ISTITUTO DI SCIENZA E TECNOLOGIE
DELL'INFORMAZIONE "A. FAEDO"

Italian National Research Council • CNR
Institute of Information Science and Technologies

Institute of Information Science and Technologies - ISTI

The Institute of Information Science and Technologies (ISTI) is an institute of the Italian National Research Council (CNR). The Institute is located in the CNR Research Area of Pisa. ISTI was constituted in September 2000 as a result of a merger between the Istituto CNUCE (CNUCE-CNR) and the Istituto di Elaborazione dell'Informazione (IEI-CNR).
ISTI is named in honor of Alessandro Faedo, former Rector of the University of Pisa and President of CNR, in recognition of his important contribution to the advancement of Information Science and Technologies in the Italian academic communities. The Institute became fully operational in 2002.

CNUCE

CNUCE was founded on 5th July 1965 as the National University Computing Centre with the goal of providing various university faculties with a valid computing support.
In 1973 CNUCE became part of the National Research Council (CNR) under the Committee for Engineering and Architecture. Besides the necessary economic support for developing Computing Services which by then had become widespread in Italy, CNR also provided the CNUCE Institute with an appropriate framework to conduct research in Computer Science.

IEI

The beginnings of the Istituto di Elaborazione dell'Informazione (IEI) can be traced back to 1954 when Pisa University, on the advice of the Nobel laureate Enrico Fermi and financially backed by the provinces of Pisa, Lucca and Livorno decided to design and construct a computer intended entirely for scientific use, the first in Italy. The CSCE (Centre for Studies on Electronic Computing) was thus founded, and in 1961 the CEP – Calcolatrice Elettronica Pisana - was inaugurated. In 1962 the CSCE became part of the Italian National Research Council, and in 1968 was renamed Istituto di Elaborazione dell'Informazione (IEI).

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Historical notes

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Mission and activity of the Institute

The Institute of Information Science and Technologies "A. Faedo" carries out research activity, knowledge and technology transfer and education in Computer Science and in the Information and Communication Technologies.

Most of the research activity of the Institute is developed in the context of the ICT Department of CNR - 14 Tasks and 4 Sub-tasks of the Projects of the ICT Department are committed to the Institute – some of the research activity is also developed in the framework of other thematic departments: Materials and Devices (1 Sub-task), Cultural Identity (1 Sub-task), and Cultural Heritage (1 Task) as well [Data 2009].
4 "curiosity driven" research projects have been activated in 2008 and founded by CNR.

The scientific activity can be classified into **5 thematic areas** (in parentheses the research personnel, in percentage, working in the area):

Networking Science and Technologies (13,6%): main topics are satellite communication networks, wireless terrestrial networks, sensors networks, networks integration and safety; design and implementation of Internet services; domotics technologies;
Knowledge Science and Technologies (39%): Information retrieval and digital libraries; multimedia content search and intelligent content access; knowledge discovery, web and data mining, machine learning; ontology mapping and semantic integration; predictive modeling for business intelligence; multimodal ubiquitous and adaptive user interfaces; design and evaluation of information systems;
Software Science and Technologies (11,7%): research activity in analysis, testing and validation of software systems, formal methods for modeling and analyzing complex software-intensive systems; fault tolerant systems, quantitative evaluation of the dependability and quality of service; evaluation and certification of ICT products and processes.
Visual and High Performance Computing (28,6%): computer graphics, 3D scanning and surface reconstruction, scientific visualization; computer vision and computational intelligence, imaging systems, multi-dimensional signals composition, processing, analysis and recognition; high performance, distributed solutions for Web mining and search, Grid, P2P, and service-oriented middleware.
Flight and Structural Mechanics (7,1%): astrodynamics, space debris modeling, flight control of stratospheric balloons, satellite reentry predictions, physics of asteroids; mathematical models and numerical methods for the thermomechanics of solids.

Research Organization

The partitioning into 5 thematic areas aims at giving a synthetic view of the scientific activities of the Institute. Of course, dynamic interactions take place among different areas, giving raise to fruitful cross-fertilization. From a practical point of view, the research staff is organized into **16 laboratories or technology centers**, each having a wide scientific and administrative autonomy. Members of the research staff are normally involved in one or more of these units.

"Curiosity driven" and independent research are also encouraged and supported.
ISTI is actively involved in collaborations with the academic world and in cooperative research and development programs, both national and international.
In recognition of the importance of training in today's Information Society, ISTI pays great attention to involving doctoral students and post-doctoral fellows in research activities and participates actively in the doctoral programs of the University of Pisa and other partner universities.

Research Laboratories

Research Laboratories pursue a well-defined set of strongly related scientific objectives.
In addition to research, objectives may also cover technology development and training.
The teams include permanent staff, visitors, post-doctoral fellows and doctoral students, with an average number of 10 members per Lab.
The Research Laboratories are largely independent and results are subject to periodical evaluation.
The current number of Research Laboratories is 13.

Technology Centers

Technology Centers are aimed at enhancing and exploiting the patrimony of competence existing at ISTI in specific areas. Typical activities are pre-competitive development, technology transfer and training.
The Technology Centers work in close collaboration with the Research Laboratories, in order to foster the sharing of competence and the bi-directional flow of knowledge. As a general rule, the staff of the Technology Centers is also involved in one or more Research Laboratory.
The Technology Centers are largely independent and subject to periodical evaluation.
The current number of Technology Centers is 3.
With reference to the thematic areas, the laboratories and technology centers of the Institute are distributed as follows (in parenthesis the name of the heads, centers are underlined).

Networking S&T	*Domotics* (V. Miori) *Internet Services* (F. Gennai) *Wireless Networks* (E. Ferro)
Knowledge S&T	*Human Interfaces in Information Systems* (F. Paternò) *Knowledge Discovery and Delivery* (F. Giannotti) *Information Systems* (G. Cresci) *Networked Multimedia Information Systems* (F. Rabitti)
Software S&T	*Dependable Computing* (F. Di Giandomenico) *Formal Methods and Tools* (S. Gnesi) *Software Engineering* (A. Bertolino) *System and Software Evaluation Center* (F. Fabbrini)
Visual and High Performance Computing S&T	*High Performance Computing* (R. Perego) *Signal & Images* (O. Salvetti) *Visual Computing* (R. Scopigno)
Flight and Structural Mechanics	*Mechanics of Materials and Structures* (C. Padovani) *Space Flight Dynamics* (A. Cardillo)

The Management (2009)

The Director of the Institute (Claudio Montani) is assisted by the *Advisory Committee*. The committee is composed of 5 members elected by research & technology staff (Diego Latella, Claudio Lucchese, Carlo Meghini, Alessandro Rossi, and Oreste Signore) and by 1 member elected by technical & administrative staff (Enrico Fantini).
The committee: (a) provides the director with a quarterly opinion on the development of competence, on the status of activities and on the mission of the institute, (b) formulates proposals to the director for improving quality of research and development of competence, (c) assists the director to draw up the Management Plan and the Annual Report.

The staff (June 2009)

The table reports the staff to June 2009. In parenthesis the number of collaborators with a contract by the Institute:

Research staff (Researchers, Technologists)	98 (22)
Technical and Administrative staff	59 (9)
Graduate Fellows, PhD Students, Post-doctoral Fellows	73 (73)
Research Associate	46

Scientific results (2008)

The main scientific results of the Institute are reported in the table. Other important aspects to be underlined are (a) the design and implementation of software packages and tools, (b) the activities of training (university courses, other courses) and dissemination (journal editors, program committee members), (c) the activities of addressing (panels, international committees) and evaluation (international or national projects).

- 114 – International Journal Papers
  - 87 – ISI Classification
  - 27 – not ISI
- 106 – Papers in International Conference Proceedings
- 19 – Books / Chapters of books
- 169 – Other publications

Active projects (2008)

Financing Entity	***Number of Projects***	***Keuro (n)***
European Commission	34	3.538
Government	4	127
Public and regional authorities	15	593
Universities and research institutions	21	363
Industry	22	823
Total	***96***	***5.444***

The contribution of the central administration of CNR for the same year was 148 KEuro.

ISTI and ERCIM

ERCIM - the European Research Consortium for Informatics and Mathematics - aims at fostering collaborative work within the European research community and at increasing co-operation with European industry. Leading research institutes from sixteen European countries are currently members of ERCIM.

CNR has been member of ERCIM since 1988. Since 2002, ISTI has been delegated to represent CNR into the Board of Directors, the Executive Committee and Editorial Board of ERCIM.

ERCIM activities include the formation of working groups, the workshop sponsorship and a Fellowship Program, aimed at enabling young scientists from around the world to perform research at ERCIM institutes.

ERCIM publishes a quarterly Newsletter "ERCIM News" as well as a wide variety of technical reports, workshop, proceeding, etc.

Visit http://www.ercim.org/ for additional information.

ISTI and W3C

The World Wide Web Consortium (W3C) was created to lead the Web to its full potential by developing common protocols that promote its evolution and ensure its interoperability. W3C is an international industry consortium jointly run by the MIT Laboratory for Computer Science (MITLCS) in the USA, the National Institute for Research in Computer Science and Control (INRIA) in France and Keio University in Japan. Since January 1st, 2003 the W3C European Host has been moved from INRIA to ERCIM. This change allows W3C to better leverage research relationships throughout Europe, while maintaining its historically strong relationship to INRIA, one of the ERCIM founders. Services provided by the Consortium include: a repository of information about the World Wide Web for developers and users, and various prototype and sample applications to demonstrate use of new technology. To date, over 500 organizations are Members of the Consortium. For more information see http://www.w3c.org/

The Italian Regional W3C Office is hosted by ISTI-CNR. The activity of this office is described in detail at http://www.w3c.it

The Library

The ISTI library, which began life in 1954 with the Center for Studies on Electronic Computing (CSCE) of the University of Pisa (later IEI-CNR), is one of the oldest ICT Libraries in Europe and probably the most complete Italian library in the field. It contains over 20000 books and 2000 serial publications. Therefore, access is given to about 6500 electronic journals, 9141 proceedings, 300 standard IEEE together with databases and digital libraries and a number of bibliographic, full-text and numeric databases.

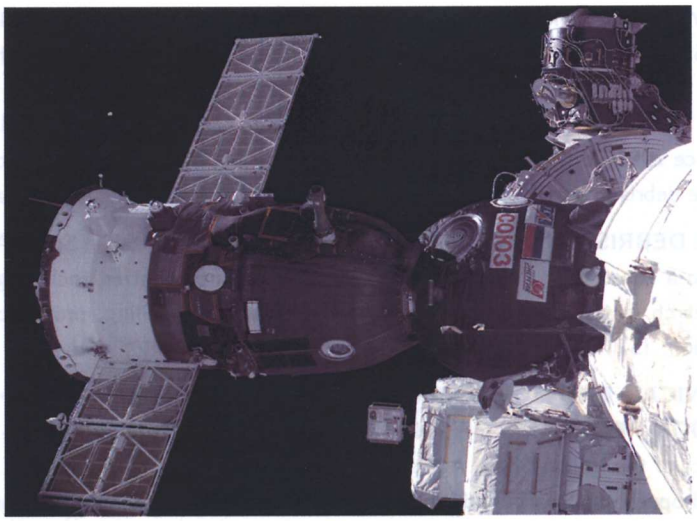
The Library also preserves the historical archives of papers and publications of CSCE and IEI as well as current archives of ISTI. The Library is publicly available; it offers basic and advanced services.

Network Infrastructure

Among the administrative, technical and support services of the Institute, the network services have to be underlined. The network working group of ISTI manages e-mail and dns services for 57 internet domains (34 CNR).

Flight and Structural Mechanics

Space Flight Dynamics Lab



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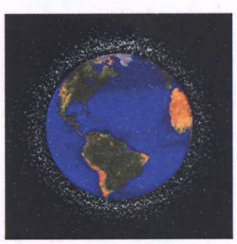
The laboratory is active in the fields of space mission analysis, satellite re-entry predictions, orbital debris, stratospheric balloons flight, astrodynamics and planetary science.

Research topics

SPACE MISSION ANALYSIS, DESIGN AND OPERATIONAL SUPPORT : trajectory design for terrestrial, lunar and interplanetary missions, mission planning, ground system requirements, flight dynamics software, trajectory perturbations, mission constraints, navigation, trajectory determination, and flight dynamics operational support.

STRATOSPHERIC BALLOONS FLIGHT DYNAMICS AND OPERATIONAL SUPPORT : flight dynamics, mission analysis and simulation, study and implementation of flight control techniques, mission operations, flight safety including the launching and landing phases, design and development of software tools for flight monitoring, control and prediction.

SATELLITE RE-ENTRY PREDICTIONS : re-entry predictions of potentially risky space objects for the Italian Civil Protection authorities, performance evaluation of different atmospheric density models, software development, participation in the international re-entry test campaigns promoted by the Inter-Agency Space Debris Coordination Committee (IADC), re-entry predictions and risk assessment for Italian satellites, emergency management.



SPACE DEBRIS : orbital debris environmental models, debris clouds dynamics, modelling of sources and sinks, traffic models, short and long term evolution in low earth and geostationary orbit, satellite constellations, evaluation of impact risk, assessment of mitigation measures effectiveness, spaceborne tethers survivability, support to space projects and operations, development of software tools, space surveillance, participation in international committees and working groups.

PLANETARY SCIENCE AND DYNAMICAL ASTRONOMY : Celestial mechanics, solar system dynamics, asteroids, space geodesy, physics of gravitation, tests of General Relativity, non gravitational perturbations, solar system exploration.

Flight and Structural Mechanics

Space Flight Dynamics Lab

Main research projects

ANALYSIS OF SPACE DEBRIS MITIGATION MEASURES BASED ON THE SEMI-DETERMINISTIC MODEL (2004-2009): Contract of the European Space Operations Centre (ESOC) of the European Space Agency (ESA) to ISTI for the upgrade of a comprehensive software tool developed by the laboratory since 1992 for the efficient and detailed modelling of the long-term evolution of space debris in earth orbit and the evaluation of possible mitigation measures.

SPACE DEBRIS PROJECT (2006-2010): Contract of the Italian Space Agency (ASI) to a consortium of Italian universities and research centres, including ISTI, for research in the fields of space debris observation, modelling, protection and mitigation. ISTI is responsible for the modelling and mitigation activities.

TECHNICAL AND SCIENTIFIC SUPPORT TO THE STRATOSPHERIC BALLOON PROGRAMS OF THE ITALIAN SPACE AGENCY (2005-2007): Contract of the Italian Space Agency (ASI) to ISTI for the flight dynamics activities and operational support during the 2005-2007 balloons missions and projects (Local, Trans-Mediterranean and Circum-Polar).

TECHNICAL AND SCIENTIFIC SUPPORT TO THE ASI STRATOSPHERIC BALLOON PROGRAMS AND ASSESSMENT OF ALTERNATIVE MEANS FOR ACCESS TO SPACE (2009-2011): Contract of the Italian Space Agency (ASI) to ISTI for the flight dynamics activities and operational support during the 2009-2011 balloons missions and projects (Local, Trans-Mediterranean, Circum-Polar and Circum-Equatorial) and for the evaluation of alternative means for accessing space using the Malindi Station.

Achievements

Space Projects : The laboratory took part in several space projects, being involved in feasibility studies, mission design and analysis, ground system development, management responsibilities, evaluation boards and operations: SIRIO, SIRIO 2, Columbus, Piazzi, IRIS/LAGEOS-2, LAGEOS-3, X-SAR, Italsat F1 and Italsat F2,Temisat, BeppoSAX, LUPO, VEGA, MITA/NINA, CESAR, SRTM, HYPSEO, Cosmo/Skymed.

Re-entry Predictions Campaigns : Since 1979, the laboratory has carried out more than two dozen of re-entry predictions campaigns for the Italian Civil Protection Authorities (including two nuclear emergencies), for the Italian Space Agency (ASI) and for the Inter-Agency Space Debris Coordination Committee (IADC). It also contributed to the drawing of the Civil Protection operational manual for the management of nuclear emergencies.

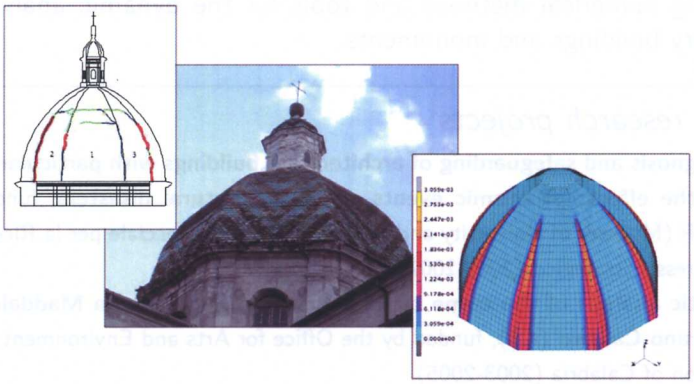
Other Achievements : People of the laboratory have been members of the editorial board of international journals, of professional associations, of the International Academy of Astronautics (IAA), of several international working groups and of many program and organizing committees of international conferences, as the International Astronautical Congress and the COSPAR Scientific Assembly.

People

Anselmo Luciano	*Research Staff*
Cardillo Andrea	*Research Staff*
Lucchesi David	*Research Associate*
Pardini Carmen	*Research Staff*
Rossi Alessandro	*Research Staff*
Santoro Antonino	*Technical Staff*
Valsecchi Giovanni B.	*Research Associate*

Flight and Structural Mechanics

Mechanics of Materials and Structures



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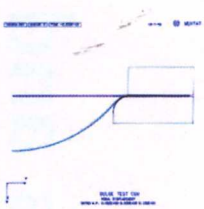
The Mechanics of Materials and Structures Laboratory carries out research, software development and consulting in the field of continuum mechanics, with particular focus on structural engineering.

Research topics

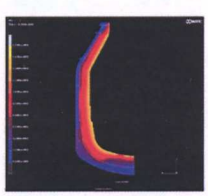
The activities of the laboratory are aimed at studying constitutive equations for materials with non-linear behaviour and developing numerical methods for the solution of equilibrium and evolution problems of particular interest in applications. The models studied and the algorithms formulated are implemented in the finite element code for non-linear structural analyses, NOSA, which has been successfully applied to a number of engineering problems.



Finite plasticity and metal-forming processes The research aims at studying the mechanical behaviour of elastic-plastic solids in the presence of finite strains and finds relevant applications in the modelling of several processes of metal-forming.

Masonry-like materials and masonry constructions A constitutive equation for masonry materials has been studied; it models the masonry as a non-linear elastic material with zero tensile strength and bounded compressive strength. The Laboratory has moreover developed numerical techniques for solving equilibrium problems of masonry structures. The constitutive models and the numerical techniques have been implemented in the NOSA code, which allows for determining the static behaviour of masonry constructions, as well as modelling restoration and consolidation operations, such as the application of metal chains and rods, and evaluating their effectiveness before their execution. NOSA has been applied to the study of several structures of particular historical and architectural value (the Cathedral Baptistery of Volterra, the Medici Arsenal in Pisa, the Goldoni Theatre in Livorno, the Church of San Pietro in Vinculis in Pisa, the Buti bell tower, the Church of Santa Maria Maddalena in Morano Calabro and the Church of San Ponziano in Lucca).

Thermodynamics of masonry-like materials The constitutive equation of masonry materials has been generalised in order to take into account the presence of thermal expansion, as well as the dependence of the elastic moduli on temperature. The NOSA code has been used to study the thermomechanical behaviour of the refractory linings of converters and ladles employed in the iron and steel industry.

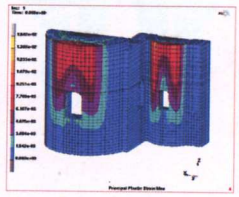


Non-linear Dynamics The modelling of masonry structures subjected to time-dependent loads is crucial in assessing their mechanical behaviour in the presence of earthquakes, as well as in planning

Flight and Structural Mechanics

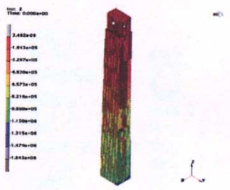
Mechanics of Materials and Structures

suitable strengthening operations. Currently the Laboratory is developing numerical methods and tools for the dynamic analysis of masonry buildings and monuments.



Main research projects

- **Diagnosis and safeguarding of architectural buildings with particular focus on the effects of seismic events and other natural disasters**, funded by MUR (Ministry of University and Research) - Fondo Speciale per la Ricerca di Interesse Strategico (2003-2007).
- **Static analysis of the dome of the Church of Santa Maria Maddalena in Morano Calabro (CS)**, funded by the Office for Arts and Environment of the region of Calabria (2003-2005).
- **Static analysis and strengthening of masonry vaults**, funded by the Cassa di Risparmio di Lucca Foundation (2004-2005).
- **Dynamical behaviour of age-old masonry constructions**, funded by the Cassa di Risparmio di Lucca Foundation (2006-2007).
- **Masonry vaults and domes: classical methods and finite element modelling**, funded by the Cassa di Risparmio di Lucca Foundation (2007-2008).
- **Thermomechanical behaviour of multilayer plates**, funded by the Cassa di Risparmio di Lucca Foundation (2008-2009). The project is aimed at studying a mathematical model of the mechanical behaviour of structures made up of superimposed plates with different thermomechanical properties subjected to thermal loads.
- **ST@rT - Sciences and technologies for the Tuscan artistic, architectural and archaeological heritage**, funded by the Region of Tuscany (2007-2010). The development of computational tools for Cultural Heritage is currently being carried out within the framework of this project aimed at modelling the dynamic behaviour of masonry constructions and assessing their seismic vulnerability.
- **Seismic analysis of masonry towers**, funded by the Cassa di Risparmio di Lucca Foundation (2009- 2010). This research is devoted to implement a finite element code for the dynamic analysis of masonry towers and bell towers.
- The Laboratory is a member of the European Research Group "Lagrange Laboratory" for major civil engineering problems, comprising both French and Italian universities and research institutes (since 2000).



Software Tools

- NOSA (NOn-Linear Structural Analysis), finite element code for non-linear structural analysis, entirely developed by the Laboratory. NOSA can perform linear and non-linear structural analysis in both the static and dynamic regimes, as well as heat transfer analysis.
- COMES-NOSA, finite element code for the static analysis of ancient masonry constructions. The code, which is freely available for download from the website http://www.isti.cnr.it/comesnosa, can be used to assess the safety of artistically important masonry buildings and optimising potential operations of maintenance and strengthening in terms of their architectural impact and static effectiveness.
- MARC, commercial general-purpose finite element code by the MSC Corp.
- MENTAT, commercial pre- and post-processor by the MSC Corp.

People

Girardi Maria	*Post-doc Fellow*
Padovani Cristina	*Research Staff*
Pagni Andrea	*Research Staff*
Pasquinelli Giuseppe	*Research Staff*
Lucchesi Massimiliano	*Research associate (University of Florence)*
Zani Nicola	*Research associate (University of Florence)*

Visual Computing Lab

Visual and High Performance Computing

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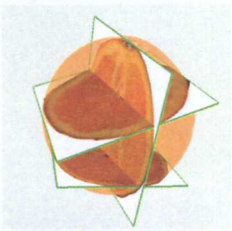
The mission of the Visual Computing Lab is to design new methodologies for reconstruction and visualization of digital 3D representations. We focus our work in the design of new algorithms and tools, most of them disclosed to the community. Our main application domain is Cultural Heritage, but the technologies developed have much wider application opportunities.

Research topics

3D Digitization We are designing new algorithms and tools for processing sampled geometric and color data, to build optimized digital models for local and/or remote graphics applications. We have experimented both active 3D scanning and passive acquisition (multi-stereo matching), focusing our work on the design of algorithms and software tools which should make the production of sampled 3D models cheaper, faster and nearly automatic. Most of the research activity in this field is related to the Cultural Heritage domain. The activity is financed mainly by the EC FP7 project "3D-COFORM" and the Tuscany Region project "START".

Visualization This topic relates to the design of algorithms and data structures for the interactive visualization of huge amount of data embedded in a 2D or 3D domain. Main goal of the research, which has applications in multiple scientific fields (medicine, environmental sciences, etc.), is the promotion of the knowledge of complex phenomena and the improvement of the decisional process. Research is concerned with the design of efficient data structures to represent very complex datasets (including approaches based on data simplification, multiresolution representation, and external memory techniques) and new rendering methodologies to support interactive visualization of complex data. More recently, the focus of our research has been the efficient visualization of huge terrain models (up to the planet scale) and urban contexts (up to the scale of an entire 3D city). The activity is financed mainly by EC FP7 IST "V-City" and FP7 Security "CRIMSON" projects.



Deformable Object Modelling This topic relates to the design of algorithms for the interactive modelling and visualization of deformable objects. Deformable objects modelling techniques are investigated with a main orientation towards the use of particle systems and multiresolution techniques. Our application reference field is the modelling of soft tissues for applications in medicine.

Visual and High Performance Computing

Visual Computing Lab

Main research projects

EU 7FP IP "3DCOFORM - Tools and expertise for 3D Collection Formation" ICT-2007.4.3 (2008-2012)

The main goal of 3DCOFORM is digitizing, presenting, accessing and promoting cultural heritage by means of interactive, high quality 3D graphics. Forecasted users of high quality 3D models will be researchers, restorers and the general public, by means of virtual exhibits in museums or on internet.

EU 7FP STREP "The Virtual City" ICT-2007.4.3 (2008-2011)

The V-City project aims to research, develop and validate an innovative system for the rapid and cost-effective reconstruction, visualisation and exploitation of complete, large-scale and interactive urban environments. This system will enable historians, architects or archaeologists to study, understand or document urban environments using an innovative interactive 3D user interface.

Tuscany Region "START - Sciences and technologies for the artistic, architectural and archaeological heritage in Tuscany" (2008-2010)

New technologies for documenting the status of conservation, the restoration and the presentation to the public of cultural heritage. The partners include research institutions, CH restoration labs and the conservation institutions.

Forthcoming projects (recently approved): FP7 Security "INDIGO - Innovative Training and Decision Support for Emergency Operations" (2009-2012), Tuscany Region POR "Visito" (2009-2012)

Other CH-related activities: we often contribute to projects concerning CH restoration or virtual presentation (e.g. Michelangelo's David restoration; "Digital Cathedral" project, aimed at the reonstruction of a digital 3D model of the Pisa Dome; the diagnostic investigation on the Nettuno's fountain in Florence).

Software Tools

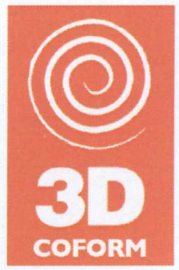
VC lab developed and distributed many prototypal software packages, since mid 90s (Surfactor, Tan, DeWall, Jade, Metro, 3DScanningTools). A recent success story is MeshLab, a GPL tool for mesh processing, downloaded by more than 50.000 users worldwide.

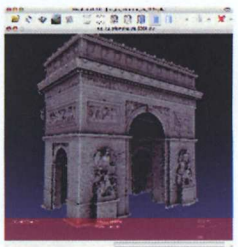
Awards

- R. Scopigno Eurographics "Outstanding Technical Contributions Award 2008"
- M. Tarini Eurographics "Young Researcher Award 2006"
- P. Cignoni Eurographics "Young Researcher Award 2004"

People

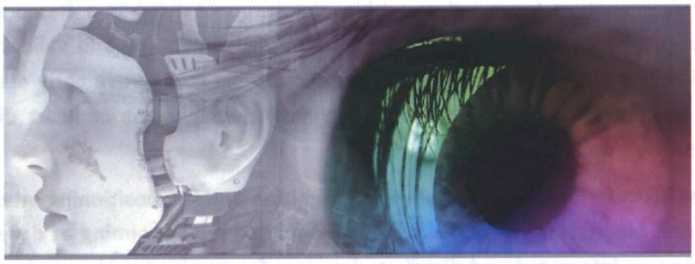
Benedetti Luca	*Research Fellow*
Bernabei Daniele	*Research Fellow*
Callieri Marco	*Researcher*
Cignoni Paolo	*Senior Researcher*
Corsini Massimiliano	*Researcher*
Di Benedetto Marco	*Researcher*
Dellepiane Matteo	*Researcher*
De Mitry Francesca	*Technical Staff*
Ganovelli Fabio	*Researcher*
Marras Stefano	*Doctoral Student*
Palma Gianpaolo	*Doctoral Student*
Marroquim Ricardo	*Post-doc Fellow*
Palma Gianpaolo	*Doctoral Student*
Pietroni Nico	*Post-doc Fellow*
Ponchio Federico	*Researcher*
Ranzuglia Guido	*Research Fellow*
Scopigno Roberto	*Head*
Tarini Marco	*Research Associate*





Visual and High Performance Computing

Signals and Images Lab



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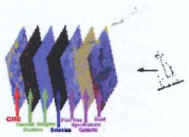
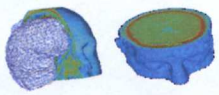
The "Signals & Images" Laboratory has the general goal to increase knowledge in the fields of signal processing, image understanding and artificial vision, in both theoretical and applicative contexts. The aim of the Lab is to develop its activities dynamically, becoming part of the national and international networks in the field of automated vision.

Research Topics

Computational Intelligence in Computer Vision The activities in this field are particularly focused on advanced and innovative intelligent methods, designed and developed for categorizing and interpreting heterogeneous, multimodal and multisource imagery data.

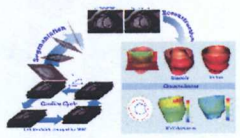


Statistical Signal Processing Research in this field faces all the issues of complex signal elaboration, ranging from DSP hardware development to signal compression to signal analysis.



Computational and Conformal Geometry The main activity in this field regards the definition of computational methodologies for modeling, reconstructing and manipulating multidimensional images.

Vision Machines and Systems Research in this field is currently concentrated on the development of systems for image formation, processing and analysis in different strategic application fields.



Diagnostic Imaging Main focus is given to investigate those aspects related to image quantitative analysis within an emerging interdisciplinary field involving informatics, engineering, healthcare and industrial management.

Audio/musical signal analysis and synthesis The work is herein mainly devoted to the development of algorithms for musical signal processing and computer music production.

Computational Biology The activity is aimed at developing models, methods and algorithms that can be used in the description and the understanding of the spatial and functional characteristics of DNA, and the computational mechanisms behind complex biological systems.

Projects

MUSCLE (Multimedia Understanding through Semantic Computation and LEarning) is an EC-sponsored Network of Excellence that aims at establishing and fostering closer collaboration between research groups in multimedia datamining and machine learning. The Network integrates the expertise of over forty research groups working on image and video processing, speech and text analysis, statistics and machine learning.

Visual and High Performance Computing
Signals and Images Lab

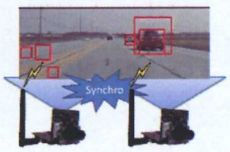
HEARTFAID (A knowledge based platform of services for supporting medical-clinical magement of heart failure within elderly population) is a Research and Development EC-funded project aiming at devising, developing and validating an innovative knowledge based platform of services, able to improve early diagnosis and to make more effective the medical-clinical management of heart diseases within elderly population.

ARGOMARINE (Automatic Oil-Spill Recognition and Geopositioning integrated in a Marine Monitoring Network) is R&D EC-funded project aiming at developing and testing an integrated and distributed system for monitoring the marine traffic and pollution events due to carriers/commercial ships as well as recreational boats through environmental-sensitive sea areas for effective interventions in case of maritime accidents.

CHRONIOUS (An Open, Ubiquitous and Adaptive Chronic Disease Management Platform for COPD and Renal Insufficiency) is an EC-funded project which aims at developing a smart distributed platform, based on multi-parametric sensor data, signals and images processing, for monitoring people suffering from chronic diseases in long-stay setting.

PLANCK was selected as the third Medium-Sized Mission (M3) of ESA's Horizon 2000 Scientific Programme, and is today part of its Cosmic Vision Programme. It is designed to image the anisotropies of the Cosmic Background Radiation Field over the whole sky, with unprecedented sensitivity and angular resolution.

The IPERMOB project is a regional project which aims at designing and developing a metropolitan infomobility control system, also considering visual information obtained by multimedia wireless sensor networks.



Awards

- G. Coppini, R. Favilla, E. Lami, P. Marraccini, D. Moroni and O. Salvetti: "Best Paper Award", Int. Conference on Mass Data Analysis 2009
- Marco Tampucci: "Young Talents and Excellences of Collesalvetti", 2007
- E. Kuruoglu, D. Gencaga and A. Ertuzunare: "Best paper Award", Signal Processing and Communications Applications Conference, IEEE-SIU 2005
- S. Di Bona: "Recognition Award", International Conference on Pattern Recognition and Image Analysis, PRIA 2004
- M. Cardini, L. Tarabella: Wireless - XV International Award "Guglielmo Marconi", 2002
- S. Di Bona, O. Salvetti: the paper "Neural method for three-dimensional image matching" (published in *J. Electronic Imaging*, 11, 497–506, 2002) has been selected for the *Virtual Journal of Biological Physics Research*, 2002

People

Azzarelli Luciano	*Research Associate*	Barcaro Umberto	*Research Associate*
Bedini Luigi	*Research Associate*	Beltrame Renzo	*Research Associate*
Bertini Graziano	*Research Associate*	Bottini Sergio	*Research Staff*
Bozzi Renzo	*Technical Staff*	Chimenti Massimo	*Research Associate*
Colantonio Sara	*Research Staff*	Coltelli Primo	*Research Staff*
Di Bona Sergio	*Research Associate*	Fantini Enrico	*Technical Staff*
Fusco Giuseppe	*Technical Collaborator*	Gagliardi Guido	*Technical Staff*
Gerace Ivan	*Research Associate*	Kayabol Koray	*Post-doctoral Fellow*
Kuruoglu Ercan Engin	*Research Staff*	Landucci Alberto	*Technical Staff*
Magrini Massimo	*Research Staff*	Martinelli Francesca	*Post-doctoral Fellow*
Martinelli Massimo	*Technical Staff*	Moroni Davide	*Research Staff*
Musto Daniela	*Research Staff*	Palamidese Patrizia	*Research Staff*
Paolini Filippo	*Visiting Fellow*	Pieri Gabriele	*Research Staff*
Salerno Emanuele	*Research Staff*	Salvetti Mario	*Research Associate*
Salvetti Ovidio	*Research Staff*	Tampucci Marco	*Fellow*
Tarabella Leonello	*Research Staff*	Tonazzini Anna	*Research Staff*

Visual and High Performance Computing
High Performance Computing Lab

The High Performance Computing Lab carries out research on computational, and data-intensive problems arising in scientific, business, social, and knowledge-based applications within the Future Internet scenario.

Research Topics

We exploit High Performance Computing techniques to deal with the exponential growth in the amount of data, knowledge and services available on line on the Internet and Intranets. Such huge amount of information needs in fact to be efficiently stored, managed, summarized, searched, and delivered.

The main research areas of the Lab are: Data and Web Mining, Web Information Retrieval, Parallel and Distributed Programming Environments, Many-core Algorithms, Resource Management and Discovery, Grid/Cloud and P2P Systems, Grid Operating Systems, Service-Oriented Architectures, and Service-Based Applications for the Future Internet. The group is currently composed of 24 people, and is very varied and dynamic, with close ongoing collaborations and exchanges with outstanding international partners from both industry and academia. We host very often foreign PhD students and professors visiting our Lab to collaborate with our researchers. The most fruitful scientific collaborations are with research groups from academia (Pisa Univ., EPFL, INRIA, New York Univ., La Coruna Univ., Glasgow Univ., Brno Univ., Dortmund Univ. Illinois Institute of Tech., Carnagie Mellon Univ., etc.), and industry (Yahoo! Research, IBM, Google, Wolfram Research, etc.).

Our research activities are funded by European projects belonging to the EU IST FP6 and FP7, national projects, and research contracts. It is worthy to mention the important role played by projects activities for people of the Lab. The continuous cooperation with international research groups over a common project goal, contributes to create a very exciting and stimulating working environment for both researchers and PhD students developing their thesis work within our Lab.

Projects

S-CUBE (FP7 NOE) Software Services and Systems Network (2008-2012). S-CUBE aims to push the frontiers of research in Service Oriented Computing by creating a vigorous research agenda where knowledge from diverse research communities is meaningfully synthesized, integrated and applied. Its mission is to establish a research community which will shape the software service based Internet which will underpin the whole of our future society.

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HPC laboratory

S-CUBE

Visual and High Performance Computing
High Performance Computing Lab

SAPIR (FP6 STREP) Search on Audio-visual content using Peer-to-peer Information Retrieval (2007-2009). SAPIR aims at breaking this technological barrier by developing a large-scale, distributed P2P architecture that will make it possible to search audio-visual content using the query-by-example paradigm. Considering that a picture is worth a thousand words, an image taken by a cell phone can be used to find information. For example, search for a monument using its photo or search for a song using its melody. Combining these search hints with optional annotations and user contexts will provide the next level of search capabilities.

XtreemOs (FP6 IP) Building and Promoting a Linux-based Operating System to Support Virtual Organizations for Next Generation Grids (2006-2010). The objective of XtreemOS is the design, implementation, evaluation and distribution of an open source Grid operating system with native support for virtual organizations and capable of running on a wide range of underlying platforms, from clusters to mobiles.

ASSETS (FP7 BPN) Advanced Search Service and Enhanced Technological Solutions for the Europeana Digital Library (2010-2012). ASSETS aims to improve the usability of the Europeana Digital Library platform by designing, implementing and deploying large-scale, scalable services for search and browsing. These services include: efficient storing and indexing, searching based on metadata and on content similarity; advanced ranking algorithms; browsing through semantic cross-links; semi-automatic ingestion of metadata requiring normalization, cleaning, knowledge extraction and mapping to a common structure.

GridComp (FP6 STREP): GRID programming with COMPonents: an advanced component platform for an effective invisible grid (2006-2009). The GridComp project main goal is the design and implementation of a component based framework suitable to support the development of efficient grid applications. The framework will implement a kind of "invisible grid" concept as it will properly abstract all those specific grid related implementation details that usually require high programming efforts to be dealt with.

People

Perego Raffaele	*senior researcher*
Baraglia Ranieri	*senior researcher*
Ferrini Renato	*senior researcher*
Lucchese Claudio	*researcher*
Silvestri Fabrizio	*researcher*
Coppola Massimo	*researcher*
Dazzi Patrizio	*researcher*
Tonellotto Nicola	*researcher*
Venturini Rossano	*research fellow*
Mordacchini Matteo	*research fellow*
Martinelli Susanna	*research fellow*
Orlando Salvatore	*research associate (Univ. of Venice)*
Laforenza Domenico	*research associate (CNR-IIT)*
Ricci Laura	*research associate (Univ. of Pisa)*
Baeza-Yates Ricardo	*research associate (Yahoo! Inc.)*
Bartoli Giancarlo	*technical staff*
Versienti Loredana	*technical staff*
Lombardi Stefania	*admin. staff*
Broccolo Daniele	*PhD student*
Capannini Gabriele	*PhD student*
Carlini Emanuele	*PhD student*
Hoang-Thanh Lam	*PhD student*
Nardini Franco Maria	*PhD student*
Tolomei Gabriele	*PhD student*

Software Science and Technology

System and Software Evaluation Center

System and Software Evaluation Center
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The System and Software Evaluation Center performs third-party evaluation and certification of processes and products in the area of Information Technology, according to given requirements and standards to meet the needs of users, suppliers and public administration.

Research Topics and Activities

The research issues are focused on:

- Development of models and methods for software measurement and evaluation
- Development of quality models and evaluation methods for system and software requirements
- Methodologies to improve the management of software projects

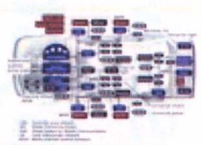
A cooperation agreement in the area of requirement engineering has been established between the Center and the Software Engineering Institute, Carnegie Mellon University, Pittsburg.

The activities carried out by the Center include:

- Software process assessment and improvement (according to ISO/IEC 15504 standard)
- Measurement and evaluation of quality attributes of software products (according to quality models based on ISO/IEC 9126)
- System evaluation (Reliability prediction, Safety, MTBF of context-dependent systems, Compliance to standards)
- Software certification according to defined requirements and standards
- Analysis and evaluation of system and software requirements
- Design of Software Engineering international standards, with participation in working groups
- Education and training on software quality

Projects

Fiscal Meters Since 1984 the Center has been appointed by the Italian Ministry of Finances to certificate the conformance of fiscal software and systems to specific standard and law requirements. In the framework of this appointment the Center issues conformance certificates for Electronic Cash Register, POS, and Automated Ticketing Systems.



Automotive Software This project Ð carried out in cooperation with FIAT Auto Ð is aimed at determining and improving the capability level of software suppliers. Monitoring of software projects includes software process assessment (ISO/IEC 15504 compliant) and work product evaluation.

Embedded Software Evaluation The Center performs software product evaluation according to quality models and measures based on the characteristic/subcharacteristic

classification proposed by ISO/IEC 9126 and ISO/IEC 14598. Another set of quality indicators can be measured through source code static analysis. The Center has gained significant experience in using tools for the static analysis of C source code, which is currently the most commonly used language for embedded systems in the automotive industry. Software products evaluation, including tool-based static analysis of source code, is part of cooperation projects with Fiat Auto and Autostrade per lÕItalia.

Website Quality Evaluation . The Center developed, on the basis of statistical analysis, a quality model for the evaluation of the characteristics of both commercial and public administration websites.

Development of international standard : Participation in the following International Working Groups on Standardization:

- ISO SPICE (Software Process Improvement and Capability dEtermination)
- ISO/IEC JTC1/SC7 WG10 (Software Process Assessment)
- ISO/IEC JTC1/SC7 WG6 (Software Products Evaluation & Metrics)
- UNINFO (the Italian National Body for Standardization in IT)
- Special Interest Group on Automotive Software (The Procurement Forum)

Methods and Tools for the Analysis of Natural Language Requirements . In cooperation with the Formal Methods and Tools Laboratory a project has been started to develop an automatic tool supporting the analysis and quality evaluation of NL SRS. The adopted approach has been first to define a Quality Model, then to verify this model on real cases of SRS in order to be sure that the Quality Model provides a real contribution to solve some NL SRS related problems and finally to develop an automatic tool for the verification of the requirements and guarantee their conformance to the defined Quality Model.

Software Tools and Achievements

QuARS . As a first result of the joint project with the Formal Methods and Tools Laboratory a prototype tool was developed. The tool Ð named QuARS (Quality Analyzer of Requirements Specifications) Ð performs an automatic analysis of textual requirement documents to detect lexical and syntactical defects and calculate quality metrics. QuARS is also able to extract semantic information for consistency and completeness analysis support.

Almost 300 compliance certificates have been issued for the Italian Ministry of Finances, concerning the evaluation of Electronic Cash Registers and POS from more than 30 national and international suppliers.

More than 50 compliance certificates have been issued for the Italian Ministry of Finances, concerning the evaluation of Automated Ticketing Systems.

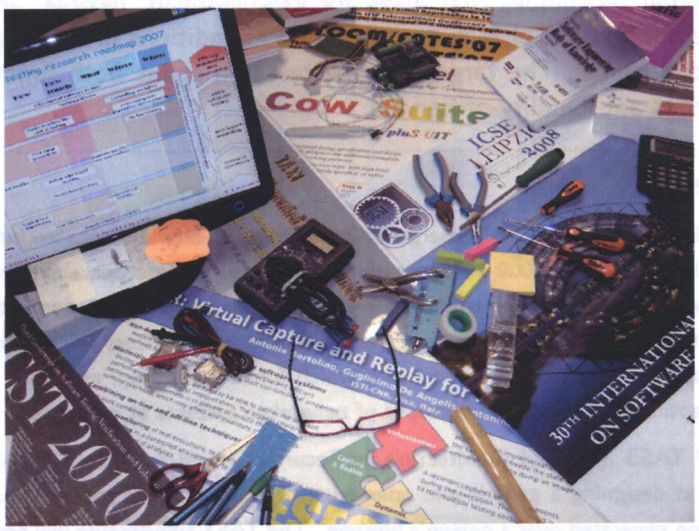
Members of the Center are qualified inspectors of the software process for SINAL (an accreditation body for testing laboratories), SPICE (Software Process Improvement and Capability Determination according to ISO/IEC 15504) and AICQ (the Italian National Association for Quality).

People

Fabbrini Fabrizio	*Senior Researcher (Head)*
Fusani Mario	*Senior Researcher*
Lami Giuseppe	*Researcher*
Trentanni Gianluca	*Technologist*
Coco Alessandro	*Technologist*
Landucci Alberto	*Technician*
Serchiani Giuliano	*Technician*
Biscoglio Isabella	*Research Fellow*
Bedini Luigi	*Research Associate*

Software Science and Technology

Software Engineering Lab



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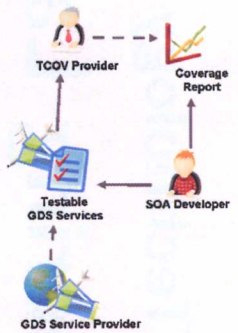
Research focuses on the development, evolution and application of sound systematic methods and relative tools supporting the engineering/validation of large, complex software-intensive systems and services. We expressly seek cost/effective approaches and transferability of results: rather than dreaming of revolutionizing the existing processes, or imposing unrealistic constraints to developers, we pursue feasible ways to improve quality, testability and dependability starting from the state-of-practice.

Research Topics

Verification and Validation of service-oriented systems: the emergence of the SOA paradigm brings both new challenges and new opportunities to software engineers, and asks for a novel development process. We investigate methods and tools for functional and extra-functional assessment of service compositions, including:

- a collaborative approach to the testing of multi-organization service compositions, which we called SOA test governance (STG);
- fully automated generation of black-box test cases from a standard web service interface (WS-TAXI tool);
- novel strategies and tools supporting on-line testing, e.g., service-oriented coverage testing (SOCT approach);
- model-driven derivation of a testbed for off-line Quality-of-Service testing (Puppet tool).



Model-driven development: model-driven approaches foster the adoption of automated development practices, thus allowing for lower development costs, artefact reuse and improved software quality. Our laboratory is especially concerned with the application of model-driven approaches, such as model transformation and code generation, to support software engineering activities (esp. testing), and with model and meta-model construction and validation.

Model-based testing: the goal is the automated and systematic generation of test cases from a formal or semi-formal model of the system under test. We currently focus on interoperability verification with reference to the widespread standard XML notation. We have developed an original approach to the automatic generation of sets of XML instances which comply to a given XML Schema (TAXI tool).

Software Science and Technology

Software Engineering Lab

Monitoring of dynamic software systems: we investigate novel monitoring techniques that allow for low-overhead, flexible, and effective observation of relevant events and conditions in running networked systems. The target of such research spans both functional properties and Quality-of-Service.

Projects

FP7 FET IP CONNECT (Emergent Connectors for Eternal Software Intensive Networked Systems) (2009-2012): it aims at dropping all interoperability barriers by a revolutionary approach to the seamless networking of digital systems, that is, the on-the-fly synthesis of the connectors. The synthesis process will consist of a novel formal foundation for connectors, which foresees learning, reasoning about and adapting the interaction behavior of networked systems at run-time.

FP7 IP TAS3 (Trusted Architecture for Securely Shared Services) (2008-2012): it aims at designing a generic and open trusted architecture to securely share information generated over a person's lifespan. The TAS3 architecture will empower its users to manage and process their personal information in a generic, adaptable, sustainable, trustworthy and cross-domain applicable way.

POR FESR IPERMOB (Pervasive Heterogeneous Real-time Infrastructure for Mobility Control) (2009-2011): this is a Tuscany Region funded project, which proposes a new-generation multi-tier integrated system for monitoring urban vehicular mobility and facilitating effective decision support. A demonstrator at the Pisa Airport will collect and process data of parking availability and vehicular flow by means of a wireless network, and will be used to assess performance, feasibility and scalability in terms of costs and infrastructures.

MIUR FIRB ART-DECO (Adaptive Infrastructures for DECentralised Organisations) (2006-2010): it aims at developing techniques and methods for the diffusion of "networked enterprises" among the Italian SMEs, testing the proposed approach in association with companies working in two crucial test fields: the agro-industrial sector and the textile-fashion sector.

Other News

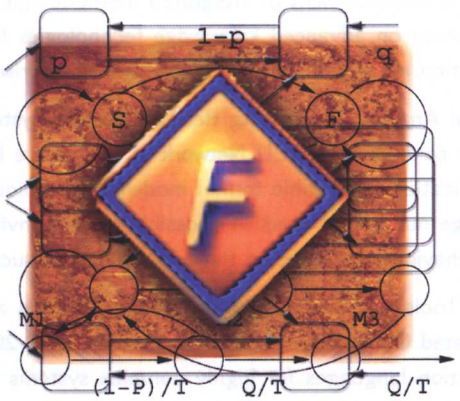
The laboratory maintains a set of tools at http://labse.isti.cnr.it.
Among these, the TAXI tool, which generates XML instances compliant with an input XML Schema, has been deployed to several industry-relevant applications.
The Plastic Validation Platform (http://plastic.isti.cnr.it), developed in the context of the EU FP6 STREP PLASTIC, includes a set of techniques/tools supporting the validation of networked services with regard to both functional and extra-functional properties.
In the last five years six industry-sponsored students have successfully completed their PhD dissertations.
The ACM FOSE Software Testing Research Roadmap by A. Bertolino has been listed among the top 10 most downloaded papers among all ACM refereed journals and proceedings in Sept. 2007.

People

Bartolini Cesare	*Post-doctoral Fellow*
Bertolino Antonia	*Research Staff*
De Angelis Guglielmo	*Research Staff (temp.)*
Fusani Mario	*Research Staff*
Lonetti Francesca	*Post-doctoral Fellow*
Marchetti Eda	*Research Staff (temp.)*
Mulas Daniela	*Technical Staff*
Polini Andrea	*Research Associate*
Ribolini Alberto	*Technical Staff*
Sabetta Antonino	*Research Staff (temp.)*

Software Science and Technology

Formal Methods and Tools Group



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The Formal Methods & Tools Group is active in the fields of development and application of formal notations, methods and software support tools for the specification, design and verification of complex computer systems

Research topics

Formal Modelling and Verification to Service-Oriented and Mobile Computing

- Development of new qualitative and quantitative temporal logics for specifying services and mobile computations properties (SOCL & MoSL)
- Development of new languages for modelling stochastic behaviour for services and mobile computations (MarCaSPiS & Stoklaim)
- Verification techniques for Abstract Service-Oriented Properties
- Model-checking algorithms and tools

Formal Approaches to the modeling of Human-Computer Interaction

- Modeling Continuous Interaction
- Stochastic Time Modeling of Human Computer Interaction
- HCI in Safety-Critical Systems
- Novel devices

Formal Approaches to Safety-Critical Systems

- Model driven development of railway signalling systems
- Formal Specification of Railway Interlocking Systems.

Formal Approaches to Requirements Engineering

- Formalization of requirements as temporal logic formulae
- Applications of Natural Language Processing techniques to the analysis of requirements documents
- QuARS and QuARS express: automatic tools for the evaluation of Natural Language Requirements

Formal Approaches to Product Family Engineering

- Logics for Modeling Behavioral Variability
- Development of behavioral models for product families

Advances in formal modeling approaches

- (Team) Automata and Language Theory
- Formal Methods in Molecular Biology and Digital Physics

Research projects

SENSORIA : Software Engineering for Service-Oriented Overlay Computers (FP6-2004-IST-FETPI). Development of a novel comprehensive approach to the engineering of software systems for service-oriented architectures where foundational theories, techniques and methods are fully integrated.

SENSORIA

Software Science and Technology

Formal Methods and Tools Group

TOCAI.IT : Knowledge-oriented technologies for enterprise aggregation in Internet (FIRB-MIUR). Development of integrated methodologies, techniques, and software systems based on advanced knowledge technologies for evaluating new enterprise organization models in the "internetworked enterprise" perspective.

FAERUS : Formal Analysis of Evolving Resilient Usable Systems, International mini-project in the context of the EU Network of Excellence ReSIST, 2008 Research on the application of scalable formal modelling techniques to analyse the behaviour of a large number of users in (possibly smart) environments and the effect that their behaviour may have on the performance of such environments.

XXL : Advanced Tools and Techniques for the Specification and Verification of Systems with Elevated Granularity, CNR-RSTL project, 2008-2009. Development of formal specification languages for highly complex systems and of automatic tools to support the verification of functional and non-functional properties.

D-ASAP : Adaptive and reliable Software Architectures for Pervasive Systems, Italian National Scientific Research Programme, PRIN 2007. Definition of methods, techniques and tools to develop distributed applications, considering dynamic reconfiguration aspects due to changes in the requirements or execution environment.

PaCo : Performability-Aware Computing: Logics, Models, and Languages. Italian National Scientific Research Programme, PRIN 2007. Study on stochastic variants of temporal logics and model checking, stochastic variants of process calculi and behavioral equivalences.

Software Tools

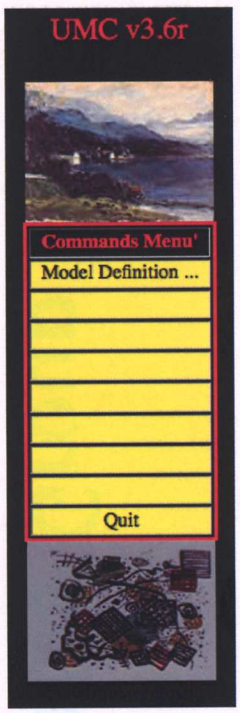
The laboratory developed the following tools:
UMCTOOLS (http://fmt.isti.cnr.it/umc/): a set of tools for exploration and verification of UML statecharts;
FMC (http://fmt.isti.cnr.it/fmc/): a set of tools for exploration and verification of networks of automata, including an "on the fly" model checker for full pi-calculus;
CMC (http://fmt.isti.cnr.it/cmc/): On the fly Model Checker for SOCL and COWS specifications
QuARS (Quality Analyzer of Requirements Specification).

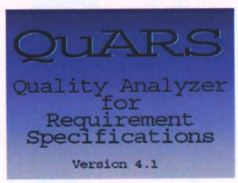
Achievements The group has a main role in the FME (Formal Methods Europe) association being Stefania Gnesi Deputy Chair. Diego Latella, permanent member of FM&T Lab, founded in 1994 the ERCIM Formal Methods in Industrial Critical Systems (FMICS) working group. The FMICS-WG currently headed by Alessandro Fantechi has gained the award as best ERCIM working group of 2003.

People

Asirelli Patrizia	*Research Staff*
Bolognesi Tommaso	*Research Staff*
Faconti Giorgio	*Research Staff*
Fantechi Alessandro	*Research Associate*
Gnesi Stefania	*Research Staff*
Latella Diego	*Research Staff*
Massink Mieke	*Research Staff*
Mazzanti Franco	*Research Staff*
ter Beek Maurice	*Research Staff*
Trentanni Gianluca	*Research Staff*
Trivella Maria Luisa	*Technical Support*

toca.it





Software Science and Technology

Dependable Computing Lab

Design and evaluation of dependable systems

Dependable Computing Lab
ISTI - CNR
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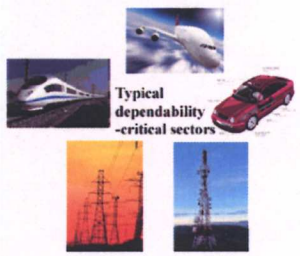
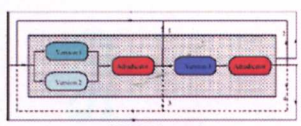


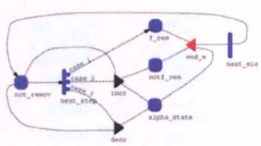
Main Research Topics

The group is involved in research spanning two macro areas: Architectures and Techniques for Fault-Tolerant Systems, Quantitative Dependability and QoS Evaluation. The research activities are mainly carried on in the framework of national and European projects.

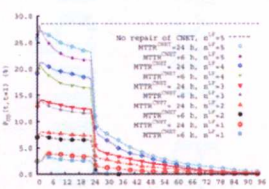
Mechanisms for fault-tolerant systems. Research in this field is long-dated, being the activity of the group rooted in the field. Major achievements include: i) flexible and adaptive error processing structures; ii) on-line restoration of a correct state in a component belonging to an N-modular structure; iii) management of transient faults through a threshold based approach, aiming at improving the availability of a system as well as its efficiency.


SCOP Operation

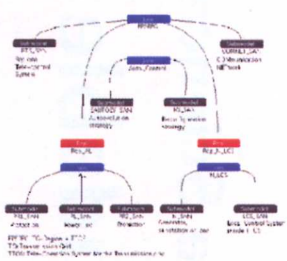
Generic architectures for fault-tolerant systems. The group has contributed to the development of generic architectures for dependable (real-time) embedded systems, largely based on COTS components, with a special focus on railway applications.



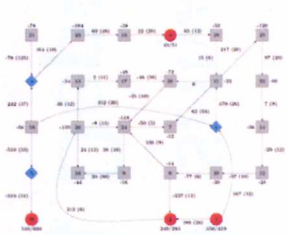
Methods for early validation and evaluation of system designs. Concerning model-based analysis, the group has relevant experience in: i) approaches for copying with the complexity of model definitions and related solution methods; ii) definition of automatic transformations from system description languages (e.g., UML) to Petri-nets like models for quantitative dependability assessment. Evaluation methodologies to support on-line system adaptation and reconfiguration strategies are among currently challenging research explorations.



Analysis of interdependencies in critical infrastructures. Modelling the interdependencies among interlinked infrastructures, which provide critical services to our everyday life, and assessing interdependencies impacts on the ability of the system to provide resilient and secure services are widely recognised to be paramount. With focus on the electrical power sector, the group has proposed a general modelling framework, implemented through the multi-formalism/multi-solution tool Mobius, as well as an ad hoc simulator, called EPSyS.



Quality of Service assessment. In this context, the term QoS encompasses aspects such as reliability, availability, performance and performability. Model-based analysis shows very suitable to support design decision, refinements and tuning of systems under development as well as to assess properties of already built components/infrastructures. The group has conducted numerous studies on model-based QoS assessment in several application sectors, including evaluation of distributed communication protocols and wireless networks.



Software Science and Technology

Dependable Computing Lab

Research projects

ARTEMIS-JU CHESS - Composition with Guarantees for High-integrity Embedded Software Components Assembly (2009–2012). CHESS seeks industrial-quality research solutions to problems of property-preserving component assembly in real-time and dependable embedded systems. It develops model-driven solutions, integrates them in component-based execution frameworks, assesses their applicability in multiple domains (such as space, railways, telecommunications and automotive), and verifies their performance through industrial use cases. More info at https://www.artemisia-association.org/chess

FET Proactive CONNECT - Emergent Connectors for Eternal Software Intensive Networked Systems (2009–2012). It aims at enabling continuous composition of networked systems to respond to the evolution of functionalities provided to and required from the networked environment. The revolutionary approach of CONNECT consists in synthesising on the fly the connectors via which networked systems communicate. The project undertakes interdisciplinary research in behaviour learning, formal methods, semantic services, software engineering, dependability, and middleware. More info at http://connect-forever.eu/

Recently completed projects . The list of recently concluded projects include:
IST-2004-27513 CRUTIAL - CRitical UTility InfrastructurAL Resilience. More info at http://crutial.cesiricerca.it/
IST-031413 SAFEDMI - Safe Driver Machine Interface for ERTMS automatic train control. More info at http://www.safedmi.org/

Software Tools

The group contributed to the development of tools for the dependability and resiliency analysis of complex and critical systems, in particular:
DEEM (DEpendability Modelling and Evaluation of Multiple Phased Systems), in cooperation with the DSI Department of the Univ. of Florence: it is a computationally efficient tool for model-based evaluation of dependability attributes of Multiple Phased Systems (MPS). http://dcl.isti.cnr.it/DEEM
EPSyS (Electric Power Systems Simulator): it is an ad hoc simulator for the evaluation of dependability and performability measures in Electrical Power System (EPS). http://dcl.isti.cnr.it/EPSyS

Achievements

Conferences: The group is active in the organisation of several prime conferences in the dependability field, including: The International Conference on Dependable Systems and Networks, IEEE Symposium on Reliable Distributed Systems, European Dependable Computing Conference, IEEE Symposium on High Assurance Systems Engineering. Major roles covered include: Program Chair, General Chair, Steering Committee Member, PC member.

Recent editorial activities: Architecting Dependable Systems V, LNCS 5135-0052 (co-editor).

Professional European activities: reviewers for the EU Commission in the evaluation of project proposals.

Professional Associations: IEEE Computer Society Member; Member of IFIP W.G. 10.4 on Dependable Computing and Fault Tolerance

People

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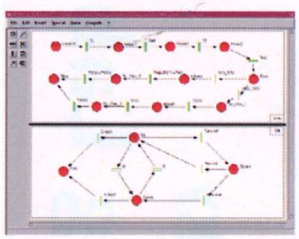

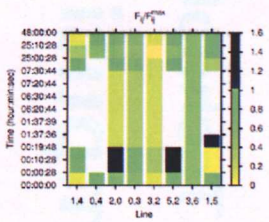

Knowledge Discovery and Delivery Lab

Knowledge Science and Technology

Science is built up with facts, as a house is with stones.
But a collection of facts is no more a science
than a heap of stones is a house.
Henri Poincaré, La Science et l'hypothèse, 1901

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Joint initiative of ISTI and the Computer Science Department of the University of Pisa

RESEARCH TOPICS

Develop of theory, techniques, and systems for extracting and delivering useful knowledge out of large masses of complex data in:

- Mining novel forms of data: new data mining methods for spatial, temporal and spatio-temporal data, web log data and graph data from social networking, proteomics and business processes.
- Privacy-preserving data mining: methods for anonymizing, randomizing, sanitizing both data and patterns, to the purpose of protecting the privacy and anonymity of the data subjects.
- Data mining query languages: support environments to the knowledge discovery process for expressing complex analytical queries and reasoning on data mining.
- Knowledge discovery and ontologies: combination text and data mining for ontology-driven knowledge discovery.
- Advanced data mining applications: intelligent adaptive solutions for forecasting complex phenomena in CRM & fraud detection.
- Mobility data analysis: fundation of new multidisciplinary field aimed at the discovery of movement behaviour of people and vehicles, especially in urban context.

PROJECTS

GeoPKDD Geographic Privacy Preserving Knowledge Discovery - funded by EC-FP6-FET. The project aims to discover useful knowledge about human movement behavior from mobility data, while preserving the privacy.

MOTUS - funded by Italian Ministry of Innovation. MOTUS provides a service platform capable of aggregating, and interpreting urban mobility in real time by using information from heterogeneous infrastructures and mobile device data.

MdM - Mercato della Mobilità, funded by Regione Toscana. MdM develops models for analysis of data collected from mobile sensors and wireless networks, to promote the use of public transport and optimize the use of private vehicles.

MOVE & MODAP - funded by COST Action and by EC. The objective of these two projects is to stimulate an interdisciplinary research area combining a variety of disciplines such as data mining, geography, visualization, data/knowledge representation, in the new context of mobility.

Knowledge Discovery and Delivery Lab

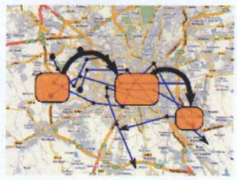
Knowledge Science and Technology

ANONIMO - funded by Italian Ministry of REsearch PRIN. This project aims to develop a formal framework for measuring privacy and anonymity and, from the legal viewpoint, to study and define the very concepts of privacy and anonymity.

MiningForLife & FSE - Fascicolo Sanitario Elettronico - funded by Noemalife company and by Italian Ministry of Innovation. The objective of these projects is to apply novel data mining methods to medical data on oncological patients, to discover correlation between clinical values and disease progression.

BI-COOP - funded by Unicoop Tirreno. KDDLab developed a very large sales data warehouse, equipped with advanced BI solutions for strategic marketing and customer care based on data mining predictive analytics.

DIVA - funded by Agenzia delle Entrate. In DIVA, a predictive system to detect evasions in the VAT tax has been developed in collaboration with the Italian Revenue Agency and SOGEI.



SOFTWARE

KDDLab research produced a number of free opensource data mining tools:

- Trajectory Pattern Miner: Data mining tool for the extraction of spatio-temporal frequent patterns from GPS traces of moving objects.
- Never Walk Alone: Exploiting spatial location uncertainty for ensuring anonymity in moving objects databases.
- Temporally Annotated Sequences: Extraction of sequential patterns with typical transition times between elements of the sequences.
- Daedalus and Athena: Knowledge Discovery support environment for data mining queries on mobility data and a semantic enrichment environment for trajectories and pattern interpretation and understanding.
- T-Cluster: Density-based clustering algorithm to discover set of similar trajectories, according to a repertoire of trajectory similarity functions.
- BF-2kA: Prefix tree-based technique to anonymize sequence data, yet ensuring usability of data through the extraction of high quality data mining models.
- WhereNext: Prediction of the next location of a moving object, based on prediction models built on historical movement data in a predefined area.
- GERM, the Graph Evolution Rule Miner: Pre-processesor of collections of graphs to enforce a set of given constraints to every graph or edge.

People

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Knowledge Science and Technology

Information Systems Technology Center

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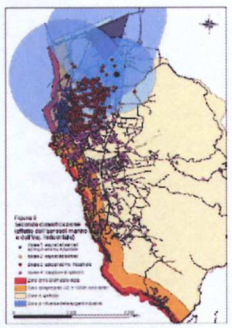
Design, implemention, improvement of Information Systems through the experienced application of state-of-the-art technologies.



Activity Topics

GIS and Health Spatial analysis and geo-statistics to support epidemiological studies in order to find measurable relationships between pollutants and human - environmental health.

Information Systems for Marine Resources Expertise on innovative applications for the marine resource management (e. g. fishery, environment protection) using GIS technologies.

Information Systems for Mobility Application of the know-how on information system's design and GIS to Intelligent Transport Systems.

Information system evaluation and design Consolidated know-how and experience on methodologies and techniques for computer performance / capacity evaluation, forecasting and management and for information system design.

Technologies and applications for disabled and elderly people Long term activities in studying / implementing special environments and in technology transfer for users and operators.

Safeguard and restoration of audio analogical media Expertise on protocols for digitization and training for technicians.

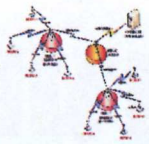
Main Research Projects

IT support for IAMC IAMC-CNR delegated the design and creation of an information system to support its institutional activities to IS Center. The system includes:

- The web portal to publish activities and results and to access public and internal services (first implementation in http://iamc.isti.cnr.it/IAMC/);
- An information system to support management functions: projects, surveys, agreements with external institutions, administrative activities, ...;
- A decision support system for scientific activities with GIS capabilities.

SETA The project aims to study, design and prototype a low cost information system for monitoring road traffic and environmental parameters. It includes:

- Wireless sensor nodes acquiring data on traffic, micro-climate parameters and air pollutants;
- A network architecture (wireless and wired) to convey data from nodes to a control system;
- A control system to verify, collect, archive data and to extract information to be distributed to various types of users.



IT support for Consiglio Regionale Toscano The regional parliament of Tuscany required an assessment of its information system and a set of proposals for its evolution. A feasibility study was carried out to identify the main shortcomings of the system, define the actions to be activated to enhance it, propose a strategy for a complete re-engineering and discuss technological trends.

REGIONE TOSCANA

SODO The project aimed at providing support and technical upgrade to professionals and companies working in the home and building automation systems. The project addressed three main goals:

- Training: almost 1000 hours of courses were delivered to more than 200 designers and installers;
- A laboratory on technologies and applications was created that remained active after the end of the project as a focal point for demonstrations and for advising;
- A number of demonstrators (pilot installations) were installed in public buildings and on a mobile unit (the camper Lucy).

SODO

Archivi Sonori The project aims at creating an excellence center, MARTlab, for the safeguard and digitization of analogical audio media. Objectives:

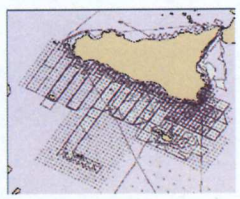
- development of digitization protocols for media of different formats;
- definition of specific metadata according to international standards;
- analysis of the temporal decay of the information content of CDs;
- training on digitization and restoration techniques.

MART Lab

Recent Results

Most of the results are in form of documents (feasibility studies and design reports) of restricted distribution. Studies were required by CNR Institutes, Universities, Italian Central and Local Administrations, private companies and companies associations. Some organizations required a long term tutoring to set up, develop, improve the internal IT know-how and organization. In some cases, prototypes and experimental implementations were carried out; two recent experiences are:

- The mobile unit Lucy realized by the SODO project with advanced solutions for automating typical home functions and special interfaces for many kinds of disability
- A support system for scientific activities on marine resources to import, manage, export and visualize (physical, chemical, biological) data acquired in annual surveys. The system allows alphanumeric and geographical selections, mapping and visualization and the implementation of customized functions.



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Human Interfaces in Inf. Systems Lab

Knowledge Science and Technology

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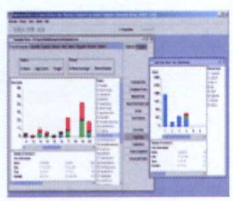
Design of Interactive Systems We develop methods, tools, and models for making systems easier to use. In this work we consider the possible variations of the context of use in terms of tasks to support, user preferences and abilities, media and interaction techniques available, environment. For this purpose various models have proved to be useful in human-computer interaction: task, user, domain, interaction models. We have developed tools supporting their development, analysis and use in order to design and develop multi-device interactive applications in which access to multiple services can occur at various levels (user interface, application and service). Relationships between HCI models and Business Process Models have been investigated as well.

Accessibility and Usability We design tool support for usability evaluation. The goal is to provide a number of pieces of information that can be helpful to evaluators and developers. To this end, we also consider remote usability evaluation techniques, where the user and the evaluators are separate in time and/or space. Another important concept is accessibility, which indicates whether an application can be actually accessed from all types of users in any context. In this area we have developed guidelines for usability and accessibility for blind users; tools for accessibility evaluation, including languages to represent and manipulate user interface guidelines; tools for making e-documents accessible and readable by using various devices such as mobile smart phones or mobile special devices.



Ubiquitous Interfaces Our research goal is to support users to seamlessly access information and services even when the device or the environment changes dynamically. For this purpose we design and implement run-time environments supporting techniques and components that facilitate adaptation to the changing context and task continuity across various device types while preserving usability. We have also designed various types of mobile guides, in particular for museums, able to support access to public displays and provide location aware information (using various technologies including RFIDs).

MultiModal User Interfaces We work on the design of multimodal user interfaces for both desktop and mobile systems. For this purpose we consider various modalities and their combinations: graphics, voice, gesture, vibro-tactile feedback, user orientation, ... In this area we also design and assemble custom hardware devices (such as detectors and output modules) enabling multimodal user interaction, and the resulting integrated hardware/software solutions are evaluated by means of user testing.

Knowledge Science and Technology

Human Interfaces in Inf. Systems Lab

Main Research Projects

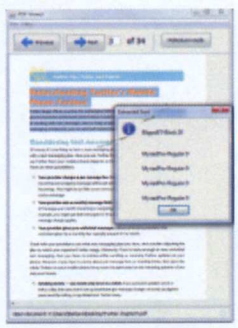
EU ICT OPEN (Open Pervasive Environments for migratory iNteractive services). The objective of OPEN is to provide users with migratory interactive services, which enable users to change interaction platform and still continue their tasks through an interface adapted to the new context of use. The benefits of this type of service are multifaceted: migration can be used to improve user experience by switching to a more suitable device (bigger screen, better resources). Our solution is able to dynamically consider existing Web applications developed with any authoring tool according to the W3C standards and make them able to migrate from one device to another.

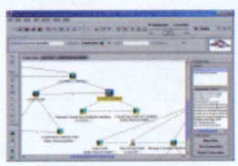
EU ICT ServFace (Service annotations for user interface composition). Service-oriented architecture (SOA) promise to break former monolithic applications into pieces that can be distributed across several systems. Despite this potential, the development of interactive applications in terms of user interfaces and their flexible combination together with functional services is not properly reflected in current Web Service standards and research approaches and, thus, remains a major challenge and requires substantial development resources. Servface aims to develop solutions that overcome such limitations through methodologies and tools that allow designers to develop service front-ends by exploiting HCI models and service annotations.

MIUR aBook (The accessible and usable electronic book for students with visual disabilities). The project proposes a series of guidelines, specially designed and implemented using the GAL format, which can make educational books easily accessible and increase the effectiveness of the study by the blind students. The prototype software tool aBook assists the operator to easily apply the guidelines.

Software Tools

- ConcurTaskTrees Environment - Development, analysis, and simulation of task models of interactive applications.
- Migrantes - Server-based platform for Migratory Web User Interfaces
- MARIA - Authoring Environment for Ubiquitous User Interfaces for Applications based on Web services
- WebRemUsine - Usability evaluation of Web sites.
- WebRevEnge - Reverse engineering in order to reconstruct the task model of a Web site.
- TERESA - Support for design and development of interactive applications accessible through multiple platforms (desktop, PDA, cell phone, ...).
- Marble Museum - Adaptable and adaptive interactive system to navigate in the information of the Marble Museum and the Carrara town.
- UbiCicero - Interactive, Location-aware, mobile Guide able to exploit public large displays.
- Book4All - A tool to make an e-book more accessible to students with vision-impairments.
- Mobile Guides for Blind Users - Able to exploit combination of vocal and vibro-tactile feedback.





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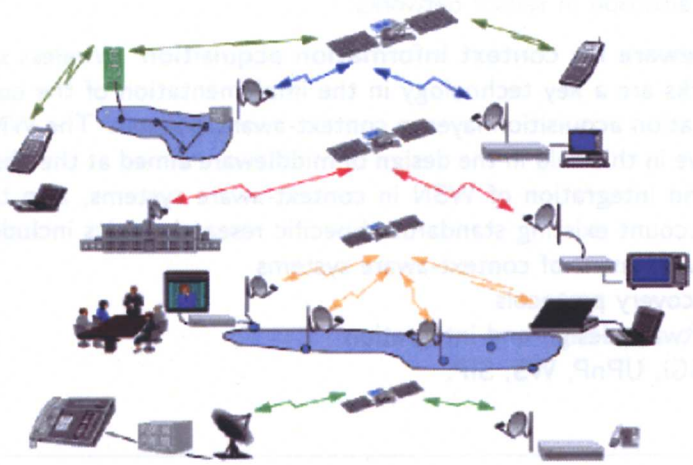
Networking Science and Technology

Wireless Network Lab



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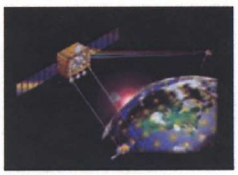
Research topics



Digital satellite communications Satellite communication systems differ both from wired and other kinds of wireless links in some peculiar aspects, such as the coverage width, the signal attenuation pattern, the transmission delay, the security issues, and the distance independent transmission costs. One critical aspect of satellite transmissions is the need of suitable countermeasures to overcome signal degradation due to adverse weather conditions, multipath fading and shadowing effects. Specific research topics include:

- fade countermeasure techniques
- multiple access techniques
- prototypal system developments
- dynamic bandwidth assignment algorithms
- cross-layer optimization
- DVB and DVB-S2 standards
- measurement campaigns
- system performance evaluation
- quality and security issues in video and audio streaming.

Wireless ad hoc and sensor networks Mobile, wireless ad-hoc networks are the ultimate response to the needs of self-adapting, rapidly deployable networks, to cope with situations where wired networks or base stations to support mobile terminals are unavailable or unfeasible. Their range of applications includes communications in remote or hostile environments, management of emergencies, disaster recovery, and ad-hoc commercial installations. Ad hoc and sensor networks implement a distributed cooperation environment, by using a peer-to-peer paradigm. Given the limited range of wireless communications and the mobility of nodes, the network connectivity is variable and, to some extent, unpredictable. Major issues are how to implement communications in such a dynamic context and how to guarantee consistency and integrity of the global information. Specific research topics include:

- routing algorithms
- dependable and secure data storage and retrieval
- failure recovery
- integration of wireless networks with wired ones
- QoS of the transmissions
- multi-hop transmissions
- sensor networks

Networking Science and Technology

Wireless Network Lab

- energy efficiency
- localization in sensor networks.

Middleware for context information acquisition Wireless sensor networks are a key technology in the implementation of the context information acquisition layer in context-aware systems. The WN Lab is active in this field in the design of middleware aimed at the abstraction and integration of WSN in context-aware systems, also taking into account existing standards. Specific research topics include:

- development of context-aware systems
- discovery protocols
- software design and integration
- OSGi, UPnP, WS, SIP.

Major Research Projects

SatNEx - (Satellite communication Network of Excellence). Financing source: European Commission. The primary goal of SatNEx is to achieve long-lasting integration of the European research in satellite communications and to develop a common base of knowledge. http://www.satnex.org

INTERMEDIA : (Interactive Media with Personal Networked Devices). Financing source: European Commission. INTERMEDIA seeks to progress beyond home and device-centric convergence toward truly user-centric convergence of multimedia. http://intermedia.miralab.unige.ch

PERSONA : (PERceptive Spaces prOmoting iNdependent Aging). Financing source: European Commission. PERSONA is one of the Integrated Projects funded by the European Commission within the VI Framework Programme for IST (Information Society Technologies) on Ambient Assisted Living for the Ageing Society. PERSONA aims at providing a scalable open technological platform to build a broad range of services for social inclusion, independent living and healthy lifestyle of Senior Citizens. http://www.aal-persona.org/

EASY RIDER : (Enhancement of sustAinability and Safety of mobility by integRating Intelligent roaDs, vEhicles and services). Financing Source: Industria per lo Sviluppo Economico. The aim of Easy Rider is to design and implement a communications network between vehicles, control centres and road infrastructures that makes available infomobility and traffic safety services in urban contexts, with the option to extend this to extra-urban contexts. Test sites will be set up in the city and province of Turin, the city of Rome, on the Naples bypass and in Sicily. The environmental and safety impact will be evaluated by means of feedback from test sites and will enable estimates to be made of the reduction of pollutants as a result of implementing the system developed.

People

Nedo Celandroni	*Director of research*
Erina Ferro	*Director of research*
Francesco Potortì	*Senior researcher*
Francesco Furfari	*Researcher (temporary)*
Antonio Blasco Bonito	*Technician*

Networking Science and Technology

Internet Services Technology Center

Internet Services Technology @ Center

Internet Services Technology Center
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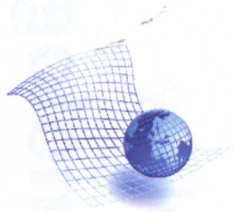
Analysis and development of innovative highly reliable solutions for Internet Services management.

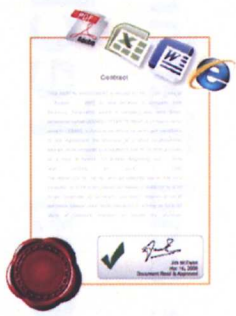
Research Topics

The Center has been working in the analysis and development of Internet Service Solutions for over 15 years, and has achieved a remarkable experience to meet the demands of large communities of users. The Center is also often commissioned by public and private organizations to evaluate and test new solutions and products.

Internet Services Although Internet Services are now based on widely adopted versions of protocols and stable products, a distinctive feature of this field is its rapid development. Updates are constantly released, and new protocols, products, and services introduced. In such an environment that requires high service reliability, it is not easy to propose innovations if they are not effective and dependable.



Digital Signatures and Cryptography application The continuous growth of Internet Services contributes to the increase in security problems, such as trust in on-line transactions, guarantee of user privacy, and message confidentiality. The necessity of Digital Signatures and the application of cryptography thus arises, particularly in the sending of documents via certified email.



Spam Problematic e-mail, informally called spam, has increased on the Internet markedly in recent years, to a point where it threatens to make e-mail unusable. The Center investigates tools and techniques to mitigate the sending and effects of spam. Its focus is on approaches that can be defined, deployed and used in the near term, by addressing underlying characteristics of spam.

Projects

Certified Electronic E-mail (PEC) National project funded by the Italian National Agency for Digital Administration (CNIPA). The Center offers its support in the activities of scientific and technical revision of PEC's Technical Specifications. It also runs interoperability tests of possible PEC service providers upon request from the CNIPA.

Development of international standards Participation in publishing the PEC specification as a European and international standard at the:

- Internet Engineering Task Force (IETF);
- European Telecommunications Standards Institute (ETSI).

Networking Science and Technology

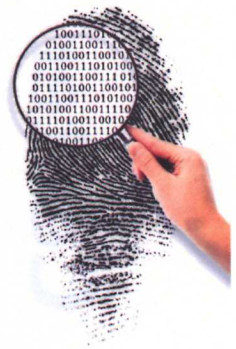
Internet Services Technology Center

National Network Infrastructure for the Agricultural Research Council National project funded by the Agricultural Research Council (CRA). The Center is designing and implementing the network infrastructure, which connects over 50 sites throughout the national territory.

Internet Services for the CNR's Institutes The CNR assigned the Center the task of developing and supplying Internet services for about 34 CNR Institutes and 57 domains through the use of the Integrated Network Services Manager (INSM). It represents the largest homogeneously organized area in CNR for Internet services, e-mail, and DNS.

MsgVerify Funded by the Institute of Informatics and Telematics (IIT-CNR), the Center takes care of the development and management of the reception of faxes and digitally signed messages, protocol and archiving of the ccTld .IT register. The system handles about 70.000 incoming faxes a month.

Identity Management - Single Sign On (SSO) Design of an identity management system for some services used in CNR Institutes.

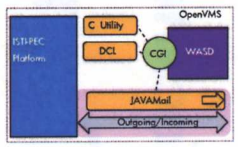


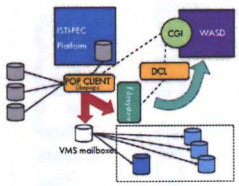
Software Tools

Internet Network Services Manager (INSM) An integrated modular system composed of MailboxManager, ListManager, AliasManager, DnsManager and DhcpManager. Since 1995, it has permitted to introduce in the Italian National Research Council an organizational model that reduces the cost of managing Internet Services by using a Centralized Management With Delegated Administration (CMDA) model.It allows the separation of technical/operational aspects of the servers (e-mail and DNS) from the management of information contained within. The INSM system is currently installed at the ISTI and the CNR's Research Area of Padova.

ISTI-PEC Suite Composed of:

- ISTI-PEC Platform: Implemented on OpenVMS, it's where tests are run. It relies on PMDF, libxml and libcurl libraries, NetHSM (a FIPS 140-2-compliant hardware security module), and Gnu/Linux;
- PEC TEST Manager: Web-based system that schedules test execution and runs on OpenVMS. Its implemenation uses WASD, DCL & C programming languages, Javamail, and PMDF;
- PEC TEST History: System that stores test restults and allows access and message retrieval through a web interface. It relies on libspopc library and SSL.





Achievements

Within the PEC project, the Center is in the process of publishing PEC's Technical Specifications as a Request For Comments (RFC) Standard at the Internet Engineering Task Force (IETF).

The Center has also gained an extensive experience in the following areas:

- Networking;
- Public Key Infrastructures;
- Identity Management
- OpenVMS operating system
- Linux operating system
- Software design and development
- Teaching, tutoring and training.

People

Beltrame Renzo	*Research Associate*	Canino Domenico	*Technical Staff*
Donini Francesco	*Graduate Fellow*	Gennai Francesco	*Technical Staff (Head)*
Lemmetti Giuseppe	*Technical Staff*	Leone Salvatore	*Research Associate*
Martinelli Massimo	*Technical Staff*	Serchiani Giuliano	*Technical Staff*

Networking Science and Technology

Domotics Lab

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Domotics Lab contribute to improve the quality of everyday life moving towards the achievement of Ambient Intelligence (AmI) and Internet of Things visions.

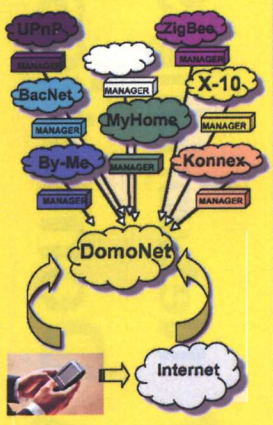
Research topics

Domotics Lab focuses its research activities on the home environment trying to reach new scenarios in which computing capabilities are not limited to traditional, stand-alone computing devices, but also in common, everyday objects. In our vision devices, objects and the environment itself seamlessly interact in order to support users (with special attention to children, elderly and disabled people) in carrying out everyday life activities, in an effortless and natural way, using a transparent user computing systems employed at home and in urbotic environment. This is the concept on which Ambient Intelligence and Internet of Things are based and covers the three key paradigms: ubiquitous computing, ubiquitous communication and intelligent user friendly interfaces. Exploiting this approach, isolated devices are integrated in order to achieve global and unified goals and made able to auto-organize and auto-adapt themselves depending on the users' context and anticipating their needs. Our guidelines are directed to achieve a fully-integrated home of the future and they are developed by systems and technologies that are:

- embedded: integrated within the environment;
- context aware: able to recognize users and their context;
- personalized: tailored to user needs;
- adaptive: able to change in response to new scenarios;
- anticipatory: able to anticipate user desires.

The lab is therefore dealing with a multi-disciplinary field including computer science, social science, electrical/electronic engineering, industrial design, architectural design, user interfaces, and cognitive science. The activities we are carring out are:

- Home Network Architecture: development activity focused on design and experimental domotic applicative scenarios, exploiting several home automation technologies to enhance quality of life.
- Interoperability and Standards: addressing the technological issue of incompatibility between devices belonging to heterogeneous domotic standards. A service oriented architecture prototype (DomoNet) has been developed and a domotic XML language (DomoML) has been standardized.



Networking Science and Technology
Domotics Lab

- Domotics Human Interface: designing simple and intuitive interaction mechanisms with electronic devices and the environment through a unique interface. Effort is directed towards facilitating access to external services, such as "electronic" participation to social life. Brain driven interfaces are currently under development.
- Context aware systems: automatic learning and adaptive processes can be exploited to provide a responsive domotic system, able to gather knowledge and experience both on current context and user behavior.

More detailed information at: http://www.domoticslab.it

Selected projects

Smart-Life : National project funded by Italian Ministry of University and Research (MIUR) within the innovation framework "Grandi Progetti Strategici". The goal is to develop a new generation of wireless devices in order to deliver services aiming at monitoring environmental parameters on a large scale, inside the house, and in real-time sanitary contexts.

Edem 1.0 : National project funded by Italian Ministry of Innovation. The main goal of the project is to introduce a new way to promote e-democracy process. As a result the lab has developed the innovative Open Source platform named Quimby.

Rimmel : European project of Marie Curie Industry-Academia Strategic Partnership Scheme. Research activity deals with the implementation of a new Open Source functional programming language conceived specifically for programming complex web applications.

The knowledge coast : European project Equal Initiative. The main obyective is the organization of refresher courses for tutors and other professional figures for the training on the job of beneficiaries, the Distance Learning for workers, etc. In this context Domotics Lab has organized several Domotic courses.

C.A.S.A. : Project in collaboration with "Almaviva-Cnr" enterprise for the design and development of new domotic solutions mainly thought for elderly and disabled users. Result of this project is the prototype Domo.IN.STA.NT. (Domotic Interoperability Standard Network), an interoperability framework for the "Domotics anyhow, anytime, anywhere, anydevice" providing a unique user interface for all home devices and an home auto-learning system. To demonstrate this and other Domoticslab prototypes' capabilities, a Democenter has been set up at ISTI-CNR in Pisa.

Other Activities

Consulting Activity : Support to third parties for the design of domotic systems in residential and public buildings. The lab staff has been involved in designing solutions for student lodges, offices and assistive organizations for elderly people.

Education : The lab is involved in providing both basic and advanced domotic teaching and is responsible for the course at Pisa University of Domotics.

Standardization : Our staff is currently involved in the UNI pre-normative working group for the topic "Smart Home Services for Elderly and Disabled People".

People

Vittorio Miori	*(Head)*	Rolando Bianchi Bandinelli	*(Research staff)*
Alfredo Ceccarelli	*(Research staff)*	Massimo Aliberti	*(Graduate Fellow)*
Armida Bianco	*(Graduate Fellow)*	Dario Russo	*(Graduate Fellow)*
Domenico Canino	*(Technical staff)*	Giuseppe Lemmetti	*(Technical staff)*

Knowledge Science and Technology

Networked Multimedia Inf. Systems Lab

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NeMIS is the largest Research Laboratory of ISTI-CNR, consisting of 12 permanent researchers and 34 non permanent and associate researchers. The main objective of the NeMIS laboratory is the research and development of technologies for the management, distribution and fruition of multimedia information, i.e., information represented not only in textual form but also in other forms, like images, audio/video, etc. We expect that, in the coming years, there will be a tremendous growth in the use of multimedia applications and, thus, the design of efficient and cost-effective networked multimedia information systems will be of central importance to the growth of a multitude of applications areas such as Cultural heritage, publishing, broadcasting/interactive TV, e-learning, e-government, medicine, etc.

Research topics

Service-oriented, Peer-to-peer and Grid digital library systems

- gCube: Grid based digital library system
- D-NET: European distributed digital library system
- DOROTY: Digital Object RepOsitory with TYpes

Digital Library Infrastructures and Services

- Digital Library management systems
- Services for Managing Libraries and Accessing Information

Multimedia Similarity Search

- Efficient management and search of multimedia content (MILOS)
- Distributed access methods for similarity searching (P2P)
- filtering of video stream based on MPEG-7

Automatic text and image categorization

- Automatic generation of text and image classifiers
- Applications of automatic classification

Cross-language information access

- Research in the multilingual information access domain and support for the evaluation of results through the coordination of the Cross language Evaluation Forum

Data Management in Wireless Sensor Networks

- In-network query processing in Wireless Sensor Networks
- Power aware query optimization in Wireless Sensor Networks

Knowledge management

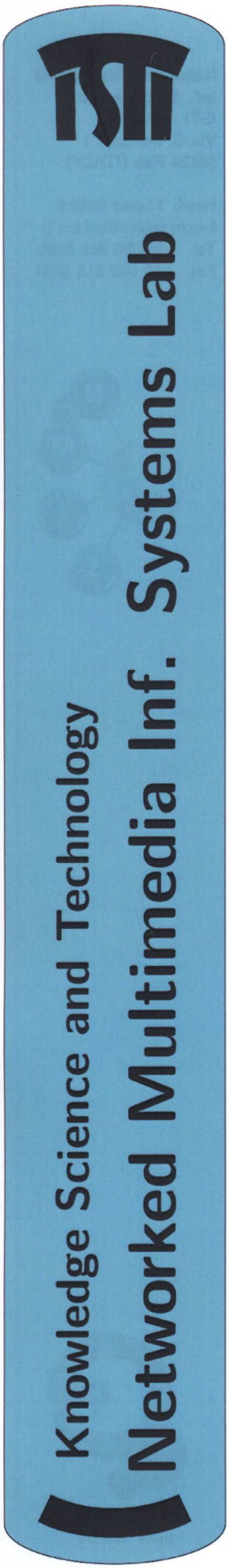
- Broad sense Knowledge Representation and Reasoning (KRR), and the Management of Uncertainty.

Projects

(for further details see lab website: www.isti.cnr.it/ThematicAreas/Knowledge/nmis-lab/).

EuropeanaLabs It supports the clusters of projects that will build Europeana (the European Digital Library) by offering an infrastructure for the development

europeana
think culture



and testing of innovative components for digital libraries and in particular for Europeana. www.europeanalabs.eu

BELIEF II (Bringing Europe's eLectronic Infrastructures to Expanding Frontiers II). www.beliefproject.org

DL.org (Digital Library Interoperability, Best Practices and Modelling Foundations). www.dlorg.eu

D4Science (DIstributed colLaboratories Infrastructure on Grid ENabled Technology for Science). www.d4science.eu

EFG (The European Film Gateway). www.europeanfilmgateway.eu

NeP4B (Networked Peers for Business). www.dbgroup.unimo.it/nep4b/

TrebleCLEF (Cross Language Evaluation Forum). www.trebleclef.eu

CASPAR (Cultural, Artistic and Scientific knowledge for Preservation, Access and Retrieval). www.casparpreserves.eu

DRIVER II (Digital Repository Infrastructure Vision for European Research). www.driver-repository.eu

MultiMATCH (Multilingual/Multimedia Access to Cultural Heritage). www.multimatch.org

SAPIR (Search on Audio-visual content using Peer-to-peer Information Retrieval). www.sapir.eu

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Software Tools

ETRDL - ERCIM Technical Reference Digital Library: A digital library service that assists the scientists of the European Research Consortium for Informatics and Mathematics (ERCIM), to rapidly access, manage and disseminate technical reports and other reference material in the IT domain.

MILOS . It is a multimedia content management system with special functionalities for multimedia document intensive applications. It offers functionalities for multimedia document management, arbitrary metadata management and retrieval, metadata mapping. More info at: milos.isti.cnr.it

MaD-WiSe - Management of Data in Wireless Sensor networks. It is a wireless sensor network database that allows processing complex query in the network by orchestrating communications and transducer activation so that energy consumed is minimized and long autonomy of the network is obtained. More information can be found at mad-wise.isti.cnr.it

PUMA and MetaPUB . PUMA (puma.isti.cnr.it) is a software infrastructure for institutional repositories of technical or scientific documents, developed by the Institute of Information Science and Technologies (ISTI) of the Italian National Research Council (CNR).

D-Net is an Open Source software for enabling service-oriented infrastructures with orchestration principles, where services are implemented as web services. D-Net running instances are dynamic environments where participants can add and share service resources to build Digital Library oriented applications.

DOROTY is a Digital Library Management System, designed to support content management for Digital Library applications. System design is inspired by traditional DBMS, where content management is preceded by the declaration of content's structure (schema or types). The software is in use in the DRIVER infrastructure and EFG infrastructure.

People

See lab website: www.isti.cnr.it/ThematicAreas/Knowledge/nmis-lab/

ISTITUTO DI SCIENZA E TECNOLOGIE
DELL'INFORMAZIONE "A. FAEDO"

Italian National Research Council • CNR
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