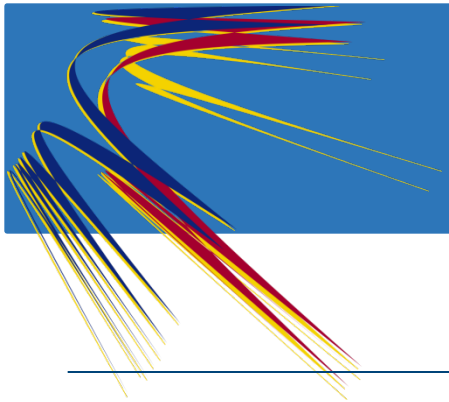

horizon
DIGITAL ECONOMY RESEARCH

Becoming Dataware

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University of Nottingham

With thanks to James Goulding, Derek McAuley,
Anil Madhavapeddy (CUCL)

The University of Nottingham

RCUK Digital Economy

- Digital Economy is defined by the Research Councils as:

  The novel design or use of information and communication technologies to help transform the lives of individuals, society or business.

- The Digital Economy progamme is:
  - Cross-Research Council (EPSRC, ESRC, AHRC)
  - Funded 2008-2011 for:
    - £80m research – including 3 x £12m hubs
    - £36m training – 8 x DTCs
  - Aimed at realising the transformational impact of ICT for all aspects of Business, Society and Government

What is Horizon?

- A Digital Economy Research Centre at the University of Nottingham comprising:
  - A Digital Economy Hub
    - £20m from RCUK and university
    - Spokes at Cambridge, Reading, Exeter, Brunel
  - A Doctoral Training Centre
    - £15m from RCUK and university
    - 20 PhD students per year for 5 years
  - Now 120+ partner companies, from 40 in initial bid
  - 3 TEDDI projects
  - … + future Digital Economy projects

Our Digital Footprints

"Every time we register for a new web service, or upload our photos and videos, we are enlarging our own digital footprints"

- Whether "informed" or not
  - Facebook, Google
- Growing digital footprint poses major societal challenges
- …but also forms a key basis for the digital economy's growth

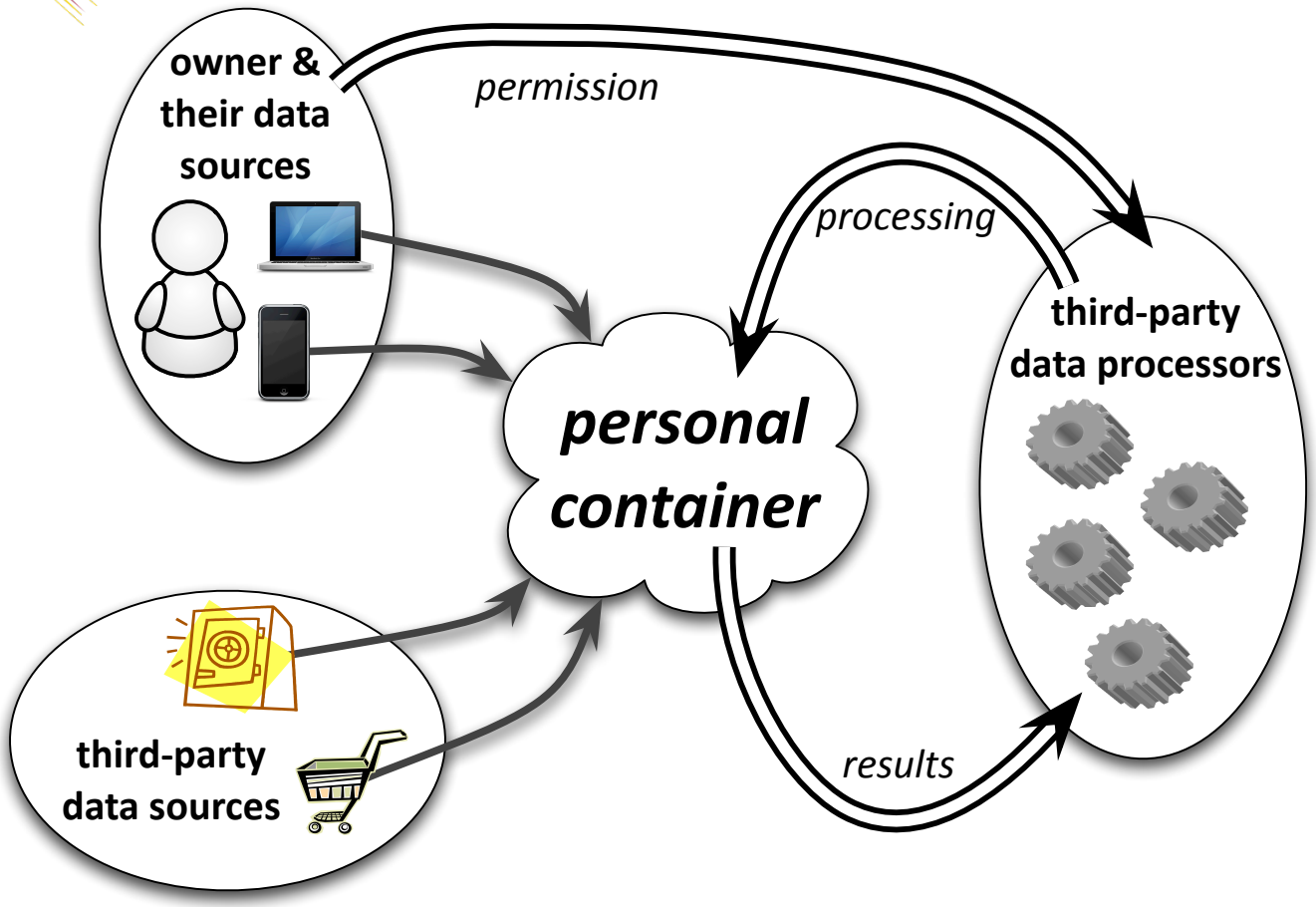
In More Detail

- We are making more and more information about our lives available, digitally
  - Whether or not we realise it
  - Often in very large, very rich data silos (e.g., Facebook)
  - "Contextual footprint"
- Simultaneously, there are more and more opportunities for mutually beneficial exploitation of digital personal data
  - E.g., Shopping basket optimizer;
    Boots prescription conflict detector

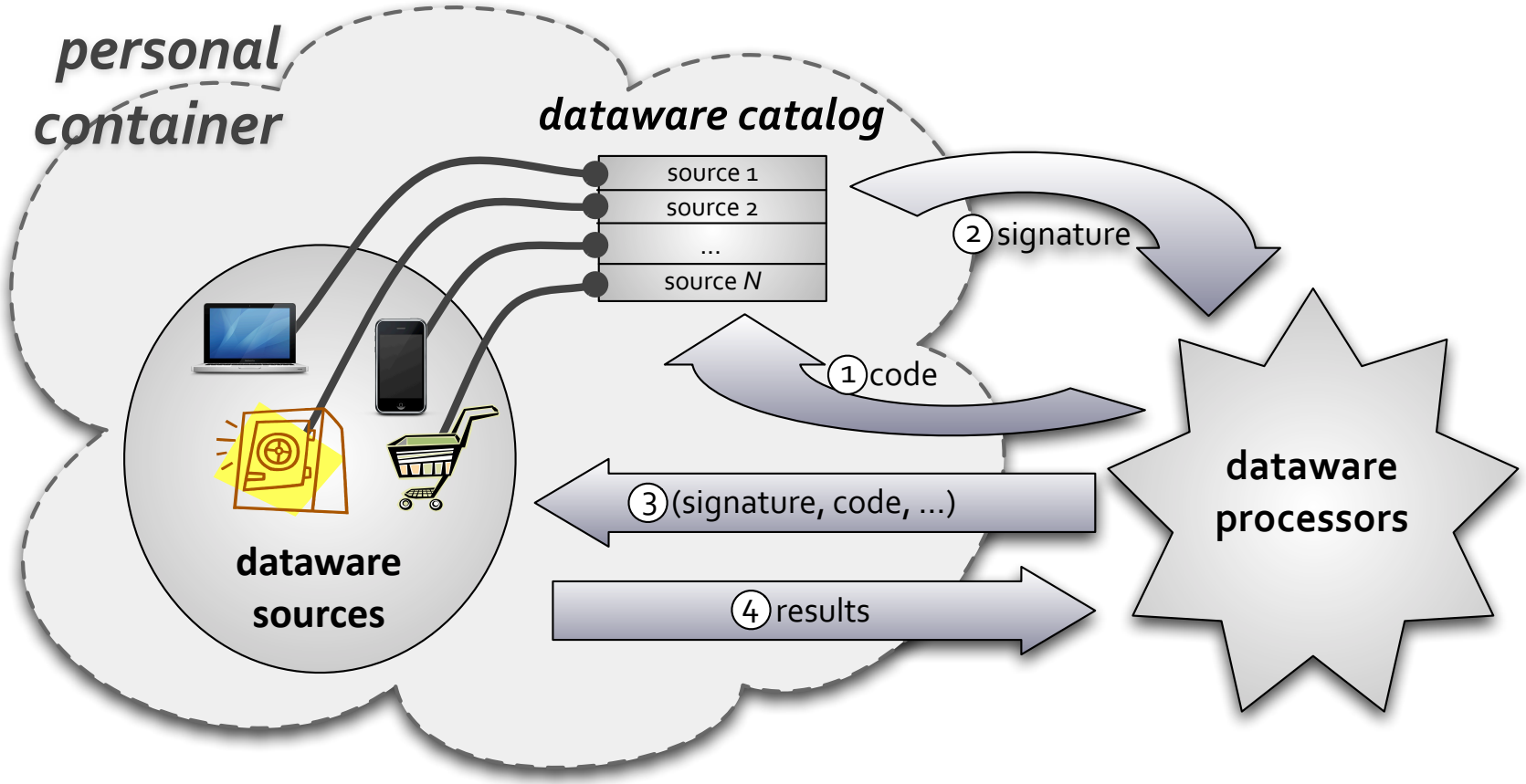
Key Challenge:

How do we enable individuals to control collection and exploitation of both *their data* and *data about them*?

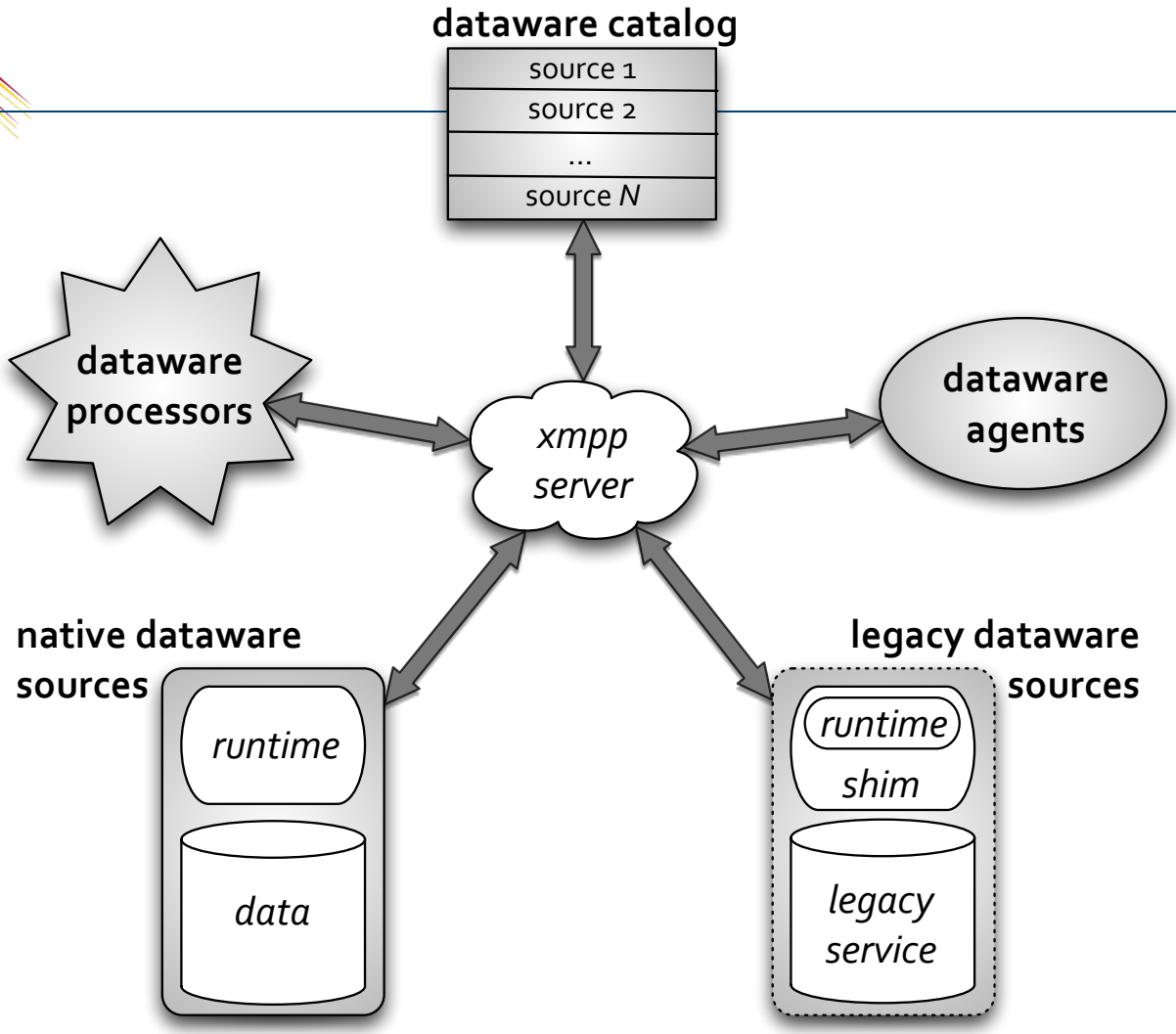
Dataware


owner &
their data
sources
permission
processing
third-party
data processors
personal
container
third-party
data sources
results

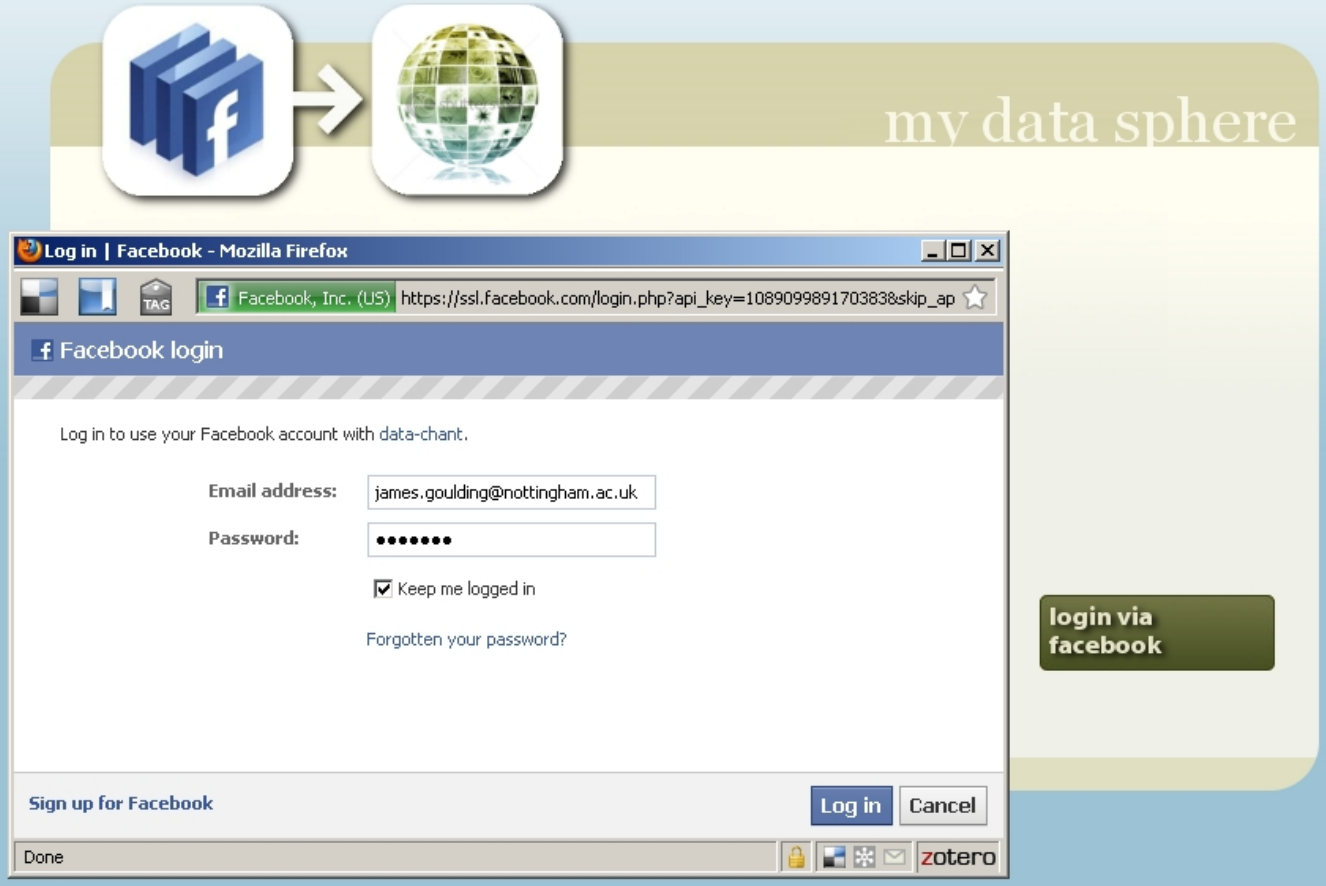
Components


personal container
dataware catalog
source 1
source 2
...
source N
2 signature
1 code
3 (signature, code, ...)
4 results
dataware sources
dataware processors

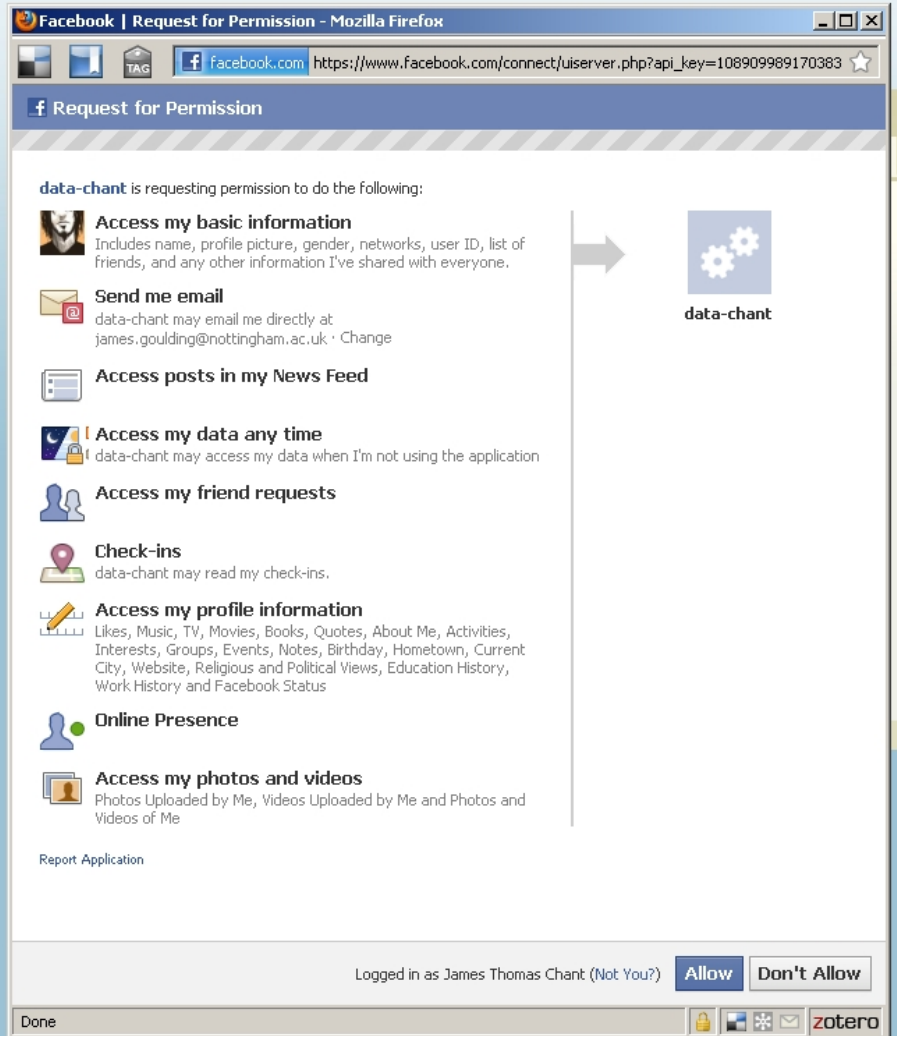
Implementation

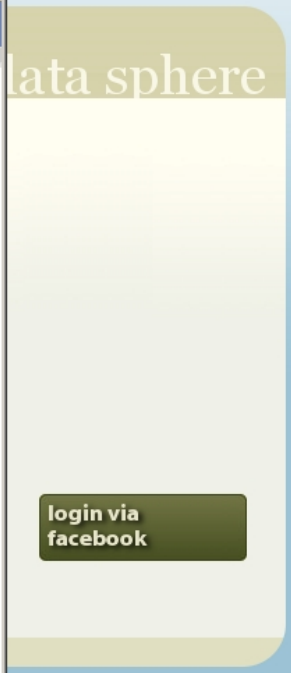


Shim Login

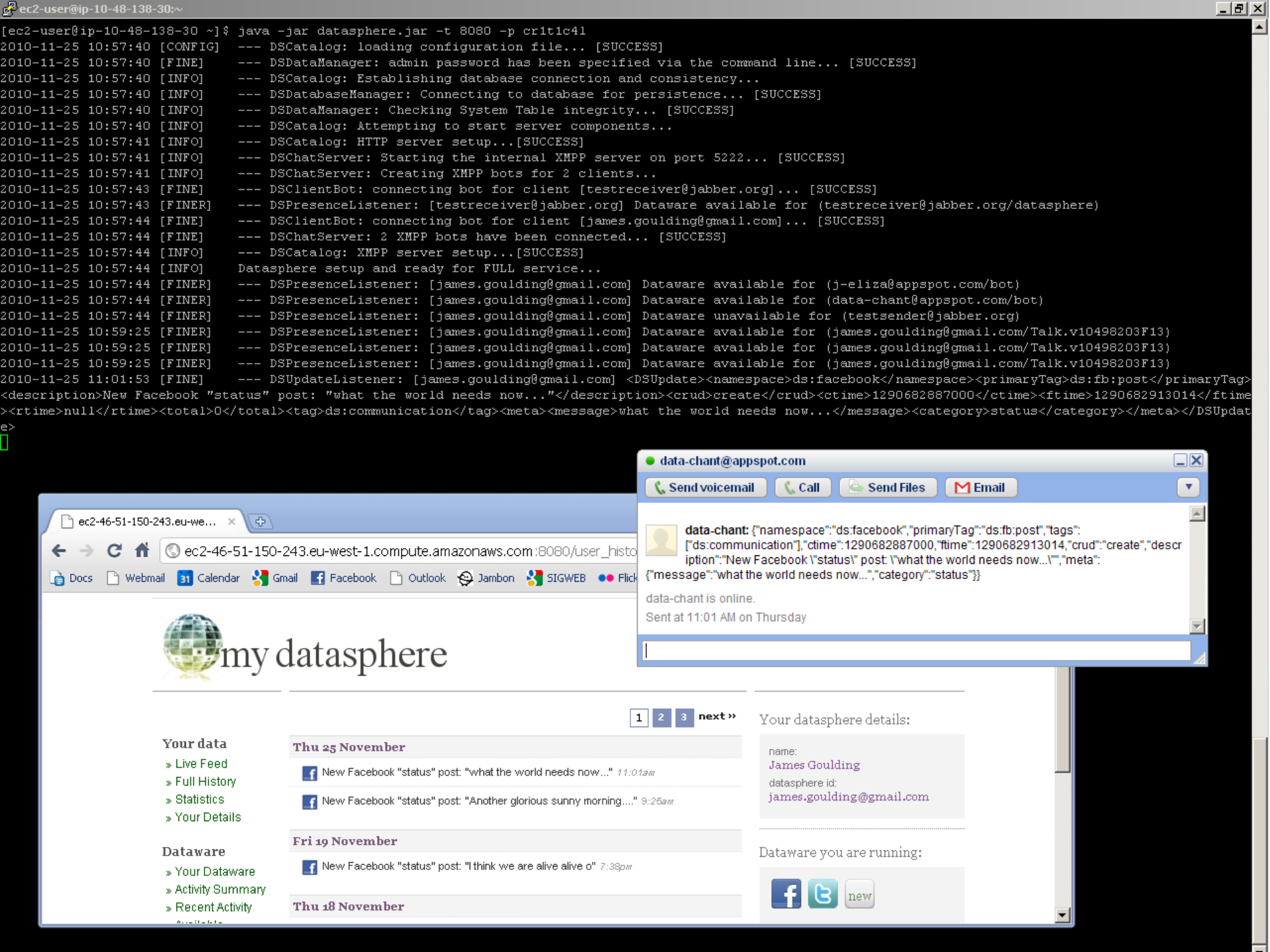

my data sphere
Log in | Facebook - Mozilla Firefox
Facebook, Inc. (US)
https://ssl.facebook.com/login.php?api_key=108909989170383&skip_ap
Facebook login
Log in to use your Facebook account with data-chant.
Email address:
james.goulding@nottingham.ac.uk
Password:
Keep me logged in
Forgotten your password?
Sign up for Facebook
Log in
Cancel
Done
zotero
login via facebook

Shim Permission

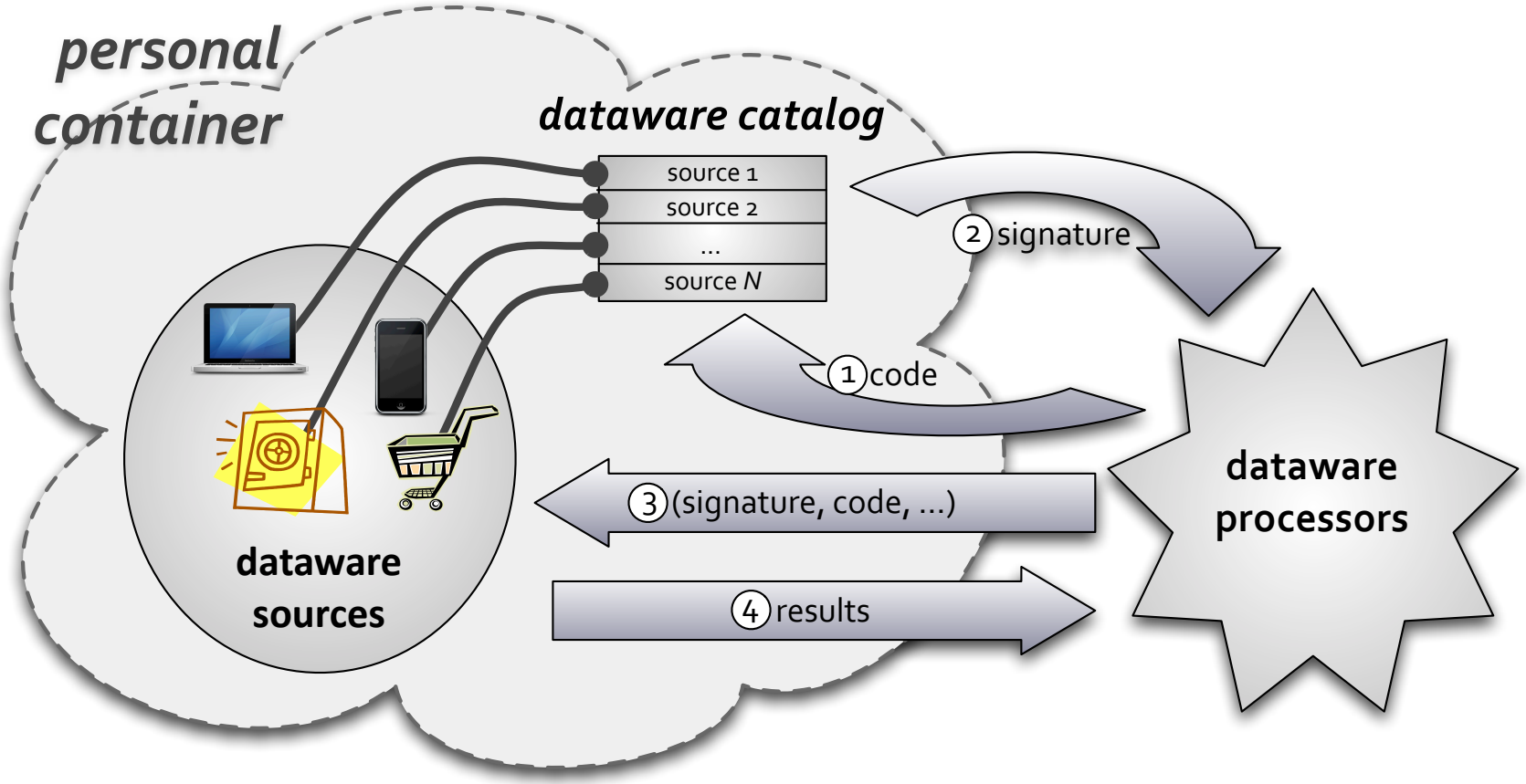




Web Interface


ec2-user@ip-10-48-138-30:~
[ec2-user@ip-10-48-138-30 ~]$ java -jar datasphere.jar -t 8080 -p cr1t1c41
2010-11-25 10:57:40 [CONFIG] --- DSCatalog: loading configuration file... [SUCCESS]
2010-11-25 10:57:40 [FINE] --- DSDataManager: admin password has been specified via the command line... [SUCCESS]
2010-11-25 10:57:40 [INFO] --- DSCatalog: Establishing database connection and consistency...
2010-11-25 10:57:40 [INFO] --- DSDatabaseManager: Connecting to database for persistence... [SUCCESS]
2010-11-25 10:57:40 [INFO] --- DSDataManager: Checking System Table integrity... [SUCCESS]
2010-11-25 10:57:40 [INFO] --- DSCatalog: Attempting to start server components...
2010-11-25 10:57:41 [INFO] --- DSCatalog: HTTP server setup...[SUCCESS]
2010-11-25 10:57:41 [INFO] --- DSChatServer: Starting the internal XMPP server on port 5222... [SUCCESS]
2010-11-25 10:57:41 [INFO] --- DSChatServer: Creating XMPP bots for 2 clients...
2010-11-25 10:57:43 [FINE] --- DSClientBot: connecting bot for client [testreceiver@jabber.org]... [SUCCESS]
2010-11-25 10:57:43 [FINER] --- DSPresenceListener: [testreceiver@jabber.org] Dataware available for (testreceiver@jabber.org/datasphere)
2010-11-25 10:57:44 [FINE] --- DSClientBot: connecting bot for client [james.goulding@gmail.com]... [SUCCESS]
2010-11-25 10:57:44 [FINE] --- DSChatServer: 2 XMPP bots have been connected... [SUCCESS]
2010-11-25 10:57:44 [INFO] --- DSCatalog: XMPP server setup...[SUCCESS]
2010-11-25 10:57:44 [INFO] Datasphere setup and ready for FULL service...
2010-11-25 10:57:44 [FINER] --- DSPresenceListener: [james.goulding@gmail.com] Dataware available for (j-eliza@appspot.com/bot)
2010-11-25 10:57:44 [FINER] --- DSPresenceListener: [james.goulding@gmail.com] Dataware available for (data-chant@appspot.com/bot)
2010-11-25 10:57:44 [FINER] --- DSPresenceListener: [james.goulding@gmail.com] Dataware unavailable for (testsender@jabber.org)
2010-11-25 10:59:25 [FINER] --- DSPresenceListener: [james.goulding@gmail.com] Dataware available for (james.goulding@gmail.com/Talk.v10498203F13)
2010-11-25 10:59:25 [FINER] --- DSPresenceListener: [james.goulding@gmail.com] Dataware available for (james.goulding@gmail.com/Talk.v10498203F13)
2010-11-25 10:59:25 [FINER] --- DSPresenceListener: [james.goulding@gmail.com] Dataware available for (james.goulding@gmail.com/Talk.v10498203F13)
2010-11-25 11:01:53 [FINE] --- DSUpdateListener: [james.goulding@gmail.com] <DSUpdate><namespace>ds:facebook</namespace><primaryTag>ds:fb:post</primaryTag>
<description>New Facebook "status" post: "what the world needs now..."</description><crud>create</crud><ctime>1290682887000</ctime><ftime>1290682913014</ftime
><rtime>null</rtime><total>0</total><tag>ds:communication</tag><meta><message>what the world needs now...</message><category>status</category></meta></DSUpdat
e>
data-chant@appspot.com
Send voicemail
Call
Send Files
Email
data-chant: {"namespace":"ds:facebook","primaryTag":"ds:fb:post","tags":
["ds:communication"],"ctime":1290682887000,"ftime":1290682913014,"crud":"create","descr
iption":"New Facebook \"status\" post: \"what the world needs now...\"","meta":
{"message":"what the world needs now...","category":"status"}}
data-chant is online.
Sent at 11:01 AM on Thursday
ec2-46-51-150-243.eu-we...
ec2-46-51-150-243.eu-west-1.compute.amazonaws.com:8080/user_histo
Docs
Webmail
Calendar
Gmail
Facebook
Outlook
Jambon
SIGWEB
my datasphere
1
2
3
next »
Your data
» Live Feed
» Full History
» Statistics
» Your Details
Dataware
» Your Dataware
» Activity Summary
» Recent Activity
Thu 25 November
New Facebook "status" post: "what the world needs now..." 11:01am
New Facebook "status" post: "Another glorious sunny morning...." 9:25am
Fri 19 November
New Facebook "status" post: "I think we are alive alive o" 7:38pm
Thu 18 November
Your datasphere details:
name:
James Goulding
datasphere id:
james.goulding@gmail.com
Dataware you are running:
new

Processing


personal container
dataware catalog
source 1
source 2
...
source N
2 signature
1 code
3 (signature, code, ...)
4 results
dataware sources
dataware processors

Applications

- An application is a list of source schemas and signed components
  - Each element defines processing occurring on some data
- Each component starts out as
  - *Code*, describing the computation
  - *Schedule*, against which the code is executed
  - *Result schema*, describing the results
  - *Result destination*, JID to which results are sent

Application Signing

- Processor presents application to catalog
- Catalog applies user policy to determine whether to sign
  - Static policy concerning data to be processed, source, &c
  - Or interacting directly with user via web, chat, &c
- To sign, replace each component with one or more:
  - *Result schema, schedule, code*, as before
  - *Source JID*, specifying data source
  - *Destination JID*, to which results are sent
  - *Signature*, an HMAC for the component
- …And then return to the submitting processor

Application Execution

- Processor distributes signed components to given sources
- Sources then:
  - Install components, notifying catalog
  - Execute components in runtime, as per schedule
  - Send results to specified destination
- During execution, the runtime monitors code
  - Enables periodic reporting back to user
  - Exceptions raised if code operates outside boundaries

JOINing Data

- A clear issue is how to deal with data JOINs
  - Recall: we're avoiding giving access to raw data
  - We must also avoid giving access to intermediate results
- Setup *trusted third-party sources*
  - Have no data of their own
  - Act as destination for other code
  - May host subsequent application components
- Makes sense that the catalog serves as at least one such

Summary

- So conceptually, a *dataware application* is:
  - A network of running components,
  - Each processing your personal data,
  - In a manner acceptable to you
- Your *dataware* implements your *personal container*:
  - Defining APIs to your data,
  - Enabling third-parties to process your data,
  - While ensuring *you* retain control,
  - And they *don't* get copies of your data
    - (unless you want them to!)

Evolution or Revolution?

- One way to put this in context is via Van Jacobson's *content centric networking*:
  - Telephones care about building paths (not calls)
  - Internet cared about connections (not data)
  - Content centric networking cares about data (not results)
- …so, finally,
- *Dataware*, cares about results
  - Computation is as mobile as data, if not more so
  - (Anil) cf. datacentre computing, map-reduce, &c

Status

- First version of catalog built
- First legacy source built
  - Facebook, using Graph API
  - Twitter, Google Gdata on their way
- Now prototyping
  - Dataware Processor and first applications, and
  - Native source
- Challenge: how to build protocols for trusted aggregation
  - Would like to guarantee *at-least-N* contributors