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Internet Technologies AG

a spin-off of

Novel Interactive Music Search Techniques

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- **Automatically Computed Content-based music similarities often do not represent the perception of human listeners (semantic gap)**
- **Well-known Web 2.0 services rely on user tagging to categorize music (e.g. Last.fm, iLike)**
  - ***Complex statistical analysis on the tags is needed***
  - ***Drawback: New content cannot be easily recommended because of missing attributions (cold start problem)***
- **Both approaches can benefit from each other**
- **Idea: Enhance the quality of music search and recommendation by combining these approaches and semantically analyzing textual descriptions on music in the Web**

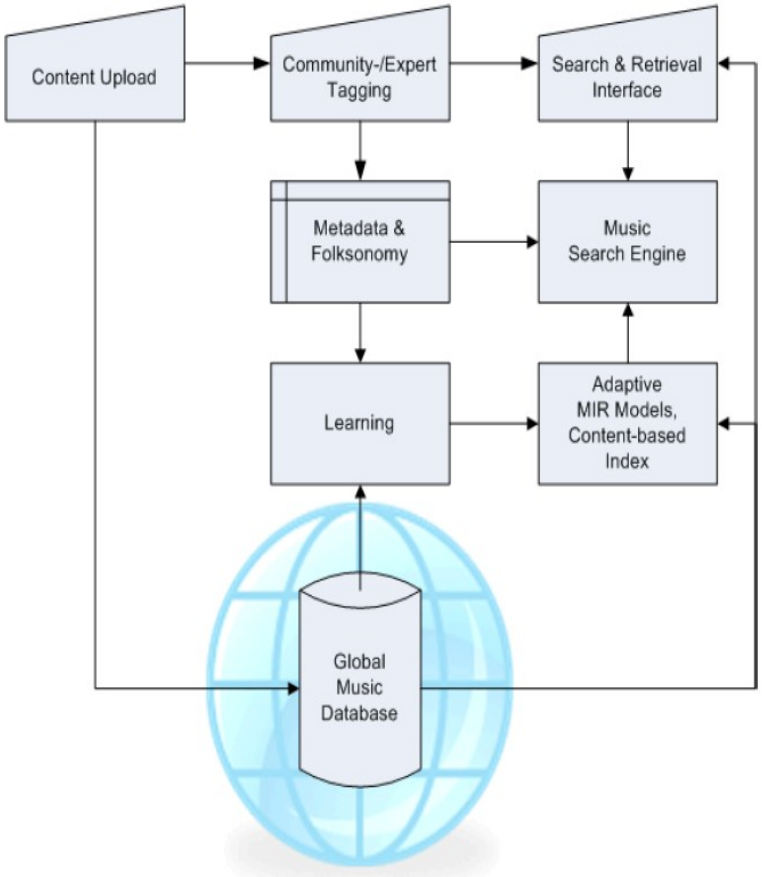
GlobalMusic2one

- *Project develops new adaptive methods for hybrid music search and recommendation of global music content*
- *Funded by the German Federal Ministry of Education and Research*
- *Participating members: Bach Technology GmbH, Fraunhofer Institute for Digital Media Technology (IDMT), Piranha Musik & IT AG and 4FriendsOnly.com Internet Technologies AG*

Objectives

- *Creation of a software system that users train by adding new musical categories and assigning them example songs*
- *Identify musical qualities (e.g. genre, tempo, mood) by automatic content analyzation (Fraunhofer IDMT)*
- *System should "learn" to recognize relationships of musical categories based on these training sets and musical qualities*
- *Get additional information on music content based on statistical Web document analysis*

Architecture



- **Search & Retrieval Interface**
  - Interactive website and visualization
  - Interactive assignment of musical categories
  - User feedback
- **Adaptive MIR Models, CB-Index**
  - Provides music similarity information based on automatic music classification and community/expert training sets
- **Hybrid Music Search Engine**
  - Combines folksonomy data and content-based music similarities
  - Returns search results and recommendations based on calculated hybrid music similarities
- **GlobalMusic2one Database**
  - Stores user profiles, content-based metadata, semantic categories...

Basic Idea

- *The World Wide Web contains a lot of freely accessible and descriptive information on music content (lyrics, discographies...)*
- *This knowledge from diverse sources presents a valuable and up-to-date resource to gather dynamically changing music trends and to obtain relationships between musical entities*
- *Music search engines most often only accept textual queries, the importance of this knowledge is therefore further underpinned when it comes to presenting appropriate search results*
- *Usage of statistical text analysis to gain this knowledge*

What to Expect from this Approach?

- *Automatically gather textual metadata on music*
- *Obtain semantic relationships between musical entities*
- *Sensibly complements methods for community-based and content-based music similarity analysis*

NIMS

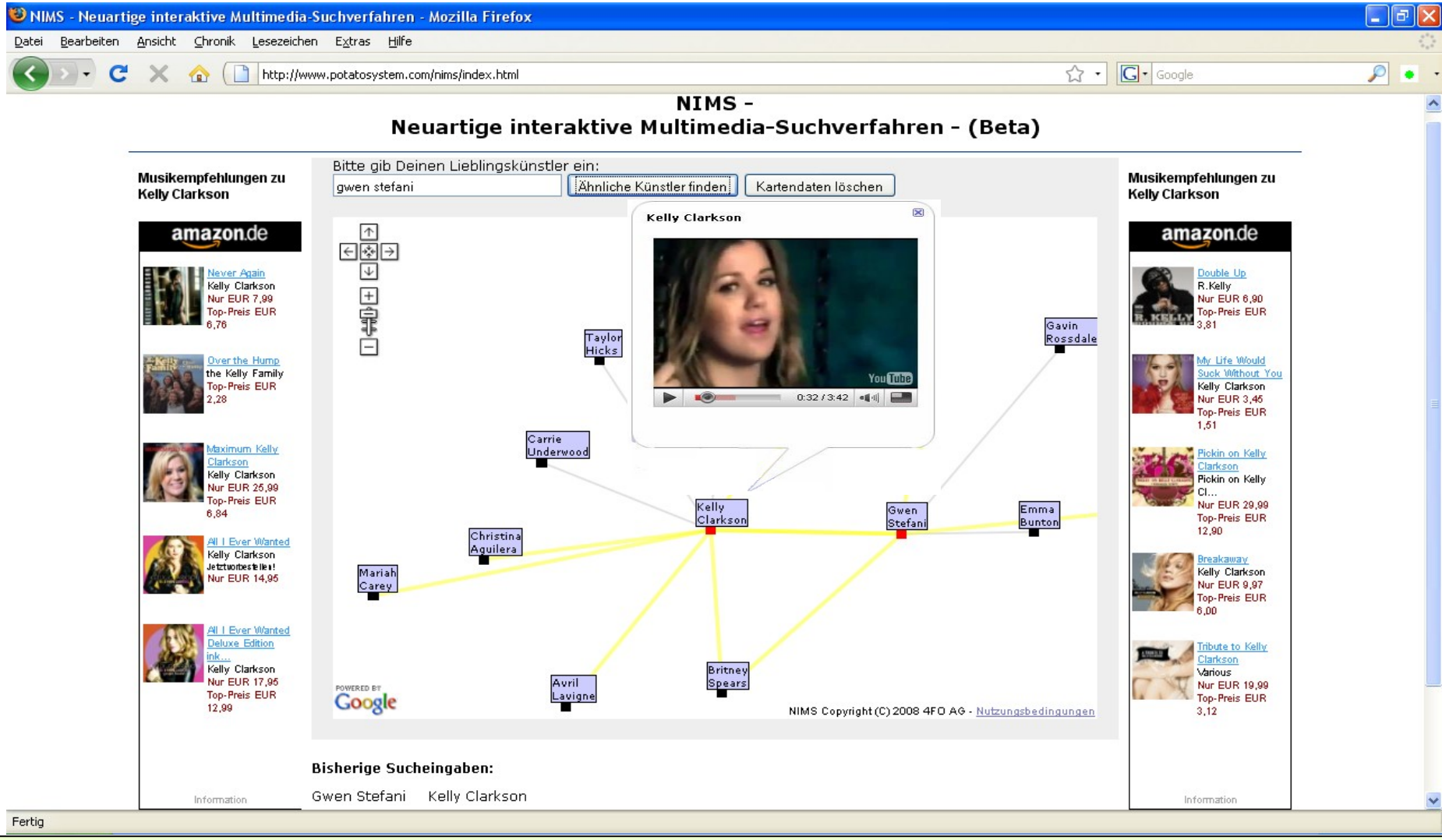
- *First showcase project for this approach*
- *Was funded by the German Federal Ministry of Economics and Technology (2007-2008)*
- *Developed by 4FO AG in collaboration with the NLP (Natural Language Processing) department at the University of Leipzig*
- *Website: http://www.potatosystem.com/nims*

Objectives

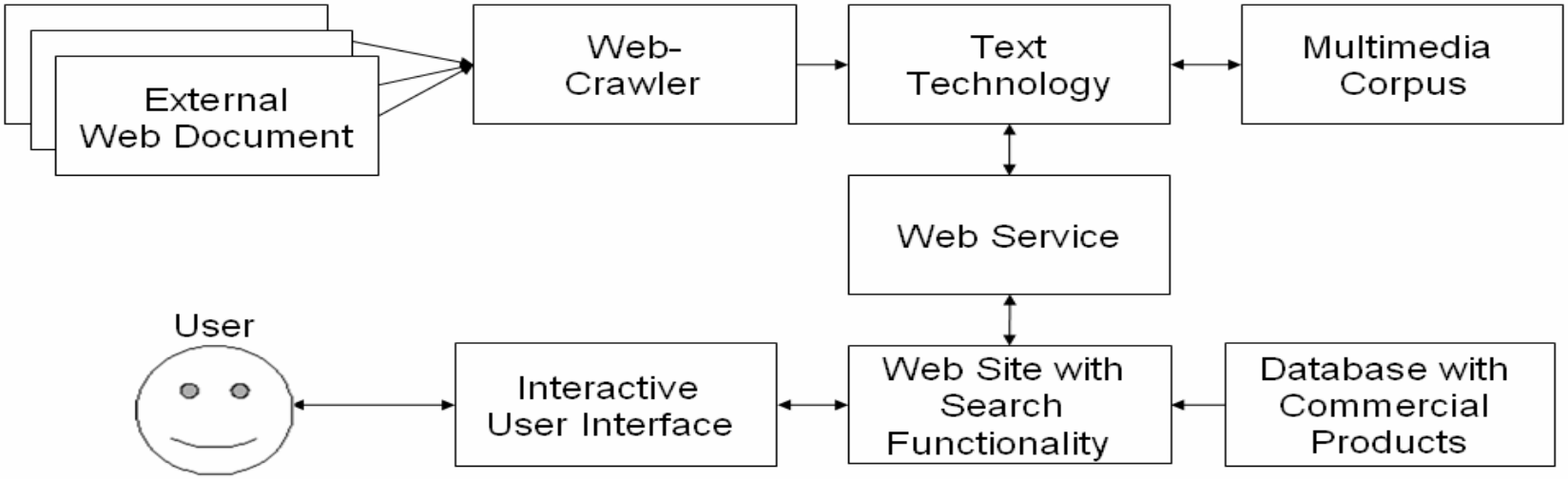
- *Develop novel interactive multimedia search techniques based on text mining and statistical text analysis*
- *Collect musical metadata and transfer them to a music text corpus*
- *Calculate their significance and semantic relationships between them based on co-occurrence analysis*
- *Visualize them as a graph on an interactive website*
- *Embed matching commercial advertisements*

- **Interactive Website**
  - *Consists of a query input field, the interactive map, search history and commercial advertisements*
- **Interactive Map**
  - *Provides users a convenient way to navigate and zoom inside the graph of musical entities (here artist similarities)*
  - *Well-known Google Maps API used for graph visualization*
    - *Widely accepted interface*
    - *Ajax support*
    - *"Custom-Maps" allow to visualize third-party datasets*
  - *Graph grows while the user explores it*
    - *Close nodes suggest high similarity*
    - *Graph calculated using a modified version of the Fruchterman-Reingold algorithm*
    - *Area around requested node is recalculated only*
  - *Gimmick: Youtube videos of selected artists*

Visualization



Architecture



- ***Webcrawler gathers freely accessible music descriptions in the Web***
  - ***Also filters out unsolicited content as advertisements***
  - ***Identifies relevant documents on music using a stopword list***
- ***Text Technology (software Medusa) determines significant occurrences and significant co-occurrences of music entities***
  - ***MusicBrainz Database used to further enhance the detection rate***
- ***Components for statistical text analysis and graphical user interface interconnected by a Webservice***

- **Webservice**
  - ***Provides a subset of previously calculated term frequencies and co-occurrences for an incoming query***
  - ***Returns them in form of XML formatted data***
- **Example query: Udo Lindenberg**
  - ***Results descendingly ordered according to the query's distance***

```
<nims_service>
<cooccurrences search="Udo Lindenberg" search-freq="304" search-freq-class="7.27">
<coocc term="Peter Maffay" label="ARTIST" dist="19.44" freq="335" freq-class="7.13"/>
<coocc term="Herbert Grönemeyer" label="ARTIST" dist="40.17" freq="299" freq-class="7.29"/>
<coocc term="Inga Rumpf" label="ARTIST" dist="52.29" freq="48" freq-class="9.93"/>
<coocc term="BAP" label="ARTIST" dist="54.16" freq="200" freq-class="7.87"/>
<coocc term="Ton Steine Scherben" label="ARTIST" dist="73.98" freq="158" freq-class="8.21"/>
<coocc term="Frumpy" label="ARTIST" dist="76.78" freq="47" freq-class="9.96"/>
<coocc term="Nena" label="ARTIST" dist="81.97" freq="310" freq-class="7.24"/>
<coocc term="Truck Stop" label="ARTIST" dist="101.1" freq="54" freq-class="9.76"/>
<coocc term="Peter Herbolzheimer" label="ARTIST" dist="106.42" freq="74" freq-class="9.31"/>
<coocc term="Nina" label="ARTIST" dist="123.8" freq="2631" freq-class="4.09"/>
<coocc term="Bruce Springsteen" label="ARTIST" dist="131.87" freq="314" freq-class="7.22"/>
</cooccurrences>
</nims_service>
```

FireMatcher – Find Matching Documents

- *New Firefox Extension to search for similar documents*
- *Based on the text technology of NIMS*
- *Principle: User selects local documents or documents from the WWW, FireMatcher analyzes them and presents topically matching documents from the WWW*
- *Support filetypes: TXT, HTML, PDF, DOC and PPT*
- *Supported OSs: Windows and Linux*

Usage

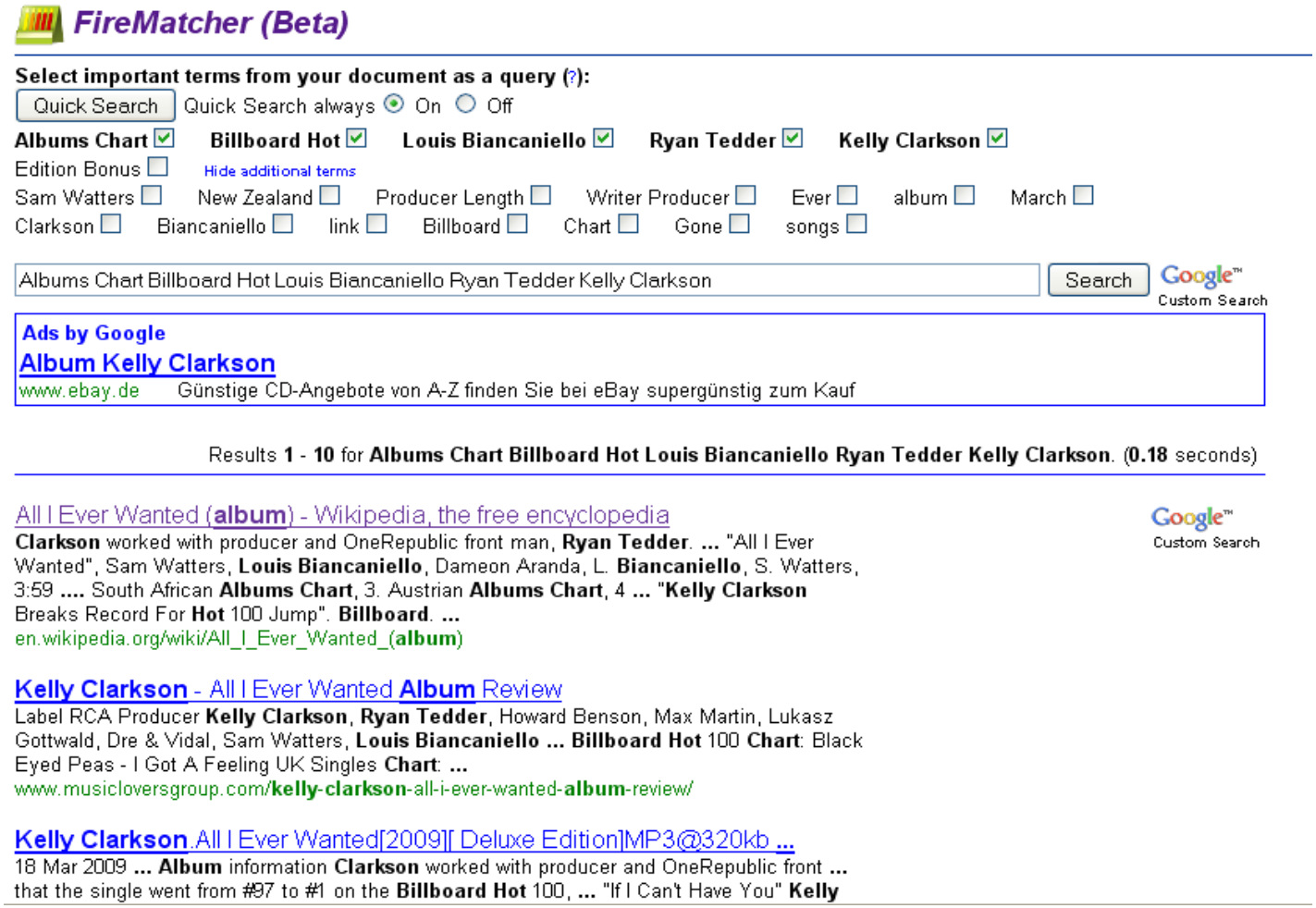
- *Drag & Drop local documents or texts / links from webpages to the FireMatcher icon in the navigation bar*
- *OR: Click on the FireMatcher icon and select a local document*
- *OR: Analyze selected text on webpages (click in context menu)*

Download Beta Version

- *http://www.firematcher.com/*

FireMatcher – Demonstration

http://en.wikipedia.org/wiki/All_I_Ever_Wanted_(album)



Summary

- *Introduced GlobalMusic2one: Create new adaptive methods for hybrid music search and recommendation of global music content*
- *New approach: Enhance music recommendations by gathering musical metadata from the WWW and determine their relationships by applying statistical text analysis*
  - *Can complement methods for community-based and content-based music similarity analysis*
- *NIMS is first showcase project for this approach*
  - *Architecture outlined*
  - *Visualization discussed*
- *FireMatcher*
  - *Further field of application for the text technology*
  - *Finds similar documents in the Web*
  - *Live demo*

- **Future Developments** (focus on text technology)
  - *Integrate the approach of NIMS in GlobalMusic2one*
  - *Evaluation of methods for the statistical analysis of textual annotations of musical entities provided by users*
    - *Challenge: Semantically interconnect mostly sparse data from users (only a few tags might be available) and find similar tags, content and users*
    - *Solutions:*
      - *Interpret tags of users as co-occurrences; similar tags have high significance co-occurence value; find these tags with spreading activation approach (last year's FXResearcher)*
      - *Identify user communities with a similar taste by applying clustering algorithms (e.g. Flake's algorithm)*
    - *Further application scenarios:*
      - *Calculate expanded or associated queries*
      - *Suggest tags for not yet annotated content*

Thank you for your attention!

Questions?