WRed: Web-Based Data Reduction

Joe Redmon

The NCNR is a user facility

Researchers come from all over the world to use 15 different neutron instruments

Researchers vary greatly in background and experience

Raw data isn't pretty

```
#ICE         1.0
#Filename    meshbefieldneg1p353466
#Date        2008-01-09 05:05:39 EST
#InstrName   BT7
#Epoch       1199873139.25
#ExptID      9175
#ExptName    ratcliff
#ExptParticipants ratcliff
#ExptDetails polarized
#ExptComment
#User        bt7
#Comment
#Npoints     31
#TemperatureUnits Kelvin
#Ncolumns    103
#DetectorDims
#Signal      9 Detector
#Reference   8 Monitor
#Scan        15 DFM
#AnalyzerSDGroup SDC0 SDC1 SDC2
#AnalyzerFocusMode FLAT
#Fixed       A5 A6 ANADET ANALYZER
#ScanDescr   Scan:Prefac=1.0:Fixed=1:Title=MyTitle:HoldScan=0.0:DetectorType=detector:JTYPE=VECTOR:SubID=0:Range=Q=0.502~0.485~0.0 0.502~0.515~0.0 S:Range=E=0.0
0.0 S:CountType=monitor:FixedE=14.7:Npts=31:Counts=200.0:Filename=meshbefieldneg1p3
#Columns             QX            QY            QZ             E            A4          Time          Temp       Monitor      Detector        DFMRot            A2
A3            A5            A6           DFM            A1 AnalyzerBlade01 AnalyzerBlade02 AnalyzerBlade03 AnalyzerBlade04 AnalyzerBlade05 AnalyzerBlade06
AnalyzerBlade07 AnalyzerBlade08 AnalyzerBlade09 AnalyzerBlade10 AnalyzerBlade11 AnalyzerBlade12 AnalyzerBlade13 AnalyzerRotation     ApertHori     ApertVert
BkSltHght     BkSltWdth          DDC0          DDC1          DDC2       DiffDet      EFcancel        EFflip       EFguide      EIcancel        EIflip       EIguide
FLIP        FilRot       FilTilt       FilTran       FocusCu       FocusPG             H           HKL       Hsample             K             L      Monitor2
MonoBlade01   MonoBlade02   MonoBlade03   MonoBlade04   MonoBlade05   MonoBlade06   MonoBlade07   MonoBlade08   MonoBlade09   MonoBlade10      MonoElev
MonoTrans         PSDet   PostAnaColl  PostMonoColl    PreAnaColl   PreMonoColl            RC            SC          SDC0          SDC1          SDC2     SingleDet
SmplElev     SmplGFRot     SmplLTilt      SmplLTrn     SmplUTilt      SmplUTrn         TDC00         TDC01         TDC02         TDC03         TDC04         TDC05
TDC06         TDC07         TDC08         TDC09         TDC10       Vsample TemperatureControlReading TemperatureSetpoint TemperatureHeaterPower TemperatureSensor1
TemperatureSensor2 TemperatureSensor3
                 0.502         0.486             0           0.0       29.4045       31.5885        49.995           200            13        20.591       41.1771
68.742       20.5885            IN       20.5885       20.5885    0.00803333    0.00833333    0.00796667   0.000366667        -0.008         0.016    0.00763333
0.00803333   0.000333333        -0.008        0.0003    0.00803333    0.00563333       20.5883       79.9998           150             1        9.9944
2             6             5           180        1.4006        1.2014         1.001        0.0212        0.0215        0.5143             A        -0.805
-1.9496            IN          9000          1327           N/A           N/A          None           N/A           N/A             0             0             0
0             0             0             0             0             0             0             0             0         2.486      -84.9998           N/A
N/A           N/A         25MIN       237.999        79.002             0             0             1           145        -1e-04       39.9993             4
0.0004        1.5216             0             0             0             0             0             0             0             0             0             0
1             1          None 49.995 50.0 4.6 31.077 0.0 0.0
```

Raw data needs processing

```
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#Filename     meshbefieldneg1p353466
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#AnalyzerFocusMode FLAT
#Fixed        A5 A6 ANADET ANALYZER
#ScanDescr    Scan:Prefac=1.0:Fixed=1:Title=MyTitle:HoldScan=0.0:DetectorType=detector:JTYPE=VECTOR:SubID=0:Range=Q=0.502~
0.502~0.515~0.0 S:Range=E=0.0 0.0 S:CountType=monitor:FixedE=14.7:Npts=31:Counts=200.0:Filename=meshbefieldneg1p3
#Columns              QX            QY            QZ             E            A4          Time          Temp       Monitor
DFMRot            A2            A3            A5            A6           DFM           A1 AnalyzerBlade01 AnalyzerBlade0
AnalyzerBlade04 AnalyzerBlade05 AnalyzerBlade06 AnalyzerBlade07 AnalyzerBlade08 AnalyzerBlade09 AnalyzerBlade10 AnalyzerB
AnalyzerBlade12 AnalyzerBlade13 AnalyzerRotation     ApertHori     ApertVert     BkSltHght     BkSltWdth          DDC0
DDC2       DiffDet      EFcancel        EFflip       EFguide      EIcancel        EIflip       EIguide          FLIP
FilTilt       FilTran       FocusCu       FocusPG             H           HKL       Hsample             K             L
MonoBlade01   MonoBlade02   MonoBlade03   MonoBlade04   MonoBlade05   MonoBlade06   MonoBlade07   MonoBlade08   MonoBlade
MonoElev     MonoTrans         PSDet   PostAnaColl  PostMonoColl    PreAnaColl   PreMonoColl            RC            SC
SDC1          SDC2     SingleDet      SmplElev     SmplGFRot     SmplLTilt      SmplLTrn     SmplUTilt      SmplUTrn
TDC01         TDC02         TDC03         TDC04         TDC05         TDC06         TDC07         TDC08         TDC09
Vsample TemperatureControlReading TemperatureSetpoint TemperatureHeaterPower TemperatureSensor1 TemperatureSensor2 Temper
                  0.502         0.486             0           0.0       29.4045       31.5885        49.995           200
20.591       41.1771        68.742       20.5885            IN       20.5885       20.5885    0.00803333    0.00833333
0.000366667        -0.008         0.016    0.00763333    0.00803333   0.000333333        -0.008        0.0003    0.008033
20.5883       79.9998           150             1        9.9944             2             6             5           180
1.2014         1.001        0.0212        0.0215        0.5143             A        -0.805       -1.9496            IN
1327           N/A           N/A          None           N/A           N/A             0             0             0
0             0             0             0             0             0             0             0         2.486      -8
N/A           N/A           N/A         25MIN       237.999        79.002             0             0             1
-1e-04       39.9993             4        0.0004        1.5216             0             0             0             0
0             0             0             0             0             1             1          None 49.995 50.0 4.6 31.07
                  0.502         0.487
```
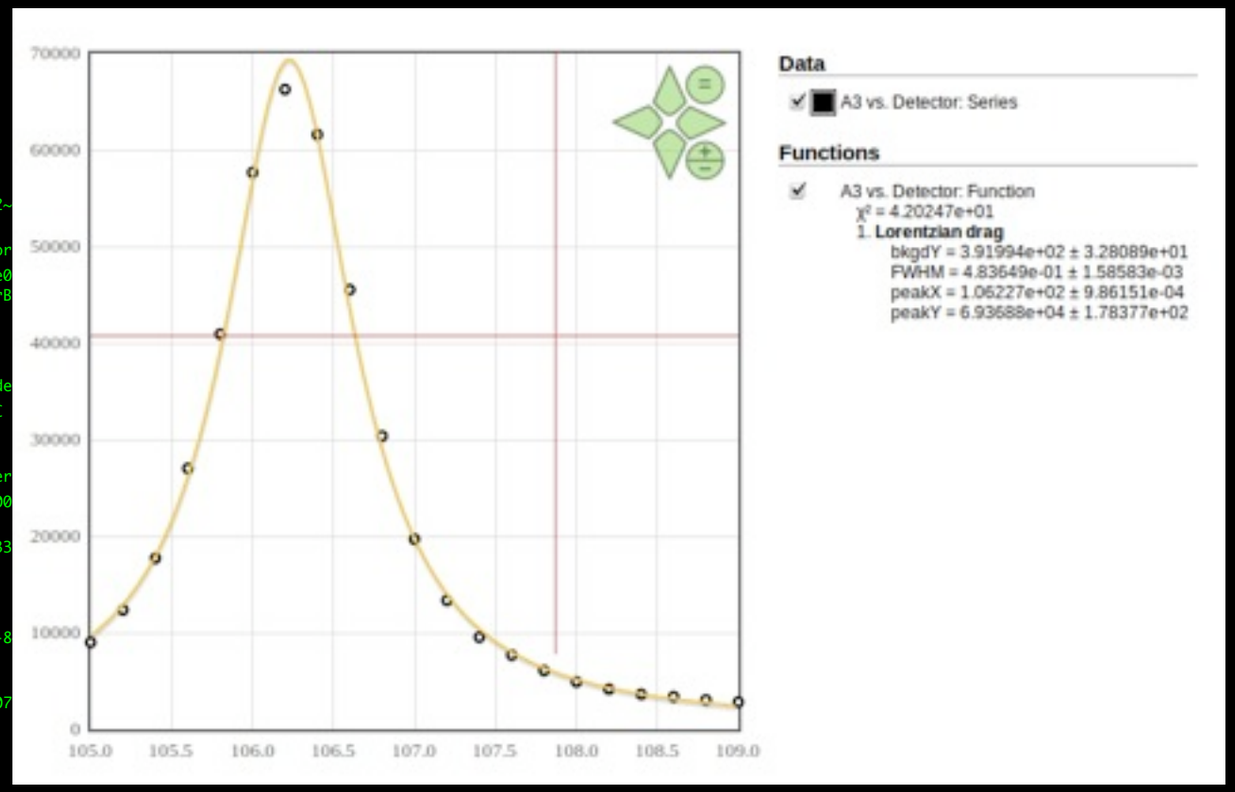
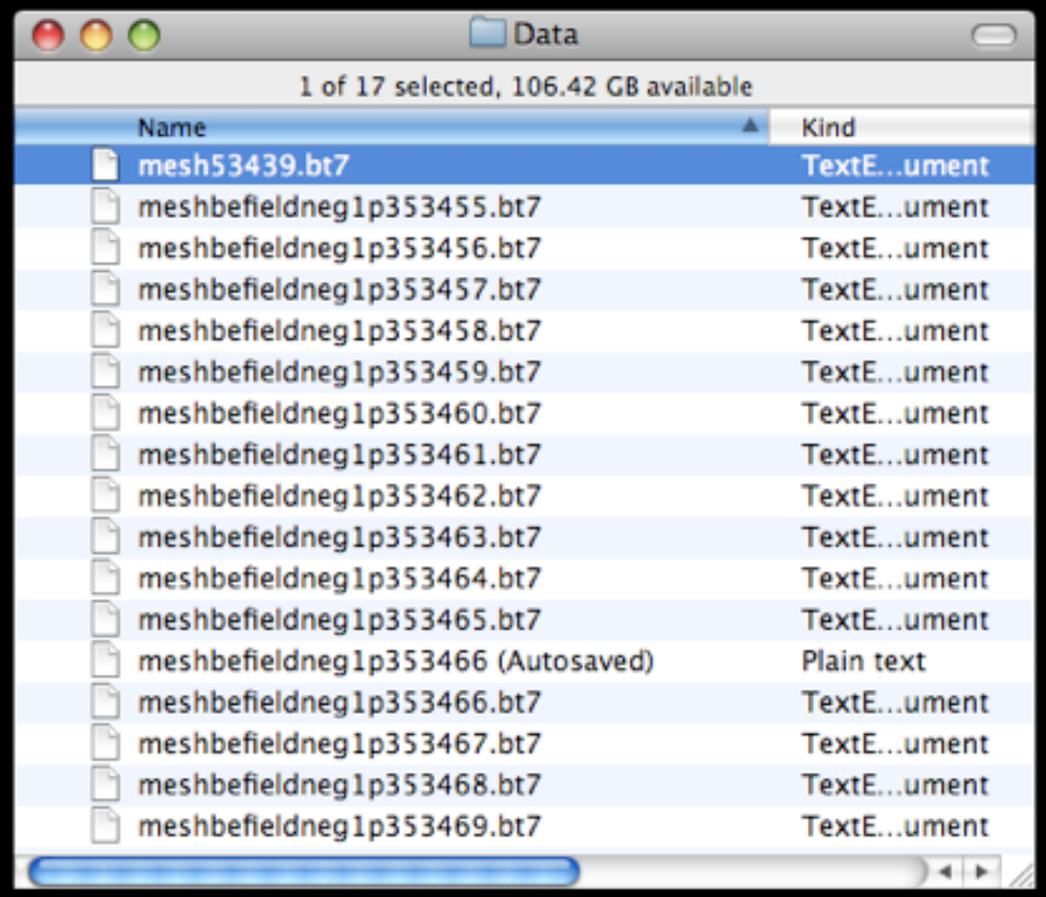

Data off the instrument is unreadable and unstructured...



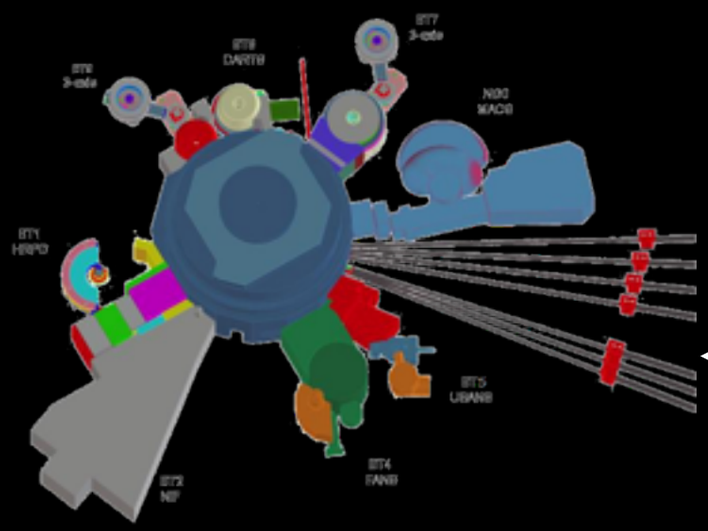
Structure makes the data meaningful and useful

Data files are often split up and incomplete



Data files need to be combined, background noise subtracted, etc. for the data to make sense.

Web-based data reduction has key advantages



Live data as it comes off the instrument

Updates and patches are instantaneous

Portable to any standards compliant browser, OS independent

Web apps have 3 main components

The front end allows users to easily view and manipulate their data

The database stores file information and user data

The server connects the front end to the database

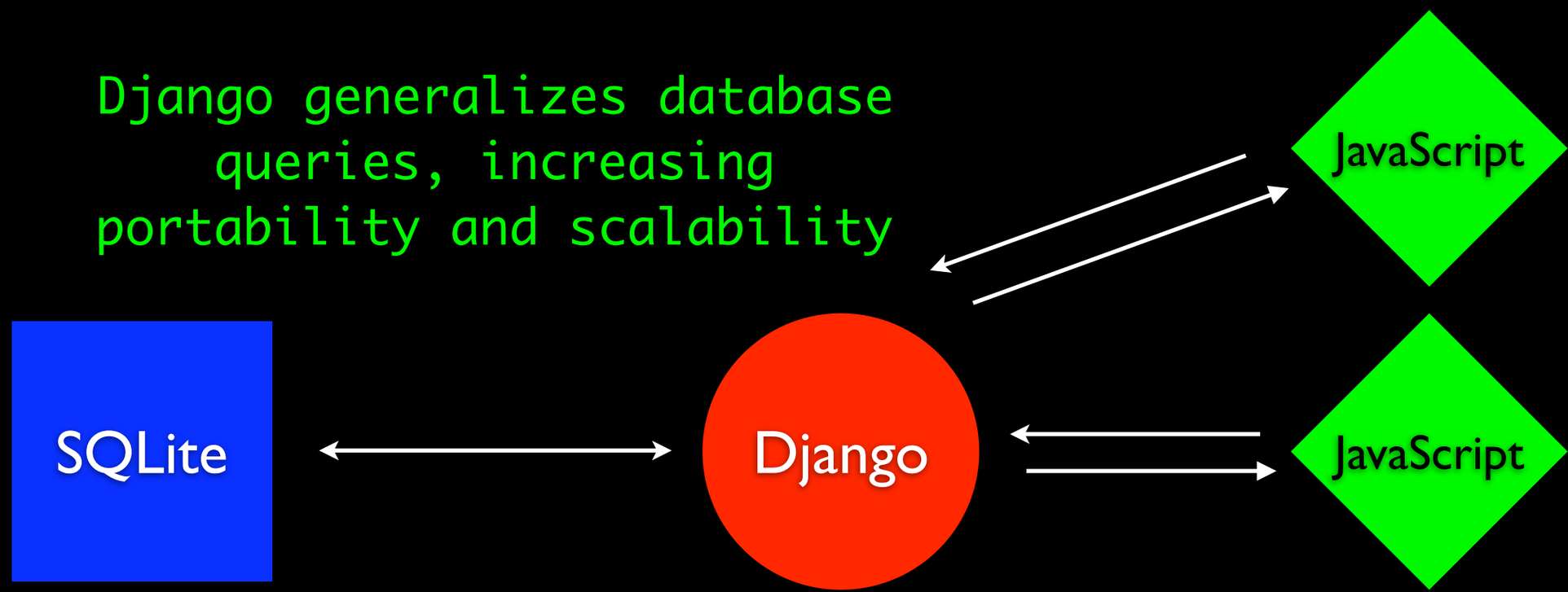
Front End

Demonstration

Back End

The back end connects users with their data

Django generalizes database queries, increasing portability and scalability



Client requests resources from Django using asynchronous javascript and xml requests (AJAX), which responds with JSON formatted objects

Hold on AJAX, JSON, what is all this stuff??

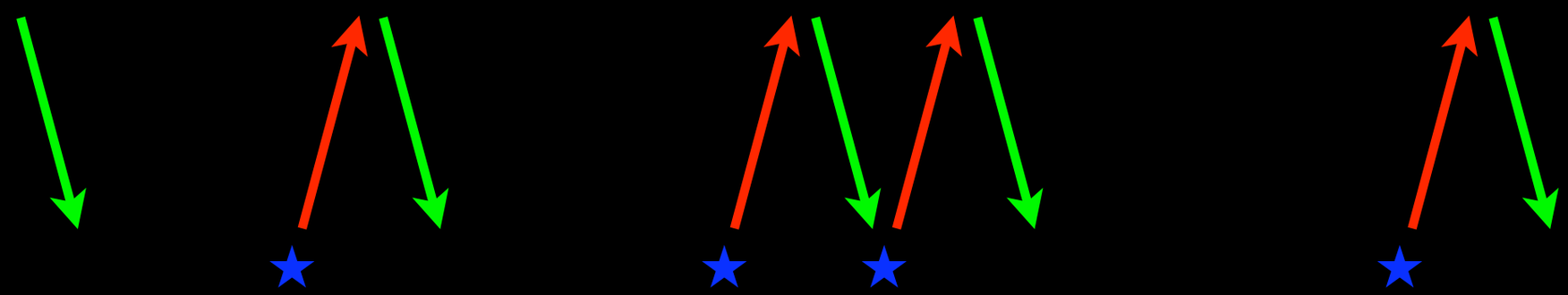
AJAX is simply a framework for client-server requests and responses without reloading the page

```
{
   "name": "Joe Redmon",
   "species": "Human",
   "weight": 183.1415927,
   "height": 72.125,
   "age": 20,
   "attributes": {
      "strengths": ["stunning good looks", "humility"],
      "weaknesses": ["sharks", "Chipotle"]
   }
}
```

JSON is a format for storing object information as text

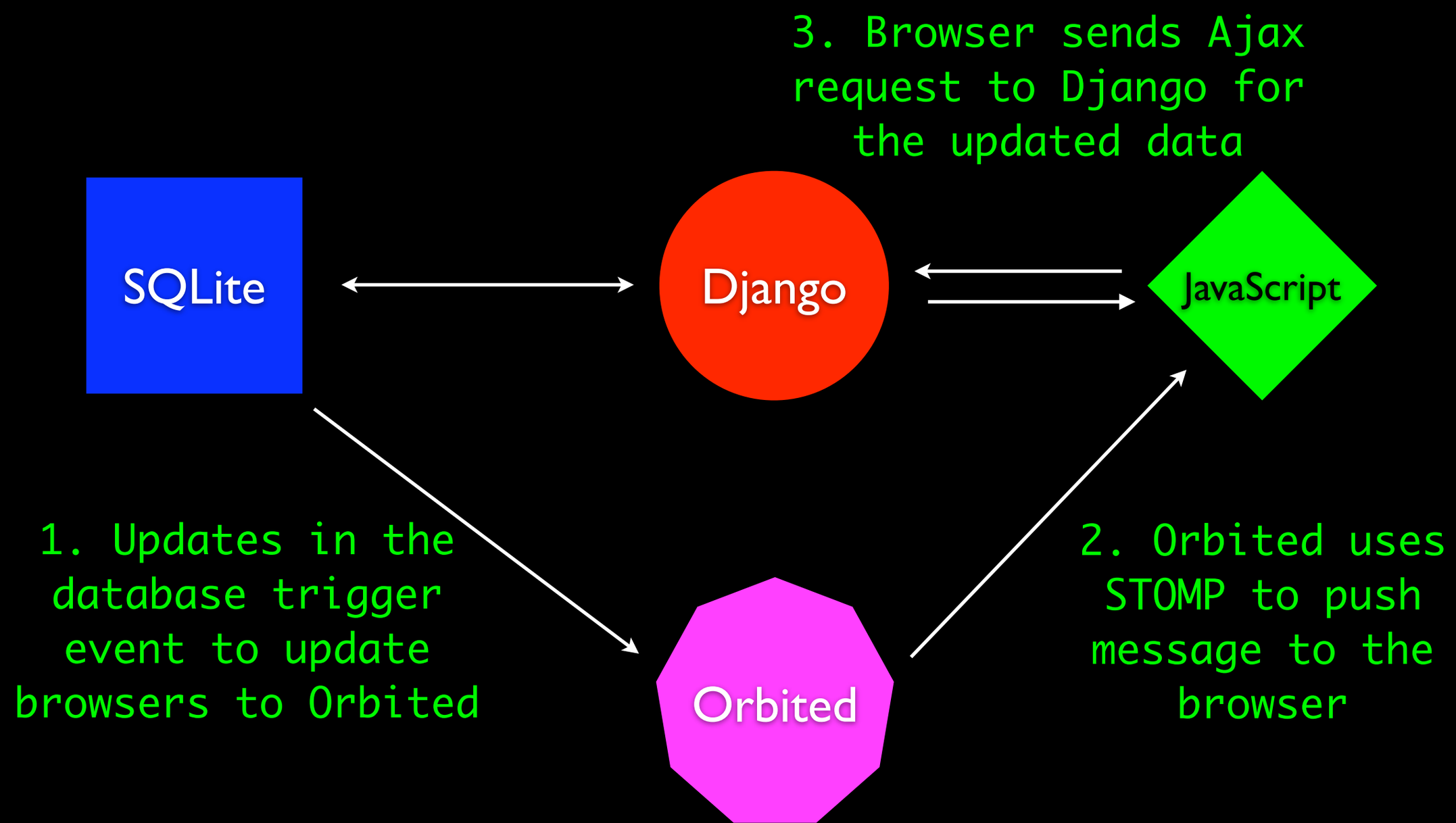
Long-polling with AJAX lets the server push data

Client sends request for update



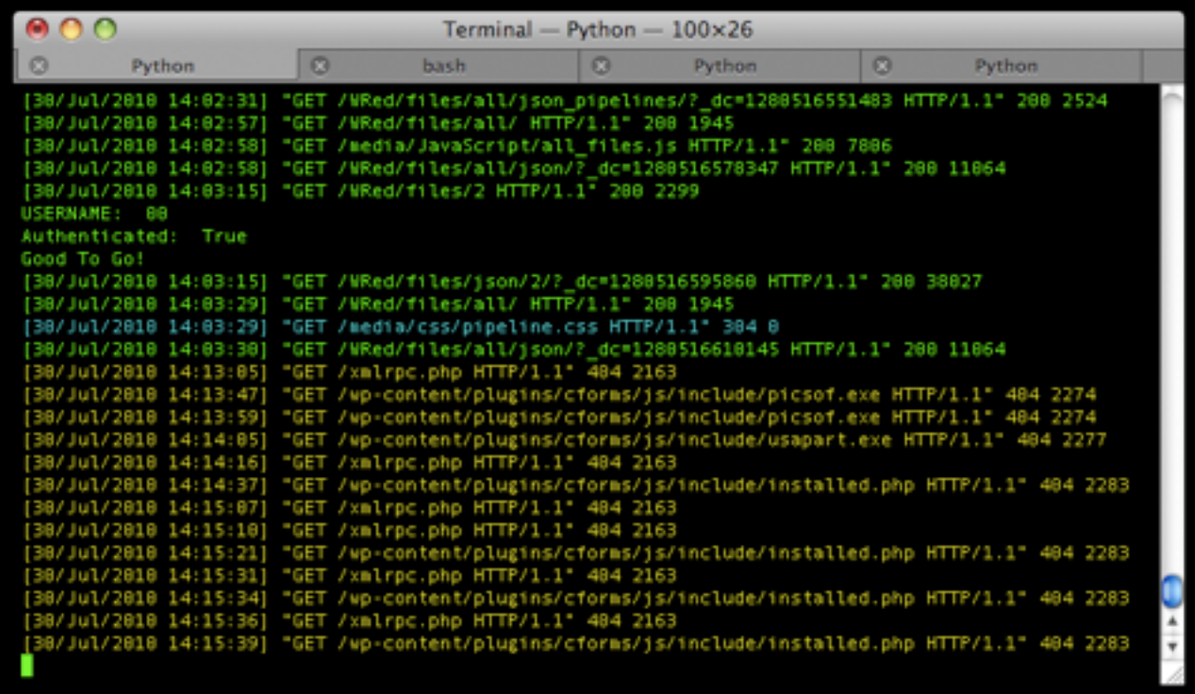
Database updates trigger response

Orbited allows the user to see live data as it comes off the machine



There are still some challenges with a web-based approach

Extension and customization is virtually impossible



Security is a concern since anyone can access the site

Acknowledgements

William ‘The Equation’ Ratcliff - The brains behind WRed

Ophir ‘Sensei’ Lifshitz - Javascript master

Alex ‘The Code Breaker’ Yee - Has the
fun and joy of production

Paul ‘The Deal’ Kienzle - He’s the real deal