

Towards Web-scale Content Search: the SAPIR Approach

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Search In Audio Visual Content Using Peer-to-Peer IR

Partners:



IST FP6 Project



SAPIR Goals

Develop cutting-edge technology to
index and search large scale audio-visual
information by **content**

Support **Web2.0** MM content production:
personal producer VS professional producers

- The datasets:
 - *CoPhIR:*
Content-based Photo Image Retrieval Test-Collection
 - *BBC Videos*
- State of the art in searching:
 - *MUFIN* for similarity search in P2P
 - *MINERVA* for text search in P2P
 - Optimized Threshold *Algorithms* for merging results
 - *Metric-Cache* for improving efficiency and efficacy of similarity search results

Chorus Gap Analysis: Scalability Problems

- Today **scalability** issues already **put brake** on growth of multimedia search engines
- The amount of row data is still **growing exponentially**
- Content enrichment techniques produce more and more **heavy features**
- The quality of multimedia search would greatly benefit from solving **scalability issues**

Chorus Gap Analysis: Scalability Challenges

- Breakthroughs are urgent
- Scalability considerations must be taken into account at all stages of:
 - **indexing** – content enrichment , and
 - **retrieval** – query evaluation

Effectiveness Improvement via Scalability

Query image



Search in 1M Flickr images



Search in 10M Flickr images



Search in 50M Flickr images



Content-based Photo Image Retrieval



100M

images + metadata + MPEG-7 VDs

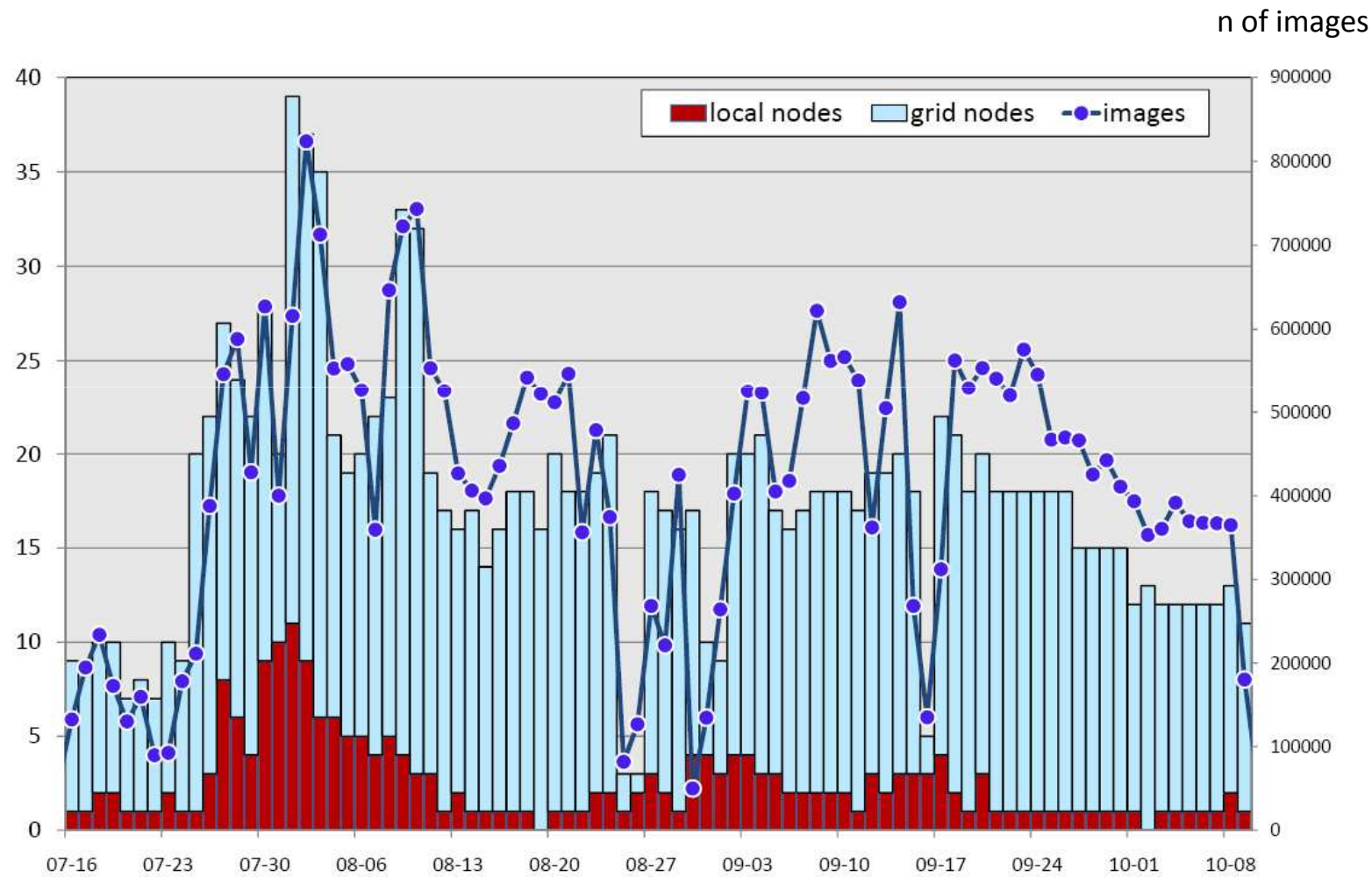
<http://cophir.isti.cnr.it/>

- largest publicly available collection of high-quality images
metadata: **106 Million images**.
- Each contains five MPEG-7 VDs:
 - Scalable Color, Color Structure, Color Layout, Edge Histogram, Homogeneous Texture.
- and other textual information:
 - title, tags, comments, etc.
- Photos have been crawled from the **Flickr** photo-sharing site.

CoPhIR: EGEE European Grid



CoPhIR: GRID Statistics



Content Searching Architecture

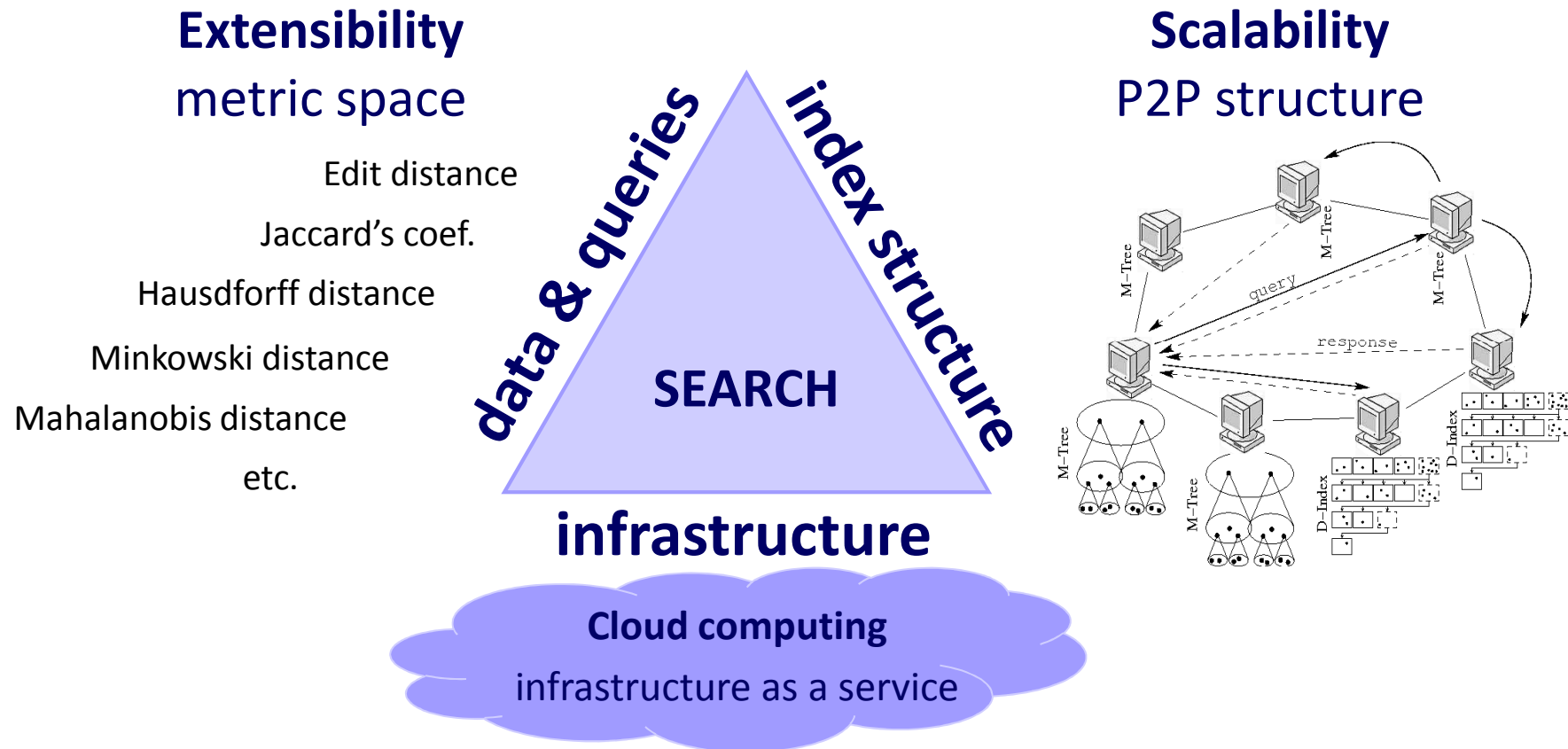


Image Search Demo

Extensibility

COPHIR

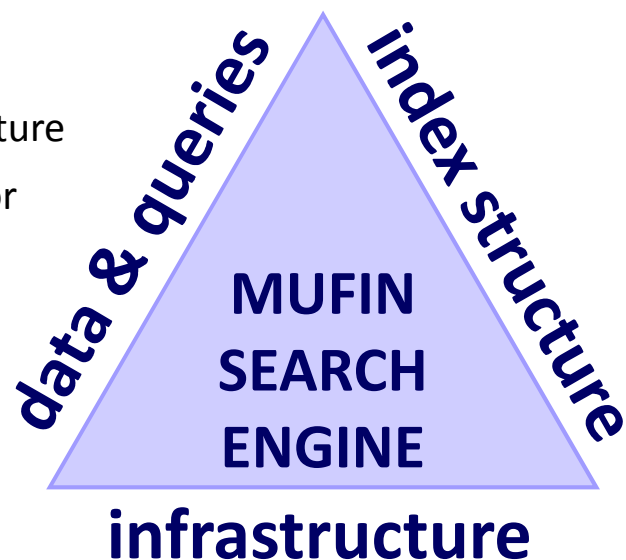
color structure

scalable color

color layout

edge histogram

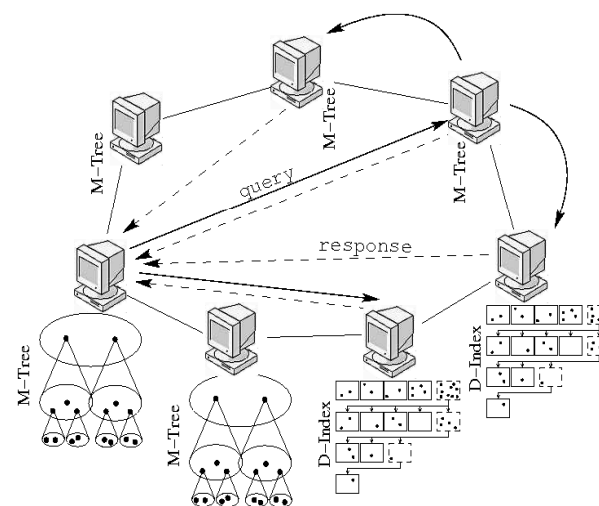
homogeneous texture



6 x IBM server x3400

Scalability

M-Chord + M-Tree



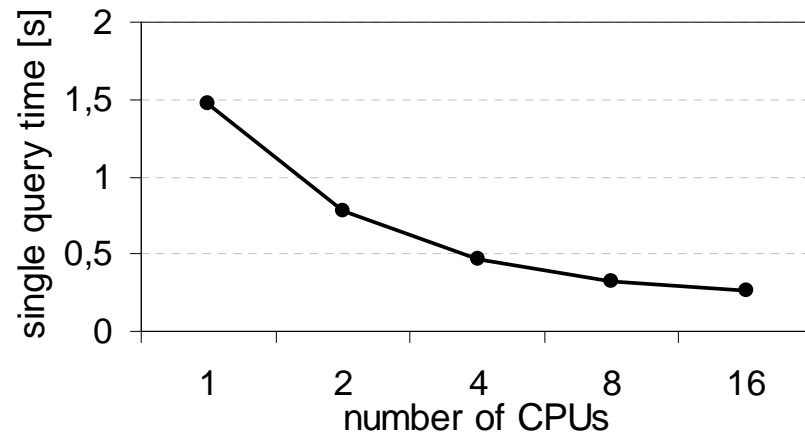
Content Search Query Response Times

Technique	CPUs	100k	1M	10M	50M
Sequential scan	1	4.3s	43.4s	7.2min	36min
M-Tree	1	1.4s	12s	1.8min	-
Parallel sequential scan	16	0.4s	2.7s	27s	2.3min
	80	0.3s	0.5s	5.4s	27s
M-Chord	16	0.29s	0.45s	1.7s	5.9s
M-Chord with approximation	16	0.31s	0.38s	0.44s	2.6s
	80	0.3s	0.36s	0.43s	0.45s
M-Chord with approximation and disk	32	0.75s	0.82s	0.87s	1.2s

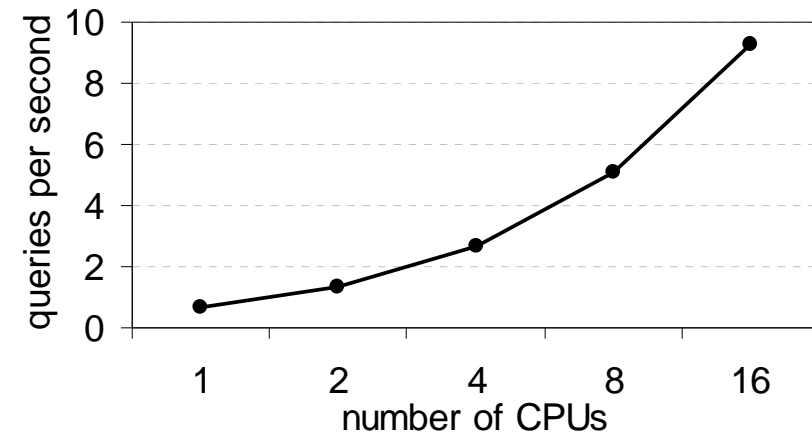
How SAPIR achieve scalability

- 10M network, 500 peers, memory-based
- Batch of 250 queries started from 10 peers

Execution time




Throughput



Demo Invitation: SAPIR Image and Video similarity search




[All](#) [Images](#) [Videos](#)




SAPIR 




Search in Audio-Visual




All results **1-15** search time: **2922 ms**




images




[similar](#) [adv search](#)  [similar](#) [adv search](#)  [similar](#) [adv search](#) 




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Demo Invitation: SAPIR Image GPS search (e.g. Matera)

All Images Videos

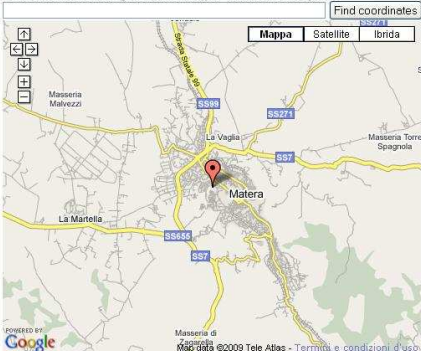
SAPIR Search in Audio-Visual

Lat: 40.67048 Lng: 16.59176 Map

Find coordinates using the name and/or address of the place

Find coordinates

Mappa Satellite Ibrida




Images

results 1-15 search time: 266 ms

☐ content to use commercially
☐ content to modify, adapt, or build upon

similar adv search



These images are miniature versions of the original ones that come from the site www.flickr.com.

All rights are reserved to the author of the original image, which is directly available on the Flickr site through a hypertext link (surface linking).

The videos are low quality versions of the original ones that are property of the [BBC](http://www.bbc.com) and are copyrighted. The videos are provided for research purposes by the [BBC](http://www.bbc.com) through the [SAPIR Project](http://www.sapir-project.org), no other uses are allowed.



Demo Invitation:
SAPIR Video





















Demo Invitation: MUFIN image similarity search

MUFIN
Multi-feature Indexing Network

Search in 100 million Flickr images

Keywords

Similar images (search: 670 ms)

0.000  <u>Visually similar</u>	0.210  <u>Visually similar</u>	0.439  <u>Visually similar</u>	0.463  <u>Visually similar</u>	0.463  <u>Visually similar</u>	0.516  <u>Visually similar</u>
0.530  <u>Visually similar</u>	0.542  <u>Visually similar</u>	0.549  <u>Visually similar</u>	0.555  <u>Visually similar</u>	0.566  <u>Visually similar</u>	0.570  <u>Visually similar</u>
0.571  <u>Visually similar</u>	0.577  <u>Visually similar</u>	0.599  <u>Visually similar</u>	0.601  <u>Visually similar</u>	0.601  <u>Visually similar</u>	0.603  <u>Visually similar</u>

