

MANAGING SPATIO TEMPORAL ASPECTS OF LAND REGISTRATION IN NATIONAL LAND INFORMATION SYSTEM

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INDONESIA

FIG 2011 Marrakech-Marocco, 18-22 May 2011

BACKGROUND

□ The important of Land Administration System,

The objective of Land Management is the use of land resources to support all of the people demand now and the future, in **sustainable use** without environmental degradation, and gives the maximum benefit economically.

Coordinated land resource management requires the simultaneous consideration of physical and socioeconomic interrelationships and impacts. It is necessary to **integrates large amount of spatial information** and knowledge from several disciplines. To be useful, the information and knowledge must be made available to decision makers in a rational framework.

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INDONESIA LAND ADMINISTRATION SYSTEM



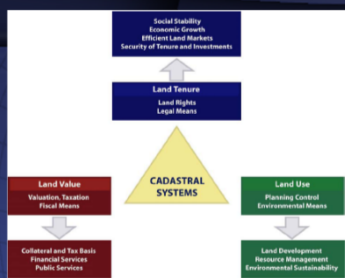
- **Registration map** is a map which depict all the parcels of land to be registered on the official land book.



- **Surat Ukur (letter of survey)** is a document which depict all physical data about a parcel of land in form of map and its detail description.
- **Buku Tanah (land book)** is a document which depict all physical data dan yuridical information related to the ownership titles..

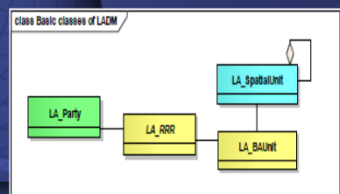
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LAND ADMINISTRATION



- **Land Administration** is a activities and process to handle the records of lands and also to manage information of ownership title related to the land properties. → **Land Management** → **Sustainable Development.**

LAND ADMINISTRATION DOMAIN MODEL (LADM)



- Is a standard concentual model for land administration domain which administratively related to **R-R-R Spatial Unit, Surveying dan Spatial Representation.**

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FACT

- The dynamic of Land Administration Data (Spilt, Joint, Updating, Reconstruction)



- The important of Textual and Spatial History Record of Land Administration Data

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PROBLEM & OBJECTIVE

Problem:

- Indonesian National Land Administration System (SIMTANAS) records the textual history without the spatial history.

Objective:

- Build the Indonesian National Land Administration System (SIMTANAS) that records the textual history with the spatial history

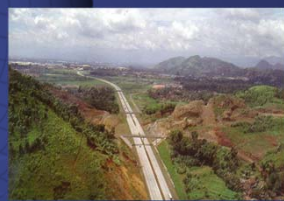
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INCREASING DEMAND OF LANDS



- Urbanisation, population increases, transmigration, etc will need and increasing demand of the lands for housing.



- The development and the economic activities become the fundamental issues of increasing demands lands.

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River Urban Development of Bengawan Solo River, Java Indonesia



Land Forest Management of Mahakam River, Borneo Indonesia



The Diversity of Borneo Rain Forest, Indonesia



The Diversity of Borneo Rain Forest, Indonesia



Forest Degradation of Borneo, Indonesia



Forest Degradation of Borneo, Indonesia



Land registration model

Static system

- Land registration related to the main 3 components: owner of land, title of land and the land itself.

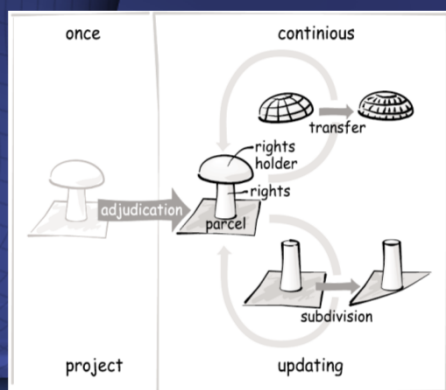
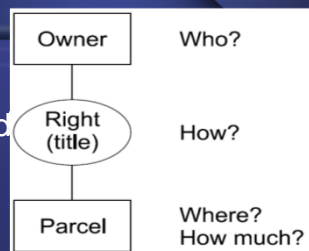


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Dynamic System

Land registration related to the 3 processes, such as the first land registration, change the titles and the record processes of splitting. Joining and also agglomeration of lands.

SPATIAL DYNAMIC

Physical data changes

- **Spatial changes** (land geometric) or physical data changes according to law No. 24 year 1997.
- The changes will consist of **splitting, joining, up dating and reconstruction.**

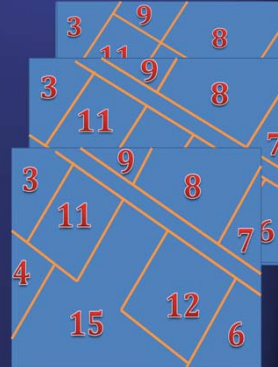


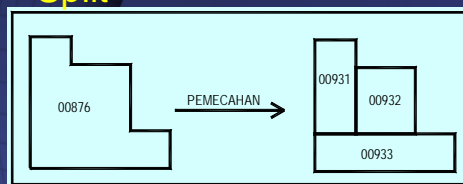
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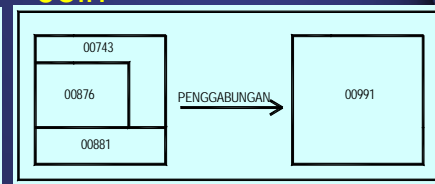
GEOMETRY OF SPATIAL DYNAMIC

Physical data changes (land parcels)

Split



Join



Reconstruction

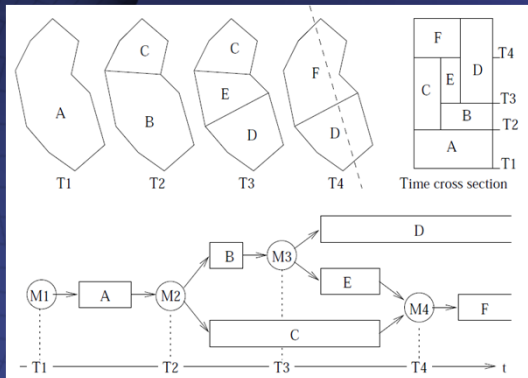


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SPATIO TEMPORAL DYNAMIC

Spatio temporal aspect on land registration



- can be decided as a condition of **spatially land registration** within a certain period of time.

Spatial condition can be changed because of title changes to some part or all the land by the need of the land owner for the certain purposes.

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METHOD

Software Integration between Oracle, Oracle Spatial Extension, Mapguide Open Source and Autodesk Mapguide Studio.

Oracle:

Textual Database Management

Oracle Spatial Extension:

Spatial Database Management

Mapguide Open Source and Autodesk

Mapguide Studio:

Textual and Spatial Data Visualisation

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Procedure Implementation

1. Identification of spatial data changes
2. Create the conceptual framework of spatio temporal database.
3. Database development
4. Data and map conversion.
5. Spatio temporal query and
6. Visualisation of spatio temporal database

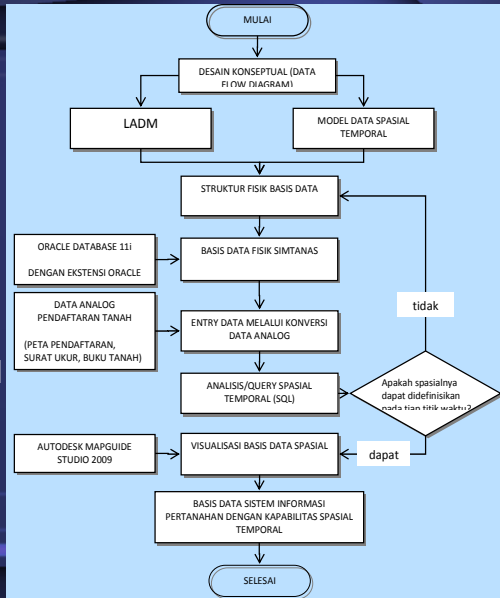
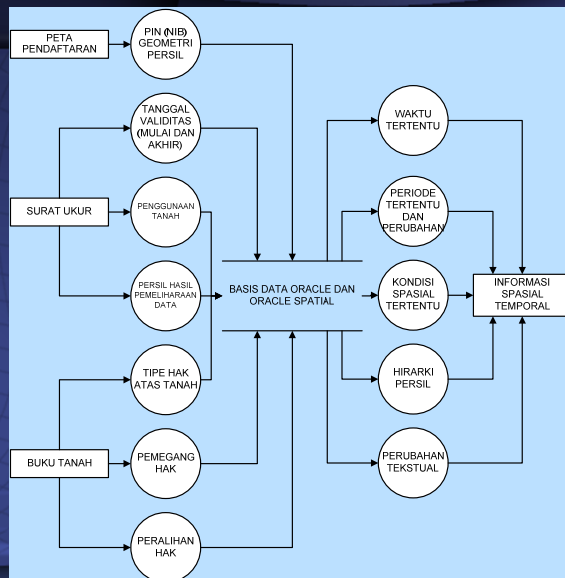


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CONCEPTUAL DIAGRAM

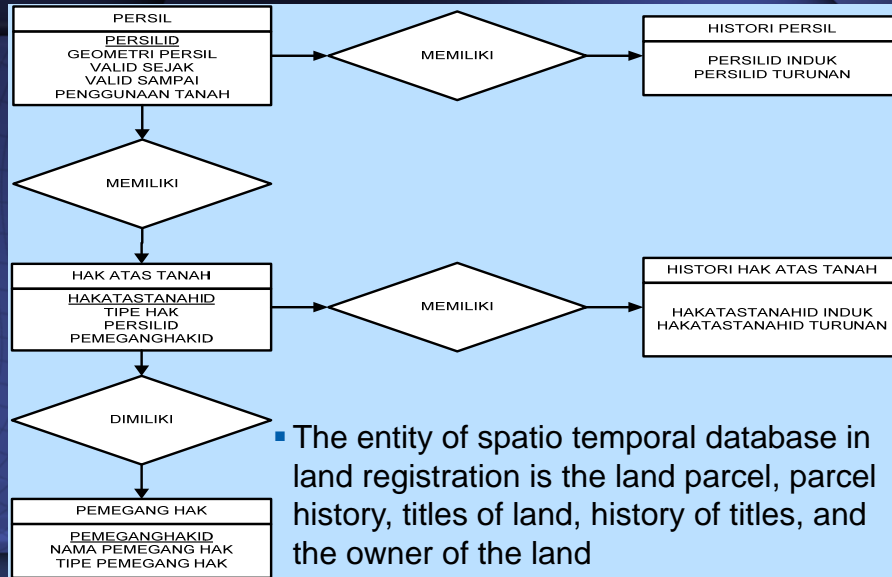


- As a part of National Land Information System,
- The Input is land registration data.
- The data will be put in to Oracle Database platform with Oracle Spatial extension (process).
- The output is spatio temporal Information for land registration.

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LOGICAL DESIGN

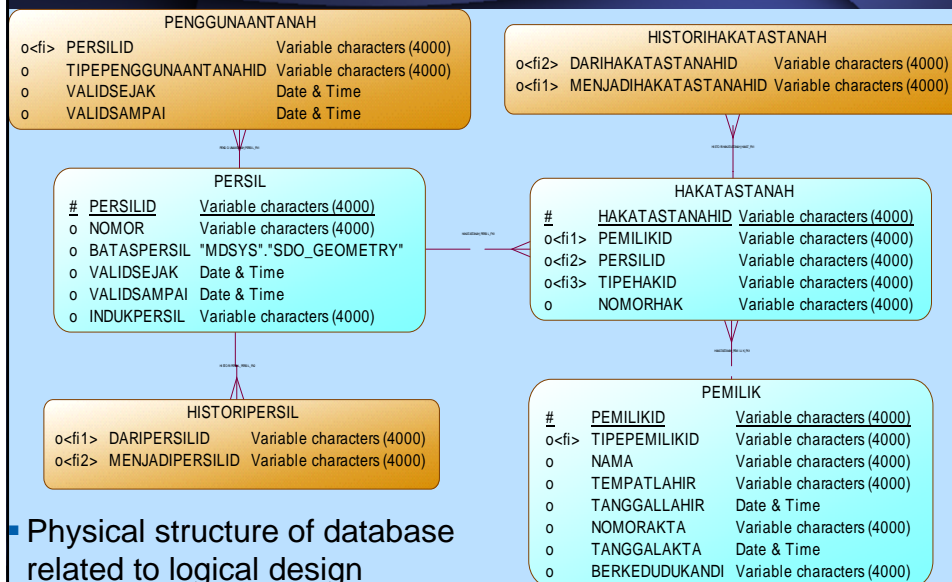


- The entity of spatio temporal database in land registration is the land parcel, parcel history, titles of land, history of titles, and the owner of the land

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PHYSICAL DATA BASE DESIGN



- Physical structure of database related to logical design

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DATABASE DEVELOPMENT

Spatial table definition on Oracle SQL Developer

Parcel table

```
CREATE TABLE "PERSIL"
("PERSILID" VARCHAR2(4000), "WILAYAHID" VARCHAR2(4000), "NOMOR"
VARCHAR2(4000), "BATASPERSIL" "SDO_GEOMETRY", "VALIDSEJAK" DATE,
"VALIDSAMPAI" DATE, "LUASTERHITUNG" NUMBER, "INDUKPERSIL" VARCHAR2(4000),
"LETAKTANAH" VARCHAR2(4000) );

INSERT INTO user_sdo_geom_metadata (TABLE_NAME, COLUMN_NAME, DIMINFO,
SRID)
VALUES ( 'persil', 'bataspersil', SDO_DIM_ARRAY( SDO_DIM_ELEMENT('X', 10115,
500000, 0.001), SDO_DIM_ELEMENT('Y', 0, 2000002, 0.001)), 23834);

CREATE INDEX "SIBT"."PERSIL_INDEX1" ON "SIBT"."PERSIL" ("BATASPERSIL")
INDEXTYPE IS "MDSYS"."SPATIAL_INDEX" ;
```

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DATABASE DEVELOPMENT

Parcel table

PERSILID	WILAYAHID	NOMOR	BATASPERSIL	VALIDSEJAK	VALIDSAMPAI	LUASTERHITUNG	INDUKPERSIL	LETAKTANAH
8	1	02970	MDSYS.SDO_GEOMETRY...	30-10-2008	(null)	169,105 (null)		Blok Sekeliang
5	1	02809	MDSYS.SDO_GEOMETRY...	11-08-2008	29-10-2008	21372,561 (null)		Blok Sekeliang
2	1	2	MDSYS.SDO_GEOMETRY...	18-02-1991	10-08-2008	11513,721 (null)		Blok Sekeliang
1	1	1	MDSYS.SDO_GEOMETRY...	18-02-1991	10-08-2008	8917,813 (null)		Blok Sekeliang
12	1	02974	MDSYS.SDO_GEOMETRY...	30-10-2008	(null)	163,598 (null)		Blok Sekeliang
14	1	02976	MDSYS.SDO_GEOMETRY...	30-10-2008	(null)	231,209 (null)		Blok Sekeliang

Land titles table

ASTANAHID	WILAYAHID	PEMILIKID	PEMILIKBERSAMAID	PERSILID	TIPEHAKID	ASALHAKID	NOMORHAK	VALIDSEJAK	VALIDSAMPAI	HAKBERAKHERIT
21	2	(null)	2	1	1		00136	27-03-1991	(null)	(null)
1	1	(null)	6	3	3		01094	06-11-2008	(null)	06-08-2038
21	3	(null)	1	1	1		00135	27-03-1991	(null)	(null)
1	1	(null)	7	3	3		01095	06-11-2008	(null)	06-08-2038
1	1	(null)	8	3	3		01096	06-11-2008	(null)	06-08-2038
1	1	(null)	9	3	3		01097	06-11-2008	(null)	06-08-2038

Ownership table

PEMILIKID	TIPEPEMILIKID	NOMORKTP	NAMA	TEMPATLAHIR	TANGGALLAHIR	NOMORAKTA	TANGGALAKTA	BERKEDUDUKANDI
11	1	(null)	Rita Manueke	(null)	05-11-1964	(null)	(null)	(null)
7	1	(null)	Suroto Zahri	(null)	13-09-1968	(null)	(null)	(null)
8	1	(null)	Mochamad Ali Adipermana	(null)	26-06-1976	(null)	(null)	(null)
10	1	(null)	Andi Alita Putra	(null)	10-04-1982	(null)	(null)	(null)
9	1	(null)	Fanny Triana	(null)	13-10-1988	(null)	(null)	(null)
5	1	(null)	Soni Santika	(null)	(null)	(null)	(null)	(null)

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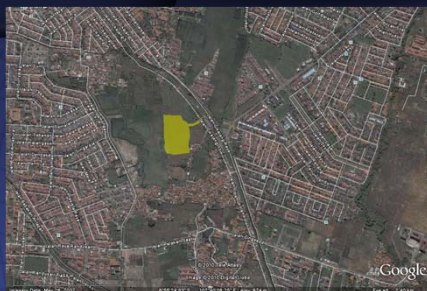
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RESULT

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RESEARCH CASE STUDY



Some residential area in Bandung city at Cikajang road within sub district Antapani.



Land occupation in 2007 still to be used as an agriculture land where relatively large compared to the year 2010 become a residential area

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DYNAMIC & HIERARCHY OF LAND DATA

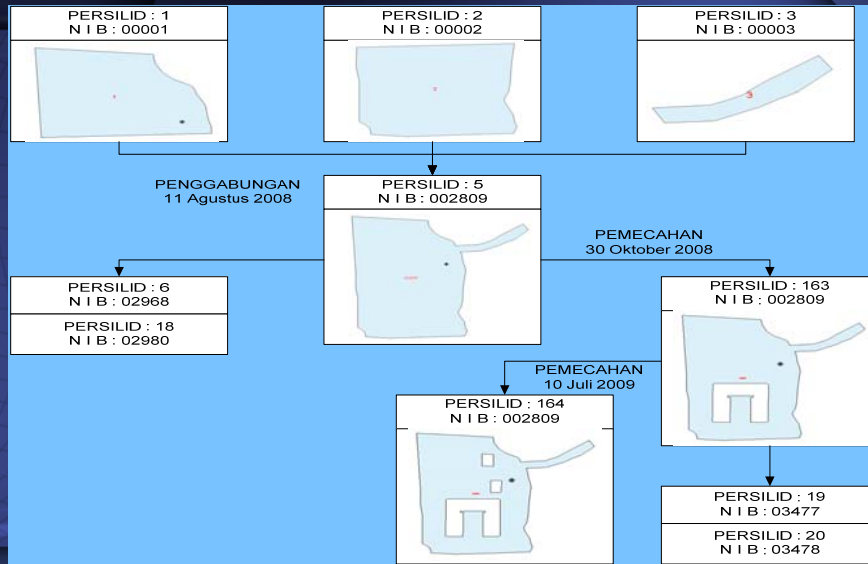
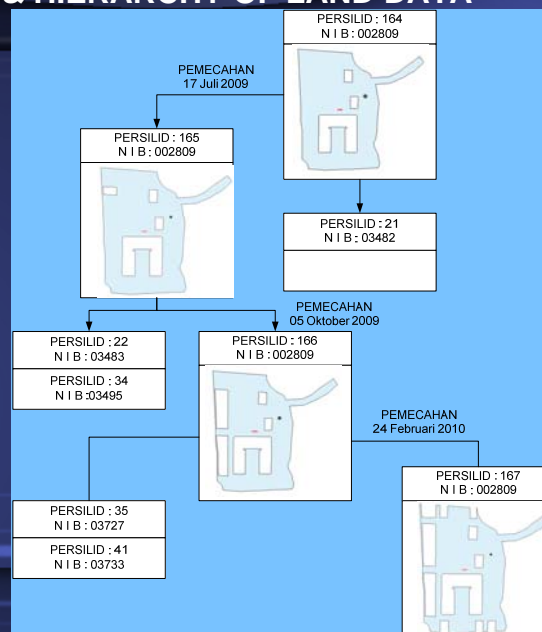


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DYNAMIC & HIERARCHY OF LAND DATA



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SPATIO TEMPORAL ANALYSIS

- Spatio temporal analysis in a certain time.
- Spatio temporal analysis in a certain periode and change detected.
- Analisis Hirarki of land parcel.
- Spatio temporal analysis in a certain condition.
- Spatio temporal analysis of the atribute changes.

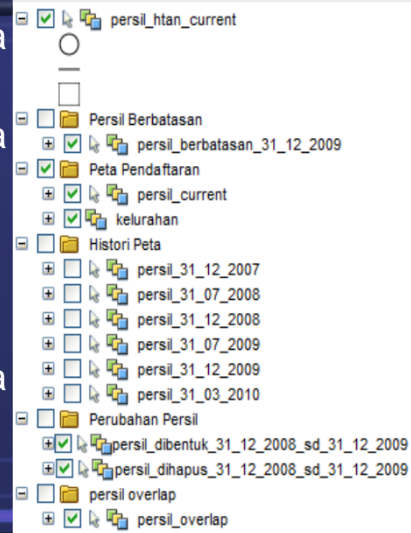
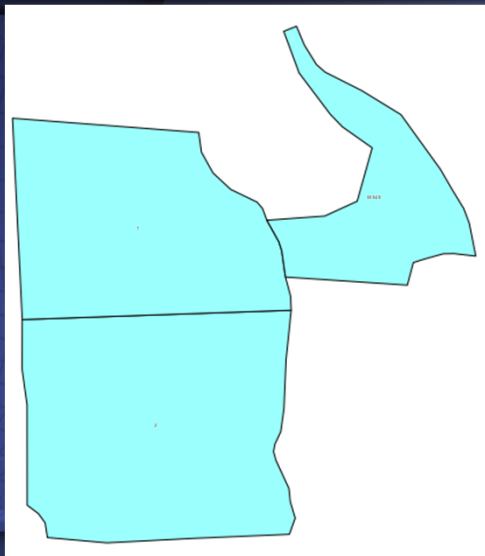


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Spatio temporal analysis in a certain time.



This analysis aim to know land condition at one periode of time on certain date.

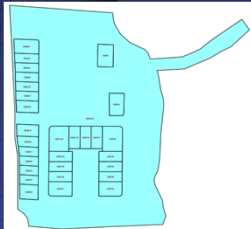
```
select * from persil
where validsejak < '31-07-2008'
and (validsampai > '31-07-2008' or
validsampai is null);
```

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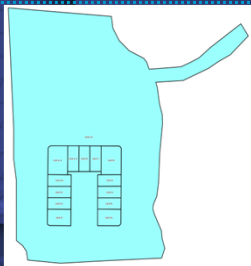
Spatio temporal analysis in a certain periode.

This analysis aim to get information off land on the periode/time interval.



Land condition on 31th december 2009

- select * from persil
- where validejsek < '31-12-2009' and (validsampai > '31-12-2009' or validsampai is null);



Land condition on 31th december 2008

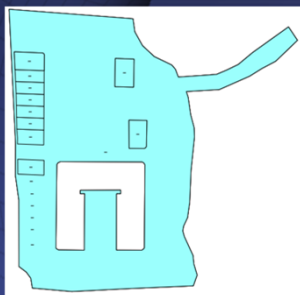
- select * from persil
- select * from persil
- where validejsek < '31-12-2008' and (validsampai > '31-12-2008' or validsampai is null);

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Spatio temporal analysis in a certain periode.

The new land parcel to be created in certain periode



Information of land to created between I31 Dec 2008 until 31 Dec 2009.

- select * from persil
- where validejsek between '31-12-2008' and '31-12-2009';

Query Result: x All Rows Fetched: 19 in 0,014 seconds

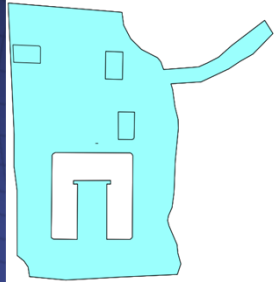
PERSILID	NOMOR	DATASPERSEL	VALIDSEJAK	VALIDSAMPAI
1 164	02209	(2007, 23834, NULL, INFO_ARRAY(1,1005,1,1,2,1,93,1005,1,93,2,1,175,1005,1,175,2,1,189,1005,1,189,2,1),	10-07-2009	16-07-2009
2 165	02209	(2007, 23834, NULL,	17-07-2009	04-10-2009
3 166	02209	(2007, 23834, NULL,	05-10-2009	23-02-2010
4 31	03492	(2003, 23834, NULL, INFO_ARRAY(1,1003,1), ORD_ARRAY(328943.48100759,734348.645894237,	05-10-2009	(null)
5 30	03491	(2003, 23834, NULL, INFO_ARRAY(1,1003,1), ORD_ARRAY(328943.53420598,734356.645717356,	05-10-2009	(null)
6 29	03490	(2003, 23834, NULL, INFO_ARRAY(1,1003,1), ORD_ARRAY(328943.594054169,734365.645518365,	05-10-2009	(null)
7 28	03489	(2003, 23834, NULL, INFO_ARRAY(1,1003,1), ORD_ARRAY(328943.660552157,734375.645297263,	05-10-2009	(null)

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Spatio temporal analysis in a certain periode.

Land parcel to be deleted in certain periode



- Information of Land parcel to be removed 31 Dec 2008 until 31 Dec 2009.
- select * from persil
where validsampai between '31-12-2008' and '31-12-2009';

Query Result x

All Rows Fetched: 3 in 0,007 seconds

PERSILID	WILAYAHID	NOMOR	SATASPERFIL
1 163	1	02809	(2007, 23834, NULL, INFO_ARRAY(1,1005,1,1,2,1,93,1005,1,93,2,1), ORD_ARRAY())
2 164	1	02809	(2007, 23834, NULL, INFO_ARRAY(1,1005,1,1,2,1,93,1005,1,93,2,1,175,1005,1,175,2,1,189,1005,1,189,2,1), ORD_ARRAY())
3 165	1	02809	(2007, 23834, NULL, INFO_ARRAY(1,1005,1,1,2,1,93,1005,1,93,2,1,103,1005,1,103,2,1,117,1005,1,117,2,1,199,1005,1,199,2,1), ORD_ARRAY())

FIG 2011 Marrakech-Marocco

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Analysis of Hierarchy of land parcel

The purpose of the analysis is to get the history of land data and the hierarchy of the data.

```
SELECT menjadipersil, menjadinomor, menjaditm, menjadita,
LEVEL, SYS_CONNECT_BY_PATH(daripersil, '-') as rantai_persil, SYS_CONNECT_BY_PATH(darinomor, '-') as
rantai_nomor_persil
FROM (select a.daripersilid as daripersil, b.nomor as darinomor, b.validsejak as daritm, b.validsampai as darita,
a.menjadipersilid as menjadipersil, c.nomor as menjadinomor, c.validsejak as menjaditm, c.validsampai as menjadita
from historipersil a, persil b, persil c
where a.daripersilid = b.persilid
and a.menjadipersilid = c.persilid)
WHERE menjadipersil = (select persilid from persil where nomor = '03731')
CONNECT BY PRIOR menjadipersil = daripersil
ORDER BY daripersil, menjadipersil, level, rantai_persil;
```

Query Result x

All Rows Fetched: 8 in 0,011 seconds

MENJADIPERSIL	MENJADINOMOR	LEVEL	RANTAI_PERSIL	RANTAI_NOMOR_PERSIL
1 39	03731	1	- 166	- 02809
2 39	03731	2	- 165 - 166	- 02809 - 02809
3 39	03731	3	- 164 - 165 - 166	- 02809 - 02809 - 02809
4 39	03731	4	- 163 - 164 - 165 - 166	- 02809 - 02809 - 02809 - 02809
5 39	03731	5	- 5 - 163 - 164 - 165 - 166	- 02809 - 02809 - 02809 - 02809 - 02809
6 39	03731	6	- 1 - 5 - 163 - 164 - 165 - 166	- 1 - 02809 - 02809 - 02809 - 02809 - 02809
7 39	03731	6	- 2 - 5 - 163 - 164 - 165 - 166	- 2 - 02809 - 02809 - 02809 - 02809 - 02809
8 39	03731	6	- 3 - 5 - 163 - 164 - 165 - 166	- 3 - 02809 - 02809 - 02809 - 02809 - 02809

FIG 2011 Marrakech-Marocco

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Analysis of Hierarchy of land parcel

```

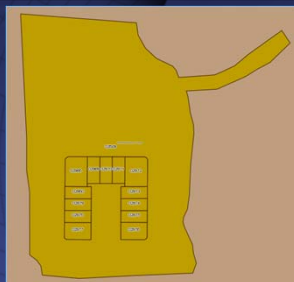
SELECT daripersil, darinomor, daritm, darita,
LEVEL, SYS_CONNECT_BY_PATH(menjadipersil, '-') as rantaipersil, SYS_CONNECT_BY_PATH(menjadinomor, '-') as
rantainomorpersil
FROM (select a.daripersilid as daripersil, b.nomor as darinomor, b.validsejak as daritm, b.validsampai as darita,
a.menjadipersilid as menjadipersil, c.nomor as menjadinomor, c.validsejak as menjaditm, c.validsampai as menjadita
from historipersil a, persil b, persil c
where a.daripersilid = b.persilid
and a.menjadipersilid = c.persilid)
where daripersil = 165
CONNECT BY PRIOR daripersil = menjadipersil
ORDER BY daripersil, menjadipersil, level, rantaipersil;
    
```

Query Result x All Rows Fetched: 41 in 0,034 seconds

DARIPERSIL	DARINOMOR	DARITM	DARITA	LEVEL	RANTAIPERSIL	RANTAINOMORPERSIL
7	5	02809	11-08-2008 29-10-2008	1	-16	-02978
8	5	02809	11-08-2008 29-10-2008	1	-163	-02809
9	5	02809	11-08-2008 29-10-2008	2	-164-163	-02809-02809
10	5	02809	11-08-2008 29-10-2008	2	-19-163	-03477-02809
11	5	02809	11-08-2008 29-10-2008	2	-20-163	-03478-02809
12	5	02809	11-08-2008 29-10-2008	3	-165-164-163	-02809-02809-02809
13	5	02809	11-08-2008 29-10-2008	3	-21-164-163	-03482-02809-02809
14	5	02809	11-08-2008 29-10-2008	4	-166-165-164-163	-02809-02809-02809-02809
15	5	02809	11-08-2008 29-10-2008	4	-22-165-164-163	-03483-02809-02809-02809
16	5	02809	11-08-2008 29-10-2008	4	-23-165-164-163	-03484-02809-02809-02809
17	5	02809	11-08-2008 29-10-2008	4	-24-165-164-163	-03485-02809-02809-02809
18	5	02809	11-08-2008 29-10-2008	4	-25-165-164-163	-03486-02809-02809-02809

FIG 2011 Marrakech-Marocco

Spatio temporal analysis of the attribute changes.



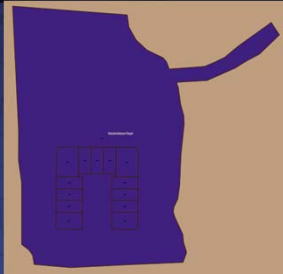
Land Title Atribut in 31 December 2008



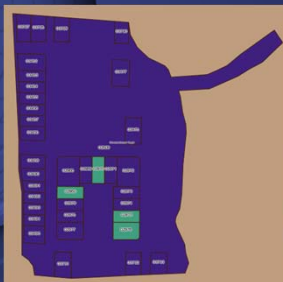
Land Title Atribut in 31 March 2010

FIG 2011 Marrakech-Marocco

Spatio temporal analysis of the attribute changes.



- Land Ownership Atribut in 31 December 2008



- Land Ownership Atribut in 31 March 2010

FIG 2011 Marrakech-Marocco

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CONCLUSIONS

Software *Integration* between;

- Oracle,
- Oracle Spatial Extention,
- Mapguide Open Source and
- Autodesk Mapguide Studio

has been proof to solve the problem of *textual and spatial history record* in Indonesian Land Administration System.

This system is to support *Land use planning & Land Management* for Sustainable Development.

FIG 2011 Marrakech-Marocco

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