FluidDB

Design ▻ Architecture ▻ Tradeoffs

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Or...

How someone
who knows nothing about databases
started building a database

Early days

- FluidDB is not yet released
- It's an experiment
- Much remains to be done
- Alpha release *real soon now* (end of June?)

Fluidinfo

- Founded in the UK in March 2006
- Two full-time employees
- Development in Barcelona
- Friends, family, & Esther Dyson funded

Motivations

- How humans work with information: Concepts
- User interface and API difficulties / restrictions
- Personalization
- Make the world more writable

Concepts

Are not owned
No formal structure
No permission is needed
Partial or full disorganization
No predefined set of qualities
No special central piece of content
Easy to reorganize or multiply organize

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To engineer this kind of flexibility,
we must rethink control

UIs and APIs

- Where did my information go?
- Can I extract, re-use, add, delete?
- Is there an API?
- What am I allowed to do?
- Can I search? On what?
- Special pleading
- Wouldn't it be cool if...

Personalization

In our hands vs on our behalf

- Add anything to anything, and search on it
- Protect, share, delete as you wish
- Organize things as you please
- Freedom of choice in applications

Read ▻ Search ▻ Write ?

- The web is readable (c. 1990)
- And searchable (c. 1995)
- But not generally writable

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- Plus, search is not very interactive:
  - Dull: refine query or ask for more results
  - Can't change results
  - Can't organize

Why don't our architectures let us work with information more flexibly?

What would it take
to build something that did?

How can we address all these problems at once ?

Alan Kay

At PARC we had a slogan: "Point of view is worth 80 IQ points." It was based on a few things from the past like how smart you had to be in Roman times to multiply two numbers together; only geniuses did it.

We haven't gotten any smarter, we've just changed our representation system. We think better generally by inventing better representations; that's something that we as computer scientists recognize as one of the main things that we try to do.

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1	1
2	10
4	100
8	1000
16	10000
32	100000
64	1000000
128	10000000
256	100000000
512	1000000000
1024 +	10000000000 +
??????	11111111111

VIII

XVII

XLIV

LXXX

XCVI

CCLV

VIII

XVII

XLIV

LXXX

XCVI

CCLV +

VIII

XVII

XLIV

LXXX

XCVI

CCLV +

D

VIII

XVII

XLIV

LXXX

XCVI

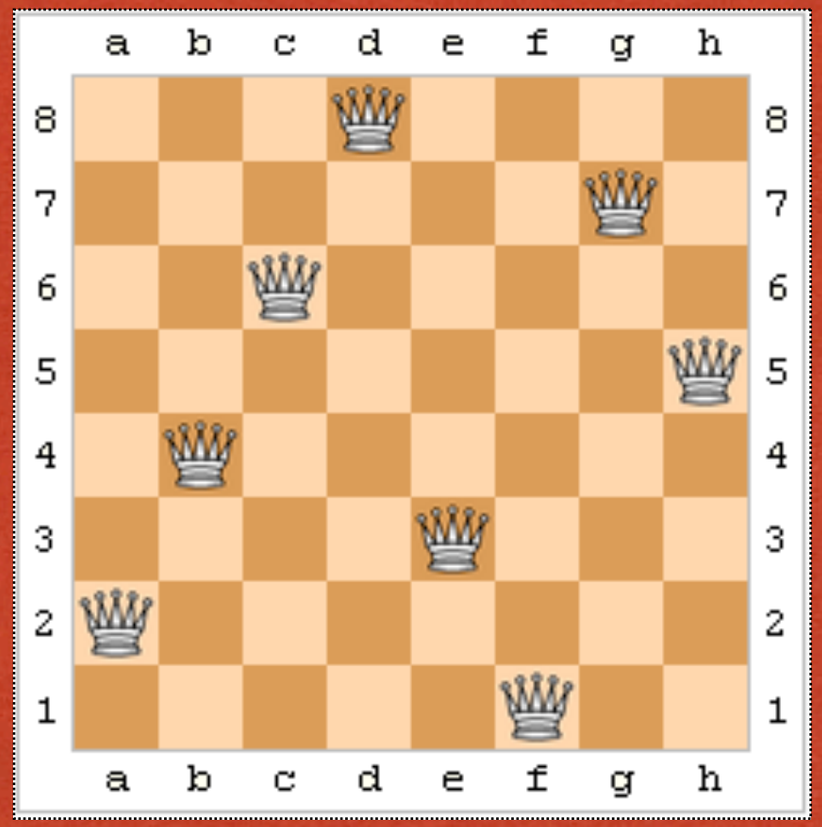
CCLV +

D

8 queens problem

Use a poor representation with 2^{64} (281,474,976,710,656) states:

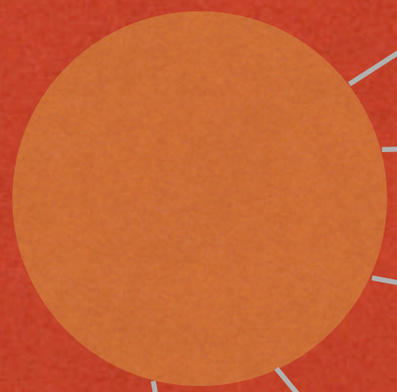
Look for a smart algorithm!



Or...

Use a good representation with 8! (40,320) states and exhaustive search as an algorithm!

Objects



digg.com/date May 21, 2009

meg/web/rating 6

tim/seen true

about http://digg.com/news.html

mike/opinion “half-baked nonsense”

What else?

- Objects have no owner, though attributes do
- No metadata/data duality
- Unlimited aggregation & combination of information
- No a priori organization
- Search, search, search!
- Dynamic data structures

FluidDB

- Objects composed of attributes with values
- Attributes in namespaces: *joe/rating*, *amazon.com/price*
- Simple query language
- Simple API: HTTP, JSON, REST etc.
- Users, attributes, namespaces each have an object
- Applications are users too

FluidDB

- Single-instance hosted database (like SimpleDB)
- Enables *sharing* between applications, people
- Distributed storage and query processing

Design goals

- Simple data model
- Simple permissions model
- Simple, easily parallelizable, query language
- Horizontally scalable
- Fast for common tasks
- Implementable!

Permissions

- For each action on a namespace or attribute:
  - There's a policy: 'open' or 'closed'
  - And a (possibly empty) list of exceptions

Permissions

attribute or namespace	action	policy	exceptions
tim/seen	read	closed	tim, meg
mike/opinion	update	open	
mike/	create	closed	mike
meg/rating	see	open	
meg/rating	read	closed	meg

Query language

Numeric: attribute value (=, <, etc.)

Textual: attribute text match

Presence: has attribute

Grouping/logic: (...), and, or, not

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Designed to bring back object ids

Demo

Data buffet

- username seen, lastvisited, rating, goingtoread, comment
- username me, FBfriend, linkedInContact, met, family
- username/myusername name, password
- flickr.com longitude, latitude, owner, date, camera/make
- username/flickr title, description
- VCspotter fredwilson, bradburnham
- nasdaq.com name, symbol, type, outstanding, value, price
- username/stocks shares, date
- google.com pagerank
- tracks album, artist, name, year
- username/music count, favorite, lastPlay, stars, bestOf2007

Data buffet 2

- email messageId, fromId, toId
- username/email from, to, subject, date
- alexa.com rank
- digg.com title, description, date, diggs
- mahalo.com appeared, category
- readwriteweb.com appeared
- reddit.com date, score
- techcrunch.com appeared, URI
- attribute description, name, path
- namespace description, name, path

Example queries

- terry/rating > 5 and has reddit.com/score
- has goingtoread and seen > "January 1, 2008"
- has FBfriend and has linkedInContact
- has james/FBfriend and not has anne/FBfriend
- alexa.com/rank < 50 and fred/comment ~ cool
- has reddit.com/score and not has digg.com/diggs
- has readwriteweb.com/appeared and not has techcrunch.com/appeared

More queries

- terry/seen > "July 1, 2007"
- has russell/myusername/name and not has terry/myusername/name
- flickr.com/latitude > 52.15 and flickr.com/latitude < 52.35 and flickr.com/camera/make ~ Sony and has sally/seen
- amazon.com/stars > 3 and amazon.com/price < 20 and amazon.com/title ~ chess and peter/bookrating > 3 sort by amazon.com/publication-date

Architecture

- Permissions
- Software
- Communications
- Functional
- Storage
- Query processing
- Per box

Twisted

- Asynchronous Python libraries
- We're using Python because of Twisted
- Event-driven, using deferreds with callbacks
- Steep learning curve, documentation is patchy

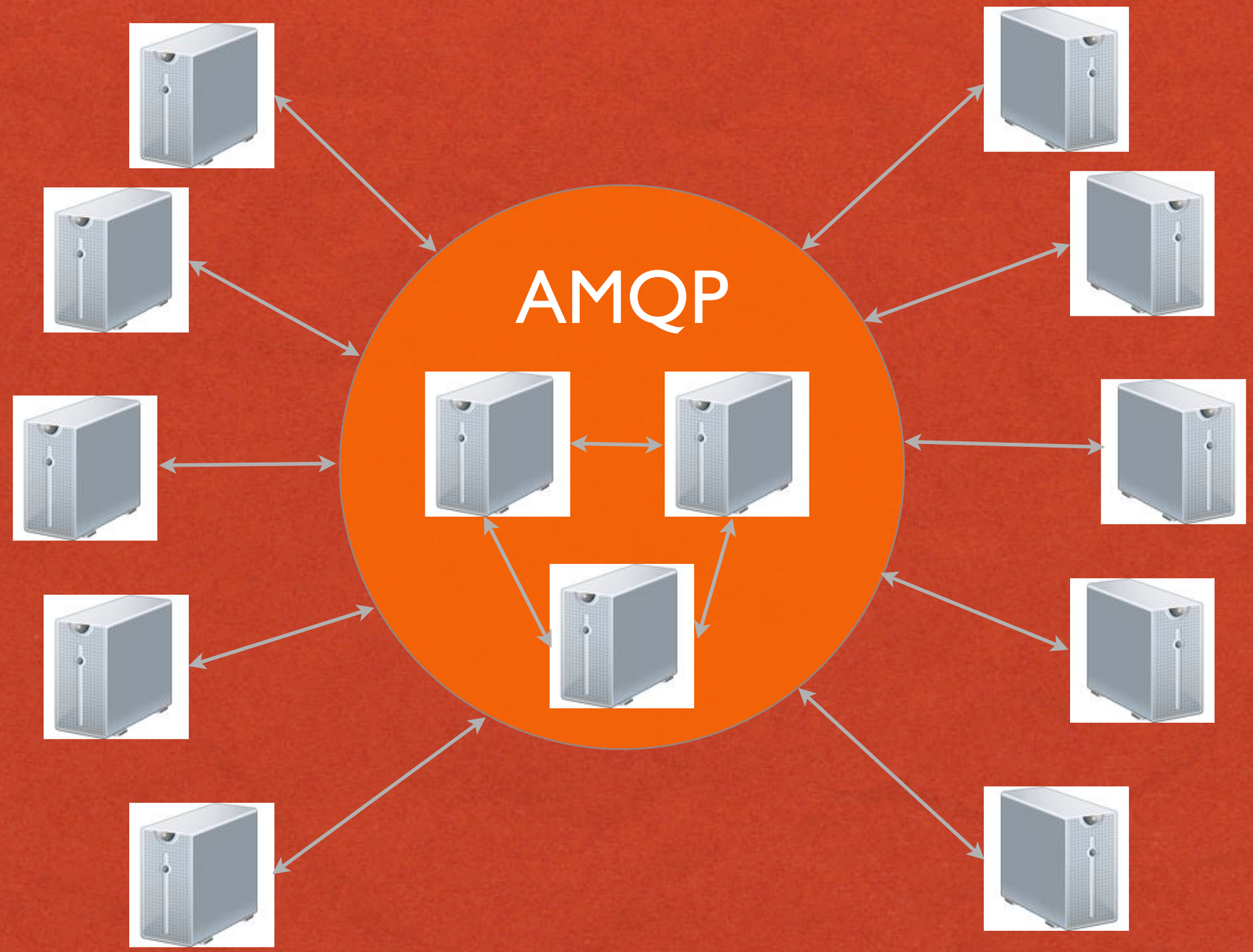
AMQP

- Standardized, high perfomance messaging
- Backed by JP Morgan, Novell, MS, Redhat
- Fully asynchronous, up to 600K messages/sec
- Exchanges, queues, bindings
- We released txAMQP

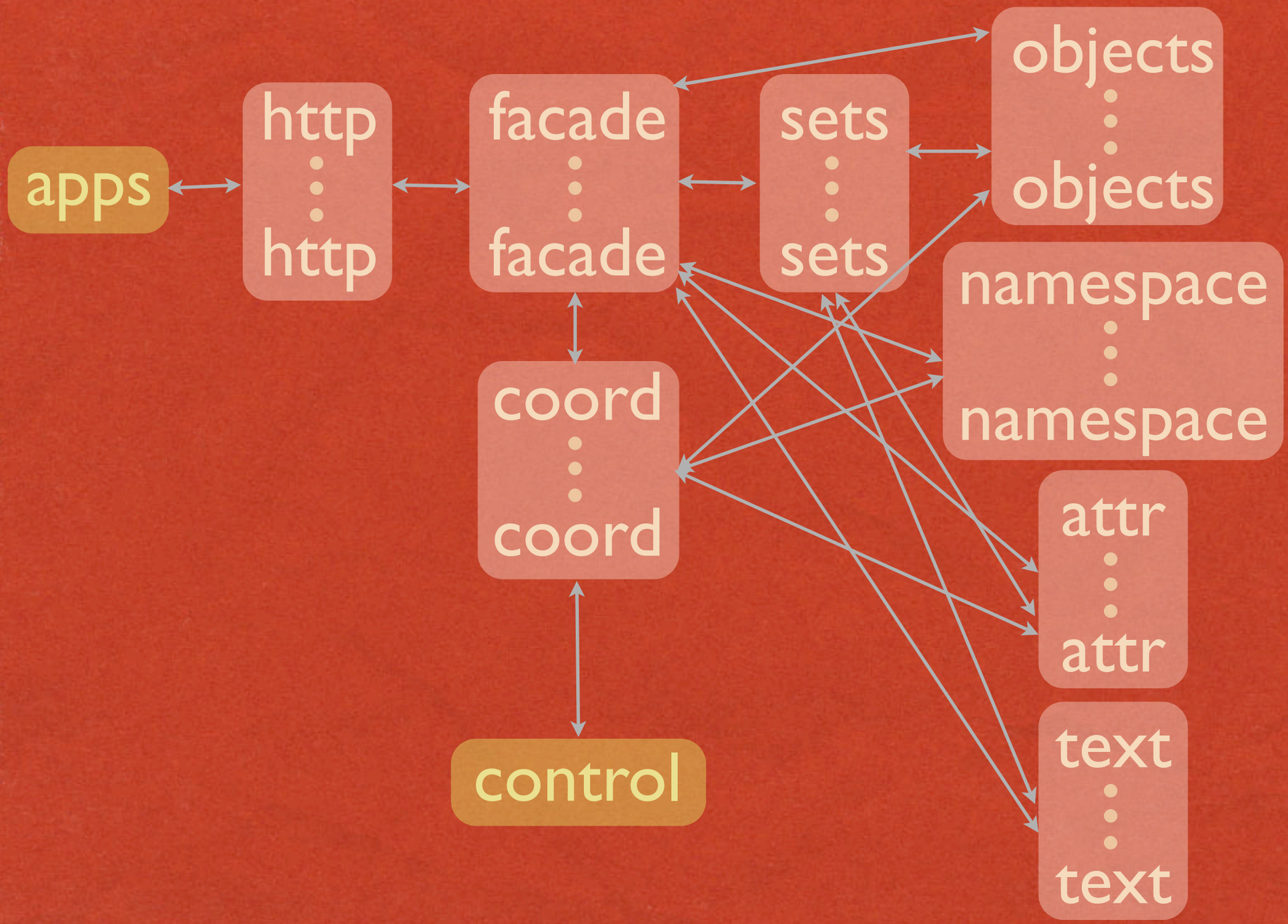
Thrift

- Released by Facebook
- Serialization of structures
- Definition of services
- RPC
- We released txThrift

Communications



Functional


apps
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attr
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text
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coord
coord
control

Functional

http ⋮ http

facade ⋮ facade

sets ⋮ sets

objects ⋮ objects

namespace ⋮ namespace

coord ⋮ coord

attr ⋮ attr

text ⋮ text

Functional

http ⋮ http

facade ⋮ facade

sets ⋮ sets

objects ⋮ objects

namespace ⋮ namespace

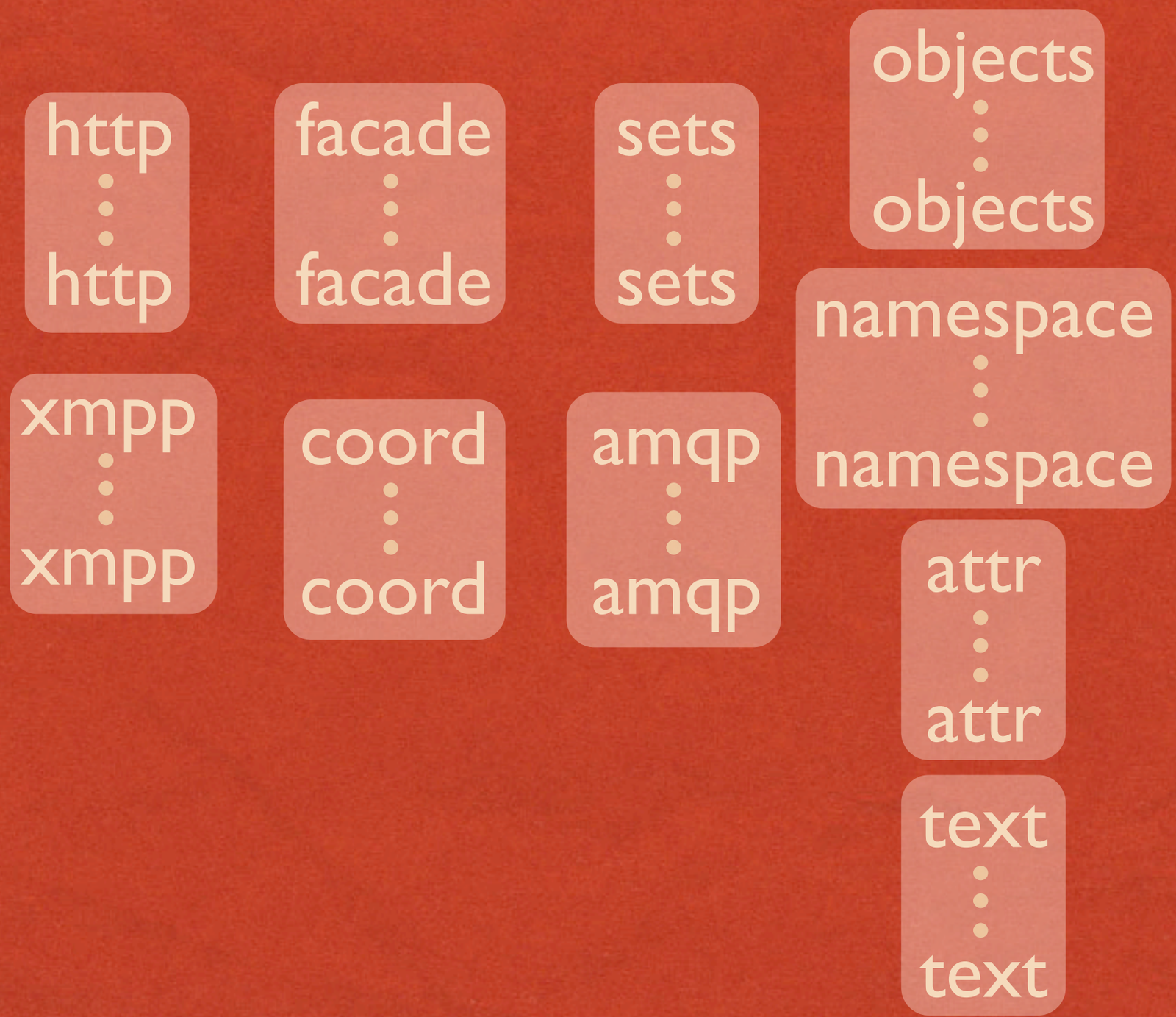
coord ⋮ coord

amqp ⋮ amqp

attr ⋮ attr

text ⋮ text

Functional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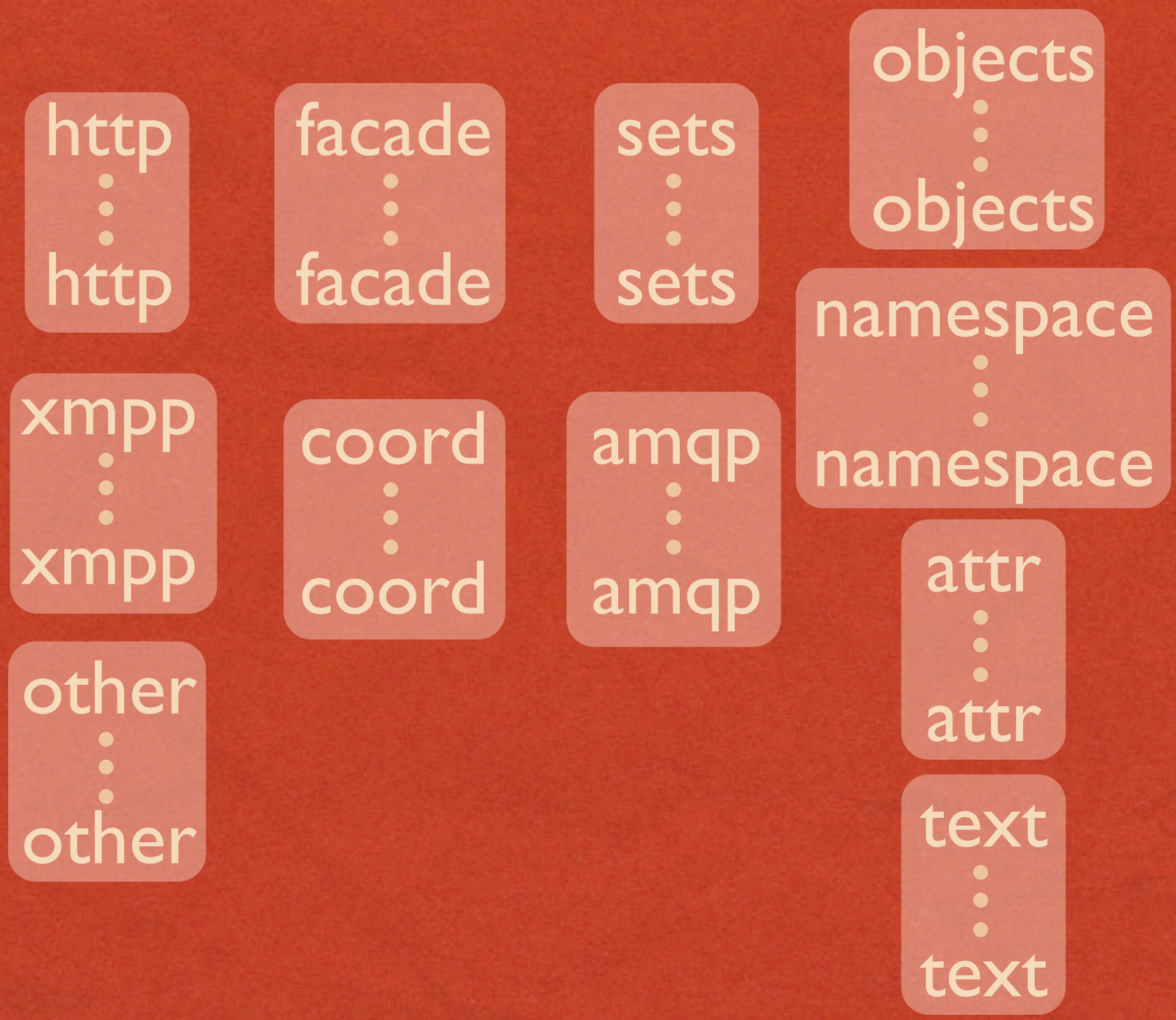
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attr
text
text
other
other

Functional

load … load

http … http

facade … facade

sets … sets

objects … objects

namespace … namespace

load … load

xmpp … xmpp

coord … coord

amqp … amqp

attr … attr

other … other

text … text

Functional

load ⋮ load

http ⋮ http

facade ⋮ facade

sets ⋮ sets

objects ⋮ objects

namespace ⋮ namespace

load ⋮ load

xmpp ⋮ xmpp

coord ⋮ coord

amqp ⋮ amqp

attr ⋮ attr

other ⋮ other

memcache ⋮ memcache

text ⋮ text

Functional

load … load

http … http

facade … facade

sets … sets

objects … objects

db … db

namespace … namespace

db … db

load … load

xmpp … xmpp

coord … coord

amqp … amqp

attr … attr

db … db

other … other

memcache … memcache

text … text

db … db

Functional

load … load

http … http

facade … facade

sets … sets

objects … objects

namespace … namespace

db … db

kv

load … load

xmpp … xmpp

coord … coord

amqp … amqp

attr … attr

db … db

other … other

memcache … memcache

text … text

db … db

Attribute Storage

meg/rating

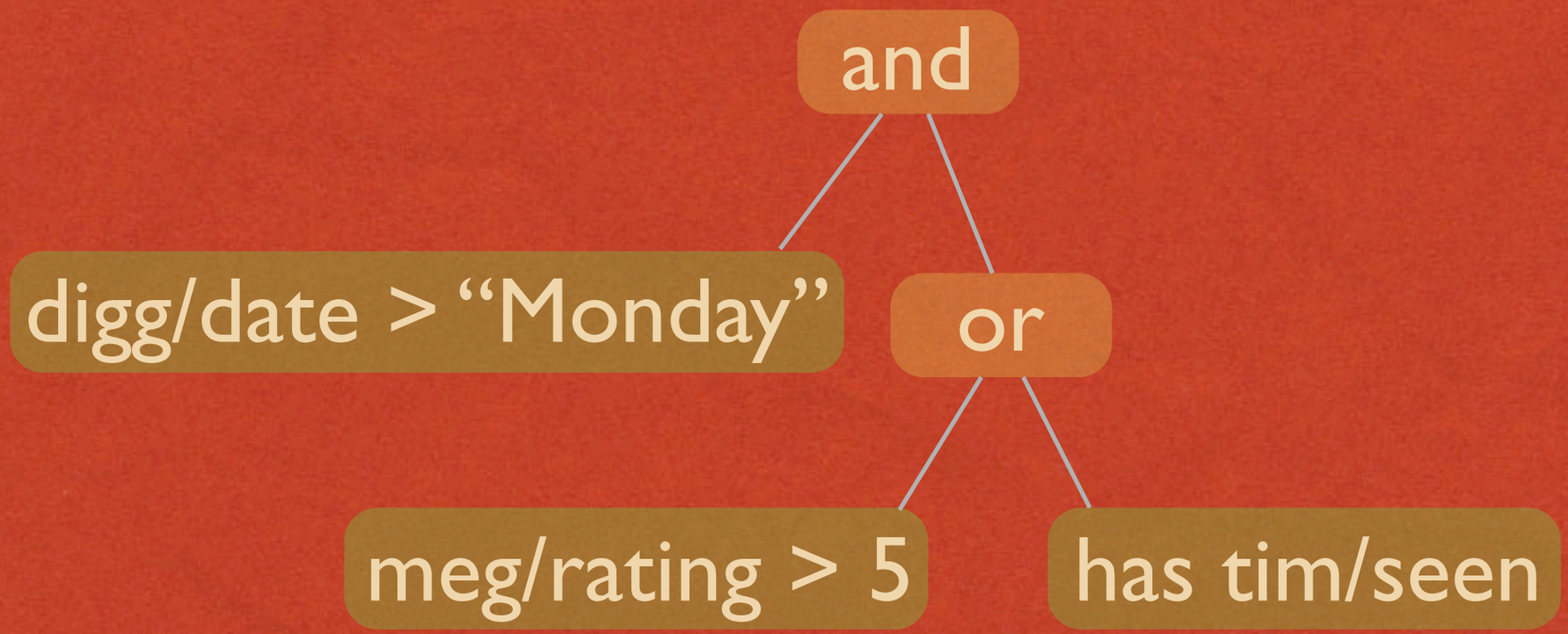
object id	user id	value
1234567	667	26
6527527	667	188
2876281	17	207
7628876	667	1225

tim/books/opinion

object id	user id	value
526141	362	nice
726483	362	fun
635378	362	boring
477582	362	sexy
362782	362	long

- PostgreSQL
- Tall tables
- Independent (column store)
- Backed by key/value store (Amazon S3, for now)

Query processing



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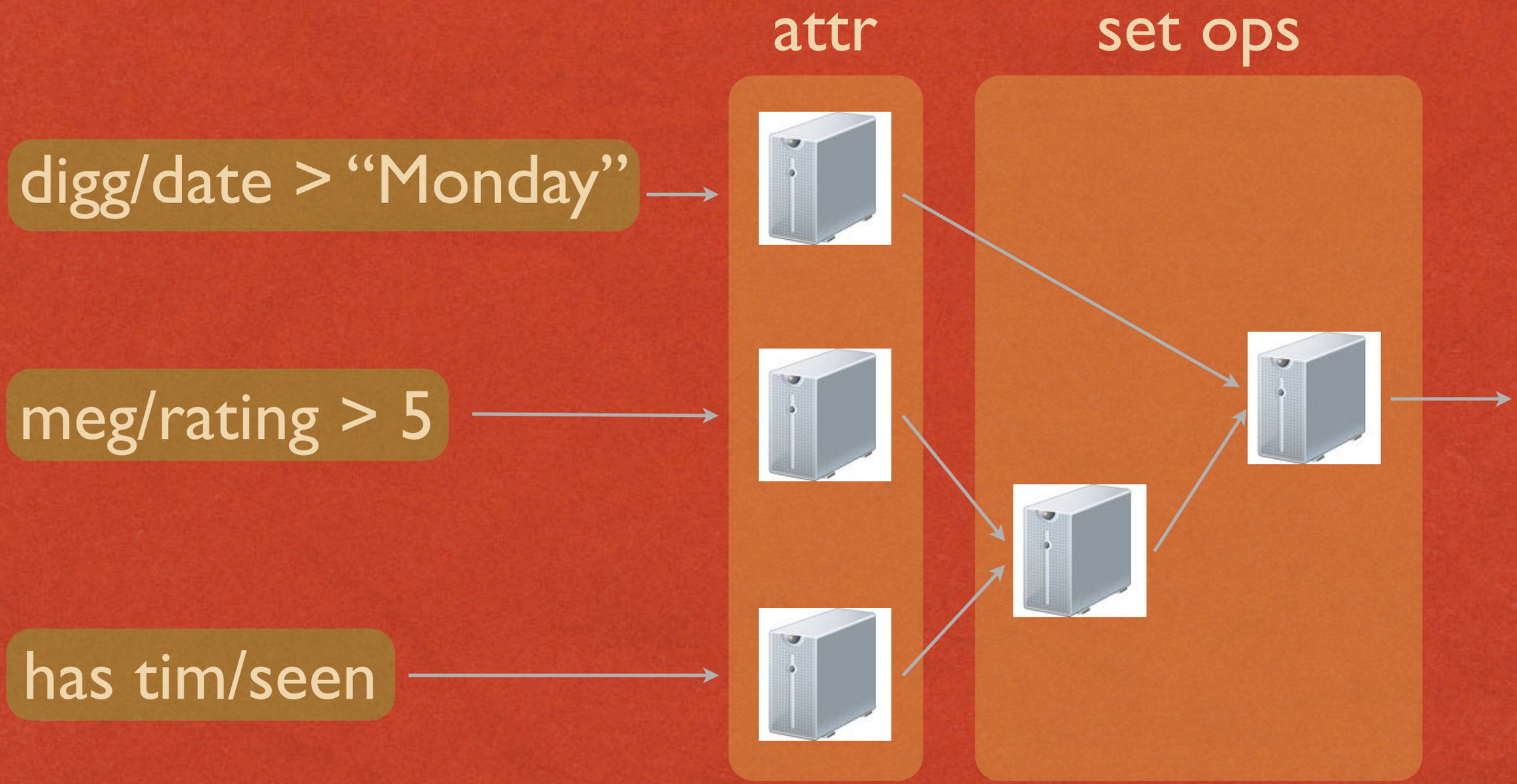
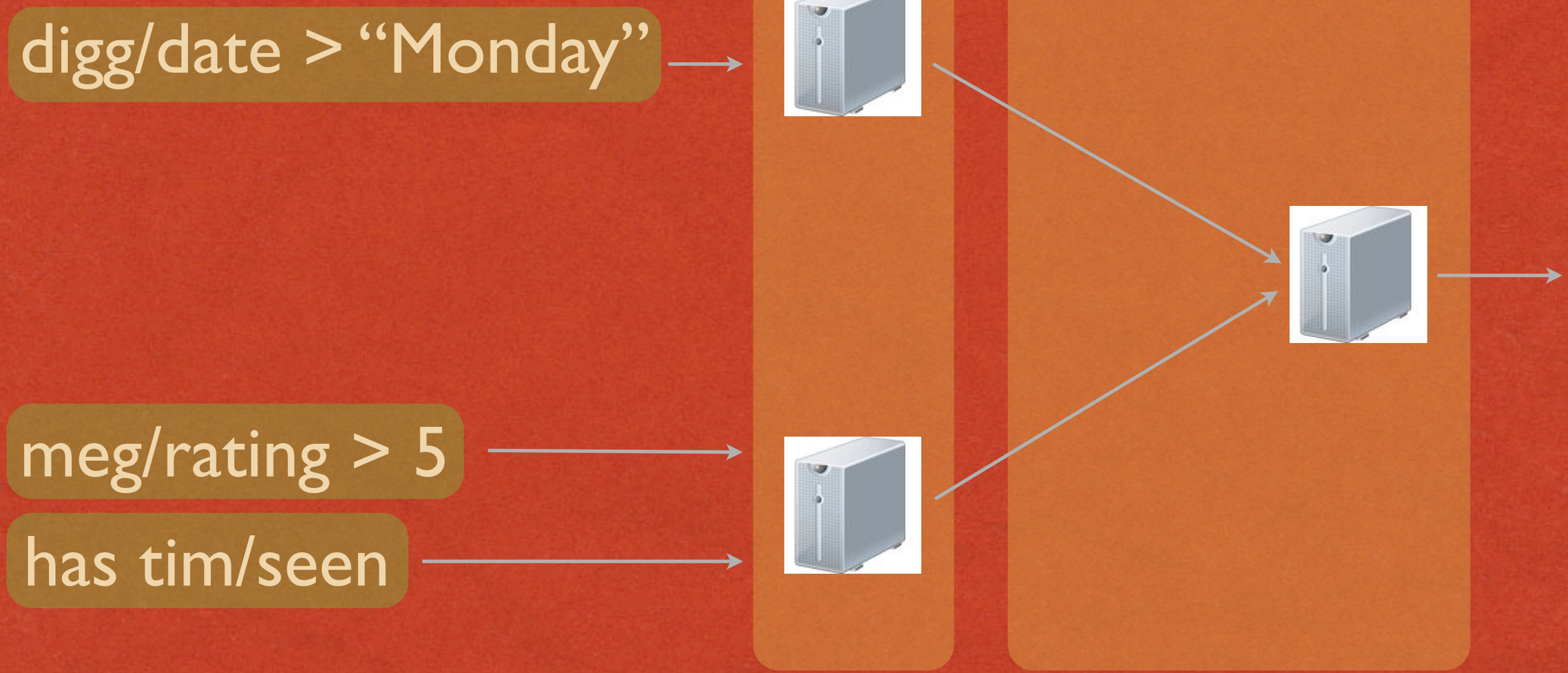


Attribute affinity



Per box

- A controller service, launched on boot
- The controller launches new services (processes)
- All services talk AMQP as well as pure Thrift
- A coordinator brings up new boxes & services
- We use Amazon EC2, for now