

The Changing (?) Face of Programming

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A new programming world?

"Mr. Hong describes himself as well off enough so that work is optional. He was collecting more than \$1 million a year from HotOrNot, a project he and his partner had created in seven days ..."

New York Times, 10/28/07

languages
tools
interfaces
components
methodologies

"Language shapes the way
we think and determines
what we can think about."

Benjamin Whorf (1897-1941),
Language, Thought and Reality



"What languages do you focus on?"

parent of a prospective undergrad

"C makes it easy to shoot yourself in the foot; C++ makes it harder, but when you do it blows your whole leg off."

Bjarne Stroustrup, creator of C++



Scripting languages

- the nature of many applications has changed
 - gluing components, web page creation
- scripting languages (Perl, Python, PHP, Ruby, ...)
 - avoid C & C++ memory management, awkward string handling, ...
 - more expressive than Java: e.g., RE's, string operators
 - casual type checking, object hierarchies, data structures
- comparatively weak tools
- slower but no one cares
 - computers are fast and cheap
 - programmers are slow and expensive

Javascript

- very weak typing
- potentially risky object model
- inconsistent implementations, poor tools
- complicated irregular interface to browser
 - no life elsewhere
- no academic credentials

But:

- very widely used in many innovative systems
 - AJAX applications, libraries, web-based programs
- illustrates important programming ideas
 - event-driven programming, callbacks, closures
 - DOM: object oriented interface with a vengeance
 - JSON: a lightweight alternative to XML for structured data



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Spring 2007 - 2008

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start typing here: (e.g., eng for English courses or qr mw for Monday/Wednesday QR courses or smith; mouse over results for details.)

COS 116	ST	TTh 01:30-02:50	COMPU 105	The Computational Universe
COS 126	QR	TTh 11:00-11:50	FRIST 302	General Computer Science
COS 217	QR	MW 10:00-10:50	COMPU 105	Introduction to Programming Systems
COS 226	QR	MW 11:00-12:20	FRIST 302	Algorithms and Data Structures
COS 320		MWF 10:00-10:50	FRIEN 008	Compiling Techniques
COS 333		TTh 11:00-12:20	COMPU 105	Advanced Programming Techniques
COS 398		-		Junior Independent Study
COS 423		MW 11:00-12:20	FRIEN 008	This is a course about the practice of programming. Programming is more than just writing code. Programmers must also assess tradeoffs, choose among design alternatives, debug and test, improve performance, and maintain software written by themselves & others. At the same time, they must be concerned with compatibility, robustness, and reliability, while meeting specifications. Students will have the opportunity to develop these skills by working on their own code and in group projects. <i>Brian W. Kernighan 41946</i>
COS 424		TTh 11:00-12:20	COMPU 104	
COS 426		TTh 01:30-02:50	EQUAA A224	
COS 435		MW 01:30-02:50		
COS 444	SA	TTh 01:30-02:50	COMPU 102	
COS 461		MW 01:30-02:50	COMPU 105	
COS 498		-		Senior Independent Study (S.I.S.) - Candidates Only
COS 511		MW 01:30-02:50	FRIEN 008	Theoretical Machine Learning
COS 598A		F 01:30-04:20	COMPU 402	Advanced Topics in Computer Science: Parallel Architectures
COS 598B		M 01:30-04:20	COMPU 301	Advanced Topics in Computer Science: Vision: From Neural Networks to Deep Learning
COS 598C		TTh 01:30-02:50	COMPU 301	Advanced Topics in Computer Science: Geometric Modeling
COS 598D		F 01:30-04:20	COMPU 301	Advanced Topics in Computer Science: Mathematical Methods
COS 598F		F 01:30-04:20	COMPU 401	Advanced Topics in Computer Science: Biological Networks

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"A language that doesn't affect the way you think about programming is not worth knowing."

Alan Perlis, Epigrams on Programming



languages

tools

interfaces

components

methodologies

**"Give us the tools and
we will finish the job."**

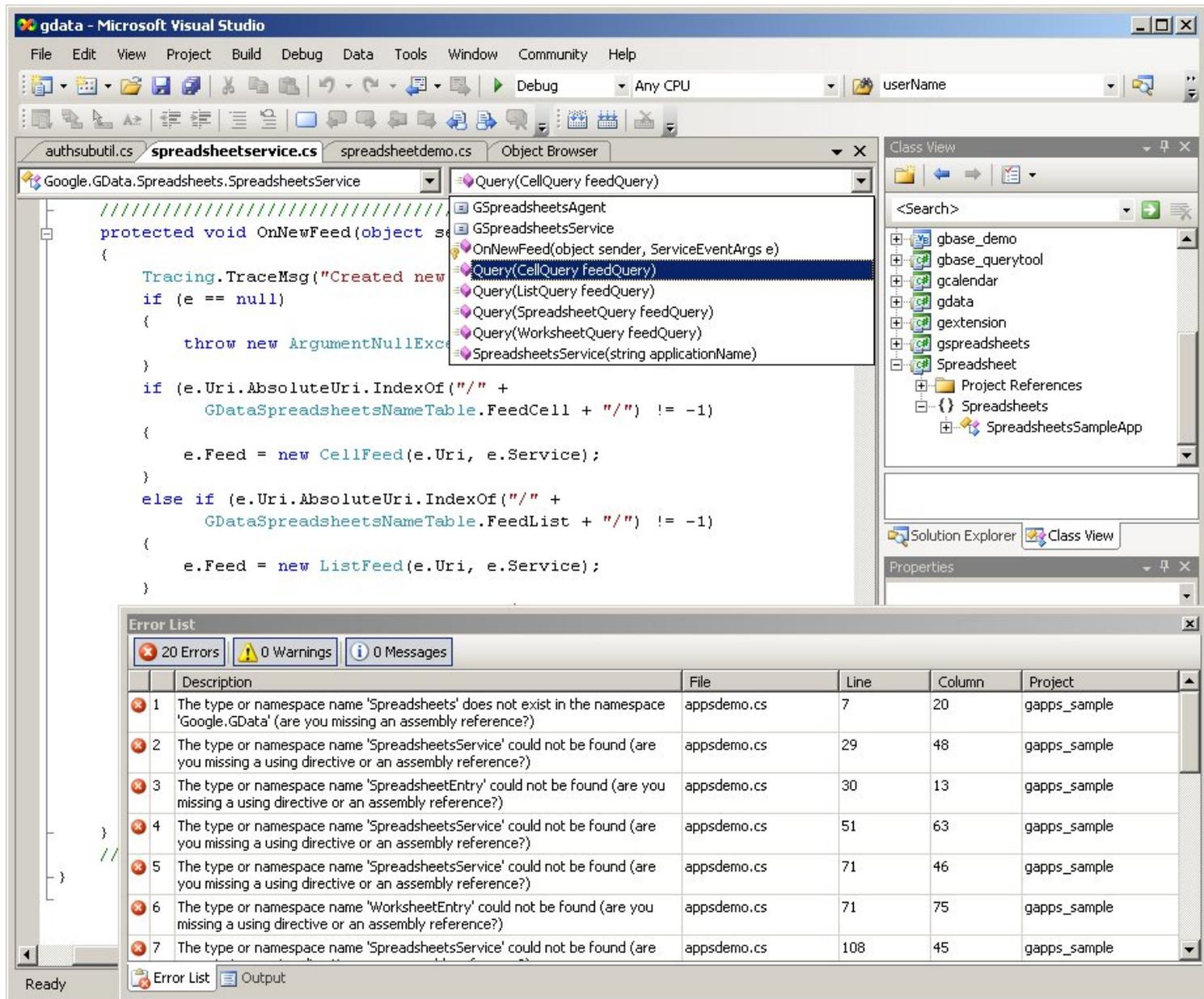
Winston Churchill,
radio address,
February 9, 1941



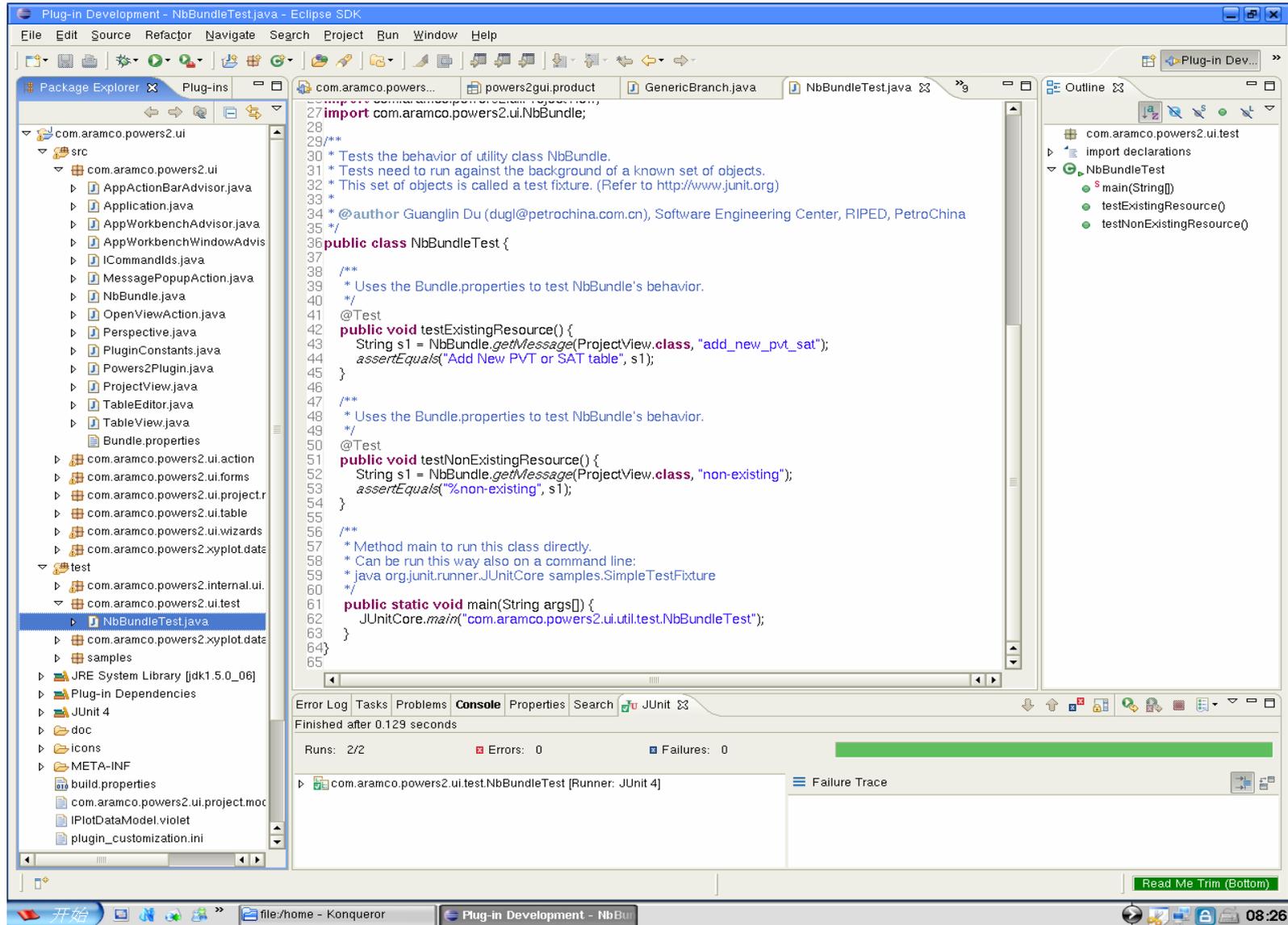
Tools

- mechanization of repetitive / tedious / error-prone tasks
- Unix introduced the conscious focus on creating and using tools
 - small tools: `grep`, `diff`, `wc`, `sort`, `uniq`, ...
 - specialized tools: `yacc`, `lex`, `make`
 - programmable tools: `shell`, `awk`
- Microsoft popularized IDEs
(integrated development environments)
 - complete systems for editing, compiling, debugging, packaging

Visual Studio



Eclipse



Web Frameworks

- software systems to create web applications
 - client (web) front end, server code, database access, administrative subsystem, etc.
- programs that write programs
 - generate code from specification plus conventions
- examples:
 - Rails (Ruby)
 - Django (Python)
 - Google Web Toolkit (Java)
 - and zillions of others [Wikipedia lists nearly 180!!]

Google Web Toolkit

- write client (browser) code in Java
- including GUI layout, using classes like Java Swing
- test client code on server side
- once this works, compile Java to Javascript and HTML
- use the generated code on the client side

Mortgage Calculator

Update Clear Quit

Principal
10000

Interest Rate
10

Monthly Payment
100

1	83.33	16.67	9983.33
2	83.19	16.81	9966.53
3	83.05	16.95	9949.58
4	82.91	17.09	9932.50
5	82.77	17.23	9915.27
6	82.63	17.37	9897.89
7	82.48	17.52	9880.38
8	82.34	17.66	9862.71
9	82.19	17.81	9844.90
10	82.04	17.96	9826.94
11	81.89	18.11	9808.83
12	81.74	18.26	9790.57
13	81.59	18.41	9772.16

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8	82.34	17.66	9862.71
9	82.19	17.81	9844.90
10	82.04	17.96	9826.94
11	81.89	18.11	9808.83
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13	81.59	18.41	9772.16

Django: Python web framework



The image shows a screenshot of the Spare Stuff website. At the top left is a brown cardboard box icon. To its right is the site logo "Spare Stuff" in a bold, brown font, followed by the tagline "finding use for your spare goods." in a smaller green font. Further right are navigation links: "info | charities | mystuff". Below the logo is a large green cloud containing a large question mark and several categories of items: "clothes", "books", "canned foods", "computers", "cars", "toys", and "furniture". To the right of the cloud, the text "Search for charities that can utilize your spare goods or excess inventory" is displayed in a bold, white font. Below this is a search bar with an orange border and the label "Search" in white. The search bar contains the text "bicycles, business attire, cars, laptops, music instruments, prom dresses, recliners, school supplies, tables, to". Below the search bar is a large white box with the text "Let your spare stuff be put to good use..." in a green font. At the bottom center of the page is the copyright notice "SpareStuff.org © 2007".

Spare Stuff finding use for your spare goods. info | charities | mystuff

clothes
books
canned foods
computers
cars
toys
furniture

Search for charities that can utilize your spare goods or excess inventory

Search bicycles, business attire, cars, laptops, music instruments, prom dresses, recliners, school supplies, tables, to

Let your spare stuff be put to good use...

SpareStuff.org © 2007



Top 10 Charities

[Top 10](#)

[Top 25](#)

[Top 50](#)

Charities are ranked by how many users click on their page for more information.

1 [Goodwill Industries Of Greater New York And Northern New Jersey, Inc.](#)

Astoria, NY: Goodwill Industries is a leading provider of vocational, youth and community redevelopment services for people with disabilities and other special needs in New York and Northern New Jersey. Its mission is to expand opportunities and job capabilities for people outside the mainstream workforce, whether they are mentally or physically disabled, economically disadvantaged, recent immigrants, unskilled workers or urban youth. The agency operates its programs in the five boroughs of New York City and the metropolitan area, including Long Island and ... [\(more info\)](#)

2 [Goodwill Industries Of Southern New Jersey/Quaker City Goodwill](#)

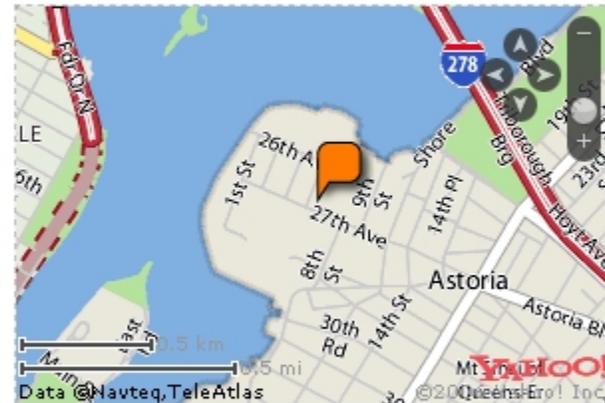
Maple Shade, NJ: Goodwill Industries of Southern New Jersey/Quaker City Goodwill is a nonprofit, community-based organization. Its mission is to provide education, job training and employment services that prepare individuals with disabilities and other disadvantaging conditions, such as welfare dependency, illiteracy, and spousal abuse, for competitive community employment. Revenue from the mass collection and resale of donated items in Goodwill's area retail stores fund employment training programs. [\(more info\)](#)



Goodwill Industries Of Greater New York And Northern New Jersey, Inc.

4-21 27th Avenue, Astoria, NY, 11102

Goodwill Industries is a leading provider of vocational, youth and community redevelopment services for people with disabilities and other special needs in New York and Northern New Jersey. Its mission is to expand opportunities and job capabilities for people outside the mainstream workforce, whether they are mentally or physically disabled, economically disadvantaged, recent immigrants, unskilled workers or urban youth. The agency operates its programs in the five boroughs of New York City and the metropolitan area, including Long Island and Northern New Jersey. [More info...](#)



Contact Information

Email: info@goodwillny.org

Phone: 718-728-5400

Website: <http://www.goodwillny.org> (preferred)

Accepted Items

- clothing
- sporting goods
- housewares
- furniture

"A most important ... aspect of any tool is its influence on the habits of those who train themselves in its use."

Edsger Dijkstra, A Discipline of Programming, 1976



languages

tools

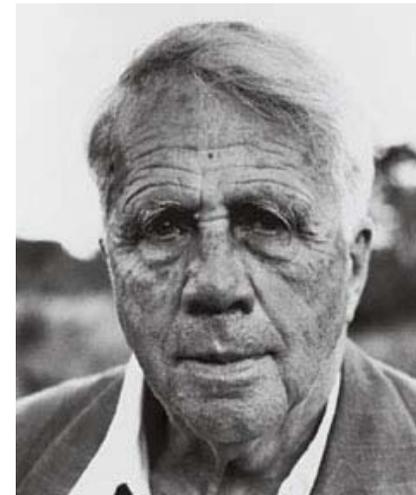
interfaces

components

methodologies

"Good fences make good neighbors"

Robert Frost,
Mending Wall, 1914



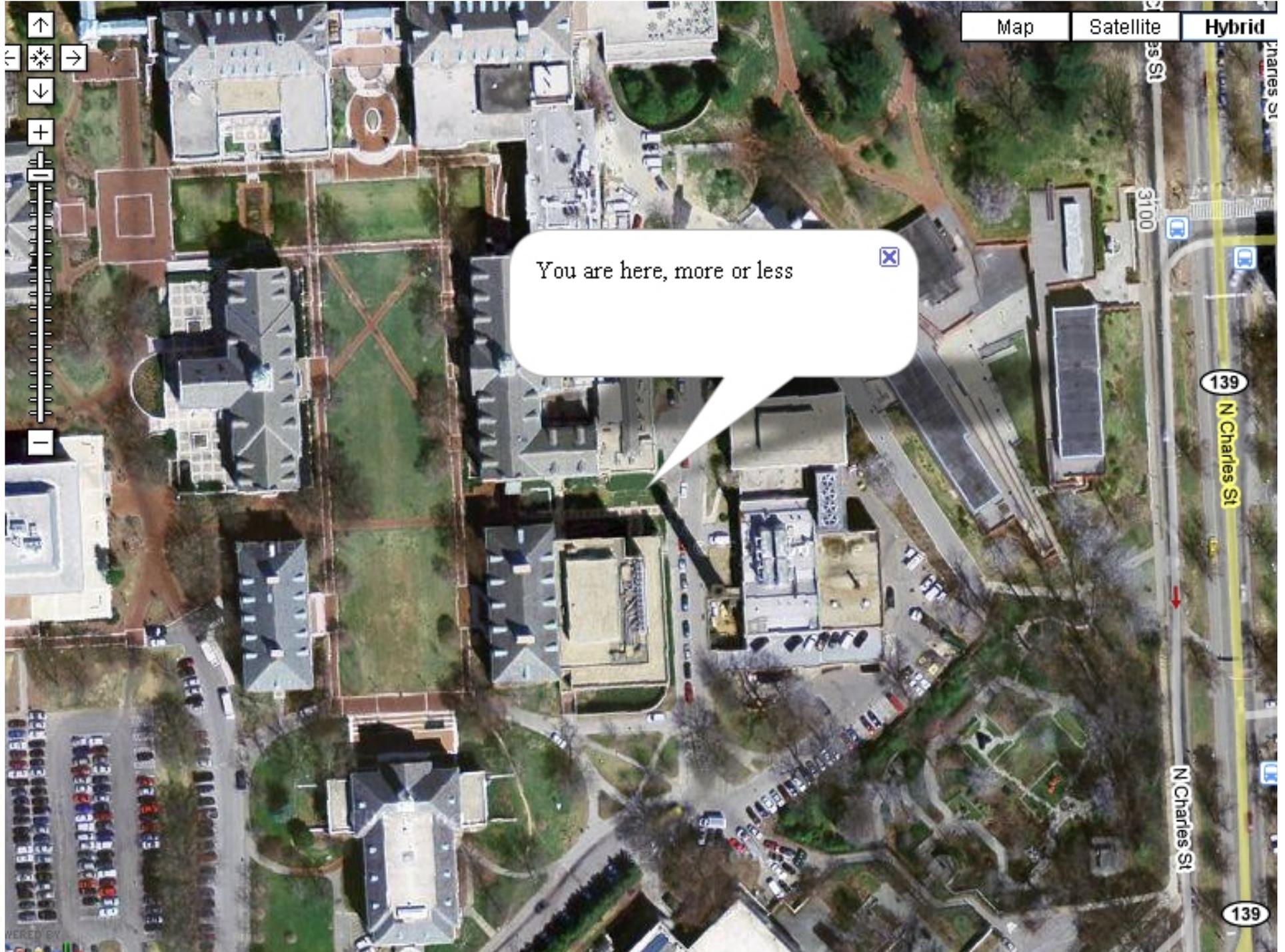
Interfaces

- the boundary between a service and its users
- "Every module ... is characterized by its knowledge of a design decision which it hides from all others. Its interface was chosen to reveal as little as possible about its inner workings."
 - David Parnas, "On the criteria to be used in decomposing systems into modules", *CACM*, 1972
- opaque types [e.g. *C* standard I/O library]
- objects
- web interfaces

Google Maps API

```
<body>
  <div id="map" style="width: 800px; height: 600px"></div>
  <script type="text/javascript">
    //
    var here = new GPoint(-76.6195160150528, 39.32743436955435 );
    var map = new GMap(document.getElementById("map"));
    map.addControl(new GLargeMapControl());
    map.addControl(new GMapTypeControl());

    map.setMapType(G_HYBRID_MAP);
    map.centerAndZoom(here, 0);
    map.openInfoWindow(map.getCenterLatLng(),
      document.createTextNode("You are here, more or less"));
    //]]&gt;
  &lt;/script&gt;
&lt;/body&gt;</pre></div>
```



You are here, more or less

Map

Satellite

Hybrid

139

N Charles St

N Charles St

139

APIs in the News (November 2007)



Search

e.g. "ajax apis" or "open source"

OpenSocial

Hot

The web is better when it's social

The web is more interesting when you can build apps that easily interact with your friends and colleagues. But with the trend towards more social applications also comes a growing list of site-specific APIs that developers must learn.

OpenSocial provides a common set of APIs for social applications across multiple websites. With standard JavaScript and HTML, developers can create apps that access a social network's friends and update feeds.

Many sites, one API

Common APIs mean you have less to learn to build for multiple websites.



"Little wonder then that we see so many poorly designed APIs: it is not reasonable to expect programmers to be good at something they have never been taught."

Michi Henning, "API: Design Matters",

ACM Queue, May 2007



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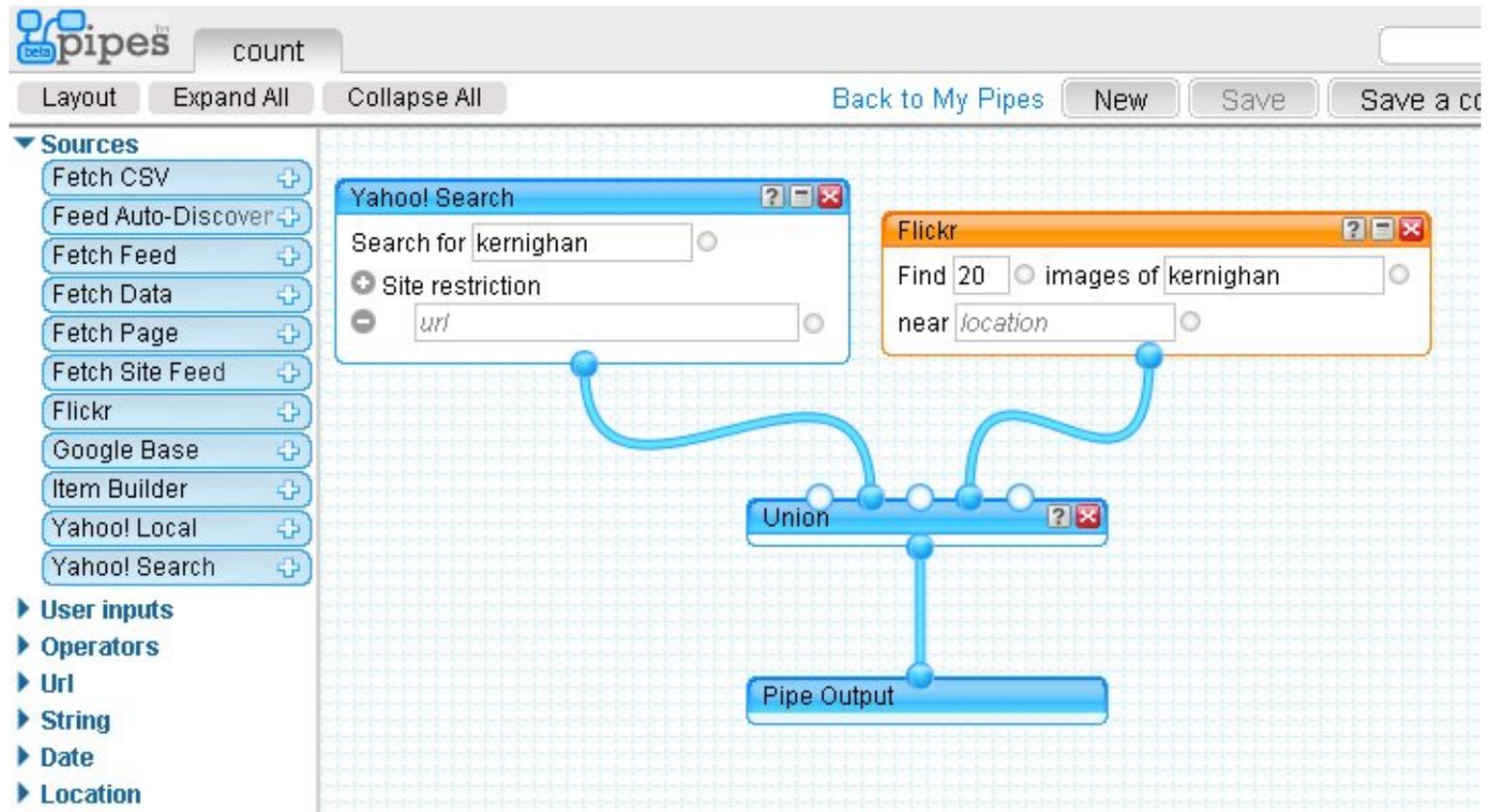
"We undoubtedly produce software by backward techniques. ... I would like to see components become a dignified branch of software engineering."

Doug McIlroy, *Mass Produced Software Components*, NATO Software Engineering Conference, 1968



Pipes then and now

- one of earliest component implementations
 who | grep Joe | wc
- Yahoo pipes:



Serendipity (?)

Kernighan and Ritchie

 ALL SIZES



Age 9 weeks

 Uploaded on [September 29, 2007](#)
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[anonymous42's photostream](#)



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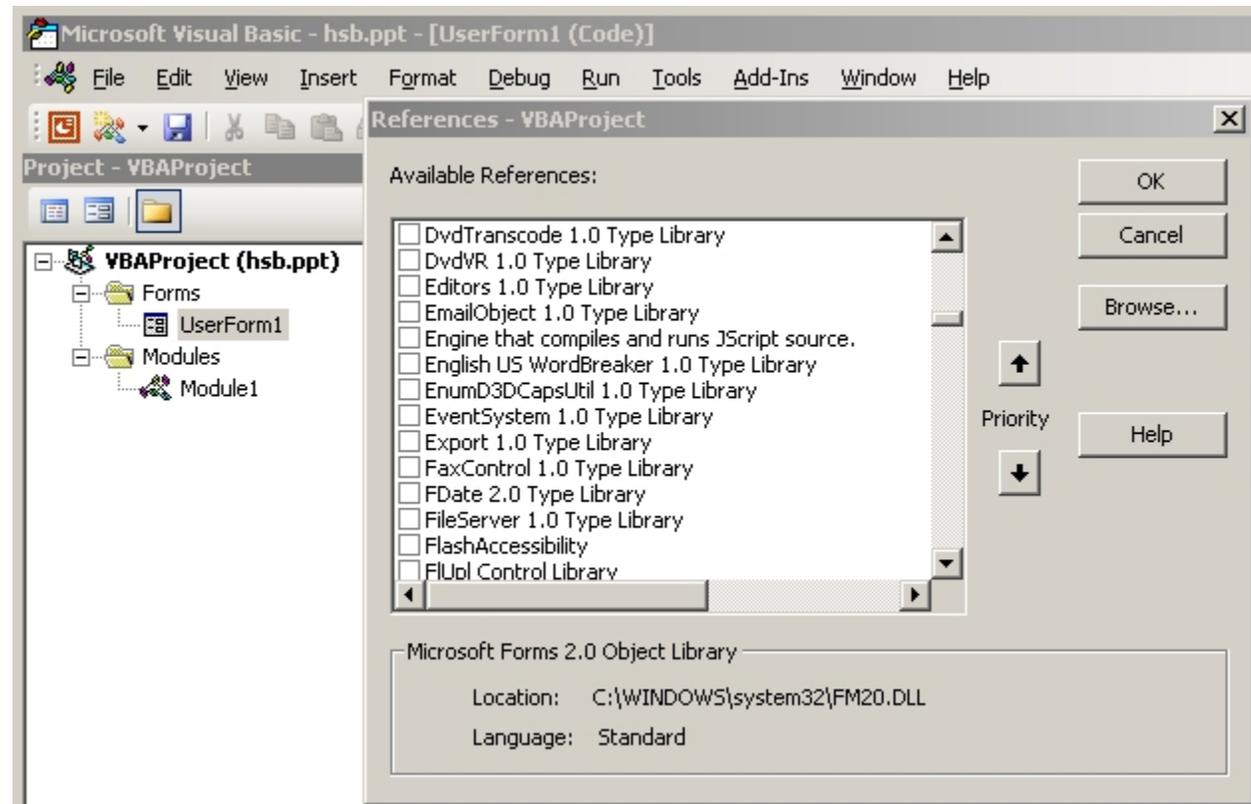
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- ◇ Taken on [September 29, 2007](#)
- ◇ Viewed **12** times

COM: the Component Object Model

- McIlroy's components: small libraries
- COM: objects on steroids
 - the most successful example of components in practice



Mashups: duct tape programming

- the web version of components?
- the browser as operating system?

The screenshot shows a website with a navigation bar at the top containing links for Home, News, Mashups, APIs, Markets, How-To, Contests, and Members. Below this is a secondary navigation bar with links for Overview, Mashup Directory, Most Popular Mashups, New Mashups by Date (highlighted), Mashup Matrix, and Mashup Tag Cloud. The main content area features a title 'Keep Up With Jones' with a navigation arrow and the text '3 of 2473 Mashups by Date'. Below the title are tabs for 'Summary' and 'Comments (0)'. The 'Overview' section is active, displaying a screenshot of a Facebook app interface. This interface shows a search bar, a sidebar with 'Applications' (Photos, Groups, Events, Marketplace), and a main content area for the app 'Keep up w/ the Jones'. The app's details include an address '123 Main Street, SomeCity, ST, 12345', pricing information with a 'Zestimate' of \$270,267.00 and a 'Value Range' of \$245,943.00 to \$297,294.00, and a 'Value Range' slider. Below the app screenshot are five stars and the text 'Click stars to vote'. To the right of the app screenshot is a 'Description' section stating: 'This Facebook app allows you to connect to Zillow from Facebook. View information about your house and see what your friends houses are worth.' Below the description are sections for 'APIs' (Facebook + Microsoft Virtual Earth + Zillow), 'Tags' (mapping, money, realstate, social, widgets), 'Mashup of the Day' (with a checkmark), 'Added' (02 Nov 2007), 'Who' (bbuffone [Profile]), and 'URL' (http://apps.facebook.com/keep ...). On the far right, there is a vertical sidebar with a 'Programmabl' logo, the text 'openkapow', and a slogan 'Connect. Collect. Mashup. Everything!' with a Facebook 'f' logo. At the bottom of the sidebar is a 'VOICE MASHUPS' logo with 'THOMAS HOWE' below it.

(programmableweb.com)

**"If I have seen further than others,
it is by standing upon the shoulders of
giants."**

Isaac Newton, 1642-1727



languages

tools

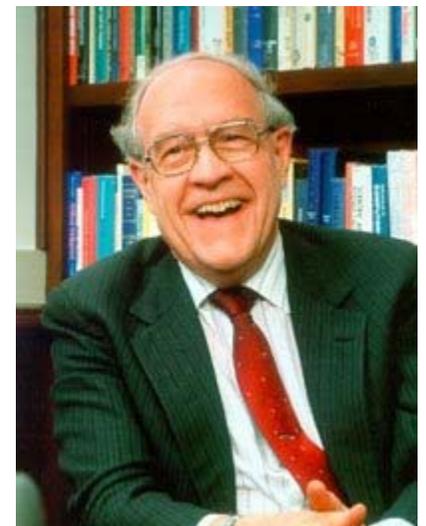
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methodologies

"There is no single development, in either technology or management technique, which by itself promises even one order-of-magnitude improvement within a decade in productivity, in reliability, in simplicity."

Fred Brooks, "No Silver Bullet", 1986



Snake Oil?

- **structured programming**
 - top-down development, successive refinement, chief programmer teams, egoless programming
 - structured everything: design, analysis, requirements, specification, walkthroughs..
- **object-oriented programming**
 - CRC cards (Class, Responsibilities, and Collaborators)
 - object-oriented everything: design, analysis, requirements, specification, walkthroughs...
- **components**
 - RAD (rapid application development), COTS (Components off the Shelf)
 - 4th generation languages, automatic programming, programming by example, graphical programming
- CASE tools (Computer Aided Software Engineering)
 - UML, message sequence charts, state diagrams
- formal methods
 - verification, validation, correctness proofs, model checking
- **design patterns**
 - patterns of everything
- extreme programming, refactoring, agile methods, ...
- aspect oriented programming

Conclusions

- languages
 - notation matters: scripting languages are here to stay
- tools
 - mechanization matters: let the machine do the work
- interfaces
 - interfaces matter: bad APIs are easy; good APIs are hard
- components
 - reuse matters: don't reinvent the wheel
- methodologies
 - knowledge and skill matter: there is no royal road to software

The Changing Face of Programming??

Plus ça change, plus c'est la même chose