Network Awareness and Failure Resilience in Self-Organising Overlay Networks

3/17/2004

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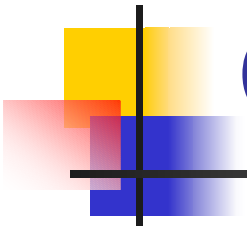
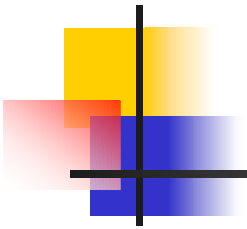


Outline

- Introduction
- Network awareness and load balancing
- Resilience to failure
- Performance evaluation
- Conclusion and Discussion



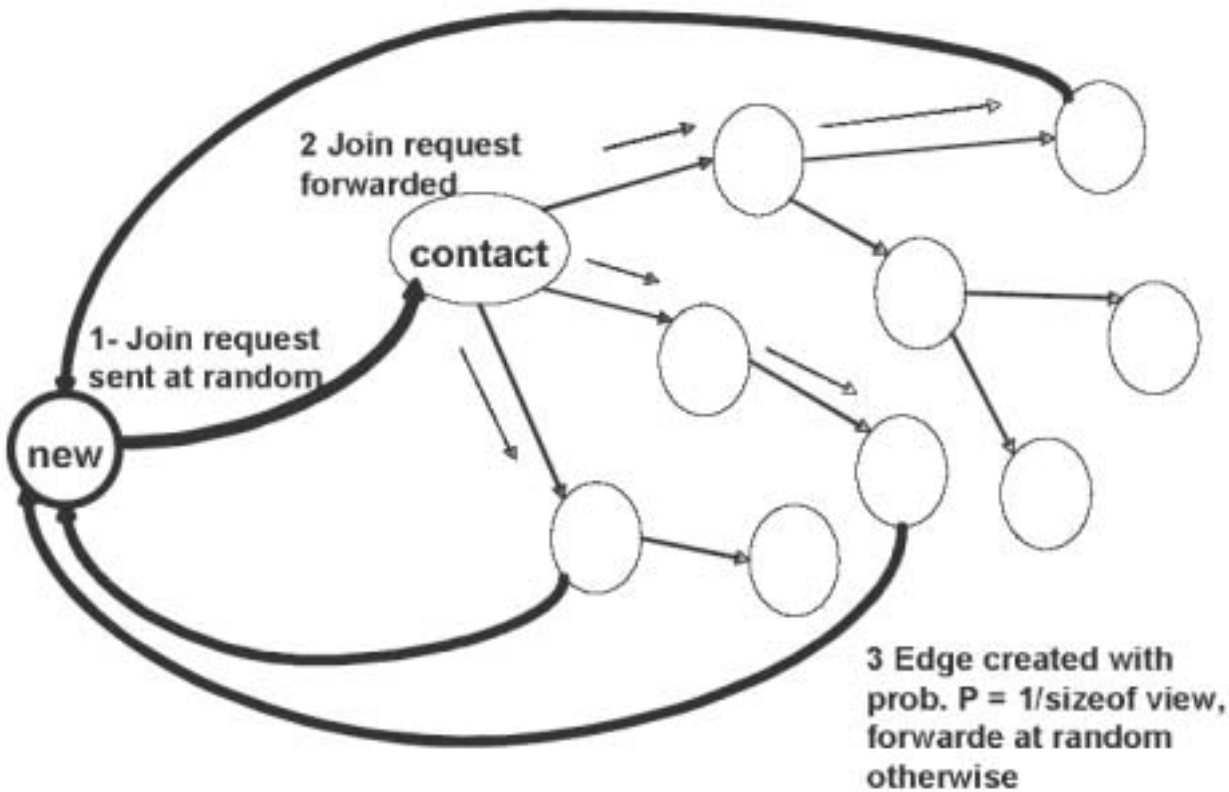
Introduction

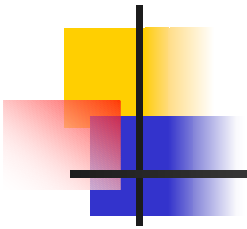
- Connections in the overlay should reflect the underlying network topology
- Connectivity among active nodes of the overlay should be maintained
- The cost of using the overlay should be spread evenly among peer nodes

Introduction-SCAMP

- Each node only maintain a list of addresses of its neighbor
- The mean degree of a node is $c \log(N)$

Introduction-Scamp





Introduction-Scamp

But!!

- Scamp is oblivious to the underlying network topology
- The degree of individual nodes are not tightly constrained

Network awareness algorithm

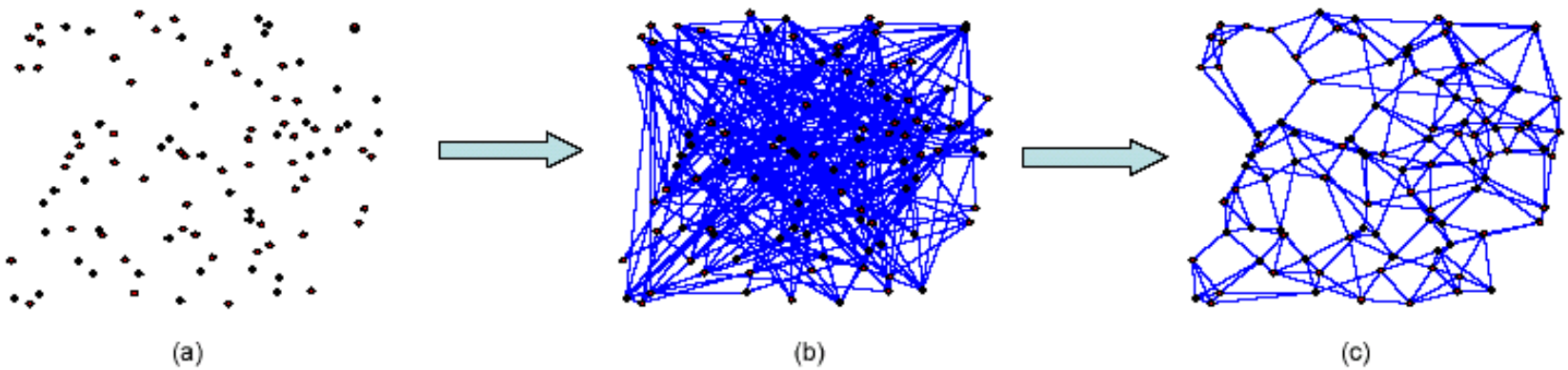
- Localiser

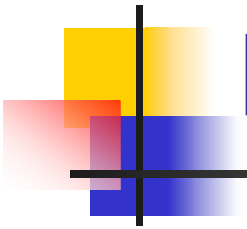
$$E(G) = w \sum_{i \in \mathcal{V}(G)} d_i^2 + \sum_{(i,j) \in \mathcal{E}(G)} c(i,j)$$

Network awareness algorithm

- Localiser
  - Node i performs the following steps periodically
    - 1.measure c(i,j) c(i,k)
    - 2.request j,k for d(j),d(k), and get c(j,k)
    - 3. $\Delta E = 2w(d_k - d_i + 1) + c(j,k) - c(i,j)$
    - 4.determined if we should change the connection

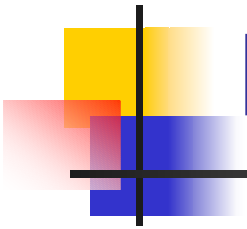
Localiser





Resilience to failure

- If a node leave the system voluntarily, it will send a leave message to the system
- Lease mechanism



Performance evaluation

- Environment
  - 50000 nodes
  - Distance is measured by delays
- three metrics
  - Degree balancing mechanism
  - Network awareness
  - Resilience to failure

Performance evaluation

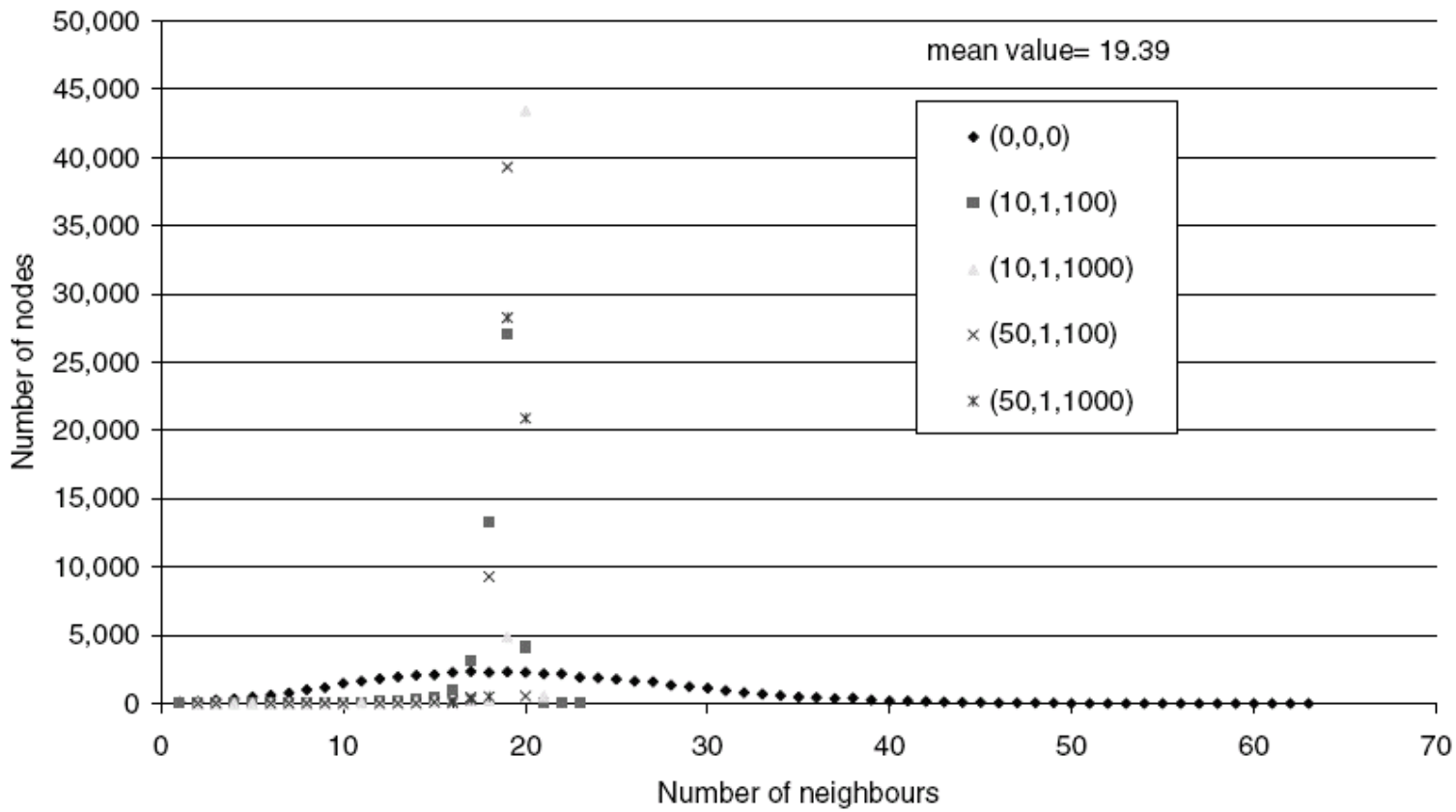
- Degree balancing mechanism

(W, T, NbIt)	(0,0,0)	(10,1,100)	(10,1,1000)
Max degree	63	23	21

(10,1,5000)	(50,1,100)	(50,1,1000)
20	20	20

Performance evaluation

- Degree balancing mechanism



Performance evaluation

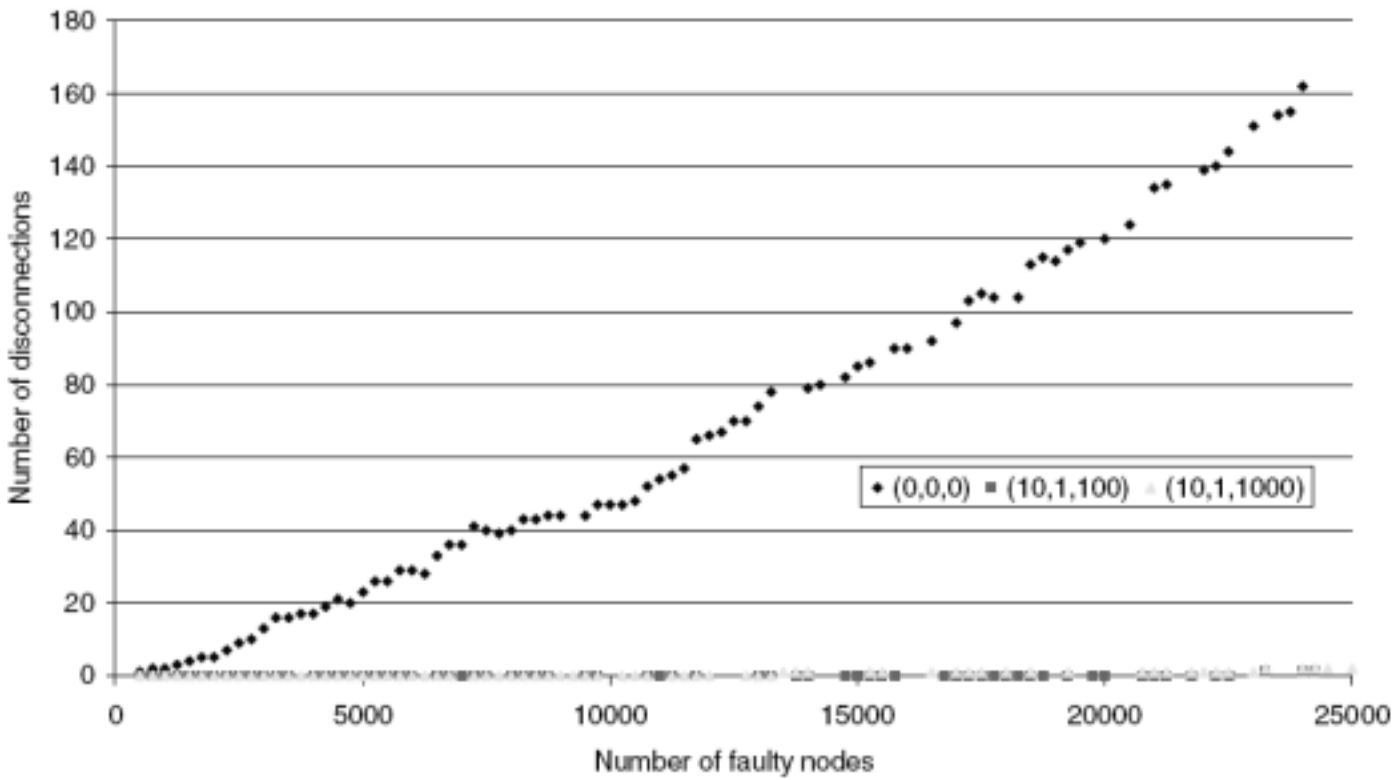
- Network awareness

(W, T, NbIt)	(0,0,0)	(10,1,100)	(10,1,1000)
Mean distance	266	225	141
Standard deviation	250	208	124

(10,1,5000)	(50,1,100)	(50,1,1000)	(50, 1, 5000)
66	253	224	215
51	237	207	199

Performance evaluation

- Resilience to failure



Conclusion and Discussion

- 3 purpose
  - Degree balance
  - Network awareness
  - Resilience to failure
- Potential problem
  - overhead