Development of Accelerator Management Systems with GIS

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Outline

- What is GIS?
- Requirements to GIS for SPring-8
- MapServer framework
  - How it works.
- Two systems on MapServer.
  - Equipment location manager
  - Real-time alarm Display
- Conclusion
What is GIS?
From Wikipedia

Geographic Information System (GIS) is a system for creating, storing, analysing and managing spatial data and associated attributes.
Simply say
We wanted Google map for SPring-8.
**SPring-8**

- 4+1 accelerator complex
  - Injector linac
  - Injector synchrotron
  - 8GeV Storage ring.
  - 1.5GeV NewSUBARU
  - SCSS test accelerator
- New X-FEL – under construction
- 266VME CPUs
- 87 PLC's
- Distributed in 1km x 1km area.
SPring-8

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ICALEPCS 2005

- Evaluating the Potential of Commercial GIS for Accelerator Configuration Management
  
  T. Larrieu, Y. Roblin, K. White, R. Slominski
  
  Jefferson Lab, USA
We developed.
Development the application from hyperlink

Starting with different window size, style and language:

Manserver tree view

javascript:openFrames('1100#860#large:en,"")
Systems using GIS

- Equipment management linked to their location
  - Information integration with map.
    - Drawings
    - Maintenance history
    - Photos
    - ...
    - Access form web map.
- Real-time alarm display.
- X-FEL property management system
  - Under construction
Requirements

- Google map like interface – Of course!
  - Zooming, panning, multi-layer
- Web-based
  - No client application installation.
  - Access from everywhere.
- Open source framework
  - Not from scratch.
- Database cooperation.
MapServer

- De facto standard of open source Web based map system framework.
- Developed at University of Minnesota.
  - http://mapserver.gis.umn.edu/
  - Originally developed for forest resource management.
MapServer

- Open source.
- Developed in C.
- Multi data sources.
  - CAD data, image data, databases...
- Multi platform
  - Unix, Windows and Macintosh
- Multi front-end development languages
  - Web application using PHP, perl, java, python, .NET
MapServer

- Lack of many functions comparing to commercial GIS.
- But
- It is enough for our applications.
Two books on MapServer
How MapServer works.
Send http request

HTTP request → http server

- Web application frontend
- Map server
- MapFile

Vector data | Raster data | database | xml datafile
Http server calls MapServer as cgi script

http server

Web application front-end

map server

MapFile

Vector data

Raster data

database

xml datafile
MapServer integrates data with Mapfile

- http server
- Web application frontend
- map server
- map file
- Vector data
- Raster data
- database
- xml datafile
Generates a temporary image file
Output formats

- GIF
- JPEG
- PNG
- GDAL
- GML
- Flash
- PDF
MapFile
MapFile
MapFile

- Configuration file
  - Text file format
- Integrates data files and databases
  - Defines location of data in the map
  - Image size
  - Layer
  - Font
  - Color
  - etc.
Data sources

- Vector data
  - Shape file
  - CAD data (.dxf file converted to shape file)
- Database
  - PostgreSQL, Oracle
- Raster data
  - jpg, png, gif, GDAL, OGR
  - Remote WMS layers
- Information
  - Gxml (geographic XML)
Web application frontend
Web application frontrnd

http server

Web application frontend

map server

MapFile

Vector data

Raster data

database

xml datafile
APIs

- Python
- Perl
- PHP
- Java
- .NET
- C
- OpenGIS WMS, WFS, WCS, SOS
  - Open standard APIs
Implementations

- Ka-map
- CartoWEB3
- PrimaGIS
  - plone
  - p.mapper
p.mapper

- Framework written in PHP.
- Pan/zoom
- Reference map
- Query functions (identify, select, search)
- Print functions: HTML and PDF
- HTML legends
Accelerator management with MapServer

- P.mapper used as front-end.
- Two applications.
  - Equipment management for SPring-8
  - Real-time alarm display for SCSS test accelerator
- Under construction.
  - Property management for X-Ray FEL.
Equipment management for SPring-8

- Managing equipment data
  - Location
  - Attributes
    - Manufacturer
    - Production date
    - Production serial number
    - VME slot
    - Stored into a RDB (PostgreSQL)

- Multi layers
- User Generated Contents
- CAD data (.dxf) files are converted to a shape file format. (File or Database)
Functions
Database query and find location
Query on map and edit.
<table>
<thead>
<tr>
<th>Position Number</th>
<th>150</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location 1:</td>
<td>utozon B</td>
</tr>
<tr>
<td>Location 2:</td>
<td>位相調整室 B</td>
</tr>
<tr>
<td>Rack Name:</td>
<td>高周波系 B, 位相調整室-VME(1)</td>
</tr>
<tr>
<td>Description:</td>
<td>19インチ Rack, rfspha_b</td>
</tr>
</tbody>
</table>

- 登録機器数: 1
- 登録ID: 34
- 機器名: Media Converter
- メーカー: 不明
- i/f: 
- Speed: 100M
- 使用ポート数: 

---

Read mapserver.spring8.or.jp

![Map Image]

X: 443073, Y: 428620
## Edit Data NetMachine

**Home**

**InputObject**

**DB_OBJ NO 34**

<table>
<thead>
<tr>
<th>Item</th>
<th>DB data</th>
<th>Edit data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Point Name1</td>
<td>克里斯托内 B</td>
<td>克里斯托内 B</td>
</tr>
<tr>
<td>Point Name2</td>
<td>位相调整室 B</td>
<td>位相调整室 B</td>
</tr>
<tr>
<td>Rack Name</td>
<td>高周波系 B 位相调整室-VME(1)</td>
<td>高周波系 B 位相调整室-VME(1)</td>
</tr>
<tr>
<td>Maker</td>
<td>不明</td>
<td>不明</td>
</tr>
<tr>
<td>MachineName</td>
<td>Media Converter</td>
<td>Media</td>
</tr>
<tr>
<td>I/F</td>
<td>100M</td>
<td>100M</td>
</tr>
<tr>
<td>Speed</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Used_port</td>
<td></td>
<td></td>
</tr>
<tr>
<td>OTHER</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Your ID**

**Password**

[Submit] [Reset]

---

**Done**

**Apply on Layer NetworkRack2**

---

**X: 443073  Y: 428620**
DB登録番号 "797"

詳細データ
固有名前: R16
使用: VMEシャーシ
製造会社: リタール
インフォメーション: use
管理シリアル: R:52005031334
シール付き無し: sticker
製造番号: rkks06-0024
モデル番号: el3687302-058
生産年月日: 2005-03-13
登録者: 1372
履歴:
設置場所: BL02B2

Yasu_TEST_DB
Mapserver DB Viewer

Home  INPUT  test

BL02B2 VMEの使用状況

VME挿入カード詳細

<table>
<thead>
<tr>
<th>SLOT</th>
<th>カード名</th>
<th>送受信</th>
<th>管理ID</th>
<th>リンク</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>8001</td>
<td>cpu</td>
<td>239</td>
<td>詳細</td>
</tr>
<tr>
<td>2</td>
<td>3122</td>
<td>ai</td>
<td>172</td>
<td>詳細</td>
</tr>
<tr>
<td>3</td>
<td>2005</td>
<td>pmc</td>
<td>529</td>
<td>詳細</td>
</tr>
<tr>
<td>4</td>
<td>2005</td>
<td>pmc</td>
<td>530</td>
<td>詳細</td>
</tr>
<tr>
<td>5</td>
<td>2006</td>
<td>pmc</td>
<td>531</td>
<td>詳細</td>
</tr>
<tr>
<td>6</td>
<td>2005</td>
<td>pmc</td>
<td>532</td>
<td>詳細</td>
</tr>
<tr>
<td>7</td>
<td>2006</td>
<td>pmc</td>
<td>533</td>
<td>詳細</td>
</tr>
<tr>
<td>15</td>
<td>220</td>
<td>sram</td>
<td>719</td>
<td>詳細</td>
</tr>
</tbody>
</table>

VME挿入カード図

[Image of VME card diagram]
Add point from screen.
DBポイント登録番号 "213"

位置情報をキャッシュしました。以下の項目に必要な事項を入力してください。
Submitで登録完了します。

<table>
<thead>
<tr>
<th>選択した位置X</th>
<th>X=764987.4055</th>
</tr>
</thead>
<tbody>
<tr>
<td>選択した位置Y</td>
<td>Y=551003.1662</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>場所の登録名</th>
<th>test</th>
</tr>
</thead>
<tbody>
<tr>
<td>説明</td>
<td>test for ICALEPCS</td>
</tr>
<tr>
<td>Your ID</td>
<td>1372</td>
</tr>
<tr>
<td>Password</td>
<td>******</td>
</tr>
</tbody>
</table>

Submit  Reset
Alarm display for SCSS test accelerator
Equipment management for X-ray FEL.

- 700m length – linac+undulartors.
- Management system is under construction.
- Manage with 2-D barcode (QR-code).

50 digits in 1 cm x 1 cm label
• Location management

• Barcode on the floor or wall.
• 1m mesh
• Register location at the installation time.
Development

- About 1 man month to develop property location management system from zero.
  - Little knowledge of PHP.
  - Mostly spend to understand MapServer framework.
- About 1 week to develop alarm display.
- Little effort to convert Autocad .dxf to shapefile
  - Utility program – fGIS.
- Continuous effort of data entry.
Conclusion

- Geographic presentation of accelerator is very useful for property management.
- MapServer provides easy way to develop our own google map like system
- Framework development was easy.
- Data entry requires huge effort.
  - We hope user will generate their own data.