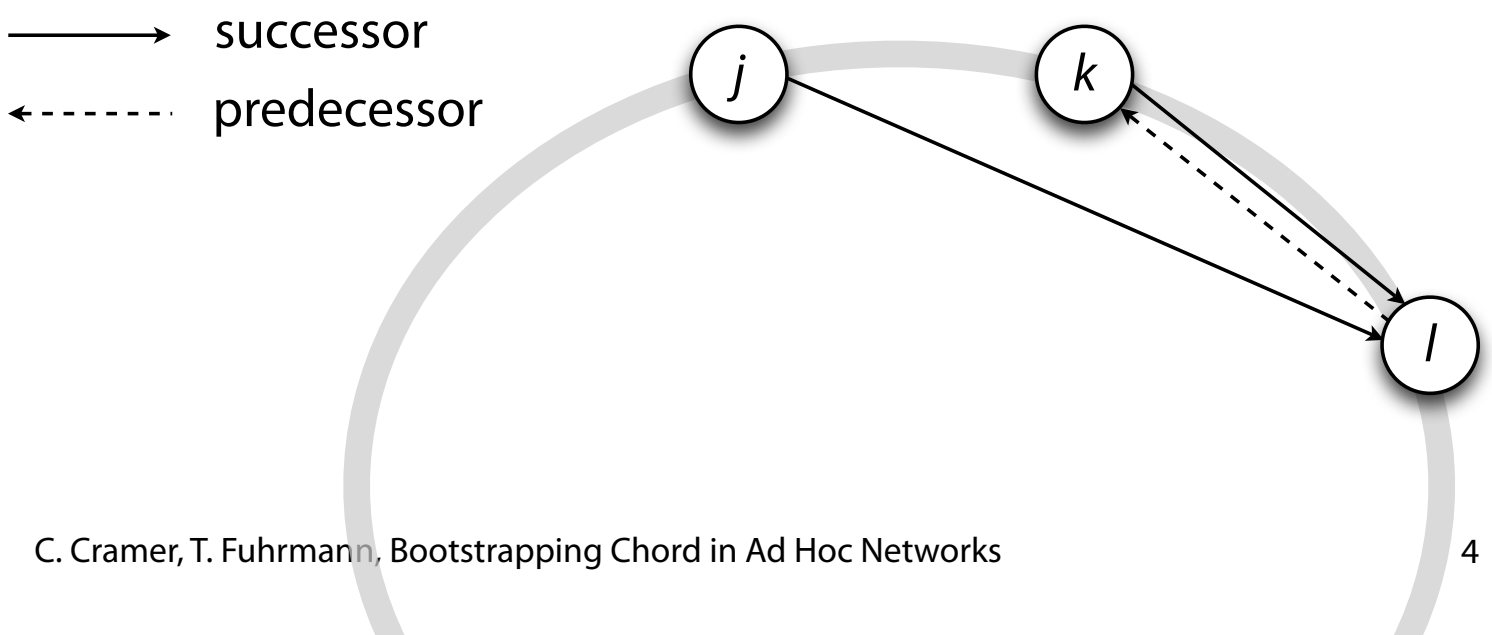

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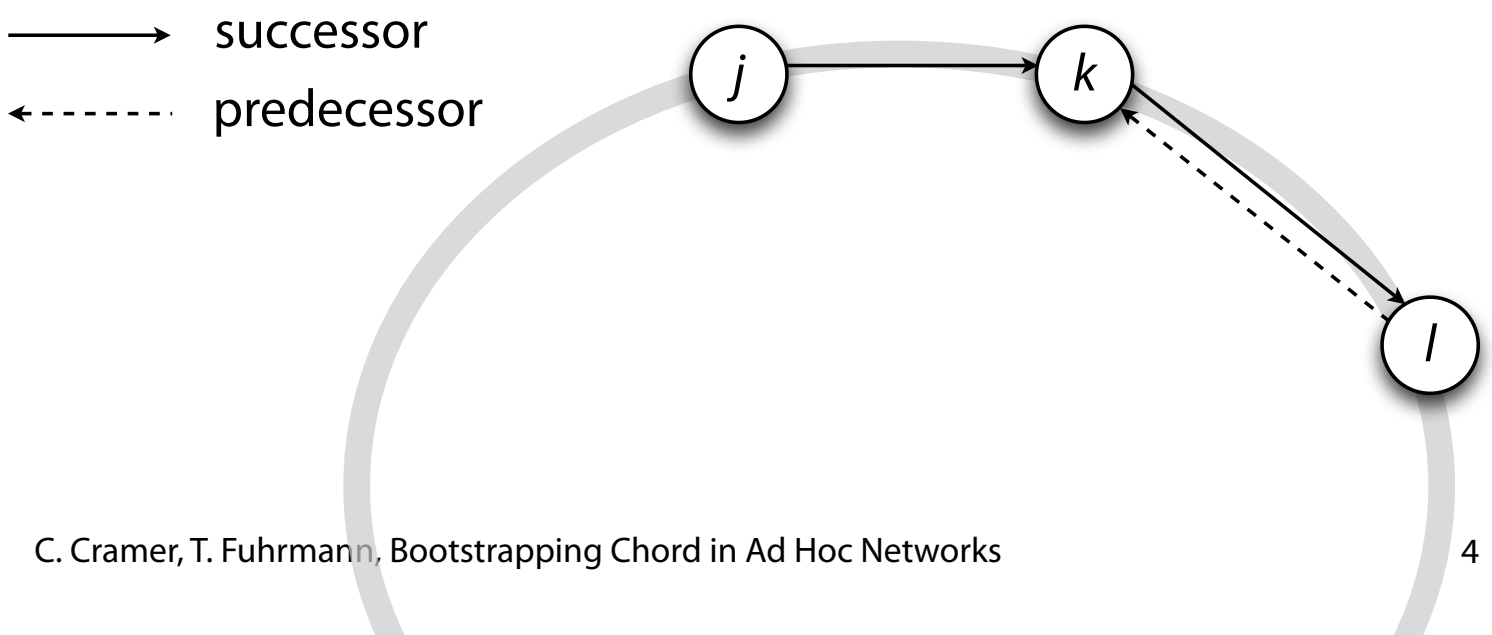

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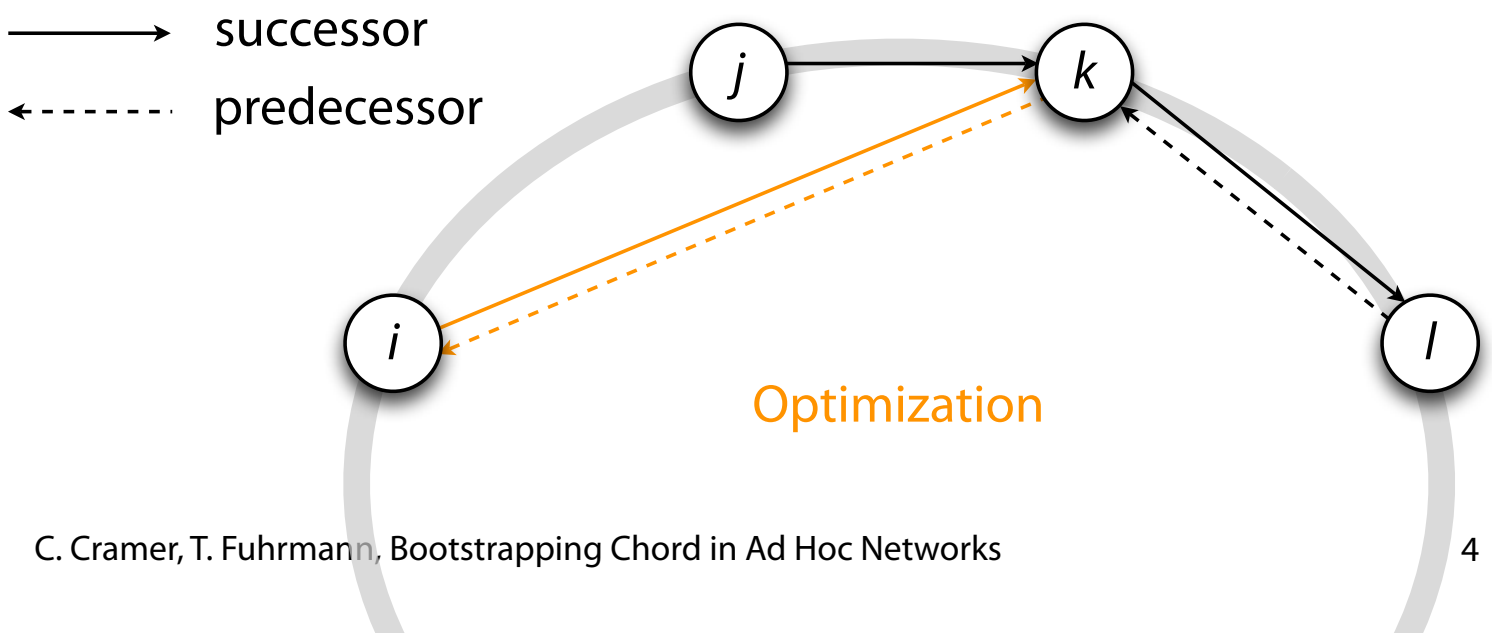

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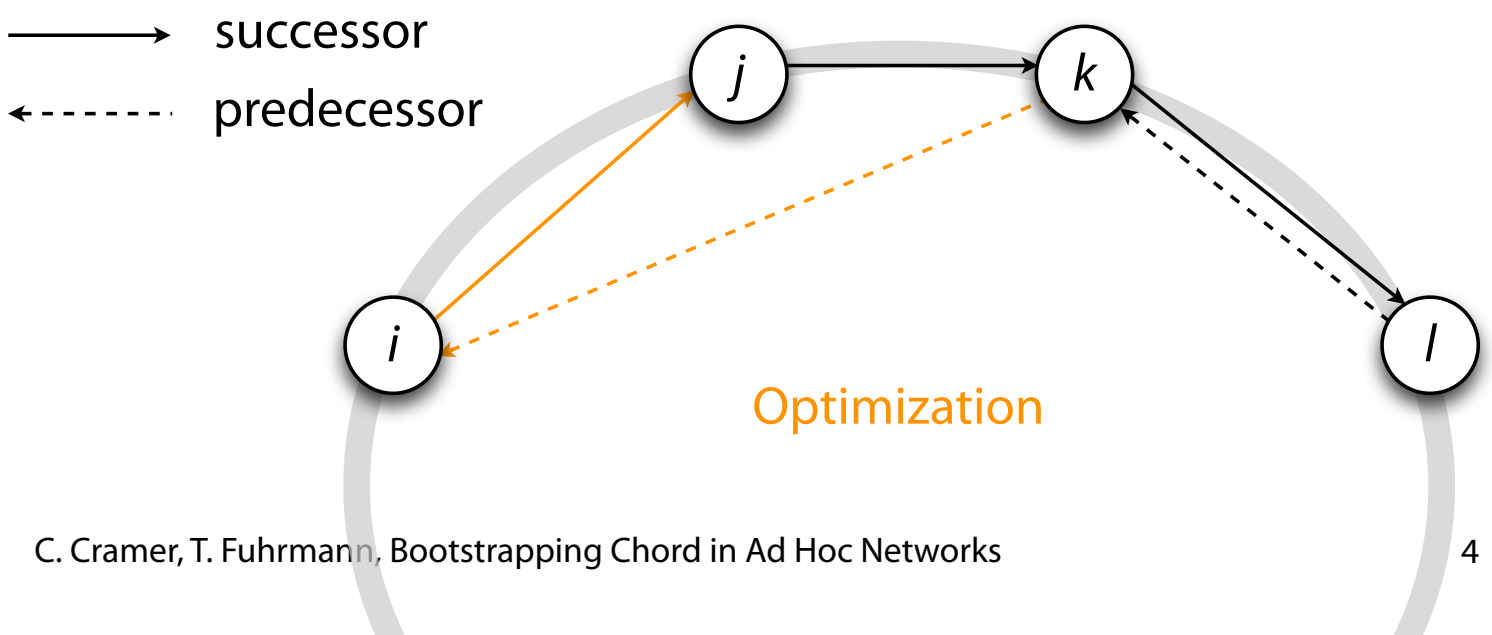

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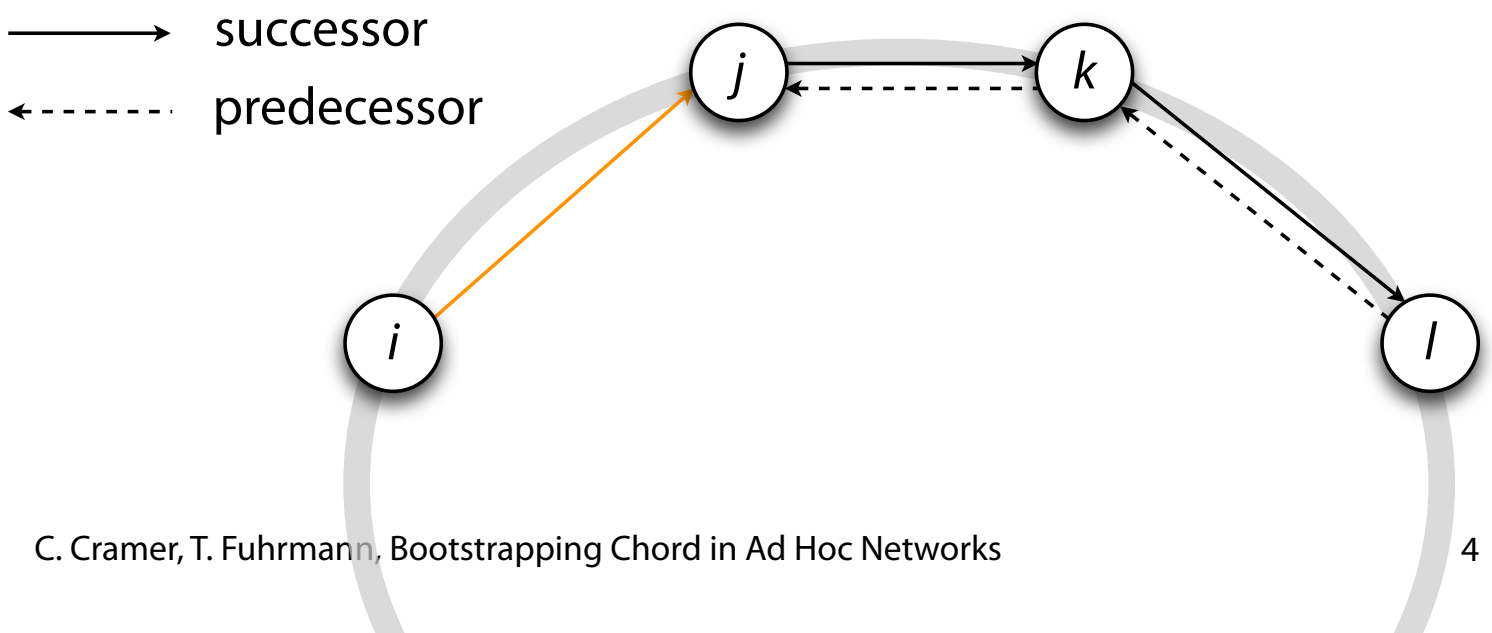
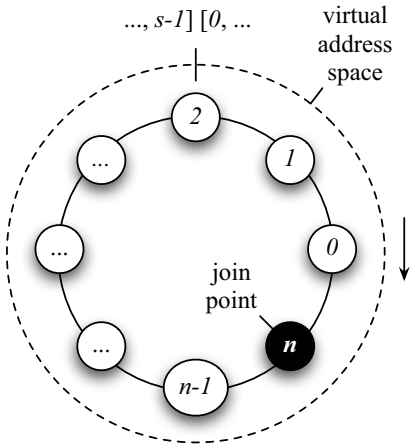


Notation

Node labels



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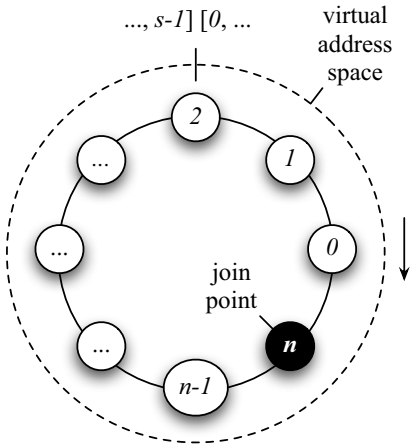
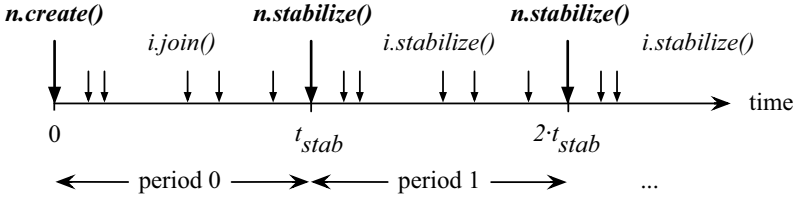
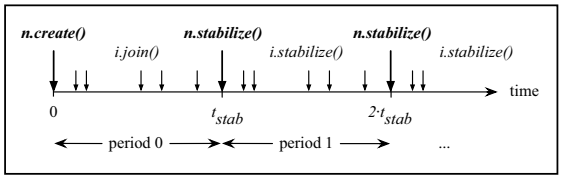


Bootstrapping timeline



Best-Case Time Complexity



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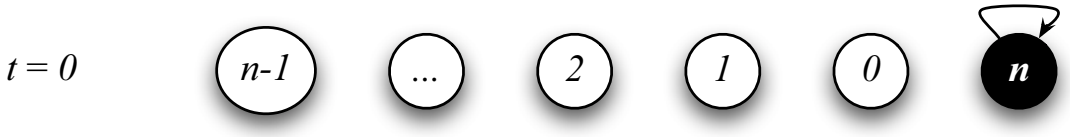

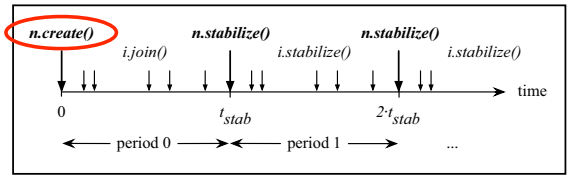

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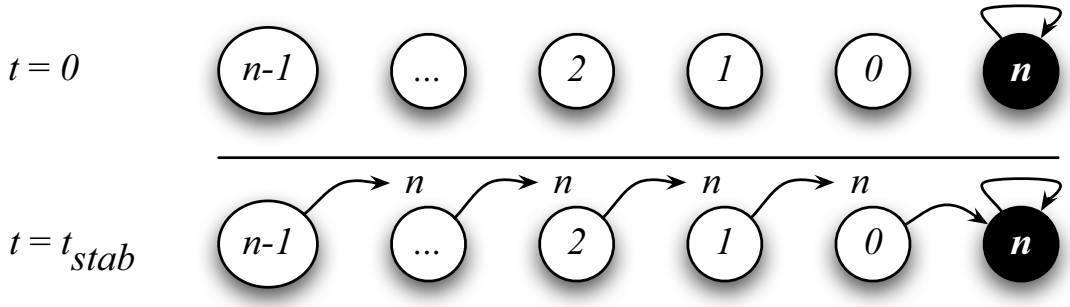

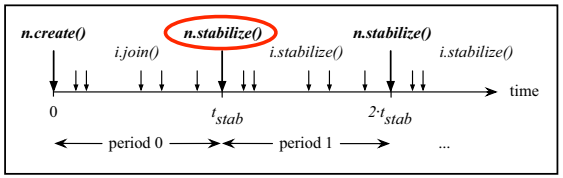

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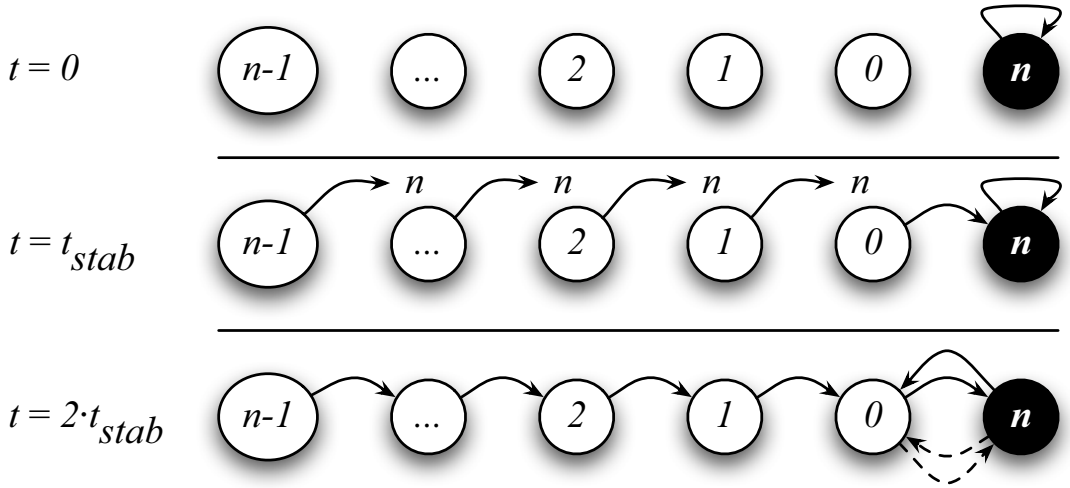

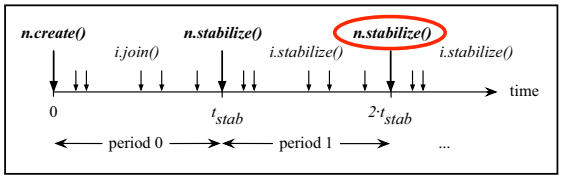

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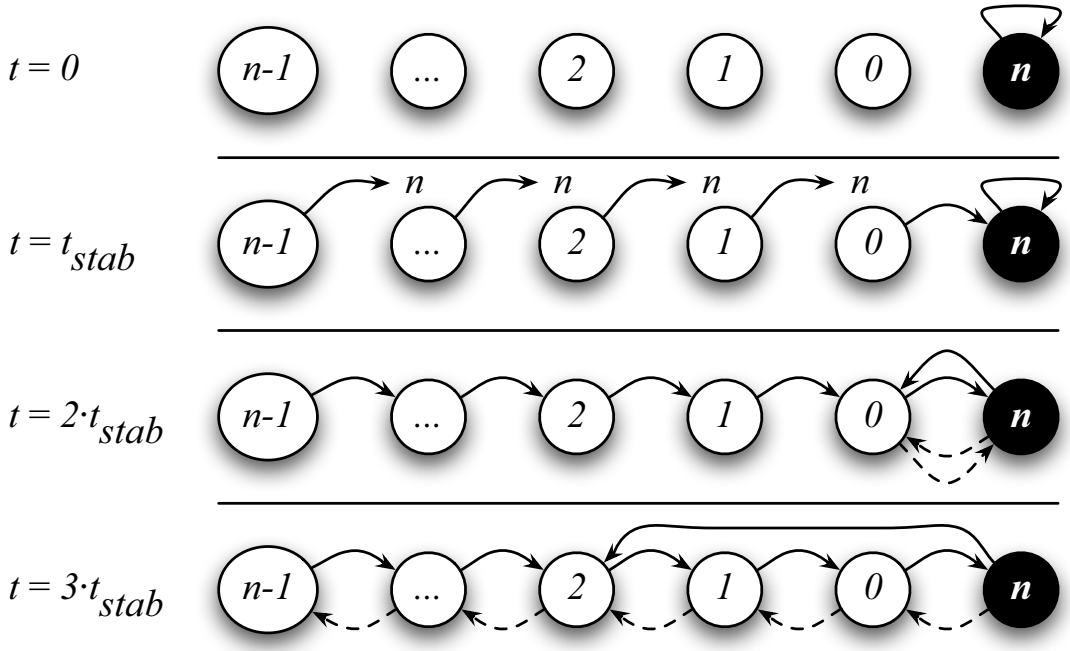

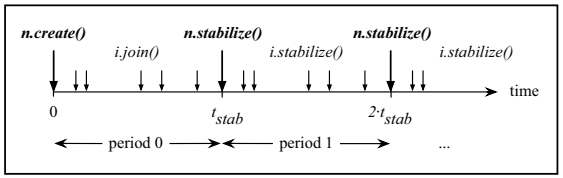

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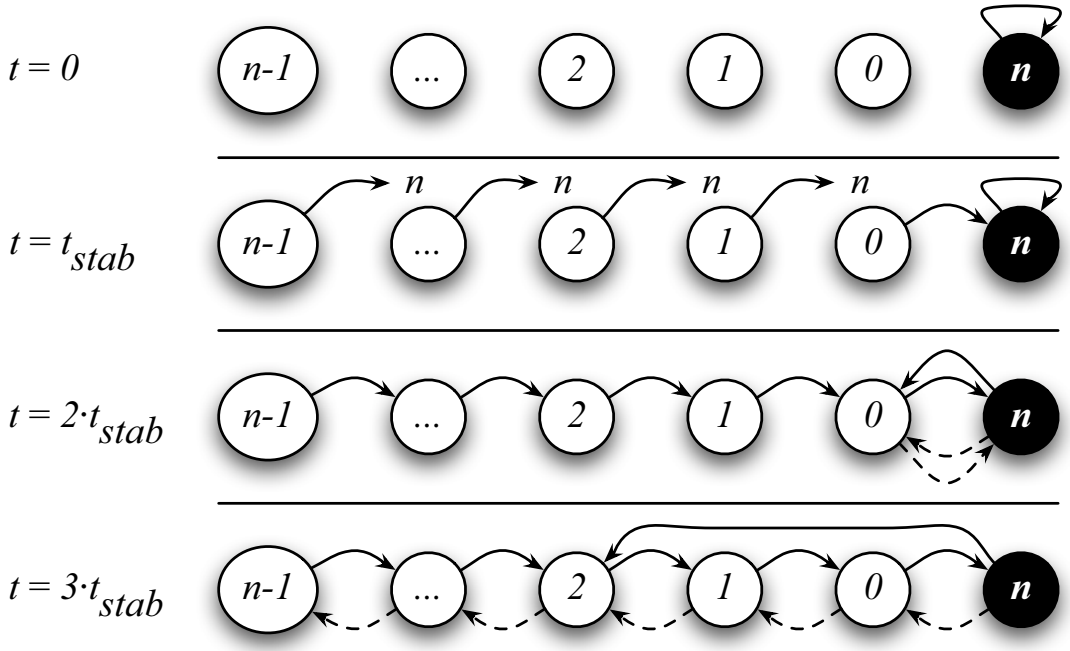
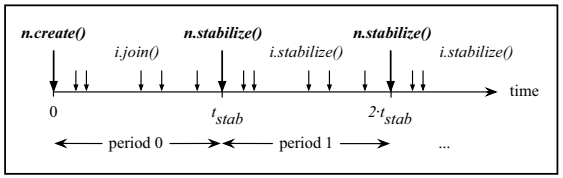
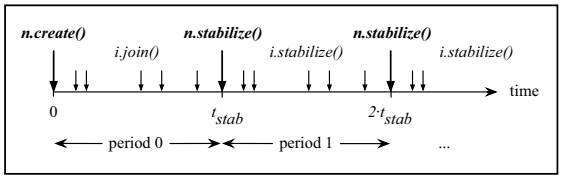




Time complexity: *O(N)*

Worst-Case Time Complexity



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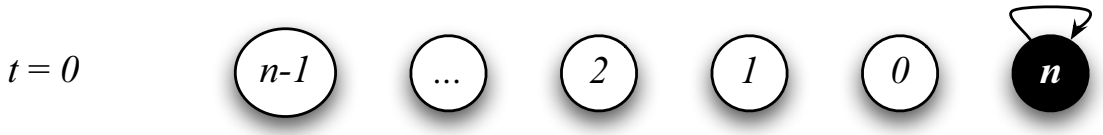

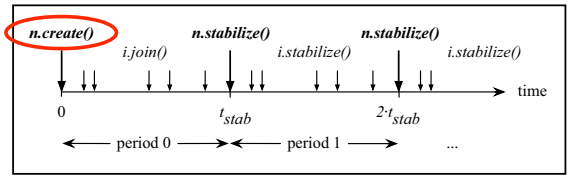

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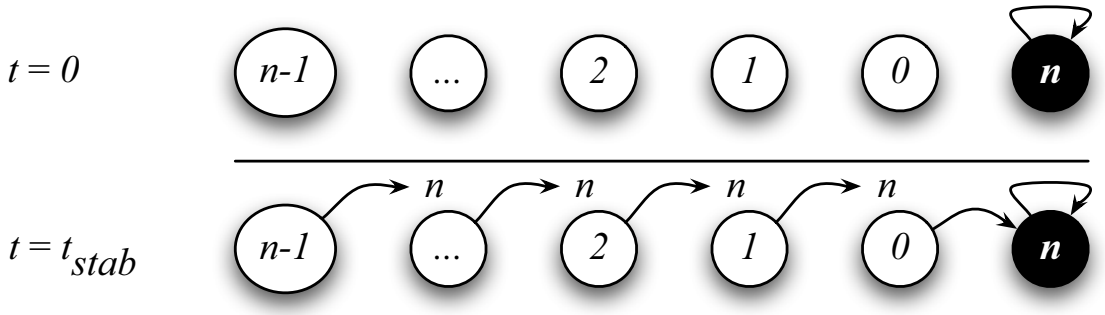

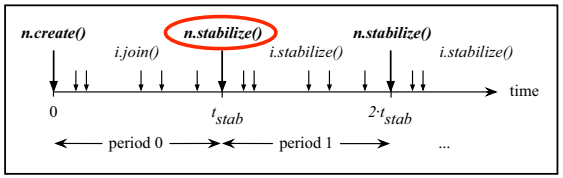

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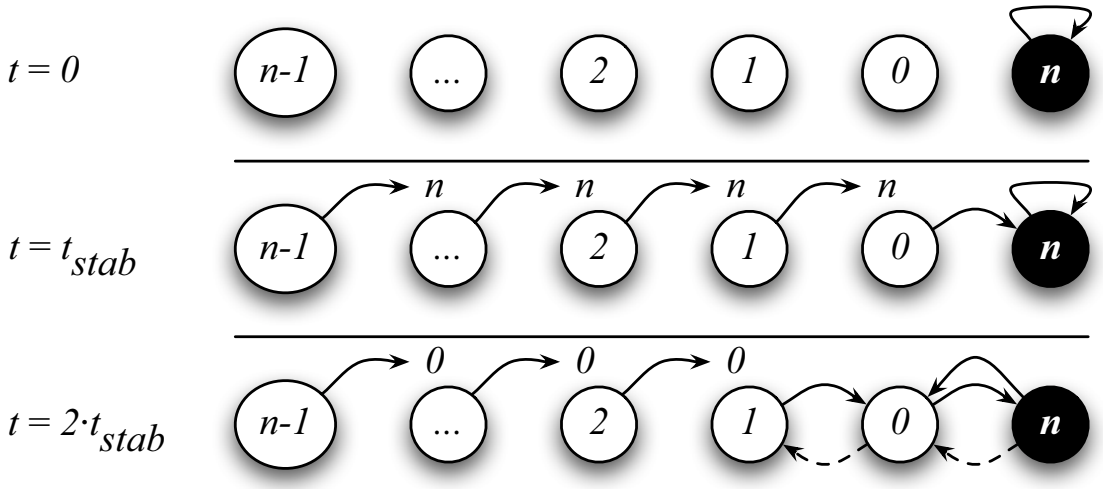

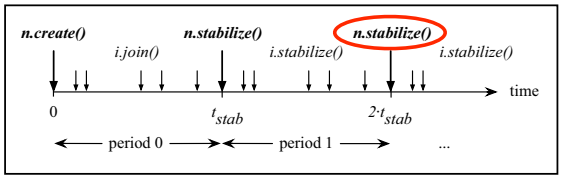

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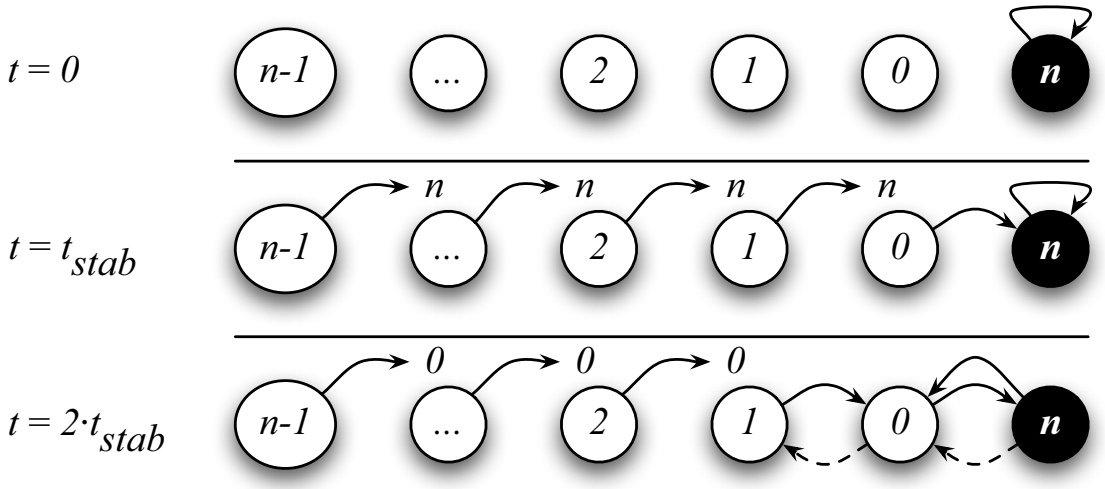

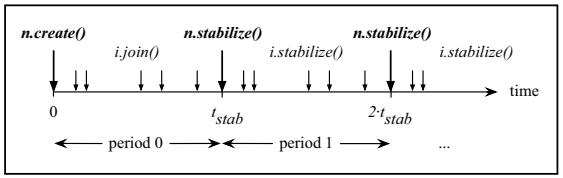

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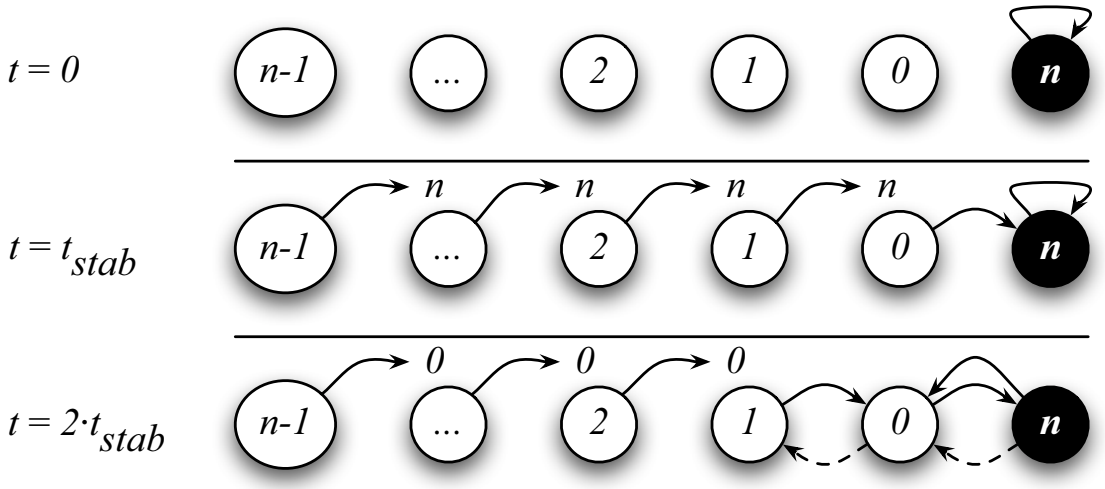

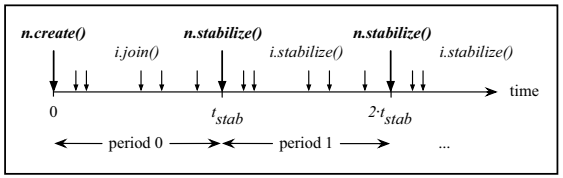

⇒ Tight bound:

Time complexity *Θ(N)*

Experimental Validation

- GloMoSim: Chord over AODV
- $t_{stab} = 30$ s

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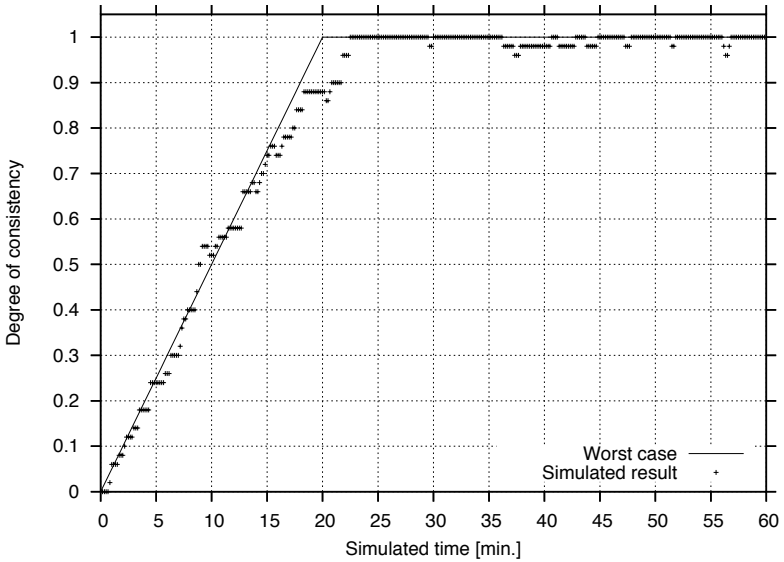

Convergence of a 40-node network

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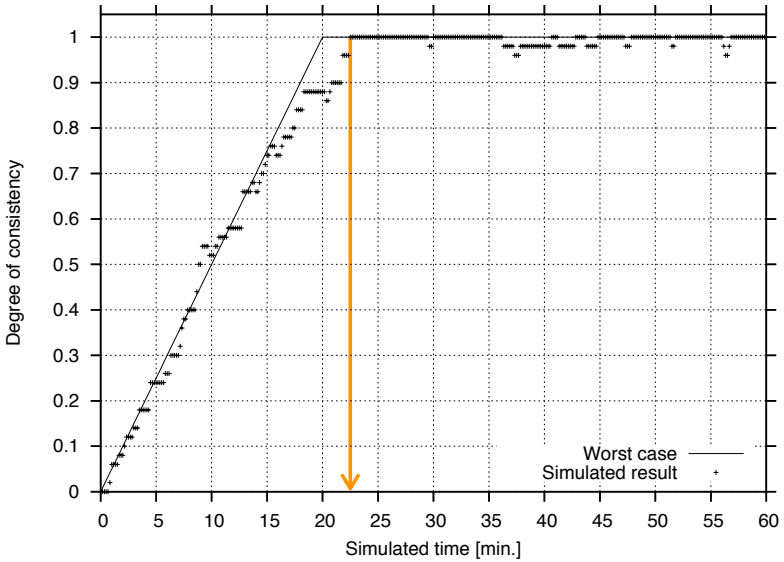

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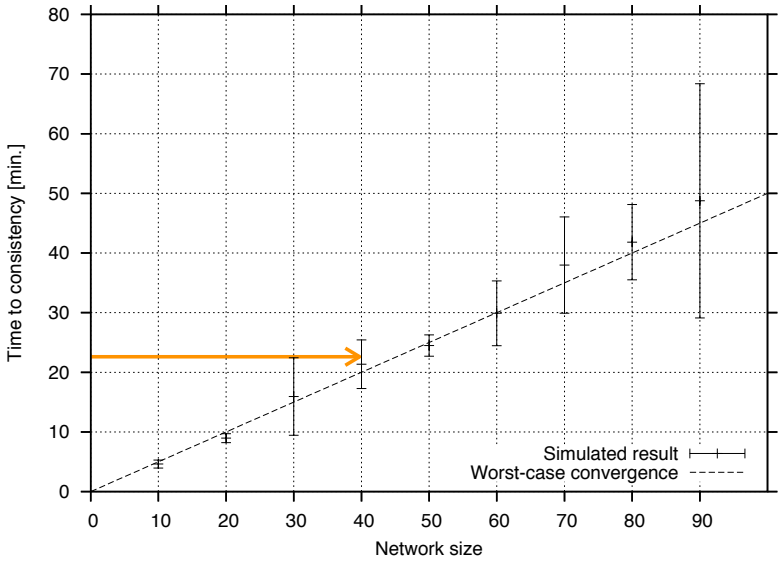
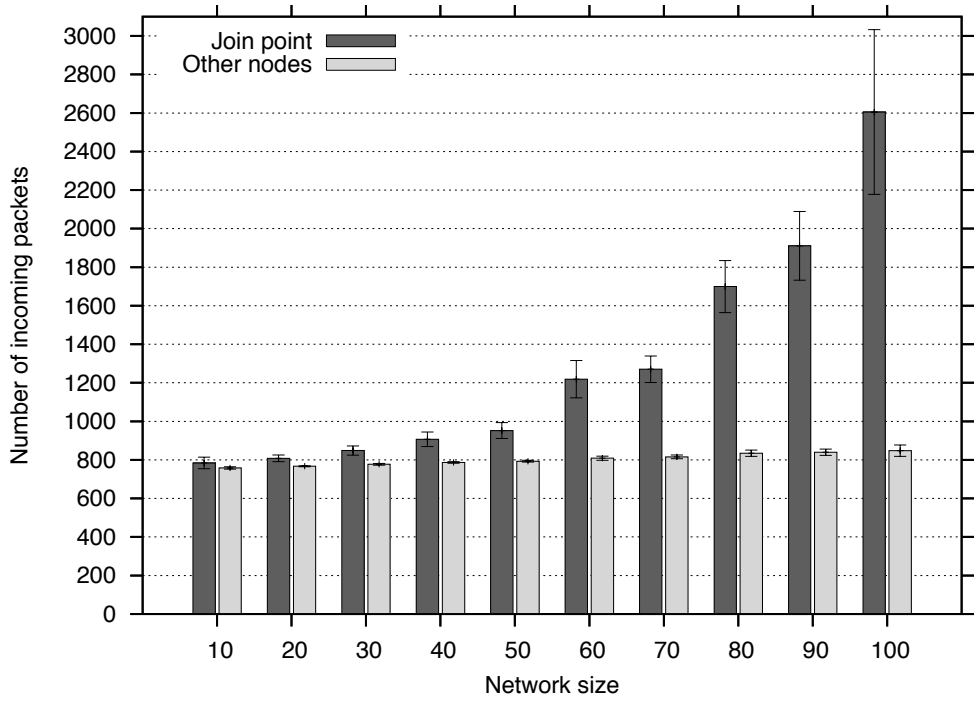


Conv. times against network size

Traffic Load



Discussion

- $k \geq 1$ join points: $\Theta(k + \lceil (N-k)/k \rceil) = \Theta(N)$
- Load distribution
- Selection of join points
- Simulations: *Mind the initial transient period*

Conclusions

- Self-organization in ad hoc networks
  - Distributed services: Peer-to-peer protocols
  - Spontaneous deployment
- Bootstrapping Chord
  - Centralized join points
  - Time complexity: Θ(*network size*)

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