Relational Access Control with Bivalent Permissions in a Social Web/ Collaboration Architecture

Todd Davies and Mike D. Mintz

Symbolic Systems Program

Stanford University

http://deme.stanford.edu

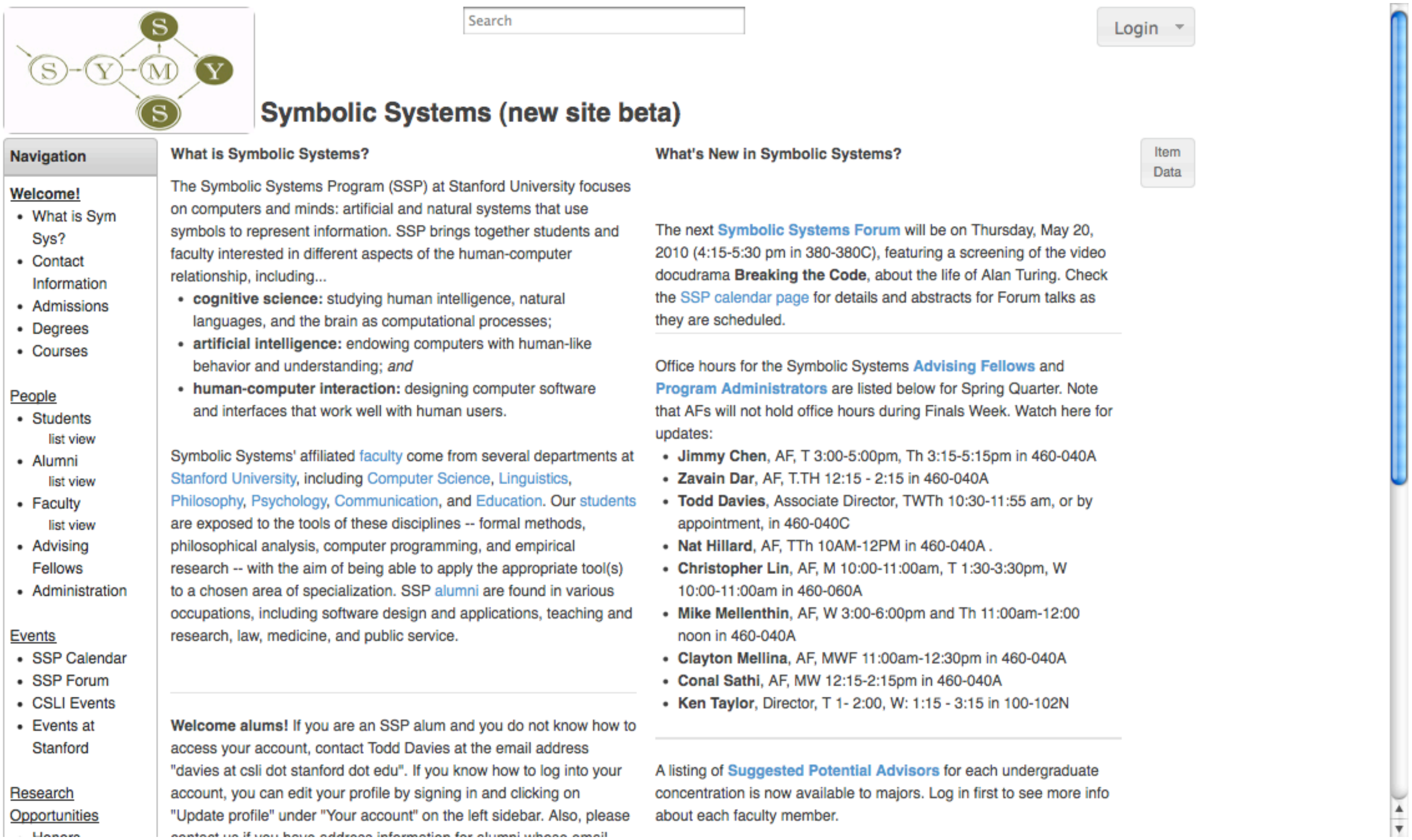
This paper is about

access control.

But we are not

specialists in access control research.

Deme with Anonymous user



Symbolic Systems (new site beta)

Navigation

Welcome!

- What is Sym Sys?
- Contact Information
- Admissions
- Degrees
- Courses

People

- Students
  - list view
- Alumni
  - list view
- Faculty
  - list view
- Advising Fellows
- Administration

Events

- SSP Calendar
- SSP Forum
- CSLI Events
- Events at Stanford

Research Opportunities

- Honors

What is Symbolic Systems?

The Symbolic Systems Program (SSP) at Stanford University focuses on computers and minds: artificial and natural systems that use symbols to represent information. SSP brings together students and faculty interested in different aspects of the human-computer relationship, including...

- **cognitive science:** studying human intelligence, natural languages, and the brain as computational processes;
- **artificial intelligence:** endowing computers with human-like behavior and understanding; *and*
- **human-computer interaction:** designing computer software and interfaces that work well with human users.

Symbolic Systems' affiliated faculty come from several departments at Stanford University, including Computer Science, Linguistics, Philosophy, Psychology, Communication, and Education. Our students are exposed to the tools of these disciplines -- formal methods, philosophical analysis, computer programming, and empirical research -- with the aim of being able to apply the appropriate tool(s) to a chosen area of specialization. SSP alumni are found in various occupations, including software design and applications, teaching and research, law, medicine, and public service.

Welcome alums! If you are an SSP alum and you do not know how to access your account, contact Todd Davies at the email address "davies at csli dot stanford dot edu". If you know how to log into your account, you can edit your profile by signing in and clicking on "Update profile" under "Your account" on the left sidebar. Also, please contact us if you have address information for alumni whose email

What's New in Symbolic Systems?

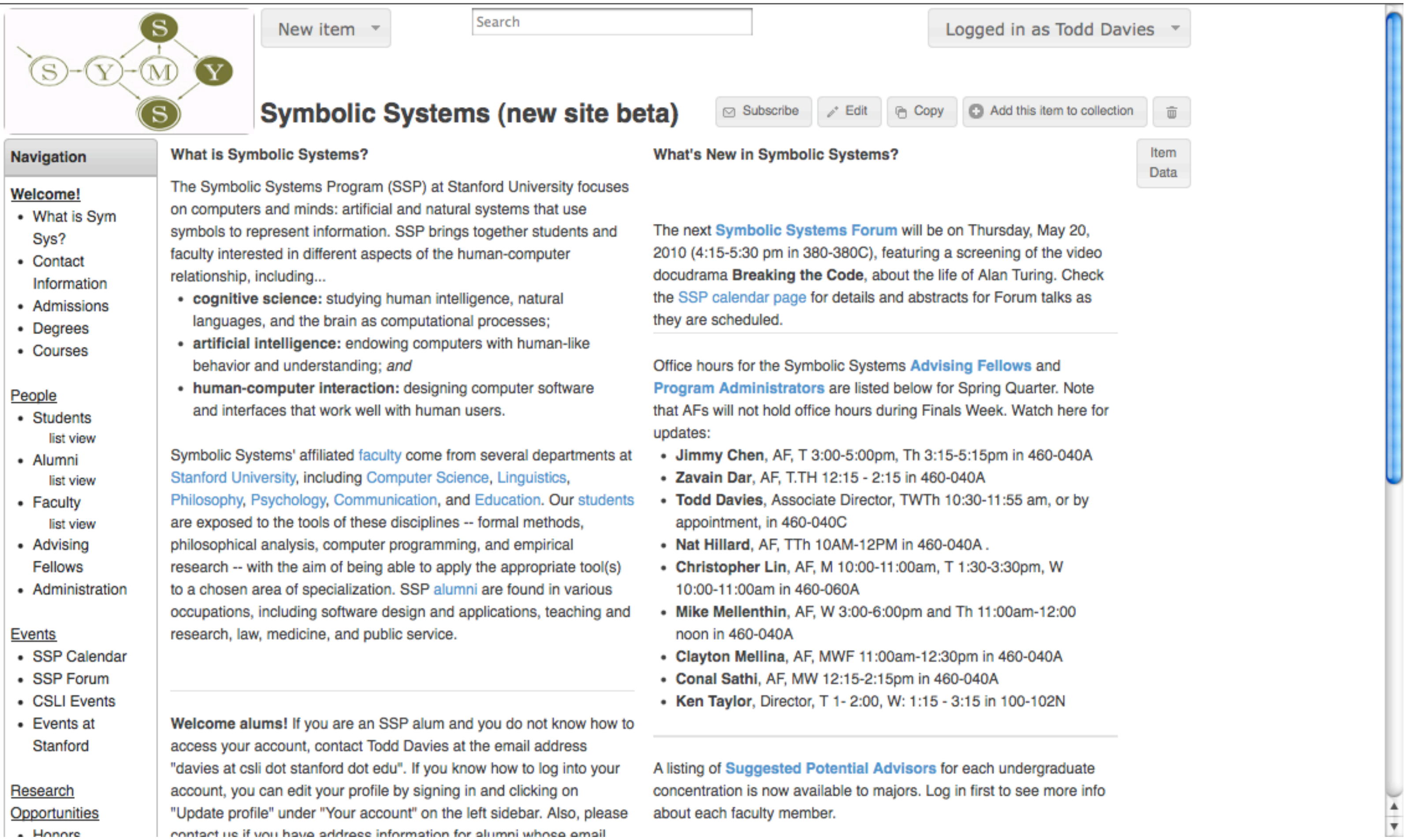
The next **Symbolic Systems Forum** will be on Thursday, May 20, 2010 (4:15-5:30 pm in 380-380C), featuring a screening of the video docudrama **Breaking the Code**, about the life of Alan Turing. Check the SSP calendar page for details and abstracts for Forum talks as they are scheduled.

Office hours for the Symbolic Systems **Advising Fellows** and **Program Administrators** are listed below for Spring Quarter. Note that AFs will not hold office hours during Finals Week. Watch here for updates:

- **Jimmy Chen**, AF, T 3:00-5:00pm, Th 3:15-5:15pm in 460-040A
- **Zavain Dar**, AF, T.TH 12:15 - 2:15 in 460-040A
- **Todd Davies**, Associate Director, TWTh 10:30-11:55 am, or by appointment, in 460-040C
- **Nat Hillard**, AF, TTh 10AM-12PM in 460-040A .
- **Christopher Lin**, AF, M 10:00-11:00am, T 1:30-3:30pm, W 10:00-11:00am in 460-060A
- **Mike Mellenthin**, AF, W 3:00-6:00pm and Th 11:00am-12:00 noon in 460-040A
- **Clayton Mellina**, AF, MWF 11:00am-12:30pm in 460-040A
- **Conal Sathi**, AF, MW 12:15-2:15pm in 460-040A
- **Ken Taylor**, Director, T 1- 2:00, W: 1:15 - 3:15 in 100-102N

A listing of **Suggested Potential Advisors** for each undergraduate concentration is now available to majors. Log in first to see more info about each faculty member.

Deme with logged in user



Symbolic Systems (new site beta)

Navigation

Welcome!

- What is Sym Sys?
- Contact Information
- Admissions
- Degrees
- Courses

People

- Students
  list view
- Alumni
  list view
- Faculty
  list view
- Advising Fellows
- Administration

Events

- SSP Calendar
- SSP Forum
- CSLI Events
- Events at Stanford

Research Opportunities

- Honors

What is Symbolic Systems?

The Symbolic Systems Program (SSP) at Stanford University focuses on computers and minds: artificial and natural systems that use symbols to represent information. SSP brings together students and faculty interested in different aspects of the human-computer relationship, including...

- **cognitive science:** studying human intelligence, natural languages, and the brain as computational processes;
- **artificial intelligence:** endowing computers with human-like behavior and understanding; *and*
- **human-computer interaction:** designing computer software and interfaces that work well with human users.

Symbolic Systems' affiliated faculty come from several departments at Stanford University, including Computer Science, Linguistics, Philosophy, Psychology, Communication, and Education. Our students are exposed to the tools of these disciplines -- formal methods, philosophical analysis, computer programming, and empirical research -- with the aim of being able to apply the appropriate tool(s) to a chosen area of specialization. SSP alumni are found in various occupations, including software design and applications, teaching and research, law, medicine, and public service.

Welcome alums! If you are an SSP alum and you do not know how to access your account, contact Todd Davies at the email address "davies at csli dot stanford dot edu". If you know how to log into your account, you can edit your profile by signing in and clicking on "Update profile" under "Your account" on the left sidebar. Also, please contact us if you have address information for alumni whose email

What's New in Symbolic Systems?

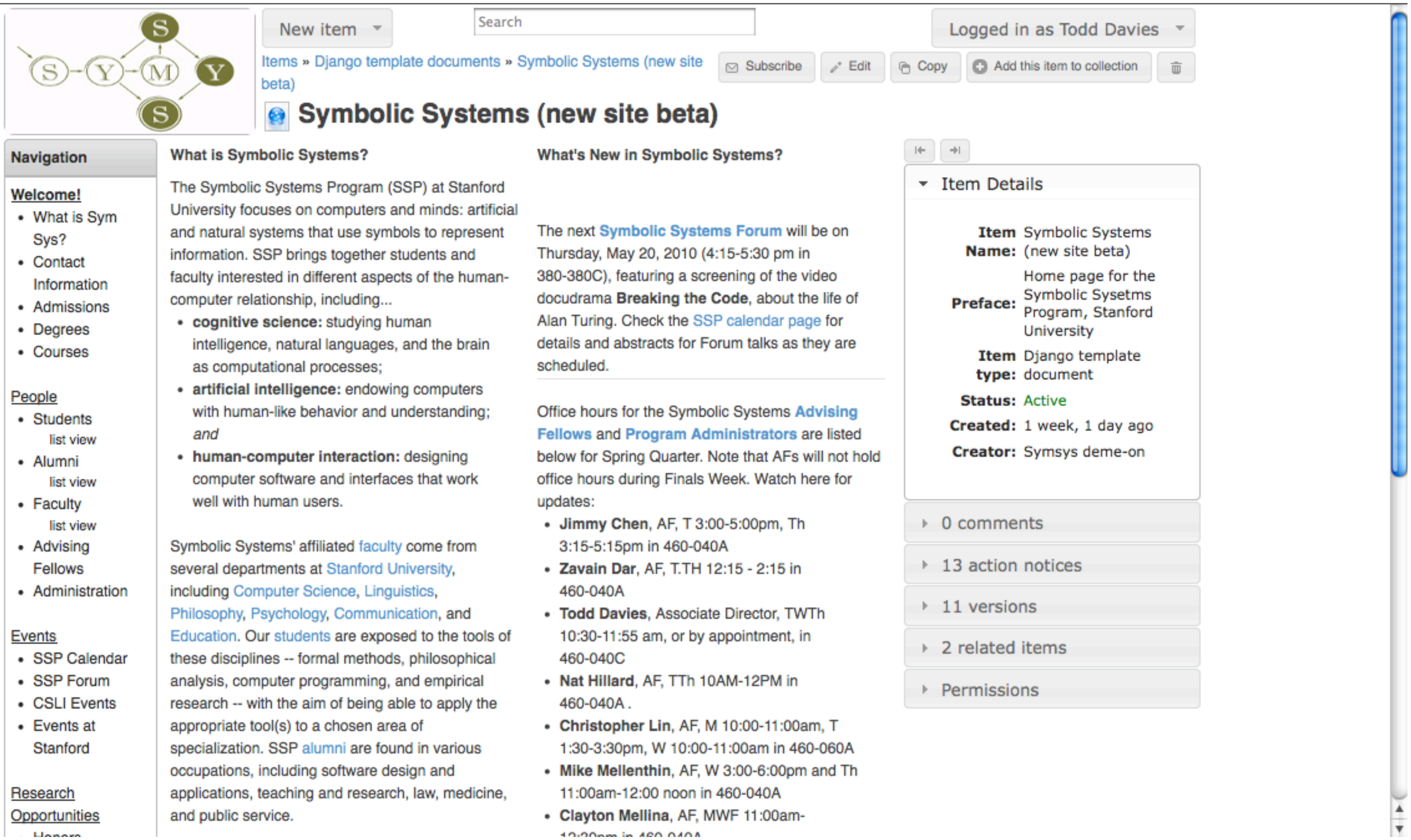
The next **Symbolic Systems Forum** will be on Thursday, May 20, 2010 (4:15-5:30 pm in 380-380C), featuring a screening of the video docudrama **Breaking the Code**, about the life of Alan Turing. Check the SSP calendar page for details and abstracts for Forum talks as they are scheduled.

Office hours for the Symbolic Systems **Advising Fellows** and **Program Administrators** are listed below for Spring Quarter. Note that AFs will not hold office hours during Finals Week. Watch here for updates:

- **Jimmy Chen**, AF, T 3:00-5:00pm, Th 3:15-5:15pm in 460-040A
- **Zavain Dar**, AF, T.TH 12:15 - 2:15 in 460-040A
- **Todd Davies**, Associate Director, TWTh 10:30-11:55 am, or by appointment, in 460-040C
- **Nat Hillard**, AF, TTh 10AM-12PM in 460-040A .
- **Christopher Lin**, AF, M 10:00-11:00am, T 1:30-3:30pm, W 10:00-11:00am in 460-060A
- **Mike Mellenthin**, AF, W 3:00-6:00pm and Th 11:00am-12:00 noon in 460-040A
- **Clayton Mellina**, AF, MWF 11:00am-12:30pm in 460-040A
- **Conal Sathi**, AF, MW 12:15-2:15pm in 460-040A
- **Ken Taylor**, Director, T 1- 2:00, W: 1:15 - 3:15 in 100-102N

A listing of **Suggested Potential Advisors** for each undergraduate concentration is now available to majors. Log in first to see more info about each faculty member.

Deme with item data


S
S
Y
M
Y
S
New item
Search
Logged in as Todd Davies
Items » Django template documents » Symbolic Systems (new site beta)
Subscribe
Edit
Copy
Add this item to collection

Symbolic Systems (new site beta)

Navigation

Welcome!
- What is Sym Sys?
- Contact Information
- Admissions
- Degrees
- Courses

People
- Students
  list view
- Alumni
  list view
- Faculty
  list view
- Advising Fellows
- Administration

Events
- SSP Calendar
- SSP Forum
- CSLI Events
- Events at Stanford

Research Opportunities
- Honors

What is Symbolic Systems?

The Symbolic Systems Program (SSP) at Stanford University focuses on computers and minds: artificial and natural systems that use symbols to represent information. SSP brings together students and faculty interested in different aspects of the human-computer relationship, including...

- **cognitive science:** studying human intelligence, natural languages, and the brain as computational processes;
- **artificial intelligence:** endowing computers with human-like behavior and understanding; *and*
- **human-computer interaction:** designing computer software and interfaces that work well with human users.

Symbolic Systems' affiliated faculty come from several departments at Stanford University, including Computer Science, Linguistics, Philosophy, Psychology, Communication, and Education. Our students are exposed to the tools of these disciplines -- formal methods, philosophical analysis, computer programming, and empirical research -- with the aim of being able to apply the appropriate tool(s) to a chosen area of specialization. SSP alumni are found in various occupations, including software design and applications, teaching and research, law, medicine, and public service.

What's New in Symbolic Systems?

The next **Symbolic Systems Forum** will be on Thursday, May 20, 2010 (4:15-5:30 pm in 380-380C), featuring a screening of the video docudrama **Breaking the Code**, about the life of Alan Turing. Check the SSP calendar page for details and abstracts for Forum talks as they are scheduled.

Office hours for the Symbolic Systems **Advising Fellows** and **Program Administrators** are listed below for Spring Quarter. Note that AFs will not hold office hours during Finals Week. Watch here for updates:

- **Jimmy Chen**, AF, T 3:00-5:00pm, Th 3:15-5:15pm in 460-040A
- **Zavain Dar**, AF, T.TH 12:15 - 2:15 in 460-040A
- **Todd Davies**, Associate Director, TWTh 10:30-11:55 am, or by appointment, in 460-040C
- **Nat Hillard**, AF, TTh 10AM-12PM in 460-040A .
- **Christopher Lin**, AF, M 10:00-11:00am, T 1:30-3:30pm, W 10:00-11:00am in 460-060A
- **Mike Mellenthin**, AF, W 3:00-6:00pm and Th 11:00am-12:00 noon in 460-040A
- **Clayton Mellina**, AF, MWF 11:00am-12:30pm in 460-040A

Item Details

Item Name:	Symbolic Systems (new site beta)
Preface:	Home page for the Symbolic Systetms Program, Stanford University
Item type:	Django template document
Status:	Active
Created:	1 week, 1 day ago
Creator:	Symsys deme-on

- 0 comments
- 13 action notices
- 11 versions
- 2 related items
- Permissions

Deme aims to mirror the structure of real world groups.

Deme…

aims to merge

collaborative production, document-centered discussion, and group decision making

with

content management, social networking, data sharing and portability, and user control

Deme’s technical orientation

End-user OOP/extensible content management

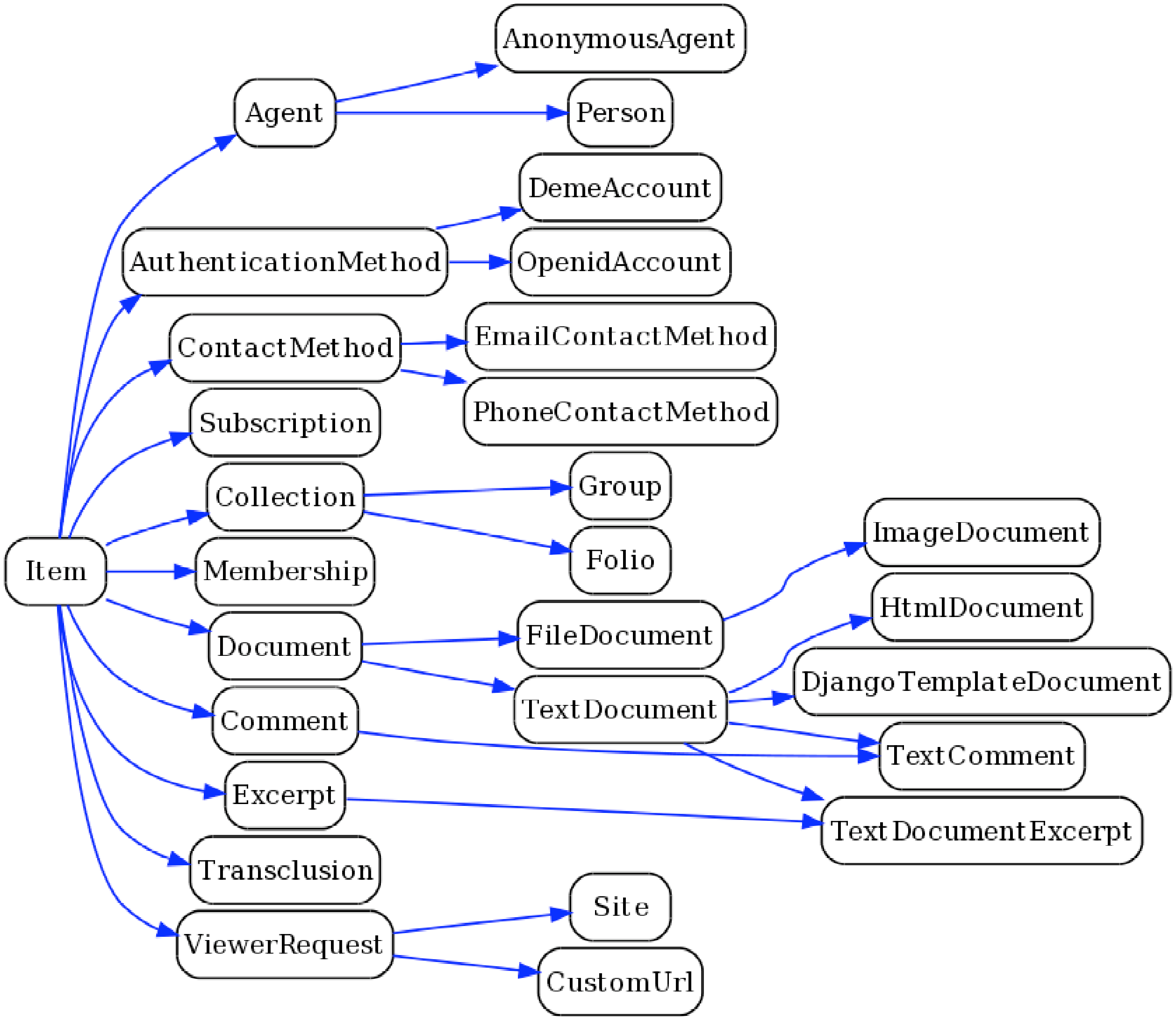
Content type inheritance

The Django web app framework

- Object-relational mapping
- Model-view code separation

Standard relational practice (no complex data structures in db cells)

Deme architecture (see IWWOST '09 paper)



Access control has evolved...

Old, discretionary access control (DAC) model:

- Files with single owners, users
- Permissions stored with user as capabilities; or with file as an access control list (ACL)

Role-based access control (RBAC) adds:

- Permissions for roles
- Support for finer grain control (e.g. fields of a database record)

An emerging paradigm for the social Web:

Relational access control (RAC)

- access control rules (ACRs) stored separately from both subject and object
- allows very flexible specification of rules as a relation between subject, object, ability, and sign (positive and negative permissions)
- subjects can be groups of users; objects can be collections of objects
- rules can be subjects of further rules
- developed in depth in theoretical work on XML access control (especially by Dongwon Lee et al.)

ACRs may be stored...

as a set of rules in a language for specifying ACRs;

or

as first-class relation objects in the same database as the objects/subjects of permissions

(relation object access control - ROAC)

ROAC versus ACMs

In an access control matrix (ACM), rows are subjects and columns are objects, and the permission is defined at each cell

In a ROAC database, each permission is its own row; columns are the fields of the permission, which is a relation object

Some advantages of ROAC

Integrates permissions within database, so that code designed to interact with objects can access permissions/ACRs as well

Allows permissions to be searched and discussed more easily

Allows dynamic referencing through pointing

Allows end users to modify permissions within the normal UI

BROAC - *Bivalent* relation object access control

Traditional permissions are positive only - no distinction between absence of permission and prohibition

Bivalent permissions may be positive or negative

Bivalent permissions are useful for representing conflicts in permissions, e.g. a personnel staff member who would otherwise have access to their own interview file

Some characteristics of social Web/collaboration environments

Objects (photos, webpages, comments, etc.) can be tagged/labeled into multiple overlapping categories, with competing indications of permission

Users can be members of multiple overlapping groups

Groups can have positive, negative, or unspecified permissions

Deme permissions

Principles:

1. A permission is a relation between a subject, an object, an ability, and a sign
2. Closed world assumption - if no relevant permission exists between a subject and an object, subject does not have that ability
3. Precendence:
   - More specific has precedence over less specific
   - Subject specificity has precedence over object specificity
   - Negative has precedence over positive

Practicalities: in *Deme*, you...

can specify a permission through membership in a collection (RecursiveMembership)

cannot specify competing permissions differing only in sign

cannot specify precedence between groups or collections

Precedence by permission types in *Deme*

			Object	
		Item	*Collection*	*All Items*
	Agent	One To One (**1**)	One To Some (**2**)	One To All (**3**)
Subject	*Group*	Some To One (**4**)	Some To Some (**5**)	Some To All (**6**)
	All Agents	All To One (**7**)	All To Some (**8**)	All To All (**9**)

Conflict Resolution in Deme - examples

Example 1. The executive director of a nongovernmental organization, who is hired and supervised by the NGO's board of directors, has access to most board documents as a member of the board's Group, but does not have access to those documents related to the board's deliberations over the executive director himself. The board's Group permission for reading its Folio is positive for the Collection of executive director hiring and review documents. The executive director's Agent permission for reading this Collection is negative. The latter (negative) permission has precedence. *2(-) defeats 5(+).*

Conflict Resolution in Deme - examples

Example 2. Each student has access to their own transcript, but not to those of other students. The Group of students has a negative permission for reading a student's transcript. But a student's Agent permission is positive for reading their own transcript. The latter (positive) permission has precedence. *1(+) defeats 4(-)*.

Conflict Resolution in Deme - examples

Example 3. A student is a programmer for an academic program, and also a member of the staff Group as well as the Group of students. The staff Group has a positive permission for reading student intern applications. The students Group has a negative permission for reading intern applications. The latter (negative) permission has precedence, reflecting a policy that students cannot view transcripts of other students, regardless of their staff status. *5(-) defeats 5(+).*

For more info...

http://deme.stanford.edu

Sites powered by Deme:

- http://symsys.stanford.edu
- http://odbook.stanford.edu
- http://mindroll.org