



Liberating the API Economy with Scale-Free Networks

Mike Amundsen
CA Technologies
@mamund



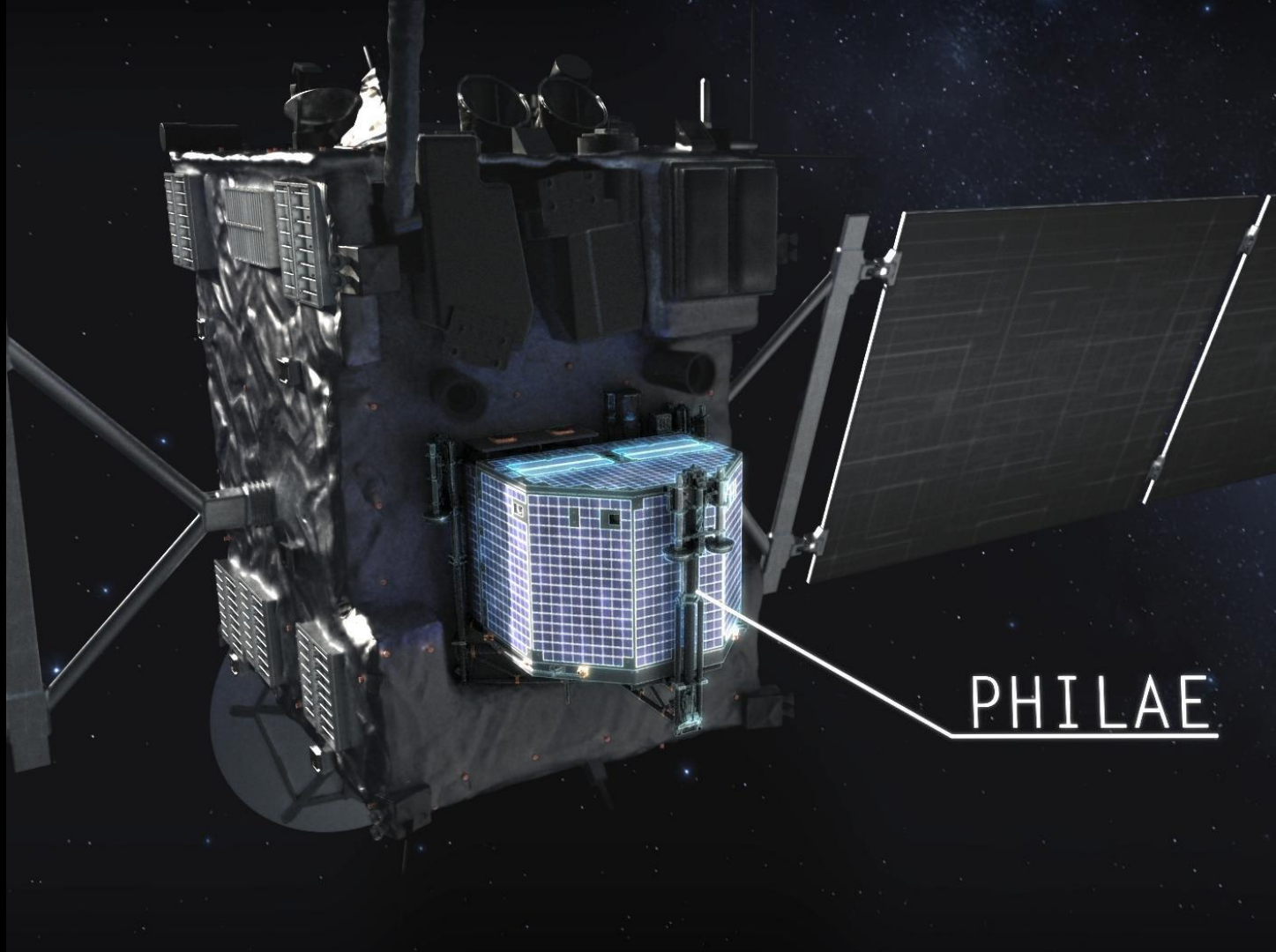
Mike Amundsen
@mamund

I come as a messenger...



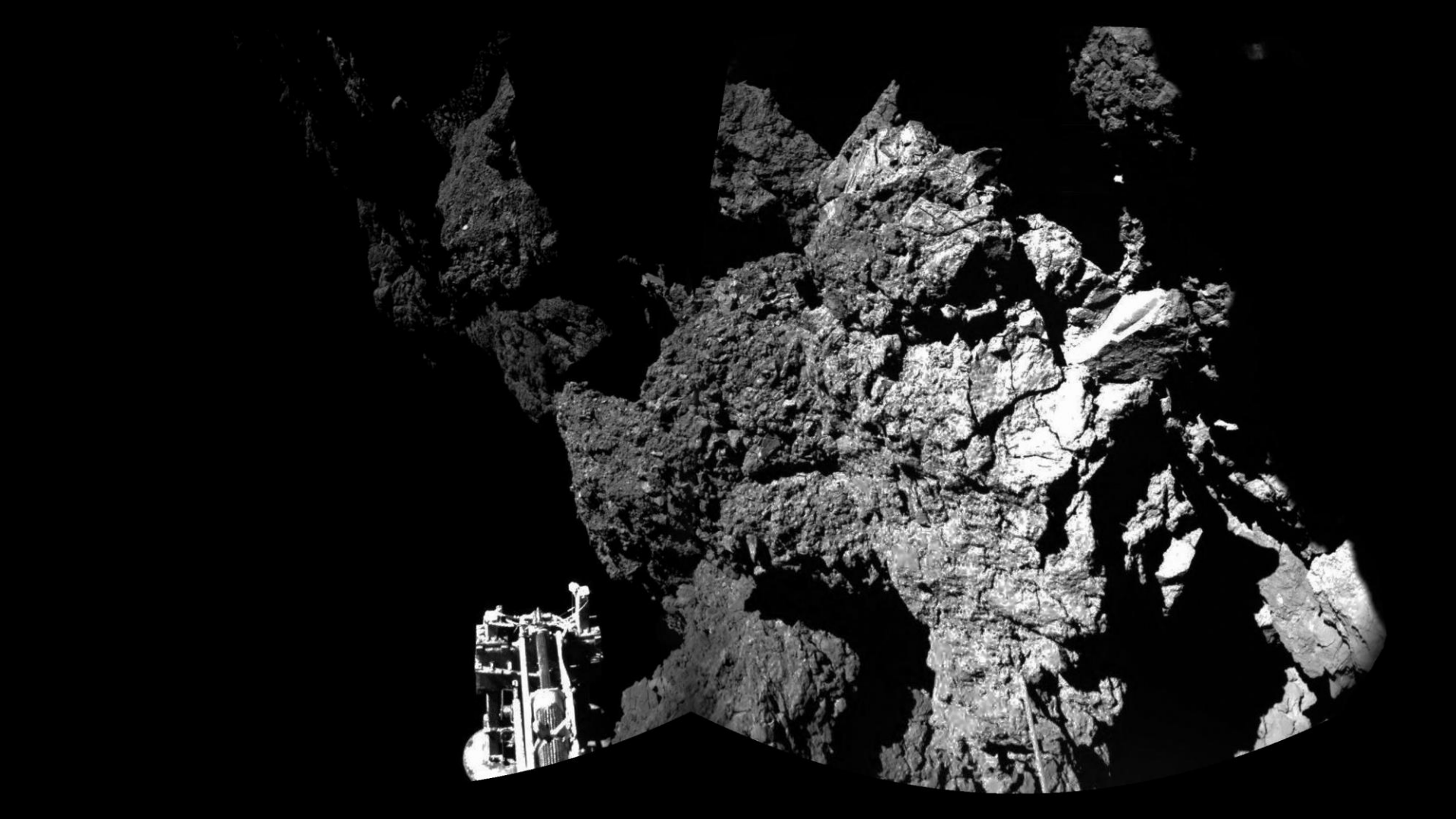


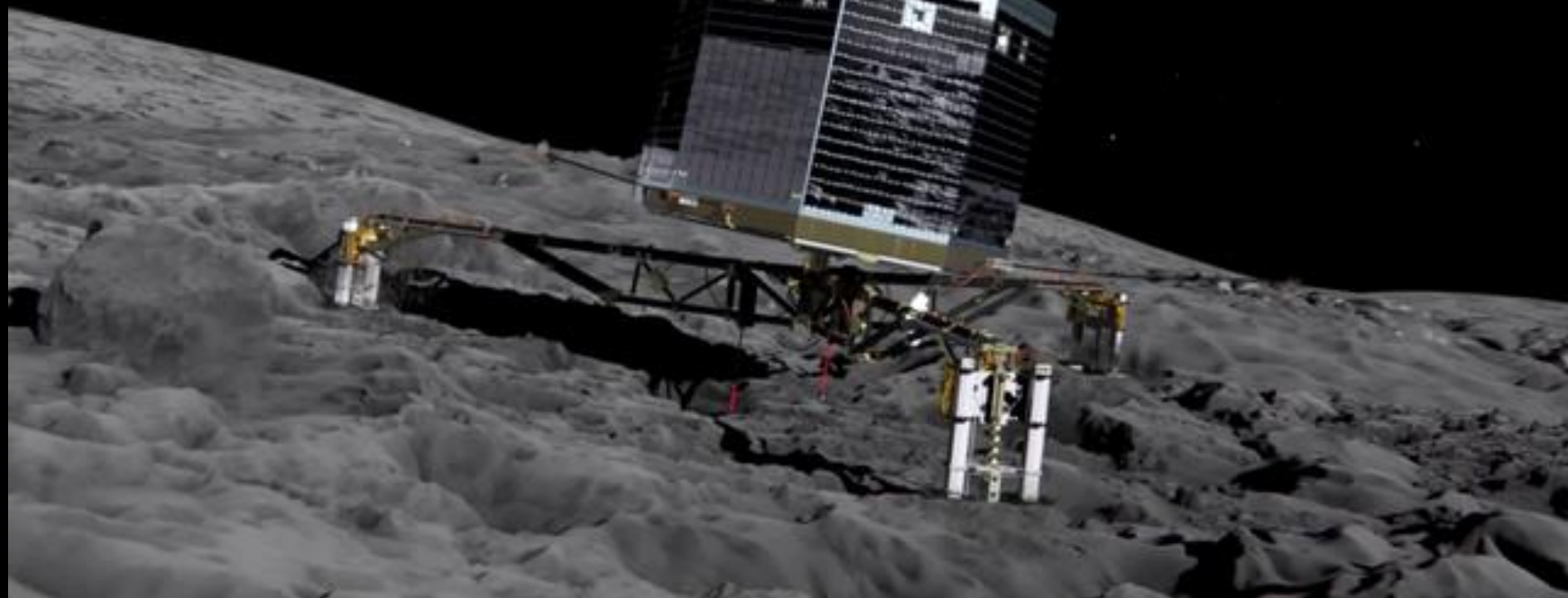


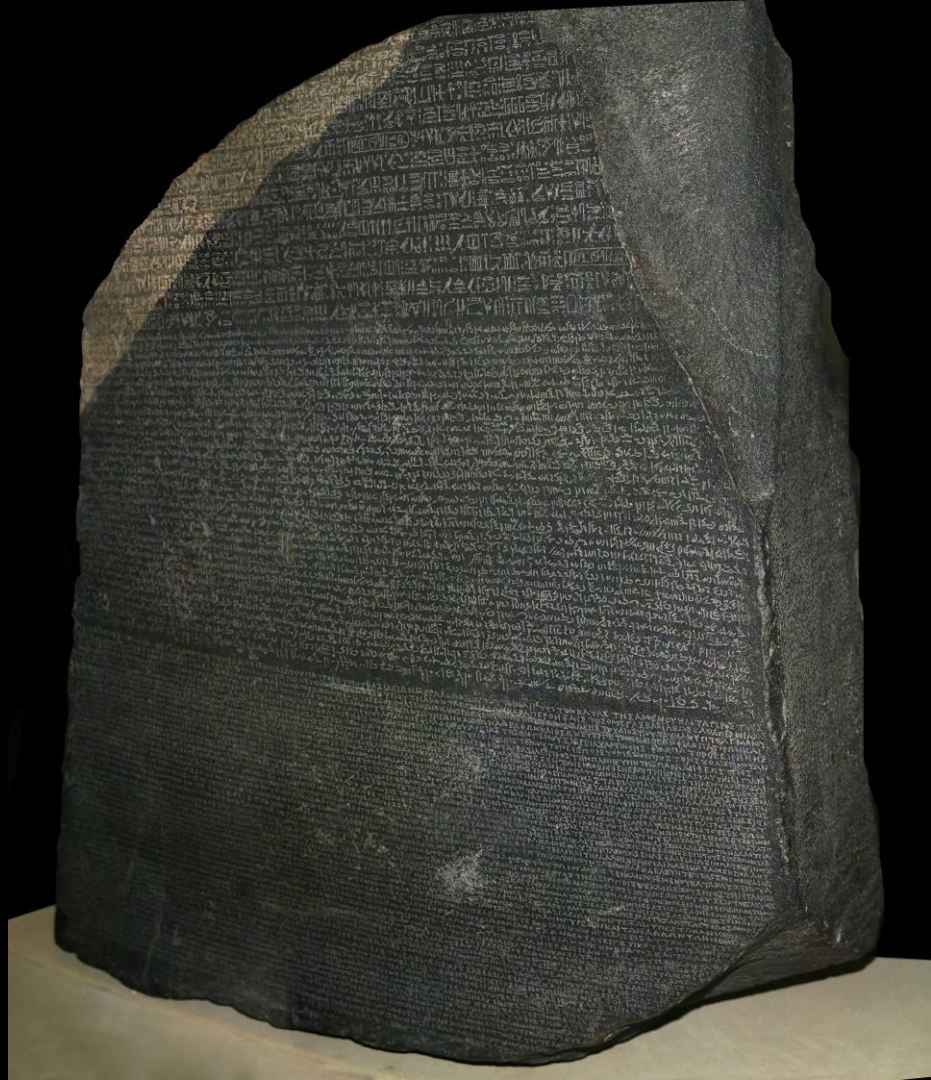


PHILAE

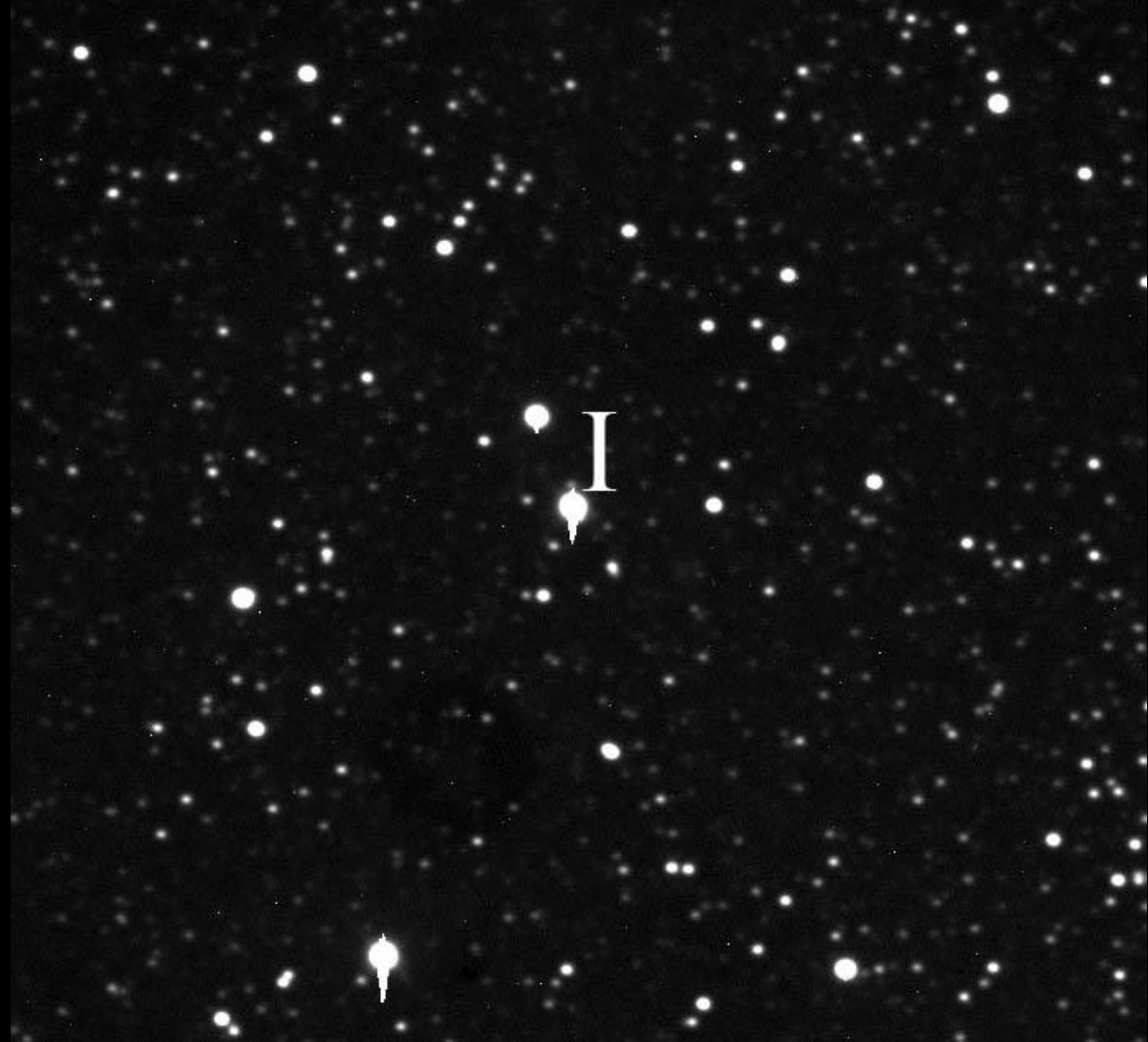










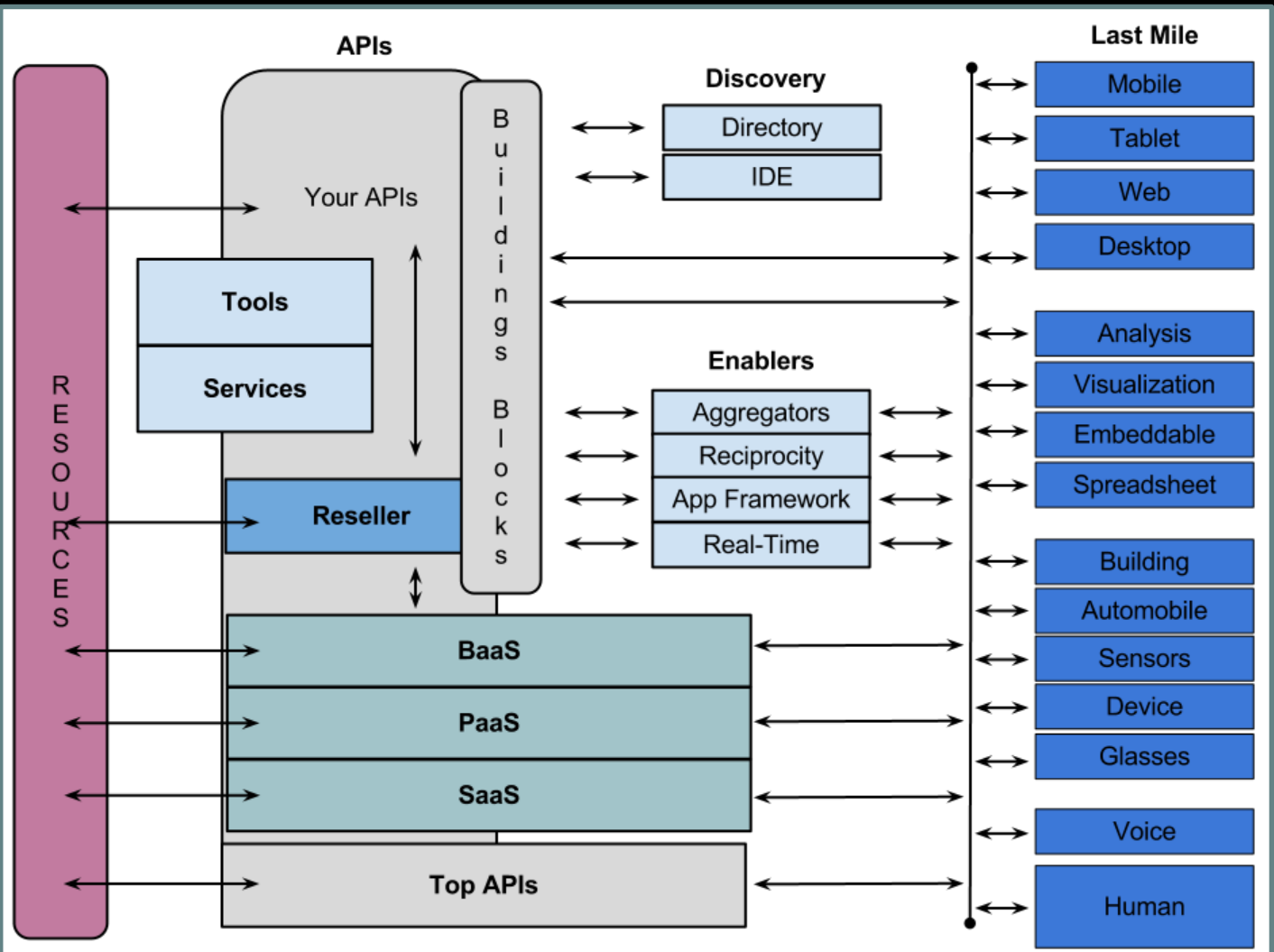




... and the news is not so good...

The
end
is
near





15B

CONNECTED
DEVICES IN 2015



15B

CONNECTED
DEVICES IN 2015



40B

CONNECTED
DEVICES BY 2020



= 1B DEVICES

27 SIGNS THAT THE END TIMES ARE NEAR

2012

END OF THE WORLD

MAYAN
SECRETS
REVEALED

**REVELATION
REVEALED**
BIBLICAL PROPHECY
DECODING KIT

EPIC FAIL
13 END-OF-WORLD
PREDICTIONS THAT
NEVER HAPPENED

+
BEST BOOKS,
MOVIES & MUSIC
FOR THE END TIMES

**ISLAMIC
APOCALYPSE**
MIND-BLOWING PREDICTIONS
FROM THE QURAN



27 SIGNS THAT THE END TIMES ARE NEAR

2012

END OF THE WORLD

MAYAN
SECRET
REVEALED

REVELATION
REVEALED
BIBLICAL PROPHECY
CODING KEY

SCALE-POCALYPSE!

EPIC FAIL

13 END-OF-WORLD
PREDICTIONS THAT
NEVER HAPPENED

+ BEST BOOKS,
MOVIES & MUSIC
FOR THE END TIMES

**ISLAMIC
APOCALYPSE**

MIND-BLOWING PREDICTIONS
FROM THE QURAN



Wait, I'm getting ahead of myself...

1998

East Lansing, Michigan, USA

East Lansing, Michigan, USA
1973



Michigan Union

Michigan Union



Carl V. Page

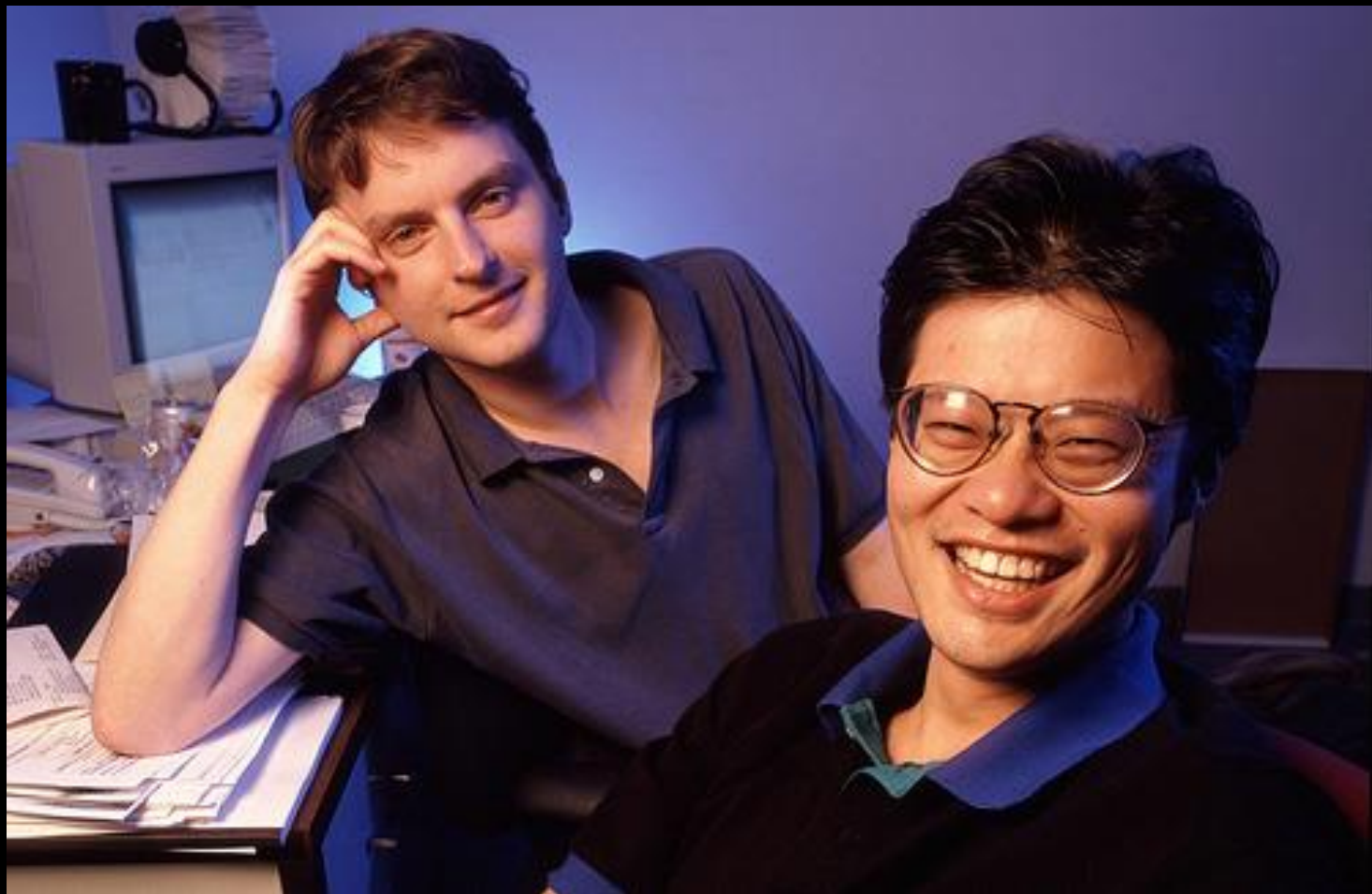




Stanford, California, USA

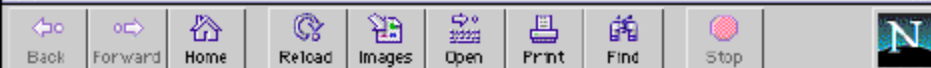
Stanford, California, USA
1994





***“Jerry’s Guide to the
World Wide Web”***



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American

Andrews

After
North

Movies and Film > Documentary

[Directory](#) > [Entertainment](#) > [Movies and Film](#) > [Genres](#) > [Documentary](#)



Search



the Web



just this category

Search

[Advanced Search](#) | [Suggest a Site](#)



[email this category to a friend](#)

INSIDE YAHOO!



Movies: visit [Yahoo! Movies](#) for showtimes, reviews, and more

Yellow Pages: find [Movie Theaters](#) near you

CATEGORIES

- [Directors](#) (17)
- [Ethnographic Film and Video@](#)
- [Festivals](#) (13)
- [Institutes](#) (3)
- [Photography@](#)
- [Titles@](#)
- [Videos@](#)

SITE LISTINGS

- [Center for Independent Documentary](#) - nonprofit organization collaborating with independent producers in the production of documentaries.
- [Docs on TV](#) - web log provides news, links, and articles about documentaries airing on television.
- [Documentary Box](#) - journal of the Yamagata International Documentary Film Festival, Japan. Devoted to covering recent trends in making and thinking about documentaries.
- [Documentary Educational Resources](#) - nonprofit educational organization incorporated in 1971 to produce, distribute, and promote the use of ethnographic and documentary films.
- [Documentary Filmmakers Group London](#) - holds regular meetings and screenings and acts as a resource for anyone interested in documentary film and video.

More Yahoo!

[Featured Category: Cannes](#)

the stars will shine.

[Trailers and Clips](#)

get a sneak peek.

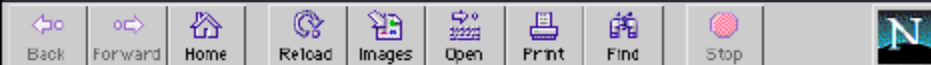
[Y! Shopping: Video and DVD](#)

[Finding Nemo](#)

Pixar's latest treat.

[Y! Buzz Index: Movies](#)
popular searches

Stanford, California, USA
1998

Location:
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[Anthropology](#), [Sociology](#), [Economics](#), ..
- [Society and Culture](#)
[People](#), [Environment](#), [Religion](#), ..

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The Anatomy of a Large-Scale Hypertextual Web Search Engine

Sergey Brin and Lawrence Page

*Computer Science Department,
Stanford University, Stanford, CA 94305, USA*
sergey@cs.stanford.edu and page@cs.stanford.edu

Abstract

In this paper, we present Google, a prototype of a large-scale search engine which makes heavy use of the structure present in hypertext. Google is designed to crawl and index the Web efficiently and produce much more satisfying search results than existing systems. The prototype with a full text and hyperlink database of at least 24 million pages is available at <http://google.stanford.edu/>. To engineer a search engine is a challenging task. Search engines index tens to hundreds of millions of web pages involving a comparable number of distinct terms. They answer tens of millions of queries every day. Despite the importance of large-scale search engines on the web,

"...due to rapid advance in technology and web proliferation, creating a web search engine today is very different from three years ago."

*"...due to rapid advance in technology and web proliferation, creating a web search engine today is very different from **three years ago.**"*



“Free” as in “Scale-Free”

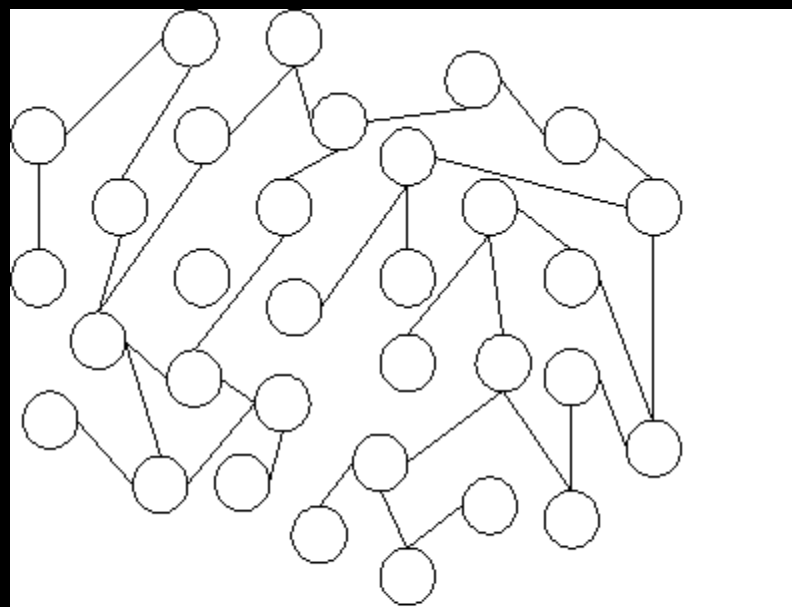
*“A **scale-free network** is a network whose degree distribution follows a power law.”*

*“A **scale-free network** is a network whose degree distribution follows a **power law**.”*

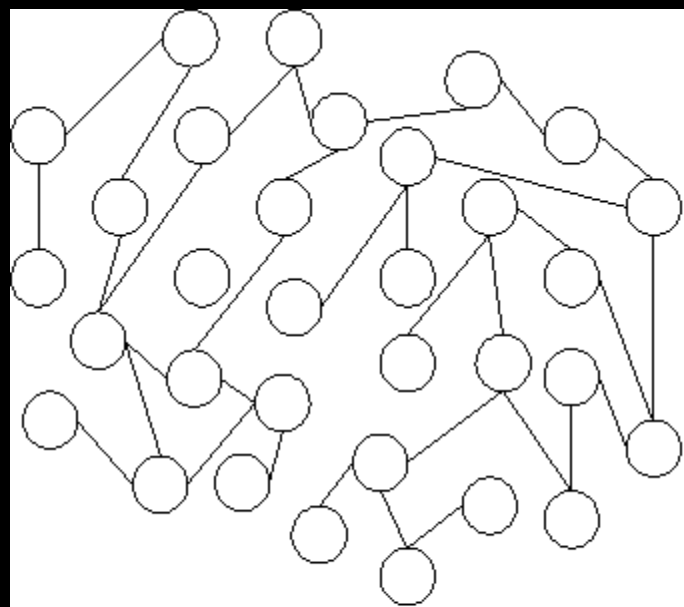
$$P(k) \sim k^\Gamma$$



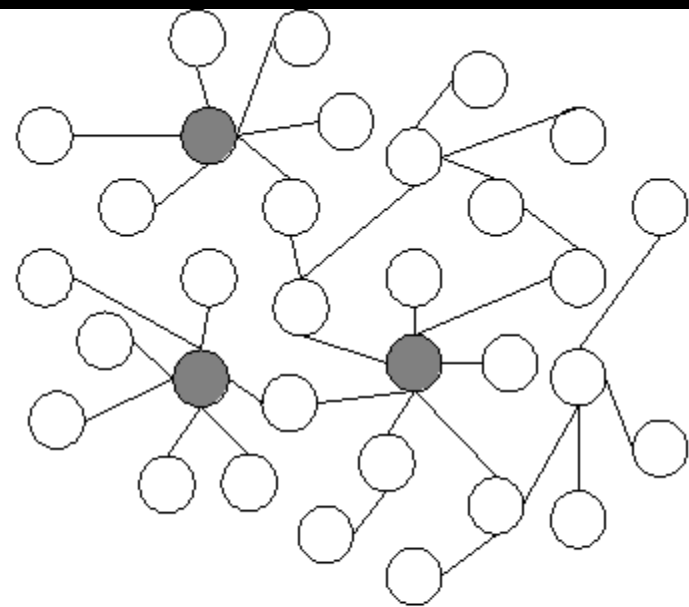




(a) Random network

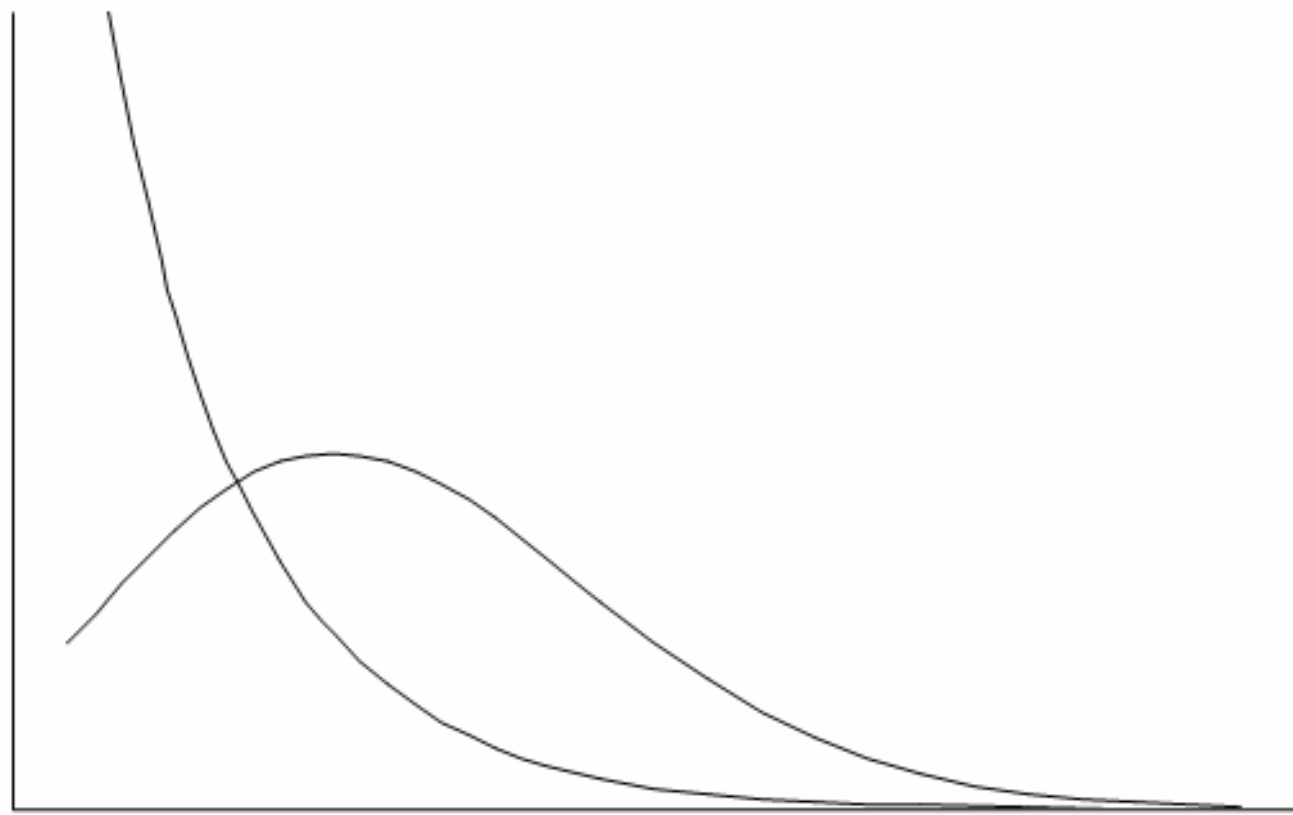


(a) Random network

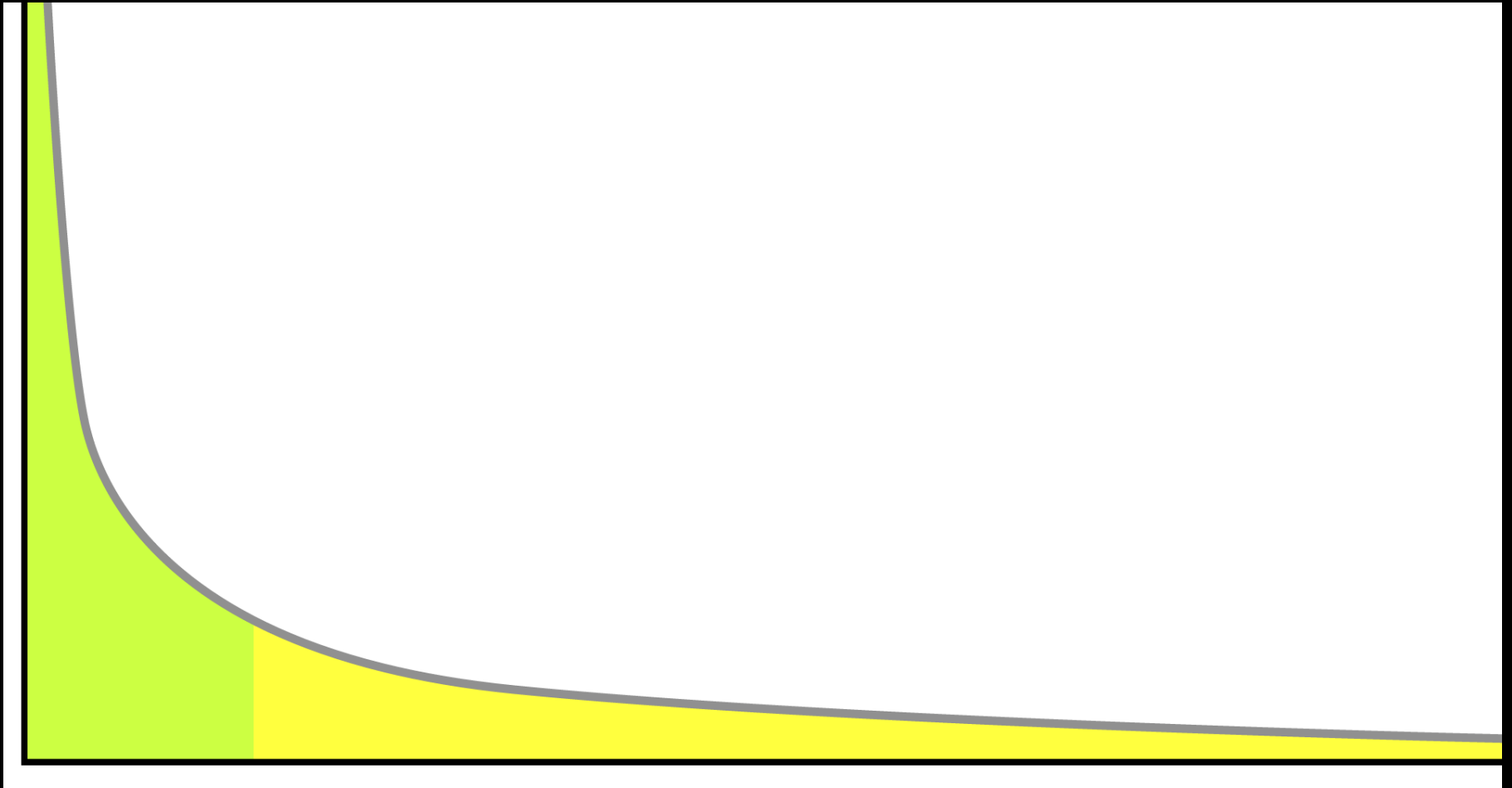


(b) Scale-free network

$p(k)$



k

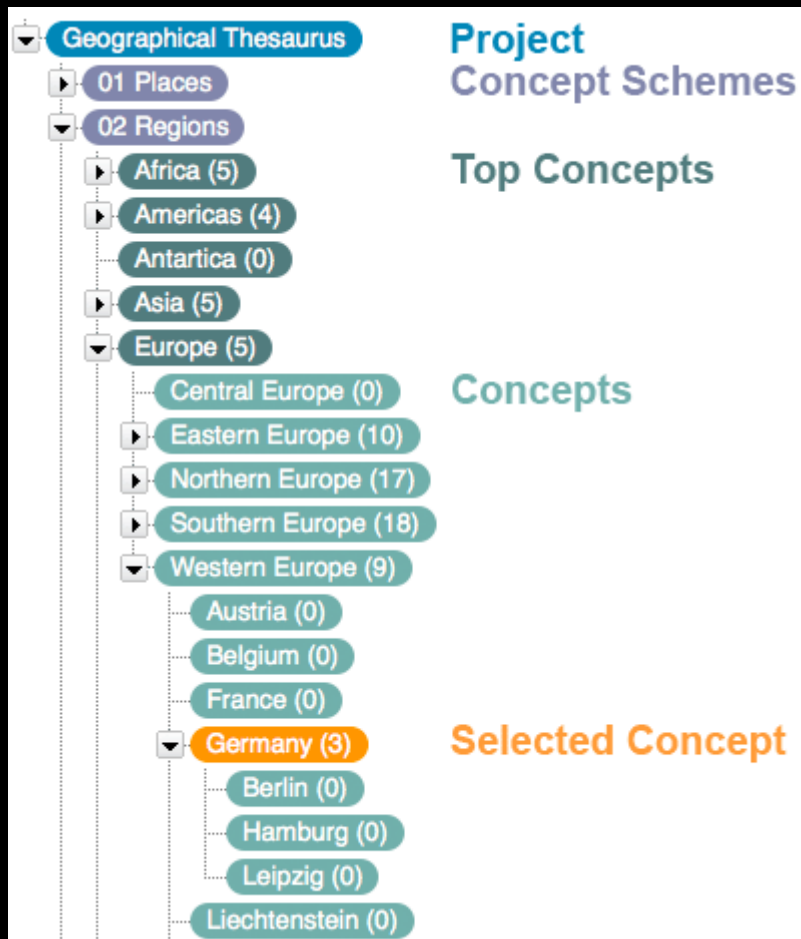


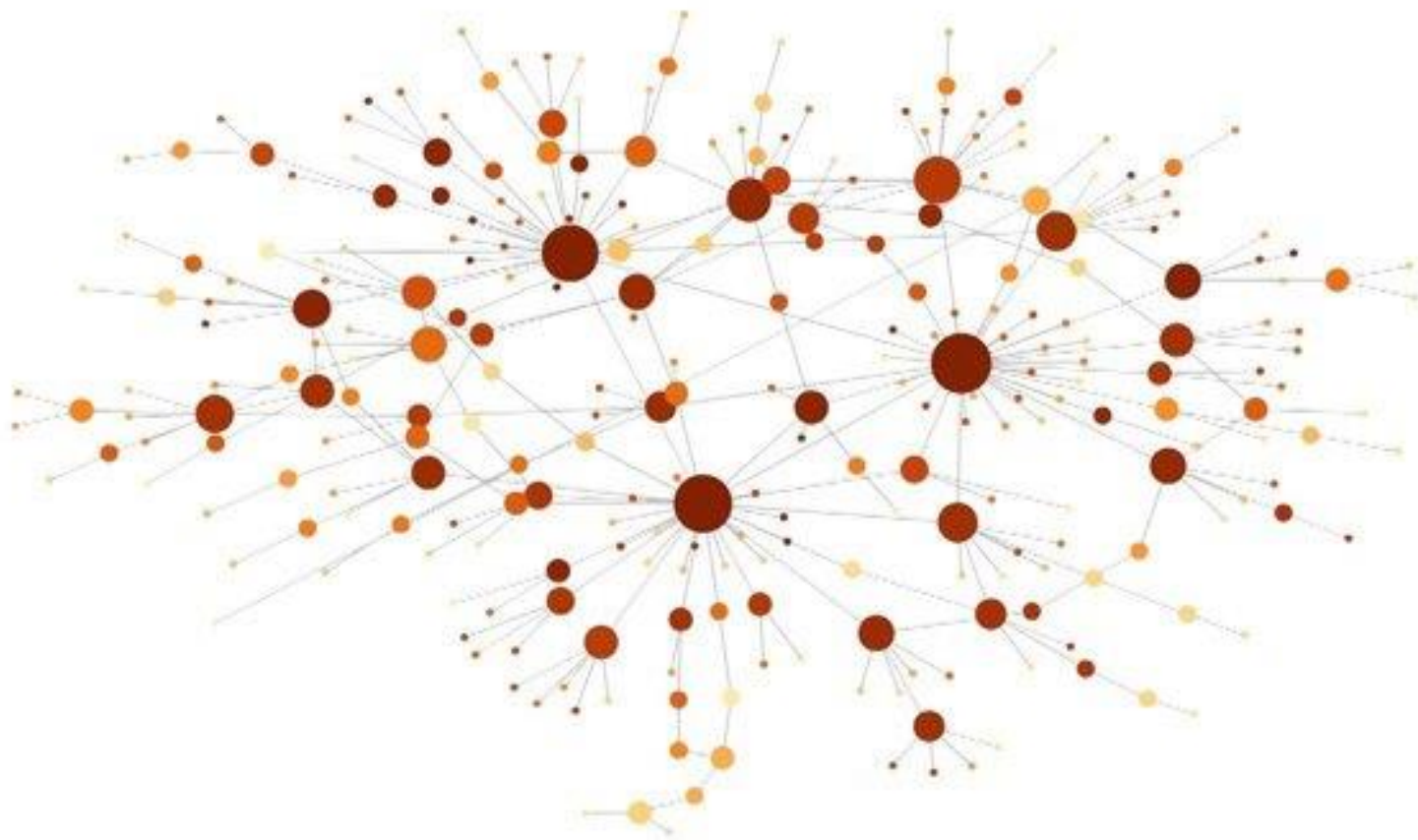
Emergence of Scaling in Random Networks

Albert-László Barabási* and Réka Albert

Department of Physics, University of Notre-Dame, Notre-Dame, IN 46556

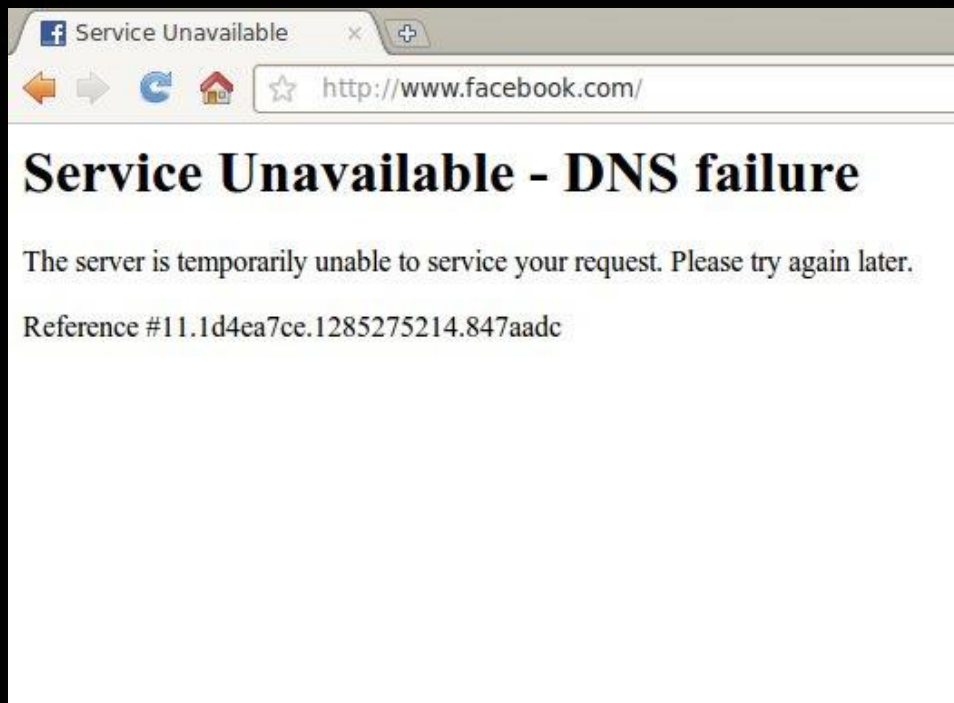
Systems as diverse as genetic networks or the world wide web are best described as networks with complex topology. A common property of many large networks is that the vertex connectivities follow a scale-free power-law distribution. This feature is found to be a consequence of the two generic mechanisms that networks expand continuously by the addition of new vertices, and new vertices attach preferentially to already well connected





G \$\$ ggle™

Have we forgotten so soon?



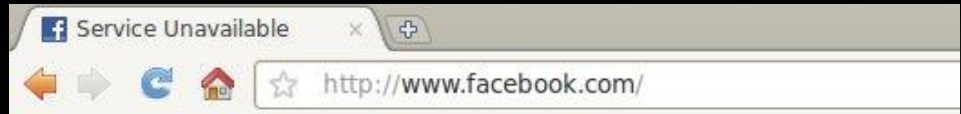
f Service Unavailable x +

← → ↻ 🏠 ☆ http://www.facebook.com/

Service Unavailable - DNS failure

The server is temporarily unable to service your request. Please try again later.

Reference #11.1d4ea7ce.1285275214.847aad



Service Unavailable - DNS failure

our request. Please try again later.

AWS Global Infrastructure

GovCloud (US ITAR Region)	US West (Northern California)	US East (Northern Virginia)	South America (Sao Paulo)	Europe West (Dublin)	Asia Pacific Region (Singapore)	Asia Pacific Region (Tokyo)
------------------------------	----------------------------------	--------------------------------	------------------------------	-------------------------	------------------------------------	--------------------------------

Scale with AWS

- World-wide footprint
- Elastically increase your EC2, DB, NoSQL etc

AWS Regions

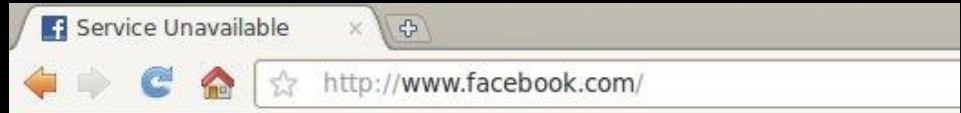
AWS Edge Locations

Navigation

Region:

- US East (Virginia)
- US West (Oregon)
- US West (N. California)
- EU West (Ireland)
- Asia Pacific (Singapore)
- Asia Pacific (Tokyo)
- South America (Sao Paulo)

Image Source: AWS



Service Unavailable - DNS failure

Your request. Please try again later.

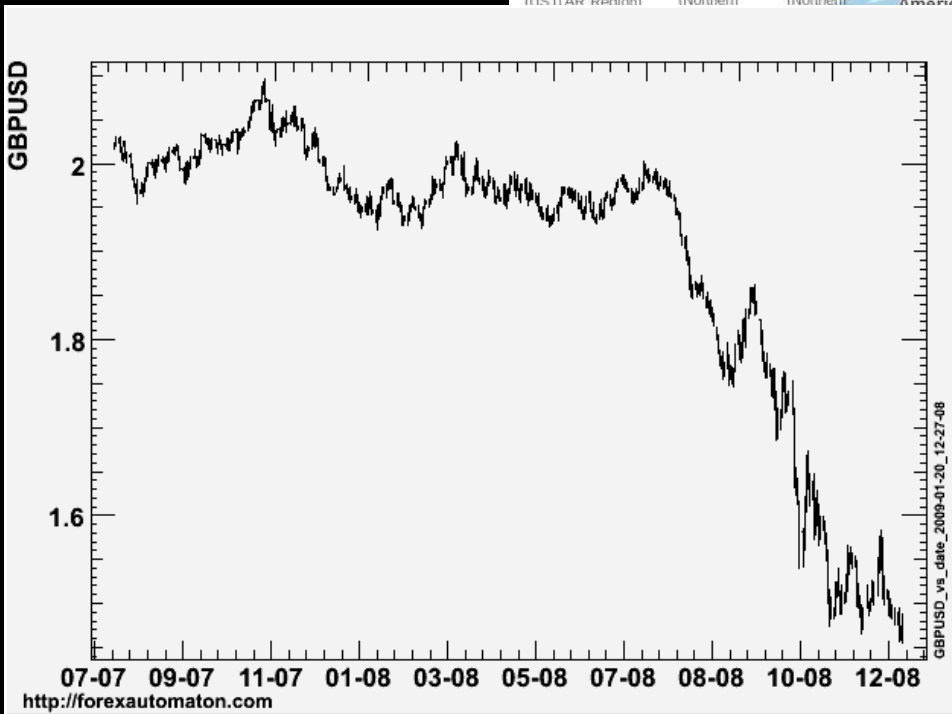
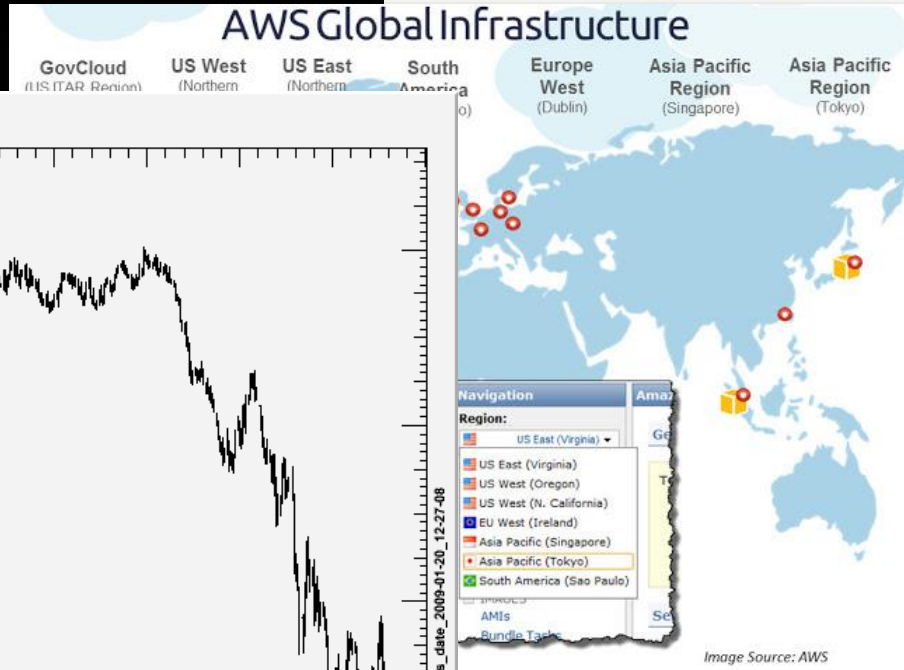


Image Source: AWS

Hub Vulnerability

Hub Vulnerability

“Too big to fail.”

too big to fail

A gallery installation featuring the phrase "too big to fail" in large, black, lowercase letters mounted on a white wall. Each letter is filled with a different black and white photograph. The 't's show a person in a dark jacket, the 'o's show a person holding a white pole, the 'b' shows a person in a dark jacket, the 'i' shows a person in a dark jacket, the 'g' shows a person in a dark jacket, the 't' shows a person in a dark jacket, and the 'o's show a person in a dark jacket. The floor is a light-colored, reflective surface. The ceiling has a track with a camera or light fixture.

NORMAL ACCIDENTS

**Living With
High-Risk
Technologies**

**Charles
Perrow**

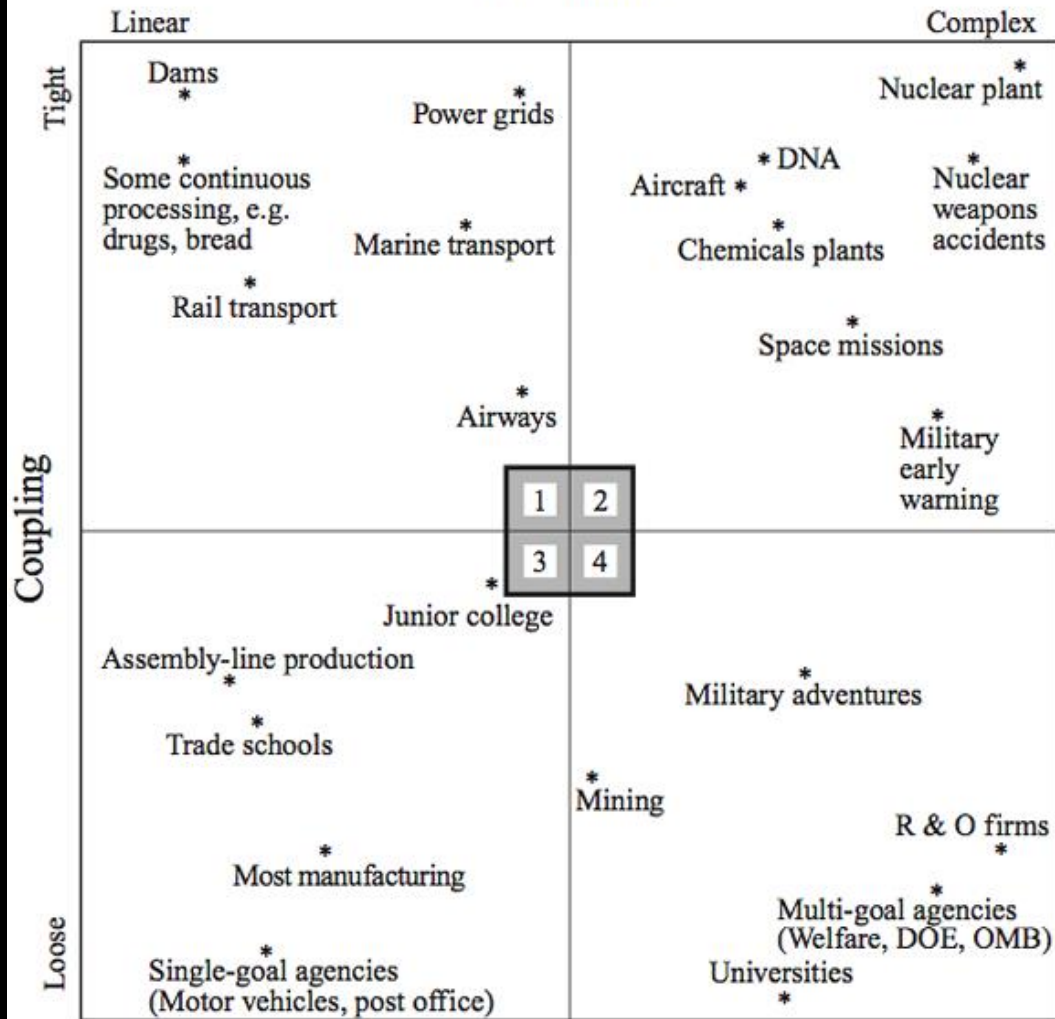
NORMAL ACCIDENTS

L
I
Te
S

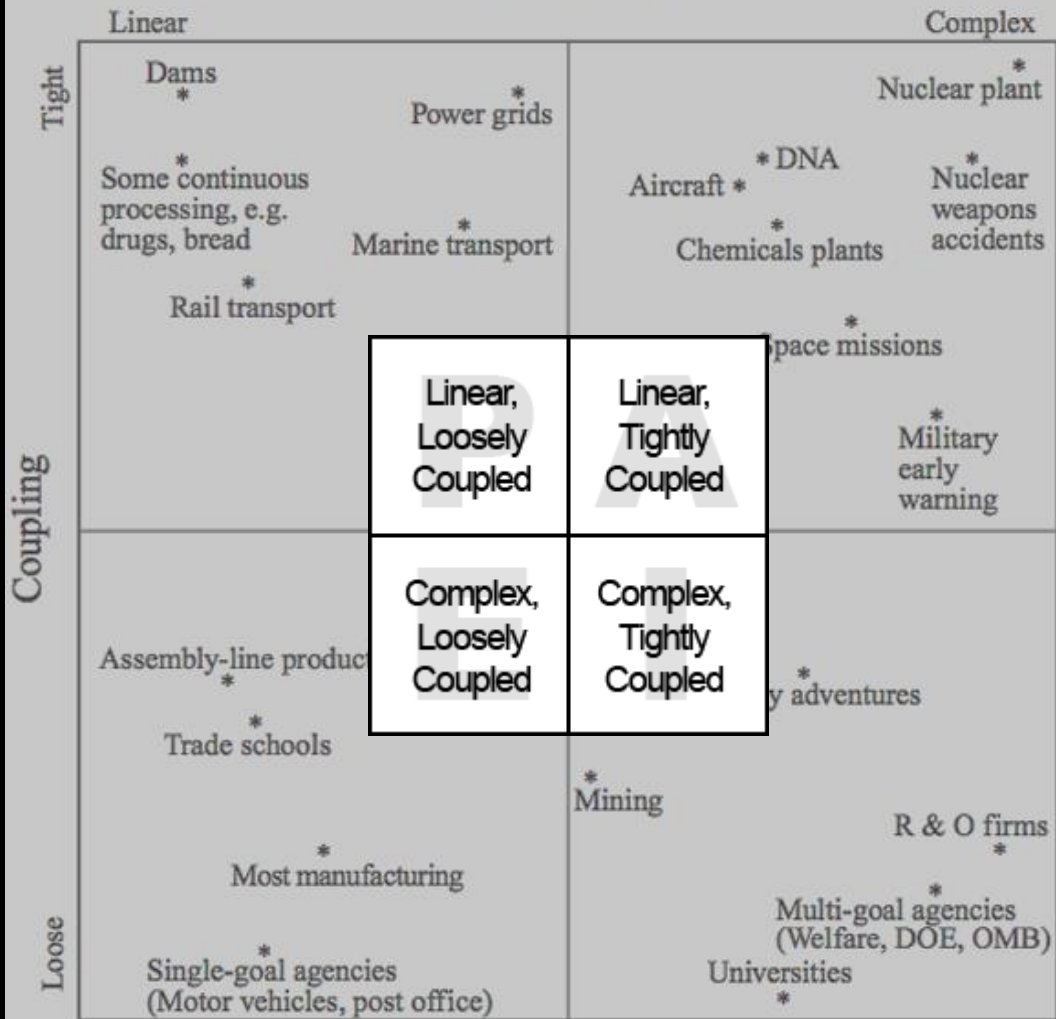


**Charles
Perrow**

Interactions



Interactions



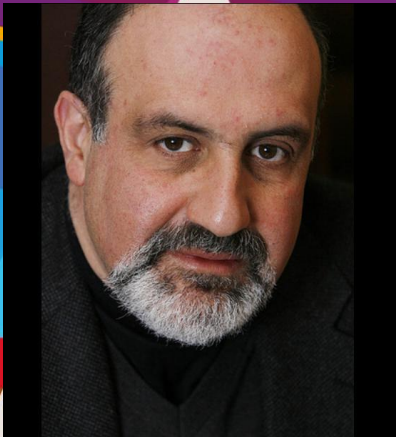
NASSIM NICOLAS

TALEB

ANTI-
FRAGILE

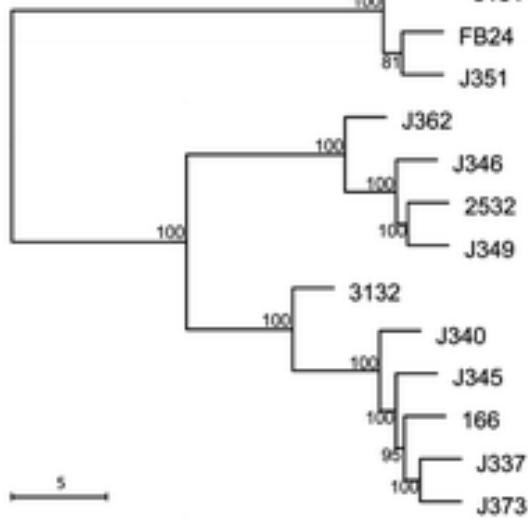
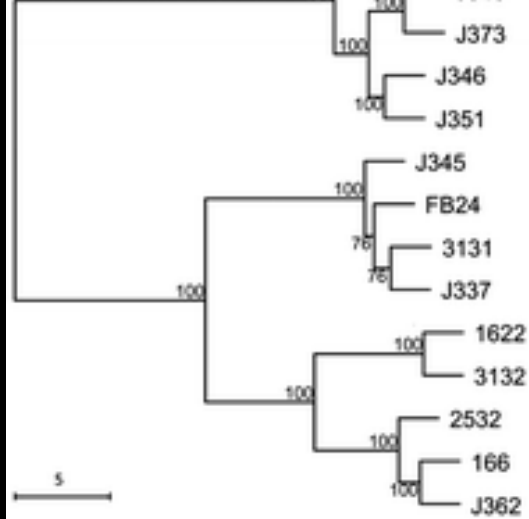
NASSIM NICOLAS

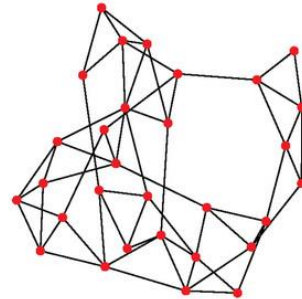
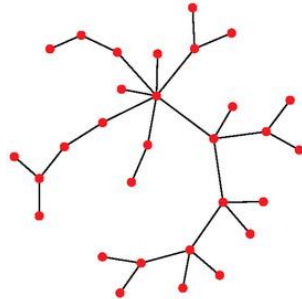
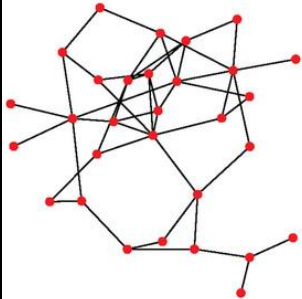
TALEB



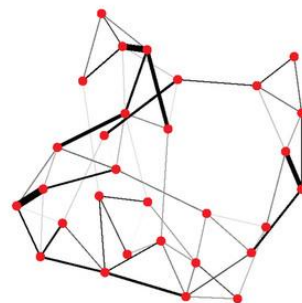
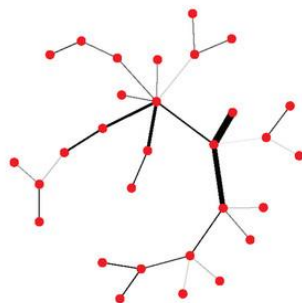
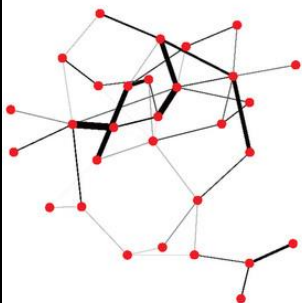
ANTI-
FRAGILE

***Does the power law
only apply to search?***

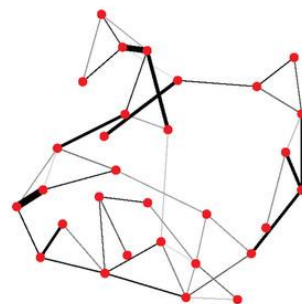
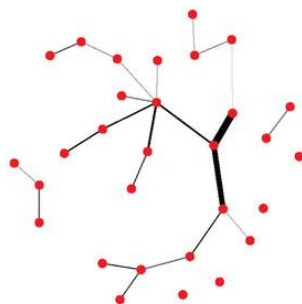
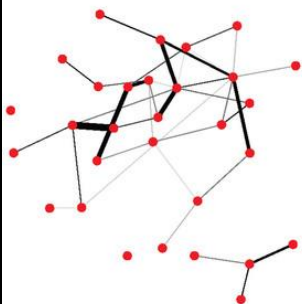




(a)



(b)



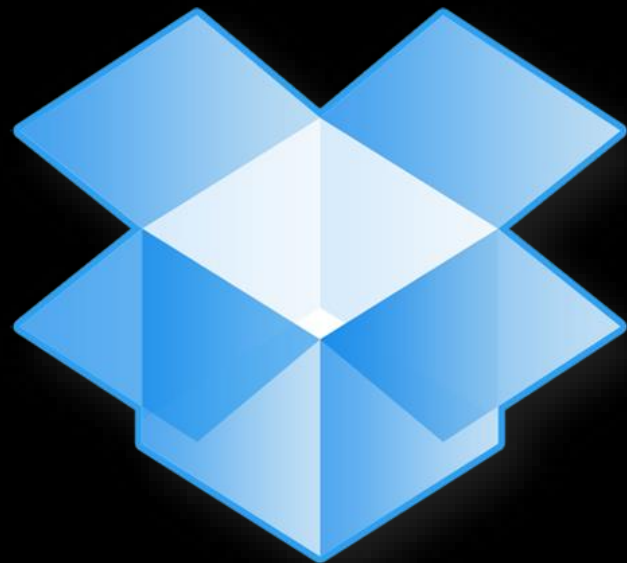
(c)



Google Drive



Google Drive











f Service Unavailable

x













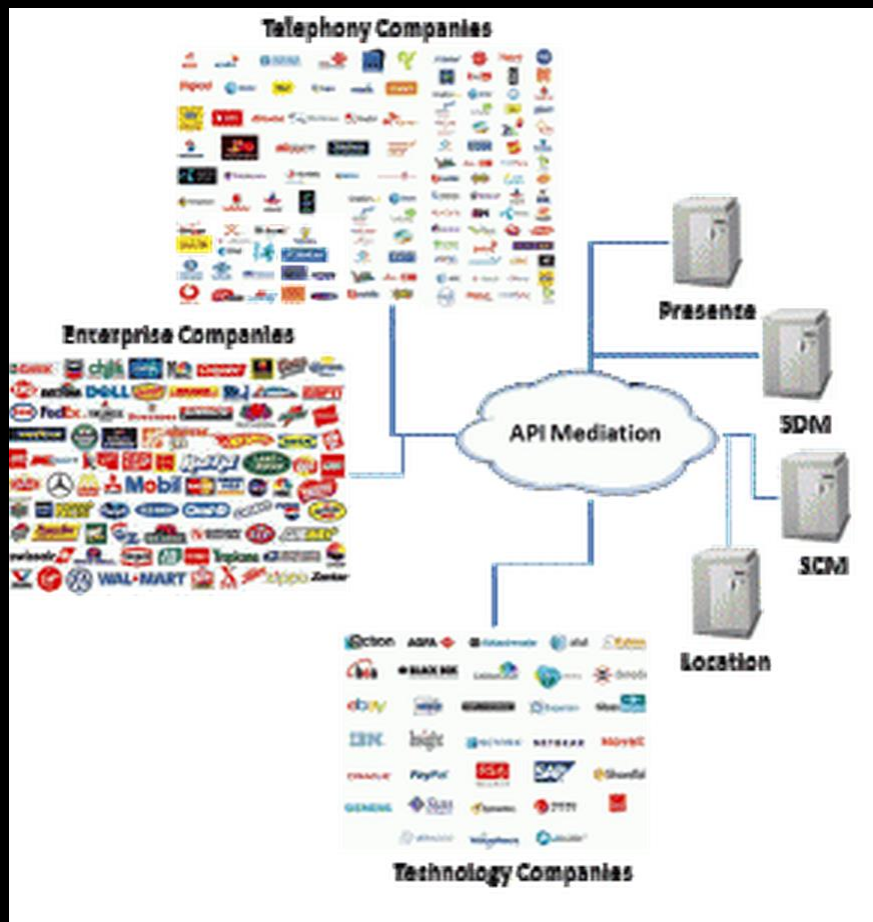
http://www.facebook.com/

Service Unavailable - DNS failure

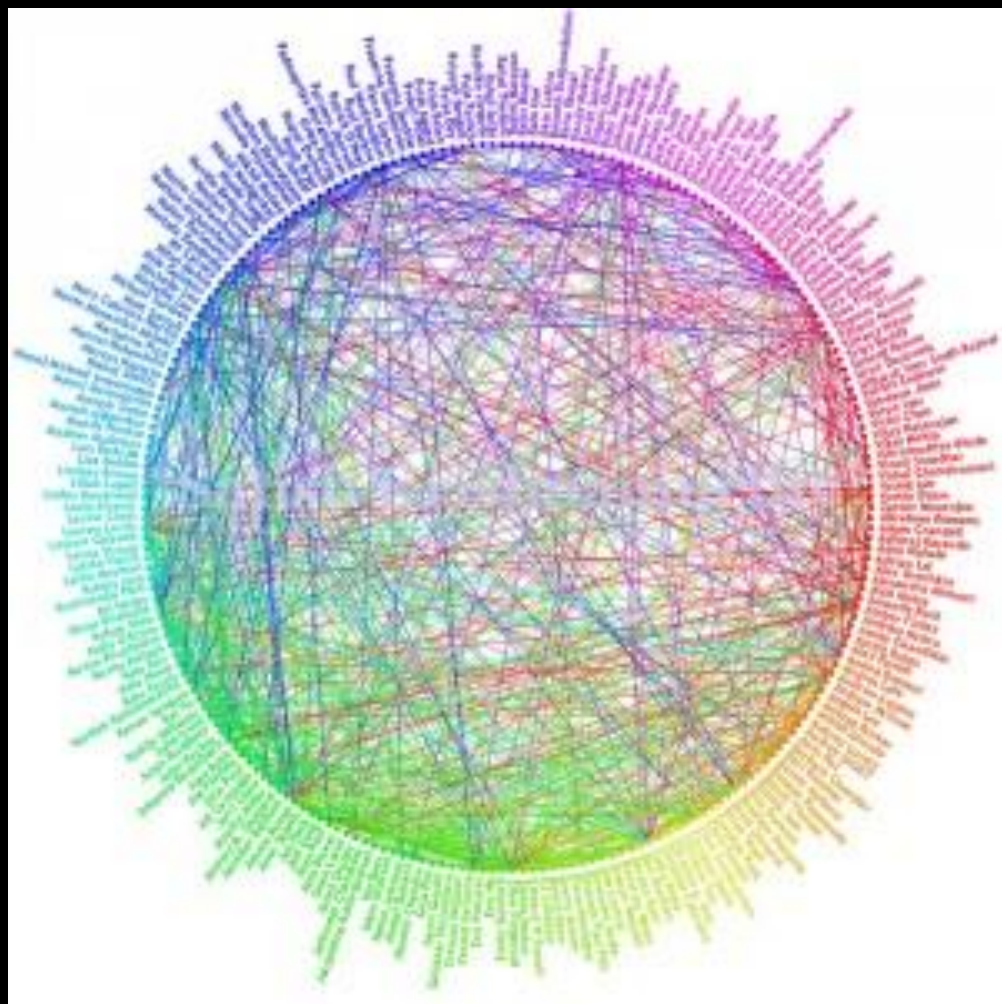
The server is temporarily unable to service your request. Please try again later.

Reference #11.1d4ea7ce.1285275214.847aad

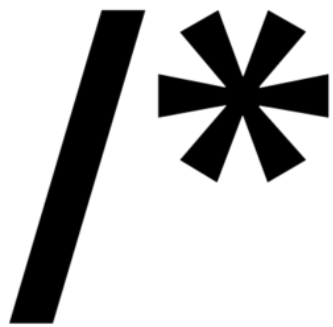
Dewey Number	Cute little Cave guy!	What's written on handout	Notes I give them
000		<i>Basic Information</i> Generalities (Information you need to learn)	Encyclopedias Newspapers Books about libraries Internet
100		<i>Who am I?</i> Philosophy & Psychology (Man thinks about himself)	Things we don't understand: UFO's Ghosts Bigfoot Aliens from outer space
200		<i>Who made me?</i> Religion (Man thinks about God)	Any religions Catholic, Jewish, Baptist, etc. Mythology
300		<i>Who lives next door?</i> Social Sciences (Man thinks about others)	Law & Government Jobs & Money Families & holidays Folk & Fairy Tales
400		<i>How can I talk to others?</i> Languages (Philology) (Man wants to communicate)	Any language French, German, Italian Dictionaries from any language Books on sign language
500		<i>What's around me?</i> Natural Science* (Man thinks about Nature)	Anything that happens by itself Rocks, trees, weather, oceans, rivers, wild animals, dinosaurs, plants, space, moon, stars, sun, math, time, chemistry
600		<i>How can I use Nature?</i> Applied Science* (Man thinks about his world)	Cars, boats, planes, cookbooks, computers, pets, farm animals, medicine, human body
700		<i>What can I do for fun?</i> Arts & Recreation (Man thinks about leisure time)	Dance, music, theater, drawing, jokes, riddles, sports <i>(One child pointed out all their "special classes" are here)</i>
800		<i>How can I record deeds?</i> Literature (Man becomes a storyteller)	Any literature: Spanish, French, English Shakespeare Poems Plays
900		<i>How can I leave a record?</i> History, Geography & Biography (Man thinks about history)	Countries, s States Biographies historical events Wars Travel books



What if we changed our model?

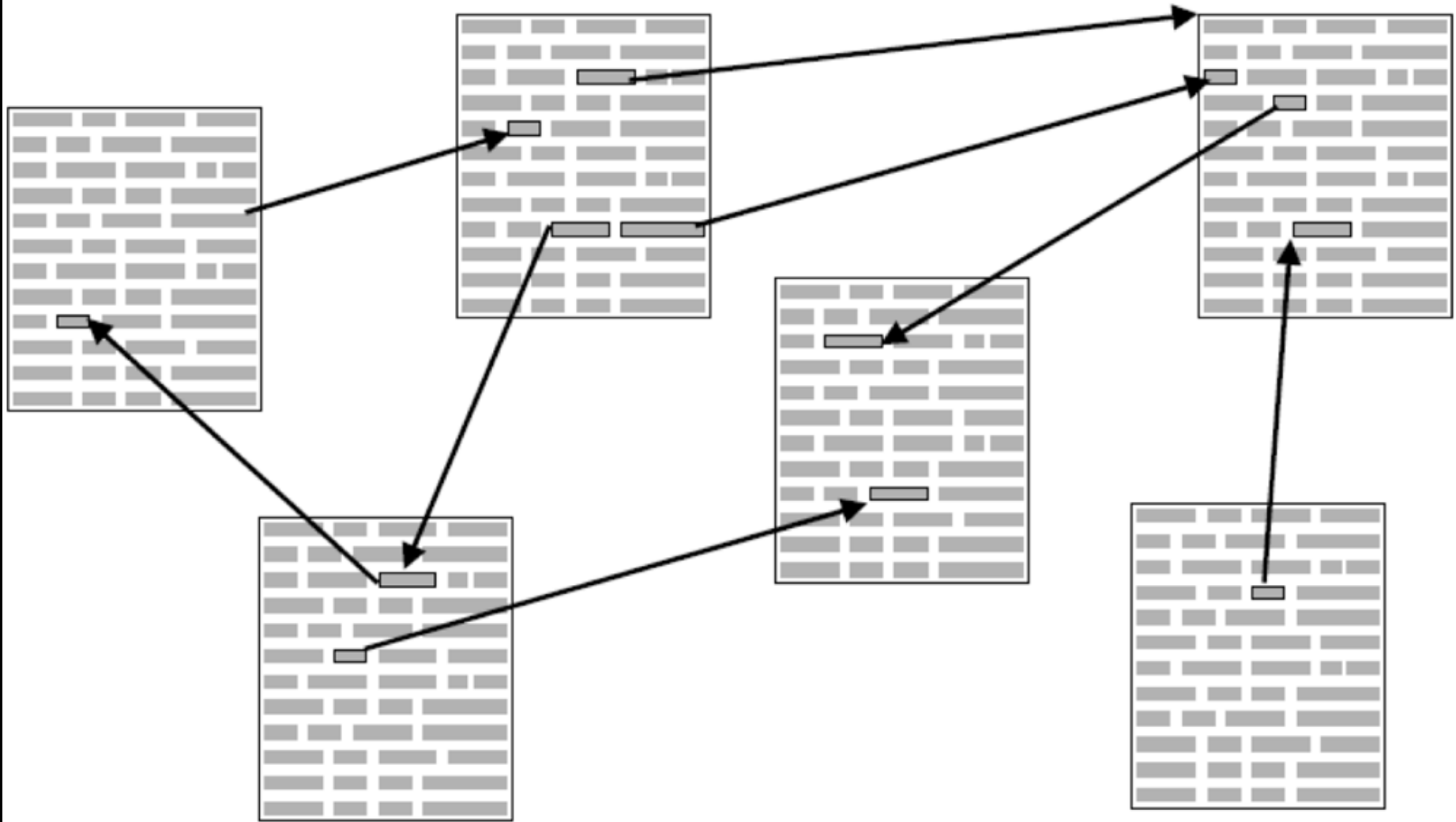






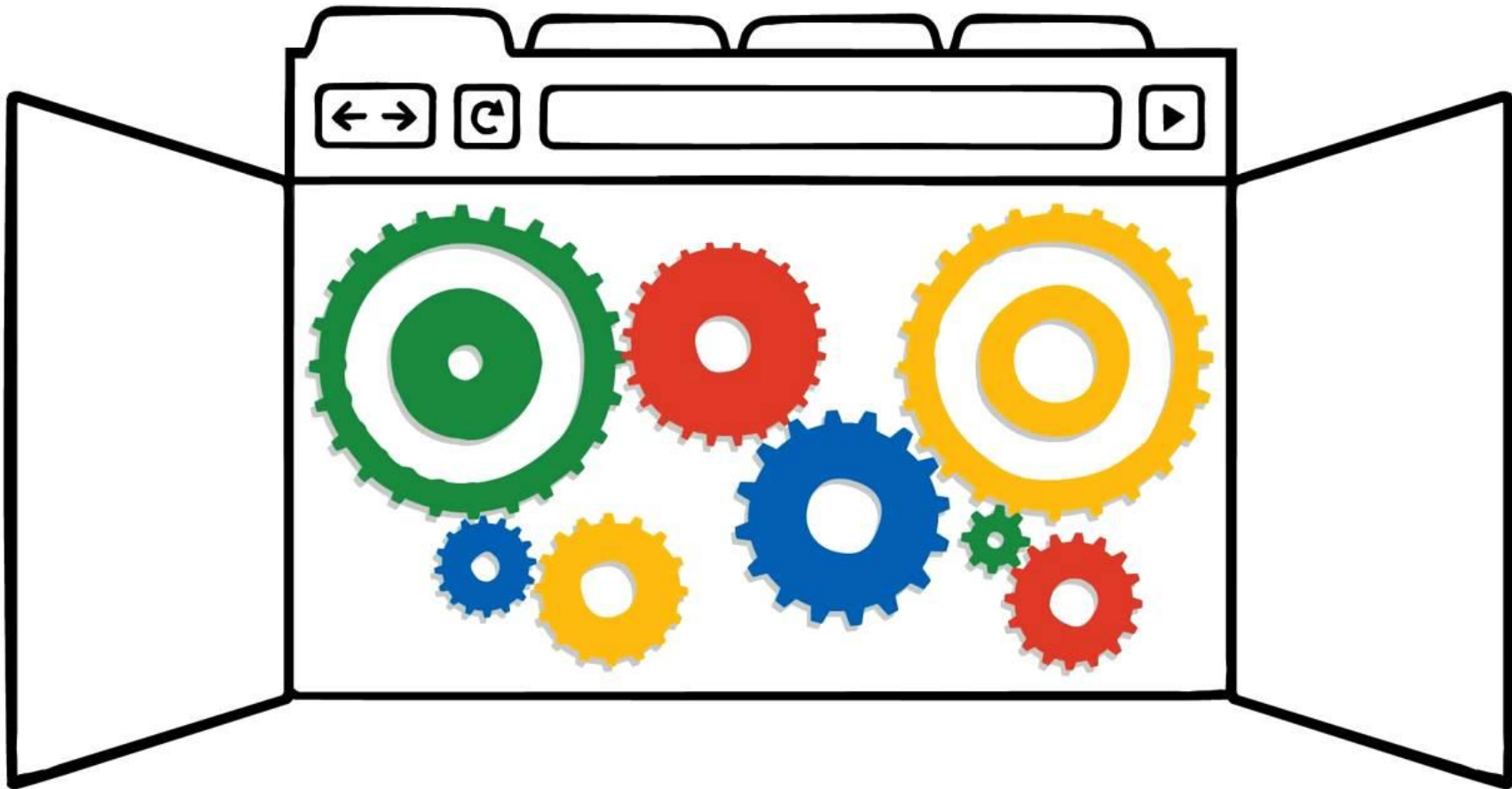
{A}













Home

Presentation

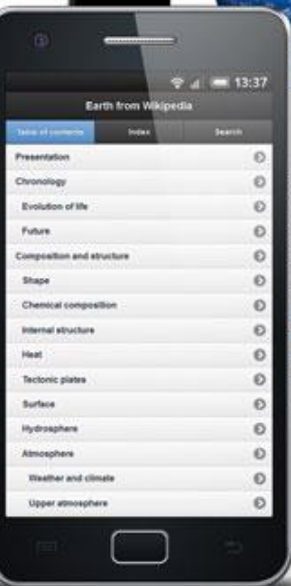
Chronology



Earth (or the Earth) is the third [planet](#) from the [Sun](#), and the densest and fifth-largest of the eight planets in the [Solar System](#). It is also the largest of the Solar System's four [terrestrial planets](#). It is sometimes referred to as the [World](#), the Blue Planet, or by its Latin name, [Terra](#).

Home to millions of [species](#), including [humans](#), Earth is the only place in the universe where [life](#) is known to exist. The planet formed [4.54 billion years](#) ago, and [life appeared](#) on its surface within one billion years. Earth's [biosphere](#) has significantly altered the [atmosphere](#) and other [abiotic](#) conditions on the planet, enabling the proliferation of [aerobic organisms](#) as well as the formation of the [ozone layer](#) which, together with [Earth's magnetic field](#), blocks harmful [solar radiation](#) permitting life on land. The [physical properties of the Earth](#), as well as its [geological](#) history and orbit, have allowed life to persist during this period. The planet is expected to continue supporting life for at least another 500 million years.

Earth's [outer surface](#) is divided into several rigid segments, or [tectonic plates](#), that migrate across the surface over periods of [many millions of years](#). The surface is covered by salt water oceans, with the remainder continents and islands which together have many lakes and other sources of water that contribute to the [hydrosphere](#). Liquid water, necessary for all known life, is also present on other planet's surface. Earth's [polar ice sheets](#) or [sea ice](#) ([Arctic ice sheet](#) or [ice sheet](#)) and [ice caps](#) form a thin, but significant, layer of relatively solid



13:37

Earth from Wikipedia

- Table of contents
- Index
- Search
- Presentation
- Chronology
- Evolution of life
- Future
- Composition and structure
- Shape
- Chemical composition
- Internal structure
- Heat
- Tectonic plates
- Surface
- Hydrosphere
- Atmosphere
- Weather and climate
- Upper atmosphere



BlackBerry

2:21

Tuesday, May 2

- Search results
- Tempate configuration file
 - Access to helpdesk
 - The GWT viewer indicates that the page cannot be displayed
 - Large font on the comment box
 - Link to a file
 - Building a single page HTML template
 - Best practices
 - Under the general topic tree
 - CRM and HTML tag
 - Introduction



13:37

Presentation



Earth (or the Earth) is the third [planet](#) from the [Sun](#), and the densest and fifth-largest of the eight planets in the [Solar System](#). It is also the largest of the Solar System's four [terrestrial planets](#). It is sometimes referred to as the [World](#), the Blue Planet, or by its Latin name, [Terra](#).

Home to millions of [species](#), including [humans](#), Earth is the only place in the universe where [life](#) is known to exist. The planet formed [4.54 billion years](#) ago, and [life appeared](#) on its surface within one billion years. Earth's [biosphere](#) has

generates a magnetic field, and with other objects in space, especially about its own axis, which is equatorial and [perpendicular](#) to the plane of the [orbital plane](#) (85.24 solar days). Earth's only natural satellite, the [Moon](#), [lean](#) [tides](#), stabilizes the axial tilt. Earth has numerous [asteroid](#) impacts throughout its history.

Earth's resources of the planet, as well as its [population](#). These inhabitants include humans, and trade, and military action. Humans have a [flat Earth](#) or in the [Earth as a flat Earth](#) that requires stewardship.

Earth orbits the Sun once every year. The Earth's axis of rotation is tilted at an angle to the plane of the planet's surface with a period of approximately 26,000 years. The planet's surface is covered by salt water oceans, with the remainder continents and islands which together have many lakes and other sources of water that contribute to the [hydrosphere](#). Liquid water, necessary for all known life, is also present on other planet's surface. Earth's [polar ice sheets](#) or [sea ice](#) ([Arctic ice sheet](#) or [ice sheet](#)) and [ice caps](#) form a thin, but significant, layer of relatively solid

Earth's resources that are used by humans, and trade, and military action. Humans have a [flat Earth](#) or in the [Earth as a flat Earth](#) that requires stewardship.

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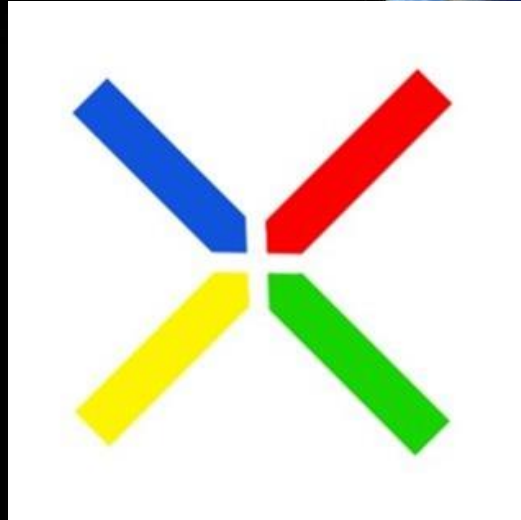
SETI@home

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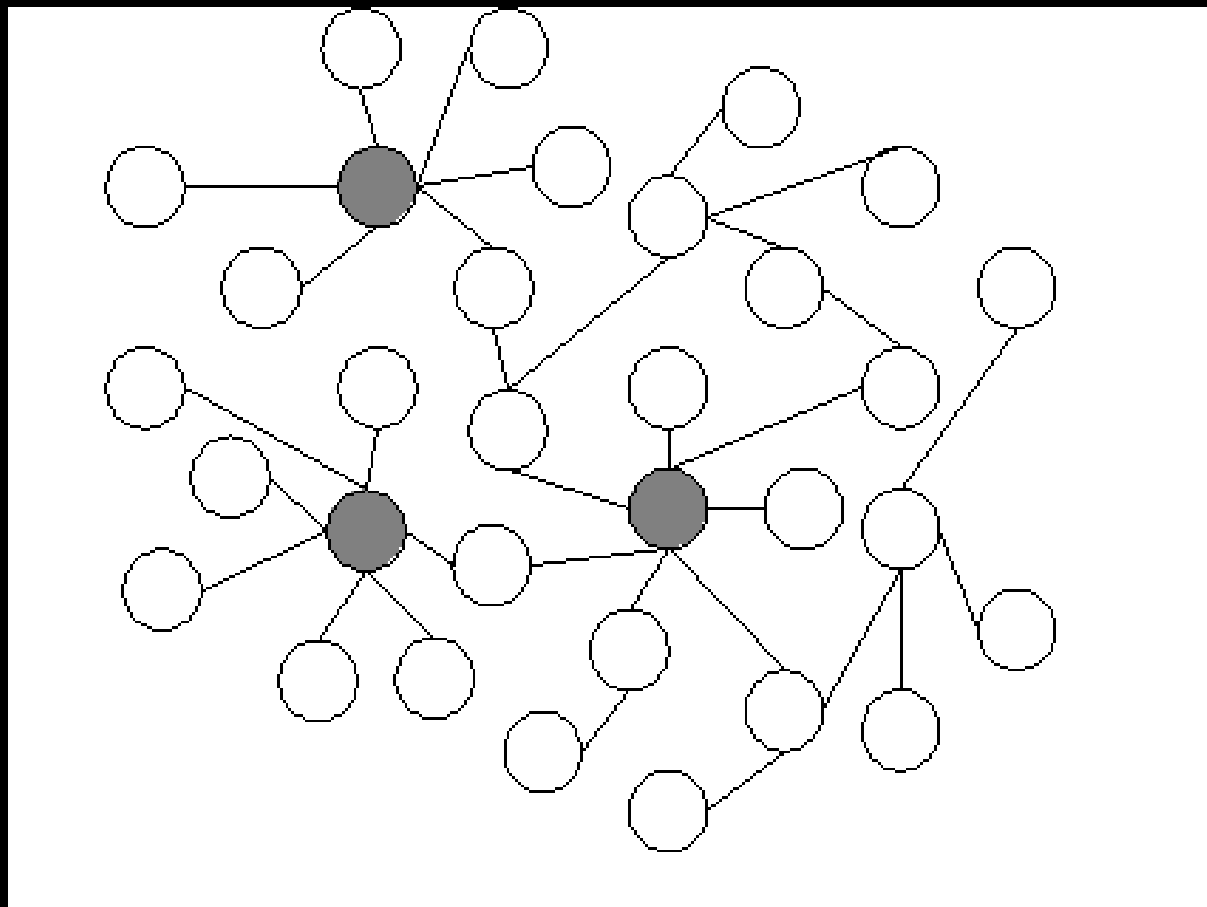
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The
INTERNET
of **THINGS**





***Yes, but can you make money
with this model?***





Microsoft[®]



Microsoft®





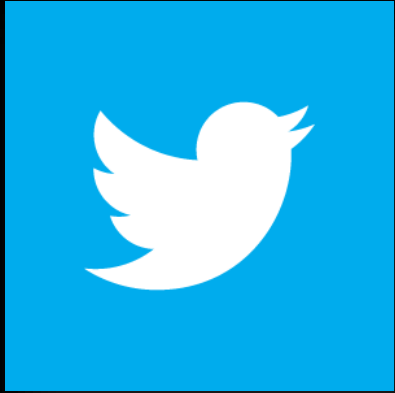
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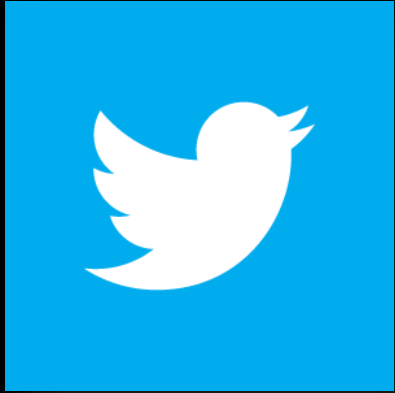
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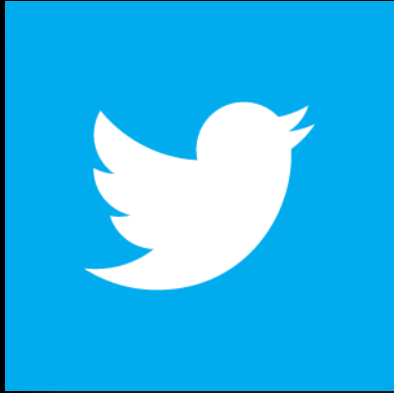


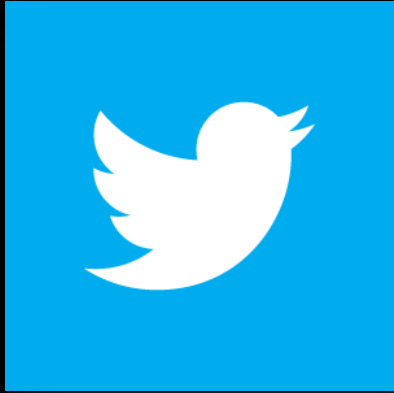


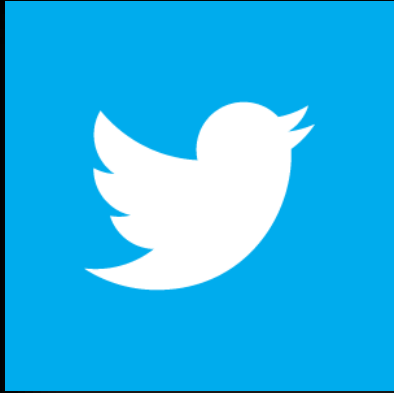
Let's re-imagine common hubs...

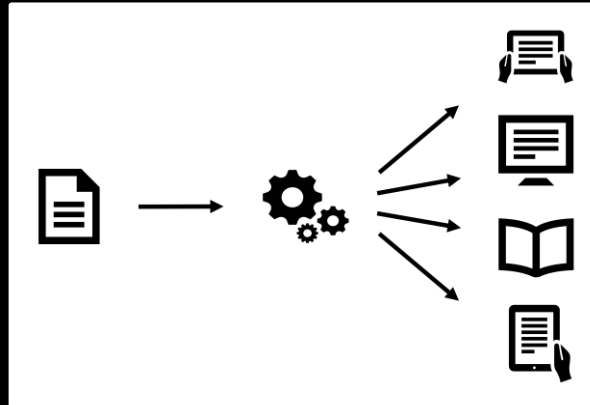
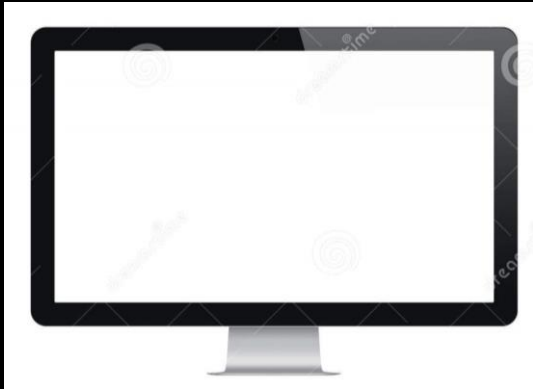


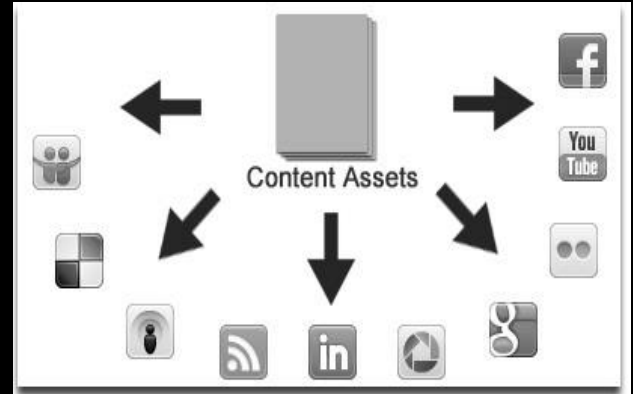
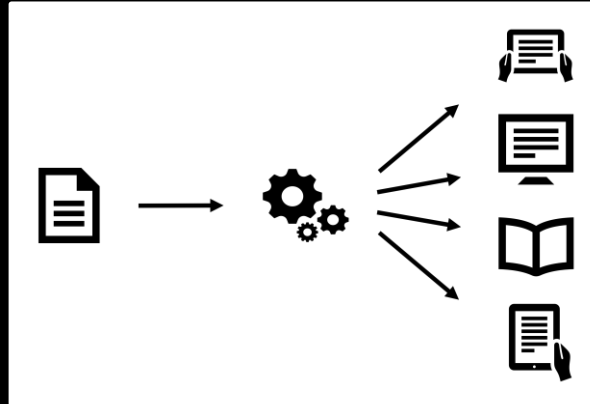
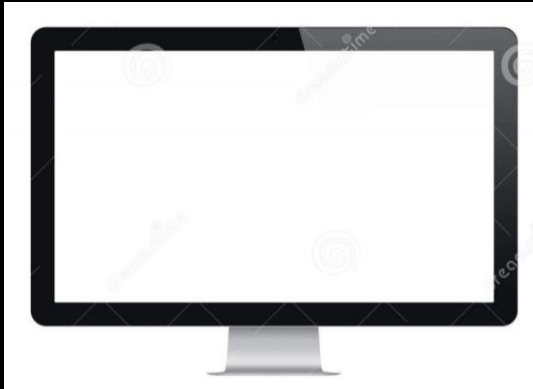
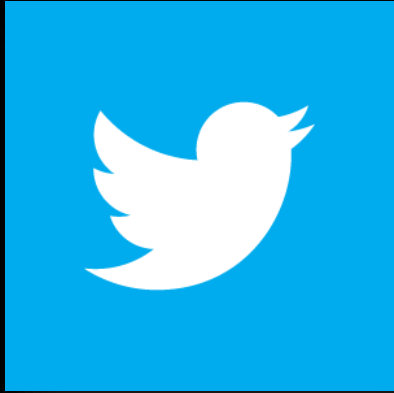












Advice for API providers...

Beware of the hub vulnerability problem



Explore node-based models

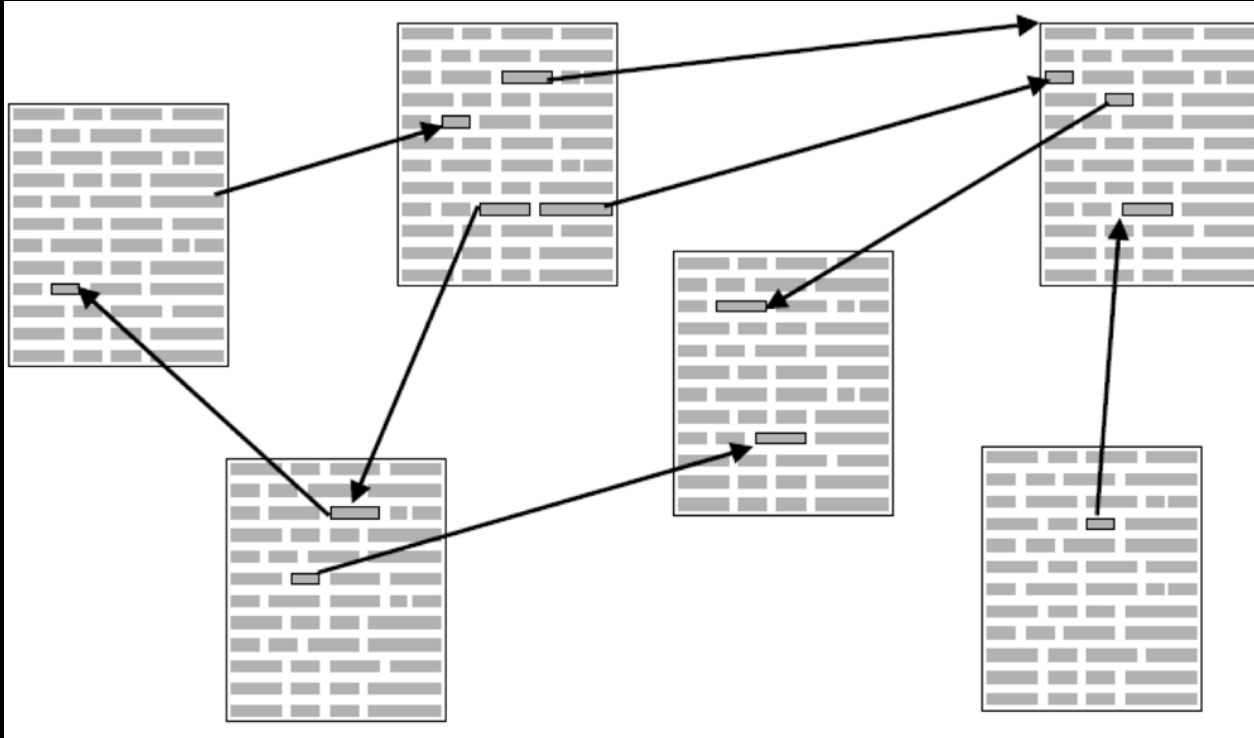


Empower users and reap the rewards

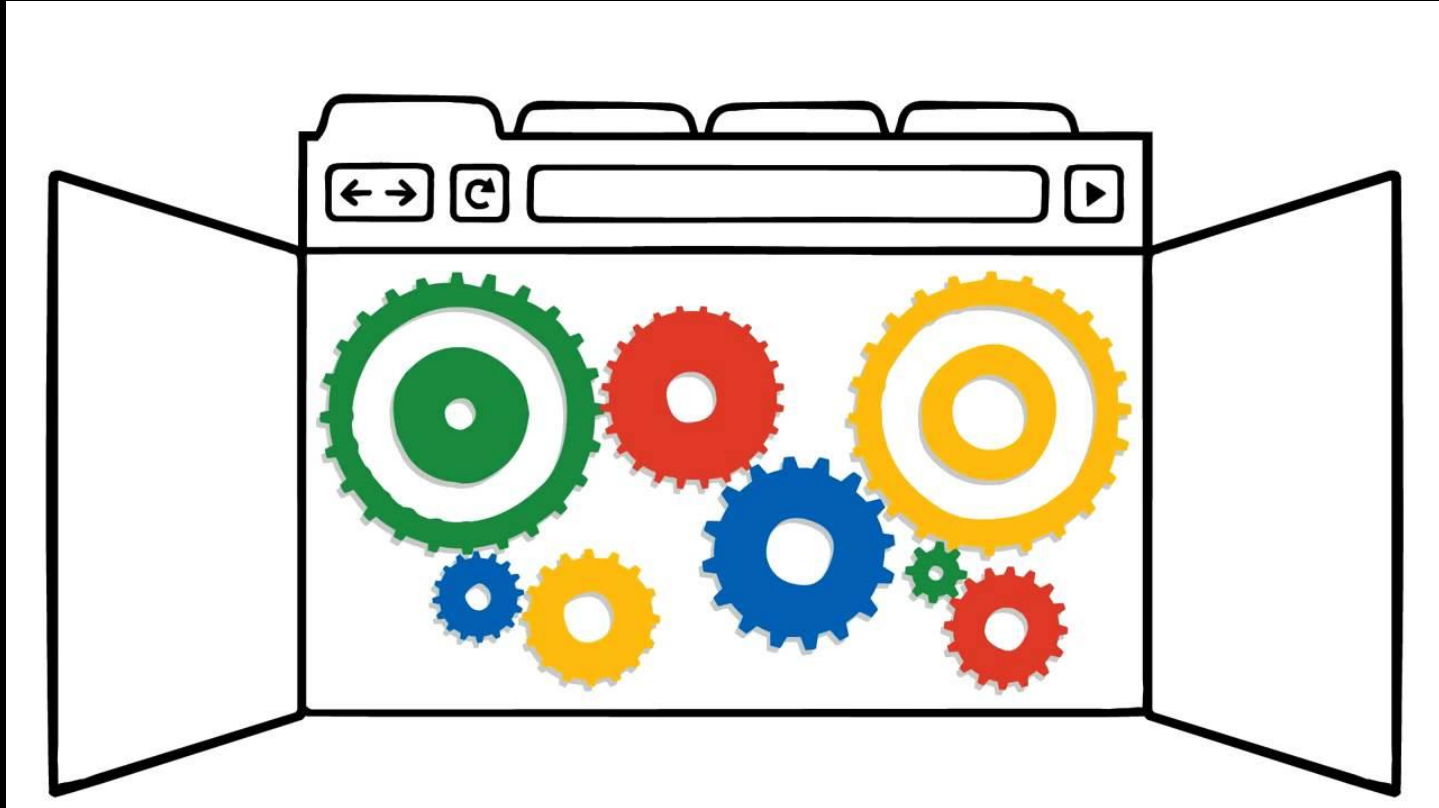


Advice for API consumers...

Is a node-based provider available?



Build client-based aggregators



Empower users and reap the rewards



Wait, I had a message, right?

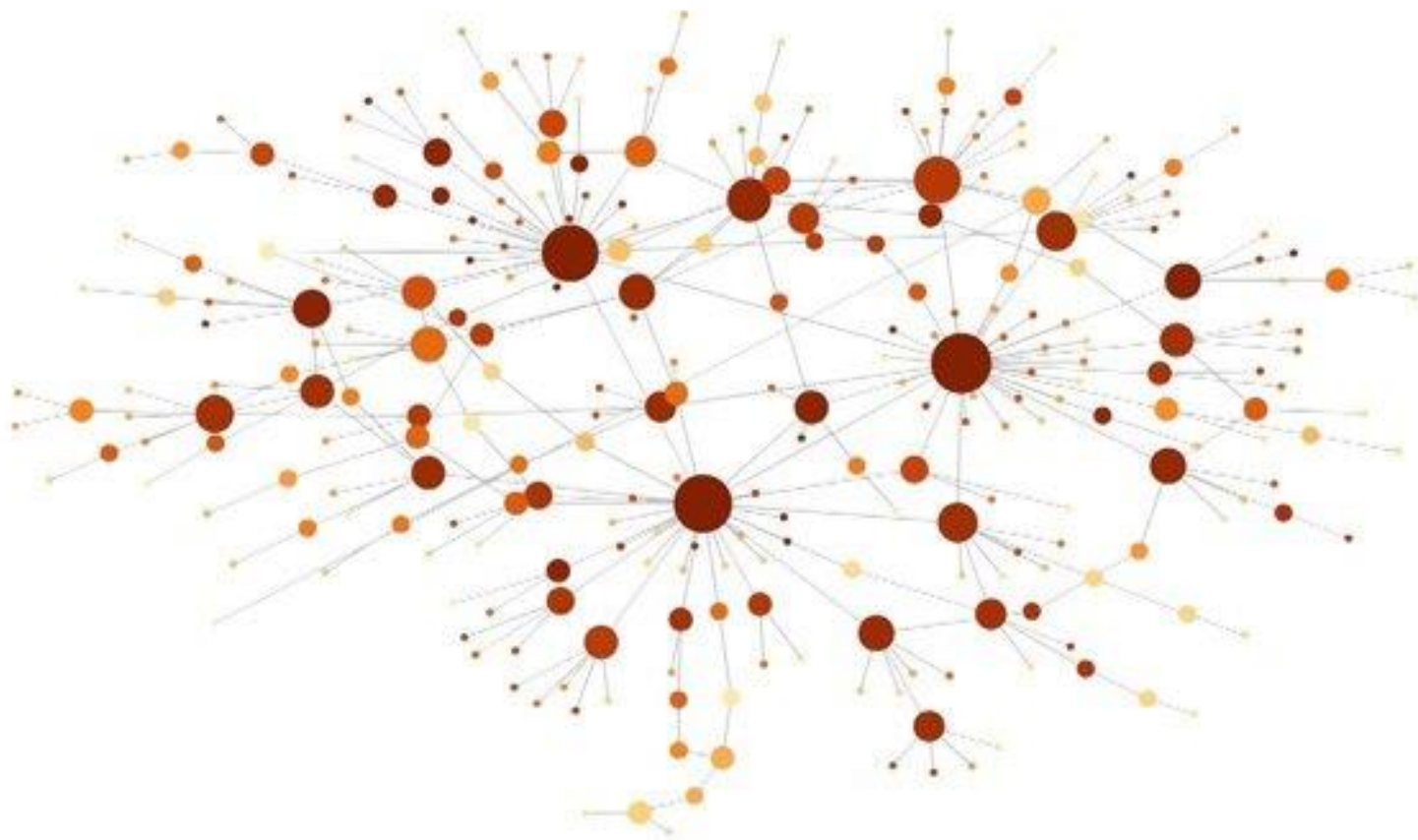




ACTUALLY,
THE END ISN'T
NEAR.

SO, THERE'S TIME TO, LIKE,
THINK AND TALK THINGS THROUGH.

$$P(k) \sim k^\Gamma$$



15B

CONNECTED
DEVICES IN 2015



40B

CONNECTED
DEVICES BY 2020



= 1B DEVICES

27 SIGNS THAT THE END TIMES ARE NEAR

2012

END OF THE WORLD

MAYAN
SECRETS
REVEALED

**REVELATION
REVEALED**
BIBLICAL PROPHECY
DECODING KIT

EPIC FAIL
13 END-OF-WORLD
PREDICTIONS THAT
NEVER HAPPENED

+
BEST BOOKS,
MOVIES & MUSIC
FOR THE END TIMES

**ISLAMIC
APOCALYPSE**
MIND-BLOWING PREDICTIONS
FROM THE QURAN



27 SIGNS THAT THE END TIMES ARE NEAR

2012

END OF THE WORLD

MAYAN
SECRETS
REVEALED

**REVELATION
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BIBLICAL PROPHECY
DECODING KIT

EPIC
3 ENIGMAS OF THE WORLD
QUESTIONS THAT
HAPPENED

+
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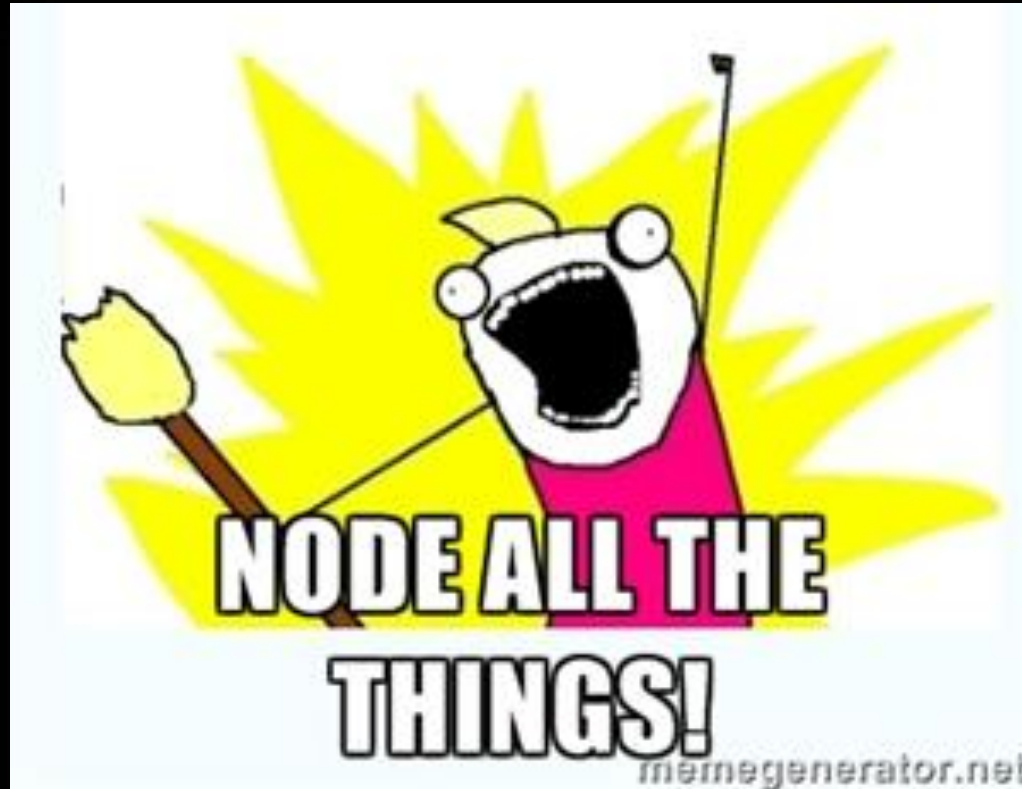
**ISLAMIC
APOCALYPSE**
MIND-BLOWING FACTS
FROM THE QURAN



U.S. \$9.99
Spring 2012, Shelves until 04/18/12
Duckett Entertainment Plus



Be a node and not a hub!





Liberating the API Economy with Scale-Free Networks

<http://g.mamund.com/apidays-sydney-2015>

Mike Amundsen
CA Technologies
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