Semantic Technology for Online, Broadcast and Print Media

- Jem Rayfield: Head of Solution Architecture
- Financial Times: www.ft.com
Outline

BBC: Dynamic Semantic Publishing and the World Cup 2010

BBC: Sport 2012 + Olympics

Financial Times: Semantic Re-platform

Financial Times: Semantic Prototype

Financial Times: Behavioral Recommendations
World Cup 2010

1. 32 teams, 8 groups, 736 players ➔ 776 pages
2. Fixtures & Results, Groups & Teams pages
3. To many web pages for too few journalists
4. Improve the publishing system to help achieve all of this
Page Per Player

http://news.bbc.co.uk/sport/football/world_cup_2010/groups_and_teams/team/england/wayne_rooney
Italy

Italy 1-1 Paraguay
Monday, 14 June
Italy v New Zealand
Sunday, 20 June, 15:00
Slovakia v Italy
Thursday, 24 June, 15:00

Latest stories

Buffon confident after back pain
Gattuso to retire after World Cup round-up
Sunday's World Cup 2010 round-up
Tuesday's World Cup 2010 round-up
Lippi in post-World Cup exit hint

Latest audio and video

World Cup 2010
Highlights - Italy
De Rossi equalises

Features

World Cup 2010 performance analysis
All the facts and figures from the World Cup 2010 tournament
My World Cup - Noel Gallagher
Guide to the teams at South Africa 2010

Around the web

Italian FA site
Italy Fifa Profile
BBC Search+ country page
Italy Wikipedia profile
Group F

<table>
<thead>
<tr>
<th>TEAM</th>
<th>P</th>
<th>W</th>
<th>D</th>
<th>L</th>
<th>F</th>
<th>A</th>
<th>GD</th>
<th>PTS</th>
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<td>0</td>
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<td>0</td>
<td>1</td>
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<td>0</td>
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<td>New Zealand</td>
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<td>0</td>
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<tr>
<td>Slovakia</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Latest stories

- Buffon confident after back pain
- Paraguay boss delighted with draw
- Gattuso to retire after World Cup
- Skrtel hopeful for opening game
- Rossi left out of Italy Cup squad
- Skrtel makes final Slovakia squad
- Italy's Pirlo to miss two matches
- Sunday's World Cup 2010 round-up
- Tuesday's World Cup 2010 round-up
- Cameroon secure Slovakia draw

Latest audio and video

- World Cup 2010 extended highlights - Italy 1-1 Paraguay
- Highlights - Italy 1-1 Paraguay
- De Rossi equalises for Italy
- Scotch whisky cvn - Scotch whisky cvn

Matches

- **Italia 1-1 Paraguay**
  - Match report
  - Monday, 14 June
  
- **New Zealand - Slovakia**
  - Today 12:30

- **Slovakia v Paraguay**
  - Preview
  - Sunday, 20 June, 12:30

- **Italy v New Zealand**
  - Preview
  - Sunday, 20 June, 15:00

- **Paraguay v New Zealand**
  - Preview
  - Thursday, 24 June, 15:00

- **Slovakia v Italy**
  - Preview
  - Thursday, 24 June, 15:00

Features

- World Cup 2010 performance analysis
  - All the facts and figures from the World Cup 2010 tournament

- Slovakia performance analysis
- Paraguay performance analysis
- New Zealand performance analysis
- My World Cup - Noel Gallagher
- Guide to the teams at South Africa 2010
Semantic publishing

<table>
<thead>
<tr>
<th>Tournament Table</th>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Games played</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Shots on target</td>
<td>1</td>
<td>9</td>
</tr>
<tr>
<td>Men's Penalty</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Total England</td>
<td>8</td>
<td>3</td>
</tr>
</tbody>
</table>

TRIPLE STORE

ONTOWLOGY

USER EXPERIENCE
Open Sport Ontology

BBC Sport: http://www.bbc.co.uk/ontologies/sport
Extendable Domain Driven Asset Tagging
Open Ontology/Dataset reuse
Event | Geonames | Foaf | Etc.
Infer... player->team->competition
Graffiti: Suggest -> Tag [Player]

Green and Barry on road to recovery
Posted Mon 14 Jun 2010, 1:32 PM by Phil McNulty in Phil McNulty
World Cup 2010: Rustenburg Robert Green's work was not being done under the icy gaze of an expectant nation - but he was literally the focus of attention as England got back to World Cup business at their Rustenberg base....

Tag story > Select main topics
Select the topics that this story is primarily focused on. Topics could be anything from a person or organization to a broad subject such as 'women in the workplace'.

Suggested topics
- England
- United States
- Algeria
- Robert Green
- Gareth Barry
- Joe Hart

This story is mostly about:
- England
- Robert Green
- Gareth Barry

Gareth Barry

Personal information
Full name: Gareth Barry
Date of birth: 29 January 1981 (age 29)
Place of birth: Hastings, England
Height: 1.83 m (6 ft 0 in)
Playing position: Midfielder

Club information
Current club: Manchester City
Man killed as four lorries crash

A man dies in a crash between four lorries, leading to the closure of the M1 and 12-mile tailbacks.
World Cup DSP Architecture

Content Creation Network
- CPS UI (WPF)
- CPS API (WPF)
- Oracle RDBMS
- CPS PUBLISHER (JAVA)

Metadata
- Graffiti UI (silverlight)

Extract Asset Metadata

DELIVERY CHAIN (C++)

Sports Stats
- metadata [rdf]

REST API [java]
- metadata [rdf]

Ontology Aware NLP

BigOWLIM Triple Store Cluster

Dynamic RDF Driven Aggregations [PHP]

Archives
- Apache HTTPd

Get archive content

Get Dynamic Aggregation [mod:includeless]

Audience Facing Network

Audience

Browser

Phone

ITV

CDN
API Stack
Highly Scalable Clustered BigOWLIM
Rationale

• Automated content publishing
• Huge increase in content breadth (number of manageable pages)
• Content re-use and re-purposing, increasing reach
• Simplified content management
• Journalist headcount reduction
• Multi-dimensional entry points and semantic navigation
• Improved user experience with high levels of user engagement
• Dynamic, state (time|event) and semantic driven page layout
• Personalized content aggregations
• Open data and API’s
World Cup statistics the GOOD

• 750+ Dynamic aggregations/pages (Player, Squad, Group, etc.)

• Average unique page requests a day : 2 million +

• Average OWLIM SPARQL queries a day : 1 million

• 100s RDF statement updates/inserts per minute with full OWL reasoning and associated inference.

• Multi data center fully resilient, clustered 6 node triple store

• RDF graph model ideally suited to model domain representations such as sport
World Cup statistics the BAD

• Sports stories and indices static
• Sport content not responsive or personalized
• RDF Store unable to handle thousands of statistic updates a second
• RDF Store forward-chained closures expensive increase write latency
• RDF graph model and SPARQL not ideally suited to the BBC’s News and Sport document publication model
Sport Refresh 2012

- Page per Athlete [10,000+], Page per country [200+], Page per Discipline [400-500], Page per venue, Page per team
  ➔ A lot of output…

- Almost real time statistics and live event pages

- Time coded, metadata annotated, on demand video, 58,000 hours of content

- Far too many web pages for far too few journalists

- DSP annotation architecture to automate content aggregation
Lots of Dynamic (Live) sports stats
Future Media

London 2012

Spectacular close to London 2012 Games
The curtain closes on the London Olympics with a spectacular musical ceremony and the official handover to Rio de Janeiro.

Best moments of the Olympic Games
BBC Sport's pundits and commentators talk about their highlights of the London 2012 Olympic Games.

20 memories of the London 2012 Olympics
BBC Sport looks back at 20 of the most memorable moments of London 2012 - including Bolt, Ennis & Farah.

Great Britain Golds in Video

Headlines
'Greatest ever' GB finish third
Broadcasting revolution of the digital Olympics
TECHNOLOGY
Record visits to BBC Sport online
MODERN PENTATHLON
Munoz wins Britain's 65th & final medal
AFRICA
The effect of Mo Farah's success
Who will be in Britain's class of 2016?
How can Rio follow London?
SAILING
Anchise wins fifth Olympic gold medal
ATHLETICS
Holmes wins female recognition
School-clubs link 'key to legacy'
UK
Home towns welcome GB heroes home
Cuts expected to some GB sports
Lighthouse named after

 Medal Table

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Gold</th>
<th>Silver</th>
<th>Bronze</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>United States</td>
<td>27</td>
<td>9</td>
<td>2</td>
<td>38</td>
</tr>
<tr>
<td>2</td>
<td>China</td>
<td>29</td>
<td>6</td>
<td>10</td>
<td>45</td>
</tr>
<tr>
<td>3</td>
<td>Great Britain &amp; N. Ireland</td>
<td>20</td>
<td>17</td>
<td>19</td>
<td>56</td>
</tr>
</tbody>
</table>

Relive every Olympics moment

Click up on every session of every event from the London 2012 Olympics in our video player.

Olympics: Key Info

London 2012 Results

Full medal table
Team GB medals roll of honour
In numbers: the 2012 Games
London 2012 FAQs on accessed
Video delivery

Video Content Route & Workflow

- **Venue & Unilateral feeds (50+)**
  - HD Video to **Stratford IBC**

- **Stratford IBC**
  - HD Video to **TVC**
  - 24 HD Circuits to **Salford Building C**

- **TVC**
  - Host & BBC video switched BBC Commentary added
  - 24 HD Circuits

- **Salford Building C**
  - On Demand encoded files
  - Red Button TX
  - Up to 24 IP live streams

- **CDN**

*Note: Cont. routes not shown*
Augment architecture with a Content Store

1. Atomic content assets stored in MarkLogic XML store

2. XML content queryable via Xquery

3. Content Assets searchable

4. Sports statistics searchable/queryable via XQuery

5. Ontological SPARQL via BigOWLIM, assets Xquery via MarkLogic
API Stack

MarkLogic

OWLIM Enterprise
Ontology Aware NLP

- Information Workbench
- OWLIM
- (Spice) GATE+Ontotext
Ex-England boss Sven-Goran Eriksson says a "smear campaign" has been aimed at Roy Hodgson for omitting Rio Ferdinand.

- Eriksson (78%)
- Roy Hodgson (69%)
- Rio Ferdinand (58%)
- ...

Generic Analysis

Disambiguation

Relevance Ranking

KB Gazetteer

OWLIM

CES APP

Update

Retrain & Adapt

Curate

Roy Hodgson: coach
Roy Hodgson: hockey player
Entity Relevance: Objective

- Rank entities by their relatedness to the article
- Accuracy 75%
- We consider various frequencies of entity mentions in the article and in the entire set of articles
- Positions in the article fields or in the first paragraphs of the body boost the relevance
Confidence and Relevance

The relevance of an entity in arbitrary document may depend on:

Text context and the vicinity of an entity/concept within the text. (Confidence)

Ontological graph context and the vicinity of an entity/concept within the graphs knowledge model

The frequencies of entities in the corpus and document. (Relevance)
Disambiguation of Locations

- Geospatial distance - a feature of OWLIM (geosparql)

- Super region – GeoNames hierarchy and containment relations, e.g. parentFeature

- RDF Rank – Similar to Page Rank but RDF links

- Human approval score (on the basis of curated documents)
Plenty of Caching
Sport Stats REST API

REST Endpoint for all Sports Stats on BBC

- /football/teamstats/team/{team}
  - /clubstats
- /football/table
  - /ais/competition/{comp}
  - /competition/{comp}
  - /positions/competition/{comp}/team/{team}
  - /snapshot/competition/{comp}
  - /structure/{structureid}/group/{groupid}
- /football/matches
  - /structure/{structureid}/group/{groupid}
- /football/match
  - /{matchid}
- /football/recentresults
  - /match/{matchid}
- /football/videoprinter
- /football/config
  - /competition/structure/{structureid}
  - /competition/structure/{structureid}/groups
  - /competition/{competitionId}/structure/{structureid}/groups
- /football/stats
  - /competition/{comp}
  - /competition/{comp}/team/{team}
- /cricket/scorecard
  - /{matchid}
- /cricket/matches
- /cricket/table
  - /competition/{comp}
  - /positions/competition/{comp}/team/{team}
- /cricket/stats
Olympic numbers

Unique Browser Requests per day
Peaked at just over 8 million UK and
11 million Globally.

Cumulative Unique browsers
online total 34.6 million
On the busiest day, the BBC delivered 2.8 petabytes, with the peak traffic moment occurring when Bradley Wiggins won Gold and we shifted 700 Gb/s.

106 million requests for BBC Olympic video content across all online platforms.

Number of people watching individual Streams →
…some background about the Financial Times
World business.
In one place.
We live in FINANCIAL TIMES
The FT Audience: The world’s most wealthy and powerful people
Who does the man everyone listens to, listen to?
'I read the Financial Times before other people. Now everybody carries around a Financial Times.'
Barack Obama

We live in FINANCIAL TIMES®
Global network of over 500 journalists

“The old “page editor” is dead; long live today’s content editor”
The FT product portfolio
FT has been successfully charging for online content since 2002

- Subscriptions were launched in 2002
- The model was flexible and business rules were determined by various departments
- Customer experience wasn’t great!
  (Customer data wasn’t been captured or used intelligently)
Digital subscriptions continue to grow

- **2002**: FT.com subscriptions first introduced
- **2007**: FT.com metered model is launched
- **2012**: Digital subs overtake print circulation
- **2013**: FT has 443k paying digital subscribers

2 million people worldwide read the FT in print or online

600,000+ Combined Print & Digital Circulation

443,000 Digital Subscribers

14% in past year

51%+ Revenue expected to be generated through content sales/subscriptions by end of 2013
Digital is our future

100k more digital subs than print

- Print circ
- Digital subs
The FT is where our readers wish to consume it
Meteoric rise of mobile

- Over 50% of subscriber consumption
- Third of FT.com traffic
- Driving 24% of new digital subs
- Mobile advertising up 26% yoy
First major publisher to launch an HTML5 web app

• Supporting offline content consumption
Existing Very complex Publishing Architecture.

Just to publish a content object. No search no metadata?
Top story is about Samsung?

FT.com/search

So far, Apple Inc.

AAPL:NSQ
Apple Inc 498.69 10.11 / +2.07% 1 year change -26.12%

As of Sep 04 2013 21:00 BST. Data delayed by at least 15 minutes.

9 hours ago
Only time will tell for Samsung smartwatch
...already launched a smartwatch, albeit to mixed reviews, and Apple, Google and LG are all working on devices of their own...for smartwatches that touchscreen were for smartphones. Both Apple and Samsung have already filed patents for putative devices with...

FT ALPHAVILLE 6 hours ago
The Closer
...launch: “Samsung Electronics has become the first global mobile computing company to launch a smartwatch, leaping ahead of rivals Apple, Google and Microsoft in the "wearable technology" market.” (Financial Times) FT Alphaville

13 hours ago
Apple event raises hopes of China Mobile deal
Apple plans to hold near-simultaneous product...latest iPhone is expected to make its debut at Apple’s Cupertino headquarters. The event follows a barrage of media reports for Apple in China earlier this year after it was announced...
Taxonomy Based Tagging & Event Based Story editing
Moving towards: Semantic Publishing Platform

Provide a Universal Publishing "UP" platform where all FT content is universally accessible across all of its channels:

RDF Store; semantically understand, interlink and store all FT content within a single pan FT Content Store

APIs; content, metadata and the links between will be exposed and made publicly available via APIs

Publishing tools; provide tooling which allows journalists, users, readers and contributors to publish to the Content Store via APIs.

Metadata and Semantics; author content directly in addition publish data about the content - semantic metadata. Provide intelligent query and search capabilities empowering the next generation of FT products
Annotation ontology - Semantic fingerprint
News Business ontology
Collaboration: (FT, BBC, Reuters, Bloomberg, EuroMoney)
Future: Storyline ontology

Associate Creative Works to storylines using an appropriate tagging / annotation model

Assign provenance to a storyline to indicate the owner of the interpretation

Convenience properties for 'slug' information, summaries or editorial notes

Slots contain real world events or other storylines (chapters, subplots, news developments etc)

This property could be specialised to capture more specific ordering between slots such as causality

StorylineSlots can be unordered, fully ordered, arranged as a graph, or ordered by time

Relationships between Storylines expressed through property specialisation. Editorial convention dictating the most suitable subProperty.
JSON+LD For all public (secure) endpoints (Demo)
Peter Mutharika wins Malawi presidential elections

President Banda tried to nullify an election citing ‘rampant irregularities’ but was overruled by the high court and the counting and recounting of votes went on for days.

Radoslaw Sikorski in the hot seat.

Poland’s foreign minister is helping drive a hardline stance on the Ukraine crisis, propelling himself and his country into the first rank of European diplomacy.

It is time for the ECB to act, but more talk is needed too

A further bout of disinflationary pressures could force more troubled member states into a prolonged bout of Japanese-style deflation.

World diary: June 2 – June 8

Nato defence ministers meet; war-torn Syria elects a new president; a G7 summit is held without Russia; Lithuania’s progress on eurozone membership is outlined; Ukip’s showing at Newark’s byelection will be closely watched.

Companies diary: June 2 – June 8

Diary commentary from FT reporters; data and company announcements, unless otherwise stated, from Thomson Reuters. Company announcements are of information publicly available before last week.

Manchester airport’s 21m passengers a year is busiest since 2008

Numbers are rising by 5.5 per cent year on year, compared with 3 per cent for the UK as a whole, according to Civil Aviation Authority data.
Banks test market appetite for Greece

For the chief executive of Greece’s biggest bank by assets, the nadir of the eurozone crisis arrived in autumn 2012 when a deteriorating balance sheet required an emergency fund raising. An investor conference was announced in London. No one came.

"The only people who would see me were the hedge fund guys," says Anthimos Thomopoulos, Piraeus Bank’s chief executive. "[Anyone else] wouldn’t touch Greece."
Credit Suisse hearing attacks Swiss secrecy
Facebook buys WhatsApp in $19bn deal

Facebook is buying WhatsApp in a cash-and-stock deal worth up to $19bn, as the world’s leading social network enters the fast-growing chat app market that is popular among younger generations and emerging markets.

The Menlo Park-based social network is acquiring an app which boasts more than 450m users who use it to message without paying high fees. Users of the app send almost as many messages as the number of text messages sent over the entire global telecoms network.

The purchase – far larger than Facebook’s next largest deal of $1bn – is designed to achieve Facebook’s two main aims: to maintain its dominance in social networking as users move to mobile devices, and to grow its already massive userbase in less penetrated areas of the world.

WhatsApp is a leading player in the chat app world which has grown rapidly in the last couple of years. It is more dominant in countries outside the US, particularly in emerging markets.

The deal – which is 25 per cent in cash and the rest in stock – will see the app maintained as a
Primary Objective

Serve **relevant** articles to increase user **engagement** and improve **usability**
Recommendations

Subject, Object and Action

Subject: **User**

Object: **Article**, Media Asset, Data, ...

Action: **Read**, Preview, Comment, ...
Barclays hit with £26m fine over gold fix

UK financial regulator has fined Barclays over poor controls that allowed trader to move the price of gold to avoid paying out on a client’s order.

Contextual Similarity

Similars Articles

Feb 16, 2014
Forex in the spotlight
Banks are braced for a potential barrage of multibillion-dollar fines and litigation from the probe into alleged collusion in the foreign exchange market.

Oct 31, 2013
Forex probes raise fears of a repeat of Libor scandal
Barclays becomes latest bank to launch probe into its foreign exchange trading, adding to a growing worries over an industry-wide investigation.

Nov 18, 2013
UK probes private accounts of foreign exchange traders
FCA is probing the use of private accounts by foreign exchange traders amid allegations they traded their own money.
Behavioural Recommendations

User Profile

Behavioural Similarity

Similar Articles

Feb 16, 2014
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Nov 18, 2013
UK probes private accounts of foreign exchange traders
FCA is probing the use of private accounts by foreign exchange traders amid allegations they traded their own money
Combined Contextual + Behavioural Recommendations

User Profile

Behavioural and Contextual Similarity

Reads

Similar Articles

Feb 16, 2014
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Barclays hit with £26m fine over gold fix

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User Actions: A wider behavioural perspective
“Content” Based Recommendations

- Results will be based on the similarity of content items. Similarity will be defined by the terms/entities within the content (content fingerprint).

- Results will be based on the past choices of an individual user (a user's profile). (Users content fingerprint)
Content based ranking

Two-fold scoring approach

1. Similarity to recently viewed articles (*context*)

2. Relevance to a long-term user profile,
   - Weights reflecting the **relative importance** of the **individual terms** (*static component*)
   - **Transition likelihoods** among any pair of terms (*dynamic component*)
Collaborative Ranking

- Results based on statistics that reflect the past choices of all users

- Results based on user ratings, and the similarity of users or items

- Content-agnostic

- Aware of the quality of content
Collaborative Ranking Mechanisms

- User to Content Similarity Score
- User to User Similarity Score
- Content to Content Similarity Score
API : Recommend for :
http://www.ft.com/cms/s/0/398e6d5e-e858-11e3-9cb3-00144feabdc0.html

GET http://ft-recommendations.ft.com/api/behavioural/getsmartcontent?
userid=6753665&contentid=398e6d5e-e858-11e3-9cb3-00144feabdc0

{
    "SmartAPI": "Recommendations API v1.8",
    "type": "behavioural",
    "status": "ok",
    "method": "getsmartcontent",
    "response": {
        "result": [
            {
                "headline": "Apple seeks to work Jobs magic on the internet of things",
                "feedid": 21,
                "feed": "FT Mobile Content API",
                "rel": 1.331479549407959,
                "date": "Thu May 29 18:33:04 UTC 2014",
                "cid": "3c6e330a-e74b-11e3-8b4e-00144feabdc0",
                "url": "http://www.ft.com/cms/s/0/3c6e330a-e74b-11e3-8b4e-00144feabdc0.html",
                "popularity": 2452
            }
        ]
    }
}
Architecture

Read Article

1. get related

click stream

2. ask

3. on cache miss

4. query

update user

update popularity

store user profiles

Replication Group I

SOLR 1
SOLR 2
SOLR 3

CS Node 1
CS Node 2
CS Node 3

AWS Elastic LB

OWLIM Worker

Varnish Cache

Fetch & Annotation

Recommendation API

AWS INSTANCE

AWS INSTANCE

AWS INSTANCE

AWS INSTANCE
Main Actions

1. **Pull** content – annotate/enrich – index

2. **Accumulate**/update user profile

3. **Recommend**
Main Actions

Profile Update Request (User ID, Item ID) → Profile Update
User:
- context
- static component
- dynamic component

Profile Storage (Cassandra)

Recommendation Request (User ID) → Query Generation
Article:
- co-visitation matrix
- popularity

Query Generation → Items Index (Solr)
Boosted sub-queries for all involved ranking schemes:
content-based, collaborative, popularity, recency
Thank you. Questions?

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