Python for Distributed Systems

PyData Madrid. April 8th 2016

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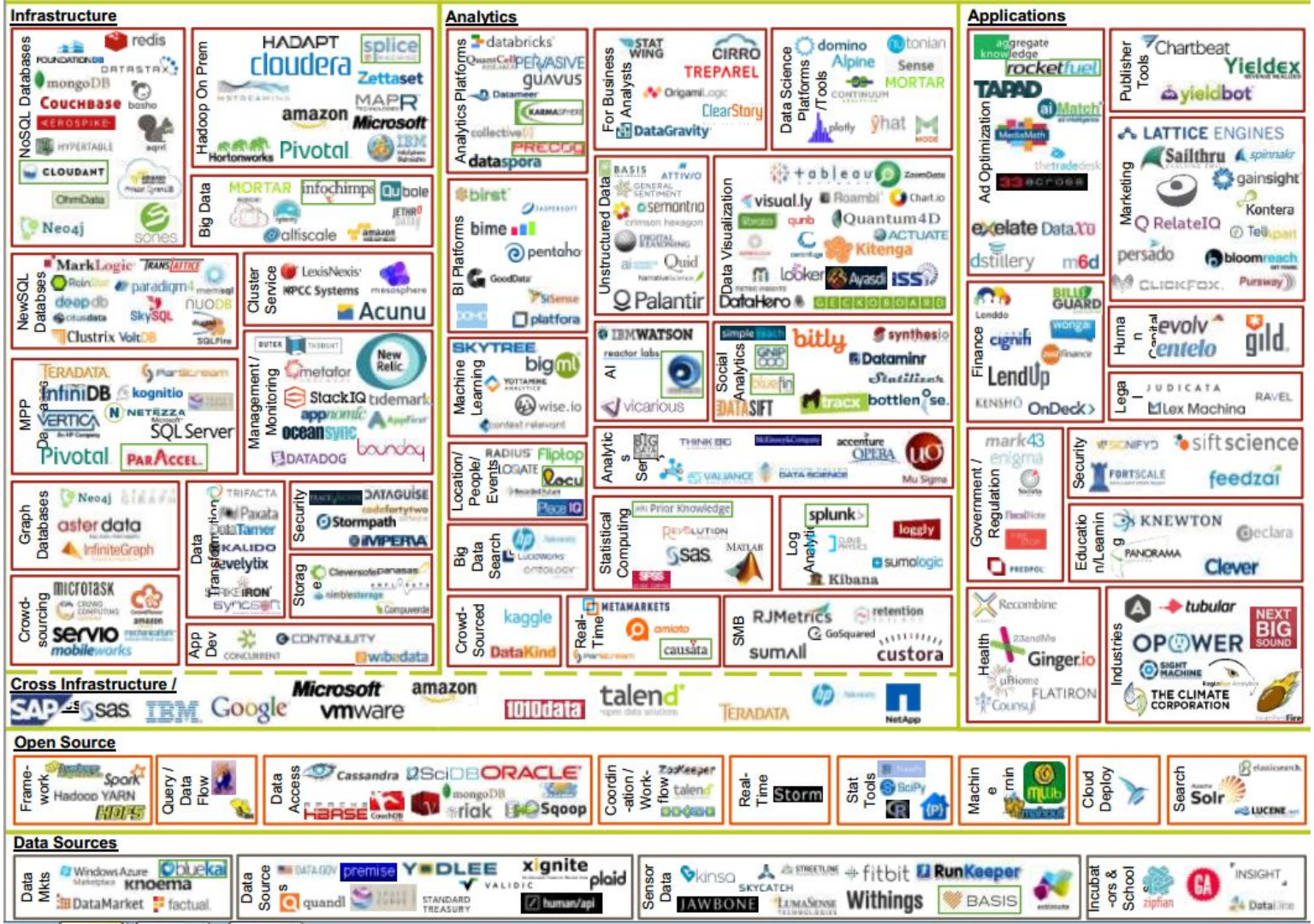
Me

- Aerospace Engineer. PhD.
- I worked with supercomputers.
- I dealt with lots of data.
- In some cases I actually built the supercomputers I used.
- I build high-performance distributed tools for a living.
- @guillemborrell
- http://guillemborrell.es

High performance distributed systems

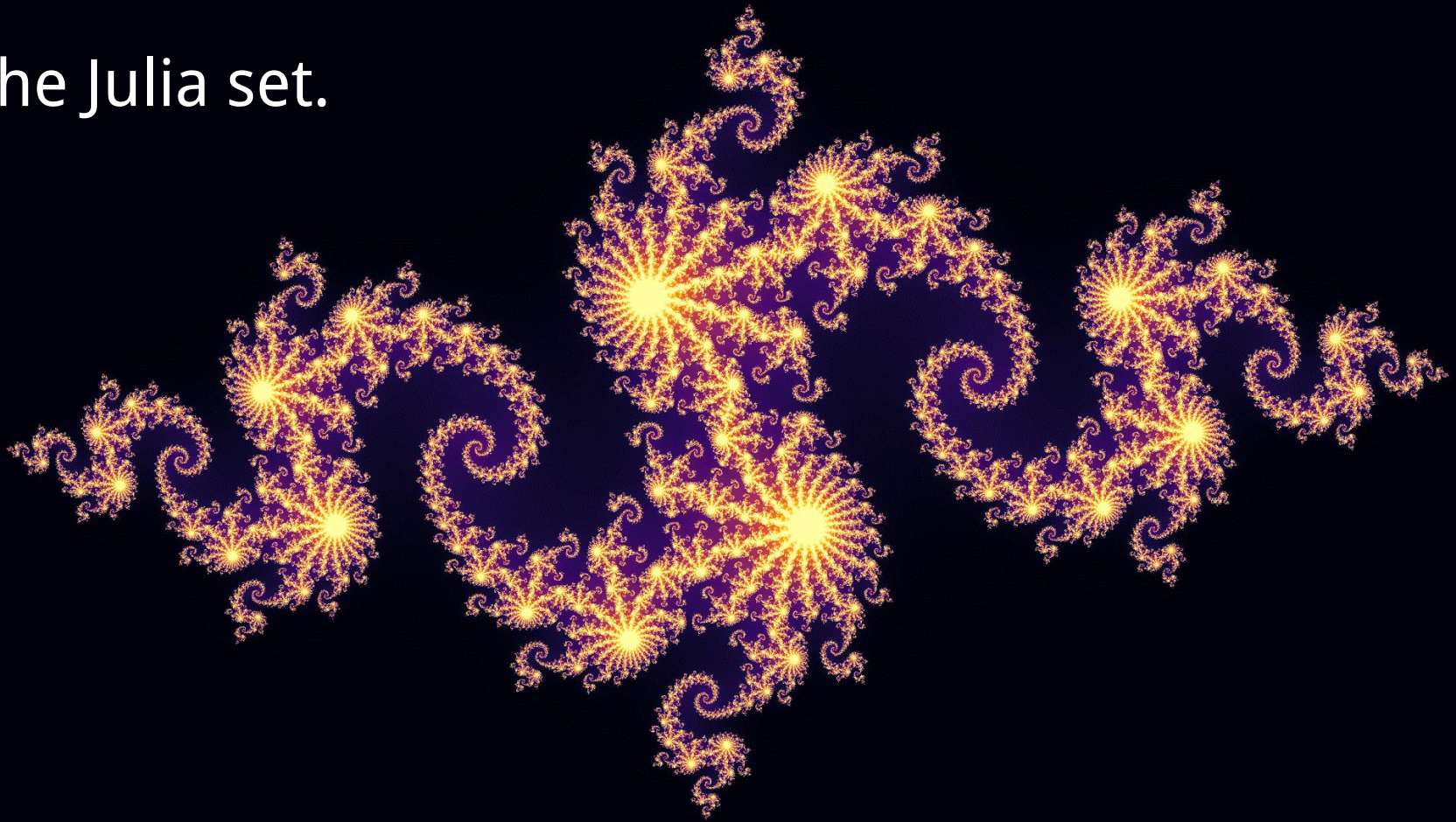

ZX Spectrum
BLUE
EDIT
1
DEF FN
RED
CAPS LOCK
2
FN
MAGENTA
TRUE VIDEO
3
LINE
GREEN
INV. VIDEO
4
OPEN #
CYAN
5
CLOSE #
YELLOW
6
MOVE
WHITE
7
ERASE
8
POINT
GRAPHICS
9
CAT
BLACK
DELETE
0
FORMAT
SIN
Q
PLOT
ASN
COS
W
DRAW
ACS
TAN
E
REM
ATN
INT
R
RUN
VERIFY
RND
T
RAND
MERGE
STR $
Y
RETURN
CHR $
U
IF
CODE
I
INPUT
IN
PEEK
O
POKE
OUT
TAB
P
PRINT
READ
A
NEW
RESTORE
S
SAVE
DATA
D
DIM
SGN
F
FOR
ABS
G
GOTO
SQR
H
GOSUB
CIRCLE
VAL
J
LOAD
VAL $
LEN
K
LIST
SCREEN $
USR
L
LET
ATTR
ENTER
CAPS SHIFT
LN
Z
COPY
BEEP
EXP
X
CLEAR
INK
L PRINT
C
CONT
PAPER
L LIST
V
CLS
FLASH
BIN
B
BORDER
BRIGHT
IN KEY $
N
NEXT
OVER
PI
M
PAUSE
INVERSE
SYMBOL SHIFT
BREAK
SPACE


Infrastructure
NoSQL Databases
redis
FOUNDATIONDB
DATASTAX
mongoDB
COUCHBASE
basho
AEROSPIKE
HYPERTABLE
aerospike
CLOUDANT
OrientDB
Neo4j
sones
Hadoop On Prem
HADAPT
cloudera
splice machine
Zettaset
HSTREAMING
MAPR
amazon
Microsoft
Hortonworks
Pivotal
IBM
Big Data
MORTAR
infochimps
qubole
JETHRO DATA
altiscale
amazon web services
NewSQL Databases
MarkLogic
TRANSLATTICE
Rainstor
paradigm4
memsql
deepdb
SkySQL
NUODB
citusdata
Clustrix
VoltDB
SQLFire
Cluster Service
LexisNexis
KPCC Systems
mesosphere
Acunu
MPP Databases
TERADATA
ParStream
InfiniDB
kognitio
NETEZZA
VERTICA
SQL Server
Pivotal
PARACCEL
Management / Monitoring
OUTER THOUGHT
New Relic
metafor
StackIQ
tidemark
appnomic
AppFirst
oceansync
boundary
DATADOG
Graph Databases
Neo4j
aster data
InfiniteGraph
Data Transformation
TRIFACTA
Paxata
DataTamer
KALIDO
Pervasive
Security
DATAGUISE
codefortytwo
Stormpath
IMPERVA
Storage
CleversafePanasas
nimbleStorage
Conquerede
Crowd-sourcing
microtask
CROWD COMPUTING
CrowdFlower
amazon mechanical turk
servio
mobileworks
App Dev
CONCURRENT
CONTINUITY
wibidata
Analytics
Analytics Platforms
databricks
QuantCell
PERVASIVE
guavus
Datameer
KARMASPHERE
collective
PRECOG
datasphera
For Business Analysts
STAT WING
CIRRO
TREPAREL
Origami Logic
ClearStory
DataGravity
Data Science Platforms / Tools
domino
tonian
Alpine
Sense
CONTINUUM
MORTAR
plotly
yhat
MODE
BI Platforms
birst
JASPERSOFT
bime
pentaho
GoodData
SiSense
platfora
Unstructured Data
BASIS
ATTIVIO
GENERAL SENTIMENT
semantria
crimson hexagon
DIGITAL REASONING
Quid
Palantir
Data Visualization
tableau
ZoomData
visual.ly
Roambi
Chart.io
Quantum4D
ACTUATE
Kitenga
looker
Ayasdi
ISS
DataHero
GECKOBOARD
Machine Learning
SKYTREE
bigml
YOTTAMINE ANALYTICS
wise.io
Social Analytics
simple reach
GNIP
bitly
synthesio
Dataminr
Statilytics
tracx
bottlenose
DATASIFT
AI
IBM WATSON
reactor labs
vicarious
Location/ People/ Events
RADIUS
LOCATE
Fliptop
Locu
PlaceIQ
Analytic Services
BIG DATA
THINK BIG
accenture
OPERA
Mu Sigma
VALIANCE
DATA SCIENCE
Big Data Search
Lucidworks
ONTOLOGY
Statistical Computing
Prior Knowledge
REVOLUTION
sas
MATLAB
SPSS
Log Analytics
splunk
loggly
sumologic
Kibana
Crowd-Sourced
kaggle
DataKind
Real-Time
METAMARKETS
metamarkets
SMB
RJMetrics
retention science
GoSquared
sumAll
custora
Applications
Ad Optimization
aggregate knowledge
rocketfuel
TAPAD
ai Match
MediaMath
the trade desk
33across
exelate
Data.xu
dstillery
m6d
Publisher Tools
Chartbeat
Yieldex
yieldbot
Marketing
LATTICE ENGINES
Sailthru
spinnaker
gainsight
Kontera
RelateIQ
Telkpart
persado
bloomreach
CLICKFOX
Pursway
Finance
Lenddo
BILLGUARD
Wonga
cignifi
LendUp
KENSHO
OnDeck
Human Capital
evolv
centelo
gild
Legal
JUDICATA
Lex Machina
RAVEL
Government / Regulation
mark43
enigma
Security
SIFTSCIENCE
FORTSCALE
feedzai
Education/Learning
KNEWTON
declara
PANORAMA
Clever
Health
Recombine
23andMe
Ginger.io
uBiome
FLATIRON
Counsyl
Industries
tubular
NEXT BIG SOUND
OPOWER
SIGHT MACHINE
THE CLIMATE CORPORATION
Cross Infrastructure /
SAP
sas
IBM
Google
Microsoft
vmware
amazon
1010data
talend
TERADATA
NetApp
Open Source
Frame-work
Spark
Hadoop YARN
HIVE
Query / Data Flow
Data Access
Cassandra
SciDB
ORACLE
mongoDB
HBase
riak
Sqoop
Coordin-ation / Work-flow
ZooKeeper
talend
Oozie
Real-Time
Storm
Stat Tools
SciPy
R
Machine Learning
MLlib
Cloud Deploy
Search
Solr
elasticsearch
LUCENE
Data Sources
Data Mkts
Windows Azure Marketplace
bluekai
knoema
DataMarket
factual
Data Sources
DATA.GOV
premise
YODLEE
xignite
quandl
STANDARD TREASURY
VALIDIC
plaid
human/api
Sensor Data
kinsa
SKYCATCH
STREETLINE
fitbit
RunKeeper
JAWBONE
LUMOSITY
Withings
BASIS
estimote
Incubat-ors & School
zipfian
INSIGHT
DataKind

Let’s start from ground up.
And let’s be ambitious.

The Unicorn idea.

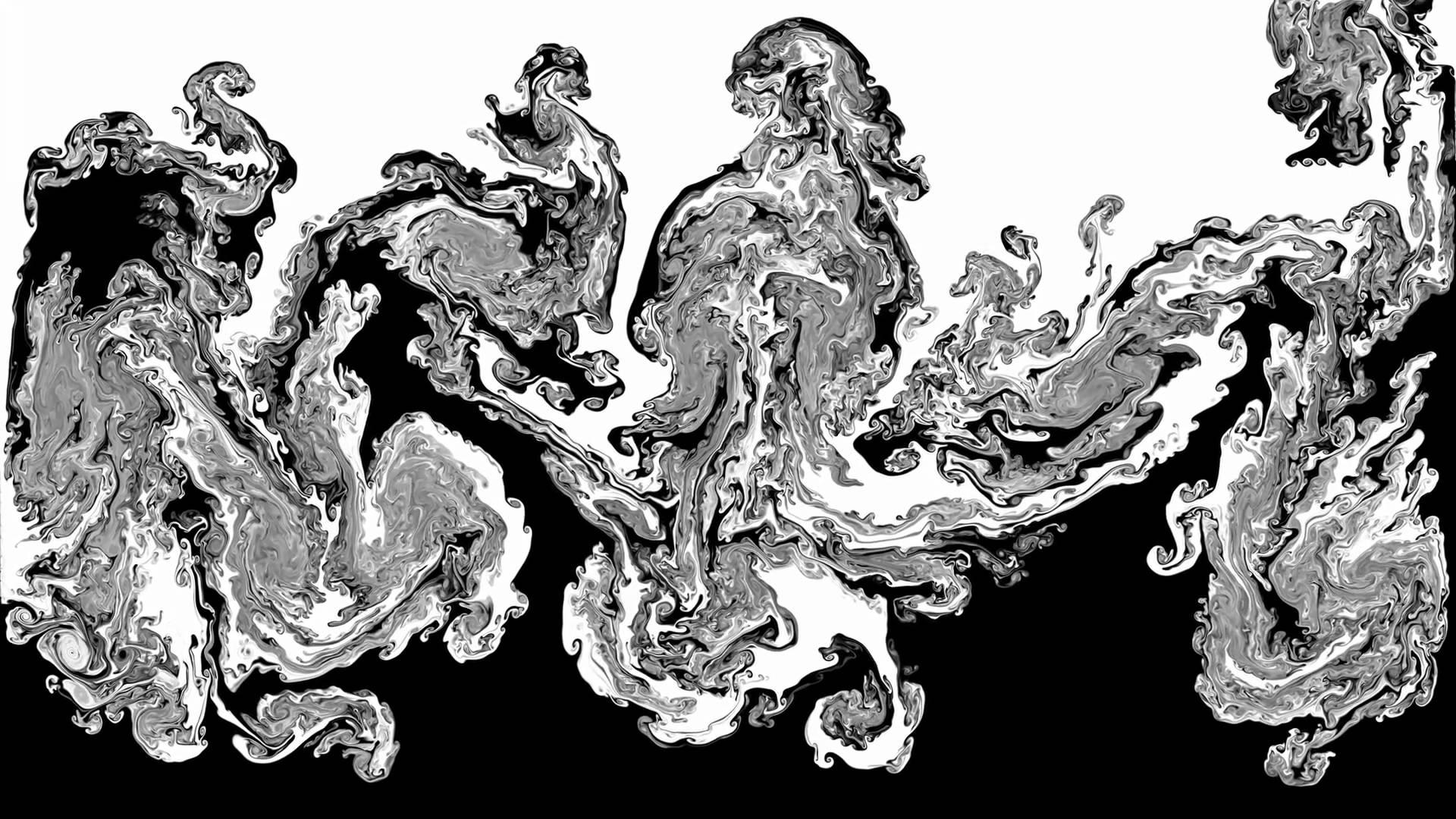
The Julia set.



Pierre Fatou
1878 - 1929

Gaston Julia
1893 - 1978

$$z_{n+1} = z_n^2 + c$$



Let’s make a Julia set.

Now we have an application

- Something that is useful, but takes a good amount of resources. Like CPU/IO intensive stuff.
- But applications are for cellphones and pirates!
- Services = $, €, ¥…
- We need a name, an elevator pitch, and a REST API to hire a frontend developer.
- We will make something that works in the Angel round.

Fractal.ly

Find beauty in complexity…
Web scale!

The REST API

Is it scalable?
Is it responsive?
Is it efficient?

Let’s make it a little more efficient.

Now we visit a business angel.
And we got money to rent servers!

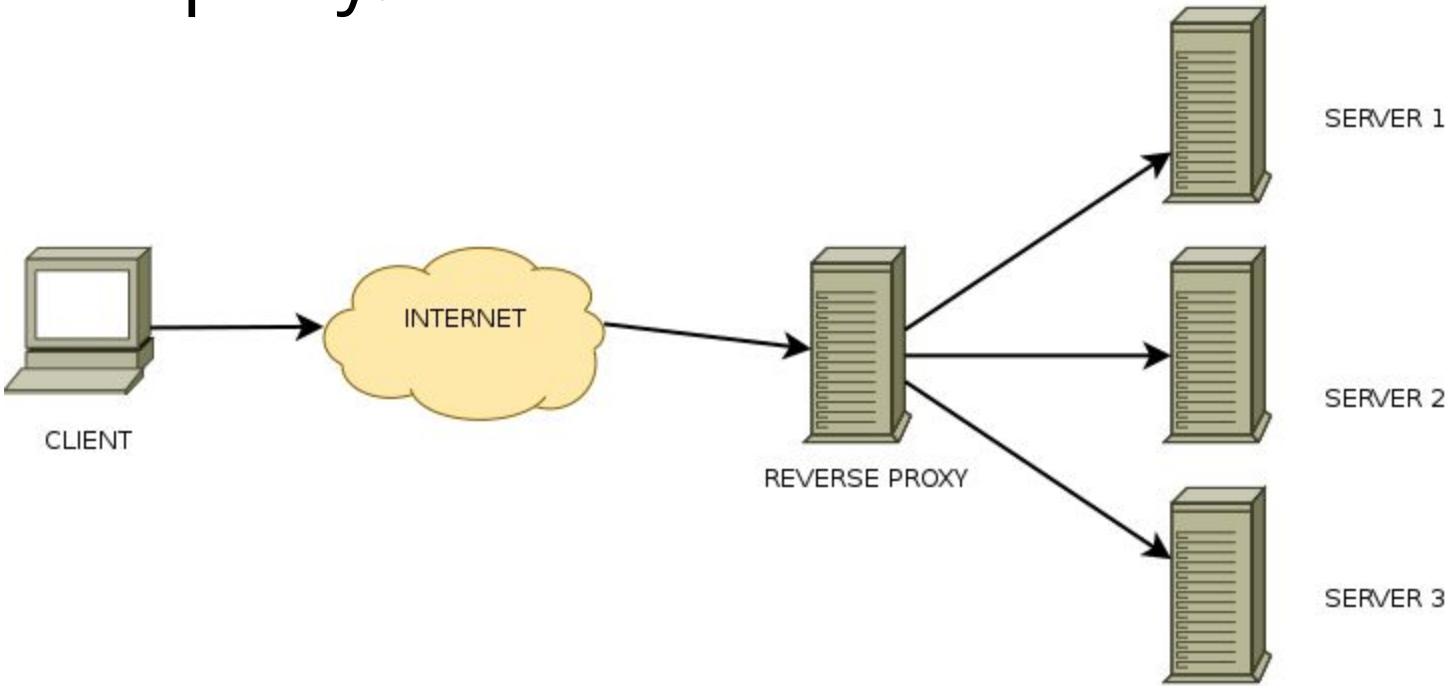
Let’s make it parallel.

Parallelization is about domain decomposition

- Split the problem in separated portions.
- The portions should share the minimum amount of information. (CAP)
- Exploit low-hanging fruits.

It is fine to deal with each request in parallel. We have to be pragmatic, it’s not about publishing a CS paper.

A reverse proxy.



Is it scalable?
Is it responsive?
Is it efficient?

We have our first users. They complain because the application is not responsive enough.

We hire a frontend developer.
And we make the application asynchronous.

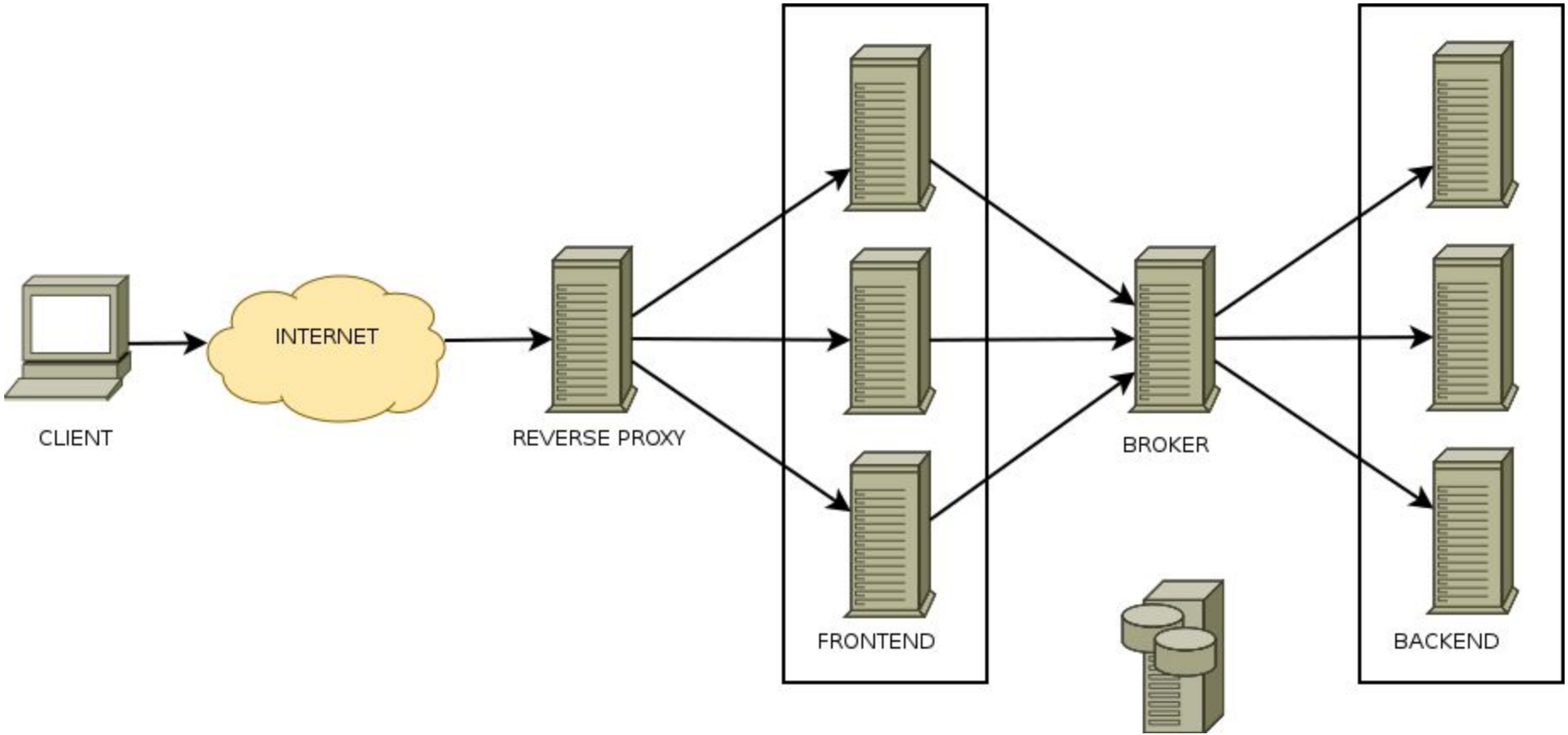
Polling is a good way to deal with asynchronicity.

But the application is not as responsive as we expected


GIL
HYATT
REGENCY
SANTA CLARA

The GIL is there because the alternatives are quite frightening.

Split I/O intensive process from CPU intensive processes.


CLIENT
INTERNET
REVERSE PROXY
FRONTEND
BROKER
BACKEND

We need message passing.

A message queue

A serialization format

Is it scalable?
Is it responsive?
Is it efficient?


julia

We now have a parallel, distributed, multi-threaded, multi-language, responsive and efficient service to obtain julia sets WEB SCALE!


amc

Questions?