THE SKEMASNET PROJECT

SESSION KEY MANAGEMENT IN A SPONTANEOUS NETWORK

HGP Team

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CS642 - Distributed Systems

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BACKGROUND

- In the context of spontaneous networks, we focused on session key management during the merger of two networks and when a user leaves the network

- We surveyed some paper about GKA to compare it to our idea

- We started to simulate our idea using the ns2 simulator

REVIEW OUR PROPOSAL (GOAL)

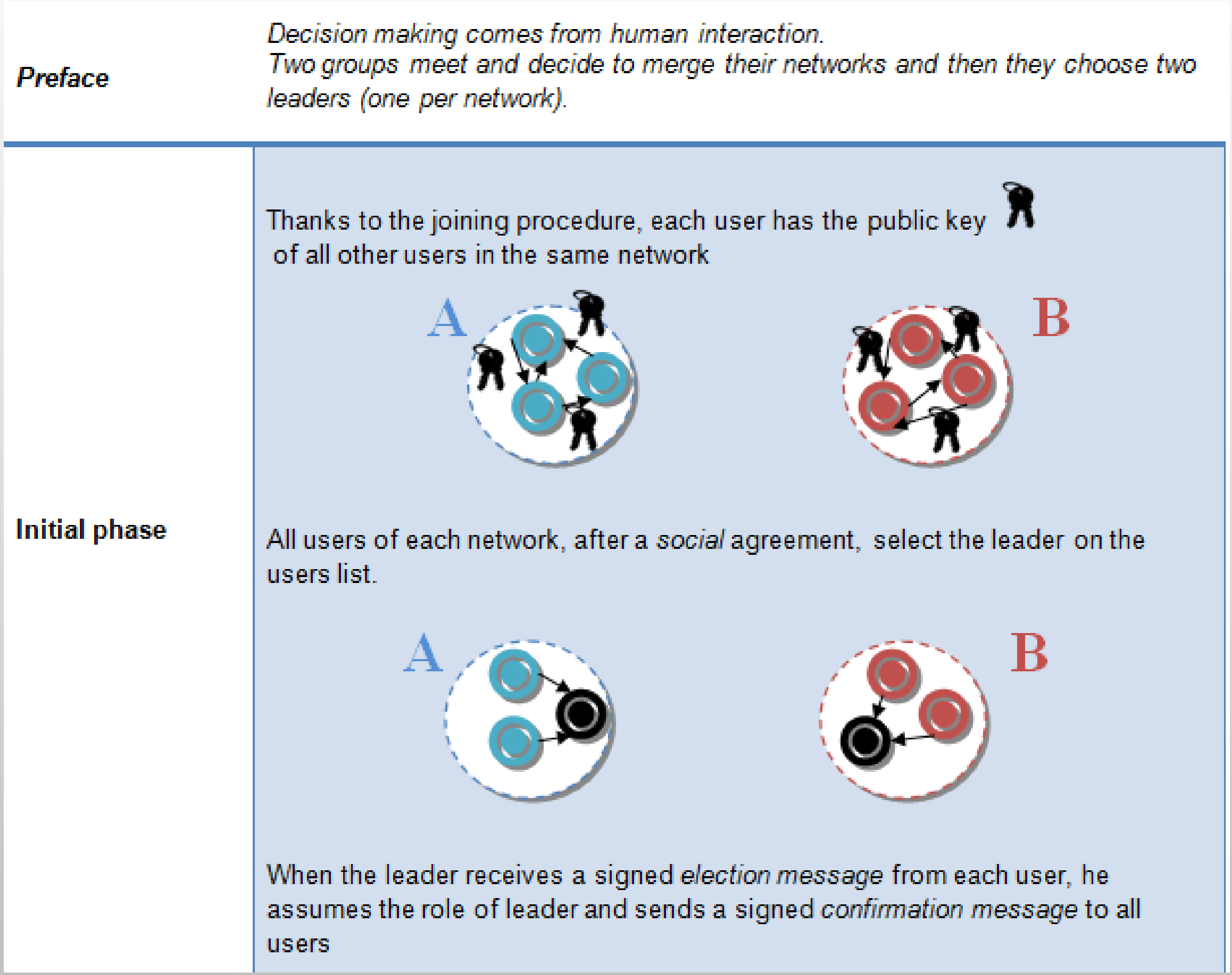
- We are interest in the case of:
  - Two private spontaneous networks decide to merge together

- We wish to find an efficient way for merging multiple private networks in terms of number of messages and size of the message.

REVIEW OUR PROPOSAL (PROBLEM DEFINITION)

- In the private networks they are using common session keys for secure communication,
  - When merging network(s) it needs to manage session keys.
    - Creating a new session key or choosing one of them for the merged network.
    - Share the new session key to all members.
- Related works
  - GKA(Group Key Agreement)-key paper
    - A mechanism to create a common session key for a group of users.
    - Each member provide a public contribution for creating a common session key.
    - It can share a common session key **without** the use of a *secure* channel.
  - Problem
    - ❑ Require creation of a new session key at every times when the network members are changed(join, leave, merge, separating)
    - ❑ Requires 2n messages exchanges for creation and distribution of a new session key.
    - ❑ Each message for exchange a session key is in size of encrypting SizeOfSessionKey*2*n
      - ❑ Ex) if the key size is 256bit, and size of node is 100=> 256*100*2 = 51200 bit = 6.4kbytes.

DESIGN CASE: MERGING 2 NETWORKS

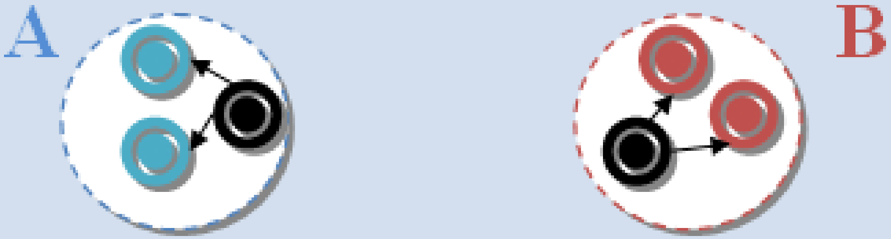


Preface	*Decision making comes from human interaction.* *Two groups meet and decide to merge their networks and then they choose two leaders (one per network).*
Initial phase	Thanks to the joining procedure, each user has the public key 🔑 of all other users in the same network All users of each network, after a *social* agreement, select the leader on the users list. When the leader receives a signed *election message* from each user, he assumes the role of leader and sends a signed *confirmation message* to all users

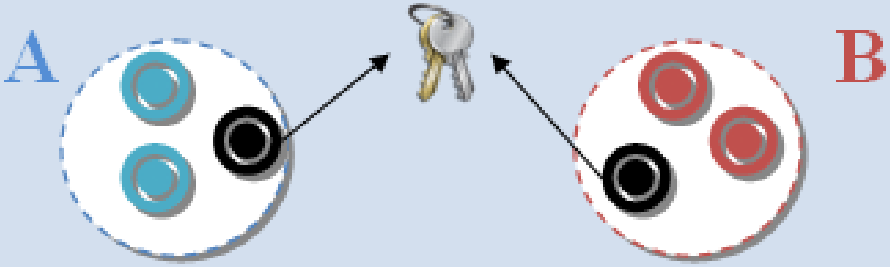
DESIGN CASE: MERGING 2 NETWORKS (CONT.)

Initial phase

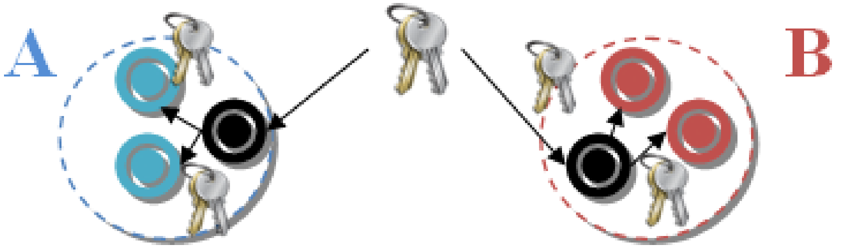
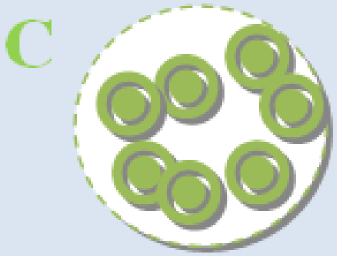
When the leader receives a signed *election message* from each user, he assumes the role of leader and sends a signed *confirmation message* to all users



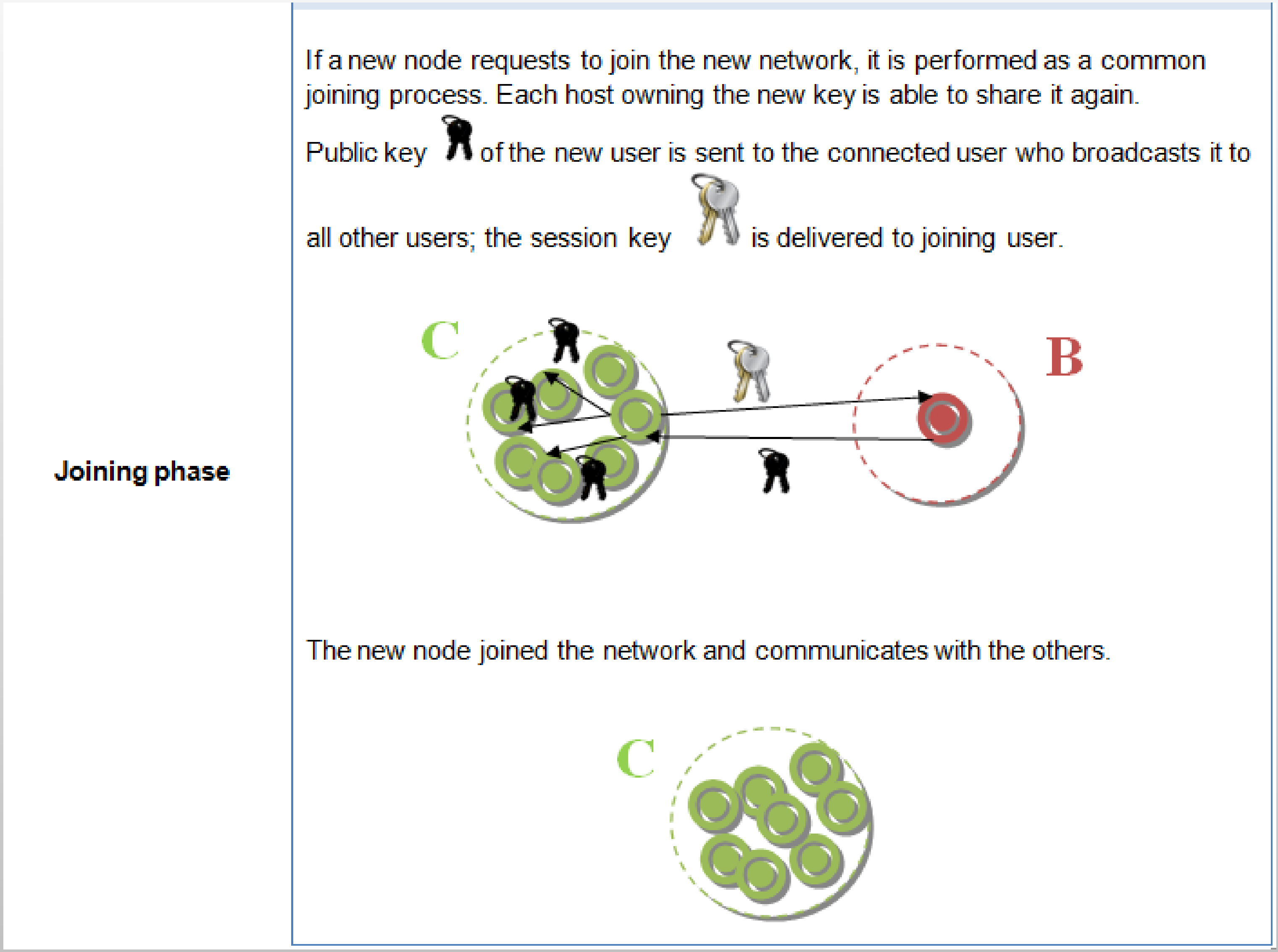
The two leaders meet **face to face** and share a new session key using a *secure side channel*



DESIGN CASE: MERGING 2 NETWORKS (CONT.)

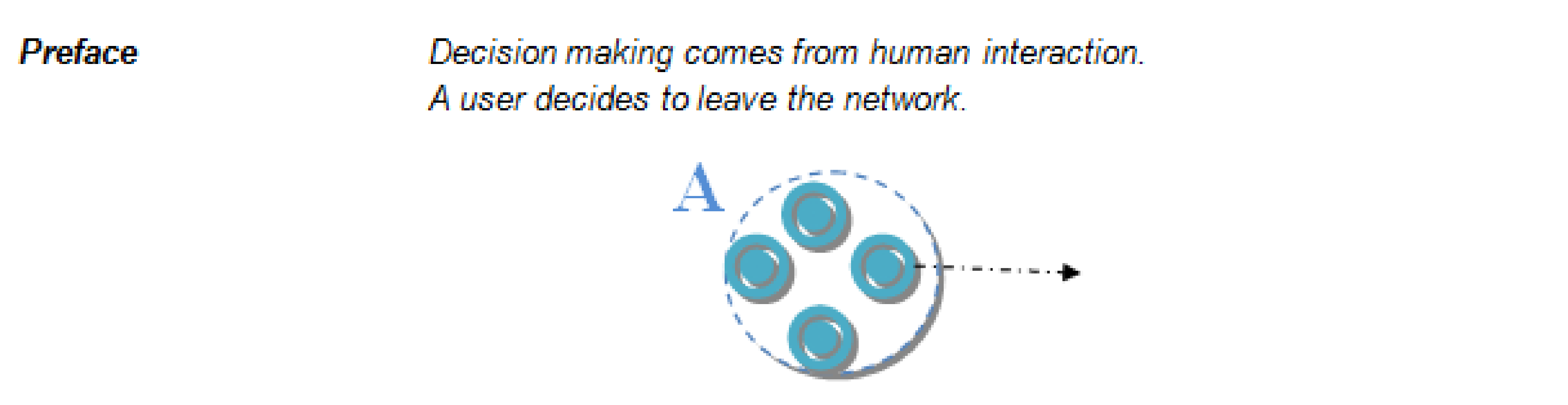
Propagation phase	Each delegate propagates the new key 🔑 to the members of his/her pre-existing network through the network itself. 
Creation & communication phase	Users from both original networks can communicate one to each other 

DESIGN CASE: MERGING 2 NETWORKS (CONT.)



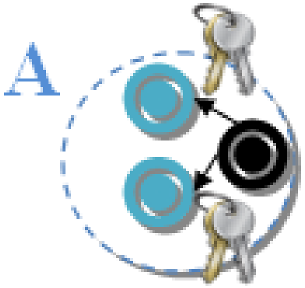
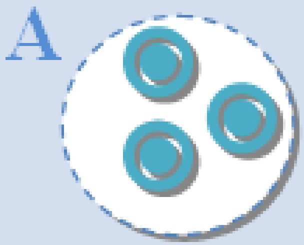
Joining phase	If a new node requests to join the new network, it is performed as a common joining process. Each host owning the new key is able to share it again. Public key 🔑 of the new user is sent to the connected user who broadcasts it to all other users; the session key 🔑 is delivered to joining user. The new node joined the network and communicates with the others.

DESIGN CASE: LEAVING A NETWORK



Preface	*Decision making comes from human interaction.* *A user decides to leave the network.*

DESIGN CASE: LEAVING A NETWORK (CONT.)

Propagation phase	The leader creates the new key and sends it to all other users, encrypting it with their public keys 
Communication phase	Nodes can now communicate once again, in a new secure network that the previous node cannot see anymore 

COMPARISON TO GKA

- Number of exchanged messages

	GKA	Skemasnet
Merging Networks	2*(2N-1)	2(N-1) + (N-2)
Leaving User	2*(2N-1)	2(N-1) + (N-1)

COMPARISON TO GKA

- Size of exchanged messages to deliver a new session key

GKA	SizeOfSessionKey * 2 * N
Skemasnet	SizeOfSessionKey + max(N1, N2)*SizeOfPubKey

REVIEW OUR PROPOSAL (RELATED WORKS)

- Related works(cont.)

Protocol	# of messages for creating and sharing a common session key.	Size of a message
GKA	O(N)	2*N*sizeOfSessionKey
Dynamic Group Diffie-Hellman Key Exchange	$O(N^{\wedge 2})$	sizeOfSessionKey
Scalable Protocols for authenticated Group Key exchange	O(N)	…
Simple and Fault-Tolerant Key Agreement for Dynamic Collaborative Groups	O(LogN*(N))	…
Our Idea	O(N) for leave, merging O(1) for join	Join, Merge: sizeOfSessionKey Leave: N*sizeOfSessionKey

IMPLEMENTATION STARTING REVIEW

Thank you for your attention !

Any question ?

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[4] Daniel Augot, Raghav Bhaskar, Valerie Issarny and Daniele Sacchetti
An Efficient Group Key Agreement Protocol for Ad hoc Networks