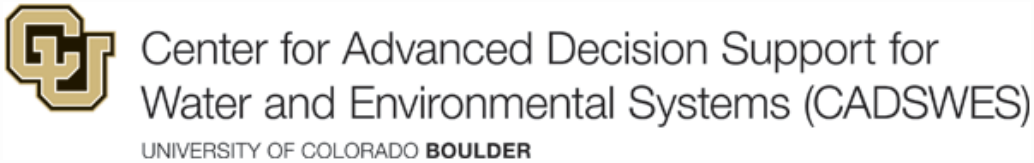




# RiverWare Integration into Modeling Frameworks

**2019 RiverWare User Group Meeting**

**David Neumann**

# Agenda

1. What are modeling frameworks
2. Four frameworks with integrated RiverWare models

# What are Modeling Frameworks?

- Frameworks allow models to work together
  - Modeling different processes
  - From different agencies
  - Written in different languages
  - Have different interfaces
  - Have different data formats
- Often, the framework provides a common interface for visualization and control

# Adapters

- Model integration is implemented using **adapters**
- A model adapter is the software that “bridges” between the framework and the model
  - Controls model execution
  - Communicates between the framework and models
  - May convert data to a common format

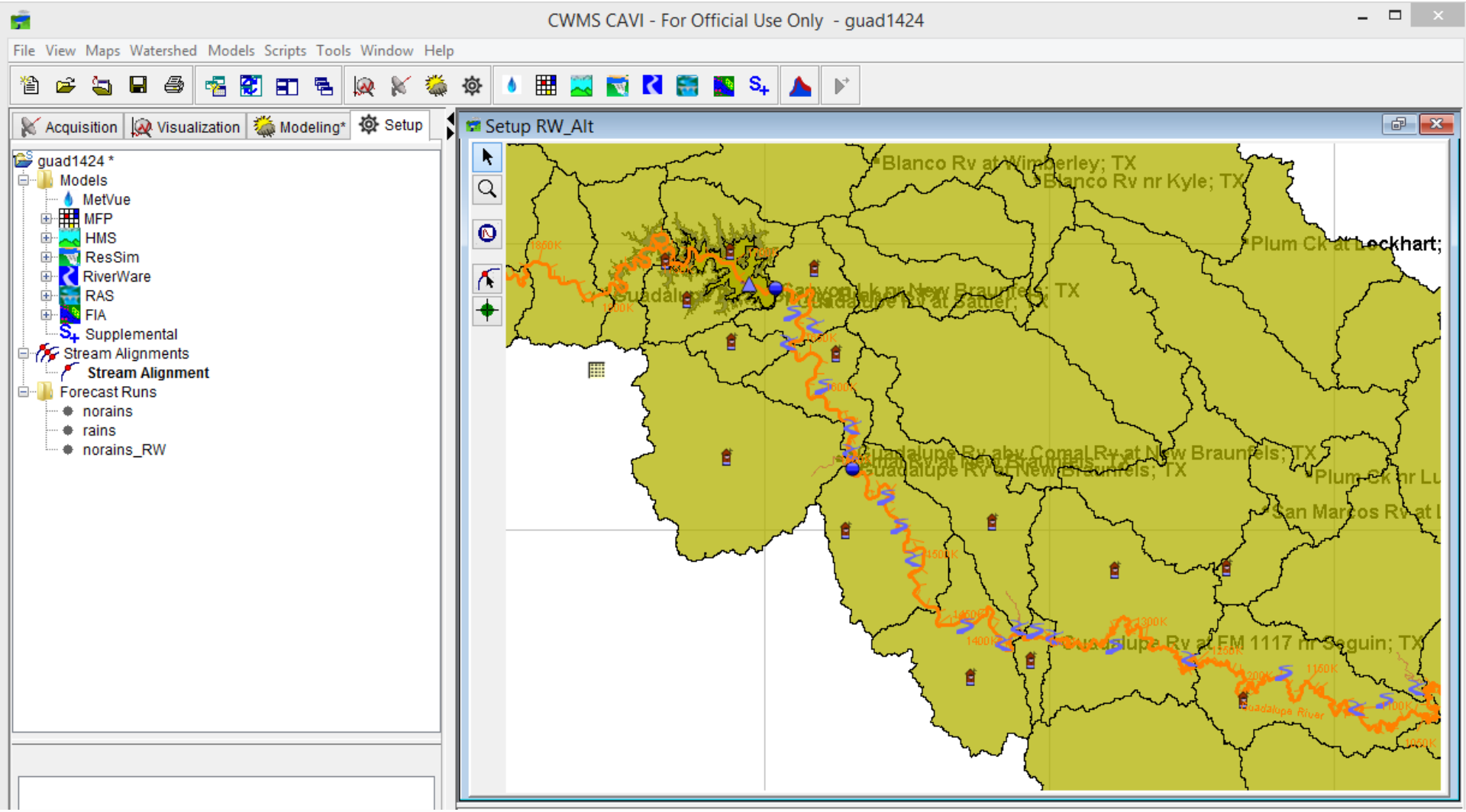
# Some Modeling Frameworks

- USACE CWMS
- USACE HEC-RTS
- USACE HEC-WAT
- Deltares Delft-FEWS

# Corps Water Management System (CWMS)

- USACE modeling framework that integrates these and other models together
  - HEC MFP – Precipitation forecast
  - HEC HMS – Rainfall runoff


  - HEC RAS – Flood inundation
  - HEC FIA – Flood Impacts Analysis
- Typically used for short-term operations


CWMS CAVI - For Official Use Only - guad1424
File View Maps Watershed Models Scripts Tools Window Help
Acquisition
Visualization
Modeling*
Setup
guad1424 *
Models
MetVue
MFP
HMS
ResSim
RiverWare
RAS
FIA
Supplemental
Stream Alignments
Stream Alignment
Forecast Runs
norains
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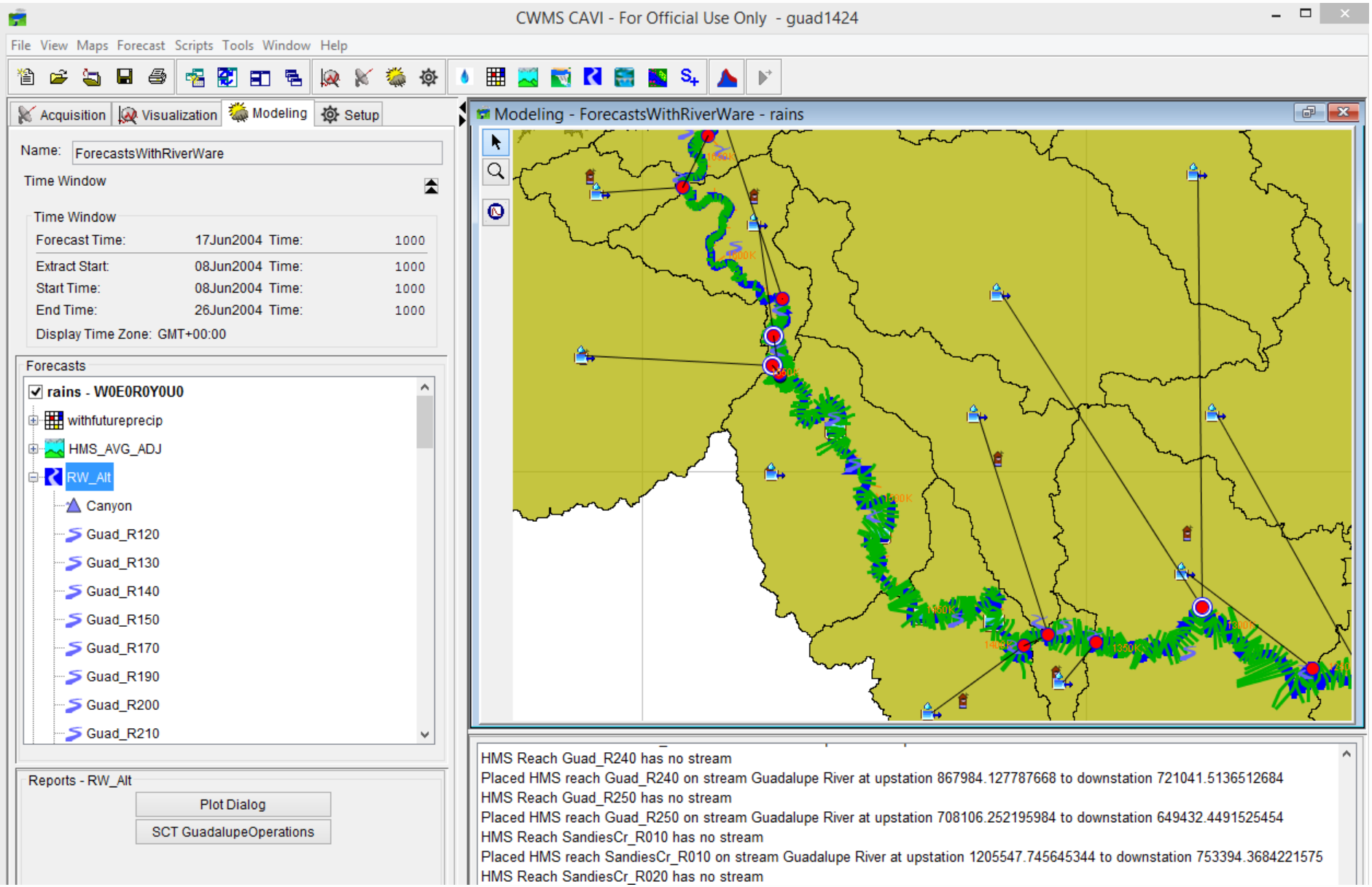
Setup RW_Alt
Blanco Rv at Wimberley; TX
Blanco Rv nr Kyle; TX
Plum Ck at Lockhart;
Guadalupe Rv abv Comal Rv at New Braunfels; TX
Guadalupe Rv at New Braunfels; TX
Guadalupe Rv at FM 1117 nr Seguin; TX
Guadalupe River


CWMS CAVI - For Official Use Only - guad1424
File View Maps Forecast Scripts Tools Window Help
Acquisition
Visualization
Modeling
Setup
Name: ForecastsWithRiverWare
Time Window
Time Window
Forecast Time: 17Jun2004 Time: 1000
Extract Start: 08Jun2004 Time: 1000
Start Time: 08Jun2004 Time: 1000
End Time: 26Jun2004 Time: 1000
Display Time Zone: GMT+00:00
Forecasts
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Guad_R200
Guad_R210
Reports - RW_Alt
Plot Dialog
SCT GuadalupeOperations
Modeling - ForecastsWithRiverWare - rains
HMS Reach Guad_R240 has no stream
Placed HMS reach Guad_R240 on stream Guadalupe River at upstation 867984.127787668 to downstation 721041.5136512684
HMS Reach Guad_R250 has no stream
Placed HMS reach Guad_R250 on stream Guadalupe River at upstation 708106.252195984 to downstation 649432.4491525454
HMS Reach SandiesCr_R010 has no stream
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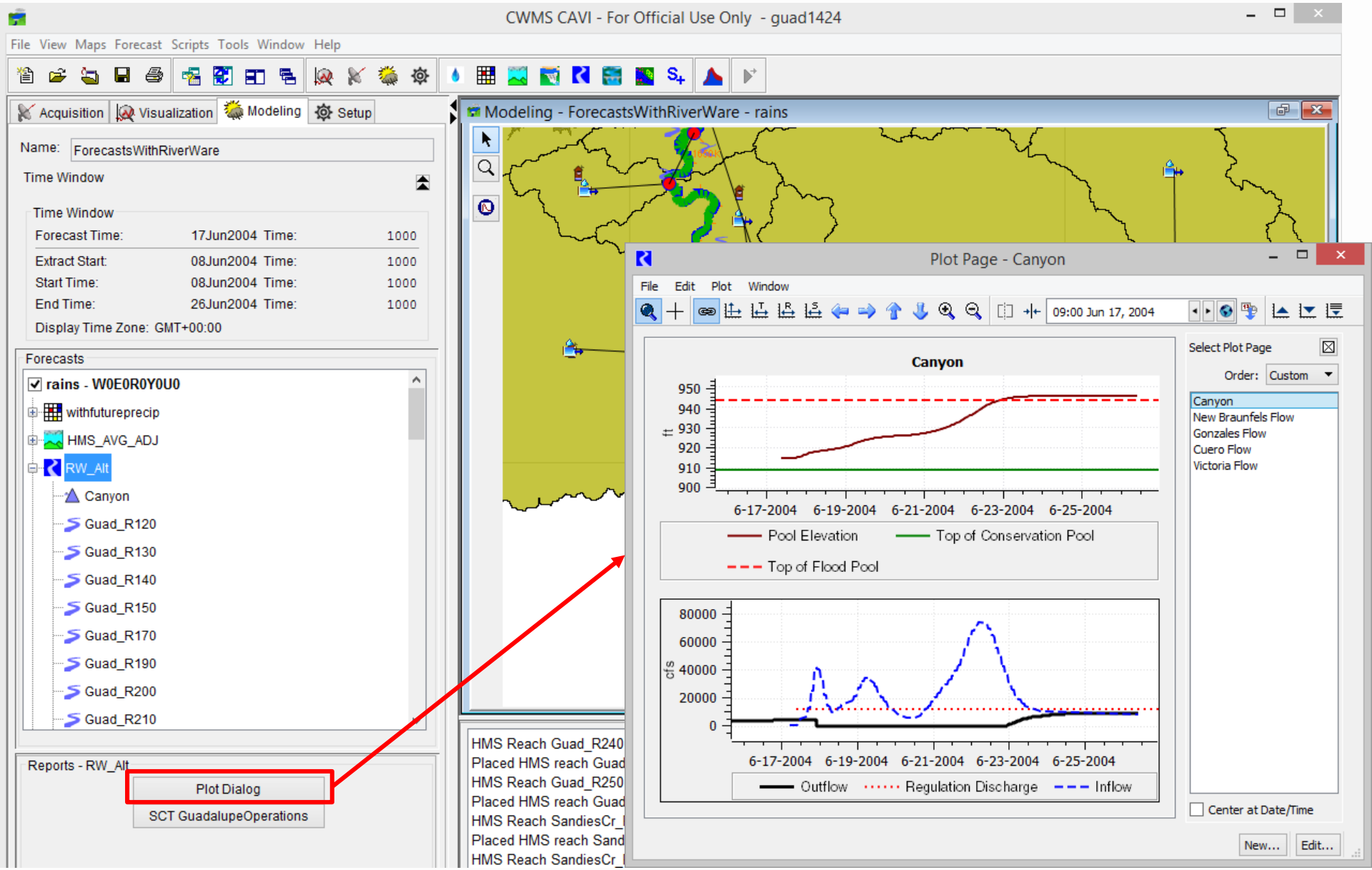
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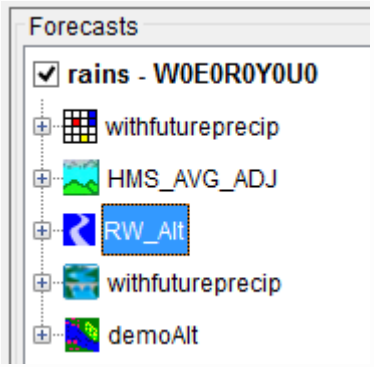
HMS Reach Guad_R240
Placed HMS reach Guad
HMS Reach Guad_R250
Placed HMS reach Guad
HMS Reach SandiesCr_
Placed HMS reach Sand
HMS Reach SandiesCr_
Plot Page - Canyon
File Edit Plot Window
09:00 Jun 17, 2004
Canyon
950
940
930
920
910
900
ft
6-17-2004 6-19-2004 6-21-2004 6-23-2004 6-25-2004
Pool Elevation
Top of Conservation Pool
Top of Flood Pool
80000
60000
40000
20000
0
cfs
6-17-2004 6-19-2004 6-21-2004 6-23-2004 6-25-2004
Outflow
Regulation Discharge
Inflow
Select Plot Page
Order: Custom
Canyon
New Braunfels Flow
Gonzales Flow
Cuero Flow
Victoria Flow
Center at Date/Time
New...
Edit...

# CWMS Interface opens these RiverWare Dialogs

- SCT
- Scripts
- RPL Sets
- Objects
- Plots
- Output Canvas
- Charts
- Workspace
- Diagnostics

# CWMS "Compute"

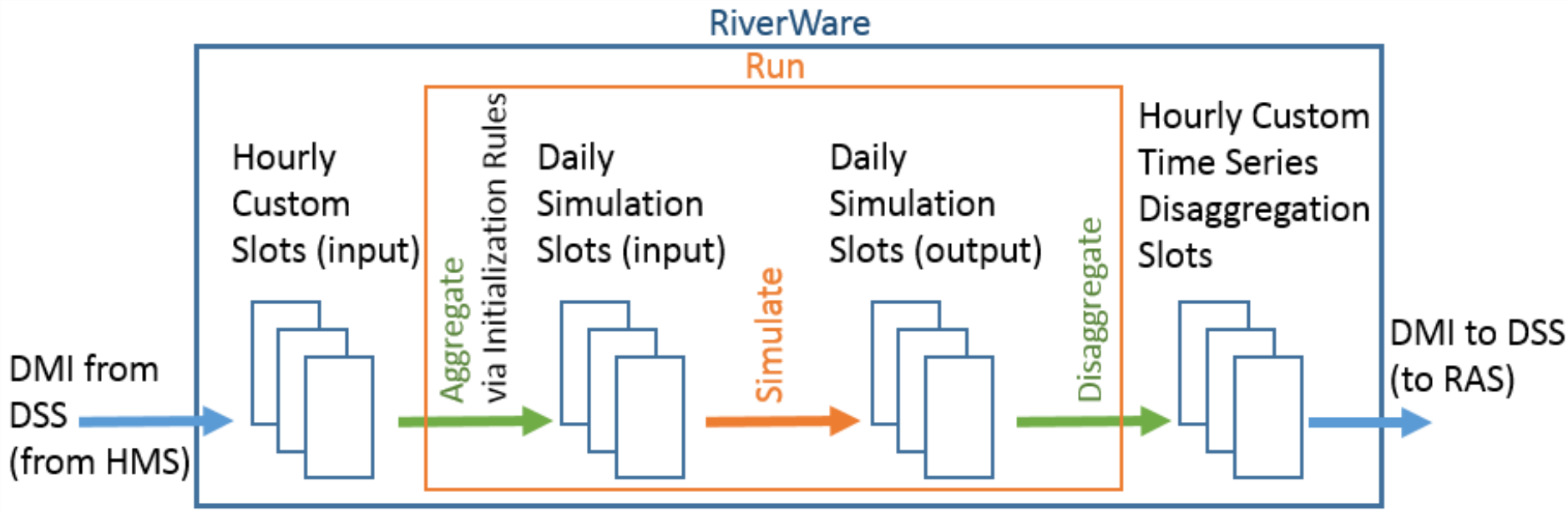
- Each model is run in sequential order
- Data is automatically loaded
  - Input data from previous model
  - Output data sent to the next model
- All models use HEC-DSS for data transfer
- RiverWare uses Database DMIs



# Development Status

- Recent Enhancements
  - Show additional dialogs
  - Better messaging and error handling
  - Saving of RiverWare model
- Upcoming
  - Aggregate / disaggregate data to different time scales
    - HMS models = 1hr
    - RiverWare = 1day
    - RAS = 1hr or 6hr

# Aggregation / Disaggregation




- Modifications to the CMWS RiverWare Plugin
- New RPL function to AggregateSeriesSlot
- New Time Disaggregation Series Slot

# USACE HEC – RTS

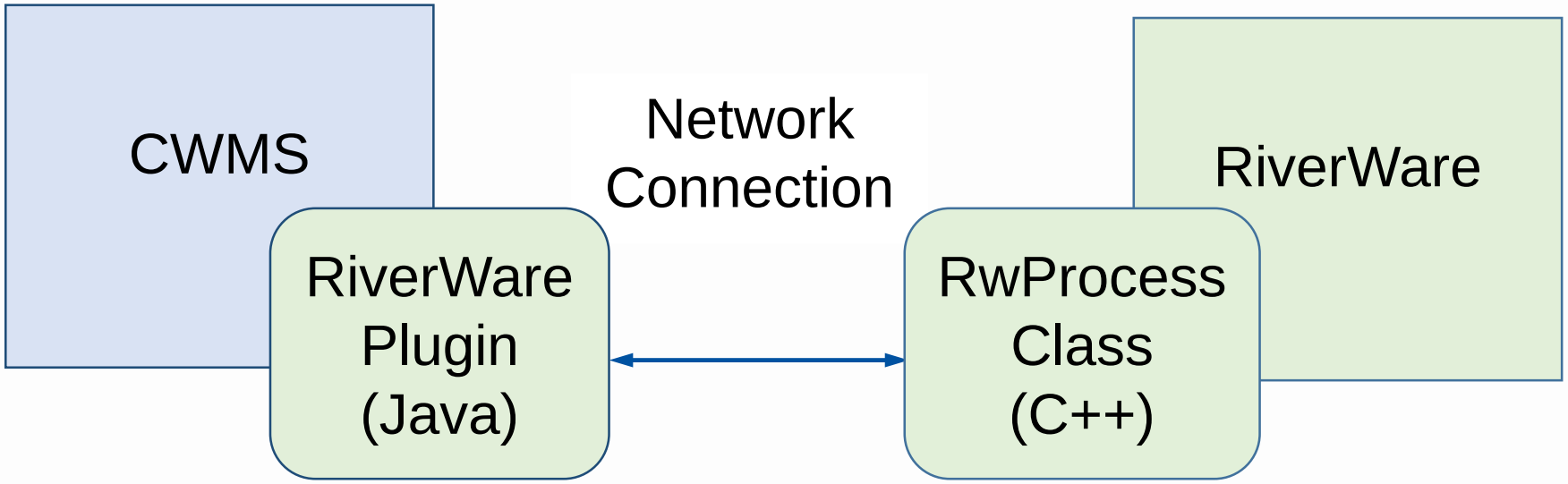
- **R**eal **T**ime **S**imulation
- Public version of CWMS
- CWMS RiverWare Plugin v1.0 Released 6/2019

# HEC – WAT

- **W**atershed **A**nalysis **T**ool
- Planning version of CWMS
- Adapter design finished in FY 2019
- Adapter implementation in FY 2020

# Adapter Architecture

CWMS, HEC-RTS and HEC-WAT Plugin executes RiverWare as server, communicating with RiverWare across a network connection



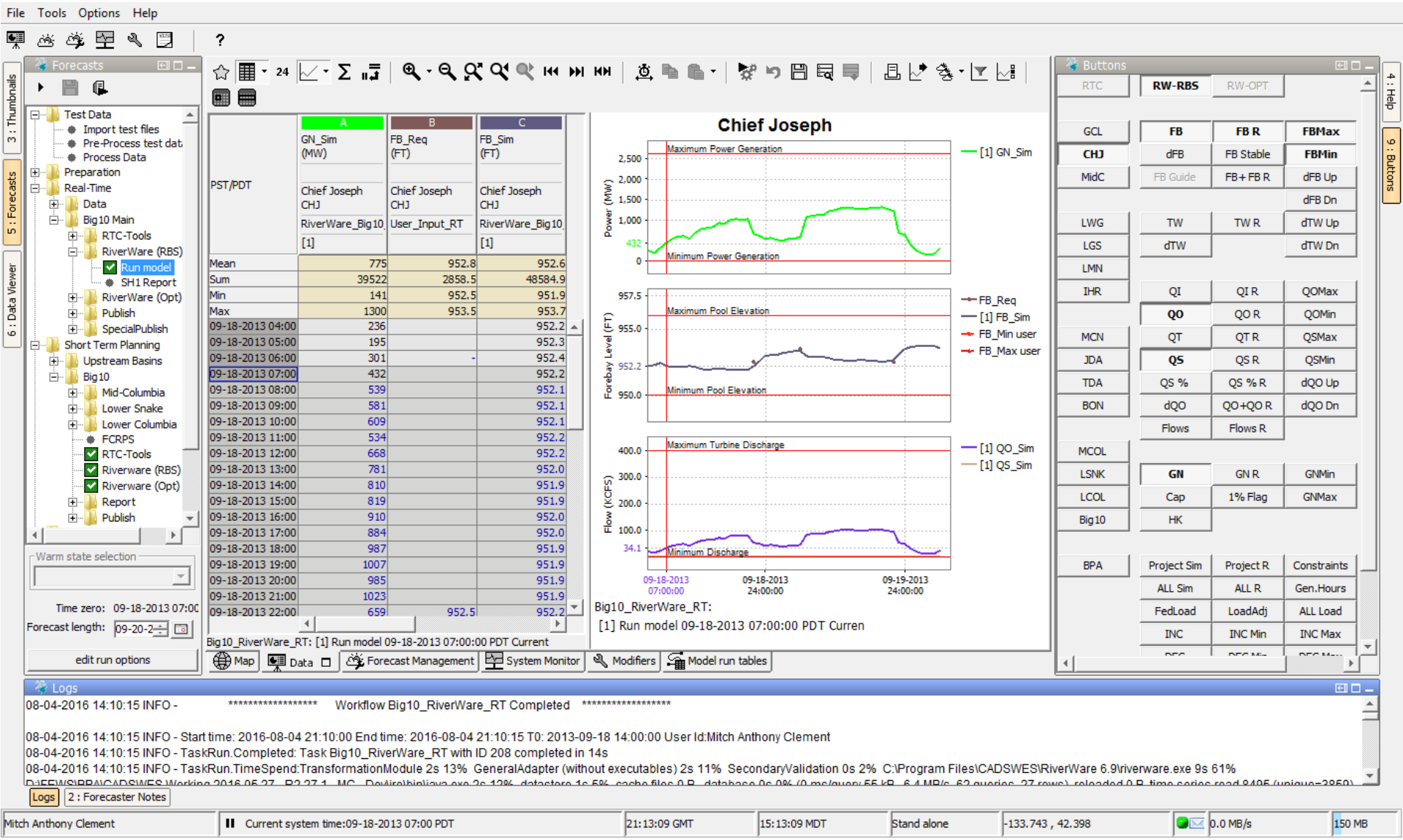
# Deltares Delft-FEWS

**F**lood **E**arly **W**arning **S**ystem

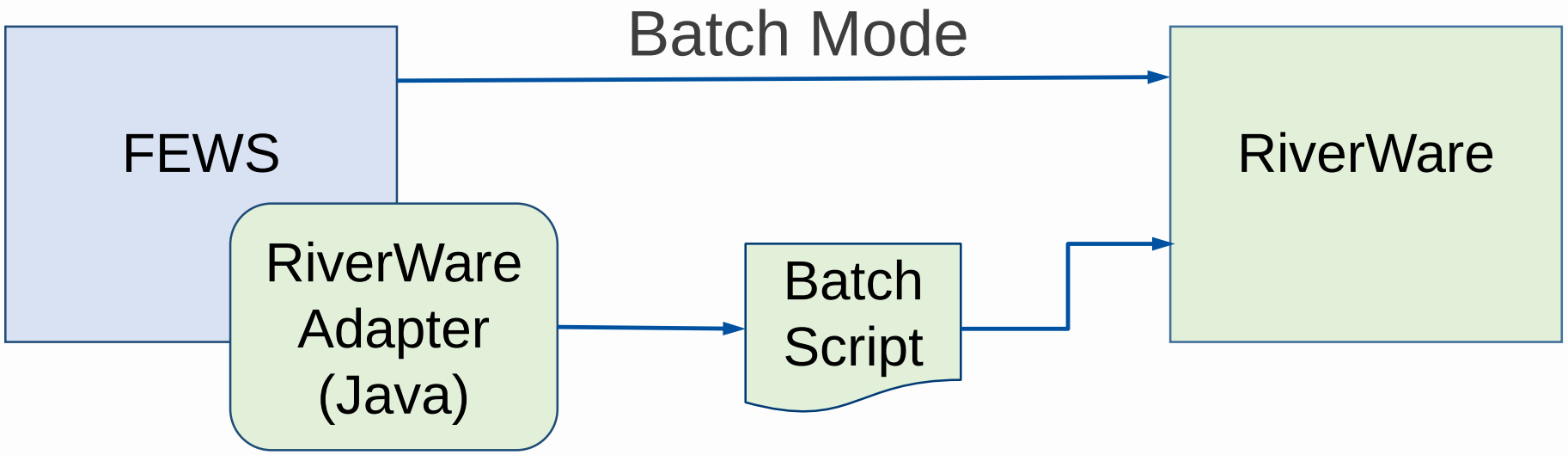
FEWS is a common platform and interface that

- Integrates multiple models to automate workflows
- Manages data
  - Automated data streams
  - Edit inputs
- Visualizes data and other model feedback
- Archives the models and data

# FEWS Interface



# FEWS Adapter Architecture



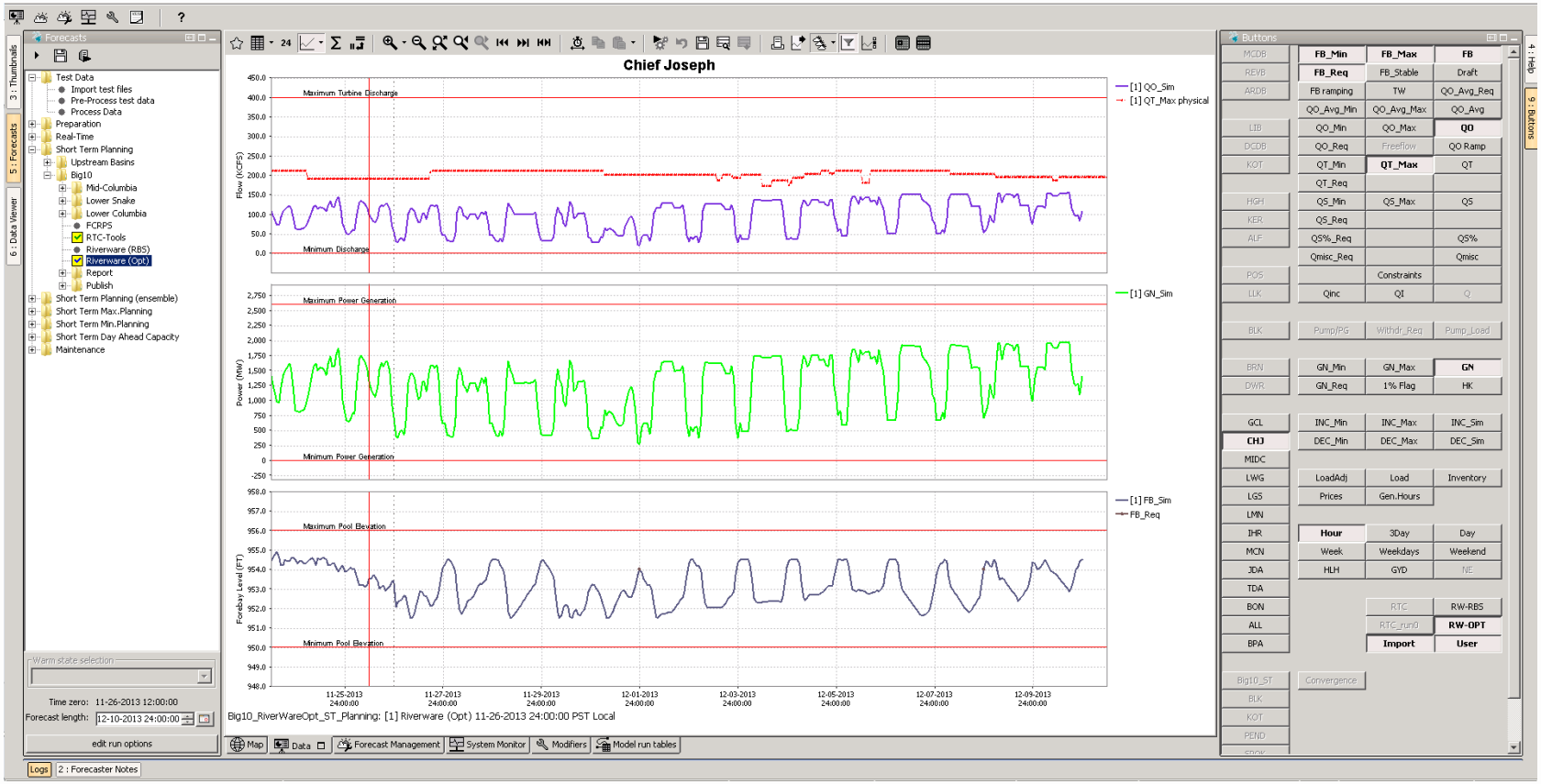

- Headless: run RiverWare in batch mode
- Interactive:
  - Batch mode sets up the run
  - Operator uses RiverWare interface
  - Sends data back to FEWS

# A few FEWS Applications

- **Bonneville Power Administration**
  - Short Term Planning
  - Real Time Scheduling

# FEWS Applications

## Bonneville Power Administration

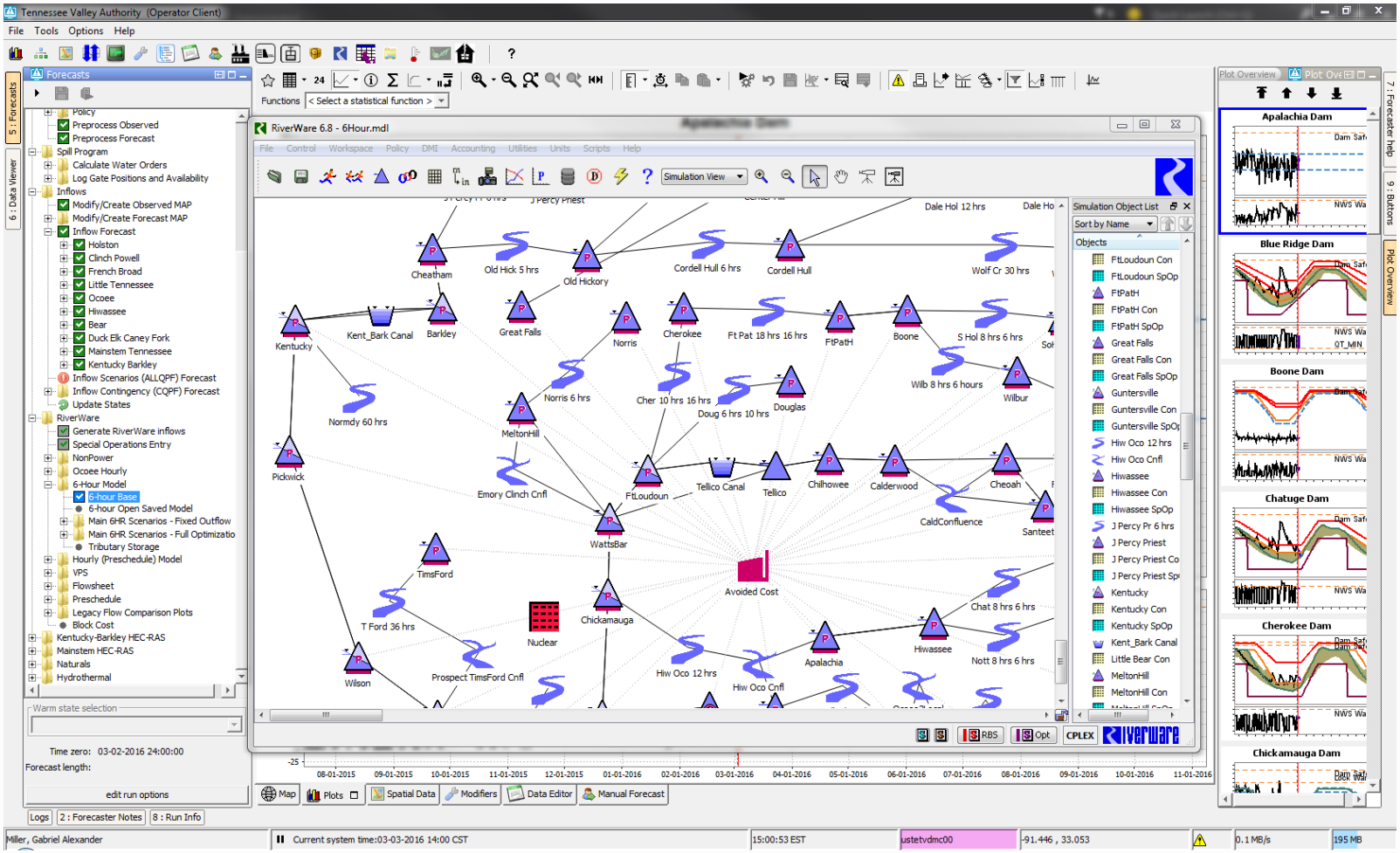


# A few FEWS Applications

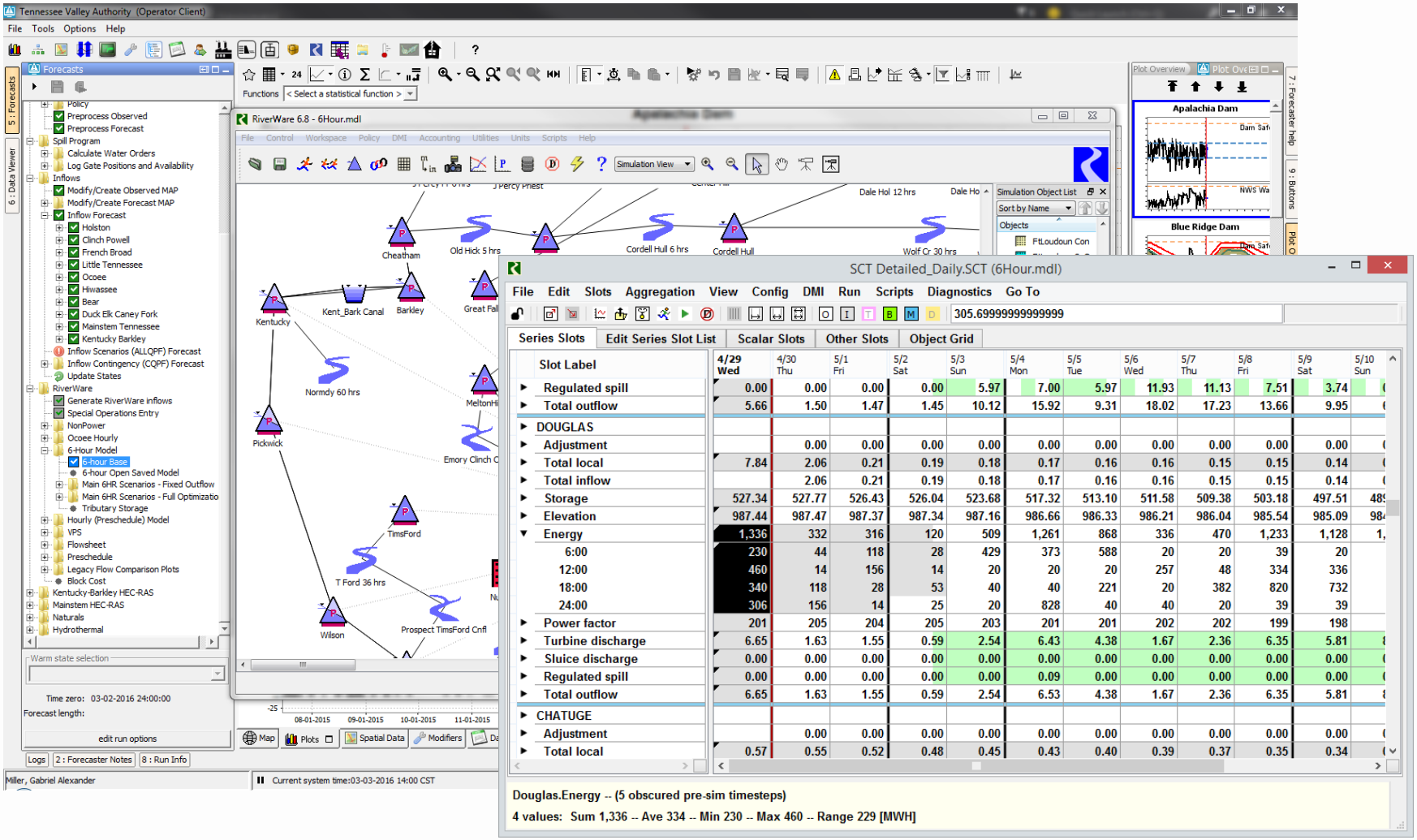
RiverWare in FEWS

- Bonneville Power Administration
  - Short Term Planning
  - Real Time Schedulers
- **Tennessee Valley Authority**
  - 6 Hour Model
  - Hourly Model

# TVA FEWS Applications



# TVA FEWS Applications



# A few FEWS Applications

RiverWare in FEWS

- Bonneville Power Administration
  - Short Term Planning
  - Real Time Schedulers
- Tennessee Valley Authority
  - 6 Hour Model
  - Hourly Model
- **Idaho Power**
  - **Operations both Interactive and headless**

# Thank you