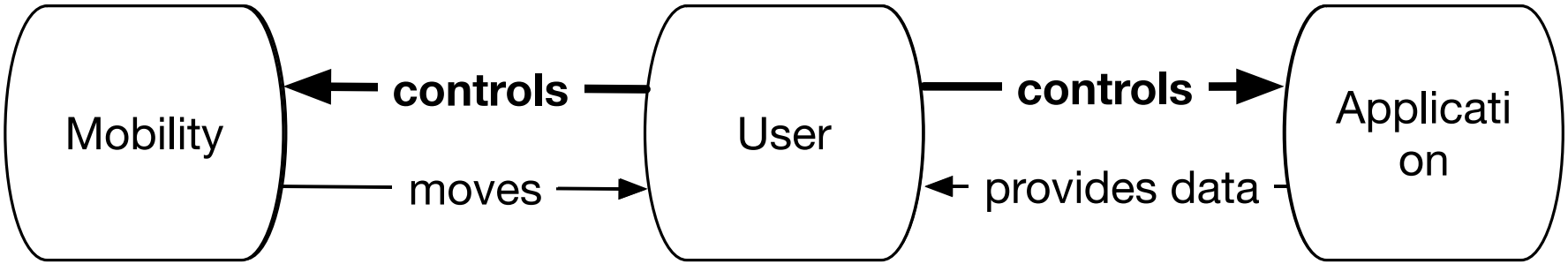
Reactive User Behavior and Mobility Models

Anna Förster, Anas Bin Muslim, Asanga Udugama

University of Bremen
OMNeT++ Summit 2017

Motivation



- Goal 1: Users should **react** to the application messages in an appropriate way and change their moving pattern.
- Goal 2: Give **meaning** to the messages exchanged and provide the simulated user with an ability to react to these messages and to act non-deterministically.

User Definition

$INT = \{i_1, .. , i_m\}$: the interests of the user, e.g. {theater, cinema, cooking}

$R = \{r_1, .. , i_n\}$: the possible reactions of the user to a message, e.g. {delete, ignore, like, save}

$base = Pr[X = r_i]$: the probability of the user to react with a particular reaction to a message, e.g. I will delete 90% of them, ignore 9% and like 1%.

Message Definition

KEYS = {k_1, .. , k_l}: the keywords associated with this message. Could be empty!

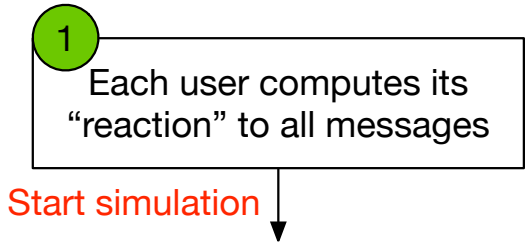
pop in [0…100]: the predefined popularity of the message.

start: the start time of the event in the message

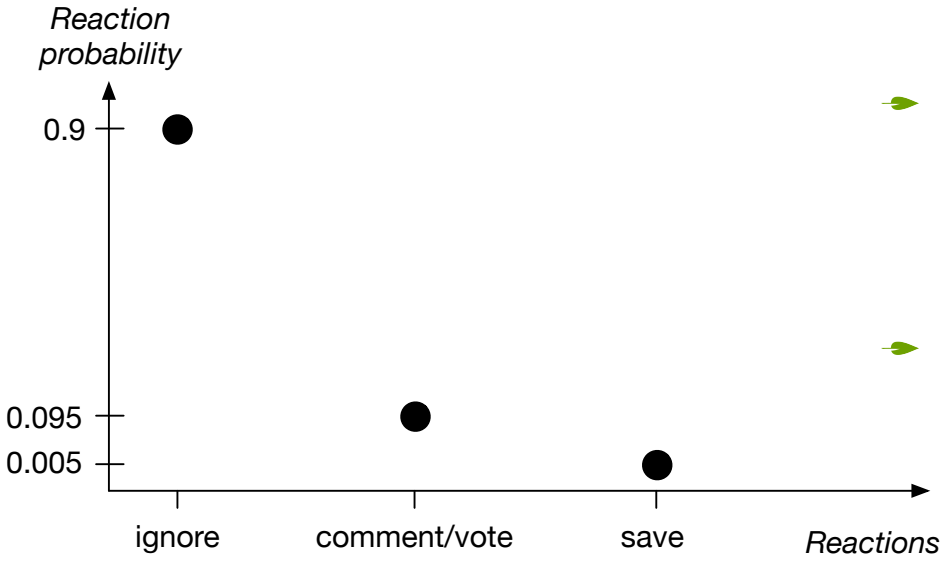
end: the end time of the event

addr: the address of the event

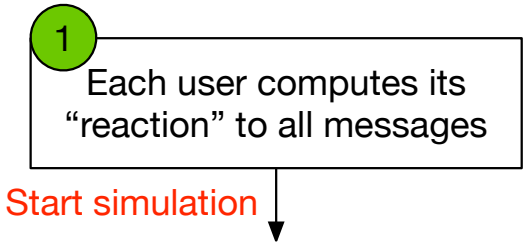
radius: the danger radius of an emergency event



Which messages would I have liked to see?

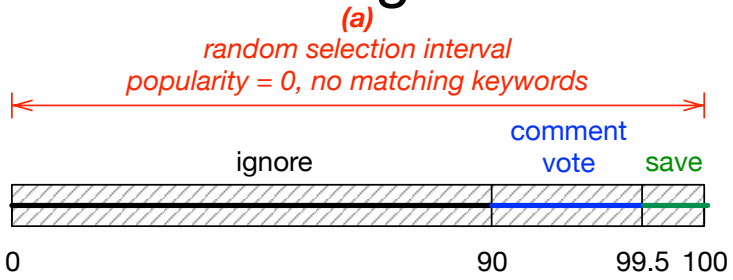


- Example from Jodel application (Bremen and Hamburg, one weekend)
- Base probability if no other details are provided

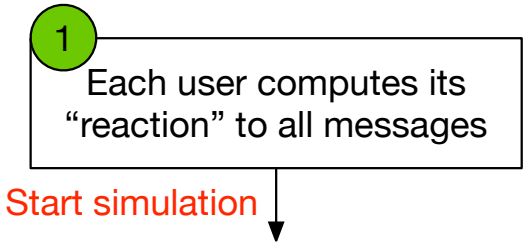


Which messages would I have liked to see?

- With message details:

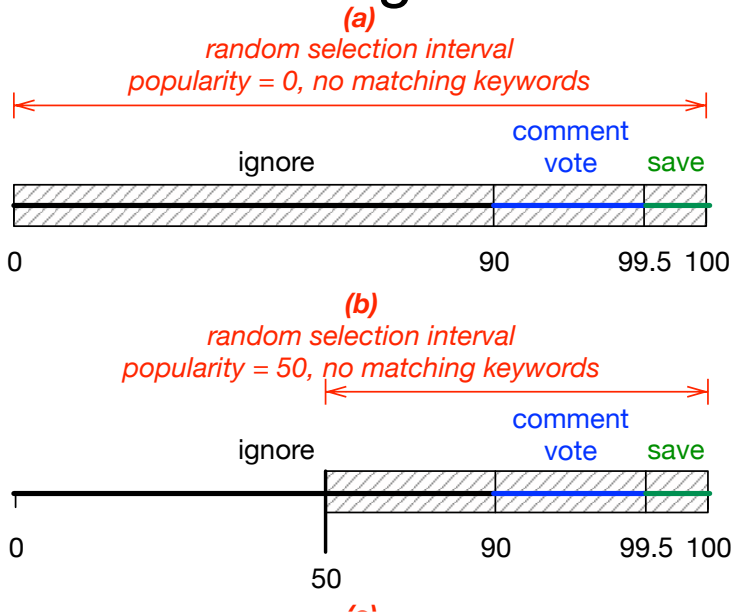


$$r_{msg}^{user} = rand(0, 100)$$



Which messages would I have liked to see?

- With message details:



$$r_{msg}^{user} = rand(0, 100)$$

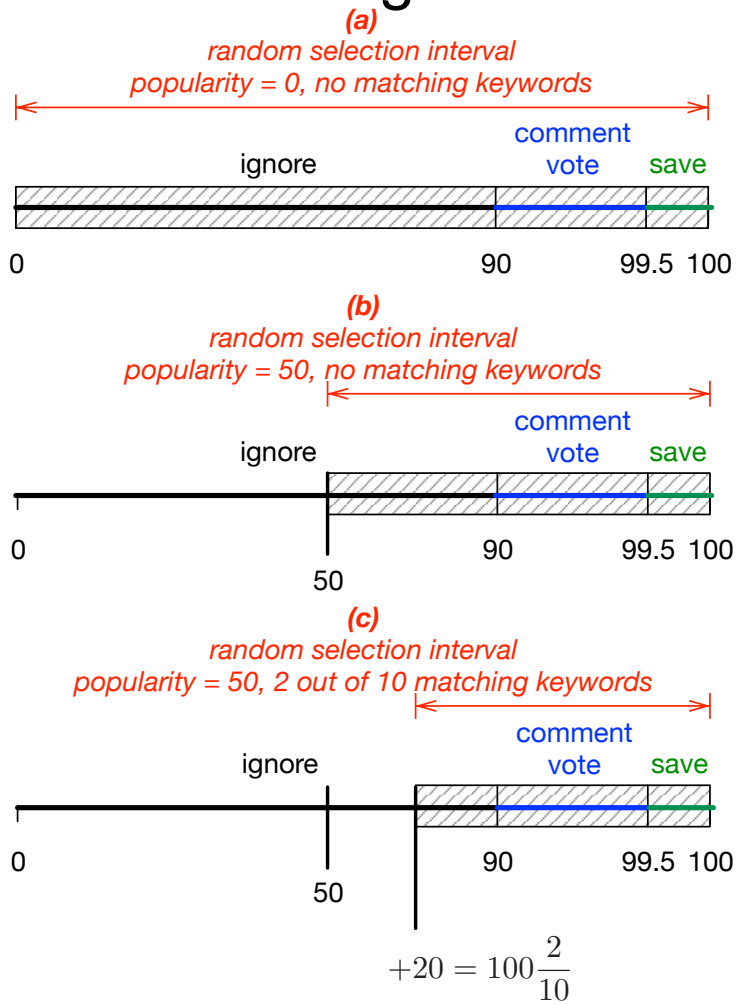
$$r_{msg}^{user} = rand(pop_{msg}, 100)$$

1 Each user computes its "reaction" to all messages

Which messages would I have liked to see?

Start simulation

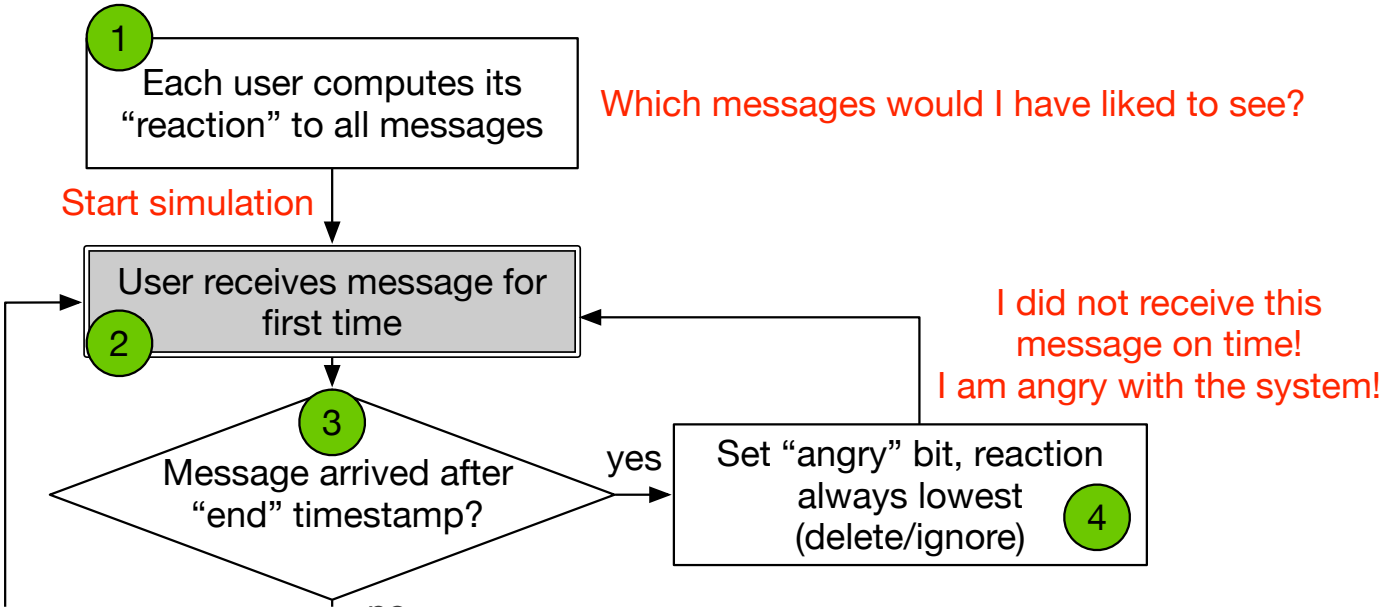
- With message details:

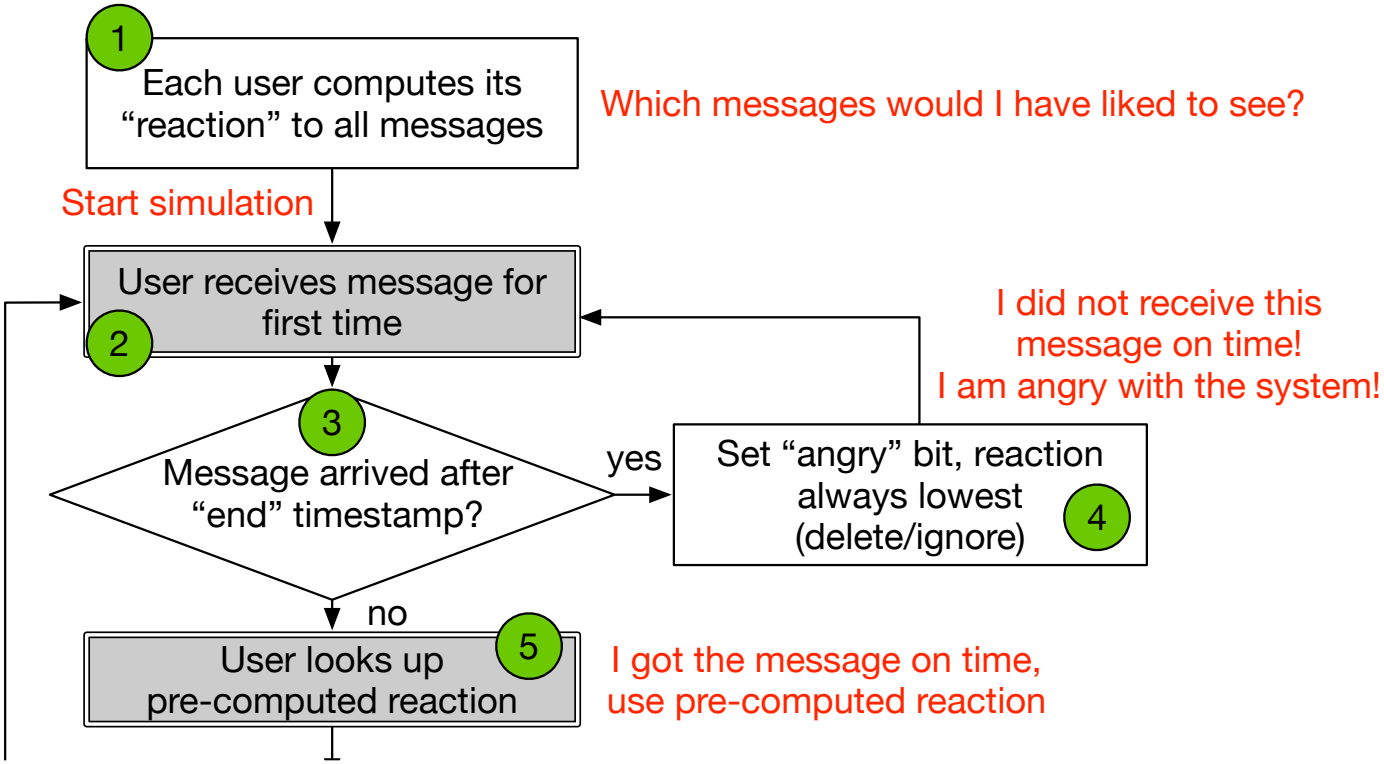


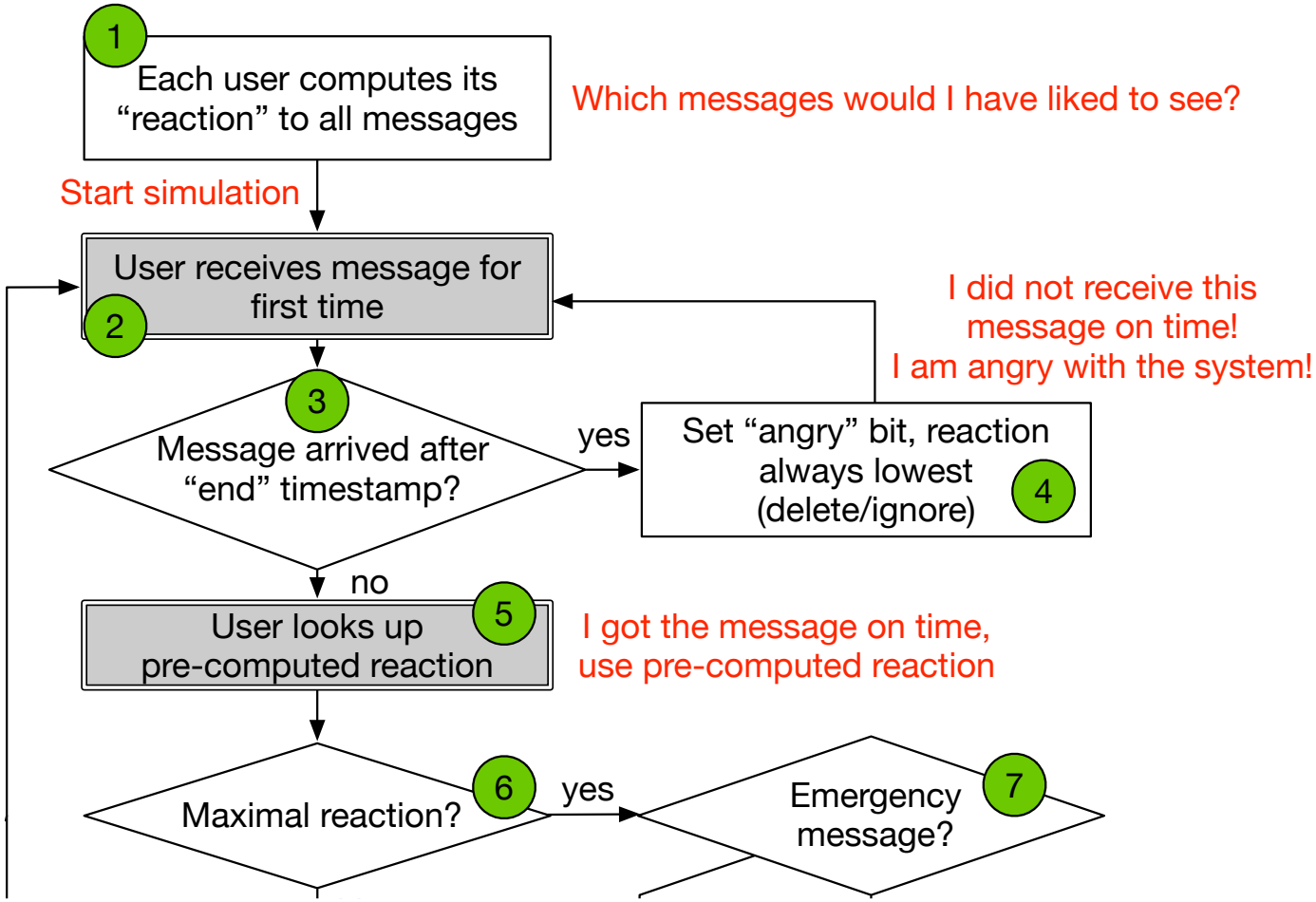
$$r_{msg}^{user} = rand(0, 100)$$

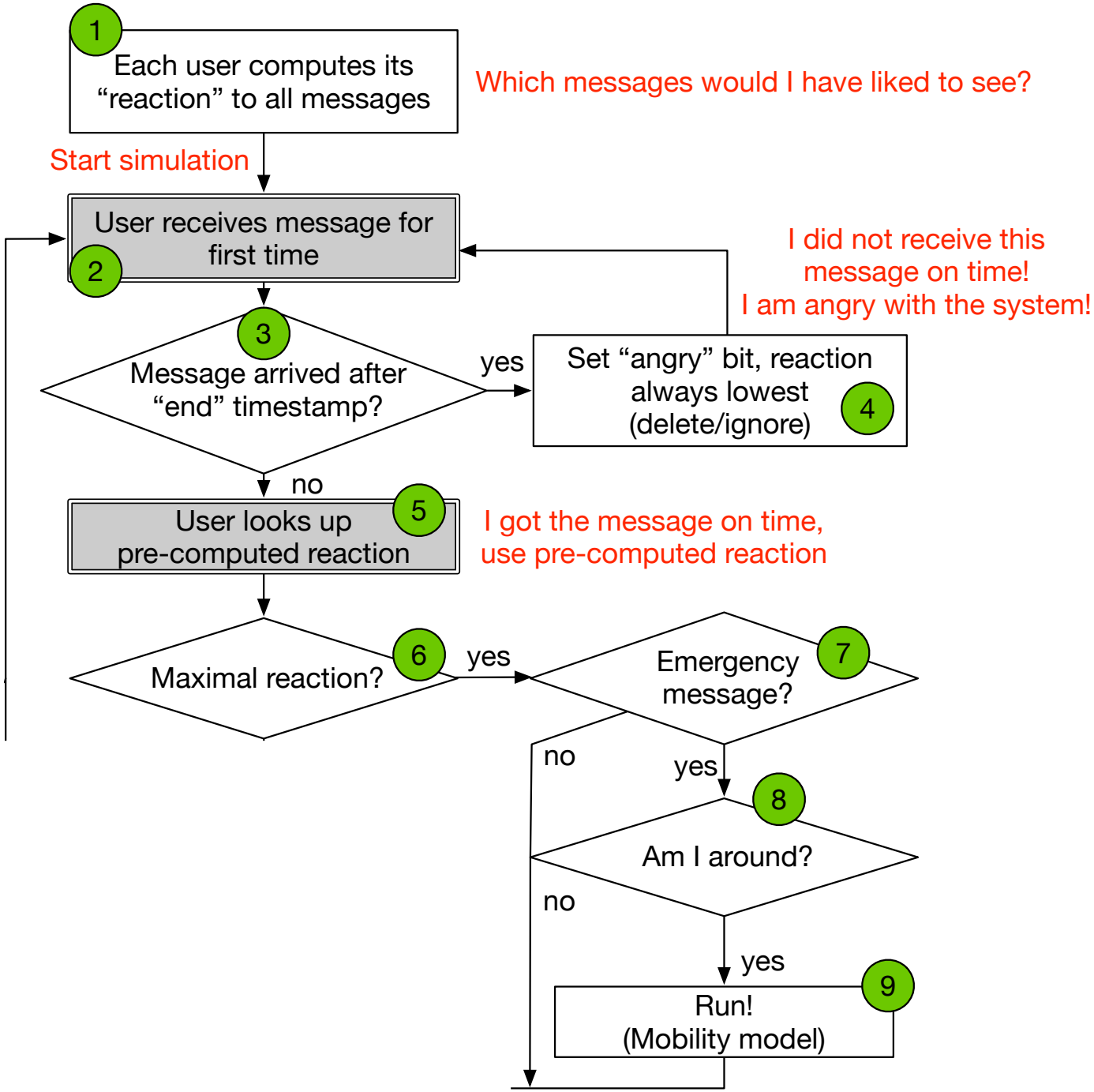
$$r_{msg}^{user} = rand(pop_{msg}, 100)$$

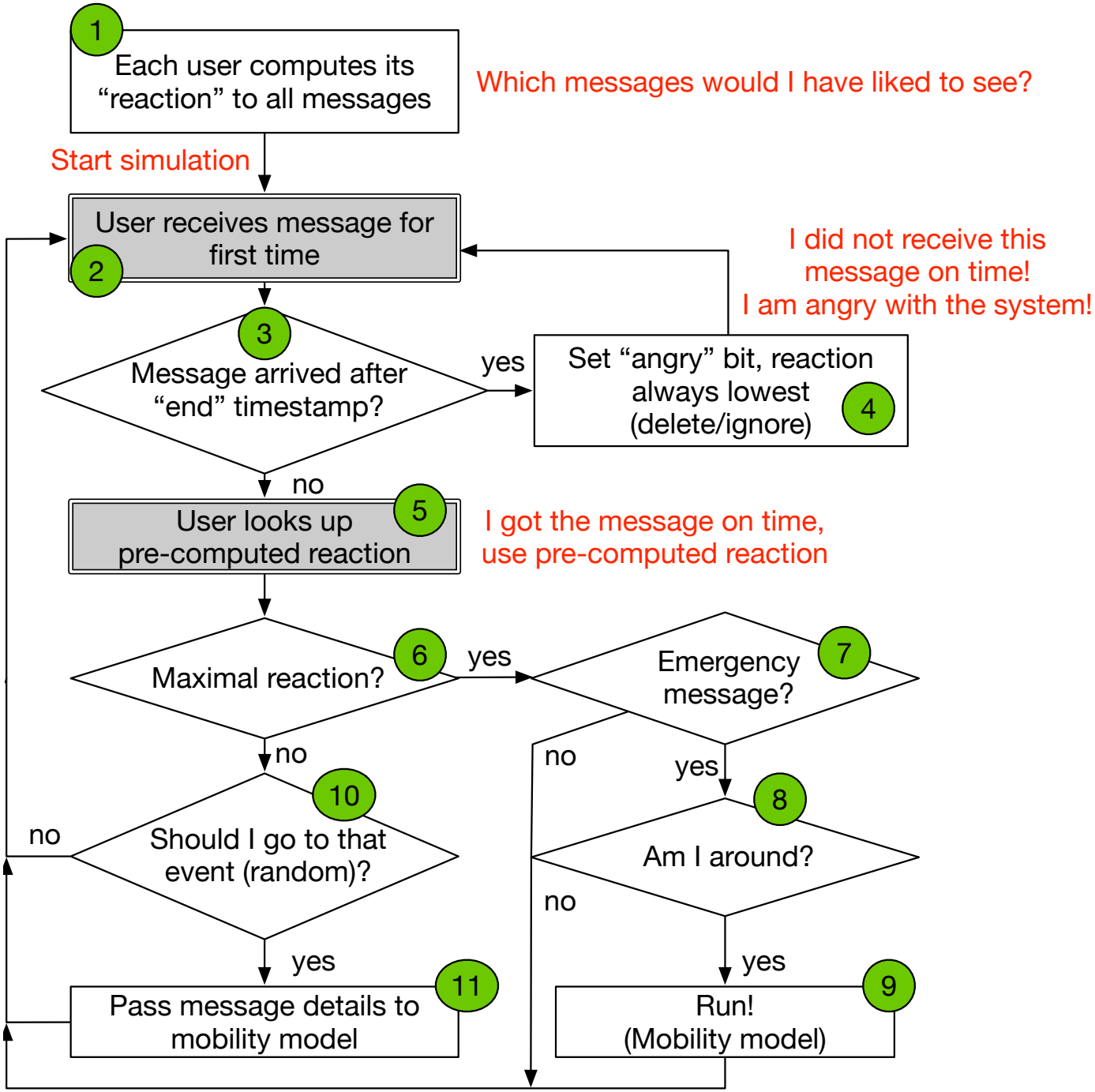
$$r_{msg}^{user} = rand(pop_{msg} + \frac{100k_{msg}^{user}}{l_{msg}}, 100)$$


1
Each user computes its "reaction" to all messages
Which messages would I have liked to see?
Start simulation
User receives message for first time
2
I did not receive this message on time!
I am angry with the system!
3
Message arrived after "end" timestamp?
yes
Set "angry" bit, reaction always lowest (delete/ignore)
4


1
Each user computes its "reaction" to all messages
Which messages would I have liked to see?
Start simulation
User receives message for first time
2
I did not receive this message on time!
I am angry with the system!
3
Message arrived after "end" timestamp?
yes
Set "angry" bit, reaction always lowest (delete/ignore)
4
no
User looks up pre-computed reaction
5
I got the message on time, use pre-computed reaction


1
Each user computes its "reaction" to all messages
Which messages would I have liked to see?
Start simulation
User receives message for first time
2
I did not receive this message on time!
I am angry with the system!
3
Message arrived after "end" timestamp?
yes
Set "angry" bit, reaction always lowest (delete/ignore)
4
no
User looks up pre-computed reaction
5
I got the message on time, use pre-computed reaction
Maximal reaction?
6
yes
Emergency message?
7


1
Each user computes its "reaction" to all messages
Which messages would I have liked to see?
Start simulation
User receives message for first time
2
I did not receive this message on time!
I am angry with the system!
3
Message arrived after "end" timestamp?
yes
Set "angry" bit, reaction always lowest (delete/ignore)
4
no
User looks up pre-computed reaction
5
I got the message on time, use pre-computed reaction
Maximal reaction?
6
yes
Emergency message?
7
no
yes
8
Am I around?
no
yes
Run! (Mobility model)
9


1
Each user computes its "reaction" to all messages
Which messages would I have liked to see?
Start simulation
User receives message for first time
2
I did not receive this message on time!
I am angry with the system!
3
Message arrived after "end" timestamp?
yes
Set "angry" bit, reaction always lowest (delete/ignore)
4
no
User looks up pre-computed reaction
5
I got the message on time, use pre-computed reaction
Maximal reaction?
6
yes
Emergency message?
7
no
yes
no
8
Am I around?
10
Should I go to that event (random)?
no
yes
no
yes
11
Pass message details to mobility model
Run! (Mobility model)
9

Sample Applications

Parameter	Jodel
Num. of Users	500-1000
User interests	none
User reactions	Ignore (90%), comment/vote (9.5%), save (0.5%)
Num. of messages	5 (day/user)
Traffic model	Poisson
Keywords (messages)	none
Popularity of messages	0 (70%), 10-20 (29%), 50 (1%)
Time and place of messages	none

Sample Applications

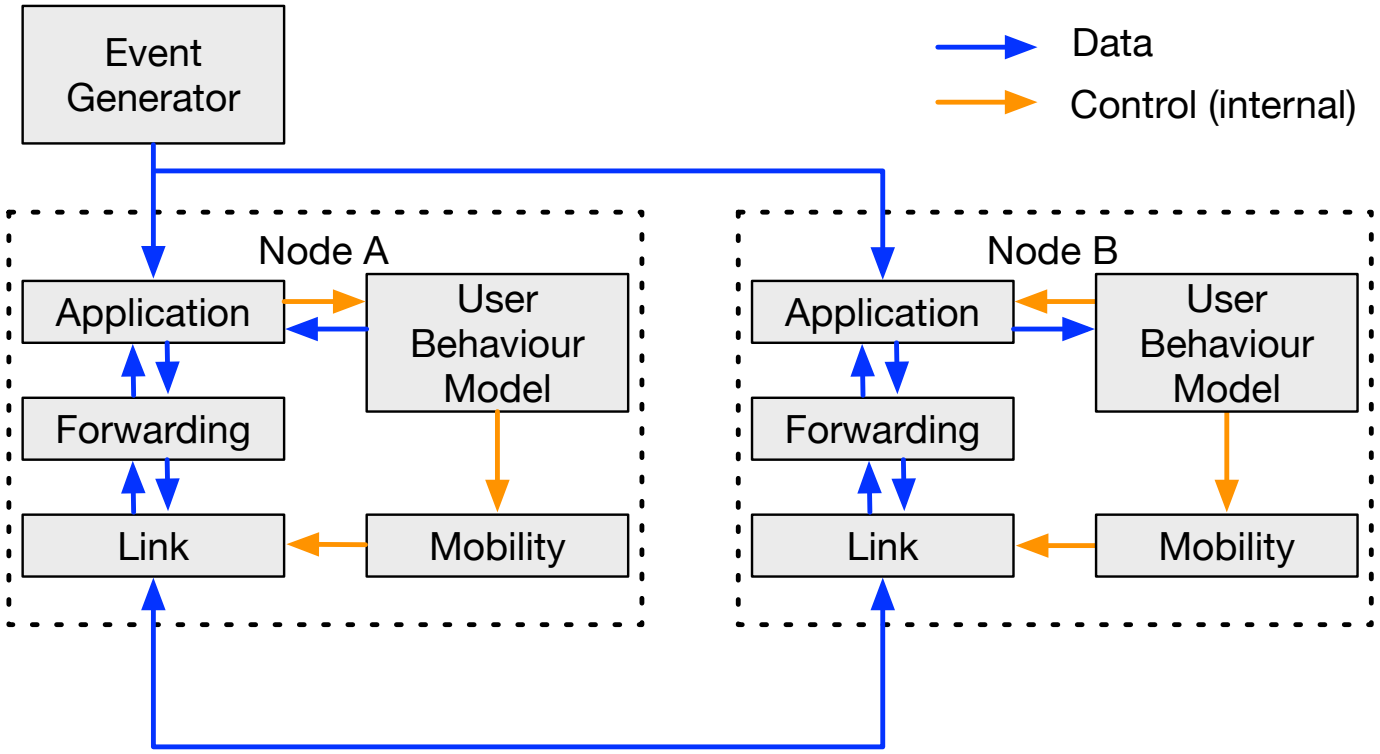
Parameter	Jodel	City events
Num. of Users	500-1000	2000-10000
User interests	none	2-5 out of: sale, con- cert, exhibition, out-door, food, happy hour, market, sports, demonstration
User reactions	Ignore (90%), comment/vote (9.5%), save (0.5%)	Ignore (80%), like (15%), save (4.5%), save&go (0.5%)
Num. of messages	5 (day/user)	0.1 (day/user)
Traffic model	Poisson	Poisson
Keywords (messages)	none	(see user interests)
Popularity of messages	0 (70%), 10-20 (29%), 50 (1%)	0 (70%), 1-5 (29%), 10 (1%)
Time and place of messages	none	Place: mostly city center. Time: mostly evenings/ weekends.

Sample Applications

Parameter	Jodel	City events	Emergency notification
Num. of Users	500-1000	2000-10000	2000-10000
User interests	none	2-5 out of: sale, con- cert, exhibition, out-door, food, happy hour, market, sports, demonstration	none
User reactions	Ignore (90%), comment/vote (9.5%), save (0.5%)	Ignore (80%), like (15%), save (4.5%), save&go (0.5%)	Read&run (if close) (100%)
Num. of messages	5 (day/user)	0.1 (day/user)	0.1 (day/user)
Traffic model	Poisson	Poisson	Poisson
Keywords (messages)	none	(see user interests)	none
Popularity of messages	0 (70%), 10-20 (29%), 50 (1%)	0 (70%), 1-5 (29%), 10 (1%)	100 (100%)
Time and place of messages	none	Place: mostly city center. Time: mostly evenings/ weekends.	Random

OMNeT++ Implementation

- Part of the OPS Simulation Framework



Next steps

- Validate the model with real users!
- Can we contact you for some studies? ☺