## Chapter 3.4 Multi - Dimension Index

*Definition:*

The Index which we discussed so far has only single dimension, which is to say, it just uses one Single Query Key to query the record according to the Key. Such as B - Tree, it needs Property Value on Query Key, then Query Process can be processed very smoothly; Otherwise, this Index can not play any role. The Single Key Space has several methods:

* *The Index on Sequence File and B - Tree all use Single, Sorted Sequence Key Value.*
* *Hash Table needs to know the Query Key before hand. If the Query Key consists of several fields, then even with one single unknown field, then we can not use Hash Table, but need to Query all Buckets.*

### Chapter 3.4.1 Application of Multi - Dimension Index

*Definition:*

Many applications needs us to treat Data as Binary or much more Dimension Space. Such application can be supported by Traditional DBMS System, but also some kinds are designed by Multi - Dimension Applications. The special aspect of such Application is that some kinds of Query Data Structure are used in the normal SQL application.\

*Application:*

One important application of Multi - Index is that it supports the process procedure of Geography Data. *GSI (Geography Information System) is one Two - Dimensional Space Storage Object, while object may be Dot or Shape. Normally, these Databases are Map, among which, the stored object may be house, road, bridge, pipe or other Physical Object.* The picture below is just like this.

*GSI (Geography Information System) is not ordinary SQL Query, although through some efforts, many queries can be present as the format of SQL.* Such Queries are as below:

1. *Partial Matching Query:* *We need to assign values on Single - Dimension or Multi - Dimension, and match all points which equal to points on these Dimensions.*
2. *Range Query:* *We need to assign range on Single - Dimension or Multi - Dimension, and find the exact range which matches the assigned range.* Or it has such possibility that when it presents the Shape, we need to find partial or the whole shape collection which satisfies range condition.
3. *The Nearest Neighbor Query:* *We need to query the nearest point from the given point.* For example, if the point presents City, then we may need to find one city which has more than 100 000 population compared with the given smallest city.
4. *Where - am - I Query:* *Given one point, and we need to know the shape of the given point.* Especially, when you click the mouse, the system would help decide which element would be shown when you click.

### Chapter 3.4.2 Range Query by Traditional Index

### Definition:

For simple Realization, assume that there had two Dimensions, which are x and y. We can set up Auxiliary Index for each Dimension. Setting up B - Tree for each Dimension would make the range Query very easy.

Given two - Binary range, at first, we can get all pointers in range of x through B - Tree index. Then, we can get all pointers in range of

### Chapter 3.4.3 The Nearest Neighbor Query by Traditional Index

### Chapter 3.4.4 Overview of Multi - Index Index