GMA and the relational model – progress report, protocols, and where we might have strayed...

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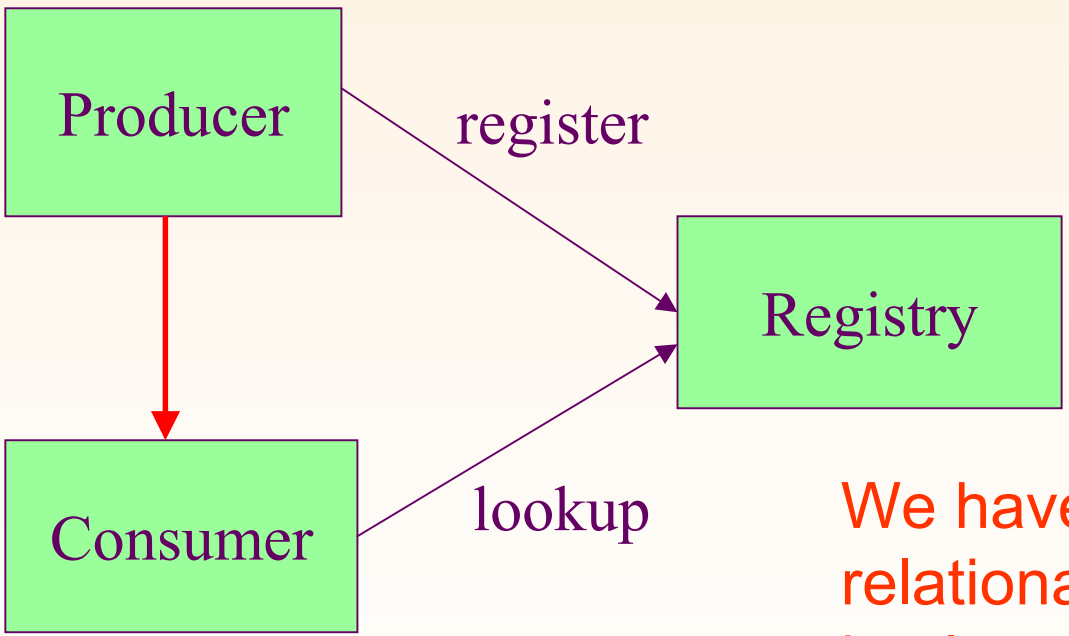
(people with code in CVS)

European DataGrid

- EU DataGrid project with 21 partners from a number of countries around Europe is part-funded by the EU.
- It brings together:
  - particle physics,
  - earth observation
  - bio-informatics
  - computer science
- For information and monitoring system, seeing if we can do “better” than MDS/LDAP

Grid Monitoring Architecture (gma)

- We use it not only for monitoring but also as the basis of an information system



We have chosen a relational implementation

Relational Approach

- Not a general distributed RDBMS system, but a way to use the relational model in a distributed environment where ACID properties are not generally important.
- Producers announce what they have by an SQL "CREATE TABLE" statement and publish it with an SQL "INSERT"
- Consumers collect information by an SQL "SELECT" statement.
- It may use a number of RDBMS for archival, for the schema and for the registry

Registration of producers

- Tables are effectively partitioned over several sites – we assume that each partition is characterised by fixed values of one or more columns (e.g. “site=CERN” or “site=RAL”)
- Register the name of the table with the names of any attributes which are fixed and the values of those attributes.
- No explicit registration is carried out by the normal user.

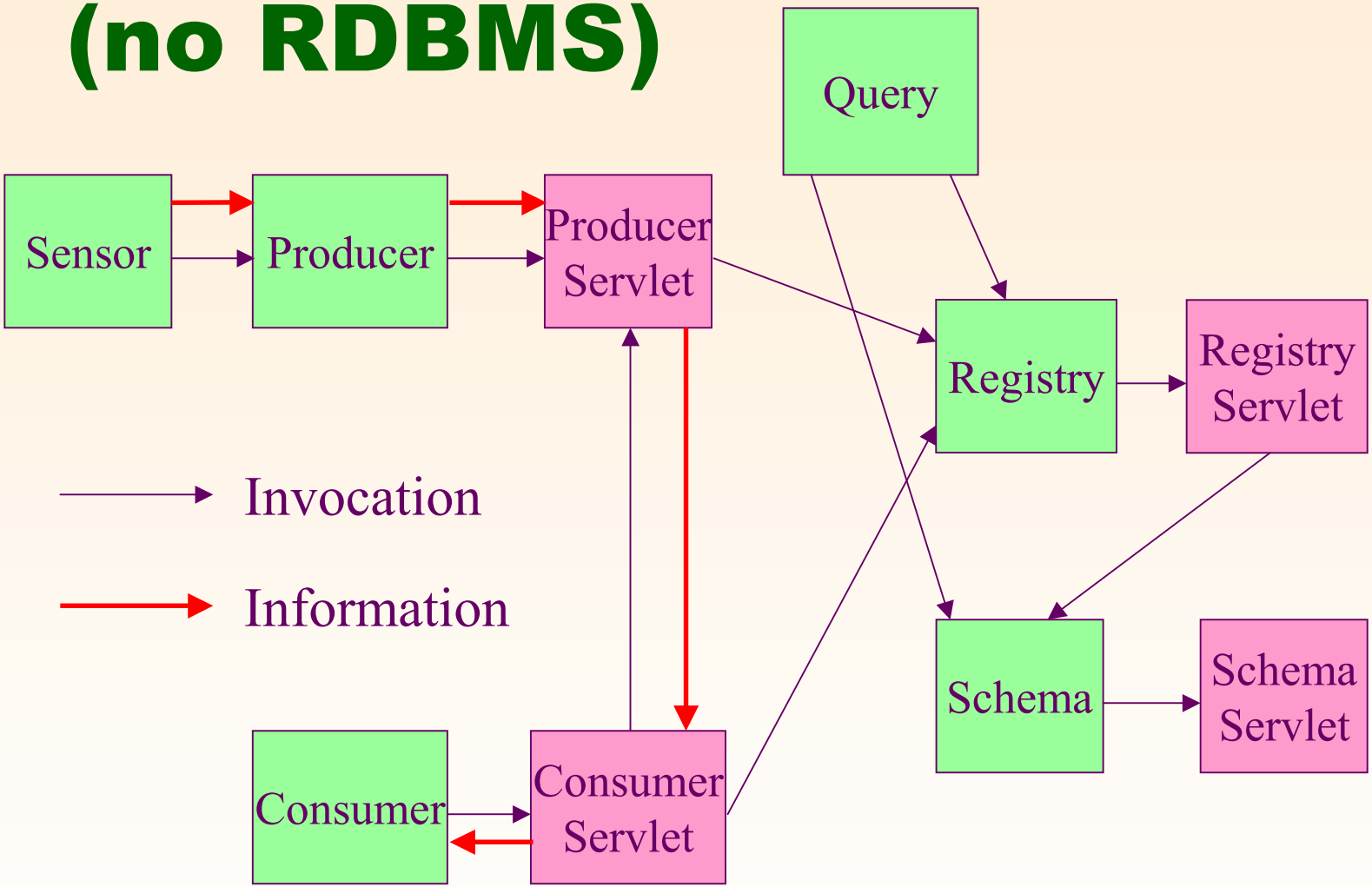
Schema

- When a producer registers itself as a producer of a certain table, if the table is not known it is added to the schema. If a table is no longer used its definition can be removed.
  - Handles schema evolution.
- The schema information must be universally known within a VO.
- Schema will need to be replicated for scalability and reliability, but it must done in such a way as to allow producers around the world to add new tables.

Implementation - servlets

- Code is concentrated in servlets
- With one exception, all communication with servlets (even from another servlet) is via an interface object.
  - This interface object can be coded in multiple programming languages
  - Hides the communication bit (so it can be changed more easily)

Schematic (no RDBMS)



Implementation - XML

- We use normal http parameters so that URLs such as:
  http://localhost:8080/ProducerServlet/getOne?id=6&select=SELECT …
  will work – i.e. no XML encoding of the input.
- All responses as XML
  - Exceptions are trapped by the servlet and error message sent back as XML

Consumer/Producer XML

```
<?xml version = '1.0' standalone ='yes'?>
<ROWSET>
  <ROWDESC>
     <COL>animal</COL>
     <COL>legs</COL>
  </ROWDESC>
  <ROW>
     <COL>aardvark</COL>
     <COL>4</COL>
  </ROW>
  <ROW>
     <COL>tarantula</COL>
     <COL>8</COL>
  </ROW>
</ROWSET>
```

Multipart response

- We use multipart response to stream information
  - content type defines separator
  - keeps connection open.

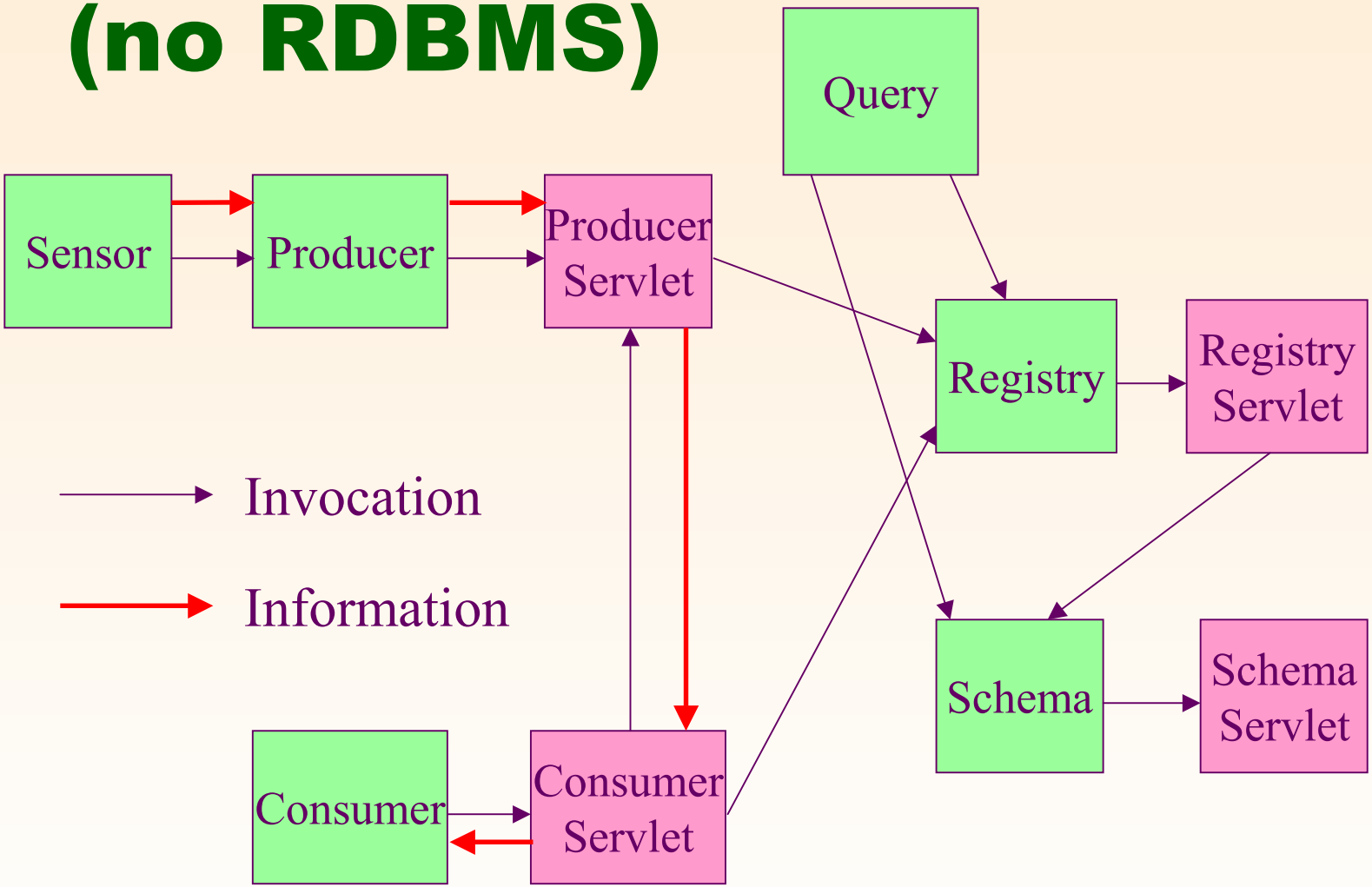
Comparison with proposed "Simple XML protocol"

- XML between consumer and producer is described by a single DTD/Schema
  - This is more compact though less "XML like"
- XML is only used for the response
  - Otherwise use http parameters – hence would need more if it were separated from http
- Relies upon http(s)

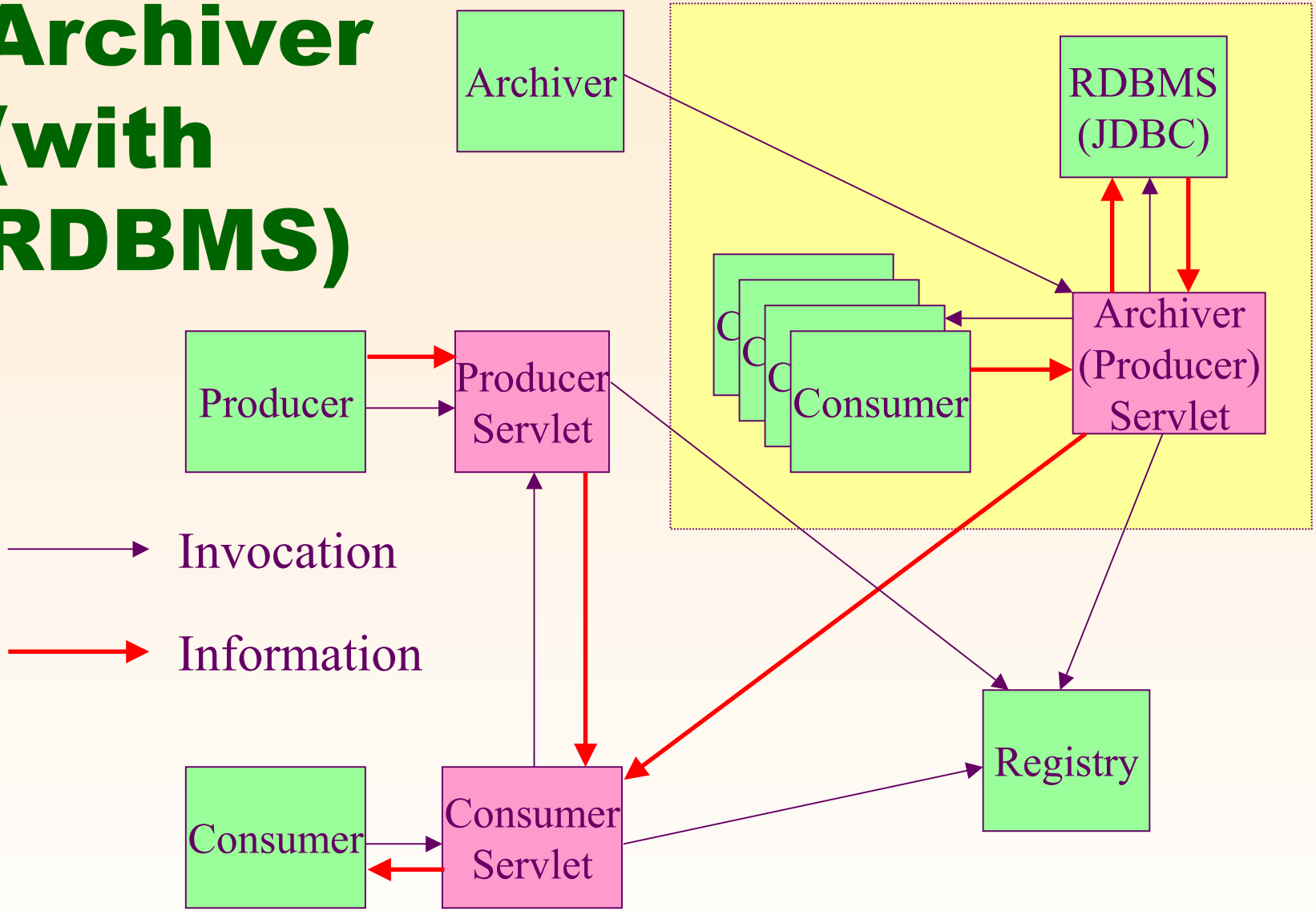
Comparison with "normal" GMA

- true to the GMA spirit as we understand it
- but:
  - Producer's don't find consumers (e.g. archives)
    - It is not really consistent with the GMA model for the producer to solicit client
      - In our case a person instantiating a producer could also instantiate an archive or tell an archive to consume from the producer
  - The user is not aware of the registry
  - Sensors not explicit – a sensor/application instantiates a producer to publish its information

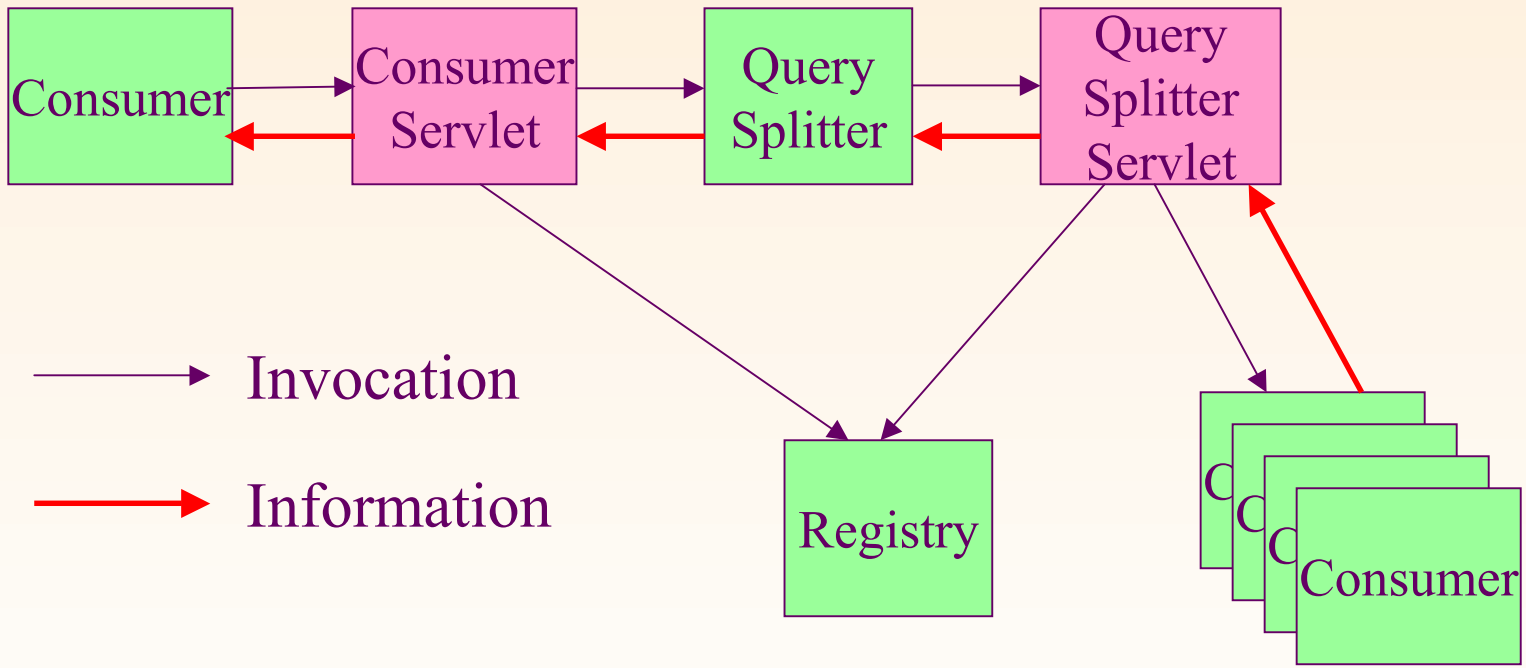
Schematic (no RDBMS)



Archiver (with RDBMS)

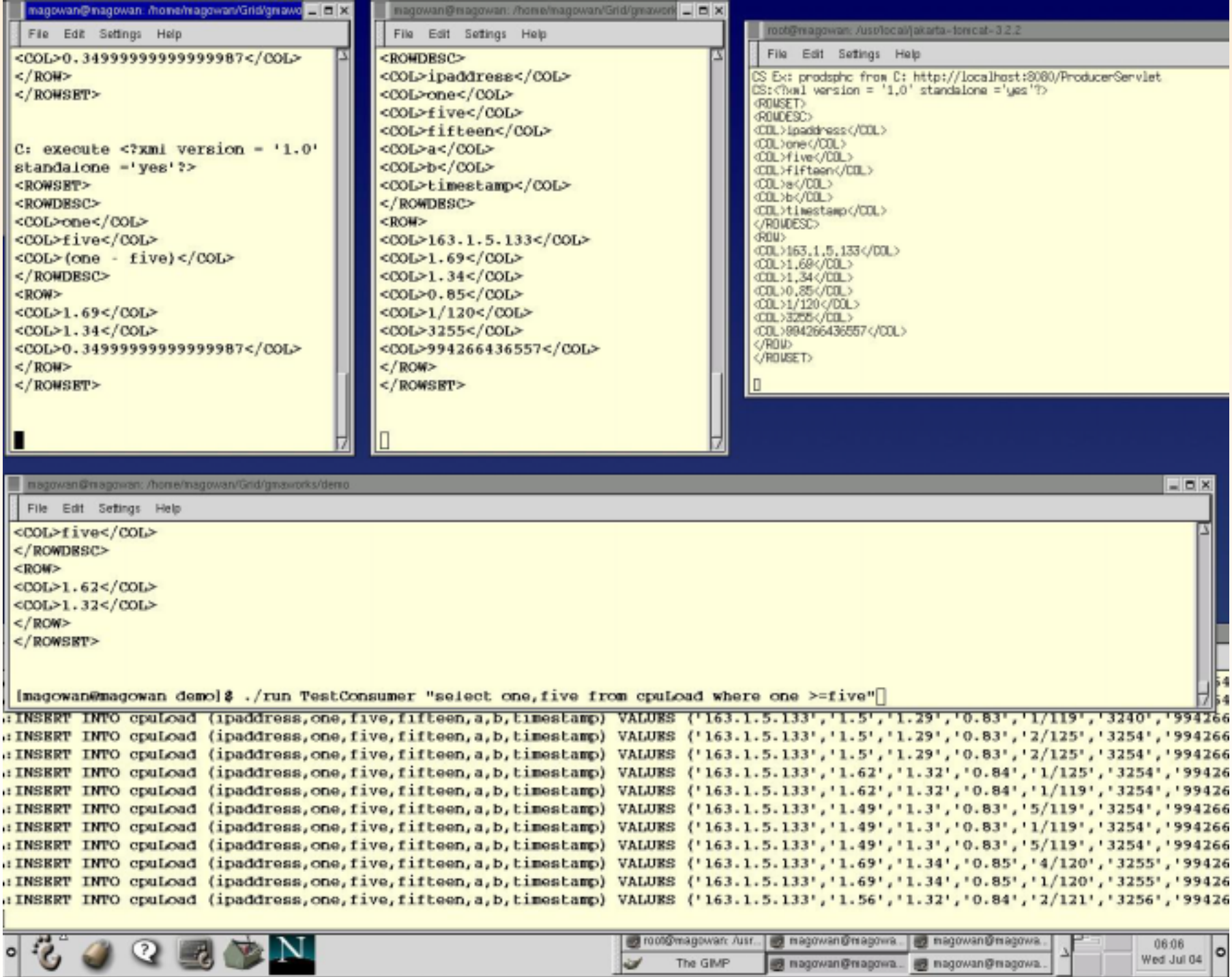


Query Splitter



Technology choices

- All in Java
- Tomcat servlet engine
- MySQL (and postgresql) via JDBC
- HTML queries – return XML
- Multipart response
- DOM parser to read XML
- JavaCC to build SQL parser
- JUnit as test framework
- Log4j for internal logging


magowan@magowan: /home/magowan/Grid/gnawo
File Edit Settings Help
<COL>0.34999999999999987</COL>
</ROW>
</ROWSET>
C: execute <?xml version = '1.0' standalone ='yes'?>
<ROWSET>
<ROWDESC>
<COL>one</COL>
<COL>five</COL>
<COL>(one - five)</COL>
</ROWDESC>
<ROW>
<COL>1.69</COL>
<COL>1.34</COL>
<COL>0.34999999999999987</COL>
</ROW>
</ROWSET>
magowan@magowan: /home/magowan/Grid/gnawork
File Edit Settings Help
<ROWDESC>
<COL>ipaddress</COL>
<COL>one</COL>
<COL>five</COL>
<COL>fifteen</COL>
<COL>a</COL>
<COL>b</COL>
<COL>timestamp</COL>
</ROWDESC>
<ROW>
<COL>163.1.5.133</COL>
<COL>1.69</COL>
<COL>1.34</COL>
<COL>0.85</COL>
<COL>1/120</COL>
<COL>3255</COL>
<COL>994266436557</COL>
</ROW>
</ROWSET>
root@magowan: /usr/local/jakarta-tomcat-3.2.2
File Edit Settings Help
CS Ex: prodsphc from C: http://localhost:8080/ProducerServlet
CS:<?xml version = '1.0' standalone ='yes'?>
<ROWSET>
<ROWDESC>
<COL>ipaddress</COL>
<COL>one</COL>
<COL>five</COL>
<COL>fifteen</COL>
<COL>a</COL>
<COL>b</COL>
<COL>timestamp</COL>
</ROWDESC>
<ROW>
<COL>163.1.5.133</COL>
<COL>1.69</COL>
<COL>1.34</COL>
<COL>0.85</COL>
<COL>1/120</COL>
<COL>3255</COL>
<COL>994266436557</COL>
</ROW>
</ROWSET>
magowan@magowan: /home/magowan/Grid/gnaworks/demo
File Edit Settings Help
<COL>five</COL>
</ROWDESC>
<ROW>
<COL>1.62</COL>
<COL>1.32</COL>
</ROW>
</ROWSET>
[magowan@magowan demo]$ ./run TestConsumer "select one,five from cpuLoad where one >=five"
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.5','1.29','0.83','1/119','3240','994266
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.5','1.29','0.83','2/125','3254','994266
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.5','1.29','0.83','2/125','3254','994266
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.62','1.32','0.84','1/125','3254','99426
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.62','1.32','0.84','1/119','3254','99426
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.49','1.3','0.83','5/119','3254','994266
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.49','1.3','0.83','1/119','3254','994266
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.49','1.3','0.83','5/119','3254','994266
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.69','1.34','0.85','4/120','3255','99426
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.69','1.34','0.85','1/120','3255','99426
:INSERT INTO cpuLoad (ipaddress,one,five,fifteen,a,b,timestamp) VALUES ('163.1.5.133','1.56','1.32','0.84','2/121','3256','99426
The GIMP
06:06
Wed Jul 04

Problems

- How to maintain schema
  - Fairly static
  - Replicated
  - Reliable and consistent
  - Might require that dynamic names are prefaced by the originating DNS
- How to maintain registry of producers
  - Dynamic
  - Replicated
  - Maybe inconsistent
  - Maybe adopt/adapt an idea of EU DataGrid WP2
- How to do the query splitting.
  - Probably mostly in the textbooks
  - Hope we can find suitable open source code out there

Future work

- Tidy up what we have
- Archiver
- Access to data from GRIS
- C++ API for Producer and Consumer
- Package into RPM
- First release end of month (31st July 2001)

WE WOULD WELCOME EARLY (TOLERANT AND FRIENDLY) ADOPTERS