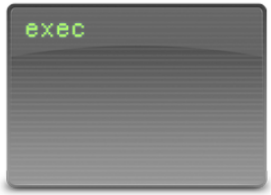
A Lightweight Platform for Logging, Analyzing, and Visualizing Experimental Data

Outline

- Motivation
- Functional Requirements
  - Proprietary, Text, DBMS
- Speedy
  - Approach
  - System
  - Evaluation
  - Future Work

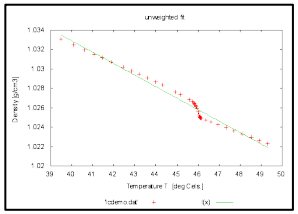
Motivation: Empirical Study

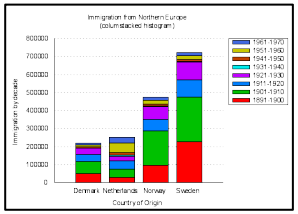


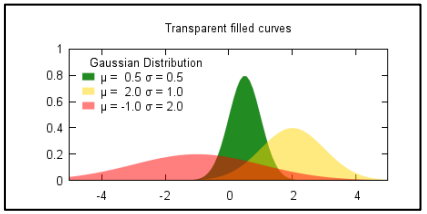
Producer

Data

Analysis







Name	Thread pitch (mm)	Minor diameter tolerance	Nominal diameter (mm)	Head shape	Price for 50 screws	Available at factory outlet?	Number in stock	Flat or Phillips head?
M4	0.7	4g	4	Pan	$10.08	Yes	276	Flat
M5	0.8	4g	5	Round	$13.89	Yes	183	Both
M6	1	5g	6	Button	$10.42	Yes	1043	Flat
M8	1.25	5g	8	Pan	$11.98	No	298	Phillips
M10	1.5	6g	10	Round	$16.74	Yes	488	Phillips
M12	1.75	7g	12	Pan	$18.26	No	998	Flat
M14	2	7g	14	Round	$21.19	No	235	Phillips
M16	2	8g	16	Button	$23.57	Yes	292	Both
M18	2.1	8g	18	Button	$25.87	No	664	Both
M20	2.4	8g	20	Pan	$29.09	Yes	486	Both
M24	2.55	9g	24	Round	$33.01	Yes	982	Phillips
M28	2.7	10g	28	Button	$35.66	No	1067	Phillips
M36	3.2	12g	36	Pan	$41.32	No	434	Both
M50	4.5	15g	50	Pan	$44.72	No	740	Flat

Issues

- One-off data format and analysis
  - Difficult to change, maintain, and share
- Time-consuming to write, verify, and run

Functional Requirements

Logging	Storage	Analysis
General	General	General
Platform-Independent	Platform-Independent	Platform-Independent
Easy	Reusable	Easy
Efficient/Scalable	Efficient/Scalable	Reusable
	Mobile/Collaborative/ Accessible	Efficient/Scalable
		Reliable/Verifiable
		Incremental
		Mobile/Collaborative/ Accessible

Evaluation: Proprietary

Logging	Storage	Analysis
General	**General**	**General**
Platform-Independent	**Platform-Independent**	**Platform-Independent**
Easy	**Reusable**	Easy
Efficient/Scalable	**Efficient/Scalable**	**Reusable**
	Mobile/Collaborative/ Accessible	**Efficient/Scalable**
		Reliable/Verifiable
		Incremental
		Mobile/Collaborative/ Accessible

Evaluation: Text

Logging (Standard Out)	Storage (Files)	Analysis (Custom)
General	General	General
Platform-Independent	**Platform-Independent**	Platform-Independent
Easy	**Reusable**	**Easy**
Efficient/Scalable	Efficient/Scalable	**Reusable**
	Mobile/Collaborative/ Accessible	**Efficient/Scalable**
		Reliable/Verifiable
		Incremental
		Mobile/Collaborative/ Accessible

Evaluation: DBMS

Logging (SQL)	Storage (Relational)	Analysis (SQL+Custom)
General	General	General
Platform-Independent	Platform-Independent	**Platform-Independent**
Easy	Reusable	**Easy**
Efficient/Scalable	Efficient/Scalable	Reusable
	Mobile/Collaborative/ Accessible	Efficient/Scalable
		Reliable/Verifiable
		Incremental
		Mobile/Collaborative/ Accessible

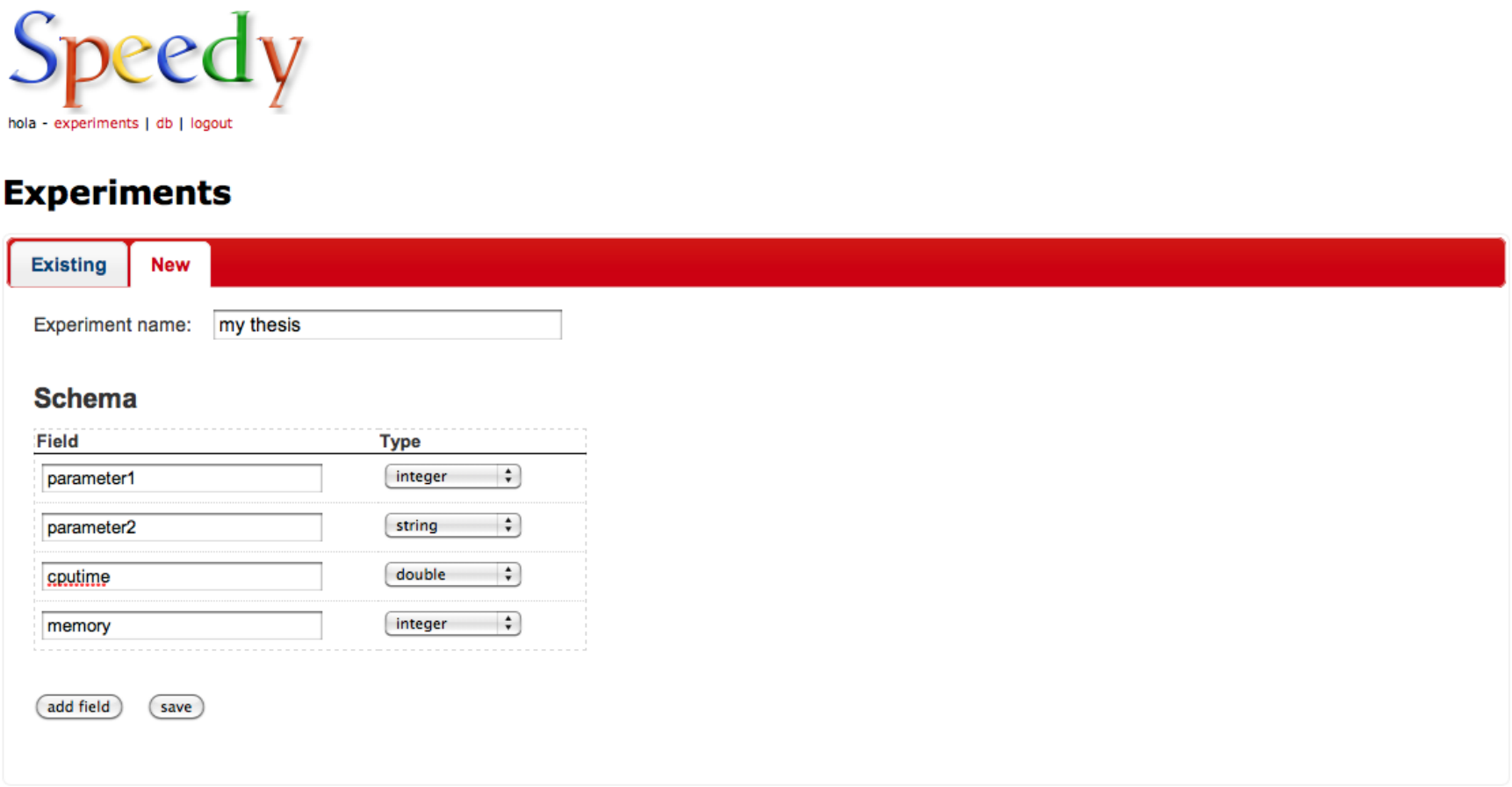
Speedy: Approach

- Supplement DBMS with web-based functions
  - Schema design
  - Data entry/management
  - Analysis
    - Querying
    - Visualization

Speedy: System

- Model
  - Datum: set(key/value pairs)
    - Value is integer, double, or string
  - Experiment: bag(datum) with fixed keys & types (schema)
- Mechanism: URL
  - Universality and portability of text, structure of underlying DBMS
  - Web front-end to facilitate complex operations
    - Can fall back to SQL+scripting (with useful libraries)

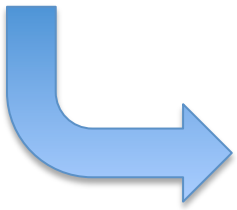
Speedy: Schema Design



Speedy: Data Entry

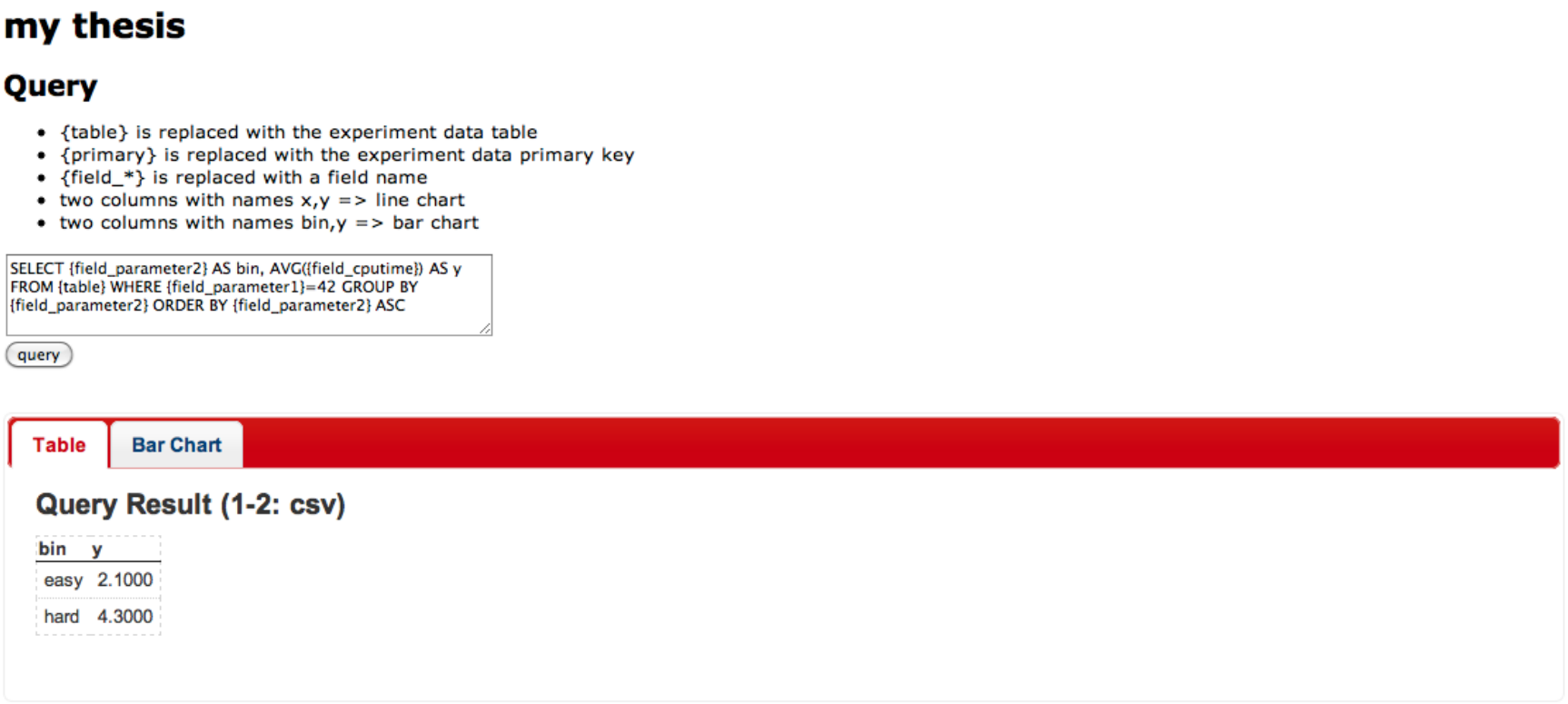
10: my thesis, 0 (view, modify)

Field	Type	
parameter1	integer	42
parameter2	string	hard
cputime	double	4.3
memory	integer	2048
		add

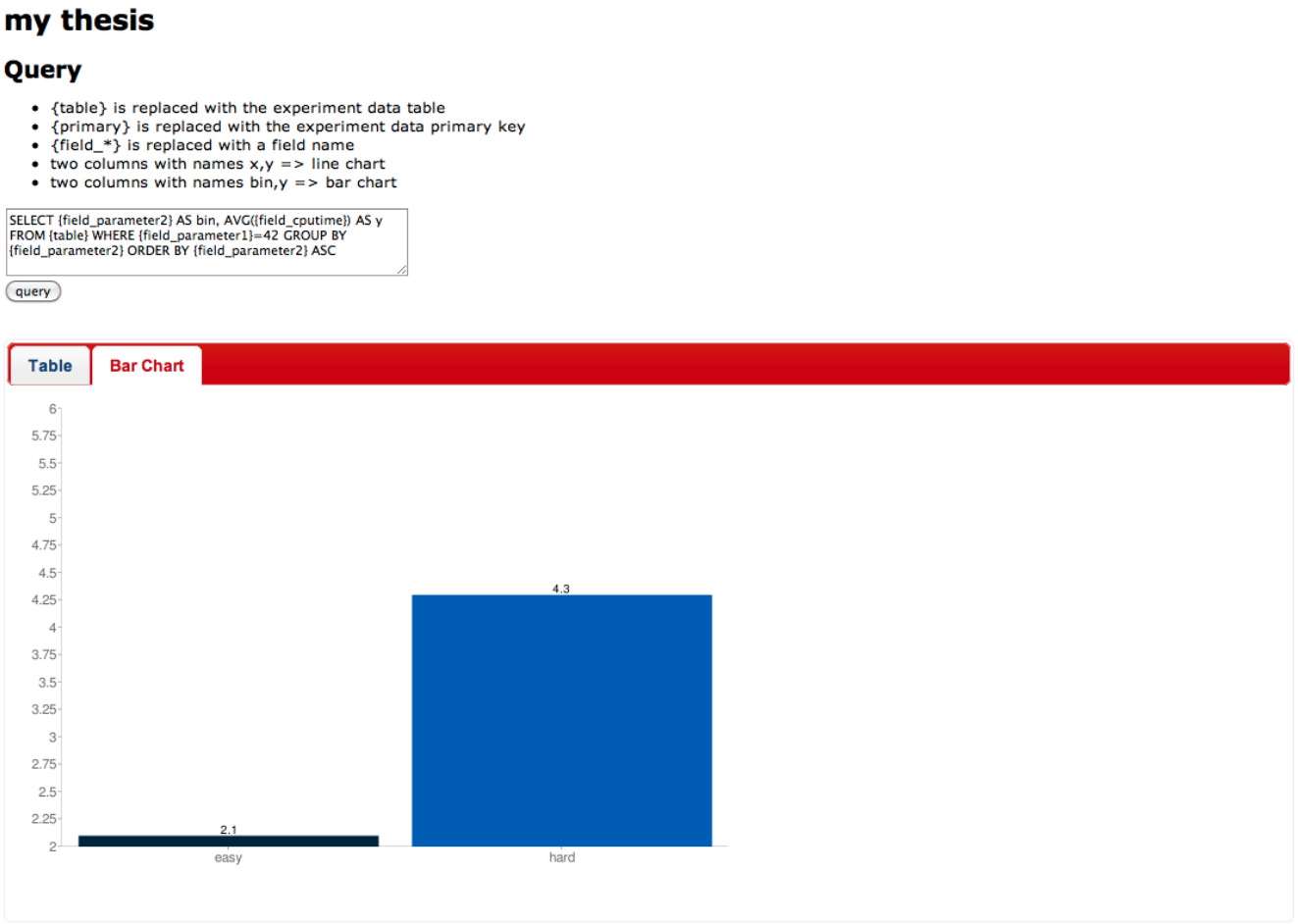


http://host/path/experiments.php?
cmd=data&
exp_id=10&
parameter1=42&
parameter2=hard&
cputime=4.3&
memory=2048

Speedy: Querying



Speedy: Visualization

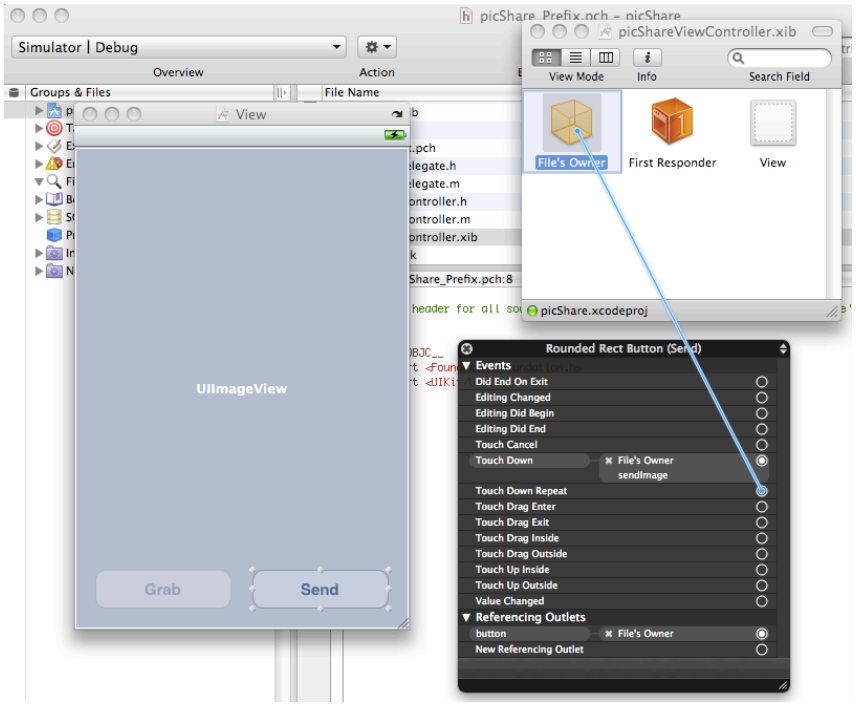


Speedy

Logging (URL)	Storage (Relational)	Analysis (Forms/SQL+Custom)
General	General	General
Platform-Independent	Platform-Independent	Platform-Independent
Easy	Reusable	**Easy**
Efficient/Scalable	Efficient/Scalable	Reusable
	Mobile/Collaborative/ Accessible	Efficient/Scalable
		Reliable/Verifiable
		Incremental
		Mobile/Collaborative/ Accessible

Future Work

- UI for specifying and saving complex queries
  - Amend model to support "stored procedures"
  - Some intelligence for query-specific indexes
- UI for connecting query outputs to visualization inputs
- UI for specifying data privacy/security policies



Thanks :)

- Speedy is freely available at…
  - http://soar.googlecode.com
    - svn/trunk/speedy
    - BSD
  - Example data & reports
  - Publication script to convert stdin to URLs