POLARIS

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POLARIS

(Planning and Operations Language for Agent-based Regional Integrated Simulation)

- Mandates from FHWA:
  1. Model Traffic Control Centers and other ITS Systems
  2. Enhance Interoperability among Existing Tools

- Core Goals and Philosophies of the POLARIS Effort:
  - Develop Transportation Modeling Standards and Protocols
  - Create an **Open Source** Model Development Environment and "Concept" Repository
  - Seek Out Opinions from and Actively Listen to the Transportation Community
  - Separate Model Functionality from Computational Logistics
  - Offer Tools and Structure without Inhibiting Developer Flexibility, Code Modularity, or Performance
  - Foster Cooperative Model Development Among Many Diverse Groups

Confluent Trends Shaping Transportation Modeling

- Existing models previously considered unrelated have realized the need to interoperate with one another to answer more complex questions
- Computational capabilities have crossed a threshold such that a transportation simulation can model large scale high fidelity systems in a reasonable time frame
- Significant advances in data collection, intelligent transportation system technologies, and new transportation modeling theories beg for inclusion in these more comprehensive models
- Matured research is readily available in highly applicable fields such as: artificial intelligence, agent based modeling, the computational sciences, and video game engine design

Common Conceptual Threads in Transportation Models

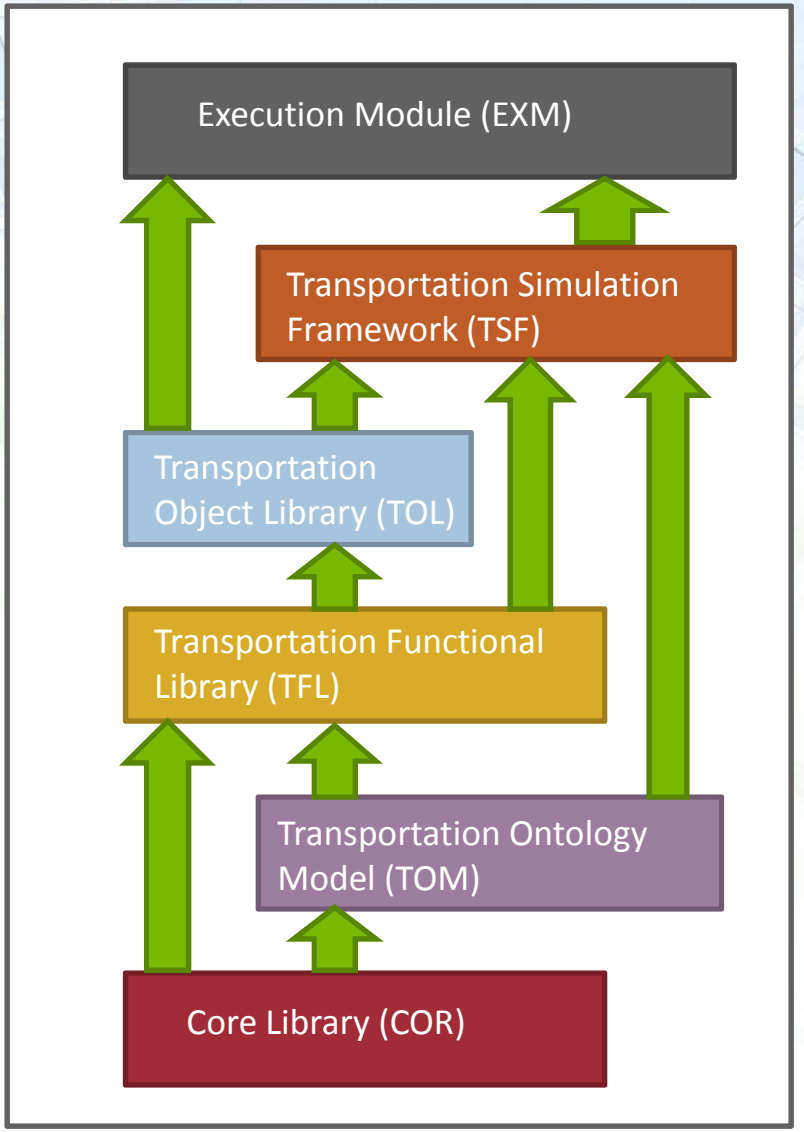
- Differing descriptions of attributes, behaviors, and conceptual organization of the same real world transportation objects and agents: travelers, traffic signals, vehicles, roadways, etc…
- Discrete event simulation evolves the multi-agent system's behavior to more cost effectively test the outcome of practical decisions and develop intuition about real world behavior
- Iteration routines calibrate model parameters to seek optimal and/or real world solutions
- Conceptual disaggregation or aggregation of the real world objects and their behaviors are applied in order to mold and re-scope the model to answer specific questions

Who is the POLARIS User Community?

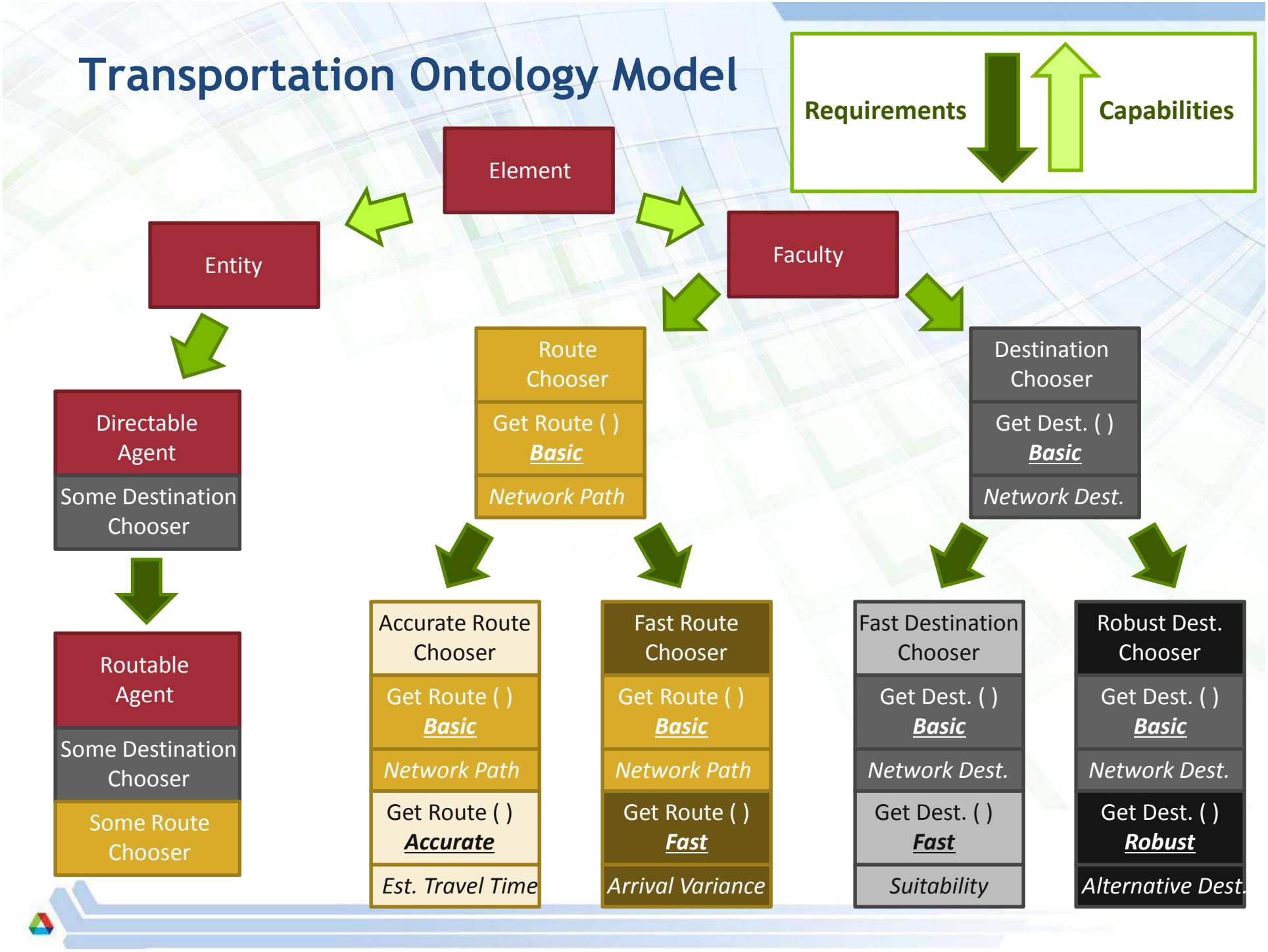
- Transportation Researchers
  - Test and validate theories in an integrated environment quickly and easily
  - Refine and expand the transportation ontological model and add building blocks to the transportation functional and object libraries
- Integrated Transportation Model Developers
  - Weave together model components developed by researchers
  - Bring in new technologies and connect with existing models of interest
- Transportation Modelers
  - Apply models created by the Integrated Model Developers
  - Solve real world problems using POLARIS

POLARIS Component View

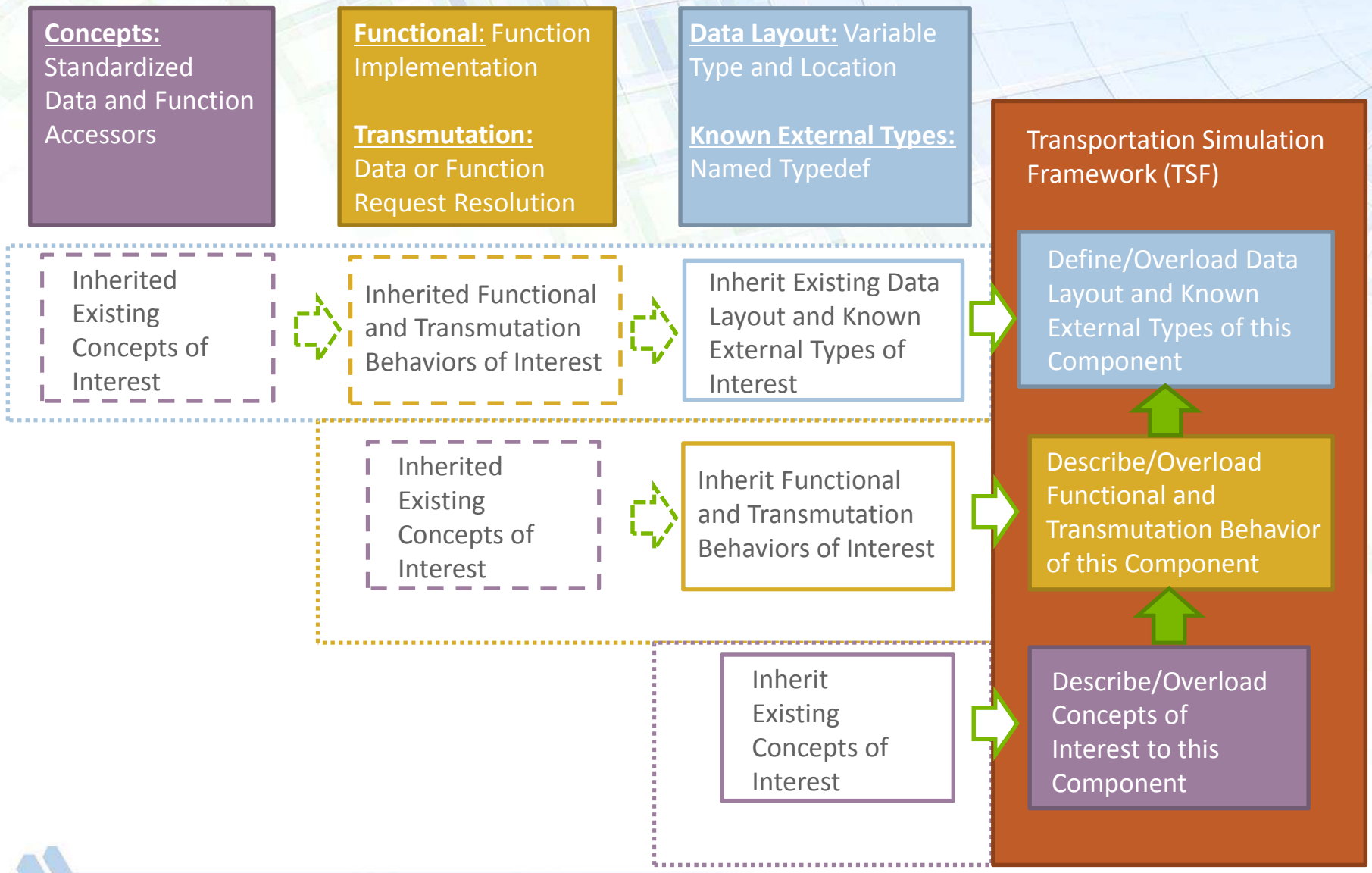
- COR: Data Layout, Memory Management, and Parallel Execution Scheduling
- TOM: Ontological Representation of Transportation System Components
- TFL: Description of Transportation Object Functionality
- TOL: General Purpose Pre-Configured Transportation System Building Blocks
- TSF: Sandbox for User-Defined Components
- EXM: Simulation Initialization and Execution



Transportation Ontology Model



The POLARIS Component Construction Process



Specific Developer Tools Provided by POLARIS

- High Performance Memory Manager
- Automated Data Placement Service
- Resource Constrained Task Scheduling
- Adaptive Dependency-Aware Task Execution Engine
- Automated Thread Parallelization
- Compile Time Polymorphism
- Thread Safe Data Structures

The Long View of the POLARIS Effort

- Initial Phase: *Design in Full, Implement in Part*
  - Proof of Concept Prototype
  - Integrated Model Case Study
  - Interoperable Model Case Study
  - Limited Release
- Follow Up Phase: *Clean Up, Implement in Full*
  - Focus on Usability and User Interface
  - Improve Core Algorithms
  - Stress Testing, Beta Testing, and Full Release
- Final Phase: *Technology Transfer, Community Adoption*
  - Create User Interaction and Collaboration Faculties
  - Training Courses, Presentations, and Research Papers
  - Foster and Support Project Growth