

PCOG

Yearly team meeting



Research Activities

Bi-level Optimisation

■ CARBON

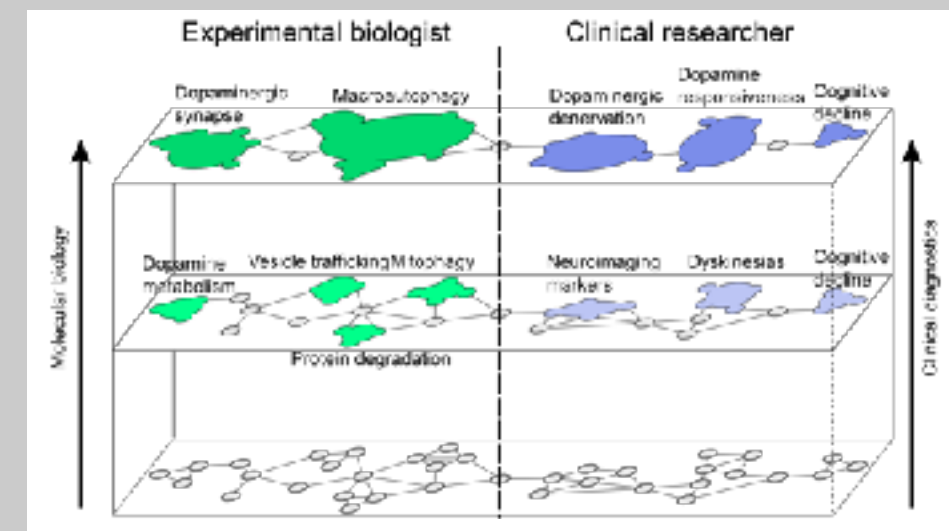
- Coevolutionary HybRid Bi-level Optimization
- AFR PhD of **Emmanuel**

■ Bi-level problems

- Coevolution, Bayesian, Heuristics generation

■ Applications

- Constrained problems [3,4] - MD Knapsack [6] Bi-level problems [5]
- Biological Data Clustering (PD map) - LCSB [1]
- Cloud Brokering optimisation [2]



[1] Marek Ostaszewski; Emmanuel Kieffer; Gregoire Danoy; Pascal Bouvry. Clustering approaches for visual knowledge exploration in complex biomedical repositories; BMC Bioinformatics journal, 2017 (submitted).

[2] Jędrzej Musiał; Emmanuel Kieffer; Mateusz Guzek; Gregoire Danoy; Shyam S. Wagle; Pascal Bouvry; Jacek Blazewicz; Cloud Brokering with Bundles: Multiobjective Optimization of Services Selection, 4OR Journal; 2017 (submitted)

[3] E. Kieffer, G. Danoy, P. Bouvry, and A. Nagih. A new co-evolutionary algorithm based on constraint decomposition. In 2017 IEEE International Parallel and Distributed Processing Symposium Workshops, IPDPS Workshops 2017, Orlando / Buena Vista, FL, USA, May 29 - June 2, 2017, pages 492–500. IEEE Computer Society, 2017.

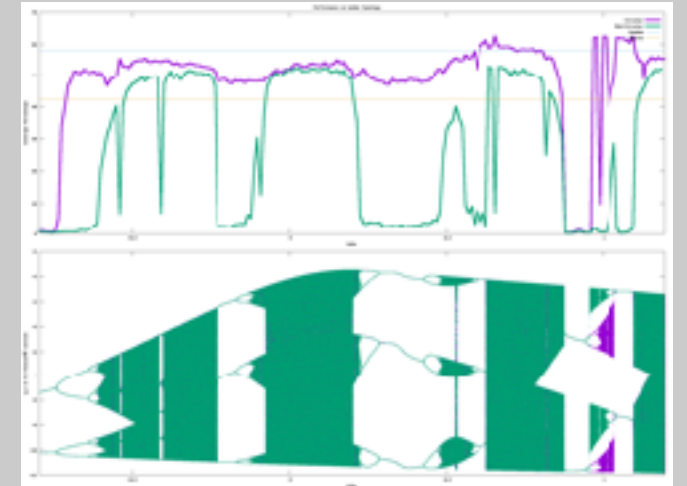
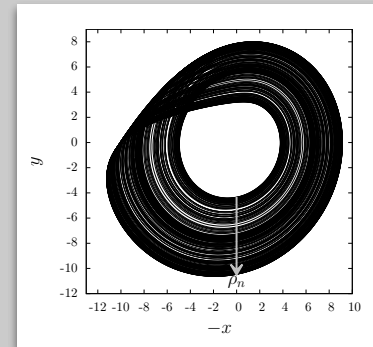
[4] Emmanuel Kieffer; Gregoire Danoy; Pascal Bouvry, Anass Nagih; A hybrid co-evolutionary algorithm for constrained optimization problems; Swarm and Evolutionary Computation; 2017 (submitted)

[5] E. Kieffer, G. Danoy, P. Bouvry, and A. Nagih. Bayesian optimization approach of general bi-level problems. In P. A. N. Bosman, editor, Genetic and Evolutionary Computation Conference, Berlin, Germany, July 15-19, 2017, Companion Material Proceedings, pages 1614–1621. ACM, 2017.

[6] Emmanuel Kieffer; Grégoire Danoy; Pascal Bouvry; Anass Nagih; Automatic Heuristic Generation : application to the Multidimensional Knapsack Problem; Annals of Operations Research Journal; 2017 (submitted)

■ Huge graphs traversal

- PhD of Boonyarit
- Objective
 - Memory-less Graph traversal
- Approach
 - Chaotic exploration [7]



■ Parking allocation

- Collaboration with Examotive
- First Problem Model
- Solving with exact, heuristics and meta [8]



[7] Boonyarit Changaival, Martin Rosalie, Grégoire Danoy, Pascal Bouvry, Kittichai Lavangnananda; Chaotic Traversal (CHAT): Very Large Graphs Traversal using Chaotic Dynamics, International Journal of Bifurcation and Chaos, 2017 (submitted)

[8] Boonyarit Changaival; Grégoire Danoy; Dzmitry Kliazovich; Frédéric Guinand; Matthias R. Brust; Jedrzej Musial; Kittichai Lavangnananda; Pascal Bouvry; Fleet Placement in Station-based Round-trip Car Sharing Service, Annals of Operations Research Journal, 2017 (submitted)

- **ASIMUT project (03/2015 - 04/2017) [9]**
 - Aid to Situation Management based on MUtlmodal, MultiUAVs, Multi-level acquisition Techniques
 - First EDA project in Luxembourg
- **Design, optimisation and validation of mobility models**
 - Coverage of surveyed area
 - Connectivity preservation of the UAVs
 - Randomness of the surveillance movement
 - Energy conservation
- **Collaborations**
 - University of Bordeaux (FR)
 - Fraunhofer IOSB (GE)
 - Thales Systèmes Aéroportés SAS (FR)
 - Fly-N-Sense (FR)



[9] P. Bouvry, S. Chaumette, G. Danoy, G. Guerrini, G. Jurquet, A. Kuwertz, W. Müller, M. Rosalie, J. Sander, and F. Segor. ASIMUT project: Aid to situation management based on multimodal, multiuavs, multilevel acquisition techniques. In Proceedings of the 3rd Workshop on Micro Aerial Vehicle Networks, Systems, and Applications, DroNet@MobiSys 2017, Niagara Falls, NY, USA, June 23, 2017, pages 17–20. ACM, 2017.

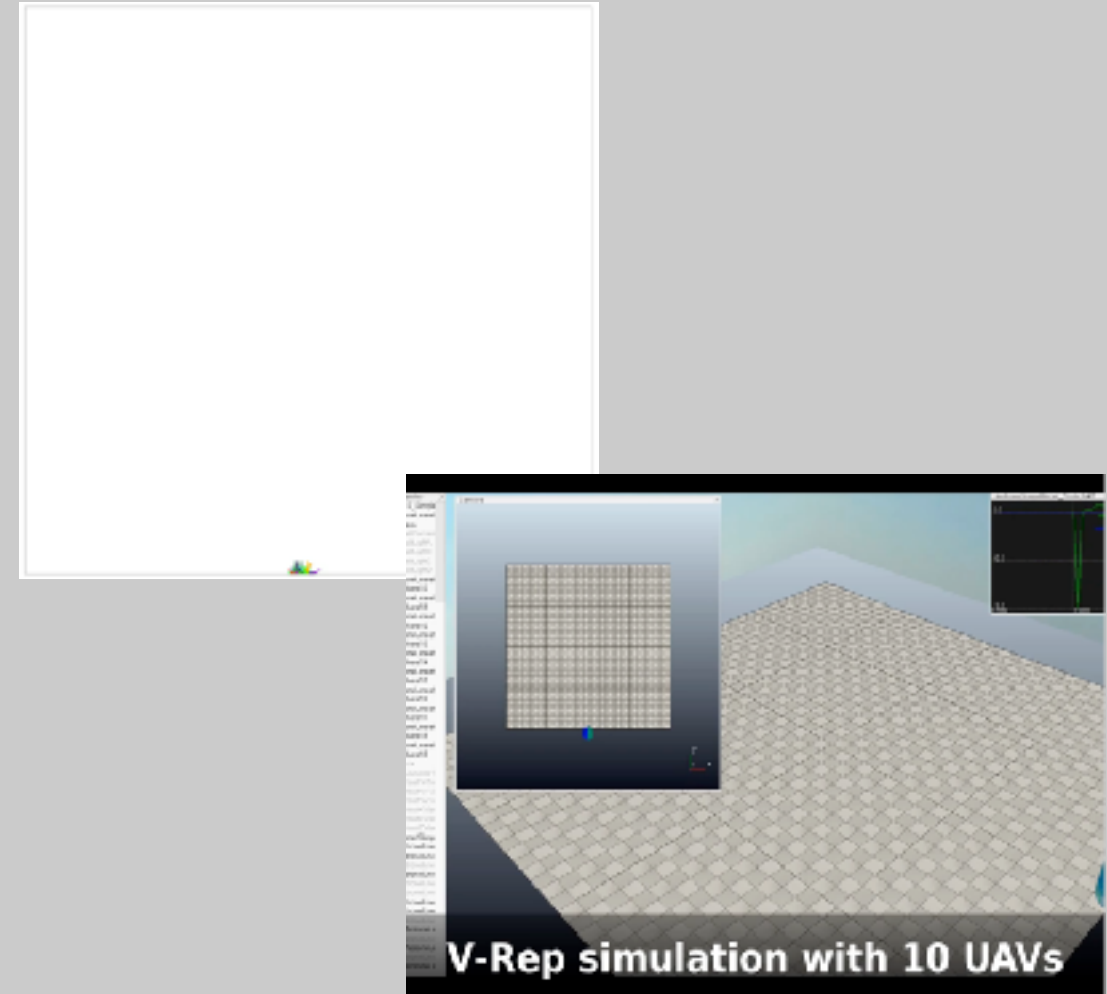
UAV Swarms - Mobility models

■ Chaos theory

- Work with **Martin** [10,11]
- Comparison with control theory models [12,13]

■ Clustering

- Work with **Matthias**
- Tracking with dual pheromone [14]
- Defense against malicious UAV [15]



[10] M. Rosalie, G. Danoy, S. Chaumette, and P. Bouvry. Impact du mécanisme chaotique sur l'optimisation d'un modèle de mobilité pour un essaim de drones devant réaliser une couverture de zone, Comptes-rendus de la 20e Rencontre du Non Linéaire, 2017

[11] M. Rosalie, G. Danoy, S. Chaumette, and P. Bouvry. Chaos-enhanced mobility models for multilevel swarms of UAVs, SWEVO Journal, 2017 (submitted)

[12] M. Rosalie, J. E. Dentler, G. Danoy, P. Bouvry, S. Kannan, M. A. Olivares-Mendez, and H. Voos. Area exploration with a swarm of UAVs combining deterministic chaotic ant colony mobility with position MPC. In 2017 International Conference on Unmanned Aircraft Systems (ICUAS), pages 1392–1397, June 2017.

[13] J. E. Dentler, M. Rosalie, G. Danoy, P. Bouvry, S. Kannan, M. A. Olivares-Mendez, and H. Voos. Collision avoidance effects on the mobility of a UAV swarm using Chaotic Ant Colony with Model Predictive Control", Journal of Intelligent & Robotic System, 2017 (submitted)

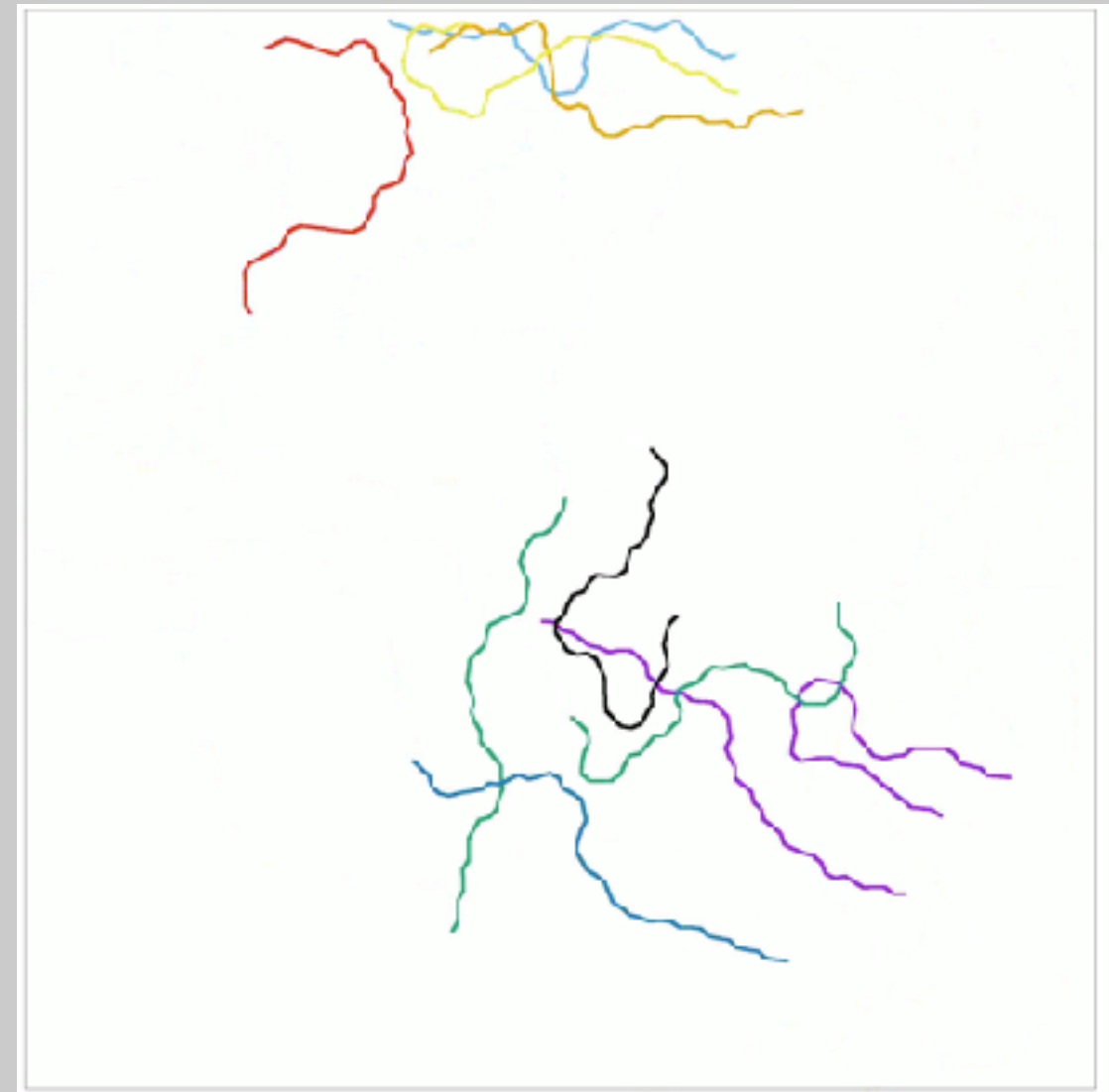
[14] M. R. Brust, M. Zurad, L. Hentges, L. Gomes, G. Danoy, and P. Bouvry. Target tracking optimization of UAV swarms based on dual-pheromone clustering. In 3rd IEEE International Conference on Cybernetics, CYBCONF 2017, Exeter, United Kingdom, pages 1–8. IEEE, 2017 - **Best paper award**

[15] M. R. Brust, G. Danoy, P. Bouvry, D. Gashi, H. Pathak, and M. P. Goncalves. Defending against intrusion of malicious uavs with networked UAV defense swarms. In 42nd IEEE Conference on Local Computer Networks Workshops, LCN Workshops 2017, pages 103–111. IEEE Computer Society, 2017.

UAV Swarms - Mobility models

■ Chaos + boids

- CACOC²
- Rule 1: Boids try to fly towards the centre of mass of neighbouring boids



[16] M. Rosalie, M. R. Brust, G. Danoy, S. Chaumette, and P. Bouvry. Coverage optimization with connectivity preservation for UAV swarms applying chaotic dynamics. In X. Wang, C. Stewart, and H. Lei, editors, 2017 IEEE International Conference on Autonomic Computing, ICAC 2017, Columbus, OH, USA, July 17-21, 2017, pages 113–118. IEEE Computer Society, 2017.

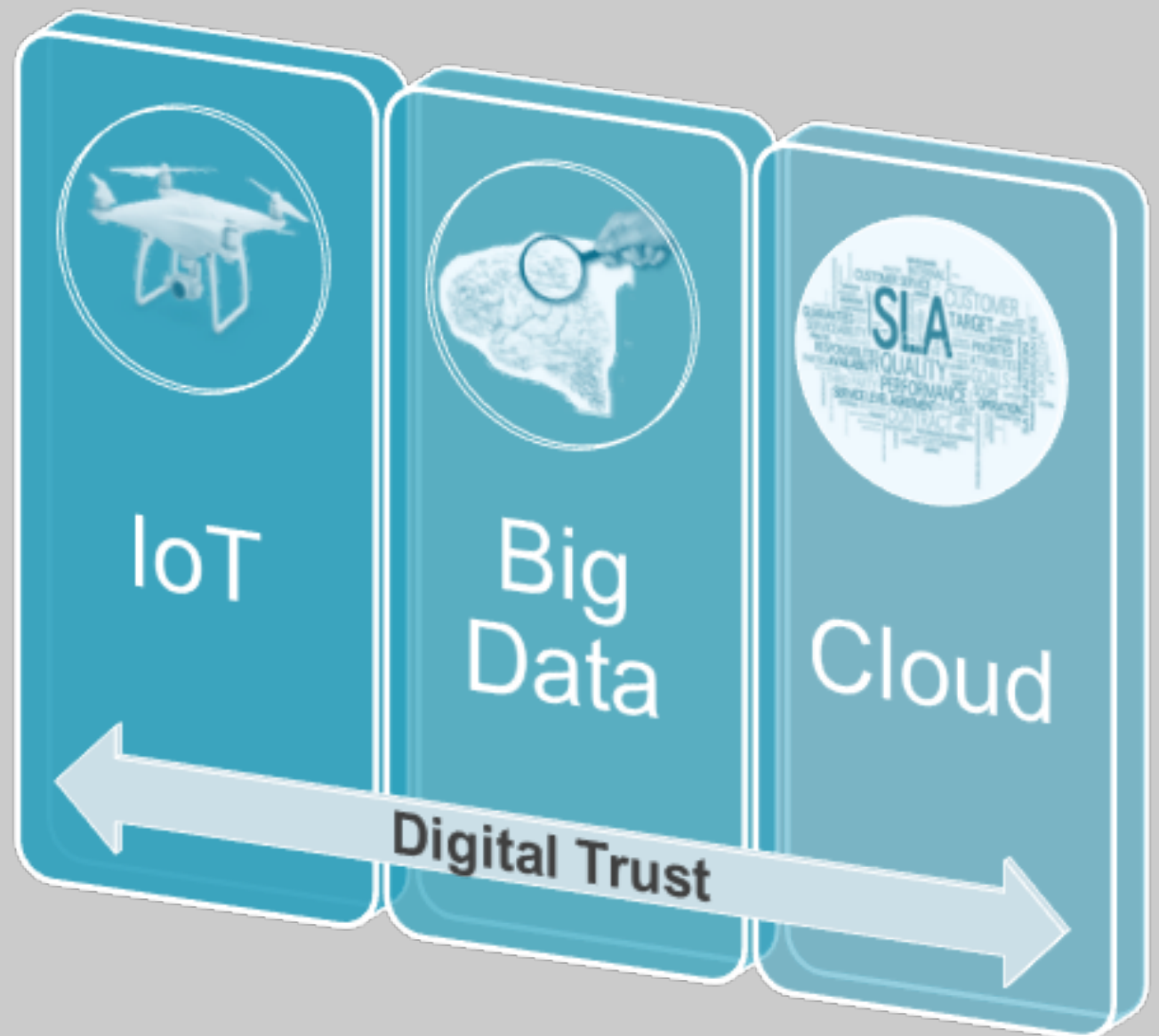
■ Digital Trust in Smart ICT

■ Postdoc: Matthias

■ PhDs

- IoT: Nader Samir
- Cloud: Chao Liu
- Big Data: Saharnaz Esmaelzadeh

■ ILNAS/ANEC/UL personnel also participates



Other collaborations

■ University of Cadiz, Spain

- Dr. Bernabe Dorronsoro
- Cooperative Coevolutionary algorithms [17]

■ Universidad de la Republica, Uruguay

- Dr. Sergio Nesmachnow
- Biological knowledge clustering (Parkinson Disease Map)

■ IMDEA NETWORKS Institute, Madrid, Spain

- Dr. Claudio Fiandrino
- mm-wave communications for UAVs localisation

[17] A. Atashpendar, B. Dorronsoro, G. Danoy, and P. Bouvry. A scalable parallel cooperative coevolutionary PSO algorithm for multi-objective optimization. Journal of Parallel and Distributed Computing, 2017.

Project Proposals and Dissemination Activities

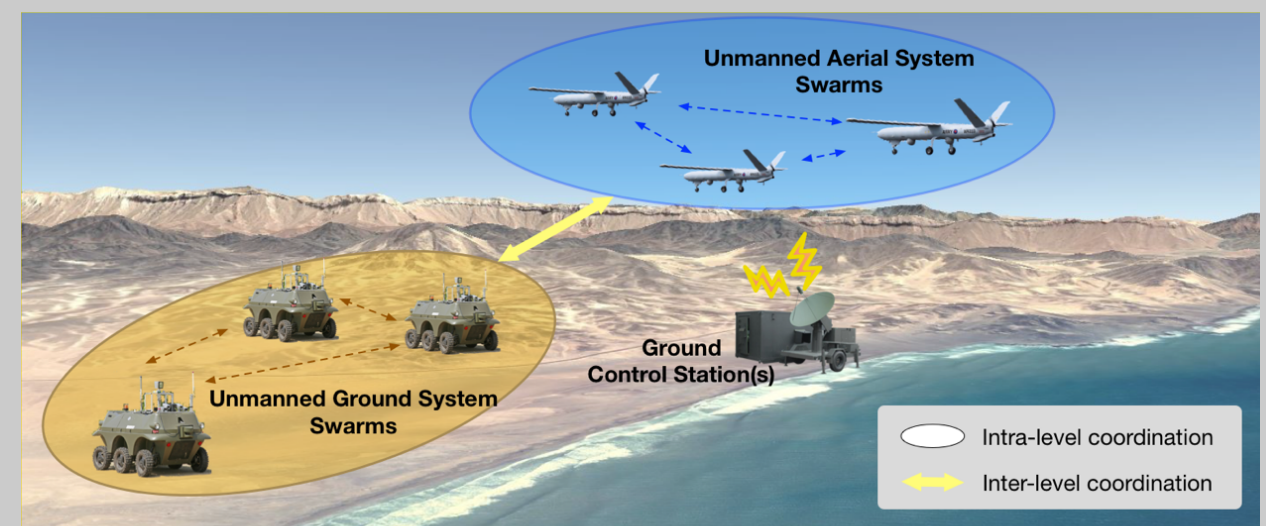
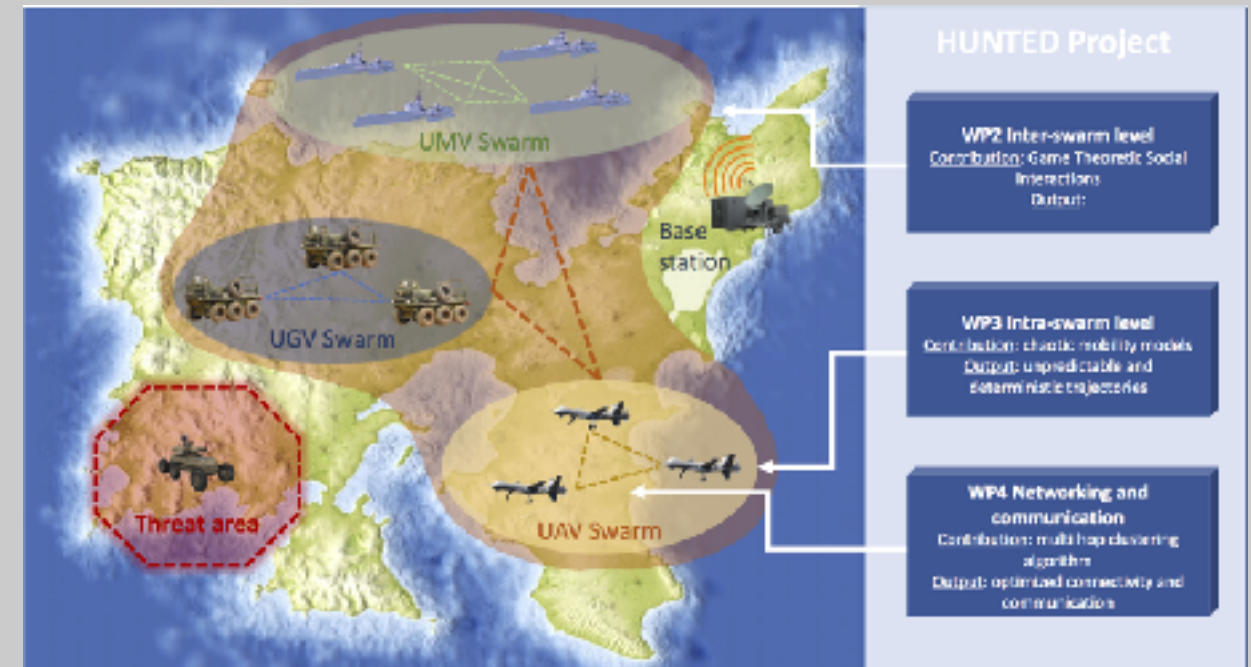
Project pipe

■ ONRG

- HUNTED - Heterogeneous multi-swarms of UNmanned auTonomous systEms for mission Deployment

■ EDA

- SUSPECT - Swarms of Unmanned Surveillance Platforms Extended to Collaborative Teaming



Dissemination activities

■ Scientific events organisation

■ PDCO 2018 (Vancouver, Canada) - May 21- May 25, 2018

- IEEE Workshop on Parallel / Distributed Computing and Optimization (as part of IPDPS)
- Deadline December 15, 2017



■ IEEE CloudCom 2018 (Cyprus). -December 12-15, 2018

- Deadline June 15, 2018



■ Other upcoming events

■ IPMU 2018 (Alicante, Spain)

- SS on Metaheuristics and Machine Learning
- Deadline: December 12 (extended)



■ BIOMA 2018 (Paris, France)

- Deadline December 1st



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Thanks for your attention