TECHNISCHE UNIVERSITÄT DRESDEN

Department of Architecture, Institute of Building Climate Control, Chair of Building Physics

NANDRAD FMU Import/Export

Activity 1.2, Annex 60

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NANDRAD FMI Interface

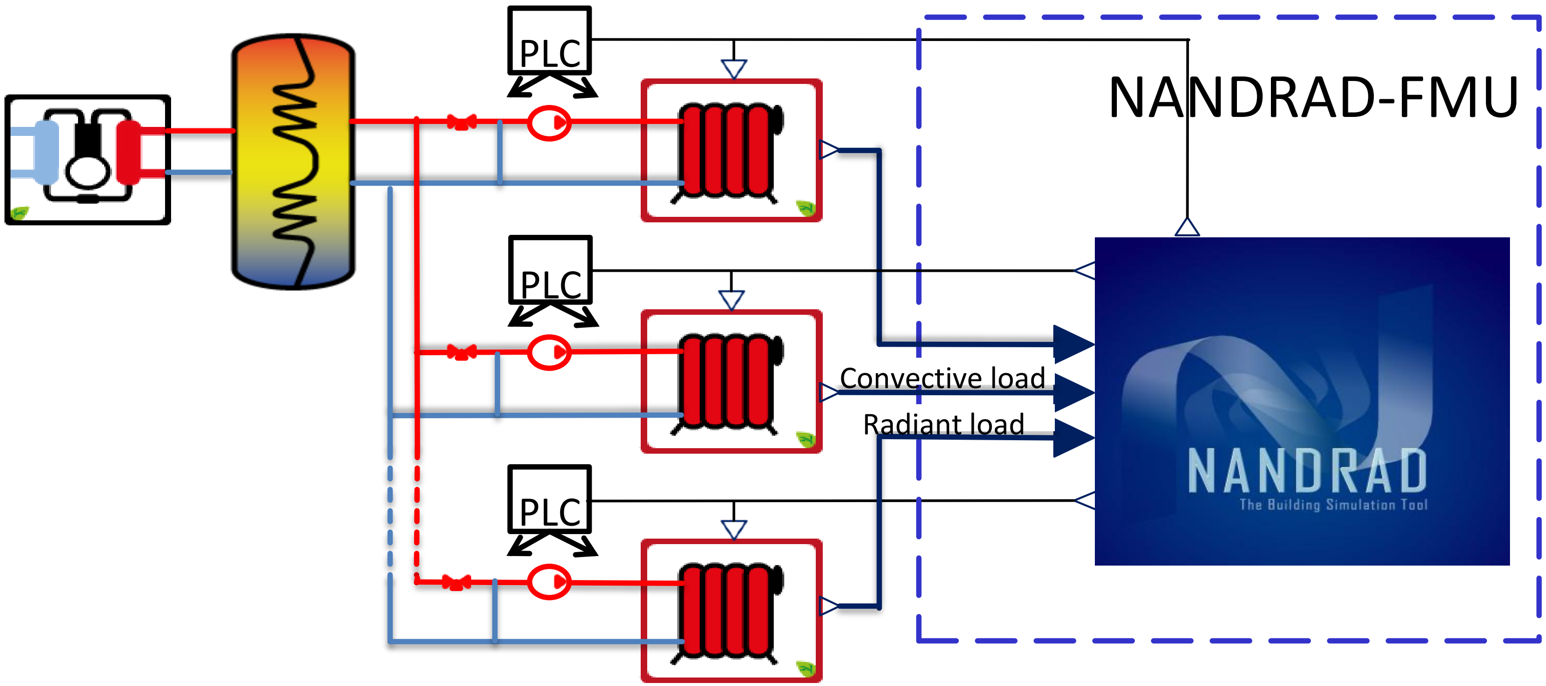
Time synchronization

- Current local time = Time offset + Master time [s]
- Apperant solar time → climate data synchronization, no direct exchange

Climate data synchronization

- FMU-exchanged quantity: building FMU output/other FMU input

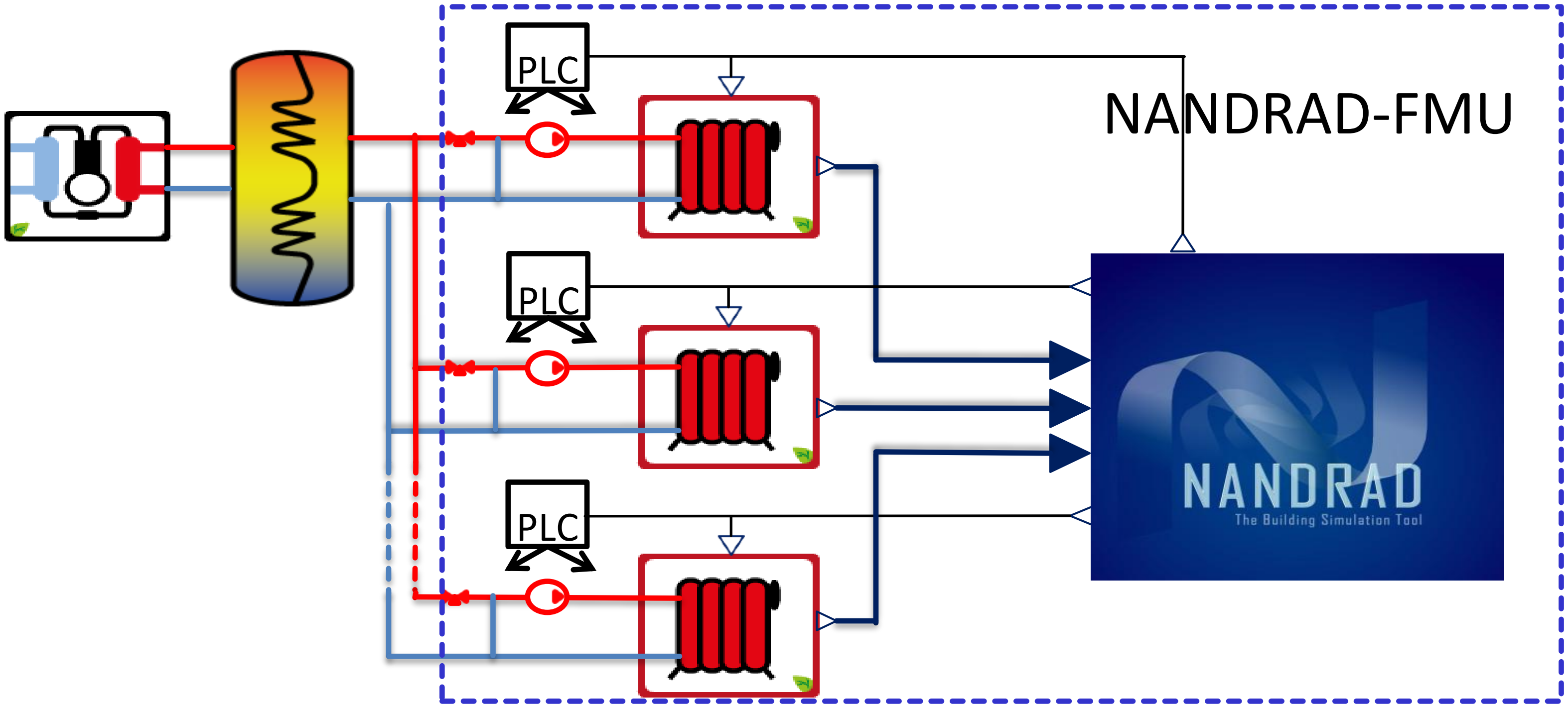
NANDRAD FMI Interface



Interface to Plant FMU:

1. Interface between ideal heating/cooling control and building

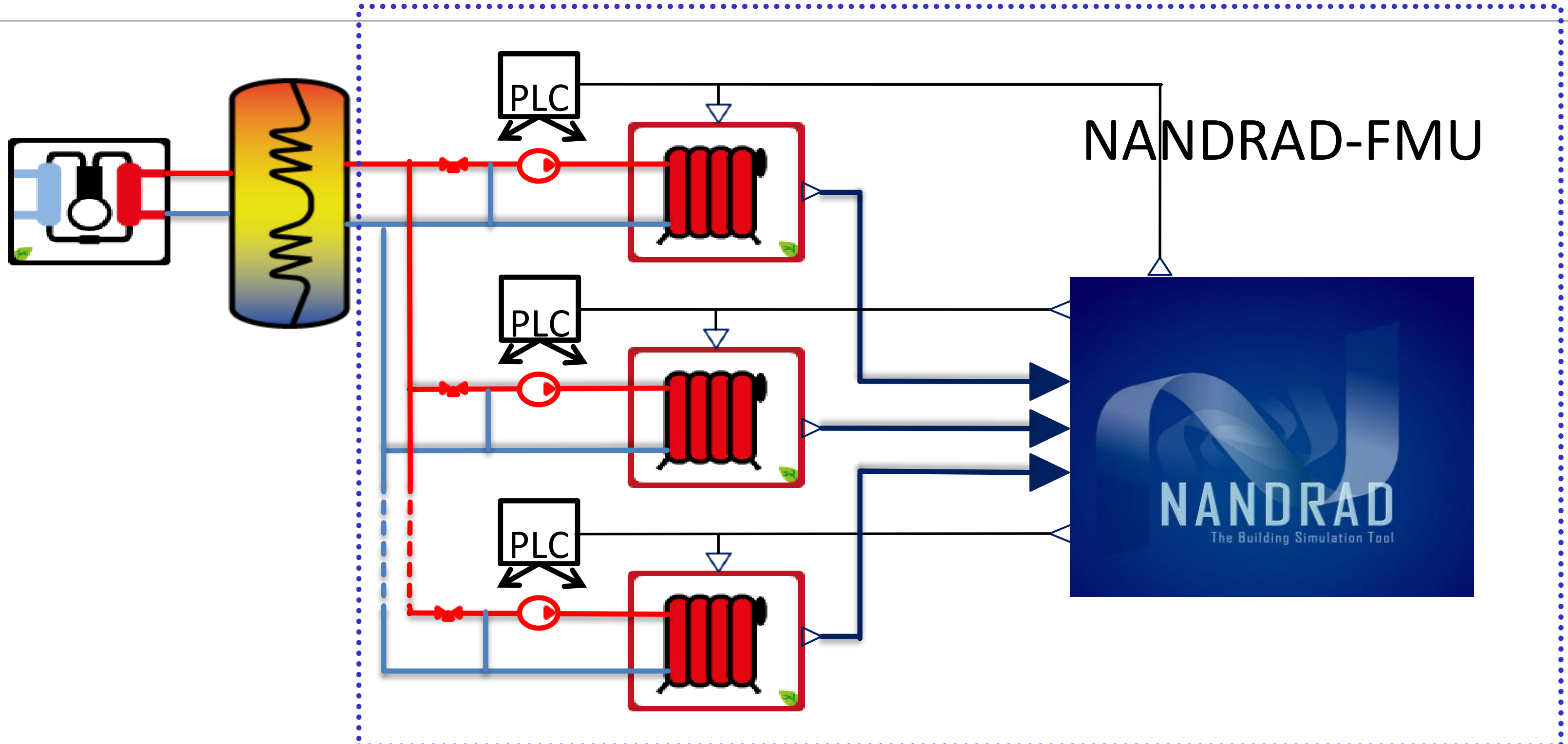
NANDRAD FMI Interface



Interface to Plant FMU:

1. Interface between ideal heating/cooling control and building
2. Interface between supply and return flow of heater/cooler

NANDRAD FMI Interface



Interface to Plant FMU:

1. Interface between ideal heating/cooling control and building
2. Interface between supply and return flow of heater/cooler
3. Interface between supply and demand side of hydraulic network

NANDRAD FMU Export

Generation of NANDRAD FMUs

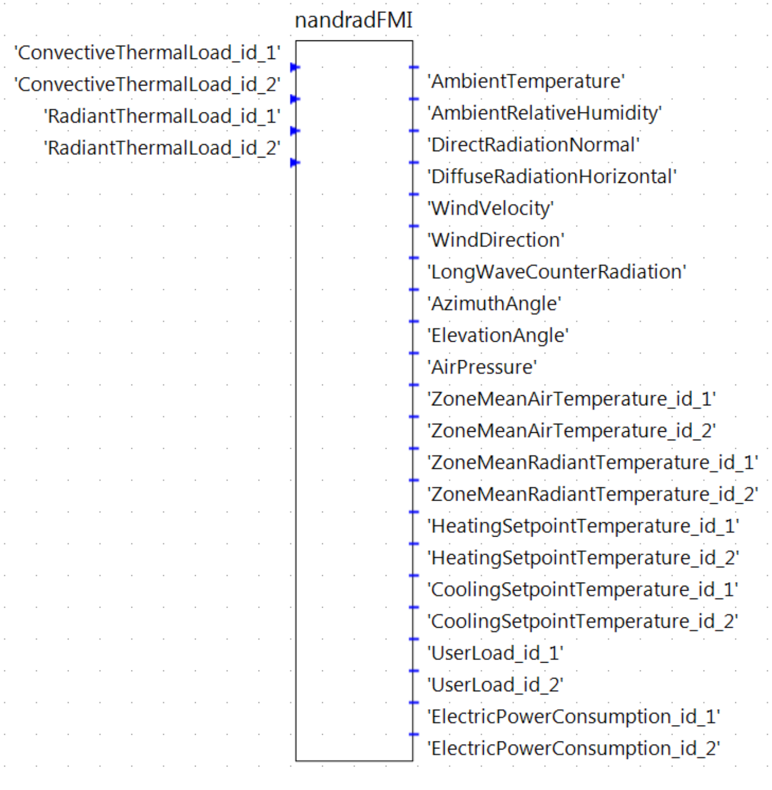
- We support plant coupling scenario 1.
- Heating/cooling interface is individually defined for each zone/space type

```xml
<!-- Properties of defined spaces. -->
<SpaceTypes>
  <SpaceType name="Office">
    <IBK:String name="FMUInterfaceDefinition">HeatingScenario1</IBK:String>
    <IBK:Parameter name="MaximumPersonPerArea" unit="Person/m2">0</IBK:Parameter>
    <IBK:Parameter name="EquipmentElectricInputPower" unit="W/m2">0</IBK:Parameter>
    <IBK:Parameter name="LightingElectricInputPower" unit="W/m2">0</IBK:Parameter>
  </SpaceType>
</SpaceTypes>
```

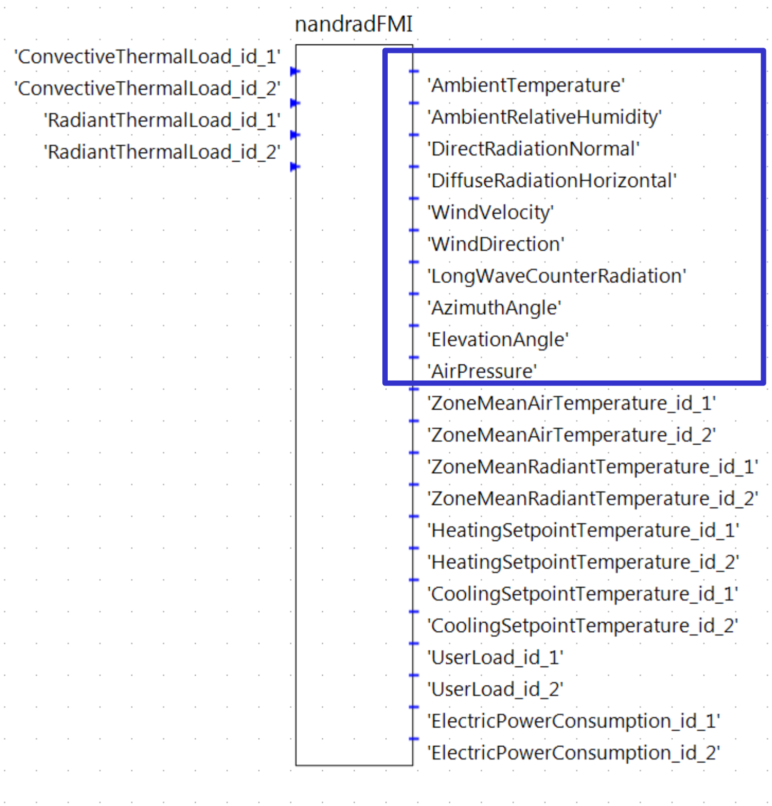
- FMU-Export via command line:

```
NandradSolver --fmu-export=TestProject.fmu TestProject.nandrad
```

NANDRAD FMU Export



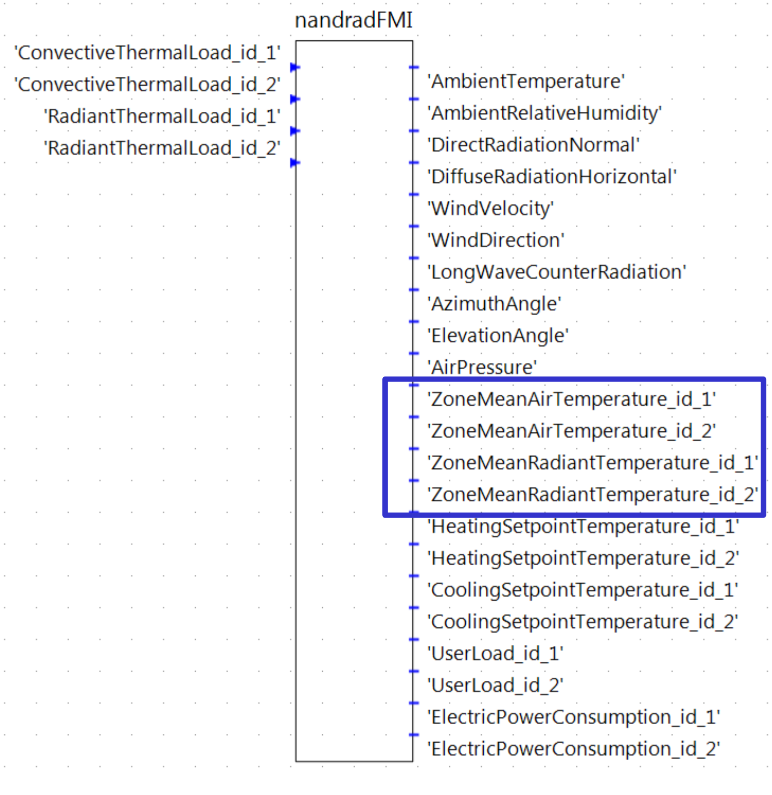
NANDRAD FMU Export



Outputs

- Climate data

NANDRAD FMU Export



Outputs

- Climate data
- Zone air/ radiant temperatures

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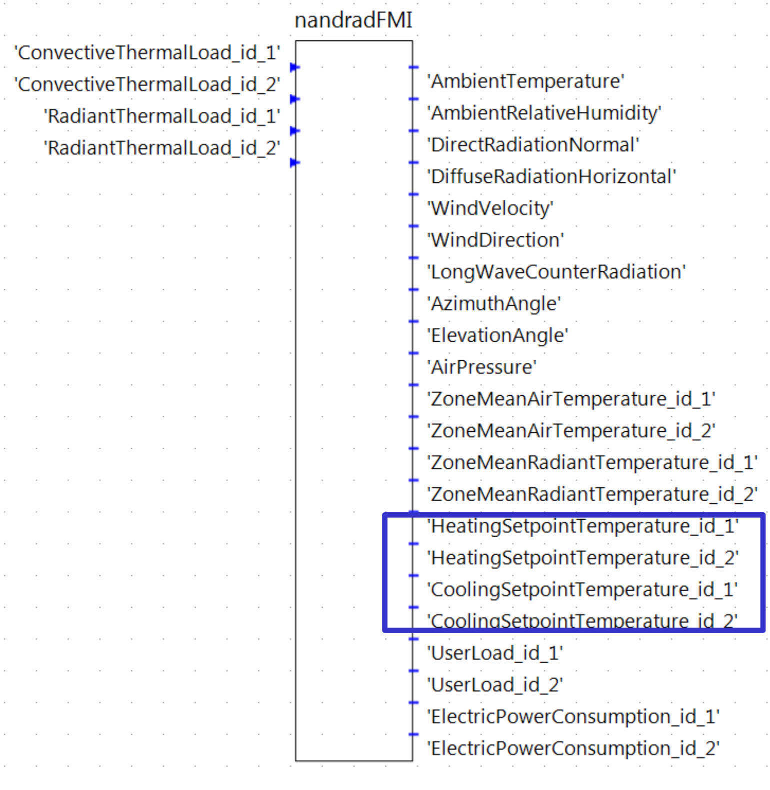
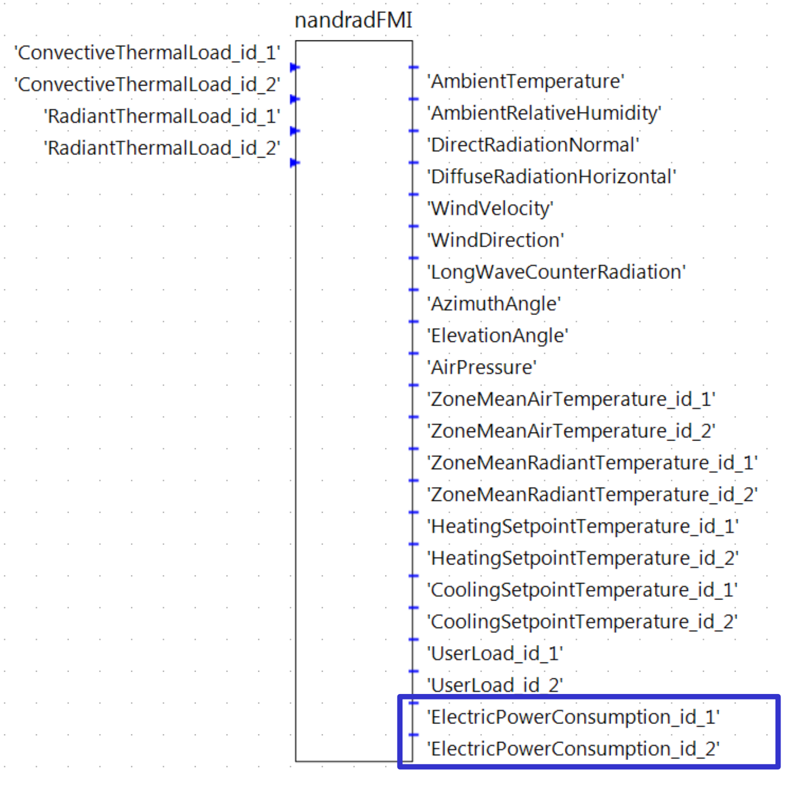
NANDRAD FMU Export



Outputs

- Climate data
- Zone air/ radiant temperatures
- Setpoint temperatures

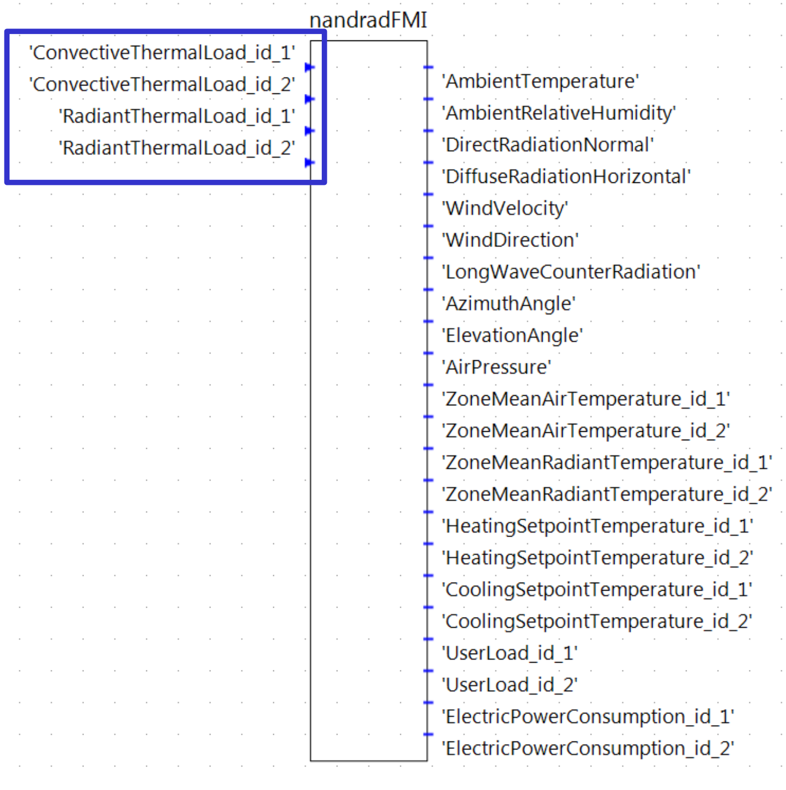
NANDRAD FMU Export



Outputs

- Climate data
- Zone air/ radiant temperatures
- Setpoint temperatures
- Electric loads

NANDRAD FMU export



Outputs

- Climate data
- Zone air/ radiant temperatures
- Setpoint temperatures
- Electric loads

Inputs

- Convective and radiant thermal loads

NANDRAD FMU Export

Naming convections for zone specific inputs/outputs

- Physical mapping via zone ID number
- advantageous for plant design: each zone provides floor area, design parameters for heating and cooling
- disadvantageous for connector/port design: vector valued connectors are not supported ⇒ problems with automatic connection of large buildings

↕

- Numerical mapping via vector index
- advantageous for connector/port design: FMU standard allows vector valued inputs/outputs
- disadvantageous for error control: physical meaning of the zones is lost

NANDRAD FMU Export

Naming convections for zone specific inputs/outputs

- Physical mapping via zone ID number

- FMU report file, documents mapping between physical and numerical indices, floor area, heating and cooling design parameters

ZoneIndex	ZoneName	ZoneID	ZoneFloorArea [m2]	HeatingDesignThermalLoad [W]	CoolingDesignThermalLoad [W]
1	ground_floor	1	136.4	3694	0
2	upper_floor	2	136.4	3835	0

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NANDRAD FMU Import

- Large number of FMU input/output quantities: climate data (10 ports), temperatures and loads for all zones (7 ports per zone)
- automatic connecting necessary for large buildings

SimulationX/Modelica

- Plant model with is composed in Modelica
- Building FMU is encapsulated inside wrapper model (with collector ports)
- Wrapper model is generated automatically while FMU export (script based)
- Plant model is connected to wrapper ports

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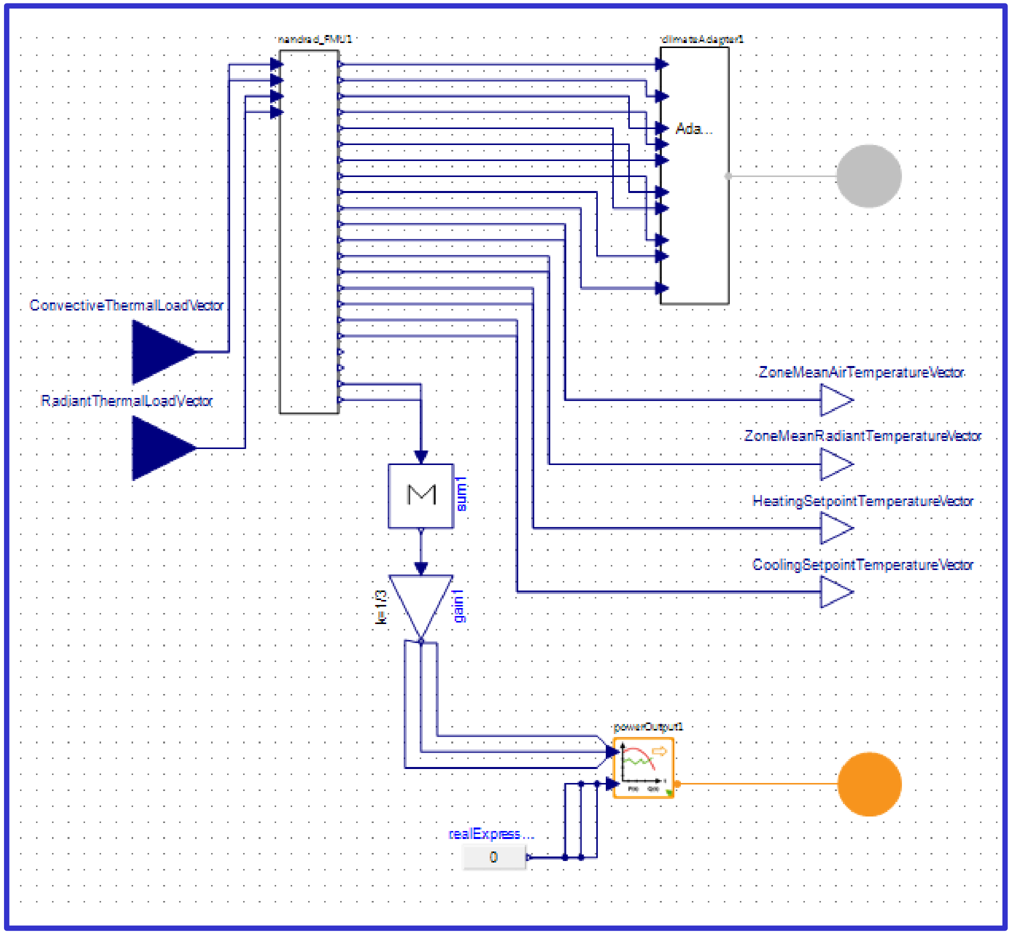
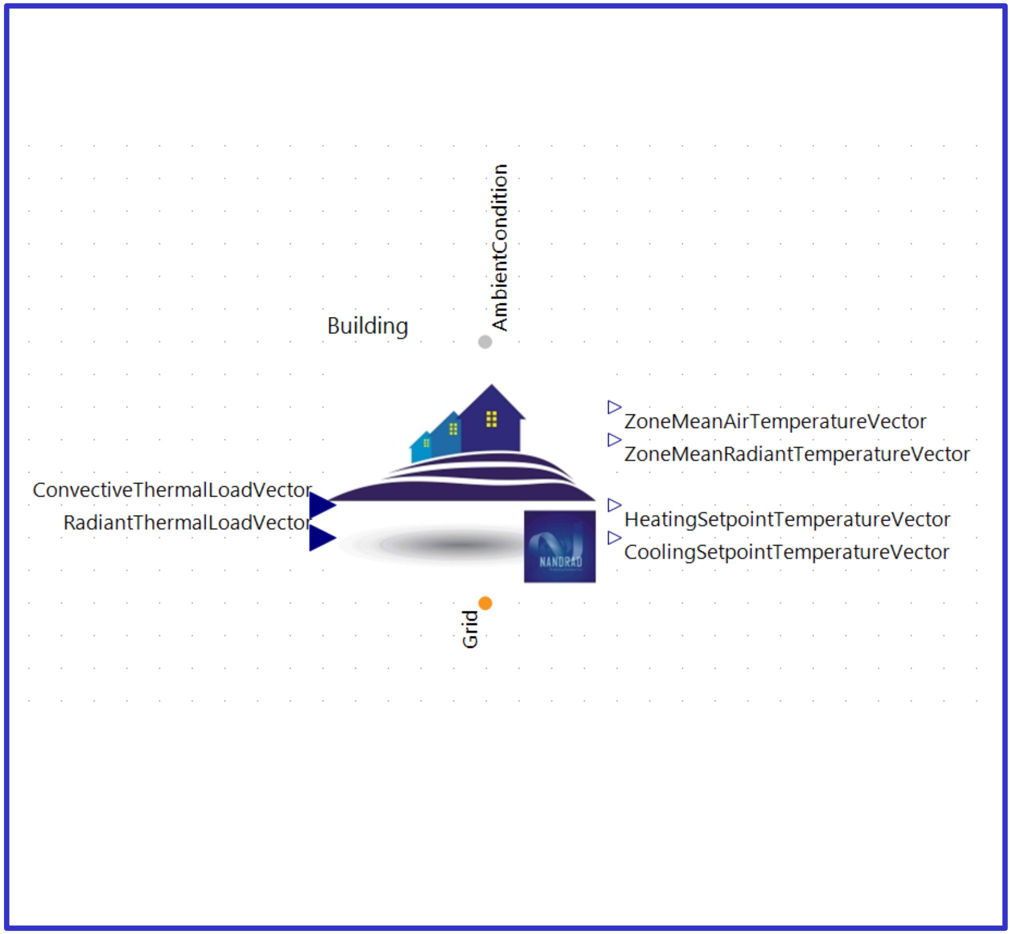
NANDRAD FMU Import SimulationX



NANDRAD FMU Wrapper

NANDRAD FMU Import SimulationX



NANDRAD FMU Wrapper

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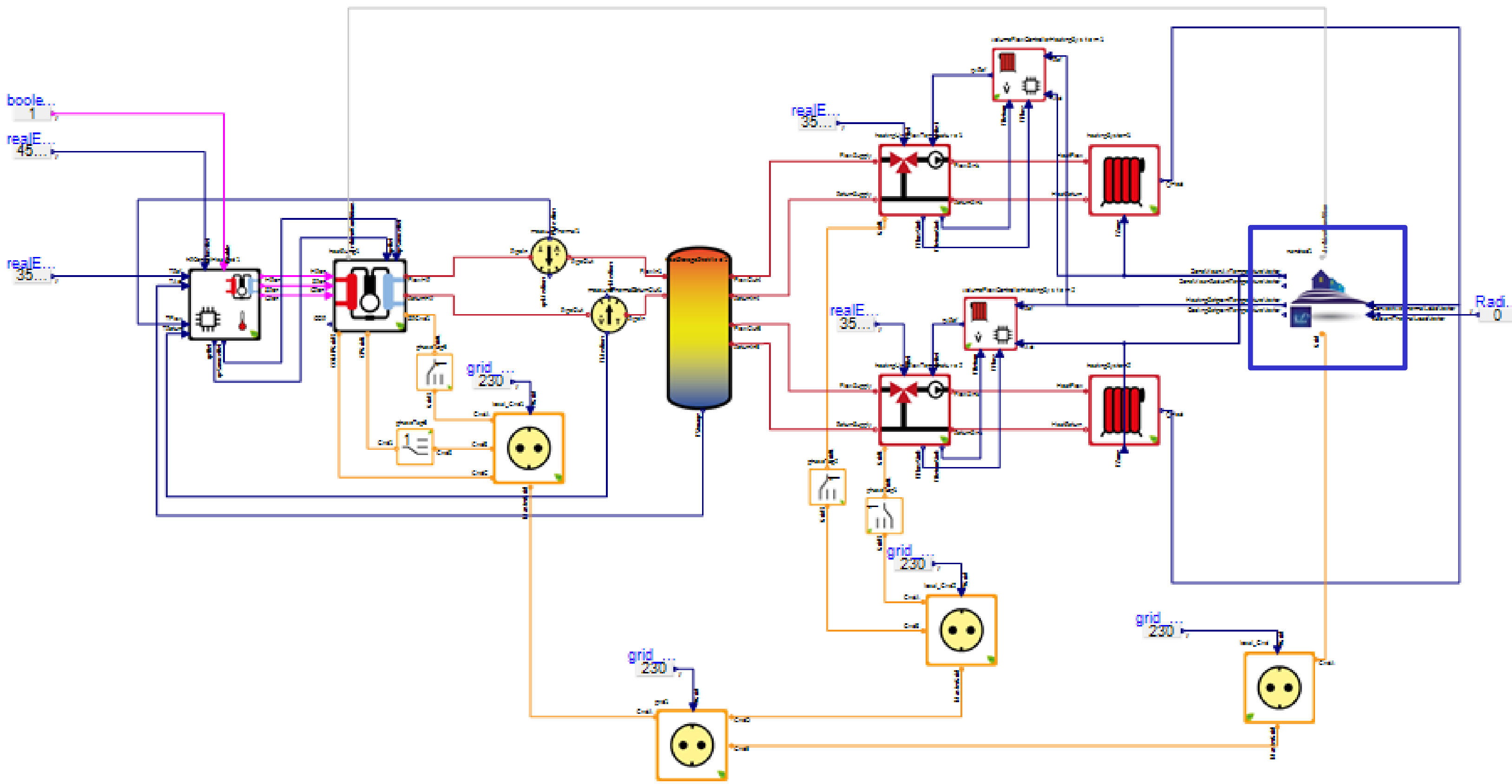
NANDRAD FMU Import SimulationX



NANDRAD FMU Import

- Large number of FMU input/output quantities: climate data (10 ports), temperatures and loads for all zones (7 ports per zone)
- automatic connecting necessary for large buildings

Master outside Modelica environment

- Plant model is composed in Modelica/SimulationX
    a. Empty wrapper model is connected to plant model, FMU export of Plant model + wrapper ports (not supported by SimulationX, yet)
    b. Plant model is exported, building FMU is connected via mapping information file:

heatingSystem1.QConv --> FMU1.ConvectiveHeatingsLoad_1
heatingSystem2.QConv --> FMU1. ConvectiveHeatingsLoad_2

- not solved yet