Managing digital collections: the scalability factor

Scalable Preservation and Archiving Repository (SPAR)
Agenda

• Digital collections in the library
• Size of the problem
• Scalability in processes
• Scalability in storage
Missions of the library

Missions:
– to build up the collections,
– to preserve and communicate them to the public,
– to produce a reference catalog,
– to cooperate with other institutions,
– to participate to research programs.

Legal deposit:
– legal deposit since 1537 for printed materials
– 1648: engravings and maps
– 1793: musical scores
– 1925: photos
– 1938: phonograms
– 1975: videograms
– 2006: Web legal deposit
Variety of the collections
Digital archiving at BnF
Decomposition in channels

- To deal with the variability and heterogeneity of the data, definition of **channels**
- build on the relation between the digital objects and the archival system, independently of any given organization:
  - Preservation digitization
  - Audiovisual material
  - Negotiated legal deposit (dark Web, regional press)
  - **Automatic legal deposit (web harvests)**
  - Administrative production
  - Deposit / Third party archiving
  - Acquisition / Donation
Strategies for web harvesting

Bulk large harvests:
- annual
- .fr domain
- partnership with AFNIC

Focused crawls:
- linked to a particular event or a subject

Ongoing harvests:
- during all the year
- news or reference sites

One year

number of sites
Agenda

• Digital collections in the library

• Size of the problem
  – Digitized content
  – Web archives
  – Preserved collections

• Scalability in processes
• Scalability in storage
Volume & growth of the digitization (1)
Volume & growth of the digitization (2)

- Number of documents per kind of material
Volume & growth of web archiving (1/2)
Volume & growth of web archiving (2/2)

Full harvests

Number of URLs

2010 2011

Size in TB

30,00 31,00 32,00 33,00 34,00 35,00 36,00 37,00 38,00

0 200 000 000 400 000 000 600 000 000 800 000 000 1 000 000 000 1 200 000 000

(BnF)
Volume & growth of the preserved collections (1/2)
Volume & growth of the preserved collections (2/2)

Cumulative package
Cumulative Size (TB)
Agenda

• Digital collections in the library
• Size of the problem
• Scalability in processes
  ▶ Digitized content
  ▶ Web archives
  ▶ Preserved collections
• Scalability in storage
Handling growth in flow

• Choose the right level of granularity
• Each digital “document” is handled by standalone workflows
• To scale: addition of new instances to be able to handle more workflows
Digitization QA workflow

- jBPM workflow:
  - one conductor
  - multiples musicians

1 conductor server
(CentOS release 5.4 – Quadri-proc – 8 GB RAM)

12 musician servers
(CentOS release 5.4 – Quadri-proc – 8 GB RAM)
Manage the workflow

<table>
<thead>
<tr>
<th>Document</th>
<th>Process 1</th>
<th>Etat</th>
<th>Cause</th>
<th>Machine</th>
<th>Dernière activité</th>
<th>Démarré</th>
<th># passage</th>
<th>Code prestation</th>
</tr>
</thead>
<tbody>
<tr>
<td>6200560</td>
<td>618152</td>
<td>Document à transmettre prêt à archiver</td>
<td>lundi 26 mars 2012 15:35:53</td>
<td>lundi 26 mars 2012 15:26:45</td>
<td>3</td>
<td>101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6200416</td>
<td>618151</td>
<td>Document invalide</td>
<td>lundi 26 mars 2012 15:41:49</td>
<td>lundi 26 mars 2012 15:26:45</td>
<td>1</td>
<td>101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6200569</td>
<td>618150</td>
<td>Document à transmettre prêt à archiver</td>
<td>lundi 26 mars 2012 15:07:40</td>
<td>lundi 26 mars 2012 15:26:43</td>
<td>2</td>
<td>101</td>
<td></td>
<td></td>
</tr>
<tr>
<td>620075</td>
<td>618137</td>
<td>Erreur système</td>
<td>jeudi 22 mars 2012 11:52:26</td>
<td>mercredi 21 mars 2012 16:08:17</td>
<td>10</td>
<td>597</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6200264</td>
<td>618110</td>
<td>Document à transmettre prêt à archiver</td>
<td>mardi 13 mars 2012 15:30:21</td>
<td>mardi 13 mars 2012 15:07:28</td>
<td>3</td>
<td>111</td>
<td></td>
<td></td>
</tr>
<tr>
<td>932921</td>
<td>618050</td>
<td>A statuer</td>
<td>mardi 13 mars 2012 09:59:13</td>
<td>lundi 13 février 2012 14:14:38</td>
<td>5</td>
<td>462</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1699461</td>
<td>618052</td>
<td>Document à transmettre prêt à archiver</td>
<td>mardi 13 mars 2012 15:44:08</td>
<td>mercredi 18 janvier 2012 10:24:23</td>
<td>3</td>
<td>100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

15 documents affichés sur 27, de 1 à 15. Page 1 sur 2. 0 documents sélectionnés.

15 lignes par page.
Web archiving

• Modular platform: virtualization of common needs
  – Harvesters
  – Indexers
  – Displayers
• Modular platform: adaptation for the different phases
  – Bulk automatic harvests
  – Focused crawls
Simplified application diagram

- Database
- GUI
- JobManager
- Broker
- Indexer
- viewerProxy
- PILOT
- Jobs
- CRAWLERS
- Storage array
- Internet

(BnF)
Flexible platform

- Flexibility: dynamically add/remove/move virtual machines
- Easily modify/adapt hardware configuration (e.g. add CPU)
- Optimization and pooling of hardware resources
- Centralised administration for managing and supervising our machines
- Easy increase of resources if needed (by adding one or more blade in the cluster)
- More reliable physical servers
- Some key machines can be even more secured with the “Fault tolerance” functionality
Preservation workflow

- Granularity at the archival package level: to allow for parallelization
- Each module is independent and interact with defined interfaces
- Every package follows the same workflow but specialized and driven by the requirements of the channel
Workflows driven by the SLA

- Which formats are allowed?
- What is the maximum size of a package?
- How copies are needed, in what kind of media?
- Do we need to log each access?

Ingest

Storage abstraction service

SIP
mets
AIP
AIP
DIP

rdf
rdf
Production platform for preservation
Agenda

- Digital collections in the library
- Size of the problem
- Scalability in processes

- Scalability in storage
  - Store digitized information for access
  - Store it for preservation
Scalability in storage

• Easy to expand
• Easy to migrate
• Interoperable
• Need for periodic audit with minimal disturbance
### Online storage for the digitized documents

<table>
<thead>
<tr>
<th>FNR</th>
<th>Full</th>
<th>CE NUM1</th>
<th>CE OLD</th>
<th>Nb fichiers</th>
<th>Plus ancienne VERIF</th>
<th>Dernier inventaire</th>
<th>Prochain inventaire</th>
<th>Fichiers à copier</th>
<th>Problèmes</th>
<th>Plus ancienne VERIF</th>
<th>Fichiers à copier</th>
</tr>
</thead>
<tbody>
<tr>
<td>FNR1</td>
<td>66%</td>
<td>408</td>
<td>0</td>
<td>21059969</td>
<td>19 M 5 h</td>
<td>3 M 28 j</td>
<td>1 M 8 j</td>
<td>80</td>
<td>0</td>
<td>5 M 29 j</td>
<td>96</td>
</tr>
<tr>
<td>FNR2</td>
<td>68%</td>
<td>198</td>
<td>0</td>
<td>21362307</td>
<td>17 M 24 j</td>
<td>3 M 28 j</td>
<td>1 M 27 j</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>148</td>
</tr>
<tr>
<td>FNR3</td>
<td>72%</td>
<td>148</td>
<td>0</td>
<td>23401101</td>
<td>19 M 24 j</td>
<td>3 M 28 j</td>
<td>29 j 12 h</td>
<td>0</td>
<td>0</td>
<td>5 M 25 j</td>
<td>578</td>
</tr>
<tr>
<td>FNR4</td>
<td>30%</td>
<td>211</td>
<td>0</td>
<td>5513622</td>
<td>5 M 29 j</td>
<td>3 M 28 j</td>
<td>1 M 3 j</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>2</td>
</tr>
<tr>
<td>FNR5</td>
<td>32%</td>
<td>113</td>
<td>0</td>
<td>9053352</td>
<td>17 M 16 j</td>
<td>3 M 28 j</td>
<td>1 M 9 j</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
<tr>
<td>FNR6</td>
<td>20%</td>
<td>310</td>
<td>0</td>
<td>5426859</td>
<td>5 M 29 j</td>
<td>3 M 28 j</td>
<td>2 M 5 j</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
<tr>
<td>FNR7</td>
<td>27%</td>
<td>163</td>
<td>0</td>
<td>7155961</td>
<td>16 M 19 j</td>
<td>3 M 28 j</td>
<td>27 j 12 h</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
<tr>
<td>FNR8</td>
<td>31%</td>
<td>181</td>
<td>0</td>
<td>9024343</td>
<td>17 M 4 j</td>
<td>3 M 28 j</td>
<td>2 M 19 j</td>
<td>0</td>
<td>0</td>
<td>6 M 0 m</td>
<td>0</td>
</tr>
<tr>
<td>FNR9</td>
<td>27%</td>
<td>184</td>
<td>0</td>
<td>4644819</td>
<td>6 M 0 m</td>
<td>3 M 28 j</td>
<td>2 M 1 j</td>
<td>0</td>
<td>0</td>
<td>6 M 0 m</td>
<td>0</td>
</tr>
<tr>
<td>FNR10</td>
<td>21%</td>
<td>118</td>
<td>0</td>
<td>6260302</td>
<td>7 M 3 j</td>
<td>3 M 28 j</td>
<td>1 M 7 j</td>
<td>73</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
<tr>
<td>FNR11</td>
<td>21%</td>
<td>18</td>
<td>0</td>
<td>3962909</td>
<td>5 M 29 j</td>
<td>3 M 28 j</td>
<td>9 j 14 h</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
<tr>
<td>FNR12</td>
<td>39%</td>
<td>18</td>
<td>0</td>
<td>5018758</td>
<td>5 M 29 j</td>
<td>3 M 28 j</td>
<td>1 M 6 h</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
<tr>
<td>FNR13</td>
<td>30%</td>
<td>201</td>
<td>0</td>
<td>6813921</td>
<td>15 M 28 j</td>
<td>3 M 28 j</td>
<td>2 M 8 j</td>
<td>0</td>
<td>0</td>
<td>6 M 0 m</td>
<td>0</td>
</tr>
<tr>
<td>FNR14</td>
<td>29%</td>
<td>179</td>
<td>0</td>
<td>5486295</td>
<td>6 M 0 m</td>
<td>3 M 28 j</td>
<td>9 j 21 h</td>
<td>28</td>
<td>0</td>
<td>6 M 0 m</td>
<td>28</td>
</tr>
<tr>
<td>FNR15</td>
<td>30%</td>
<td>84</td>
<td>0</td>
<td>7212667</td>
<td>16 M 9 j</td>
<td>3 M 28 j</td>
<td>2 M 1 j</td>
<td>1</td>
<td>0</td>
<td>5 M 1 m</td>
<td>0</td>
</tr>
<tr>
<td>FNR16</td>
<td>45%</td>
<td>102</td>
<td>0</td>
<td>6094976</td>
<td>5 M 29 j</td>
<td>3 M 28 j</td>
<td>28 j 21 h</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
<tr>
<td>FNR17</td>
<td>35%</td>
<td>104</td>
<td>0</td>
<td>9805022</td>
<td>20 M 20 j</td>
<td>3 M 28 j</td>
<td>2 M 24 j</td>
<td>54</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
<tr>
<td>FNR18</td>
<td>32%</td>
<td>107</td>
<td>0</td>
<td>6977813</td>
<td>6 M 20 j</td>
<td>3 M 28 j</td>
<td>1 M 7 j</td>
<td>256</td>
<td>0</td>
<td>6 M 1 m</td>
<td>0</td>
</tr>
<tr>
<td>FNR19</td>
<td>29%</td>
<td>373</td>
<td>0</td>
<td>5356391</td>
<td>5 M 29 j</td>
<td>3 M 28 j</td>
<td>2 M 20 j</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>3</td>
</tr>
<tr>
<td>FNR20</td>
<td>23%</td>
<td>144</td>
<td>0</td>
<td>4545912</td>
<td>5 M 29 j</td>
<td>3 M 28 j</td>
<td>1 M 14 j</td>
<td>62</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
<tr>
<td>FNR21</td>
<td>49%</td>
<td>116</td>
<td>0</td>
<td>9110230</td>
<td>17 M 1 j</td>
<td>3 M 28 j</td>
<td>2 M 24 j</td>
<td>0</td>
<td>0</td>
<td>6 M 0 m</td>
<td>416</td>
</tr>
<tr>
<td>FNR22</td>
<td>36%</td>
<td>97</td>
<td>0</td>
<td>10131236</td>
<td>16 M 18 j</td>
<td>156 M 19 j</td>
<td>2 M 19 j</td>
<td>0</td>
<td>0</td>
<td>5 M 29 j</td>
<td>0</td>
</tr>
</tbody>
</table>
Access through Gallica

Gallica offers
1,850,581 documents
382,414 books,
51,201 maps,
28,175 manuscripts,
527,921 images,
848,853 periodicals,
9,910 scores,
2,107 sound recordings,
including
91,924 from e-distributeurs,
135,528 from partner libraries

Gallica audience

(BnF)
Storage abstraction with storage units
Preservation in storage units

A storage unit is an abstract view of storage hardware that exhibits given characteristics

<table>
<thead>
<tr>
<th>Capsule</th>
<th>Statut</th>
<th>% occupation</th>
<th>Taille (octets)</th>
<th>Capacité (octets)</th>
<th>Nb enregistrements</th>
</tr>
</thead>
<tbody>
<tr>
<td>aip-ref</td>
<td>ONLINE</td>
<td>0</td>
<td>200 Mo</td>
<td>37 Go</td>
<td>213</td>
</tr>
<tr>
<td>capsAIP01</td>
<td>READONLY</td>
<td>0</td>
<td>46408 Go</td>
<td>46566 Go</td>
<td>149326</td>
</tr>
<tr>
<td>capsAIP02</td>
<td>READONLY</td>
<td>0</td>
<td>46553 Go</td>
<td>46566 Go</td>
<td>64441</td>
</tr>
<tr>
<td>capsAIP03</td>
<td>READONLY</td>
<td>0</td>
<td>46566 Go</td>
<td>46566 Go</td>
<td>43917</td>
</tr>
<tr>
<td>capsAIP04</td>
<td>READONLY</td>
<td>0</td>
<td>46566 Go</td>
<td>46566 Go</td>
<td>62668</td>
</tr>
<tr>
<td>capsAIP05</td>
<td>READONLY</td>
<td>0</td>
<td>46566 Go</td>
<td>46566 Go</td>
<td>58036</td>
</tr>
<tr>
<td>capsAIP06</td>
<td>READONLY</td>
<td>0</td>
<td>46566 Go</td>
<td>46566 Go</td>
<td>36447</td>
</tr>
<tr>
<td>capsAIP07</td>
<td>ONLINE</td>
<td>0</td>
<td>42857 Go</td>
<td>93132 Go</td>
<td>58199</td>
</tr>
<tr>
<td>capsAIP08</td>
<td>ONLINE</td>
<td>0</td>
<td>24 Mo</td>
<td>93132 Go</td>
<td>1</td>
</tr>
<tr>
<td>capsTA01</td>
<td>ONLINE</td>
<td>0</td>
<td>1 o</td>
<td>46566 Go</td>
<td>0</td>
</tr>
</tbody>
</table>
Preserved collection – year 2012

Occupation des capsules - by year

Nombre de AIP par capsule - by year
Conclusion

Ways to deal with scalability

- Separation of concerns
- Adaptation of the architecture: need for efficiency but still being flexible
- Choice of the right level of granularity
Thanks for your attention

Questions?

Thomas Ledoux
thomas.ledoux_AT_bnf.fr