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iCoSys
Institute of Complex Systems

iSIS
Institute of Smart and Secured Systems

The TAKE Project

Tactical Ad-hoc networK Emulation

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Context

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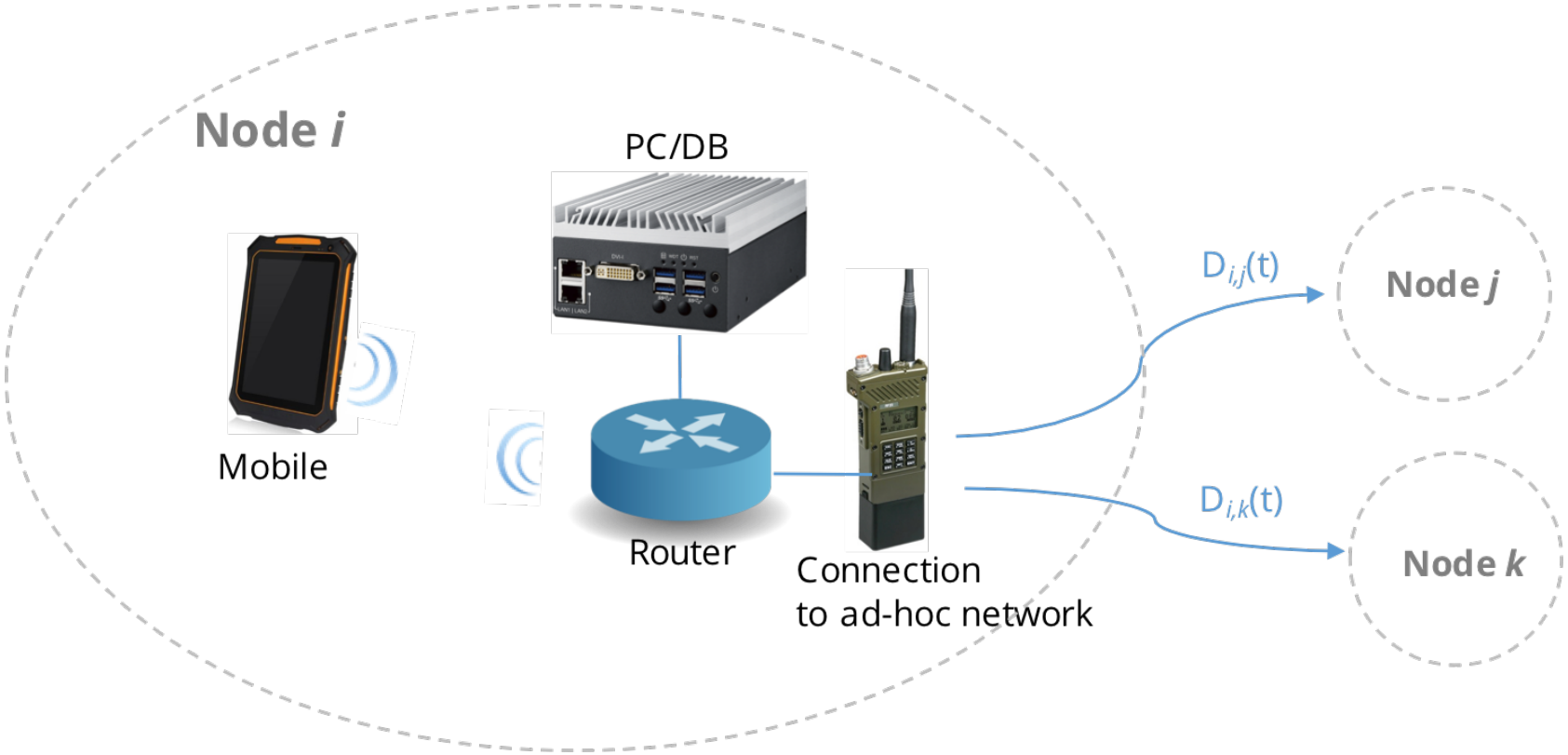
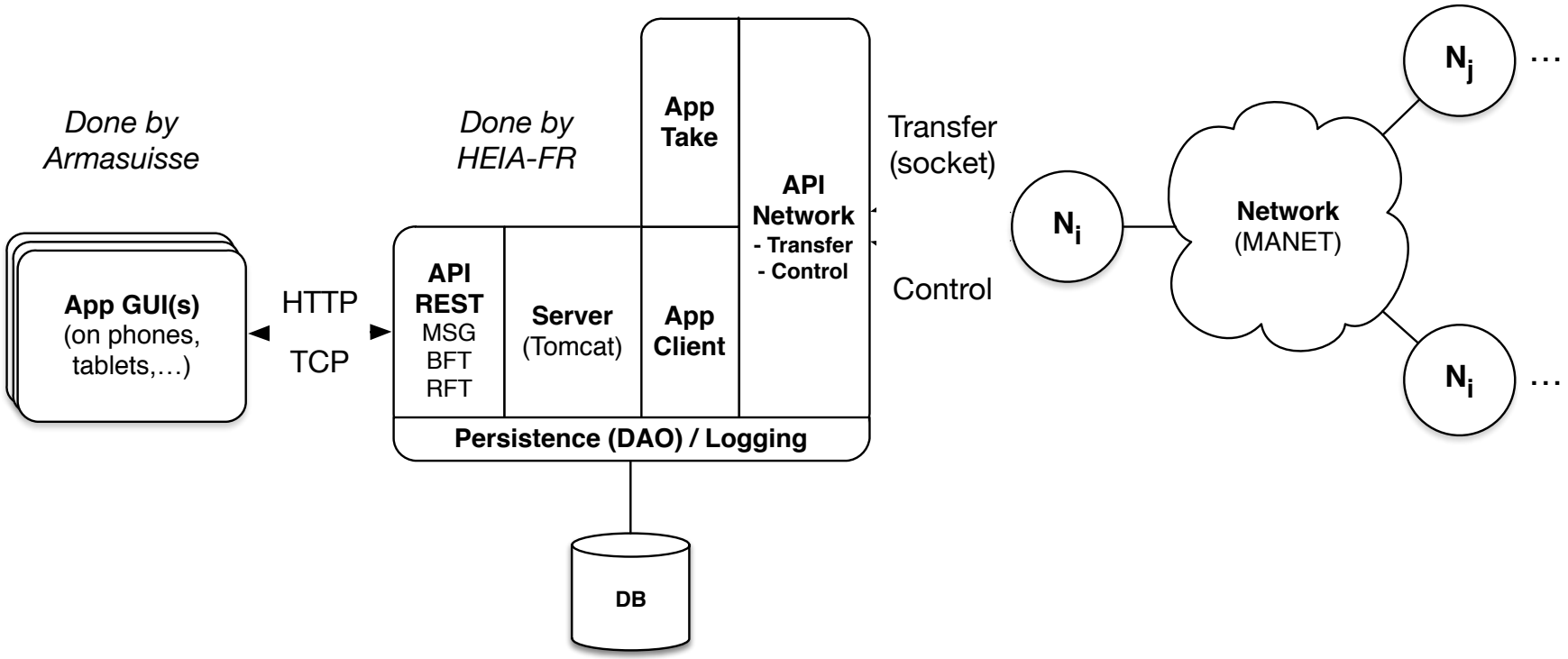


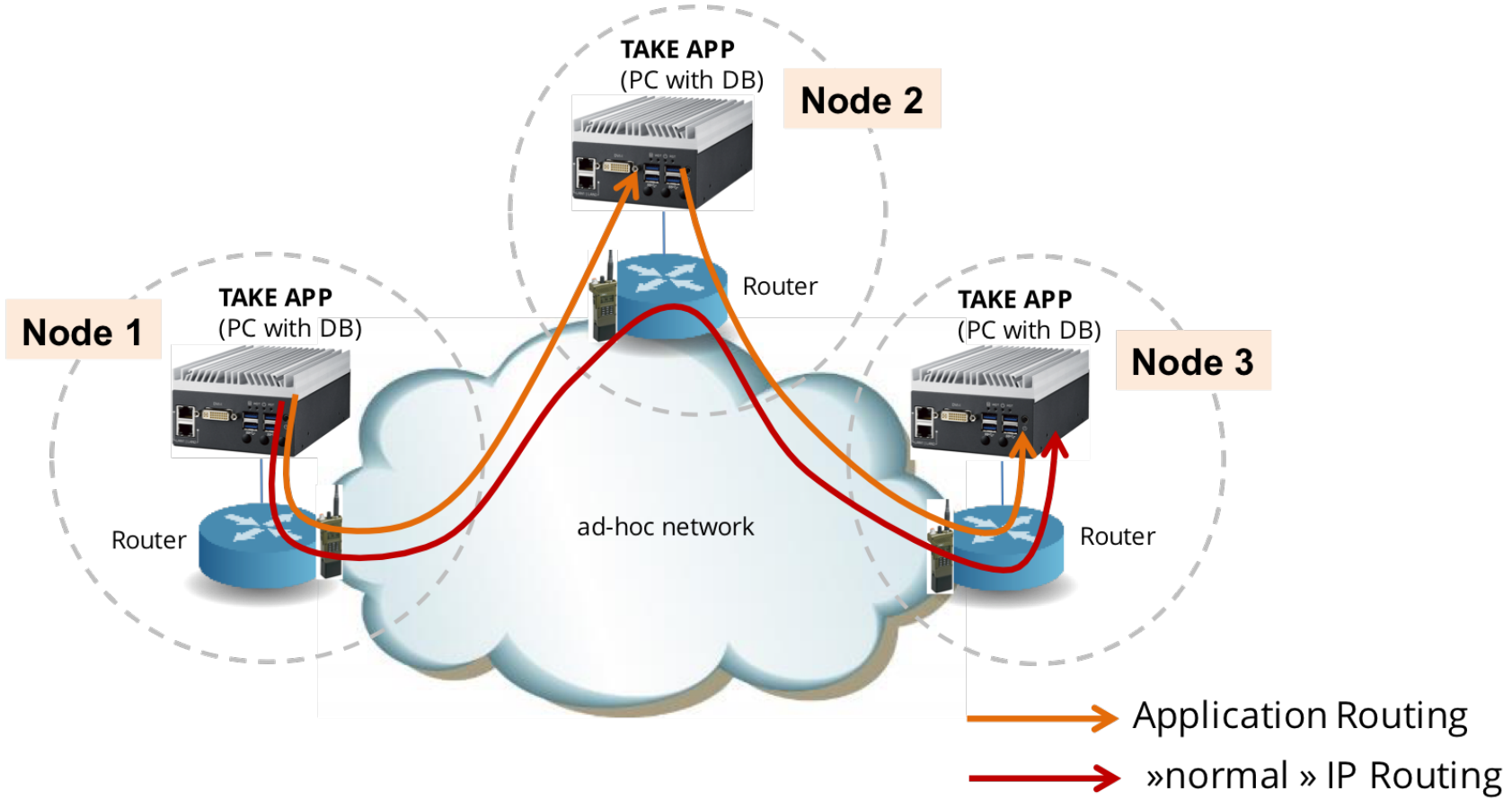
Objectives

- Develop a specific messaging application: TAKE
- Develop smart applicative routing algorithms
- Develop a simulation platform: SimTAKE
  - Metrics to quantify the performances of the routing algorithms
- Develop a field test platform: EmulTAKE
  - Control and manage field tests on real nodes

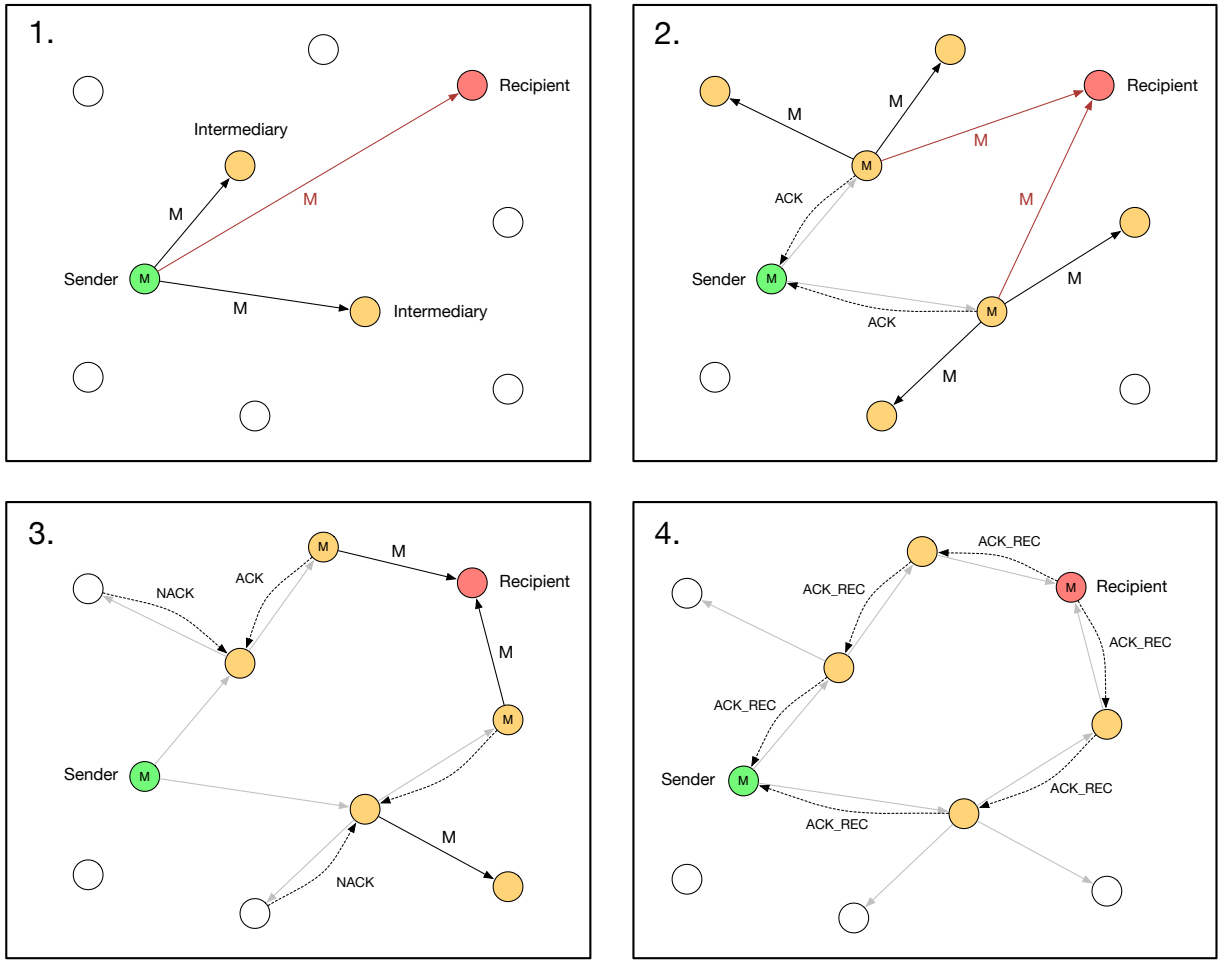
TAKE Java application



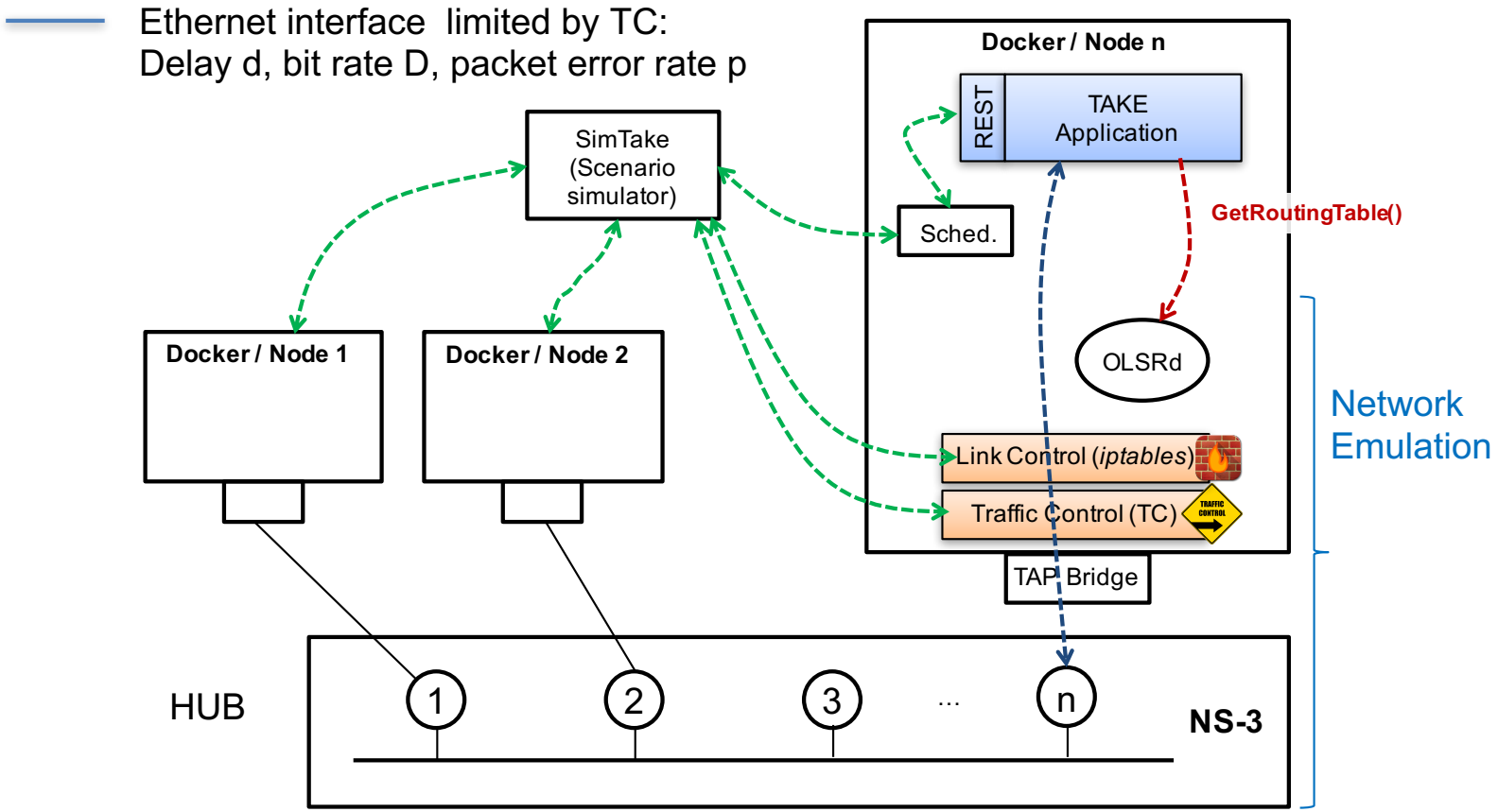
Applicative Routing VS Normal IP Routing



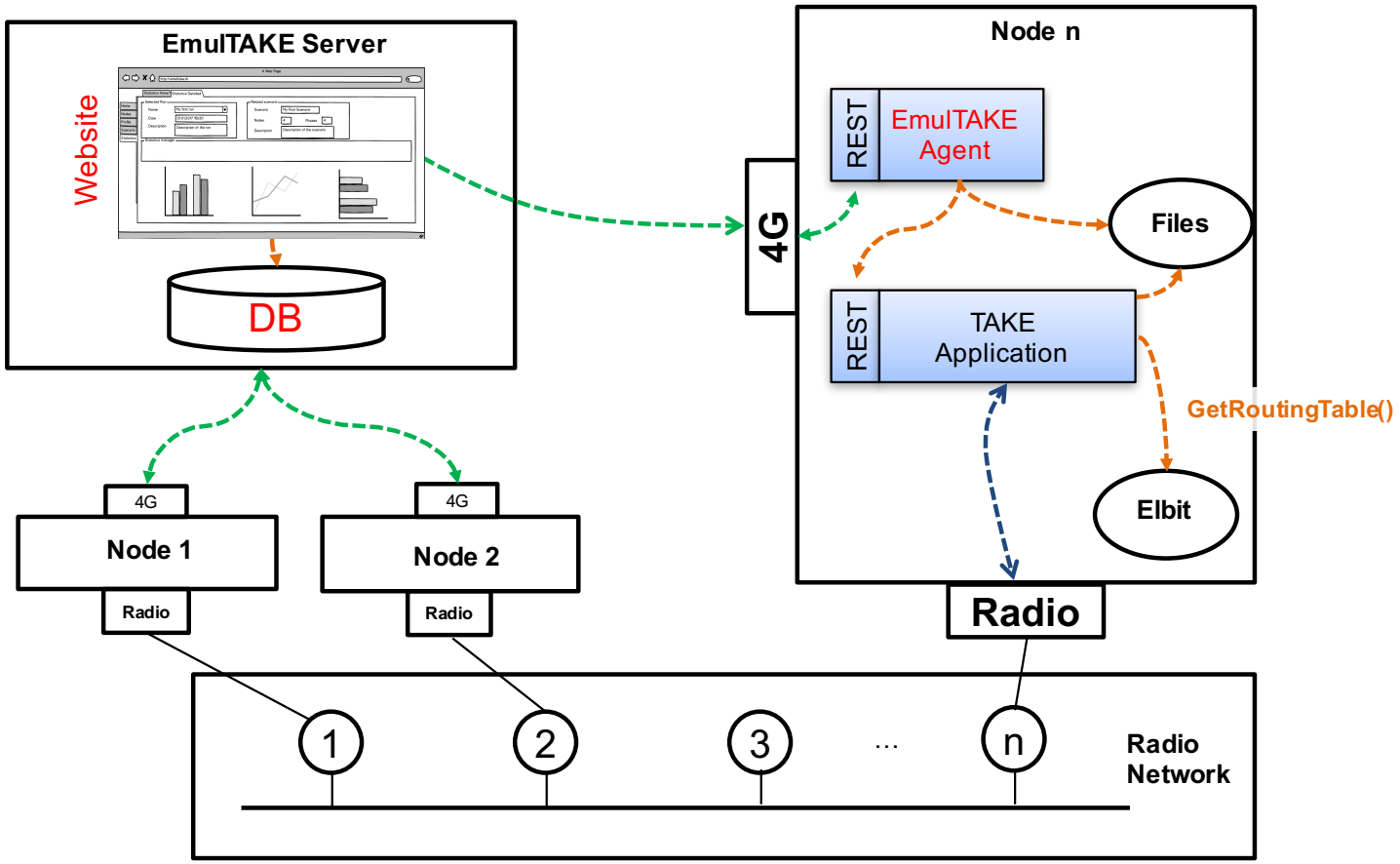
Routing Algorithm: *GetCloser*



Simulation Platform: *SimTAKE*



Field Test Platform: *EmulTAKE*



Field Test Platform: *EmulTAKE*

LIVE DEMO!

Results: Metrics

- Mean Round Trip Time (RTT)
- Message Completion Rate (CR)
- Quality of Experience (QoE)

$$QoE(n) = \frac{w_{CR} * f(cr_n) + w_{RTT} * g(rtt_n)}{w_{CR} + w_{RTT}}$$

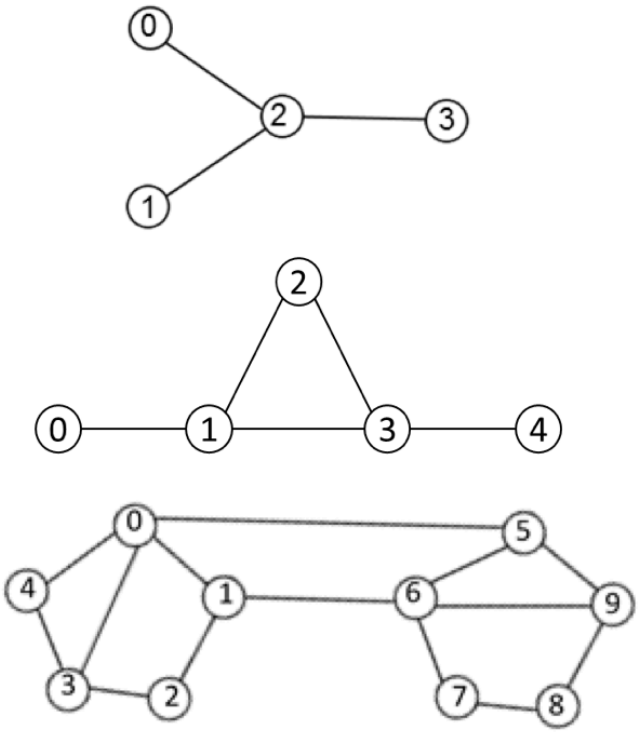
Ou cr_n et wr_n correspondent respectivement à la « completion rate » et au mean round-trip time pour le nœud *n*. La QoE finale étant la moyenne des $QoE(n)$ Avec $w_{CR} = 0.75$ et $w_{RTT} = 0.25$.

$$f(cr) = \begin{cases} 1, & x \geq 0.99 \\ 0.8, & 0.99 > x \geq 0.95 \\ 0.3, & 0.95 > x \geq 0.80 \\ 0.1, & 0.80 > x \geq 0.50 \\ 0, & x < 0.50 \end{cases} \qquad g(rtt) = \begin{cases} 1, & x \leq 100 \\ 0.8, & 100 < x \leq 500 \\ 0.5, & 500 < x \leq 1000 \\ 0.3, & 1000 < x \leq 5000 \\ 0, & x > 5000 \end{cases}$$

Results: Test Topologies

We evaluated the following **topologies**:

- **4 nodes**
  - Fully meshed topology
  - Custom ‘Star’ topology
- **5 nodes**
  - Custom ‘Hat’ topology
- **10 nodes**
  - Fully meshed topology
  - Custom ‘2Groups’ topology
- **17 nodes**
  - Fully meshed topology
- **60 nodes**
  - Fully meshed topology



Results

Sim Nr.	#Nodes	Topology	Algorithm	Throughput	Mean RTT	Mean Completion [%]	Overhead [%]
1	4	Custom	Direct	200kbit	4506	100.00	-
2	4	FullyMeshed	Direct	200kbit	3006	100.00	-
3	4	Custom	**GetCloser**	200kbit	4562	100.00	2.90
4	4	FullyMeshed	**GetCloser**	200kbit	3030	100.00	1.60
5	4	Custom	Direct	50kbit	4505	100.00	-
6	4	FullyMeshed	Direct	50kbit	3007	100.00	-
7	4	Custom	**GetCloser**	50kbit	4657	100.00	2.50
8	4	FullyMeshed	**GetCloser**	50kbit	3056	100.00	1.60
9	5	Custom	Direct	200kbit	4746	100.00	-
10	5	Custom	**GetCloser**	200kbit	4809	100.00	1.30
11	5	Custom	Direct	50kbit	4766	100.00	-
12	5	Custom	**GetCloser**	50kbit	4824	100.00	2.00
13	10	Custom	Direct	200kbit	6314	100.00	-
14	10	FullyMeshed	Direct	200kbit	3006	100.00	-
15	10	Custom	**GetCloser**	200kbit	6511	100.00	2.10
16	10	FullyMeshed	**GetCloser**	200kbit	3046	100.00	1.50
17	10	Custom	Direct	50kbit	6279	100.00	-
18	10	FullyMeshed	Direct	50kbit	3007	100.00	-
19	10	Custom	**GetCloser**	50kbit	6511	100.00	3.80
20	10	FullyMeshed	**GetCloser**	50kbit	3060	100.00	2.00
21	17	FullyMeshed	Direct	200kbit	3140	78.52	-
22	17	FullyMeshed	**GetCloser**	200kbit	3153	99.49	21.67
23	17	FullyMeshed	Direct	50kbit	3176	79.90	-
24	17	FullyMeshed	**GetCloser**	50kbit	3151	99.28	23.16

Results

Results for 16 messages per second per node

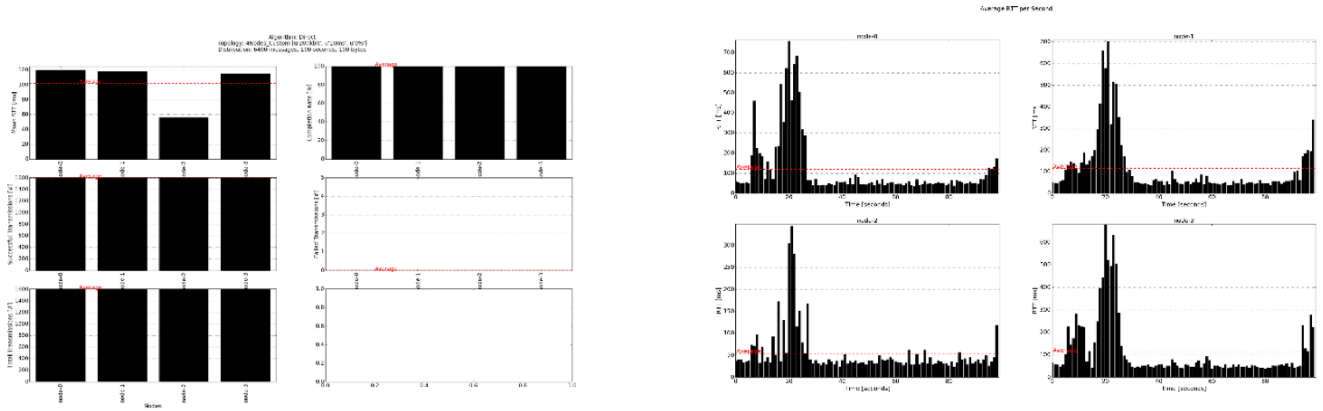


Figure 6. Simulation with 16 messages per second. Left: Overview of the results with no messages dropped. Right : The evolution of the RTT over time. We can observe that the system almost saturates and the recovers.

Results for 18 message per second per node

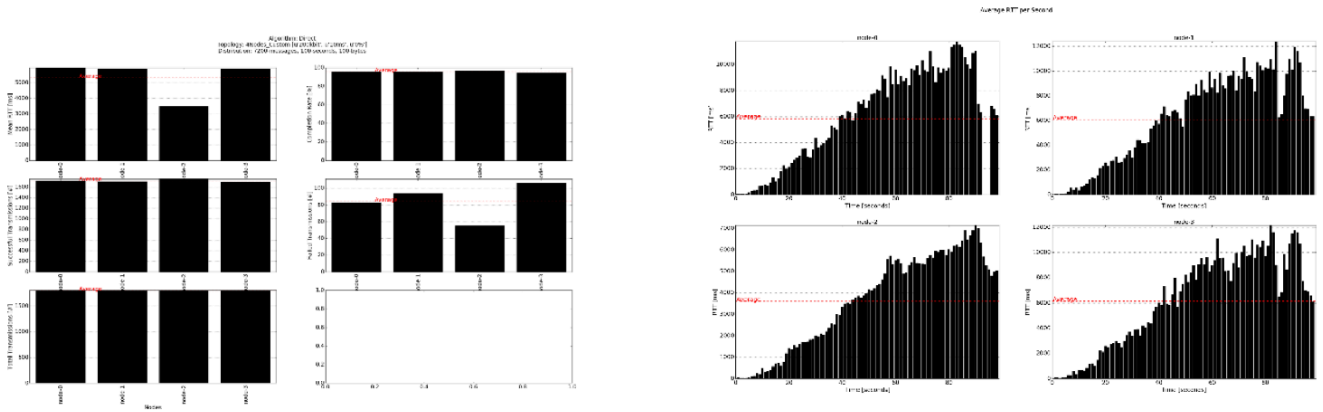


Figure 7. Simulation with 18 messages per second. Left: Overview of the results with some messages dropped. Right: The evolution of the RTT over time. We can observe that the system saturates.

Perspectives: *PredicTAKE*

- Improve applicative routing algorithms
  - Predict best routes according to:
    - Node positions
    - Node radio coverage
    - Node traffic

Questions ?

- Thanks for your hungry attention