Trajectware - Timeline-Based Navigation across Computing Heritage

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FOSDEM 22 – Retrocomputing – February 5 (online)
Context – NAM-IP Computer Museum

• Located in Namur/Belgium - 30’ from Brussels (worth a visit when FOSDEM is back at ULB or if you come in Belgium!)
• Missions:
  • Preservation: safeguarding digital heritage, focus on local pioneers
  • Acquisition of artefacts, enriching collections
  • Exhibitions: for all, specific animation, permanent/temporary
  • Research: about machines, software, communities
• “Container design”, an historical parallel

www.nam-ip.be
Our problem – Providing Support for Exhibition

• Physical experience provided by an exhibition is great
  • Real hardware (outside/inside), possibly running (on emulator), advertisements
  • Scenography = immersion, grouping/sequencing to make sense, common thread,...

• But limited by physical media!
  • Explanatory poster = a selected viewpoint
  • Limited space = limited level of detail
  • Accessibility (FR/NL/EN need):
    • either one language for posters/video (subtitling)
    • or devote space/poster)/time (video)

➔ Idea to complement physical experience with an “digital experience”
  • Mobile application: easy to deploy and use
  • More detailed content: pictures, videos, off-line or online, multiple languages
  • Dynamic perspective: discover make your own connections
    • across artefacts, themes, actors,...
  • Could be used before/during/after physical experience
    → requires links with physical experience (especially in “during” case)
  • Beyond this support to visits : could be used as learning/research tool
Why Selecting a Timeline Approach?

- In our case... timelines are everywhere (explicitly or implicitly)
  - Chronological sequencing of the exhibition
  - Main thread = co-emergence and cross-fertilisation of user interfaces and micro-computers
  - Many posters with milestones: GUI, games, Moore’s law...
  - Panel with major CPU

- More views, more connections possible/interesting!
- Probably also valid for other (technological) museums
Process

• Understanding the need [done]

• Understanding what to capture/structure
  ➔ conceptual modelling, ontologies

• Front-end focus, all-in-one off-line app
  ➔ delivery need for temporary exhibition: multilingual, available content
  ➔ generalisation in mind

• Elaboration phase
  ➔ internal linking (automated)
  ➔ more elaborated navigation scenarios
  ➔ back-end extraction, on-line mode, Open API design

• Next steps...
(Meta-)Models /Ontologies of Historical Concepts

SEM

DOLCE

CPT

SHO

dBpedia
Our (inspired) modelling framework

• Timeline first class concept
• Rely on Endurant/Perdurant (stereotype)
• Generic « tagging » for extensibility
• Multiple aggregation levels on time/actors/artefacts
• App to Physical mapping: id, location, picture
All-in-one Off-line Application

• Selecting an Open-Source Framework:
  • Criteria:
    • cross-platform
    • scalability
    • Learnability
    • component Library
    • Perennity
    • Internationalisation
  • Candidates:
    • Flutter (Dart)
    • React-Native (js)
    • Ionic/angular (js)
    • Solar2D (Lua)

• Might evolve later (back-end ➔ multiple front-ends)
Architecture

- Page instances
  - Intro
  - Timeline
  - Video mngr
  - Quiz
  - ...

- Components:
  - timeline
  - details
  - video
  - quiz/question
  - QR-code
  - database
  - ...

- Management scripts
  - Translation
  - Internal linking (automatic keyword aliasing)
    e.g. “first Macintosh” = “Macintosh 128K”
Feedback on the Current Application

• Good points
  • Very nice experience and user feedback
  • Resource bundling/translation process quite easy
  • Very good scalability (efficient state update, lazy loading...)
    → large timeline tested

• Known issues
  • Off-line mode not great in React-Native
    • Reading a local HTML page mostly “statically linked” to resource via tables
      required some ad-hoc solution (page template)
    • Loading a sqlite DB locally requires some web library
      actually requiring an (unnecessary) WIFI connection!
  • Expo Go
    • Great for testing but sometimes requires cache clearing/refresh
    • Not all libraries will work
  • Large footprint of “all-in-one” solution (200 MB)
  • Static relational schema
Elaboration – Dynamic On-line Backend

• Access to heavy resources: high resolution pictures, videos
• Access to dynamic timeline, through queries on conceptual resources:
  • actor(s) at different granularity levels:
    • life of a person (e.g. Clive Sinclair)
    • evolution of a group (FSF)
    • or a company (Commodore International)
  • object(s), at different granularity levels:
    • precise history of a specific object (e.g. the design of the LISA computer)
    • family of object w.r.t. specific criteria, micro-computers of a specific period, manufacturer, using a specific CPU,…
  • temporal, spatial or thematic contexts respectively through
    • Event (dates)
    • Location
    • Tag characteristics.
Open API Design ➔ on-going implementation
Elaboration – Flexible Navigation Front-end

- Idea: allow to “jump” from one timeline to another (like switching metro)

- E.g. micro → Amiga 500 → OS context → Commodore context

- “Pivoting” operation on
  - event pivoting between related entities or features e.g. see above
  - time zoom in/out based on a defined period e.g. micro computers → “early phase”
  - actor zoom in/out, from person level to company e.g. Clive Sinclair → Sinclair Research
  - object zoom in/out e.g. down to version level and up to product family
  - relations inclusion, possibly iterative/closure e.g. to look for event causes/consequences
  - combining multiple timelines, either merged or keeping them visually separated (+ synergies) e.g. GUI // micro-computers
Elaboration - Tentative Information Extraction

- Query using SPARQL on OpenLink Virtuoso (DBPedia endpoint)

```sparql
SELECT DISTINCT ?date ?name (GROUP_CONCAT(DISTINCT ?founder; SEPARATOR=", ") AS ?founders)
WHERE {
  ?company foaf:name ?name.
  ?company dbo:industry dbr:Computer_hardware.
  ?company dbo:foundingYear ?date.
  ?company dbo:abstract ?abstract
  FILTER langMatches(lang(?abstract),'en')
  FILTER(?date >= "19750101"^^xsd:date)
}
ORDER BY ASC(?date)
```

- Results

<table>
<thead>
<tr>
<th>date</th>
<th>name</th>
<th>founders</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;1979&quot;</td>
<td>&quot;Convergent Technologies&quot;</td>
<td><a href="http://dbpedia.org/resource/Allen_Michels">http://dbpedia.org/resource/Allen_Michels</a></td>
</tr>
</tbody>
</table>
To Conclude

• Timeline concept rich to support museum guide
  • Good feedback on our current exhibition
  • Plan to extend it to permanent exhibition

• Concept might be generalised
  • other museums, although underlying ontology focused to “technological” museum
  • research/learning purposes

• Try it, give feedback / ideas / contributions welcome !
  • https://github.com/NAMIP-Computer-Museum/guideApp
  • christophe.ponsard@gmail.com

• Also try the Quiz (sorry in French, not yet translated)
  but questions to be generated from knowledge base soon ;-)