WA-Trans; Washington's Geospatial Transportation Network: Architecture, Processes, and Interesting Problems

Transportation Pooled Fund: Software Tools for Sharing and Integrating GIS Data

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Presentation Content

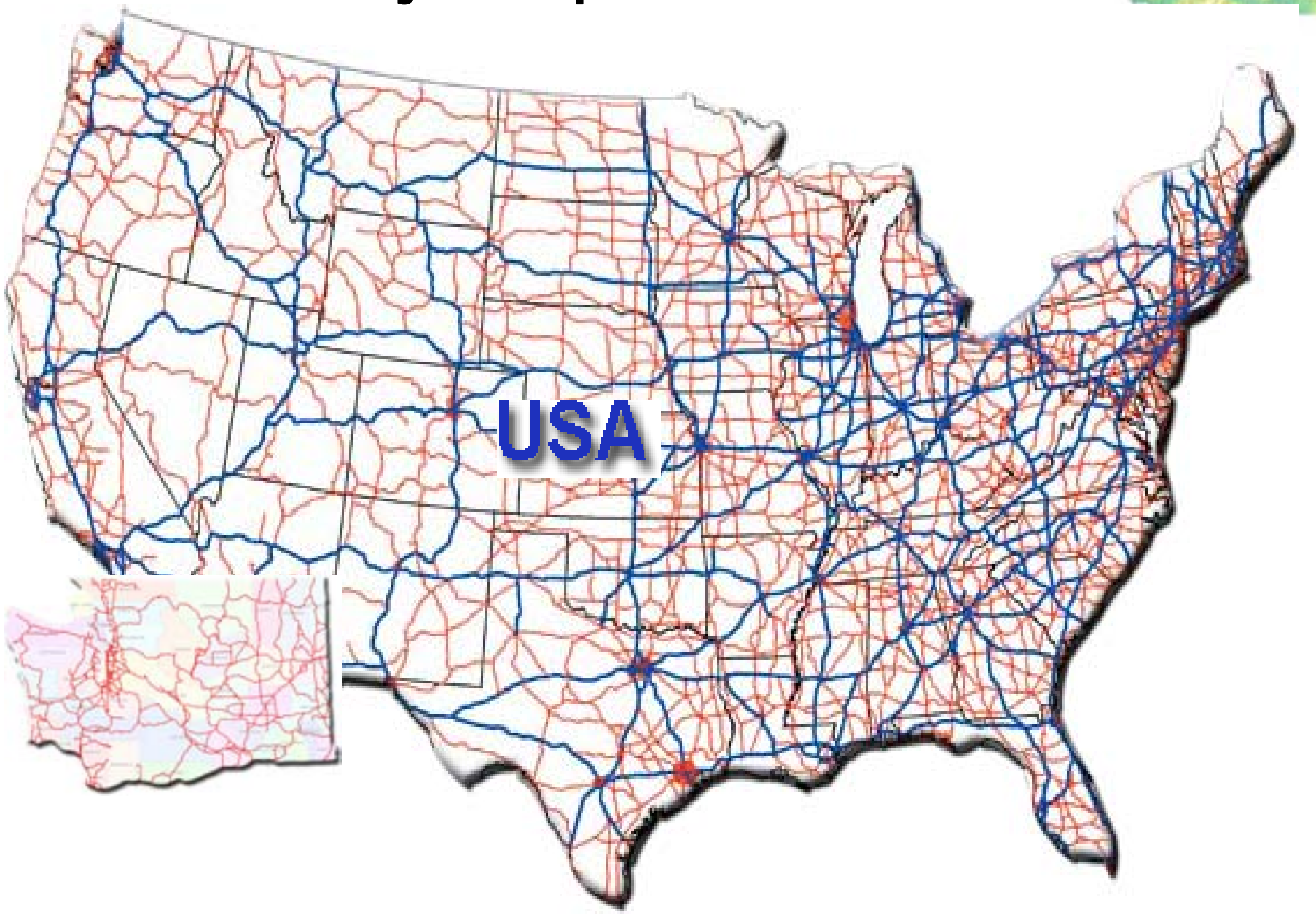
- Project background and architecture,
- Identify administrative processes needed for data in WA-Trans,
- Overview of infrastructure,
- Obtaining Provider Data and the Data Provider Portal,
- Change Detection and Change Management,
- QA/QC of provider data in the WA-Trans database,
- Data Integration Processes,
- Promotion to Production,
- Production Data and the Data User Portal

Basic GIS Terminology

- **Feature**: A record in a relational table that has a ***core geospatial*** component.
- **Attribute**: Describes a feature. Not specifically spatial, but may add spatial or non-spatial information about a feature.
- **Geometry**: The actual pictorial representation of the feature. In the case of WA-Trans we have vectors to represent pieces of roadway (called segments) or other linear transportation feature and points for intersection and other types of single location features.

WA-TRANS

Washington Transportation Framework for GIS



Project Organization:

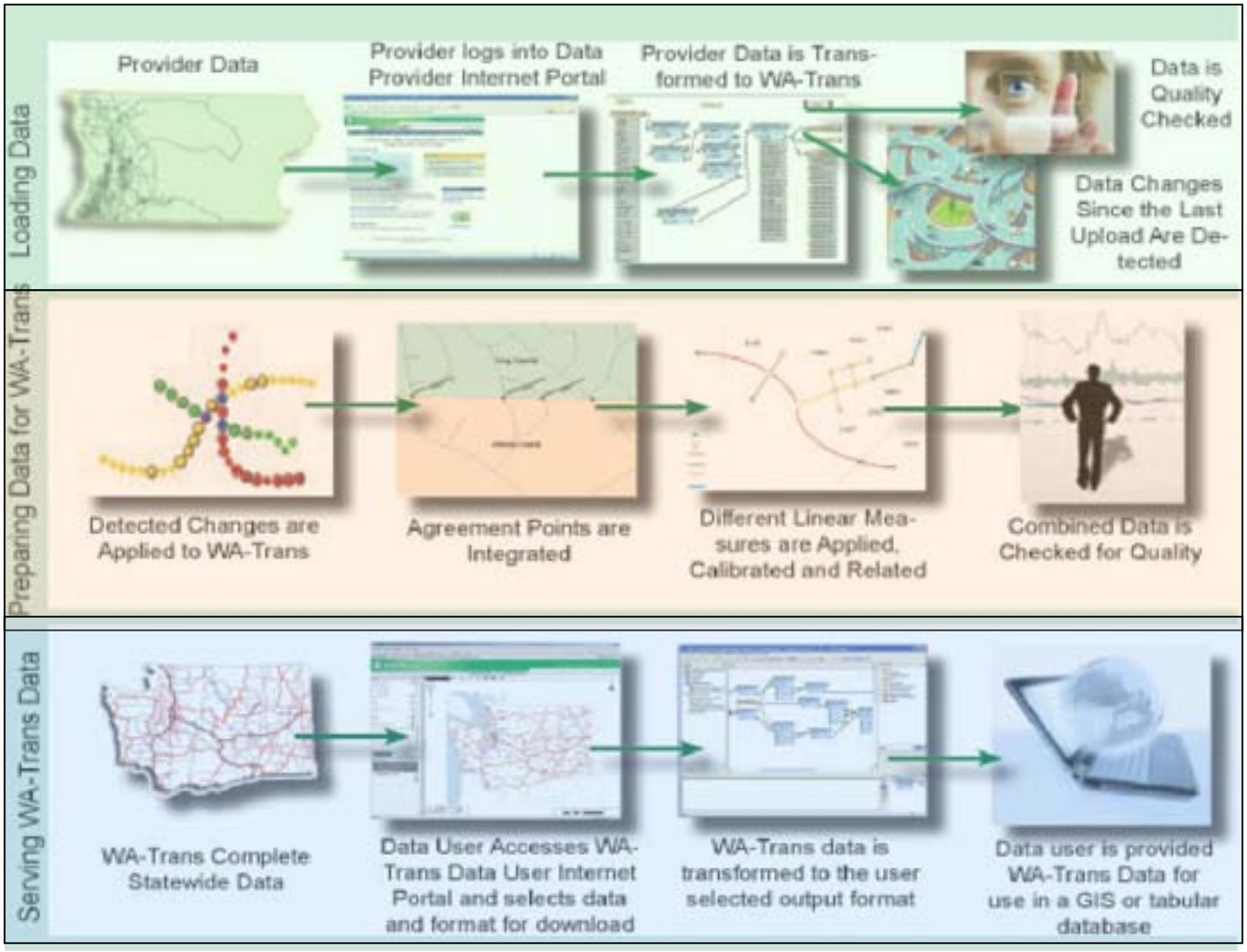
- Facilitated by the Washington State Department of Transportation (WSDOT),
- Collaboratively organized,
- Includes counties, cities, planning organizations, tribal nations, transit organizations, freight interests, federal agencies and private organizations, *other states*,
- Planned and advised by a steering committee from different levels and disciplines of government,

Developing Partnerships

- Geospatial Integration and Sharing Data Consortium (GISDC)
  - California Department of Transportation (Caltrans),
  - Idaho Department of Transportation (IDT),
  - Nebraska Department of Roads (NDOR),
  - Ohio Department of Transportation (ODOT),
  - Oregon Department of Transportation (ODOT),
  - Tennessee Department of Transportation (TDOT)

GOAL: Share development of the needed data structures, infrastructures, agreements, processes and ***experiences*** so we can ***collaboratively*** develop, maintain and share our statewide transportation data as envisioned by each state. ***We are looking for more partners!***

WA-Trans Work / Data Flow



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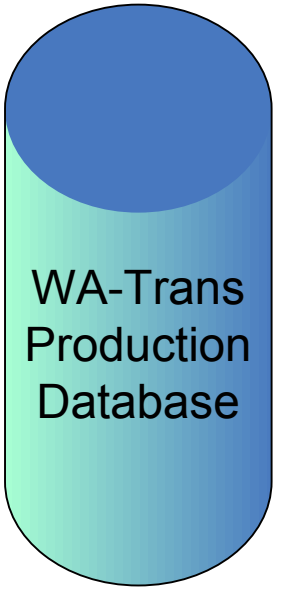
Database Architecture

The differences between the three WA-Trans databases is based on function.

- Initial Loading of data,
- Structured for Change Detection,
- Change Mgmt. moves data to Staging

- Structured for QA/QC, Integration and processing for production,
- Maintains a copy of “raw” incoming data data used for Change detection,



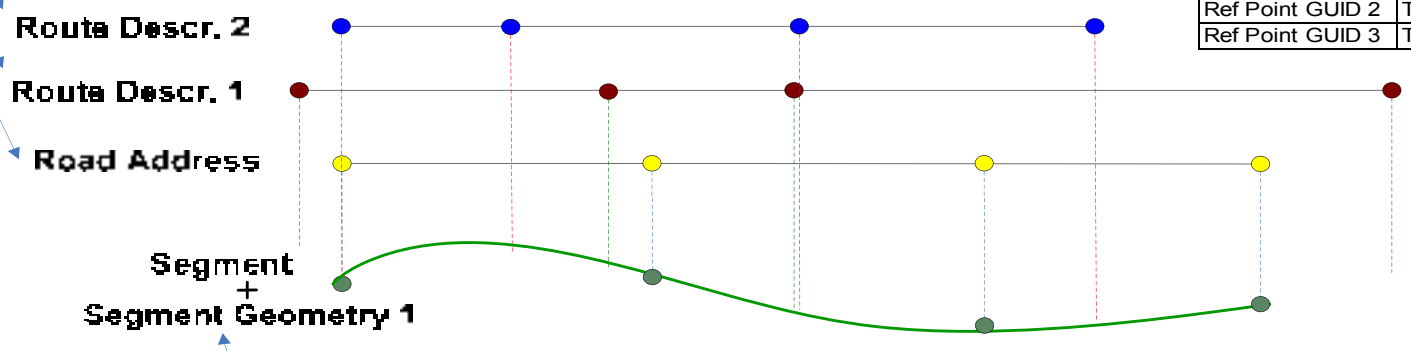
- Data ready to serve to public,
- Structured for delivery of products meeting WA-Trans users business needs,
- Contains history of the WA-Trans Data

The LRS, Segments and the Database

Road Address Description			
Road Addr Descr ID	**To Seg End Point ID**	**From Seg End Point ID**	**Seg ID**
Road Addr Descr GUID 1	Road Addr Descr From Point GUID 13	Road Addr Descr To Point GUID 16	Seg GUID 1
Road Addr Descr GUID 2	Road Addr Descr From Point GUID 14	Road Addr Descr To Point GUID 17	Seg GUID 2
Road Addr Descr GUID 3	Road Addr Descr From Point GUID 15	Road Addr Descr To Point GUID 18	Seg GUID 3

Route Description				
Route Descr ID	**To Seg End Point ID**	**From Seg End Point ID**	**LRS Type**	**Seg ID**
Route Descr GUID 1	Route Descr From Pt GUID 1	Route Descr To Pt GUID 4	1	Seg GUID 9
Route Descr GUID 2	Route Descr From Pt GUID 2	Route Descr To Pt GUID 5	1	Seg GUID 1
Route Descr GUID 3	Route Descr From Pt GUID 3	Route Descr To Pt GUID 6	1	Seg GUID 2
Route Descr GUID 4	Route Descr From Pt GUID 7	Route Descr To Pt GUID 10	2	Seg GUID 1
Route Descr GUID 5	Route Descr From Pt GUID 8	Route Descr To Pt GUID 11	2	Seg GUID 1
Route Descr GUID 6	Route Descr From Pt GUID 9	Route Descr To Pt GUID 12	2	Seg GUID 2

Reference Point	
Seg Point ID	**Point Type ID**
Ref Point GUID 1	TypeID 1
Ref Point GUID 2	TypeID 1
Ref Point GUID 3	TypeID 1



Segment		
Seg ID	**Seg End Point 1 ID**	**Seg End Point 1 ID**
Seg GUID 1	End Point GUID 20	End Point GUID 23
Seg GUID 2	End Point GUID 21	End Point GUID 24
Seg GUID 3	End Point GUID 22	End Point GUID 25

Segment Geometry	
Seg Geom ID	**Seg ID**
Geom GUID 1	Seg GUID 1
Geom GUID 2	Seg GUID 2
Geom GUID 3	Seg GUID 3

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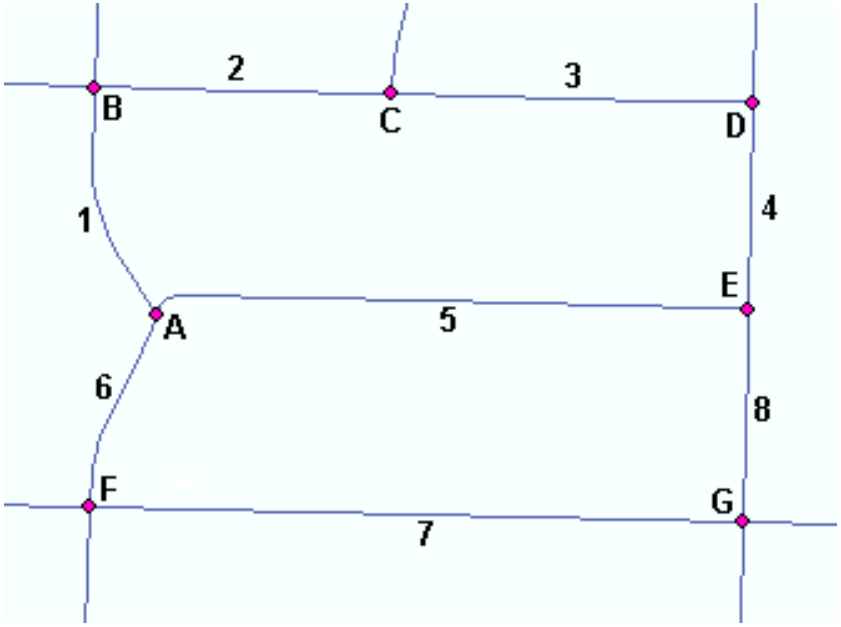
Segments and End Points

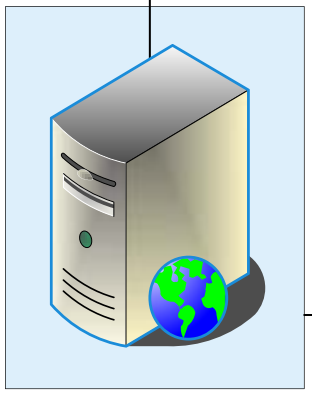


Segment	Endpoint 1	Endpoint 2
1	A	B
2	B	C
3	C	D
4	D	E
5	E	A
6	A	F
7	F	G
8	G	E

Physical Architecture used for this Pilot

Web Tier

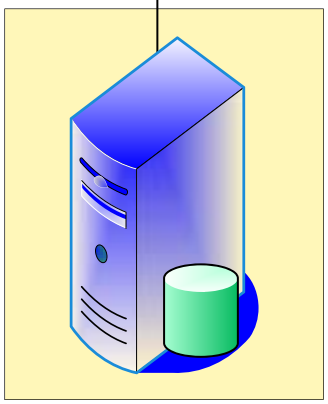
Application Tier



Description:
Combination Web Server and Application Server

Software:
ArcGIS 9.3, Latitude Geocortex Essentials v1.5,
Safe Software FME Server

Data Tier



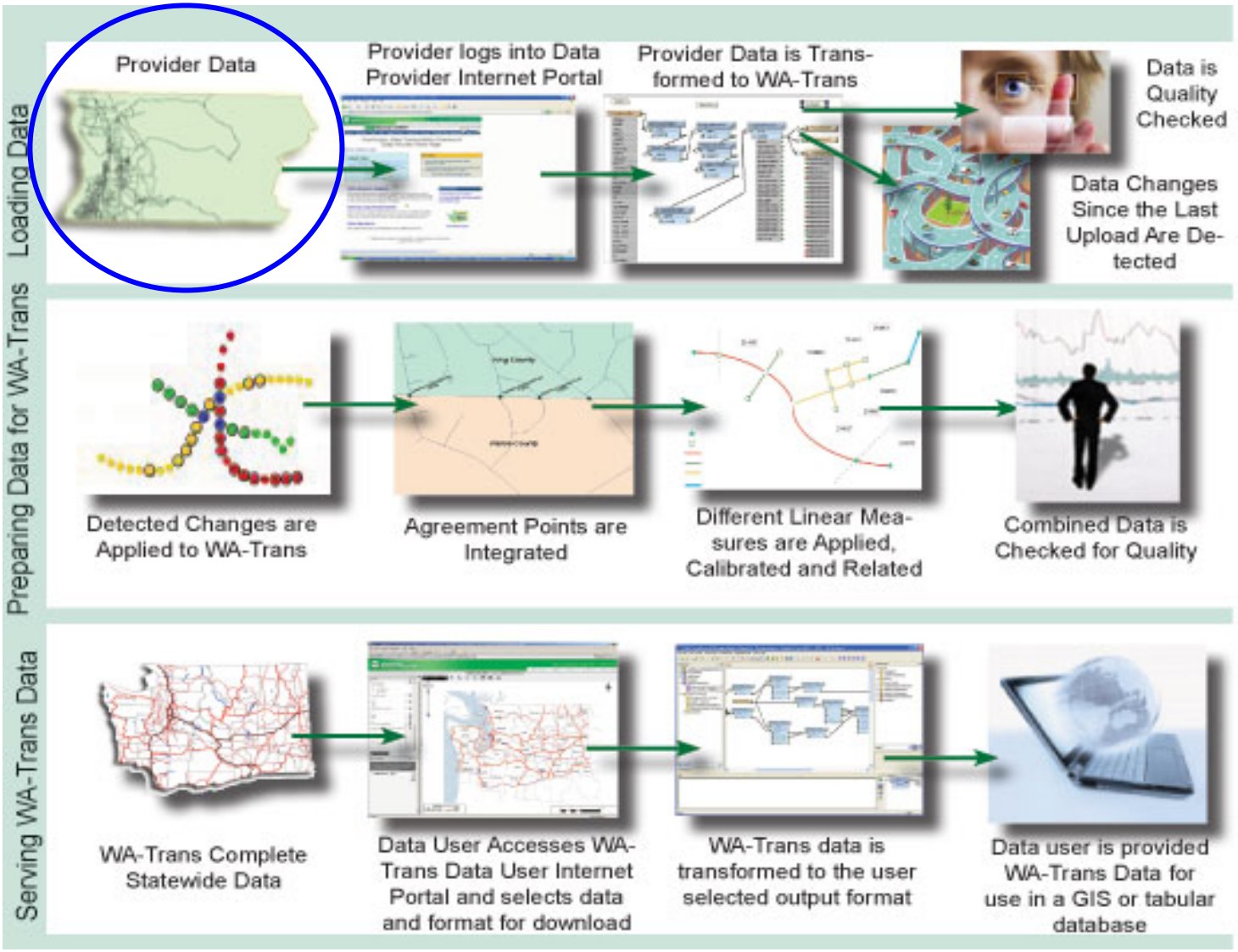
Description: Development SQL Server (Interna)

OS Version: Windows 2003 Standard Server

SQL Version: SQL 2003 Standard

GIS Software: ArcSDE 9.3

WA-Trans Work / Data Flow



Basic Data Provider
Rules of the Road

- Only the Data Provider really knows their own GIS data,
- Data Providers will continue to maintain their data in their own GIS systems,
- Changes to provider data, their business processes, or their systems will be kept to a minimum,
- Data Providers are encouraged to maintain connected road centerline data at their jurisdictional boundaries,
- Providers will submit their current GIS data on a regularly scheduled update cycle,
- WA-Trans processes are designed to support and facilitate continued improvement of data by the provider

New Provider/Changed Data Initiation Process

- Organization particulars and contacts?
- Is this the best source of GIS transportation data for this jurisdiction?
- What kind of data and in what form?
- Attribution characteristics, e.g. perpetual identifiers, LRS data, Address data?
- Is data maintained for other jurisdictions, e.g. cities?
- What is the LRS and/or Address data used for?
- What are the domains for the system lookup data?
- Relationship with other jurisdictions?

“Seamless, connected, consistent and continuous data between jurisdictions, boundaries and other framework layers”

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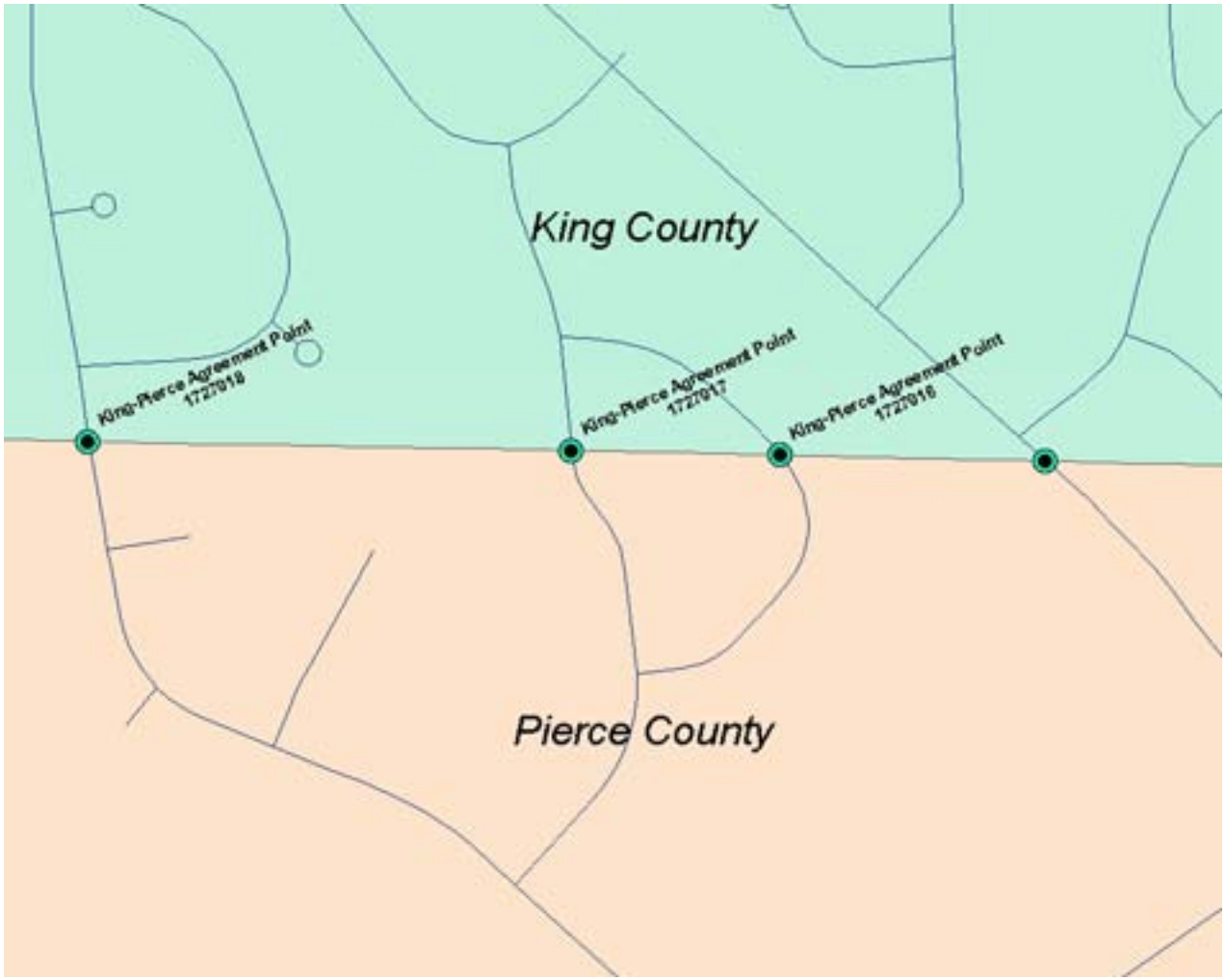
With Agreement Points



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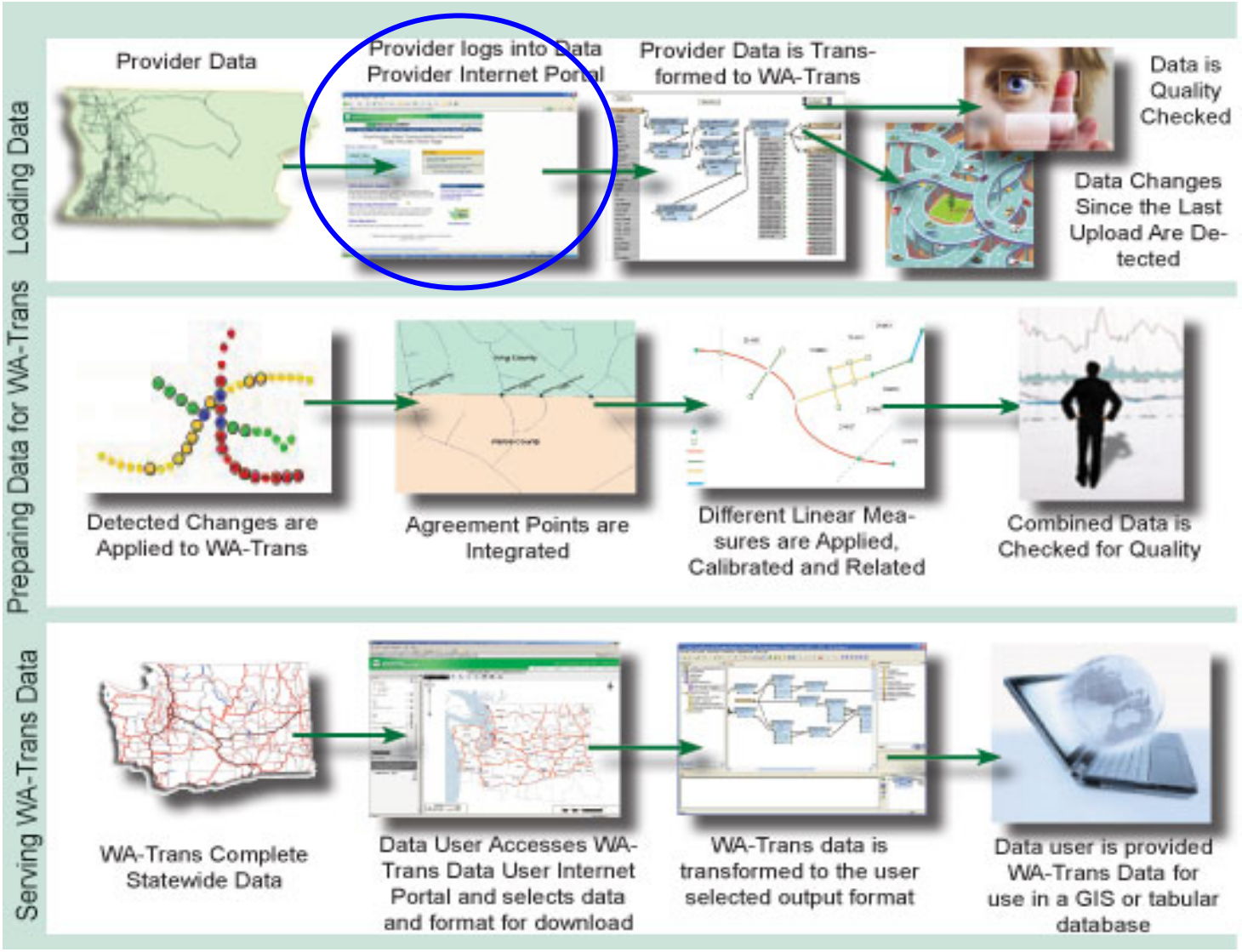
WA-Trans Work / Data Flow



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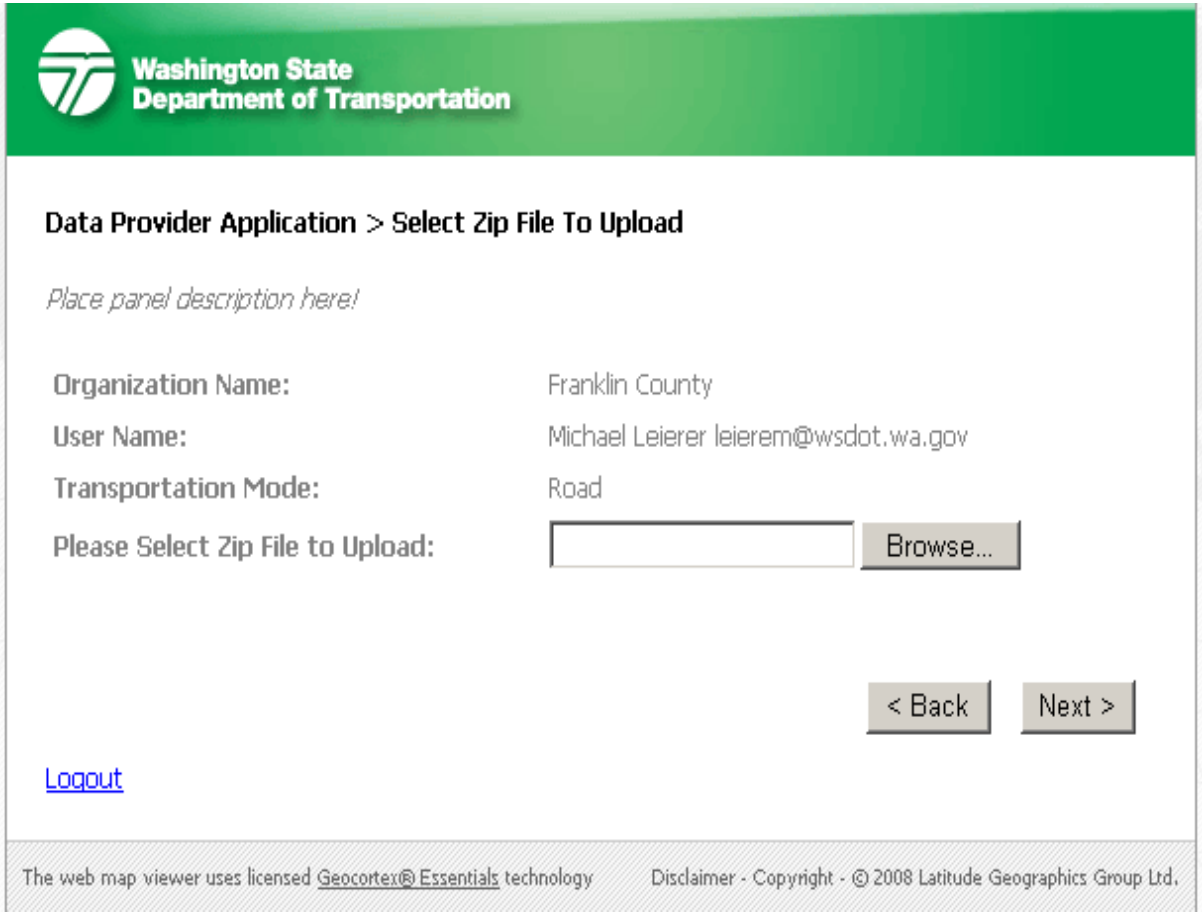
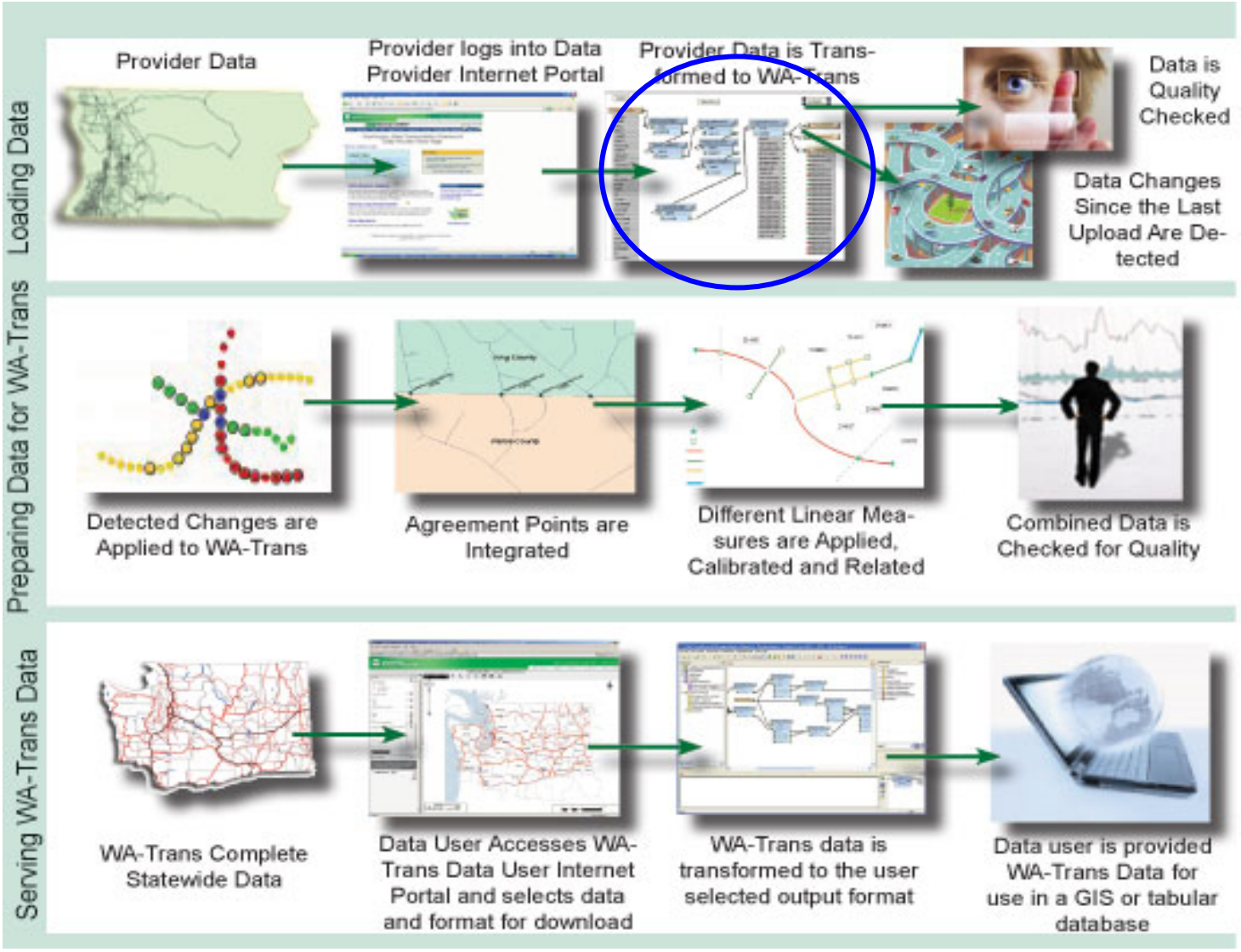
Data Provider Portal Demonstration



WA-Trans Work / Data Flow



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WA-Trans Translator Goals

- WA-Trans wants to minimize impact to data providers and data users while making the most usable product possible.

- The translator is a critical success factor, because it significantly minimizes or removes the need for data providers and users to change their data structures or business processes.

- The first time data is put into or taken out of WA-Trans will be time consuming. After that the goal is for it to be a very simple upload or download process.

Barriers to Translating Data

Schema Mapping

WA-Trans Loading Database

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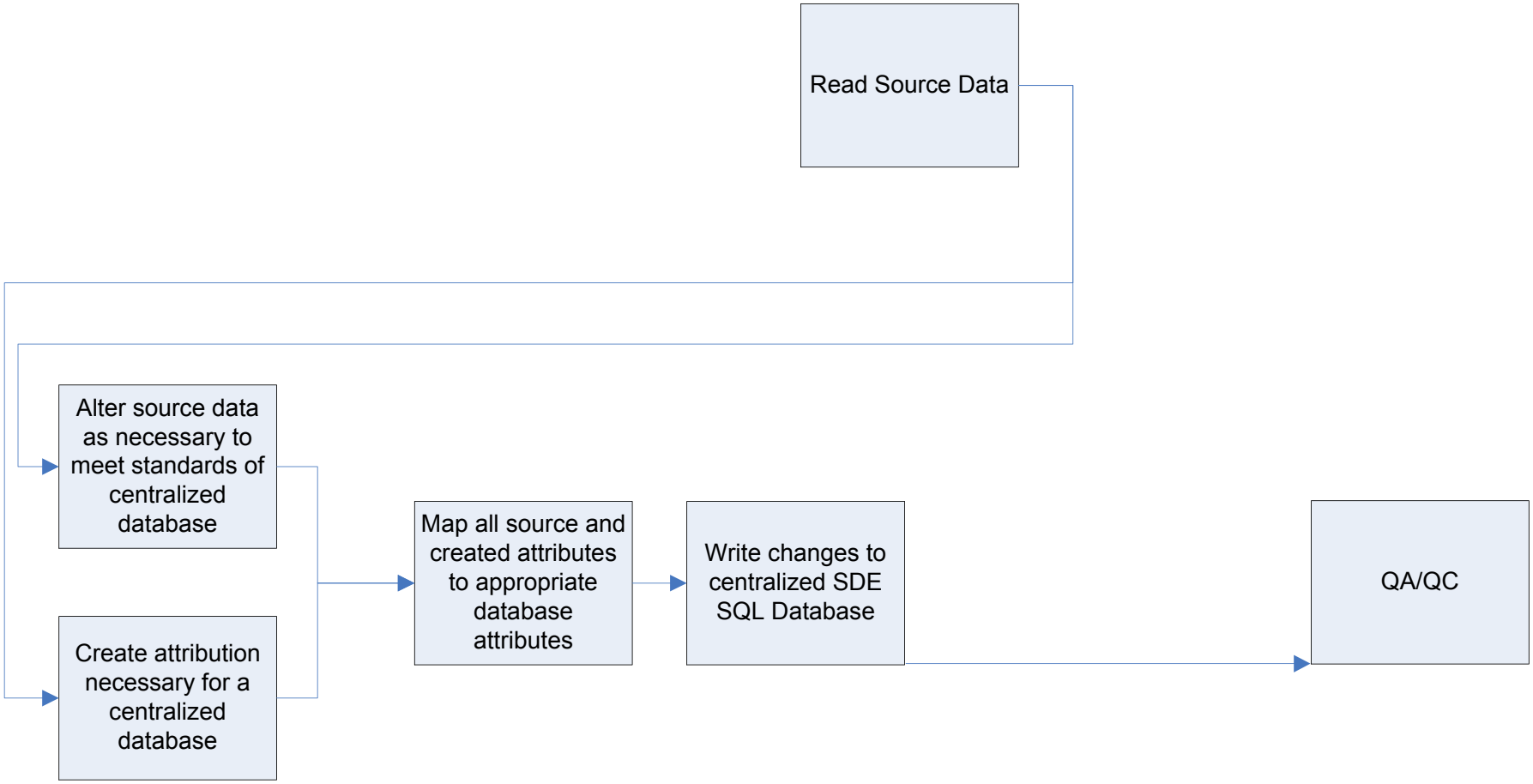
Transformation Process



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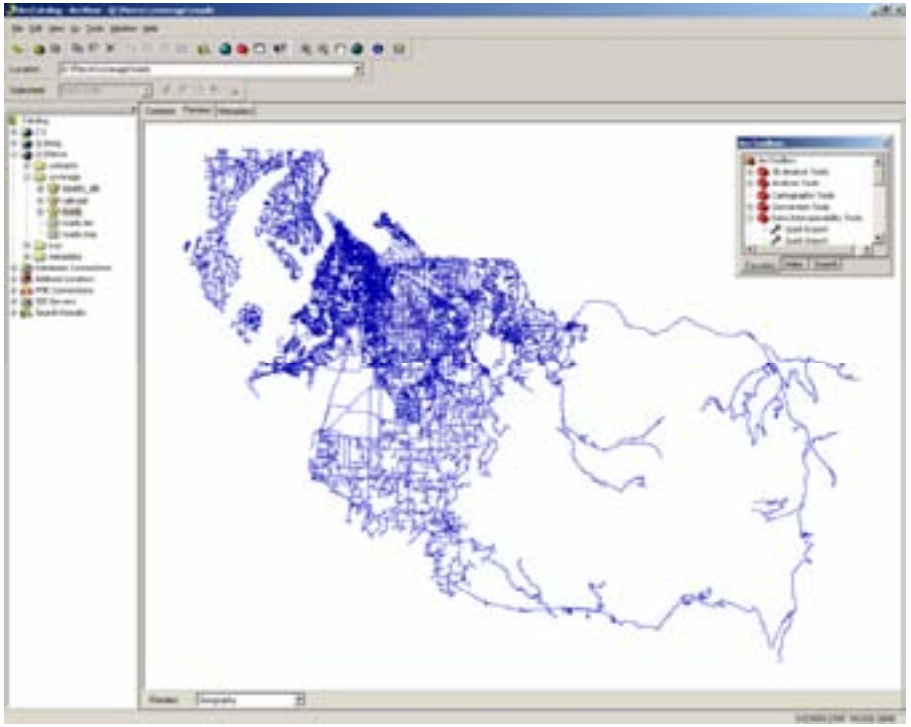
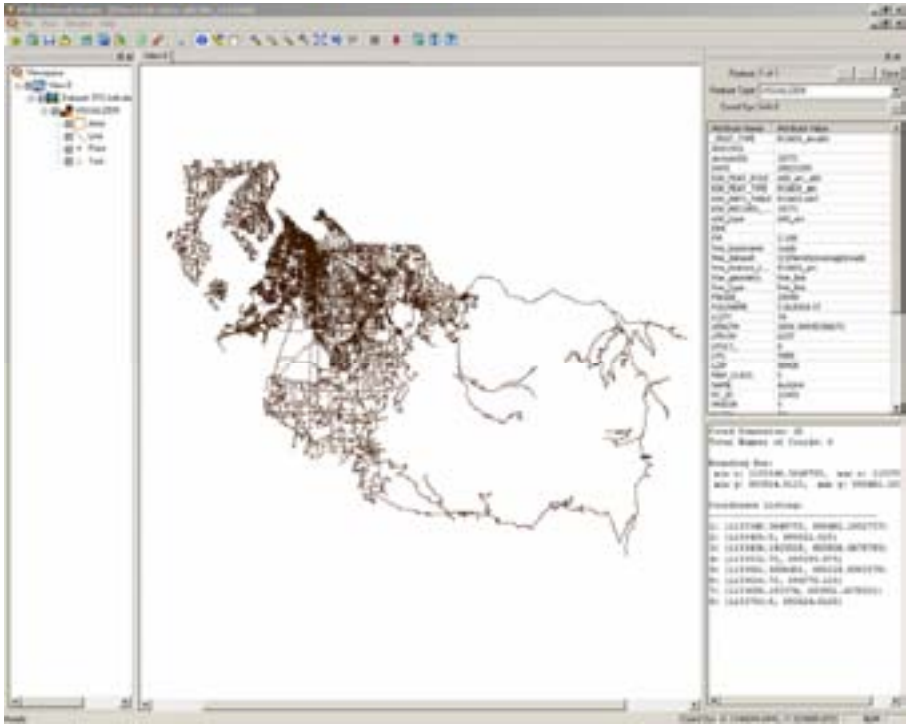


Pierce County
ESRI Coverage files

Pierce County Data
after Translation to SDE
SQL Database



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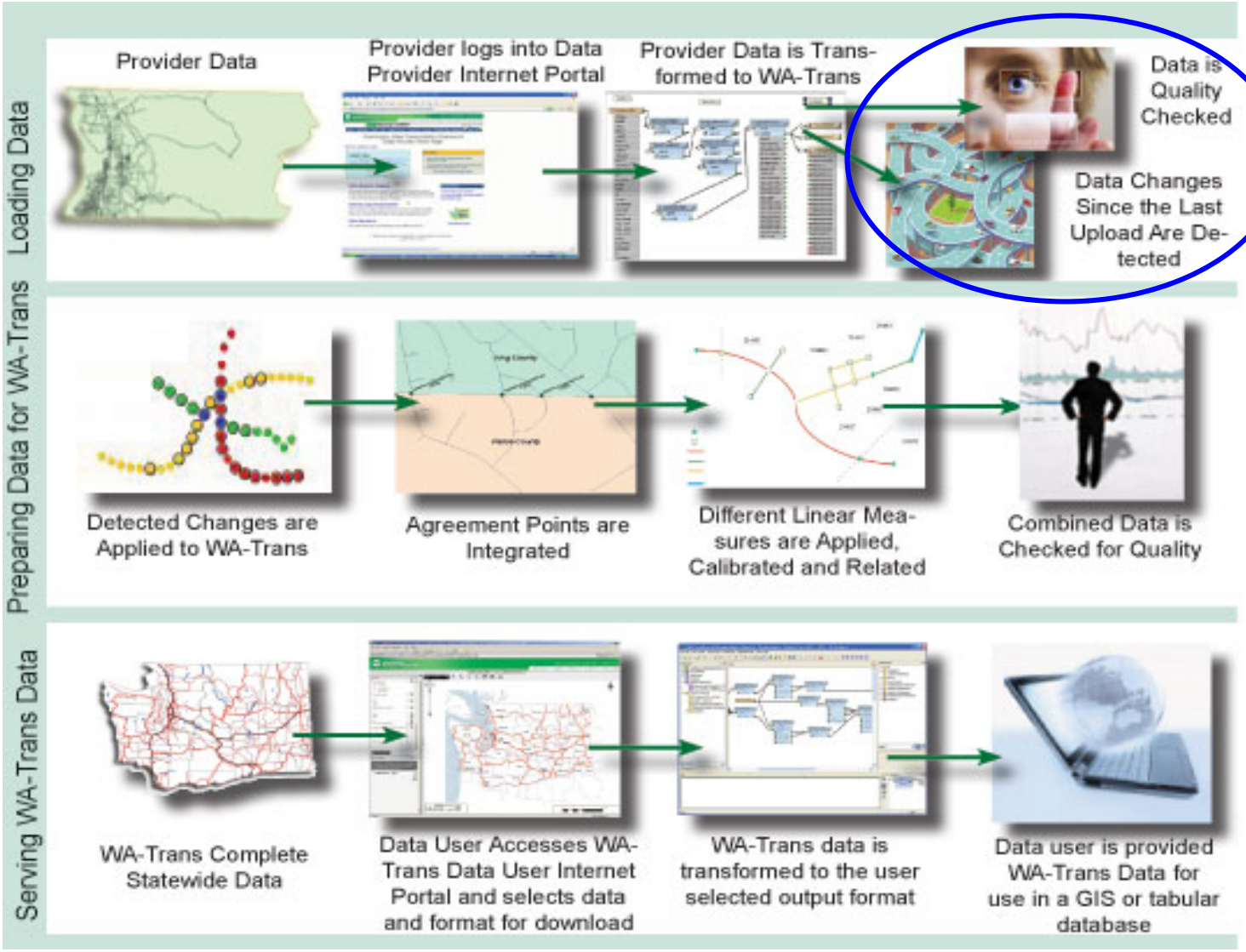
WA-Trans Work / Data Flow



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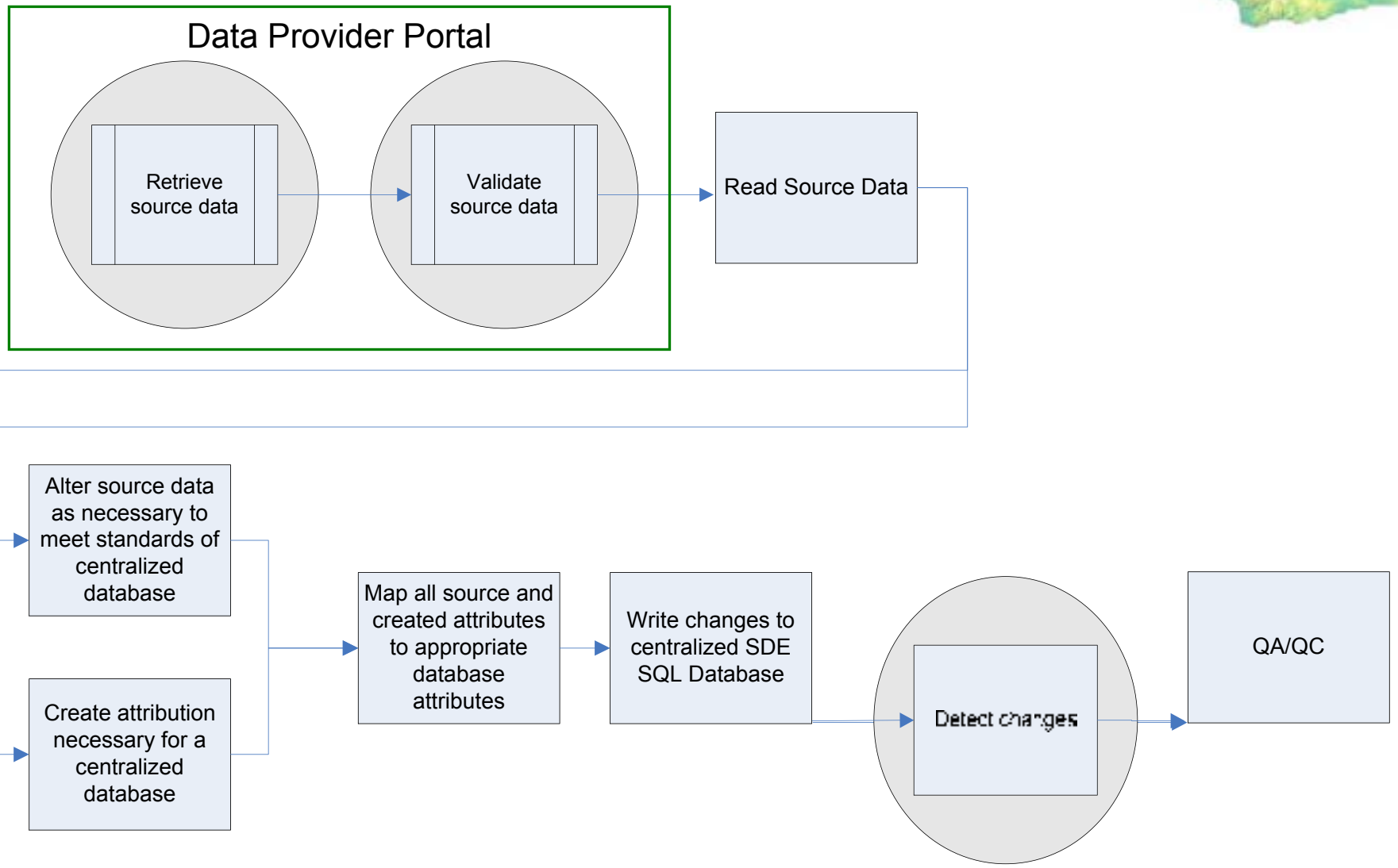
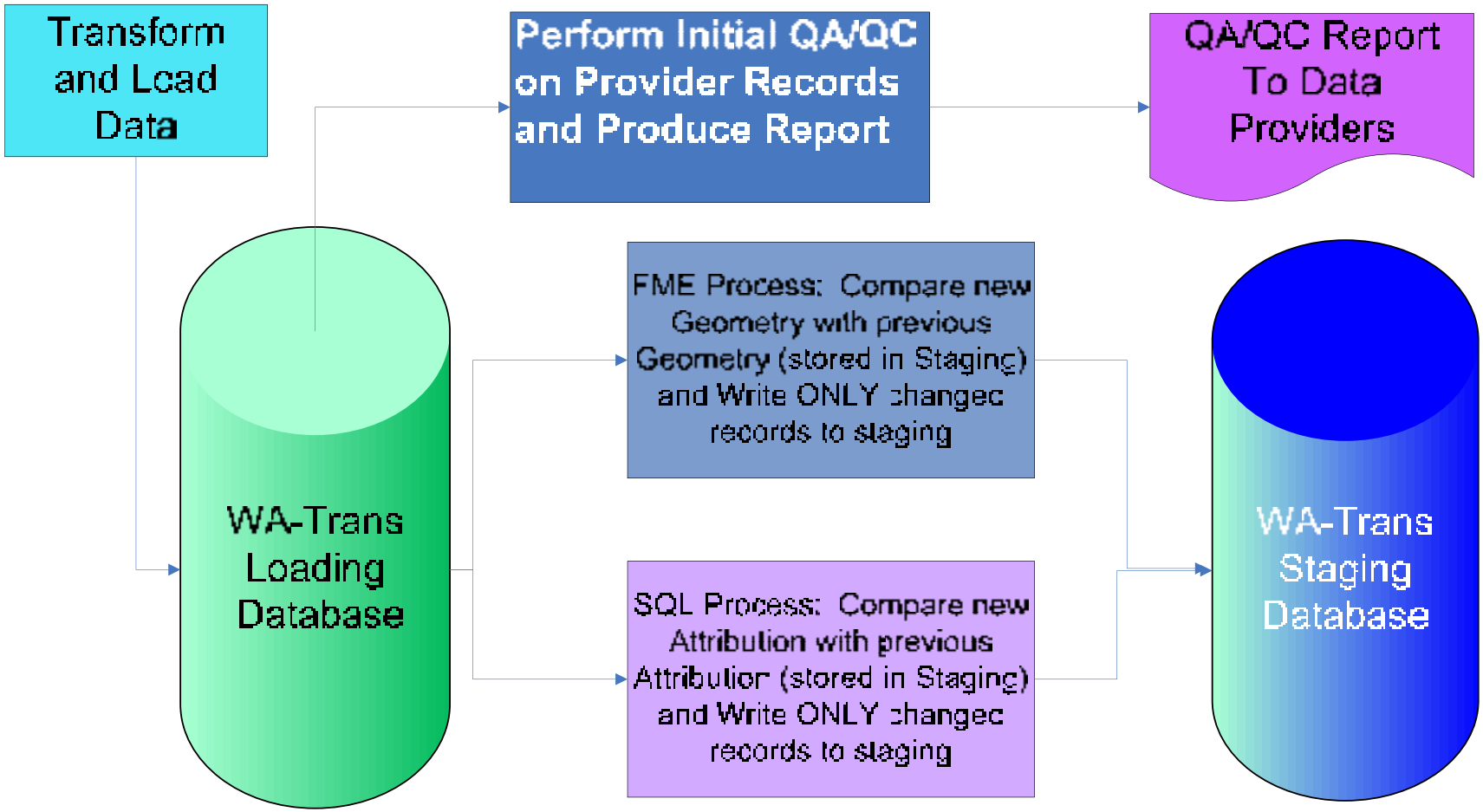
Where does Change Detection start?



WA-Trans Loading and Change Detection and Change Management
Conceptual Architecture 10 - 2008



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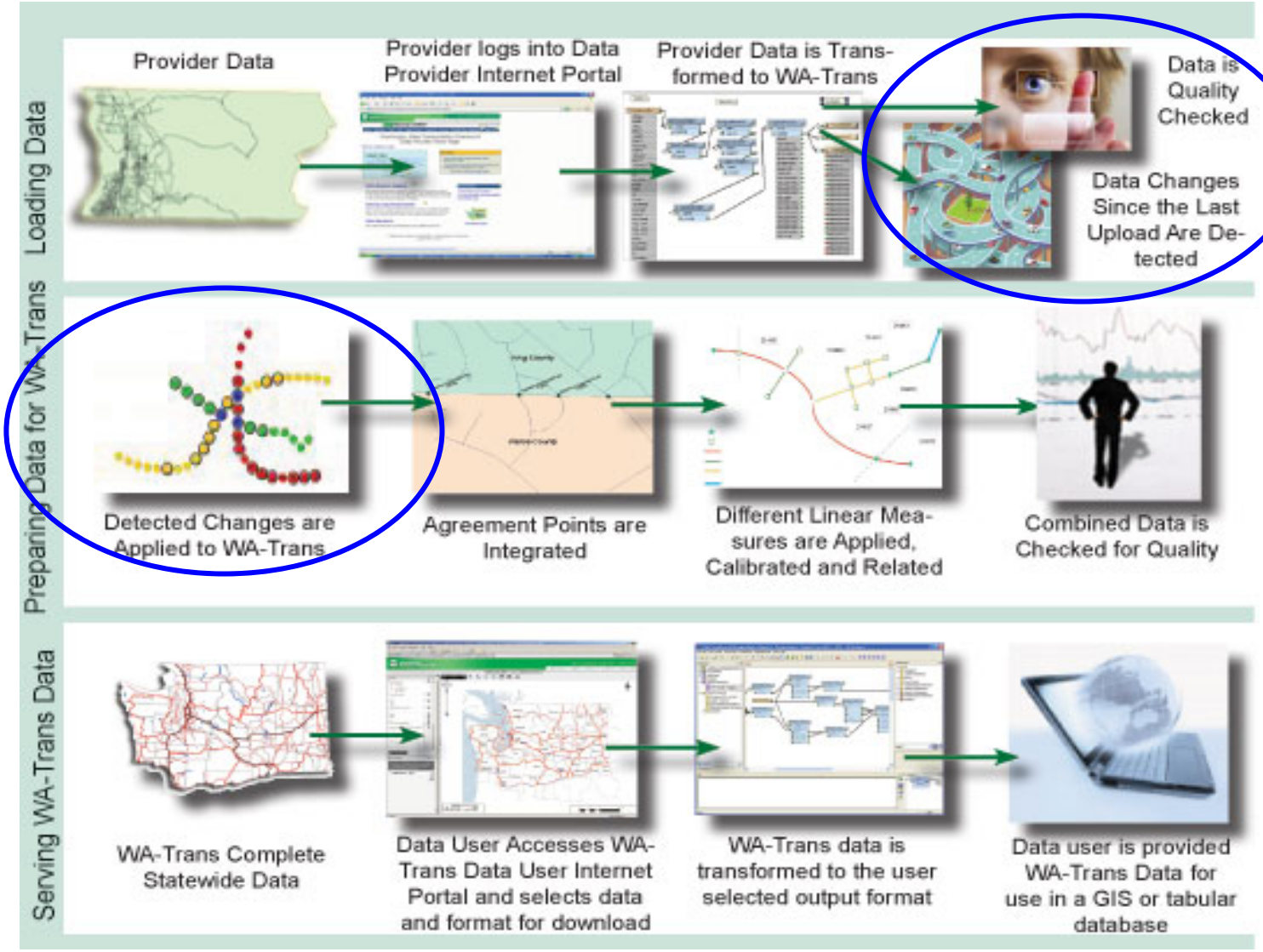
The “Truth” of the data

- What do we really know about providers data?
- We need to be careful with our judgments of providers data,
- We will have to accept that we will have some bad data in production,
- With a reliable source, QA/QC reports and user feedback providers will possibly improve their data

WA-Trans Work / Data Flow



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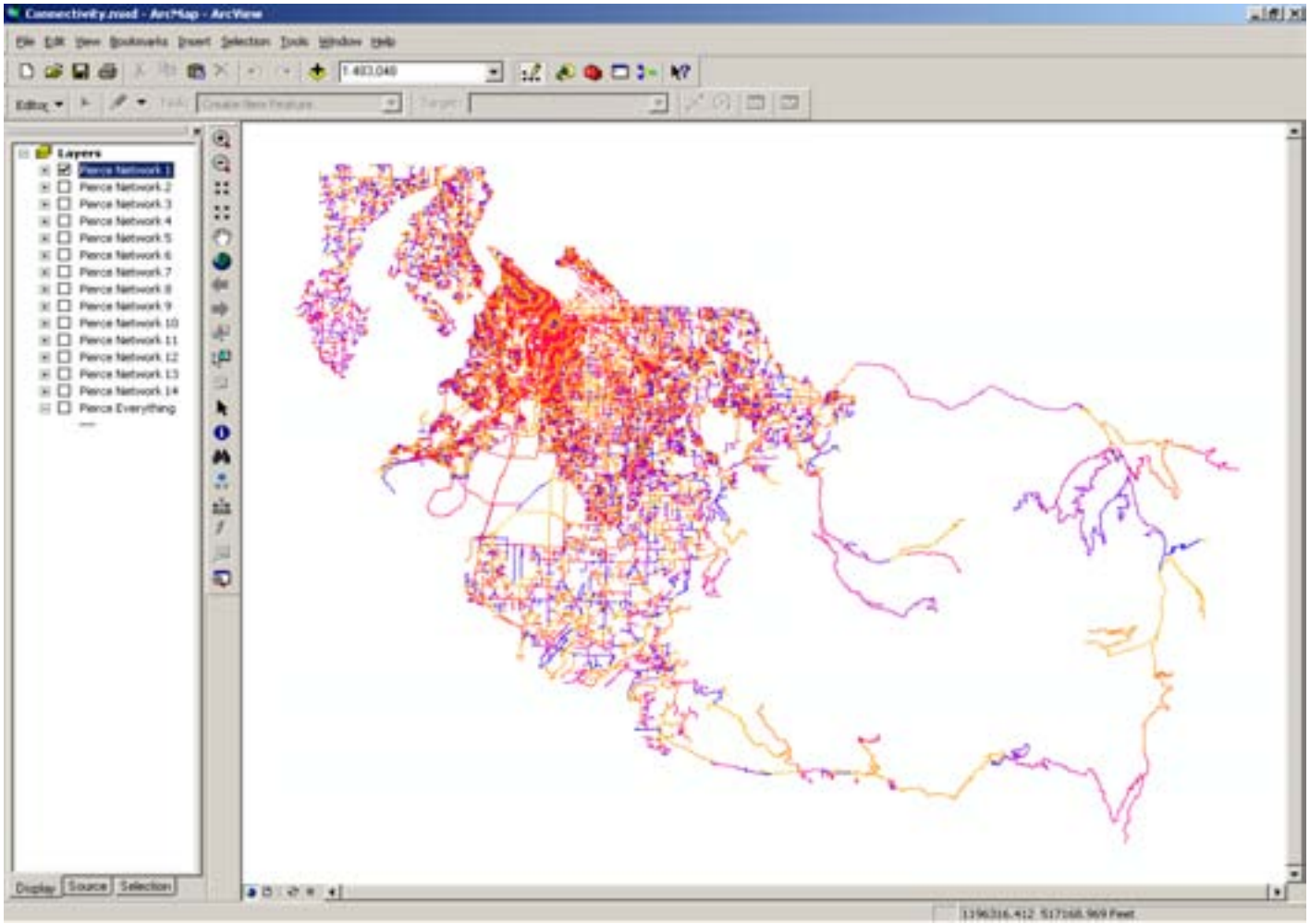
Provider Data and QA/QC Reports; Connectivity Report



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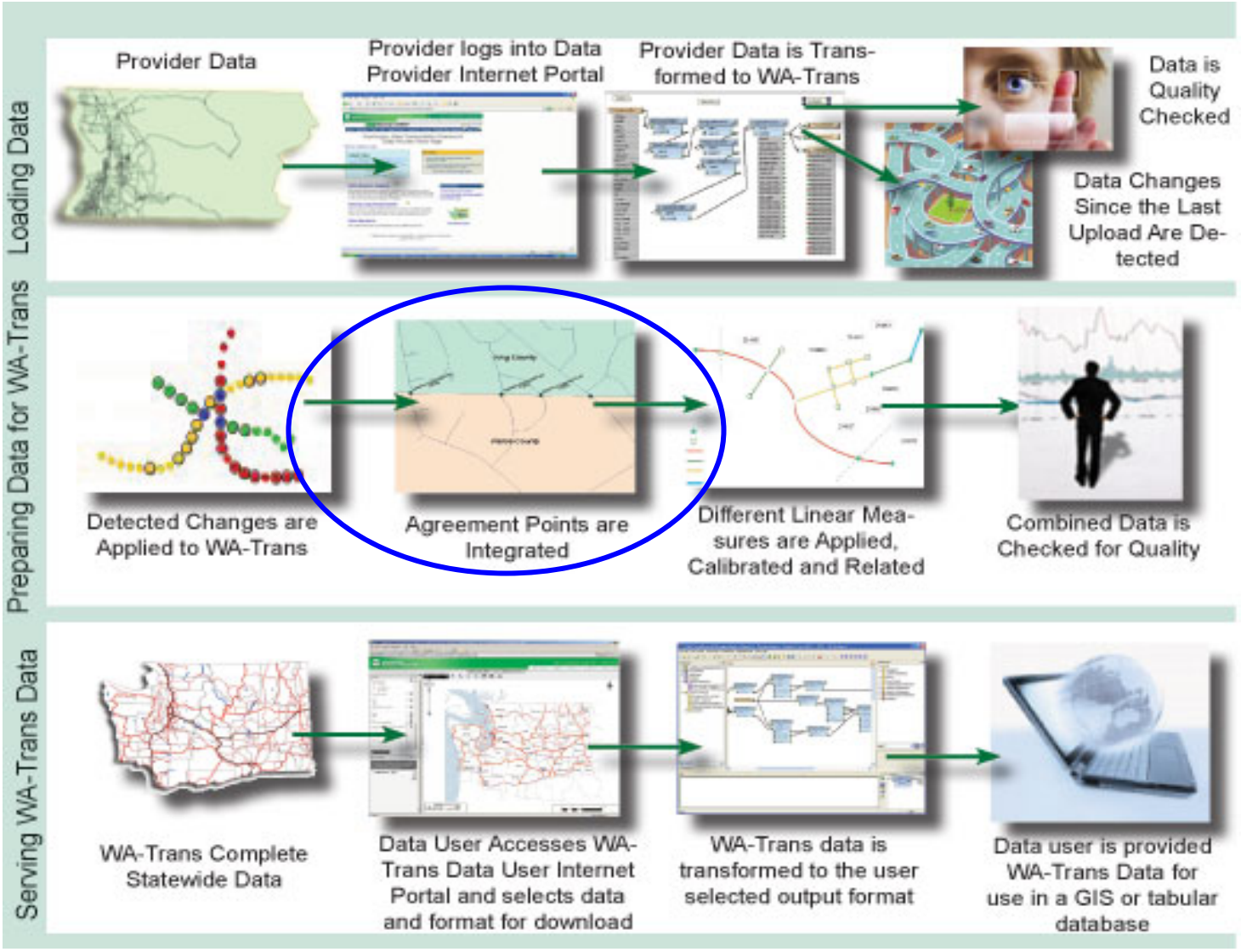
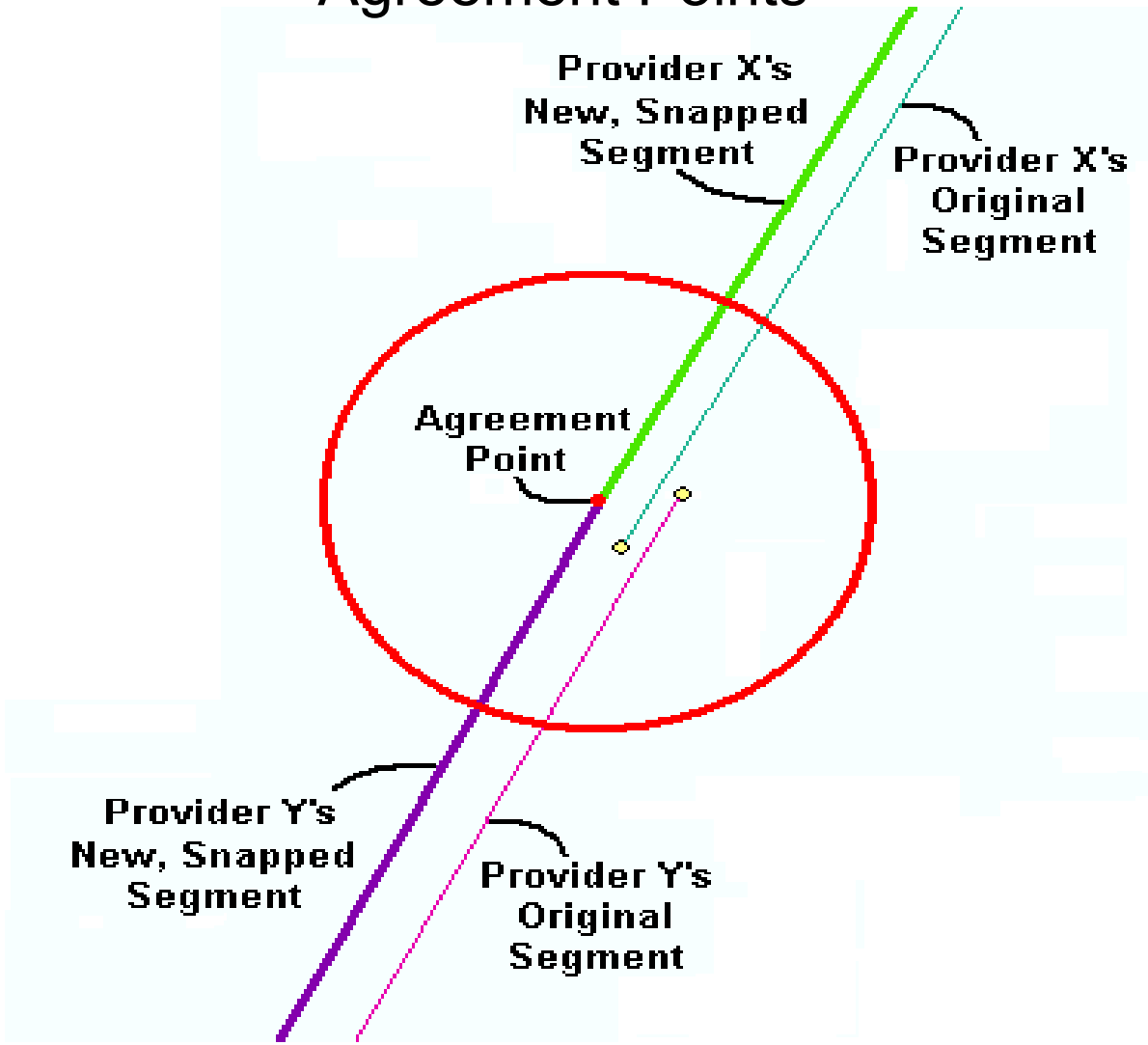


Implementation of Agreement Points



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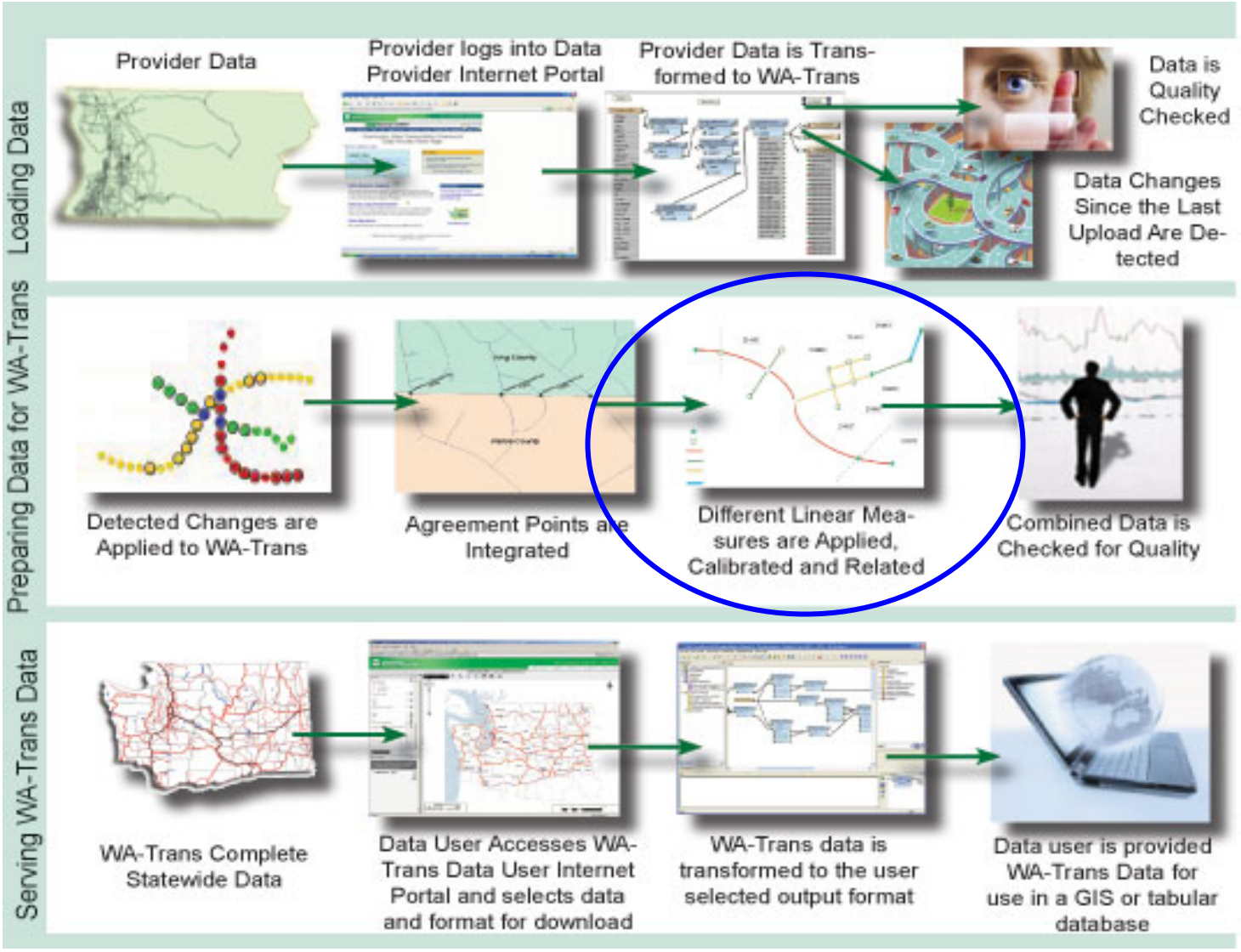

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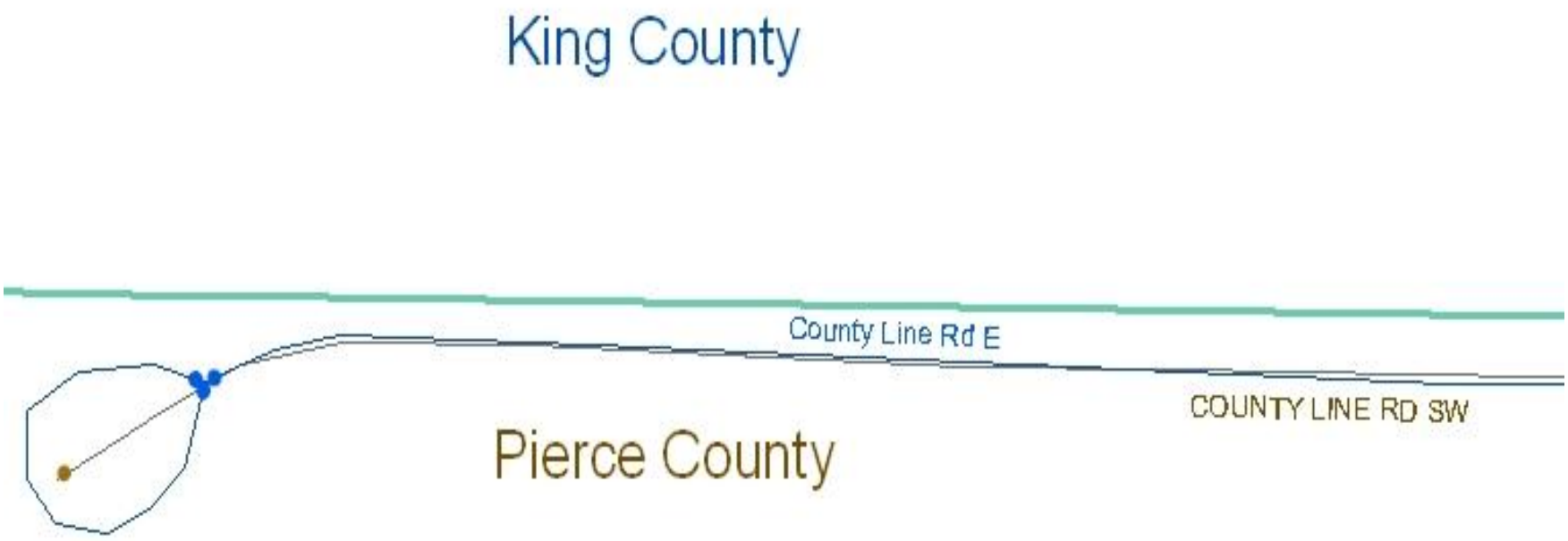
Coincident Data (two examples)

1. Between jurisdictions there are coincident segments near the boundaries,
   a) We need to maintain attribution for both jurisdictions

2. Within a jurisdiction there may be multiple files with different geometries,
   a) One file may contain a centerline with LRS attribution,
   b) Another file may contain a centerline with Address Range attribution
   c) Centerlines will not be exactly the same as they are maintained by two separate offices

Coincident Segments at Boundaries



County Boundary

Pierce County

King County

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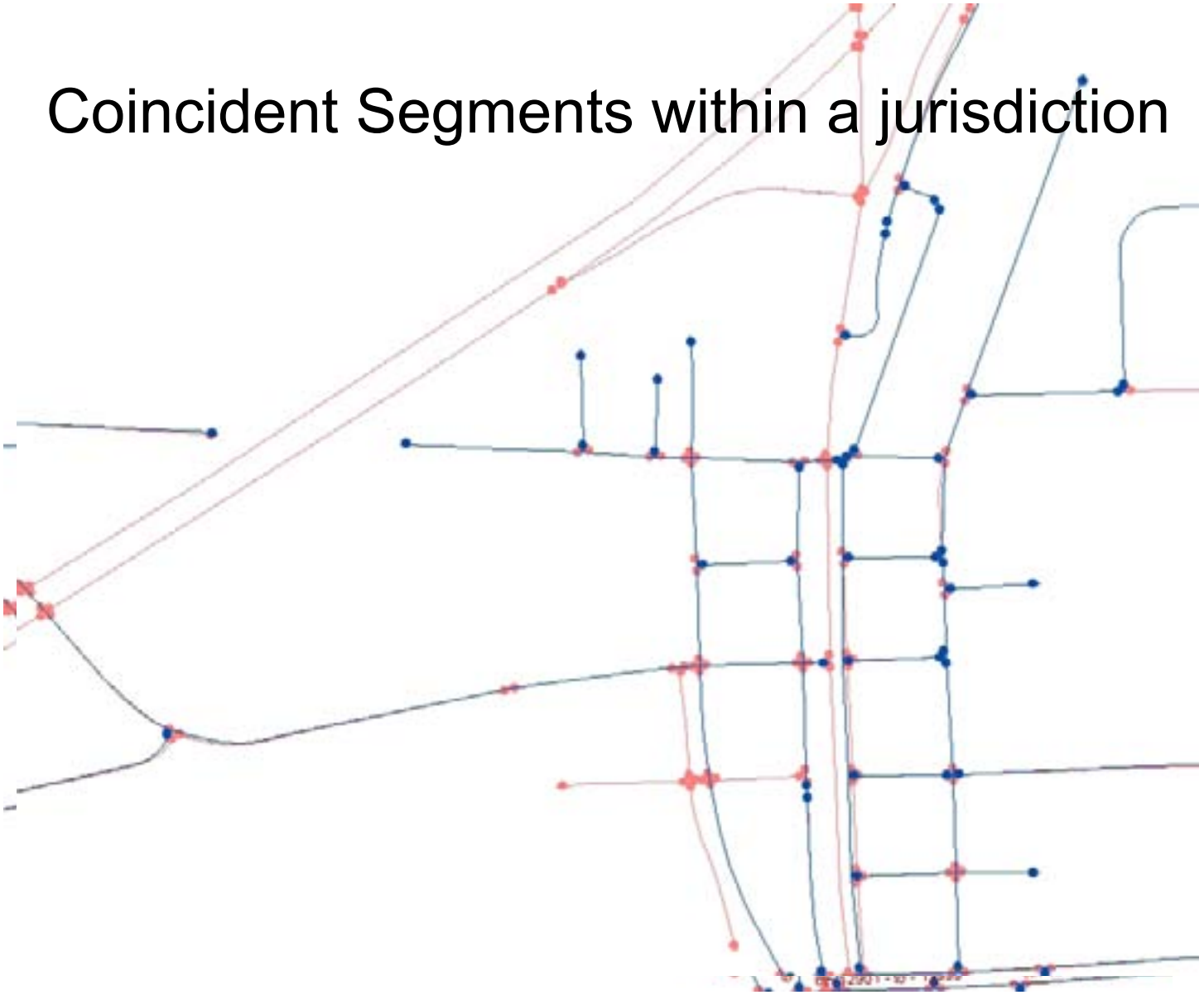
Coincident Segments within a jurisdiction



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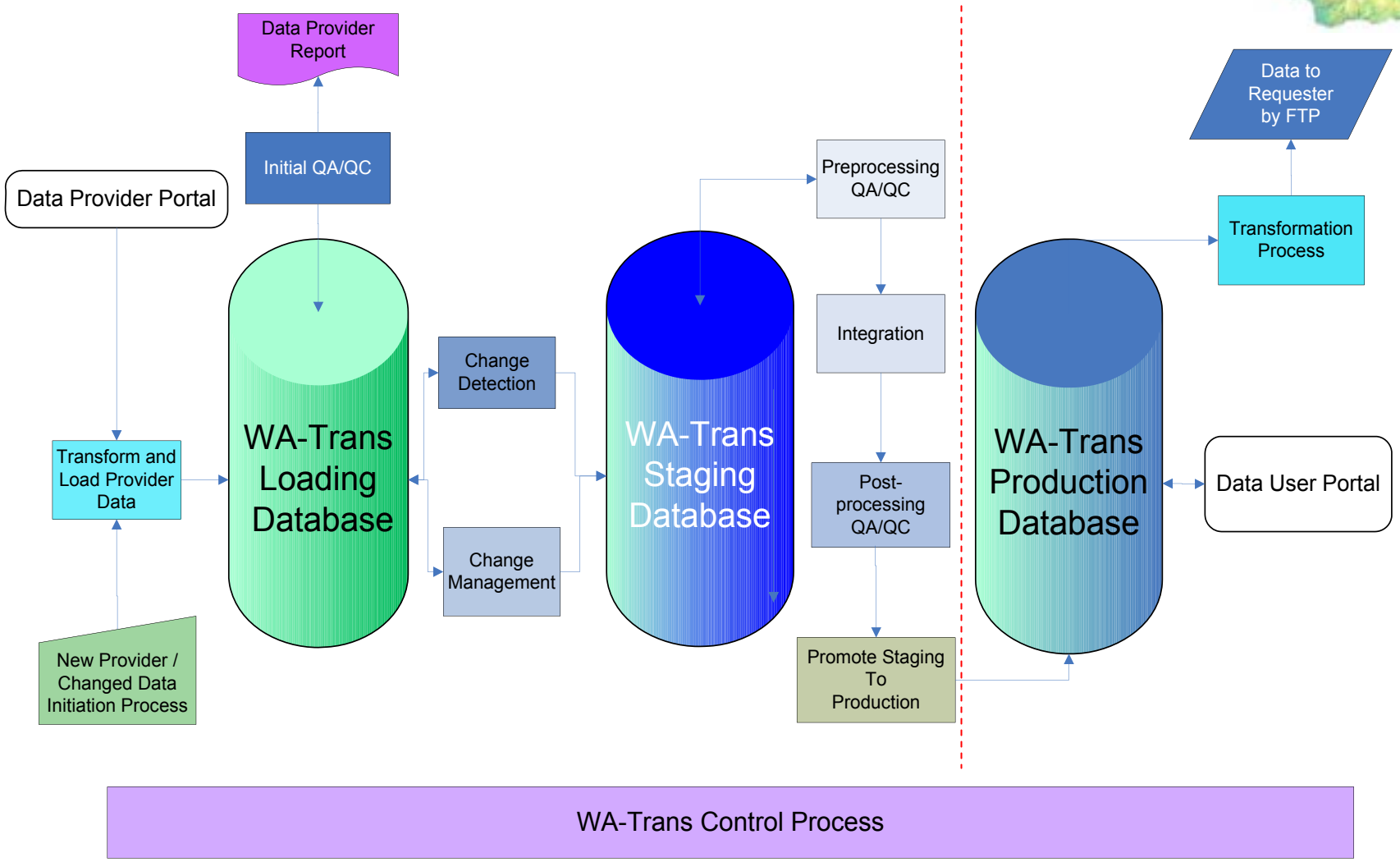
WA-Trans Conceptual Architecture



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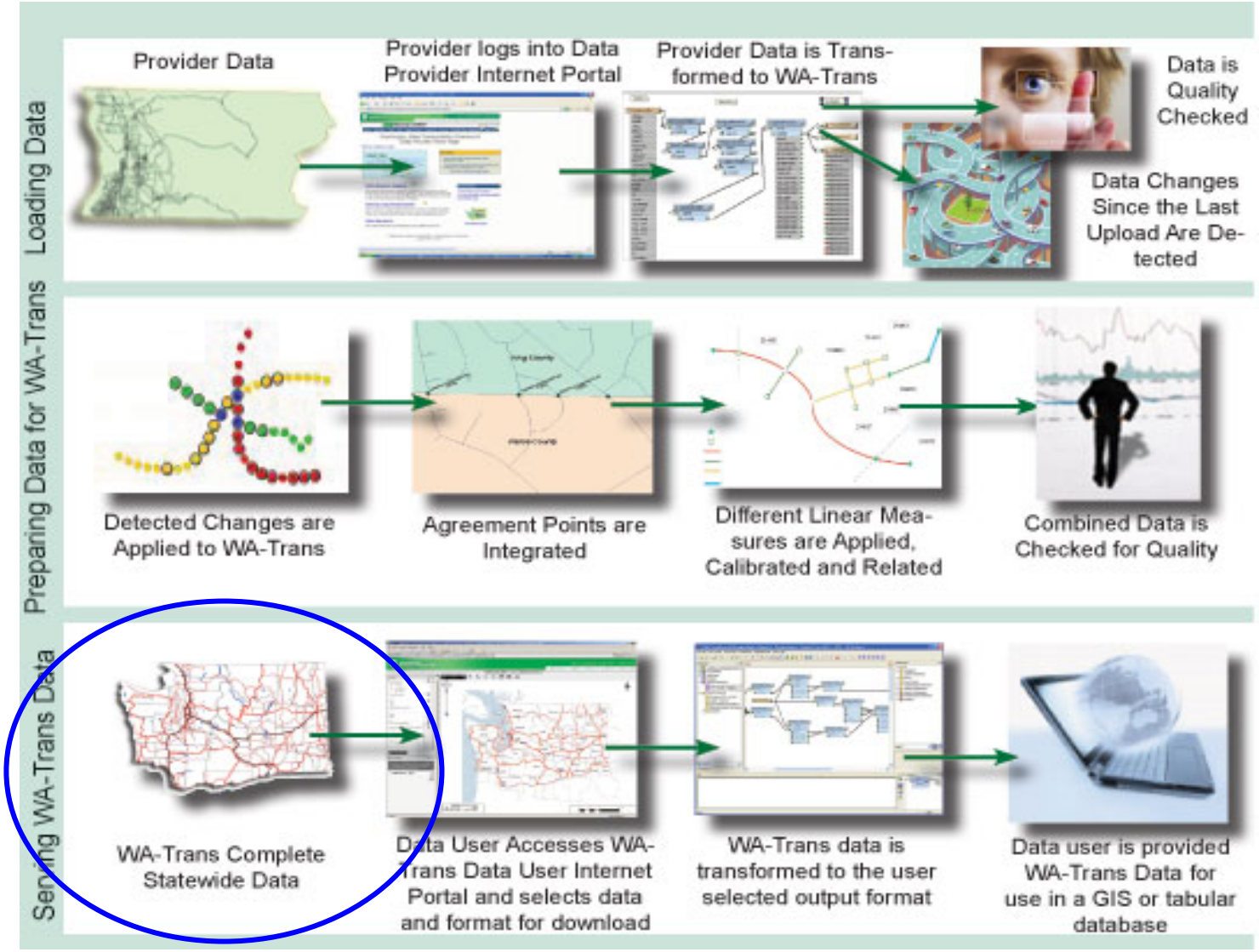

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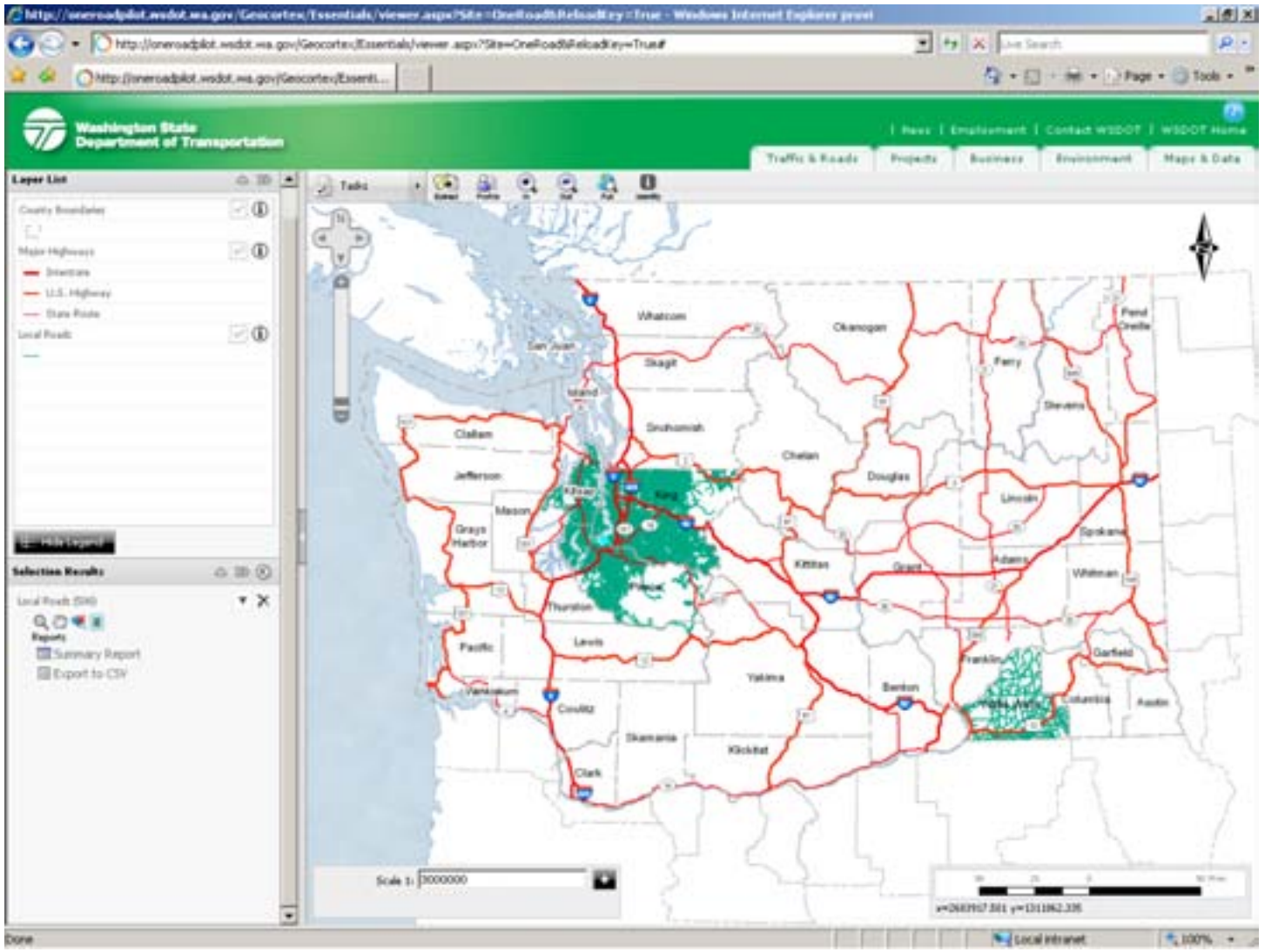
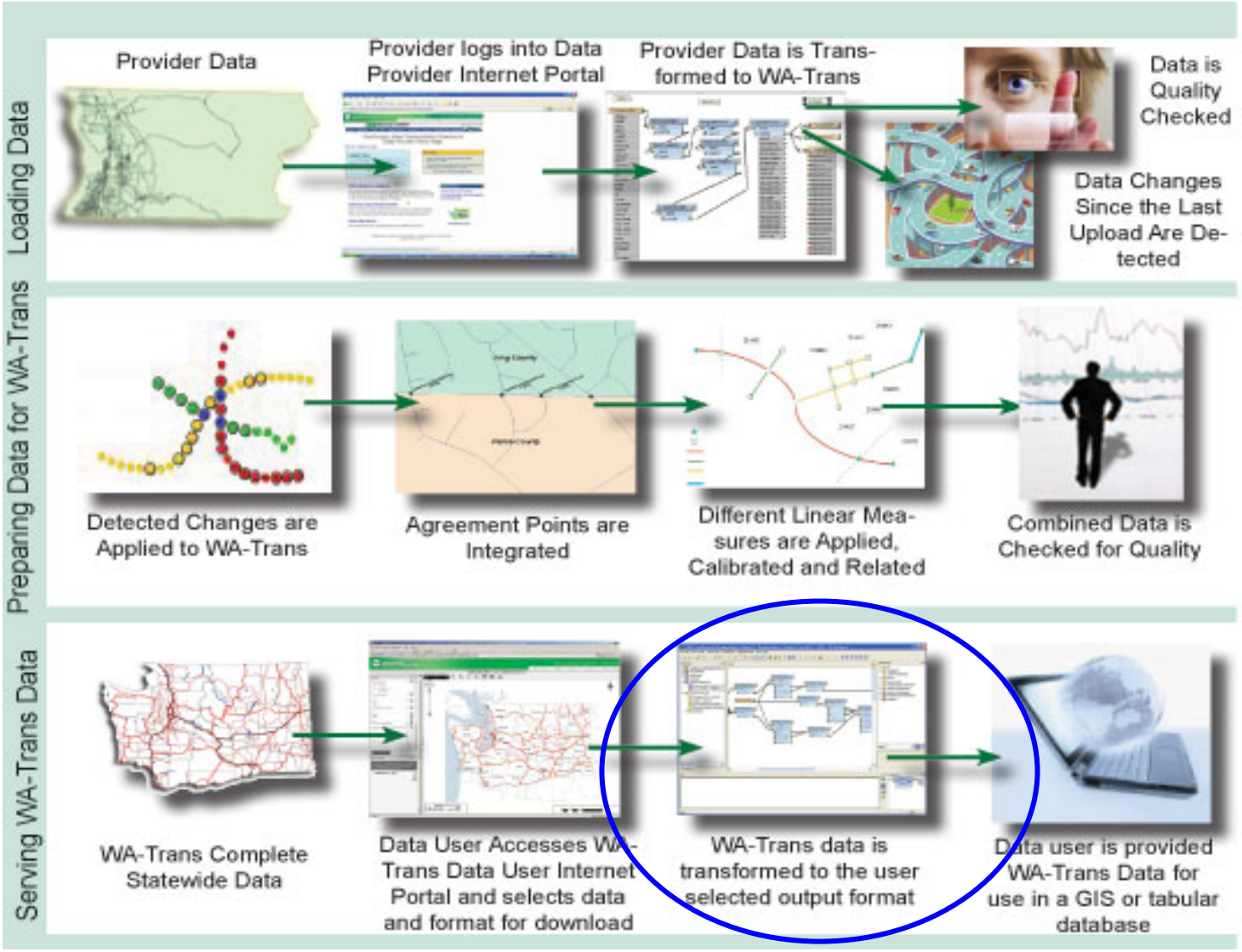
WA-Trans Data User Portal



WA-Trans Work / Data Flow



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Defined Output Datasets for Users

- WA-Trans contains Transportation Framework data, and is not a final ready to use transportation product,
- WA-Trans data contains and is structured to allow the creation of different user defined products,
- It is possible to create products specifically for a data user.

WA-Trans is currently focusing on several defined output datasets that include centerline data for:

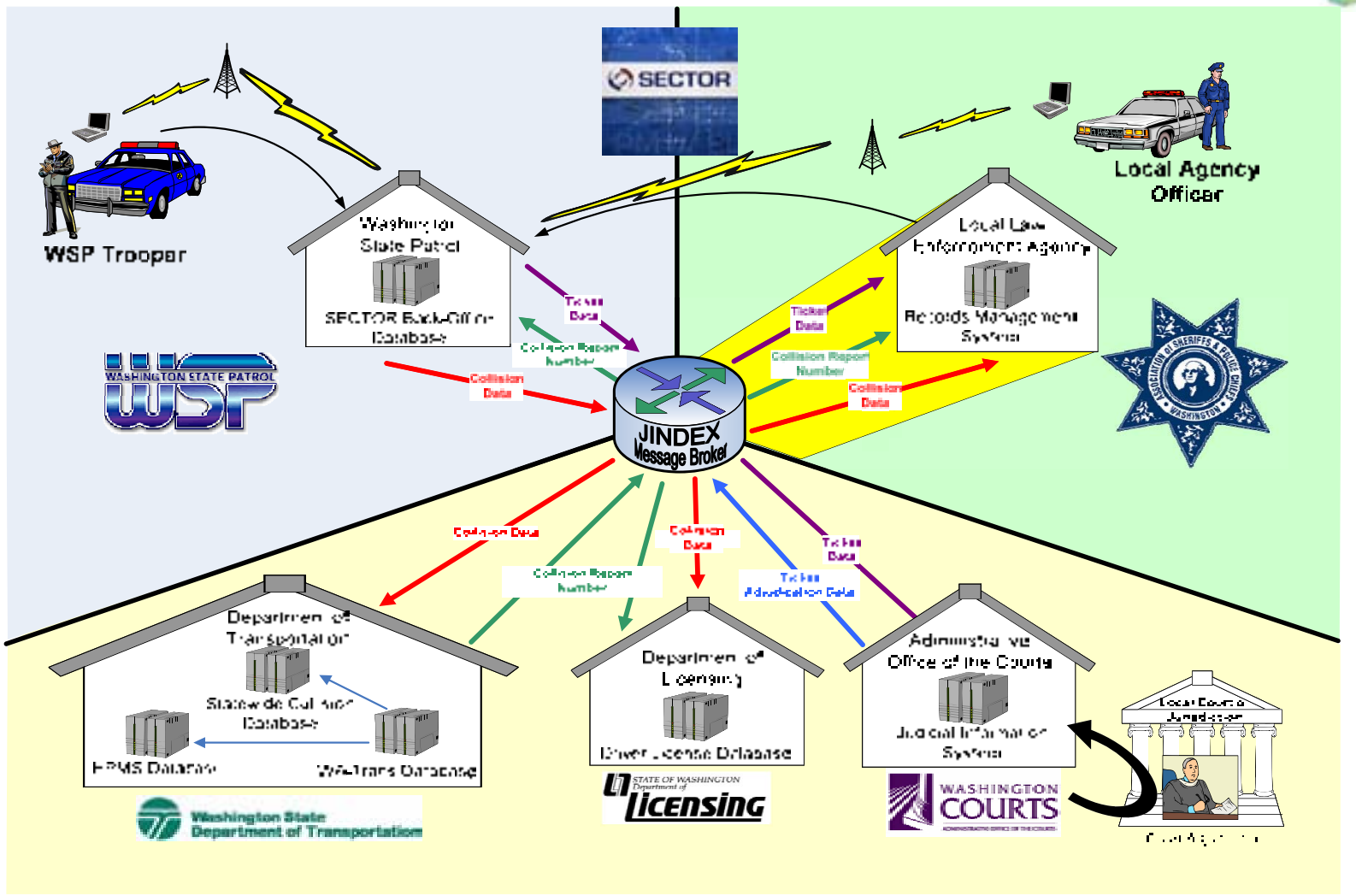
1. Geocoding and E911 uses,
2. Planning and event location to include all available LRS attribution,
3. Specific business uses as WSDOT.

HPMS, Functional Class and WA-Trans – the connection

The benefit of representing the same data in WA-Trans as is used in FHWA reporting is two-fold.

- The Roadway needs reported to the US Congress, used to determine dollars available for Washington's roads, are based on the most accurate data available as reported by local agencies to WA-Trans.
- Data carried in the HPMS-FC system is used to verify eligibility for the project funds and also for FHWA oversight. This use of HPMS-FC data, as represented in WA-Trans, will increase with HPMS 2010 reporting*.

* Increased HPMS 2010 reporting requirements include AADT for all Federal Aid roadways, a GIS of the Functional Classification System, and more extensive Pavement Data.



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WA-Trans Data Progress and Plans

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How To Get Involved

- TPF 5(108) – Software Tools for Sharing and Integrating GIS Data,
- "http://www.pooledfund.org",
- Seeking 4 more partners (at least),
- We can also partner with other levels of government and private companies,
- Our goal is to having working prototypes in an Open GIS environment as a result as well as processes and other useful templates and information.

Links for more Information

Interview with V1 Magazine “WA-Trans Provides a Vision for Road Data Integration”

- www.vector1media.com/dialogue/interview/wa%11trans-provides-a-vision-for-road-data-integration/

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www.wsdot.wa.gov/mapsdata/transframework/default.htm

Transportation Pooled Fund: Software Tools for Sharing and Integrating GIS Data

http://www.pooledfund.org/projectdetails.asp?id=340&status=4