

# Building Scalable and Smart Multimedia Applications on the Semantic Web



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# Agenda

- Motivation
- Real-world Multimedia Assets
- Data Access Layer
- Formal Representation
- Deployment Issues
- Conclusion

# Motivation

<<http://www.flickr.com/photos/mhausenblas/2883727293/>>

The screenshot shows a Flickr photo page. At the top, the Flickr logo is on the left, and 'Signed in as mhausenblas' with 'Help' and 'Sign Out' links is on the right. Below the navigation bar, the photo title 'Saphira, Ranya and Iannis' is highlighted with a red box. The photo itself shows three children: a girl on the left, a boy with glasses in the middle, and a baby in the foreground. A red box highlights the baby. Below the photo, the text 'dc: title' is visible. To the right of the photo, there are icons for 'ADD NOTE', 'SEND TO GROUP', 'ADD TO SET', 'BLOG THIS', and 'A SI'. Further right are 'ROTATE', 'EDIT PHOTO', and 'DELETE' icons. On the right side of the page, there is a 'Share This' button, a user profile for 'mhausenblas' with the text 'Uploaded on September 24, 2008 by mhausenblas', and a 'mhausenblas' photostream widget showing '103 uploads'. Below the widget are 'Tags' (children [x]), 'Add a tag', and 'Additional Information' which includes 'Some rights reserved (edit)' (highlighted with a red box), 'Photo stats', and 'Viewed 0 times (Not including you)'. At the bottom of the page, there is a 'Flag your photo' link.

dc: title

dc: license <<http://creativecommons.org/licenses/by/2.0/deed.en>>

foaf: depicts <<http://saphira.blogr.com/#me>>

# Motivation

- some global metadata is available (title, license, etc.)
  - tags
  - microformats, RDFa
  - mostly accessible via proprietary interfaces (e.g., [flickr API](#), etc.)
- fine-grained descriptions (such as 'region X depict person Y') are lacking

# Motivation

- Enable the development of Web applications for **large-scale, high-quality content descriptions** and their **consumption** in order to:
  - find specific persons, objects etc.
  - perform temporal queries
  - create automated summaries (for example video skims, etc.)

# Motivation

## **Semantic Web Multimedia Application**

- a Web application (URI, HTML, HTTP)
- additionally, Web of Data compliant (RDF, vocabularies, etc.)
- fine-grained description and/or manipulation of multimedia content

# Motivation



# Motivation

- reusability
- trust, quality, etc.
- open world – serendipity
- semantics vs. pragmatics  
(POSH –  $\mu$ F – RDFa)
- **scalability vs. expressivity**



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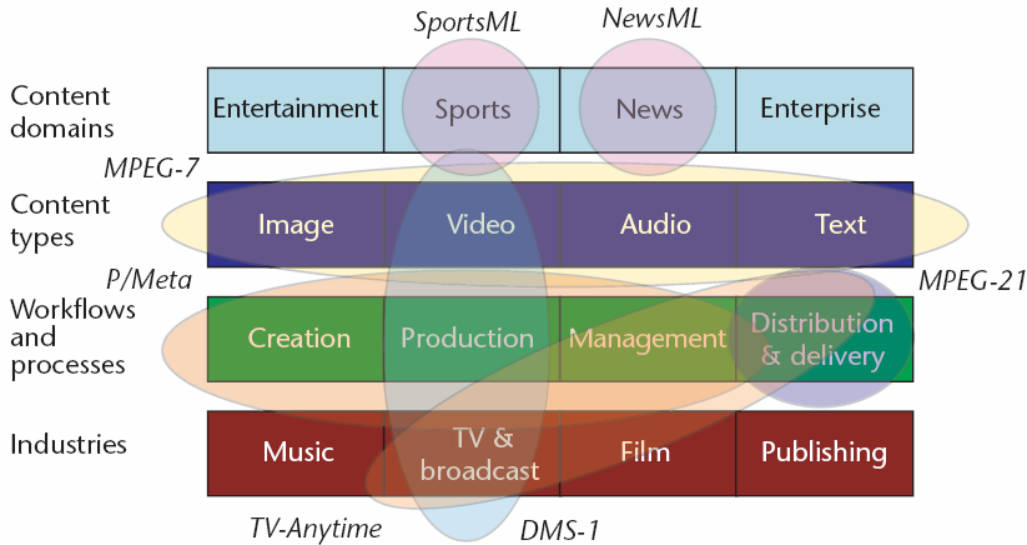
# Real-world Multimedia Assets

- multimedia content and metadata
- large-scale deployment (typically Web-size)
- distributed environment, inhabited by contribuser (contributor and consumer roles)

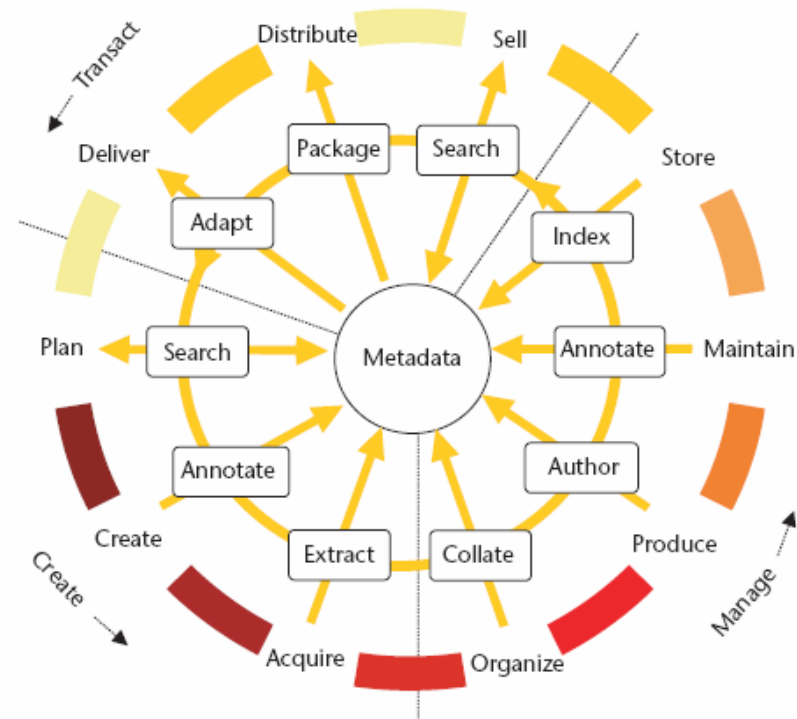
# Real-world Multimedia Assets

- Multimedia content
  - modalities (audio, visual, etc.)
  - spatio-temporal aspects
- Metadata
  - type (administrative, low-level feature, domain semantics, etc.)
  - scope (global, fine-grained, etc.)

# Real-world Multimedia Assets



metadata types and workflow [1]



# Real-world Multimedia Assets

- In [2] we have described requirements for real-world multimedia content descriptions:
  - formal grounding
  - extensibility & reusability
  - linking (URI-based)
  - authoring & consumption
  - performance & scalability

# Real-world Multimedia Assets

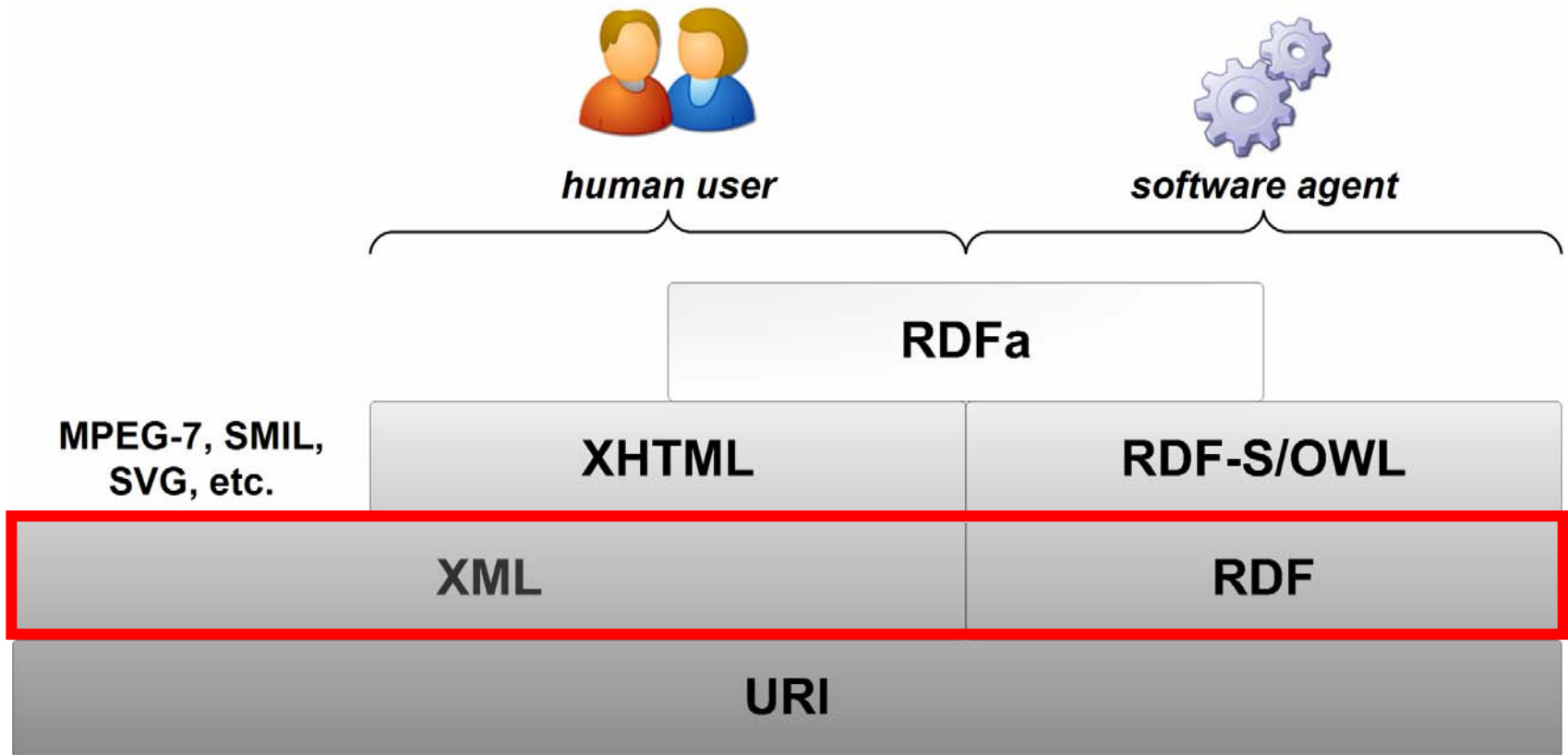
- 👍 still-images
- 👍 some administrative metadata
- 👍 scales well
- 👎 no fine-grained descriptions

The screenshot shows a Flickr photo page. At the top, the Flickr logo is on the left, and navigation links (Home, You, Organize, Contacts, Groups, Explore) and a search bar are in the center. On the right, it says 'Signed in as mhausenblas' with links for Help and Sign Out. The photo title is 'Saphira, Ranya and Iannis'. Below the title is a toolbar with icons for 'ADD NOTE', 'SEND TO GROUP', 'ADD TO SET', 'BLOG THIS', 'ALL SIZES', 'PRINTS & MORE', 'ROTATE', 'EDIT PHOTO', and 'DELETE'. The photo itself shows three children: a girl on the left, a boy with glasses in the middle, and a baby in the foreground. Below the photo is the caption 'Our three little babies'. On the right side of the page, there is a 'Share This' link, a 'Photostream' widget for 'mhausenblas' showing '103 uploads', and a 'Tags' section with the tag 'children [x]'. Below that is an 'Additional Information' section with details like 'Some rights reserved (edit)', 'Anyone can see this photo (edit)', 'Add to your map', 'Taken on September 24, 2008 (edit)', 'Photo stats' (Viewed 0 times), and 'Edit title, description, and tags'. At the bottom right, there is a 'Flag your photo' link.

# Agenda

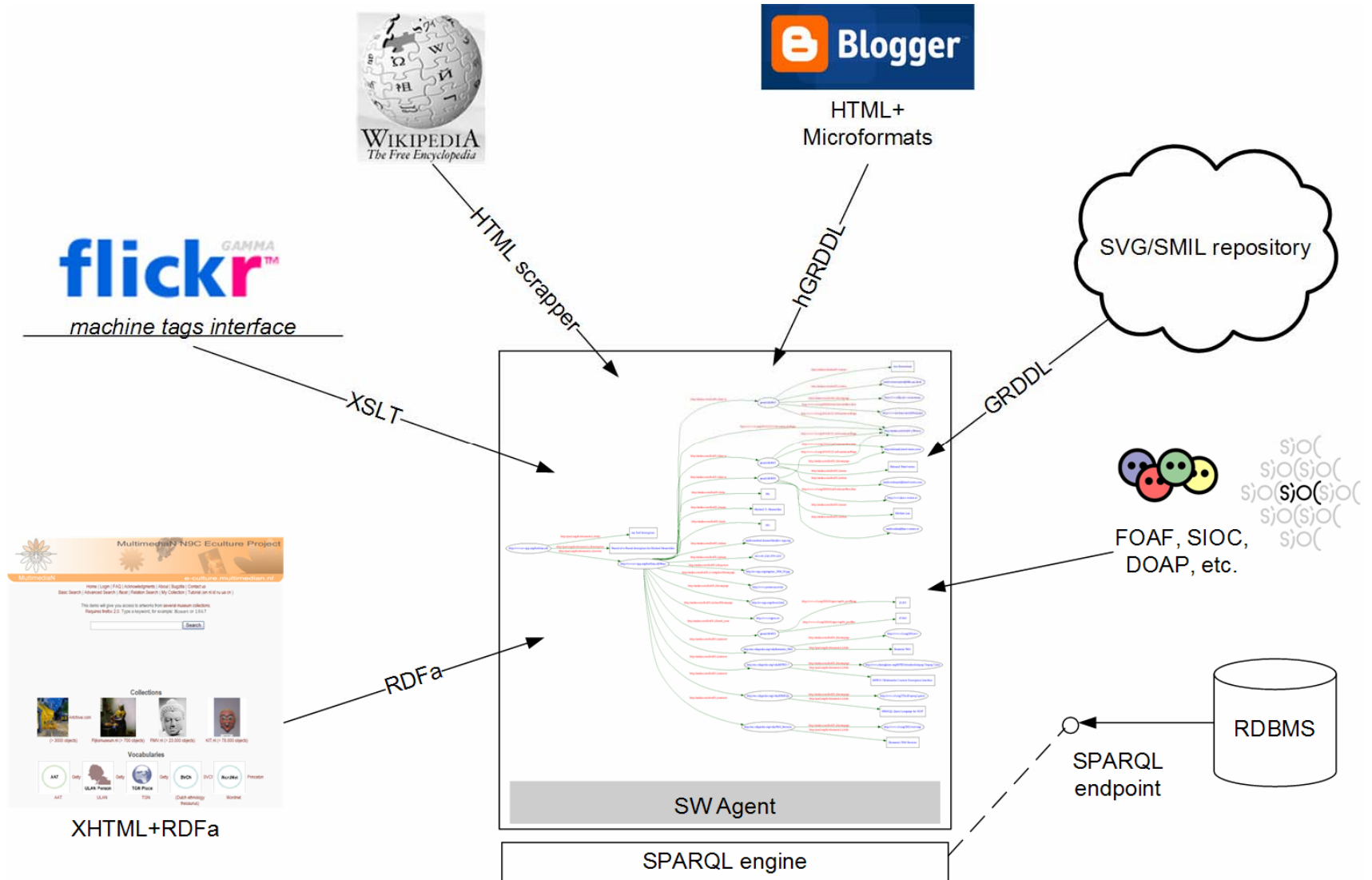
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# Data Access Layer





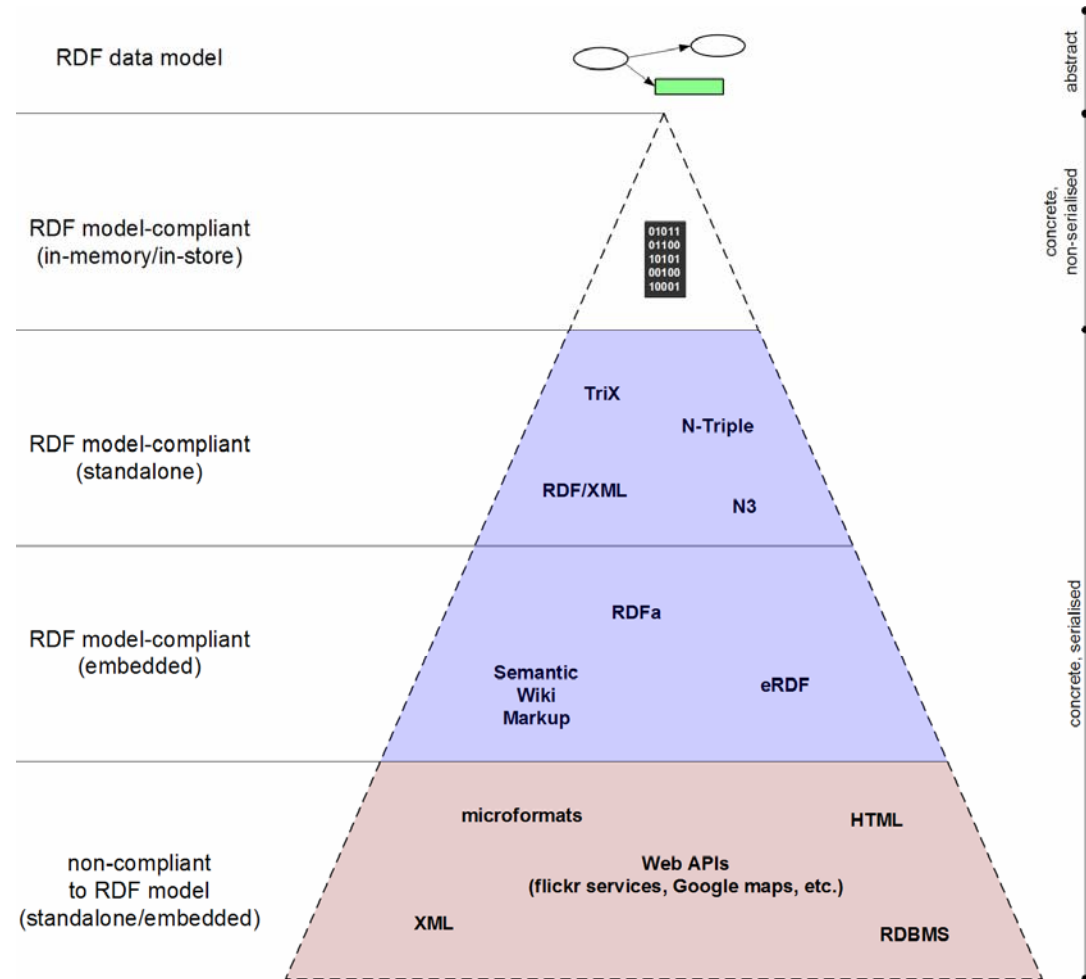
# Data Access Layer



# Data Access Layer

## Virtual RDF Graphs [3]

- types of sources (cf. pyramid)
- characteristics of sources (dynamic, etc.)



# Data Access Layer

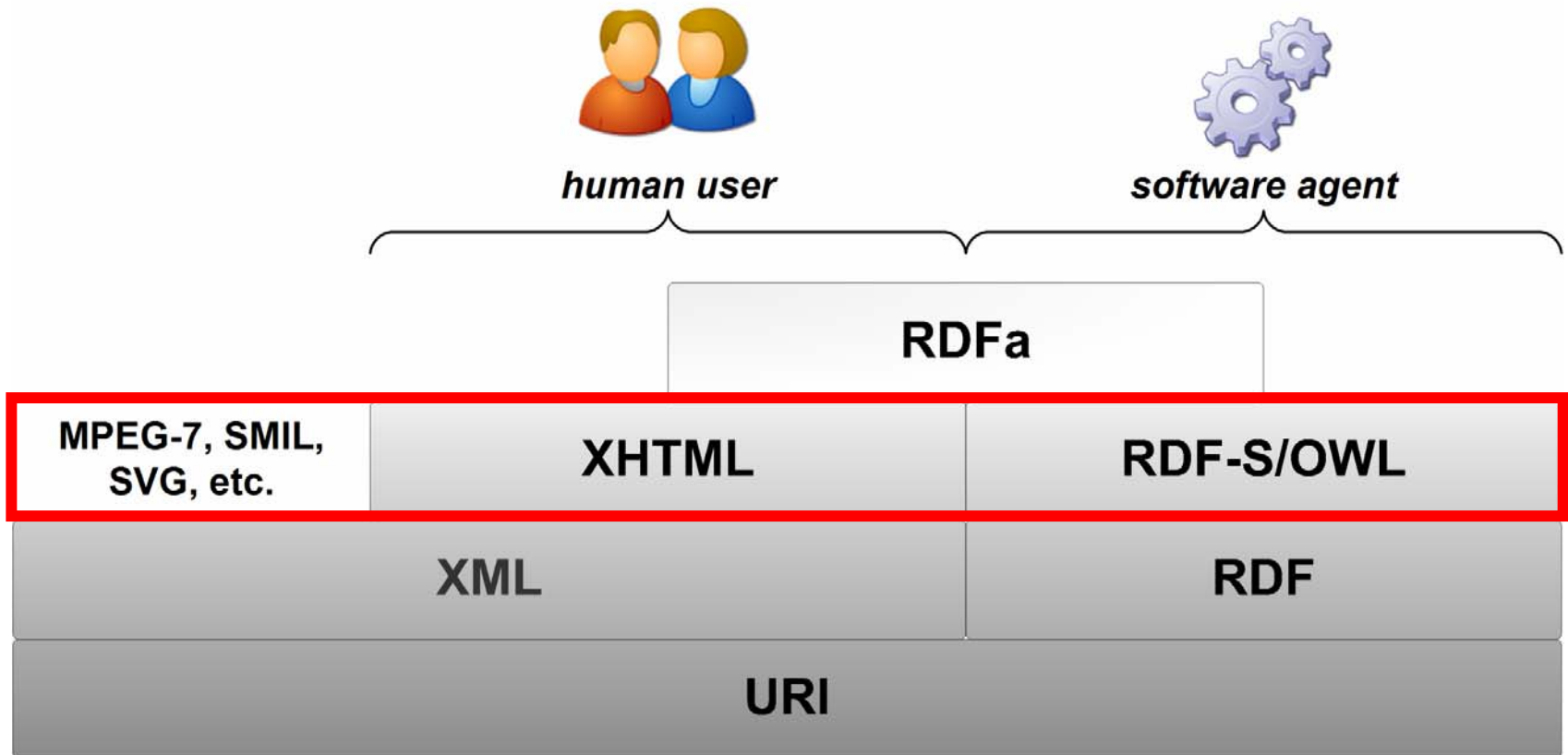
- 👉 proprietary APIs optimised
- 👉 virtual RDF graphs expensive
- 👉 trade-off: embedded vs. referenced metadata

The screenshot shows a Flickr photo page. At the top, the Flickr logo is on the left, and navigation links (Home, You, Organize, Contacts, Groups, Explore) and a search bar are in the center. On the right, it says 'Signed in as mhausenblas' with links for Help and Sign Out. The photo title is 'Saphira, Ranya and Iannis'. Below the title is a toolbar with icons for 'ADD NOTE', 'SEND TO GROUP', 'ADD TO SET', 'BLOG THIS', 'ALL SIZES', 'PRINTS & MORE', 'ROTATE', 'EDIT PHOTO', and 'DELETE'. The photo itself shows three children: a girl on the left, a boy with glasses in the middle, and a baby in the foreground. Below the photo is the caption 'Our three little babies'. On the right side of the page, there is a 'Share This' link, a 'Photostream' widget for 'mhausenblas' showing '103 uploads', and a 'Tags' section with the tag 'children [x]'. Below that is an 'Additional Information' section with options like 'Some rights reserved (edit)', 'Anyone can see this photo (edit)', 'Add to your map', 'Taken on September 24, 2008 (edit)', 'Photo stats' (Viewed 0 times), and 'Edit title, description, and tags'. At the bottom right, there is a 'Flag your photo' link.

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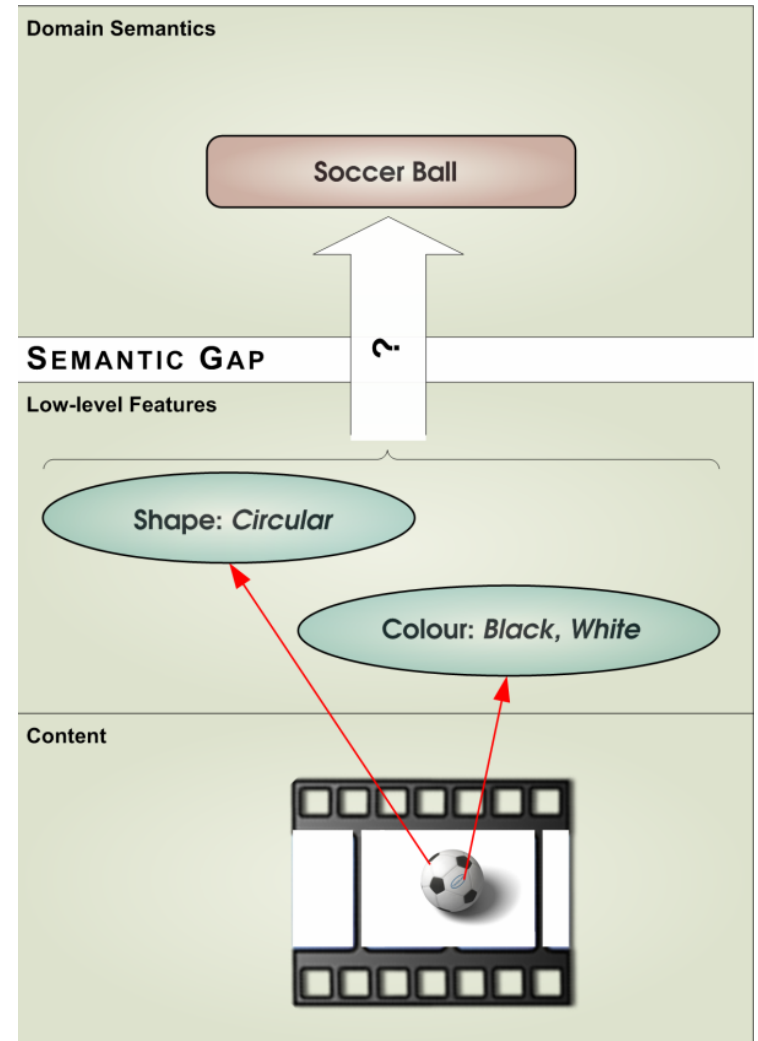
# Formal Representation



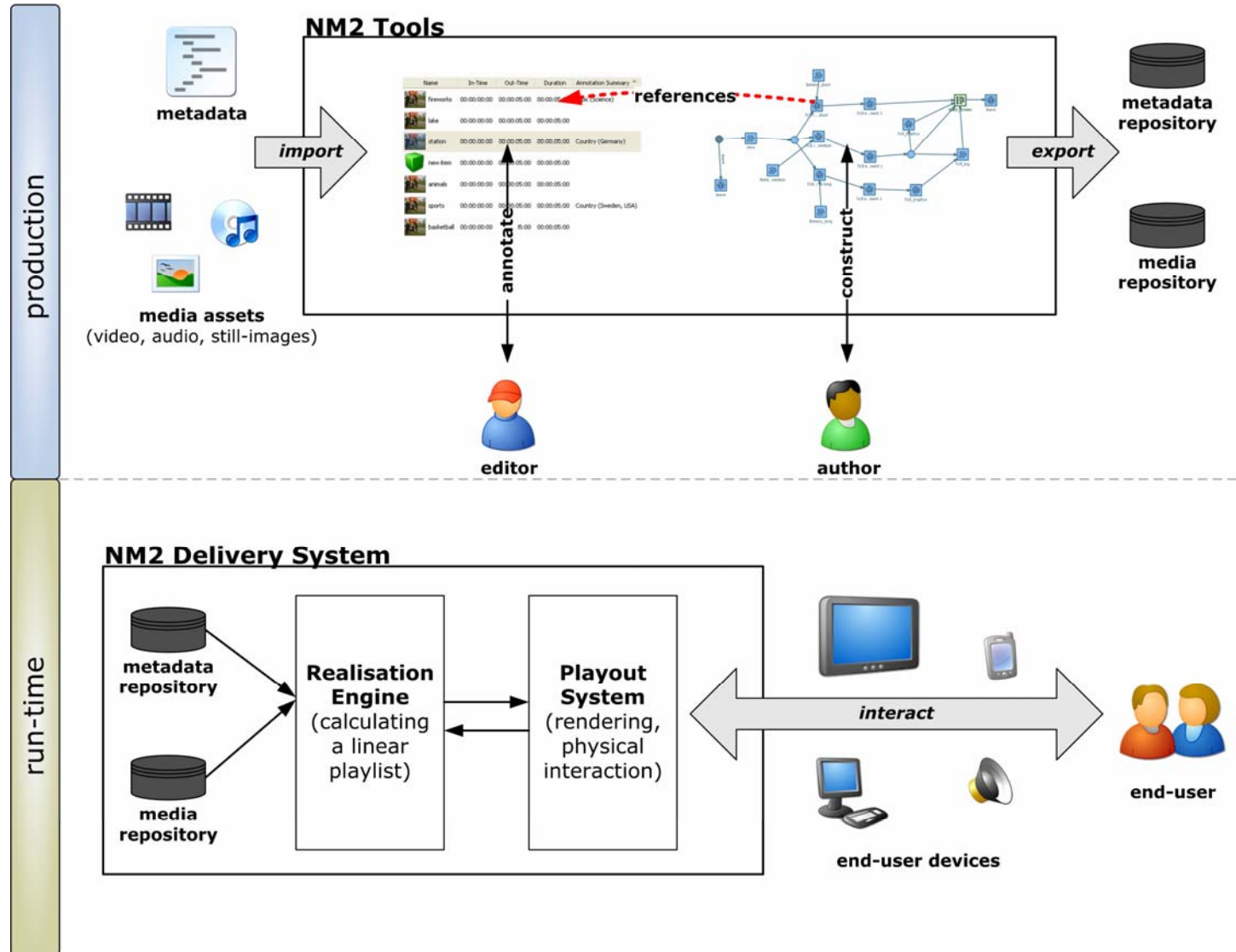
# Formal Representation

## Semantic Gap:

*“The semantic gap is the lack of coincidence between the information that one can extract from the visual data and the interpretation that the same data have for a user in a given situation.”*



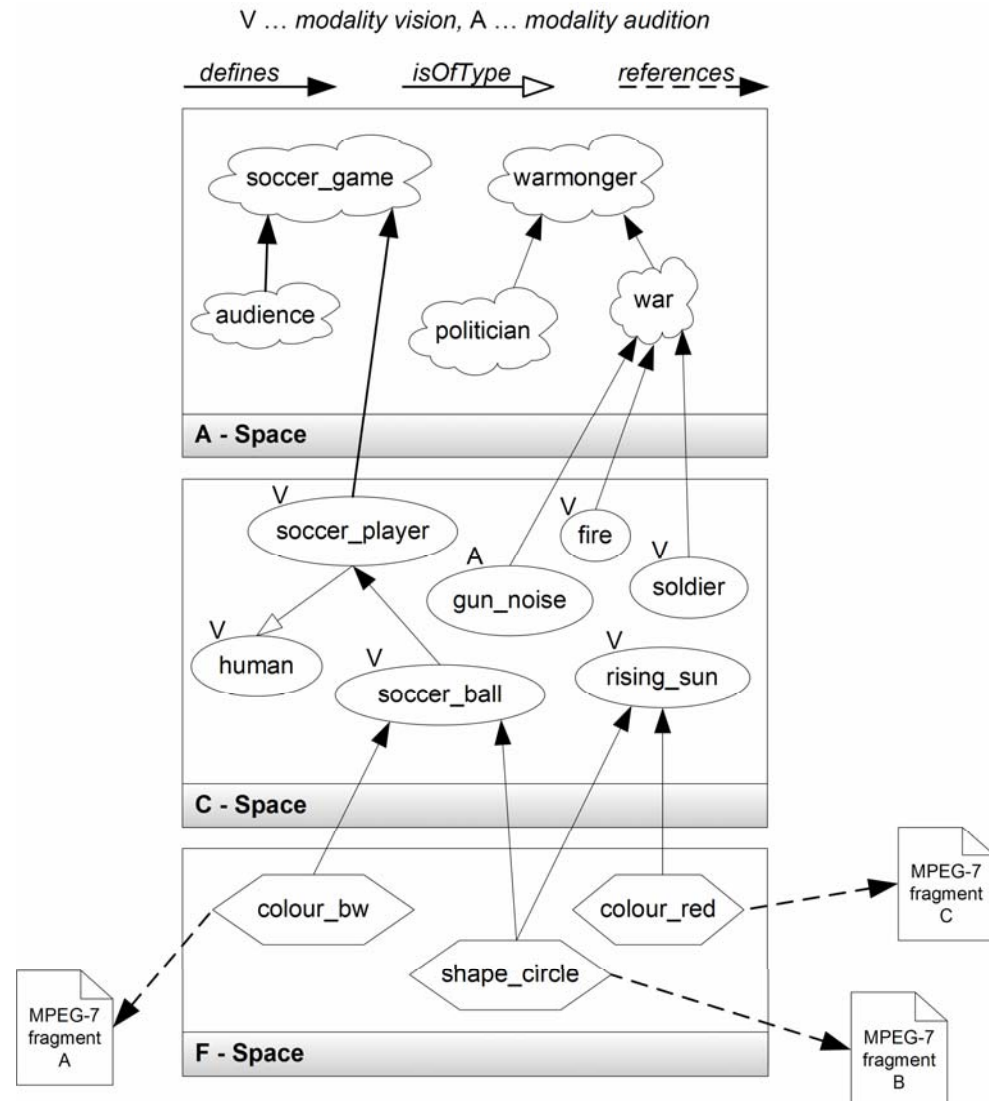
# Formal Representation



NM2 (see [4], [5])

# Formal Representation

- spaces
- subsidiary principle
- mapping
  - built-in rules
  - user-defined rules





# Formal Representation

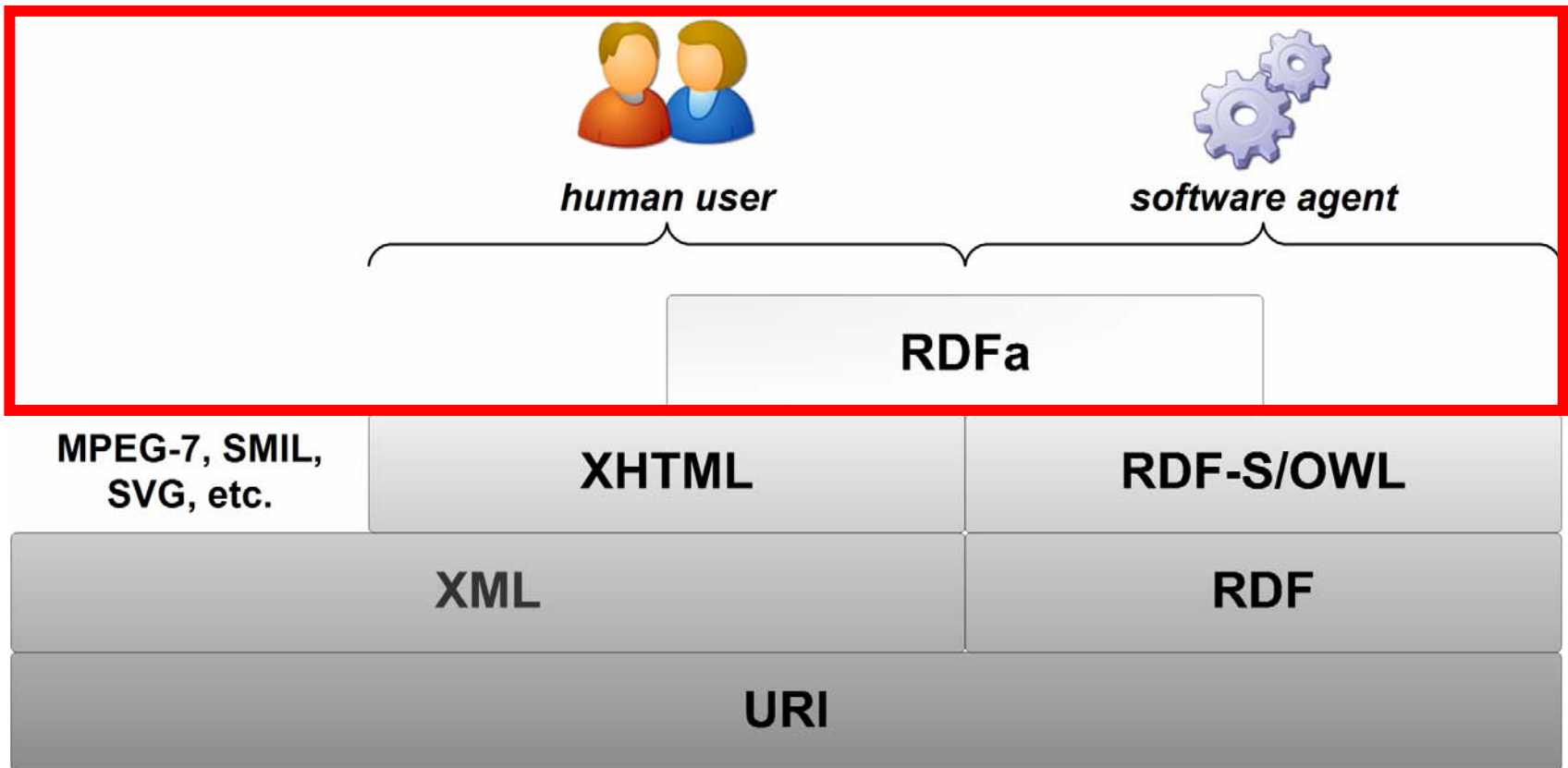
- ☞ only global descriptions
- ☞ rudimentary formal grounding

The screenshot shows a Flickr page for a photo titled "Saphira, Ranya and Iannis". The photo depicts three children: a girl on the left, a boy with glasses in the middle, and a baby in the foreground. The page includes a navigation bar with "Home", "You", "Organize", "Contacts", "Groups", and "Explore". A search bar is visible on the right. Below the photo, there are editing options: "ADD NOTE", "SEND TO GROUP", "ADD TO SET", "BLOG THIS", "ALL SIZES", "PRINTS & MORE", "ROTATE", "EDIT PHOTO", and "DELETE". The photo is captioned "Our three little babies". On the right side, there is a "Share This" button, a "Photostream" widget showing "103 uploads", and a "Tags" section with the tag "children [x]". Below the tags, there is an "Add a tag" button and an "Additional Information" section with options like "Some rights reserved (edit)", "Anyone can see this photo (edit)", "Add to your map", "Taken on September 24, 2008 (edit)", "Photo stats", "Viewed 0 times (Not including you)", and "Edit title, description, and tags". At the bottom right, there is a "Flag your photo" button.

# Agenda

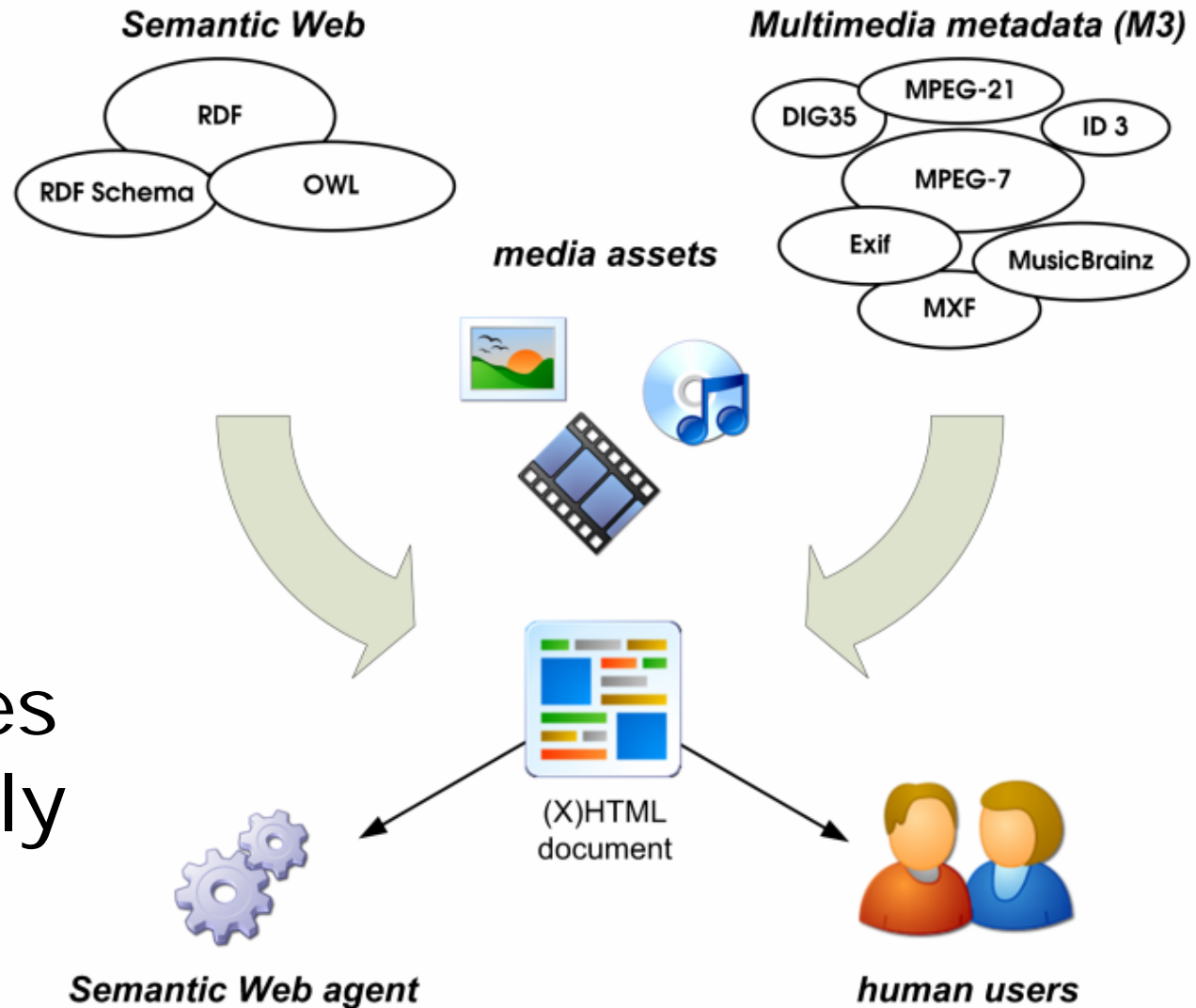
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# Deployment Issues

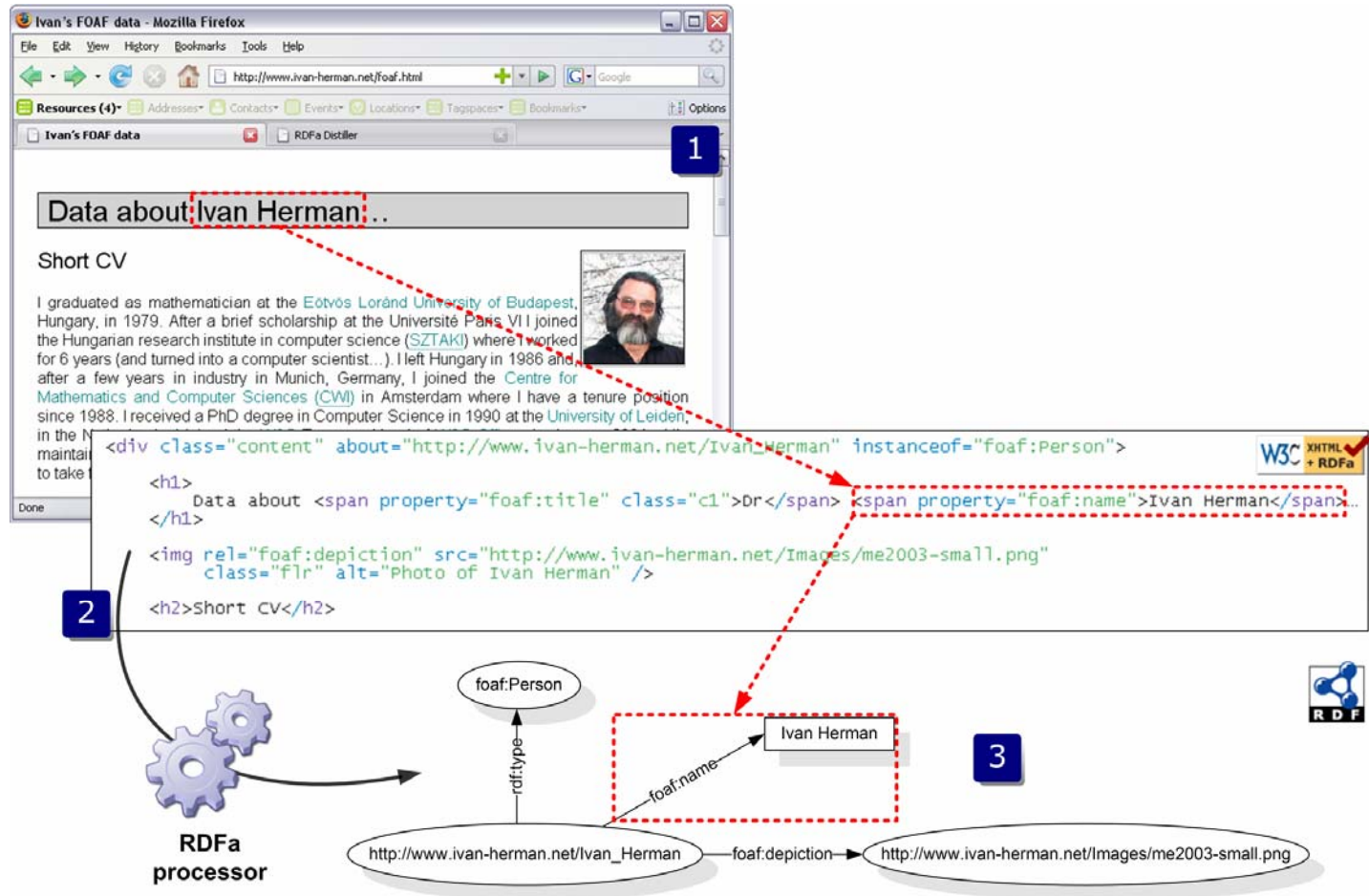


# Deployment Issues

- reuse exiting formats
- serve humans *and* machines efficiently



# Deployment Issues

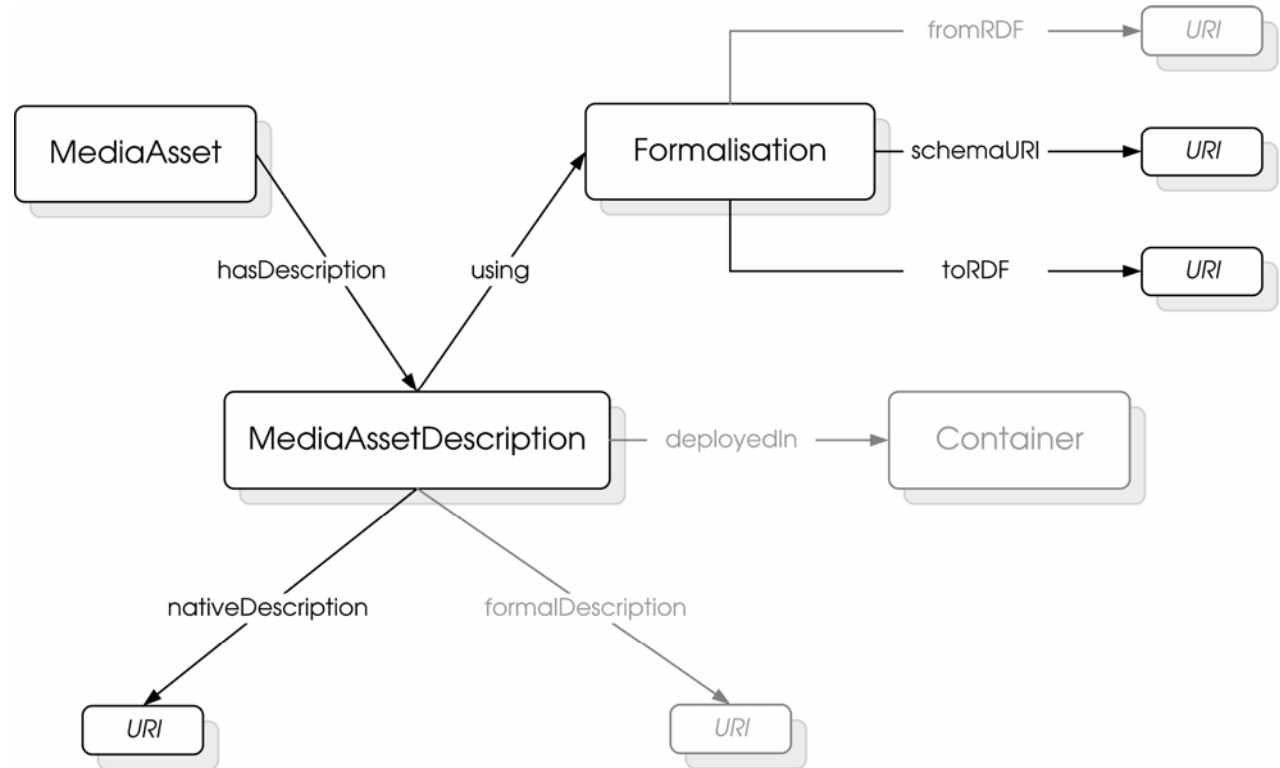


RDFa – a W3C standard for embedding RDF in (X)HTML using attributes.

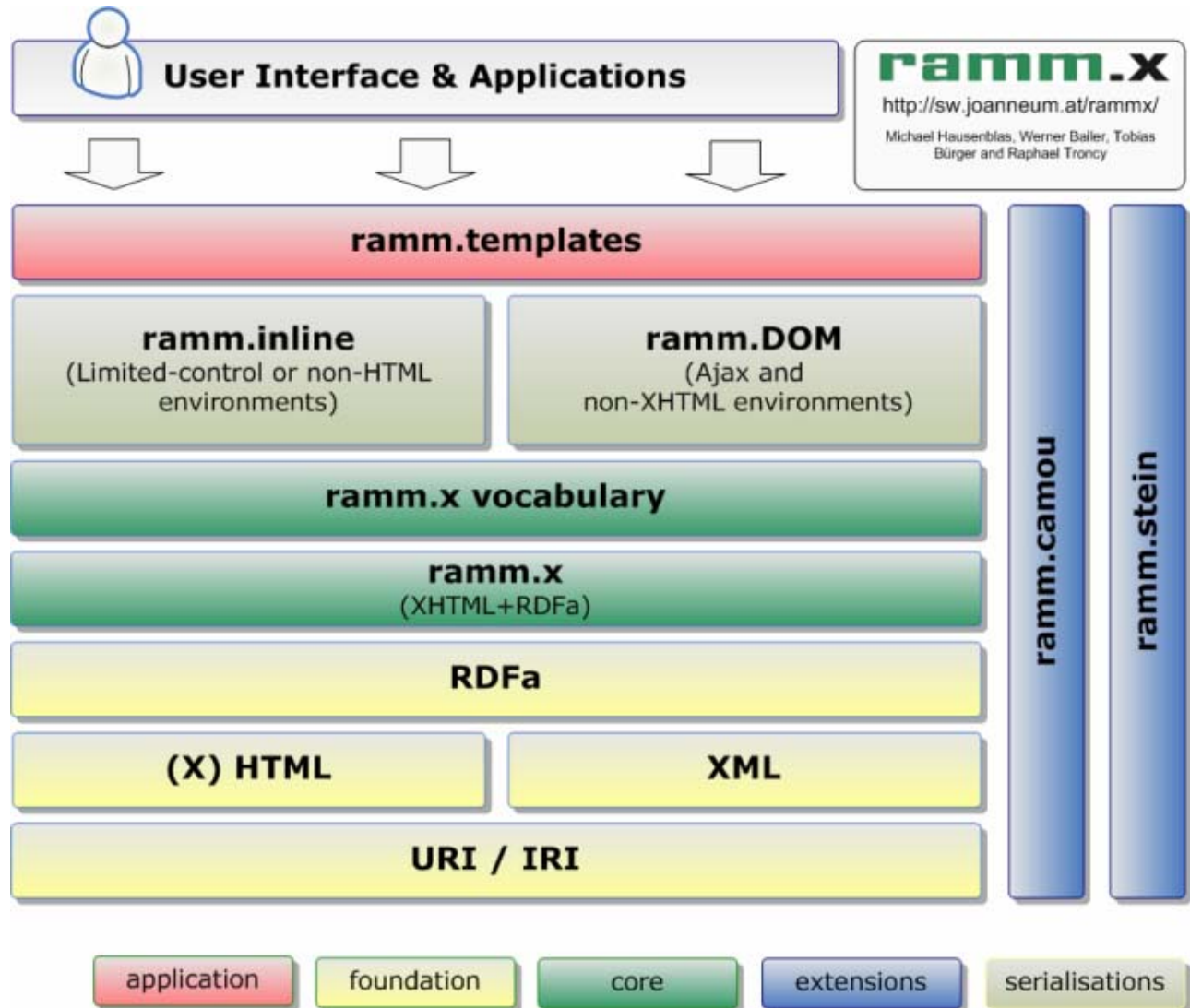
[<http://www.w3.org/TR/xhtml-rdfa-primer/>]

# Deployment Issues

- We have described a solution based on RDFa (ramm.x) in [6] and [7] for a number of [use cases](#)



# Deployment Issues



ramm.stack

# Deployment Issues

- mixed-style deployment of metadata
- ramm.x can be used (further research required)

The screenshot shows a Flickr photo page. At the top, the Flickr logo is on the left, and navigation links (Home, You, Organize, Contacts, Groups, Explore) and a search bar are in the center. On the right, it says 'Signed in as mhausenblas' with links for Help and Sign Out. The photo title is 'Saphira, Ranya and Iannis'. Below the title is a toolbar with icons for 'ADD NOTE', 'SEND TO GROUP', 'ADD TO SET', 'BLOG THIS', 'ALL SIZES', 'PRINTS & MORE', 'ROTATE', 'EDIT PHOTO', and 'DELETE'. The photo itself shows three children: a girl on the left, a boy with glasses in the middle, and a baby in the foreground. Below the photo is the caption 'Our three little babies'. On the right side of the page, there is a 'Share This' link, a user profile for 'mhausenblas' with the text 'Uploaded on September 24, 2008 by mhausenblas', a 'mhausenblas' photostream widget showing '103 uploads', and a 'Tags' section with the tag 'children [x]'. Below the tags are sections for 'Add a tag', 'Additional Information' (including 'Some rights reserved (edit)', 'Anyone can see this photo (edit)', 'Add to your map', 'Taken on September 24, 2008 (edit)', 'Photo stats' (Viewed 0 times), and 'Edit title, description, and tags'), and a 'Flag your photo' link.



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# Conclusion

- from end-user's point-of-view multimedia content is easy to produce and share
- from professional user's point-of-view multimedia content requires lot of manual work (editing, distribution, etc.)
- metadata widely neglected
- some tasks (such as summarisation, surveillance, etc.) are hard if not impossible without metadata



# Conclusion

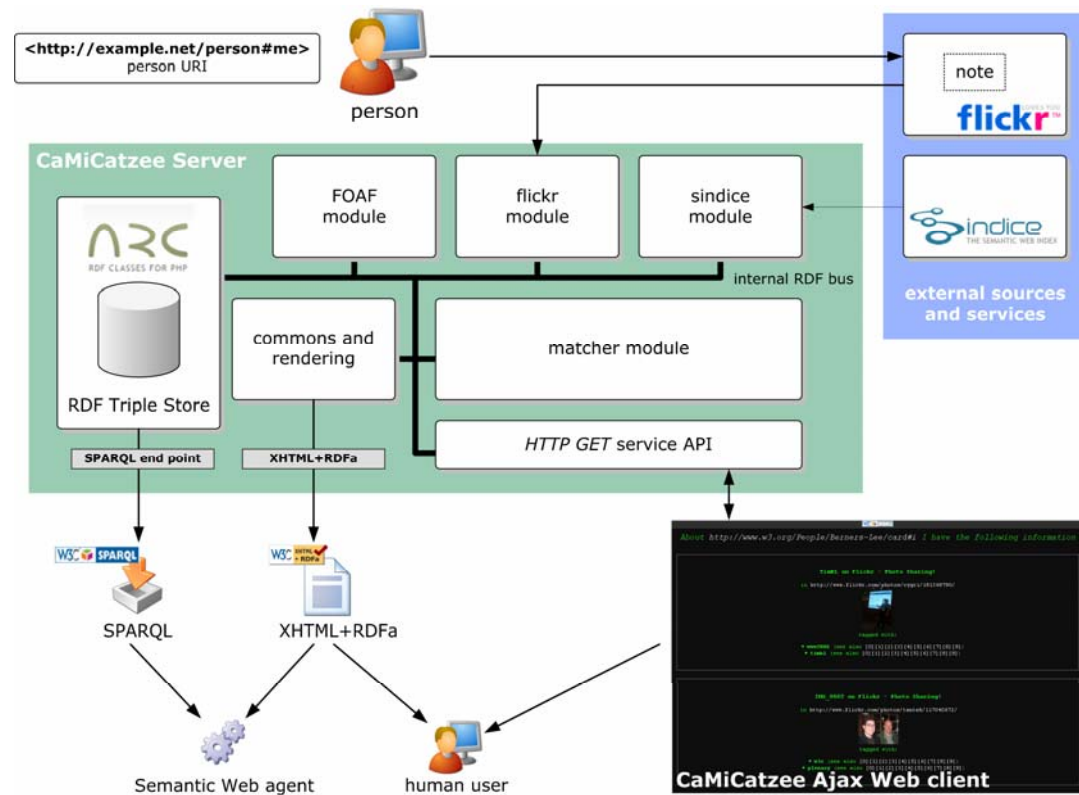
## Interlinking Multimedia



- linked data principles
- common multimedia vocabularies, such as Exif, ID3, etc. along with [ramm.x](http://ramm.x)
- set of interlinking methods, such as User Contributed Interlinking [UCI](#)

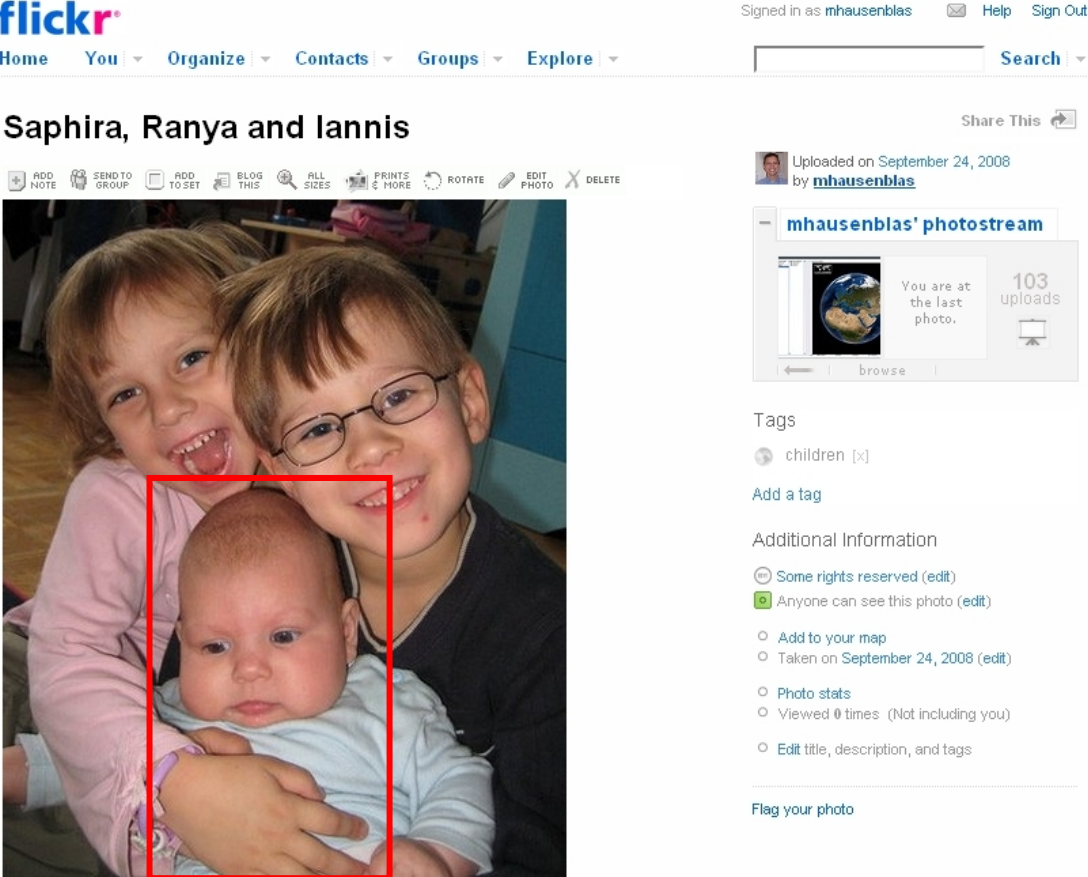
# Conclusion

CaMiCatzee,  
an interlinking  
multimedia  
concept  
demonstrator



# Conclusion

Allows  
**FOAF-based**  
search for  
**person**  
**depictions**  
on flickr photos



The screenshot shows a Flickr photo page. At the top, the Flickr logo is on the left, and the user 'mhausenblas' is signed in on the right. Below the logo is a navigation menu with 'Home', 'You', 'Organize', 'Contacts', 'Groups', and 'Explore'. The photo title is 'Saphira, Ranya and Iannis'. Below the title is a toolbar with icons for 'ADD NOTE', 'SEND TO GROUP', 'ADD TO SET', 'BLOG THIS', 'ALL SIZES', 'PRINTS & MORE', 'ROTATE', 'EDIT PHOTO', and 'DELETE'. The main image shows three children: a girl on the left, a boy with glasses on the right, and a baby in the center. A red rectangular box highlights the baby. To the right of the photo is a sidebar with 'Share This', 'Uploaded on September 24, 2008 by mhausenblas', 'mhausenblas' photostream' (103 uploads), 'Tags' (children [x]), 'Add a tag', 'Additional Information' (Some rights reserved, Anyone can see this photo, Add to your map, Taken on September 24, 2008, Photo stats, Viewed 0 times), and 'Flag your photo'.

foaf:depicts <<http://saphira.blogr.com/#me>>

# Conclusion

- future research
  - discovery and usage of datasets ([voiD](#))
  - interlinking quality (user-contributed interlinking)
- related issues
  - provenance, trust & privacy
  - interaction (e.g. ubiquity [commands](#))





# References

- [1] J. R. Smith and P. Schirling. Metadata Standards Roundup. *IEEE MultiMedia*, 13(2), 2006.
- [2] T. Bürger and M. Hausenblas. Why Real-World Multimedia Assets Fail to Enter the Semantic Web. *International Workshop on Semantic Authoring, Annotation and Knowledge Markup*, 2007.
- [3] M. Hausenblas, W. Slany, and D. Ayers. A Performance and Scalability Metric for Virtual RDF Graphs. *3<sup>rd</sup> Workshop on Scripting for the Semantic Web, collocated with ESWC07*, 2007.
- [4] M. Hausenblas. Applying Media Semantics Mapping in a Non-linear, Interactive Movie Production Environment. *International Conference on New Media Technology*, 2007.

# References

- [5] M. Hausenblas. Non-linear Interactive Media Productions. *Special Issue of ACM Multimedia Systems Journal on Canonical Processes of Media Production*, 2008.
- [6] M. Hausenblas, W. Bailer, and H. Mayer. Deploying Multimedia Metadata in Cultural Heritage on the Semantic Web. *International Workshop on Cultural Heritage on the Semantic Web, collocated with ISWC07*, 2007.
- [7] M. Hausenblas, W. Bailer, T. Bürger, and R. Troncy. Deploying Multimedia Metadata on the Semantic Web (Poster). *International Conference on Semantics And digital Media Technologies*, 2007.