



Siderean[™]
SOFTWARE

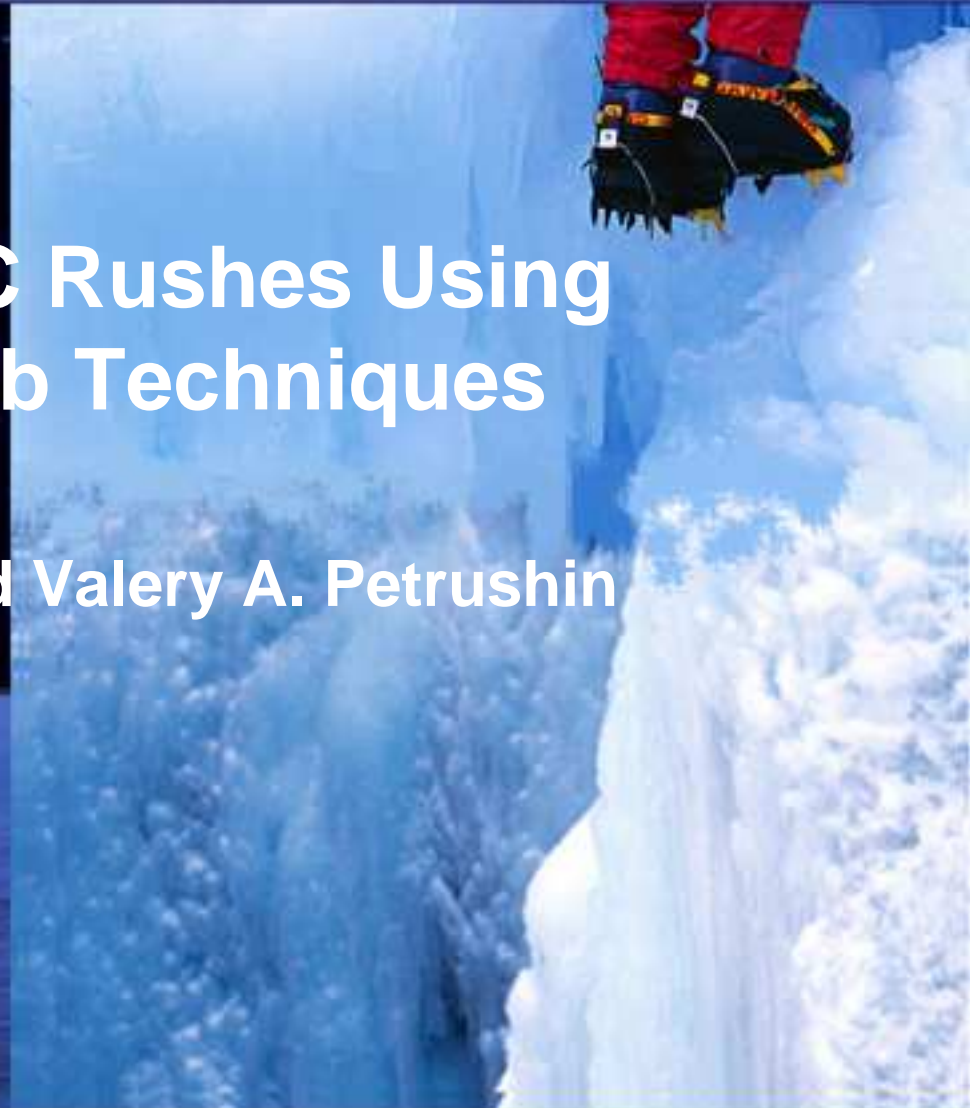
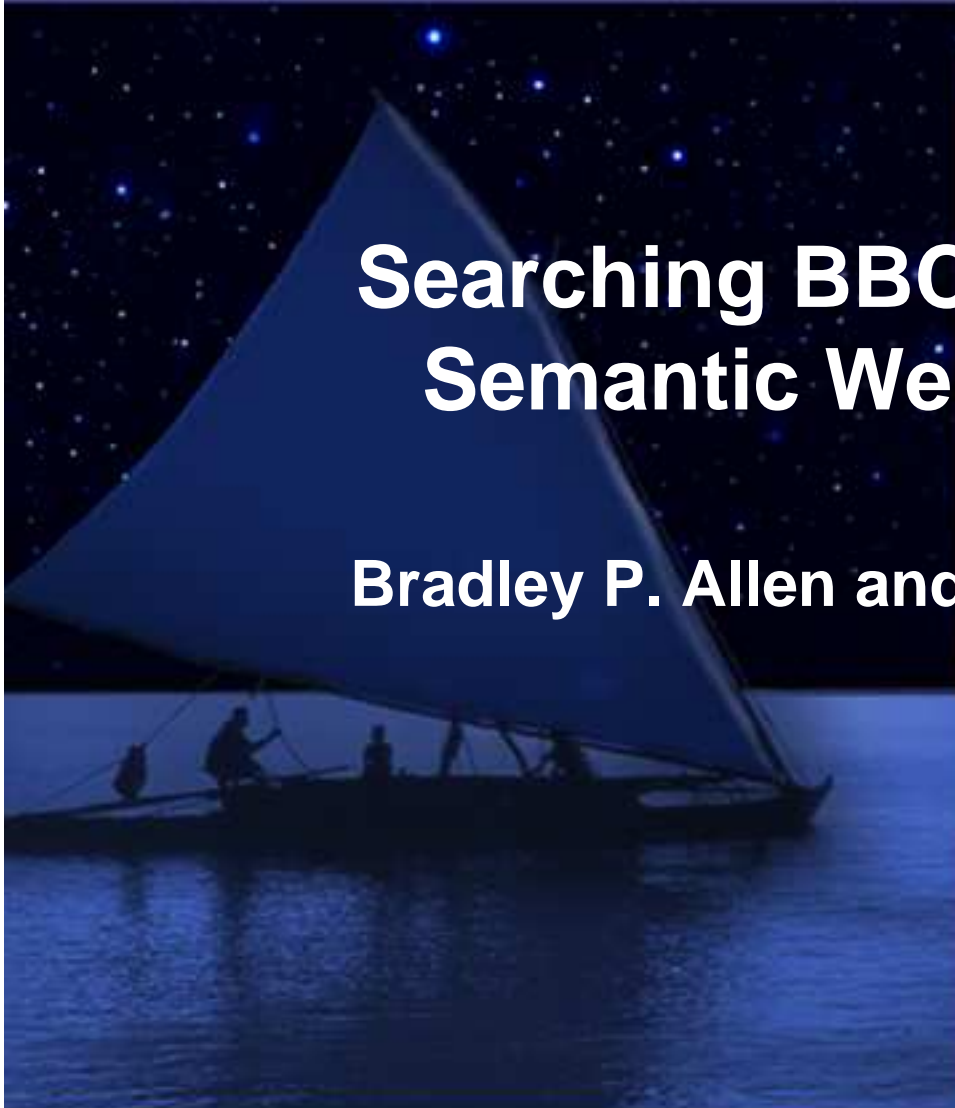
Navigation for the Digital Universe

>
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High performance. Delivered.

Searching BBC Rushes Using Semantic Web Techniques

Bradley P. Allen and Valery A. Petrushin





Outline

- Task
 - BBC Rushes exploration
- Approach
 - Build a faceted navigation interface exploiting both textual and visual metadata
- Implementation
 - BBC Rushes Navigator
 - Metadata representation
 - Architecture
 - User interface
- Future work
- Recommendations

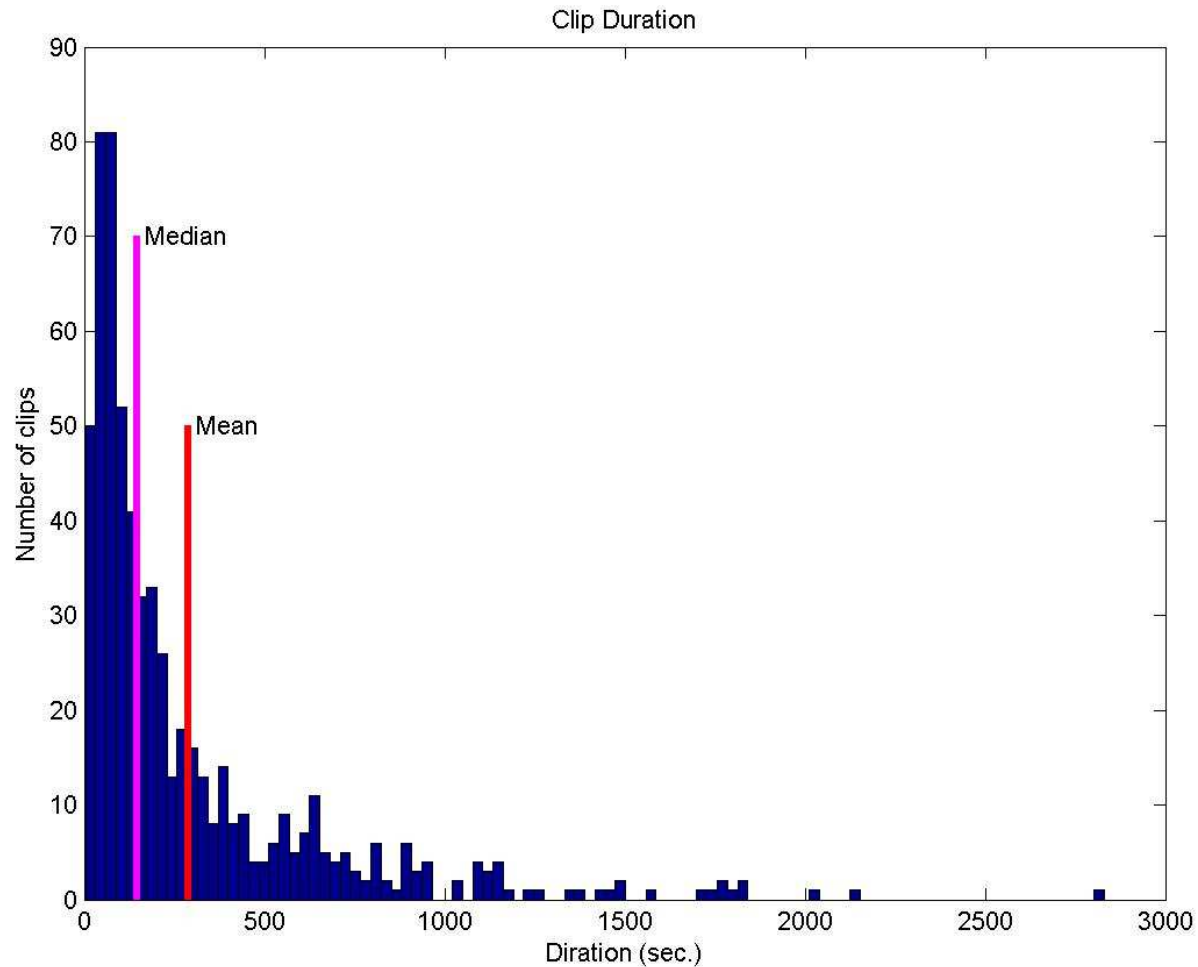


BBC Rushes: data statistics - 1



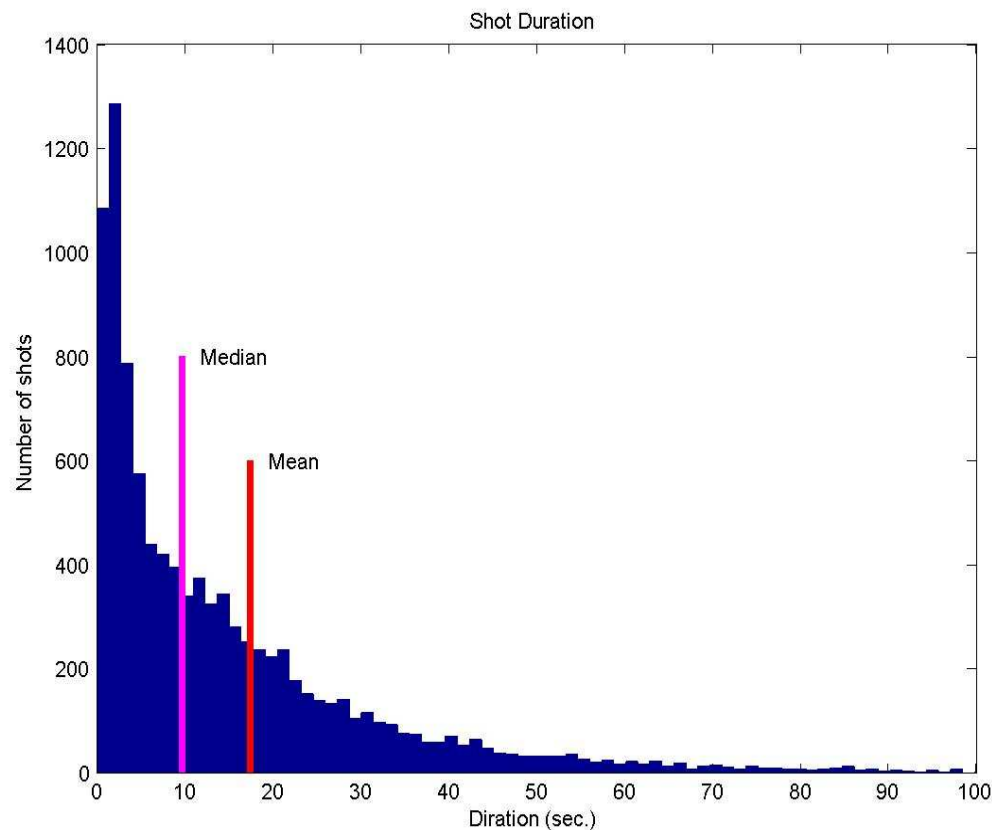
- Rushes are raw footage ...
 - with a promise to turn into golden nuggets of stockshots
- BBC Rushes: 49.3 hours
 - 4 issues of “Summer Holiday” (~ 2 hours)
 - BBC One News (30’) + fragment (~3’)
- Statistics: clip level
 - 615 clips (308 development + 307 test sets)
 - Duration (mm:ss) :
 - » Minimal / Maximal - 00:03.48 / 47:11
 - » Mean / Median – 04:49 / 02:25
 - » Std - 06:02.73
 - Keywords:
 - » Different keywords / Occurrences – 1036 / 4908
 - » Mean / Median – 7.98 / 7
 - » Minimal / Maximal – 0 / 34

BBC Rushes: data statistics - 2



BBC Rushes: data statistics - 3

- Statistics: shot level



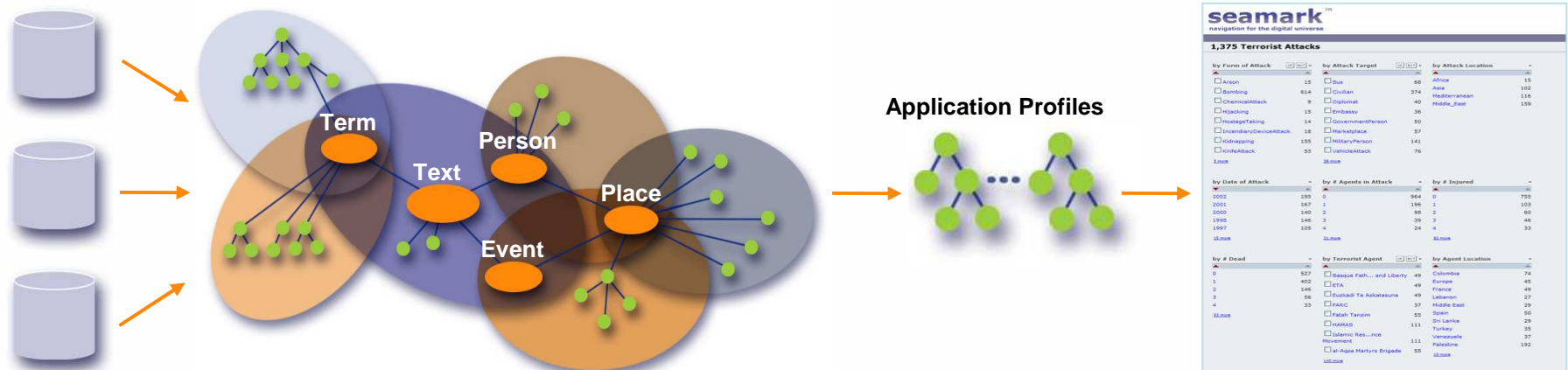
- Number of shots 10,064
- Shot duration (mm:ss)
 - » Minimal - 0:00.04
 - » Maximal – 22:45.16
 - » Mean – 0:17.51
 - » Median – 0:09.74
 - » Std - 0:33.97
- Number of key frames
 - » Total: 39,132
 - » Median per shot: 2
 - » Mean per shot: 3.8
 - » Maximal: 377
 - » Minimal: 1



Faceted navigation

- *Facets* are metadata properties whose ranges form a near-orthogonal set of controlled vocabularies
 - Creator: “Dickens, Charles”
 - Subject: Arsenic, Antimony
 - Location: World > U.S. > California > Venice
- Facets form a frame of reference for information overview, access and discovery
 - Other properties serve as landmarks and cues
- *Faceted navigation* uses facets to provide end user access and discovery in the context of large collections of semi-structured information
 - Providing end user with scope and context directly

Building faceted navigation applications



Metadata is aggregated...

... then represented as instances of concepts in ontologies and tagged using controlled vocabularies...

... then application profiles are created...

... that define navigation services for user applications



Faceted navigation built using SW standards

- Define/reuse ontologies expressed in RDF(S)/OWL
 - Classes for defining instances and controlled vocabularies
 - Properties for facets and additional asset metadata attributes
- Import/transform aggregated instance metadata into an RDF representation
 - Resources referred to via URIs
 - Content and controlled vocabularies
- Write application profiles in terms of RDF



BBC Rushes: representation

- Ontologies
 - RDFS, Dublin Core, SKOS
- Controlled vocabularies
 - TGM-1 (reflecting LSCOM Lite facets), ISO8601 (temporal hierarchy of dates)
- Instances
 - `trecvid:Shot`, `trecvid:Clip`
- Application profile
 - Retrieve instances of type `trecvid:Shot`
 - Textual facets: `dc:title` (clip title), `dc:subject` (keywords), `dc:creator` (director), `dcterms:created` (production date), `dcterms:issued` (show date), `dc:extent` (duration)
 - Visual facets: `dc:subject` with values `skos:narrower` than `trecvid:color`, `trecvid:texture` and `trecvid:colorplustexture`

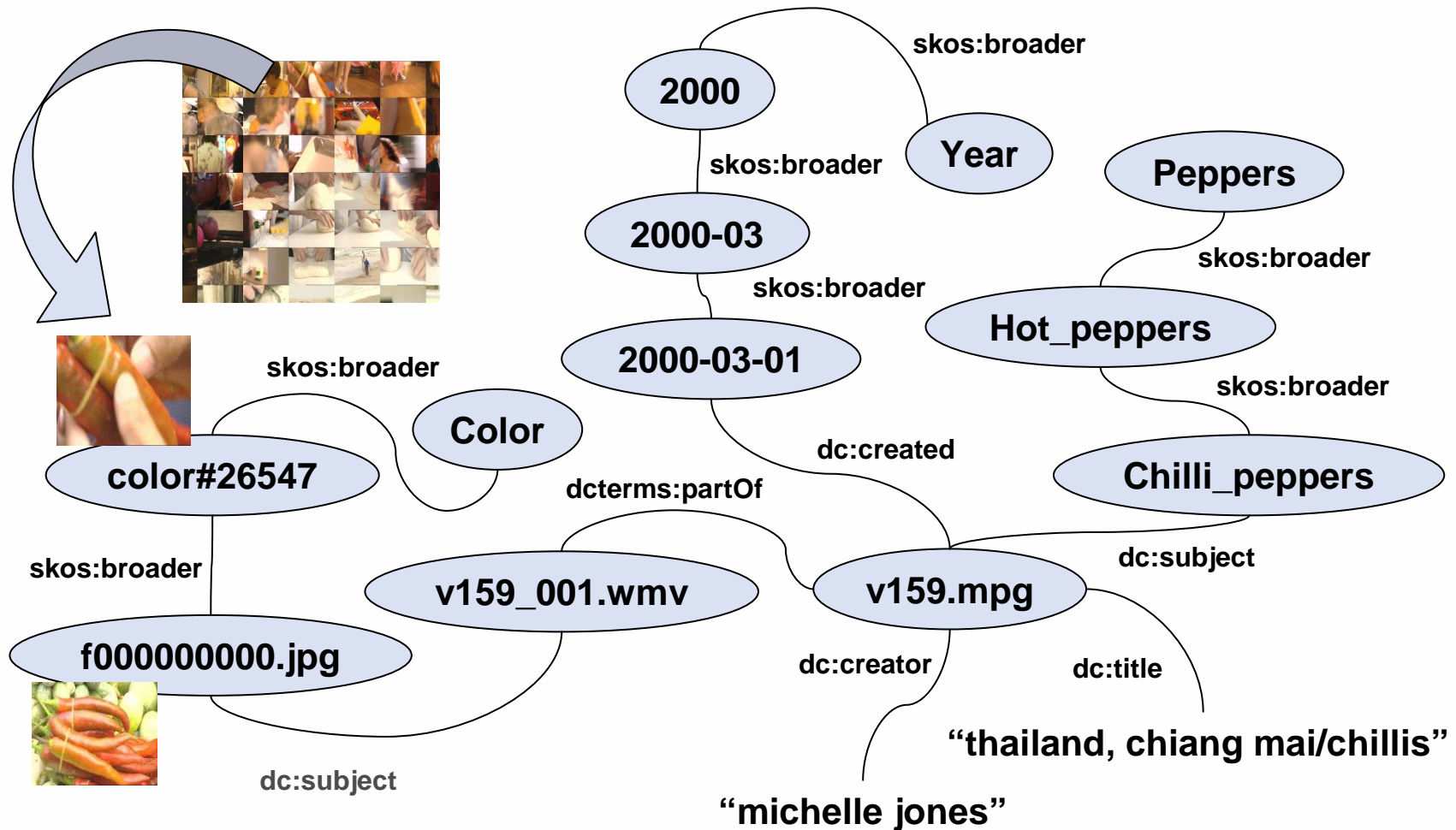


BBC Rushes: visual facets



- Facets: color, texture, [shape] + combinations
 - Color, texture, color+texture
- To build facets
 - Extract features (MPEG-7):
 - Color: dominantColor, colorStructure, colorLayout
 - Texture: edgeHistogram, homogenousTexture
 - SOM Clustering of keyframes
 - Select as a visual “word” the closest keyframe to node centroid
 - Represent keyframes as SKOS concepts, centroids as skos:broader of cluster members
- Example:
 - SOM for color 35x28

BBC Rushes: RDF subgraph





BBC Rushes: RDF/XML serialization

```
<trcvid:Clip rdf:about="http://swvideo.techlabs.accenture.com/v159.mpg">
  <rdf:type rdf:resource="&dctype;MovingImage" />
  <dc:title>thailand, chiang mai/chillis</dc:title>
  <dcterms:extent>202200</dcterms:extent>
  <dc:creator>michelle jones</dc:creator>
  <dc:identifier>mrs320354</dc:identifier>
  <dcterms:created rdf:resource="tag:siderean.com,1752-09-14:2000-03-01" />
  <dcterms:issued rdf:resource="tag:siderean.com,1752-09-14:2000-07-18" />
  <dc:subject rdf:resource="&trcvid;thailand" />
  <dc:subject rdf:resource="&trcvid;chiang_mai" />
  <dc:subject rdf:resource="&trcvid;chillis" />
  <dc:subject rdf:resource="&tgm1;Peppers" />
  <dc:subject rdf:resource="&trcvid;chilli_peppers" />
  <dc:subject rdf:resource="&tgm1;Vegetables" />
  <dc:subject rdf:resource="&tgm1;Markets" />
  <dc:subject rdf:resource="&trcvid;street_markets" />
  <dc:subject rdf:resource="&trcvid;food_markets" />
  <dc:subject rdf:resource="&tgm1;Food" />
  <dc:subject rdf:resource="&tgm1;Herbs" />
  <dc:relation>http://swvideo.techlabs.accenture.com/v159.fset/f000000000.jpg</dc:relation>
</trcvid:Clip>
```

```
<skos:Concept rdf:about="&trcvid;chilli_peppers">
  <skos:broader rdf:resource="&tgm1;Hot_peppers" />
  <skos:prefLabel>chilli peppers</skos:prefLabel>
</skos:Concept>
```

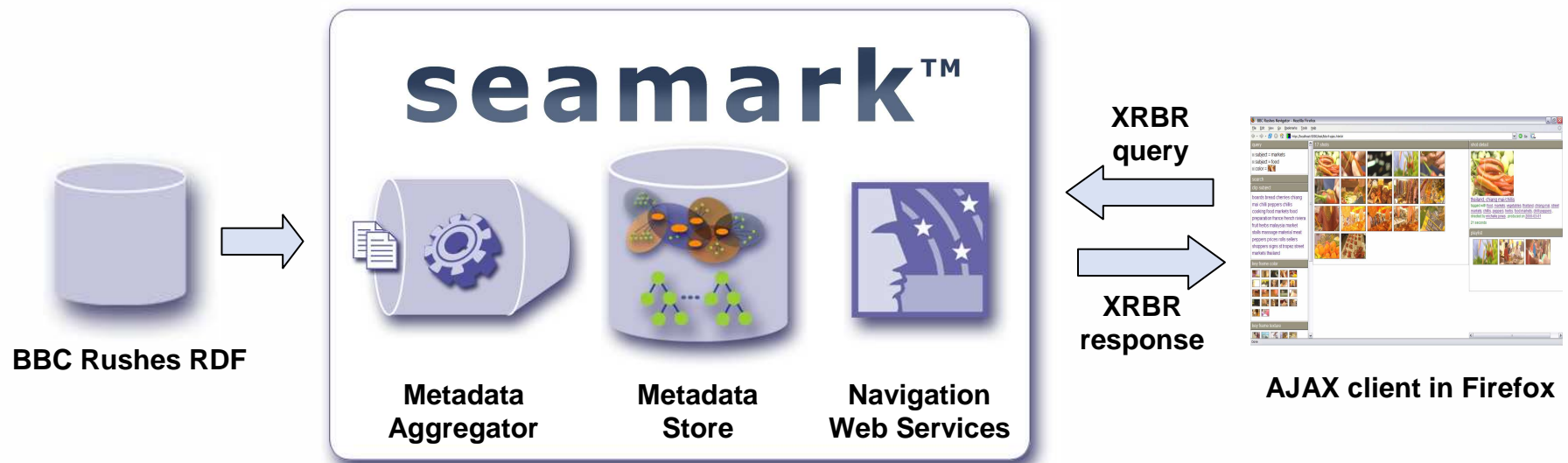
```
<skos:Concept rdf:about="tag:siderean.com,1752-09-14:2000-03-01">
  <skos:prefLabel>2000-03-01</skos:prefLabel>
  <skos:broader rdf:resource="tag:siderean.com,1752-09-14:2000-03-01">
</skos:Concept>
```

```
<trcvid:Shot rdf:about="http://swvideo.techlabs.accenture.com/shotsWMV/v159_001.wmv">
  <rdf:type rdf:resource="&dctype;MovingImage" />
  <dcterms:isPartOf rdf:resource="http://swvideo.techlabs.accenture.com/v159.mpg" />
  <dcterms:extent>21000</dcterms:extent>
  <dc:relation>http://swvideo.techlabs.accenture.com/v159.fset/f000000000.jpg</dc:relation>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000000000.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000000240.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000000280.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000001440.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000003120.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000005440.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000009680.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000011520.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000012040.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000013800.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000014800.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000015120.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000016760.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000018280.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000019360.jpg"/>
  <dc:subject rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000021000.jpg"/>
</trcvid:Shot>
```

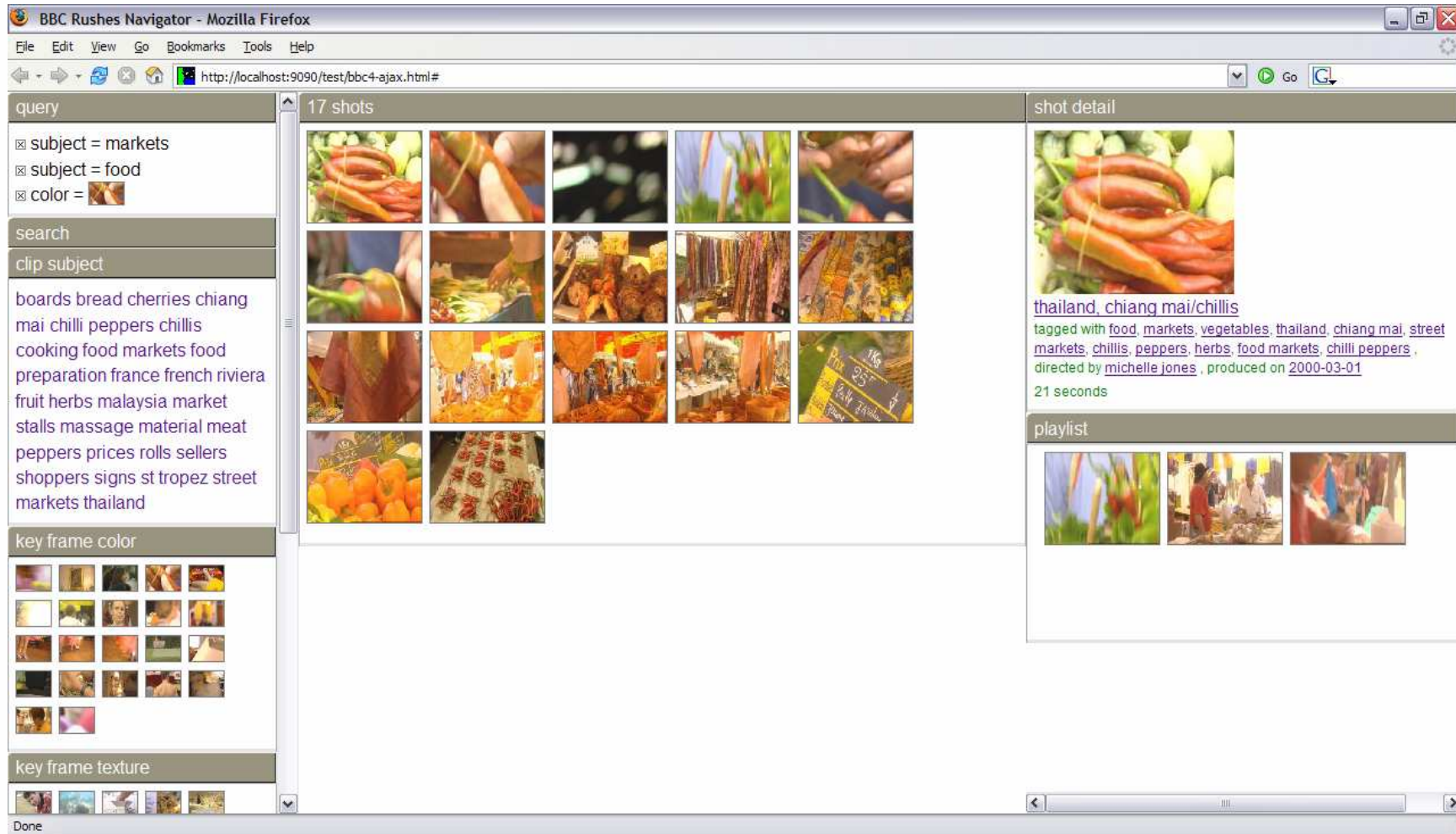
```
<skos:Concept rdf:about="http://swvideo.techlabs.accenture.com/v159.fset/f000000000.jpg">
  <skos:broader rdf:resource="http://swvideo.techlabs.accenture.com/color#26547" />
  <skos:prefSymbol rdf:resource="http://swvideo.techlabs.accenture.com/v159.fset/f000000000.jpg" />
</skos:Concept>
```

```
<skos:Concept rdf:about="http://swvideo.techlabs.accenture.com/color#26547">
  <skos:broader rdf:resource="&trcvid;color" />
  <skos:prefSymbol rdf:resource="http://swvideo.techlabs.accenture.com/v289.fset/f000048880.jpg" />
</skos:Concept>
```


BBC Rushes Navigator: architecture



BBC Rushes Navigator: user interface





Future work

- More facets
 - Shape + combinations
 - Geographical location
- More Interfaces
 - Map of the world for browsing places
 - Hierarchy of SOM for browsing clips and shots
- More Tools
 - Tagging tool for creating and managing metadata
 - Tools for creating video databases (shot extraction, feature extraction, clustering, classification of events, etc.)
 - Tools for creating audio-video compositions (TV programs, commercials, etc.)





Recommendations

- To bi(-sect) or not?
 - Development / Test sets
- Video database management
 - From shot extraction to semantic classification
 - Mining for stockshots
 - Interesting shots detection
 - New shots classification
 - Usage statistics
- Search for
 - Geographical location
 - Concrete concept (boat, fish, etc.)
 - Abstract concept (serenity, dance, etc.)
- Effectiveness and Usability
 - Interactive query model: fit of faceted navigation
 - Role of tagging in exploration