EPA's Plan for MOVES: A Comprehensive Mobile Source Emissions Model

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MOVES

- **M**ultiscale
- m**O**tor
- **V**ehicle & equipment
- **E**mission
- **S**ystem

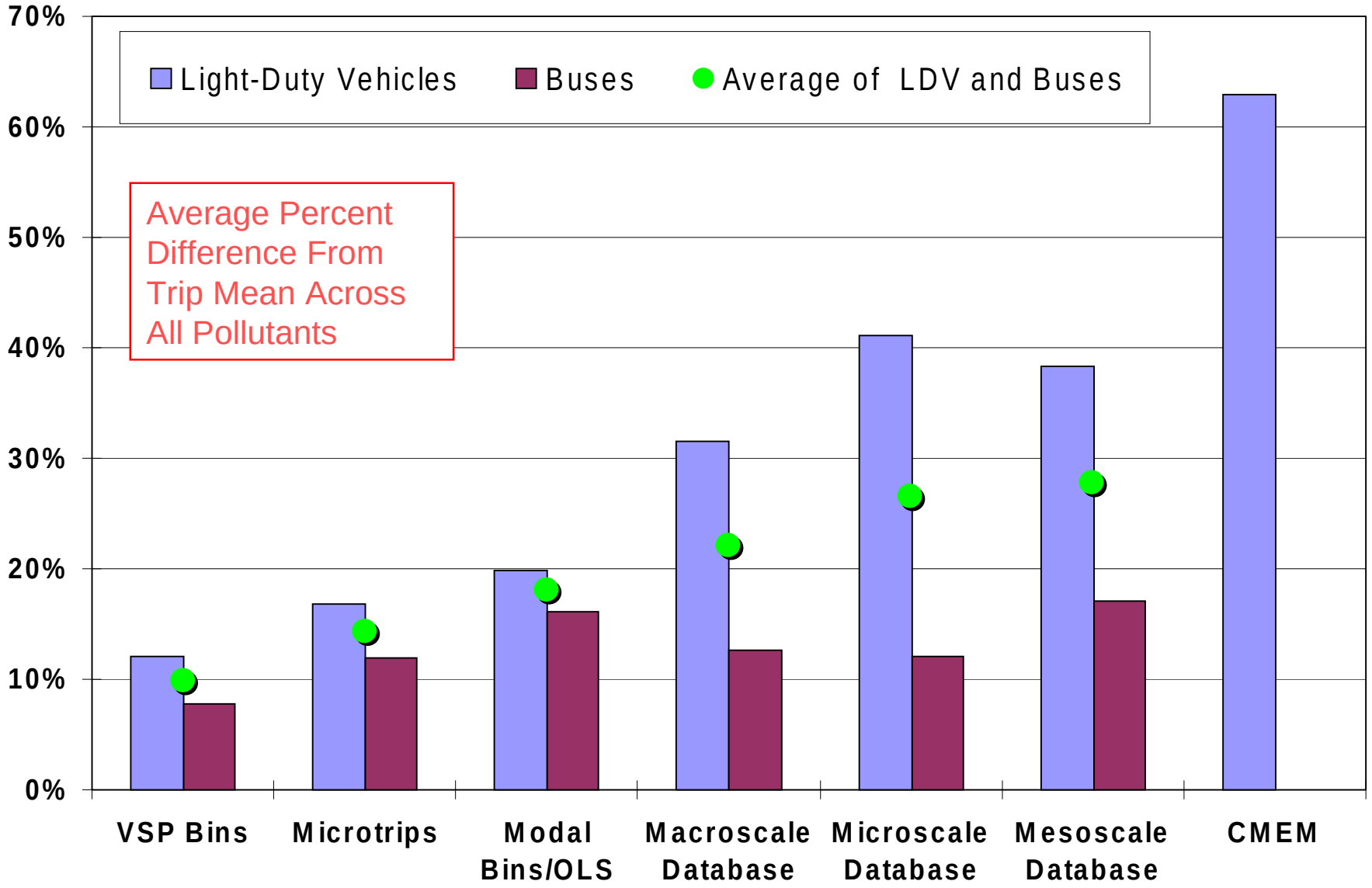
MOVES "Use Cases"

- Multi-scale analysis
  - Macroscale Inventories (EPA Reports, SIPs)
  - Mesoscale Inventories (SIPs, Conformity)
  - Microscale Analyses (e.g. hot spot / project level)
- Transportation/AQ model linkage
- Policy evaluation
- Model validation and uncertainty
- Model updates and expansion

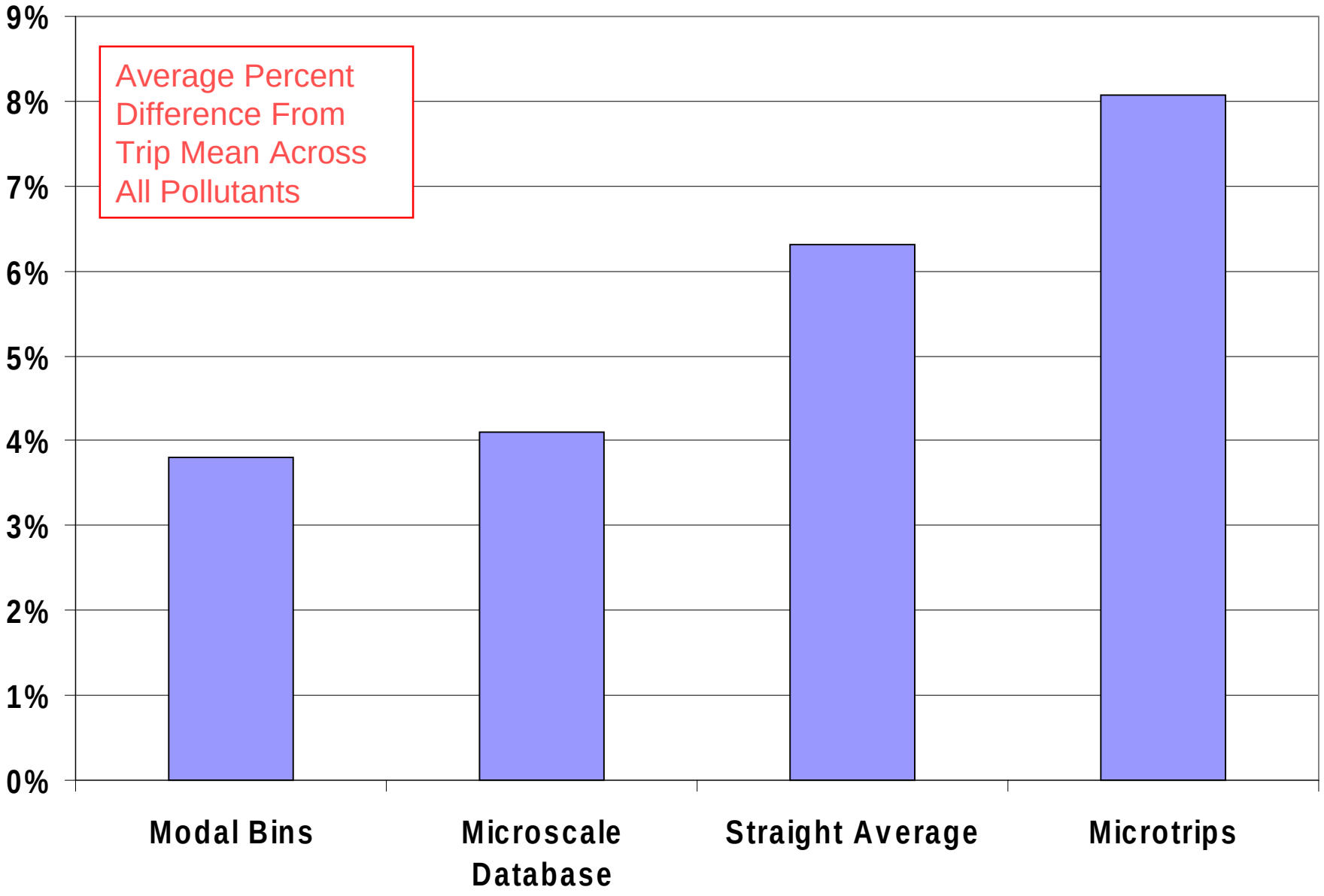
Judging the Shootout

- Criteria 1: Performance
  - On-Road Validation
    - 3 independent vehicles/ 6 trips each for LD & HD
    - Prediction of trip-average emissions across all pollutants
  - Off-Road Validation
    - Same 3 equipment pieces, 1 additional hour of operation
    - Prediction of total emission across 3 equipment pieces
- Criteria 2: Feasibility of Application

Summary Results: On-Road



Summary Results: Off-Road



Observations

- VSP is an excellent metric for characterizing emissions
- Empirical modal binning approaches simple & effective
  - VSP Binning
  - Modal Bins / OLS
- Database approach hurt by small dataset
- Aggregate approach may be sufficient for off-road

Assessing Feasibility Criteria

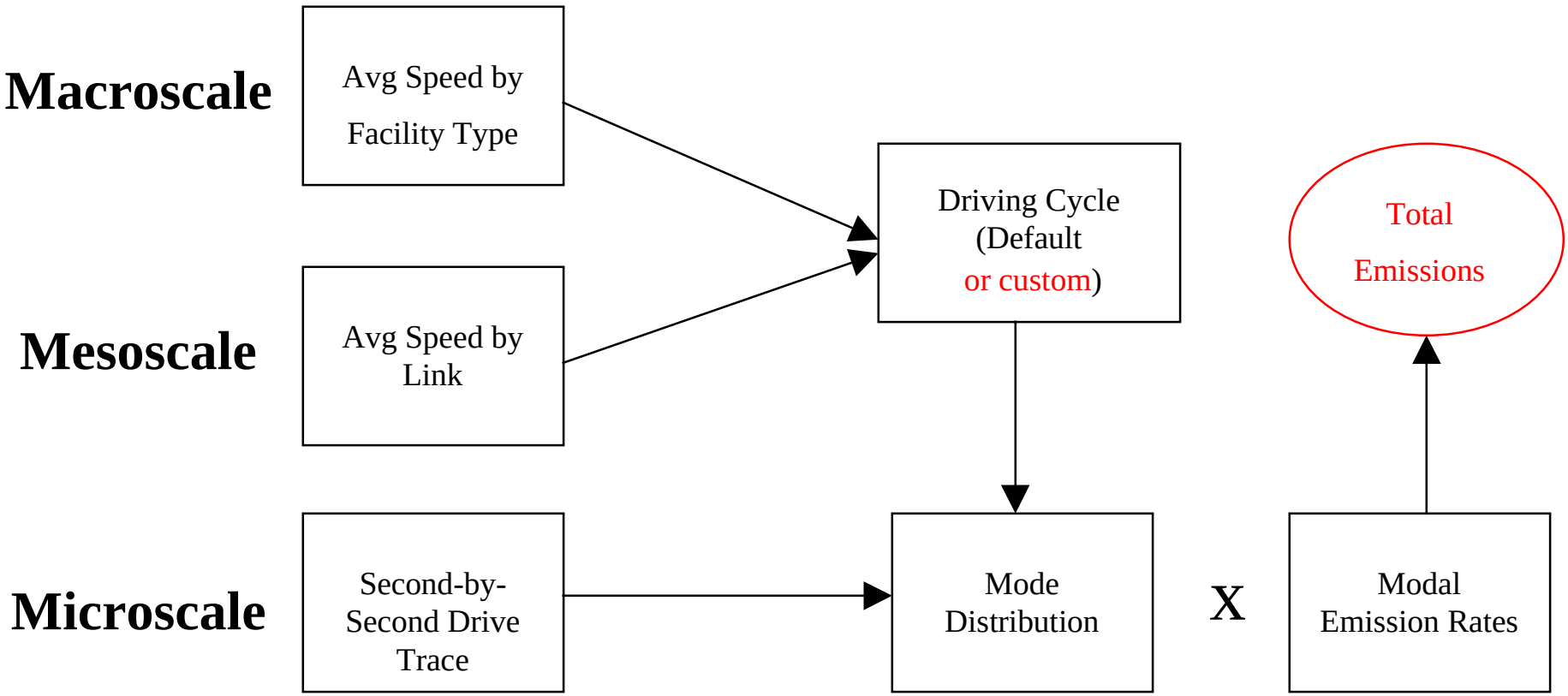
Feasibility Criteria	Physical Model	Modal Binning	Database	Microtrip
Consistent Across Scales?	X	X		
Easily Updated?		X	X	X
Can Incorporate Many Data Sources?		X	X	
Software Efficiency?	X	X		X

Preliminary Conclusion:

Modal binning shows most overall promise for MOVES

Applying Modal Emissions

Running Exhaust Process



Phase 2 Evaluation

- Competitive contract (one award)
- Evaluate binning methods on several data sources
  - Laboratory second-by-second (EPA MOBILE6 Cycles)
  - On-Board Data (Shootout)
  - IM240 Data (Denver)
  - RSD Data (CRC Denver 2000)
  - Laboratory bag (CMEM Dataset)
- Evaluate uncertainty methodologies
- Validate with independent test results

Emission Processes

Combustion Products	Hydrocarbon Evaporation	Other
Tailpipe Running Exhaust	Diurnal	A/C Refrigerant Leakage
Tailpipe Start Exhaust	Hot Soak	Brake Wear
Crankcase	Resting Loss	Tire Wear
	Running Loss	
	Vehicle Refueling	
	Fuel Leakage	
	Offgassing	

Generic Core Model Design

- Core model steps (apply to any scale/source/process):

Loop By Space & Time

1. Estimate total activity

   e.g. Vehicle Hours Operating (VHO)

2. Distribute across fleet bins/operating modes

   e.g. Mileage Bin, VSP Bin

3. Get emission rate for each fleet bin/operating mode

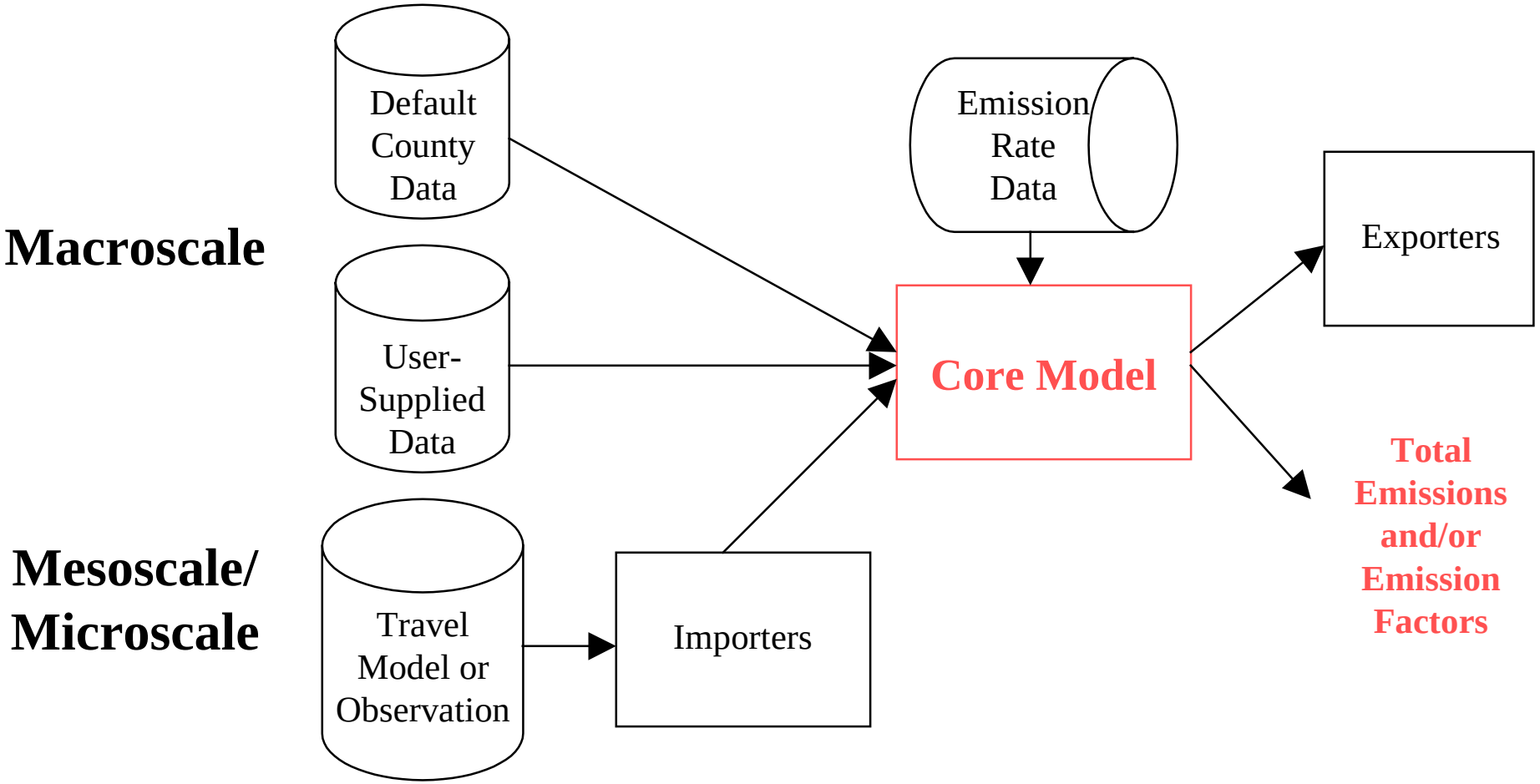
   e.g. Gram/Second emission rate by Mileage Bin, VSP bin

4. Aggregate across all fleet bin/operating modes

   $\sum$ (Total Activity * Frequency $_{BIN/MODE}$ * Emission Rate $_{BIN/MODE}$)

- Add front & back ends to implement use cases

MOVES Data Flow Overview



Model Quality

- New EPA guidance on model quality planning requires Quality Assurance Project Plan:
  - Model quality objectives and assessment
  - Coding and documentation standards
  - Stakeholder and scientific peer review
- EPA Peer Review Guidelines
  - Recommends Independent Peer Review Panel

Implementation Plan

- Interim Product: Fall 2002
  - Macroscale (county-level) inventory generation w/ MOBILE6.3 and NONROAD
- GHG On-Road Implementation: Fall 2003
  - CO_2, Air Conditioning HFCs, N_20, CH_4
  - Macroscale only
- Full On-Road Implementation: Fall 2005
  - Adds HC, CO, NOx SOx, PM, NH_3, air toxics
  - Mesoscale/Microscale capability

Next Steps

- Planning Documents
  - Conceptual Design & Theory: Summer 2002
  - Emission Analysis Methodology: Fall 2002
  - Quality Assurance Project Plan: Fall 2002
- More Information
  - http://www.epa.gov/otaq/ngm.htm
  - Posted soon:
    - Shootout - Contractor Reports and EPA Overview/Results
    - EPA-OAQPS Emission Inventory Conference Paper