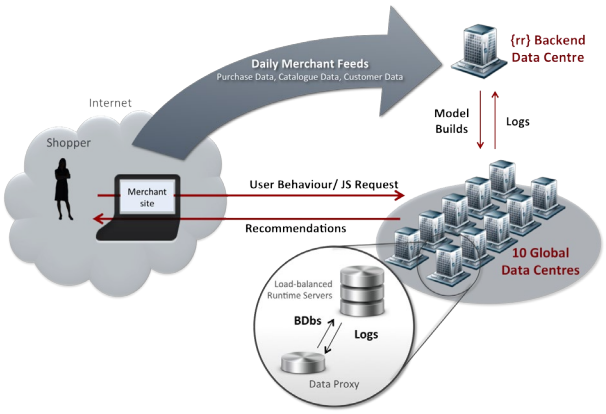
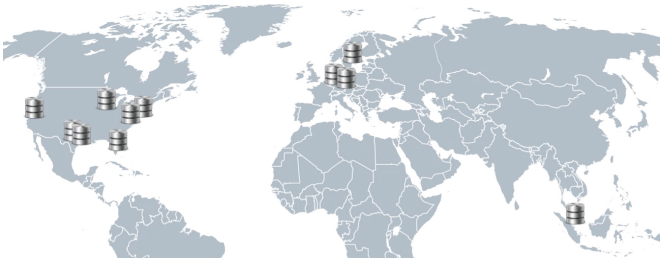
RichRelevance Infrastructure

METHODOLOGY AND APPROACH



{rr} is built on a fully redundant self-healing service. Each data center runs as a separate standing replicate of the others. All front-end data centers are geographically load balanced and failover to a secondary and tertiary data center or region.

Current data centers



Front-end data centers:

US

- San Francisco, CA
- Richardson, TX
- New York, NY
- Miami, FL
- Chicago, IL
- Ashburn, VA
- Seattle, WA
  (peaker data center)

EU and APAC

- Frankfurt, Germany
- Amsterdam, The Netherlands
- Stockholm, Sweden
- Singapore, Singapore

Back-end data centers:

- Dallas, TX

In the US, we serve on average 600-700 requests per second from each data center, or 3600-4200 requests per second nationwide. We top out on Black Friday weekend at nearly 11,100 RPS from our seven data centers. (We bring on an additional "peaker" data center in Seattle, WA to balance loads during peak holiday season.) That's over 5,184,000 requests per day, with an average response time of 70 ms or better.

FAILOVERS

Failovers occur first within their own region (e.g. VA to NY), then region by region per below:

- EU fails over to Eastern US (VA then NY)
- US/CA East fails over to US Central
- US/CA Central fails over to US East and/or US West depending on data center
- US/CA West fails over to US Central
- Asia/Japan fails over to US West then US Central
- Dallas Hadoop, Postgres, Portal, feeds and Model Builders are replicated in a secondary location in San Francisco and utilized continuously for QA and Development. Data is copied constantly between sites to maintain data integrity.
- DNS services via Dynect is a three-tiered solution. They utilize Anycast, Enterprise Bind and Consumer Bind to provide three separate and fully cross-functional DNS services. Losing one service does not render DNS unusable. The services fail over between each other, providing three distinct solutions worldwide. This also provides the geographic load balancing to each data center, such that a user in California is resolved to San Francisco or Plano, while a user in Boston is resolved to New York or Virginia.

RESPONSE TIMES

Globally, we pull a recommendation from our servers every few seconds to test response times. Worldwide, we average sub-75 ms per response across 29 nodes. On individual data centers using local responses (three cities within 100 miles of data center), we average sub-40 ms.

Data Summary

Test Name	Avg Response Time (sec)	Availability (%)
Amsterdam - Direct Recs Test	0.034	100.00
Chicago Central - Direct Recs Test	0.026	100.00
Chicago East - Direct Recs Test	0.029	100.00
Frankfurt - Direct Recs Test	0.044	100.00
Miami - Direct Recs Test	0.076	100.00
NewYork - Direct Recs Test	0.013	100.00
Richardson Central - Direct Recs Test	0.057	100.00
Richardson West - Direct Recs Test	0.064	100.00
RichRelevance - Recs	0.069	100.00
San Francisco - Direct Recs Test	0.046	100.00
Virginia - Direct Recs Test	0.020	100.00

PERFORMANCE SNAPSHOT

Every five minutes, RichRelevance processes:

- 79,683 shopping sessions
- 338,308 retail page views
- 17,677 clicks on recommendations
- 2,413 orders
- 385 orders with a recommended product (15.9% of orders)

Source: {rr} Analytics: January 1 – June 30, 2013.
Average performance per 5-minute period.

TESTING OF RESPONSE TIMES

We test every five minutes from each of the following nodes into the data centers and directly to "recs.richrelevance.com."

Therefore, one test is run every 11 seconds across the 29 cities below to verify response rate and availability. We pick cities not only for diversified locations but also for carrier (ISP), to best capture any anomalies that a region may have. In this manner, we can capture latency, bad content, timeouts, etc.

- CA: Los Angeles - Level3
- CA: Los Angeles - Verizon
- CA: San Diego - AT&T
- CA: San Jose - AT&T
- CA: San Jose - Verizon
- DC: Washington - Verizon
- FL: Miami - Internap
- GA: Atlanta - Internap
- GA: Atlanta - Verizon
- IL: Chicago - CenturyLink
- IL: Chicago - Level3
- MA: Boston - Verizon
- MO: Kansas City - Level3
- NY: New York - Sprint
- NY: New York - Verizon
- PA: Philadelphia - Level3
- TX: Dallas - AT&T
- TX: Houston - Internap
- VA: Reston - SAVVIS
- WA: Seattle - InterNap
- AUSTRIA: Vienna - Telekon Austria
- CANADA: Toronto - Bell Canada
- FRANCE: Paris - France Telecom
- FRANCE: Paris - Limelight
- GERMANY: Frankfurt - Deutsche Telekom
- NETHERLANDS: Amsterdam - Interoute
- SWEDEN: Stockholm - Telia
- UNITED KINGDOM: London - British Telecom
- UNITED KINGDOM: London - Level3

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