Slide 1: Thomas Jefferson

Let's start with this guy. The United States has just won its independence, and is flat broke. The Constitution has yet to be approved, and under the Articles of Confederation, the federal government did not have the power to levy taxes. To pay off debt, the federal government sold the Western Territories, and some states sold land to compensate the soldiers for their service.

Slide 2: I have some land…

There was just one problem with the idea. No one had any real idea what lay west of the Alleghenies. Border disputes between colonies had turned ugly in the past (the Mason-Dixon Line arose from a dispute between Maryland and Pennsylvania). Lands were being granted or sold sight unseen, and no one really wanted a bunch of little border wars to come from debt payment.

Slide 3: Depreciation Lands

Here's one such parcel, in western Pennsylvania, known as the Depreciation Lands. These lands were sold to fund "depreciation certificates", which were given to soldiers to settle their wages. We can see two meridians on the northern and western boundaries, while the eastern and southern boundaries are formed by the Allegheny River.

Slide 4: Metes and Bounds

Latitude and longitude were well known, and often used for demarcating large borders, like the Depreciation Lands, or the 45th parallel between the US and Canada. For smaller parcels of land, metes and bounds were still used. Obviously, a better system was needed.

Slide 5: PLSS

Back to our hero. Jefferson's idea is what we know as the Public Land Survey System, also known as township-range system. It is the system which makes Kansas look like it does. Land was divided into well known, well-marked, easily surveyed tracts of land. Surveyors were sent westward to map and demarcate the lands, which were then used to establish townships, and then further subdivided and sold.

It is the subdivisions of this system which give us phrases like "the back 40", "40 acres and a mule", homesteads and "home on the range".

Easy, right?

Slide 6: Fort Blunder

Maybe not so easy. Early surveys weren't always very accurate, especially over long distances. "Fort Blunder" is one of the best examples. After the War of 1812, British and American forces still skirmished along the US-Canada border. In 1816, a fort was built to protect from an invasion from Canada. However, a survey error had the 45th parallel in the wrong place. A survey during construction showed the actual border was about ¾ mile to the south. "Fort Blunder" was abandoned, and Fort Montgomery was built on the proper side of the line. Oops!

Slide 7: How did this happen?

Before the theodolite, and way before GPS satellites, surveyors used plumb-bobs, astrolabes and Gunter's Chains. Surveyors literally carried around a metal chain which is 66 feet in length. Each chain is comprised of 100 links. It's an oddball system, but it's ingenious because it precisely bridges the conversion between the old feudal English system, based on quarters, and the decimal system coming into fashion when the chain was invented (remember we stole decimals from the Arabs).

To use this, a surveyor would mark a starting point, and an ending point (using a ranging rod). The chainman would stretch the chain out completely straight, mark the end, and move the chain. And so on. For short distances, this system is very accurate and very easy to use. But over really, really long distances, a little less so.

Note that the chain is metal. There will be a slight variation in length between cold and hot days. Over long distances, that can result in an additional degree of inaccuracy.

Slide 7: So what's the point?

The point is, exactly that. A point. This marker designates the point where the PLSS started.

Over time, geographic systems evolved from irregular polygons defined by rocks and trees and middles of creeks, and meridian lines demarcating boundaries between states and countries, to a system based on points. The single point itself evolved from a witness object (rock, tree) to a precise geographic measurement.

Everything is based on points now. The most obvious points are the four corners marking a tract of land. Two points makes a line, and that's your boundary. Four points make four boundaries make a regular polygon, and that's your tract. We no longer rely on plumb-bobs, markers and chains. Instead, we have GPS satellites, which position us fairly close, to gyroscopic stabilized laser theodolites with unbelievable accuracy.

There are, in theory, an infinite number of points in the space currently occupied by your hindquarters. Yet, on Foursquare, when we check in at a mall, or an airport, despite how large they are, they are marked by a single point. Finding and keeping track of these points is the reason we're here today.

The process of translating a physical location (such as an address) to a geographic position (usually latitude and longitude, but there are other systems) is called geocoding.

Slide 8: Why do we need geocoding?

Grids, charts and reports are the traditional pillars of traditional BI, but maps are a fourth, often overlooked pillar. Charts are great, but imagine if you took a chart of demand in various areas, and placed those charts on a map. Or when running a report of crime statistics, include maps showing where the different types of crimes occurred. The possibilities are nearly endless.

New business models have emerged around geocoded data, too. Foursquare isn't in the business of giving out electronic badges. Foursquare is in the business of collecting and analyzing demographic habits, as well as building an accurate database of location data.

Slide 9: Who provides geocoding services?

The two main sources are ESRI and Bing. Google has recently changed its TOS so that unless you are displaying the geocoded data on a Google map, you're not allowed to use the geocode API.

The services work pretty much the same—you need an application key, and you get a certain allotment for free. If you need more, you can buy more. ESRI actually supplies a lot of data to Bing. Both Bing and ESRI provide controls to consume their maps. ESRI supports both ESRI and Bing maps, while Bing just supports Bing maps. ComponentOne currently supports Bing maps, but soon will be shipping the ESRI component in our studios.

Before deciding on a service, figure out the level of detail you need. I used to work for a logistics company, and truck rates are ZIP to ZIP. There are only several thousand ZIP codes, so we just bought a ZIP code database and cross-referenced.

Slide 10: When to geocode?

When a user submits data to our application, it's a no brained on when to save those data--right away. With geocoding, because of our dependence on services, it's less clear. If you don't have to have the data right then, it might be best to do a nightly batch.

If your app is running on a mobile device, or an HTML 5 compatible browser with geoolocation enabled, the latitude and longitude may be immediately available to you.

Slide 11: Spatial data types in SQL Server 2008

In SQL Server 2008, two new data types were introduced--geometry and geography. The geometry data type is used for standard 2D Euclidian geometry--basically anything with an X and Y axis. This data type can be used for maps, floor plans, features on noted works of art, fingerprints, and so on. Geography data type is used for ellipsoidal geometry--basically, globes. Each data type has a library of calculations which simplify a lot of geographic work.

These two types are actually CLR libraries, which can also be used in our code.

Slide 12: Points, lines and polygons

In each data type, we can have various shapes. These are point, line, polygon, etc. We're just going to focus on the point here, but this shows there is a lot more we can do with these two types. All are found in each type, and the ones in blue are the ones we can directly instantiate.

In SQL Server, a point is more than just a set of X/Y coordinates. There can also be Z, and M (measure) as well.

Slide 13: SQL Syntax

This syntax is actually SQL, but because we're working with .NET CLR types, it looks a lot like .NET. WE can instantiate an object, assign values to properties, and retrieve those values from the objects.

We can also use the values in SQL queries. If you're going to query, use a little lower precision.

Slide 14: Demo outline

So here's what we're going to do for today's demo. First, we'll look at the sample database table. Then we'll start coding. Because we're calling web services, we'll generate proxy classes to handle most of the work for us. Usually, we'd just Add Reference, then Add Service Reference. However, for his Bing service, Visual Studio craps out. Instead, we'll use a command line tool. For ASP.NET, WinForms and WPF, we can use svcutil.exe, which creates synchronous classes. For Silverlight, we'd use SlSvcUtil.exe, which generates asynchronous classes.

We'll then build a simple web form which takes address input, gets the latitude and longitude, and stores the data in our database. We'll then query specific data, and plot it on a map.

There are several dozen methods available to us, including distance calculations, boundaries for what's close, equality, length and so on.

Demo

There isn't a lot of code, because it doesn't take a lot of code.

If you query the database with a spatial column, there is a new spatial tab, which plots the spatial data.