Masters Program in Geospatial Technologies

Semantic web approach for dealing with administrative boundary revisions: A case study of Dhaka City

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Author´s Declaration

I hereby, certify that this Master thesis product is my independent work and with no other tools than the specified. All external sources are evidently acknowledged in the thesis.

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Signature

Münster, March 2013

SEMANTIC WEB APPROACH FOR DEALING WITH ADMINISTRATIVE BOUNDARY REVISIONS: A CASE STUDY OF DHAKA CITY

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ABSTRACT

Dhaka City is the capital of Bangladesh and boundary revisions of Dhaka city refers to the changes of Dhaka city administrative boundary or jurisdiction over time. Dhaka is growing very fast in terms of population and area. So, government is redefining city boundaries and also making big units into several parts for better city management. Now, the challenge is to deal with these changes of administrative regions that seem to be helpful to match with census record that comes out every ten to fifteen years. Dhaka city boundary revisions dataset contains data about the name of the administrative unit, type of administrative unit, year of establishment, year of data record, geometry of administrative unit defining the jurisdiction, type of revisions occurred in the administrative units, time of revisions and the number of subdivisions inside an administrative unit. This thesis aims to integrate Dhaka city boundary revision dataset using semantic web technology that preserves information about changes occurred in the Dhaka city boundary over time.

KEYWORDS

Linked Open Data, Semantic Web, Administrative Boundary, Administrative Divisions, Geographical Information Systems, Spatio-Temporal Changes, SAPO

ACRONYMS

CSV – Comma Separated Values

DCC – Dhaka City Corporation

DMDP – Dhaka Metropolitan Development Plan

DNCC – Dhaka North City Corporation

DSCC – Dhaka South City Corporation

FOAF – Friend of a friend

GI- Geographic Information

GIS – Geographic Information Systems

GIScience – Geographic Information Science

HTTP – Hypertext Transfer Protocol

LOD – Linked Open Data

OWL – Ontology Web Language

RAJUK - Rajdhani Unnayan Katripakha

RDB – Relational Database

RDBMS – Relational Database Management System

RDF – Resource Description Framework

SAPO - Suomen Ajallinen Paikka Ontologia (Finnish Spatio-Temporal Ontology)

SIOC – Semantically interlinked online communities

SONADUS - Spatiotemporal Ontology for the Administrative Units of Switzerland

SPARQL – SPARQL Protocol and RDF Query Language

SQL - Structured Query Language

URI – Unified Resource Identifier

URL – Unified Resource Locator

W3C – World Wide Web Consortium

WWW – World Wide Web

XML – Extensible Markup Language

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Chapter One: Introduction

This thesis is about administrative boundary revisions of Dhaka city and related problems and possible solution to manage boundary revision database. Thus, it can offer better management, data finding and sharing for administrative and research purposes. This chapter focuses on the study problems in detail, research questions to be solved, and approach to answer.

1.1 Introduction

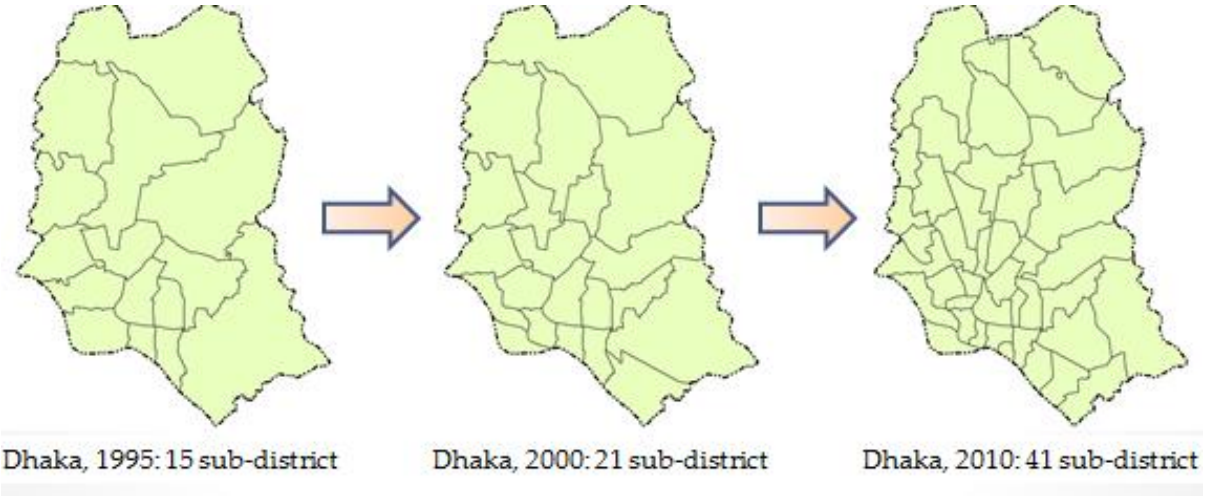
Dhaka city, the capital of Bangladesh, has a dynamic history of name changes and boundary revisions over the last 150 years of its municipal life. Now, the difficulty is to find an appropriate reference data set of the geographic extent of city and sub regions and match with census information. Administrative regions refer to the areal extent of the regions. The region might change with the next census period and accordingly census and other statistics related to the region might also change So , it is difficult to compare the area and the census information related to a geographic region of previous sessions (Worboys 1994). The administrative boundary revisions include redefining the city boundary, name change of administrative units, change of the administrative status, and redistribution of geographic extent. This thesis aims to integrate administrative boundary revision data in semantic web for Dhaka city. The outcome of the thesis will help us to compare the area with the aggregate statistics linked with it, e.g., total population, male female ratio, population density, birth rate, education rate, etc. The study will extend the scope of linking other information to the existing developed data set and help to find new facts by relating other discipline (e.g., water supply, taxation, business, crime, crops production, disease rate, education etc.) of data to regional dataset.

1.2 Rationale of the study

City is an administrative unit refers to as a region of governance. But historic administrative regions such as countries, municipalities and cities undergo changes over time in terms of name, being merged with other regions, or one region being divided into two and getting two different identities. City as an aerial extent has census and other statistical data linked to it. If name and geographic extent change over time, it is difficult to compare the properties of two different time periods without a proper system addressing and linking spatial data with appropriate temporal reference.

Development organization such as the World Bank and researchers who are involved in gathering huge records of data referring to geographic regions or places in the world. To plan our planet, locate our project and business, we need to compare data trend such as population growth, education status, crops production and economic progress, settlement growth for future planning and finding new potentialities and drawbacks. For example-to find a suitable location of Diarrhea Hospital in Dhaka, it is important to find where the cholera venerable areas are and what the trend of affecting population

by cholera was. Cholera occurs to places and if place name is changed, it is difficult to compare the data to find trend. Figure 1shows the changes of administrative Subdistrict of Dhaka city metropolitan police area from 1995 to 2010. In 1995 Dhaka city had 21 Thana/Subdistrict and in 2000, 7 new Thanas added to the list splitting from previous area and became 21 in total. In 2010, again 20 new Thanas added and become 41 Thana however the total metropolitan area remains the same. So it is now difficult to compare the census data of three different time periods.



Source: Dhaka City Corporation, RAJUK (Rajdhani Unnayan Katripakha), DMP (Dhaka Metropolitan Police), http://www.citypopulation.de/php/bangladesh-dhaka.php, Banglapedia

Figure 1: Revision of Subdistrict boundaries of Dhaka city metropolitan area from 1995 to 2010.

Currently it is not possible to retrieve the administrative boundary of Dhaka City and its historic data from the web. Moreover, the traditional GIS software can store historical data as a snapshot of a specific time period and unable to describe the changes of administrative status and geometry over time. Modeling and visualization of spatio-temporal data is still a challenge for geographic information system. Most of the gazetteers return point location against place name and it is difficult to know the areal extent and historical existence of geographic region. Semantic web[1] technologies by using linked data principles represent real world resources as uniform resource identifiers (URIs) and can also publish spatio-temporal data in a machine readable format. Linking of data is very powerful for exploring, sharing, and connecting pieces of data and information using URIs.

1.3 Problem Background

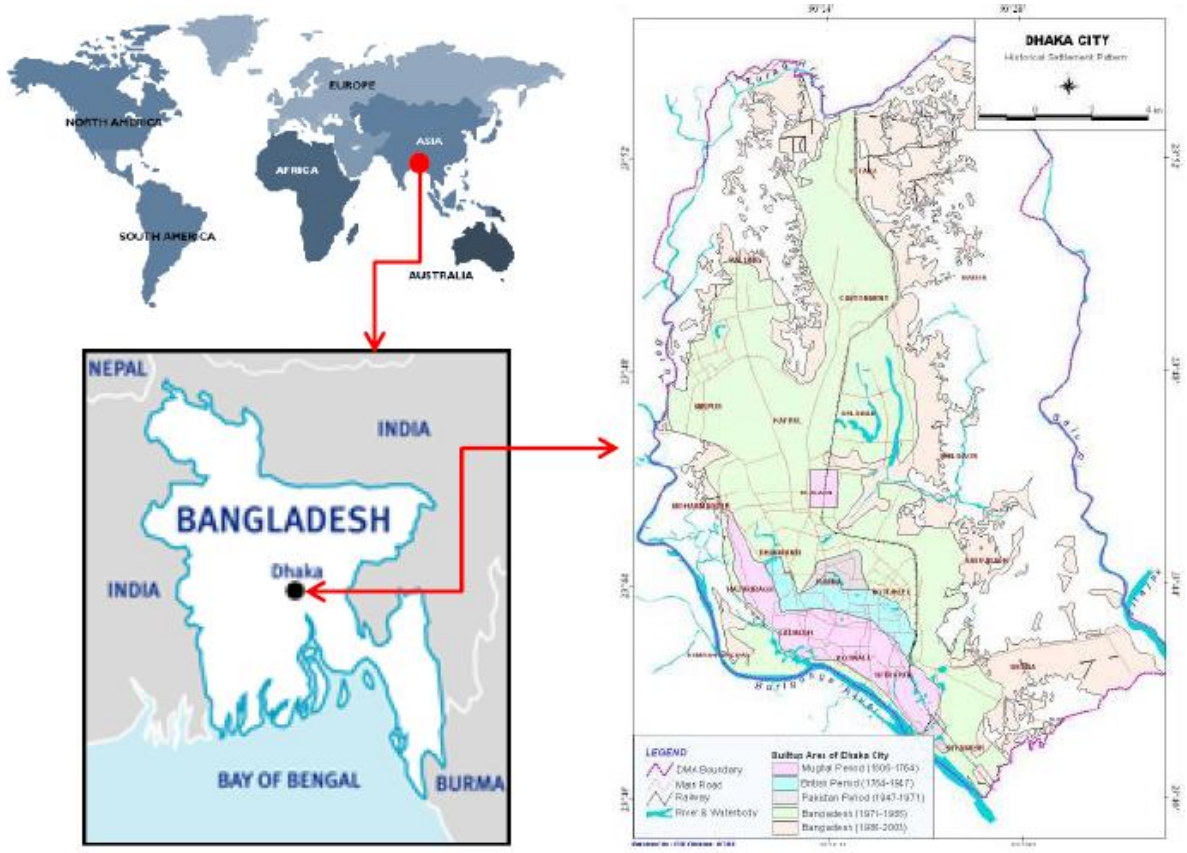
Dhaka City, the capital of Bangladesh is the research setting for this thesis. Bangladesh is divided into seven administrative divisions[2] in the year 2010. But after independence of Bangladesh in 1971, there were only four divisions and in 1993 the number of divisions becomes five and again in 1998 the

[1] www.semanticweb.org

[2] http://www.rakub.org.bd/divisionprofile.htm

county divided into six divisions. Accordingly, different administrative entities such as city planning authority redefine their services boundary regularly to include new areas as a process of formalizing urban growth in the master plan.

Dhaka is one of the mega cities in the world and situated nearly in the center of Bangladesh. Dhaka City Corporations had an area of 155sqmiles in 2008 under its jurisdiction. But in 1997 the city development authority known as Rajdhani Unnayan Katripakha(RAJUK) published Dhaka Metropolitan Development Plan(DMDP) for the year 1995-2015 and declared the land area under DMDP master plan which constitute 590sqmiles that is officially known as Dhaka Metropolitan statistical area(Islam et. al., 2009) or Dhaka Mega city jurisdiction defined in Banglapedia (Banglapedia, 2009). The administrative subdivisions of Dhaka city are Spatial Planning Zone (SPZ), Thana, wards, Mahallah or community.



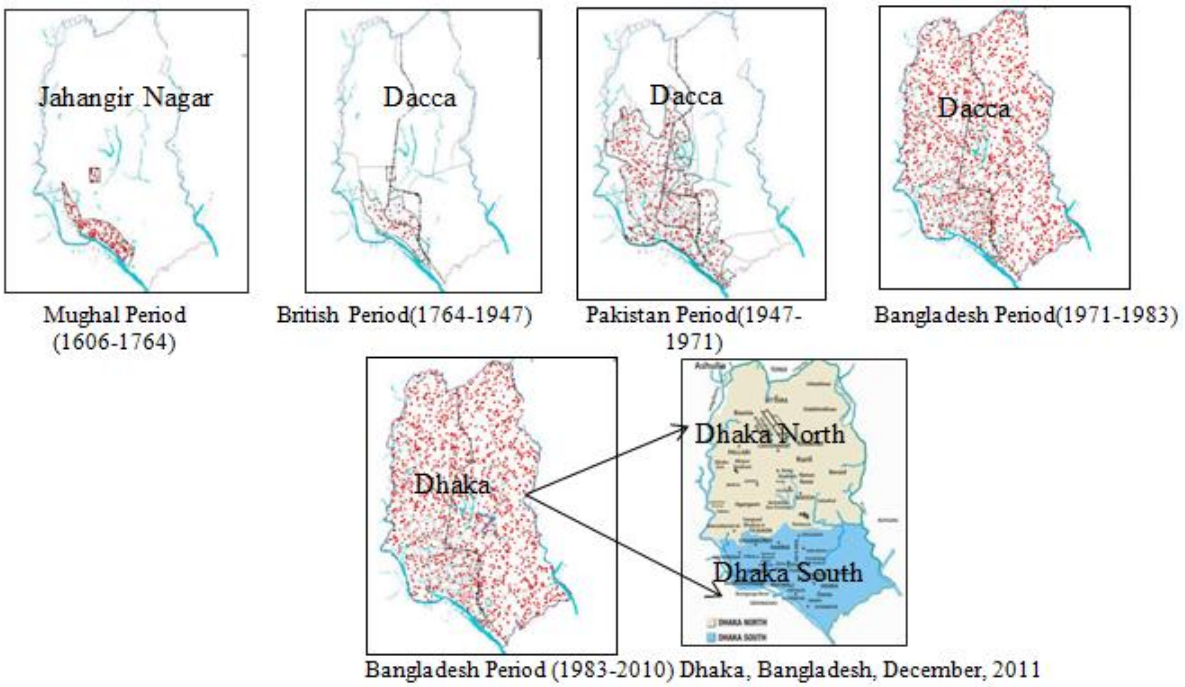
(Sources: a. Bangladesh in the World: http://www.twizi.com/images/world_map_blue.png,

b. Dhaka in Bangladesh: http://www.wateraid.org/bangladesh/,

c. Dhaka City: http://www.rrcap.unep.org/reports/soe/dhaka-soe-05/2-1dhaka-Introduction.pdf)

Figure 2: Location of Dhaka City (Study Area)

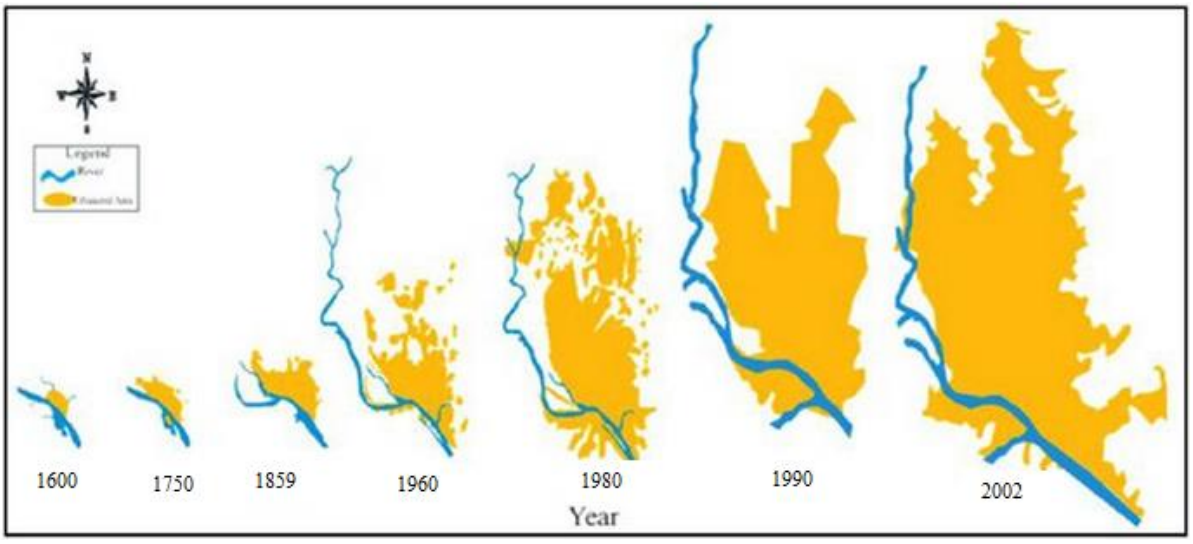
The boundary of Dhaka city has passed through several revisions as well as name changes. The following Figure 3 states more about how the name changes occurred in Dhaka city from Mughal period to present time. Now, the difficulty is to record these changes of name and footprint/geographic extent and match with census information.



(Source: http://www.rrcap.unep.org/pub/soe/dhaka-soe-05/2-1dhaka-Introduction.pdf)

Figure 3: Evolution of Dhaka City between British periods to Bangladesh

Another evidence of historical growth of Dhaka city was found from a study titled "Land cover change prediction of Dhaka City: A Markov Cellular Automata Approach (Published in: February 2011)3". Figure 4 shows the settlement extent of Dhaka city in different time periods.



Source: Urban Planning Department, Dhaka City Corporation, 2004

Figure 4: Growth of Dhaka City (not in scale)

[3] http://beta.geospatialworld.net/paper/application/ArticleView.aspx?aid=1416

Dhaka was renowned as capital from the last 400 years and had dramatic ups and downs in its administrative status and growth patterns Figure 4 shows the dynamic growth of Dhaka city and evidence of the changes of the geographic extent of Dhaka city in different periods of time.

The Table 1 shows the dynamic rise of population and area size of Dhaka from 1947 to 2011. This table contains the information before the split of Dhaka city on 4th December 2011 and shows the information of area and population for different type of administrative regions labeled as "Political and administrative identity

Table 1: Area, Population and administrative identity of Dhaka City from 1947 to 2011

Year	Area (sq. km)	Population (rounded)	Political and administrative identity
1947	73	200000	Dhaka City (Capital of East Pakistan)
1971	323	9000000	Dhaka City (Capital of Bangladesh)
1974	323	1607000	Dhaka Statistical Metropolitan Area(DSMA)
1981	401	3440000	Dhaka Statistical Metropolitan Area(DSMA)
1991	1353	6844000	Dhaka Statistical Metropolitan Area(Dhaka Mega City)
2001	1353	9900000	Dhaka Mega City
2004	1530	12000000	Dhaka Metropolitan Development Plan Area/RAJUK area
2005	1530	12623000	Dhaka Metropolitan Development Plan Area/RAJUK area
2010	1530	14230000	Dhaka Metropolitan Development Plan Area/RAJUK area
2011	1530	14543124	Dhaka Metropolitan Development Plan Area/RAJUK area

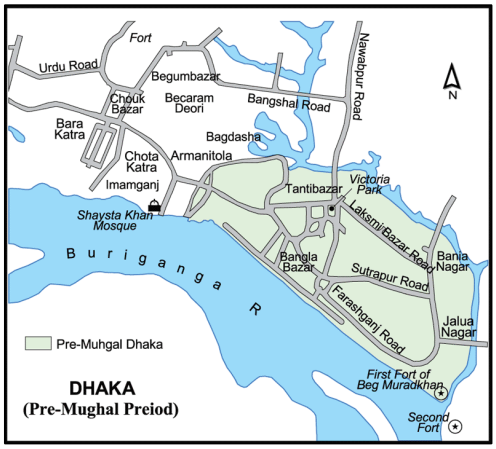
Source: Urban Hazard of Dhaka City, August 2011

From online sources we have some image maps of Dhaka city at different periods of time which in various cases not in scale and thus difficult to get clear impression of geographic extent. The Figure 5 shows the image map of the output of web search of Dhaka City.

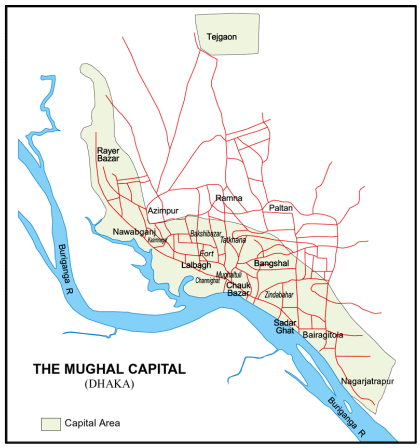
Table 2: Life of Dhaka city and Availability of Geometric Data

POE	Pre Mughal(before 1608)	Mughal(1608-1864)		British(1868-1947)					Pakistan Period(1947-1971)		Bangladesh Period(1971 to now)					
											Dhaka City				Dhaka North	Dhaka South
DAG	Before 1608	1608	1864	1864	1859	1905	1911	1945	1960	1964	1971	1982	1983	1995	2011	2011
NOS	NA	NA	NA	NA	NA	NA	NA	NA	25	30	50	56	75	90	36	56
SGD	AV	AV	AV	AV	AV	AV	AV	AV	AV	AV						
AGD	NA	NA	NA	AV	NA	NA	NA	NA	NA	NA	NA	NA	NA	AV	AV	AV

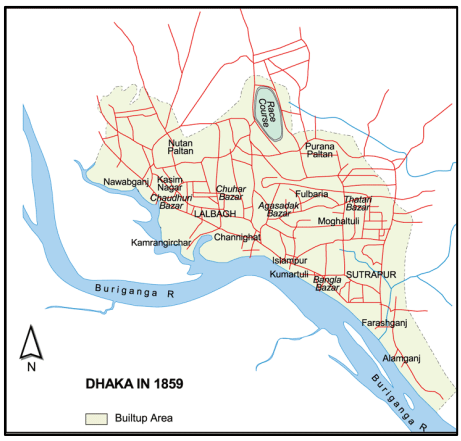
POE= Period of Existence DAG = Year of available Geometry NOS = Number of Subdivision
AGD = Administrative Geometry I SGD= settlement Geometry Data NA= Not Available



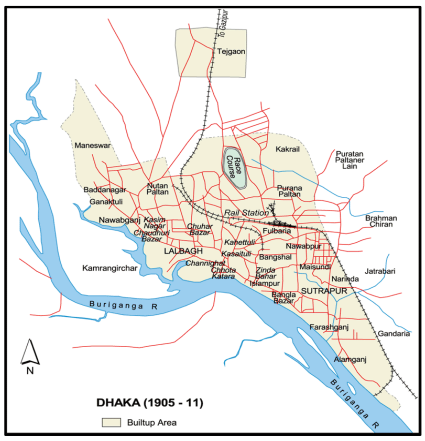
Dhaka: Pre-Mughal Period[4]



Dhaka: Mughal Period[4]

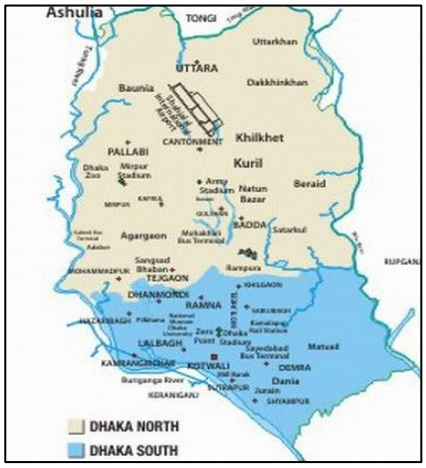


Dhaka: in 1859[4]



Dhaka: 1905-1911[4]

Dhaka: DMDP Area (google search snapshot)



Dhaka: Dhaka City Split, 4th December, 2011[5]

Figure 5: Dhaka city in different historic period to present

According to the record from Table 2 the geometry of Dhaka city administrative units is available from 1995 with all the subdivision information. Therefore, 1995-2011 as the time period of data and

[4] Source: http://www.banglapedia.org/Maps/MD_0145A.GIF

[5] http://southdhaka.files.wordpress.com/2011/12/dhaka-divided-2.jpg%3Fw%3D640

Dhaka metropolitan area and its subdivisions as an administrative boundary were considered for implementing my thesis.

Dhaka, the capital of Bangladesh has two city corporations now: Dhaka North City Corporation and Dhaka South City Corporation as of 4th December 2011 according to Local Government (City Corporation) Amendment Act (2011). Dhaka was founded in 1608 as the capital of the province during the Mughal period and it was renamed as Jahangir Nagar. In 1864 Dhaka was declared as Municipality (Pourashava). In 1905, Dhaka was the capital of a new province comprising East Bengal and Assam. The city became the provincial capital of East Pakistan after Pakistan emerged as an independent country in 1947. Dhaka became the capital of Bangladesh in 1971 just after independence. 1n 1978 administrative status of Dhaka uplifted from Pourashava to Municipal Corporation and the head of the administrative body was called Major. Again, in 1990, the Dhaka Municipal Corporation was renamed as Dhaka City Corporation. Now, Dhaka South City Corporation is considered as the Original Dhaka City and Capital. All the information stated in this paragraph is taken from Dhaka South City Corporation web site. The interesting part is all data are in text format and there is no information about the geographic extent of the city or even there is no city map available online. We can only get an image of Dhaka city split with two different colors. This makes it difficult for a researcher to find the survey data and use it for intended study area.

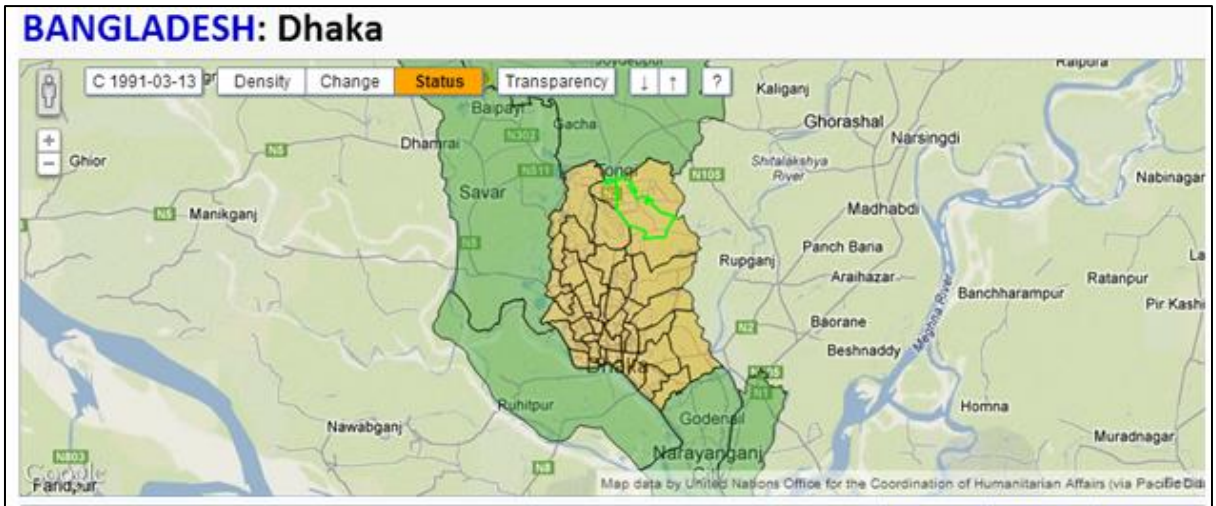
1.4 Problem Statement

System of data sharing is not a flexible task. Furthermore, different organizations produce geodata separately in the same area and lack the enthusiasm to share data among themselves. Therefore, researchers always face the problem of choosing the most appropriate data set. For this thesis, most of the data came from paper maps produced by Dhaka City Corporation from which I got only the area name and sometimes subdivision names. Getting supporting of official information was primarily very hard. This made me go through all prominent publications about the Dhaka city that discuss about the city extensively in different periods of time. The experience gained is that all data available either text format or as books or in maps of the city authority as a cartographic paper map. Every time a researcher wants to work in Dhaka city, s/he needs to take great hardship to find the geodata in digital format and also match the data with census information. The difficulties of gathering information usually compel the researcher to limit study scope. This was all true for my study of collecting map and data of administrative boundary revisions. I had to spend a lot of time to access the data and also reproducing the data from paper maps collected from Dhaka City Corporation (DCC), Rajdhani Unnayan Katripakha (RAJUK), available books and publication.

A current search of Dhaka city spatial information can only show the current information as a JPEG image or text format and the information is also not in an appropriate data sharing format. www.*citypopulation.de* has developed a nice interface to display metropolitan sub districts of Dhaka

City and population in different census years. It also shows which area is split from other areas. However, there is no temporal information about the change and no scope to search previous state of regions. It is not possible to download the geometry data as digital format too (Figure 6).

From Figure 6, we also notice in the first column with place name there is an effort to indicate which area is split from what area. But there is no further information available to navigate back to dates.



Name	Status	District	Population census 1991-03-13	Population census 2001-01-22	Population census 2011-03-15
Darus Salam [split from Mirpur]	City District (Thana)	Dhaka	...	...	159,139
Demra	City District (Thana)	Dhaka	...	...	226,679
Dhanmondi	City District (Thana)	Dhaka	...	...	147,643
Gendaria [split from Sutrapur]	City District (Thana)	Dhaka	...	...	137,721
Gulshan	City District (Thana)	Dhaka	...	...	253,050
Jatrabari [split from Demra]	City District (Thana)	Dhaka	...	...	443,601
Kadamtali [split from Shyampur]	City District (Thana)	Dhaka	...	...	370,895
Kafrul (Kāfrul)	City District (Thana)	Dhaka	...	...	396,182
Kalabagan [split from Dhanmondi]	City District (Thana)	Dhaka	...	...	118,660
Kamrangir Char (Kāmrāngir Char)	City District (Thana)	Dhaka	...	...	93,601
Khilgaon	City District (Thana)	Dhaka	...	...	327,717
Khilkhet [split from Badda]	City District (Thana)	Dhaka	...	...	130,053

Source: http://www.citypopulation.de/php/bangladesh-dhaka.php

Figure 6: Population census data integrated with Dhaka Metropolitan Thana boundary

There were several attempts made to preserve the spatial temporal data that can visualize historical footprint but still not very effective. The footprint places varied dynamically over time even if its name and hierarchical status remained the same (Mostern, 2008). The traditional GIS software suggests the visualization as an animation of change of footprint in a same frame to show the change over time or using several data frames (ITC, 2001). This is not a good solution to go through several views to understand the change. The geography changes rapidly and it is hard by the annotator to reference to spatio-temporal regions for the end user to understand the historical geography (Kauppinen, Väätäinen, Hyvönen, 2008). This is also difficult to return the optimum query result to search for historical information of administrative boundary changes over historical period. The GIS also expects the end user to be able to see historical regions with proper temporal context (Kauppinen, Väätäinen,

and Hyvönen 2008). The census information comes up after every 10 years and within this time the administrative subdivision may change. This obviously can cause the problem of adjusting non spatial information linked with it (Michael, 1994).

1.5 Research questions

Based on the problem of poor management system of Dhaka city boundary revisions data, the thesis intends to answer the following research question:

1. What is the semantic web solution for keeping track of administrative boundary revisions?

1.6 Approach

The existing web search can give information about Dhaka city and its current state as textual format. But it is very difficult finding out its spatio-temporal state or changes of the city from its origin. This thesis considers a city as place and location of places. The location provides an essential link between various disparate forms of information and also distinct process from all other disciplines of information (Goodchild et al, 2010). So, spatial thinking is very important for researchers from all disciplines to relate their information and finding with a location or a place to explore and identify new knowledge and social problems.

Semantic web allows us to integrate the spatio-temporal data inside of a schema. According to the W3C[6], "The Semantic Web provides a common framework that allows data to be shared and reused across application, enterprise, and community boundaries." This thesis produced a database for administrative boundaries of Dhaka city and its temporal existence using semantic web technologies in order to answer the research question. This thesis introduced conceptual data model to define the data related to the administrative boundaries of Dhaka city and the data set is evaluated by querying information from the data set.

1.7 Conclusion

This chapter addressed the research problem and introduced a research question and a brief of approaches. The next chapter two is about literature review. Chapter two consists of definition of administrative boundary, GIS approaches to deal with spatio-temporal data, related work, an introduction of semantic web and also focus on available vocabulary suitable for defining administrative boundaries and its temporality.

[6] http://www.w3.org/standards/semanticweb/

Chapter Two: Literature review

Literature review focus on defining administrative unit boundaries and also discussing traditional approaches of the incorporating temporality of boundary revisions in databases. This chapter again focuses on semantic web approaches to integrating data set of boundary revisions.

2.1 Administrative Boundary

From a broader point of view, administrative boundary[7] is a limit or border of a geographic area under the jurisdiction of some Governmental and managerial entity.

Administrative boundaries in geoservices are well defined invisible lines or polygons; follow a theoretical structure such as countries, state, Zip code areas, constituencies and language borders. Boundaries are also used to establish the relationship between a well-defined area and statistics. Most often administrative boundaries are hierarchically structured. For example—Federal, state or municipal area and municipal areas are also subdivided into the neighborhood for naming and identification.

The basic three components for defining administrative units are:

1. Place Name

2. Feature Type/Administrative Status

3. Location/Footprint

4. Time of Existence is the fourth component refers to temporality of administrative unit.

Boundary revision has a spatio-temporal dimension. The temporal changes can be *name change, feature type/administrative status or location /footprint*.

"The core element of Digital gazetteer are place name itself, the type of place it labels, and a geographic footprint representing its location and possibly its extent." (Hill, 2000)

Spatial changes in this study mean changes related to administrative boundary. There are GIS approaches to deal with spatial changes over time. The spatio- temporal capabilities in GIS are growing attention day by day for many applications with the web by introducing the importance of spatial thinking. (Wachowicz and Healy, 1994)

Spatio-temporal updates of boundary start dealing with initial entity, updating the description, and creation of new object from previous object, relocation of boundary. To detect this updates we need to look at the object version of boundary updates. The basic premises to model spatio-temporal boundary

[7] http://www.eionet.europa.eu/gemet/concept?langcode=en&ns=1&cp=14932

updates are: Every object must have an initial version, a hierarchical structure is imposed on the version of an object, different versions of an object denote different object instances and among all versions, a current version is always distinguishable (

Figure 7).

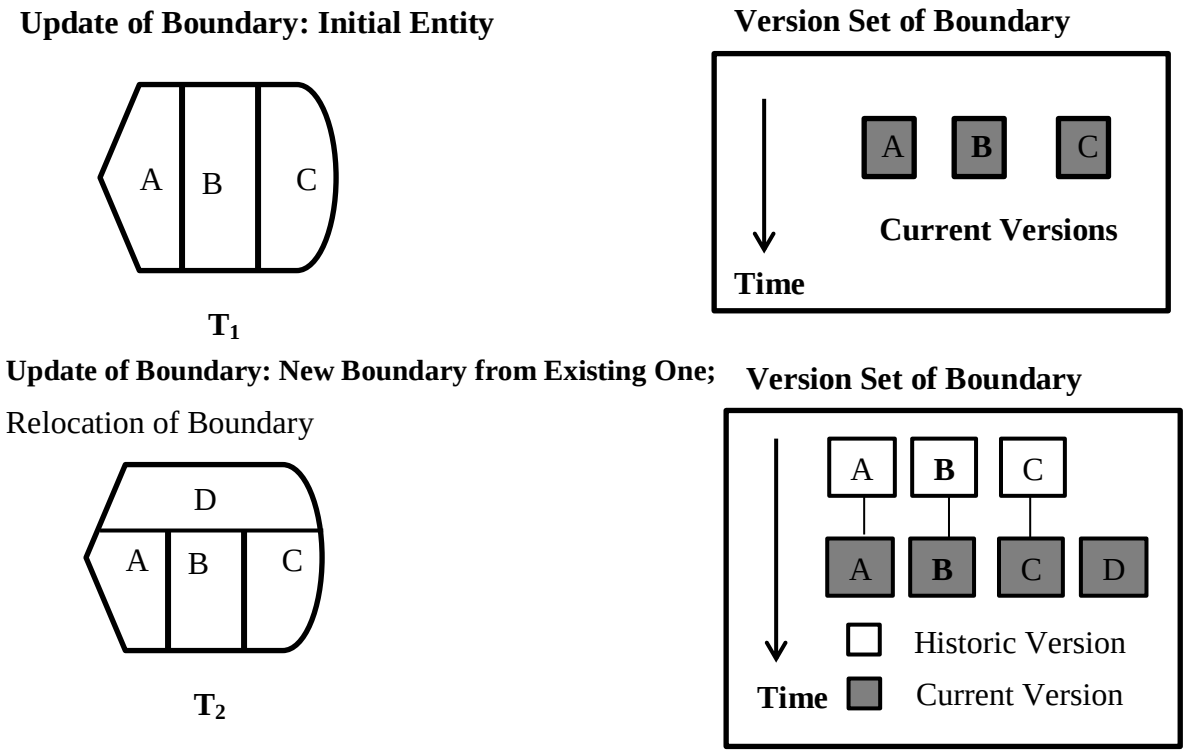


Figure 7: Boundary update procedure for different versions (modified) (Wachowicz and Healy, 1994)

2.2 GIS approaches to incorporate time into the database

GIS database management has examined three ways of incorporating time into information system: the traditional (snapshot), the object-oriented and the event oriented (Gantner et al, 2012). *Traditional approach* of dealing with spatio-temporal changes includes the relational database by maintaining an updated version of current state or taking a snapshot of the same object in different periods of time (Abraham and Roddick, 1999). *Object-oriented approaches* are distinct objects characterized by thematic, topological and geometric properties (Worboys, 2001). Object changes over time and as soon as an object has changed, it generates a new object with a unique identifier (Lohfink et al, 2007). According to a formal description by Hornsby and Egenhofer (2000),

> *"The identity determines the existence and nonexistence of an object and can undergo a set of possible changes."*

The basic difference of *event-oriented approaches* from traditional and object-oriented approaches is that they stores changes explicitly (Gantner et al, 2012). So, the event oriented approaches facilitate formulation of query about changes and predicting future conditions (Worboys, 2005).

Thus, any of the approaches can capture both the continuous state of the objects and explicit changes. This is now important to combine both object oriented and snapshot approach with event-oriented approaches to represent spatio-temporal data of geographic features.

2.3 Related Work

The research initiates to develop ontology for expressing changes of geographic regions in a declarative way. This study developed a graph (Figure 8) for defining ontology time series of two instances of time with respect to covered by and merge (Kauppinen and Hyvönen, 2007). Figure 8 shows an example developed by spatio-temporal ontology time series. It explains two different ontologies of relationship for two instances of time and shows by temporal expression before and after and spatial relation as merge and also time instance of Change Bridge.

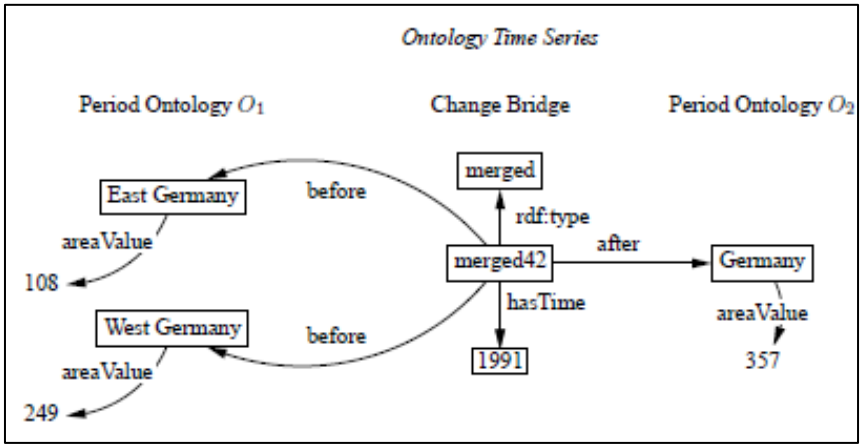


Figure 8: An RDF instance of merge bridge and change bridge ontology

The paper entitled "Creating and Using Geospatial Ontology Time Series in a Semantic Cultural Heritage Portal", has provided a schema of meaning of changing geospatial resources. There is a very simple schema of metadata to maintain and represent geospatial changes. The ontology time series is supported by semantic search of content and visualization of historical region overlay on the map. The author defines the time series of historical region under three metadata schemas:

1) Metadata schema of changes
2) Metadata schema of current places
3) Metadata schema of historic places

According to the author, the region of different time periods should be identified by URIs and also essential geographical properties like geometry, time span and name of historical region need to be

assigned to the URIs of the region. (Kauppinen, Väätäinen, and Hyvönen, 2008). This study introduces Change vocabulary[8] to describe spatio-temporal changes in semantic web.

Change Vocabulary is a lightweight spatio-temporal vocabulary that aims provide spatial and temporal terms, e.g. merge, split to enable practitioners to describe changes. The change vocabulary is the outcome of research about modeling changes administrative regions. This vocabulary can describe the data about administrative boundary change information with temporal dimension.

Ontology time series, Finish Spatio-Temporal Ontology (SAPO) can automatically generate 142 different parts-of hierarchies of the administrative units of Finland between 1865 and 2007 (Gantner et al. 2012)**.** But, there was no information about sources of information and measure required to integrate the data (Gantner et al, 2012)**.** I used data model to integrate administrative revision data in the semantic web of data using existing vocabularies from already available spatial and temporal domain.

There are much work on ontology and modeling already done to describe historical data. The International Committee for Documentation of the International Council of Museum (CIDOC) Conceptual Reference Model (CRM) is one of the earlier to take an ontological approach to semantic interoperability of metadata. It focuses on context free interpretation and considers historical event having time span, actor, conceptual objects, location or places as a Qualitative Meta schema of CIDOC CRM. It only deals with an artifact stored in a museum but not the history of places and how it changes. It shows a good conceptualization of how we can use the before and after term to link two different events and their temporal relationship.

Basic Formal Ontology is upper most ontology that combines two ontologies SNAP and SPAN. According to SPAN the world is composed of four-dimensional entities as something occurred in space and time. Therefore, SPAN records the events and processes that occur in a certain period of time. The snap is the snap short or version of object records the state of the world in a specific time period. BFO combines both SNAP and SPAN that at a time can say the state of the world in certain period and also the change explicitly to better explain the historical changes of spatial region.

SAPO is an application ontology that contributes the change vocabulary to define the changes of geometry Finish administrative units as merge, split, and overlap. This is a very good example of querying knowledge base of efficiently for part of hierarchies and changes.

Geographical Linked Data: The Administrative Geography of Great Britain on the Semantic Web, the national mapping agency of Great Britain had an attempt to produce the example data set for the administrative geography of Great Britain. The article tried to encode the topological relations between geographic entities over traditional spatial queries. The outline of approach follows the

[8] http://linkedearth.org/change/ns/

systematic approach of creating an ontology and RDF dataset, creating triples for linking data and querying RDF data via SPRQL query. But, this study did not try to integrate temporality of the dataset. The issues faced by the project are the semantics and identity, modularization, provenance and authorization of data publication(Gantner et al, 2012).

Geographic information needs to include semantic specifications in order to achieve semantic interoperability (Kuhn, 2005). There is also need to specify the local semantics of terminology used for a place name that was differently called in different time periods and also need ontological structure to define the database schema. Defining GI Science concepts and Geographic data with semantics has potentiality to the development of linked dataset and semantic sources of GIS (Gür, 2012). The definition can be reusable as linked data vocabulary as a schema to add linked geodata resources. Geography is a sector that links data from almost all topical domains and we can say everything happening in the world is somewhere in the world. Then to answer the question of what, when and where, spatio- temporal semantic is very important to address the changes. There is always involved high cost of collecting and managing geographic data that lead to more demand on data sharing. Data should be collected and maintained once but should be used by many (Goodchild et al, 1998, Guarino and Welty, 2000). The real world is always changing and tracing manages spatio-temporal data is very important to preserve as reusable format (Frank, 2003).The changing nature of geospatial data needs proper ontological open commitments (Frank, 2003).

The frequently used geo-related data hub includes Geonames.org[9] and the linked graduate project that provides an RDF serialization of open street map. The advent of linked locations with link data must tend to reduce the gap between the semantic web and geo web (Janowicz, 2011). This study will use the Geonames gazetteer to geocode the administrative unit.

There are several studies on going on linked open data (LOD)[10] techniques to incorporate geographic and attribute data into the semantic web and grounded with GI as all resources of the world is located in geographic space.

2.4 Semantic Web

Semantic web[11] is the extension of World Wide Web (WWW). The main difference between web and semantic web is that a web browser navigates along the links between documents and semantic web browser navigates along relationships (predicates) in a web of concepts (Lee et al, 2006). Semantic web technologies allow people to create data stores on the web, crate vocabularies and guide to handling data. It enables people to share information beyond the boundaries of application and

[9] www.geonames.org

[10] http://linkeddata.org/

[11] http://semanticweb.org/wiki/Main_Page

websites. Ontology is considered to be the pillar of semantic web. A semantic web[12] vocabulary can be considered as special form of ontology or sometimes a collection of URIs with described meaning.

Ontology is a formal specification of a shared conceptualization (Gruber, 1993). Ontology defines the logical relationship of a real world entity of how things are related to each other. Ontology is the abstraction of the real world and the entities of constituent is defined in a particular ontology language e.g. Web Ontology Language (OWL); (Antonious and van Harmelen, 2009). The most important contributions of GIScience are to enhance interoperability and integrate different databases (Agarwal, 2005). An ontology can provide the standardized structure and definition of common entities or general categories and relationships of a certain domain (Gantner et al, 2012). So, the semantic interoperability can be increased by reusing the vocabularies for similar other cases.

According to Wikipedia, linked open data is a term used to "describe a recommended best practice of exploring, sharing and connecting pieces of data, information and knowledge on the semantic web using RDF (Resource Description Framework)." RDF is a standardized format for publishing data on the web to keep web interoperable. RDF uses URI's for naming of things that means the subject of data and model data as triple structure: *Subject, Predicate (predicate is the vocabulary used to integrate data set), Object.*

Almost everything about the real world we can describe as subject, predicate and object from that means semantic web can convert the statement. For example, to describe a city: X is a city, X has a name, X is established in 1971, X is the Capital of Bangladesh and X has 150, 0000 populations. The Table 3 expresses these statements as Subject, Predicate and Object.

Table 3: Example of basic data about a city

Subject	Predicate	Object
www.example/city/dK	Name	Dhaka
www.example/city/dK	Type	City
www.example/city/dK	Year of information	2011
www.example/city/dK	Type	Capital
www.example/city/dK	Country	Bangladesh

The predicate will be integrated by vocabulary developed for the semantic web to define a similar meaning of information.

[12] www.semanticweb.org

RDF triple is a labeled connection between two resources. The triple format of the data will be as follows as N3 format:

<www.example/city/dK>< http://xmlns.com/foaf/0.1/name> “Dhaka” ^^xsd:string.

URI **Vocabulary** **Literals**

Subject can be represented as a blank URI to identify resources and predicate or properties refer to the vocabulary of describing similar concept and object can be URI or literal. RDF links consists of three URI references and describe the relationship between two URI resources. The URI in the position of subject and object position identifies related resources. Literals include data types as sting, date, double, float or integer etc. Data type of literals can be specified by a data type URI e.g., http://www.w3.org/2001/XMLSchema#string. Literal triples are used to describe the properties of resources such as name and date of birth of a person can be described as literals. (Tom Heath, Christian Bizer, 2011)

The Figure 9 shows an RDF graph of dataset with a blank URI that relates all other information related to a subject.

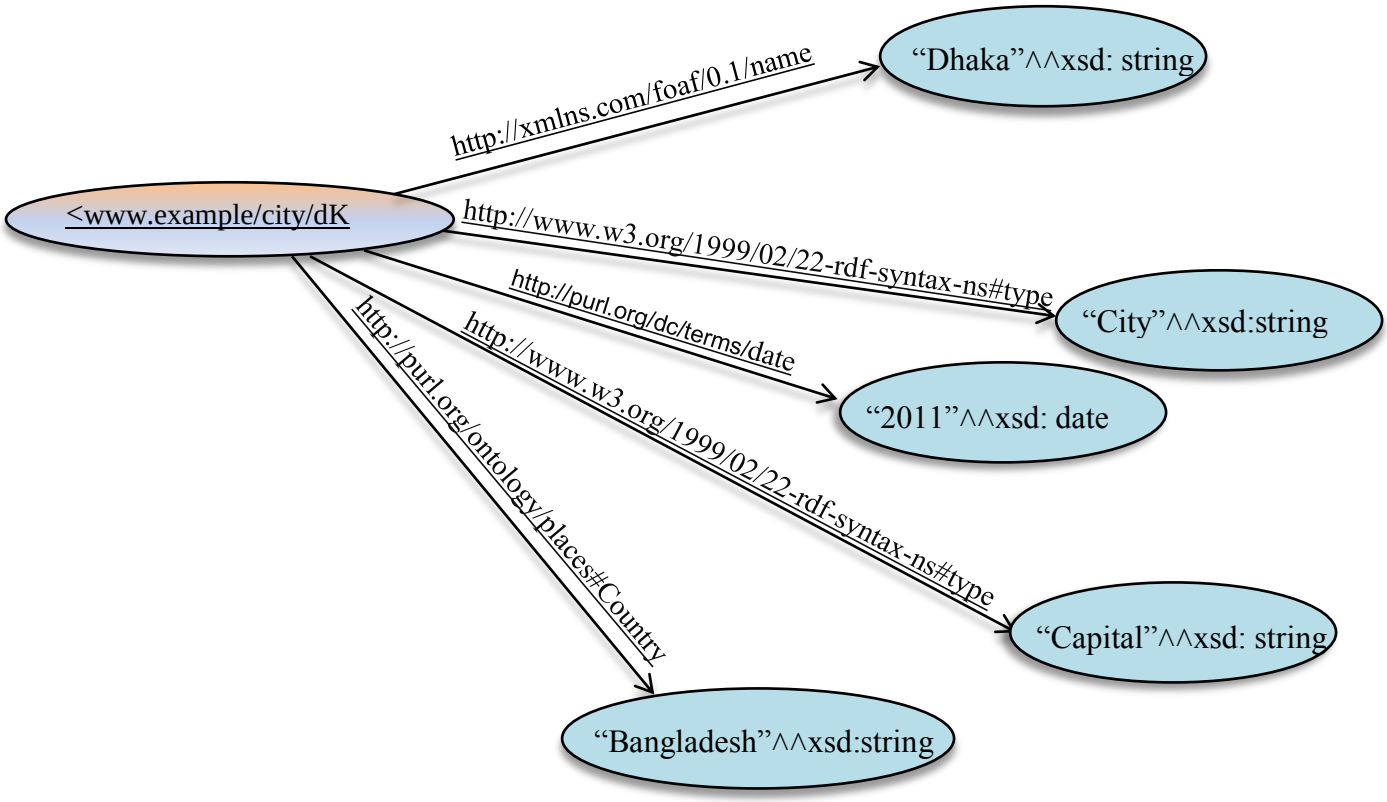


Figure 9: RDF graph with related information about Dhaka City

This thesis uses semantic web triple model to describe the dataset about administrative boundary and its temporality. Finish Spatio Temporal Ontology time series and a spatio- temporal ontology for administrative units of Switzerland attracts my attention to use the triple model to integrate administrative boundary dataset and revisions scenarios.

SPARQL protocol and RDF Query Language (SPARQL)

SPARQL protocol and RDF Query Language (SPARQL[13]) is a query language and protocol for RDF.SPARQL is a W3C recommendation and also among the most frequently used query languages for the semantic web. SPAQL can query semantically define the dataset from the triple set of introducing the concept. For example, information about Dhaka City integrated as name, type, date, capital, country and we can query the information about a specific concept

SPARQL query of RDF graph in Figure 9 are shown by following example Query

Example: What is the capital of a country?

```
PREFIX rdf: http://www.w3.org/1999/02/22-rdf-syntax-ns#type.
PREFIX places: http://purl.org/ontology/places#Country
PREFIX foaf: http://xmlns.com/foaf/0.1/name.
PREFIX xsd: http://www.w3.org/2001/XMLSchema#.
SELECT ?Name? Country
WHERE
        {
        ? a foaf: name ?Name.
        ?a rdf:type "Capital" ^^xsd: string.
        ?a place: Country ?Country.
        }
```

Name	Country
"Dhaka" ^^ http://www.w3.org/2001/XMLSchema#string	"Bangladesh"^^ http://www.w3.org/2001/XMLSchema#string

SPARQL can identify the terms of concept defined as Prefix name and resource URI and extract request from the dataset.

2.5 Choosing and using existing vocabulary

The RDF data format of semantic web provides a generic, abstract model of describing the real world entity as subject, predicate and object format. But, it does not provide any domain specific terms to describe the entities and how they relate to each other. Here comes the functionality of taxonomies, vocabularies and ontologies expresses in SKOS (Simple Knowledge Organization System), RDF vocabulary description language and Ontology Web Language (OWL) (Tom Heath, Christian Bizer, 2011). There are several domain specific vocabularies available to define different knowledge base.

[13] http://www.w3.org/TR/rdf-sparql-protocol/#div-construct-simple

The challenge is to find appropriate vocabularies to define the data model to be populated. So, I need the vocabulary for defining geographic regions, geographic names, time and changes of geographic region. For integrating the administrative data into RDF triples, the existing vocabularies and ontologies are listed in Table 4.

Table 4: Concepts to define an administrative unit and vocabulary in use

Concepts	**Vocabularies and name space**
Administrative unit	
City name	FOAF: http://xmlns.com/foaf/0.1/
Type	RDF: http://www.w3.org/1999/02/22-rdf-syntax-ns#
subClassOf	RDFs: http://www.w3.org/1999/02/22-rdf-syntax-ns#
Spatial	
Footprint/geometry/coordinate A set of coordinates	TISC: http://observedchange.com/tisc/ns/#
City point as latitude, longitude	GEO: http://www.w3.org/2003/01/geo/wgs84_pos#
GeonamesId An identifier of place used in Geonames Gazetteer	Geonames: http://www.geonames.org/ontology#
Time	
Date	Dublin Core: http://purl.org/dc/terms/
Temporality	
existenceBeginsAt	TISC: http://observedchange.com/tisc/ns/#
existenceEndsAt	TISC: http://observedchange.com/tisc/ns/#
Spatial Changes	
merge, nameChange, changePartOf	Change: http://linkedearth.org/change/ns#
Region before change	Change: http://linkedearth.org/change/ns#before
Region after Change	Change: http://linkedearth.org/change/ns#after

Ontologies and vocabularies of Table 4 will be reused to populate the data model for this thesis. All introduced ontologies require case testing for the usability of common cases and in the same field of different case studies. The administrative units are considered here is the city and it has attribute

properties, spatial properties, temporal properties and also changing behavior's properties to describe the city units. Table 4 has listed the properties specifically for each domain and also indicates the corresponding vocabularies in use.

We discuss about the related work done so far about administrative boundary change, dealing with spatiotemporal data in semantic web, the available ontology and vocabularies, the traditional way of handling change of geographic region .This chapter also points out the methods background of data structure as triple and available vocabularies to deal with spatio- temporal and geographic region data in semantic web. The next chapter will focus on the data structure and source and management for the triple model solution.

2.6 Conclusion

Literature review focuses on defining the concept of the administrative unit and its component, GIS approaches to deal with spatio-temporal geographic data, related work that tried to define administrative units and changes in semantic and ontological approaches, semantic web contribution to describe data as triple model and also existing vocabularies to match with concept to focus. The review benefits us to get a deep insight of effort to handle spatio-temporal GI data and suitability of the semantic web triple model to handle spatial-temporal administrative boundary data.

Chapter Three: Methodology

The methodology of this thesis closely deals with obtaining study data and for serving the semantic web we need careful modeling of data and convert data as semantic web using appropriate relationship described by vocabularies. The database model will follow a predefined query to integrate the component of the data model related to a subject. For my thesis the subject is Dhaka city and its boundaries and temporal existence of boundaries. Figure 10 is a flow diagram of methodology visualizing control flow from obtaining study data to converting to semantic web format as RDF triple and also query and visualize results to satisfy queries.

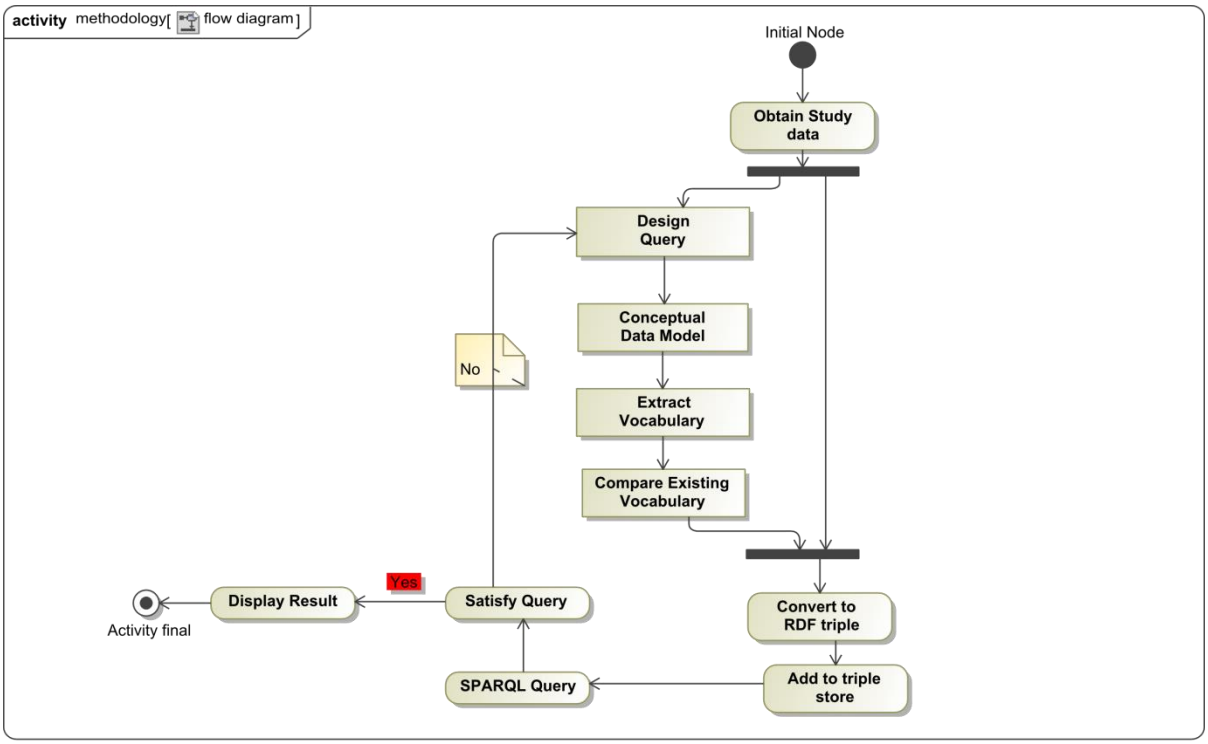


Figure 10: Flow diagram of methodology

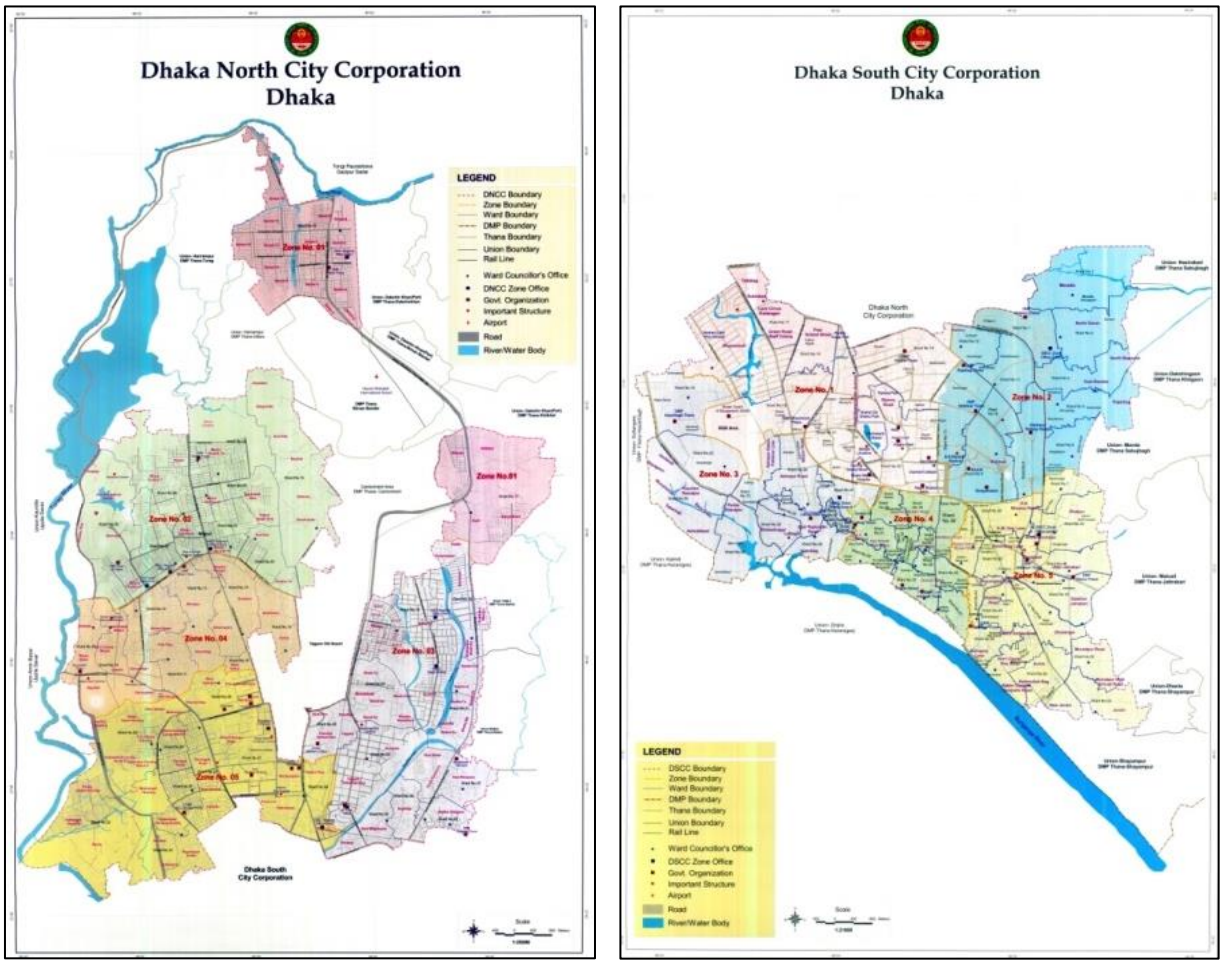
3.1 Data Preparation

Dhaka was founded in 1608 as a Thana and called as Jahangir Nagar. Dhaka is renowned as 400 years of capital[14]. According to Table 2 in section 1.3 there are some geometry data available before 1995 as settlement boundary but not as an administrative boundary.

The data required for this study are about Dhaka city and its administrative boundary and type of administration and their existence in different periods of time. Dhaka is a city and it has different administrative bodies for different public services. The city has now two City Corporation: Dhaka North City Corporation and Dhaka South City Corporation (Figure 11). Major roles of city corporation include development control, maintaining housing tax, controlling holding a number of buildings,

[14] http://www.dncc.gov.bd/

transferring of holding name of the building, providing and renewing business license, providing birth certificate, no objection certificate for high rise building construction etc.. The subdivision of City Corporation is named as Ward and suffixes are numbers. The Dhaka North City Corporation has 36 wards and Dhaka south City Corporation has 56 wards.



Source: Dhaka City Corporation, http://www.dncc.gov.bd/

Figure 11: Dhaka North and South City Corporation

Most of the information of Dhaka city corporation ward boundary was found as text or web document from corresponding web site and paper map, pdf maps, other studies related to urbanization and morphology of Dhaka. Most previous documents found as blueprint of paper map and also not in scale. The reference location to those maps is considered as road names bounded around the region and prominent natural features. The place name of the neighborhood was a major source of reference to locate old part of the city. But, there were no official registered procedures that record the historical information of digital geometry and annotation data. Most of the data obtained from secondary sources are historical book about evaluation of Dhaka city, study on morphological changes of Dhaka, city corporation reports and homepages.

Our first target was to deal with Dhaka City Corporation boundary for this study. In reality, the digital GIS data of Dhaka City corporation ward boundary was unavailable or inaccessible during this study. The geographic features of the available print maps, such as roads, boundaries were not matching with other reliable data sources such as Satellite Images or maps of RAJUK. Moreover the available map resolution was not sufficient to extract quality geo data from it.

It was found in RAJUK directory that, the Dhaka Metropolitan area was unchanged from about 1990. But, Thana boundary under Metropolitan Police area undergoes several changes over time in terms of their names, area size and physical extent and splited from one to form a new unit.

So, it was decided to do the study on Dhaka Metropolitan boundary of Dhaka City to trace the changes of Thana boundary. The digital boundary was also not possible to get directly but most of the Thana boundary was depicted (Figure 6 at page no. 8) on a website called www.citypopulation.de with due information how a new Thana was introduced (such as splitting from which Thana/s) and when. Bangladesh gazetteer notifications and information about Thana are collected from Banglapedia[15] website as the most reliable source. Finally the digital map data was prepared by digitizing available maps and editing based on comparison of information collected from various sources, such as, Banglapedia, City Population[16], Dhaka City Corporation(DCC) [17], Dhaka Rajdhani Unnayan Kartripakha (RAJUK[18]), Bangladesh Bureau of Statistics (BBS)[19], Dhaka Metropolitan Police (DMP)[20] and Google Map[21].

The study period of administrative boundary (Thana boundary) database of Dhaka city is considered from 1995 to 2010 within the Dhaka metropolitan area.

The data from variant sources gave a basis to reproduce the geometry of regions with confidence by tracing the street names referred to define the region. A major problem identified during geodata preparation is that the all the available maps was incomplete and different or organizations engaged in producing geodata do not share the data among themselves the updated versions. Absence of map metadata introduced confusion regarding their reliability. So, it was difficult to match or overlay different sources of geometric data with variant resolution and geometric shapes.

Moreover all available geo-data were prepared using a Bangladesh Transverse Mercator (BTM) projection system. From the beginning of the BTM projection system recognized problems related to

[15] http://www.bpedia.org/

[16] http://www.citypopulation.de/php/bangladesh-dhaka.php

[17] http://www.dhakacity.org/index.php

[18] http://www.rajukdhaka.gov.bd/rajuk/webHome

[19] http://www.bbs.gov.bd/home.aspx

[20] http://www.dmp.gov.bd/

[21] https://maps.google.com/

shifting of Datum. So, it was showing 300 meter shift while overlain on Google Earth. It was the most challenging work to fix the data mismatch problem. It took more time to convert projection system and match with Google map. The strategy was to take the road name bounded by the administrative region and redraw boundary line using Google Tool22. These tools can allow people to draw polygon and download as a KML file. Then, it was imported to ArcGIS and converted to shape file (Figure 12). Now, the new geodata prepared under this study shows a good edge match with Google map and all reproduced layers have a perfect match to each other. The coordinate system used for geometry data is WGS_1984_UTM_Zone_46N. The detailed Thana maps prepared under this thesis are enclosed in Appendix B.

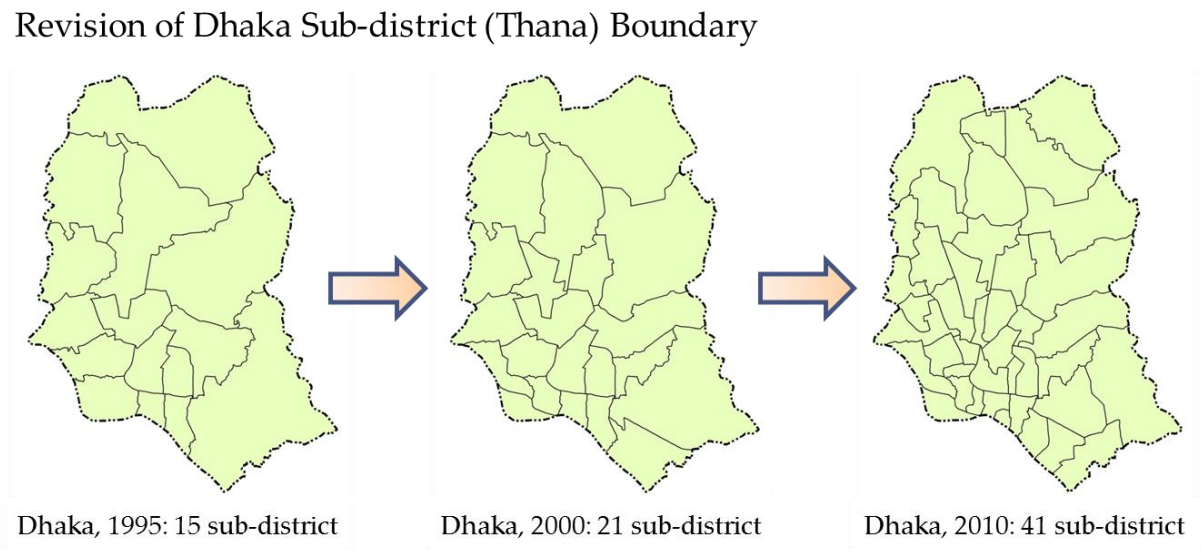


Figure 12: Thana boundaries in different periods within Dhaka Metropolitan area

The Figure 13 is the flow diagram of steps followed to get geometry data of the administrative unit for triple store. Then it was important to convert ArcGIS shape file to Linked Open Data Geometry RDF file. There is an extension tool of python script for ArcGIS to convert shape file to triple, developed under the project of Amazon Rainforest projects by Jim Jones and Alber Sánchez in 2012.

[22] http://www.birdtheme.org/useful/v3tool.html

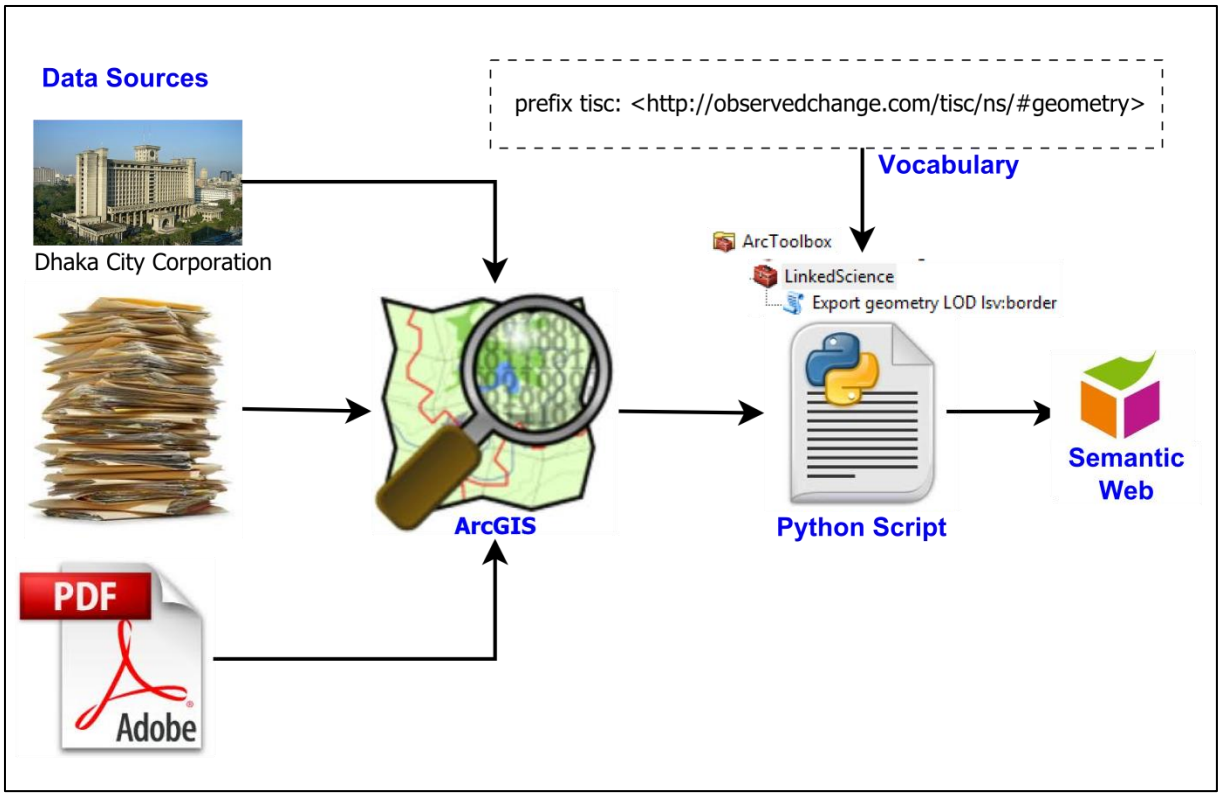


Figure 13: Graphical architecture of geodata prepration for the semantic web

3.2 Query Design

This section is about queries that retrieve information about the evolution of the administrative unit of Dhaka city. A city has administration, it has year of establishment, it has different administrative status in different periods of time and it also had different geographic extent over time. The information system has the basic ability to process queries and finding stored relationship (Yuan, 1999). The type of queries depends on the database design and ability of user to query using specific system. But first of all, data based design must consider user group and expected information that can be requested about a subject. Due to the current importance of spatial-temporal thinking in GIS, more research in this field is necessary to introduce a system that can process spatio-temporal queries (Yuan, 2008).

Currently, there is no existing database that supports spatial and temporal queries for the evolution of the administrative boundaries of Dhaka city. It is also not possible to query state of administrative unit in a certain time e.g. Where was Dhaka city in 1985? All information is available either in text format or document format as discussed in data collection and preparation section.

Queries for evolution of administrative boundary include simple attribute query, spatial query, temporal query and spatiotemporal query considering to general user requirement.

3.2.1 Attribute query

Attribute or thematic queries are the simplest type of query is used to retrieve explicitly stored information. For example- we can find or select part of a map based on some attribute variable such as name, population, area, etc. This attribute query does not require computation.

Example:

Attribute query: Find all Subdistrict (Thana) with a population density greater than 600/km^2?

3.2.2 Spatial query

Spatial query selects geographic feature based on location or spatial relationship[23]. Spatial Query can be simple spatial query, spatial range or spatial relationship queries(Gantner 2011). *Simple spatial query* search for a location based on user defined criteria and does not require any computation. *The spatial range query* retrieves information about spatial feature within a spatial entity or user defined criteria. At last, *spatial relationship query* finds features that have a relationship with another feature.

Examples:

Simple spatial query: Find all Subdistricts in Dhaka city with less than km^2?

Spatial range query: How many Subdistricts are inside of Dhaka city?

Spatial relationship query: Find all 3 storied buildings in a specific subdistrict?

3.2.3 Temporal Query

In *temporal data* time can be represented as discrete time or continuous time. Discrete time is an essential requirement for describing data pointing to the date of collection. On the other hand, continuous time is also important for modeling physical changes and global changes. The coexistence of both is very important to describe the real world as current entity and event.

Time constant can be represented as absolute time (e.g., 5th March 2013) or a relative time (e.g. Yesterday). Time can also be interpreted as a time period of something occurred denote as start time point and end time point. In temporal GIS, it is essential to incorporate geographical time zone to relate the events that happen in different places.

Temporal queries are categorized as simple temporal query, temporal range and temporal relationship query. *The simple temporal query* is used to find the snapshot or time slice of certain time. *Temporal range queries* search a feature that undergoes changes in a certain period of time (Gantner 2011). Temporal relationship queries retrieve information related to changes in feature relationship with the changes of time that means changes of topological relationship and nearby feature with time.

[23] http://en.mimi.hu/gis/spatial_query.html

Example:

Simple temporal query: How many people lived in Lalbagh Thana during 1995?

Temporal range query: How many people died in Lalbagh Thana during 1970 to 1972?

Temporal relationship query: How many times Lalbagh Thana splits with the increase of population?

3.2.4 Spatiotemporal query of geographic feature boundary changes

Supporting the spatiotemporal query is the key theme of temporal GIS and requires modeling to retrieve spatiotemporal information. According to (Langrans, 1992), spatiotemporal queries are characterized as *simple spatiotemporal query* and *spatiotemporal range query*. Simple spatiotemporal query seeks information about a region at a given time and answer represents a snapshot of the area. Whereas, the spatiotemporal range query asks question about the history of a region over time that answers the life of the snapshot table with changes in a specific period of time.

Example:

Simple spatiotemporal query: What are the Thanas in Dhaka City during 1995?

Spatiotemporal range query: How did the subdivision changes in Dhaka Metropolitan area 1995 to 2000?

Langrans approach mostly deal with static spatiotemporal data of histories at the location. In addition to Langrans, Yuan added *spatiotemporal behavior queries* to stress the need of dynamic information describing behavior. This type of query supports tracing evaluation of a given entity to follow an entity in space and time (Yuan 2002).

Example:

Spatiotemporal behavior query: What changes occur in Lalbagh Thana During 1995 to 2010?

3.3 Data Modeling for Dhaka City Boundary Revisions

Data model refers to the way of representing data along the logical operations. Data model consists of connecting all the related information that needs to define an entity. The most common data models are *spreadsheet* and *relational* data model. The new approach introduced for the semantic web is the RDF that combines best of both[24].

In *spreadsheet data model,* a single spreadsheet is broken down into rows and columns. The column heading always tells what kind of data it contains. The spreadsheet is very flexible but very difficult to manage for a fairly big dataset and also the document format of data is not self-explanatory.

[24] http://www.cambridgesemantics.com/de/blog/-/blogs/it-all-starts-with-the-data-model

One the other hand, relational data model is very manageable and consists of predefined grids with strict rules of the kind of data hold by each cell. Relational data model preserves data integrity. The main drawback of relational dataset is the difficulty of a simple modification of any part of the dataset.

RDF data model of semantic web preserves both flexibility of spreadsheet and data integrity of relational data model. It follows the standards set by the World Wide Web Consortium (W3C) to allow data combination on the web. RDF integrates data in cells with self–describing meaning set by vocabularies that define relationship with the entity. The RDF data model is known as a semantic data model as the word semantic refers to "meaning" and the meaning of each cell is attached to it[25]. Data model provides a framework that it automatically knows what information about a company implies to each of the employees and what is the relation with the companies. Semantic web navigates through relations with semantic meaning. Let us take a look at well-established data model and the uniqueness of semantic web (Table 5). The uniqueness here is the data integrated using semantic meaning of entity and their relationship. It is very important to know two terms to integrate the data according to the meaning- *vocabulary* and *ontology*. *Vocabulary* is a collection of well-defined terms that is consistent according to the context. On the other hand, *ontology* is used to define the contextual relationship behind a vocabulary. The detailed discussion of ontology, vocabulary and RDF are noted in section 2.4.

Table 5: Comparism between popular data models and semantic web

Model	Example Format	Data	Metadata	Identifier	Query Syntax	Semantics (Meaning)
Object Serialization	.NET CLR Object Serialization	Object Property Values	Object Property Names	e.g. Filename	LINQ	N/A
Relational	MS SQL, Oracle, MySQL	Table Cell Values	Table Column Definitions	Primary Key (Data Column) Value	SQL	N/A
Hierarchical	XML	Tag/Attribute Values	XSD/DTD	e.g. Unique Attribute Key Value	XPath	N/A
Graph	RDF/XML, Turtle	RDF	RDFS/OWL	URI	SPARQL	Yes, using RDFS and OWL

Source: http://www.linkeddatatools.com/semantic-modeling

[25] http://www.cambridgesemantics.com/de/blog/-/blogs/it-all-starts-with-the-data-model

3.3.1 Data model for the evolution of administrative boundary for semantic web

Data model for the Dhaka city boundary revision aims to store and retrieve the information about the evolution of administrative boundary revisions for Dhaka city. For this, it is very important to have knowledge about the boundary revision process (Figure 15) and their hierarchical relationship. According to section 2.1 administrative units refers to a place and a place can be described by place name, administrative status and location or footprint. Location or footprint is geographic extent that can be represented by polygon geometry on the map. The area bounded by the polygon to define the jurisdiction of the administrative unit is considered as an administrative boundary. In the case of Dhaka city, Dhaka is governed by two different administrations for civil service and management purposes. One is Dhaka City corporation area and another is a Dhaka metropolitan police area. The administrative subdivisions of the Dhaka city area is shown in Figure 14.

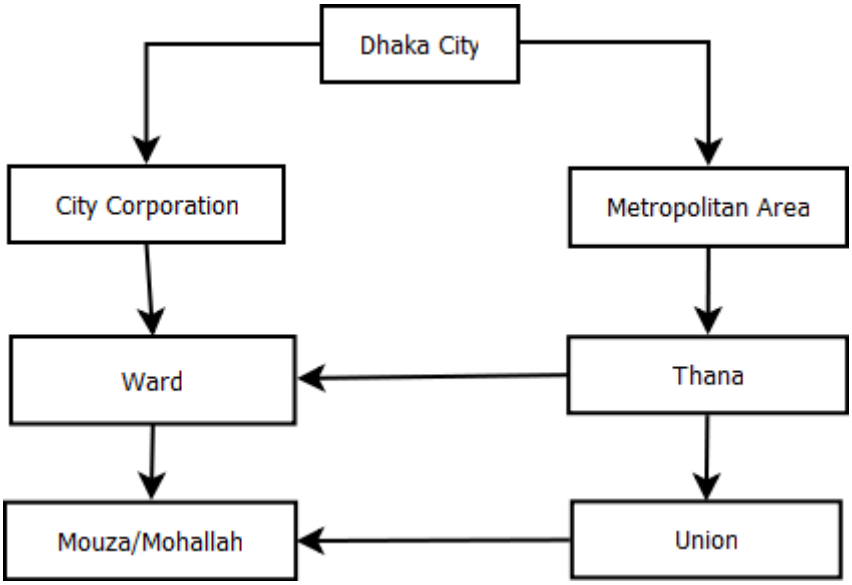


Figure 14: Administrative subdivision of Dhaka city

Now, there are two city corporations in Dhaka city- Dhaka North City Corporation ad Dhaka South City Corporation. The subdivisions of city corporations are known as Ward and wards are recognized as ward number such as ward 01, ward 02, etc. There is a tremendous change of ward numbering after the division of the Dhaka City Corporation to the Dhaka North City Corporation and Dhaka South City Corporation. Ward consists of neighborhood locally known as *Mohallah/Mouza*. Mouza is the smallest unit in cadastral survey map of Bangladesh and this unit does not change over time. But the public does not have access to *mouza* boundary map.

Metropolitan area is greater than city corporation area. In local terms, *Thana* is the subdivision of the metropolitan area. *Thana* consists of two or more Wards or Unions. Area outside city corporation area is known as Union. As in section 1.2 Rationale of the study discussed about dramatic changes of Thana boundaries because of splitting old Thana to introduce new one

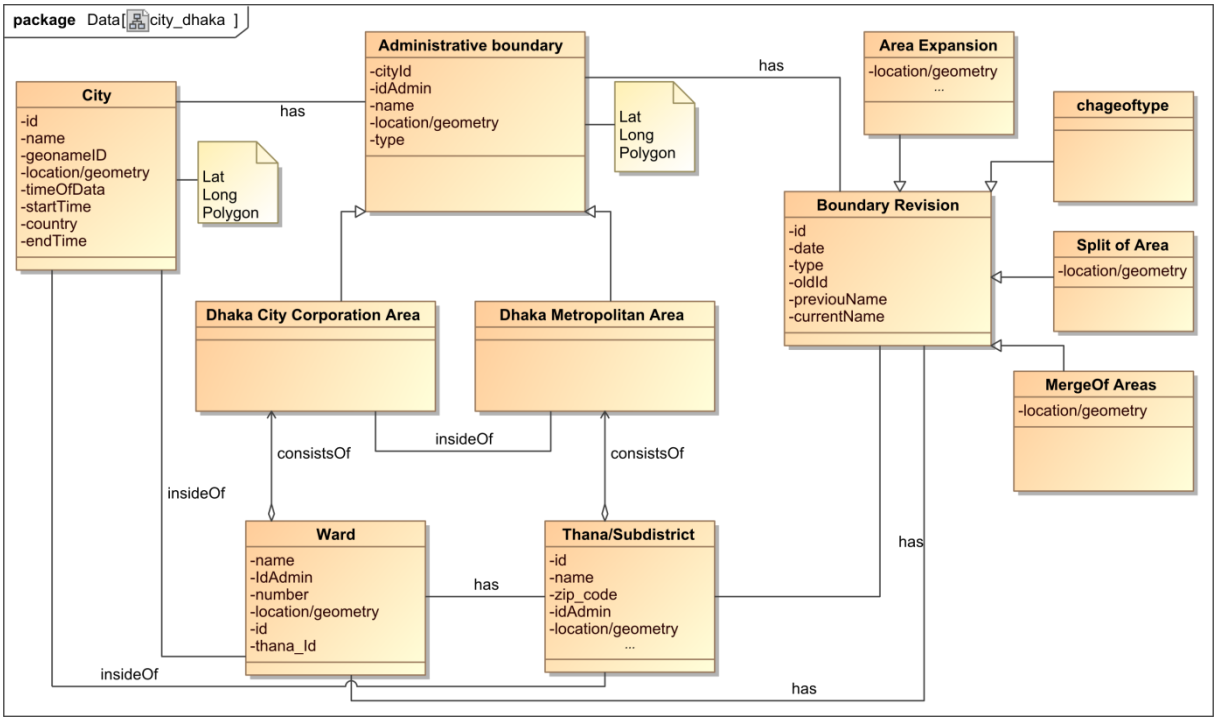


Figure 15: Dhaka city boundary revision process model

3.3.2 Boundary revisions

Boundary revisions of geographic areas include boundary change in legal and statistical areas, name changes and also geographic coding changes by legislation.

Boundary change in legal areas includes split of an area and introducing new areas from the original ones. Sometimes a new area may form with the contribution of two or three different areas. Every split of a region is introducing the new region of administration. Boundary change also includes new areas to cities from rural areas known as boundary expansion that mostly occur for city boundaries.

According to American Community Survey[26], geographic boundary change notes the types of changes of geographic regions include:

- New entities;
- Dissolution of entities;
- Changes in higher-level geographic relationships (state, county, and county subdivision levels);
- Mergers or consolidations of two or more entities;
- Name changes and corrections;
- Legal or statistical area description changes;
- Functional status changes;
- Changes in status of incorporated places as either dependent within or independent of surrounding county subdivisions;

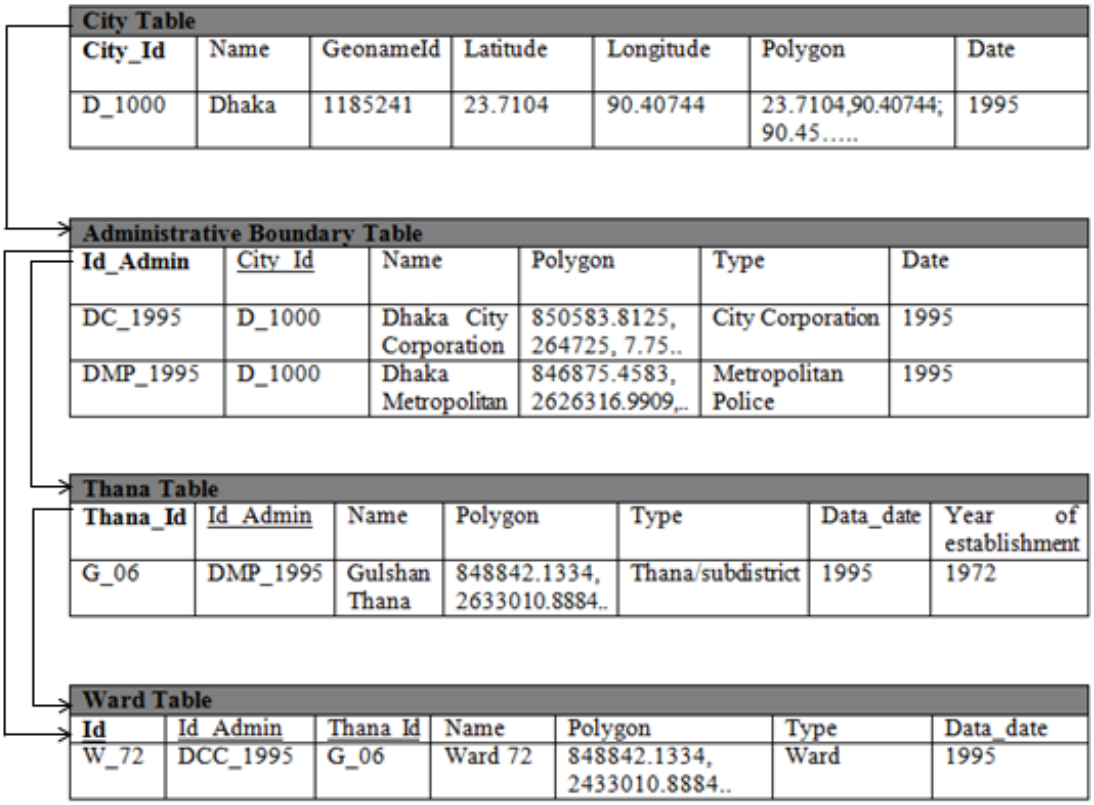
[26]http://www.census.gov/acs/www/guidance_for_data_users/geography_and_boundary_changes/

- The county redistricting;
- Census code changes and corrections; and
- Federal Information Processing Series (FIPS) code changes and corrections.

Statistical areas in Bangladesh are based on Thana and the ward as a smaller unit of aggregation of census data. So, it is important to keep proper record of areas that match with census statistics and also to compare statistics with two different time periods.

Till now, there is no appropriate record keeping system for Dhaka city to manage these changes of the geographic regions. Most of the information about changes comes from separate studies and all the geometric data are reproduced from different sources as a snapshot of a mentioned time period.

Figure 15 shows the interrelation between each table with others with an identifier as relational databases to show administrative boundary hierarchy.



City Table

City_Id	Name	GeonameId	Latitude	Longitude	Polygon	Date
D_1000	Dhaka	1185241	23.7104	90.40744	23.7104,90.40744; 90.45.....	1995

Administrative Boundary Table

Id_Admin	City_Id	Name	Polygon	Type	Date
DC_1995	D_1000	Dhaka City Corporation	850583.8125, 264725, 7.75..	City Corporation	1995
DMP_1995	D_1000	Dhaka Metropolitan	846875.4583, 2626316.9909,..	Metropolitan Police	1995

Thana Table

Thana_Id	Id_Admin	Name	Polygon	Type	Data_date	Year of establishment
G_06	DMP_1995	Gulshan Thana	848842.1334, 2633010.8884..	Thana/subdistrict	1995	1972

Ward Table

Id	Id_Admin	Thana_Id	Name	Polygon	Type	Data_date
W_72	DCC_1995	G_06	Ward 72	848842.1334, 2433010.8884..	Ward	1995

Legend:

Bold Text= Primary Key Underline Text= Foreign Key

Source: Banglapedia: www.bpedia.org

Figure 16: Administrative boundary entity relationship diagram

Now, it is important to convert the relational database schema to semantic web incorporating semantic meaning to keep the benefit of both spreadsheet and relational database.

3.3.3 Vocabularies used for data integration

3.3.3.1 Existing Vocabulary:

Class: City

Identifier: http://purl.org/ontology/places#City

A large settlement, often with some form of formal political recognition.

Semantics: It is equivalent to http://dbpedia.org/ontology/City .

Property: hasName

Existing vocabulary: foaf: name

Identifier: foaf:<http://xmlns.com/foaf/0.1/.

name - A name for something.

Semantics: The name of something is a simple textual string.

Property: hasGeonameId

Existing Vocabulary: @prefix gn: <http://www.geonames.org/ontology#

It will refer the city in Geonames gazetteer.

Property: hasLatitude

Existing Vocabulary: geo:lat

Identifier: geo: http://www.w3.org/2003/01/geo/wgs84_pos#

```
<rdf:Property rdf:about="http://www.w3.org/2003/01/geo/wgs84_pos#lat">
 <rdfs:domain rdf:resource="http://www.w3.org/2003/01/geo/wgs84_pos#SpatialThing" />
 <rdfs:label>latitude</rdfs:label>
 <rdfs:comment>The WGS84 latitude of a SpatialThing (decimal degrees).</rdfs:comment>
</rdf: Property>
```

Property: hasLongitude

Existing Vocabulary: geo:long

Identifier: geo: http://www.w3.org/2003/01/geo/wgs84_pos#

```
<rdf:Property rdf:about="http://www.w3.org/2003/01/geo/wgs84_pos#long">
 <rdfs:domain rdf:resource="http://www.w3.org/2003/01/geo/wgs84_pos#SpatialThing" />
 <rdfs:label>longitude</rdfs:label>
 <rdfs:comment>The WGS84 latitude of a SpatialThing (decimal degrees).</rdfs:comment>
</rdf: Property>
```

Property: hasGeometry

Existing Vocabulary: tisc:geometry

Identifier: tisc:http://observedchange.com/tisc/ns#>

Semantics: Geometry is an abstract property to express that an object has certain geometry.

OWL Type: ObjectProperty

Property: hasStartTime

Existing Vocabulary: tisc:extistenceBeginsAt

Identifier: tisc:http://observedchange.com/tisc/ns#>

Property: existenceBeginsAt

ExistenceBeginsAt is an abstract property to express that the existence of an object begins at a given time instant.

Property: hasEndTime
Existing Vocabulary: tisc:extistenceEndsAt

Identifier: tisc: http://observedchange.com/tisc/ns#

Property: existenceEndsAt

ExistenceBeginsAt is an abstract property to express that the existence of an object begins at a given time instant.

Property: hasSubdivision
Identifier: http://dbpedia.org/property/subdivision
Existing vocabulary: sudivision
dbpprop:subdivision rdf:type rdf:property.
dbpprop:subdivision rdfs:label "subdivision".

Existing Vocabulary for changes of geographic region
Class: Change
Change is a superclass of all different kinds of changes.
Identifier: http://linkedearth.org/change/ns#Change

Class: Merge
Merge is used to denote when some different things (e.g. Two or more administration regions) have been merged together.
Identifier: http://linkedearth.org/change/ns#Merge
SubclassOf: change:Change

Class: Split
Merge is used to denote when something has been split to two or more different things (e.g. to two or more administrational regions).
Identifier: http://linkedearth.org/change/ns#Split
SubclassOf: change:Change

Class: Namechange
Namechange is used to denote when something (e.g. administrational region) has been renamed.
Identifier: http://linkedearth.org/change/ns#Namechange
SubclassOf: change:Change

Class: Changepartof
Changepartof is used to denote when two things (e.g. two administrational region) change some parts, i.e. one part of a region A is moved to region B.
Identifier: http://linkedearth.org/change/ns#Changepartof
SubclassOf: change:Change

A new class of changes was important to introduce in order to show the changes of administrative status or change of type of administrative unit.

Class: Changetypeof
Identifier: d-city: http://dhaka-example.org/resource/
New Vocabulary: Changetypeof
d-city:Changetypeof rdf:type owl:class.
d-city:Thana rdf:label "Changetypeof".
d-city:Thana rdfs:subClassOf change:Change.
d-city:Thana dc:description "Administrative region can be changed by its type such as Municipality can uplift to City Corporation".

The Table 6 shows the example of changes occur in Dhaka City in terms of name change, split, change of type of administration and also change of part of relationship:

Table 6: Changes of Dhaka city as an administrative region

Name	Type of change	Date of Change	Type	Part of	CentralAD
Dhaka Nouth	Name change	04.12.2011	City Corporation	Bangladesh	Administration
Dhaka Nouth	Split of Geometry	04.12.2011	City Corporation	Bangladesh	Bangladesh Government
Dhaka South	Name change	04.12.2011	City Corporation, Capital City	Bangladesh	Bangladesh Government
Dhaka South	Split of Geometry	04.12.2011	City Corporation, Capital City	Bangladesh	Bangladesh Government
Dhaka South	Administrative status	04.12.2011	City Corporation, Capital City	Bangladesh	Bangladesh Government
Dhaka	Administrative status	04.12.2011	City Corporation, Capital	Bangladesh	Bangladesh Government
Dacca	Administrative status	1978	Pourosova/Municipality, Capital	Bangladesh	Bangladesh Government
Dacca	Administrative status	1971	Pourashava, Capital	Bangladesh	Bangladesh Government
Dacca	Administrative status	1947	Municipality	Indian Subcontinent	Pakistan Government
Zahangirnagor	Name change	1864	Capital Province of East Bengal and Asam	Indian Subcontinent	British Empire
Zahangirnagor	Initial entity	1608	Capital Province	Indian Subcontinent	Mughal Empire

3.3.3.2 Properties of Change:

Property: before

Before property is used to denote what was before a given change.

Identifier: http://linkedearth.org/change/ns#before
OWL: Class
Type: ObjectProperty
Domain: not set (i.e. it can be anything, also OWL:Thing)
Range: change:Change

Property: after

After property is used to denote what was after a given change.

Identifier: http://linkedearth.org/change/ns#after
OWL: Class
Type: ObjectProperty
Domain: not set (i.e. it can be anything, also OWL:Thing)
Range: change:Change

Property: hasAdministration

Identifier: d-city: http://dhaka-example.org/resource/
New vocabulary: administration
d-city:administration rdf:type rdf:property.
d-city:administration rdf:label "administration".
d-city:administration rdf:comments "Administration is a form of government such as public administration e.g., City Corporation".

Class: Thana

Identifier: d-city: http://dhaka-example.org/resource/
New Vocabulary: Thana
d-city:Thana rdf:type owl:class.
d-city:Thana rdf:label "Thana".
d-city:Thana owl:sameAs place:Subdistrict.

Property: hasNumberOfSubdivision
Identifier: d-city: http://dhaka-example.org/resource/
New vocabulary: numberOfSubdivision.
d-city:numberOfSubdivision rdf:type rdf:property.
d-city:numberOfSubdivision rdf:label "numberOfSubdivision".

Property: hasHistoricVersion
Identifier: d-city: http://dhaka-example.org/resource/
New vocabulary: historicVersion
d-city:historicVersion rdf:type rdf:property.
d-city:historicVersion rdf:label "historicVersion".
d-city:historicVersion owl:sameAs dc:hasVersion.

Now, with this vocabulary we can say lots of things about city, administrative boundary and about its changes over time and the period of existence of a specific entity. All entities or subject will be provided with a URI identifier set by users just like id field in a relational database to relate to different entities or subject.

3.3.4 RDF format view of data model

Now the relational data schema of Dhaka city boundary is integrated using the semantic vocabulary with semantic meaning to describe the city and its related attributes, administration and subdivision (Figure 17).

```
<place:City>
        <foaf:name>Name</foaf:name>
        <rdf:type>Type</rdf:type>
        <gn:GeonameId>GeonameId</gn:GeonameId>
        <geo:lat>latitude</geo:lat>
        <geo:long>longitude</geo:long>
        <tisc:geometry>geometry</tisc:geometry>
        <dc:date>Time</dc:date>
        <d-city:administration>
            <foaf:name>name</foaf:name>
            <tisc:geometry>geometry</tisc:geometry>
            <rdf:type>type</rdf:Type>
            <d-city:numberOfSubdivision>Type</d-city:numberOfSubdivision>
            <dc:date>Time</dc:date>
            <dbpprop:subdivision>
                    <foaf:name>name</foaf:name>
                    <rdf:type>Type</rdf:type>
                    <tisc:geometry>geometry</tisc:geometry>
                    <tisc:existenceBeginsAt>Time</tisc:existenceBeginsAt>
            </dbpprop:subdivision>
        </d-city:administration>
</place:City>
```

Figure 17: RDF schema of describing a city and its administration and subdivision hierarchies

The RDF data model in the Figure 17 shows the structure of current place as current version. According to Figure 18, place is considered as an event and it has a name, administrative status, location and also the period of validity as *existenceBeginsAt* and *existencEendsAt* to show the start to period and the end of the period.

```
<place:place>
        <foaf:name>Name</foaf:name>
        <rdf:type>Type</rdf:Type>
        <rdf:resources>Type</rdf:resources>
        <geo:lat>latitude</geo:lat>
        <geo:long>longitude</geo:long>
        <tisc:geometry>geometry</tisc:geometry>
        <tisc:existenceBeginsAt>Time</tisc:existenceBeginsAt>
        <tisc:existenceEndsAt>Time</tisc:existenceEndssAt>
</place:place>
```

Figure 18: Place as event or historic place

The RDF schema in Figure 19 is used to represent the changes occurred in the geographic region and concepts integrated using change vocabulary. Change vocabulary[27] is a lightweight spatio-temporal vocabulary that describes spatio-temporal term such as split, merge, and name change of geographic region. Change vocabulary is an outcome of research on Modeling Geospatial Changes (Kauppinen, Väätäinen, and Hyvönen, 2008).

[27] http://www.linkedearth.org/change/ns/

The conceptual model is designed based on the vocabulary defined in change vocabulary. The data model will be populated with an example data set of Dhaka city before and after the split of geometries.

By using change vocabulary, data model describes changes of geographic region or unit of administration by pointing to its entity before the change and the entity after the change of identity or attributes of a given date (Figure 19).

```
<change:change>
    <rdf:type>Type</rdf:Type>
    <change:before>Subject/region before change</change:before>
    <change:after>Subject/region after change</change:after>
    <dc:date>Date</dc:Date>
</change:change>
```

Figure 19: Use of change vocabulary to integrate boundary revisions dataset

In the design of database for the city and subdivision, only the basic components to describe a city is shown and every time it is possible to add all possible attribute information with the subject such as city area, population, the life expectancy rate etc. for the valid time period.

3.4 Answer to the query

It is very important to find the answer of questions that are usually asked about the boundary revision of a city. The data model should support to find the answer or retrieve the answer about the predefined questions. The data model in *closed world assumptions* states that all information that is not true in the databases are considered as false (Hustadt 1994). So, it is important for the data model to answer the designed spatio-temporal query that tells us the story of evolution of administrative boundary revision. SPARQL query language is used to retrieve information from RDF dataset. Evaluation is considered as the effectiveness of data model to retrieve required information and if the data model is not appropriate it is necessary to reshape the data model.

3.5 Conclusion

The methodology of work flow was about the steps followed to implement evolution of administrative boundary data in semantic web. The next chapter is about the implementation of methodology using case study data.

Chapter Four: Vocabulary Implementation and Testing for Dhaka City

This chapter discusses about the spatio-temporal query that retrieve the administrative boundary of Dhaka city, and integration of data about the Dhaka city in the RDF data model.

4.1 Spatio-temporal query for evolution of Dhaka City

This thesis will try to answer the following spatio-temporal query to trace the administrative boundary revisions from the database.

4.1.1 Temporal or attribute query

1) What was the name of the municipality in a specific period of time or date?

To get the answer we need to know name place, type/administrative status, date or a valid period etc. The data table with related attributes is listed in Source: Dhaka City Corporation, Banglapedia

:

Table 7: Name and administrative status of Dhaka City in different period of time

Name	Type	Type2	PartOf	StatTime	EndTime
Jahangior Nagor	Thana	Capital Province	Indian Subcontinent	1608	1864
Dacca	Municipality	Capital Province	Indian Subcontinent	1864	1947
Dacca	Pourashava	Provincial Capital	Pakistan	1947	1971
Dacca	Pourashava	Capital	Bangladesh	1971	1978
Dhaka	Municipal Corporation	Capital	Bangladesh	1978	1990
Dhaka	City Corporation	Capital	Bangladesh	1990	2011
Dhaka South	City Corporation		Bangladesh	2011	
Dhaka North	City Corporation	Capital	Bangladesh	2011	

Source: Dhaka City Corporation, Banglapedia

The Source: Dhaka City Corporation, Banglapedia

contains the name of the place, type denoting the administrative status, *partOf* refers to which country it was under and start and end time respectively define the valid period of the entity. The semantic meaning for a period of time is integrated as existenceBeginsAt and existenceEndsAt depicted from

TISC (http://observedchange.com/tisc/ns/#) vocabulary as discussed in section 2.5 choosing and using existing vocabulary.

2) Search for the period of life of administrative unit with name of Dhaka?

Source: Dhaka City Corporation, Banglapedia

can also retrieve the answer of the period of existence of an administrative unit by the name of Dhaka. The corresponding result filed should be type of unit and start and end time of validity.

4.1.2 Spatial range query

3) What were Thanas under DMP (Dhaka Metropolitan) area in 1995?

Thana is the subdivision of the Dhaka Metropolitan area. Thana is the local term of the subdistrict in Bangladesh. Now, we need to retrieve the data from dataset integrated with semantic vocabulary.

Table 8: Snap of Thanas of Dhaka metropolitan area in 1995

Name	insideOf	Type	startTime	dataTime
Kotwali	Dhaka metropolitan	Thana	-	1995
Ramna	Dhaka metropolitan	Thana	1921	1995
Mirpur	Dhaka metropolitan	Thana	1962	1995
Tejgaon	Dhaka metropolitan	Thana	1963	1995
Gulshan	Dhaka metropolitan	Thana	1872	1995
Demra	Dhaka metropolitan	Thana	1973	1995
Dhanmondi	Dhaka metropolitan	Thana	1976	1995
Motijheel	Dhaka metropolitan	Thana	1976	1995
Cantonment	Dhaka metropolitan	Thana	1976	1995
Uttara	Dhaka metropolitan	Thana	1998	1995
Sabujbagh	Dhaka metropolitan	Thana	1998	1995
Mohammadpur	Dhaka metropolitan	Thana	-	1995
Sutrapur	Dhaka metropolitan	Thana		1995
Lalbagh	Dhaka metropolitan	Thana		1995
Pallabi	Dhaka metropolitan	Thana	1993	1995

Source: Dhaka City Corporation, Banglapedia

For the subdistrict, *insideOf* refers to the upper level of the hierarchy the area is inside and the vocabulary is adapted from TISC. Here, the type of administration is Thana and start time defines the establishment year of specific Thana. But, for all the Thanas the year of establishment is not available. So, snap of time referred to data date is included to show the status of Thana in that year.

4.1.3 Spatial relationship query

4) What are the administrative boundaries having part of a relationship with Dhaka city?

Dhaka is administered by two parallel administrations – Dhaka City Corporation and Dhaka Metropolitan area and both had a different jurisdiction area and responsibility. So, both areas can be considered as part of Dhaka city (Table 9).

Table 9: Administrations that are part of Dhaka City

Name of administration	isPartOf	Country
Dhaka South City Corporation	Dhaka City	Bangladesh
Dhaka North City Corporation	Dhaka City	Bangladesh
Dhaka Metropolitan Area	Dhaka City	Bangladesh

Source: Dhaka City Corporation, Banglapedia

4.1.4 Spatio-temporal query

5) Where was the city in a specific period of time or date?

The answer of the question includes physical extent or location of a municipality in a specific period of time. The 'where' question is used to find the location and for municipality case location polygon geometry of a municipality with respect to country map or world map are used to represent the location of the municipality.

Name	Type	Point		Polygon	ExistenceBeginsAt	existenceEndsAt
		Latitude	Longitude			
Dhaka	City	23.7104	90.40744	850583,8125,2647257,75;850609,4375,2647251,5;…"	1990	-

Source: Dhaka City Corporation, Banglapedia, Google Map

By integrating this data in the data set for semantic web we can easily retrieve stored information using SPARQL query language. Here, location is represented as point geometry and also as polygon geometry with a string of coordinates.

6) When did the Dhaka City Corporation split into Dhaka North City Corporation and Dhaka South City Corporation?

Now, it is important to know the change type as split of area of administrative boundaries and when did it happen.

Table 10: Place name and administrative status in period of life Dhaka City

Place Name	Time/date	Before	Type of change	Change bridge	Type	Part of
Dhaka Nouth	04.12.2011 to now	Dhaka	Name change	04.12.2011	City Corporation	Bangladesh
Dhaka Nouth	04.12.2011 to now	Dhaka	Split of Geometry	04.12.2011	City Corporation	Bangladesh
Dhaka South	04.12.2011 to now	Dhaka	Name change	04.12.2011	City Corporation, Capital City	Bangladesh
Dhaka South	04.12.2011 to now	Dhaka	Split of Geometry	04.12.2011	City Corporation, Capital City	Bangladesh
Dhaka South	04.12.2011 to now	Dhaka	Administrative status	04.12.2011	City Corporation, Capital City	Bangladesh
Dhaka	1978 to 04.12.12011	Dacca	Administrative status	04.12.2011	City Corporation, Capital	Bangladesh
Dacca	16.12.1971 to1978	Dacca	Administrative status	1978	Pourosova/Municipality, Capital City	Bangladesh
Dacca	1947 to 16.12.1971	Dacca	Administrative status	1971	Pourashava, Capital Province of East Pakistan	East Pakistan
Dacca	01.08.1864 to 1947	Zahangir nagor	Name change	1864	Municipality	Indian Subcontinent
Zahangirnagor	1608 to 01.08.1864	Initial entity	Initial entity	_	Capital Province of East Bengal and Asam	Indian Subcontinent

Source: http://www.dhakacity.org/

The Table 10 summarizes the status of Dhaka city from initial entity to current time stating the dynamic history of name change, change of type of administrative status and administration name. This table is created from the chronological history of Dhaka city found in text document from Dhaka City Corporation web site.

4.2 Conceptual data model implementation for Dhaka City

This thesis models the data for administrative unit considering three core elements to describe a place-name, type, footprint/geometry and additionally added time component to define temporality of administrative units changing over time.

"http://dhaka-example.org/resource/" is the identifier used to integrate the dataset for administrative units of Dhaka city.

4.2.1 Implementation of triple model for Dhaka city as object

This section will draw an example of administrative unit using Open Time and Space Core Vocabulary (TISC)[28] and other stated vocabularies (Figure 20) to integrate dataset about a place as an object version.

The following is the implementation of example of Dhaka City as geographic region as well as administrative units in the semantic web schema of N3 triples considering its administrations and their subdivisions.

Namespaces or identifier for vocabularies:

dc dbpedia-owl geo foaf d-city tisc gn rdfs dbpedia xsd owl rdf dbpprop place

```
@prefix xsd:<http://www.w3.org/2001/XMLSchema#>.
@prefix rdf:<http://www.w3.org/1999/02/22-rdf-syntax-ns#>.
@prefix dbpedia:<http://dbpedia.org/resource/>.
@prefix foaf:<http://xmlns.com/foaf/0.1/>.
@prefix tisc:<http://observedchange.com/tisc/ns#>.
@prefix geo:<http://www.w3.org/2003/01/geo/wgs84_pos#> .
@prefix dc:<http://purl.org/dc/terms/>.
@prefix d-city:<http://dhaka-example.org/resource/>.
@prefix dbpprop: <http://dbpedia.org/property/>.
@prefix rdfs:<http://www.w3.org/2000/01/rdf-schema#>.
@prefix place:<http://purl.org/ontology/places#>.
@prefix dbpedia-owl:<http://dbpedia.org/ontology/>.
@prefix gn: <http://www.geonames.org/ontology#>.
@prefix owl:<http://www.w3.org/2002/07/owl#>.
```

Figure 20: Vocabularies that are used to integrate semantic meaning

Figure 20 states the vocabularies used to integrate the attributes or statements about the place and its related entity. The example down is the implementation of the conceptual data model of a current city and its relationship of subdivision hierarchies. This thesis will deal with only one level of administrative hierarchies for the metropolitan areas basing on the availability of data.

In the Table 11, subject is the individual entity for Dhaka city, Metropolitan area and its subdivision as Thana. An identifier is used for individual entity and all statements links with the identifier URI. Red mark in the identifiers means to show the relationship between each entity and a subject became the object for another statement. This is how the one entity linked to another to describe the whole world. The RDF graph of the implementing triple model is shown in Figure 21 visualizing the hierarchy mapping of administrative subdivisions.

[28] http://observedchange.com/tisc/ns/

Table 11: Dhaka City in semantic web triple model

Subject	Predicate	Object
Dhaka City		
d-city:Dhaka d-city:Dhaka d-city:Dhaka d-city:Dhaka d-city:Dhaka d-city:Dhaka d-city:Dhaka d-city:Dhaka d-city:Dhaka	foaf:name rdf:type geo:lat Go:long dc:date tisc:geometry tisc:existenceBeginsAt owl:sameAs d-city:administration	"Dhaka"^^xsd:string. <place:City>. "23.7104"^^xsd:string. " 90.40744"^^xsd:string. "1995"^^xsd:date. "850583,8125,2647257,75;850609,4375,2647251,5; …"^^xsd:string. "1990"^^xsd:date. <http://sws.geonames.org/1185241/>. **d-city:DMP_1995.**
Dhaka Metropolitan area		
d-city:DMP_1995 d-city:DMP_1995 d-city:DMP_1995 d-city:DMP_1995 d-city:DMP_1995	Fog:name dbpprop:subdivision d-city:numberOfSubdivision rdf:type tisc:geometry	"Dhaka metropolitan area "^^xsd:string. d-city:Pallabi_Thana_1995. "14". <http://dbpedia.org/page/Metropolitan_area>. "850609,4375,2647251,5;850618,8125,2647251,75…".
Thana as subdivision		
d-city:Pallabi_Thana_1995 d-city:Pallabi_Thana_1995 d-city:Pallabi_Thana_1995 d-city:Pallabi_Thana_1995 d-city:Pallabi_Thana_1995 d-city:Pallabi_Thana_1995 d-city:Pallabi_Thana_1995	dbpedia-owl:isPartOf foaf:name rdf:type rdfs:subClassOf tisc:existenceBeginsAt dbpedia-owl:areaTotal tisc:geometry	**d-city:DMP_1995.** "Pallabi Thana"^^xsd:string. "Thana". place: District. "15.03.1993"^^xsd:date. "17000000"^^xsd:double." 850583,8125,2647257,75;850609,4375,2647251,5;850618,8125,2647251,75;;…. ^^xsd:string ".

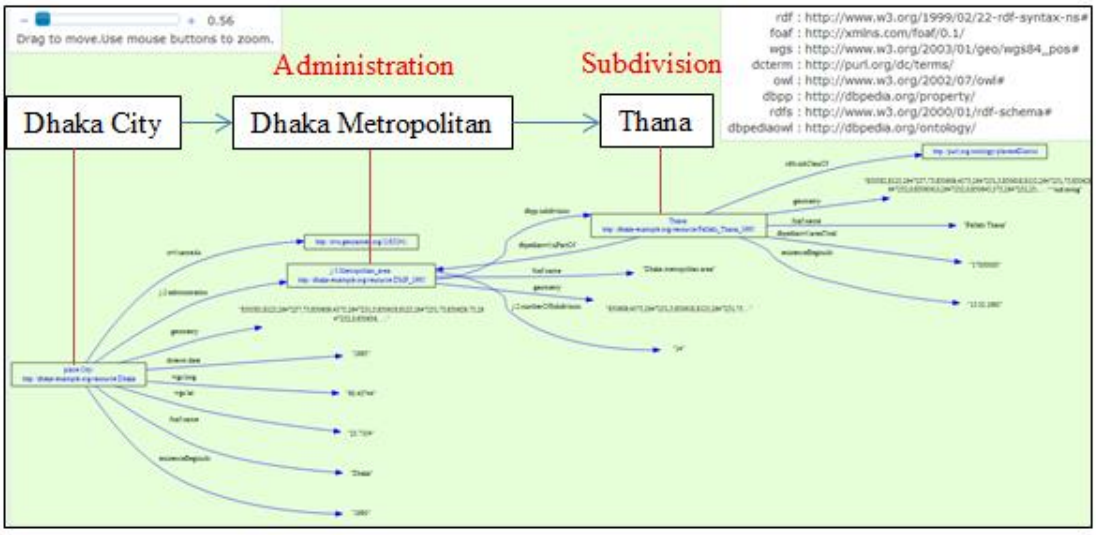


Figure 21: RDF graph of Dhaka City triple model for a specific time instance

Now, it is possible to state from Figure 21 that Dhaka city has a Dhaka metropolitan area as administration and metropolitan area is subdivided into Thana.

It is also possible to link this information to additional information as dataset from geonames gazetteer and also with dbpedia dataset. Data set is always extendable by adding additional properties with the subject as area, population, birth rate, death rate pointing specific date of observation. We can use owl:sameAs to link our resources to same resources defined by other data set. The additional resource library also added to show a complete example (Table 12) of using owl: sameAs predicate.

Table 12: Adding external resources on the subject

@prefix dbpedia: <http://dbpedia.org/resource/>. @prefix gn: <http://www.geonames.org/ontology#>. @prefix owl: <www.w3.org/2002/07/owl#>. @prefix geos: <http://www.telegraphis.net/ontology/geography/geography#>		
Subject	**Predicate**	**Object**
d-city:Dhaka	gn:locationMap	<http://www.geonames.org/maps/google_23.71_90.407.html>.
d-city:Dhaka	owl:sameAs	<dbpedia: Dhaka>.
d-city:Dhaka	Owl: sameAs	<http://sws.geonames.org/1185241/>.
d-city:Dhaka	geos:capitalOf	<dbpedia:Bangladesh>.

4.2.2 Triple model of Place for semantic web as an event

Here, Dhaka city is considered as an event to integrate information about the period of existence of city in certain state. To define an event, we need to answer the question of who, what, where and when (Van Hage et al, 2011). So, Dhaka was a municipality during 1864 to 1947 (see Source: Dhaka City Corporation, Banglapedia

). In this circumstance, Dhaka municipality is the participant, Dhaka had a location and it has temporal existence.

Table 13: Triple model representation of Dacca municipality as Event

The namespace of vocabularies is in use @prefix foaf: <http://xmlns.com/foaf/0.1/>. @prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>. @prefix d-city: <http://dhaka-example.org/resource/>. @prefix geo: <http://www.w3.org/2003/01/geo/wgs84_pos#> . @prefix tisc: <http://observedchange.com/tisc/ns#>. @prefix dbpedia-owl:<http://dbpedia.org/ontology/>.		
Subject	**Predicate**	**Object**
d-city:Dhaka1964-947	foaf:name	"Dacca".
d-city:Dhaka1964-947	rdf:type	"Municipality".
d-city:Dhaka1964-947	d-city:historicPeriod	"British Period ".
d-city:Dhaka1964-947	geo:lat	"23.721554".
d-city:Dhaka1964-947	geo:long	"90.386066".
d-city:Dhaka1964-947	tisc:existenceBeginsAt	"1864"^^xsd:date.
d-city:Dhaka1964-947	tisc:existenceEndsAt	"1947"^^xsd:date.
d-city:Dhaka1964-947	dbpedia-owl:isPartOf	<http://dbpedia.org/page/Mughal_Empire>.
d-city:Dhaka1964-94	dbpedia-owl:isPartOf	<http://dbpedia.org/page/Indian_subcontinent>.

The information integrated in Table 13 is based on data model in Figure 18. RDF graph of triple data is shown in Figure 22. The subject is the identifier of the event and predicate describes the properties about the subject. The additional properties added to define name of historic period of the event and also its central administrative situation.

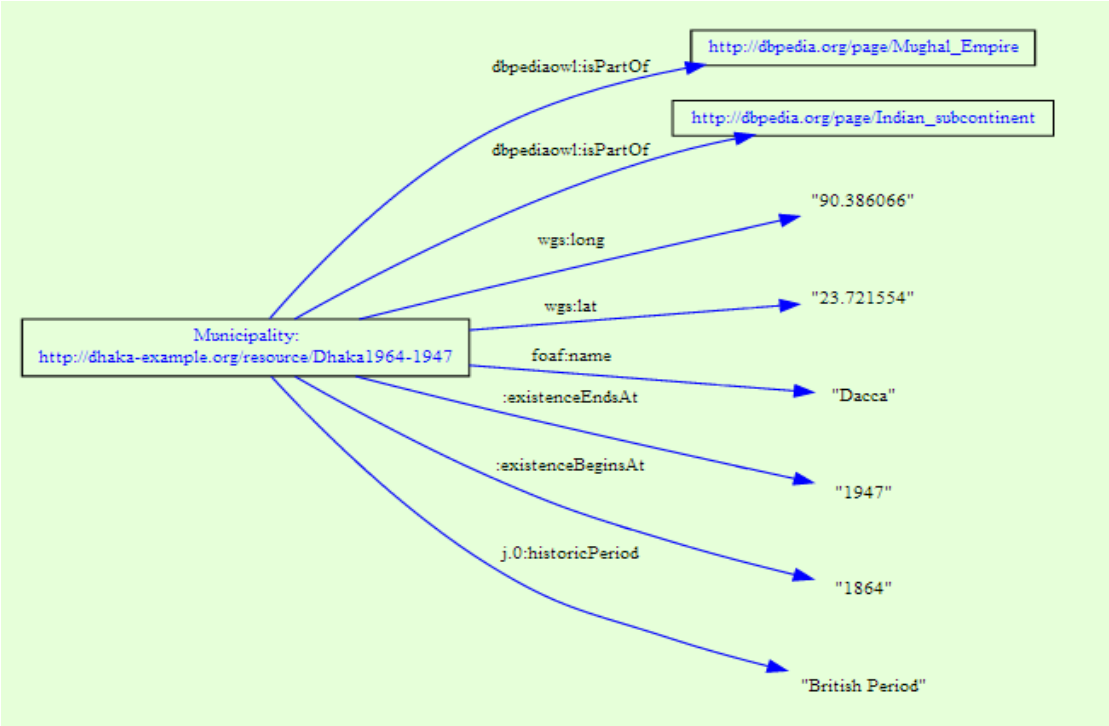
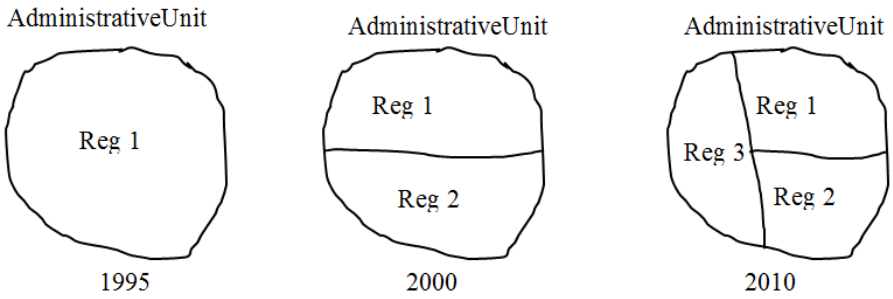


Figure 22: RDF graph of Dhaka as an Event or historic place

4.2.3 Conceptual background of changes of geographic regions

As we discussed before the place is changing over time in terms of name, type and also footprint. A conceptual diagram of changes of the region over time is shown in the Figure 23.



Source: (Worboys 1994)

Figure 23: Changes of number of subdivisions of administrative units and shape of areas.

We need to know the changes of Administrative units to compare statistics. For example:

1. What was the variation of population density of Reg1 between 1995 and 2010?
2. What was variation of water consumption of a population of Reg3 between 2000 and 2010?

The graphical example of Dhaka city split reproduces for split case from "Modeling and reasoning about changes in ontology time series ontology change and information" (Figure 24).

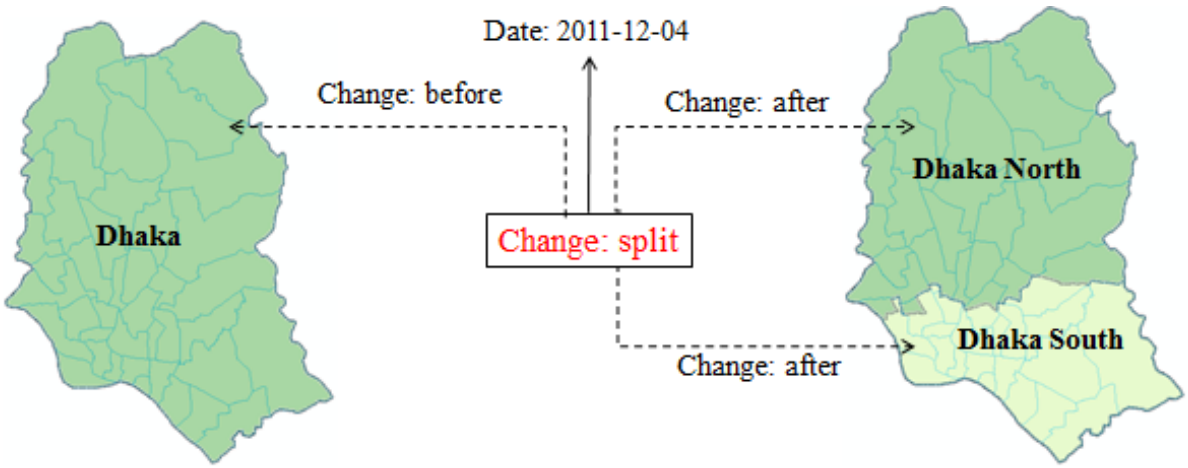
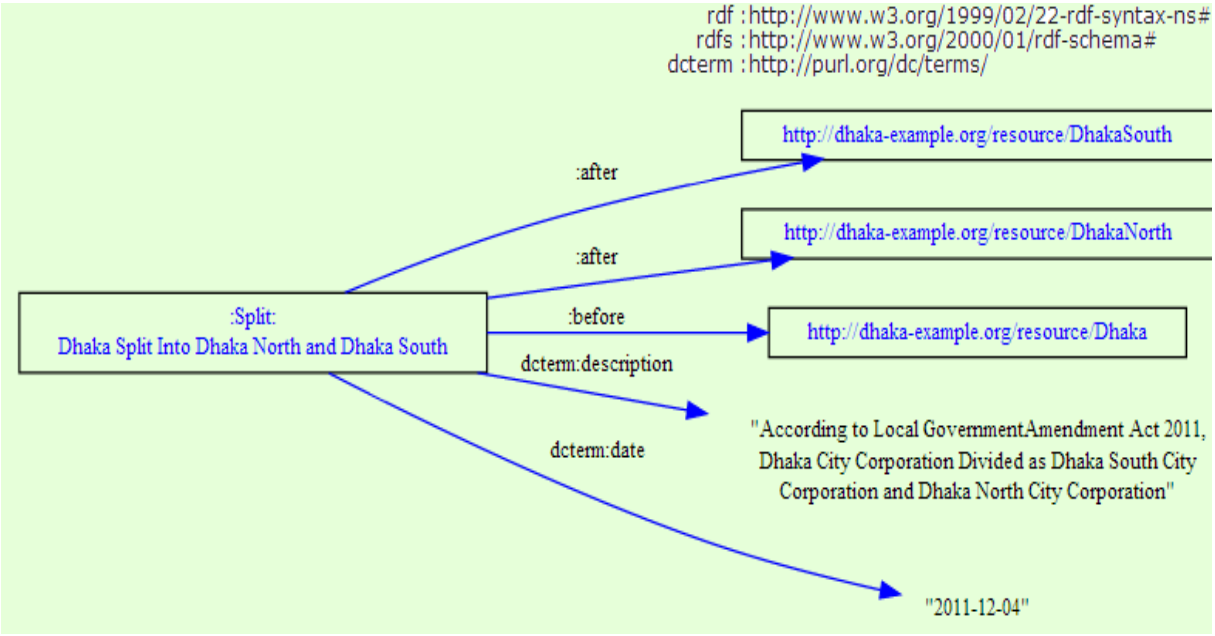


Figure 24: Change of Dhaka City Corporation to Dhaka South and Dhaka North City Corporation

It is very important to have an identifier to every historic period of place with its name and also changes identified in history. Firstly, places can be given an identity based on different name of existence. Then, we can give a different identity for every change that occurs for administrative status and also to identify individual geometry noted down from evidence of a temporal entity. Now, we can relate the current city to its historic version. Triple data of Dhaka city corporation split are included in Appendix-A.



Tool: http://inspector.sindice.com/

Figure 25: RDF graph of change type split

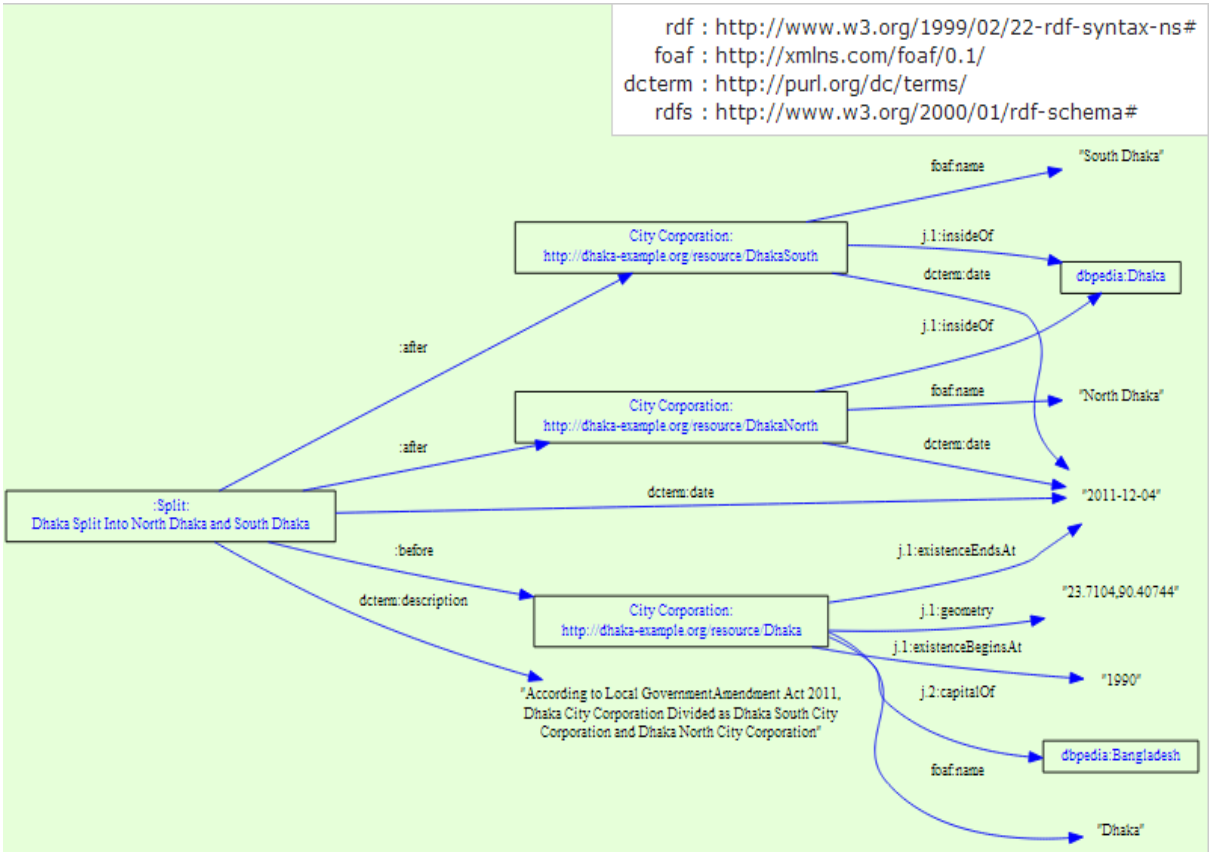
From Figure 25 we can relate the place of two different instances that are separated by a time point where the place is differentiable.

The RDF graph of Figure 25 can be represented as following statement:

According to Local Government Amendment Act 2011, Dhaka City Corporation was splited into Dhaka north City Corporation and Dhaka South City Corporation in 4th December 2011.

URIs is the identifier of individual entity and linked to relevant information provided by the data set about Dhaka, Dhaka North and Dhaka South. Each individual place has an identifier URIs for every snap short of a time periods and again we describe the *ocurrent* considering place an event. The period of a place being unchanged can be identified by an individual URI of historic places. Here, places are considered as both objects and events. An object consists of current places and historic places and an event consists of name of event, place of occurrence, period of existence and participant. A place also considered as participant of event.

A full RDF graph of the split of Dhaka City Corporation into Dhaka North City Corporation and Dhaka South City Corporation are drawn in Figure 26.



Tool: http://inspector.sindice.com

Figure 26 : Full Graph to show the Dhaka City administrative boundary revision

Change of subdistrict of Dhaka metropolitan area:

As population in a geographic region is increasing day by day, the growth of population is very high for Dhaka city. Therefore, an administrative sub-region of Dhaka had to redefine the administrative regions not only for political reasons but also for management purposes. Type of change of geometry occurs during 1995 to 2010 in the Dhaka sub regions are 36 times in terms of split and 8 times in term of merging from part of other areas (Table 14).

Table 14: Temporal overlap of sub district of Dhaka Metropolitan Area

Legend: 100% overlap / Partial overlap / No overlap	Kotwali (1872-1995)	Ramna (1921-1995)	Mirpur (1962-1995)	Tejgaon	Gulshan (1972-1995)	Demra (1973-1995)	Dhanmondi (1976-	Motijheel (1976-1995)	Cantonment (1976-	Uttara (1988-1995)	Sabujbagh (1988-1995)	Mohammadpur (1993-	Sutrapur (1993-1995)	Lalbagh (1993-1995)	Pallabi (1993-1995)	Shyampur (1998-2000)	Badda (1998-2000)	Khilgaon (1998-2000)	Kafrul (1998-2000)	
Hazaribagh (1998-2000)							■					■		■						3
Shyampur (1998-2000)						■							■			■				2
Beta (1998-2000)					■				■								■			2
Kafrul (1998-2000)			■						■										■	2
Kamragir Char (1998-2000)														■						1
Khilgaon (1998-2000)					■	■					■							■		3
Adabor (2000-2010)												■								1
Bangshal (2000-2010)	■																			1
Biman Bandar (2000-2010)									■											1
Chak Bazar (2010)													■							1
Dakshinkhan (2010)										■										1
Darus Salam (2010)			■																	1
Jatrabari (2010)						■														1
Kadamtali (2007-2010)						■										■				2
Kalabagan (2010))							■													1
Khilkhet (2010)																	■			1
Newmarket (2010)							■													1
Paltan (2010)								■												1
Rampura (2010)																		■		1
Shah Ali (2010)			■												■					2
Shahbagh (2010)		■																		1
Sher-E-Bangla Nagor (2010)				■								■							■	3
Tejgaon Industrial Area (2010)				■																1
Turag (2010)															■					1
Uttar Khan (2010)										■										1
	1	1	3	2	2	4	3	1	3	2	1	3	2	2	2	1	1	1	1	36

Source: http://bpedia.org/, http://www.citypopulation.de/php/bangladesh-dhaka.php

From Table 14, black color shows 100% overlap and gray color shows partial overlap with other regions. If we count the number of gray bars vertically it will show how many split done in a single region, if count the gray bars horizontally it will show number of parts of regions consisting the new regions.

We found that there was no change of the boundary of the Dhaka Metropolitan area but its subdivision had significant changes in numbers and also in geometric shapes as well as 26 new names were added to the list of subdivisions. According to Figure 27, in 1995 the number of Thana inside Dhaka Metropolitan area was 15 and in 2000, 6 new Thanas were added to the list sharing some part from previous areas.

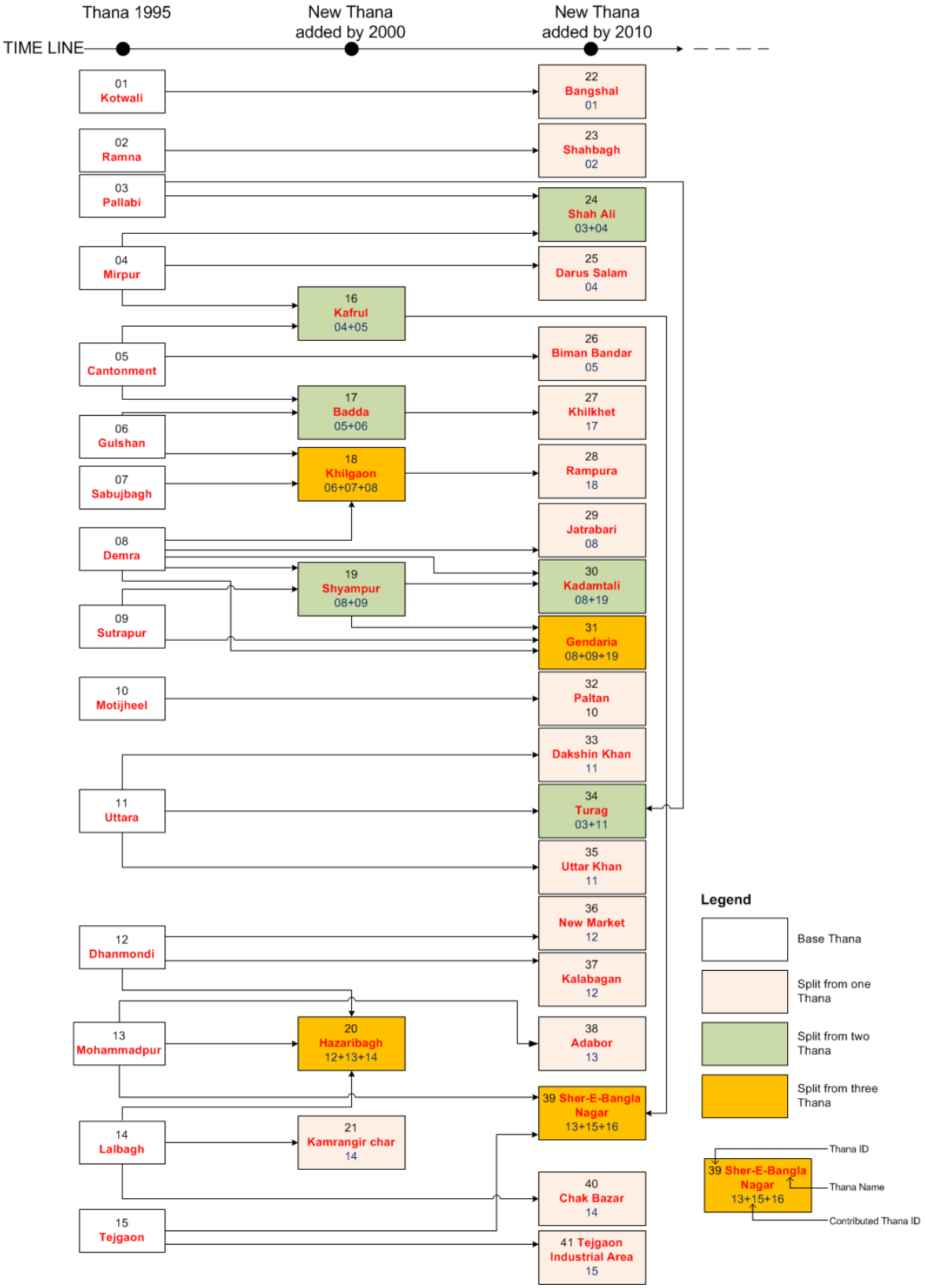


Figure 27: Evolution of sub-district of Dhaka from 1995 to 2010

The number of Thanas increased to 41 in 2010. The Map of Dhaka metropolitan area for the year of 1995, 2000, 2010 are included in Appendix-B.

Some areas are split from previous one and sometimes a new Thana form splitting from two or three previous Thanas.

Now, we need to integrate the data into the semantic web to describe all the changes occurred during the period between 1995and 2011 for the subdivision of the metropolitan area. The major challenge was the information found in the subdivision is a snapshot version of the object. But, it was not possible to collect information about the specific date of the change of geometry.

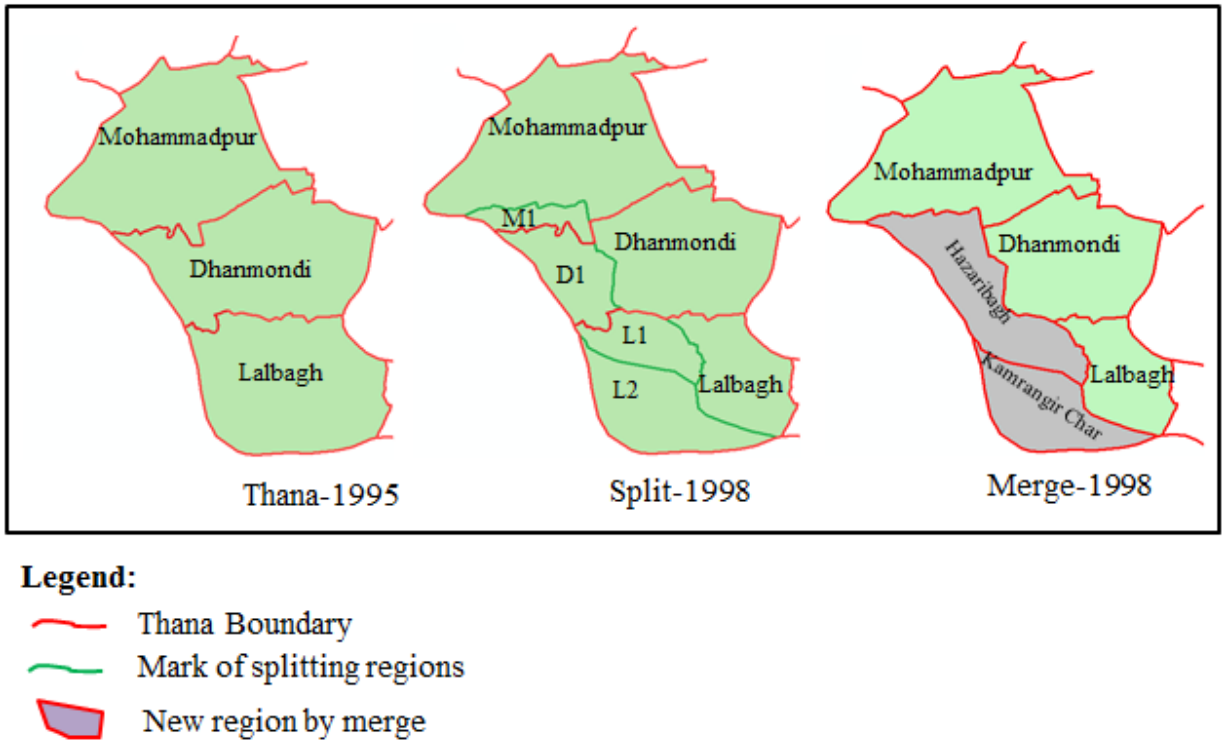


Figure 28: Example of Thana boundary changes in terms of the split , merge and name Change

According to Figure 28:

T_{1995}=Muhamaadpur + Dhanmondi + Lalbagh

$T_{1998\ (Split)=}$ (Muhamaadpur +M1) + (Dhanmondi +D1) + (Lalbagh + L1+l2)

$T_{1998\ (Merge)=}$ Muhammadpur +(M1+D1+L1) + Dhanmondi + Lalbagh + L2

T_{1998}= Muhammadpur + Hazaribagh + Dhanmodi + Lalbagh + Kamrangir Char

So, in 1995 there were only three Thanas, namely Muhammadpur, Dhanmodi and Lalbagh. In 1998, two Thanas added in the same geographic extent of previous than and the number of Thanas become five. The change of the region according to Figure 28 is split of geometries, merge of geometries and name changes to introduce new names.

This is how boundary changes are occurring and the system is too complex to compare with old areas.

The modeling of these changes was done using change vocabulary[29] developed by Tomi Kauppinen (Institute for Geoinformatics, University of Muenster, Germany) based on a research by modeling changes[30].

[29] http://linkedearth.org/change/ns/#

[30] http://linkedearth.org/change/ns/#

Chapter Five: Evaluation and Visualization Issues

This chapter discusses about the tools to integrate dataset as RDF and query capabilities of data model to retrieve relevant information and visualization issues for semantic web dataset for end users.

5.1 Evaluation

Evaluation includes uploading the data set in a triple store and generating the RDF graph and capabilities to query from the data set.

5.1.1 Tools for integrating dataset

I have created all annotation data using *http://epad.ifgi.de* , a very useful online text editor tool. It was very comfortable in using it as I could instantly check the syntax error while preparing data set. I have used RDFpad (epad.ifgi.de) to check the syntax error and view the dataset and this site has also a SPARQL endpoint to query the data set. For geometry dataset, I used ArcGIS10.0 by the python script to directly convert the geometry as triple using predefined namespace id for the region. But, I could not use *epad* .de online for processing geometry triple set. Geometry has huge coordinate point and show syntax error while copying and pasting from .ttl file and it was very time consuming to fix the problem.

Parliament triple store

Parliament™ is a high performance triple store designed for semantic web[31]. The semantic web data store is called triple store, graph storage or knowledge base. Unlike relational database table format data, triple store can store RDF data as a list of triple form (*subject, predicate, object*) (Parliament online,12). Parliament triple store is used to store the triple data set created for this thesis and data set become ready for the query using the SPARQL endpoint supported by the Parliament triple store. It is possible to visualize the whole graph of data. But Parliament cannot visualize geometry directly. It can only show the results as a string of coordinate as inserted into the dataset.

5.2 Implementation of queries

This section of the thesis faces the challenge to answer to predefined queries. Implementation shows the effectiveness of data set to retrieve the information about the revisions of the boundaries of the administrative unit of Dhaka city. The full RDF data of administrative boundary revision of Dhaka city is enclosed Appendix-C. The section listed all predefined queries and implementing the queries using SPARQL and showing corresponding results.

[31] http://parliament.semwebcentral.org/

Q-1). What was the name of the municipality in a specific period of time or date?

SPARQL query in the Figure 29 first selects all names, then filter by type as a municipality and for the period of existence retrieves the time of the beginning and end of their existence and also retrieve the name of the historic period. A new vocabulary *historicPeriod* is introduced in section3.3 to define the name of the historic period of a historical place name. The Figure 30 eventually states the name of municipality, period of validity and name of the historic era.

```
PREFIX d-city: <http://dhaka-example.org/resource/>
PREFIX tisc: <http://observedchange.com/tisc/ns#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/terms/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX geos: <http://www.telegraphis.net/ontology/geography/geography#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT distinct ?Name ?Type ?startTime ?endTime ?Era
FROM <http://giv-heatmap.uni-muenster.de:8080/epad.ifgi.de/p/shiuli_Dhaka_final.rdf>
WHERE {

?a foaf:name ?Name.
?a rdf:type "Municipality".
?a rdf:type ?Type.
?a tisc:existenceBeginsAt ?startTime.
?a tisc:existenceEndsAt ?endTime.
?a d-city:historicPeriod ?Era.
}
```

Figure 29: SPARQL query Q-1

Name	Type	StartDate	EndDate	Era
"Dacca"	"Capital of Province"	"1864"	"1905"	"British Period "
"Dacca"	"Municipality"	"1864"	"1905"	"British Period "

Figure 30: SPARQL query result Q-1

Q-2). Search for the period of life of administrative unit with the name of Dhaka city?

With SPARQL query we have to retrieve information about Dhaka when it was a city and the name is also “Dhaka”. In the data model we integrated all information about administrative unit such as the period of validity, name and type as a core component to describe a place. Now, we filtered the information according to type of administrative unit and corresponding information related to it. *existenceBeginsAt* and *existenceEndsAt* refers to start and end of an administrative unit. SPARQL query for Q-2) is shown in Figure 31 and the result is shown in the Figure 32.

```
PREFIX d-city: <http://dhaka-example.org/resource/>
PREFIX tisc: <http://observedchange.com/tisc/ns#>
PREFIX rdfs: <http://www.w3.org/2000/01/rdf-schema#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT Distinct?Name ?StartdDate ?EndDate
FROM <http://giv-heatmap.uni-muenster.de:8080/epad.ifgi.de/p/shiuli_Dhaka_final.rdf>
WHERE {
?a foaf:name ?Name.
?a rdf:type <http://dbpedia.org/page/City>.
?a tisc:existenceBeginsAt ?StartDate.
?a tisc:existenceEndsAt ?EndDate.
} LIMIT 10
```

Figure 31: SPARQL query Q-2

SPARQL query Result:

Type	Name	StartDate	EndDate
http://dbpedia.org/page/City	"Dhaka"	"1990"	"2011"
http://dbpedia.org/ontology/Place	"Dhaka"	"2011-12-04"	"not ended"
"City Corporation"	"Dhaka"	"2011-12-04"	"not ended"
http://dbpedia.org/page/City	"Dhaka"	"2011-12-04"	"not ended"

Figure 32: SPARQL query result Q-2

Q-3). What were Thanas under DMP (Dhaka Metropolitan) area between 1990 to1999?

To answer this question I had to consider snapshots of geometries. There was no proper record of when each change occurred in an administrative sub region but the collected data was found as a snapshot of a specific year. It is comfortable to handle snapshots as it is very easy to model. SPARQL query in Figure 33 retrieves the number of Thanas under the Dhaka Metropolitan area in specific period of time. The query asks for the name with type as Thana and part of relationship indicates the hierarchical relationship with upper level administration. The date is filtered by asking for the period of time to find the implemented instance in the data model. Data model uses *dc: date* for representing the date of data preparation or collection. Figure 34 represents the result of SPARQL query and filter returns the Thana in 1995 under Dhaka Metropolitan area.

```
PREFIX d-city: <http://dhaka-example.org/resource/>
PREFIX tisc: <http://observedchange.com/tisc/ns#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/terms/>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT DISTINCT ?Name ?PartOfName ?Type ?Date

WHERE {
?a foaf:name ?Name.
?a rdf:type d-city:Thana.
?a dbpedia-owl:isPartOf ?PartOf.
 ?PartOf foaf:name ?PartOfName.
?PartOf rdf:type ?Type.
?PartOf dc:date ?Date.

FILTER (
?Date>= "1900"&&?Date<= "1999")
}
```

Figure 33: SPARQL query Q-3)

Count: 15

Name	PartOfName	Type	Date
"Tejgaon"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Lalbagh"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Mohammadpur"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Dhanmondi"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Uttara"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Motijheel"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Sutrapur"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Demra "	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Sabujbagh"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Gulshan"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Cantonment"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Mirpur"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Pallabi"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Ramna"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"
"Kotwali"	"Dhaka "	http://dbpedia.org/page/Metropolitan_area	"1995"

Figure 34: SPARQL query result Q-3)

Q-4). What are the administrative boundaries having part of a relationship with Dhaka city?

Dhaka City is now governed by two different city corporations as Dhaka South City Corporation and Dhaka North City Corporation. It is very important to have this information available to show the administrative boundary status of Dhaka city. Data model implemented part of relationship using

existing vocabulary and filtered by the type as city to retrieve which areas are under the city. Figure 35 is the SPARQL query and Figure 36 represents the outcome of the query.

```
PREFIX d-city: <http://dhaka-example.org/resource/>
PREFIX dbpedia: <http://dbpedia.org/resource/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX dbpedia-owl: <http://dbpedia.org/ontology/>
PREFIX tisc: <http://observedchange.com/tisc/ns#>
PREFIX owl: <http://www.w3.org/2002/07/owl#>
PREFIX gn: <http://www.geonames.org/ontology#>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT distinct  ?NameOfAdministration  ?TypeofAdministration ?DateOfEstablishment ?PartOf
?Country
WHERE {
?b foaf:name ?NameOfAdministration.
?b rdf:type ?TypeofAdministration.
?b tisc:existenceBeginsAt ?DateOfEstablishment.
?a foaf:name ?PartOf.
?a rdf:type "City Corporation".
?b dbpedia-owl:isPartOf ?a.
?b gn:Country ?Country.
}
```

Figure 35: SPARQL query Q-4)

SPARQL query result:

Count: 2

NameOfAdministration	TypeofAdministration	DateOfEstablishment	PartOf	Country
"Dhaka South "	"City Corporation"	"2011-12-04"	"Dhaka"	http://www.geonames.org/countries/BD/bangladesh.html
"Dhaka North"	"City Corporation"	"2011-12-04"	"Dhaka"	http://www.geonames.org/countries/BD/bangladesh.html

Figure 36: SPARQL query result Q-4)

Q-5). Where was the city in a specific period of time or date (1980-2012)?

SPARQL query in Figure 37 can retrieve information about the city filtering data between two different years. Here, Figure 38 shows the city name, date of establishment and boundary during that period. In our data set, geometry is represented as string of coordinates.

```
PREFIX d-city: <http://dhaka-example.org/resource/>
PREFIX tisc: <http://observedchange.com/tisc/ns#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT distinct ?Name ?DateOfEstablishment ?Geometry
WHERE {
?a foaf:name ?Name.
?a rdf:type <http://dbpedia.org/page/City>.
?a tisc:existenceBeginsAt ?DateOfEstablishment.
?a tisc:geometry ?Geometry.
FILTER (
?DateOfEstablishment>="1980"&&?DateOfEstablishment<="2012")
}
```

Figure 37: SPARQL query Q-5)

SPARQL query result:

Count: 2

Name	DateOfEstablishment	Geometry
"Dhaka"	"1990"	"233851.8108,2645303.4682;233898.2244,2645206.8511;233997.7282,264512 ^^<http://www.w3.org/2001/XMLSchema#string>
"Dhaka"	"2011-12-04"	"233851.8108,2645303.4682;233898.2244,2645206.8511;233997.7282,264512 ^^<http://www.w3.org/2001/XMLSchema#string>

Figure 38: SPARQL query results Q-5)

Q-6). When did the Dhaka City Corporation split into a Dhaka North City Corporation and Dhaka South City Corporation?

SPARQL query in Figure 39 retrieves all changes as split and then filter it as type City Corporation and also retrieve the specific date of change occurred. Figure 40 shows the SPARQL query results for the date of Dhaka City Corporation split into Dhaka North and Dhaka South City Corporation.

```
PREFIX change: <http://linkedearth.org/change/ns#>
PREFIX d-city: <http://dhaka-example.org/resource/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/terms/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT  ?Change ?Before ?After ?Date
FROM <http://giv-heatmap.uni-muenster.de:8080/epad.ifgi.de/p/shiuli_Dhaka_final.rdf>
WHERE {
?Change rdf:type change:Split.
?Change change:before ?Be.
?Be foaf:name ?Before.
?Be rdf:type "City Corporation".
?Change change:after ?AF.
?AF foaf:name ?After.
?Change dc:date ?Date.
}
```

Figure 39: SPARQL query Q-6)

SPARQL Query Results

Change	Before	After	Date
http://dhaka-example.org/resource/split-of-geometries1	Dhaka City Corporation	Dhaka South City Corporation	2011-12-04
http://dhaka-example.org/resource/split-of-geometries1	Dhaka City Corporation	Dhaka North City Corporation	2011-12-04

Figure 40: SPARQLL query result Q-6)

Q-7). What was the administrative status of Dhaka in different periods of time?

For this thesis I had to introduce a new vocabulary as “historic version” that will connect all other versions of geographic unit to its current version. This is very effective to easily retrieve all related information of different versions of regions with very simple SQL statements. Figure 41 is the SPARQL query to retrieve information about the different name of Dhaka city in different periods of time and their administrative status. Table 15 is the result of the query and start and end date denotes the valid period of administrative unit in certain status.

```
PREFIX change: <http://linkedearth.org/change/ns#>
PREFIX d-city: <http://dhaka-example.org/resource/>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/terms/>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>
PREFIX tisc: <http://observedchange.com/tisc/ns#>

SELECT  Distinct?Name ?Type ?StartDate ?EndDate
FROM <http://giv-heatmap.uni-muenster.de:8080/epad.ifgi.de/p/shiuli_Dhaka_final.rdf>
WHERE {
d-city:Dhaka2011-2013 d-city:historicVersion ?a.
?a foaf:name ?Name.
?a rdf:type ?Type.
?a tisc:existenceBeginsAt ?StartDate.
?a tisc:existenceEndsAt ?EndDate.
}
ORDER BY DESC(?StartDate)
```

Figure 41: SPARQL query Q-7)

PARQL Query Results:

Table 15: SPARQL query result Q-7)

Name	Type	StartDate	EndDate
Dhaka	http://dbpedia.org/page/City	1990	2011
Dhaka	http://dbpedia.org/page/Municipal_corporation	1978	1989
Dacca	Municipal Corporation	1971	1977
Dacca	Pourashava	1955	1971
Dacca	Capital of Province	1905	1947
Dacca	Pourashava	1905	1947
Dacca	Capital of Province	1864	1905
Dacca	Municipality	1864	1905
Zahangirnagor	http://dhaka-example.org/resource/Thana	1608	1864
Zahangirnagor	Capital of Province	1608	1864

Q-8). How the number of subdivisions does changes in the Dhaka Metropolitan Area?

SPARQL query in Figure 42 shows how frequently the number of subdivision changes that means every administrative subunits become smaller and smaller. The information about the number of total subdivisions always helps to verify data. As SPARQL query cannot handle count, I have introduced a new vocabulary *numberOfSubdivision*. The SPARQL query result is represented in Figure 43.

```
PREFIX d-city: <http://dhaka-example.org/resource/>
PREFIX tisc: <http://observedchange.com/tisc/ns#>
PREFIX rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>
PREFIX dc: <http://purl.org/dc/terms/>
PREFIX db: <http://dbpedia.org/ontology/PopulatedPlace/>
PREFIX geo: <http://www.w3.org/2003/01/geo/wgs84_pos#>
PREFIX foaf: <http://xmlns.com/foaf/0.1/>
PREFIX xsd: <http://www.w3.org/2001/XMLSchema#>

SELECT Distinct ?Name ?NumberOfSubdivision ?AreaSqKM ?Date
FROM <http://giv-heatmap.uni-muenster.de:8080/epad.ifgi.de/p/shiuli_Dhaka_final.rdf>
WHERE {
?a foaf:name ?Name.
?a rdf:type <http://dbpedia.org/page/Metropolitan_area>.
?a d-city:numberOfSubdivision ?NumberOfSubdivision.
?a db:areaTotal ?AreaSqKM.
?a dc:date ?Date.
}
```

Figure 42: SPARQL query Q-8)

SPARQL Query Results

Name	NumberOfSubdivision	AreaSqKM	Date
Dhaka Metropolitan Area	14	1553 (^^ http://www.w3.org/2001/XMLSchema#double)	1995
Dhaka Metropolitan Area	41	1553 (^^ http://www.w3.org/2001/XMLSchema#double)	2010
Dhaka Metropolitan Area	21	1553 (^^ http://www.w3.org/2001/XMLSchema#double)	2000

Figure 43: SPARQL query result Q-8)

5.3 Visualization of Result

Visualization is beyond the scope of this study but visualization is very important for the usability of data set and usually SPARQL query can return a result of query as various format as RDF/XML[32], HTML, plain text, N3[33], turtle[34], JSON[35]. However, the format expected depends on the purpose of use of the dataset and also level of understanding of the user.

SPARQL endpoint is a protocol service for the user to query the RDF store or triple store using the SPARQL query language. It is also necessary to use server that can support storing triple data and provide SPARQL endpoint facilities.

Usually in semantic web documentation portrays about the visualization of result but results are not likely to suit the purpose of common people. But, after working a lot to prepare the data set, the harder steps become visualization. There is not much discussion about the visualization of semantic web dataset especially about spatial data visualization (Nainyte 2011). Current state of semantic web is more oriented to data consumer and expert user who know how to get the data and use it for technical visualization.

Primary goal of my thesis is to create a database for administrative boundary revisions that means to add the data set for the temporal state. Query was done to trace the change information as well as the current state of information. Now, it is important to have the technical skill to visualize the information as a contribution to society as a researcher or development organization or NGO who want to use the data to locate their project in the same areas. This data can allow people to find their appropriate location and make better decisions by comparing past instances. For this, it is important to have a nice data sharing web interface for both expert users as well as for common people.

This section is about the available visualization tradition of spatial data by semantic web user. SMILE Exhibit[36] is an open source software platform that supports JSON and RDF/XML format data. SMILE Exhibit is good for basic users to develop an interactive web service using JavaScript but it also requires data to be stored in a server. SMILE Exhibit is more compatible with the virtuoso triple store. All the available example shown on the SMILE Exhibit web site are about visualization of point geometry but there is not enough information about how to handle polygon geometry. Here is an example of visualization with a smile widget for Billionaires where are they from (Figure 21).

[32] http://www.w3.org/TR/rdf-syntax-grammar/

[33] http://www.w3.org/DesignIssues/Notation3.html

[34] http://www.w3.org/TeamSubmission/turtle/

[35] http://json-ld.org/spec/latest/

[36] http://www.simile-widgets.org/exhibit/

Figure 44: Billionaires and compare their wealth

SMILE Exhibit has very nice visualization capabilities of RDF data but it is important to know the JavaScript for interactive visualization especially for polygon geometries.

ArcGIS can also be used to visualize RDF geometry but user must have to be familiar with storing RDF geometry to Oracle Spatial Server for ArcGIS desktop visualization. Figure 22 shows the Hardware support ESRI uses to implement RDF visualization. Also it is expensive to use and all user do not have access to those technologies (Tsengouras, 2010).

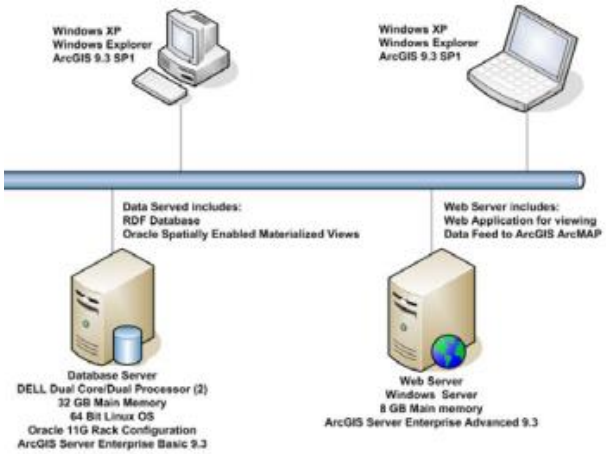


Figure 45: The hardware system ESRI is used for implementation of RDF data visualization

CultureSampo [37](Finish culture on semantic web) is an excellent example of semantic visualization of Finish history, timeline, artifacts records. It must be a tremendous effort to prepare this visualization and useful interface for all to navigate comfortably with preferred direction. A snapshot is shown in Figure 46 from the website.

[37] http://www.kulttuurisampo.fi/kulsa/historiallisetAlueet.shtml

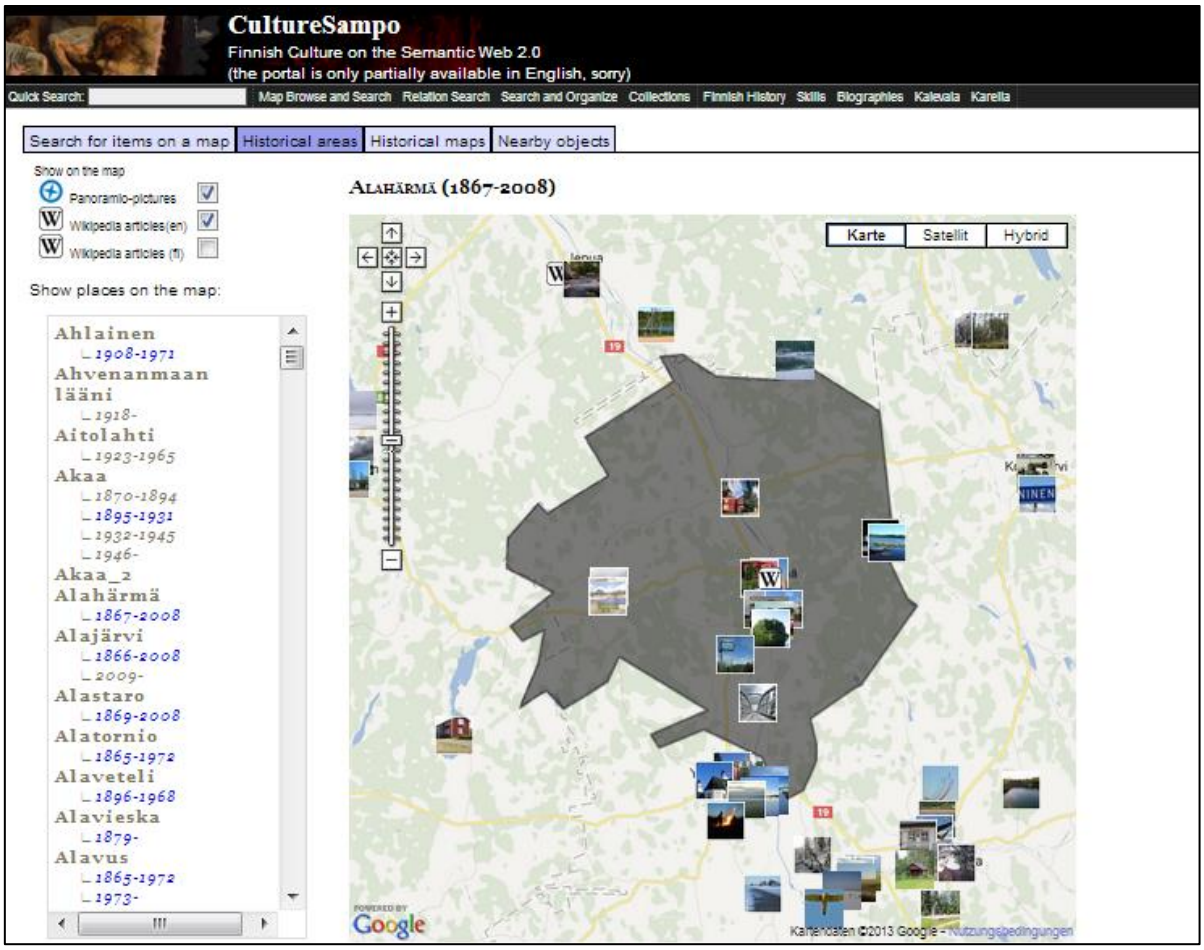


Figure 46: CultureSampo visualization of historical regions

This chapter discussed about the implementation of pre-designed query and results of the query. This chapter contents the visualization issues as visualization provides users an interactive environment to find relevant information efficiently. However, the scope of this research is limited to data modeling and integration for the evolution of the administrative boundaries of Dhaka city.

Chapter Six: Discussion

This thesis developed a conceptual data model based on predefined queries that reflect the evolution of Dhaka city Boundary changes over time. Then, data is integrated using semantic vocabulary for the semantic web. There are several expert works already done to develop ontology of Administrative regions and their temporality. Besides all other traditional approaches, SONADUS (Gantner et al. 2012) ontology and SAPO(Kauppinen, Väätäinen, and Hyvönen, 2008) was the most helpful literature to support my study. But, in both cases they have a very good dataset from the authority and had the access to the proper record keeping system. SONADUS uses very rich dataset from the historical register and also geometric dataset produced by the authority. But for my study it was really hard to follow any of them totally in terms of adopting the properties like finding the life of geometry or time of annexations. SAPO also had data available to produce nice resource data. I did not use SONADUS ontology because it does not match with my available data set but it contributes to improving my data model considering both snapshot of the geometry of a specific time period and also representing the changes as occurrence or event. I explicitly use Change[38] vocabulary introduced by SAPO ontology and also use tisc[39] vocabulary that describes observed changes. This study has used "tisc" vocabulary to define geometry and also to describe the fact of "existenceBeginsAt" for establishment date of administrative regions and "existenceEndsAt" for the abolition date of identity of a region.

6.1 New vocabularies introduced to serve semantic data integration

This study also introduces some essential vocabulary that was important to describe the data. The new introduced vocabularies are listed below:

1. **Predicate**-*numberOfSubdivision*: The number of subdivisions refers to how many sub regions under an administrative region such as city.
2. **Predicate**-*Administration:* Administration is a form of government such as public administration e.g., City Corporation
3. **Predicate**-*historicVersion*: The previous existence of regions in terms of name, area and population.
4. **Class**-*Thana*: Subdistrict is Thana according to local term in Bangladesh.
5. **Predicate**-*historicPeriod*: historicPeriod is a notation of period of historic region such as British Period, Mughal Period, etc.
6. **Class**- Changetypeof: Administrative region can be changed by its type such as Municipality can be uplifted to City Corporation.

[38] http://linkedearth.org/change/ns#

[39] http://observedchange.com/tisc/ns#

Mostly, this study reuses the existing vocabulary but for the simplicity of data model and easy retrieval of information the new vocabularies are introduced.

From Chapter Five: Evaluation and Visualization Issues , it is found that data set works well with making queries and retrieving results. The data model can retrieve current information about the city such as name, type, administrative statutes and also geometry or boundaries as well as changes occurred with the city e.g., split of Dhaka City Corporation and the date of the split. After and before terms relate the previous and current state of administrative region. The newly introduced term "Historic version can relate the current city to all its historical existence status of a region in different time periods".

6.2 Identified changes

There was very frequent boundary revisions occurred for the subdivision of metropolitan areas. All the changes identified in Dhaka city as a whole were annotation data and very few evidence was found to retrieve to the administrative boundaries of historic Dhaka. The kind of changes identified of Dhaka city boundary revisions are listed below:

Boundary revisions type	**Number of times**	**Unit of changes**
Namechange	3	City
NameChange	38	Subdivisions/Thana
Changepartof	3	City
Changetypeof	3	City
Split	1	City
Split	36	Subdivisions/Thana
Merge	11	Subdivisions/Thana

Except change type of administration, all other changes suitable with existing change vocabulary for changes in geographic regions.

6.3 Insights from evaluation

Evaluation was the effort to answer queries that was designed to record the changes that occur in Dhaka city boundary. SPAQL query with Parliament Triple store is used to query dataset from triple store. Now, it is possible to find answer to the queries but the queries are explicitly for implemented data set. Implemented dataset was based on secondary sources such as publications, home page of Dhaka City Corporation and documentation collected from Dhaka City Corporation. The study period

is limited to 1995 to 2010 for the administrative unit of Dhaka Metropolitan area and subdivision known as Thana. This study also implemented annotation data about Dhaka from 1608 to 2011 with all the changes occurred in Dhaka in terms of name, type of administration, colonization to independence stage of changes and query support to find all historic stages of Dhaka.

6.4 Limitations

Data accuracy:

- **Edge mismatch:** Data found from secondary sources are in different resolution at different period and it was difficult to match one layer with another.
- **Non compatible data:** Same data produced in different organizations are different in shape and, size without explanation.

Data availability problem:

- **Record missing:** Absence of proper record keeping by the authority
- **Unavailability of digital data:** Unavailability of digital data is a big problem and reproducing digital data was time consuming.

Time shortage:

- **Time Limit:** Time was short to capture all the real data from the field in digital format as well as to collect information in detail and verify them.

Chapter Seven: Conclusion

7.1 Summary

Dhaka is a Mega City of about 103, 56,500 populations according to GeoNames geographical database. In 16th century during the regime of Mughal Emperor, it was a Thana or military outpost of having 2 km^2 and only 3000 populations lived there. Dhaka undergoes several changes to its life time such as it possessed different names in different time and was ruled by different Empire and liberated in 16th December 1971. All information about Dhaka city is found currently in internet is document format and also information is interpreted differently in different studies. So, it is difficult for the researchers as well as for the development organizations to find appropriate reference extent of area and compare statistics of two different time periods. Especially, census record is always based on region name that is under jurisdiction of administrative regions. City Corporation of Dhaka has also poor data management system to record the changes occurred in Dhaka city. Of course, they have text documents and old maps of different resolution prepared in different time. Dhaka has currently two different types of administrative regions-city corporation and metropolitan area. City corporation has a total area of about 360 km^2 consisting of 90 wards and Dhaka metropolitan area has 41 wards with an area of about 1553 km2 (http://www.dncc.gov.bd/dncc-setup/chronological-development-of-dncc.html).

The effort is made to find a solution to track of the changes occurred in Dhaka city over time and to store all information with appropriate temporal reference. Semantic web technology is a likely choice to implement the spatio-temporal database of city boundary changes. Semantic web allows describing thing as a statement of subject, predicate and objecting and data representation format is known as RDF. So, with semantic web technology triple format statement, it is possible to state everything about Dhaka city. Semantic web provides data set with semantic meaning that allows retrieving information by using SPARQL query language. The RDF data model of semantic web is developed to describe current city and its subdivisions, the period of existence of an administrative unit in a certain status considering city as event and also relating each event by describing changes with type of changes occurs and after-before relationship and also by describing the date of each changes. Due to the availability of information about administrative unit status in different time and changes over the region, it is possible to compare census information of two different periods of time.

This thesis shows the implementation of change vocabulary[40] for the changes of administrative regions. New vocabulary introduced by this study can also integrate number of subdivisions under an administrative unit in certain period of time and also retrieve information about previous status of administrative unit by introducing historic version.

[40] http://linkedearth.org/change/ns#

7.2 Contribution

This thesis makes following contribution:

- A brief literature review that discusses about different approaches of handling spatiotemporal data in GIS and worked done using semantic web.
- A discussion about importance of geodata management for changes of boundaries for Dhaka city
- A documentation of changes of Thana boundaries under Dhaka metropolitan area from 1995 to 2010.
- A RDF data model that contains revision history of Dhaka city and its subdivision as administrative unit.
- A data base with semantic web that can retrieve wide range of query about administrative boundary and its historical changes by using SPARQL protocol.
- A baseline data set that geometrically overlaps each other and match with Google maps.

7.3 Findings

The implementation of administrative dataset is mostly done using existing vocabularies. Implementation of change vocabulary was shown for Dhaka City and its subdistrict boundary changes. Change vocabulary did not introduce change of type of administrative unit. This study introduces *Changetypeof* vocabulary that can describe the type change of administrative unit in different periods. It is always possible to extend the dataset with additional resources. Interactive visualization is a part of the future work. Change vocabulary is very useful to describe and manage the changes of administrative regions. This thesis produces a base line study addressing the changes of administrative unit in Dhaka city. This study is most valuable for Dhaka city since so far there is no study that sheds light on importance of managing change of administrative boundaries for Dhaka City.

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Appendix A: Triple Data of Dhaka City Split

Table A1: Triple Data of Dhaka city split

Vocabularies in use
@prefix change: <http://linkedearth.org/change/ns#>.
@prefix rdf: <http://www.w3.org/1999/02/22-rdf-syntax-ns#>.
@prefix rdfs: <http://www.w3.org/2000/01/rdf-schema#>.
@prefix dc: http://purl.org/dc/terms/>.
Triple data set for Dhaka city split
change:split-of-geometries1 rdf:type change:Split .
change:split-of-geometries1 rdfs:label " Dhaka Split Into North Dhaka and South Dhaka".
change:split-of-geometries1 change:before d-city:Dhaka.
change:split-of-geometries1 change:after d-city:DhakaNorth.
change:split-of-geometries1 change:after d-city:DhakaSouth.
change:split-of-geometries1 dc:description "According to Local Government Amendment Act 2011, Dhaka City Corporation Divided as Dhaka South City Corporation and Dhaka North City Corporation"^^xsd:string.
change:split-of-geometries1 dc:date "2011-12-04"^^xsd:date.

Appendix B: Maps

Figure 47: Thana Boundaries of Dhaka Metropolitan Area, 1995

Figure 48: Thana Boundaries of Dhaka Metropolitan Area, 2000

Figure 49: Thana Boundaries of Dhaka Metropolitan Area, 2010

Appendix C: RDF data

http://giv-heatmap.uni-muenster.de:8080/epad.ifgi.de/p/shiuli_Dhaka_final.html

RDFpad

based on http://epad.ifgi.de/p/shiuli_Dhaka_final

LODUM Linked Open Data University of Münster

Namespaces

dc geof db dbpedia-owl geo foaf oeg madsrdf change d-city tisc gn geos rdfs owl dbpedia xsd rdf dbpprop place skos

Triples

d-city:Khilgaon_Thana_2000	db:areaTotal	16.63^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MK_0239.GIF
	dc:description	Administration Khilgaon thana was established in 1998 consisting of parts of gulshan and demra thanas. The Thana consists of three wards, 13 mouzas and 9 villages.Source:http://bpedia.org/K_0239.php
	rdf:label	Khilgaon, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Khilgaon
d-city:Pallabi-I	foaf:name	Pallabi
d-city:Khilkhet_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2637
	db:areaTotal	21.49^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010^^http://www.w3.org/2001/XMLSchema#date
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Khilkhet splited from Dhanmondi Thana
	rdf:label	Khilkhet, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Khilkhet ^^http://www.w3.org/2001/XMLSchema#string
d-city:Sabujbagh-I	foaf:name	Sabujbagh
d-city:Shyampur_Thana_2010	db:areaTotal	5.04^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MS_0368.GIF
	dc:description	Administration Shyampur thana was established in 1998 consisting of parts of Sutrapur and Demra thanas. It consists of one wards, 7 mouzas and 3 villages. Source:http://bpedia.org/S_0368.php
	rdf:label	Shyampur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Shyampur
d-city:merge-of-geometries1	dc:date	1998
	dc:description	In 1998 Kafrul Thana is formed from part of Mirpur Thana and Kafrul Thana^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Kafrul_Thana_2000
	change:before	d-city:cantonment-I
	change:before	d-city:Mirpur-I
	rdfs:label	Kafrul Thana splitted from Mirpur Thana and Cantoment Thana
	rdf:type	change:Merge
d-city:Pallabi_Thana_2000	db:areaTotal	25.44^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	15.03.1993
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MP_0047.GIF
	dc:description	Administration Pallabi thana was established on 15 March 1993 under the Dhaka City Corporation. It consists of 1 union parishads, 16 mouzas, 27 mahallas.Source:http://bpedia.org/P_0047.php
	rdf:label	Pallabi, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Pallabi
d-city:Demra_Thana_1995	db:areaTotal	54.48^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_1995
	tisc:existenceBeginsAt	1973
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MD_0109.GIF
	dc:description	Administration Demra thana was established in 1973. It consists of three wards, three union parishads, 36 mouzas and 53 villages.source:http://bpedia.org/D_0109.php
	rdf:label	Demra, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Demra
d-city:Motijheel_Thana_1995	db:areaTotal	5.06^^http://www.w3.org/2001/XMLSchema#double

	dbpedia-owl:isPartOf	d-city:DMP_1995
	tisc:existenceBeginsAt	1976
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MM_0334.GIF
	dc:description	Motijheel thana area Motijheel thana is considered as the commercial area of Dhaka city. The head offices of many financial institutions including bangladesh bank, sonali bank, pubali bank, agrani bank, janata bank, rupali bank, islami bank, eastern bank, basic bank, jiban bima corporation, sadharan bima corporation, american life insurance Co., dhaka stock exchange, etc are locatedin Motijheel area. Besides, Power and Water Development Board, rajukand many government and private offices are located here.source:http://bpedia.org/M_0334.php
	rdf:label	Motijheel, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Motijheel
d-city:numberOfSubdivision	rdf:label	numberOfSubdivision
	rdf:type	rdf:property
d-city:Change-part-of2	dc:date	1847
	change:after	d-city:Dhaka1955-1971
	change:after	d-city:Dhaka1947-1954
	change:before	d-city:Dhaka1905-1947
	rdfs:label	After British Period, Dhaka become under control of Pakistan
	rdf:type	change:Changepartof
d-city:Thana	dc:description	Administrative region can be changed by its type such as Municipality can uplift to City Corporation
	rdfs:subClassOf	change:Change
	rdf:label	Changetypeof
	owl:sameAs	place:Subdistrict
	rdf:label	Thana
	rdf:type	owl:class
d-city:nameChange33	dc:date	2007
	change:after	d-city:Turag_Thana_2010
	change:before	d-city:Uttara-I
	rdf:type	change:Namechange
d-city:Mirpur-I	foaf:name	Mirpur
d-city:nameChange12	dc:date	1998
	change:after	d-city:Shyampur_Thana_2000
	change:before	d-city:Demra-II
	rdf:type	change:Namechange
d-city:Dhaka1947-1954	geos:capitalOf	http://dbpedia.org/page/East_Bengal
	dbpedia-owl:isPartOf	http://dbpedia.org/page/East_Bengal
	dbpedia-owl:isPartOf	http://dbpedia.org/page/Pakistan
	tisc:existenceEndsAt	1954
	tisc:existenceBeginsAt	1947
	d-city:historicPeriod	Pakistan Period
	foaf:name	Dacca
d-city:Changetypeof2	dc:date	1971
	change:before	d-city:Dhaka1978-1989
	change:before	d-city:Dhaka1947-1954
	change:before	d-city:Dhaka1905-1947
	change:before	d-city:Dhaka1864-1905
	change:after	d-city:Dhaka1955-1971
	change:after	d-city:Dhaka1978-1989
	rdfs:label	Dhaka pourashava become Dhaka Municipal Corporation in 1971
	rdf:type	d-city:Changetypeof
d-city:merge-of-geometries9	dc:date	2007
	dc:description	Gendaria Thana is formed from part of Demra Thana, Sutrapur Thana and Shyampur Thana
	change:after	d-city:Gendaria_Thana_2010
	change:before	d-city:Sutrapur-II
	change:before	d-city:Demra-IV
	change:before	d-city:Shyampur-II
	rdfs:label	Genderia Thana splited from Demra, Sutrapur and Shyampur Thana
	rdf:type	change:Merge
d-city:split-of-geometries17	dc:date	2007
	dc:description	Badda Thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Khilkhet_Thana_2010
	change:after	d-city:Badda_Thana_2010
	change:before	d-city:Badda_Thana_2000
	rdfs:label	Badda Thana contributes to form Khilkhet Thana
	rdf:type	change:Split
d-city:Dhaka1978-1989	geos:capitalOf	http://dbpedia.org/page/Bangladesh
	dbpedia-owl:isPartOf	http://dbpedia.org/page/Bangladesh
	tisc:existenceEndsAt	1989
	tisc:existenceBeginsAt	1978
	d-city:historicPeriod	Bangladesh Period
	rdf:type	http://dbpedia.org/page/Municipal_corporation

	foaf:name	Dhaka
d-city:Mohammadpur_Thana_1995	db:areaTotal	10.86^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_1995
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MM_0297.GIF
	dc:description	Administration Mohammadpur thana consists of five wards, 45 mouzas.Source: http://bpedia.org/M_0297.php
	rdf:label	Mohammadpur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Mohammadpur
d-city:nameChange41	dc:date	1978^^http://www.w3.org/2001/XMLSchema#date
	change:after	d-city:Dhaka1978-1989
	change:before	d-city:Dhaka1971-1978
	rdf:type	change:Namechange
d-city:Pourashava1947-1954	tisc:existenceEndsAt	1954
	tisc:existenceBeginsAt	1947
	foaf:name	Dacca Pourashava
d-city:Pourashava	d-city:historicVersion	d-city:Pourashava1971-1977
d-city:nameChange20	dc:date	2007
	change:after	d-city:Shah_Ali_Thana_2000
	change:after	d-city:Darus_Salam_Thana_2010
	change:before	d-city:Mirpur_Thana_2000
	rdf:type	change:Namechange
d-city:Badda_Thana_2000	db:areaTotal	42.89^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MB_0018.GIF
	dc:description	Administration Badda thana was established in 1998 consisting of parts of Cantonment and Gulshan thanas. The thana consists of 4 wards, 16 mouzas, 2 unions (Beraid and Satarkul) and 14 mohallas. Source:http://bpedia.org/B_0018.php
	rdf:label	Badda, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Badda
d-city:split-of-geometries6	dc:date	1998
	dc:description	In 1998 Demra thana splited into three parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Demra_Thana_2000
	change:after	d-city:Demra-II
	change:after	d-city:Demra-I
	change:before	d-city:Demra_Thana_1995
	rdfs:label	Demra Thana contributes to form Shyampur and Khilgaon thana
	rdf:type	change:Split
d-city:merge-of-geometries10	dc:date	2007
	dc:description	Turag Thana is formed from part of UttaraThana and Pallabi Thana
	change:after	d-city:Turag_Thana_2010
	change:before	d-city:Pallabi-I
	change:before	d-city:Uttara-I
	rdfs:label	Turag Thana splited from Uttara and Pallabi Thana
	rdf:type	change:Merge
d-city:Gulshan-I	foaf:name	Gulshan
d-city:split-of-geometries25	dc:date	2007^^http://www.w3.org/2001/XMLSchema#date
	dc:description	Mohammadpur Thana splited into Three parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Adabor_Thana_2010
	change:after	d-city:Muhammadpur-II
	change:after	d-city:Mohammadpur_Thana_2010
	change:before	d-city:Mohammadpur_Thana_2000
	rdfs:label	Mohammadpur Thana contributes to form Adabor Thana and Sher-E-Bangla Nagor Thana
	rdf:type	change:Split
d-city:Demra_Thana_2010	db:areaTotal	23.28^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	tisc:existenceBeginsAt	1973
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MD_0109.GIF
	dc:description	Administration Demra thana was established in 1973. It consists of three wards, three union parishads, 36 mouzas and 53 villages.source:http://bpedia.org/D_0109.php
	rdf:label	Demra, Dhaka
	rdfs:subClassOf	place:District
	rdf:type	d-city:Thana
	foaf:name	Demra
d-city:Motijheel_Thana_2010	db:areaTotal	3.63^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	tisc:existenceBeginsAt	1976
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MM_0334.GIF
		Motijheel thana area Motijheel thana is considered as the commercial area of Dhaka city. The head offices of many financial institutions including bangladesh bank, sonali bank, pubali bank, agrani bank, janata bank, rupali bank, islami bank, eastern bank, basic bank, jiban bima corporation, sadharan

	dc:description	bima corporation, american life insurance Co., dhaka stock exchange, etc are locatedin Motijheel area. Besides, Power and Water Development Board, rajukand many government and private offices are located here.source:http://bpedia.org/M_0334.php
	rdf:label	Motijheel, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Motijheel
d-city:Mirpur-II	foaf:name	Mirpur
d-city:Dhaka_Municipal_Corporation	tisc:existenceEndsAt	1989
	tisc:existenceBeginsAt	1978
	dbpprop:subdivision	Ward
	foaf:name	Dhaka Municipal Corporation
d-city:nameChange28	dc:date	2007
	change:after	d-city:Genderia_Thana_2010
	change:before	d-city:Shyampur-II
	rdf:type	change:Namechange
d-city:Sutrapur_Thana_2000	db:areaTotal	4.52^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MS_0627.GIF
	dc:description	Administration It consists of 10 wards, 80 mahallas.Source: http://bpedia.org/S_0627.php
	rdf:label	Sutrapur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Sutrapur
d-city:Hazaribagh_Thana_2010	db:areaTotal	5.21^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MH_0093.GIF
	dc:description	Administration Hazaribagh thana was established in 1998 consisting of parts of Mohammadpur, Dhanmondi and Lalbagh thanas. It consists of 3 wards, 15 mouzas and one village. Source:http://bpedia.org/H_0093.php
	rdf:label	Hazaribagh, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Hazaribagh
d-city:Uttara_Thana_2000	db:areaTotal	54.42^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	tisc:existenceBeginsAt	1988
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MU_0046.GIF
	dc:description	Uttara Thana area Uttara thana is named after Uttara Model Town (residential). There are many government and private institutions and organisations including two private universities, one women's medicalcollege in the area.Source: http://bpedia.org/U_0046.php
	rdf:label	Uttara, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Uttara^^http://www.w3.org/2001/XMLSchema#string
d-city:DMP_2000	dc:Jurisdiction	Dhaka Metropolitan Police Area
	rdf:type	http://dbpedia.org/page/Metropolitan_area
	foaf:name	Dhaka Metropolitan Area
	dc:date	2000
	dbpprop:subdivision	d-city:Thana
	rdf:label	Dhaka MetroPolitan Area
	dc:Location	http://www.citypopulation.de/php/bangladesh-dhaka.php
	d-city:numberOfSubdivision	21
	dc:Description	Dhaka Metropolitan Development Plan(1995-2015): Strcture Plan, Master Plan and Detailed Area Plan for Dhaka City. Dhaka structure plan (1995-2015) : December 1995, Volume 1. It has a arbitrary defined region and overlap with Dhaka Metropolitan Police Area.
	gn:Country	http://www.geonames.org/countries/BD/bangladesh.html
	dbpprop:subdivisionName	Thana
	gn:District	http://www.geonames.org/1337178/dhaka-zila.html
	db:areaTotal	1553^^http://www.w3.org/2001/XMLSchema#double
d-city:merge-of-geometries4	dc:date	1998
	dc:description	In 1998 Shyampur Thana is formed from part of Demra Thana and Sutrapur Thana^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Shyampur_Thana_2000
	change:before	d-city:Demra-II
	change:before	d-city:Sutrapur-I
	rdfs:label	Shyampur Thana splitted from Demra Thana and Sutrapur Thana
	rdf:type	change:Merge
d-city:split-of-geometries12	dc:date	2007
	dc:description	Ramna Thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Shahbagh_Thana_2010
	change:after	d-city:Ramna_Thana_2010
	change:before	d-city:Ramna_Thana_2000
	rdfs:label	Ramna Thana contributes to form Shahbagh Thana
	rdf:type	change:Split

d-city:Cantonment-II	foaf:name	Cantonment
d-city:nameChange36	dc:date	2007
	change:after	d-city:Adabor_Thana_2010
	change:before	d-city:Mohammadpur_Thana_2000
	rdf:type	change:Namechange
d-city:Sabujbagh_Thana_1995	db:areaTotal	14.84^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_1995
	tisc:existenceBeginsAt	1988
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MS_0004.GIF
	dc:description	Administration Sabujbagh thana was established in 1988. It consists of two union parishads, five wards, 28 mouzas, 30 mahallas and 12 villages.Source: http://bpedia.org/S_0004.php
	rdf:label	Sabujbagh, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Sabujbagh
d-city:Mirpur_Thana_2000	db:areaTotal	14.08^^http://www.w3.org/2001/XMLSchema#double
	madsrdf:Source	http://bpedia.org/M_0260.php
	dbpedia-owl:isPartOf	d-city:DMP_2000
	tisc:existenceBeginsAt	1962
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MM_0260.GIF
	dc:description	Mirpur Thana (Town) area was included in keraniganj thana during the British period and in tejgaon thana during the Pakistan period. Many administrative and cultural establishments including National Zoo, National Botanical Garden, National Vagabond Shelter Centre are located in this thana area. National Martyr Intellectual Memorial has been established at the premises of the graves of martyr intellectuals. The tomb of Hazrat Shah Ali Bagdadi (R), a sacred place and historical relic, is located at Mirpur. Besides, the head offices of grameen bank, bangladesh institute of bank management, Dhaka Eye Hospital, National Heart Foundation, etc are located here.source:http://bpedia.org/M_0260.php
	rdf:label	Mirpur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Mirpur
d-city:Mohammadpur_Thana_2010	db:areaTotal	6.54^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MM_0297.GIF
	dc:description	Administration Mohammadpur thana consists of five wards, 45 mouzas.Source: http://bpedia.org/M_0297.php
	rdf:label	Mohammadpur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Mohammadpur
d-city:nameChange15	dc:date	1998
	change:after	d-city:Kamrangir_Char_Thana_2000
	change:before	d-city:Lalbagh-I
	rdf:type	change:Namechange
d-city:Shah_Ali_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2674
	db:areaTotal	4.96^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Shah ALi splited from Pallabi and Mirpur Thana
	rdf:label	Shah ALi, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Shah ALi
d-city:split-of-geometries1	dc:date	2011-12-04
	dc:description	According to Local GovernmentAmendment Act 2011, Dhaka City Corporation Divided as Dhaka South City Corporation and Dhaka North City Corporation^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Dhaka_South_City_Corporation
	change:after	d-city:Dhaka_North_City_Corporation
	change:before	d-city:Dhaka_City_Corporation
	rdfs:label	Dhaka Split Into Dhaka North and Dhaka South
	rdf:type	change:Split
d-city:Tejgaon_Thana_1995	dbpedia-owl:isPartOf	d-city:DMP_1995
	dbpedia-owl:areaTotal	10.18^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1962
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MT_0105.GIF
	dc:description	Tejgaon Thana area Tejgaon is considered to be the industrial area of Dhaka City Corporation. Many government, semi government and autonomous organisations and institutions are located in the area. Mention may be made of Jatiya Sangsad Bhaban (Parliament Building), Ganabhaban (Prime Minister's residence), MP Hostel, Bangladesh Agricultural Research Council, FDC (Film Development Corporation), International Jute Organisation and Prime Minister's Office.source:http://bpedia.org/T_0105.php
	rdf:label	Tejgaon, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Tejgaon
d-city:Shyampur_Thana_2000	db:areaTotal	11.91^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MS_0368.GIF
	dc:description	Administration Shyampur thana was established in 1998 consisting of parts of Sutrapur and Demra

	dc:description	thanas. It consists of one wards, 7 mouzas and 3 villages. Source:http://bpedia.org/S_0368.php
	rdf:label	Shyampur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Shyampur
d-city:Bangshal_Thana_2010	gn:Map	http://www.online-dhaka.com/53_1245_3927_0-map-of-bangshal-thana-dhaka.html
	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=6706
	db:areaTotal	2.08^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010^^http://www.w3.org/2001/XMLSchema#date
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Adabor splited from Mohamadpur Thana
	rdf:label	Bangshal, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Bangshal^^http://www.w3.org/2001/XMLSchema#string
d-city:split-of-geometries20	dc:date	2007
	dc:description	Shyampur Thana splited into four parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Shyampur-II
	change:after	d-city:Shyampur-I
	change:after	d-city:Shyampur_Thana_2010
	change:before	d-city:Shyampur_Thana_2000
	rdfs:label	Shyampur Thana contributes to form Kadamtali Thana and Gendaria Thana
	rdf:type	change:Split
d-city:Kalabagan_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2633
	db:areaTotal	1.70^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Kalabagan splited from Dhanmondi Thana
	rdf:label	Kalabagan, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Kalabagan
d-city:Dakshin_Khan_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2610
	db:areaTotal	17.95
	dc:date	2010^^http://www.w3.org/2001/XMLSchema#date
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Dakshin Khan splited from Uttara Thana
	rdf:label	Dakshin Khan, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Dakshin Khan
d-city:nameChange8	dc:date	1998
	change:after	d-city:Badda_Thana_2000
	change:before	d-city:Gulshan-I
	rdf:type	change:Namechange
d-city:nameChange23	dc:date	2007
	change:after	d-city:Khilkhet_Thana_2010
	change:before	d-city:Badda_Thana_2000
	rdf:type	change:Namechange
d-city:Pallabi-II	foaf:name	Pallabi
d-city:split-of-geometries9	dc:date	1998
	dc:description	In 1998 Dhanmondi thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Dhanmondi_Thana_2000
	change:after	d-city:Dhanmondi-I
	change:before	d-city:Dhanmondi_Thana_1995
	rdfs:label	Dhanmondi Thana contributes to form Hazaribagh Thana
	rdf:type	change:Split
d-city:Paltan_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2665
	db:areaTotal	1.37^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Paltan splited from Motijheel Thana
	rdf:label	Paltan, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Paltan
d-city:Jatrabari_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2629
	db:areaTotal	11.53^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Jatrabari splited from Demra Thana
	rdf:label	Jatrabari, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Jatrabari
d-city:Dhaka1990-2011	geo:long	90.40744
	d-city:administration	d-city:Dhaka_Metropolitan

	d-city:administration	d-city:Dhaka_City_Corporation
	geo:lat	23.7104
	dbpedia-owl:thumbnail	http://www.mediabangladesh.net/images/Dhaka-City-Map.gif
	foaf:name	Dhaka
	tisc:existenceBeginsAt	1990
	d-city:historicPeriod	Bangladesh Period
	rdf:type	http://dbpedia.org/page/City
	geos:capitalOf	http://dbpedia.org/page/Bangladesh
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MD_0145E.GIF
	tisc:existenceEndsAt	2011
	dbpedia-owl:isPartOf	http://dbpedia.org/page/Bangladesh
d-city:Shahbagh_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2675
	db:areaTotal	3.70^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Shahbagh splited from Ramna Thana
	rdf:label	Shahbagh, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Shahbagh
d-city:Gendaria_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2624
	db:areaTotal	3.74^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Gendaria splited from Demra, Sutrapur, Shyampur Thana
	rdf:label	Gendaria, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Gendaria
d-city:Sutrapur-II	foaf:name	Sutrapur
d-city:nameChange31	dc:date	2007
	change:after	d-city:Dakshin_Khan_Thana_2010
	change:before	d-city:Uttara_Thana_2000
	rdf:type	change:Namechange
d-city:nameChange10	dc:date	1998
	change:after	d-city:Khilgaon_Thana_2000
	change:before	d-city:Sabujbagh-I
	rdf:type	change:Namechange
d-city:Sabujbagh_Thana_2010	db:areaTotal	3.69^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	tisc:existenceBeginsAt	1988
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MS_0004.GIF
	dc:description	Administration Sabujbagh thana was established in 1988. It consists of two union parishads, five wards, 28 mouzas, 30 mahallas and 12 villages.Source: http://bpedia.org/S_0004.php
	rdf:label	Sabujbagh, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Sabujbagh
d-city:Dhaka2011-2013	d-city:historicVersion	d-city:Dhaka1608-1864
	d-city:historicVersion	d-city:Dhaka1955-1971
	tisc:localedAt	dbpedia:Bangladesh
	tisc:existenceEndsAt	not ended
	dbpprop:website	http://www.dhakacity.org/
	d-city:historicVersion	d-city:Dhaka1864-1905
	d-city:historicVersion	d-city:Dhaka1971-1977
	rdf:type	http://dbpedia.org/page/City
	gn:District	http://www.geonames.org/1337178/dhaka-zila.html
	d-city:administration	d-city:Dhaka_North_City_Corporation
	owl:sameAs	dbpedia:Dhaka
	d-city:historicVersion	d-city:Dhaka1947-1954
	geos:capitalOf	dbpedia:Bangladesh
	dbpedia-owl:isPartOf	dbpedia:Dhaka_Division
	d-city:administration	d-city:Dhaka_South_City_Corporation
	gn:Country	http://www.geonames.org/countries/BD/bangladesh.html
	d-city:historicVersion	d-city:Dhaka1905-1947
	gn:locationMap	http://www.geonames.org/maps/google_23.71_90.407.html
	d-city:historicVersion	d-city:Dhaka1990-2011
	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php
	foaf:name	Dhaka
	geo:long	90.40744
	geo:lat	23.7104
	d-city:historicVersion	d-city:Dhaka1978-1989
	dbpedia-owl:isPartOf	dbpedia:Dhaka_District
	geos:capitalOf	http://dbpedia.org/page/Bangladesh
	rdf:label	Dhaka City

	tisc:existenceBeginsAt	2011-12-04
	d-city:administration	d-city:DMP_2010
d-city:merge-of-geometries7	dc:date	2007
	dc:description	Shah Ali Thana is formed from part of Pallabi Thana and Mirpur Thana
	change:after	d-city:Shah_Ali_Thana_2010
	change:before	d-city:Mirpur-II
	change:before	d-city:Pallabi-I
	rdfs:label	Ahah Ali Thana splited from Pallabi and Mirpur Thana
	rdf:type	change:Merge
d-city:Tejgaon_Thana_2010	dbpedia-owl:thumbnail	http://bpedia.org/maps/MG_0221.GIF
	rdf:type	d-city:Thana
	dbpedia-owl:isPartOf	d-city:DMP_2010
	tisc:existenceBeginsAt	1972
	foaf:name	Tejgaon
	db:areaTotal	4.49^^http://www.w3.org/2001/XMLSchema#double
	rdf:label	Tejgaon, Dhaka
	tisc:existenceBeginsAt	1962
	dc:description	Tejgaon Thana area Tejgaon is considered to be the industrial area of Dhaka City Corporation. Many government, semi government and autonomous organisations and institutions are located in the area. Mention may be made of Jatiya Sangsad Bhaban (Parliament Building), Ganabhaban (Prime Minister's residence), MP Hostel, Bangladesh Agricultural Research Council, FDC (Film Development Corporation),International Jute Organisation and Prime Minister's Office.source:http://bpedia.org/T_0105.php
	dc:description	Gulshan Thana area Gulshan thana area is considered as the New Dhaka where most of the foreign missions are located. Besides it has been developed as a major residential area.source:http://bpedia.org/G_0221.php
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MT_0105.GIF
	foaf:name	Gulshan
	rdf:label	Gulshan, Dhaka
d-city:Kotwali_Thana_1995	owl:sameAs	http://dbpedia.org/page/Dhaka_Kotwali_Thana
	dbpedia-owl:isPartOf	d-city:DMP_1995
	db:areaTotal	2.90^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1872
	dc:description	Kotwali Thana Area is considered as old Dhaka. Many administrative establishments including Dhaka City Corporation, Police Head Quarters, Bangladesh Fire Service, Lower Court, Judge Court, CMM Court arelocated in this thana.source:http://bpedia.org/K_0289.php
	rdf:label	Kotwali, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Kotwali
d-city:split-of-geometries15	dc:date	2007
	dc:description	Cantonment Thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Biman_Bandar_Thana_2010
	change:after	d-city:Cantonment_Thana_2010
	change:before	d-city:Cantonment_Thana_2000
	rdfs:label	Cantonment Thana contributes to form Biman Bandar Thana
	rdf:type	change:Split
d-city:Demra_Thana_2000	db:areaTotal	37.70^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	tisc:existenceBeginsAt	1973
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MD_0109.GIF
	dc:description	Administration Demra thana was established in 1973. It consists of three wards, three union parishads, 36 mouzas and 53 villages.source:http://bpedia.org/D_0109.php
	rdf:label	Demra, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Demra
d-city:Dhanmondi-I	foaf:name	Dhanmondi
d-city:Motijheel_Thana_2000	db:areaTotal	5.06^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	tisc:existenceBeginsAt	1976
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MM_0334.GIF
	dc:description	Motijheel thana area Motijheel thana is considered as the commercial area of Dhaka city. The head offices of many financial institutions including bangladesh bank, sonali bank, pubali bank, agrani bank, janata bank, rupali bank, islami bank, eastern bank, basic bank, jiban bima corporation, sadharan bima corporation, american life insurance Co., dhaka stock exchange, etc are locatedin Motijheel area. Besides, Power and Water Development Board, rajukand many government and private offices are located here.source:http://bpedia.org/M_0334.php
	rdf:label	Motijheel, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Motijheel
d-city:Dhaka947-1954	rdf:type	Pourashava
d-city:nameChange39	dc:date	2007
	change:after	d-city:Tejgaon_Industrial_Area_Thana_2010
	change:before	d-city:Tejgaon_Thana_2000
	rdf:type	change:Namechange

d-city:nameChange18	dc:date	2007
	change:after	d-city:Shah_Ali_Thana_2000
	change:before	d-city:Pallabi-I
	rdf:type	change:Namechange
d-city:Rampura_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2667
	db:areaTotal	3.01^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Rampura splited from Khilgaon Thana
	rdf:label	Rampura, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Rampura
d-city:split-of-geometries4	dc:date	1998
	dc:description	In 1998 Cantonment thana splited into three parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Gulshan_Thana_2000
	change:after	d-city:Gulshan-II
	change:after	d-city:Gulshan-I
	change:before	d-city:Gulshan_Thana_1995
	rdfs:label	Gulshan Thana contributes to form Badda and Khilgaon thana
	rdf:type	change:Split
d-city:Hazaribagh_Thana_2000	db:areaTotal	5.21^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MH_0093.GIF
	dc:description	Administration Hazaribagh thana was established in 1998 consisting of parts of Mohammadpur, Dhanmondi and Lalbagh thanas. It consists of 3 wards, 15 mouzas and one village. Source:http://bpedia.org/H_0093.php
	rdf:label	Hazaribagh, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Hazaribagh
change:split-of-geometries7	dc:date	1998
	dc:description	In 1998 Sutrapur thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Sutrapur_Thana_2000
	change:after	d-city:Sutrapur-I
	change:before	d-city:Sutrapur_Thana_1995
	rdfs:label	Sutrapur Thana contributes to form Shyampur thana
	rdf:type	change:Split
d-city:Uttara-I	foaf:name	Uttara
d-city:split-of-geometries23	dc:date	2007
	dc:description	Uttara Thana splited into four parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Uttara-I
	change:after	d-city:Uttara_Thana_2010
	change:after	d-city:Dakshin_Khan_Thana_2010
	change:after	d-city:Uttar_Khan_Thana_2010
	change:before	d-city:Uttara_Thana_2000
	rdfs:label	UttaraThana contributes to form Uttar Khan Thana, Dakshin Khan Thana and Turag
	rdf:type	change:Split
d-city:nameChange26	dc:date	2007
	change:after	d-city:Genderia_Thana_2010
	change:before	d-city:Demra-IV
	rdf:type	change:Namechange
d-city:Mohammadpur_Thana_2000	db:areaTotal	9.86^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MM_0297.GIF
	dc:description	Administration Mohammadpur thana consists of five wards, 45 mouzas.Source: http://bpedia.org/M_0297.php
	rdf:label	Mohammadpur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Mohammadpur
d-city:Sutrapur_Thana_1995	db:areaTotal	4.66^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_1995
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MS_0627.GIF
	dc:description	Administration It consists of 10 wards, 80 mahallas.Source: http://bpedia.org/S_0627.php
	rdf:label	Sutrapur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Sutrapur
d-city:Turag_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2693
	db:areaTotal	24.52^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Turagsplited from Uttara Thana

	rdf:label	Turag, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Turag
d-city:split-of-geometries10	dc:date	1998
	dc:description	In 1998 Lalbagh Thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Lalbagh_Thana_2000
	change:after	d-city:Lalbagh-I
	change:after	d-city:Kamrangirchar_Thana_2000
	change:before	d-city:Lalbagh_Thana_1995
	rdfs:label	Lalbagh Thana contributes to form Kamangirchar Thana
	rdf:type	change:Split
d-city:Kotwali_Thana_2010	dbpedia-owl:isPartOf	d-city:DMP_2010
	db:areaTotal	0.832^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1872
	dc:description	Kotwali Thana Area is considered as old Dhaka. Many administrative establishments including Dhaka City Corporation, Police Head Quarters, Bangladesh Fire Service, Lower Court, Judge Court, CMM Court arelocated in this thana.source:http://bpedia.org/K_0289.php
	rdf:label	Kotwali, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Kotwali
d-city:Change-part-of3	dc:date	1847^^http://www.w3.org/2001/XMLSchema#date
	change:after	d-city:Dhaka2011-2013
	change:after	d-city:Dhaka1990-2011
	change:after	d-city:Dhaka1978-1989
	change:after	d-city:Dhaka1971-1977
	change:before	d-city:Dhaka1955-1971
	rdfs:label	Dhaka become the capital of independent Bangladesh
	rdf:type	change:Changepartof
d-city:Gulshan_Thana_2000	db:areaTotal	7.09^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	tisc:existenceBeginsAt	1972
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MG_0221.GIF
	dc:description	Gulshan Thana area Gulshan thana area is considered as the New Dhaka where most of the foreign missions are located. Besides it has been developed as a major residential area.source:http://bpedia.org/G_0221.php
	rdf:label	Gulshan, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Gulshan
d-city:nameChange34	change:after	d-city:Kalabagan_Thana_2010
	dc:date	2007
	change:after	d-city:New_Market_Thana_2010
	change:before	d-city:Dhanmondi_Thana_2000
	rdf:type	change:Namechange
d-city:nameChange13	dc:date	1998
	change:after	d-city:Shyampur_Thana_2000
	change:before	d-city:Sutrapur-I
	rdf:type	change:Namechange
d-city:Changetypeof3	dc:date	1864
	change:after	d-city:Dhaka1608-1864
	change:before	d-city:Dhaka1978-1989
	change:before	d-city:Dhaka1947-1954
	change:before	d-city:Dhaka1905-1947
	change:before	d-city:Dhaka1608-1864
	rdfs:label	Dhaka Thana become Dhaka Purashava in 1864
	rdf:type	d-city:Changetypeof
d-city:split-of-geometries18	dc:date	2007
	dc:description	Khilgaon Thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Khilkhet_Thana_2010
	change:after	d-city:Rampura_Thana_2010
	change:before	d-city:Khilgaon_Thana_2000
	rdfs:label	Khilgaon Thana contributes to form Rampura Thana
	rdf:type	change:Split
d-city:nameChange6	dc:date	1998
	change:after	d-city:Kafrul_Thana_2000
	change:before	d-city:Mirpur_Thana_1995
	rdf:type	change:Namechange
d-city:nameChange21	dc:date	2007
	change:after	d-city:Biman_Bandar_Thana_2010
	change:before	d-city:Cantonment_Thana_2000
	rdf:type	change:Namechange
d-city:Lalbagh_Thana_1995	tisc:geometry	23.011945 90.00662
	owl:sameAs	http://dbpedia.org/page/Lalbagh_Thana
	db:areaTotal	9.01^^http://www.w3.org/2001/XMLSchema#double

	dbpedia-owl:isPartOf	d-city:DMP_1995
	dbpedia-owl:thumbnail	http://bpedia.org/maps/ML_0028.GIF
	dc:description	Lalbagh Thana area belongs to the old part of the Dhaka City Corporation..Source:http://bpedia.org/L_0028.php
	rdf:label	Lalbagh, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Lalbagh
d-city:Sabujbagh_Thana_2000	db:areaTotal	6.47^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	tisc:existenceBeginsAt	1988
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MS_0004.GIF
	dc:description	Administration Sabujbagh thana was established in 1988. It consists of two union parishads, five wards, 28 mouzas, 30 mahallas and 12 villages.Source: http://bpedia.org/S_0004.php
	rdf:label	Sabujbagh, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Sabujbagh
d-city:merge-of-geometries11	dc:date	2007
	dc:description	Sher-E-Bangla Nagar Thana is formed from part of Muhammadpur Thana, Tejgaon Thana and Kafrul Thana
	change:after	d-city:Sher-E-Bangla_Nagar_Thana_2010
	change:before	d-city:Kafrul-I
	change:before	d-city:Tejgaon-I
	change:before	d-city:Mohammadpur-II
	rdfs:label	Sher-E-Bangla Nagar Thana splited from Muhammadpur, Tejgaon and Kafrul Thana
	rdf:type	change:Merge
d-city:Dhaka1608-1864	dbpedia-owl:isPartOf	http://dbpedia.org/page/Indian_subcontinent
	dbpedia-owl:isPartOf	http://en.wikipedia.org/wiki/British_Empire
	d-city:historicPeriod	Mughal Period
	tisc:existenceEndsAt	1864
	tisc:existenceBeginsAt	1608
	rdf:type	Capital of Province
	d-city:administration	Data not available
	rdf:type	d-city:Thana
	foaf:name	Zahangirnagor
d-city:Tejgaon_Thana_2000	dbpedia-owl:isPartOf	d-city:DMP_2000
	tisc:existenceBeginsAt	1962
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MT_0105.GIF
	dc:description	Tejgaon Thana area Tejgaon is considered to be the industrial area of Dhaka City Corporation. Many government, semi government and autonomous organisations and institutions are located in the area. Mention may be made of Jatiya Sangsad Bhaban (Parliament Building), Ganabhaban (Prime Minister's residence), MP Hostel, Bangladesh Agricultural Research Council, FDC (Film Development Corporation),International Jute Organisation and Prime Minister's Office.source:http://bpedia.org/T_0105.php
	rdf:label	Tejgaon, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Tejgaon
d-city:split-of-geometries26	dc:date	2007^^http://www.w3.org/2001/XMLSchema#date
	dc:description	Lalbagh Thana splited into Two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Chak_Bazar_Thana_2010
	change:after	d-city:Lalbagh_Thana_2010
	change:before	d-city:Lalbagh_Thana_2000
	rdfs:label	Lalbagh Thana contributes to form Chak Bazar Thana
	rdf:type	change:Split
d-city:Pourashava1905-1947	tisc:existenceEndsAt	1947
	tisc:existenceBeginsAt	1905
	foaf:name	Pourashava
d-city:Ramna_Thana_1995	dbpedia-owl:isPartOf	d-city:DMP_1995
	db:areaTotal	7.513^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1921
	dc:description	Ramna Thana Area Raman thana is a very important area of Dhaka City Corporation. Many government, semi government, autonomous and private institutions are located here. Mentions may be made of Bangladesh Secretariat, Food Department, Railway Bhaban, PoliceHeadquarters, City Corporation Bhaban, Postal Department, Relief Department, Taxation Department, C&AG Office, Shilpakala Academy, Telephone Bhaban, High Court Division, National Museum, Directorate of Public Library, Dhaka University, Hotel Sheraton, Roads and Highways Division, Fisheries Division, Directorate of Education, Dhaka Medical College Hospital, Bangabandhu Sheikh Mujib Medical University (PG Hospital), BIRDEM Hospital, Bangla Academy, Asiatic Society of Bangladesh, etc.source: http://bpedia.org/R_0105.php
	rdf:label	Ramna, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Ramna
d-city:administration	rdf:comments	Administration is a form of government such as public administration e.g., City Corporation
	rdf:label	administration
	rdf:type	rdf:property

d-city:nameChange29	dc:date	2007
	change:after	d-city:Genderia_Thana_2010
	change:before	d-city:Sutrapur-II
	rdf:type	change:Namechange
d-city:Pourashava1971-1977	tisc:existenceEndsAt	1977
	tisc:existenceBeginsAt	1971
	foaf:name	Dacca Pourashava
d-city:Dhaka_North_City_Corporation	foaf:homepage	http://www.dncc.gov.bd/
	rdf:label	Dhaka North City Corporation
	gn:Country	http://www.geonames.org/countries/BD/bangladesh.html
	d-city:historicVersion	d-city:Dhaka_City_Corporation
	dbpedia-owl:isPartOf	dbpedia:Dhaka_District
	foaf:name	Dhaka North City Corporation
	rdf:resources	http://en.wikipedia.org/wiki/Dhaka_North_City_Corporation
	rdf:resources	http://www.dncc.gov.bd/
	rdf:type	City Corporation
	dbpedia-owl:isPartOf	d-city:Dhaka2011-2013
	gn:District	http://www.geonames.org/1337178/dhaka-zila.html
	tisc:geometry	23.825708,90.36581^^http://www.w3.org/2001/XMLSchema#string
	owl:sameAs	http://dbpedia.org/page/Dhaka_North_City_Corporation
	tisc:insideOf	dbpedia:Dhaka
	dbpedia-owl:isPartOf	dbpedia:Dhaka_Division
	tisc:existenceBeginsAt	2011-12-04
d-city:Dhaka1864-1905	d-city:historicPeriod	British Period
	foaf:name	Dacca
	tisc:existenceBeginsAt	1864
	rdf:type	Municipality
	d-city:administration	d-city:Municipality1864-1905
	dbpedia-owl:isPartOf	http://dbpedia.org/page/Mughal_Empire
	dbpedia-owl:isPartOf	http://dbpedia.org/page/Indian_subcontinent
	dbpedia-owl:thumbnail	http://2.bp.blogspot.com/_ZPf1HUBNpK4/RmaSQ7MCptI/AAAAAAAAC9Q/4iKu4lHRV0I/s1600-h/014-dhaka+during+British+rule.gif
	tisc:existenceEndsAt	1905
	rdf:type	Capital of Province
d-city:Dhaka_City_Corporation	d-city:historicVersion	d-city:Dhaka_Municipal_Corporation
	dbpprop:subdivision	Ward
	d-city:historicVersion	d-city:Pourashava1947-1971
	tisc:existenceBeginsAt	1990
	dbpedia-owl:isPartOf	d-city:Dhaka1990-2011
	rdf:type	City Corporation
	rdf:resources	http://rdf.freebase.com/ns/m.09pw2f
	dbpedia-owl:thumbnail	http://2.bp.blogspot.com/-Vkc_e90oNbQ/TsKrWUNA28I/AAAAAAAAZc0/CB3shaK2Xyc/s1600/dcc_map.gif
	d-city:numberOfSubdivision	14
	d-city:historicVersion	d-city:Pourashava1971-1977
	d-city:historicVersion	d-city:Pourashava1905-1947
	foaf:name	Dhaka City Corporation
	rdf:resources	dbpedia:Dhaka_City_Corporation
	tisc:existenceEndsAt	2011
	d-city:historicVersion	d-city:Pourashava1947-1954
	d-city:historicVersion	d-city:Pourashava1964-1905
d-city:Sutrapur-I	foaf:name	Sutrapur
d-city:merge-of-geometries5	dc:date	1998
	dc:description	In 1998 Hazaribagh Thana is formed from part of Mohammadur Thana, Lalbagh Thana and Dhanmondi Thana^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Hazaribagh_Thana_2000
	change:before	d-city:Lalbagh-I
	change:before	d-city:Mohammadpur-I
	change:before	d-city:Dhanmondi-I
	rdfs:label	Hazaribagh Thana splitted from Mohammadur Thana, Lalbagh Thana and Dhanmondi Thana
	rdf:type	change:Merge
d-city:split-of-geometries13	dc:date	2007
	dc:description	Pallabi Thana splited into three parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Pallabi-II
	change:after	d-city:Pallabi-I
	change:after	d-city:Pallabi_Thana_2010
	change:before	d-city:Pallabi_Thana_2000
	rdfs:label	Pallabi Thana contributes to form Turag Thana and Shah Ali Thana
	rdf:type	change:Split
d-city:Lalbagh-I	foaf:name	lalbagh
d-city:Pourashava1947-1971	tisc:existenceEndsAt	1971
	tisc:existenceBeginsAt	1955

	foaf:name	Dacca Pourashava
d-city:nameChange37	dc:date	2007
	change:after	d-city:Chak_Bazar_Thana_2010
	change:before	d-city:Lalbagh_Thana_2000
	rdf:type	change:Namechange
d-city:nameChange16	dc:date	2007
	change:after	d-city:Bangshal_Thana_2010
	change:before	d-city:Kotwali_Thana_2000
	rdf:type	change:Namechange
d-city:Municipality1864-1905	tisc:existenceEndsAt	1978
	tisc:existenceBeginsAt	1864
	foaf:name	Dacca
d-city:Lalbagh_Thana_2010	tisc:geometry	23.011945 90.00662^^http://www.w3.org/2001/XMLSchema#string
	owl:sameAs	http://dbpedia.org/page/Lalbagh_Thana
	db:areaTotal	2.20^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/ML_0028.GIF
	dc:description	Lalbagh Thana area belongs to the old part of the Dhaka City Corporation..Source:http://bpedia.org/L_0028.php
	rdf:label	Lalbagh, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Lalbagh^^http://www.w3.org/2001/XMLSchema#string
d-city:split-of-geometries2	dc:date	1998
	dc:description	In 1998 Mirpur thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Mirpur_Thana_2000
	change:after	d-city:Mirpur-I
	change:before	d-city:Mirpur_Thana_1995
	rdfs:label	Mirpur Thana contributes to form new Thana Kafrul
	rdf:type	change:Split
d-city:Dhanmondi_Thana_1995	db:areaTotal	9.19^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_1995
	tisc:existenceBeginsAt	1976
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MD_0186.GIF
	dc:description	Administration Dhanmondi thana was established in 1976. It consists of three wards, 20 mouzas.source:http://bpedia.org/D_0186.php
	rdf:label	Dhanmondi, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Dhanmondi
d-city:Sher-E-Bangla_Nagar_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2680
	db:areaTotal	5.15^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Sher-E-Bangla Nagar splited from Mohammadpur, Tejgaon and Kafrul Thana
	rdf:label	Sher-E-Bangla Nagar, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Sher-E-Bangla Nagar
change:split-of-geometries5	dc:date	1998
	dc:description	In 1998 Sabujbagh thana splited into three parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Sabujbagh_Thana_2000
	change:after	d-city:Sabujbagh-I
	change:before	d-city:Sabujbagh_Thana_1995
	rdfs:label	Sabujbagh Thana contributes to form Khilgaon thana
	rdf:type	change:Split
d-city:Kafrul_Thana_2010	db:areaTotal	6.01^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MK_0015.GIF
	dc:description	Administration Kafrul thana was established in 1998 consisting of parts of Mirpur and Cantonment thanas. It consists of one ward, 16 mouzas and four villages. Source:http://bpedia.org/K_0015.php
	rdf:label	Kafrul, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Kafrul
d-city:split-of-geometries21	dc:date	2007
	dc:description	Sutrapur Thana again splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Sutrapur-II
	change:after	d-city:Sutrapur_Thana_2010
	change:before	d-city:Sutrapur_Thana_2000
	rdfs:label	Sutrapur Thana contributes to form Gendaria Thana
	rdf:type	change:Split
d-city:Kamrangirchar_Thana_2010	db:areaTotal	3.72^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998

	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MK_0065.GIF
	dc:description	Administration Kamrangir Char thana was established in 1998 consisting of six mouzas from Lalbagh thana. The thana consists of one ward and one village. Source:http://bpedia.org/K_0065.php
	rdf:label	Kamrangirchar, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Kamrangirchar
d-city:Kotwali_Thana_2000	dbpedia-owl:isPartOf	d-city:DMP_2000
	db:areaTotal	2.90^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1872
	dc:description	Kotwali Thana Area is considered as old Dhaka. Many administrative establishments including Dhaka City Corporation, Police Head Quarters, Bangladesh Fire Service, Lower Court, Judge Court, CMM Court arelocated in this thana.source:http://bpedia.org/K_0289.php
	rdf:label	Thana
	rdf:type	d-city:Thana
	foaf:name	Kotwali
d-city:nameChange9	dc:date	1998
	change:after	d-city:Khilgaon_Thana_2000
	change:before	d-city:Gulshan-II
	rdf:type	change:Namechange
d-city:Ramna_Thana_2010	db:areaTotal	3.82^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia:southOf	Tejgaon Thana
	tisc:existenceBeginsAt	1921
	dc:description	Ramna Thana Area Raman thana is a very important area of Dhaka City Corporation. Many government, semi government, autonomous and private institutions are located here. Mentions may be made of Bangladesh Secretariat, Food Department, Railway Bhaban, PoliceHeadquarters, City Corporation Bhaban, Postal Department, Relief Department, Taxation Department, C&AG Office, Shilpakala Academy, Telephone Bhaban, High Court Division, National Museum, Directorate of Public Library, Dhaka University, Hotel Sheraton, Roads and Highways Division, Fisheries Division, Directorate of Education, Dhaka Medical College Hospital, Bangabandhu Sheikh Mujib Medical University (PG Hospital), BIRDEM Hospital, Bangla Academy, Asiatic Society of Bangladesh, etc.source: http://bpedia.org/R_0105.php
	rdf:label	Kotwali, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Ramna
d-city:nameChange24	dc:date	2007
	change:after	d-city:Rampura_Thana_2010
	change:before	d-city:Khilgaon_Thana_2000
	rdf:type	change:Namechange
d-city:Darus_Salam_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2610
	db:areaTotal	4.44^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Darus Salam splited from Mirpur Thana
	rdf:label	Darus Salam, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Darus Salam
d-city:Cantonment_Thana_1995	db:areaTotal	35.92^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_1995
	tisc:existenceBeginsAt	1976
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MC_0036.GIF
	dc:description	Administration Cantonment thana, under Dhaka City Corporation, was established in 1976. It consists of one ward and 13 mouzas.source:http://bpedia.org/C_0036.php
	rdf:label	Cantonment, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Cantonment
d-city:Change-part-of1	dc:date	1864-08-01
	change:after	d-city:Dhaka1905-1947
	change:after	d-city:Dhaka1864-1905
	change:before	d-city:Dhaka1608-1864
	rdfs:label	After Mughal Period Dhaka becoms a British Colony
	rdf:type	change:Changepartof
d-city:historicPeriod	skos:example	historicPeriod is notation of period of historic region such as British Period, Mughal Period
	owl:sameAs	dbpprop:era
	rdf:label	historicPeriod
	rdf:type	rdf:property
d-city:nameChange32	dc:date	2007
	change:after	d-city:Uttar_Khan_Thana_2010
	change:before	d-city:Uttara_Thana_2000
	rdf:type	change:Namechange
d-city:Dhaka_South_City_Corporation	qn:Country	http://www.geonames.org/countries/BD/bangladesh.html
	tisc:existenceBeginsAt	2011-12-04
	foaf:homepage	http://www.dhakacity.org/index.php

	tisc:insideOf	dbpedia:Dhaka
	foaf:name	Dhaka South City Corporation
	gn:District	http://www.geonames.org/1337178/dhaka-zila.html
	rdf:label	Dhaka South City Coorporation
	dbpedia-owl:isPartOf	dbpedia:Dhaka_District
	dbpedia-owl:isPartOf	dbpedia:Dhaka_Division
	rdf:type	City Corporation
	rdf:resources	http://en.wikipedia.org/wiki/Dhaka_South_City_Corporation
	tisc:geometry	23.710396 90.40246^^http://www.w3.org/2001/XMLSchema#string
	owl:sameAs	dbpedia:Dhaka_South_City_Corporation
	d-city:historicVersion	d-city:Dhaka_City_Corporation
	dbpedia-owl:isPartOf	d-city:Dhaka2011-2013
d-city:Mohammadpur-I	foaf:name	Mohammadpur
d-city:Demra-III	foaf:name	Demra
d-city:nameChange11	dc:date	1998
	change:after	d-city:Khilgaon_Thana_2000
	change:before	d-city:Demra-I
	rdf:type	change:Namechange
d-city:Changetypeof1	dc:date	1990
	change:after	d-city:Dhaka2011-2013
	change:after	d-city:Dhaka1990-2011
	change:before	d-city:Dhaka1971-1977
	change:before	d-city:Dhaka1978-1989
	rdfs:label	Dhaka Municipal Corporation become Dhaka Cty corporation in 1990
	rdf:type	d-city:Changetypeof
d-city:Gulshan_Thana_1995	db:areaTotal	46.75^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_1995
	tisc:existenceBeginsAt	1972
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MG_0221.GIF
	dc:description	Gulshan Thana area Gulshan thana area is considered as the New Dhaka where most of the foreign missions are located. Besides it has been developed as a major residential area.source:http://bpedia.org/G_0221.php
	rdf:label	Gulshan, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Gulshan
d-city:merge-of-geometries8	dc:date	2007
	dc:description	Kadamtali Thana is formed from part of Demra Thana and Shyampur Thana
	change:after	d-city:Kadamtali_Thana_2010
	change:before	d-city:Demra-II
	change:before	d-city:Shyampur-I
	rdfs:label	Kadamtali Thana splited from Demra and Shyampur Thana
	rdf:type	change:Merge
d-city:Dhanmondi_Thana_2010	db:areaTotal	3.86^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	tisc:existenceBeginsAt	1976
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MD_0186.GIF
	dc:description	Administration Dhanmondi thana was established in 1976. It consists of three wards, 20 mouzas.source:http://bpedia.org/D_0186.php
	rdf:label	Dhanmondi, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Dhanmondi
d-city:Kadamtali_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2632
	db:areaTotal	7.85
	dc:date	2010^^http://www.w3.org/2001/XMLSchema#date
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Kadamtali splited from Shyampur Thana
	rdf:label	Kadamtali , Dhaka
	rdf:type	d-city:Thana
	foaf:name	Kadamtali
d-city:split-of-geometries16	dc:date	2007
	dc:description	Kafrul Thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Sher-E-Bangla_Nagar_Thana_2010
	change:after	d-city:Kafrul_Thana_2010
	change:before	d-city:Kafrul_Thana_2000
	rdfs:label	Kafrul Thana contributes to form Turag Thana
	rdf:type	change:Split
d-city:Gulshan-II	foaf:name	Gulshan
d-city:nameChange40	dc:date	1864^^http://www.w3.org/2001/XMLSchema#date
	change:after	d-city:Dhaka1864-1905
	change:before	d-city:Dhaka1608-1864
	rdf:type	change:Namechange
change:merge-of-geometries2	dc:date	1998
		In 1998 Badda Thana is formed from part of Gulshan Thana and Cantonment

	dc:description	Thana^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Badda_Thana_2000
	change:before	d-city:Cantonment-II
	change:before	d-city:Gulshan-I
	rdfs:label	Badda Thana splitted from Gulshan Thana and Cantoment Thana
	rdf:type	change:Merge
d-city:nameChange19	dc:date	2007
	change:after	d-city:Turag_Thana_2000
	change:before	d-city:Pallabi-II
	rdf:type	change:Namechange
d-city:Pallabi_Thana_1995	db:areaTotal	25.44^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	15.03.1993
	dbpedia-owl:isPartOf	d-city:DMP_1995
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MP_0047.GIF
	dc:description	Administration Pallabi thana was established on 15 March 1993 under the Dhaka City Corporation. It consists of 1 union parishads, 16 mouzas, 27 mahallas.Source:http://bpedia.org/P_0047.php
	rdf:label	Pallabi, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Pallabi
d-city:Demra-IV	foaf:name	Demra
d-city:Shyampur-II	foaf:name	Shyampur
d-city:split-of-geometries24	dc:date	2007^^http://www.w3.org/2001/XMLSchema#date
	dc:description	Dhanmondi Thana splited into Three parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Kalabagan_Thana_2010
	change:after	d-city:New_Market_Thana_2010
	change:after	d-city:Dhanmondi_Thana_2010
	change:before	d-city:Dhanmondi_Thana_2000
	rdfs:label	Dhanmondi Thana contributes to form New Market Thana and Kalabagan Thana
	rdf:type	change:Split
d-city:Cantonment_Thana_2010	db:areaTotal	8.64^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	tisc:existenceBeginsAt	1976
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MC_0036.GIF
	dc:description	Administration Cantonment thana, under Dhaka City Corporation, was established in 1976. It consists of one ward and 13 mouzas.source:http://bpedia.org/C_0036.php
	rdf:label	Cantonment, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Cantonment
d-city:Dhaka1955-1971	geos:capitalOf	http://dbpedia.org/page/East_Pakistan
	dbpedia-owl:isPartOf	http://dbpedia.org/page/East_Pakistan
	dbpedia-owl:isPartOf	http://dbpedia.org/page/Pakistan
	tisc:existenceEndsAt	1971
	tisc:existenceBeginsAt	1955
	d-city:historicPeriod	Pakistan Period
	d-city:administration	d-city:Dhaka_Pourashava1955-1971
	rdf:type	Pourashava
	foaf:name	Dacca
d-city:nameChange27	dc:date	2007
	change:after	d-city:Kadamtali_Thana_2010
	change:before	d-city:Shyampur-I
	rdf:type	change:Namechange
d-city:Lalbagh_Thana_2000	db:areaTotal	3.43^^http://www.w3.org/2001/XMLSchema#double
	owl:sameAs	http://dbpedia.org/page/Lalbagh_Thana
	db:areaTotal	3.43
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/ML_0028.GIF
	dc:description	Lalbagh Thana area belongs to the old part of the Dhaka City Corporation..Source:http://bpedia.org/L_0028.php
	rdf:label	Lalbagh, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Lalbagh
d-city:Muhammadpur-II	foaf:name	Mohammadpur
d-city:Demra-II	foaf:name	Demra
d-city:merge-of-geometries3	dc:date	1998
	dc:description	In 1998 KhilgaonThana is formed from part of Gulshan Thana, Demra Thana and Sabujbagh Thana^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Khilgaon_Thana_2000
	change:before	d-city:Demra-I
	change:before	d-city:Sabujbagh-I
	change:before	d-city:Gulshan-II
	rdfs:label	Khilgaon Thana splitted from Gulshan Thana, Demra Thana and Sabujbagh Thana

	rdf:type	change:Merge
d-city:Kafrul_Thana_2000	db:areaTotal	7.27^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MK_0015.GIF
	dc:description	Administration Kafrul thana was established in 1998 consisting of parts of Mirpur and Cantonment thanas. It consists of one ward, 16 mouzas and four villages. Source:http://bpedia.org/K_0015.php
	rdf:label	Kafrul, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Kafrul
d-city:Kamrangirchar_Thana_2000	dbpedia-owl:areaTotal	3.72^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MK_0065.GIF
	dc:description	Administration Kamrangir Char thana was established in 1998 consisting of six mouzas from Lalbagh thana. The thana consists of one ward and one village. Source:http://bpedia.org/K_0065.php
	rdf:label	Kamrangirchar, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Kamrangirchar
d-city:split-of-geometries11	dc:date	2007
	dc:description	Kotwali Thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Bangshal_Thana_2010
	change:after	d-city:Kotwali_Thana_2010
	change:before	d-city:Kotwali_Thana_2000
	rdfs:label	Kotwali Thana contributes to form Bangshal Thana
	rdf:type	change:Split
d-city:Ramna_Thana_2000	db:areaTotal	7.51^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	dbpedia:southOf	Tejgaon Thana
	tisc:existenceBeginsAt	1921
	dc:description	Ramna Thana Area Raman thana is a very important area of Dhaka City Corporation. Many government, semi government, autonomous and private institutions are located here. Mentions may be made of Bangladesh Secretariat, Food Department, Railway Bhaban, PoliceHeadquarters, City Corporation Bhaban, Postal Department, Relief Department, Taxation Department, C&AG Office, Shilpakala Academy, Telephone Bhaban, High Court Division, National Museum, Directorate of Public Library, Dhaka University, Hotel Sheraton, Roads and Highways Division, Fisheries Division, Directorate of Education, Dhaka Medical College Hospital, Bangabandhu Sheikh Mujib Medical University (PG Hospital), BIRDEM Hospital, Bangla Academy, Asiatic Society of Bangladesh, etc.source: http://bpedia.org/R_0105.php
	rdf:label	Thana
	rdf:type	d-city:Thana
	foaf:name	Ramna
d-city:nameChange35	dc:date	2007
	change:after	d-city:Sher-E-Bangla_Nagar_Thana_2010
	change:before	d-city:Muhammadpur-II
	rdf:type	change:Namechange
d-city:Khilgaon_Thana_2010	db:areaTotal	13.63^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MK_0239.GIF
	dc:description	Administration Khilgaon thana was established in 1998 consisting of parts of gulshan and demra thanas. The Thana consists of three wards, 13 mouzas and 9 villages.Source:http://bpedia.org/K_0239.php
	rdf:label	Khilgaon, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Khilgaon^^http://www.w3.org/2001/XMLSchema#string
d-city:nameChange14	dc:date	1998
	change:after	d-city:Hazaribagh_Thana_2000
	change:before	d-city:Dhanmondi-I
	rdf:type	change:Namechange
d-city:Changetypeof	rdf:type	owl:class
d-city:Pallabi_Thana_2010	db:areaTotal	9.51^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	15.03.1993
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MP_0047.GIF
	dc:description	Administration Pallabi thana was established on 15 March 1993 under the Dhaka City Corporation. It consists of 1 union parishads, 16 mouzas, 27 mahallas.Source:http://bpedia.org/P_0047.php
	rdf:label	Pallabi, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Pallabi
d-city:split-of-geometries19	dc:date	2007
	dc:description	Khilgaon Thana splited into four parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Demra-IV
	change:after	d-city:Demra-III

	change:after	d-city:Demra_Thana_2010
	change:after	d-city:Jatrabari_Thana_2010
	change:before	d-city:Demra_Thana_2000
	rdfs:label	Demra Thana contributes to form Jatrabari Thana, Kadamtali Thana and Gendaria Thana
	rdf:type	change:Split
d-city:Uttar_Khan_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2696
	db:areaTotal	19.94^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Uttar Khan from Uttara Thana
	rdf:label	Uttar Khan, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Uttar Khan
d-city:nameChange7	dc:date	1998
	change:after	d-city:Badda_Thana_2000
	change:after	d-city:Kafrul_Thana_2000
	change:before	d-city:Cantonment_Thana_1995
	rdf:type	change:Namechange
d-city:nameChange22	dc:date	2007
	change:after	d-city:Sher-E-Bangla_Nagar_Thana_2010
	change:before	d-city:Kafrul_Thana_2000
	rdf:type	change:Namechange
d-city:Uttara_Thana_1995	db:areaTotal	36910000^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_1995
	tisc:existenceBeginsAt	1988
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MU_0046.GIF
	dc:description	Uttara Thana area Uttara thana is named after Uttara Model Town (residential). There are many government and private institutions and organisations including two private universities, one women's medicalcollege in the area.Source: http://bpedia.org/U_0046.php
	rdf:label	Uttara, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Uttara
d-city:DMP_1995	dbpprop:subdivisionName	Thana
	rdf:type	http://dbpedia.org/page/Metropolitan_area
	dc:Location	http://www.citypopulation.de/php/bangladesh-dhaka.php
	dc:Description	Dhaka Metropolitan Development Plan(1995-2015): Strcture Plan, Master Plan and Detailed Area Plan for Dhaka City. Dhaka structure plan (1995-2015) : December 1995, Volume 1. It has a arbitrary defined region and overlap with Dhaka Metropolitan Police area
	d-city:numberOfSubdivision	14
	rdf:label	Dhaka Metropolitan Area
	dc:date	1995
	dbpprop:subdivision	d-city:Thana
	dc:Jurisdiction	Dhaka Metropolitan Police Area
	gn:Country	http://www.geonames.org/countries/BD/bangladesh.html
	db:areaTotal	1553^^http://www.w3.org/2001/XMLSchema#double
	gn:District	http://www.geonames.org/1337178/dhaka-zila.html
	foaf:name	Dhaka Metropolitan Area
d-city:split-of-geometries8	dc:date	1998
	dc:description	In 1998 Mohammadpur thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Mohammadpur_Thana_2000
	change:after	d-city:Mohammadpur-I
	change:before	d-city:Mohammadpur_Thana_1995
	rdfs:label	Mohammadpur Thana contributes to form Khilgaon thana
	rdf:type	change:Split
d-city:Dhanmondi_Thana_2000	db:areaTotal	6.84^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	tisc:existenceBeginsAt	1976
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MD_0186.GIF
	dc:description	Administration Dhanmondi thana was established in 1976. It consists of three wards, 20 mouzas.source:http://bpedia.org/D_0186.php
	rdf:label	Dhanmondi, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Dhanmondi
d-city:Adabor_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2602
	db:areaTotal	3.09^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Adabor splited from Mohamadpur Thana
	rdf:label	Adabor, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Adabor

d-city:split-of-geometries27	dc:date	2007^^http://www.w3.org/2001/XMLSchema#date
	dc:description	Lalbagh Thana splited into Two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Sher-E-Bangla_Nagor_Thana_2010
	change:after	d-city:Tejgaon_Industrial_Area_Thana_2010
	change:after	d-city:Tejgaon_Thana_2010
	change:before	d-city:Tejgaon_Thana_2000
	rdfs:label	Tejgaon Thana contributes to form Sher-E-Bangla Nagar Thana and Tejgaon Industrial Area Thana
	rdf:type	change:Split
http://epad.ifgi.de/p/student-106	foaf:topic_interest	dbpedia:Dhaka
	foaf:topic_interest	dbpedia:Semantic_Web
	foaf:topic_interest	Semantic web approach for dealing with administrative boundary revisions: A case study of Dhaka City
	teach:studyProgram	http://ifgi.uni-muenster.de/
	foaf:lastName	Pervin
	foaf:firstName	Shiuli
	rdf:label	Shiuli Thesis
	rdf:type	http://en.wikipedia.org/wiki/Student
d-city:historicVersion	owl:sameAs	dc:hasVersion
	rdf:label	historicVersion
	rdf:type	rdf:property
d-city:Mirpur_Thana_1995	dbpedia-owl:isPartOf	d-city:DMP_1995
	db:areaTotal	15.44^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1962
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MM_0260.GIF
	dc:description	Mirpur Thana (Town) area was included in keraniganj thana during the British period and in tejgaon thana during the Pakistan period. Many administrative and cultural establishments including National Zoo, National Botanical Garden, National Vagabond Shelter Centre are located in this thana area. National Martyr Intellectual Memorial has been established at the premises of the graves of martyr intellectuals. The tomb of Hazrat Shah Ali Bagdadi (R), a sacred place and historical relic, is located at Mirpur. Besides, the head offices of grameen bank, bangladesh institute of bank management, Dhaka Eye Hospital, National Heart Foundation, etc are located here.source:http://bpedia.org/M_0260.php
	rdf:label	Mirpur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Mirpur
d-city:nameChange30	dc:date	2007
	change:after	d-city:Paltan_Thana_2010
	change:before	d-city:Motijheel_Thana_2000
	rdf:type	change:Namechange
d-city:Chak_Bazar_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2609
	db:areaTotal	1.22^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Ckak Bazar splited from Lalbagh Thana
	rdf:label	Ckak Bazar, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Ckak Bazar
d-city:Badda_Thana_2010	db:areaTotal	21.39^^http://www.w3.org/2001/XMLSchema#double
	tisc:existenceBeginsAt	1998^^http://www.w3.org/2001/XMLSchema#date
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MB_0018.GIF
	dc:description	Administration Badda thana was established in 1998 consisting of parts of Cantonment and Gulshan thanas. The thana consists of 4 wards, 16 mouzas, 2 unions (Beraid and Satarkul) and 14 mohallas. Source:http://bpedia.org/B_0018.php
	rdf:label	Badda, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Badda^^http://www.w3.org/2001/XMLSchema#string
d-city:Pourashava1964-1905	tisc:existenceEndsAt	1905
	tisc:existenceBeginsAt	1864
	foaf:name	Dacca Pourashava
d-city:merge-of-geometries6	dc:date	2007
	dc:description	Shah Ali thana is formed from part of Pallabi Thana and Mirpur Thana
	change:after	d-city:Shah_Ali_Thana_2010
	change:before	d-city:Mirpur-II
	change:before	d-city:Pallabi-I
	rdfs:label	Ahah Ali Thana splited from Pallabi and Mirpur Thana
	rdf:type	change:Merge
d-city:Dhaka1905-1947	geos:capitalOf	East Bengal and Assam
	dbpedia-owl:isPartOf	http://dbpedia.org/page/Indian_subcontinent
	d-city:administration	d-city:Pourashava1905-1947
	tisc:existenceEndsAt	1947
	tisc:existenceBeginsAt	1905
	dbpedia-owl:thumbnail	http://2.bp.blogspot.com/_ZPf1HUBNpK4/RmRwFVq22_I/AAAAAAAAC7o/5KS7h3Z9YSQ/s320/007-Dhaka+during+British+rule+1924+Mughal+period.jpg

	dbpedia-owl:thumbnail	http://2.bp.blogspot.com/_ZPf1HUBNpK4/RmaSG7MCpsI/AAAAAAAAC9I/5G1I_GQZ88E/s320/015-+Dhaka+city+capital+of+E+bengal+assam+1905-11.gif
	rdf:type	Capital of Province
	rdf:type	Pourashava
	d-city:historicPeriod	British Period
	dbpedia-owl:isPartOf	http://dbpedia.org/page/Mughal_Empire
	foaf:name	Dacca
d-city:Biman_Bandar_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2606
	db:areaTotal	14.84^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Biman bandar splited from Cantonment
	rdf:label	Biman Bandar, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Biman Bandar
d-city:split-of-geometries14	dc:date	2007
	dc:description	Mirpur Thana splited into three parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Mirpur-II
	change:after	d-city:Darus_Salam_Thana_2010
	change:after	d-city:Mirpur_Thana_2010
	change:before	d-city:Mirpur_Thana_2000
	rdfs:label	Mirpur Thana contributes to form Shah Ali Thana and Darus Salam Thana
	rdf:type	change:Split
d-city:Dhaka1971-1977	geos:capitalOf	http://dbpedia.org/page/Bangladesh
	dbpedia-owl:isPartOf	http://dbpedia.org/page/Bangladesh
	tisc:existenceEndsAt	1977
	tisc:existenceBeginsAt	1971
	d-city:historicPeriod	Bangladesh Period
	d-city:administration	d-city:Dhaka_Municipal_Corporation
	rdf:type	Municipal Corporation
	foaf:name	Dacca
d-city:nameChange38	dc:date	2007
	change:after	d-city:Sher-E-Bangla_Nagar_Thana_2010
	change:before	d-city:Tejgaon_Thana_2000
	rdf:type	change:Namechange
d-city:New_Market_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2663
	db:areaTotal	1.28^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010^^http://www.w3.org/2001/XMLSchema#date
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	New Market splited from Dhanmondi Thana
	rdf:label	New Market, Dhaka
	rdf:type	d-city:Thana
	foaf:name	New Market ^^http://www.w3.org/2001/XMLSchema#string
d-city:Cantonment_Thana_2000	db:areaTotal	23.53^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2000
	tisc:existenceBeginsAt	1976
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MC_0036.GIF
	dc:description	Administration Cantonment thana, under Dhaka City Corporation, was established in 1976. It consists of one ward and 13 mouzas.source:http://bpedia.org/C_0036.php
	rdf:label	Cantonment, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Cantonment
d-city:nameChange17	dc:date	2007
	change:after	d-city:Shahbagh_Thana_2010
	change:before	d-city:Ramna_Thana_2000
	rdf:type	change:Namechange
d-city:Sutrapur_Thana_2010	db:areaTotal	2.68^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MS_0627.GIF
	dc:description	Administration It consists of 10 wards, 80 mahallas.Source: http://bpedia.org/S_0627.php
	rdf:label	Sutrapur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Sutrapur
d-city:Uttara_Thana_2010	db:areaTotal	5.25^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	tisc:existenceBeginsAt	1988
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MU_0046.GIF
	dc:description	Uttara Thana area Uttara thana is named after Uttara Model Town (residential). There are many government and private institutions and organisations including two private universities, one women's medicalcollege in the area.Source: http://bpedia.org/U_0046.php
	rdf:label	Uttara, Dhaka
	rdf:type	d-city:Thana

	foaf:name	Uttara
d-city:split-of-geometries3	dc:date	1998
	dc:description	In 1998 Cantonment thana splited into three parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Cantonment_Thana_2000
	change:after	d-city:Cantonment-II
	change:after	d-city:Cantonment-I
	change:before	d-city:Cantonment_Thana_1995
	rdfs:label	Mirpur Thana contributes to form Badda and Kafrul thana
	rdf:type	change:Split
d-city:Demra-I	foaf:name	Demra
d-city:DMP_2010	dc:Description	Dhaka Metropolitan Development Plan(1995-2015): Strcture Plan, Master Plan and Detailed Area Plan for Dhaka City. Dhaka structure plan (1995-2015) : December 1995, Volume 1. It has a arbitrary defined region and overlap with Dhaka Metropolitan Police Area.
	dbpedia-owl:isPartOf	d-city:Dhaka
	gn:Country	http://www.geonames.org/countries/BD/bangladesh.html
	dc:Jurisdiction	Dhaka Metropolitan Police Area
	db:areaTotal	1553^^http://www.w3.org/2001/XMLSchema#double
	d-city:numberOfSubdivision	41
	dbpprop:subdivisionName	Thana
	dbpprop:subdivision	d-city:Thana
	foaf:name	Dhaka Metropolitan Area
	gn:District	http://www.geonames.org/1337178/dhaka-zila.html
	rdf:type	http://dbpedia.org/page/Metropolitan_area
	dc:Location	http://www.citypopulation.de/php/bangladesh-dhaka.php
	dc:date	2010
	rdf:label	Dhaka MetroPolitan Area
d-city:Cantonment-I	foaf:name	Cantonment
d-city:Shyampur-I	foaf:name	Shyampur
d-city:split-of-geometries22	dc:date	2007
	dc:description	Motijheel Thana splited into two parts^^http://www.w3.org/2001/XMLSchema#string
	change:after	d-city:Paltan_Thana_2010
	change:after	d-city:Motijheel_Thana_2010
	change:before	d-city:Motijheel_Thana_2000
	rdfs:label	Motijheel Thana contributes to form Paltan Thana
	rdf:type	change:Split
d-city:Tejgaon_Industrial_Area_Thana_2010	rdf:resources	http://www.citypopulation.de/php/bangladesh-dhaka.php?cid=2692
	db:areaTotal	2.03^^http://www.w3.org/2001/XMLSchema#double
	dc:date	2010
	dbpedia-owl:isPartOf	d-city:DMP_2010
	dc:description	Tejgaon Industrial Area splited from Tejgaon Thana
	rdf:label	Tejgaon Industrial Area, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Tejgaon Industrial Area
d-city:nameChange25	dc:date	2007
	change:after	d-city:Kadamtali_Thana_2010
	change:before	d-city:Demra-III
d-city:Mirpur_Thana_2010	db:areaTotal	7.37^^http://www.w3.org/2001/XMLSchema#double
	dbpedia-owl:isPartOf	d-city:DMP_2010
	tisc:existenceBeginsAt	1962
	dbpedia-owl:thumbnail	http://bpedia.org/maps/MM_0260.GIF
	dc:description	Mirpur Thana (Town) area was included in keraniganj thana during the British period and in tejgaon thana during the Pakistan period. Many administrative and cultural establishments including National Zoo, National Botanical Garden, National Vagabond Shelter Centre are located in this thana area. National Martyr Intellectual Memorial has been established at the premises of the graves of martyr intellectuals. The tomb of Hazrat Shah Ali Bagdadi (R), a sacred place and historical relic, is located at Mirpur. Besides, the head offices of grameen bank, bangladesh institute of bank management, Dhaka Eye Hospital, National Heart Foundation, etc are located here.source:http://bpedia.org/M_0260.php
	rdf:label	Mirpur, Dhaka
	rdf:type	d-city:Thana
	foaf:name	Mirpur