Development of Accelerator Management Systems with GIS

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SPring-8 Japan

International Conference on Accelerator and Large Experimental Physics Control Systems
ICALEPCS 2007
Oct. 17 2007 Knoxville, TN USA

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 acclererator 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 1kmx1km area.

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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.

ファイル(F) 編集(E) 表示(V) 履歴(S) ブックマーク(B) ツール(T) ヘルプ(H)
http://mapserver/plcmap/
Google
NET_WORK GRのための...
Firefox を使ってみよう
最新ニュース
Development the application from hyperlink
Starting with different window size, style and language:
Mapserver 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.

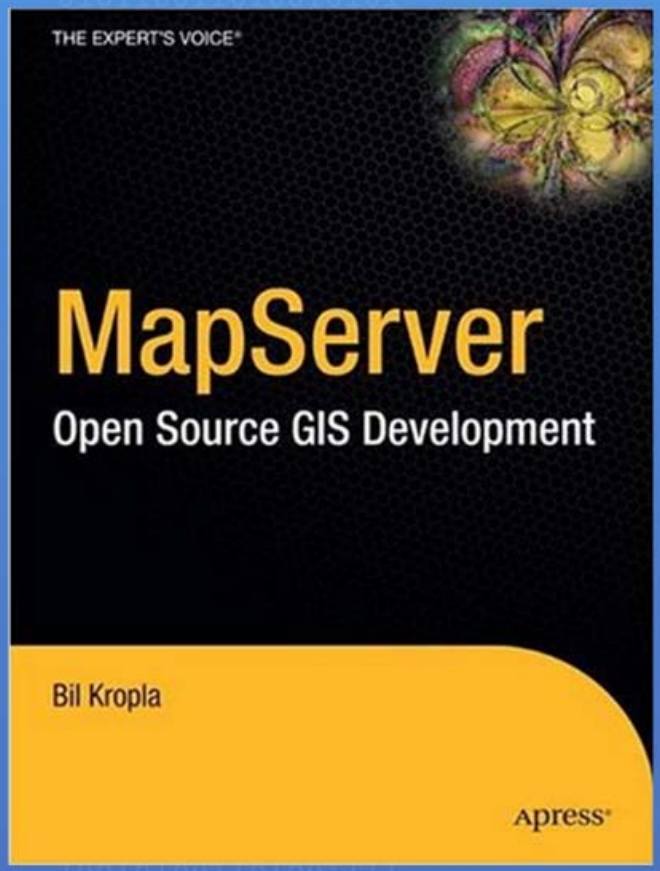
MapServer

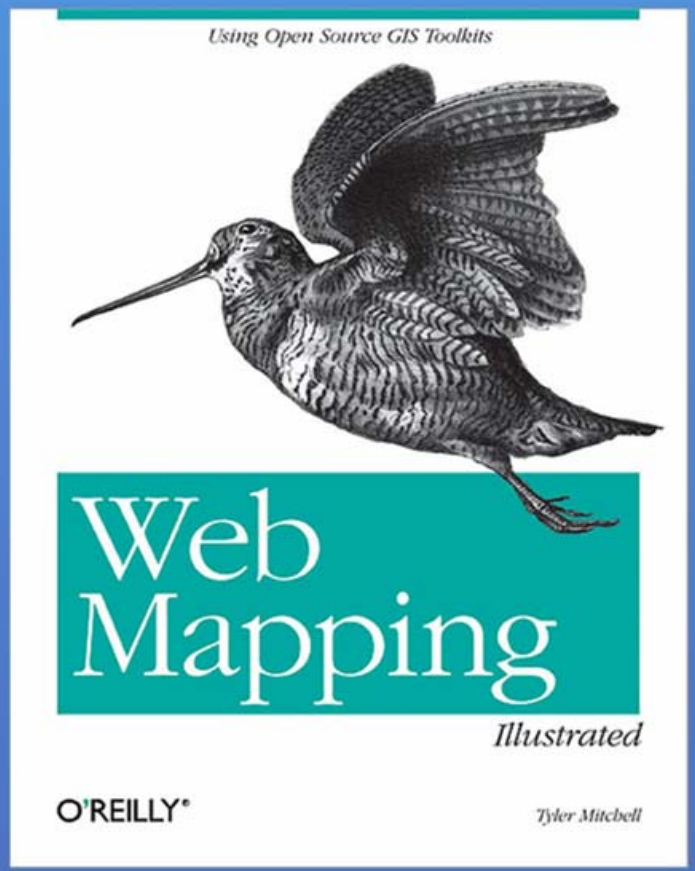
- Open source.
- Developed in C.
- Multi data sources.
  - CAD data, image data, databases...
- Multi platform
  - Unix, Windows and Macintosh
- Multi front-end development languages
  - Web application using PHP ,perl ,java ,python,.NET

MapServer

- Lack of many functions comparing to commercial GIS.
- But
- It is enough for our applications.

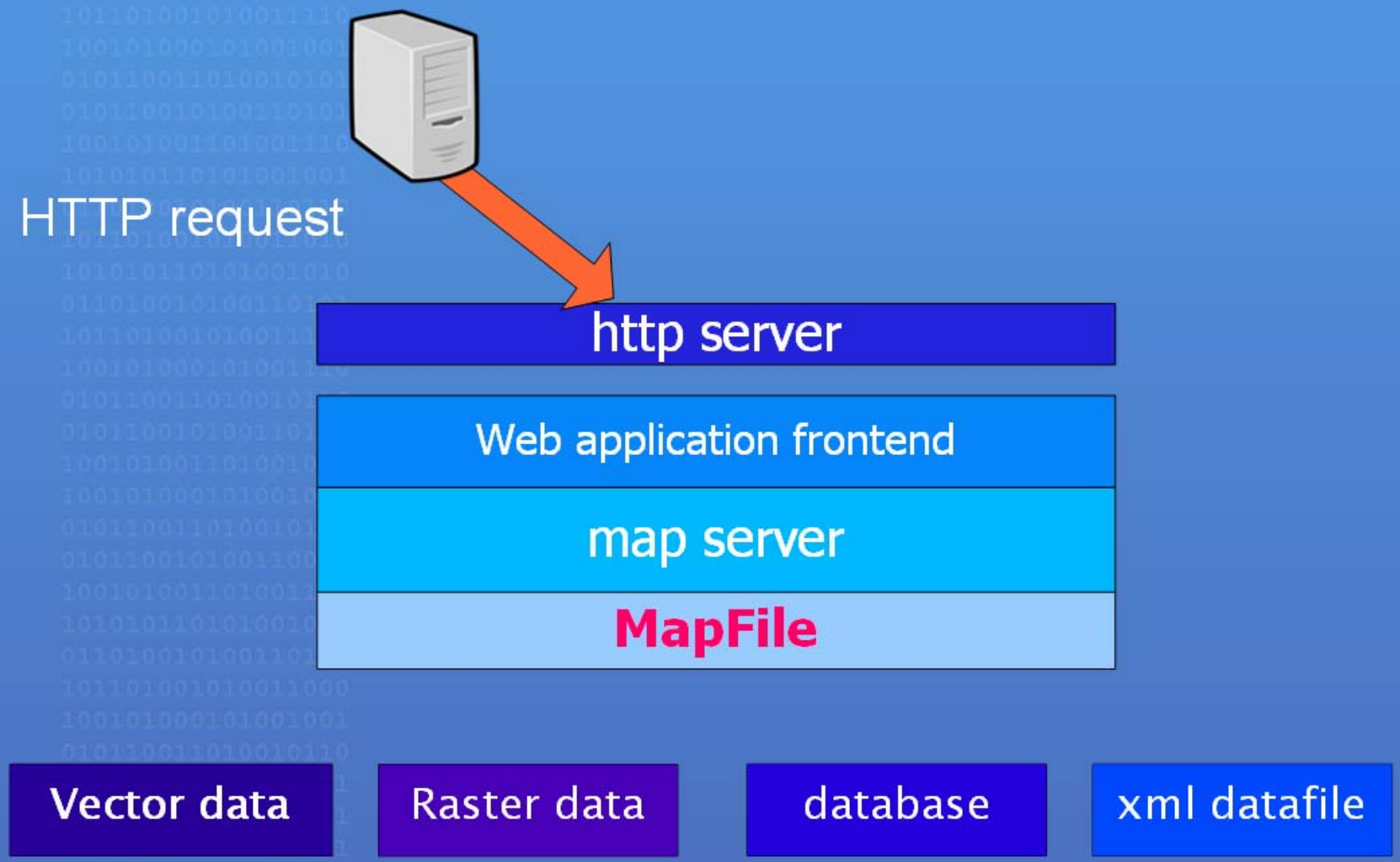
Two books on MapServer



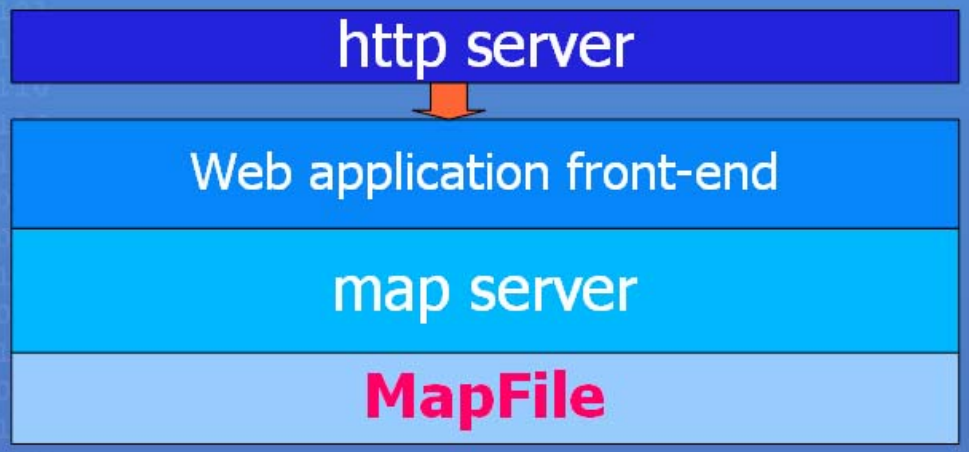


How MapServer works.

Send http request

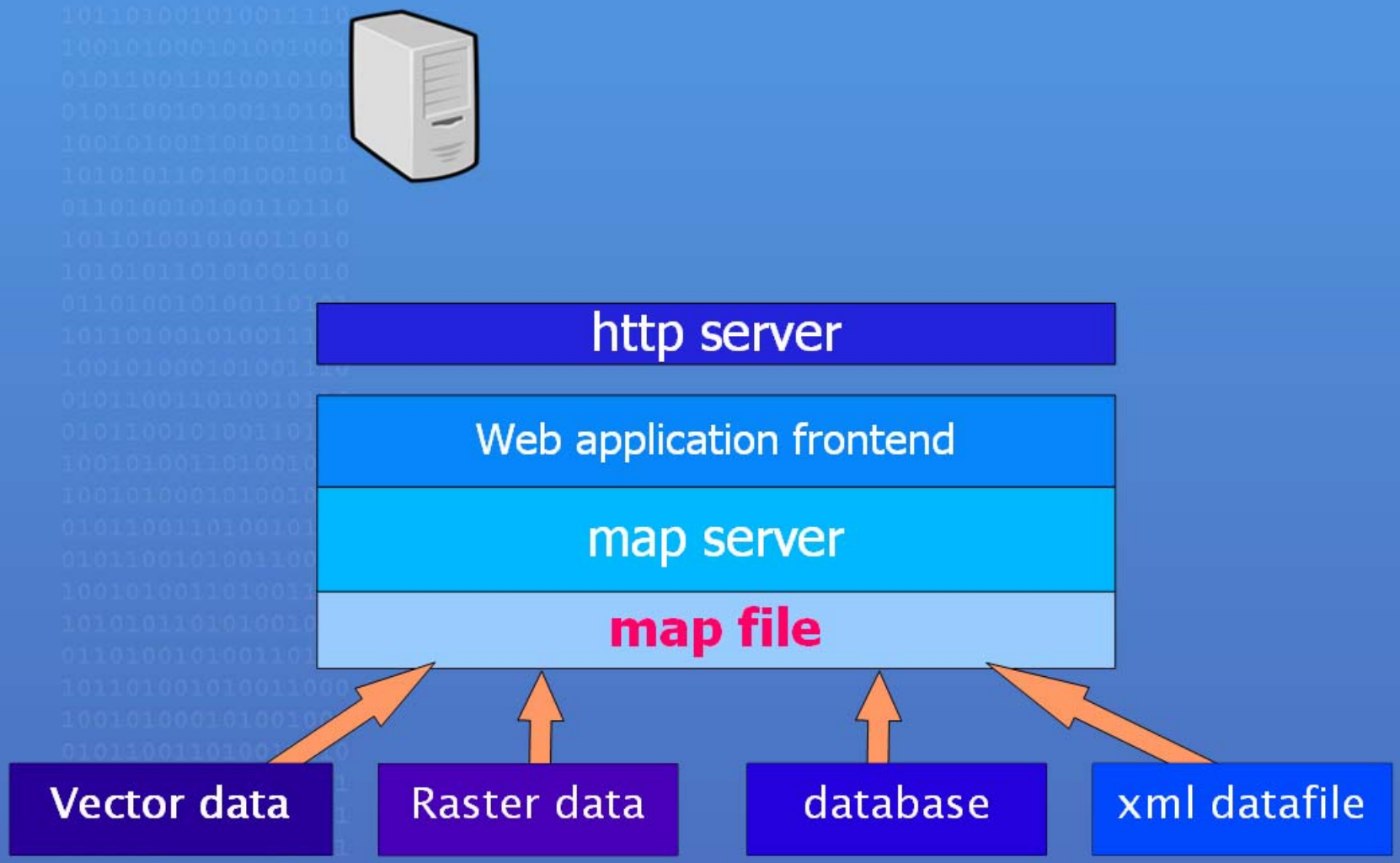


Http server calls MapServer as cgi script



Vector data | Raster data | database | xml datafile

MapServer integrates data with Mapfile



Generates a temporary image file

http server

Web application front-end

map server

MapFile

Vector data | Raster data | database | xml datafile

Output formats

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

MapFile

MapFile

http server

Web application frontend

map server

MapFile

Vector data | Raster data | database | xml datafile

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 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

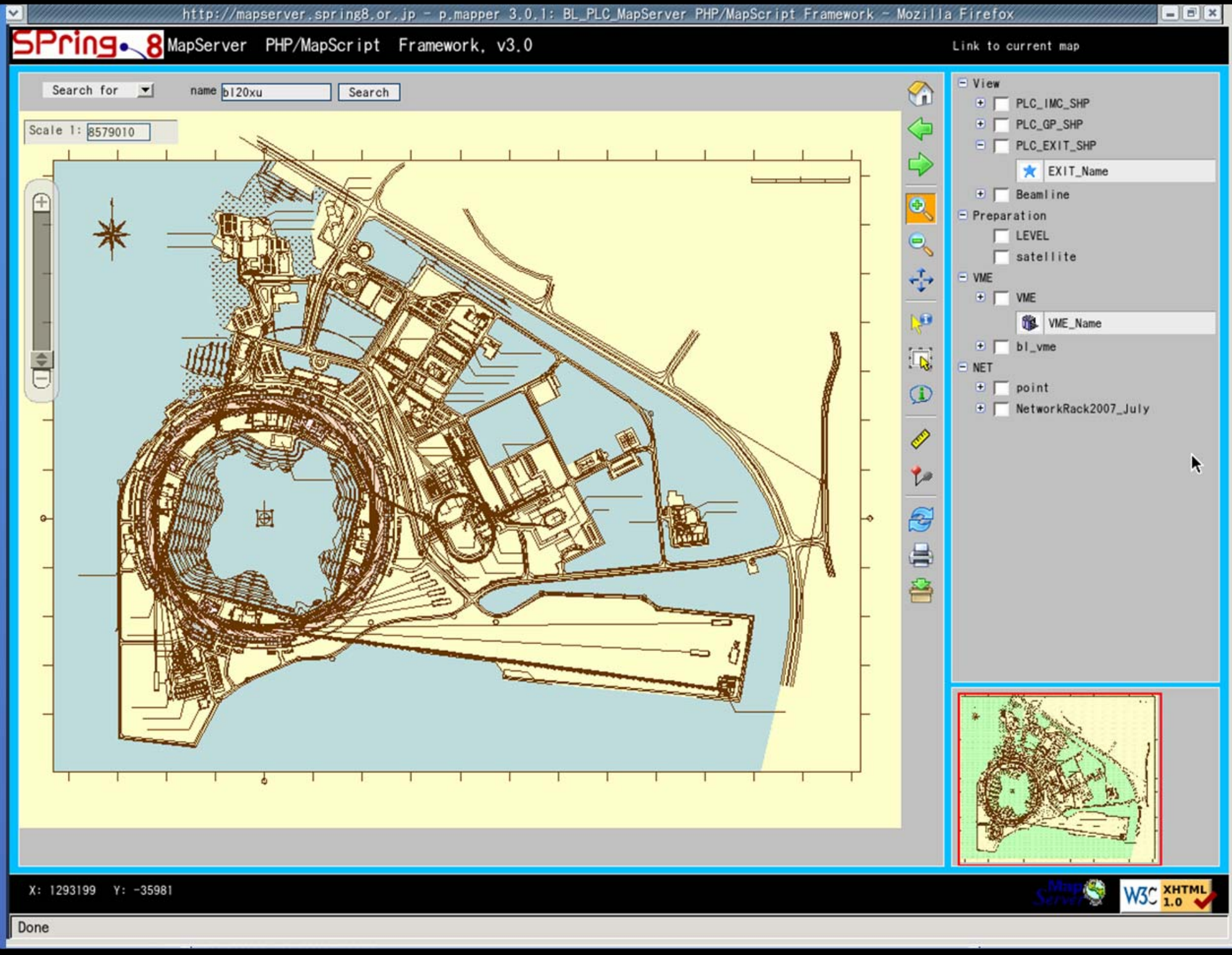
- P.mapper used as front-end.
- Two applications.
  - Equipment management for SPring-8
  - Real-time alarm display for SCSS test accelerator
- Under construction.
  - Property management for X-Ray FEL.

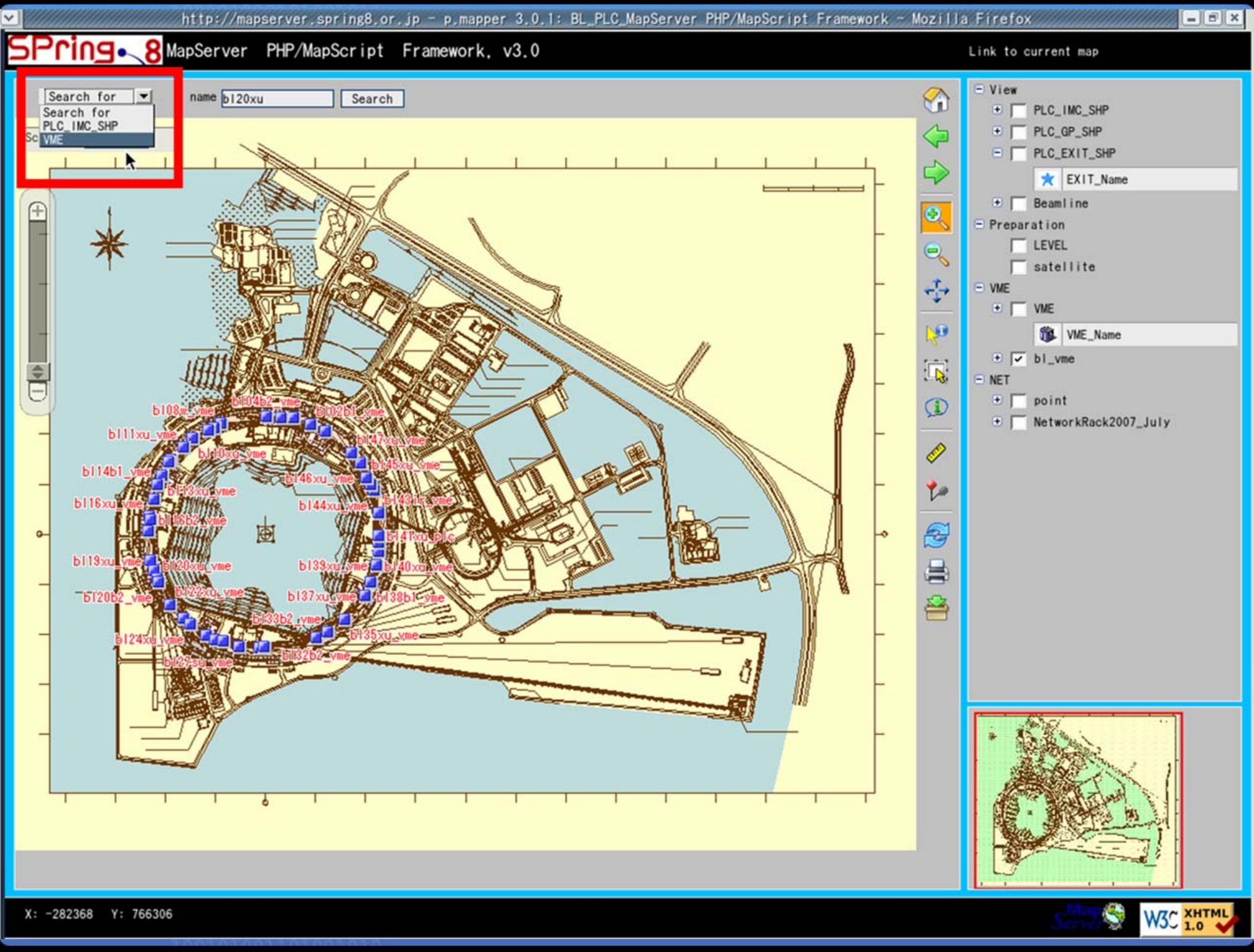
Equipment management for SPring-8

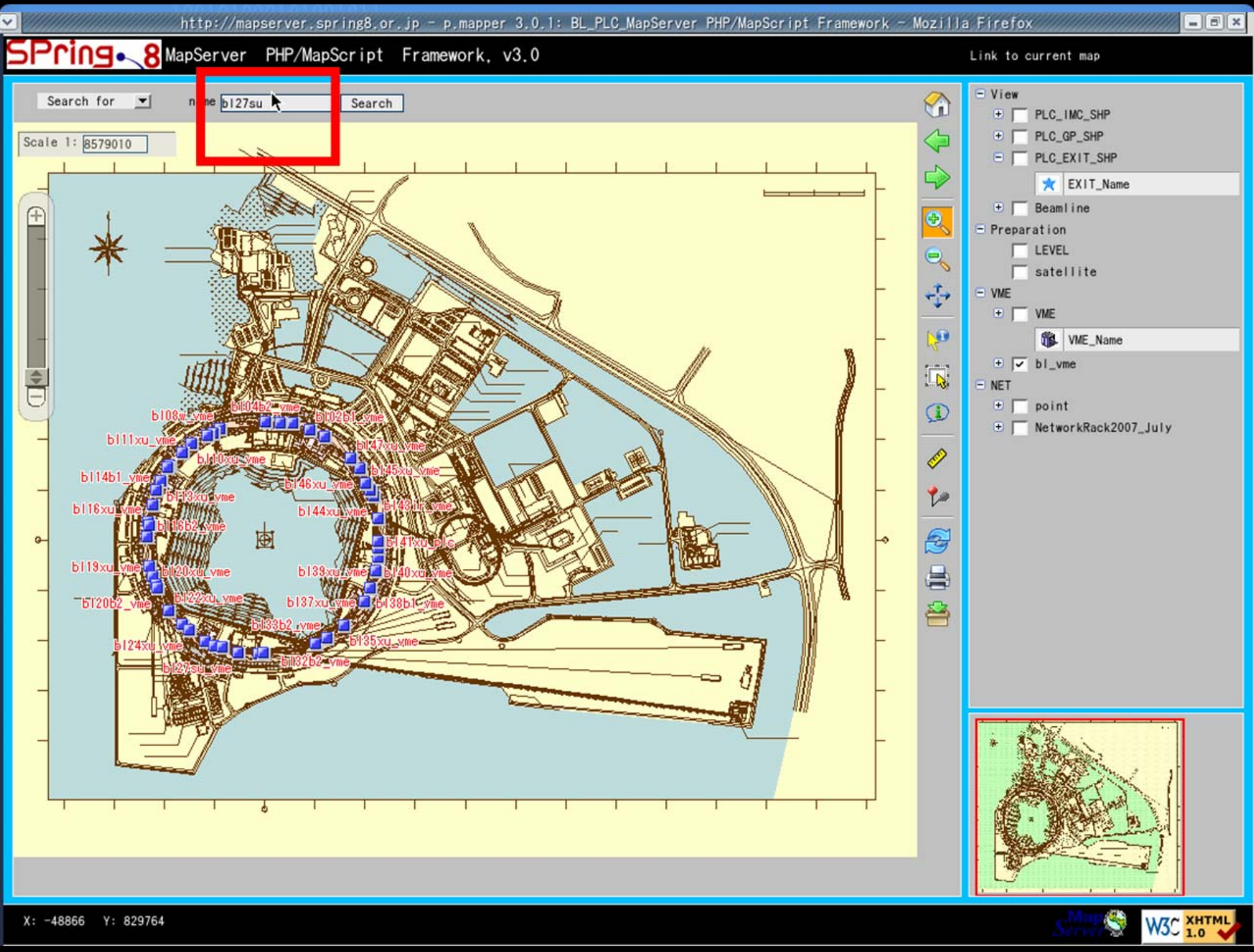
- Managing equipment data
  - Location
  - Attributes
    - Manufacturer
    - Production date
    - Production serial number
    - VME slot
    - Stored into a RDB (PostgreSQL)
- Multi layers
- User Generated Contents
- CAD data (.dxf) files are converted to a shape file format. (File or Database)

Functions

Database query and find location


http://mapserver.spring8.or.jp - p.mapper 3.0.1: BL_PLC_MapServer PHP/MapScript Framework - Mozilla Firefox
SPring-8
MapServer PHP/MapScript Framework, v3.0
Link to current map
Search for
name
bl20xu
Search
Scale 1:
8579010
View
PLC_IMC_SHP
PLC_GP_SHP
PLC_EXIT_SHP
EXIT_Name
Beamline
Preparation
LEVEL
satellite
VME
VME
VME_Name
bl_vme
NET
point
NetworkRack2007_July
X: 1293199 Y: -35981
XHTML 1.0
Done


http://mapserver.spring8.or.jp - p.mapper 3.0.1: BL_PLC_MapServer PHP/MapScript Framework - Mozilla Firefox
SPring-8
MapServer PHP/MapScript Framework, v3.0
Link to current map
Search for
Search for
PLC_IMC_SHP
VME
name
bl20xu
Search
View
PLC_IMC_SHP
PLC_GP_SHP
PLC_EXIT_SHP
EXIT_Name
Beamline
Preparation
LEVEL
satellite
VME
VME
VME_Name
bl_vme
NET
point
NetworkRack2007_July
X: -282368 Y: 766306
XHTML 1.0


http://mapserver.spring8.or.jp - p.mapper 3.0.1: BL_PLC_MapServer PHP/MapScript Framework - Mozilla Firefox
SPring-8
MapServer PHP/MapScript Framework, v3.0
Link to current map
Search for
name
bl27su
Search
Scale 1: 8579010
bl04b2_vme
bl02b1_vme
bl08w_vme
bl11xu_vme
bl10xu_vme
bl47xu_vme
bl45xu_vme
bl14b1_vme
bl46xu_vme
bl13xu_vme
bl16xu_vme
bl44xu_vme
bl43ir_vme
bl16b2_vme
bl41xu_plc
bl19xu_vme
bl20xu_vme
bl39xu_vme
bl40xu_vme
bl20b2_vme
bl22xu_vme
bl37xu_vme
bl38b1_vme
bl33b2_vme
bl35xu_vme
bl24xu_vme
bl32b2_vme
bl27su_vme
View
PLC_IMC_SHP
PLC_GP_SHP
PLC_EXIT_SHP
EXIT_Name
Beamline
Preparation
LEVEL
satellite
VME
VME
VME_Name
bl_vme
NET
point
NetworkRack2007_July
X: -48866 Y: 829764
XHTML 1.0

http://mapserver.spring8.or.jp - p.mapper 3.0.1: BL_PLC_MapServer PHP/MapScript Framework - Mozilla Firefox

http://mapserver.spring8.or.jp - Query Results - Mozilla Fi

bl_vme

@	NAME	SP8_SERIAL	CPU_TYPE	#_602A	GPIB_TYPE	#_3122	#_2005	2005	#_
	bl27su_vme		743rt	1	GPIB21	1		0	2/

Done

Link to current map

bl27su_vme

View
- PLC_IMC_SHP
- PLC_GP_SHP
- PLC_EXIT_SHP
  - EXIT_Name
- Beamline

Preparation
- LEVEL
- satellite

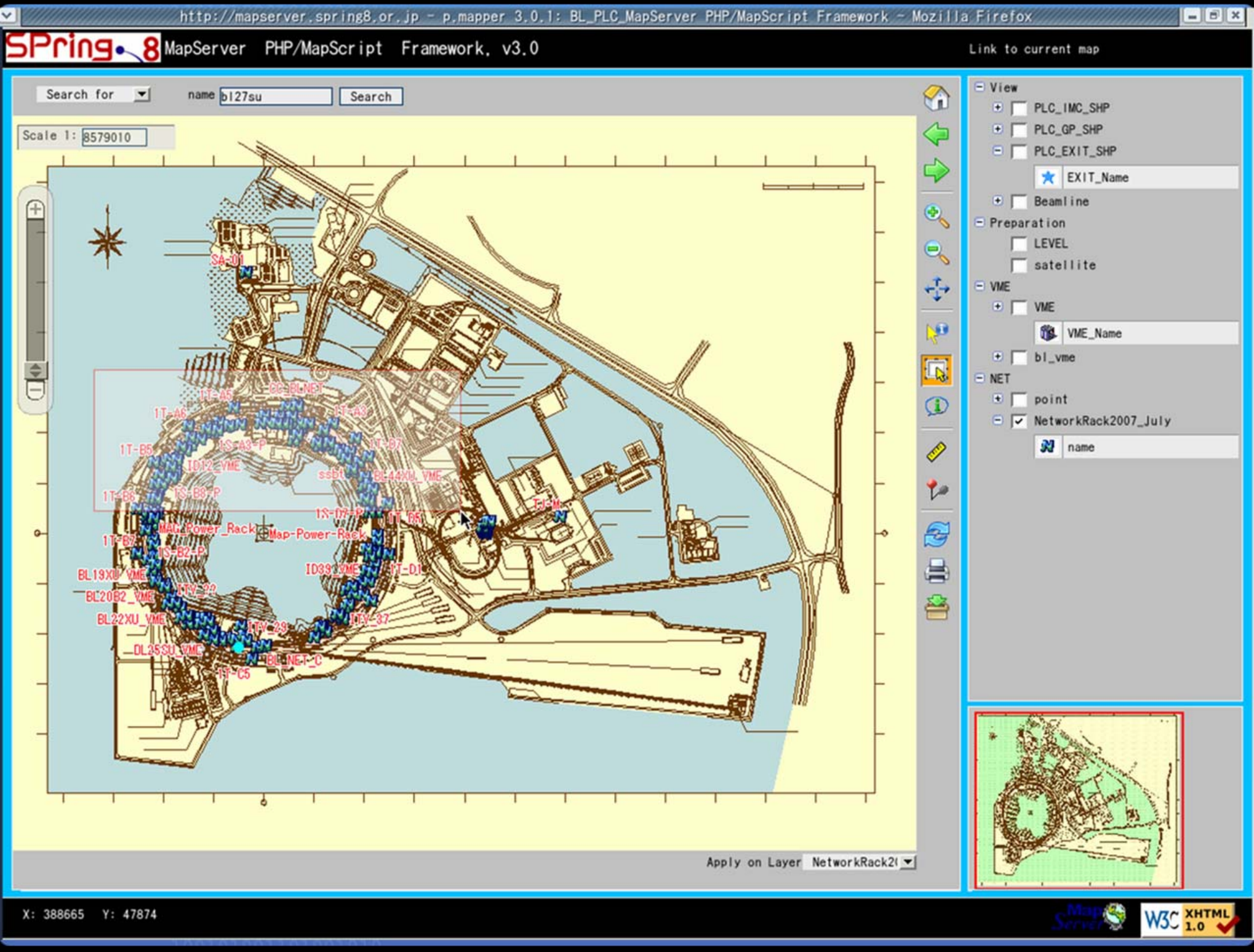
VME
- VME
  - VME_Name
- bl_vme

NET
- point
- NetworkRack2007_July

X: -48866 Y: 829764

XHTML 1.0

Query on map and edit.


http://mapserver.spring8.or.jp - p.mapper 3.0.1: BL_PLC_MapServer PHP/MapScript Framework - Mozilla Firefox
SPring-8 MapServer PHP/MapScript Framework, v3.0
Link to current map
Search for
name bl27su
Search
Scale 1: 8579010
View
PLC_IMC_SHP
PLC_GP_SHP
PLC_EXIT_SHP
EXIT_Name
Beamline
Preparation
LEVEL
satellite
VME
VME
VME_Name
bl_vme
NET
point
NetworkRack2007_July
name
Apply on Layer NetworkRack2(
X: 388665 Y: 47874
XHTML 1.0

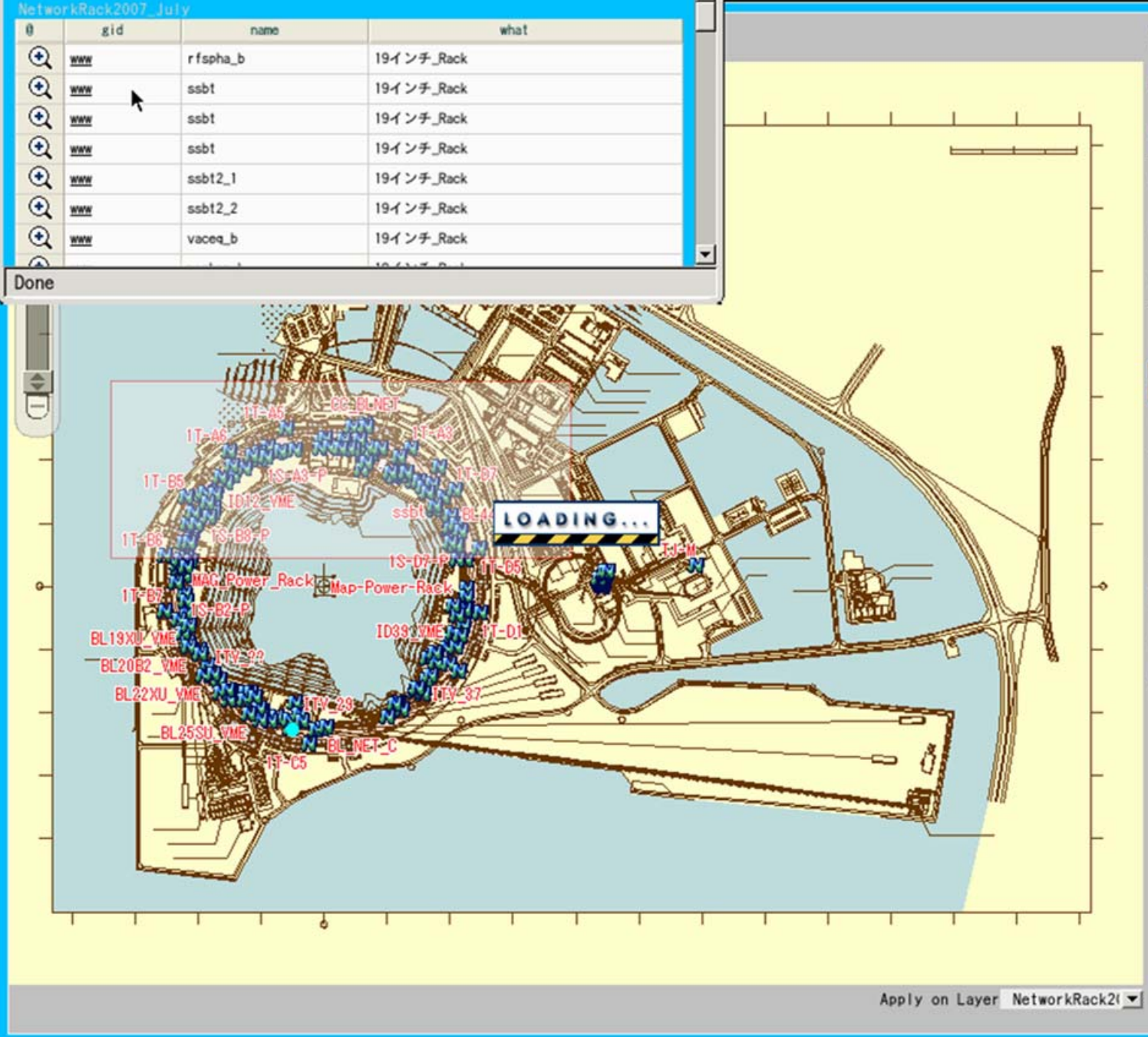
http://mapserver.spring8.or.jp - Query Results - Mozilla Fi

NetworkRack2007_July

@	gid	name	what
	www	rfspha_b	19インチ_Rack
	www	ssbt	19インチ_Rack
	www	ssbt	19インチ_Rack
	www	ssbt	19インチ_Rack
	www	ssbt2_1	19インチ_Rack
	www	ssbt2_2	19インチ_Rack
	www	vaceq_b	19インチ_Rack

Done

Link to current map



Apply on Layer NetworkRack2(

- View
  - PLC_IMC_SHP
  - PLC_GP_SHP
  - PLC_EXIT_SHP
    - EXIT_Name
  - Beamline
- Preparation
  - LEVEL
  - satellite
- VME
  - VME
    - VME_Name
  - bl_vme
- NET
  - point
  - NetworkRack2007_July
    - name

X: 443073 Y: 428620

MapServer

W3C XHTML 1.0

http://mapserver.spring8.or.jp - p.mapper 3.0.1: BL_PLC_MapServer PHP/MapScript Framework - Mozilla Firefox

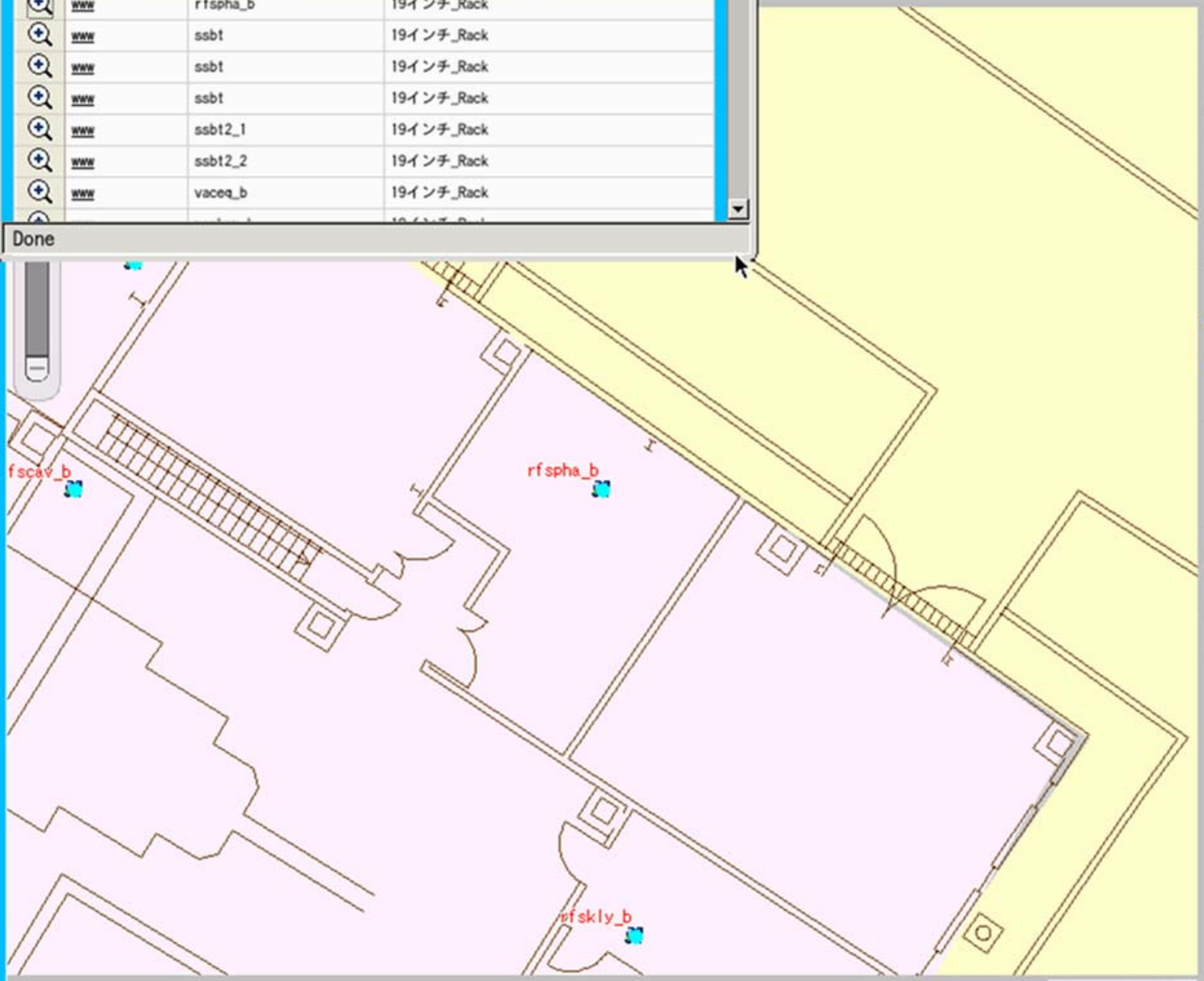
http://mapserver.spring8.or.jp - Query Results - Mozilla Fi

NetworkRack2007_July

@	gid	name	what
	www	rfspha_b	19インチ_Rack
	www	ssbt	19インチ_Rack
	www	ssbt	19インチ_Rack
	www	ssbt	19インチ_Rack
	www	ssbt2_1	19インチ_Rack
	www	ssbt2_2	19インチ_Rack
	www	vaceq_b	19インチ_Rack

Done

Link to current map



View
- PLC_IMC_SHP
- PLC_GP_SHP
- PLC_EXIT_SHP
  - EXIT_Name
- Beamline

Preparation
- LEVEL
- satellite

VME
- VME
  - VME_Name
- bl_vme

NET
- point
- NetworkRack2007_July
  - name

Apply on Layer NetworkRack2(

X: 443073 Y: 428620

MapServer W3C XHTML 1.0

http://mapserver.spring8.or.jp - 中央制御室計算機 - Mozilla Firefox

Query Results | 中央制御室計算機

NetMachineViewer

Home | Point Data Edit | Object Data Edit | New Item | NO

位置番号(Point Number)：150

位置1：クライストロン室B

位置2：位相調整室B

ラック名：高周波系B　位相調整室-VME(1)

物 ： 19インチ_Rack

用途：rfspha_b

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

Apply on Layer NetworkRack2(

nk to current map

- View
  - PLC_IMC_SHP
  - PLC_GP_SHP
  - PLC_EXIT_SHP
    - EXIT_Name
  - Beamline
- Preparation
  - LEVEL
  - satellite
- VME
  - VME
    - VME_Name
  - bl_vme
- NET
  - point
  - NetworkRack2007_July
    - name

X: 443073　Y: 428620

Map Server　W3C XHTML 1.0

http://mapserver.spring8.or.jp - 中央制御室計算機 - Mozilla Firefox

Query Results | 中央制御室計算機

Edit Data NetMchine

Home InputObject

DB_OBJ NO 34

Item	DB data	Edit data
Point Name1	クライストロン室B	クライストロン室B
Point Name2	位相調整室B	位相調整室B
Rack Name	高周波系B 位相調整室-VME(1)	高周波系B 位相調整室-VME(1
Maker	不明	不明
MachineName	Media Converter	Media
I/F		
Speed	100M	100M
Used_port		
OTHER		

Your ID

Password

Submit Reset

Done

nk to current map

View
- PLC_IMC_SHP
- PLC_GP_SHP
- PLC_EXIT_SHP
  - EXIT_Name
- Beamline

Preparation
- LEVEL
- satellite

VME
- VME
  - VME_Name
- bl_vme

NET
- point
- NetworkRack2007_July
  - name

Apply on Layer NetworkRack2(

X: 443073 Y: 428620

MapServer W3C XHTML 1.0

物データーベースビューアー - Windows Internet Explorer

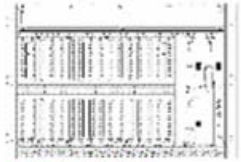
http://smap/inputphp/index.php?mode=detail&ir

ファイル(F) 編集(E) 表示(V) お気に入り(A) ツール(T) ヘルプ(H)

Mapserver DB Viewer

Home | INPUT | test | test | test

DB登録番号 "797"



挿入ボード詳細
内部詳細ボード情報にリンクします。

TMP
TMP

詳細データ

固有名詞: R16

説明: VMEシャーシ

製作会社: リタール

インフォメーション: use

管財シリアル: R:52005031334

シール有り無し: 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.

ローカル イントラネット 100%

VMEの詳細 - Windows Internet Explorer

http://smap/inputphp/morevme.php?id=797&wh

ファイル(F) 編集(E) 表示(V) お気に入り(A) ツール(T) ヘルプ(H)

Mapserver DB Viewer

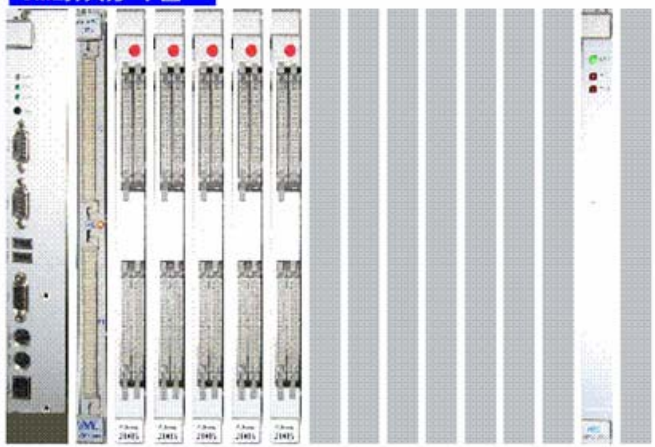
Home | INPUT | test

BL02B2 VMEの使用状況

VME挿入カード詳細

SLOT	カード名	通称	管理ID	リンク	
0	8001	cpu	239		詳細
2	3122	ai	172		詳細
3	2005	pmc	529		詳細
4	2005	pmc	530		詳細
5	2005	pmc	531		詳細
6	2005	pmc	532		詳細
7	2005	pmc	533		詳細
15	220	sram	719		詳細

VME挿入カード図



ローカル イントラネット 100%

Add point from screen.

http://mapserver.spring8.or.jp - p.mapper 3.0.1: BL_PLC_MapServer PHP/MapScript Framework - Mozilla Firefox

SPring-8 MapServer PHP/MapScript Framework, v3.0

Link to current map

Search for | name bl27su | Search

Scale 1: 8579010

SA-D1
CC-BLNET
1T-A5
1T-A6
1T-A3
1T-B5
1S-A3-P
1T-D7
ID12_VME
ssbt
BL44XU_VME
1T-B6
1S-B8-P
1S-D7-P
1T-B5
TJ-M
MAC_Power_Rack
Map-Power-Rack
1T-B7
1S-B2-P
ID39_VME
1T-D1
BL19XU_VME
BL20B2_VME
1TV-??
BL22XU_VME
1TV-29
1TV-37
BL25SU_VME
BLNET-C
1T-C5

View
- PLC_IMC_SHP
- PLC_GP_SHP
- PLC_EXIT_SHP
  - EXIT_Name
- Beamline

Preparation
- LEVEL
- satellite

VME
- VME
  - VME_Name
- bl_vme

NET
- point
- NetworkRack2007_July
  - name

X: 801259 Y: 530606

MapServer | W3C XHTML 1.0

http://mapserver.spring8.or.jp - p.mapper 3.0.1: BL_PLC_MapServer PHP/MapScript Framework - Mozilla Firefox

SPring-8 MapServer PHP/MapScript Framework, v3.0

Link to current map

Search for name bl27su Search

Scale 1: 8579010

The page at http://mapserver.spring8.or.jp says

Add location description

test

Cancel OK

View
- PLC_IMC_SHP
- PLC_GP_SHP
- PLC_EXIT_SHP
  - EXIT_Name
- Beamline

Preparation
- LEVEL
- satellite

VME
- VME
  - VME_Name
- bl_vme

NET
- point
- NetworkRack2007_July
  - name

X: 764987 Y: 551003

MapServer

W3C XHTML 1.0

http://mapserver.spring8.or.jp - Positioning Input - Mozilla Firefox

p.mapper 3.0.1: BL_PLC_Ma... | Positioning Input

DB Input

Home　　ポイント

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。

選択した位置X　X=764987.4055
選択した位置Y　Y=551003.1662

場所の登録名	test
説明	teet for ICALEPCS
Your ID	1372
Password	*********

Submit　Reset

http://mapserver.spring8.or.jp - p.mapper 3.0.1: BL_PLC_MapServer PHP/MapScript Framework - Mozilla Firefox

p.mapper 3.0.1: BL_PLC_Ma... | http://mapser...ubmit=Submit

SPring-8 MapServer PHP/MapScript Framework, v3.0

Link to current map

Search for | name bl27su | Search

Scale 1: 8589840

test

SA-01
CC_BLNET
1T-A6
1T-A3
1T-B5
1S-A3-P
1T-D7
ID12_VME
ssbt
BL44XU_VME
1T-B6
1S-B8-P
1S-D7-P
1T-B5
TJ-M
MAG_Power_Rack
Map-Power-Rack
BL41XU_VME
1T-B7
1S-B2-P
BL19XU_VME
1S-D5-P
1T-D1
1TY-22
1T-D2
BL20B2_VME
SR_C_S_04
BL22XU_VME
1TY-37
BL25SU_VME
BL_NET_C
1T-C5

View
- PLC_IMC_SHP
- PLC_GP_SHP
- PLC_EXIT_SHP
  - EXIT_Name
- Beamline

Preparation
- LEVEL
- satellite

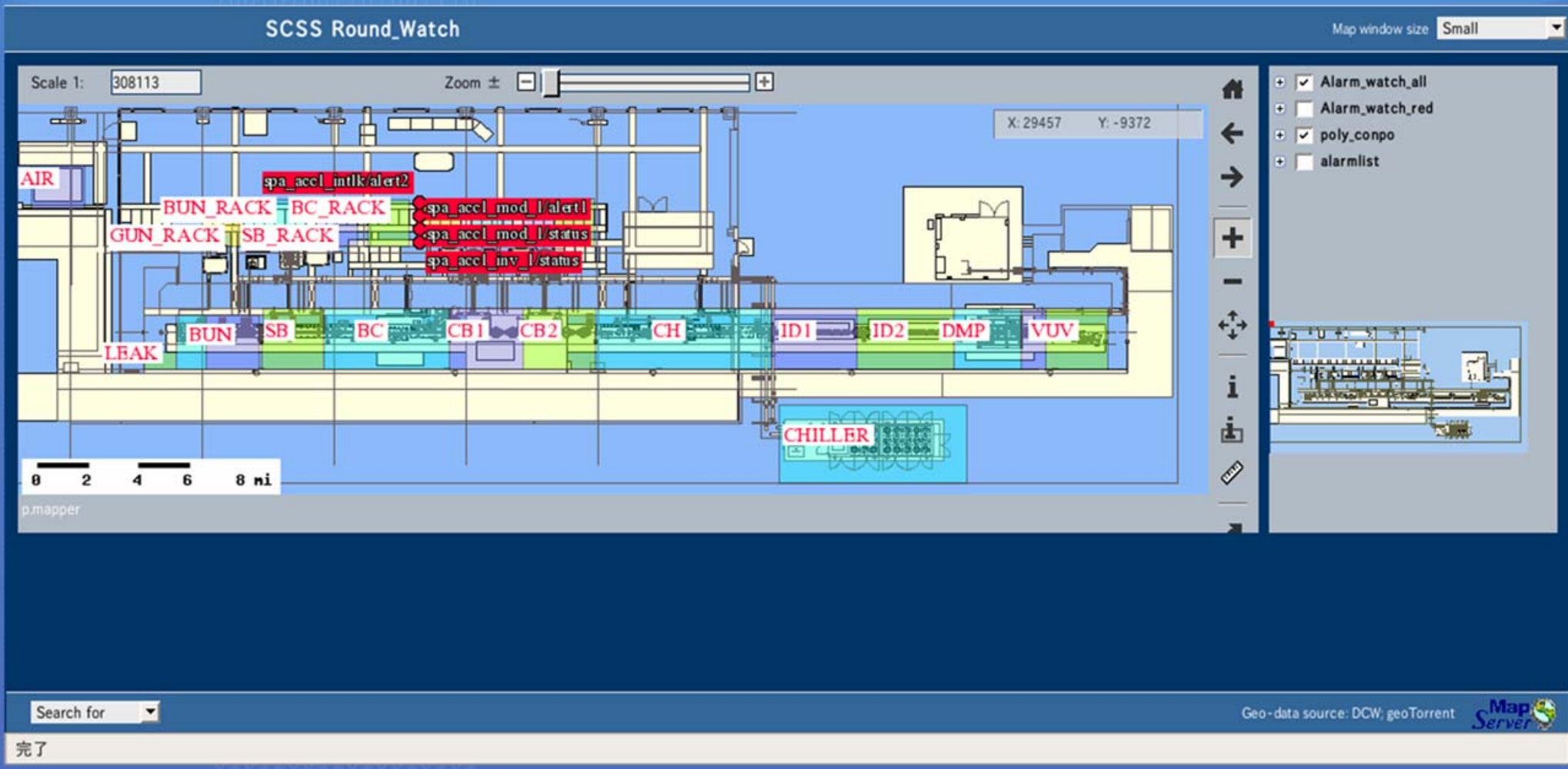
VME
- VME
  - VME_Name
- bl_vme

NET
- point
- NetworkRack2007_July
  - name

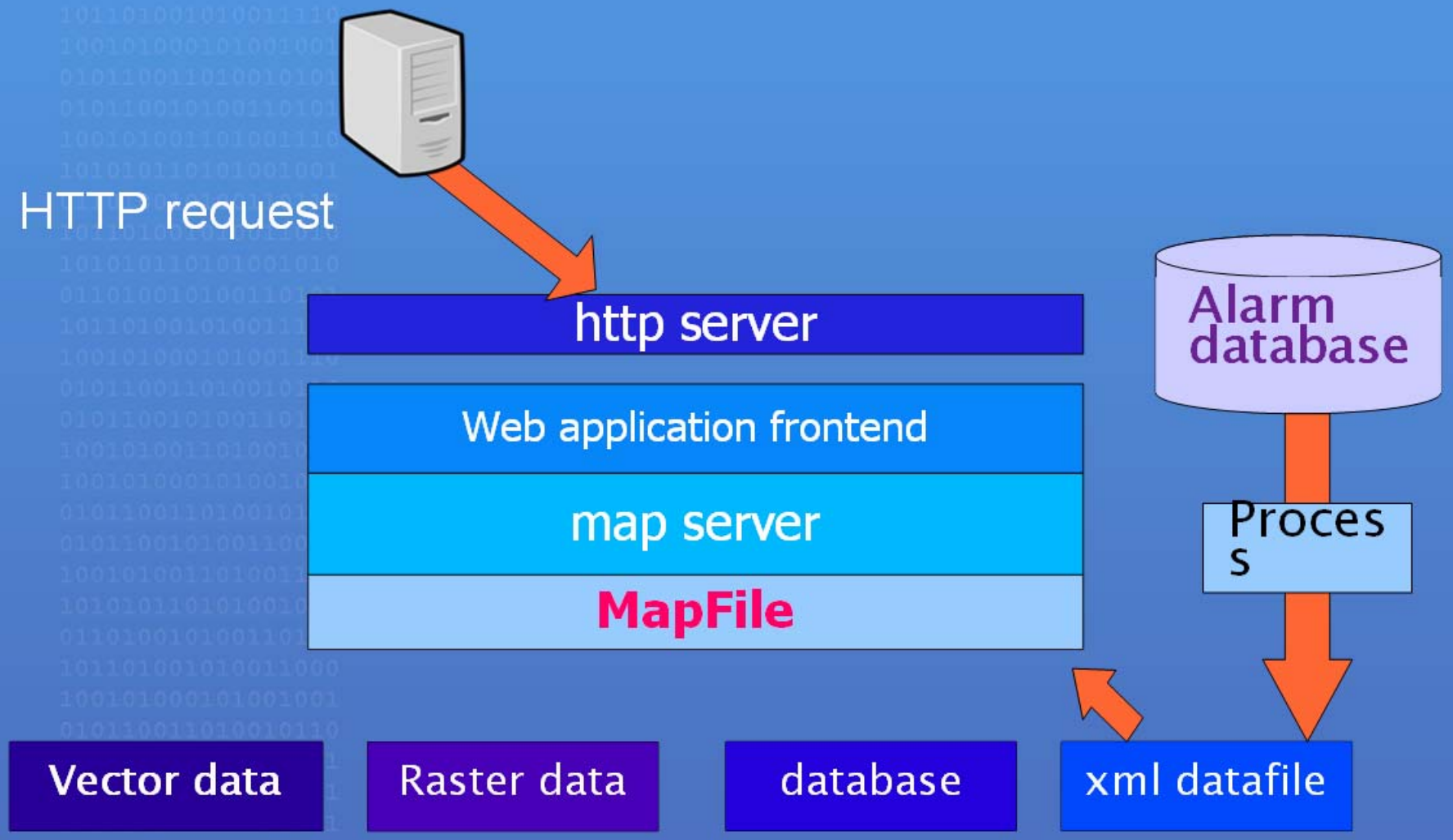
X: 239043 Y: 687285

MapServer | W3C XHTML 1.0

Alarm display for SCSS test accelerator



Real-time alarm display



Equipment management for X-ray FEL.

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

50digits in 1cmX1cm 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.