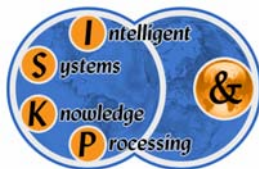


## Intelligent Systems & Knowledge Processing (ISKP) Group

Url: <http://iskp.csd.auth.gr/>



### Short Company Presentation:

The Intelligent Systems and Knowledge Processing (ISKP) group belongs to the Department of Informatics, Aristotle University of Thessaloniki, Greece. The group's main research areas include Logic Programming, Knowledge Representation and Reasoning, Automated Planning, Intelligent Applications and, of course, the Semantic Web. Research on those fields has led to a significant number of publications (over 140), including 6 authored and edited books.

Nine people are currently associated with ISKP, including two faculty members, two associate researchers (post-doctoral), three PhD students and two external associates. The group is also collaborating with many distinctive researchers from Greek and international universities and research institutes.

ISKP has participated with success in a variety of research and development projects, funded by the European Union and the Greek Government, many of which are related to the Semantic Web.

Finally, ISKP is responsible for a number of under- and postgraduate taught courses at the Aristotle University of Thessaloniki, such as: Logic Programming, Artificial Intelligence, Knowledge Systems, Intelligent Autonomous Systems, Knowledge Management, Decision Support Systems, Intelligent Agents and the Semantic Web.

### Main Products at a glance

The research of the members of the ISKP group in the Semantic Web has mainly resulted in the "DEVICE application family", which is a number of systems, designed to meet practical SW user needs. This "family" includes the following systems:

- R-DEVICE: a deductive object-oriented Knowledge Base System for querying and reasoning about RDF metadata
- O-DEVICE: a deductive object-oriented Knowledge Base System for querying and reasoning over OWL documents
- DR-DEVICE: an Object-Oriented Knowledge Base System, capable of reasoning about RDF metadata over multiple Web sources using defeasible logic rules
- VDR-DEVICE: a visual integrated development environment for developing and using defeasible logic rule bases on top of RDF ontologies
- CG-Wrapper Studio is an evolving, multi-paradigm, web content extraction workbench. It uses Conceptual Graphs to encode extraction rules that are HTML/DOM aware and supports direct visual modeling, wrapper induction, cooperation and reuse.

Furthermore, the group is involved in a number of SW-related research projects whose outcome will be SW-related products:

- SWIM - Development of an Intelligent System for the Management of Semantic Web Services (funded by the Greek R&D General Secretariat - PENED2003)
- SWEL - Planning Systems in the Semantic Web for e-Learning (funded by the Greek Ministry of Education - PYTHAGORAS)

Thessaloniki, Greece, 14.03.2006

## **Table of Contents**

Table of Contents .....	2
1. General Company Information.....	3
Objectives .....	3
SW expertise .....	3
2. Products Short Presentation .....	4
3. Services Offered .....	6
4. Big R&D projects involved .....	7
5. Key Publications.....	10
6. Open Tools for public.....	12
7. Contact details .....	13

## 1. General Company Information

The Intelligent Systems and Knowledge Processing (ISKP) group belongs to the Programming Languages and Software Engineering (PLaSE) Laboratory<sup>1</sup> of the Department of Informatics, Aristotle University of Thessaloniki. ISKP is a sub-group of the Logic Programming and Intelligent Systems (LPIS) group<sup>2</sup>, containing members from the latter as well as new researchers.

### *Objectives*

The group's objective is to perform research, develop products and offer specialized services in the areas of Knowledge Processing and Intelligent Systems. Its main research areas include Logic Programming, Knowledge Representation and Reasoning, Automated Planning, Intelligent Applications, and the Semantic Web. Research on those fields has led to a significant number of publications to scientific journals and international and Greek conferences (over 140), including 6 authored and edited books, in Artificial Intelligence, Knowledge Base Systems, Constraint Logic Programming, and Planning. Furthermore, the group has participated in quite a few national and international projects, where it has contributed in the development of practical and sophisticated systems. Furthermore, ISKP is also responsible for a number of under- and postgraduate taught courses at the Aristotle University of Thessaloniki, displaying the group's determination to offer services to education besides research.

ISKP's mother group, namely LPIS, was founded in 1990 and is also part of the PLaSE Lab at the Department of Informatics, Aristotle University of Thessaloniki. The LPIS group's research interests include the research interests of ISKP, paralleled with research on Machine Learning and Knowledge Discovery from Databases<sup>3</sup>. Twelve active researchers currently belong to LPIS, including 2 faculty members, 3 associate researchers (post-doctoral), and 7 PhD students. Furthermore, the group is collaborating heavily with 2 external associates. Finally, the LPIS group is an active node of the Hellenic Society for Artificial Intelligence and had organized the 2<sup>nd</sup> National Conference on Artificial Intelligence in Thessaloniki in 2002. It is also a member of the European Networks of Excellence PLANET and KDNET. The group has also organized the 2<sup>nd</sup> International Summer School on AI Planning in Halkidiki in 2002.

### *SW expertise*

The emergence of the Semantic Web (SW) did not find ISKP unprepared; Logic Programming and Knowledge Representation & Reasoning are two of its major research interests, which were naturally extended to the SW area. Thus, research on the field of the SW soon began, with the results now being a number of relevant publications (see Section 5), a family of systems designed for the SW (see Section 2) and participation in a variety of national and international projects that hold great potential (see Section 4). Research on the Semantic Web is considered a

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<sup>1</sup> <http://plase.csd.auth.gr>

<sup>2</sup> <http://lpis.csd.auth.gr>

<sup>3</sup> <http://mlkd.csd.auth.gr>

challenging topic, especially nowadays with the emergence of Semantic Web Services, a combination of Semantic Web and Web Services. Semantic Web Services have attracted the interest of the scientific community and revitalized the need for new standards and methodologies, giving the researchers a new motivation. ISKP's main target is to continue research on the particular field, developing tools and ideas towards the notion of the Semantic Web, where machines would act on behalf of users, searching and finding information and services with the least possible human involvement.

The research of ISKP so far was focused on alternative mappings of SW-related data, namely XML, RDF, OWL documents, to object-oriented knowledge bases, so that these documents can be stored, maintained, queried and reasoned about inside such a knowledge base system, exploiting existing rule-based systems, such as CLIPS. Furthermore, the group has developed various RuleML-compatible rule languages for querying and reasoning about these documents.

Currently, the group's research is focusing on two directions:

- To develop useful SW applications using the XML/RDF/OWL object-oriented knowledge base systems developed by the group. The applications that we are currently aiming for are a) an intelligent system for composing Semantic Web Services, and b) an intelligent system for dynamically composing e-learning curricula from various web-based learning objects based on metadata.
- To further extend our SW reasoning systems into flexible, visual integrated development environments that facilitate the development of rule bases for SW applications.

Additionally, the ISK group investigates advanced knowledge based information retrieval techniques for Web documents. The research in this area has resulted in the use of the Conceptual Graphs knowledge representation and reasoning formalism to model information extraction wrappers. Conceptual Graphs naturally support both the wrapper induction and the wrapper evaluation tasks, through the generalization, specialization and projection operations, and resulting wrappers can be easily reused to create more complex wrappers.

## **2. Products Short Presentation**

The SW-related products produced by the ISKP group belong to the “**DEVICE Application Family**”. This “family” comprises of a number of systems, specifically destined for SW applications. The systems described next are indicative of the group's expertise on the area.

### **- R-DEVICE**

R-DEVICE is a deductive object-oriented knowledge base system for querying and reasoning about RDF metadata. R-DEVICE, transforms RDF triples into objects and uses a deductive rule language for querying and reasoning about them. During this procedure, R-DEVICE imports RDF data into the CLIPS production rule system as COOL objects. The main difference between the RDF and our object model is that properties are treated both as first-class objects and as attributes of resource objects. In this way resource properties are gathered together in one object, resulting in superior query performance than the performance of a triple-based query model. Most other RDF storage and querying systems that are based on a triple model scatter

resource properties across several triples and they require several joins to query the properties of a single resource. Furthermore, the descriptive semantics of RDF data may call for dynamic redefinitions of resource classes and objects, which are handled by R-DEVICE.

R-DEVICE features a powerful deductive rule language which is able to express arbitrary queries both on the RDF schema and data, including generalized path expressions, stratified negation, aggregate, grouping, and sorting, functions, mainly due to the second-order syntax of the rule language, i.e. variables ranging over class and slot names, which is efficiently translated into sets of first-order logic rules using metadata. Furthermore, R-DEVICE rules define views which are materialized and incrementally maintained. Finally, users can use CLIPS functions or can define their own arbitrary functions using the CLIPS host language.

#### **- O-DEVICE**

O-DEVICE is a deductive object-oriented knowledge base system for reasoning over OWL documents. O-DEVICE exploits the rule language of an existing production rule system, called CLIPS and transforms OWL ontologies into an object-oriented schema of the CLIPS Object-Oriented Language (COOL). O-DEVICE is an extension of R-DEVICE and it exploits the advantages of the object-oriented programming model by transforming OWL ontologies into classes, properties and objects of the OO programming language provided within CLIPS, called COOL. The system also features a powerful deductive rule language which supports inferencing over the transformed OWL descriptions. Users can either use this deductive language to express queries or a RuleML-like syntax

#### **- DR-DEVICE**

DR-DEVICE is capable of reasoning about RDF metadata over multiple Web sources using defeasible logic rules. The system is implemented on top of CLIPS production rule system and also builds upon R-DEVICE. Rules can be expressed either in a native CLIPS-like language, or in an extension of the OO-RuleML syntax. The operational semantics of defeasible logic are implemented through compilation into the generic rule language of R-DEVICE.

The most important features of DR-DEVICE are the following:

- Support for multiple rule types of defeasible logic, such as strict rules, defeasible rules, and defeaters.
- Support for both classical (strong) negation and negation-as-failure.
- Support for conflicting literals, i.e. derived objects that exclude each other.
- Direct import from the Web of RDF ontologies and data as input facts to the defeasible logic program.
- Direct import from the Web of defeasible logic programs in an XML compliant rule syntax (RuleML).
- Direct export to the Web of the results (conclusions) of the logic program as an RDF document.

#### **- VDR-DEVICE**

VDR-DEVICE is a visual integrated development environment for developing and using defeasible logic rule bases on top of RDF ontologies. VDR-DEVICE integrates in a user-friendly

graphical shell (a) DRREd (Defeasible Reasoning Rule Editor), a visual RuleML-compliant rule editor, which serves both as a rule authoring tool and as a graphical shell for the core reasoning system and (b) DR-DEVICE, the reasoning system, described above, that performs the RDF processing and inference and produces the results. The rule editor helps users to develop a defeasible logic rule base by constraining the allowed vocabulary after analyzing the input RDF ontologies. Therefore, it removes from the user the burden of typing-in class and property names and prevents potential semantical and syntactical errors. The visualization of rules follows the tree model of RuleML. Since the reasoning is based on DR-DEVICE, the system supports multiple rule types of defeasible logic, as well as priorities among rules. Furthermore, it supports two types of negation (strong, negation-as-failure) and conflicting (mutually exclusive) literals.

### **- CG-Wrapper Studio**

CG-Wrapper Studio is an evolving, multi-paradigm, web content extraction workbench that is based on CG-Wrappers, that is, extraction rules encoded as Conceptual Graphs. CG-Wrappers combine features of diverse web content extraction approaches resulting in extraction rules that are HTML, DOM and regular expression aware, can be directly modelled or induced by training examples, have excellent visual representation, and strong potential for NLP support. The CG-Wrapper Studio includes a visual editor for direct manipulation of CG-Wrappers, a web browser supporting visual identification of training examples and extracted data inspection, a DOM tree analyzer and an executor for applying CG-Wrappers to web pages. It also supports extraction rule templates and wrapper cooperation and reuse.

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## **3. Services Offered**

As mentioned already, ISKP is responsible for a number of taught modules at the Department of Informatics, Aristotle University of Thessaloniki.

### *Undergraduate Courses:*

Logic & Functional Programming  
Artificial Intelligence  
Decision Support Theory and Systems  
Knowledge Systems  
Intelligent Autonomous Systems  
C Language and UNIX

### *Postgraduate Courses:*

Semantic Web  
Intelligent Agents  
Planning and Scheduling

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Knowledge Management  
Intelligent Systems

ISKP is also willing to offer its expertise to interested companies and other parties, regarding the design and implementation of systems and software. It's worth mentioning that in the past various collaborations had been developed with universities, institutes and private companies. Indicatively, we can mention collaborations with Purdue University (USA), Aberdeen University (UK), Paris-Dauphine University (France), University of Nantes (France), Dept. of Computer Science (University of Crete, Greece), Institute of Computer Science of the Foundation for Research and Technology - Hellas (FORTH), Dept. of Informatics and Telecommunications (University of Athens), during the ExperNet project collaborations with Technical University of Madrid (Spain), TECHNOSOFT research institute (Ukraine), Glushkov Institute of Cybernetics (Ukraine), ML company (Hungary) and during the EUROCITIZEN project collaborations with International Centre for Digital Content (John Moores University, Liverpool, UK), Institute of Technoethics (Barcelona University, Spain), and with the companies Total Language Solutions (UK, Agentscape, Germany) and MLS MULTIMEDIA (Greece).

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#### **4. Big R&D projects involved**

The following list displays the SW-related projects currently undertaken by ISKP:

**- An Object-Oriented Knowledge Base System for Reasoning about OWL Ontologies (funded by the Greek R&D General Secretariat - Bilateral Cooperation with Ukraine)**

*(Collaborating Organisations: International Software Technology Research Center "TECHNOSOFT")*

This project proposal is about the development of a system for reasoning with and querying over semantic web ontologies, expressed as OWL-based documents. The development of this system will be based on extending the existing system, called R-Device, which is a deductive object-oriented knowledge base system for querying and reasoning about RDF metadata. R-Device transforms RDF triples into objects of the CLIPS production system and uses a deductive rule language for querying and reasoning about them. This project will add value to the existing system by doing the following:

- Add necessary code (in CLIPS) for transforming appropriately OWL/RDF triples into COOL objects and classes, simulating the class hierarchy of OWL
- Extend the current rule base of R-Device, enabling it to handle the COOL classes and objects
- Extend the rule language of the system to enable queries and inferences over the objects
- Built a user interface for the final system. The interface can be either a locally installed software on the user's computer or a web-based application for distant use of the system

**- SWIM - Development of an Intelligent System for the Management of Semantic Web Services (funded by the Greek R&D General Secretariat - PENED2003)**

*(Collaborating Organisations: Harokopion University (Athens, Greece), Singular Software S.A. (Greece), South - East European Research Center (SEERC) (Thessaloniki, Greece))*

The aim of this project is the development of an intelligent Web services management system. This system will serve as a central node for automated discovery, collection, distribution, composition and control of Web services, whose characteristics will be described using ontologies or metadata according to the Semantic Web framework. The proposed system can potentially constitute the infrastructure for a variety of intelligent Web applications and services in the domains of e-commerce, e-learning and e-government. One of the main targets of the project is the development of a pilot e-commerce platform on top of the intelligent system, through which the usability of the latter will be evaluated.

The system will consist of six independent but cooperating subsystems, each of which will initially constitute a separate field of research and development by an equal number of PhD candidates. Subsequently, the six subsystems will be merged into a uniform system and the pilot e-commerce application will be developed. The six subsystems are the following: i) a Knowledge System for Ontology Management and rule-based reasoning, ii) a Management and Web services Composition System of Web services based on the model of similar Web services communities, iii) a Planning System for Web services composition, iv) an Intelligent Agent for searching and collecting information and metadata of Web services, v) a Machine Learning System for composition, control and improvement of the quality of Web services, vi) a Connectivity Model Simulating System of the Web and Web services composition.

**- SWEL - Planning Systems in the Semantic Web for e-Learning (funded by the Greek Ministry of Education - PYTHAGORAS)**

The current proposal aims at the study and development of an adaptive planning system for the automated and intelligent composition of educational resources in the Semantic Web. The purpose will eventually be the compilation of specialized e-Learning curricula, depending on the background and educational aims of each trainee. The primary goal of this proposal is the sophistication and expansion of the HAPRC planning system, which combines automated planning, machine learning and knowledge-based systems techniques. The HAP planner will be extended towards the following directions: (i) it will become more efficient, producing a better quality of plans in shorter periods of time, combining the aforementioned technologies in an optimum way, (ii) it will be able to handle XML/RDF meta-data from Semantic Web educational resources and (iii) it will be capable of representing and solving specialized e-Learning curricula composition problems, depending on the knowledge background and educational aims of each trainee.

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The following list displays projects undertaken by ISKP in the past, which are somehow related, but rather remotely, to the SW:



**EXPERNET - Development of a Distributed Expert System for the Management of a National Network (European Union under the INCO-COPERNICUS'96 program (Proposal No. 960114) for cooperation between EU countries and former Soviet Union/Central European countries).**

*(Collaborating Organisations: LINK TECHNOLOGIES S.A., Dept. of Artificial Intelligence (Technical University of Madrid, Spain), ML Consultanting & Computing Ltd. (Budapest, Hungary) International Software Technology Research Center TECHNOSOFT (Kiev, Ukraine), Glushkov Institute of Cybernetics (Ukrainian Academy of Sciences, Kiev, Ukraine))*

The main aim of this project is the development of a distributed expert system (called EXPERNET) for the management of the National Network of Ukraine. EXPERNET manages both the whole Ukrainian national network, as well as any of its sub-networks. It consists of a number of local expert systems attached to related network management nodes, that belong to one of the three network levels: national, regional and district, closely reflecting the structure of the Ukrainian WANs. The design of the expert system supports both general and node-specific network management knowledge, in order to develop one expert system that can be easily adapted to the requirements of the specific node types. Furthermore, different interfaces between the expert system instances and the local WAN management software have been developed in order to facilitate the ease of information exchange between the two components of the local management software. The run-time aspects of EXPERNET include the exchange of information and resolution co-ordination between the physically and logically distributed local expert systems, based on global and local data and goals. The whole expert system is controlled either by data or goals by providing a possibility of selecting target nodes dynamically for each node.

**- RIMM-NET - Remote Intelligent Monitoring & Management for a Nationally Distributed NETWORK (funded by the Greek R&D General Secretariat - Bilateral Cooperation with Ukraine).**

*(Collaborating Organisations: International Software Technology Research Center TECHNOSOFT (Kiev, Ukraine))*

This project is about providing remote intelligent monitoring & management for the various human administrators of a nationally distributed data network. This aim has been achieved by extending an existing distributed expert system (ExperNet, described before) for the management of a wide-area network, which has been developed in the past by the two partners. This project has added value to the existing system by doing the following:

- Build a new user-interface for the human administrator(s) of the system that allows them to monitor and manage the ExperNet system remotely through inexpensive software (web browsers). Currently monitoring is only allowed at the machine that hosts the network management software and the expert system.
- Add more knowledge to the expert system itself, involving the administration area of fault management. Currently, only a dozen of faulty network test cases are covered.

The above two extensions have twofold benefits:

- The web-based user-interface allows the easy administration and monitoring of the ExperNet system and the targeted network system on a remote host.
- The extension of the expert system's knowledge base makes the ExperNet system more useful, since it allows it to intelligently monitor, identify and resolve more faulty cases that can arise in a network, releasing the administrator from the low-level albeit time-consuming task of fault management.

**CSPCONS - Development of a Logic Programming Platform for Building Distributed Constraint Applications (funded by the Greek R&D General Secretariat - Bilateral Cooperation with Hungary)**

*(Collaborating Organisations: ML Consulting & Computing Ltd. (Budapest, Hungary))*

This project is about the development of a logic programming system that offers the necessary facilities for building distributed constraint logic programming applications as well as agent based systems. A secondary aim of the project is the implementation of a distributed application using the proposed platform, in order to evaluate the product of the project. This application concerns the distributed construction of an inter-departmental schedule for courses and exams. The selected problem presents a number of interesting features like scheduling shared resources, co-ordination issues between the distributed solvers, etc. The pilot application serves for evaluating the strengths and weaknesses of the system and of course for debugging purposes.

A logic programming platform for such applications should support basically two features:

- Communication facilities for co-ordinating the teams of agents participating in the application environment.
- Constraint Solving Capabilities.

The proposed system is based on the existing CS Prolog II system developed by ML. CS-Prolog II is a system that offers:

- parallel program execution through sequential communicating Prolog processes
- real time features
- inter-process and network communication (TCP/IP)
- WEB based GUI
- an interface for accessing external data bases (PostgreSQL).

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## **5. Key Publications**

An indicative list of the group's relevant-to-the-SW publications is the following:

- G. Meditskos, N. Bassiliades, "O-DEVICE: An Object-Oriented Knowledge Base System for OWL Ontologies", Proc. 4th Hellenic Conference on Artificial Intelligence (to be presented), G. Antoniou, G. Potamias, D. Plexousakis, C. Spyropoulos (Ed.), Springer-Verlag, Heraclion, Crete, 2006.

- N. Bassiliades, I. Vlahavas, "R-DEVICE: An Object-Oriented Knowledge Base System for RDF Metadata", *International Journal on Semantic Web and Information Systems*, Amit Sheth, Miltiadis D. Lytras (Ed.), Idea Group, Vol. 2, No. 2 (to appear), 2006.
- D. Vrakas, F. Kokkoras, N. Bassiliades, I. Vlahavas, "Towards Automatic Synthesis of Educational Resources through Automated Planning", *Proc. 4th Hellenic Conference on Artificial Intelligence* (to be presented), Heraklion, Crete, 2006.
- G. Meditskos, N. Bassiliades, "Towards an Object-Oriented Reasoning System for OWL", *Int. Workshop on OWL Experiences and Directions*, B. Cuenca Grau, I. Horrocks, B. Parsia, P. Patel-Schneider (Ed.), 11-12 Nov. 2005, Galway, Ireland, 2005.
- N. Bassiliades, E. Kontopoulos, G. Antoniou, I. Vlahavas, "A Graphical Rule Authoring Tool for Defeasible Reasoning in the Semantic Web", *10th Panhellenic Conference on Informatics (PCI 2005)*, P. Bozanis and E.N. Houstis (Eds.), Springer-Verlag, LNCS 3746, Volos, Greece, 11-13 November, 2005.
- N. Bassiliades, E. Kontopoulos, G. Antoniou, "A Visual Environment for Developing Defeasible Rule Bases for the Semantic Web", *Proc. International Conference on Rules and Rule Markup Languages for the Semantic Web (RuleML-2005)*, A. Adi, S. Stoutenburg, S. Tabet (Ed.), Springer-Verlag, LNCS 3791, pp. 172-186, Galway, Ireland, 10-12 November, 2005.
- N. Bassiliades, E. Kontopoulos, G. Antoniou, "VDR-DEVICE: A Visual Editor for a Defeasible Logic Rule-ML-compatible Rule Language", *4th International Semantic Web Conference (ISWC2005)*, Demo/Poster Session, Edward Curry (Ed.), Galway, Ireland, 6-10 Nov. 2005.
- G. Antoniou, T. Skylogiannis, A. Bikakis, N. Bassiliades, "A Semantic Brokering System for the Tourism Domain", *Journal of Information Technology & Tourism*, special issue on "Semantic Web Technologies and Applications", Vol. 7, No. 3-4 (to appear), 2005.
- N. Bassiliades, D. Anagnostopoulos, I. Vlahavas, "Web Service Composition Using a Deductive XML Rule Language", *Distributed and Parallel Databases*, Ahmed K. Elmagarmid (Ed.), Kluwer, Vol. 17, No. 2, pp. 135-178, 2005.
- N. Bassiliades, "Semantic Web: Vision and Technologies", *2nd Int. Scientific Conf. on Computer Science*, Plamenka Borovska, Sofoklis Christofordis (Ed.), IEEE Computer Society, Bulgarian Section, 30th Sep-2nd Oct 2005, Halkidiki, Greece, 2005
- G. Antoniou, T. Skylogiannis, A. Bikakis, N. Bassiliades, "A Deductive Semantic Brokering System", *9th International Conference on Knowledge-Based Intelligent Information and Engineering Systems (KES 2005)*, R. Khosla, R. J. Howlett, L. C. Jain (Ed.), Springer-Verlag, LNCS 3682, pp. 746-752, Melbourne, Australia, September 14-16, 2005.
- F. Kokkoras, N. Bassiliades, I. Vlahavas, "Aggregator: A Knowledge based Comparison Chart Builder for e-Shopping", *Intelligent Knowledge-Based Systems: Business and Technology in the New Millennium*, C.T. Leondes (Ed.), Kluwer Academic Publishers, Vol. 1: Knowledge-Based Systems, Ch. 6, pp. 140-163, 2005.
- G. Antoniou, T. Skylogiannis, A. Bikakis, N. Bassiliades, "DR-BROKERING - A Defeasible Logic-Based System for Semantic Brokering", *IEEE International Conference*

- on E-Technology, E-Commerce and E-Service, W.K.W. Cheung, J. Hsu (Ed.), IEEE, pp. 414-417, 29/3 - 1/4/2005, Hong Kong, China, 2005.
- N. Bassiliades, I. Vlahavas, "R-DEVICE: A Deductive RDF Rule Language", Third International Workshop on Rules and Rule Markup Languages for the Semantic Web (RuleML 2004), G. Antoniou, H. Boley (Ed.), Springer-Verlag, LNCS 3323, pp. 65-80, Hiroshima, Japan, 8 Nov. 2004.
  - N. Bassiliades, G. Antoniou, I. Vlahavas, "A Defeasible Logic Reasoner for the Semantic Web", Third International Workshop on Rules and Rule Markup Languages for the Semantic Web (RuleML 2004), G. Antoniou, H. Boley (Ed.), Springer-Verlag, LNCS 3323, pp. 49-64, Hiroshima, Japan, 8 Nov. 2004.
  - N. Bassiliades, G. Antoniou, I. Vlahavas, "DR-DEVICE: A Defeasible Logic RDF Rule Language", 3rd International Semantic Web Conference (ISWC2004), Demonstrations Program, Hiroshima, Japan, 7-11 Nov. 2004.
  - N. Bassiliades, G. Antoniou, I. Vlahavas, "DR-DEVICE: A Defeasible Logic System for the Semantic Web", Second International Workshop on Principles and Practice of Semantic Web Reasoning (PPSWR04), Sebastian Schaffert (Ed.), Springer-Verlag, LNCS 3208, pp. 134-148, St Malo, France, 6-10 Sept. 2004.
  - F. Kokkoras, N. Bassiliades, I. Vlahavas, "Modelling Information Extraction Wrappers with Conceptual Graphs", Proc. (2nd Volume) 3rd Panhellenic Conference on Artificial Intelligence (SETN'04), Zitis Publications, ISBN 960-431-910-8, 5-8 May 2004, Samos, Greece, 2004.
  - N. Bassiliades, I. Vlahavas, "Capturing RDF Descriptive Semantics in an Object Oriented Knowledge Base System", Proc. 12th Int. WWW Conf. (WWW2003), ACM, CDROM (Poster), Budapest, Hungary, May 2003.
  - N. Bassiliades, I. Vlahavas, D. Sampson, "Using Logic for Querying XML Data", Web Powered Databases, D. Taniar and W. Rahayu (Eds.), IDEA Group Publishing, Ch. 1, pp. 1-35, 2003.
  - N. Bassiliades, F. Kokkoras, I. Vlahavas, D. Sampson, "An Intelligent Educational Metadata Repository", Intelligent Systems, Techniques and Applications, C.T. Leondes (Ed.), CRC Press, Vol. 4, Ch.12, pp. 297-337, 2003.
  - N. Bassiliades, I. Vlahavas, "Intelligent Querying of Web Documents Using a Deductive XML Repository", Proc. 2nd Hellenic Conference on AI (SETN '02), I. Vlahavas, C. Spyrolpoulos (Ed.), Springer-Verlag, LNAI 2308, pp. 437-448, 2002.
  - I. Vlahavas, N. Bassiliades, I. Sakellariou, et al., "ExperNet: An Intelligent Multi-Agent System for WAN Management", IEEE Intelligent Systems, Vol. 17, No. 1, pp. 62-72, 2002.
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## **6. Open Tools for public**

The following list displays the aforementioned tools together with the corresponding addresses. Users can find useful information about the systems with short tutorials and download links as

well as simple examples for testing purposes. Please keep in mind that some of the tools are still under development and, therefore, there is no code to provide yet.

R-DEVICE	<a href="http://lpis.csd.auth.gr/systems/r-device.html">http://lpis.csd.auth.gr/systems/r-device.html</a>
DR-DEVICE, VDR-DEVICE	<a href="http://lpis.csd.auth.gr/systems/dr-device.html">http://lpis.csd.auth.gr/systems/dr-device.html</a>
O-DEVICE (under development)	<a href="http://lpis.csd.auth.gr/systems/o-device/o-device.html">http://lpis.csd.auth.gr/systems/o-device/o-device.html</a>

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## 7. Contact details

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