

# The SymbolicData Project

## Towards a Computer Algebra Social Network

Talk given at the CICM 2014 Work in Progress Section

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Coimbra, 2014-07-07



# Aim and Scope

## Scope

- Develop concepts and tools for profiling, testing and benchmarking Computer Algebra Software (CAS) from different areas of Computer Algebra.
- Collect and interlink relevant data and activities from different Computer Algebra subcommunities.

## SymbolicData is an

- inter-community project that has its roots in the activities of different Computer Algebra Communities and
- aims at interlinking these activities using modern Semantic Web concepts.

## Tools and data are designed to be used both

- on a local site for special testing and profiling purposes
- and to manage a central repository at <http://www.symbolicdata.org>.

# What does SymbolicData offer?

The  
SymbolicData  
Project

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Aim and  
Scope

What does  
SymbolicData  
offer?

Some History

Basic  
Concepts

SymbolicData  
meets RDF

Towards a CA  
Social  
Network  
(CASN)

Links

## Data:

- Polynomial Systems Solving
- Geometry Theorem Proving
- Fano Polytopes (A. Paffenholz)
- Free Algebras
- G-Algebras
- Test Sets from Integer Programming

## Draft:

- Birkhoff Polytopes (A. Paffenholz)
- Transitive Groups (J. Klüners, G. Malle)

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## Tools:

### SDEval Package (Albert Heinle)

- Aim: Set up, run, log, monitor standardized Computations on SD data series in a reliable way
- Technology: Python standalone on top of the OS
- <http://symbolicdata.org/wiki/SDEval>

### SDSage Package (Andreas Nareike)

- Aim: Call the new Polynomial Systems format from Sagemath
- Technology: Sagemath Python Package
- <http://symbolicdata.org/wiki/PolynomialSystems.Sage>

Short demo on local data and sdsage.

## Some History

ISSAC 1998: Special session on Benchmarking

1999-2002: Phase 1 – Olaf Bachmann, Hans-Gert Gräbe

- Focus: Polynomial Systems, tools and concepts
- Technology: XML-like special markup, elaborated Perl tools

2005-2007: Phase 2 – around the Groebner Special Year in Linz

- Focus: Geometry Theorem Proving, first interlinking projects with the GB bibliography and the GB facilities projects
- Technology: Switch to true XML concepts

2012-2014: Phase 3 – E-Science Saxonia supported project (Andreas Nareike, Hans-Gert Gräbe, Simon Johanning)

- Focus: Switch to Linked Data and Semantic Web concepts, XML resources, RDF meta data, data reorganization
- Release of version 3 in Sept. 2013

# RDF and Linked Data Principles

- RDF = Resource Description Framework
  - Main idea: Store pieces of information in a unified way as triples, use standard tools to manage these data.
- *Resources*: URI, HTTP access
  - URI = Unique Resource Identifier
  - Access to worldwide distributed data in a unified way
- *Resource Descriptions*: Deliver a valuable piece of information in structured RDF format, that can be combined with other pieces of information from other sources into new RDF sentences.
- Run *RDF Triple Stores* as part of a worldwide distributed data storage infrastructure
- (Federated) Query Language SPARQL
- Run *SPARQL Endpoints* on RDF triple stores

# SymbolicData Infrastructure

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- Main repository <http://github.com/symbolicdata> and several clones (following the Integration Master Pattern)
- A project wiki at <http://symbolicdata.org>
- A mailing list
- Web access to the XML resources
- Two centrally operated Virtuoso based RDF data stores for meta informations ('Data' and 'casn')
- Organized along Linked Data Principles
- Regular dumps of RDF data in Turtle format
- Two SPARQL endpoints to query the data
- Advise for local installation of tools and data based on Virtuoso and a local Apache Web server

# SymbolicData Data Structures

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## Resources:

- SD provides own resources in an XML based format
  - Polynomial Systems, Geometry Theorem Proving, ...
- Draft: SD addresses other resources at different stores
  - Polytopes, Transitive Groups
- Maintenance of resources requires special semantic knowledge, semantic aware tools and semantically educated people

## Resource Descriptions:

- Precomputed *fingerprints* of the different resources in RDF format to navigate and search within the data.  
It requires *semantic* knowledge both to compute fingerprints and to use them in an appropriate way.



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## Resource Descriptions (cont.)

- *Background information*: Use RDF to manage additional data, try to interlink that data with other sources along the Linked Data Principles.
  - Annotations – a notational system to associate background information to different examples and series of examples
- Bibliography – bibliographical references system (to be aligned with ZBMath)
- People – different people and groups (to be aligned with ZBMath)
- Systems – list of CA software (aligned with swmath)

# Towards a CA Social Network (CASN)

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How to turn a DDS<sup>1</sup> into a vivid, well recognized Social Network with plenty of valuable background information?

Central observation: Valuable background information is information that people care about.

- Find out the places where such information is spread today. Usually it is *streamed*, not *stored*.
- Try to semantically annotate that information.
- Build views (web sites) that harvest such information.

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<sup>1</sup>DDS = Dead Data Store

# An RDF based Road Map to a CASN

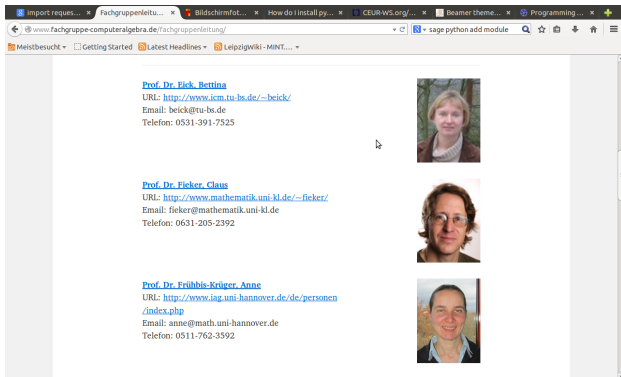
How to reach such a goal with RDF based semantic technologies?

- Main idea: Turn passive users into active ones.
- Identify and shape appropriate ontologies.
- Collect RDF data of such types, link to other sources along the Linked Data Principles.  
A very first prototype is used to collect such information and to display it within the Wordpress based CAFG site.
- The stakeholders understand, that this is a techno-social, and even more a social than a technical process that is best discussed on the Symbolicdata Mailing list.
- The CASN germ at <http://symbolicdata.org/casn> matures thanks to common efforts.

# What is already done?

<http://symbolicdata.org/casn/CAFG-Intern/>

Basic information about People – 410 instances of RDF type foaf:Person (i.e., passive users) from different sources. Used in particular to display people from the CAFG Board within the Wordpress based CAFG site.



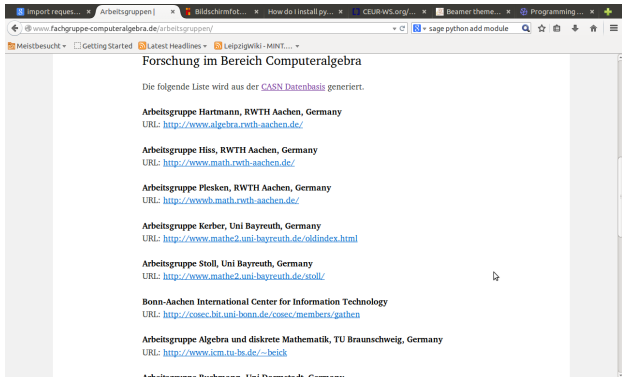
The screenshot shows a web browser window with the address bar displaying [www.fachgruppe-computeralgebra.de/fachgruppenleitung/](http://www.fachgruppe-computeralgebra.de/fachgruppenleitung/). The page content lists three individuals:

- Prof. Dr. Fick, Bettina**  
URL: <http://www.icm.tu-bs.de/~beick/>  
Email: [beick@tu-bs.de](mailto:beick@tu-bs.de)  
Telefon: 0531-391-7525
- Prof. Dr. Fieker, Claus**  
URL: <http://www.mathematik.uni-kl.de/~fieker/>  
Email: [fieker@mathematik.uni-kl.de](mailto:fieker@mathematik.uni-kl.de)  
Telefon: 0631-205-2392
- Prof. Dr. Friibbis-Krüger, Anne**  
URL: <http://www.iag.uni-hannover.de/de/personen/index.php>  
Email: [anne@math.uni-hannover.de](mailto:anne@math.uni-hannover.de)  
Telefon: 0511-762-3592

# What is already done?

<http://symbolicdata.org/casn/WorkingGroups/>

Standard information about CA Working Groups – 17 Instances of RDF type foaf:Group and sd:WorkingGroup from the old CAFG site. Used to display that within the Wordpress based CAFG site.



The screenshot shows a web browser window with the address bar displaying [www.fachgruppe-computeralgebra.de/arbeitsgruppen/](http://www.fachgruppe-computeralgebra.de/arbeitsgruppen/). The page content is in German and titled "Forschung im Bereich Computeralgebra". It lists several working groups, each with a name and a URL:

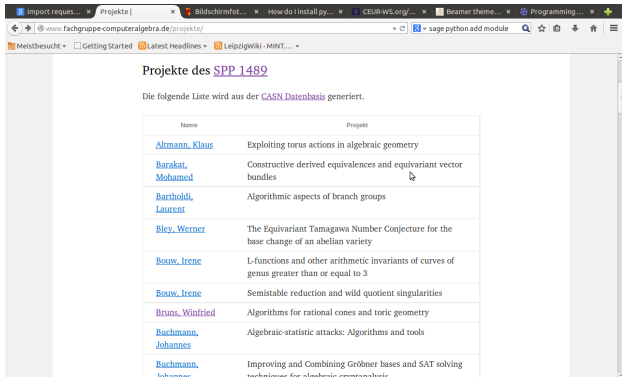
- Arbeitsgruppe Hartmann, RWTH Aachen, Germany  
URL: <http://www.algebra.rwth-aachen.de/>
- Arbeitsgruppe Hiss, RWTH Aachen, Germany  
URL: <http://www.math.rwth-aachen.de/>
- Arbeitsgruppe Plesken, RWTH Aachen, Germany  
URL: <http://wwwb.math.rwth-aachen.de/>
- Arbeitsgruppe Kerber, Uni Bayreuth, Germany  
URL: <http://www.mathe2.uni-bayreuth.de/oldindex.html>
- Arbeitsgruppe Stoll, Uni Bayreuth, Germany  
URL: <http://www.mathe2.uni-bayreuth.de/stoll/>
- Bonn-Aachen International Center for Information Technology  
URL: <http://cosec.bit.uni-bonn.de/cosec/members/gathen>
- Arbeitsgruppe Algebra und diskrete Mathematik, TU Braunschweig, Germany  
URL: <http://www.icm.tu-bs.de/~beick>

The bottom of the page shows the start of another entry: "Arbeitsgruppe Buchmann, Uni Darmstadt, Germany".

# What is already done?

<http://symbolicdata.org/casn/SPP-Projekte/>

Standard information about CA Projects – 60 instances of RDF type `sd:Project`, compiled from the list of projects within the SPP 1489 priority program.



Projekte des [SPP 1489](#)

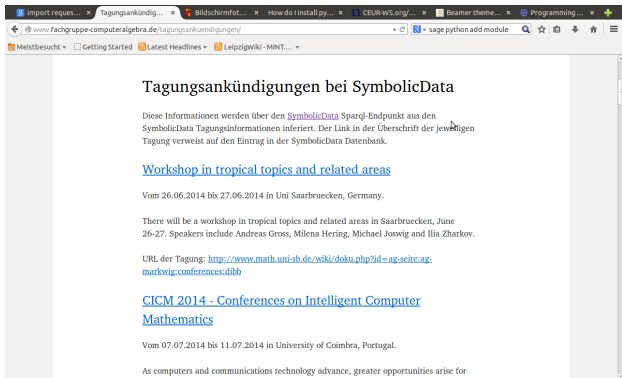
Die folgende Liste wird aus der [CASN Datenbasis](#) generiert.

Name	Projekt
<a href="#">Altmann, Klaus</a>	Exploiting torus actions in algebraic geometry
<a href="#">Barakat, Mohamed</a>	Constructive derived equivalences and equivariant vector bundles
<a href="#">Bartholdi, Laurent</a>	Algorithmic aspects of branch groups
<a href="#">Bley, Werner</a>	The Equivariant Tamagawa Number Conjecture for the base change of an abelian variety
<a href="#">Bouw, Irene</a>	L-functions and other arithmetic invariants of curves of genus greater than or equal to 3
<a href="#">Bouw, Irene</a>	Semistable reduction and wild quotient singularities
<a href="#">Bruns, Winfried</a>	Algorithms for rational cones and toric geometry
<a href="#">Buchmann, Johannes</a>	Algebraic-statistic attacks: Algorithms and tools
<a href="#">Buchmann, Johannes</a>	Improving and Combining Gröbner bases and SAT solving techniques for algebraic cvrntanalysis

# What is already done?

<http://symbolicdata.org/casn/UpcomingConferences/>

Information about upcoming CA conferences – 60 instances of RDF type `sd:Event`, compiled from different sources. Used as input for the printed version of the CA Rundbrief.



import reques... \* Tagungsankündig... \* Bildschirmfot... \* How do I install py... \* CEUR-WS.org... \* Beamer theme... \* Programming... \* +

www.fachgruppe-computeralgebra.de/tagungsankuendigungen/

Meistbesucht + Getting Started + Latest Headlines + LeipzigWiki - MINT... +

## Tagungsankündigungen bei SymbolicData

Diese Informationen werden über den [SymbolicData](#) Sparql-Endpunkt aus den SymbolicData Tagungsinformationen inferiert. Der Link in der Überschrift der jeweiligen Tagung verweist auf den Eintrag in der SymbolicData Datenbank.

### [Workshop in tropical topics and related areas](#)

Vom 26.06.2014 bis 27.06.2014 in Uni Saarbruecken, Germany.

There will be a workshop in tropical topics and related areas in Saarbruecken, June 26-27. Speakers include Andreas Gross, Milena Hering, Michael Joswig and Iliia Zharkov.

URL der Tagung: <http://www.math.uni-sb.de/wiki/doku.php?id=ag-seite:ag-markwig:conferences:dibb>

### [CICM 2014 - Conferences on Intelligent Computer Mathematics](#)

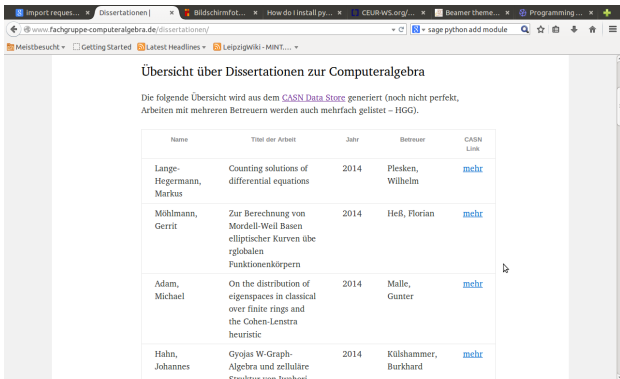
Vom 07.07.2014 bis 11.07.2014 in University of Coimbra, Portugal.

As computers and communications technology advance, greater opportunities arise for

# What is already done?

<http://symbolicdata.org/casn/Dissertationen/>

Information about dissertations in CA – 28 instances of RDF type `bibo:Thesis`, compiled from the CA Rundbrief.



The screenshot shows a web browser window with the URL `www.fachgruppe-computeralgebra.de/dissertationen/`. The page title is "Übersicht über Dissertationen zur Computeralgebra". Below the title, there is a note: "Die folgende Übersicht wird aus dem CASN Data Store generiert (noch nicht perfekt, Arbeiten mit mehreren Betreuern werden auch mehrfach gelistet – HGG)." Below this note is a table with five columns: Name, Titel der Arbeit, Jahr, Betreuer, and CASN Link. The table contains four rows of data.

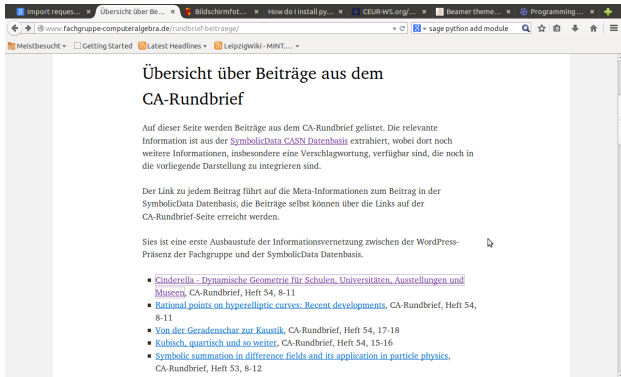
Name	Titel der Arbeit	Jahr	Betreuer	CASN Link
Lange-Hegermann, Markus	Counting solutions of differential equations	2014	Plesken, Wilhelm	<a href="#">mehr</a>
Möhlmann, Gerrit	Zur Berechnung von Mordell-Weil Basen elliptischer Kurven über globalen Funktionenkörpern	2014	Heß, Florian	<a href="#">mehr</a>
Adam, Michael	On the distribution of eigenspaces in classical over finite rings and the Cohen-Lenstra heuristic	2014	Malle, Gunter	<a href="#">mehr</a>
Hahn, Johannes	Gyojas W-Graph-Algebra und zelluläre Struktur von Twisted...	2014	Külshammer, Burkhard	<a href="#">mehr</a>



# What is already done?

<http://symbolicdata.org/casn/CAR-Beitraege/>

Information about articles in the CA Rundbrief – 75 instances of RDF type `sd:Reference` to be displayed at the website of the German Fachgruppe.



Übersicht über Beiträge aus dem  
CA-Rundbrief

Auf dieser Seite werden Beiträge aus dem CA-Rundbrief gelistet. Die relevante Information ist aus der [SymbolicData CASN Datenbasis](#) extrahiert, wobei dort noch weitere Informationen, insbesondere eine Verschlagwortung, verfügbar sind, die noch in die vorliegende Darstellung zu integrieren sind.

Der Link zu jedem Beitrag führt auf die Meta-Informationen zum Beitrag in der SymbolicData Datenbasis, die Beiträge selbst können über die Links auf der CA-Rundbrief-Seite erreicht werden.

Sies ist eine erste Ausbaustufe der Informationsvernetzung zwischen der WordPress-Präsenz der Fachgruppe und der SymbolicData Datenbasis.

- [Cinderella - Dynamische Geometrie für Schulen, Universitäten, Ausstellungen und Museen](#), CA-Rundbrief, Heft 54, 8-11
- [Rational points on hyperelliptic curves: Recent developments](#), CA-Rundbrief, Heft 54, 8-11
- [Von der Geradenschär zur Kaustik](#), CA-Rundbrief, Heft 54, 17-18
- [Kubisch, quartisch und so weiter](#), CA-Rundbrief, Heft 54, 15-16
- [Symbolic summation in difference fields and its application in particle physics](#), CA-Rundbrief, Heft 53, 8-12

## What is already done?

<http://symbolicdata.org/casn/News/>

A first approach to Annotated News – 2 instances of RDF types `sioc:BlogPost` and `bibo:Document` related to blog posts on the website of the German Fachgruppe.

No picture – pure harvesting functionality to be used with SPARQL querying.

## Links

- <http://symbolicdata.org> – the SD Wiki
- <http://symbolicdata.org/XMLResources> – the SD XML Resources
- <http://symbolicdata.org/RDFData> – the SD RDF Data Turtle Files
- <http://symbolicdata.org/Data> – the SD OntoWiki view on RDF data
- <https://github.com/symbolicdata> – the SD Repository at github