A Hitchhikers Guide to the GeoWeb

In short, software is eating the world…

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[simplicity is the ultimate sophistication]
Leonardo Da Vinci 1480
[in short, software is eating the world...]

Marc Andreessen 2011
What is the GeoWeb?

“Not only did we fail to imagine what the web would become, we still don’t see it today. “
What is the GeoWeb?

- Continuously available geoinformation content (e.g., spatial data, functions, and location-aware devices/sensors) and geospatial capabilities accessed through a services-based interface [ESRI]

- The ability to locally/globally integrate and share geospatial information via the internet [wikipedia]

Planetary digital nervous system on a massive scale
Evolution of the GeoWeb

- Web Maps
- Web GIS
- GeoWeb

Internet of Things (IoT) Inception

Source


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Principles of the GeoWeb

- Data Accuracy and Integrity/Capabilities
  - Higher
  - Lower

- User Technical Level
  - Higher
  - Lower

- System Design/Usability
  - Lower
  - Higher

Source
Geoweb & Geodetics
An Analogy: Hunting for Prime Numbers

Primality testing options:
- Deterministic (Eratosthenes Sieve 200 BC)
  - Effective, but terribly inefficient
- Non-Deterministic (Rabin-Miller 1980)
  - Fast and practical
- Who cares about prime numbers??!!
- Encryption on the web starts with the hunt for very, very large prime numbers

Primality testing

- **Sieve of Eratosthenes** (ca. 240 BC): takes $\sqrt{x}$ steps, which is exponential in $|x| = \log_2 x$.
- **Miller-Rabin** test (late 1980) is probabilistic:
  - if $x$ is prime it always outputs yes
  - if $x$ is composite it outputs yes with probability at most $\frac{1}{4}$.
  Probability is taken only over the internal randomness of the algorithm, so we can iterate!
  The error goes to zero exponentially fast.
  This algorithm is fast and practical!

In summary, sometimes close enough is close enough!
GeoWeb: A Platform Based on (some) Standards

- Application Programming Interfaces (APIs)
  - REST vs SOAP
    - Representational State Transfer (REST)
    - Simple Object Access Protocol (SOAP)

- Data-Interchange Formats
  - JSON vs XML
    - JavaScript Object Notation (JSON)
    - eXtensible Markup Language (XML)

- Do you notice what is missing?
  - WMS, WFS, GeoRSS, GeoJSON, KML, ESRI Rest
  - Metadata (SDI vs RESTful Discovery)

Distribution of API protocols and styles
Based on directory of 3,200 web APIs listed at ProgrammableWeb, May 2011
SOA FTW

Before SOA

Closed - Monolithic - Brittle

Application Dependent Business Functions

Service Scheduling
- Check Customer Status
- Determine Product Availability
- Verify Customer Credit
- Order Status

Order Processing
- Check Customer Status
- Determine Product Availability
- Verify Customer Credit
- Order Status

Account Management
- Calculate Shipping Charges
- Order Status
- Check Credit

After SOA

Shared services - Collaborative - Interoperable - Integrated

Composite Applications

Composite Application
- Order Processing
- Account Management
- Service Scheduling

Composite Business Process
- Composed Business Process

Reusable Business Services

Reusable Service
- Create Invoice
- Check Customer Status
- Order Status
- Check Credit
- Check Inventory

Data Repository

Marketing Sales CRM Finance Data Warehouse External Partner

Marketing Sales CRM Finance Data Warehouse External Partner
SOA GeoWeb
GeoWeb: A Platform for Geoinformation Accessibility

Uber, the world’s largest taxi company, owns no vehicles.

Facebook, the world’s most popular media owner, creates no content.

Airbnb, the world’s largest accommodation provider, owns no real estate.

Alibaba, the world’s most valuable retailer, has no inventory.

Possession is not as important as it once was. Accessing is more important than ever.

~TechCrunch
The GeoWeb + Internet of Things (IoT) + Big Data (Event Streams)

Connected devices (IoT)

Connected Things

People

1 trillion sensors by 2020

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# Static and Dynamic Sensing in an IoT GeoWeb Big Data World

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<thead>
<tr>
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<th>In-Situ Sensing</th>
<th>Remote Sensing</th>
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<tbody>
<tr>
<td><strong>Dynamic Positions</strong></td>
<td><img src="image" alt="ship" />, <img src="image" alt="airplane" />, <img src="image" alt="construction" /></td>
<td><img src="image" alt="drone" />, <img src="image" alt="satellite" />, <img src="image" alt="submarine" /></td>
</tr>
<tr>
<td><strong>Static Positions</strong></td>
<td><img src="image" alt="factory" />, <img src="image" alt="oil rig" />, <img src="image" alt="camera" /></td>
<td><img src="image" alt="radar" />, <img src="image" alt="weather station" />, <img src="image" alt="light" /></td>
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*In-Situ Sensing* refers to the collection of data from physical locations, while *Remote Sensing* involves the use of instruments to collect data from a distance.
Predictions based on correlations lie at the heart of big data.” - Viktor Mayer-Schönberger
What does it look like?

“In a world of abundance, the only scarcity is human attention.”
Welcome to Costco Wholesale

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Houston, TX 77027-5502
Get ...

12405 N Gessner Rd, Houston ...
Address: 12405 N Gessner Rd
Houston, TX 77064-1170
Get ...

In the news
Costco, Staples preview Black Friday tech deals
USA TODAY - 2 hours ago
The early round of Black Friday tech deals from Amazon and Dell point to some big.

More news for costco

Costco Wholesale
4.4 mi, Houston, TX (713) 570-2059
Open until 8:30 PM

Costco
Retail company

Costco Wholesale Corporation is an American membership-only warehouse club that provides a wide selection of merchandise. Wikipedia

Stock price: COST (Nasdaq) $143.14 + 0.50 (+0.35%)

Customer service: 1 (800) 774-2678
Technical support: 1 (800) 661-0540
Headquarters: Issaquah, WA
CEO: W. Craig Jelinek (Jan 1, 2012-)
Founded: September 15, 1983, Seattle, WA
Founders: Jeffrey H. Brotman, James Sinegal

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Sam's Club
BJ's Wholesale Club
Walmart
Amazon
Target Corporation
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Learn How to Make the Most of the Monetization of Things. Read Today.
Raspberry Pi 3 Model B

- Dimensions: 85.6mm x 56mm x 21mm
- 4 x USB 2 Ports
- 10/100 LAN Port
- 3.5mm 4-pole Composite Video and Audio Output Jack
- CSI Camera Port
- Full Size HDMI Video Output
- On Board Bluetooth 4.1 Wi-Fi
- MicroSD Card Slot
- DSI Display Port
- Broadcom BCM2837 64-bit Quad Core CPU at 1.2GHz, 1GB RAM
- 40 Pin Extended GPIO
- Micro USB Power Input. Upgraded switched power source that can handle up to 2.5 Amps
The Ultimate IoT Sensor (hint, it is in your pocket)

- GPS
- Magnetometer
- Camera (visual spectrum, NIR, Thermal)
- Barometer
- Altimeter
- Gyroscope
- Accelerometer
- Heart Rate Monitor
- Finger Print Reader
The GeoWeb in Oil and Gas

Curated Content from ArcGIS Online

The Living Atlas is the foremost collection of authoritative, ready-to-use global geographic information ever assembled. The themed content in the Living Atlas is curated from content available in ArcGIS Online. The Living Atlas enables the exploration of people and places around the world, as well as the natural and man-made influences that impact them. Experience the benefit of on-demand access to valuable maps, data layers, tools, services, and apps to help you achieve your goals. Always changing and evolving, like our world, the Living Atlas contains information that impacts lives.

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  These maps reflect the changing physical, political, and cultural aspects of our world over time.
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- Maradrill™
- H&P 463 Eagle Ford
- H&P 256 Bakken
- H&P 458 Eagle Ford
- Mobile Rig Network Architecture
- Maradrill™ PI System Tags
- Historized values
- PI Coresight
- PI Server
- Houston Tower
- PI DataLink

http://tinyurl.com/Maradrill
Mobile Asset Tracking

Passive Asset Tracking

Active Asset Tracking
COMMON OPERATING PICTURE

Key for Incident Preparedness & Response - Minimising harm to people, environment and reputation
DWH Findings
Incident Specific Preparedness Review (ISPR)
Deepwater Horizon Oil Spill: United States Coast Guard Final Report

- Lack of agreement on what data needed to be tracked and transmitted
- Vast geography of the response area of operations
- Lack of availability of appropriate interoperable communications technology
- Limited ability to push real-time data, both vertically and laterally, throughout the response organization
- Different computing standards
DWH Findings

- A fully operational COP Tool, such as ERMA, that can be exercised and tested during the preparedness phase and fully brought to bear during an incident is needed prior to an incident.

- There were deficiencies in all of the knowledge management systems used during the Deepwater Horizon incident, which contributed to the lack of overall situational awareness and added to the perceived lack of transparency.

- The incompatibility of proprietary databases and software used by the private sector was a hindrance to the response organization. Integrating data from multiple, restricted sources slowed down the response organization’s ability to have a complete and accurate COP.
Federal Government Reaction
- NTL # 2012-N06: “Encourage you to specify primary and alternate communications technology and software you may use when coordinating and directing spill-response operations systems and/or providing a Common Operating Picture to all spill management and response personnel, including the Federal On-Scene Coordinator and participating Federal and State government officials.”

Industry Reaction
- OGP/IPIECA - Oil Spill Response Joint Industry Project
  - JIP 11 – Common Operating Picture

Shell Reaction
- Develop Global Common Operating Picture
situational awareness
Available anywhere in the world where Shell operates (upstream, downstream, shipping)
Questions and Answers

“If you can't explain it simply, you don't understand it well enough.”

-Albert Einstein