New California Simulation Engine (CSE) for residential building energy modeling

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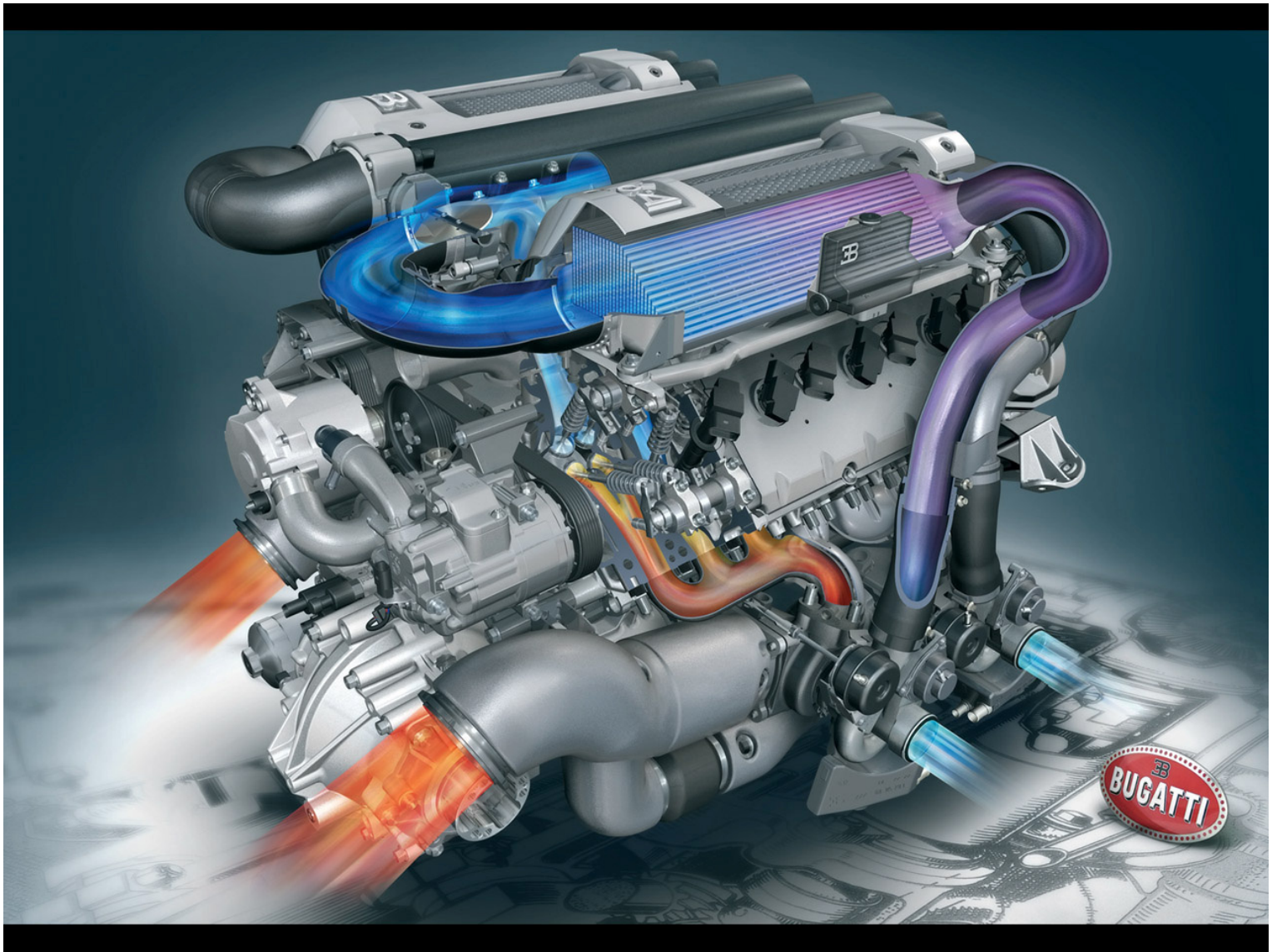
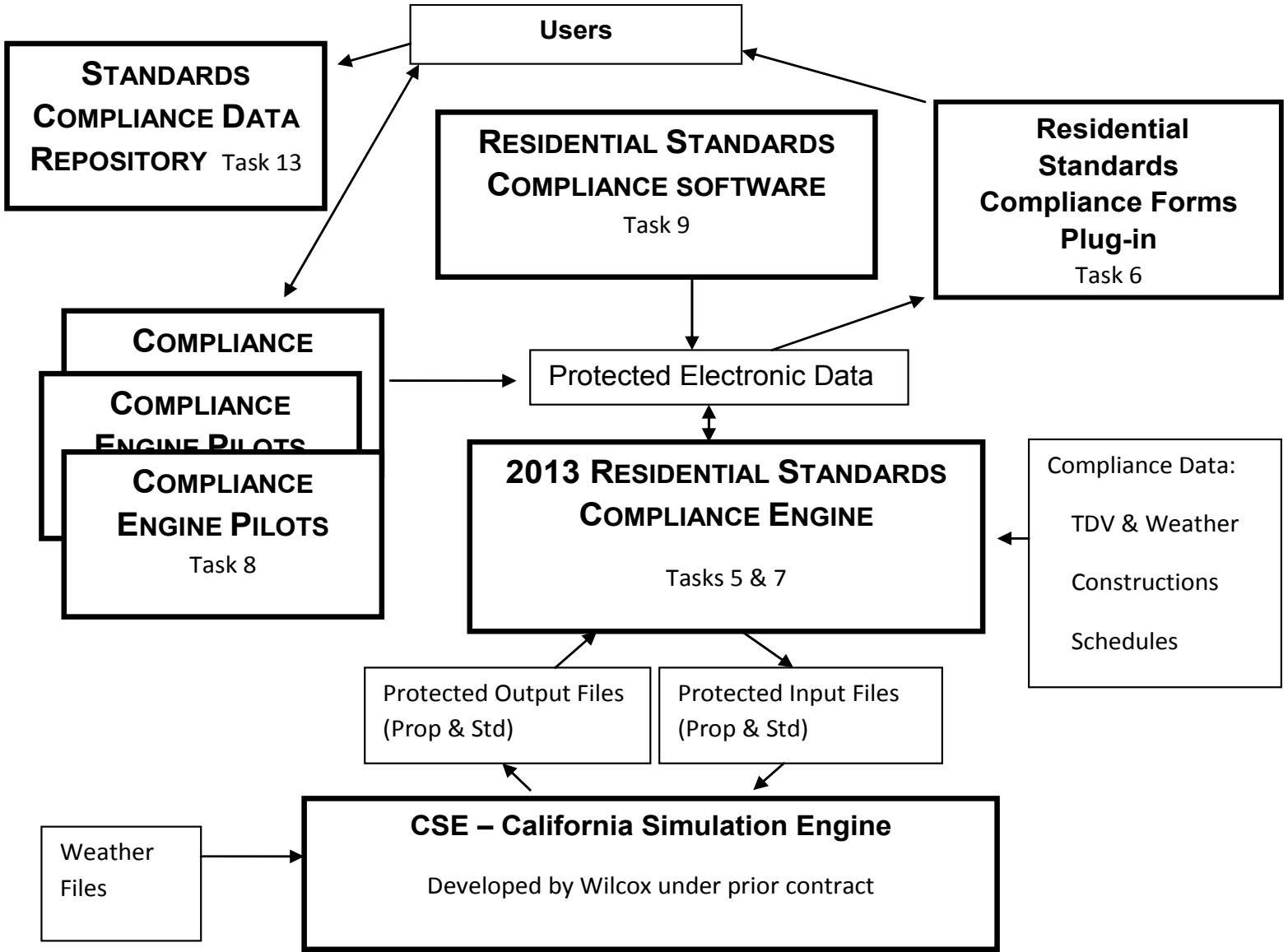
California Simulation Engine (CSE)



Agenda

- Background and istory
- CSE features
  - network schematic
  - surfaces
  - air flow network
  - windows
- Consortium web site
- Questions

RESIDENTIAL Software Plan



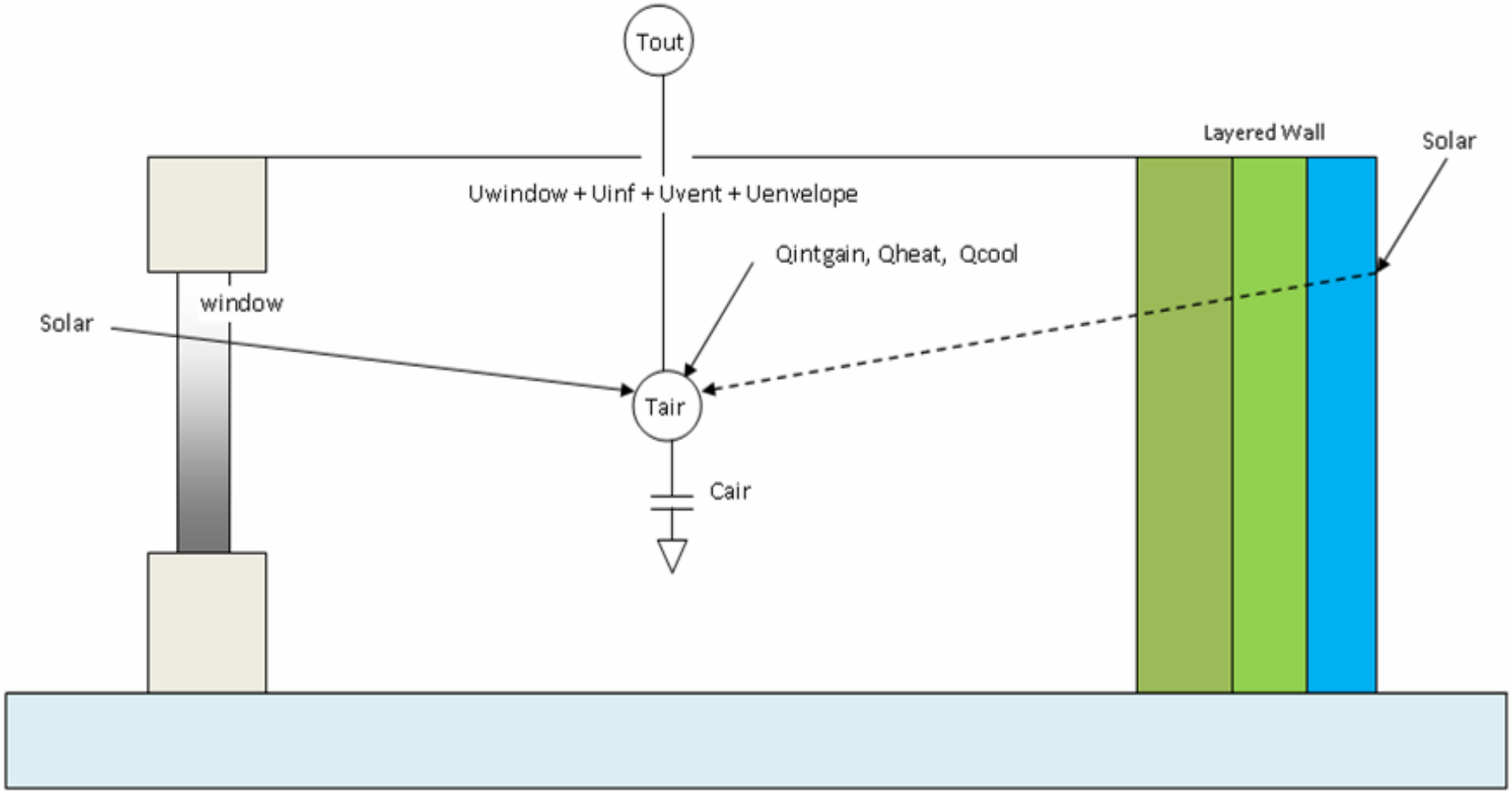
CSE Project

- Supported by the CEC and the California Statewide Utilities Codes and Standards Program
- Build on the UZM model and field data
- Goals to more accurately estimate:
  - solar gain impact on cooling energy and peak load
  - building shell and interior mass on cooling loads and indoor temperature variation
  - ventilation interaction with building mass and its impact on cooling energy and peak load
- Add new capabilities for comfort analysis, mechanical ventilation

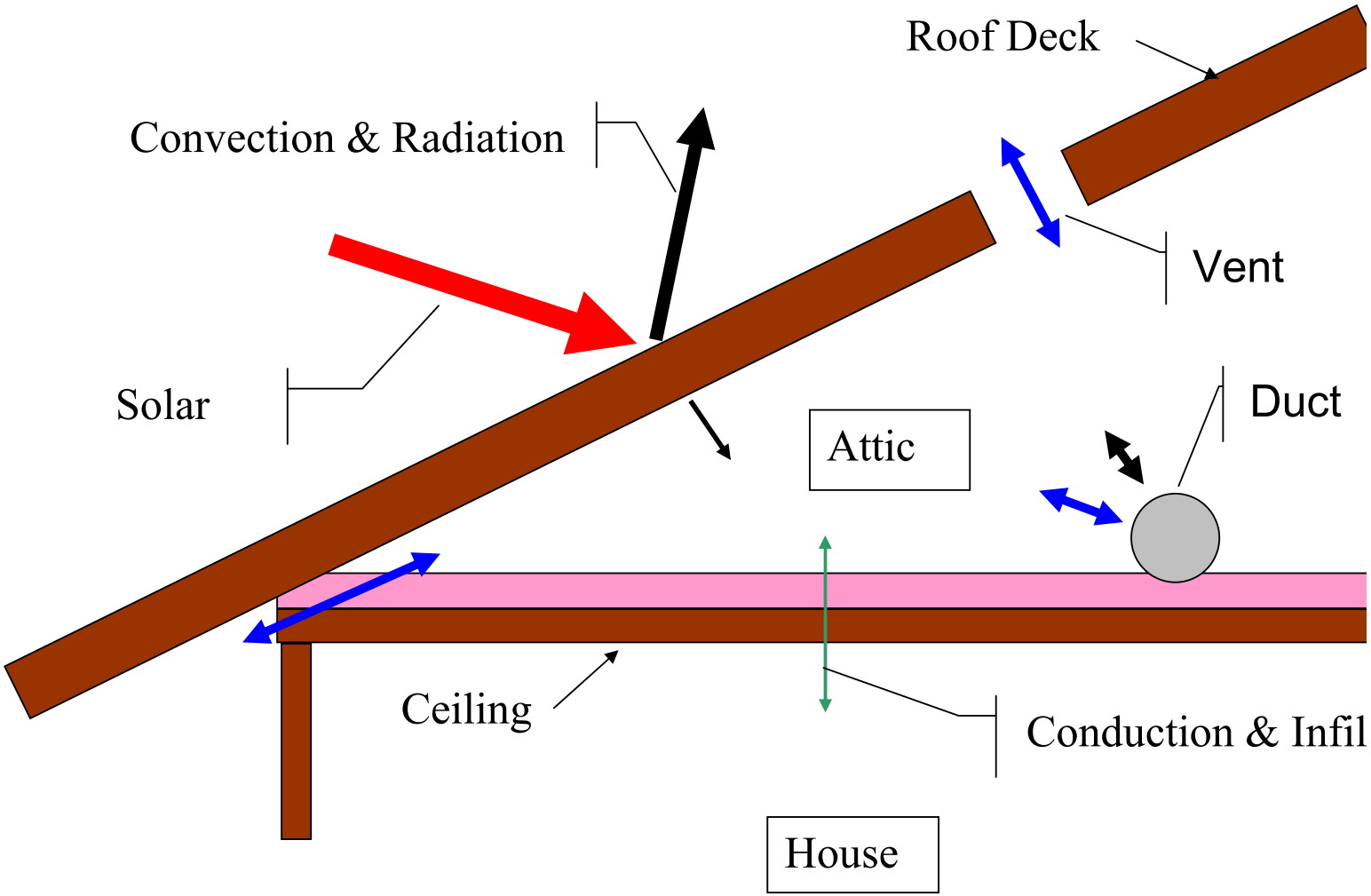
Historical Perspective

- **CALPAS1** developed by Niles for the CEC California Passive Solar Handbook project, 1980
- **CALRES** CEC Public Domain Computer Program 1989
- **Energy10**, Design Tool for Small Commercial Buildings, National Renewable Energy Laboratory, 1996
- **UZM**, CEC attic model 2007
- **CSE**, CEC Residential Simulation Engine 2011

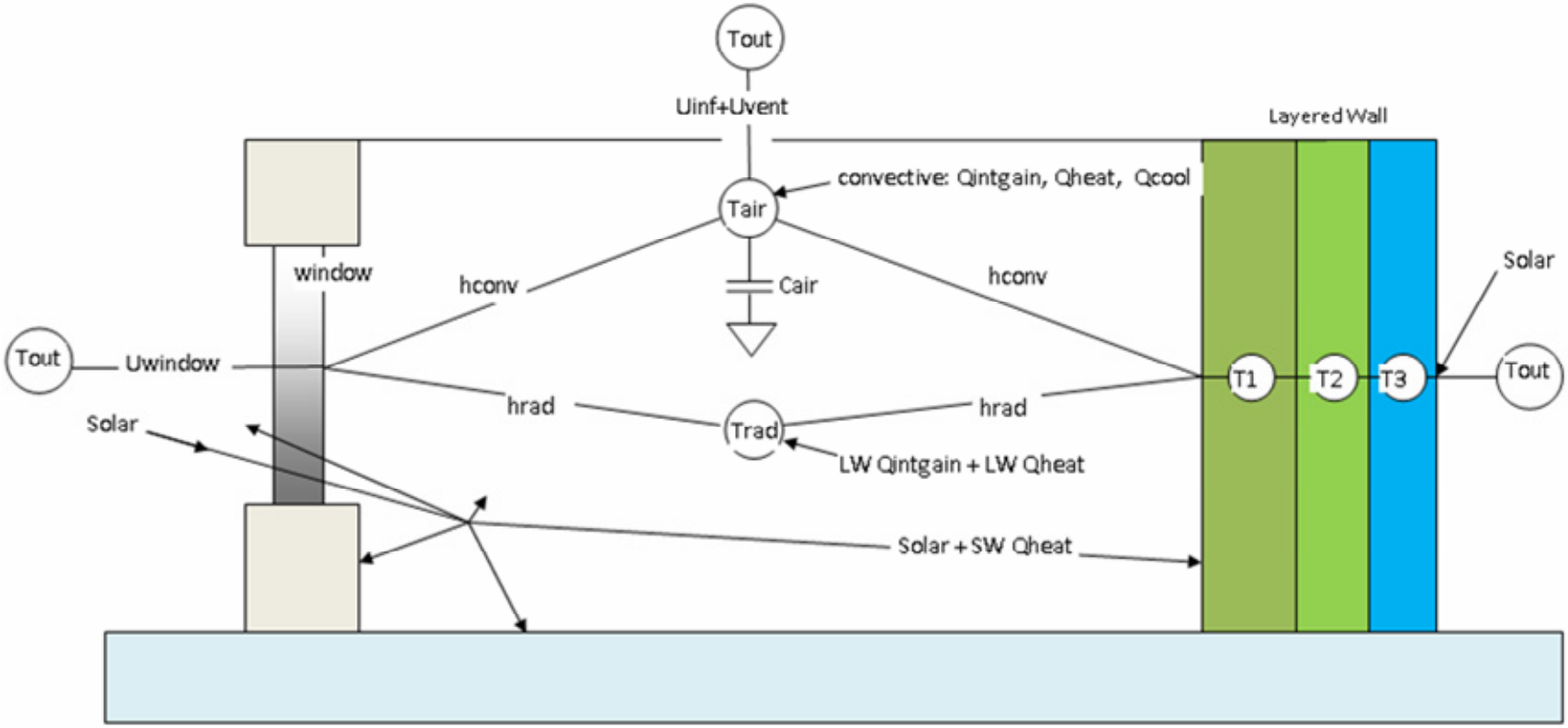
CALPAS1 Network Schematic



2008 UZM Attic Simulation Model



CSE Network Schematic



CSE Features

- All parts of opaque surfaces (frame and cavity) are calculated separately as mass elements (walls, floors, ceilings, interior walls, furniture)
- Separate radiant and variable convective heat transfer for all surfaces
- Pressure flow air flow network for infiltration, ventilation and HVAC interaction
- ASHWAT window model with hourly variable properties and interaction with interior and exterior shades

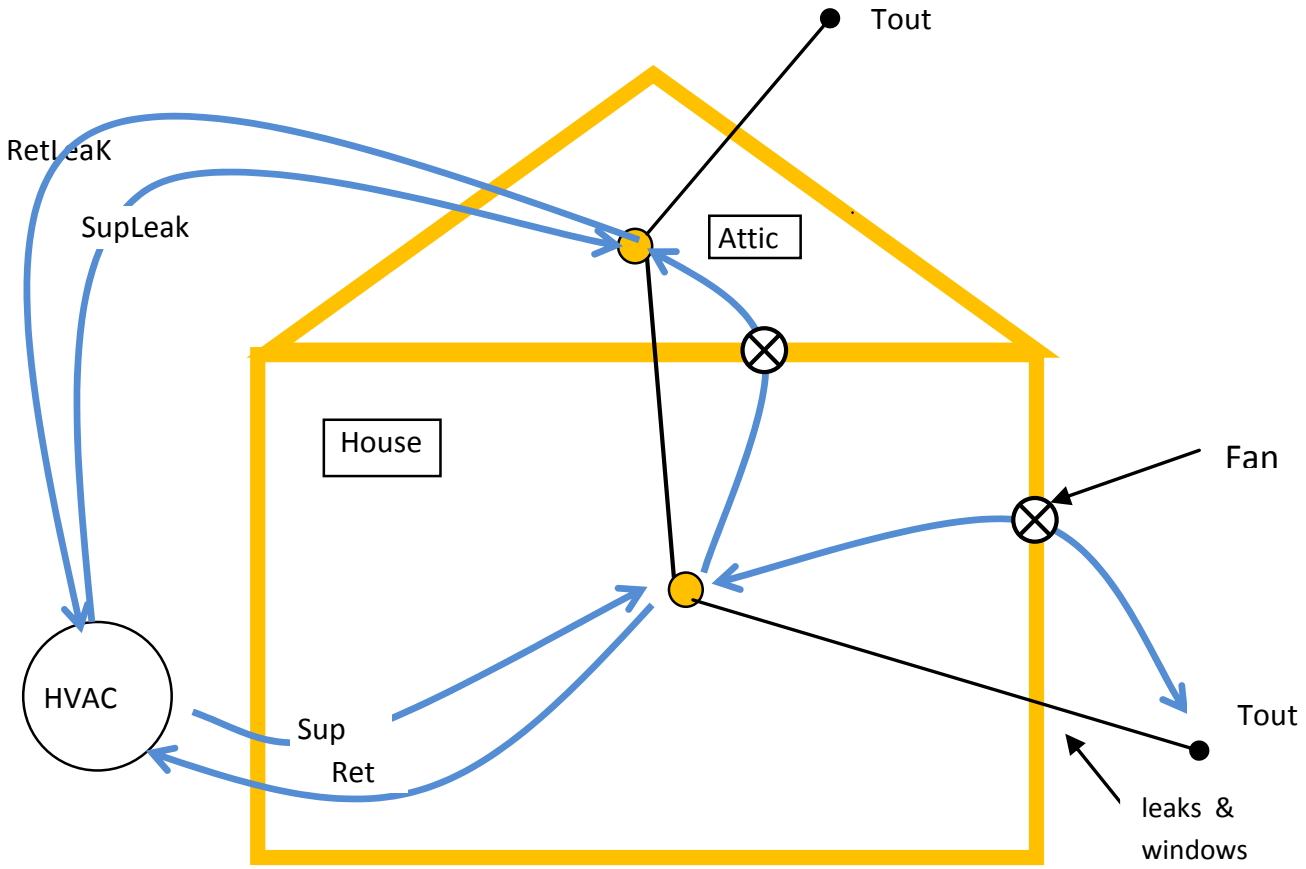
Opaque Surfaces

- Building envelope
  - Multi-layer mass surfaces with
  - Separate frame and cavity surfaces
  - Library input for common constructions in SDP
- Improved implementation of slab model
- Internal mass
  - Explicit furniture mass elements
  - Interior walls and floors
  - Function of CFA, slab area and stories

UZM Attic and Duct Model

- Slightly modified 2008 UZM
- All or part of the duct system in the attic zone
  - convection and radiation between ducts and attic air and surfaces
  - leakage from/to attic air
- Unbalanced duct leakage assumed for standard cases.
- Ventilation and infiltration between house and attic by air network

CSE Air Flow Network



New CSE Air Flow Network

- Air flows calculated based on pressure differences between house, attic and outdoors
- Includes temperature and wind effects
- Combined air leakage and ventilation
  - Infiltration
  - Natural ventilation
  - Mechanical ventilation
  - Duct leakage

New ASHWAT Window Model

- Multi-layer model of center of glass, exterior screen and operable interior shade
- Detailed calculation of solar gain and heat transfer at each layer
- Good radiant and convective connections to new room model
- Source of 2009 ASHRAE HOF glazing tables

ASHWAT Window Model Features

- Compliance oriented inputs are rated U-factor and SHGC
- Simulation U-factor and SHGC calculated hourly based on conditions:
  - Outdoor temperature
  - Wind speed
  - Sky temperature
  - Indoor air and radiant temperature
  - Position of indoor and outdoor shades and screens

Building Energy Efficiency Software Consortium

Current Development Software Implementation of CSE

using Micropas as a user interface and Compliance Manager:

http://www.energydataweb.com/Consortium/

2013 Standards Update

Please send comments on today's workshop topics
by July 21, 2011 to:

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