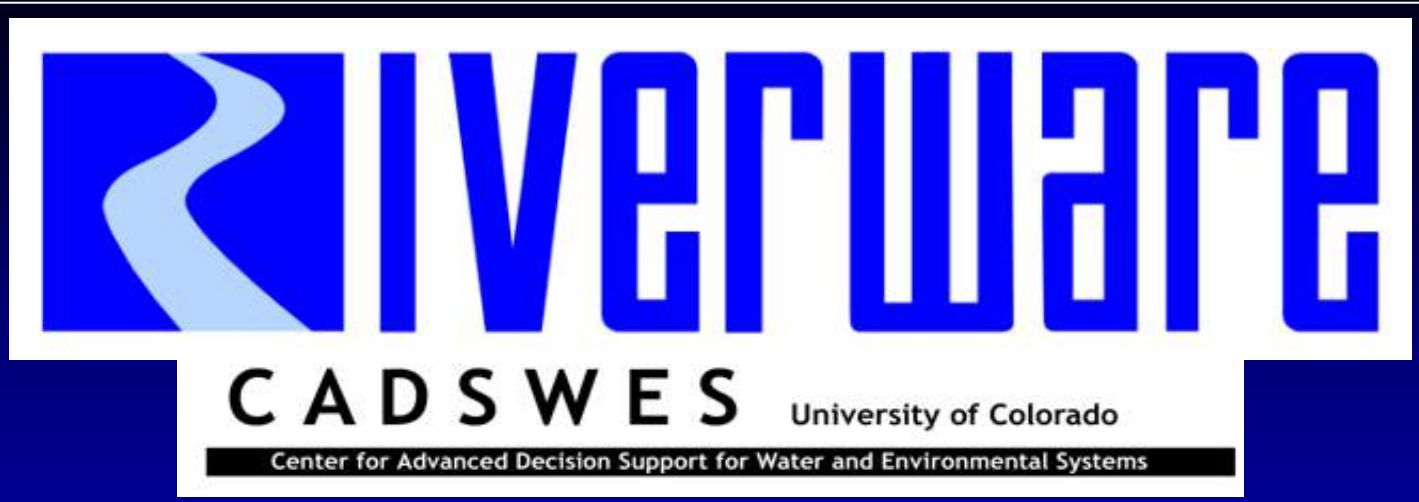


RiverWare Optimization

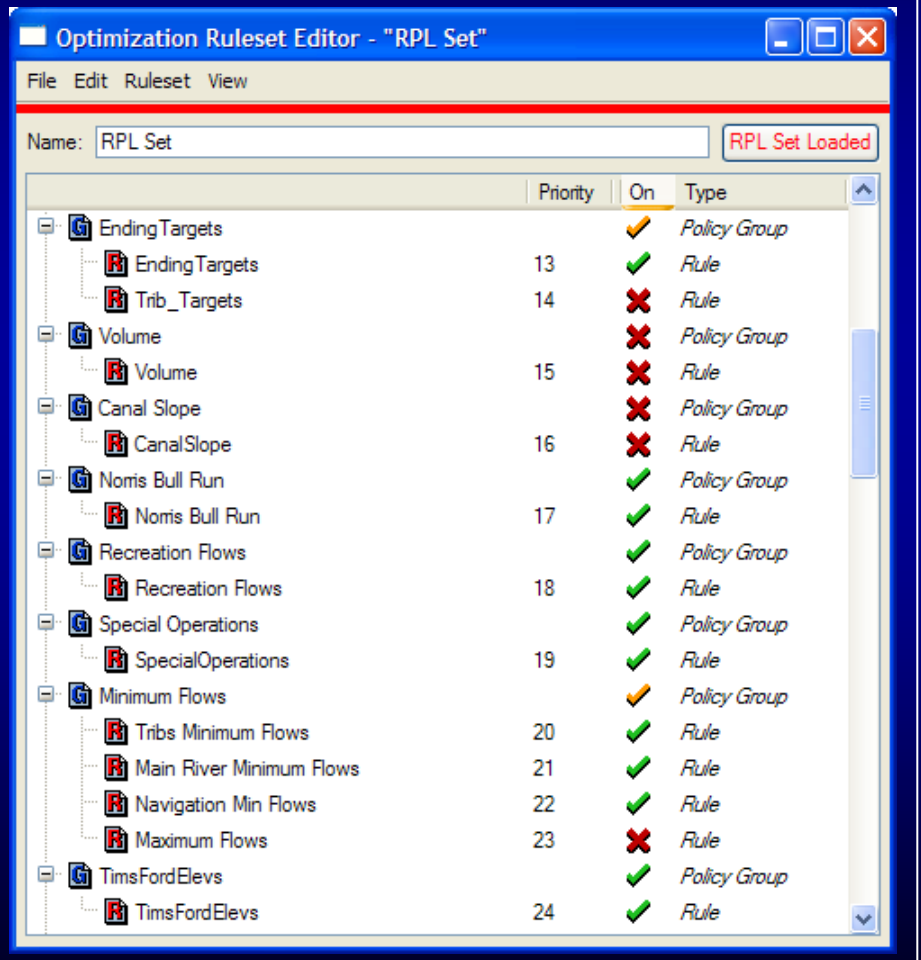
RiverWare User Group Meeting
August 13-14, 2008

Outline

- What is RiverWare Optimization?
- RPL-based Optimization
- Integer Programming & Unit Power Modeling
- Other Developments

Similarity Between Optimization and Rule Based Simulation

- Prioritized policy
  - From extreme conditions to normal operations
- Gradually remove the degrees of freedom from the solution

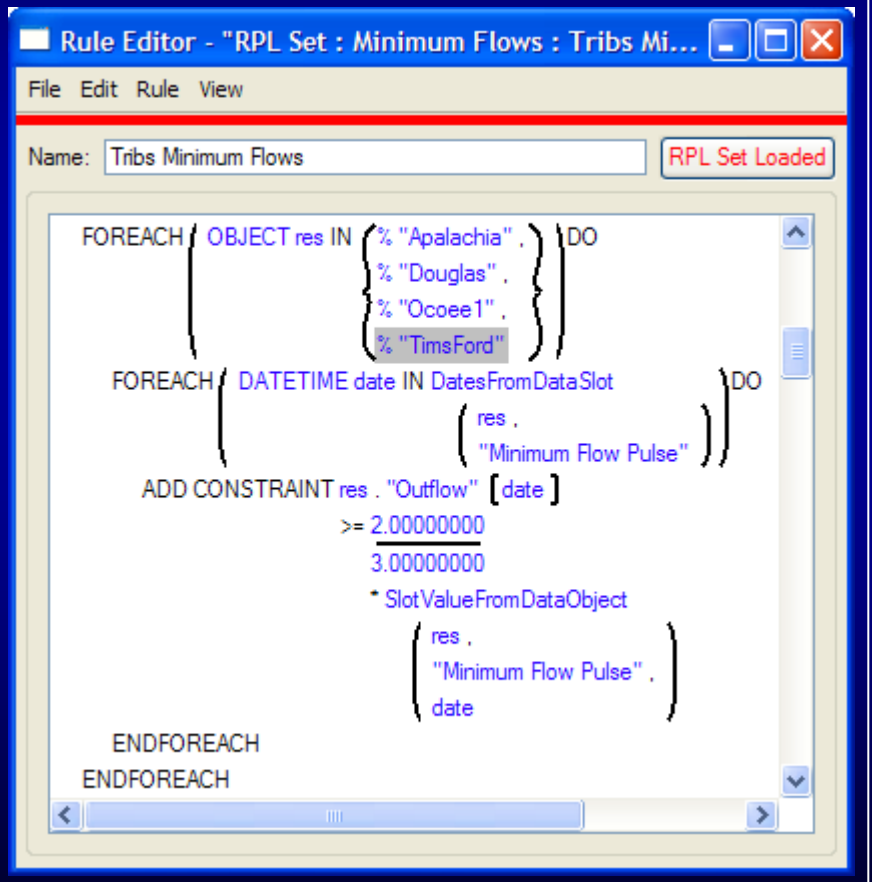


Main Differences Between Optimization and Simulation

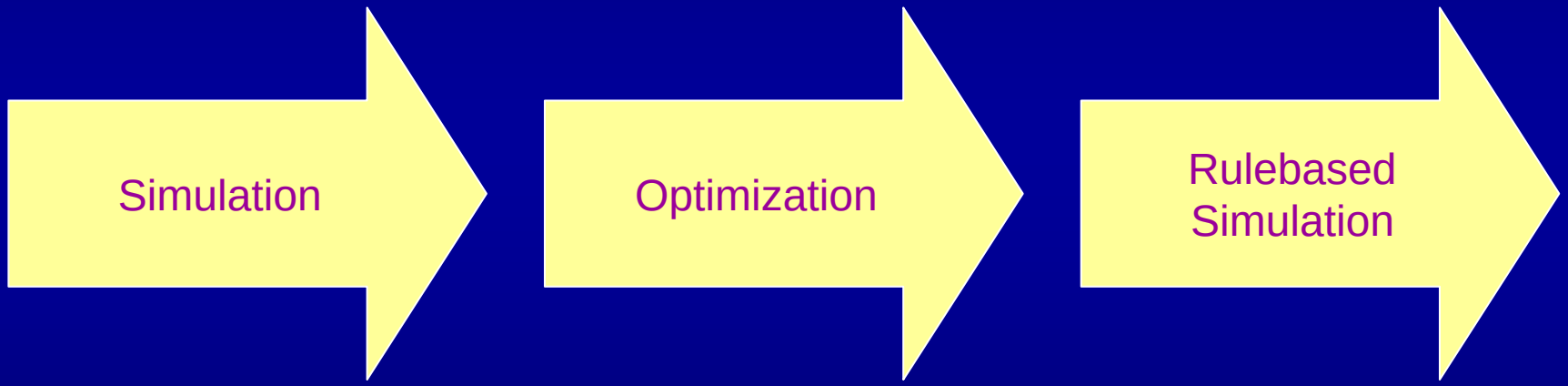
- Best solution vs. evaluating inputs or following rules
- Solve all time steps simultaneously vs. stepping through time steps
- Degrees of freedom
  - Equations and Unknowns vs. If-Then
- Approximation vs. Exact calculation
  - Nonlinear functions

RPL-based Optimization

- Policy is in RPL
  - Some statements added for optimization
- Finished Last Year
  - Replicated results of the Old Optimization
  - Similar run time to Old Optimization



A Typical Use of RPL-based Optimization



Compute consequences of input values

Solve a series of LP problems

Compute consequences of input values and selected optimal values

Integer Programming for Unit Power Modeling

- Integer Programming allows additional modeling
  - Discrete variables, a unit is on or off
  - Non-convex nonlinear functions, e.g. power
  - Power as a function of flow and head
  - Cavitation and vibration avoidance zones
  - Policies to prevent “holes” in generation
  - Startup Cost
  - Ancillary Services (Only regulation for now)

Solving Integer Programs

- Integer Programs are difficult
  - NP-Complete
- Branch and Bound
  - Compatible with the existing goal programming
  - Can prove an optimal solution with enough time
  - Expecting to use as a heuristic instead to reduce time
    - Near optimality with a measure of potential improvement

Integer Programming Status

- Mathematical design is done
- Software design is mostly done
- Coding has begun
- Finish this year

Other Developments

- Alternative Solver - postponed
- Developing a new training course for RPL-based optimization
- Additional ideas for improvement from TVA