10. Services, Apps and the Internet API

Inspired by Steven Willmott lecture (3scale networks)

Jiří Vokřínek

Department of Computer Science
Faculty of Electrical Engineering, Czech Technical University in Prague

jiri.vokrinek@fel.cvut.cz  http://agents.fel.cvut.cz
The Web is Dead, Long Live the Internet

Wired Magazine / Aug / 2010 (source: Cisco estimates based on CAIDA publications, Andrew Odlyzko)
The Web is Dead, Long Live the Internet

Rob Beschizza at BoingBoing
-> Account for Traffic Growth!
The Web is Dead, Long Live the Internet
The Web is Dead, Long Live the Internet

Global IP Traffic Growth / Top-Line
Global IP Traffic will Increase 3X from 2013 to 2018

Exabytes per Month

<table>
<thead>
<tr>
<th>Year</th>
<th>Exabytes per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>2013</td>
<td>51</td>
</tr>
<tr>
<td>2014</td>
<td>62</td>
</tr>
<tr>
<td>2015</td>
<td>76</td>
</tr>
<tr>
<td>2016</td>
<td>91</td>
</tr>
<tr>
<td>2017</td>
<td>110</td>
</tr>
<tr>
<td>2018</td>
<td>132</td>
</tr>
</tbody>
</table>

21% CAGR

Source: Cisco VNI Global IP Traffic Forecast, 2013–2018
© 2013-2014 Cisco and/or its affiliates. All rights reserved.
The Web is Dead, Long Live the Internet

Average Global Internet Bandwidth Usage

**Average Traffic per User**
- **In 2013**: 15 GB per month
- **By 2018**: 30 GB per month
- **Future**: 75 GB per month

**Average Traffic per Household**
- **In 2013**: 36 GB per month
- **By 2018**: 73 GB per month
- **Future**: 150 GB per month

Source: Cisco VNI Global IP Traffic Forecast, 2013–2018
The Web is Dead, Long Live the Internet

But right or wrong:

- The shift really about traffic or Megabytes

It’s structural:

- Where is the data?
- How does it get to people?
- How do people experience it?

This applies to e-Commerce as well as Content
Internet in 2012

Internet Users in the World Distribution by World Regions - 2012 Q2

- Asia: 44.8%
- Europe: 21.5%
- North America: 11.4%
- Lat Am / Caribb: 10.4%
- Africa: 7.0%
- Middle East: 3.7%
- Oceania / Australia: 1.0%

Source: Internet World Stats - www.internetworldstats.com/stats.htm
Basis: 2,405,518,376 Internet users on June 30, 2012
Copyright © 2012, Miniwatts Marketing Group
Internet in 2016

Internet Users in the World by Regions
June 2016

- Asia: 50.2%
- Europe: 16.7%
- Lat Am / Carib.: 10.5%
- Africa: 9.3%
- North America: 8.7%
- Middle East: 3.8%
- Oceania / Australia: 0.8%

Source: Internet World Stats - www.internetworldstats.com/stats.htm
Basis: 3,675,824,813 Internet users on June 30, 2016
Copyright © 2016, Miniwatts Marketing Group
# Internet in 2016

## WORLD INTERNET USAGE AND POPULATION STATISTICS

**JUNE 30, 2016 - Update**

<table>
<thead>
<tr>
<th>World Regions</th>
<th>Population (2016 Est.)</th>
<th>Population % of World</th>
<th>Internet Users 30 June 2016</th>
<th>Penetration Rate (% Pop.)</th>
<th>Growth 2000-2016</th>
<th>Table % Users</th>
</tr>
</thead>
<tbody>
<tr>
<td>Asia</td>
<td>4,052,652,889</td>
<td>55.2 %</td>
<td>1,846,212,654</td>
<td>45.6 %</td>
<td>1,515.2%</td>
<td>50.2 %</td>
</tr>
<tr>
<td>Europe</td>
<td>832,073,224</td>
<td>11.3 %</td>
<td>614,979,903</td>
<td>73.9 %</td>
<td>485.2%</td>
<td>16.7 %</td>
</tr>
<tr>
<td>Latin America / Caribbean</td>
<td>626,119,788</td>
<td>8.5 %</td>
<td>384,751,302</td>
<td>61.5 %</td>
<td>2,029.4%</td>
<td>10.5 %</td>
</tr>
<tr>
<td>Africa</td>
<td>1,185,529,578</td>
<td>16.2 %</td>
<td>340,783,342</td>
<td>28.7 %</td>
<td>7,448.8%</td>
<td>9.3 %</td>
</tr>
<tr>
<td>North America</td>
<td>359,492,293</td>
<td>4.9 %</td>
<td>320,067,193</td>
<td>89.0 %</td>
<td>196.1%</td>
<td>8.7 %</td>
</tr>
<tr>
<td>Middle East</td>
<td>246,700,900</td>
<td>3.4 %</td>
<td>141,489,765</td>
<td>57.4 %</td>
<td>4,207.4%</td>
<td>3.8 %</td>
</tr>
<tr>
<td>Oceania / Australia</td>
<td>37,590,820</td>
<td>0.5 %</td>
<td>27,540,654</td>
<td>73.3 %</td>
<td>261.4%</td>
<td>0.8 %</td>
</tr>
<tr>
<td><strong>WORLD TOTAL</strong></td>
<td><strong>7,340,159,492</strong></td>
<td><strong>100.0 %</strong></td>
<td><strong>3,675,824,813</strong></td>
<td><strong>50.1 %</strong></td>
<td><strong>918.3%</strong></td>
<td><strong>100.0 %</strong></td>
</tr>
</tbody>
</table>
Internet in 2016

Internet World Penetration Rates by Geographic Regions - June 2016

- North America: 89.0%
- Europe: 73.9%
- Australia / Oceania: 73.3%
- Latin America / Caribbean: 61.5%
- Middle East: 57.4%
- World, Avg.: 50.1%
- Asia: 45.6%
- Africa: 28.7%

Source: Internet World Stats - www.internetworldstats.com/stats.htm
Penetration Rates are based on a world population of 7,340,094,096 and 3,675,824,813 estimated Internet users on June 30, 2016.
Copyright © 2016, Miniwatts Marketing Group
Smartphones in 2013 (estimated in 2010)

Mary Meeker / Web 2.0 Summit / Nov 2010 / San Francisco
Smartphones in 2016

Mobile internet in 2014

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Q1 2010</th>
<th>Q1 2011</th>
<th>Q2 2011</th>
<th>Q3 2011</th>
<th>Q4 2011</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic</td>
<td>6.3%</td>
<td>6.9%</td>
<td>8.4%</td>
<td>10.3%</td>
<td>12.6%</td>
</tr>
</tbody>
</table>

**Percentage of Website Traffic Coming from Mobile Devices**

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Q1 2012</th>
<th>Q2 2012</th>
<th>Q3 2012</th>
<th>Q4 2012</th>
<th>Q1 2013</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traffic</td>
<td>13.4%</td>
<td>16.63%</td>
<td>17.53%</td>
<td>23.14%</td>
<td>23.86%</td>
</tr>
</tbody>
</table>

78% increase Q1 2012–Q1 2013

31% increase Q1 2013–Q1 2014

Tablets in 2014

Tablets in 2014

- **Apple iOS** (82): Operační systém použitý v telefonech iPhone a tabletech iPad.

- **Google Android** (483): Populární mobilní operační systém s velkou podporou výrobců tabletů i doplňkových programů.

- **Microsoft Windows** (56): Klasický systém ze stolních počítačů upravený pro ovládání dotykem.

- **Apple iOS + Android** (8)

Source: http://www.alza.cz
Tablets in 2014

- Nokia 770 Internet Tablet
- Asus Eee PC
- iPad
- Surface RT

Years:
- 2005
- 2007
- 2010
- 2012
Internet in 2015 (estimated in 2012)

World Population 7.3B

3B Internet Population

23% Computer Sales (USA) are Tablets

Internet Connected Devices 15B

800M Smartphones

2 Billion Users?
Internet in 2015

World Population: 7.3B

Internet Population: 3B

50% worldwide

Internet Connected Devices: 15B

Smartphones: 2B

Did not happen...
Internet in 2018 (estimated in 2014)

Traffic & Service Adoption Drivers, 2013–2018

- More Internet Users
  4 Billion Internet Users

- More Devices
  21 Billion Connections

- Faster Broadband Speeds
  2.6-Fold Speed Increase

- More Video Viewing
  79% of All IP Traffic
Implications

Full Page Web Browsing

App Specific Interfaces

Business Model Change
Web Page -> App+API

The Web

Web Servers

Servers host and deliver content / services to browsers to view / manipulate
Web Page -> App+API

Apps

Web Servers

iPhones

iPads

Android Devices

Desktop Widgets

Tv’s, Fridges, Microwaves...

Servers host and deliver content / services to many platforms
What’s really going on with Mobile Applications?

Application often calls “some backend somewhere”

-> Calling an API!
APPS & APIS

Which means ...

Web Servers

Data Connection

Raw Data / Service for your Application

Can be used by Many different Applications
APPS & APIS

- RESTful Web Services
  - Resources
  - Resources Identifiers (URIs)
  - Representations
  - Operators
  - Response Codes

70-80% of Web APIs Are simple REST-like
Evolution of Web Technology

1. Server sends Data, Structure & Styling to the Browser

   e.g. `<b><i>Heading 1</i></b>`

2. Server sends Data, Structure (HTML) + Styling (CSS) to the Browser

   HTML: `<h1>Heading 1</h1>`  CSS: `h1 { .... }`
EVOLUTION OF WEB TECHNOLOGY

1. Server separates Data and structure on the server before sending in big chunks

   XSLT Transformation for device specific Content

2. Start sending small chunks (AJAX)

   e.g. Gmail fetches email in the background — no full page refresh


**APPS & APIS**

- Evolution of Web Technology
- The Web is becoming Programmable
- Anybody can open up their data / service for reuse
- Apps Everywhere!
API Economy

The “Dark Traffic” of the Web

Google
5 Billion API Calls / Day [April 2010]

Facebook
5 Billion API Calls / Day [October 2009]

twitter
3 Billion API Calls / Day, 75% of all traffic [April 2010]

ebay
8 Billion API Calls / Month [Q3 2009]

Bing
3 Billion API Calls / Month [March 2009]

salesforce.com
Over 50% of all traffic via API [March 2008]

Amazon
Over 100 Billion objects stored in S3 [March 2010]
API Business Models

- **is the product**: Direct revenue
  - Utility / Pay per transaction
  - Tiered Pricing Bands
- **projects the product**: Reach more places
  - Provide more utility
  - Enable Mobile
  - Allow deeper integration
- **promotes the product**: Biz Development Lead Gen
  - User Acquisition
  - Advertising
  - Brand promotion
  - Affiliate Programs
- **powers and feeds the product**: Content Acquisition
  - Partner tie-in
  - Internal Innovation
Programmable Web Stats

- May 2010
  - 2000+ APIs
  - 4800 Mashups
- Nov 2012
  - 7900 APIs
  - 6832 Mashups
- Dec 2016
  - 16000+ APIs
  - 7828 Mashups

Top Mashup Tags (all time) at 2012

http://www.programmableweb.com/
Programmable Web Stats

APIs usage by protocol: REST (69%), SOAP (22%), JavaScript (5%), XML-RPC (2%)

2418 of 6832 Mashups use GoogleMaps API
APIs by Layer

- Personal Information
  - Facebook
  - Google
  - Plaxo

- Applications
  - 37signals
  - Shoeboxed
  - Soundcloud

- Processing
  - Strands
  - Animoto

- Content
  - Google
  - The New York Times
  - Digg
  - Gnip
  - Ribbit
  - Twitter

- Communication
  - Gnip
  - Ribbit
  - Twitter

- Infrastructure
  - Amazon Web Services
  - RightScale
  - Mosso
Model / View / Controller

- An architectural metaphor to help understand this evolution
- Highly successful architectural pattern for application development
Model / View / Controller

Originally described for Smalltalk at Xerox Park

MVC has Revolutionized Software Web App Development
Model / View / Controller

- Clear separation between Data, Presentation & Business Logic

First – MVC Applications:

- Separate at Design Time
- Baked together at Run Time
Model / View / Controller

- Clear separation between Data, Presentation & Business Logic

First – MVC Application

Then – MVC SAAS (software as a service):

- Model
  - Separate at Design Time
- View
  - Separate at Deploy Time
- Controller
  - Baked together at Run Time
Model = Data

Often most critical asset:

- Wealth of data which has value
- Real time / Reference data
- Sometimes unique / sometimes not

Often:

- has great value beyond the company that owns it
- AND value beyond the ways the company can effectively deliver it
View = Form

- This used to be the “company web site”
- Now it could be your SAAS application interface
- Increasingly on Android, iPhone ...
Controller = Business Logic

- Also known as the “smart stuff”
  - Application logic
  - Algorithms
  - Secret sauce
  - Housekeeping like user management / authentication / billing

Increasingly:

- Some companies allow others to apply smart stuff to their data
- Some companies apply their smart stuff to the data of others
APIs enable Cloud Scale MVC

Model:
Data Anywhere in any form

View:
Many Delivery Channels

Controller:
Third parties operating on data

Logos:
Impact on Their Business

- Companies focus on core competence
- Leverage their Ecosystem
- Companies are successful when they:
  - Define a clear center of gravity
  - Proactively manage the interfaces with other parts of the value chain

Originally
APIs Make This Work: Models

An API delivers you Data in Raw Form
APIs Make This Work: Controllers

APIs Provide Access to Smart Processing
APIs Make This Work: Views

APIs feed many possible ways to consume Data & Services.
A Fourth Element

The Framework – The Internet Operating System

- Location
- Activity Streams
- Advertising
- Identity & Social Graph
- Image & Speech Recognition
- Government Data
- Payment
- Search
- Time
- Media Access (Auth / Caching / Analytics)
- Communications (Email, IM, ...)
- Storage
- Compute Power
- Connectivity
A Fourth Element

Elements of the “Internet Operating System” already API Driven

Search
Location
Advertising
Time
Media Access
Identify & Social Graph
Communications

The Internet Operating System Emerging

C.f. Tim O’Reil
To Help Keep the Web Moving Forward

Standardisation will have a huge impact

HTML5 and APIs / APPs need to blend well overtime

Keeping APIs Easy to Use & Apps easy to build across platforms will be a key challenge
Conclusion

The Web / Internet is rapidly becoming an open programmable computing system

Web Page Browsing will decline & Apps / APIs become the norm

In the near future will see dramatic changes in the structure of the Web & Internet

The shift from Web Pages to Apps + APIs is at the core of this change
Conclusion

The Web / Internet is rapidly becoming an open programmable computing system

Web Page Browsing will decline & Apps / APIs become the norm

In the near future will see dramatic changes in the structure of the Web & Internet

The shift from Web Pages to Apps + APIs is at the core of this change

Move to the Internet of Things (Everything)