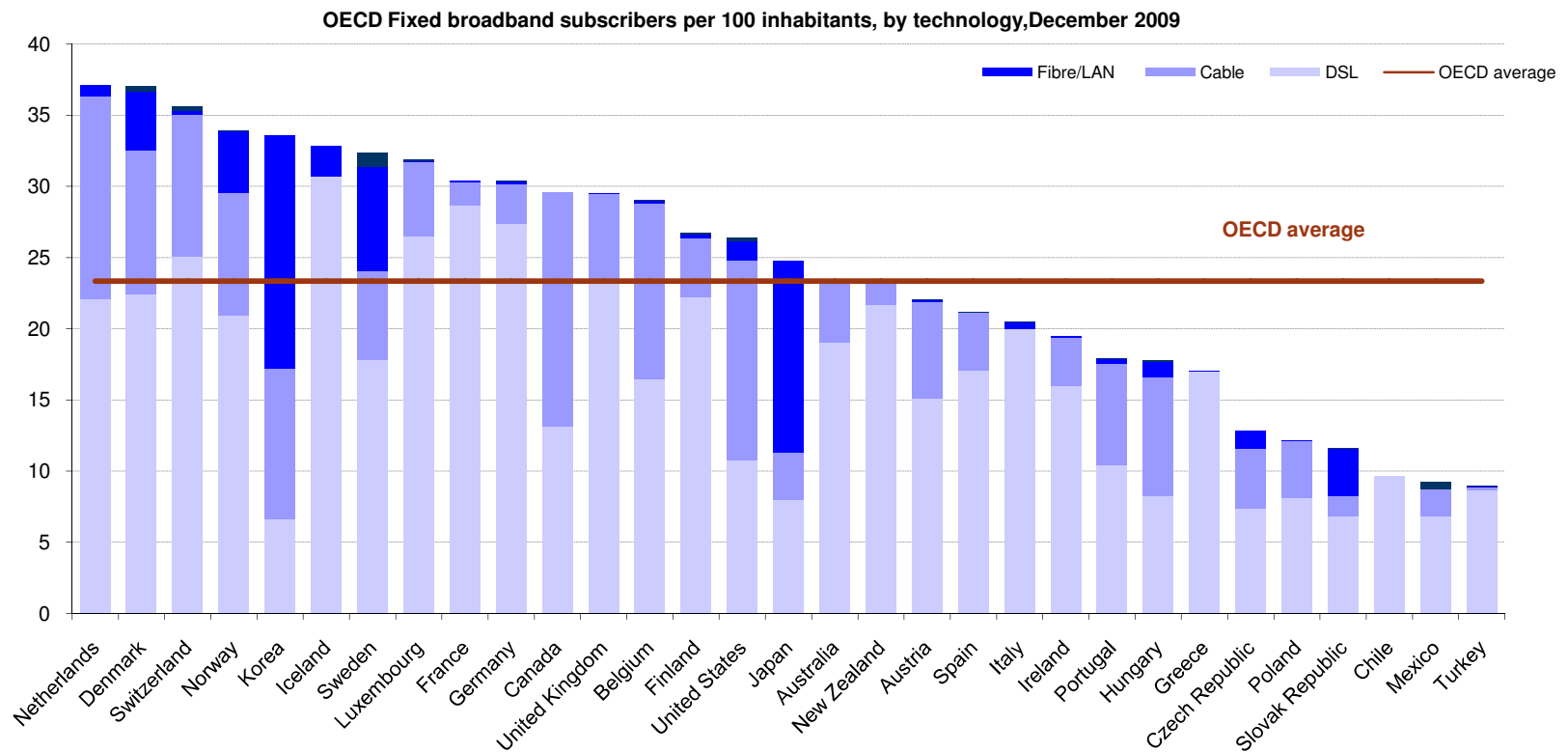


**Producing the
Oklahoma Broadband Map:**
A Description of, and Lessons Learned
from this Stimulus Funded Project

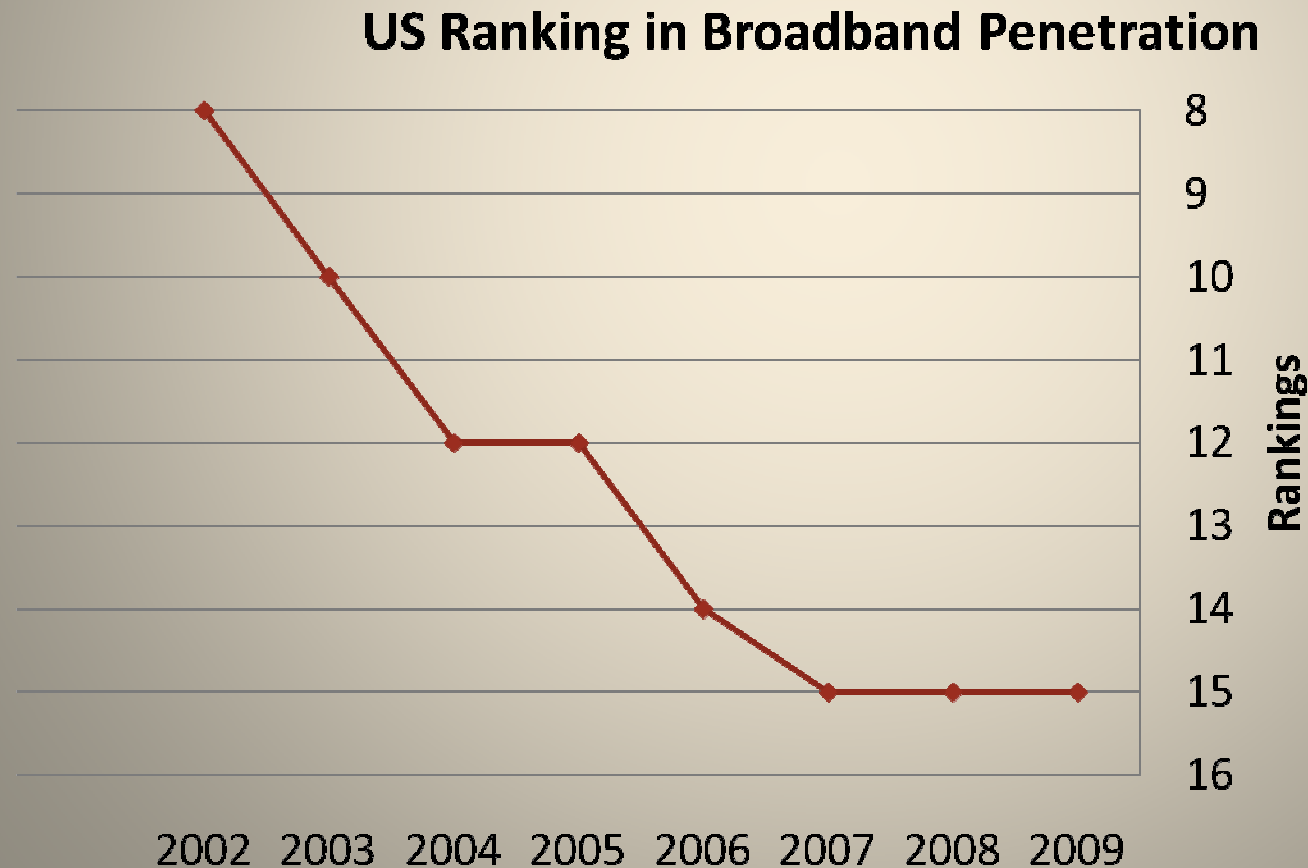
Barb Emery, Sanborn Map Company
Michael Turner, AppGeo

Broadband Penetration in Various Countries



Source: OECD

US Ranking in Broadband Penetration: A Decline or a Healthy Saturation State?

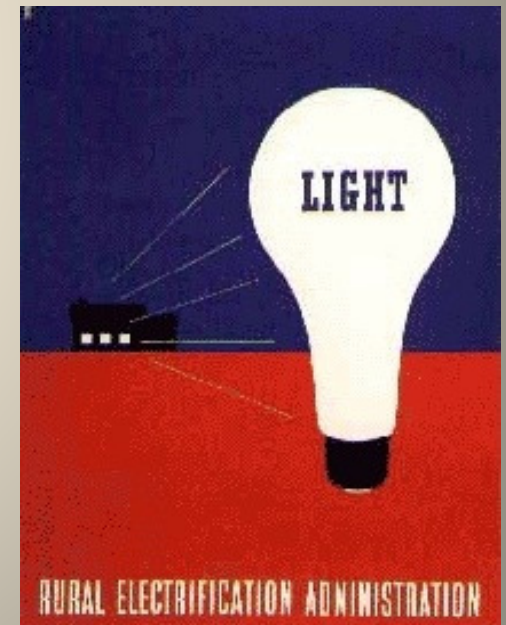
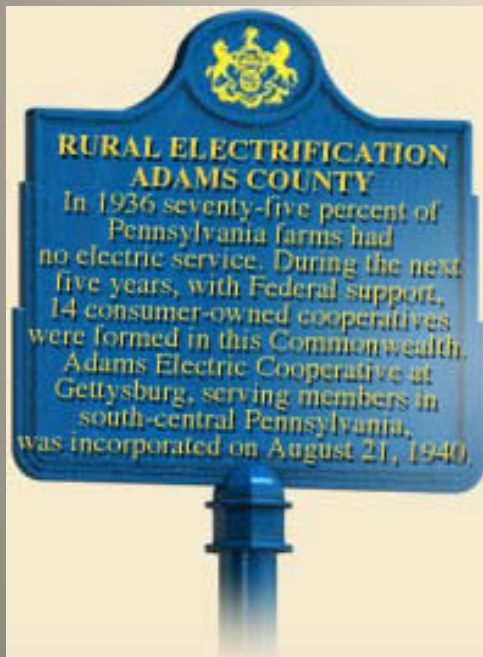


Why Broadband?

- Broadband availability key indicator of economic success
- Market vs. Government
- Digital divide – leveling of the playing field
- Stimulus-funding to states as grants for mapping and planning

The Federal government has done this before

“Why would farmers need electricity;
they have candles?”



NTIA'S State Broadband Data Development Program: Process Overview



Data
Gathering

Data
Processing

Data
Validation

Data
Integration
& Delivery

Data
Synthesis
& Display

**GIS: an integrative
framework**



The National Broadband Map

- Provide grants to the states (stimulus funded)
- Create 50 state broadband maps
- Put the 50 states together for the national map



What are we gathering?

- Information about:
 - Where is broadband available?
 - What technology is used?
cable/dsl/wireless
 - What speeds?
 - Where is the broadband infrastructure to deliver services
- Information from:
 - Providers of broadband
 - √ Public
 - √ Public
 - √ Public/Private
 - × No information from resellers

**Data
Gathering**

Data Processing

Data Validation

Data Integration
& Delivery

Data Synthesis
& Display

Access is particularly important for “Community Anchor Institutions”



Data Gathering

- Compile a list of providers
- Contact providers and inform them about the program
- Execute data sharing agreement with providers for confidentiality of data
- Collect data



**Data
Gathering**

Data Processing

Data Validation

Data Integration
& Delivery

Data Synthesis
& Display

Data Collection: Tracking Every Provider Interaction

Broadband Data Tracker

Washington

Tracking
Status
Reports
Log Out

Provider

Name	360 Networks	New	Add	Edit	Delete
Website	360 Networks				
Type	Access One, Inc.				
Source	Access Point, Inc.				
Rank	ACN Communication Services, Inc.				
Type of Service	Advanced Tel, Inc. Advanced Telecom, Inc Air Speed, LLC Airespring, Inc. AIR-PIPE (Wired or Wireless, Inc) ALEC, Inc. Alliance Group Services, Inc. Americom Technologies, Inc. Asotin Telephone Company Astound Broadband, LLC AT&T Axis Communications, Inc. Beaver Creek Telephone Company dba Bell South Long Distance, Inc. Bellevue, City of Benton Rural Electric Association Big River Telephone Company, LLC Bluebird Wireless Broadband Services, I Broadcore, Inc. Broadstripe Broadview Networks Holdings, Inc Broadcasting Communications, LLC BullsEye Telcom, Inc Cable One, Inc. Cactus International, Inc.				
FRN					
Contact Status	Sent to AppGeo				
NDA Status					
NDA Executed					
NDA Amended					
NDA Expires					
Provider Review					
Last Updated					

Contact

Name	Cforst@360.net	New	Add	Edit	Delete
Title					
Type	Single POC				
Source	Contact2Request				
Address					
City					
State		Zip	-		
Email	cforst@360.net				
Comments	Primary Contact for 360 Networks				

Data Set

Submission	Type	Provider Will Deliver?	Stage	Sta
2 - due 10/1/2010	Availability by Address	No - Not applicable		7/1
	Availability by Block	No - Not applicable		7/6
	Availability by Road Segment	No - Not applicable		7/6
	Availability Areas: Mobile Wireless	No - Not applicable		7/6
	Weighted Speed	No - Not applicable		7/6
	Maximum Advertised Speed	No - Not applicable		7/6
	Last Mile Infrastructure	No - Not applicable		7/6
	Middle Mile Infrastructure	No Changes - Use Previous Data	Sanborn Verify	7/2
	Service Area Boundary	No - Not applicable		7/6

Issues Add Show All Open only

Issue	Priority	Opened	Follow Up	Closed	Assigned To	Last Update
-------	----------	--------	-----------	--------	-------------	-------------

Activity Filter for current Contact Data Set Add

Date	No	Actor	Action	Method	Notes
7/2/2010	2	Bridget Marcotte	Sanborn Contact	Email	Thank you for your response received your email and will 360Networks (USA) Inc. duri submission 2.
7/2/2010	1	Bridget Marcotte	Provider Contact	Email	In response to this email, the inc. remains the same. Tt
7/1/2010	1	Bridget Marcotte	1st Data Request	Email	emailed S2 FirstLettertoProvi Provider for full letter
1/12/2010	1	Sudha Maheshwari		Email	Sudha sent Janet email with
1/11/2010	1	Janet Hoyt		Email	Janet asked Sudha where da received it in PDx. Sudha se
12/29/2009	3	Becca Heartwell	1st Data Request	Email	Becca confirmed with Charle and both parties are comm

Data Gathering

Data Processing

Data Validation

Data Integration & Delivery

Data Synthesis & Display

Data Collection: Crowd Sourcing of Community Anchor Institutions

Data
Gathering

Data Processing

Data Validation

Data Integration
& Delivery

Data Synthesis
& Display

Logout

Community Anchor Institution Survey

Please answer the following questions to the best of your knowledge.

What category best describes the institution? School, K through 12

In which county is the institution located? OKLAHOMA

Please select the institution from this list BETHANY MS

(if you do not see your institution on the list, please select 'Other')

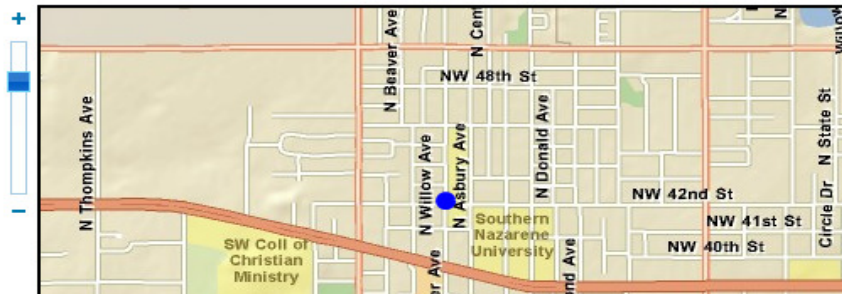
Street address of institution (no P.O.Box) 4312 North Mueller

City Bethany Zip 73008

Update Address on Map

Mapped Location

(please be patient while map loads)



*If needed, use
this tool to place
the address point
in the correct
location on the
map*

Data Collection: Secure Provider Portal

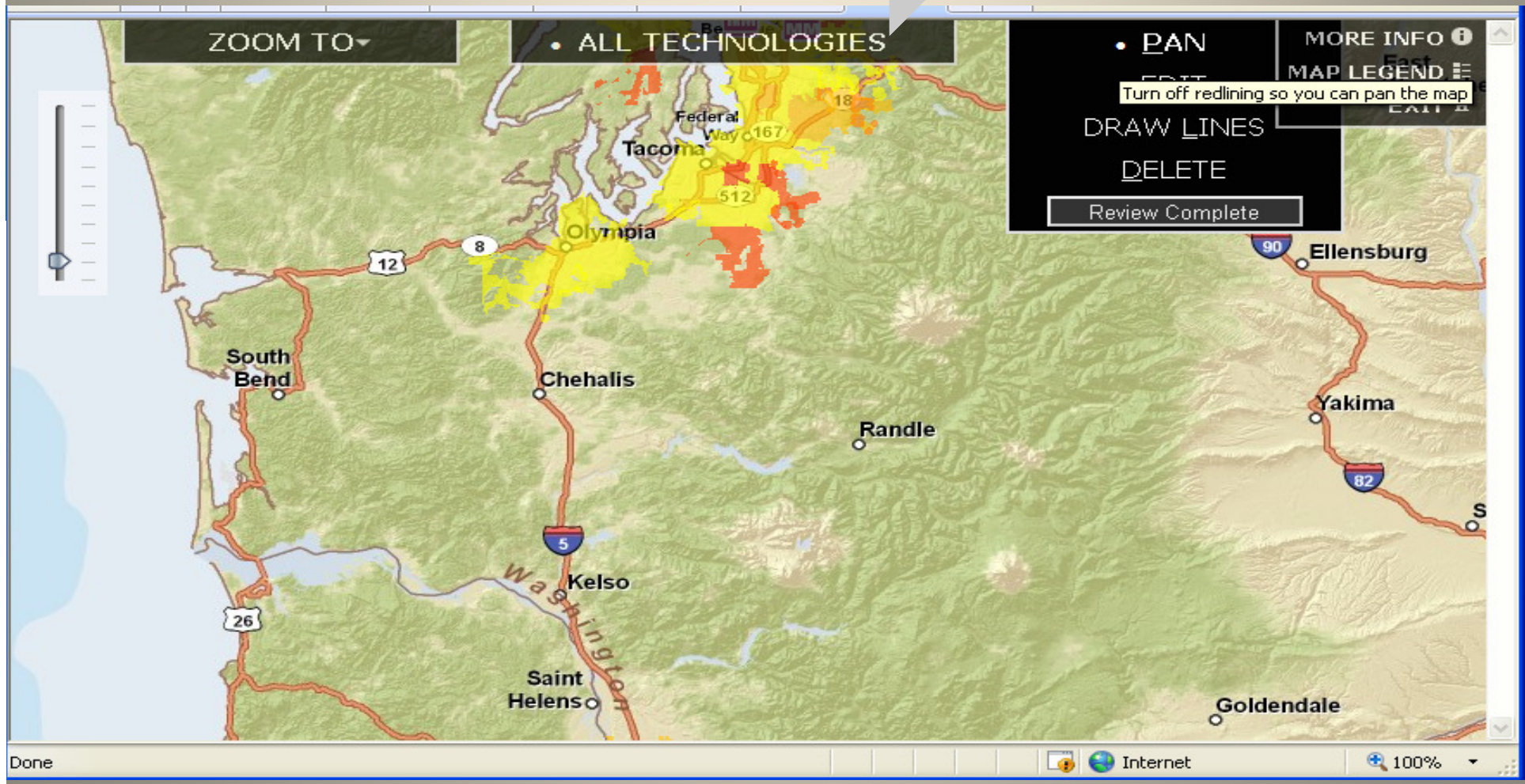
Data
Gathering

Data Processing

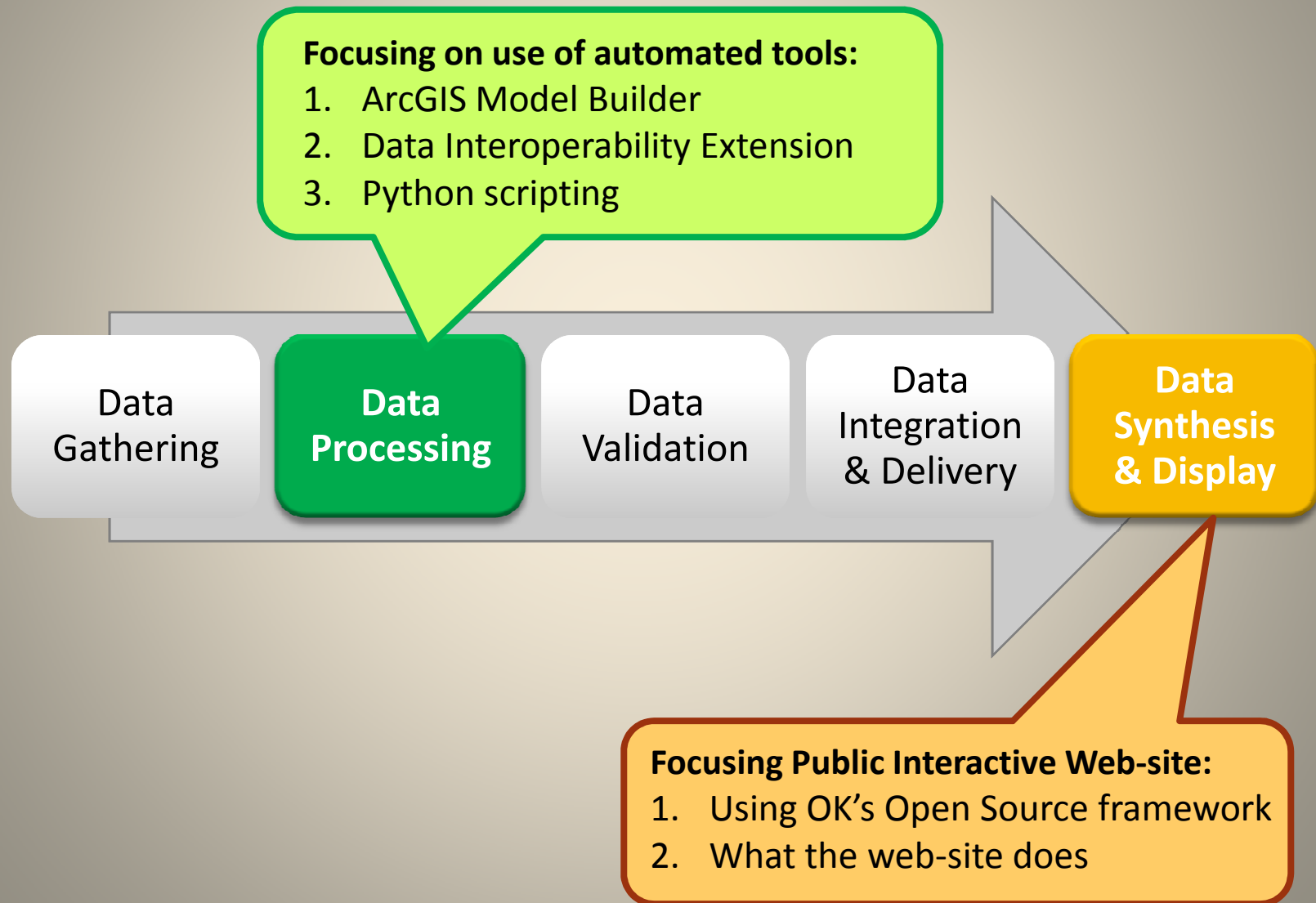
Data Validation

Data Integration
& Delivery

Data Synthesis
& Display



Technical Elements of the Broadband Mapping Project

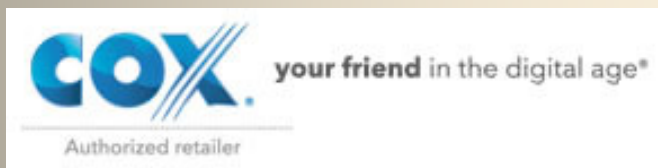


How do you map broadband availability?

Knowing who currently has
access, tells you where you
need to provide access

Data
Processing

Who has the map of broadband access?



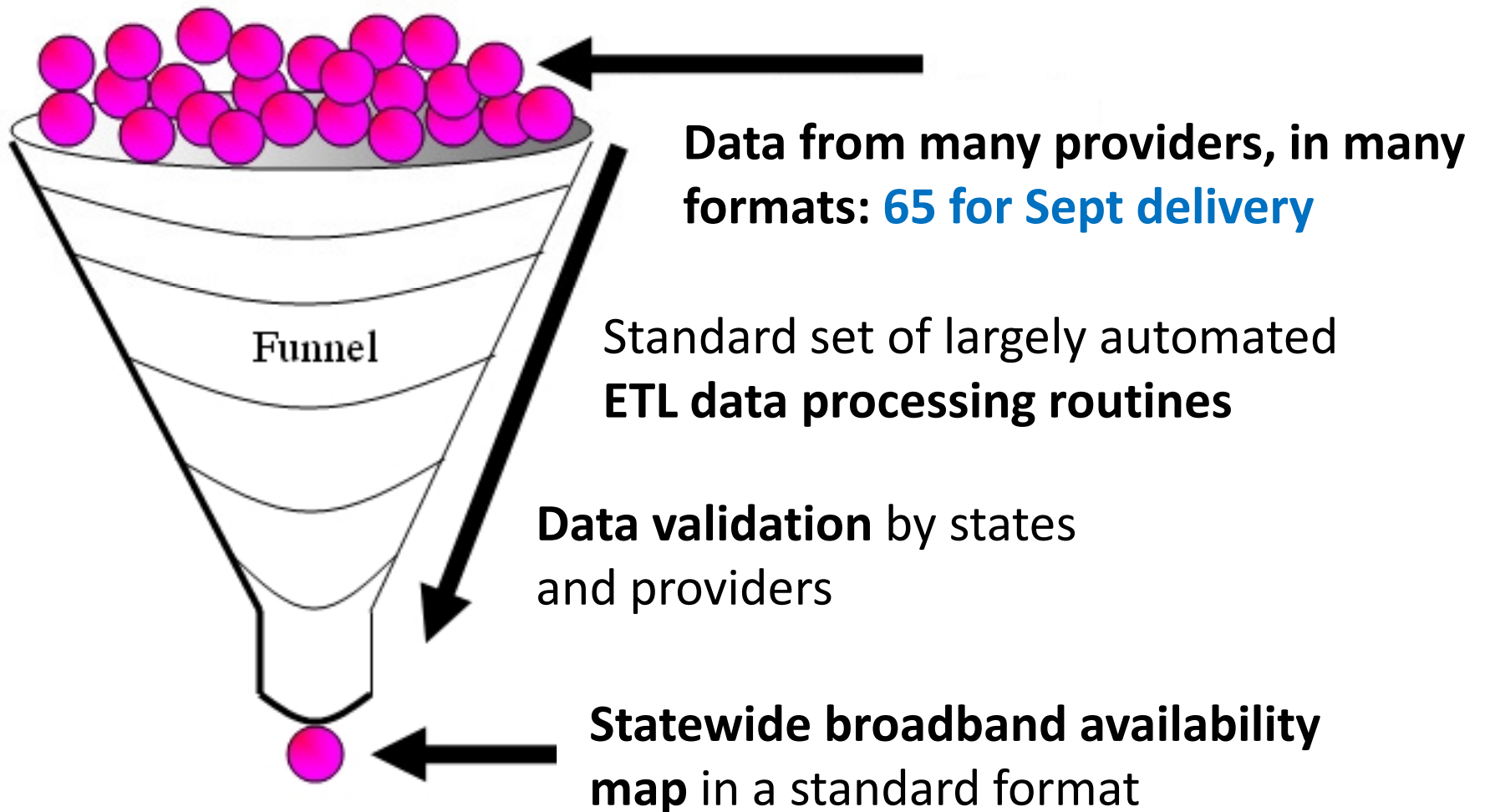
Pine-Net
A Service of Pine Telephone

SOUTHEASTERN OKLAHOMA'S PREMIER ONLINE PROVIDER



DOBSON
TELEPHONE COMPANY

Broadband mapping: It's a data aggregation process



Data collection

Data for:

- Wireline
- Wireless
- Middle mile
- Plus base map info

Comes as:

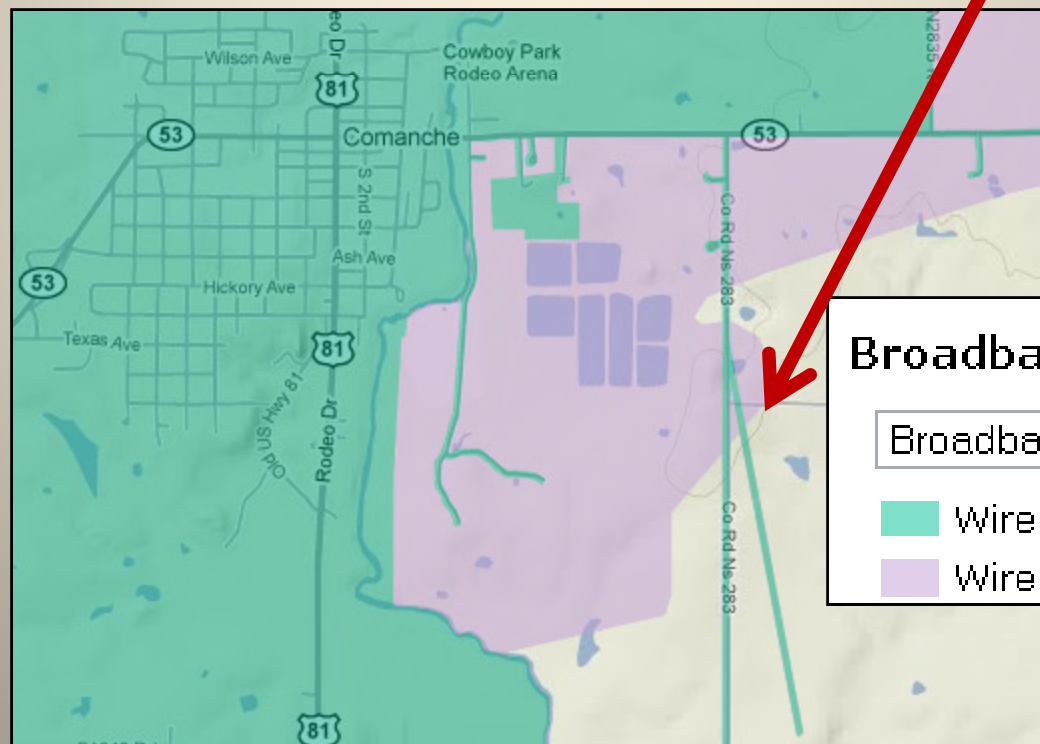
- Service area polygons
- Lists of customer addresses
- Census blocks with service
- Roads with service
- Buffers of cell towers
- Etc. Etc. Etc. Etc.

Comes from:

- Dozens of providers per state
- Under non-disclosure terms
- **Processed 65 data sets for OK**

Data Processing

- To protect provider customer data, all information is **aggregated to census blocks or street segments**
- If a census block is >2 sq. miles (indicating rural areas) information is aggregated to street segments



Broadband Map

Broadband Availability



Wireline Technology

Wireless Technology

Overview of Geospatial Data Processing Maneuvers

- **Geocoding:** convert customer lists to locations
- **Overlay analysis:** to assign customers to census blocks or roads
- **Extract, Transform, Load (ETL):** to standardize attributes and domains across providers
- **Slicing and dicing:** to put features into the proper standardized schemas
- **Append:** to join multiple providers into a statewide view

**It is critical to automate because this
is a recurring program:**

Do it over and over again for 2 years

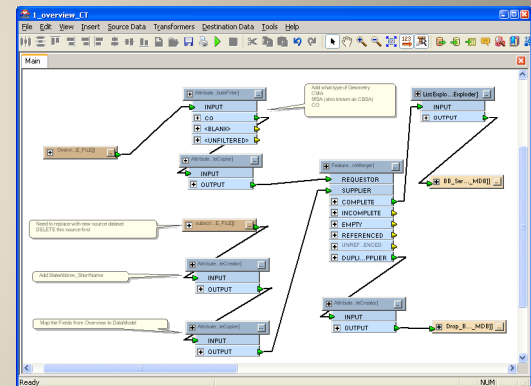
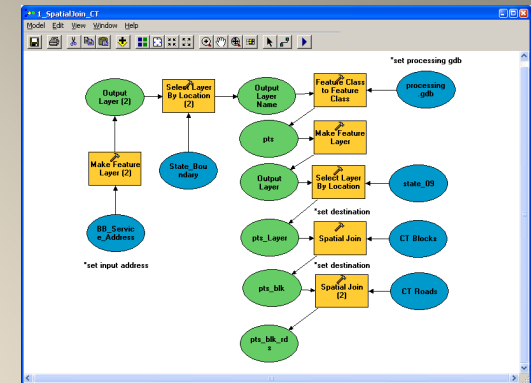
Two deliveries per year

Possibility of a 3 year extension after that



Tools Employed

- ModelBuilder Models
- Spatial ETL Tools using ArcGIS Interoperability Extension (FME)
- Python scripting



```
*FeatureProviderFromS1.py - Q:\clients\587\StateFWA\FWAHandMapping\2009-0221p.WA_Mapping\DataProcessing\S...
def extract(gp, srcGDB, destGDB, StateAbbr, ProviderSN):
    """If input FC has features, copy to output GDB"""
    expression = "[ID] = '" + StateAbbr + "' + ProviderSN + '"
    layer = "lyr"
    gp.Workspace = srcGDB

    for fc in ListFeatures(gp,srcGDB):
        # Assigns output fc and removes an ds information
        if fc.find("\") == -1:
            out_fc = fc
        else:
            out_fc = fc.split("\")[1]

        gp.MakeFeatureLayer(srcGDB + "\\" + fc, layer, expression)
        count = int(gp.GetCount_management(layer).GetOutput(0))

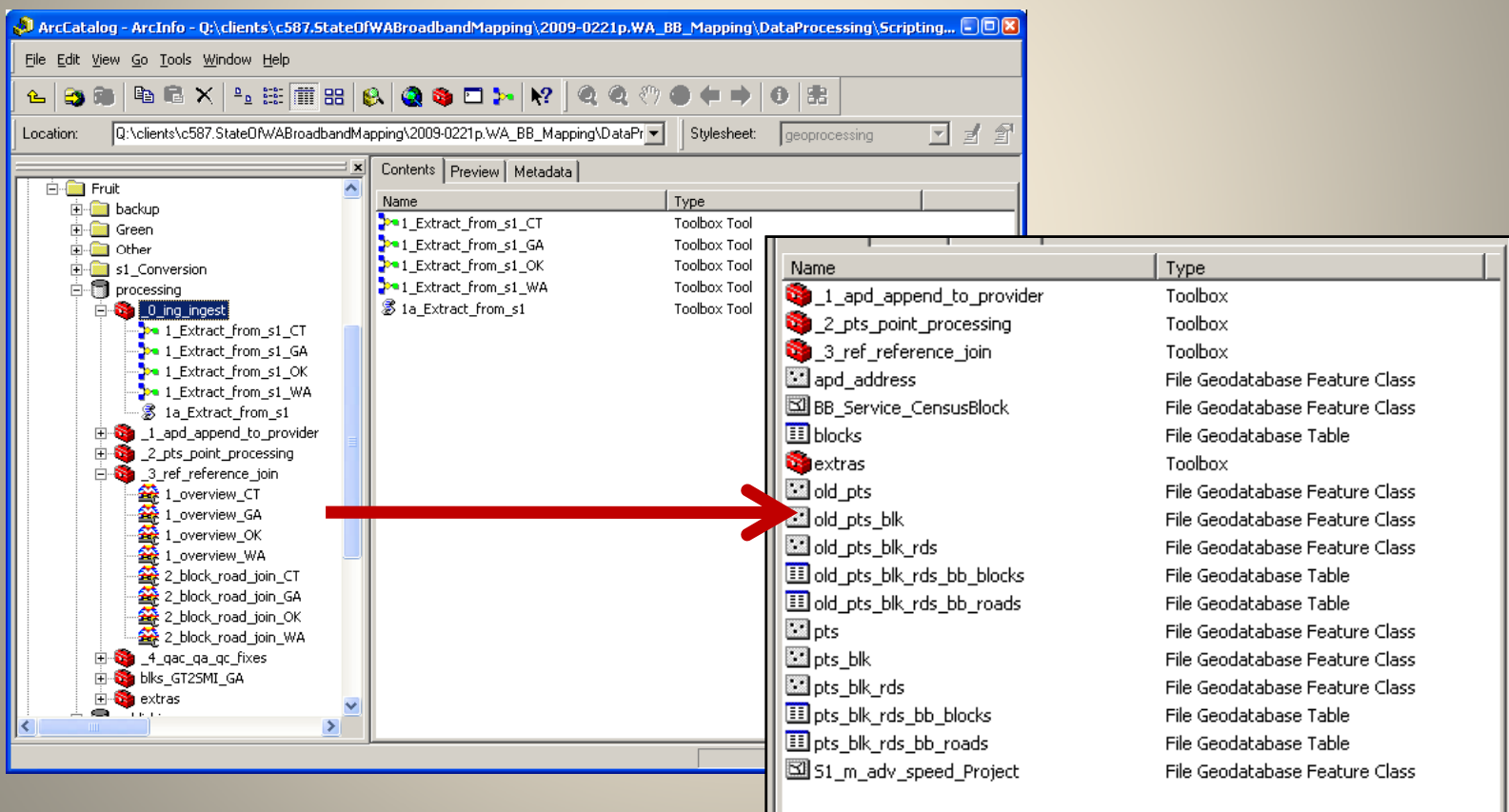
        if count > 0:
            gp.FeatureClassToFeatureClass_conversion(layer, destGDB, out_fc)
            print AGSP(gp, src(count) + '\n'+fc + ' features transferred')

    def ListFeatures(gp,GDB):
        """Iterate through objects in GDB and return list of features in GDB"""
        #create out_list and header
        out_list = []

        #Iterate in Workspace
        for fc in ListFeatures(gp,GDB):
```

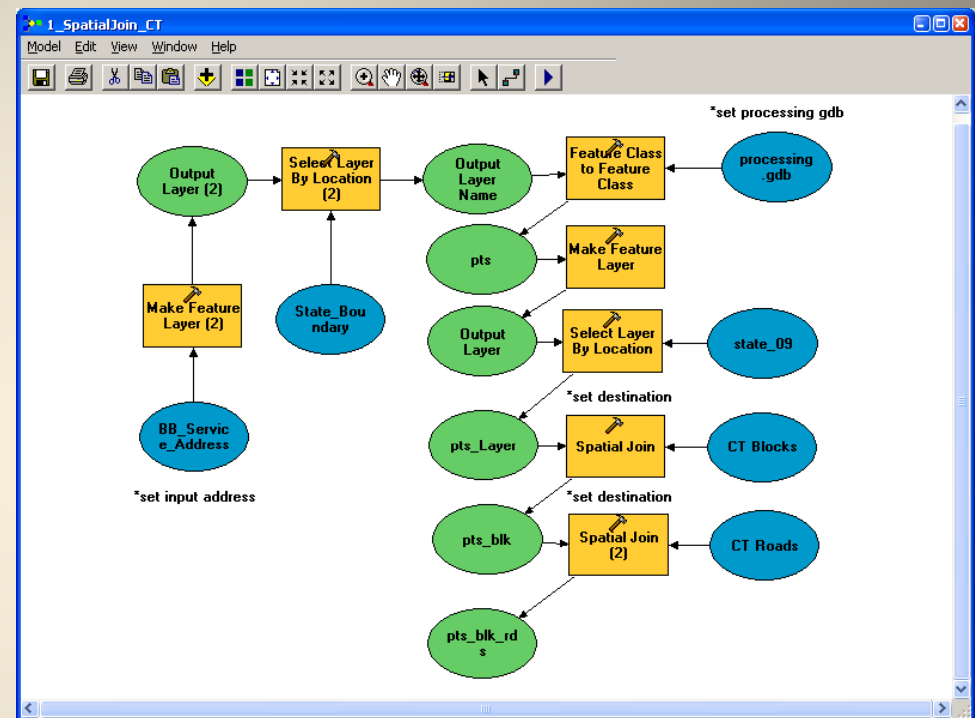
Processing GeoDB

- Toolboxes with tools are copied in from template GeoDB



ModelBuilder Models

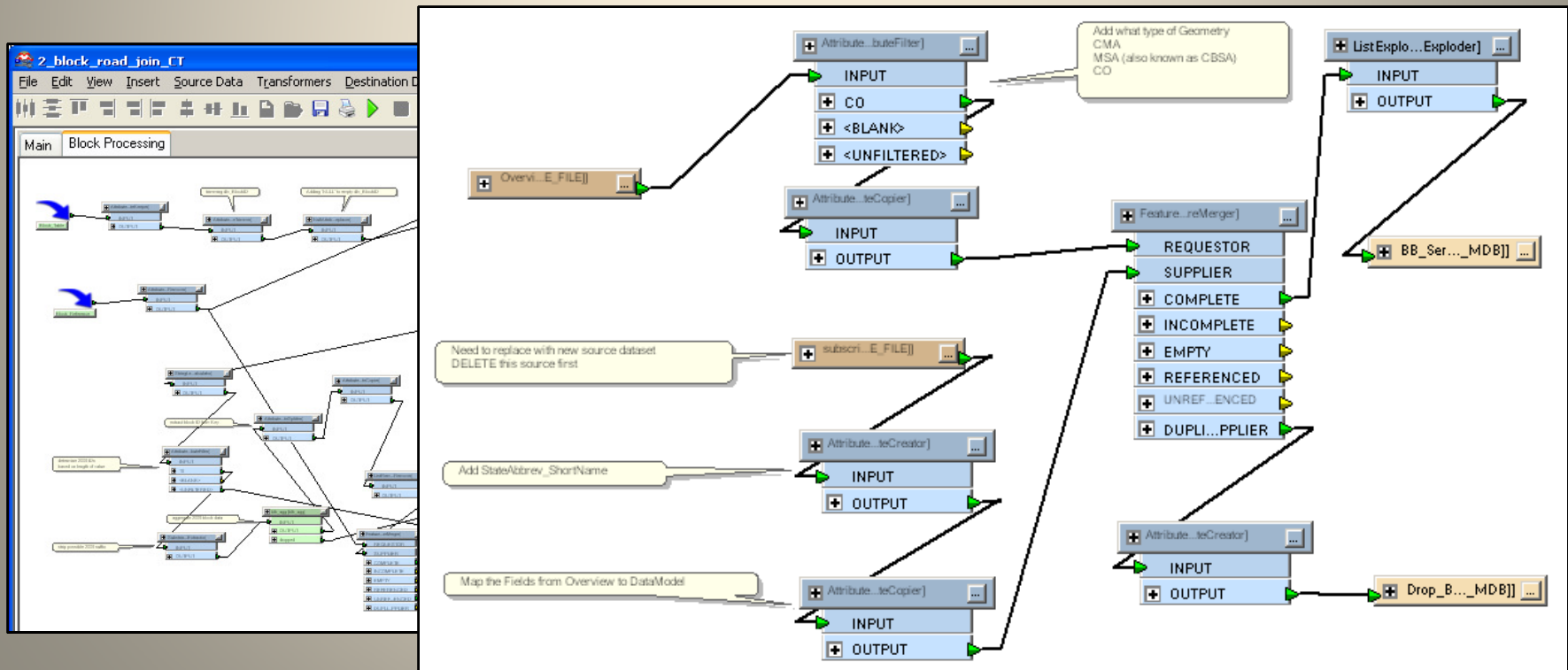
- Building simple (or complex) reusable processes
- Encapsulating and calling Python Scripts
 - Consistent operations
 - Traceable/documentated inputs and process logic



This model takes address points within a state and joins them to blocks and road data

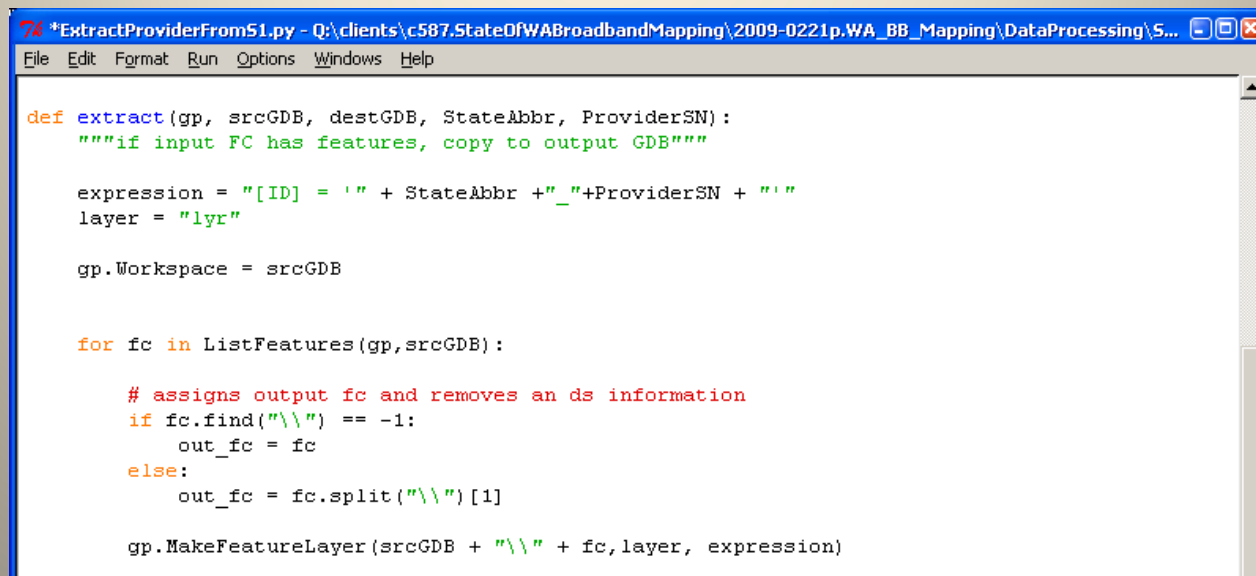
Spatial ETL Tool

- Used for:
 - Aggregation logic
 - Joining geometry
 - Filtering data into dropped tables



Python Script

- Used for:
 - Building processing logic with ESRI tools
 - Calling Spatial ETL tools
 - Making SQL queries and tables in personal GDB
 - Automating feature by feature processes
 - Managing large processes



```
*ExtractProviderFromS1.py - Q:\clients\c587.StateOfWABroadbandMapping\2009-0221p.WA_BB_Mapping\DataProcessing\S...
File Edit Format Run Options Windows Help

def extract(gp, srcGDB, destGDB, StateAbbr, ProviderSN):
    """if input FC has features, copy to output GDB"""

    expression = "[ID] = '" + StateAbbr + "_" + ProviderSN + "'"
    layer = "lyr"

    gp.Workspace = srcGDB

    for fc in ListFeatures(gp,srcGDB):

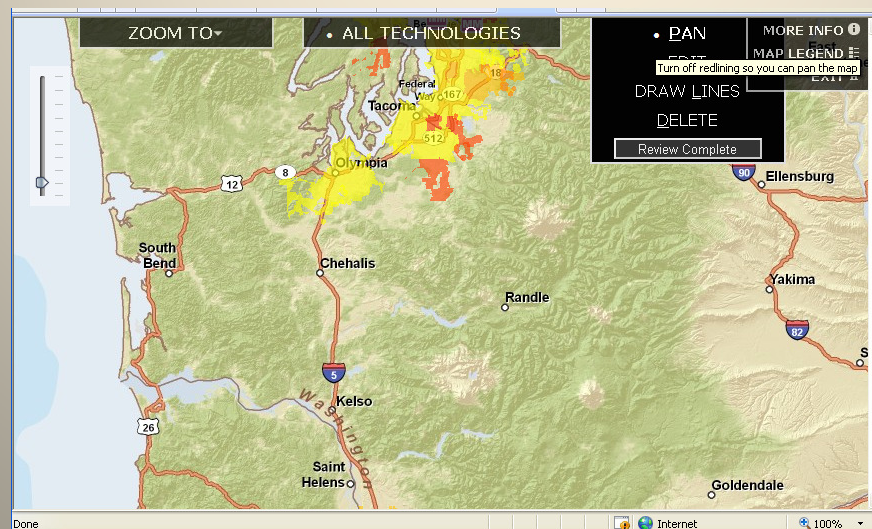
        # assigns output fc and removes an ds information
        if fc.find("\\") == -1:
            out_fc = fc
        else:
            out_fc = fc.split("\\")[1]

        gp.MakeFeatureLayer(srcGDB + "\\" + fc,layer, expression)
```

Web Mapping

- Several web-sites were constructed
 - On-line surveys and speed tests
 - Provider Portal to assist with validation
 - Public facing web map
- Requirement from NTIA

Data
Synthesis
& Display



The screenshot shows the Oklahoma Broadband Mapping Project website. The header includes the Oklahoma state logo and the text 'Oklahoma's Official Web Site' and 'www.ok.gov'. The main content area is titled 'Oklahoma Broadband Mapping Project' and describes the project's goal to build a statewide broadband map showing usage and access to broadband technology. It also mentions the project's role in creating fundamental datasets and an interactive method for displaying and using this data. The page includes navigation links for 'Broadband Home', 'Mapping Home', 'Test Your Speed', 'CAT Survey', and 'Broadband Providers'.

The screenshot shows the Oklahoma Speed Test website. The header includes the Oklahoma state logo and the text 'Oklahoma's Official Web Site' and 'www.ok.gov'. The main content area is titled 'OKLAHOMA SPEED TEST' and includes a speed test interface with a speedometer and a 'Begin Test' button. Below the speed test, there is a section for 'You Entered' with fields for 'Street Address' and 'Zip Code'.

The screenshot shows the Community Anchor Institution Survey form. The form asks for information about the institution, including its category, location, and whether it subscribes to a broadband service. It includes a map of the institution's location and a 'Log out' button. The form is titled 'Community Anchor Institution Survey' and includes a 'Log out' button.

Public Interactive Broadband Map

Scheduled to be launched in October

- Oklahoma specified that **Open Source** mapping technologies be used
- Matching OK.gov's Open Source stack:
 - **PostgreSQL** → Underlying database
 - **PostGIS** → Geospatial management w/in a DB (like ArcSDE)
 - **GeoServer** → Web Mapping Server (like IMS or AGS)
 - GeoWebCache → Tile Caching
 - **Google Maps** → For terrain base map and geocoding
 - **OGI OKMaps OGC web services** → For orthophoto service

Open Source Goal Was Simple

- Construct a good web-site
- Users don't care what the backend is
- Ideally, no one knows it's Open Source

What does it look like?

Focus is on broadband availability in OK

The screenshot displays the Oklahoma Broadband Mapping website. The header features the Oklahoma state seal and the text "Oklahoma's Official Web Site" and "OKLAHOMA www.ok.gov". The page is titled "Broadband Mapping".

The main navigation bar includes links for "Broadband Home", "Mapping Home", "Broadband Use Survey", "Test Your Speed", "CAI Survey", and "Broadband Providers".

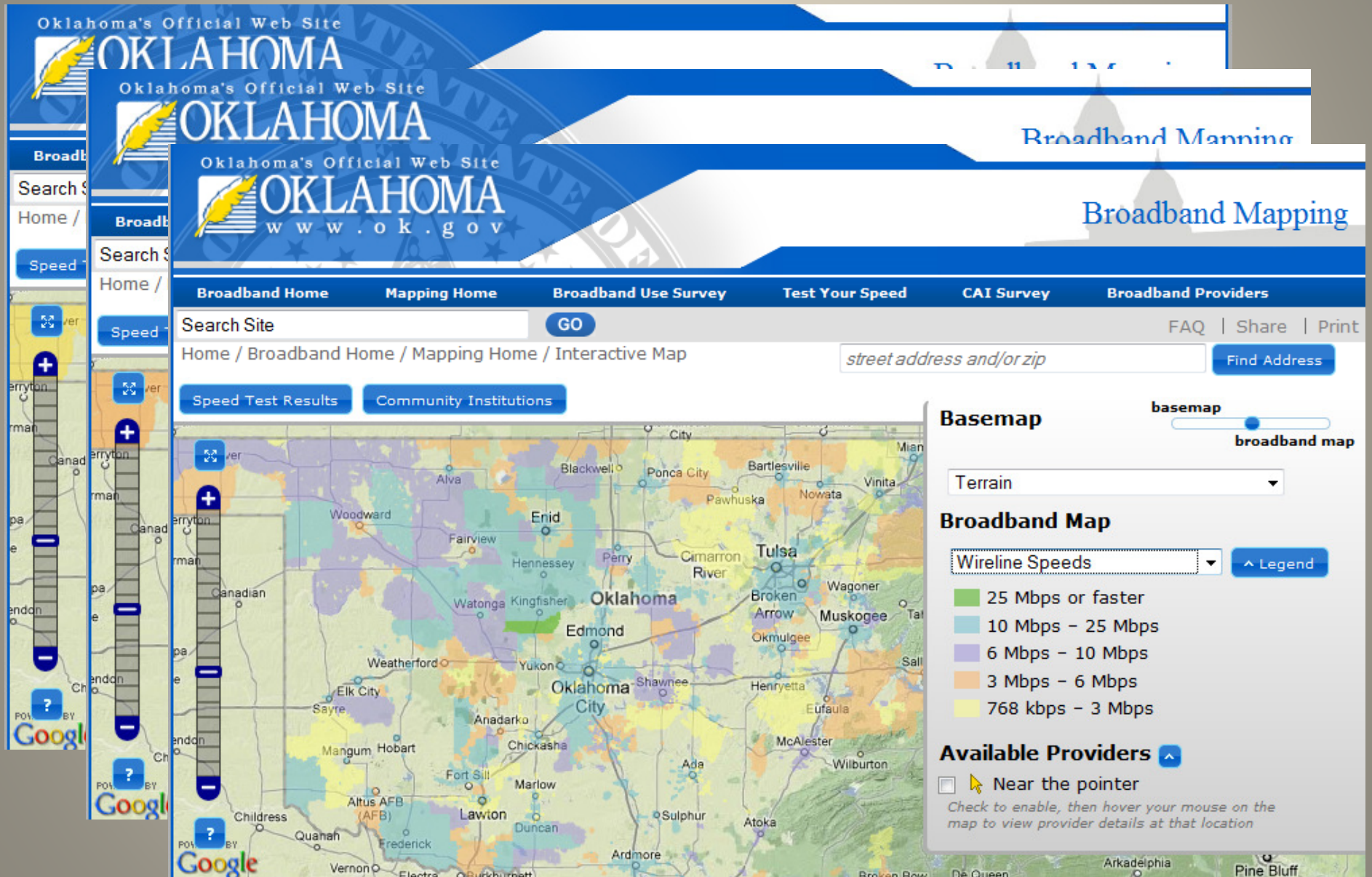
The left sidebar contains a "Search Site" box, a "Home / Broadband Home" link, and buttons for "Speed Test Results" and "Community Institutions".

The main content area shows a map of Oklahoma with broadband availability overlays. The map is titled "Interactive Map" and includes a search bar for "street address and/or zip" with a "Find Address" button. The map displays various cities and towns, including El Reno, Yukon, Bethany, Woodlawn Park, Oklahoma City, Nichols Hills, Lake Hefner, The Village, Lake Aluma, Speno, Crutcho, Midwest City, Del City, Valley Brook, Union City, Mustang, Moore, Stanley Draper Lake, Shawnee, Bethel Acres, Tuttle, Minco, and Vernon.

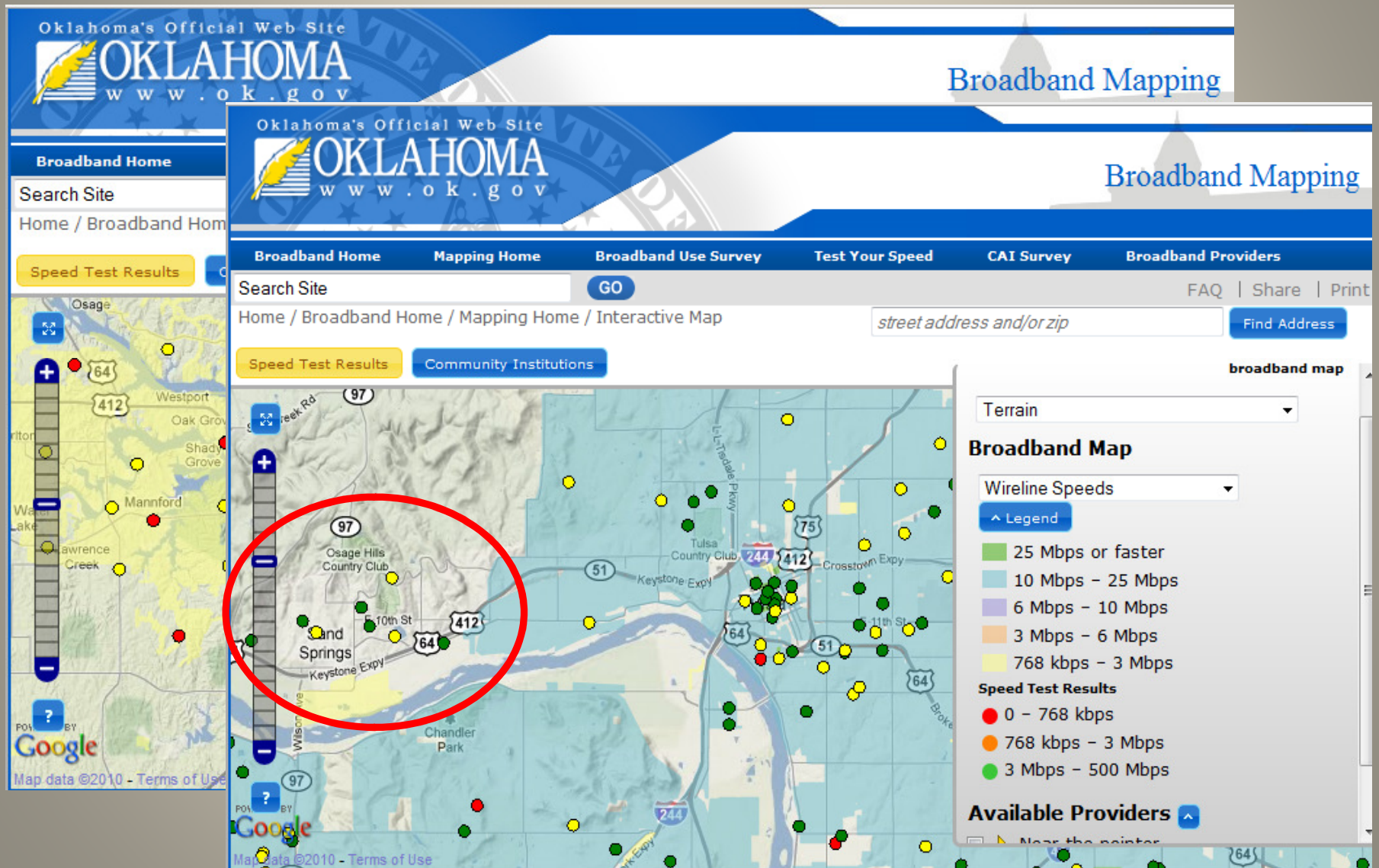
The right sidebar contains a "Basemap" section with a "Terrain" dropdown menu and a "Broadband Map" section with a "Broadband Availability" dropdown menu and a "Legend" button. The legend indicates that green areas represent "Wireline Technology" and purple areas represent "Wireless Technology".

Below the legend is an "Available Providers" section with a checkbox for "Near the pointer" and a note: "Check to enable, then hover your mouse on the map to view provider details at that location".

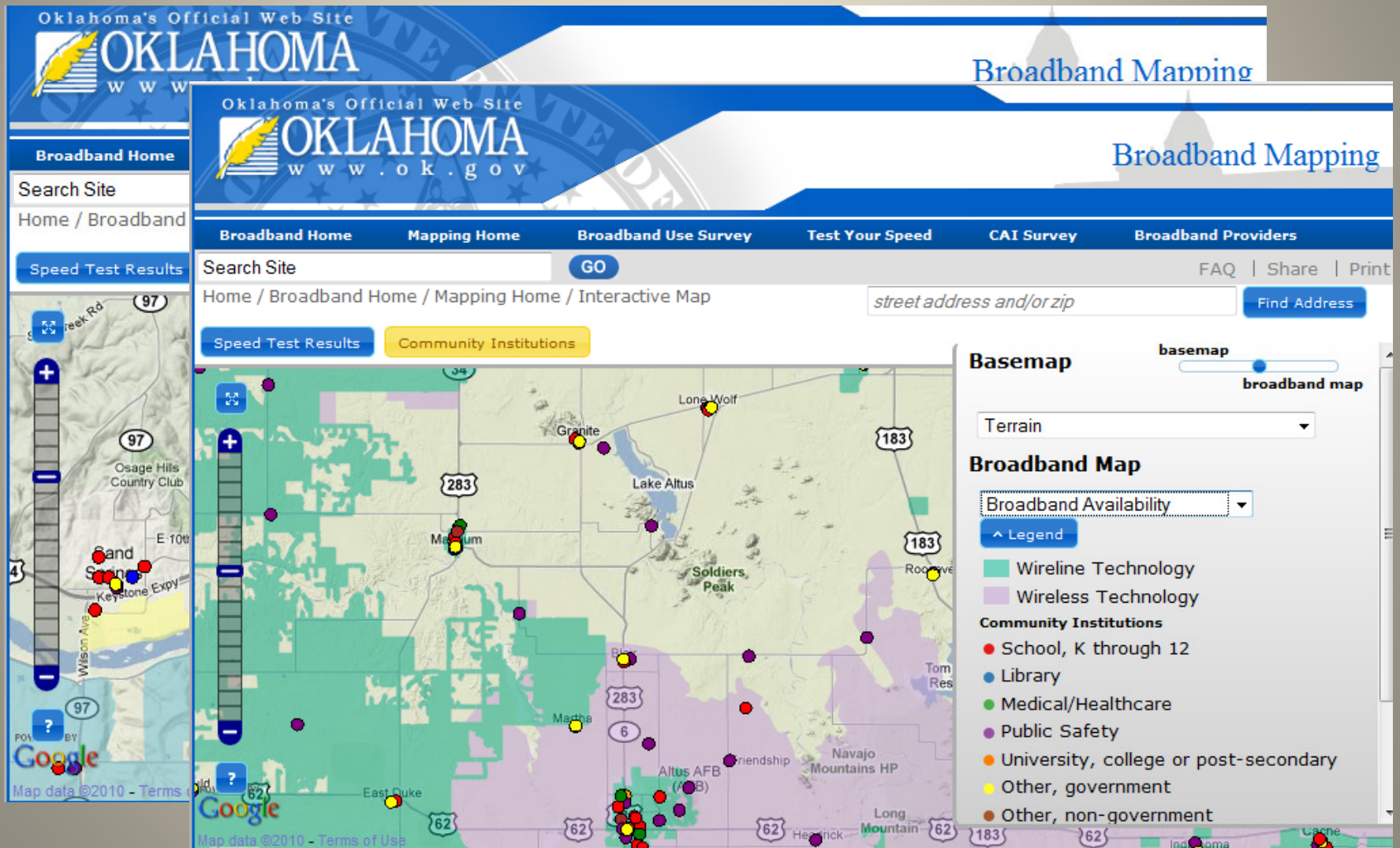
Multiple Views of Broadband Availability



Speed Tests



Community Anchor Institutions



Broadband Availability at a given location

Oklahoma's Official Web Site
OKLAHOMA
Oklahoma's Official Web Site
OKLAHOMA
Oklahoma's Official Web Site
OKLAHOMA
www.ok.gov

Broadband Mapping

Broadband Mapping

Broadband Mapping


Broadband Home Mapping Home Broadband Use Survey Test Your Speed CAI Survey Broadband Providers

Search Site GO

Home / Broadband Home / Mapping Home / Interactive Map

1203 nw 40th st. lawton, ok Find Address

Speed Test Results Community Institutions



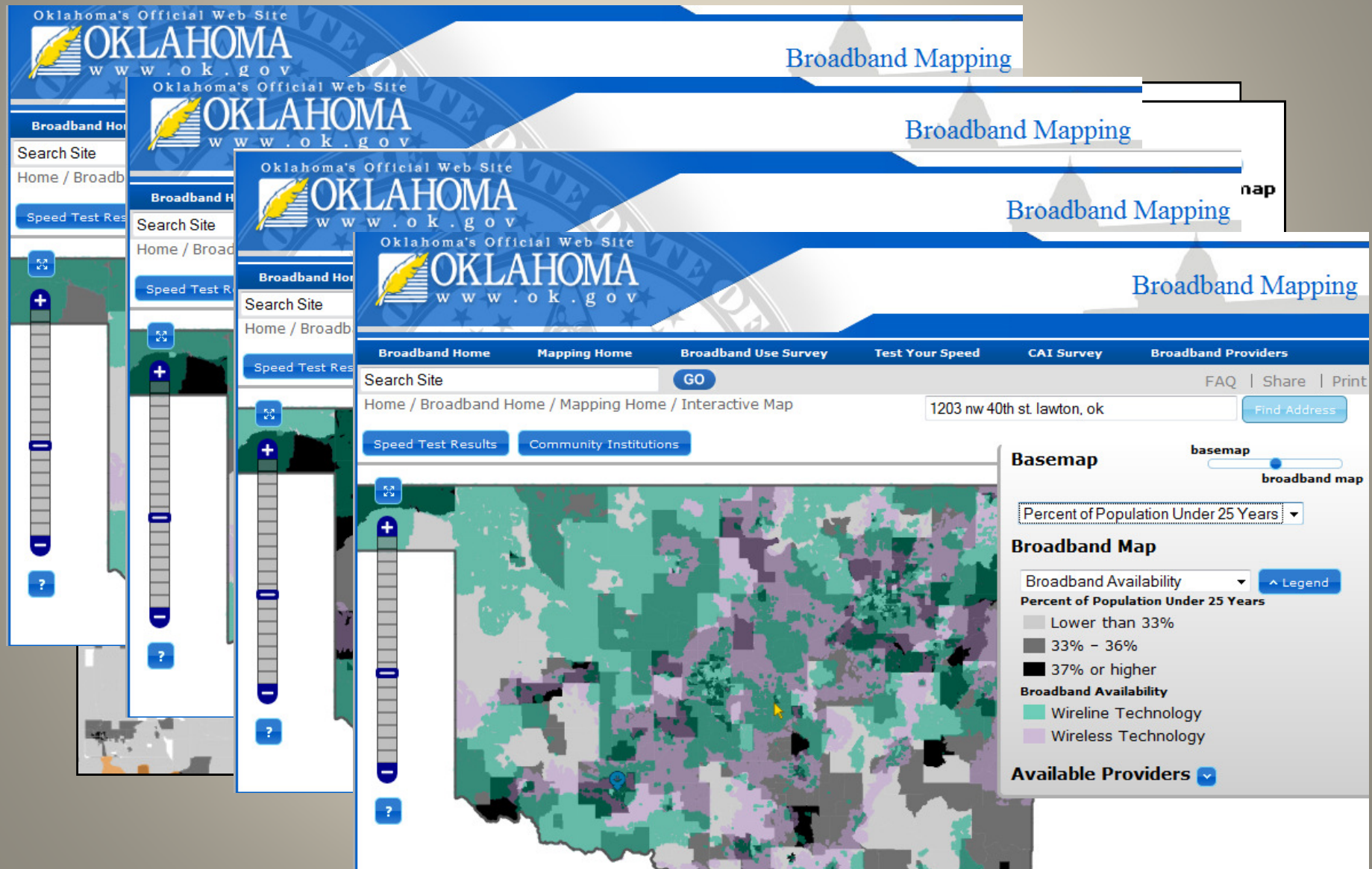
Allegiance Communications
Allegiance Communications
Cable Modem-Other
Download 6 - 10 mbps
Upload 1.5 - 3 mbps

Cellco Partnership
Verizon Wireless
Terrestrial Mobile Wireless
Download 3 - 6 mbps
Upload 1.5 - 3 mbps
Terrestrial Mobile Wireless
Download 3 - 6 mbps
Upload 1.5 - 3 mbps

Fidelity Cablevision Inc.
Fidelity Cablevision
Cable Modem-Other
Download 10 - 25 mbps
Upload 1.5 - 3 mbps

Leap Wireless International, Inc.
Cricket Communications, Inc.
Terrestrial Mobile Wireless
Download 768 kbps - 1.5 mbps
Upload 768 kbps - 1.5 mbps

Broadband & Demographic Data



To Track Project Progress

- Go To:

<http://www.ok.gov/Broadband>

<http://BroadbandMapping.ok.gov>

Thank you
Questions?