The Development of a Proposed Transportation GIS Data Model for the Delaware Valley Region

GIS-T Conference

March 19, 2003

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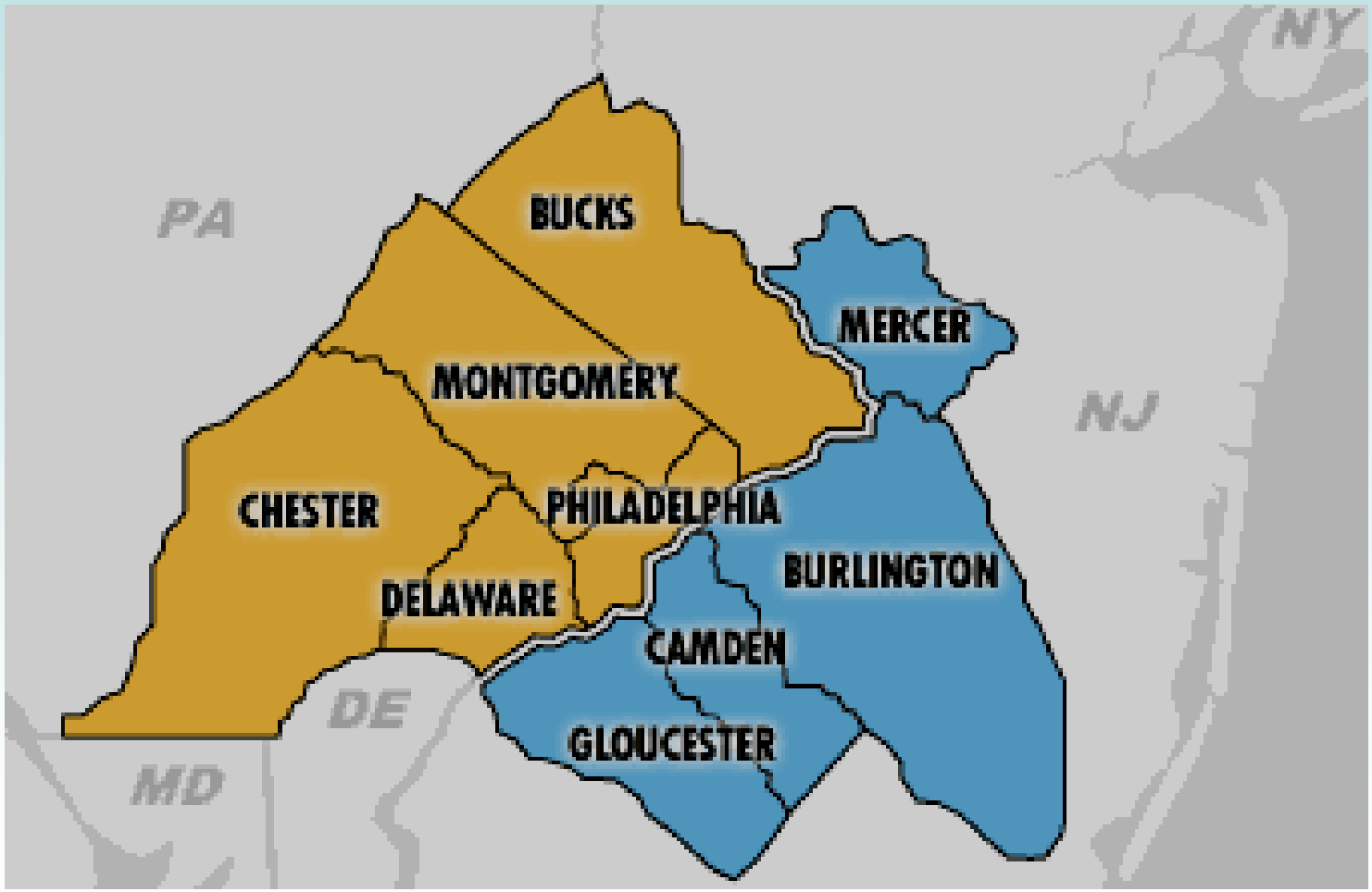
What (and where) is the Delaware Valley?



Region Serviced by the Delaware Valley Regional Planning Commission (DVRPC)

What is DVRPC?

- ***Serving the Region for over 30 years***
- ***Works to foster regional cooperation in a nine-county, two state area***
- ***Addresses key issues, including transportation, land use, environmental protection and economic development*.**
- ***Serves as Metropolitan Planning Organization (MPO)***
- ***Carries out federally funded transportation plans and programs.***

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Who Was The Project Consultant Team?

Johnson, Mirmiran and Thompson, P.A.
Engineers, Planners, Surveyors and IT Consultants
Baltimore, MD. ***www.JMT-Engineering.com***

Enterprise Information Solutions, Inc.
IT/GIS Consultants
Columbia, MD. ***www.EnterInfo.com***

TransDecisions, Inc. Boston, MA.

Supplier of enterprise software solutions utilizing location-based (spatial) technologies for logistics, location, and transportation system applications.

Why This Project?

- ***Maximize the use of GIS files developed and maintained by federal and state agencies and transit operators.***
- ***Expand transportation GIS elements required by member governments for planning and operations.***
- ***Provide for the seamless exchange of GIS data files and the integration of planning infrastructure among all member governments and operating agencies.***
- ***Position the GIS files so they can be applied to more accurate geography in the future***
- ***Use of Linear Referencing System (LRS) as Underlying Process***
- ***Technical Recommendations for Realizing Benefits***

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Project Phases

- Inventory – Member Governments
- Research and Prototypes
- Development of Technical Recommendations
- Implementation Planning
- Review and Summarize Results

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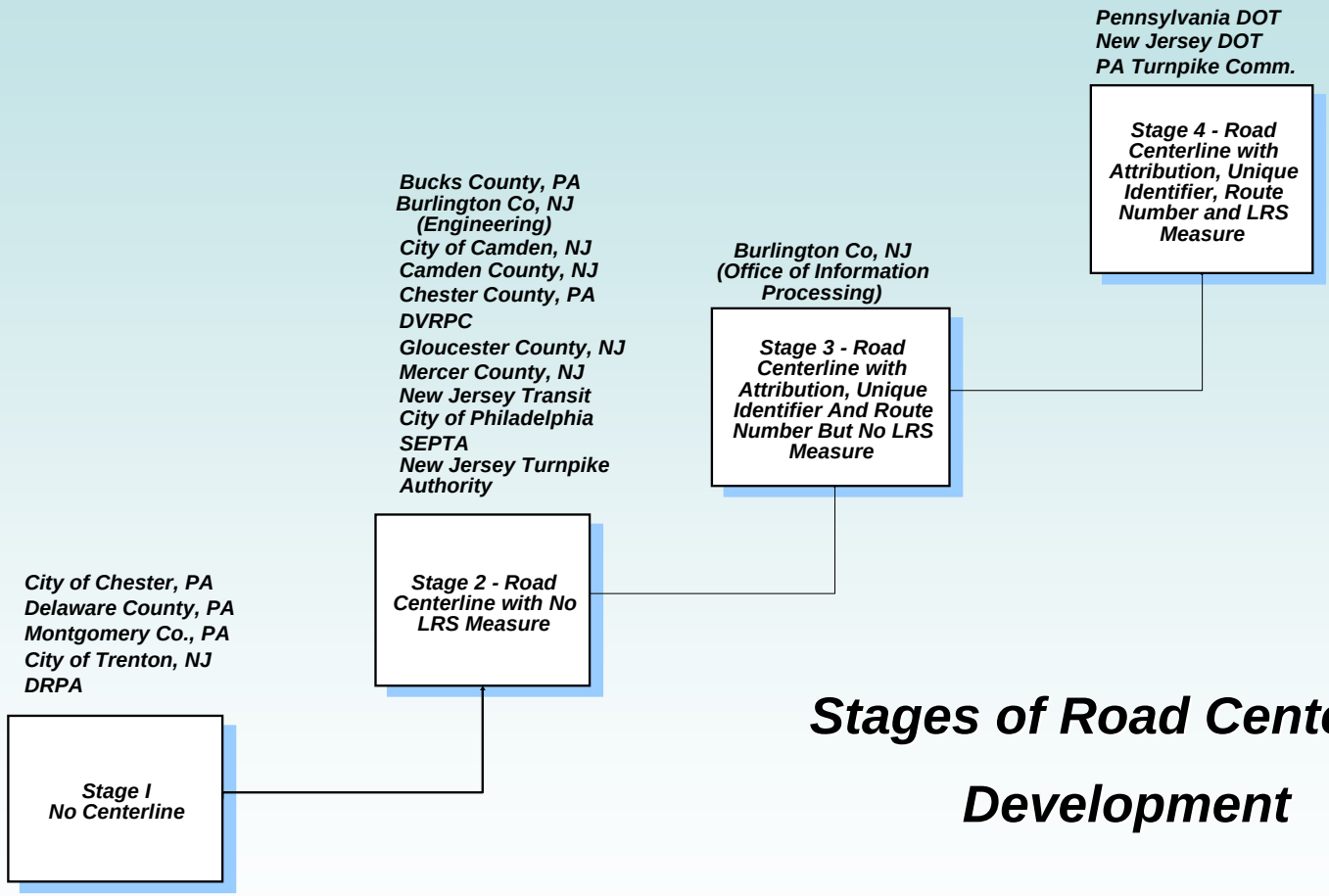
Inventory of Member Governments



Stages of Road Centerline Development

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Needs Assessment Phase Conclusions

- *Seamless, Region-wide Transportation GIS Database Unlikely*
- *Continued Development and Maintenance of Data by Participants*
- *A Significant Need and Desire to Share Data Is Obvious*
- *How to Facilitate Data Sharing in this Environment?*
  - *Database Approach*
  - *Staged Process*
  - *Prototypes*

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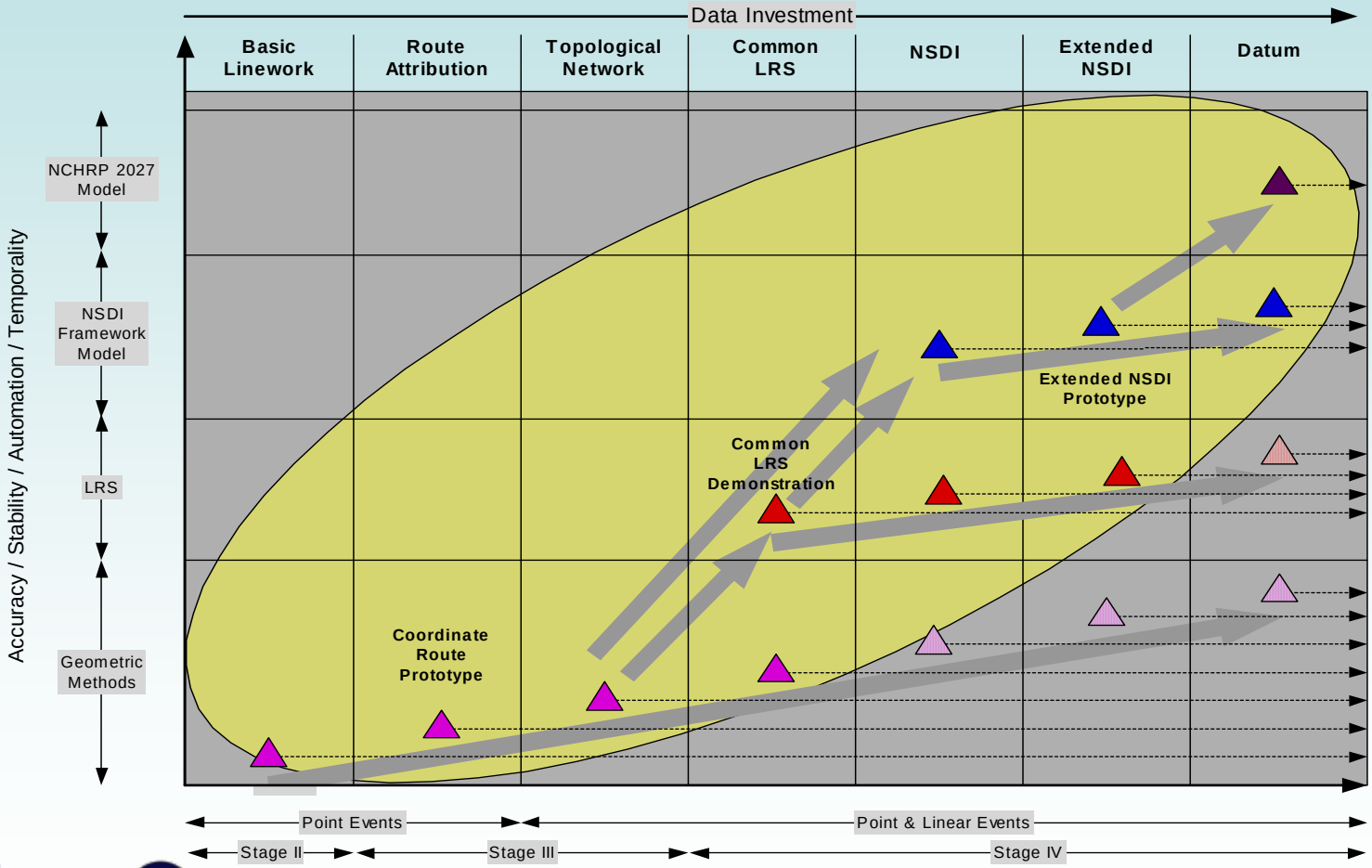
The "Technology Ramp"



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Coordinate Route Model

A combination of geometric location (x,y) and a unique road identifier to transfer information between multiple network representations.

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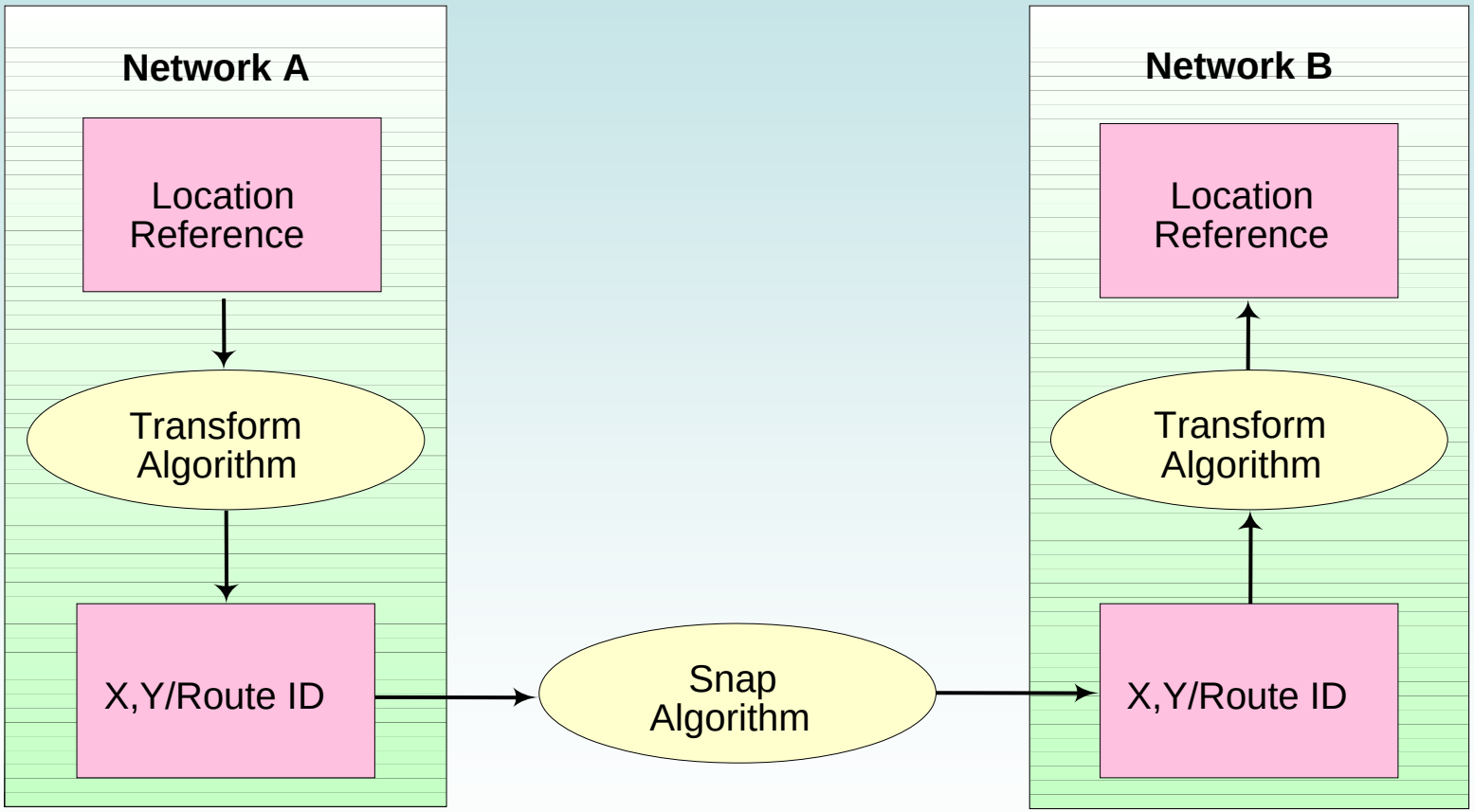
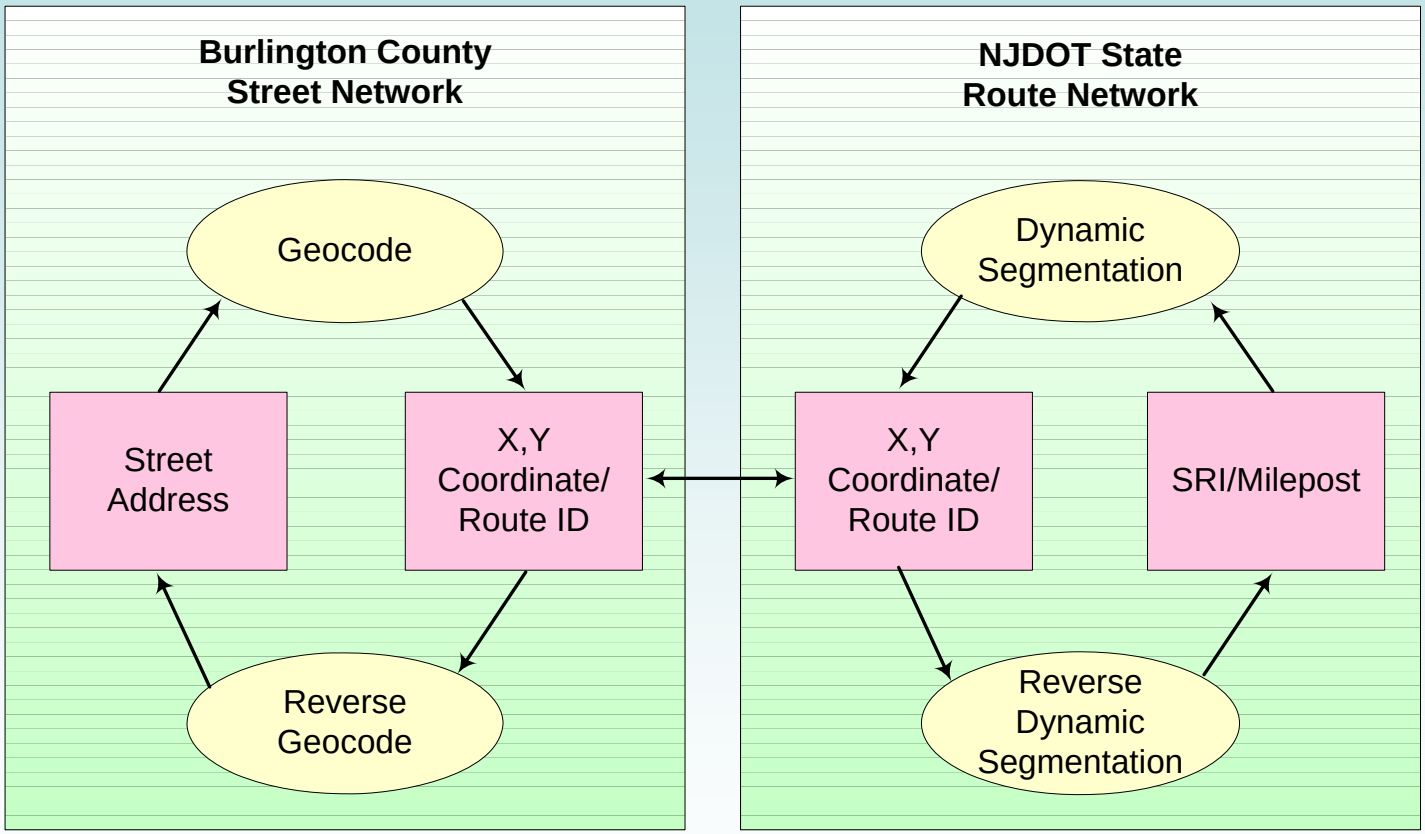
Coordinate Route Model



Coordinate Route Model Prototype



Transformations within a Network

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Coordinate Route Model

Benefits of the Coordinate Route Approach

- *Each entity can collect its transportation event information as it currently does, as long as it includes Route ID and coordinates.*
- *Departments of Transportation can collect information in Route/Milepost or County/SR/Segment and Offset format.*
- *Local governments can collect information as street addresses, known address points, or x,y coordinates (Lat/Long) from GPS systems.*
- *Compatible with many COTS packages including ArcView and GeoMedia.*

Coordinate Route Model

Tradeoffs of the Coordinate Route Approach

- There is no support for linear events due to no underlying connectivity model in the system.
- The ad-hoc approach used for data sharing could have additional data management costs.

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Common LRS Model

Use of a common linear referencing system to transfer event information between multiple agencies using dynamic segmentation.

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Common LRS Model

The data requirements for the Common LRS approach are:

- ***A source/destination network pair attributed with the same linear referencing system composed of route identifiers and measured lengths for the routes.***
- ***A set(s) of either point or line event data that contains both the unique route identifier and the offset information.***
- ***Appropriate Dynamic Segmentation software that can take the event data and place the events at the correct locations along the network.***

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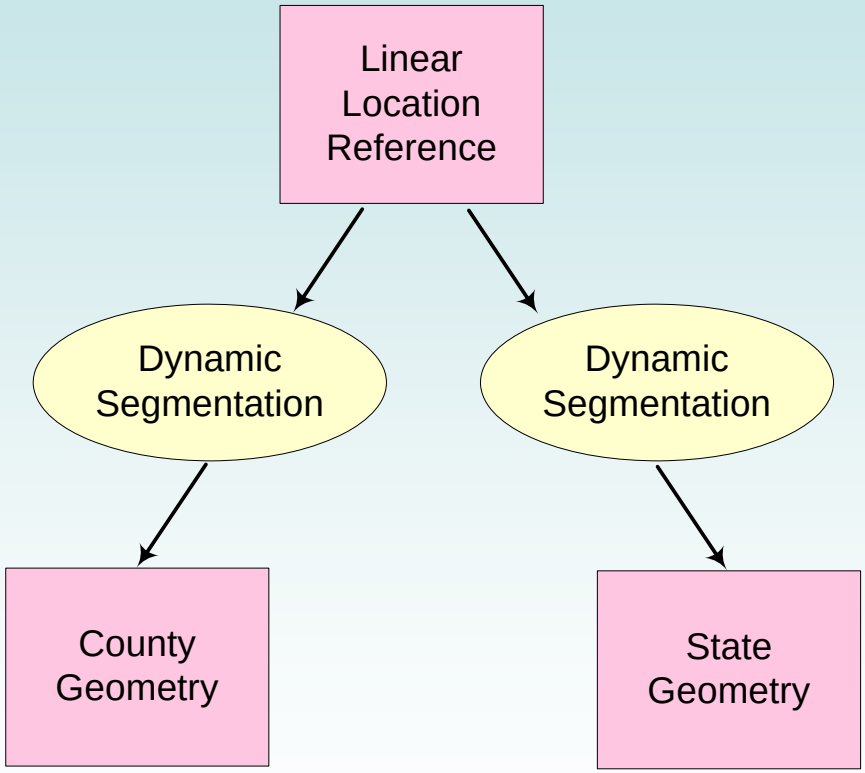
Common LRS Model



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Common LRS Model

Benefits of this Approach

- ***The ability to handle both point and linear event data.***
- ***Centralized authority is not required but can be utilized for government agencies not wanting to purchase/implement dynamic segmentation software.***
- ***Compatibility with higher-end COTS GIS packages.***
- ***Stable and accurate transformation between networks.***

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Common LRS Model

Tradeoffs of this Approach

- ***Requires a common linear referencing system to be adopted by all constituents.***
- ***To support linear events, the underlying transportation networks must have topological connectivity. This may require additional data investments to be made.***
- ***The ad-hoc approach used for data sharing could have additional data management costs.***

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NSDI Approach

- ***Framework based on equivalenced network components that tie multiple networks together***
- ***Definition and construction of a master network which represents a superset of all participant networks***
- ***Provides a single-base reference system that can be used to map between disparate "local" reference systems***

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NSDI Approach

Data Requirements

- ***A set of participant networks containing data that is linearly referenced.***
- ***A master data representation to be used in the master network.***
- ***To support linear events, the underlying transportation networks must have topological connectivity.***
- ***A defined equivalence table for each participant network that maps the data to the master network***
- ***A centralized database must be provided to host the master network .***
- ***A sponsor to host and manage the master network for all constituents must be established.***

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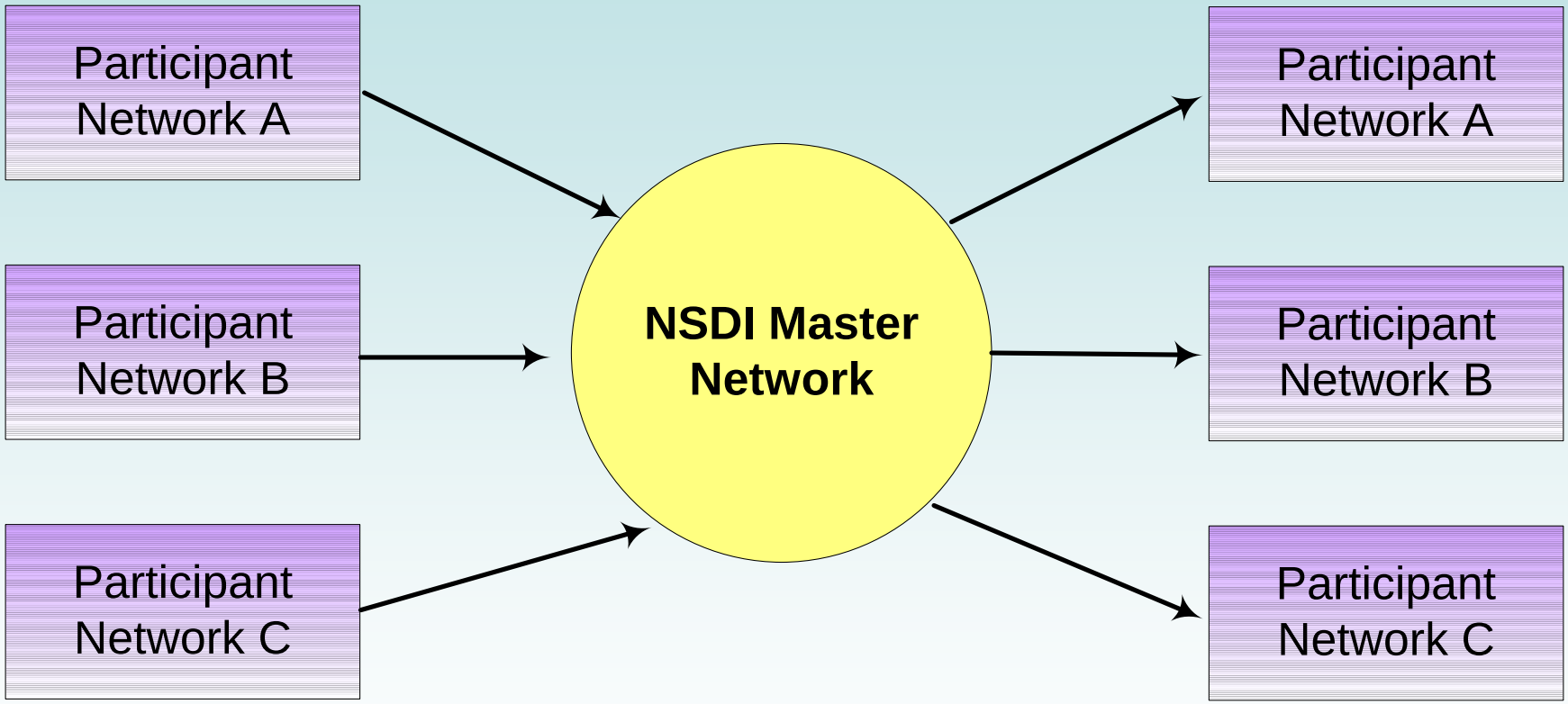
NSDI Approach



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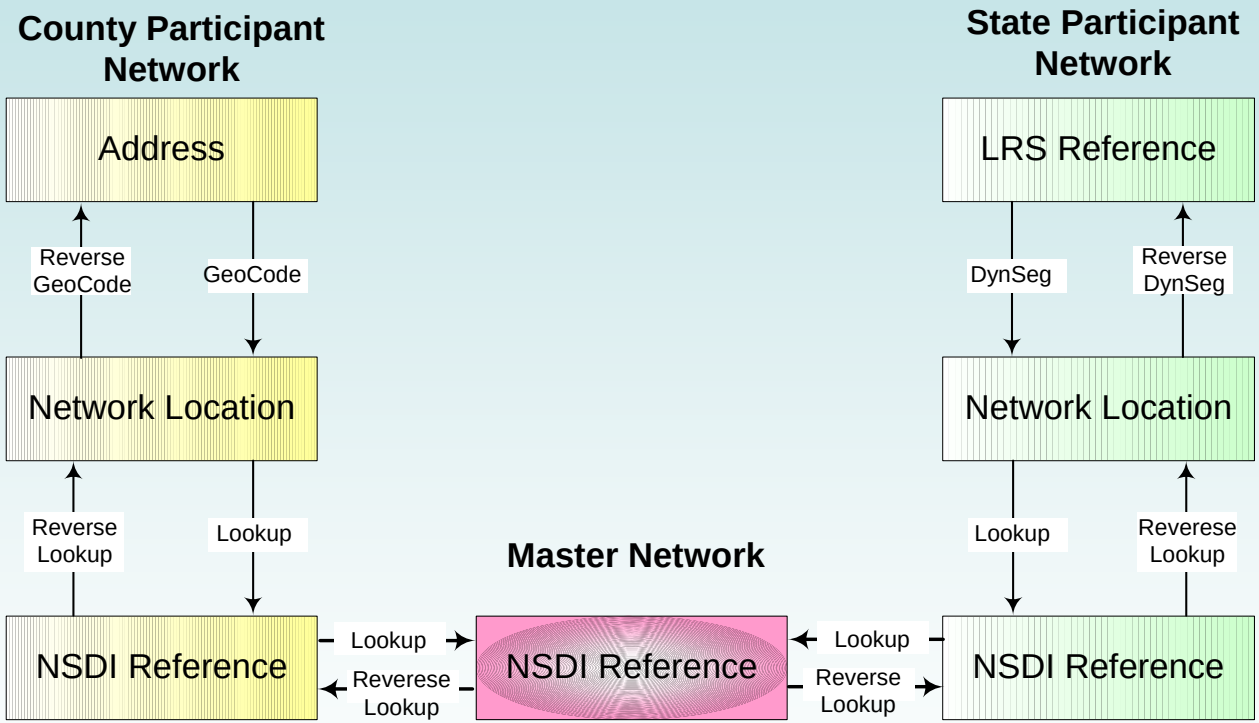
NSDI Approach



NSDI Transformations

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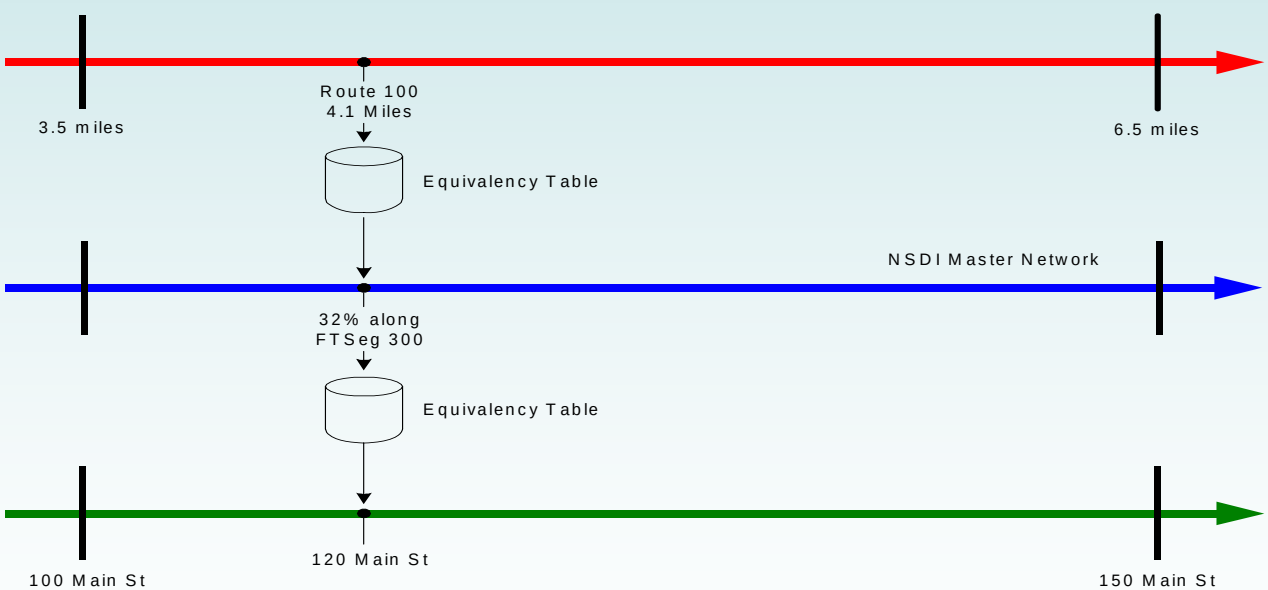
NSDI Approach

Example 1: State Route to County Road Transformation



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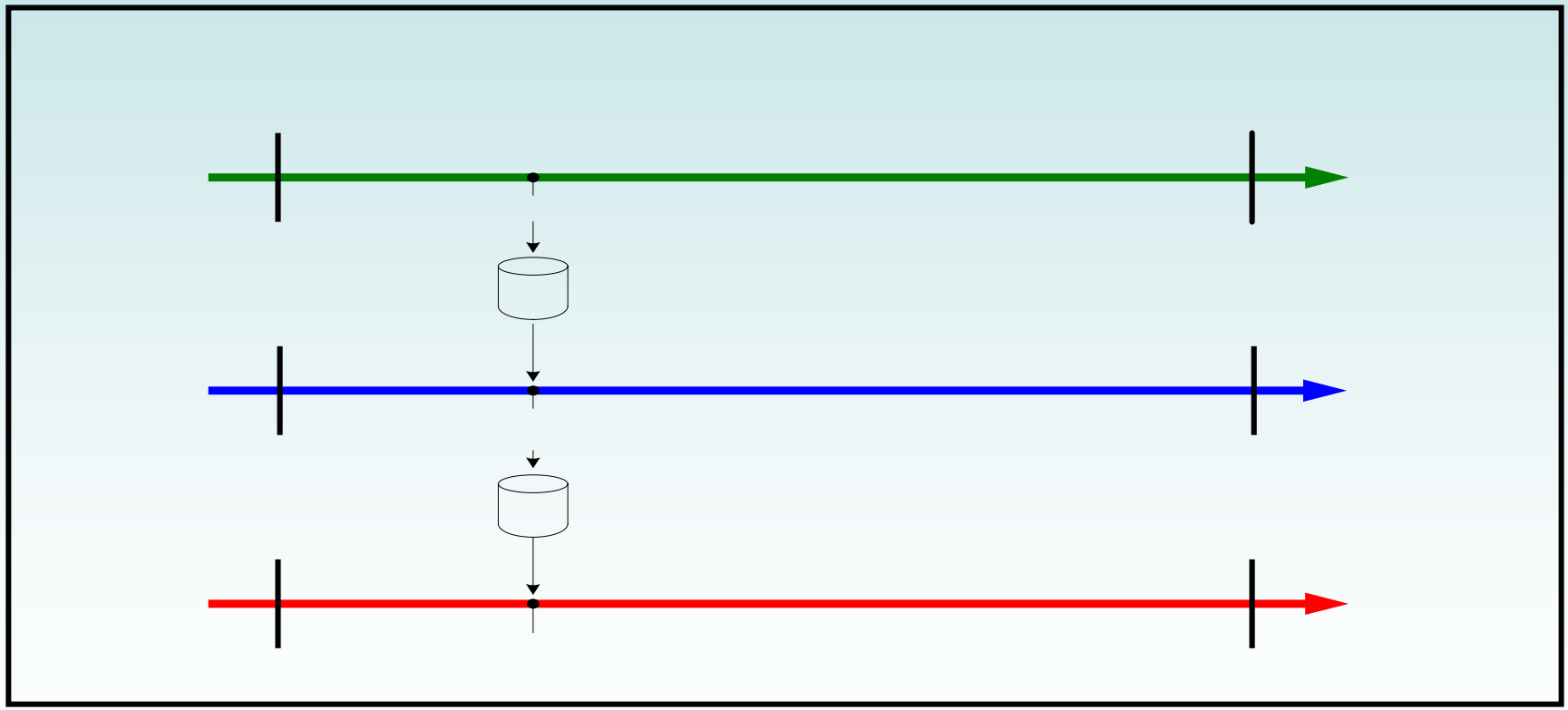
NSDI Approach

Example 2: County Road To State Route Transformation



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NSDI Approach

Benefits of this Approach

- *NSDI provides a highly stable transformation model.*
- *Compatible with many COTS packages, including ArcView and GeoMedia.*
- *Provides a basic framework for developing temporal references.*
- *Handles non-spatial networks (TranPlan, EMME/2, etc.).*
- *Does not require common reference framework (scale, projection, attribution, etc.).*
- *Provides a collaboration framework for external organizations to participate (FHWA, neighboring MPO's, and states).*

Tradeoffs of the Extended NSDI Approach

- *Sponsored centralized management and maintenance of the network is required. This is less of an issue for State DOTs as they would be a likely candidate for stewardship of the centrally managed solution.*
- *An equivalency table must be developed and maintained for each participating agency.*
- *To support linear events, the underlying transportation networks must have topological connectivity. This may require additional data investments to be made.*

Final Recommendations

Adoption of Common LRS Model

- *Most feasible and practical solution*
- *Leverages current technology and data*
- *Provides path up the "Technology Ramp"*
- *NJDOT Model in New Jersey*
- *PennDOT Model in Pennsylvania*

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What's Next?

- *The adoption and implementation of the tactical plans*
- *The development and adoption of official LRS components for each State Consideration of other transportation modes (Railroads, transit facilities, etc.)*
- *Continued communications and commitment*

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