

# How Java Powers Large Online Retail Sites

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# Agenda

- > Introduction
- > The state of e-commerce today
- > Major functions of an e-commerce system
- > What do we mean by “large scale”?
- > Challenges
- > Business requirements
- > Architecture
- > The marketplace
- > Trends and the future
- > War stories

# ATG

- > Founded in 1991
- > Early Java adopter
  - Dynamo Application Server (1996)
  - Session tracking, page compilation licensed to Sun (1997)
  - Hand in original JSP STL and EL reference app (2002)
- > More recently an e-commerce vendor

# Some ATG customers

## Selected ATG Commerce Customers



## Selected ATG Commerce Suite Customers



## Selected ATG Optimization Customers



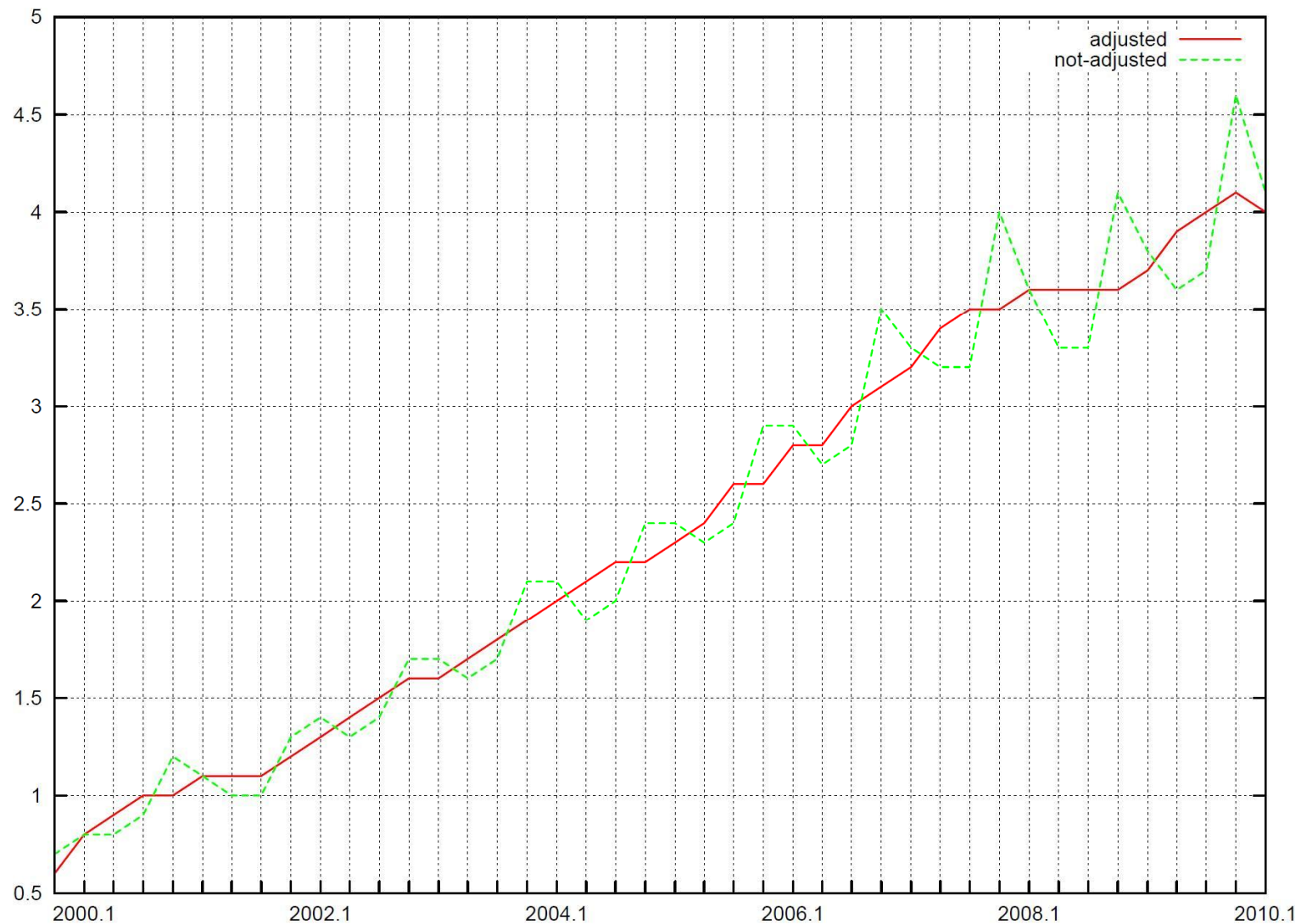
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# US Census: e-Commerce as % of total retail sales



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# A timeline: some interesting dates

- > 1979: Michael Aldrich invents online shopping (videotex with TV and phone line)
- > 1982: Online train reservations possible with France's Minitel
- > 1984: Jane Snowball, 72, first online home shopper (Gateshead SIS/TESCO)
- > 1987: Swreg: First merchant account system supporting online payments
- > 1990: Tim Berners-Lee's first web browser
- > 1991: Oak (later Java) language invented for Sun's Star7 (PDA)
- > 1994: Netscape introduced SSL encryption
- > 1995: Amazon and AuctionWeb (later ebay) launched; Gosling invents Servlet
- > 1996: JDK 1.0 software is released
- > 1997: Java Servlet API 1.0 released
- > 1998: PayPal invented; US Census Bureau begins tracking e-commerce
- > 2003: Amazon posts first yearly profit
- > 2008: Apple's iTunes passes Wal-Mart as #1 music retailer in US
- > 2009: China's Alipay passes PayPal as #1 third-party online payment platform

Sources: "Electronic commerce", *Wikipedia*, May 2010 "Servlet History", *Jim Driscoll*, 10 Dec 2005 "iTunes Store Top Music Retailer in the US", *Apple Press Release*, 3 Apr 2008

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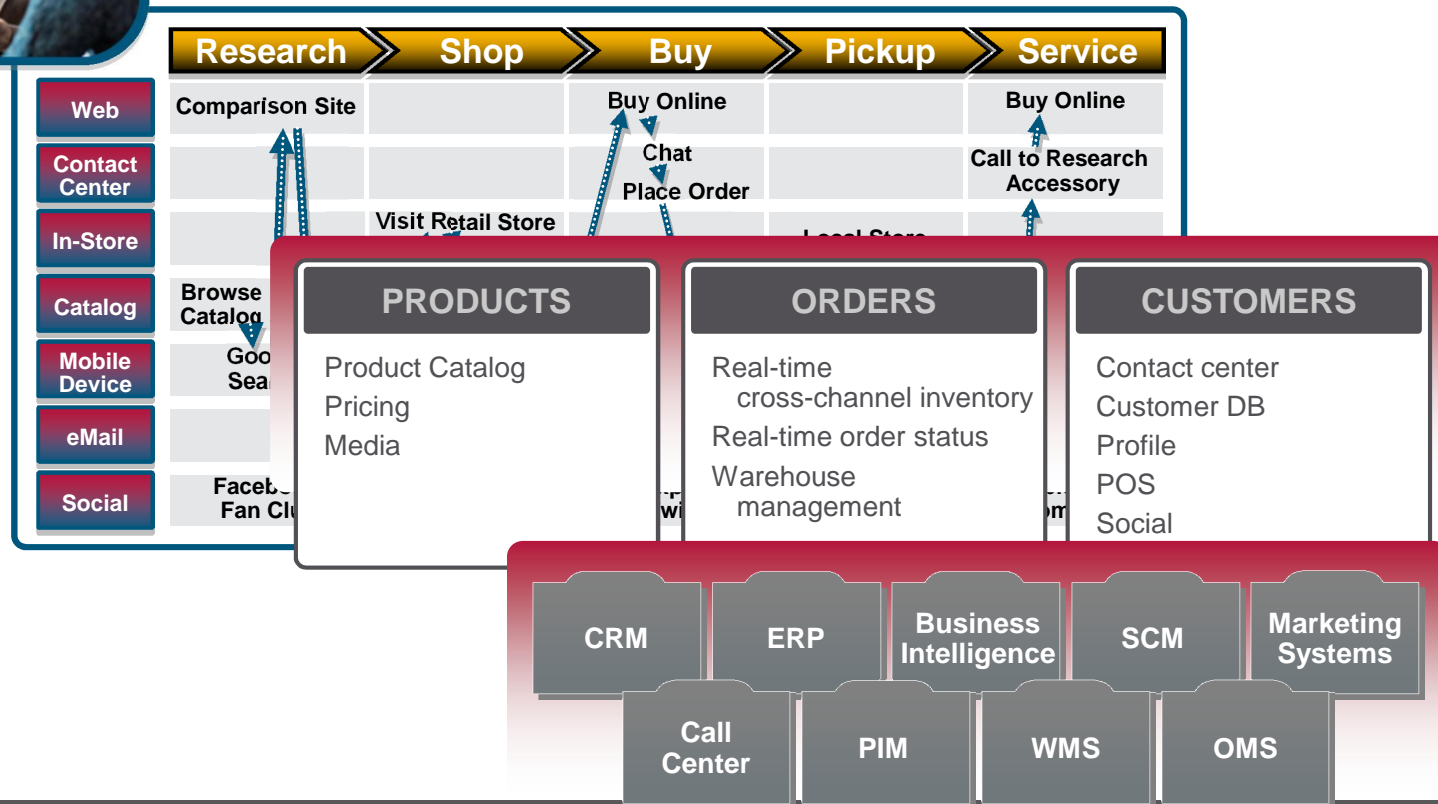
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# The evolving shopping journey

A single purchase cycle involves many interactions



# Elements required to support the journey



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# Major functions of an e-commerce system

- > Content management
- > Back-office integrations
  - Order management systems
  - Warehouse systems
  - Fulfillment systems
  - Pricing/Promotion systems
  - Combinations of these (ERP, CRM)
- > Marketing campaigns
- > Payment gateway and tax calculation
- > Customer service systems
- > Reporting and analytics
- > Service integrations
  - Ratings and reviews
  - Product Recommendations
  - “Click to call”

These systems are well-suited to Java implementation

# Examples of large scale retail: traffic

Large multinational retailer:

10M visitors 4Q09, planned for 1.5M visitors per hour

25K orders per hour

40 servers x 6 application instances per server

expected to lose 15% capacity to SEO, scaled up to 57 servers to balance mobile and kiosks run from same pile

actuals: 1.2M visitors per hour, 36K orders per hour

Thanksgiving-"Cyber Monday" accounted for 1/3 of total

287K orders, >12M visits (3:1 human:bot)

Holiday peaks are ~10x in general

# Examples of large scale: traffic

Large US retailer:

Registered Users – 16,000,000

Average Concurrent Users – 8,100

Peak Concurrent Users – 27,000

Average Page Views (Hour) – 1,100,000

Peak Page Views (Hour) – 3,600,000

Average Orders/Hour – 2,000 – 4,000 (Use 3,000)

Peak Orders/Hour – 12,300

# Examples of large scale: catalog

Sample catalog sizes:

Book retailer:

4 million products, 12 million SKUs, 18-20 million assets

Gen. merchandiser:

5-6 million products, plans to scale to 13.5 million (15M to 40M assets)

Direct merchandiser:

80k products, up to 50 SKUs per product, each SKU has 6 assets (usually translations) = close to 4 million products

Note: different organizations update different amounts and on different schedules, e.g., 30% of the products weekly, say, or all products every night

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# Key takeaway

- > “Large scale” takes on many different aspects
  - Size of catalog in number of products, SKUs, assets
  - Number of customers
  - Average order size
  - Frequency of product update
  - Volume of shopping traffic
  - Volume of transactions completed
  - Number of back-office integrations
  - etc., etc.

# Challenges

## > Business control

- Reduce business dependency on IT for simple changes
- Safe changes
- Quick changes
- Split testing
- Continuous results measurement
- Direct mgmt of business rules

## > Operations

- Monitoring and measurement
- Deployment

## > Speed, speed, speed

- Responsiveness, refresh, change
- Speed of interface, speed of change

## > UX

- Clean, usable, reduce clicks!

## > Development

- Thread-safety
- Tuning and optimization
- Developers should not be required for trivial changes

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# Operational challenges

- > Scalability/Reliability/High Availability
  - Session and database design are critical
  - Redundancy (component level, device types, app server, DB tier)
  - Scale up vs. scale out
  - Disaster recovery and resiliency (active/passive v. active/active)
  - Capacity for peak demand vs. cost vs. performance
  - Testing: functionality, load and performance
- > Integrations are critical
  - Sometimes the master for particular data types
  - Sometimes acts as proxy for other systems
  - What are business rules around availability?
  - Need to be “safe”, not bring the site down
  - Must decouple site performance from that of integrated system

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# Business requirements

## > Managing site content

- Content management (catalog and marketing content)
- Personalization (implicit, explicit, manual, automated)
- Measurement
- Marketing campaigns
- Ability to accept and use UGC

## > Managing the business

- Merchandising
- Split (A/B) and multivariate testing
- Multichannel (incl affiliate)
- Different styles of buying and selling (store, auction, bazaar, subscription)
- Search engine optimization

## > Operating the site

- Site administration, multiple sites
- Internationalization, localization
- Delegation of authority, roles
- PCI DSS/ISO 27001/2



# Architecture

- > Over-simplified history
  - Largely the history of dynamic, data-driven sites
  - Consider the timeline given earlier
  - Progression of tools favored for this  
CGI, Cold Fusion, ASP, Java, Perl, PHP, Ruby etc.
  - Today quite a mix of scripting languages, Java, and frameworks
- > Consider both application architecture and server architecture
- > In our case, a subset of Java standard features implements major infrastructure
  - Servlets, Java Beans, JTA, JMS, JDBC, various JAX elements
  - Our own dependency-injection system and dynamically-typed ORM layered on top
- > Presentation layer is independent, can be JSP, Struts, Flex/Flash, etc.

# Application architecture considerations

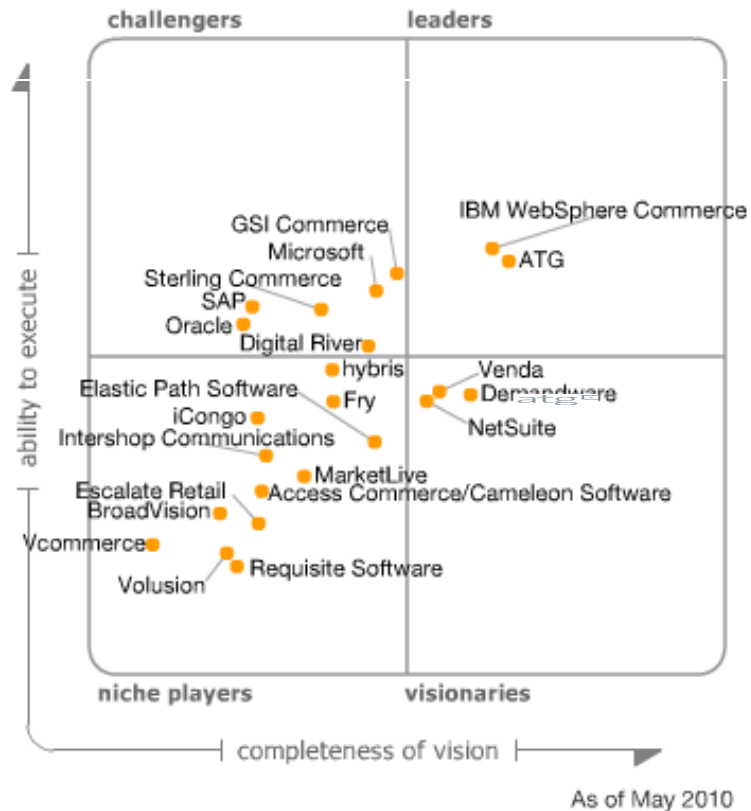
- > Must be master, or act as proxy for master, for many processes and entities
  - Catalog, prices, customer profiles, orders, etc.
- > Reusable components (both backend and site elements), services
  - Often will be used by other applications via web services
- > Presentation: reusable/re-targetable components, speed, device- and locale-specificity
- > Order processing pipeline
  - Write plug-ins for price, tax, shipping calculations, inventory checks, etc.
- > Clean data model for performance, management, and future growth

# Server architecture

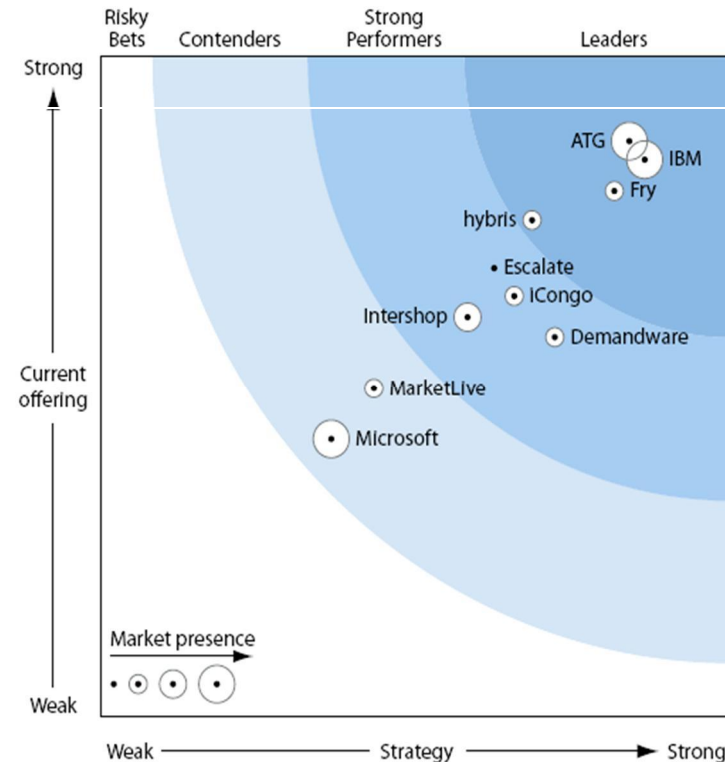
- > Cloud computing increasingly a factor
  - In services: analytics, recommendations, ratings and reviews, payment, etc.
  - Cloud hosting: scalability, disaster recovery (DR) benefits
  - Provider perspective: economy of scale through multitenancy
- > For a particular site, engineering analysis required
  - n-tier model with session-affinity vs. “shared-nothing”
  - Consider tradeoffs
    - Complexity v. scalability
    - Potentially massive, distributed relational database installation vs. NoSQL approach
- > Truly massive sites may require shared-nothing elements such as external caching and partitioning (e.g., sharding); this is determined by requirements
- > Content Distribution Networks (CDN) are heavily used to reduce server load

# Current industry: analyst view

## Gartner Magic Quadrant for e-Commerce



## Forrester Wave: B2C e-Commerce Platforms



Plus open source providers, such as Magento and osCommerce

# Trends and the future

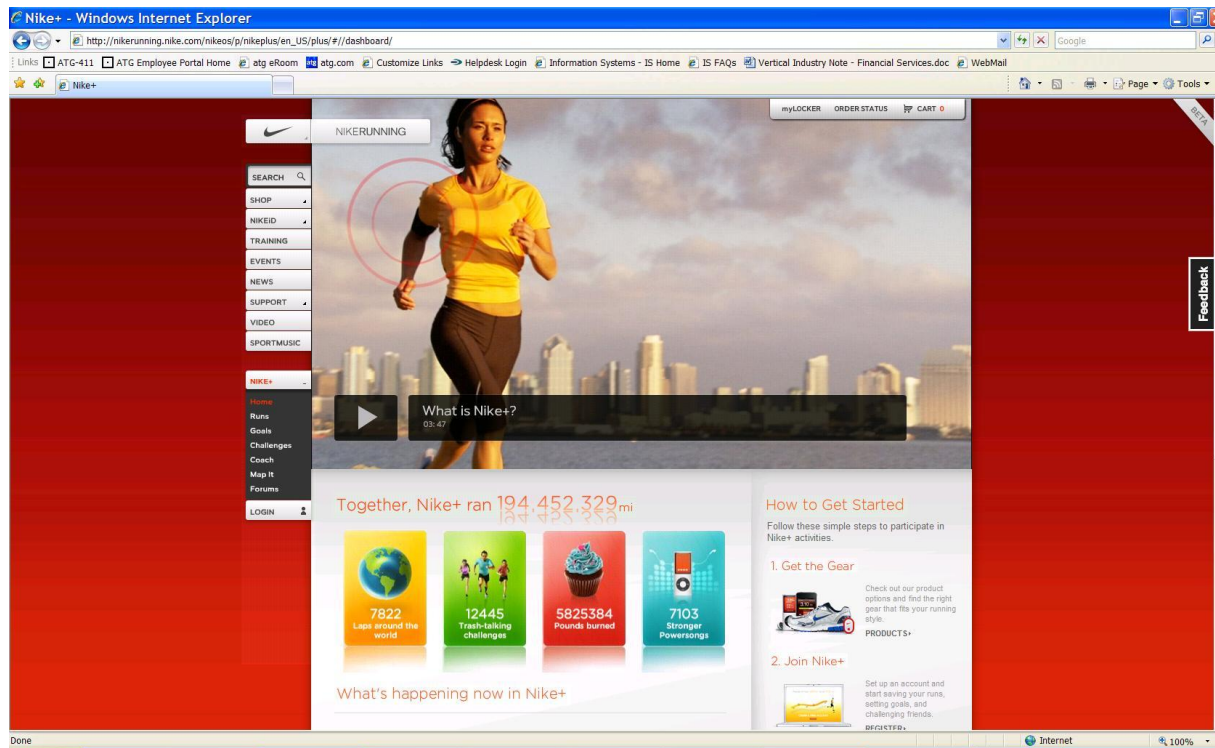
## > Business

- Mobile is growing rapidly, *is* e-commerce in developing countries, and changing business processes as well
- Social networking
- Convergence of these and other channels
- Growing use in the developing world
- Ease of use by the business user
- Spawning of many smaller sites rather than changing big one

## > Technology

- Virtualization/Cloud Computing
- NoSQL
- Scripting (PHP, Ruby, Groovy, Scala, Clojure, Erlang, etc.)
- Frameworks (Rails, Grails, Lift, etc.)
- Multi-core, more concurrency: STM?

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## Social and mobile convergence

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# Social example: Tor.com

Science-fiction and fantasy publisher, owned by Macmillan

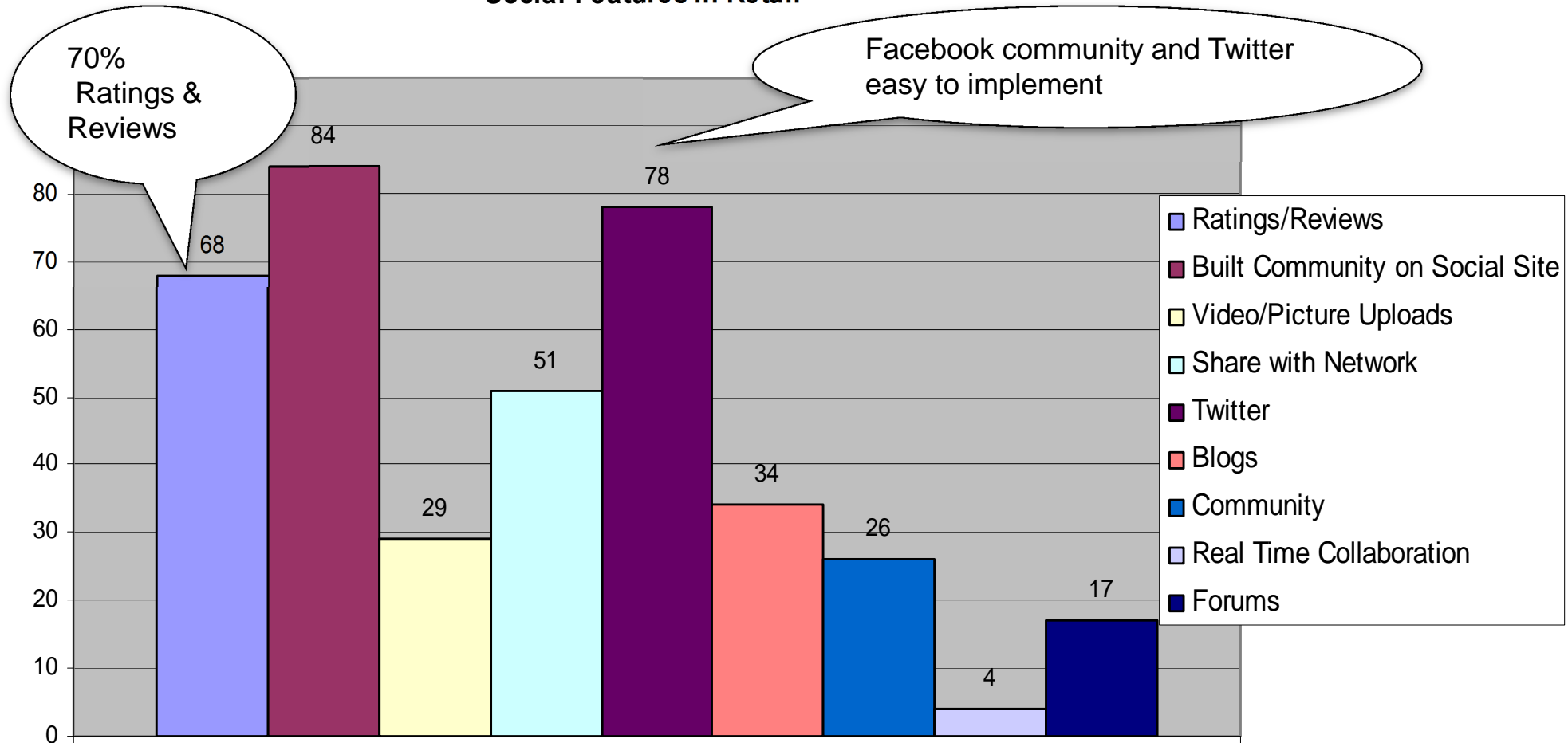
New site is pure social commerce

Content, Community, Commerce

- > Short stories, art, podcasts, reviews
- > Moderated forums (“conversations”)
- > All content tagged and accessible via a tag cloud
- > Specific entries promoted via “bookmarks”
- > Event calendar
- > Store for purchasing books and m’dise, as well as link to Main Macmillan store

# Retail

## Social Features in Retail



Retail

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# Best Buy Remix - Syndicates Product Content



## Sample Gallery



### Shelftalkers



"Shelftalkers" is a Facebook mashup that simply asks "What do you wanna talk about?" You can post comments about your favorite band, complete with full-length tracks. It's actually pretty cool to see your friend's shelves, and to be able to comment on them. It's also built on Google's App Engine, which means its both easy to develop against and scalable.

There's an article on how it was developed at <http://www.mashupcamp.com/wiki/index.php/FutureOfEcommerce>.



Consumer's Price is an application, developed by Ribbit, that brings voice to reviews of consumer electronics. They've also added a bevy of other features that make this site an interesting experiment in social shopping. From naming your price, to tweeting the item, to looking at Twitter conversations...to finding the closest Best Buy location with that item in stock, it's using a lot of the tools we all use to give a fresh perspective on shopping on the web.


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  - My Reservations
  - My Hotel Stays
  - My Cancellations
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HHonors Diamond VIP  
424,625 TOTAL POINTS

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Stays Completed: 17  
Nights Completed: 42  
Base Points: 145,542

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Dates	Hotel Name
18-Nov-2008 - 23-Nov-2008	Hilton London Pa

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The Waldorf=Astoria® <a href="#">Book Again</a>
Hilton London Metropole hotel <a href="#">Book Again</a>   <a href="#">Book Reward</a>

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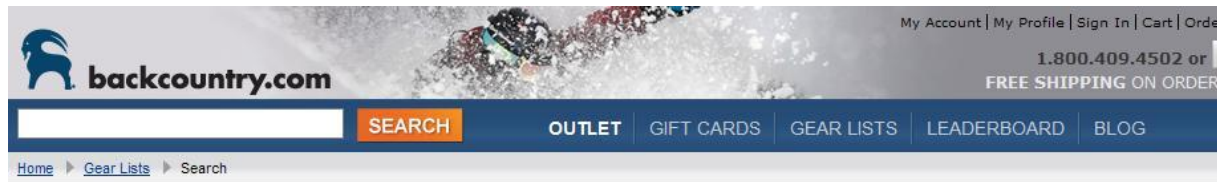
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You plan your life around using the gear you love, but how do you plan what you'll need and when? That's where Backcountry.com's Gear Lists step in. It's our way of help you create or find just the right checklist for any trip or activity. Heading out for a big expedition? Browse for what salty veterans packed along on similar adventures. Then create your own when you have some knowledge to share—just find and prioritize the items you'd hate to forget. Let us help you keep it all together, because "D'oh!" moments at altitude.

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cold (26)	alpine (23)	sno						
utah (17)	season (16)	a						
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### Appalachian Trail - Going Light!

By: [Greg Goodson](#) 

Helpful Votes: 5 Yes | 0 No

Tags: [shenandoah](#), [going](#), [backpacking](#), [light](#), [trail](#), [fastpacking](#)



### Backpacking Nepal, India, China, Tibet

By: [Niall MacRae](#) 

Helpful Votes: 4 Yes | 0 No

Tags: [travel](#)



A cool section where you can create or find the perfect checklist for any activity or trip. You can browse lists other veterans created and modify or make a gear list of your own and post it to the site.

They also have a Leaderboard section, which ranks the top "Gear Guru's" who contribute the most to the blog, reviews, and question and answers section.

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# Amazon's Listmania! Drives AOV

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Shop All Departments

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Your Lists

## Dream Home Theater

A Listmania! list by [Bryant](#) (Philadelphia, PA)

The list author says: "Have you ever thought up your own dream home theater? Are you looking for ideas? Look no further!"




1. [Samsung 50ES664 50-Inch 1080p Plasma HDTV](#) by Samsung

The list author says:  
"Instead of your theater, you need a huge TV and what better than a 1080p HDTV?"

Used & New from: **\$1,000.00**  
**★★★★☆** (112 reviews) | [Amazon Reviews](#)

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2. [Harman International HTS-10 5.1 Channel Speaker System](#) by Harman International

The list author says:  
"A surround sound system is a must when you want the full experience of movies and games!"

[Add to Cart](#) [Add to Wish List](#)  
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3. [OPPO DV-981HD Universal DVD Player with HDMI, 1080p Up-Conversion, DVD & SACD](#) by OPPO Digital

The list author says:  
"Here is a list of the DVD player. While the DVD format is going, many things will disappear DVD. With this DVD player, you can see your DVDs in HD!"

Used & New from: **\$200.00**  
**★★★★☆** (112 reviews) | [Amazon Reviews](#)

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4. [PlayStation 3 60GB Motormount Pack](#) by Sony

The list author says:  
"Game consoles are important in your home theater. Here is the best of them, the Sony PlayStation 3. It contains a console Blu-ray player for watching High-Definition movies!"

Used & New from: **\$274.00**  
**★★★★☆** (112 reviews) | [Amazon Reviews](#)

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5. [Xbox 360 Elite 120GB 1080p Version](#) by Microsoft


The list author says:  
"The best of all consoles is the Microsoft Xbox 360. With this listing, you can watch HD DVD movies and the best of all High-Definition movies!"

**\$200.00** Used & New from: **\$274.00**  
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### About the Listmania!

Author



[Bryant](#) (Philadelphia, PA)

Qualifies Member Profile

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List Stats

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### More Listmania!



[Xbox 360 Elite 120GB 1080p Version](#) by [Bryant](#)



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## Social and mobile convergence

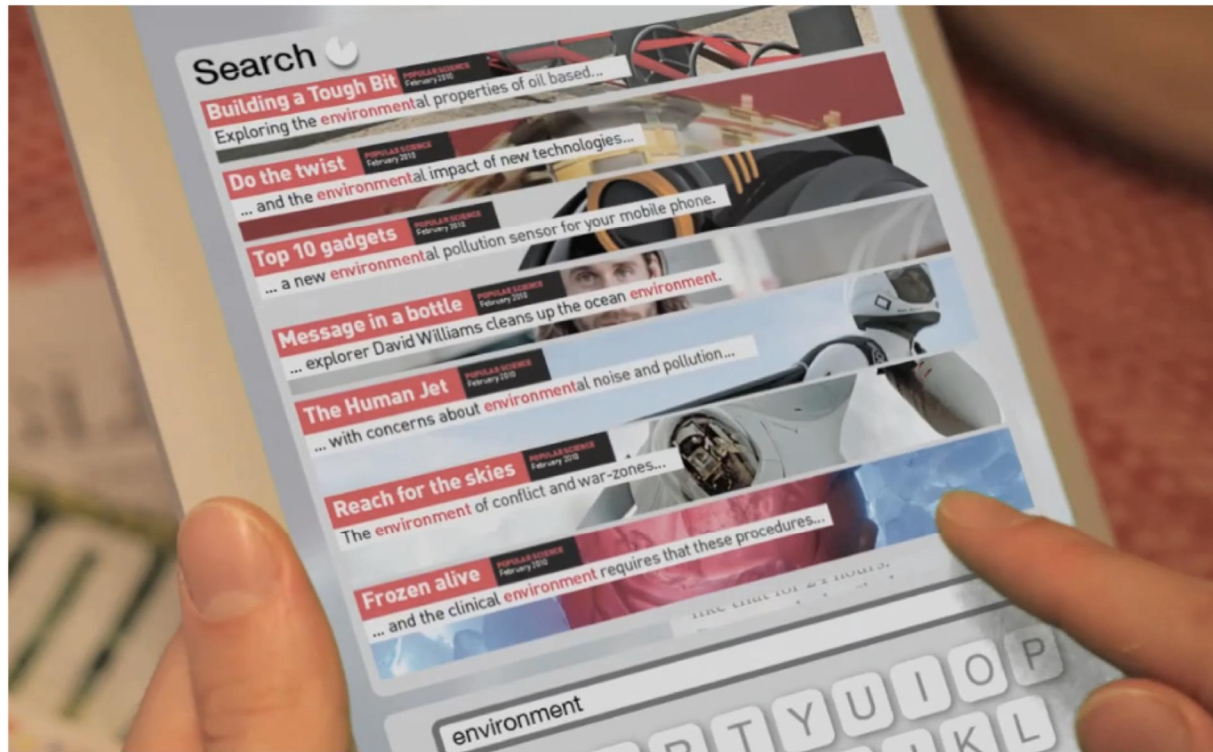
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## E-magazine

<http://bit.ly/8w6Anf>

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**Arc'teryx**

**Arc'teryx Covert Zip Neck Pullover - Women's:**  
Looks like wool, feels like fleece.

**\$72.99** 51% off  
reg. \$149.95

select color / size  
get another?

**Add to Cart**

quantity remaining: 23  
time remaining: 18:56  
people on page: 4,764

**Arc'teryx Covert Zip Neck Pullover - Women's**  
You'd like a clean, trim look in your pullover. A layer that feels soft, breathes, dries quickly, and has a distinctly wooly-looking face without actually being wool. Wow—welcome to the Arc'teryx Women's Covert Zip Neck Pullover. The Polartec Thermal Pro fabric uses a sweater knit for smooth style. Sleek design lines and a women's-specific fit cater to those who don't appreciate the boxy look. Gussets at the underarms are an added bonus—no more hem-lifting and mid-section exposure when you raise your arms.

Product Features Sizing Guide Past Product Reviews

**Material:** Polartec Thermal Pro sweater knit  
**Pockets:** 1 Sleeve  
**Hood:** No  
**Zipper:** ¼-Length  
**Recommended Use:** Casual wear in cold weather

Coriander, L (1 of 1 left)  
Green Tea, S (3 of 3 left)  
Green Tea, M (4 of 4 left)  
Green Tea, L (2 of 2 left)  
Raisin, S (2 of 3 left)  
Raisin, M (4 of 4 left)  
Raisin, L (3 of 3 left)  
Raisin, XL (0 of 2 left) **SOLD OUT**

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**Multichannel?**

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# Economist: “Internet shopping explodes in China”

- > Computers, internet cafes, smart phones are now ubiquitous
- > Local alternative payment technology established: **Alipay** (China’s PayPal)
- > Scooter delivery: <1 hour, 5 yuan (\$0.73) in major cities
- > Clothing and electronics led early
- > 66% online bought within last 6 months
- > 50% online with children bought diapers, formula
- > Average online discount 21%



From: “Clicks trump bricks”, *The Economist*, 22 Apr 2010

**B2B players:** Alibaba.com, HC360.com, Myekoo.com

**C2C players:** Taobao.com, Paipai.com, Eachnet.com

**B2C Online Retailers:** 360buy.com, Joyo.com, Dangdang.com

From: “Chinese E-Commerce Tops \$38.5 Billion; What Comes Next?”, *ReadWriteWeb*, 19 Apr 2010

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# War Stories

- > Unanticipated consequences of integrations
  - PS3 holiday promotion gone awry
- > Problems with automation:
  - Amazon: Searched for abortion, got “Did you mean *adoption*?”
  - MLK/Black History Month/Planet of the Apes fiasco
- > Effect of design choices
  - “Show all shoes”
- > Struggles with outsourcing and education
  - Outsourcer builds entire Shopping Cart, purchase pipeline when in product
  - Outsourcer builds mail sender, scheduler, SQL messaging when in product

# War stories (cont'd)

- > Perils of testing (or not testing, which is far more common)
  - Testing production site ended up allowing orders using CC test number
  - Testing production site resulted in case of whisky arriving at the test lab
  - Campaign testing: gibberish email sent to 200K people
  - Same coupon promo worked over and over again

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**ATG**

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**Jason Brazile**  
**Netcetera**

<http://netcetera.ch/>  
[jbrazile@netcetera.ch](mailto:jbrazile@netcetera.ch)