
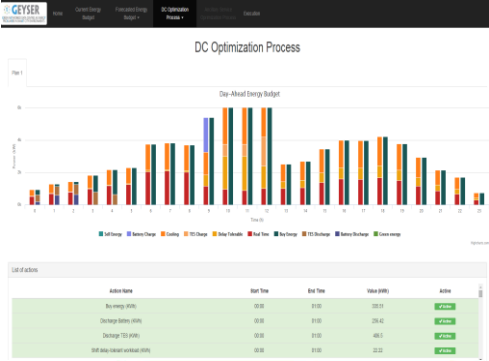


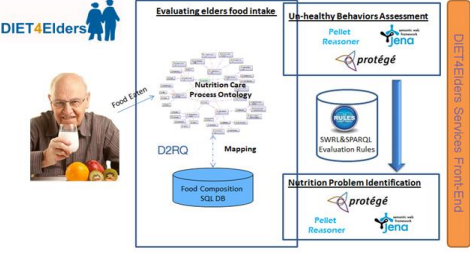
# DISTRIBUTED SYSTEMS RESEARCH LABORATORY

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The screenshot shows the GEYSER DC Optimization Process interface. It features a bar chart titled "Day-Ahead Energy Budget" with multiple bars representing different energy sources. Below the chart is a table of activities with columns for Activity Name, Start Time, End Time, and Status. The activities listed include "Recharge (MWh)", "Storage (MWh)", "Storage (TWh)", and "MWh (MWh)", all with a status of "OK".



The diagram illustrates the DIET4Elders system architecture. It shows a central "Nutrition Care Process Ontology" connected to a "Food Explan" component and a "Food Composition SQL DB". The ontology is mapped to a "D2RQ" endpoint. The system also includes a "Pellet Reasoner" and "jena" components, which are used for "Evaluating elders food intake" and "Nutrition Problem Identification". The architecture is supported by "SWRL&SPARQL Evaluation Rules" and "Protégé". The overall system is labeled "DIET4Elders Services Front-End".

## Areas of expertise

**Context-awareness and Autonomic Computing** Study and develop systems that understand the context in which they evolve and automatically decide on the actions to be executed to adapt themselves to the context changes; Developing techniques for enacting autonomic self-\* features for dynamic and complex systems.

**Green Computing** Study and develop models, techniques and algorithms for increasing the energy efficiency of computer systems, datacentres, buildings and smart cities and reducing their carbon footprint.

**Bio-inspired Distributed Systems** Study and develop techniques and algorithms inspired from biological behavior and processes, governed by decentralized control, for solving NP hard problems and enacting self-\* features; Adapt and enhance bio-inspired meta-heuristics from Immuno-computing, Swarm Intelligence, and Evolutionary computing for selecting the optimal solution in decision making, service composition, business process optimization and energy-efficient data centres

**Service-oriented Distributed Systems** Study and develop methods and techniques for automatically composing web services such as semantically annotating services using a domain ontology, matching semantic service descriptions, clustering semantic services, discovering and composing semantic services and selecting the optimal composition solution.

**Knowledge Engineering** Study and develop complex systems involving planning and decision making using knowledge engineering. Researches targeted knowledge representation and processing, domain ontology building, methods for processing documents written in natural language and methods for data mining.

## Team

**Prof. Dr. Eng Ioan Salomie**, Assoc. Prof. Dr. Eng. Viorica Rozina Chifu, Assoc. Prof. Dr. Eng. Tudor Cioara, Assoc. Prof. Dr. Eng. Ionut Anghel, Assist. Prof. Eng. Cristina Pop, Assist. Eng. Marcel Antal, Eng. Claudia Pop, Eng. Dorin Moldovan, Teodor Petrican, Ciprian Stan

## Representative projects

**eDREAM** – “eDREAM - enabling new Demand REsponse Advanced, Market oriented and Secure technologies, solutions and business models”, H2020, (2018 – 2021), <https://edream-h2020.eu/>

**CATALYST** – “Covertng DCs in Energy Flexibility Ecosystems”, H2020, (2017-2020), <http://project-catalyst.eu/>

**MedGuide** - Integrated System for Coordinated Polypharmacy management in Elders with Dementia, AAL-2016-052, (2017-2019), <http://medguide-aal.eu/>

**ReMind** – “Robotic ePartner for Multitarget INnovative activation of people with Dementia”, AAL-2017-026, (2018-2021), <https://www.aalremind.eu/>

**Eco2Cloud** – “Technologies for efficient management and scheduling of cloud resources in cloud for reducing Alps data centre energy consumption”, PNCDI III – BG (2016-2018), <http://coned.utcluj.ro/Eco2Cloud/index.html>

**OptiPlan** – “Technologies for Digitalization, Analysis and Optimization of Manufacturing of Flow Regulators and Monitors at Emerson Factory”, PNCDI III – BG (2016-2018), <http://coned.utcluj.ro/OptiPlan/>

**GEYSER**, “Green nEtworked Data Centres as Energy ProSumErs in smaRt city environments”, EU FP7, ICT-2013.6.2: Data Centres in an energy-efficient and Environmentally friendly Internet, <http://www.geyser-project.eu> (2013-2016)

**Elders-UP!**, “Adaptive system for enabling the elderly collaborative knowledge transference to small

**companies**", EU FP7 – PNCDI/II, Active and Assisted Living Programme AAL-2013-6, <http://www.eldersup-aal.eu> (2014-2016)  
**DIET4Elders**, "Dynamic Nutrition Behaviour Awareness System for the Elders", EU FP7 – PNCDI/II, Active and Assisted Living Programme AAL-2012-5, <http://www.diet4elders.eu/> (2013-2016)  
**GAMES**, "Green Active Management of Energy in IT Service centres", EU FP7, ICT-2009-6.3: ICT for Energy efficiency, <http://www.green-datacenters.eu/> (2010-2012)

## Significant results

### The most representative publications of the past 5 years:

1. M. Antal, T. Cioara, I. Anghel et al., Transforming Data Centers in Active Thermal Energy Players in Nearby Neighborhoods, SUSTAINABILITY Volume: 10 Issue: 4 Article Number: 939 Published: APR 2018
2. Pop, C.; Cioara, T.; Antal, M.; et al., Blockchain Based Decentralized Management of Demand Response Programs in Smart Energy Grids, SENSORS Volume: 18 Issue: 1 Article Number: 162 Published: JAN 2018
3. T. Cioara, I. Anghel, and I. Salomie, "Methodology for energy aware adaptive management of virtualized data centers," Energy Efficiency, vol. 10, no. 2, pp. 475-498, Apr 2017.
4. T. Cioara et al., Adaptive Workspace Interface for Facilitating the Knowledge Transfer from Retired Elders to Start-up Companies (Ambient Assisted Living and Enhanced Living Environments: Principles, Technologies and Control). Oxford: Butterworth-Heinemann, 2017, pp. 287-309.
5. A. Taweel, L. Barakat, S. Miles, T. Cioara, I. Anghel, A. R. H. Tawil, et al., "A service-based system for malnutrition prevention and self-management", *Computer Standards & Interfaces*, vol. 48, pp. 225-233, Nov 2016.
6. T. Cioara, I. Anghel, M. Antal, S. Crisan, I. Salomie - "Data center optimization methodology to maximize the usage of locally produced renewable energy", *SustainIT 2015*: 1-8 <http://dx.doi.org/10.1109/SustainIT.2015.7101363>
7. M. Bertoncini, D. Arnone, T. Cioara, I. Anghel, I. Salomie, T. H. Velivassaki, "Next Generation Data Centers Business Models Enabling Multi-Resource Integration for Smart City Optimized Energy Efficiency", *e-Energy 2015*: 247-252 <http://dl.acm.org/citation.cfm?id=2768522>
8. V.R. Chifu, C.B. Pop, and I. Salomie, "Bio-inspired methods for business process mining and optimization", *Lambert Academic Publishing*, Germany, 2015. <https://www.lap-publishing.com/catalog/details/store/es/book/978-3-659-68458-6/bio-inspired-methods-for-business-process-mining-and-optimization?search=Bianca>
9. V. R. Chifu, I. Salomie, E. Șt. Chifu, C. B. Pop, P. Poruțu, M. Antal, "Jigsaw inspired meta-heuristic for selecting the optimal solution in Web service composition", *Soft Computing Applications*, vol. 356 of the series Advances in Intelligent Systems and Computing, pp. 573-584, 2015. [http://link.springer.com/chapter/10.1007%2F978-3-319-18296-4\\_45](http://link.springer.com/chapter/10.1007%2F978-3-319-18296-4_45)
10. I. Anghel, M. Bertoncini, T. Cioara, M. Cupelli, V. Georgiadou, P. Jahangiri, A. Monti, S. Murphy, A. Schoofs, T. Velivassaki, "GEYSER: Enabling Green Data Centres in Smart Cities", E2DC 2014: 71-86 [http://link.springer.com/chapter/10.1007/978-3-319-15786-3\\_5](http://link.springer.com/chapter/10.1007/978-3-319-15786-3_5)
11. 2014: 71-86 [http://link.springer.com/chapter/10.1007/978-3-319-15786-3\\_5](http://link.springer.com/chapter/10.1007/978-3-319-15786-3_5)
12. I. Salomie, V. R. Chifu, C. B. Pop, "Hybridization of Cuckoo Search and Firefly Algorithms for Selecting the Optimal Solution in Semantic Web Service Composition", book chapter in Cuckoo Search and Firefly Algorithm: Theory and Applications, vo. 516, 2014, pp. 217-243. [http://link.springer.com/chapter/10.1007%2F978-3-319-02141-6\\_11](http://link.springer.com/chapter/10.1007%2F978-3-319-02141-6_11)

### Significant solutions and technologies:

1. Green Cloud Scheduler as OpenNebula Ecosystem Component that consolidates the virtual machines in the cloud ([http://opennebula.org/software/ecosystem:green\\_cloud\\_scheduler](http://opennebula.org/software/ecosystem:green_cloud_scheduler)).
2. Context model and associated management techniques for programmatically representing smart environments.
3. Autonomic middleware for developing context aware applications.
4. Server level optimization controller for improving Data Centre (DC) servers' energy efficiency.
5. Energy consumption optimizer for DCs based on reinforcement learning, KPI/GPI indicators and greenness level assessment.
6. Multi-criteria energy efficiency optimizer in DCs through flexible energy loads, RES usage and DC interaction with the smart grid.

## The offer addressed to the economic environment

Research & development	Core research areas: information systems, software products, advanced information systems for e-services, optimization and decision making, artificial intelligence, bio-inspired computational intelligence. Development services in the following domains: ambient assisted living, green computing and systems, intelligent systems, bio-inspired distributed computing and systems, service oriented distributed computing and systems, autonomic computing and systems, distributed pervasive systems.
Consulting	Consulting services for development of ambient assisted living systems, service oriented distributed systems, autonomic systems, pervasive distributed systems, green systems, intelligent and bio-inspired systems.
Training	Training courses in the following domains: programming techniques and languages, software engineering, web applications development, component-based and service-oriented distributed systems development.