



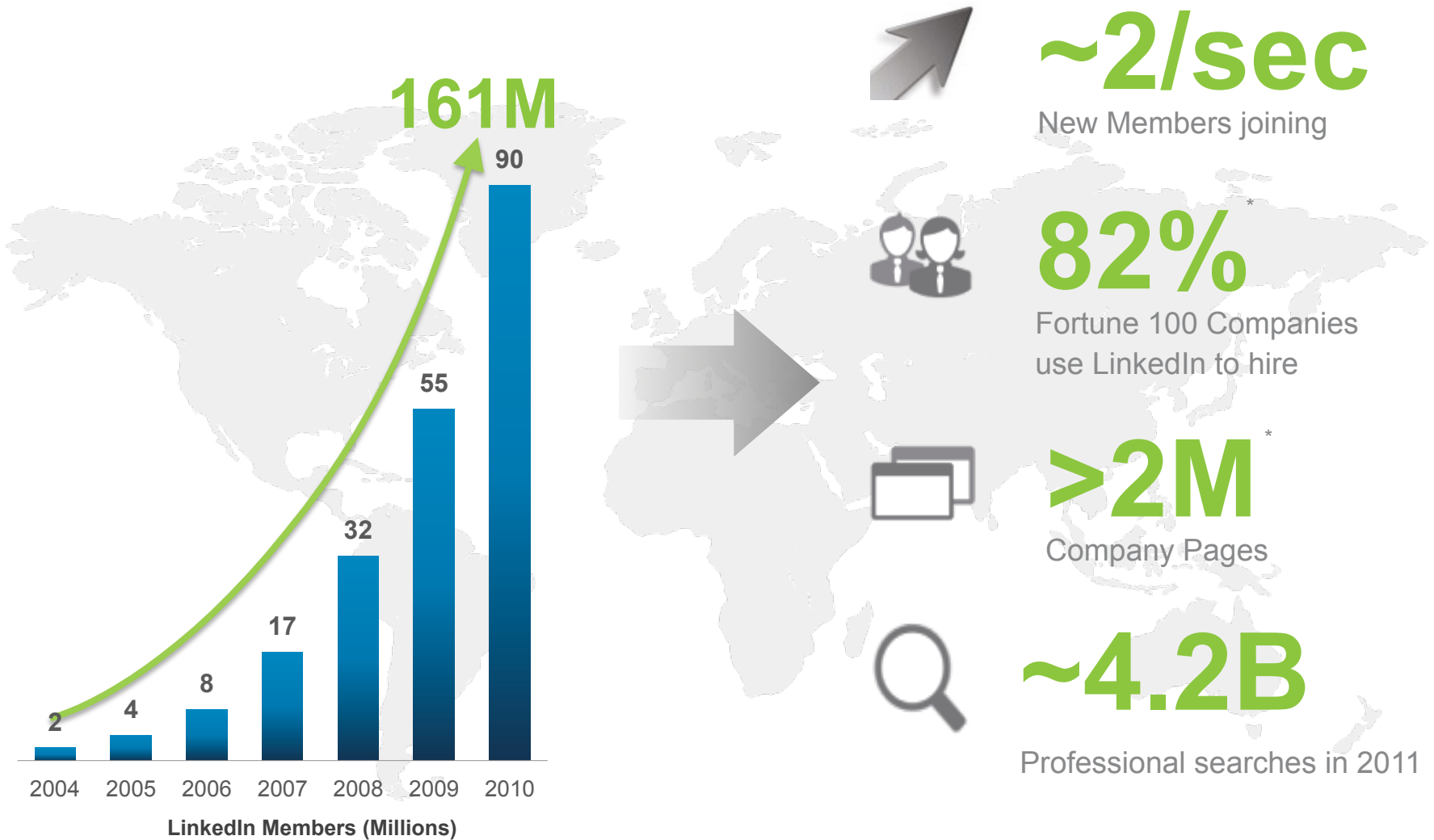
A Look at Some Dynamics of Social Networking : Following the Jobs Ecosystem

Igor Perisic, Ph.D.
Sr. Director Engineering at LinkedIn



The world's largest professional network

Over 60% of members are now international



*as of March 31, 2012



Our Mission

Connect the world's professionals to make them more productive and successful.

Our Vision

Create economic opportunity for every professional in the world.

Members First!



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Igor Perisic
Sr. Director of Engineering at LinkedIn
San Francisco Bay Area | Internet

**CPA Australia presents An Audience with Neil Armstrong**
thebottomline.cpaaustralia.com.au
In this four part series the first man to walk on the moon, gives a personal commentary on Apollo 11's historic lunar landing, his thoughts on leadership and taking risks to innovate for the future. Part 1 – Space Race now...

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Current **Sr. Director of Engineering at LinkedIn** 
Advisor at swissnex San Francisco 

Past Director of Engineering; Search, Network and Analytics at LinkedIn 
Senior Product Manager at Microsoft 
Statistical Consultant at Turn 
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Education Harvard University
Ecole polytechnique fédérale de Lausanne

Recommendations **5** people have recommended Igor

Connections **425** connections

Websites **SNA projects site**


Twitter **iperisic**


Public Profile <http://www.linkedin.com/in/igorperisic>


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Viewers of this profile also viewed...


**Kevin Scott**
SVP Engineering at LinkedIn


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
**Anmol Bhasin**
Sr. Software Engineering Manager -...


**Alex Vauthey**
VP, Engineering at LinkedIn


**Jiong Wang**
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**Jay Kreps**
Principal Staff Engineer at LinkedIn

**Christian Posse**
Principal Data Scientist and Product...

**Monica Rogati**
Senior Data Scientist @ LinkedIn

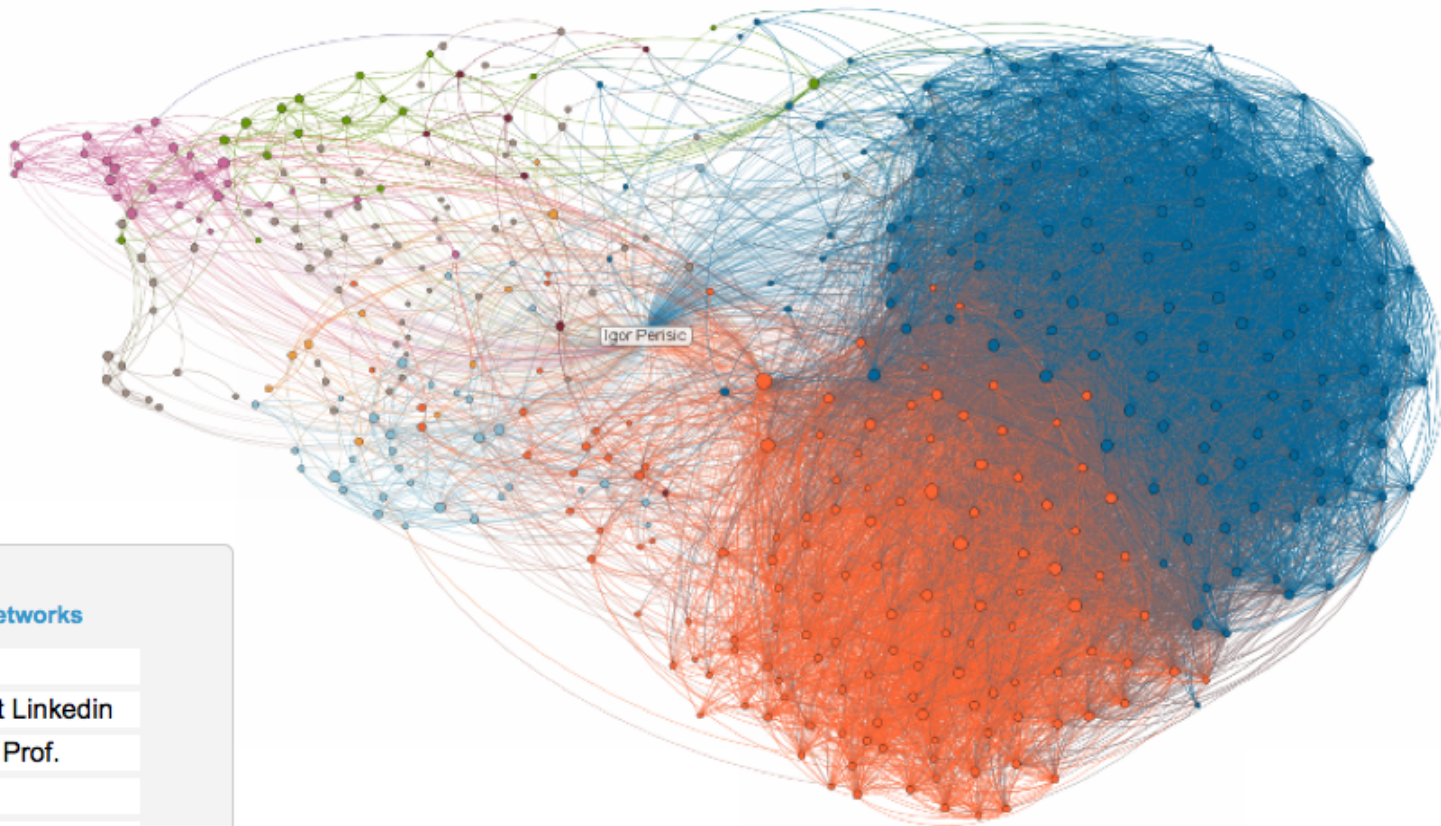
**John Wang**
Creator of SenseiDB and Search...

**Manu Sharma**
Principal Data Scientist at LinkedIn

LinkedIn

4

Connections



Label your
Professional Networks

- LinkedIn
- My Group at LinkedIn
- Switzerland Prof.
- Startup 1
- Academic
- Microsoft

<https://inmaps.linkedinlabs.com>

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☐ Group Members (2999)
☐ 3rd + Everyone Else (128573)
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☐ United Kingdom (10583)
☐ San Francisco Bay Area (8521)
☐ Greater New York City... (8484)
☐ India (8291)
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Company results for linkedin



**LinkedIn**
Internet
San Francisco Bay Area | 1001-5000 employees



People results for linkedin

**Karthik Marudhachalam Ramasamy** 1st
Senior Data Scientist at **LinkedIn**
San Francisco Bay Area · Computer Software
▶ **79** shared connections · [Similar](#) ·  **345**
[Message](#)

**Jiong Wang** 1st
Senior Engineering Manager at **LinkedIn**
San Francisco Bay Area · Computer Software
▶ **168** shared connections · [Similar](#)
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**Anmol Bhasin** 1st
Recommendations, A/B Testing and Information Extraction @ **LinkedIn**
San Francisco Bay Area · Computer Software
▶ **245** shared connections · [Similar](#)
[Message](#)

**Yevgeniy Brikman** 1st
Principal Software Engineer at **LinkedIn**
San Francisco Bay Area · Computer Software
▶ **139** shared connections · [Similar](#) ·  **498**
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**Erran Berger** 1st
Senior Engineering Manager at **LinkedIn**
San Francisco Bay Area · Computer Software
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26 Thursday April 2012

Product Design Demo
Auditorium C, 2025 Sterling Court
9:00 AM
 +6
Mei Wu Lee and 9 others

Partner Review Meeting
Room 2 in Building 3409
10:30 AM

Isaiah Goldstein and 2 others

West Coast Sales
Room 215 in Building B
1:00 PM

Nick Riccard and 2 others

New Sales Lead
Conference Room 27J
3:30 PM
 +2
George Kingsten and 5 others

UPDATES

The Secret to Making Your Message Go Viral
 inc.com

Who's viewed your profile
 Matthew Ryo
E-Business Manager, 3D Financial
San Francisco Bay Area
 Veronica Capa
Project Coordinator, CDC Corp
5 Shared Connections
 Julianne Bamford
Web Services Director, BrightNight Consulting
3 Shared Connections

9 Reasons This Boy Will Be a Billionaire Someday
 forbes.com

Walmart's Big Plans to Conquer E-Commerce in India
 theextweb.com

Behind-the-Scenes Winners in Instagram Deal
 mashable.com

9 People with new jobs
 +6
Patrick Wyser, Merry McFeely, Rob Lee, Douglas...

What your coworkers are sharing
 +11
Nicky Bailey, Rebecca Wright-Jenkins, Dominic...

red for you. 12.30

by Era
between 'Jonny' Ive
ion a decade of hits
Now Apple will be
breakthrough
ut from Jobs.
[a/Venture Capital](#)

People Mentioned In This Article
 Jonathan Ive
Senior VP of Industrial Design, Apple
 Steve Jobs
co-founder, chairman, Apple

6 hours ago

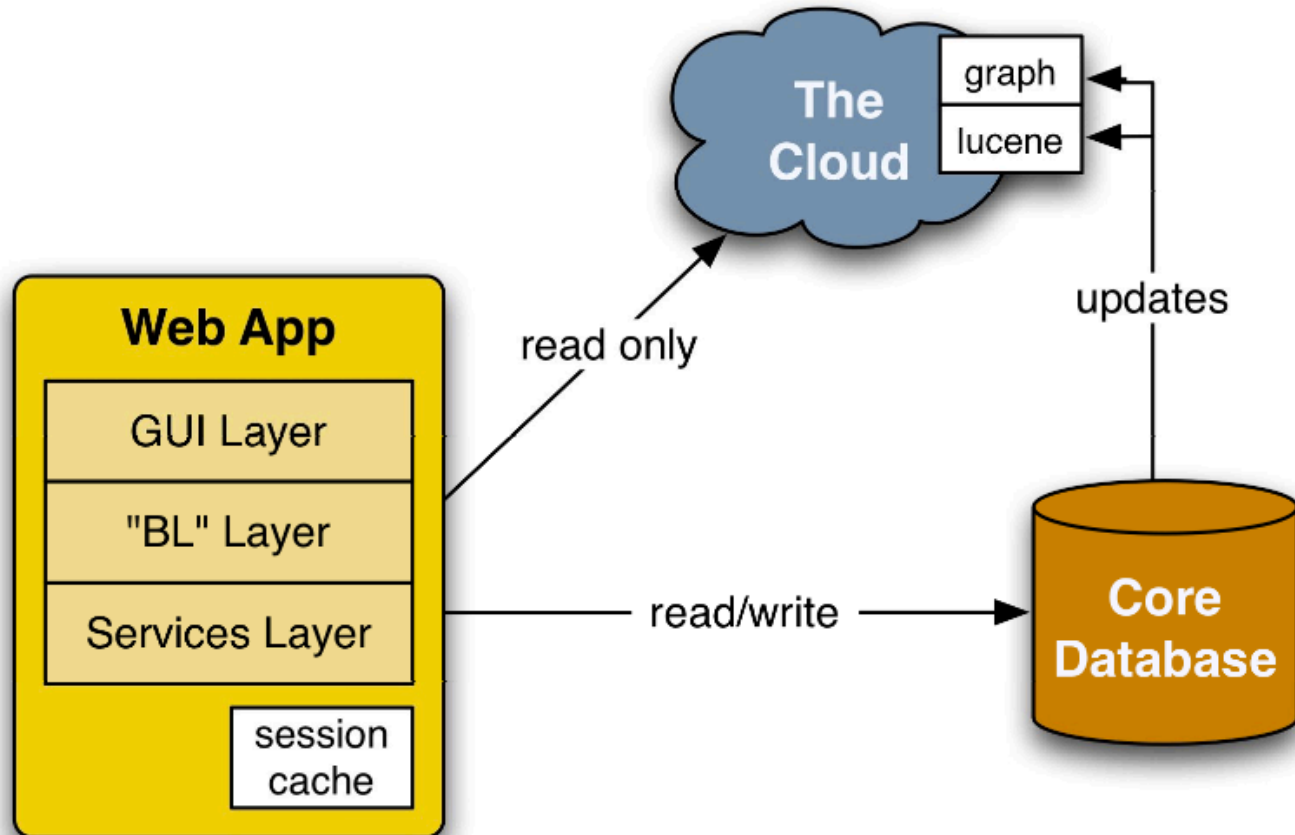
Gina Googlivasan "My haiku of the day... Tears fall for Apple Jonny Ive still innovates Best wishes Steve Jobs"
6 hours ago

Agenda

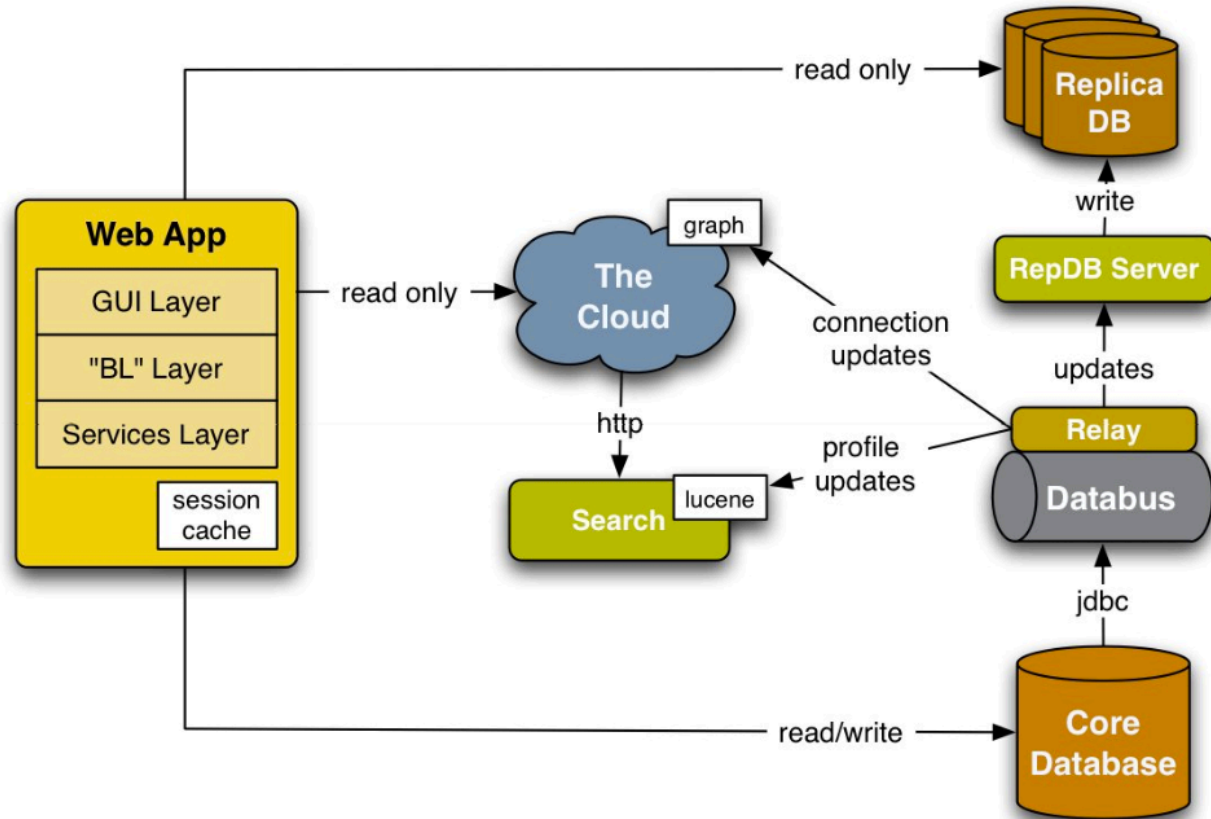
✓ Company Overview

- How does it all work together?
 - A biased historical perspective
 - Data Infrastructure and Big Data
- Recommendations?
 - Why
 - Jobs
- The Unreasonable Effectiveness of Data

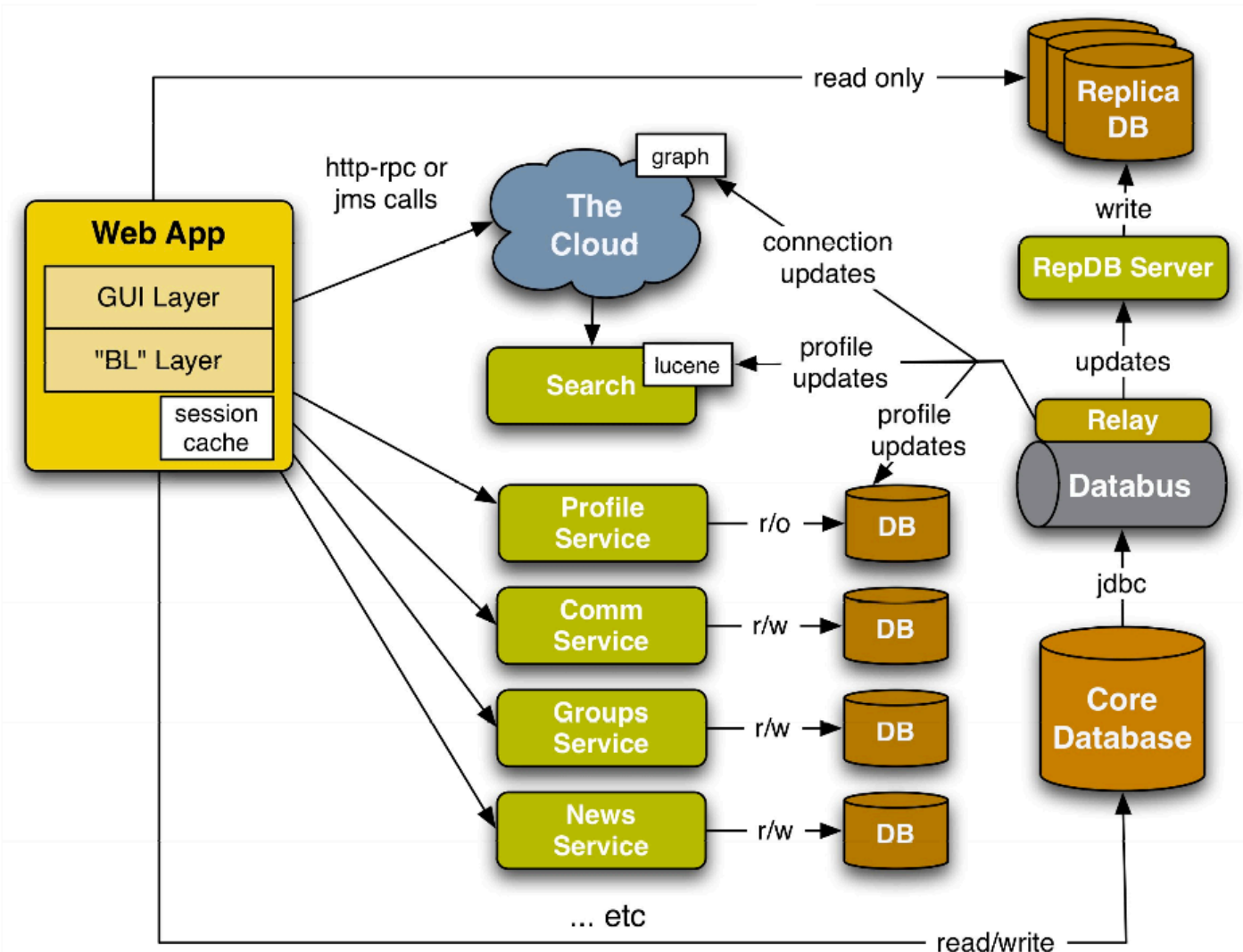
LinkedIn Product Architecture: 2003-2005



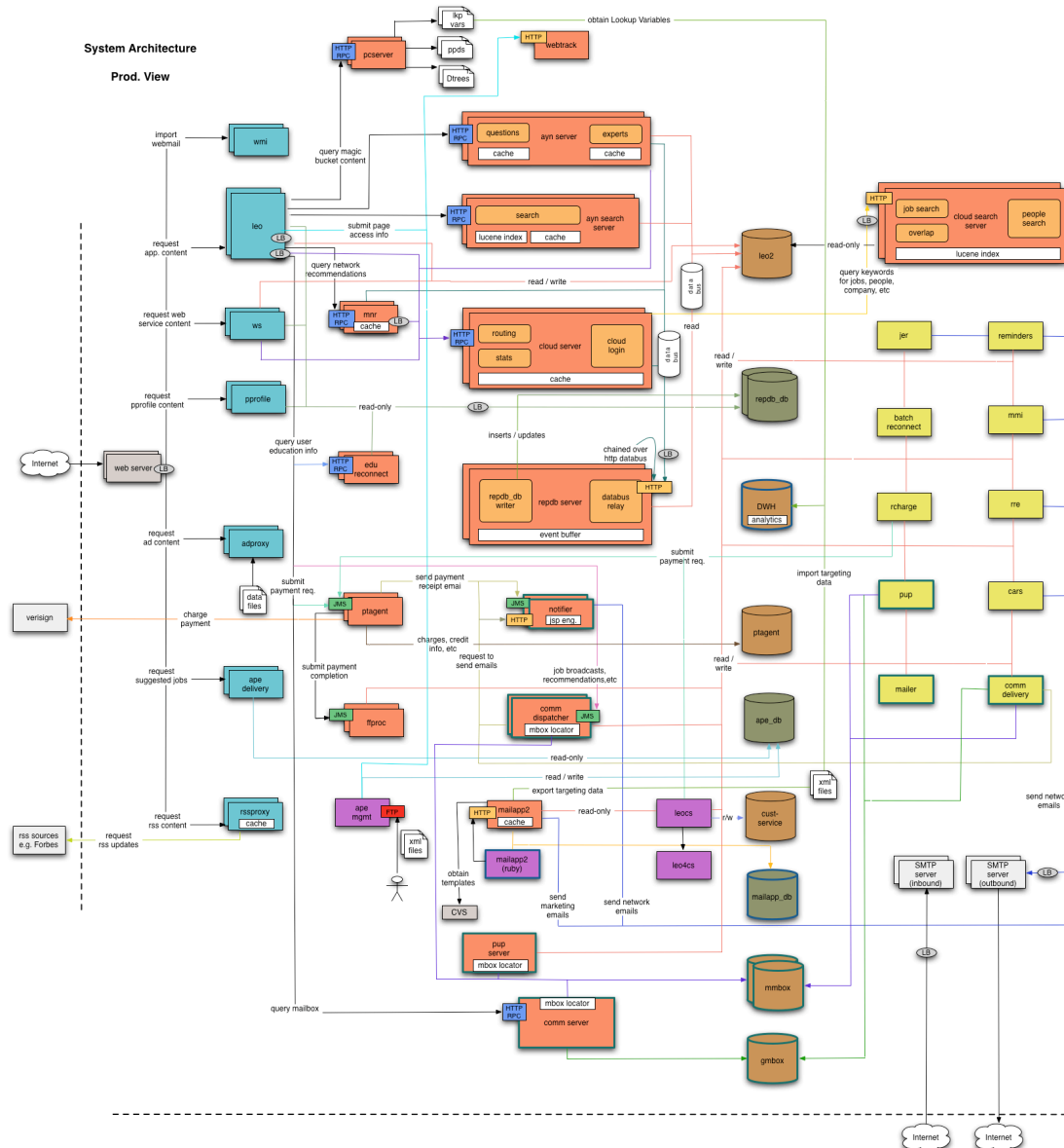
LinkedIn Product Architecture: 2006



LinkedIn Product Architecture: 2008



LinkedIn Product Architecture: 2010 (simplified)



Big Data (is the new black)

Re-Imagination of Data...

THEN...

Store Everything Because We Can Do It
Inexpensively



SOON...

Data Obesity / Data Quality Issues
How To Find a Needle in a Haystack?



Mike Abbott, KPCB (Internet Trends, D10 2012)

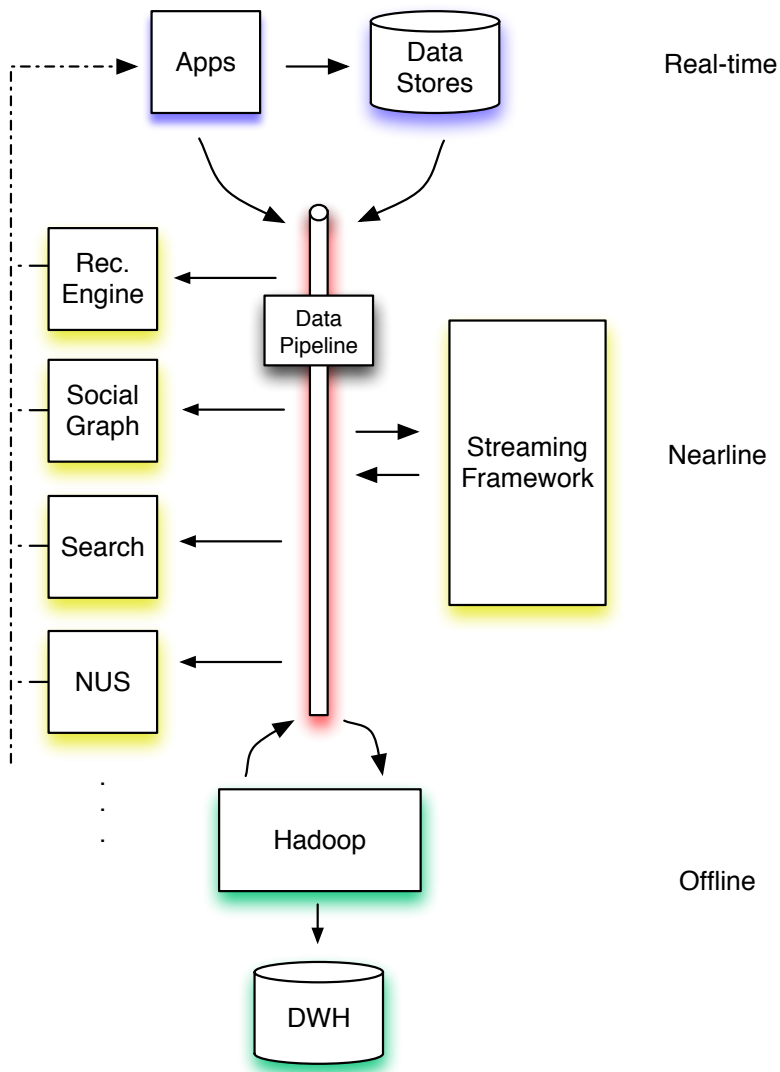
“Big Data”



“Big Data”: 4 components

- Data Pipeline
 - Data Flow is the “Food, Shelter and Clothing” of data-driven applications and analytics
- Data Quality
 - Garbage in, garbage out
- Data Processing
 - Hadoop is a centerpiece
- Data Democratization
 - Everyone has a needle to find
 - Abstraction of the complexity of accessing raw data
 - Providing access point to various levels of experience

Big Data: it is really a Data Continuum



■ Real-time

- Things that should be reflected immediately (A profile update)
- I'll block on it.

■ Nearline

- Activity that should be reflected soon (click updates, Search updates, News)
- I don't need it as it is happening.

■ Offline

- Activity that can be reflected later
- Batch

Agenda

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What is a Recommender System?

A Recommender system selects a “product” that if acquired by the “buyer” maximizes value for both the “buyer” and the “seller” at a given point in time

...Must make a strategic sense!



Director, Data Scientist
PayPal - San Jose, CA (San Francisco Bay Area)




Job Description

PayPal is the faster, safer way to pay and get paid. The service allows members to send money without sharing financial information, with the flexibility to pay using their account balances, bank accounts, credit cards or promotional financing. With nearly 100 million active accounts in 190 markets and 19 currencies around the world, PayPal enables global commerce. Putting customers' needs first, PayPal is redefining the payments category through product, marketing, and service delivery innovation. We're looking for engineers, applied scientists, and researchers with experience in implementing data mining and machine learning systems to help build innovative products all of PayPal and beyond. This is a new team under the guidance of the chief scientist at PayPal that will leverage all data throughout eBay Inc. -- from creating new products, technologies and platforms, all the way to supplement existing products for various use cases. We hope to build a world-class data science team that will have direct impact on


Apply on Company Website

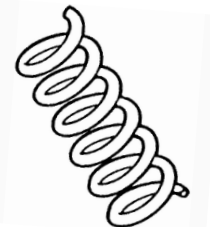
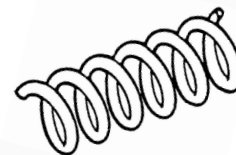
Save job
Share job
Stop following

Posted By

 **Sachi Yokota** (2nd)
Recruiter, Marketing & Strategy at PayPal
Send InMail

1 of your connections can refer you to Sachi:

 **John Kelly** (1st)



Recommendations: The case of the Homepage

The screenshot shows the LinkedIn homepage with several red annotations highlighting key recommendation sections:


- MIT Executive Education:** A red box highlights the banner at the top: "MIT Executive Education - MIT's Unique Entrepreneurial Education Program. Learn More & Enroll Today."
- LinkedIn Today:** A red box highlights the "LinkedIn Today" section, which features headlines like "Wikipedia Blackout: Survive with These 12 Alternatives", "No 'is' is the New 'Yes': Four Practices to Reprioritize Your", and "Yahoo Co-Founder Jerry Yang Resigns".
- All Updates:** A red box highlights the "All Updates" section, which lists recent activity such as "Chad Whitney is now connected to Benjamin Menasha, Consulting Engineer at ITA Software and Earl-Bert Parco, Telecom Technician at LinkedIn".
- Who's Viewed Your Profile?:** A red box highlights the "Who's Viewed Your Profile?" section, which shows a circular chart with "515" connections and "100+" profile viewers.
- Jobs You May Be Interested In:** A red box highlights the "Jobs You May Be Interested In" section, which lists job openings like "Bioinformatics/Senior Bioinformatics..." and "Senior Staff Systems Engineer (Data...)".
- Groups You May Like:** A red box highlights the "Groups You May Like" section, which lists groups like "AnalyticBridge" and "Bayesian Belief Networks with Bayesialab".
- Companies You May Want To Follow:** A red box highlights the "Companies You May Want To Follow" section, which lists companies like "ness", "Linguistics", "STATISTICS & ANALYTICS", "ontotext", and "digital trowel".

Recommendations: What are they worth? Think 50%


- > 50% of connections are from recommendations (PYMK)
- > 50% of job applications are from recommendations (JYMBII)
- > 50% of group joins are from recommendations (GYML)

If done right they leverage the similar tech. components and in the case of social networks it also means results of large-scale graph mining


People You May Know *updated*



Sophie Perisic, French Teacher at Crystal Springs Uplands School
[Connect](#)




Lissa Juan, Senior Manager, Product Management - Mobile &
[Connect](#)



Jeff King, Sr. Director X.commerce Platform Partnerships at eBay
[Connect](#)

[See more »](#)

Jobs You May Be Interested In *beta*



Director of Engineering
Pandora - Oakland, CA




Director of Engineering for Core...
CyberCoders - Santa Clara, CA




Director of Engineering
HotelTonight - San Francisco Bay...

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Groups You May Like



LinkedIn Groups Product Forum
[Join - Other...](#)



RDataMining
[Join - Professional Group](#)

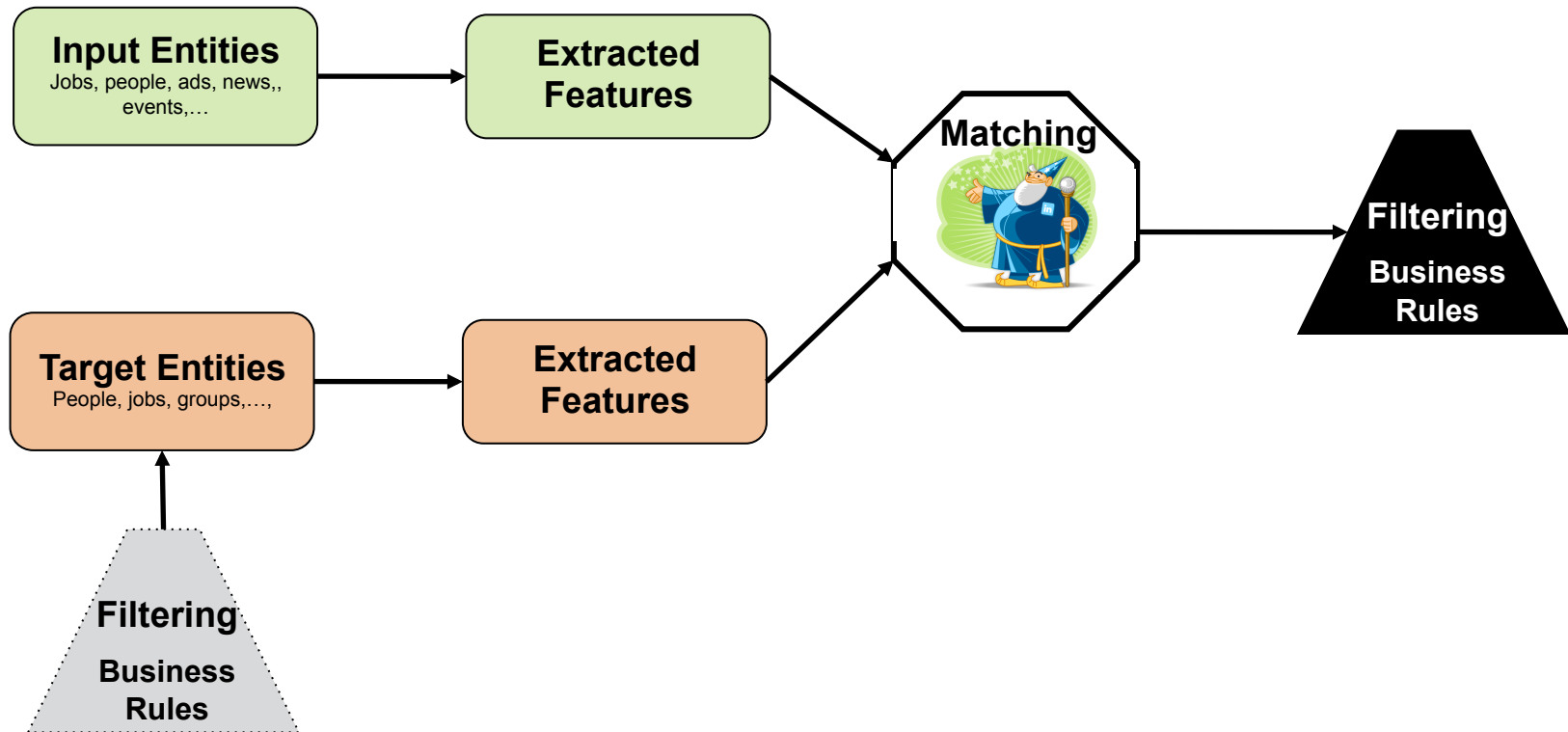


Data Mining, Statistics, and Data Visualization
[Join - Professional Group](#)

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Overview of the Recommendation Process:

Really, really high level

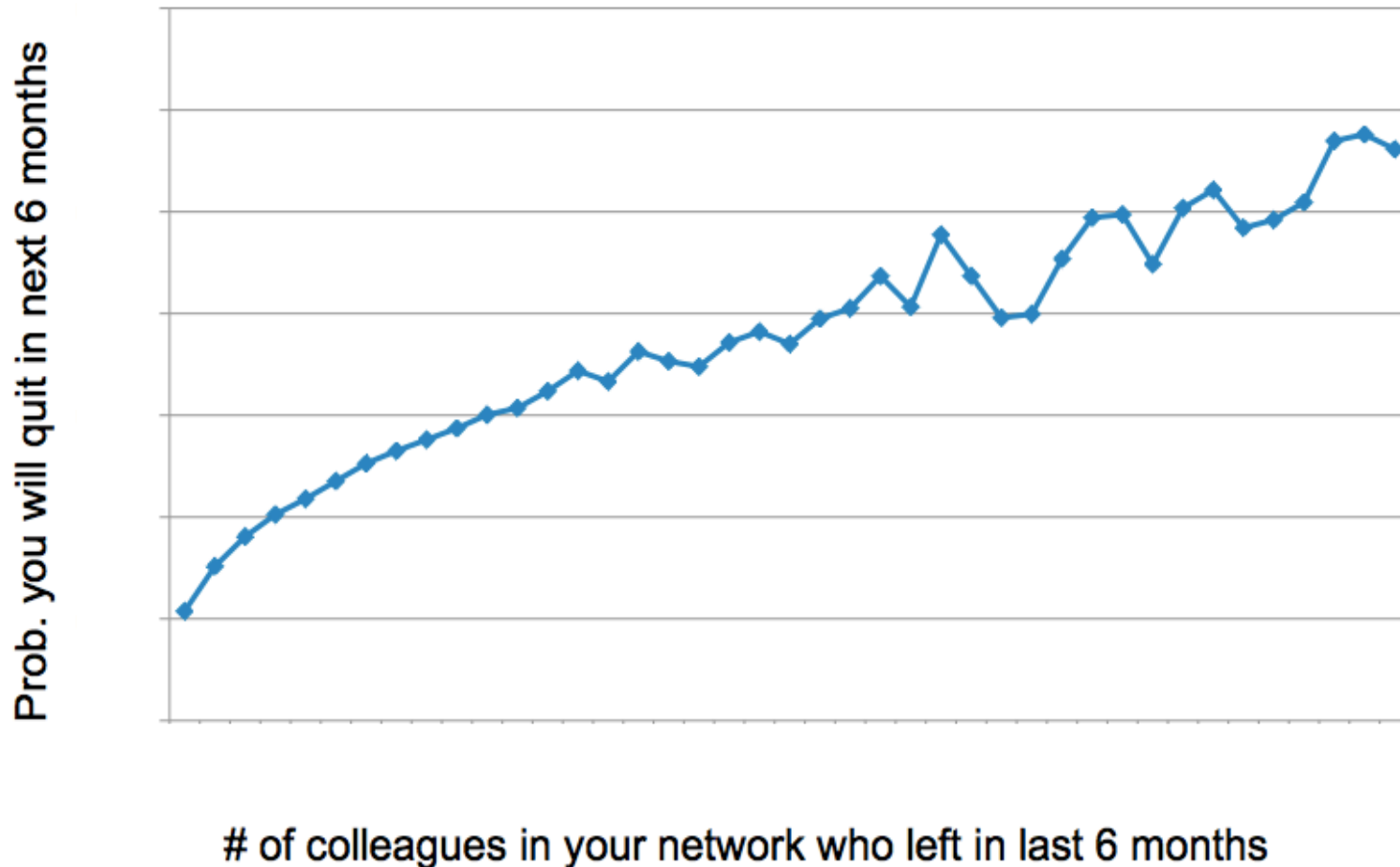


Jobs Recommendations



Jobs Recommendations:

Feature Engineering; Network Inertia (how likely are you to switch jobs?)

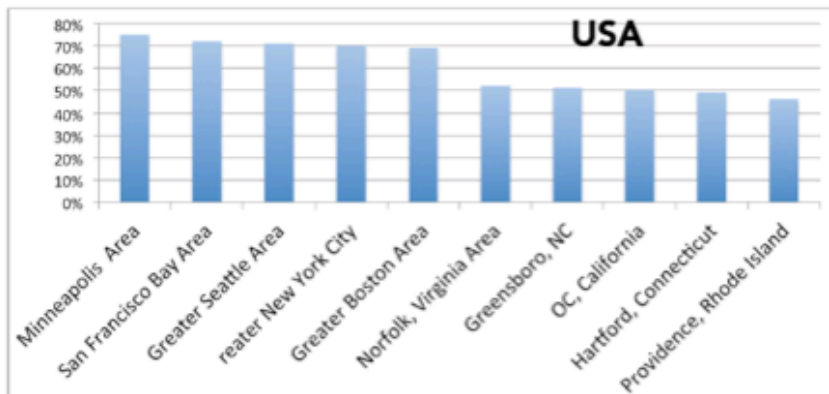


Jobs Recommendations:

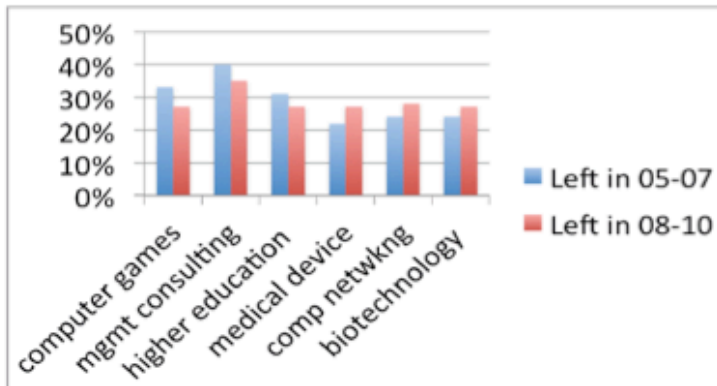
Feature Engineering; where are you likely to stay?

Most vs Least sticky regions*

*what percentage of people stay in the same region when switching companies



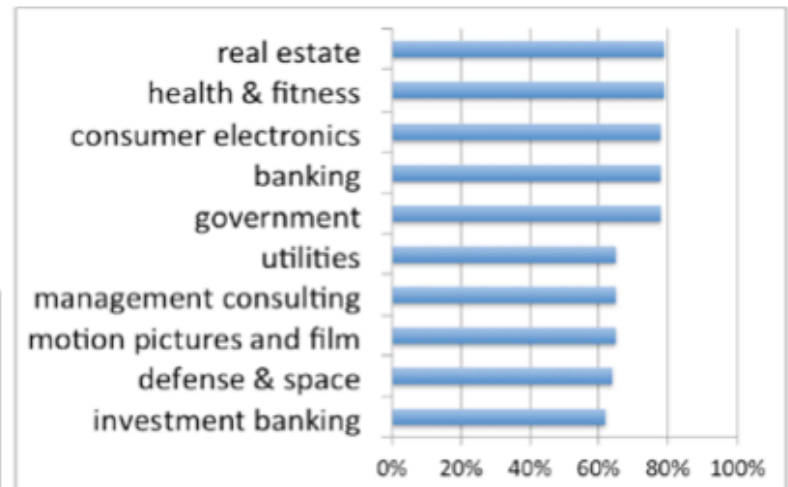
Trending industries in the Bay Area:



72%

SF Bay Area stickiness score.

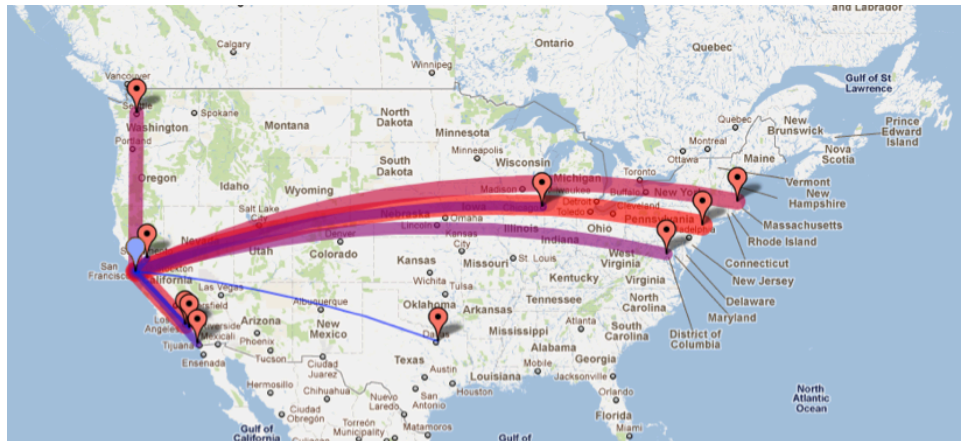
Industry breakdown:



Jobs Recommendations:

Feature Engineering; where are you likely to go?

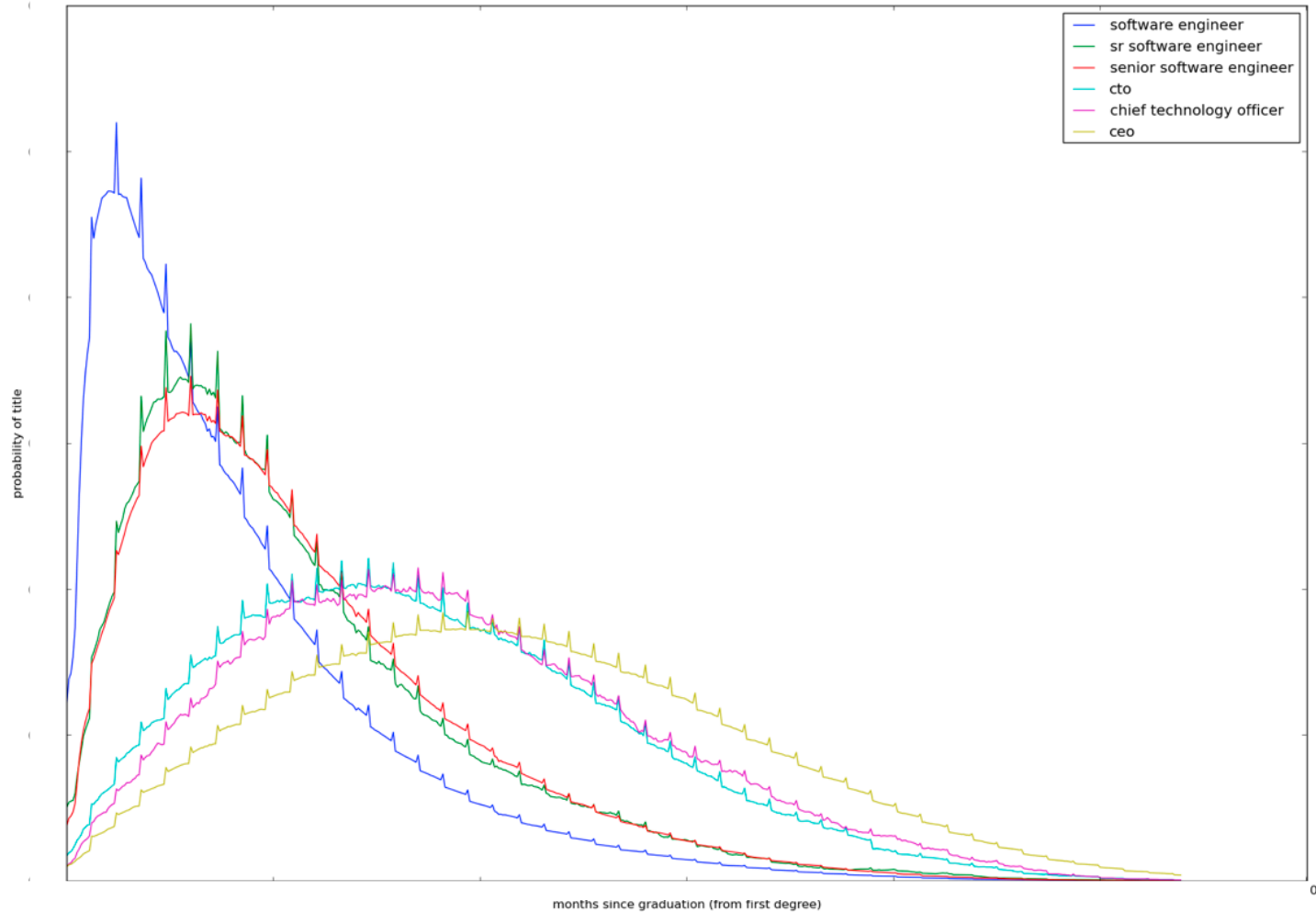
- Region transition probability



- Likely to Stay & Go predict individuals propensity to migrate and most likely migration target
- Impact on job recommendations
 - ~20% lift in views/viewers/applications/applicants

Jobs Recommendations:

Feature Engineering; what should you transition to and when?



Feature Engineering:

What type of Job Seeker are you?

- Types

- Active
- Passive receptive
- Not a job seeker

Note to recruiters: Please don't offer me a job. I already have the best job in the world at the best company in the world. **Note to engineers and**

- Modeling

- Ordered logistic reg.

$$\text{logit}[P(Y \leq j | \mathbf{x})] = \alpha_j + \boldsymbol{\beta}'\mathbf{x}, \quad j = 1, \dots, J - 1.$$

- Impact

- ~**10**x application rate between Active and Passive receptive

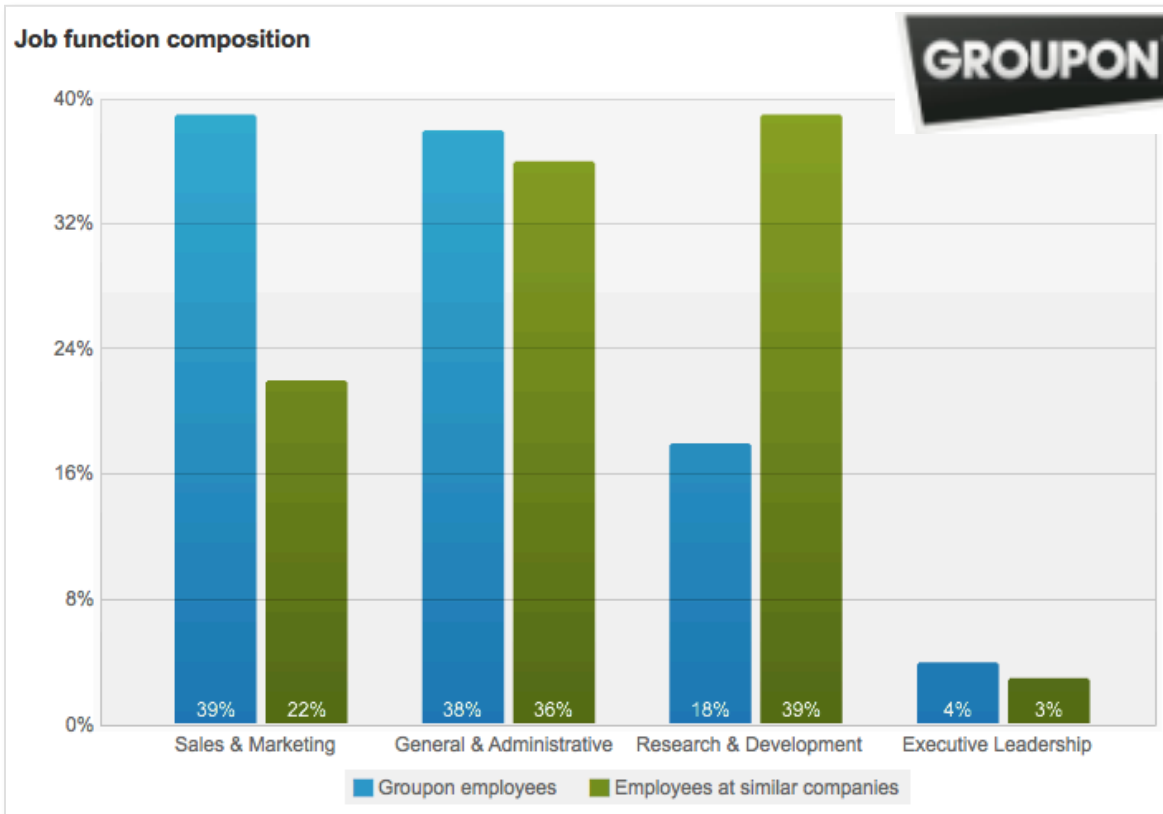
Job Matching: Some final remarks

- Most people aren't actively looking for jobs.
 - Many people are but most aren't
 - Complicates evaluation and training
- Important not to offend
 - JYMBII: I am more senior than that!
 - What is the price of a bad recommendation? (PYMK vs. JYMBII)
- You can't always get what you want
 - Every employer wants the hottest candidate.
 - The perfect candidate already works for you.

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Insights: Power of Aggregation



Before **LinkedIn** employees worked at

Yahoo! (247)
Google (139)
Microsoft (105)
Oracle (93)
IBM (68)

Before **Google** employees worked at

Microsoft (1379)
IBM (939)
Yahoo! (608)
Oracle (558)

Insights: Promotions when to ask?

Annual job promotions: Trends by industry

Information
Technology
& Services



Higher
Education



Management
Consulting

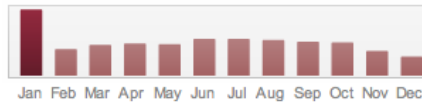


Retail

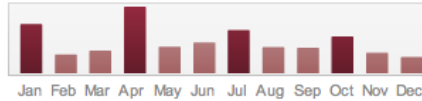


Annual job promotions: Trends by country

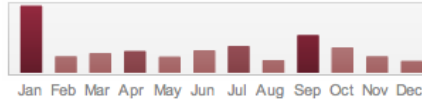
United
States



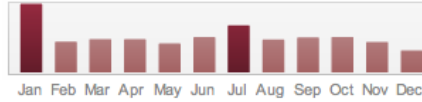
India



France



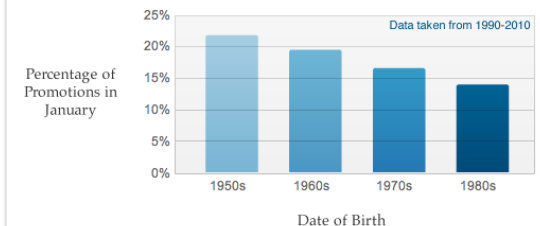
Australia



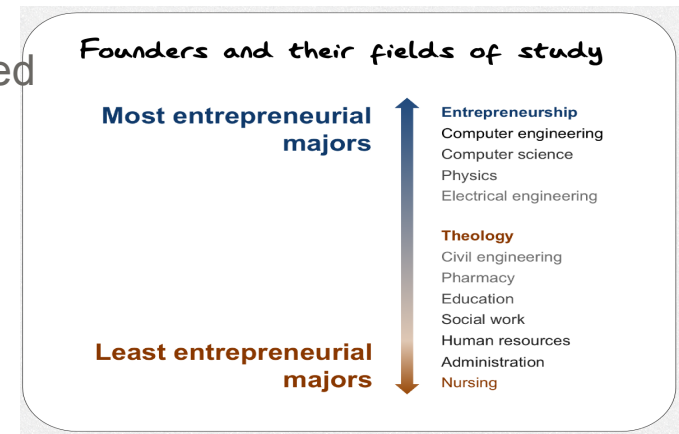
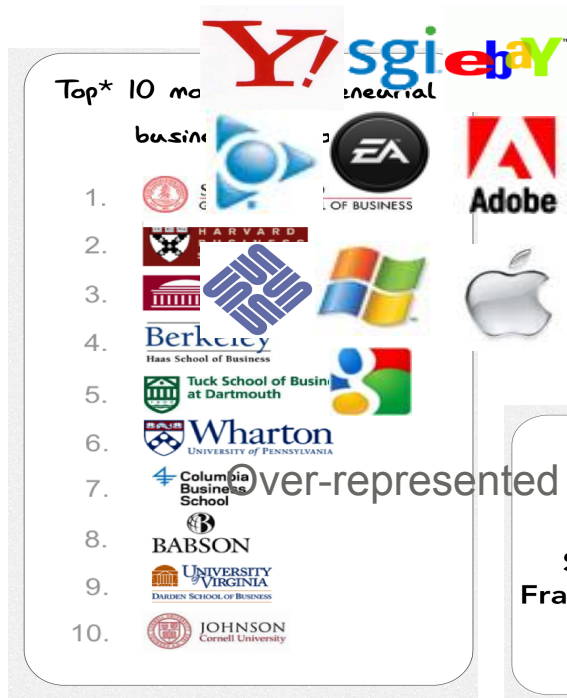
January promotions



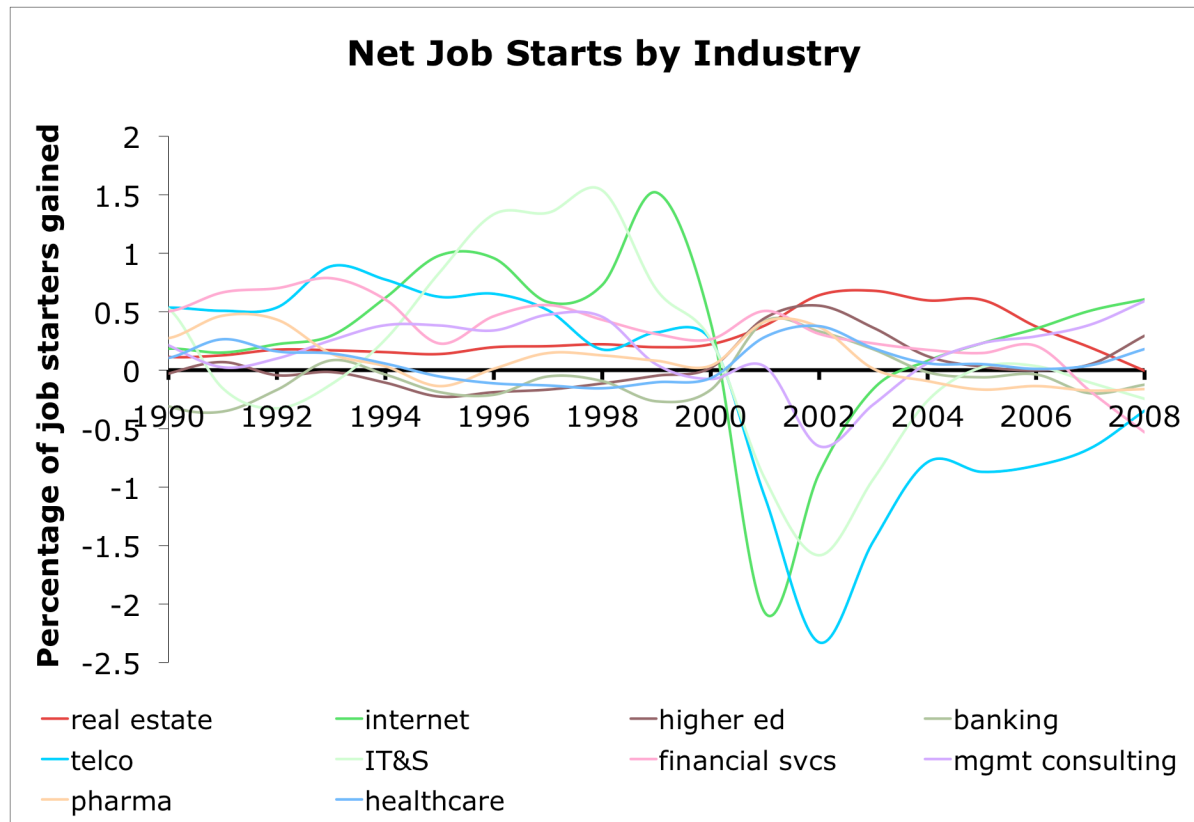
Fewer January promotions in younger generations



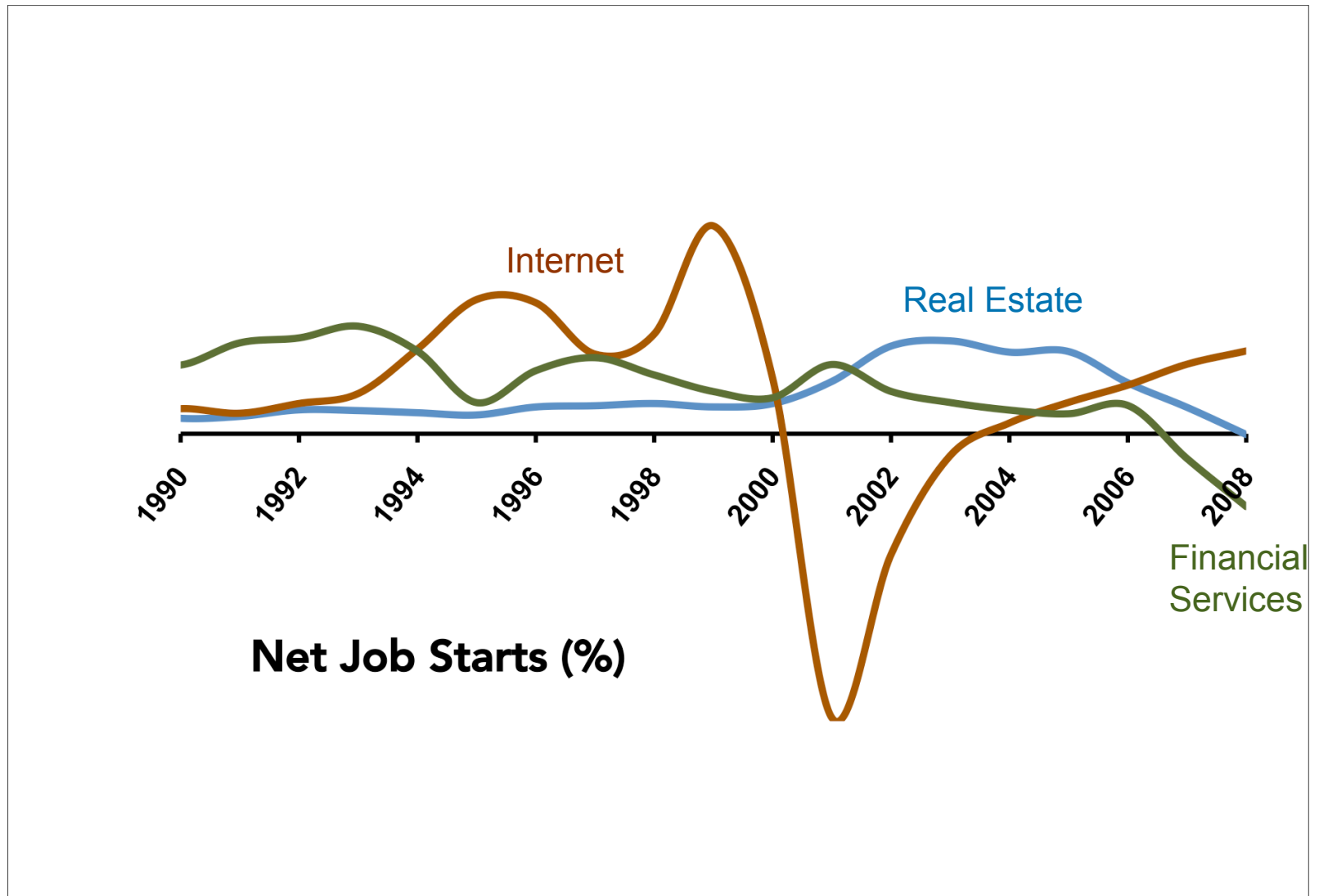
Where do Founders come from?



Job Market: Trends by Industry (1990-2008)



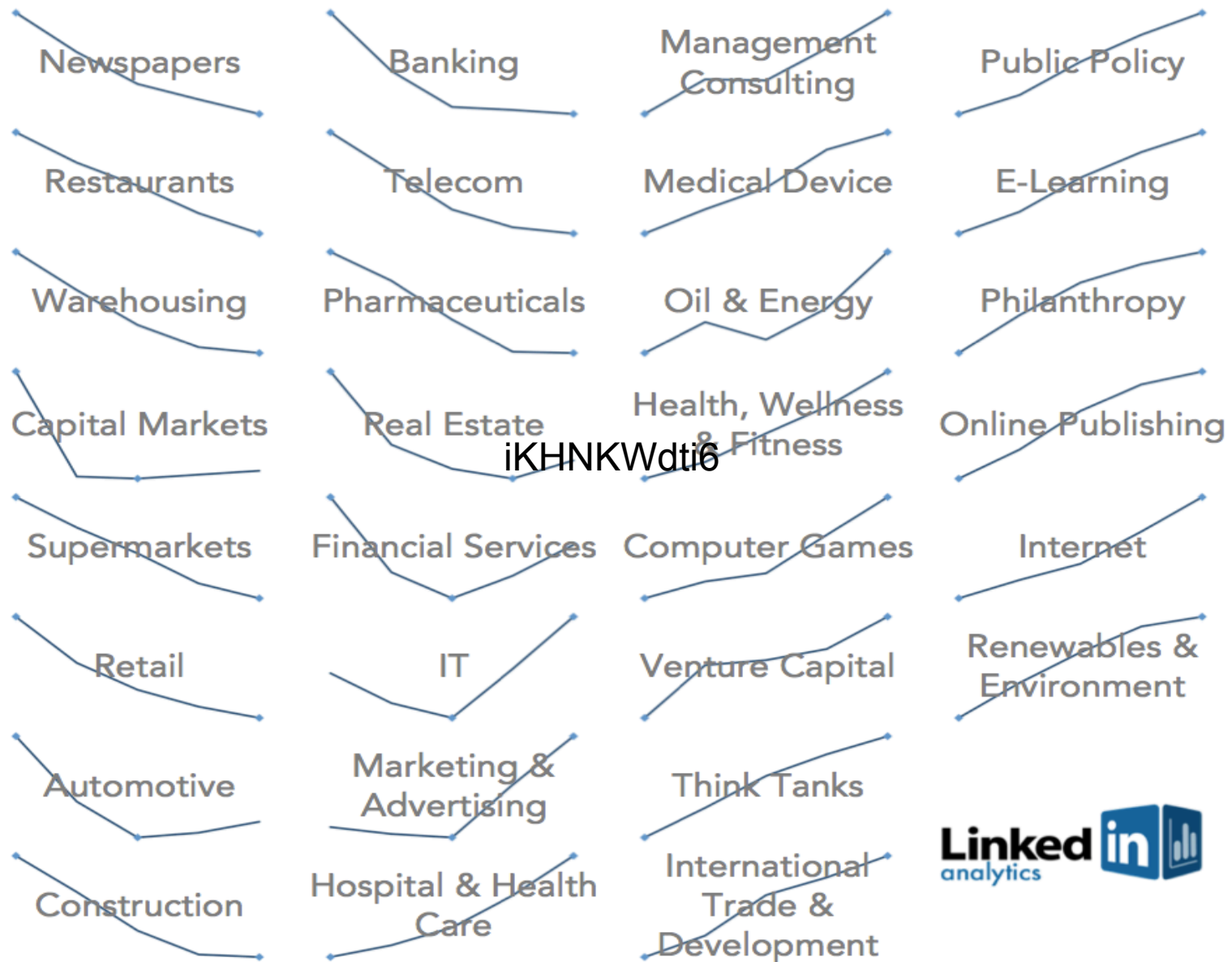
Job Market: Zoom in

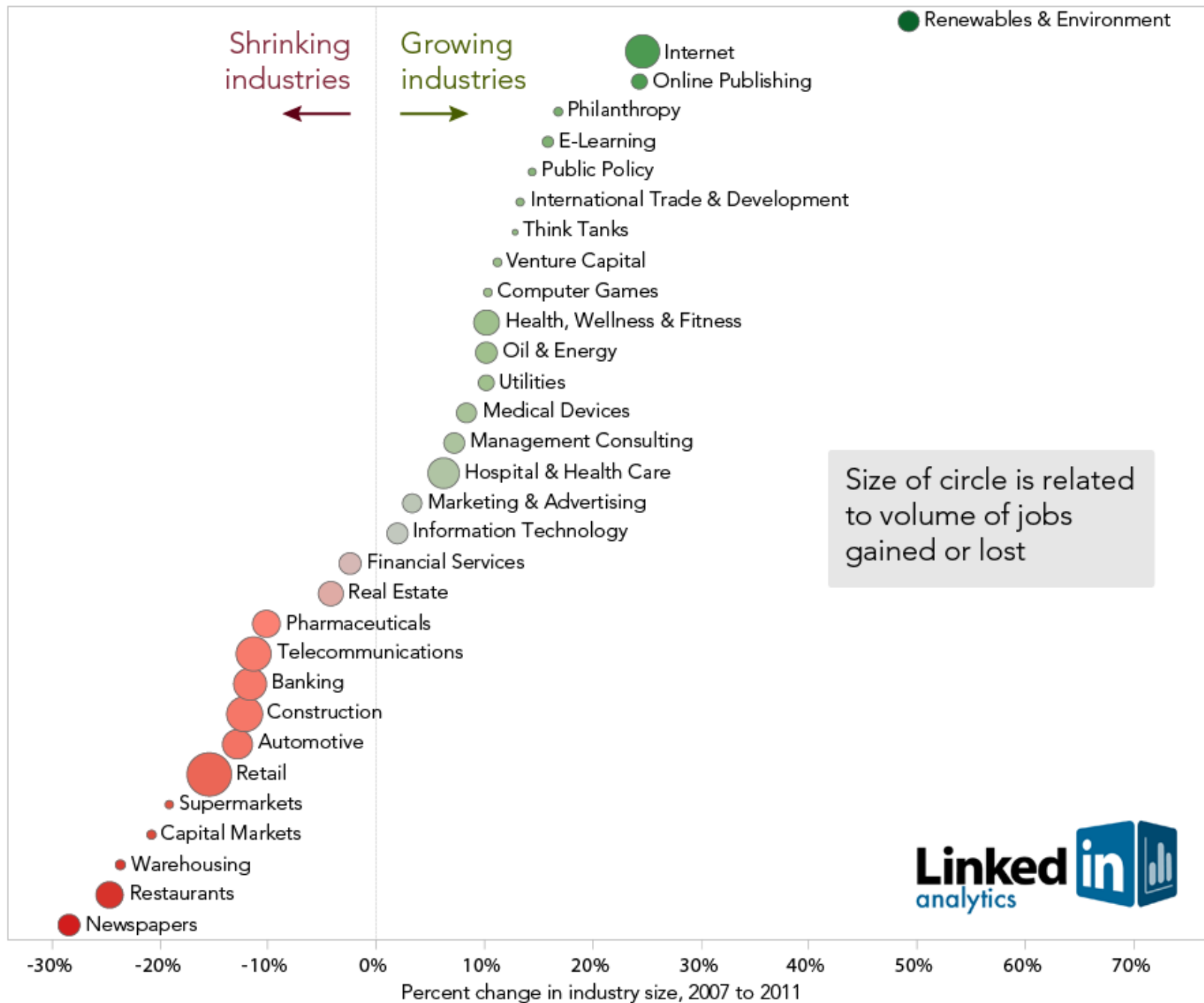


Job Market: Zoom further in (2008)

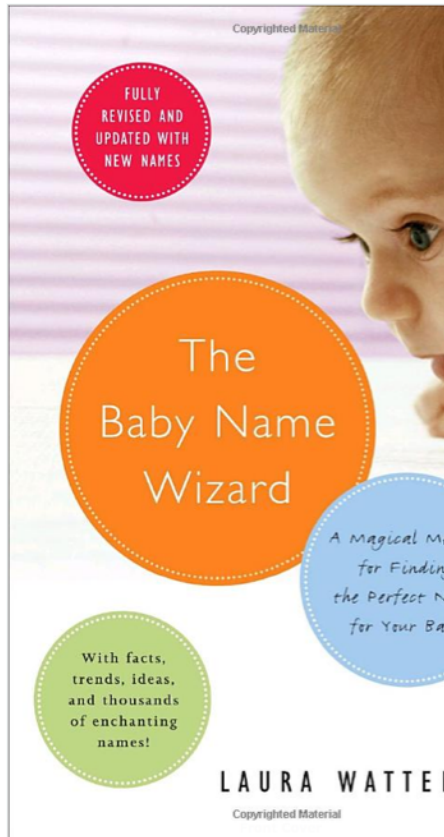


Fluctuations in industry size, 2007-2011

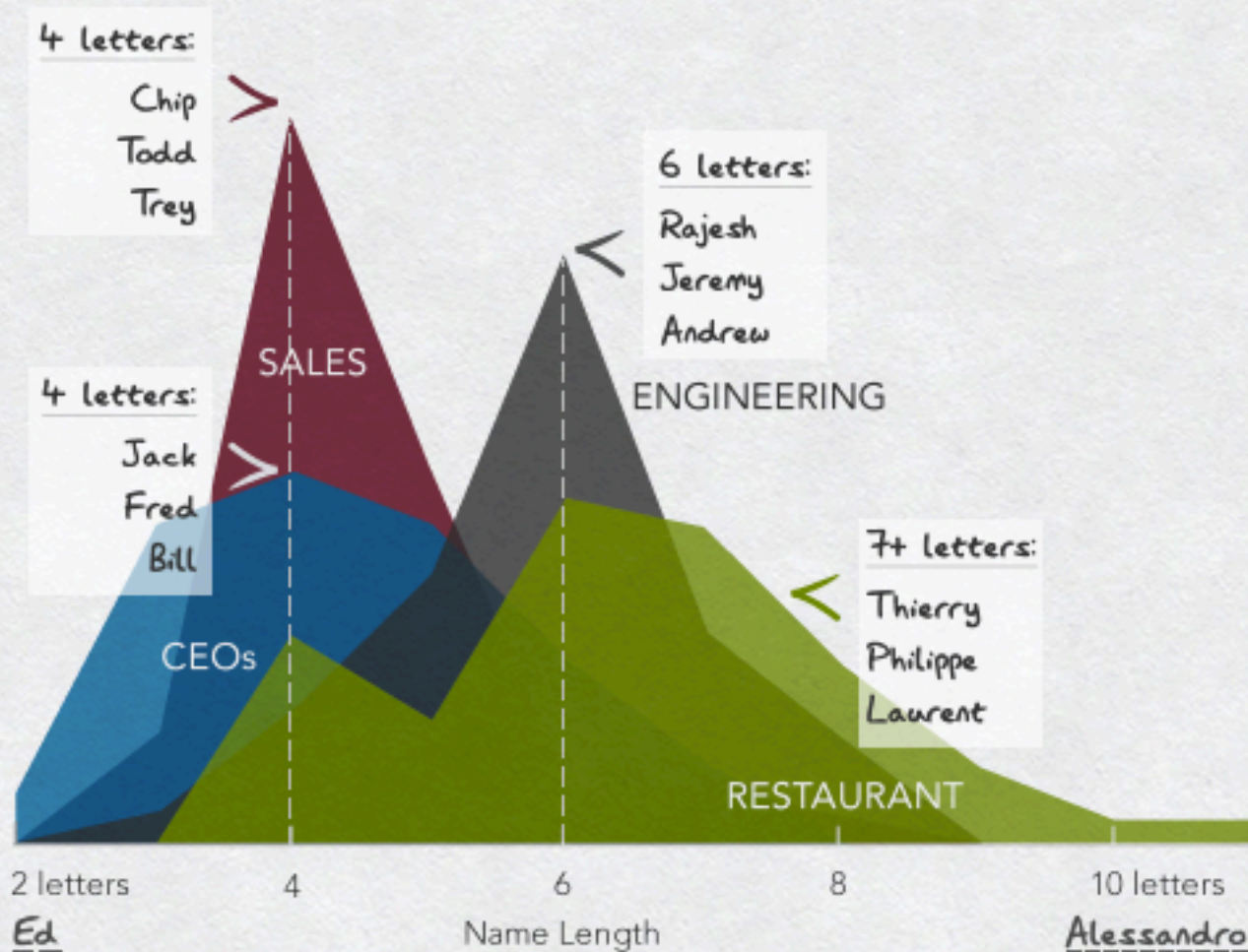




What is in a Name?



TOP NAME* LENGTH DISTRIBUTION FOR...





Questions?

iperisic@linkedin.com