The Carneades Web Service

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The Carneades Web Service[1] is open source software providing APIs for argument construction, storage, navigation, querying, evaluation, visualization, and interchange.[2] The web service offers the following features.

- It is based on an abstract mathematical model of structured argument, called Carneades Argument Graphs (CAG), inspired by the Argument Interchange Format (AIF).[3]
- Argument evaluation is provided via an implementation of ASPIC+, and thus based on Dung's abstract argumentation framework. The limitation of earlier versions of Carneades, disallowing cycles in argument graphs, has been lifted. Our instantiation of the ASPIC+ framework continues to provide all the features of our earlier model of argument evaluation, including support for multiple proof standards.
- The service includes a high-level language for argumentation schemes and domain theories. The language supports both strict and defeasible schemes. Schemes may be organized into a hierarchy of sections. Each section and each scheme may be described with metadata, including links to arguments, legislation, policy documents, comments, and other source documents. To illustrate the language, a reconstruction of about 20 of Walton's schemes is provided with the system.
- Argument graphs are stored in a relational database backend, with full ACID support for transactions. Multiuser applications, such as collaborative argument editors or e-participation systems, can be built easily using the service. The database can be configured at run-time to support any set of schemes specifiable in the scheme language.
- Arguments and statements can be represented simultaneously in multiple natural languages, in addition to an optional formal representation in predicate logic. The formal representation enables "fined-grained semantic models" of arguments and argumentation schemes, without having to define database tables for each scheme.

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[1] http://carneades.github.com

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[3] For a comparison of CAG and AIF, see "Interchanging arguments between Carneades and AIF – Theory and Practice", by Floris Bex, John Lawrence, Chris Reed and Thomas Gordon, in this volume.

- The service provides a Prolog-like query language for selecting statements, which unifies queries with the predicate logic representation of statements.
- The service provides a way to retrieve and instantiate argumentation schemes, useful for implementing argument graph editors and argument reconstruction tools like Araucaria[4].
- Metadata, using the Dublin Core elements, can be associated with statements, arguments and whole argument graphs.[5] Descriptions can be in several natural languages, simultaneously, and may be structured texts, with sections, paragraphs, footnotes, references, images, etc., represented using the "Markdown" wiki language.
- Argument graphs can be exported to XML, using the Carneades Argument Format (CAF), an XML schema derived from the Legal Knowledge Interchange Format (LKIF). Entire databases can be exported to CAF and imported into other databases with no loss of information. Universally Unique Identifiers (UUIDs) are used for statement and arguments, to allow them to retain their identity when moved between systems.
- The web service is RESTful and compliant with relevant Web standards.[6] Data is exchanged between the web service and clients using the JSON language[7], which is based on JavaScript and thus ideal for Rich Internet applications using AJAX.[8]
- All write operations are password protected. Each argument graph can have its own password. Read operations are public and do not require a password.
- Administration services are provided for creating and managing argument graph, where each argument graph is stored in a separate database, with its own password.
- The web service can generate interactive argument maps, for visualizing and browsing argument graphs on the web, using the Structured Vector Graphics (SVG) web standard for 2D vector graphics[9].
- The web service is packaged as an easy-to-install, zero-administration, platform-independent Java application, with a built-in database and web server. (Optionally other web servers, e.g. Apache, and databases, e.g. MySql, may be used as well.) Installing and using the web service requires no knowledge of Java or SQL. The service may be installed and used by end-users as a stand-alone application, with a web user interface, with or without an Internet connection.

The Carneades web service will be demonstrated using example web applications for argument reconstruction, argument visualization, structured consultation and policy modeling.

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[4] http://araucaria.computing.dundee.ac.uk/doku.php
[5] http://dublincore.org/documents/dces/
[6] http://en.wikipedia.org/wiki/Representational_state_transfer
[7] http://www.json.org/
[8] http://en.wikipedia.org/wiki/Ajax_(programming)
[9] http://www.w3.org/Graphics/SVG/