UNIVERSITÀ DEGLI STUDI DI NAPOLI FEDERICO II

itee PhD information technology electrical engineering

DIETI UNINA

PhD Student: Giovanni Stanco

Year end presentation

'Networking in IoT and Cyber-Physical Systems: Performance and Security Issues'

Tutor: prof. Giorgio Ventre

Co-Tutor: prof. Alessio Botta, Ing. Flavio Frattini

Cycle: XXXV

Year: Second (2020/2021)

itee PhD information technology electrical engineering

My background

- MSc degree: Telecommunications Engineering
- Research group/laboratory: ARCLAB
- PhD start date: November 2019
- Scholarship type: company funded scholarship
- Partner company: RisLab SRL
- Company tutor: Ing. Flavio Frattini

Research field of interest

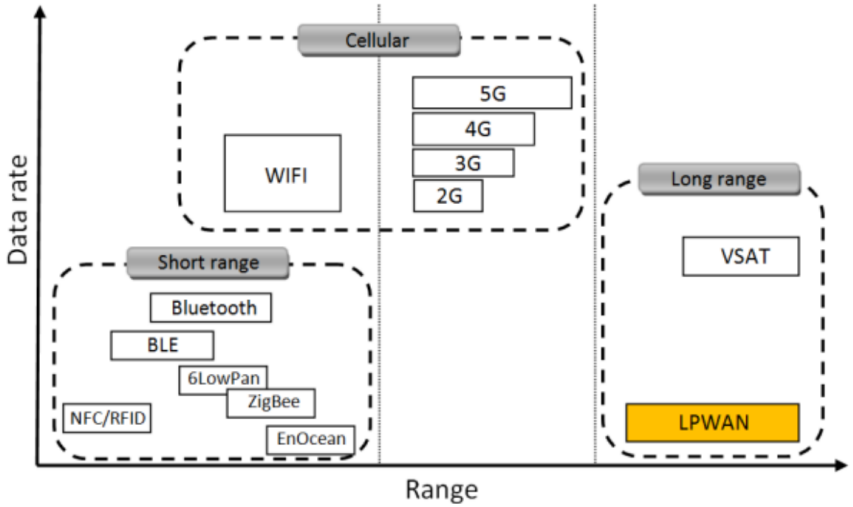
- My research topic is: “Networking in IoT and Cyber-Physical Systems: Performance and Security Issues”.
- IoT: networking infrastructure to connect a massive number of devices
- CPS: system that leverages cyber components to monitor physical components
- Our focus is :
  - performance assessment of IoT networks
  - network security in wireless communications for IoT and CPS services, especially for long range technologies

Summary of study activities

- Ad hoc PhD courses:
  - Statistical data analysis for science and engineering research (prof. Roberto Pietrantuono)

Research activity: motivation

- Interest in wireless sensors
- Wide variety of network possibilities
  - Short range (ZigBee, BLE)
  - Long range (Low Power Wide Area Networks)



- Players in the IoT scenario should know if their requirements are satisfied
- Our goal: analysis of network performance metrics
  - Latency was not considered before in literature

Instruments for our analysis

- A Pycom FiPy development board
- Three LPWAN technologies
- A database server to collect messages

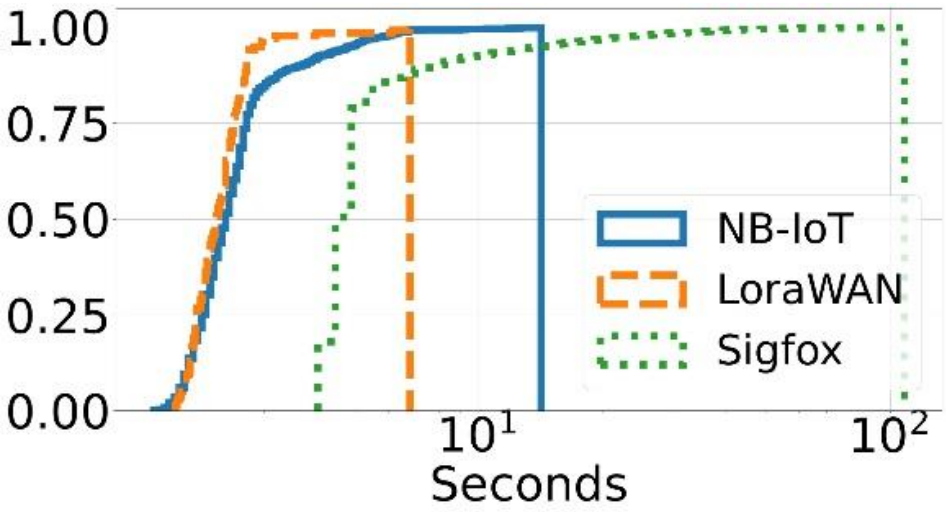
sigfox	LoRaWAN	NB-IoT
ISM Bands (868, 915 MHz)	ISM Bands (868, 915 MHz)	Licensed LTE Bands
Duty Cycle	Duty Cycle	Monthly Bundle
Subscription	Free of charge	Prepaid or subscription

Research activity: preliminary results

	Min	Avg	90th perc.	Max
LRW	1.8 s	2.4 s	2.7 s	6.8 s
NBI	1.6 s	2.7 s	3.7 s	14.1 s
SFX	4.1 s	6.3 s	8.0 s	108.3 s

	Losses	Sent messages
LRW	$\sim$ 2%	375
NBI	$\sim$ 0%	200
SFX	0%	395

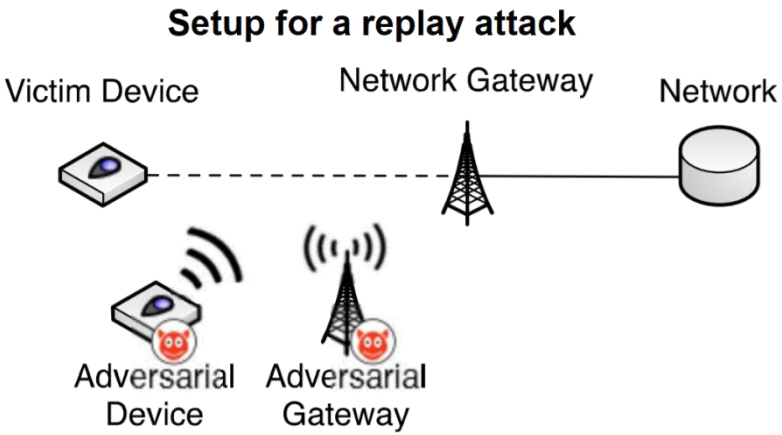
CDF of the message latencies



Research activity: outlook

- Finalization of the preliminary results
- Network-Informed task offloading
  - Task offloading could be more efficient and secure knowing the network status

- Security
  - Wireless networks are subject to several attacks (jamming, replay, Man in the Middle…)
  - Evaluation of the impact of attacks and countermeasures



Products

[P1]	**Conference paper:** 'DewROS: a platform for informed Dew Robotics in ROS' Authors: Giovanni Stanco, Alessio Botta, Giorgio Ventre Presented at the 2020 8th IEEE International Conference on Mobile Cloud Computing, Services, and Engineering (Mobile Cloud)
[P2]	**Conference paper:** 'Comparing the performance of LPWAN technology for IoT: the case of Sigfox, LoRaWAN and NB-IoT' Authors: Giovanni Stanco, Alessio Botta, Flavio Frattini, Ugo Giordano, Giorgio Ventre Submitted to the 2022 IEEE International Conference on Communications
[P3]	**Journal article:** 'DewROS: a platform for informed Dew Robotics in ROS' Authors: Giovanni Stanco, Gennaro Esposito Mocerino, Alessio Botta, Giorgio Ventre Not submitted yet
[P4]	**Survey:** 'On the security of the IoT wireless communication technologies' Authors: Giovanni Stanco, Alessio Botta, Flavio Frattini, Ugo Giordano, Giorgio Ventre Not submitted yet

	Courses	Seminars	Research	Tutorship	Total
Bimonth 1	0	2,20	7,80	0	10
Bimonth 2	0	1,10	8,90	0	10
Bimonth 3	4	2,10	3,90	0	10
Bimonth 4	0	0,80	9,20	0	10
Bimonth 5	0	0	10	0	10
Bimonth 6	0	0,60	9,40	0	10
Total	**4**	**6,8**	**49,2**	**0**	**60**

References

[R1]	J. Lin, W. Yu, N. Zhang, X. Yang, H. Zhang, and W. Zhao, "A survey on internet of things: Architecture, enabling technologies, security and privacy, and applications," IEEE Internet of Things Journal, vol. 4, no. 5, pp. 1125–1142, Oct 2017.
[R2]	T. Salman and R. Jain, "Networking protocols and standards for Internet of Things", 02 2017,
[R3]	F. Meneghello, M. Calore, D. Zucchetto, M. Polese, and A. Zanella, "IoT: Internet of threats? a survey of practical security vulnerabilities in real IoT devices," IEEE Internet of Things Journal, vol. 6, no. 5, pp. 8182–8201, 2019.
[R4]	F. L. Coman, K. M. Malarski, M. N. Petersen, and S. Ruepp, "Security issues in Internet of Things: Vulnerability analysis of LoRaWAN, Sigfox and NB-IoT" in 2019 Global IoT Summit (GIoTS)
[R5]	I. Butun, P. Osterberg, and H. Song, "Security of the internet of things: Vulnerabilities, ¨ attacks, and countermeasures," IEEE Communications Surveys Tutorials, vol. 22, no. 1, pp. 616–644, 2020.
[R6]	M. Bradbury, A. Jhumka, and T. Watson, "Trust trackers for computation offloading in edge-based IoT networks", published in: IEEE INFOCOM 2021

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