Scalable Web Software

CS193S - Jan Jannink - 1/07/10

Administrative Stuff

- Computer Forum Career Fair: Wed. 13, 11-4
  - Lawn between Hewlett Teaching Center and Gilbert Building
- Looking forward to your emails! Already received a dozen or so
- Any problems dealing with eclipse/gwt setup?

Weekly Syllabus

1. **Scalability: *(Jan.)***
2. Agile Practices
3. Ecology/Mashups*
4. Browser/Client
5. Data/Server: *(Feb.)*
6. Security/Privacy
7. Analytics*
8. Cloud/Map-Reduce
9. Publish APIs: *(Mar.)* *
10. Future

* assignment due

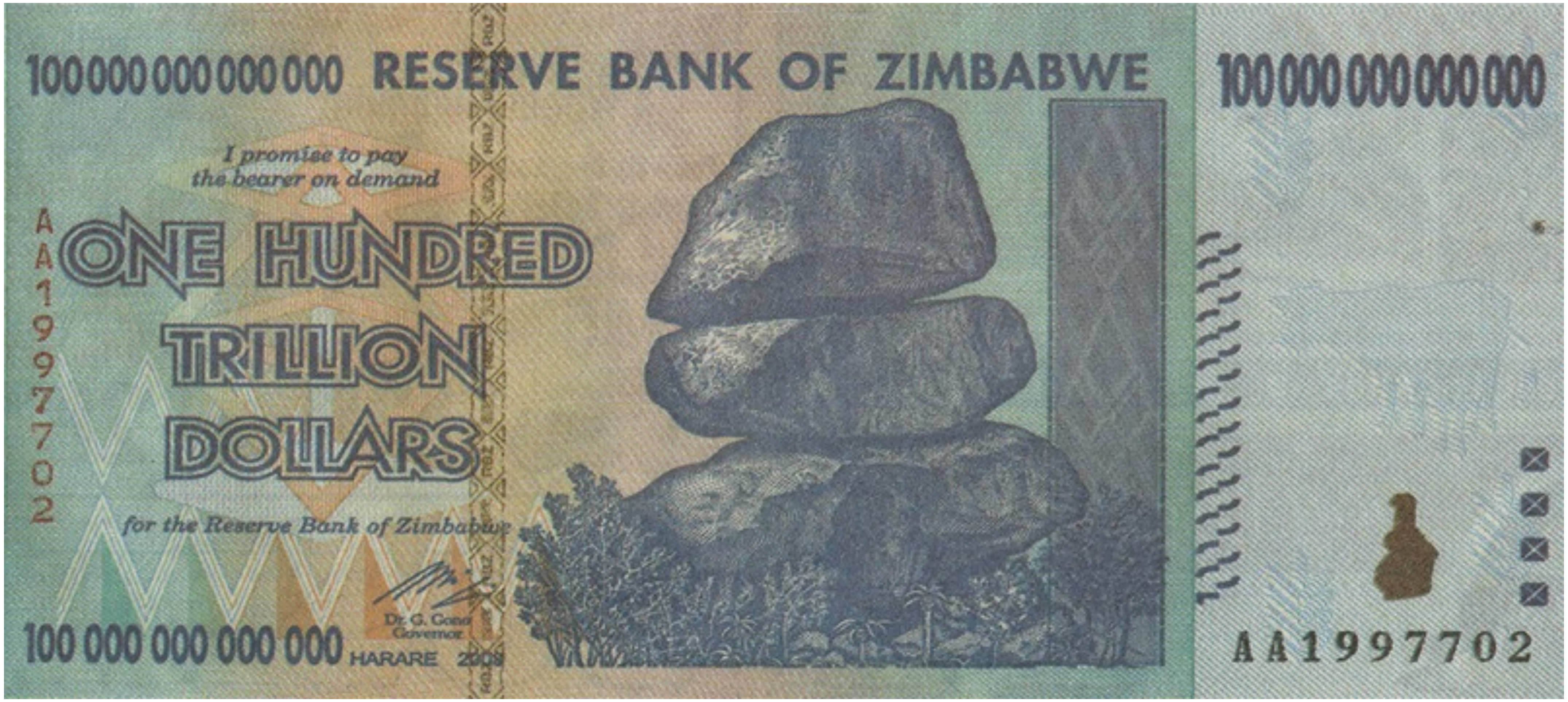
Quick Review

- Think Big
- Scalability means thriving and growing in a dynamic environment
- Java + open source: a great environment to learn scalable practices
- Engineers & investors understand innovation differently

Scale Fail

100000000000000
RESERVE BANK OF ZIMBABWE
100000000000000
I promise to pay the bearer on demand
AA1997702
ONE HUNDRED TRILLION DOLLARS
for the Reserve Bank of Zimbabwe
Dr. G. Gono Governor
100 000 000 000 000
HARARE 2008
AA1997702

Scale Fail

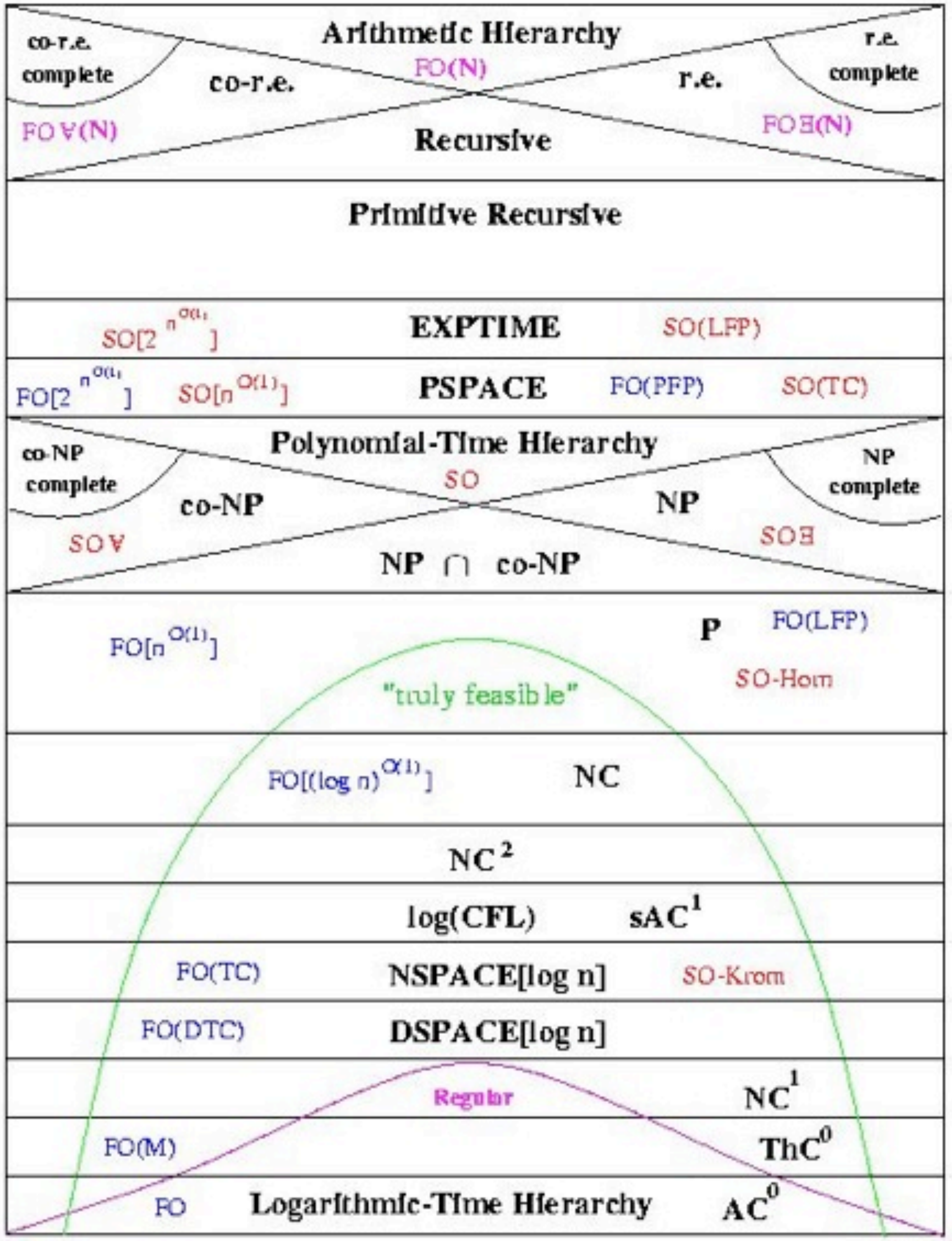


how do you get change for this?

The Web is Just Right

- Many basic computer science algorithms are well understood
- Complexity theory defines practically unsolvable problems
- Scalable web coding fits in the border region between basic and complex

Complexity Classes



YouTube Example

- Piggybacked growth on MySpace.com
- Previously unheard of bandwidth
- Growth delayed feature development
- Could not afford to continue to grow on its own
- Acquisition significantly delayed revenue model development

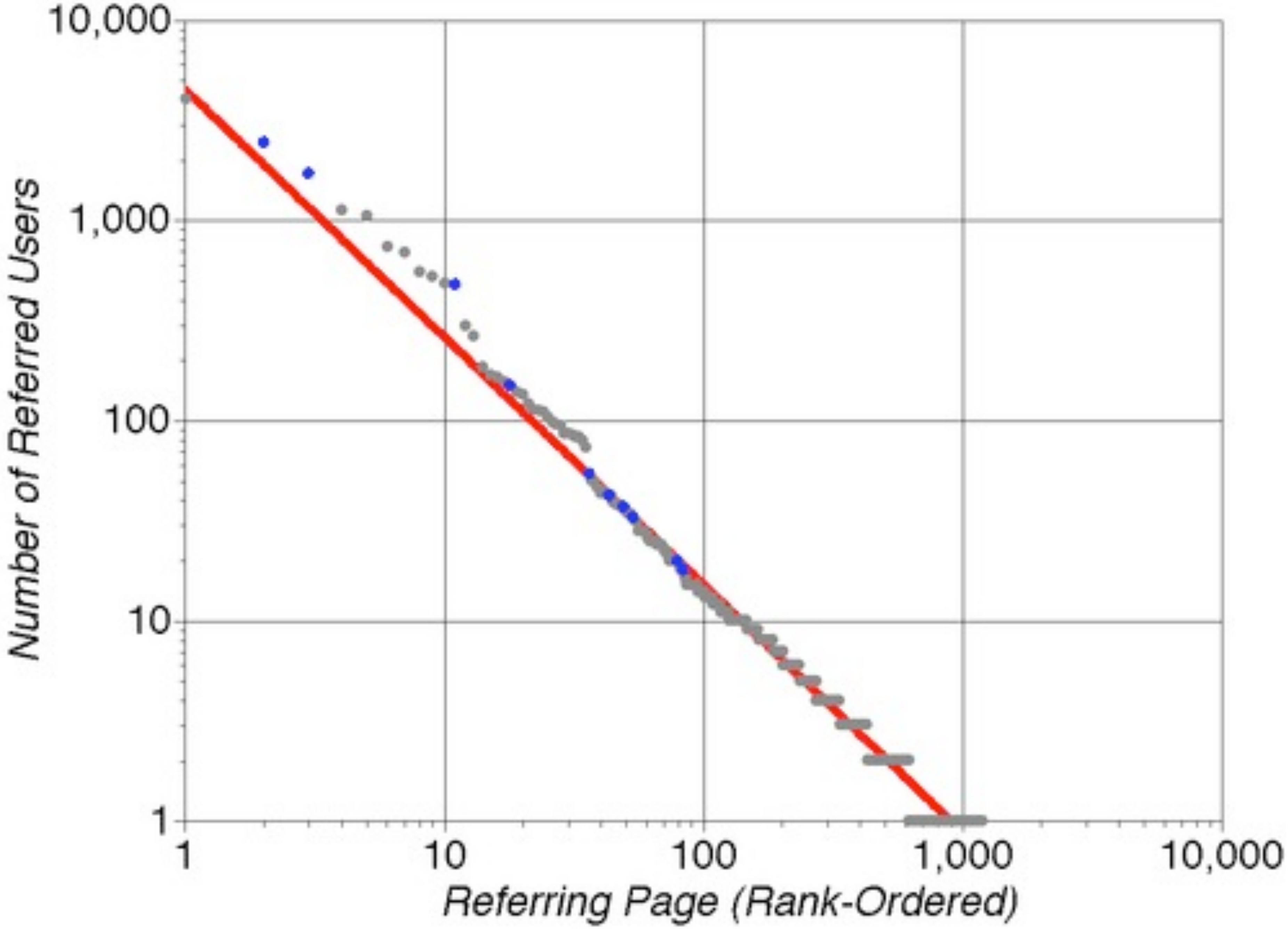
Properties of Web Data

- Quickly, iteratively, accumulated by contributors, seen by many viewers
- New additions are not independent of prior ones
- The dependency induces several power law distributions over the data
- Frequently called ‘Long Tail data’

Power Law Distributions

- Every aggregated collection of human artifacts seems expressible in this way
- They are so called because in a log/log plot they generally follow a straight line
- the slope of the line s corresponds to a power coefficient: i.e., $y = x^{-s}$

Web Traffic Referral Plot



Why This is Relevant

- Back end infrastructure
- Database partitioning
- Data replication
- Caching technique
- Web page design

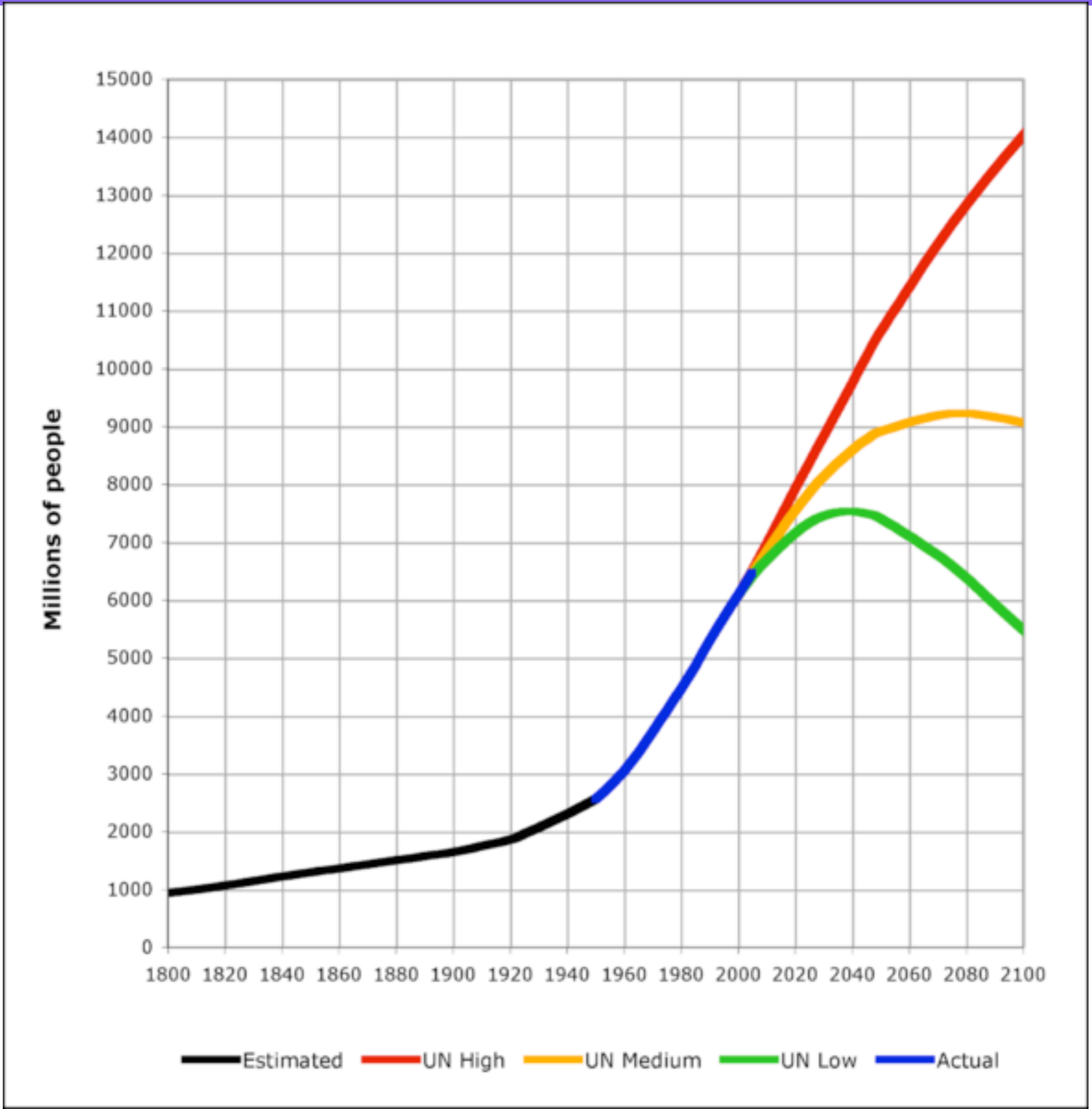
Other Examples

- Human Languages (word usage)
- Social Networks (connections)
- Financial Markets (transactions)
- Research Citations
- Called them Nexus in my PhD research

Power Law Generators

- item creation
  - object in a universe
- link creation
  - any relationship between items
  - new link probability based on existing structure
- item & link removal

Stuff to Ponder



Dynamic Environments

- Habitats/Ecosystems
  - species surviving to occupy a niche
- Organizations/Societies
  - unifying force and leadership
- Markets/Economies
  - producer consumer relationship

Back to Software

- So many technologies, so little time
- Start with a single platform, language
    - Java/gwt/junit
- Single developer code/test cycle
    - code/checkin/test/repeat
- We’ll continue today with SQL

MySQL Install

- download from website & install, download & unzip popnames.zip
- minor Mac OS X command line edit
- `sudo echo /usr/local/mysql/bin > /etc/paths.d/mysql`
- `mysql < popnames.txt`

  -
    ```
    select name, count(name), sum(count) from
    popnames group by name order by count(name) desc
    limit 20;
    ```

  -
    ```
    select gender, name, sum(count) as total from
    popnames where year(year)>1958 group by name,
    gender order by total desc limit 20;
    ```

  -
    ```
    select left(name,1) as i, sum(count) from
    popnames group by i;
    ```

Untaught MySQL Tools

- mysqlimport
- mysqldump
- workbench
- connectors
- in mysql client
    - data analysis : group by, order by

Popular Names Dataset

- Source data:
  - http://www.ssa.gov/OACT/babynames/
- Command line tools extract data from html tables, into tab separated text files
  - curl, sed, awk, python
- Import into MySQL
  - load data local infile “” into table ... fields terminated by ‘’ (@A, @B, @C) set ...;

User Account Table

- name
- hashed password
- identifier (email)
- current email
- payment info
- (secure stuff)

- everything else (potentially public data) should be kept separate

Q & A Topics

- Nexus research
- Database vs. flat file
- Hibernate vs. ODBC access layer

Worth Checking Out

- MySQL downloads
  - http://dev.mysql.com/downloads/
- The Goldilocks Enigma
  - Paul Davies
- SQLite
  - http://www.sqlite.org/