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Deltares
Enabling Delta Life

TU Delft Delft University of Technology

VORTECH BV
COMPUTING AND SIMULATION SOFTWARE TECHNOLOGY

Using OpenDA's Black Box Wrapper

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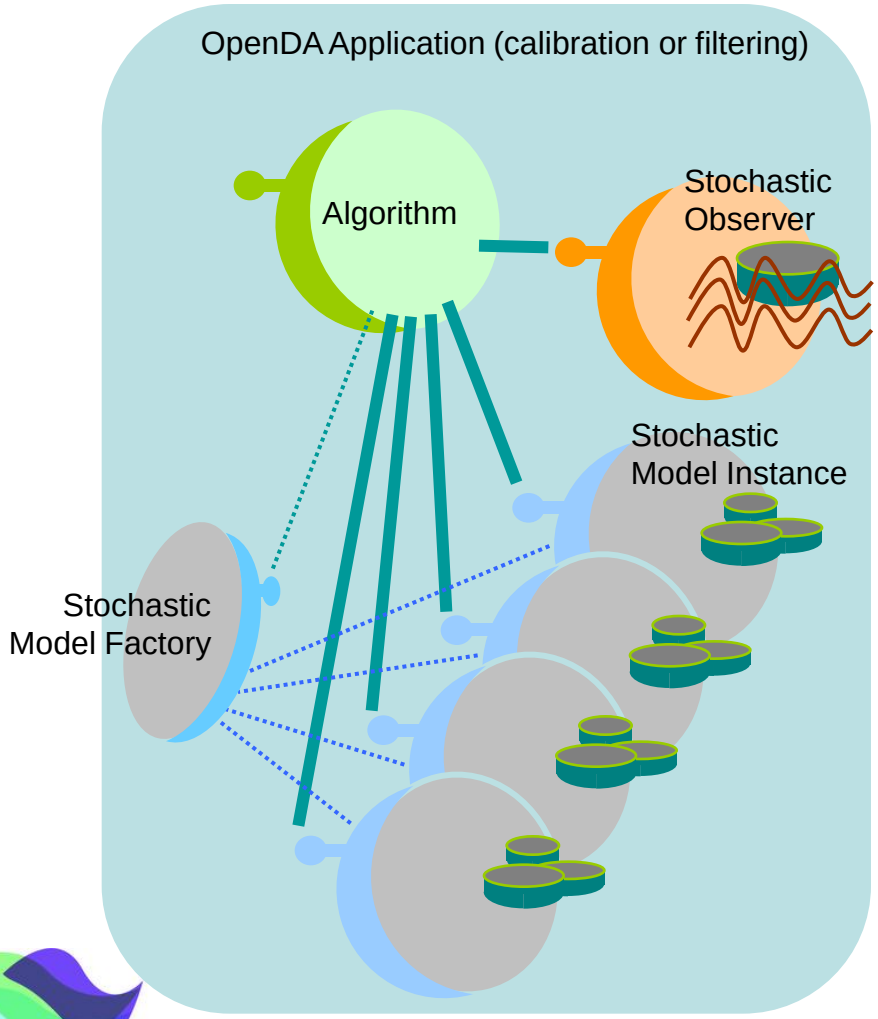
Models in an OpenDA Application (1)



To let a model run in an OpenDA application, it must:

- implement the **StochModelInstance** interface
- implement the **StochModelFactory** interface
  (creates model instances)

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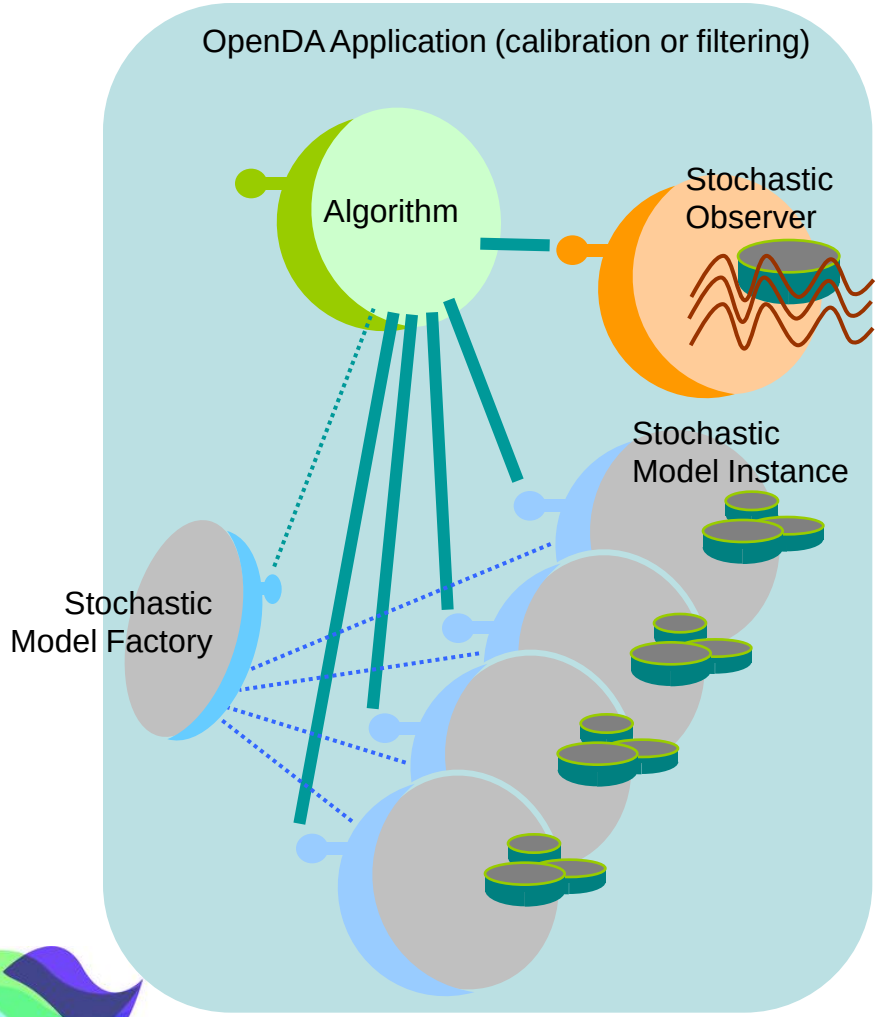
Models in an OpenDA Application (2)



Methods on the **StochModelInstance** interface:

- Get stochastic information on the parameters and on the state.
- Get/Set parameters
- Get/Set the state
- Let the model compute one or more time steps
- Get a list of computed values (the 'prediction') for each observation (location/quantity/time)

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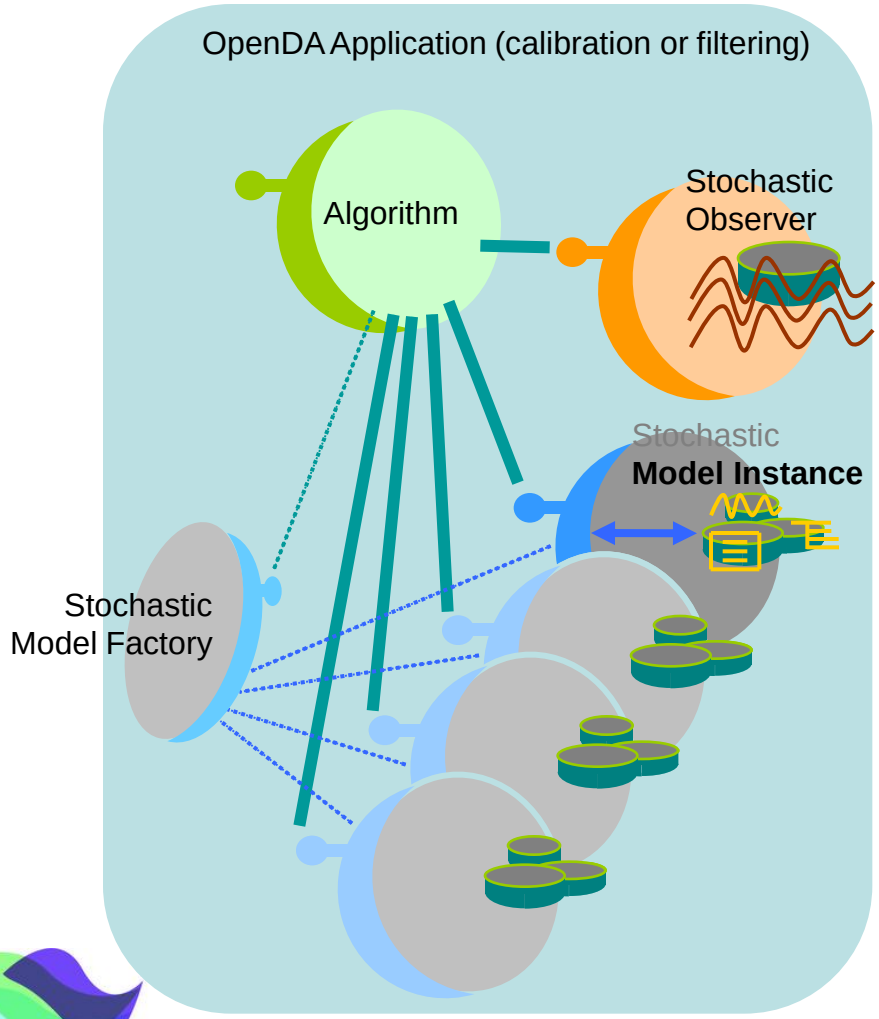
Using the Black Box wrapping utilities



The Black Box wrapper:

- Only requires one model ‘instance’ (model template directory) that will be cloned to create instances
- Standardizes the way values are set to and retreived from the model instance’s input and output files
- Takes care of the stochastic aspects:
  - uncertainty specification
  - add uncertainty to parameters and or state

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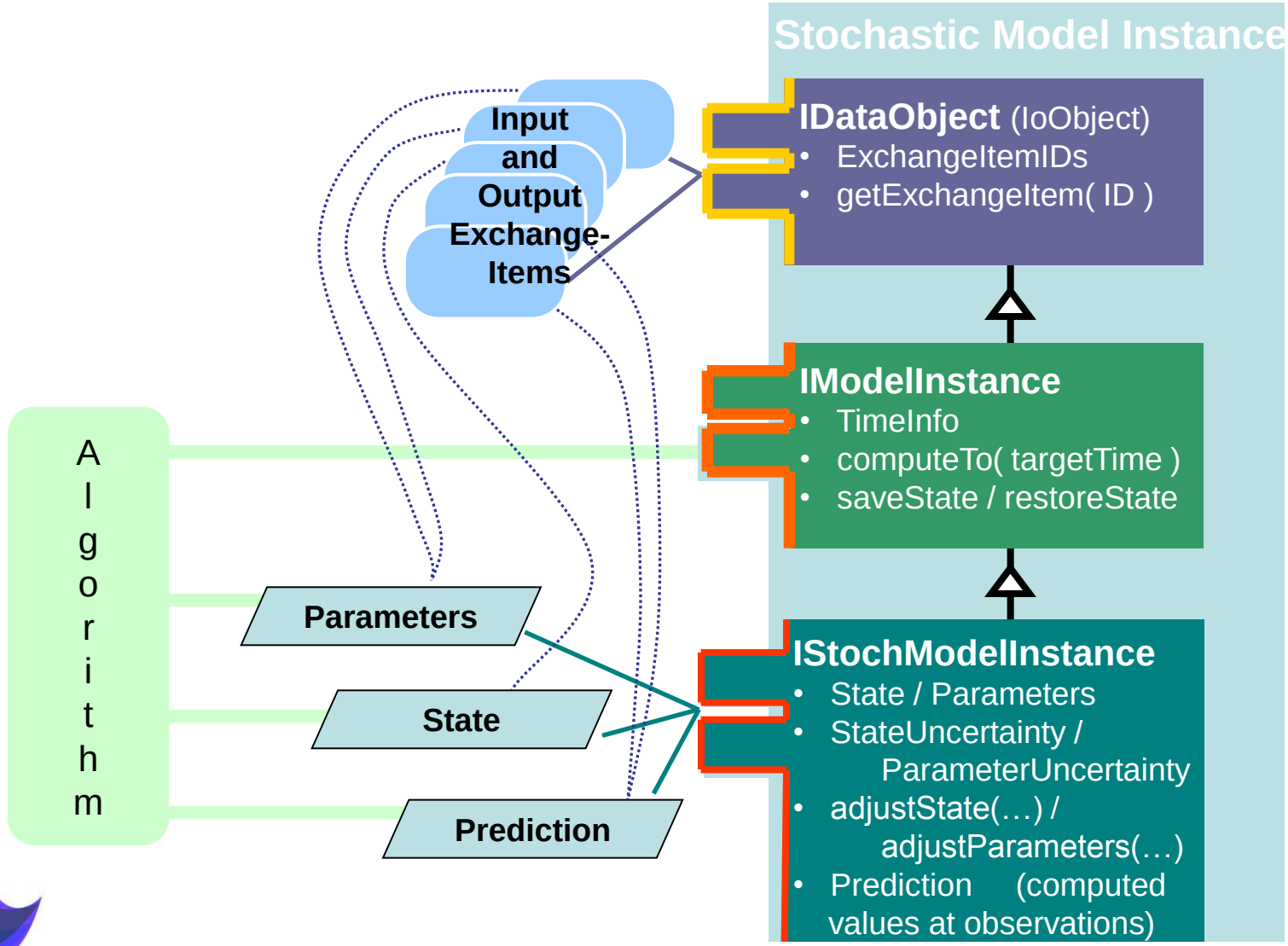
Stochastic Model / (Deterministic) Model / Data Object



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BB wrapper interaction with the model

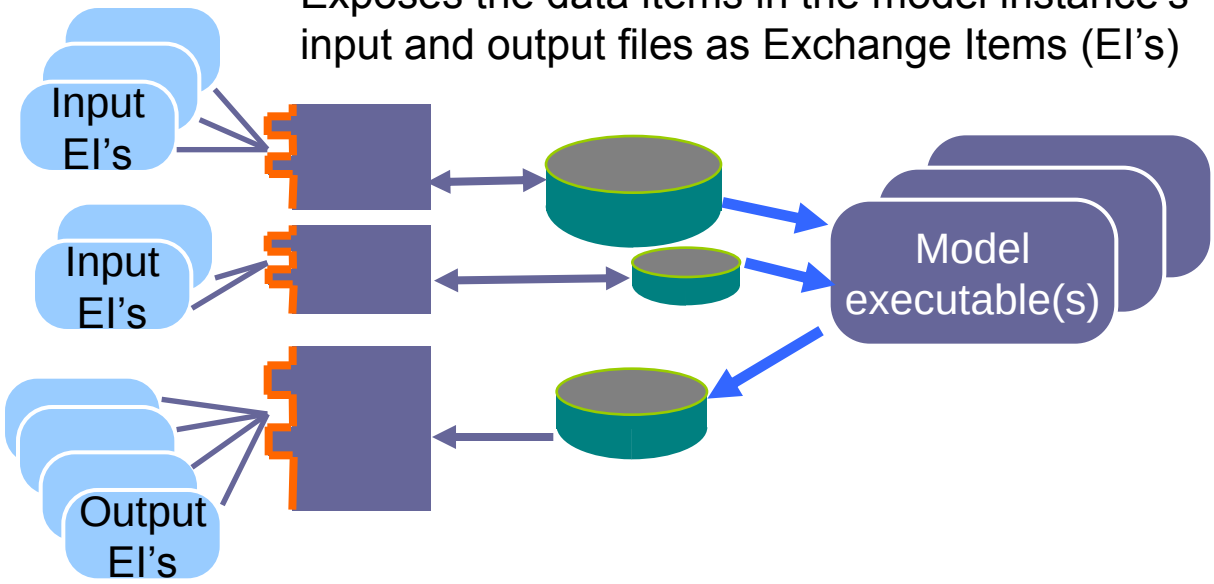
IExchangeItem

Properties:
- Quantity (e.g. “Discharge”)
- Location (e.g. “Lobith”)
- ValueType (e.g. double)
- Times (array of doubles, usually Modified Julian Day
- Identifier (e.g. “Lobith.Discharge”)

Methods:
- getValues
- setValues
- multiplyValues
- etc.

IDataObject

Exposes the data items in the model instance’s input and output files as Exchange Items (EI’s)



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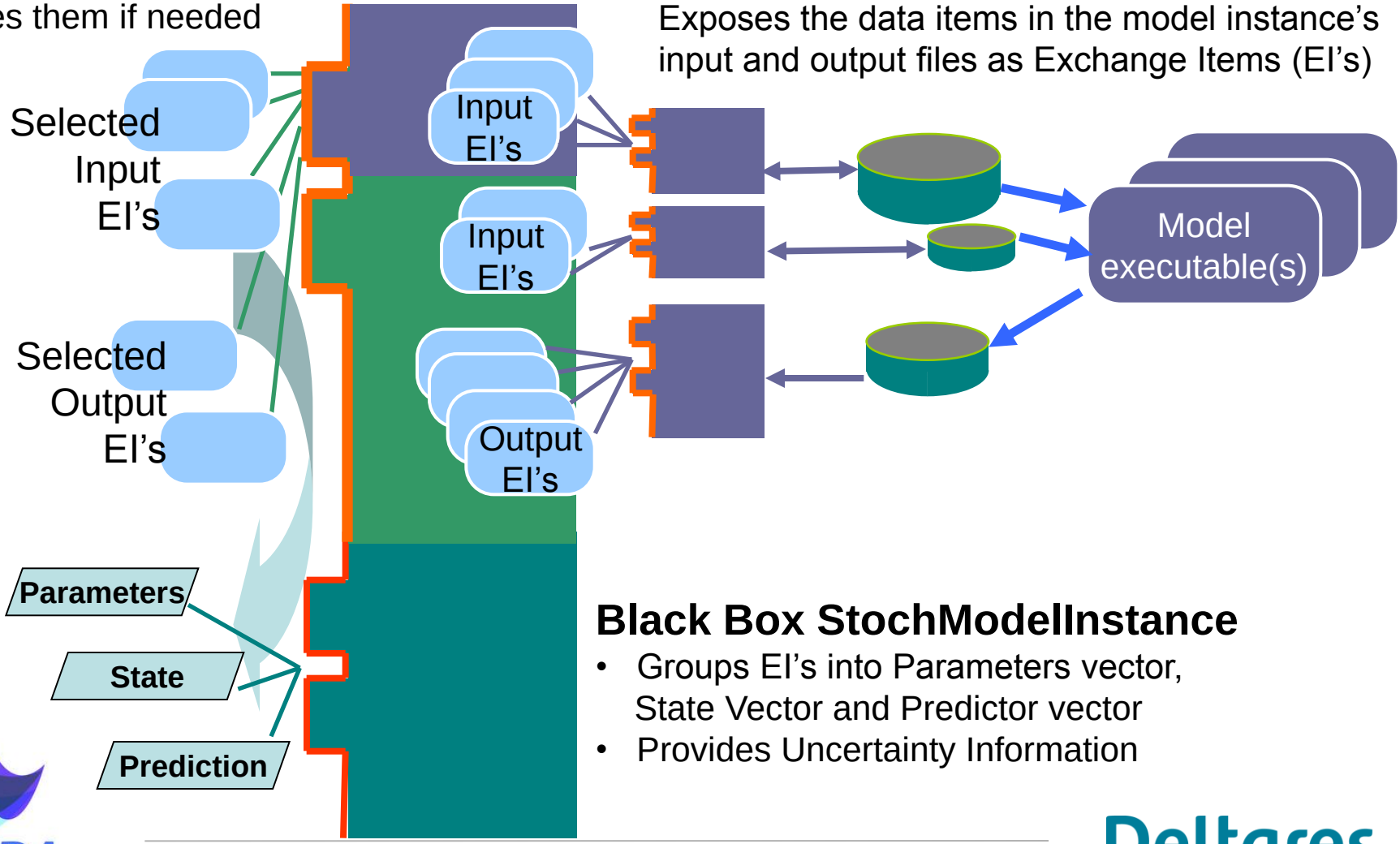
BB wrapper interaction with the model

Black Box ModelInstance

Selects (parts of) the Exchange Items,
Renames them if needed



IDataObject

Exposes the data items in the model instance's input and output files as Exchange Items (EI's)

Black Box StochModelInstance

- Groups EI's into Parameters vector, State Vector and Predictor vector
- Provides Uncertainty Information

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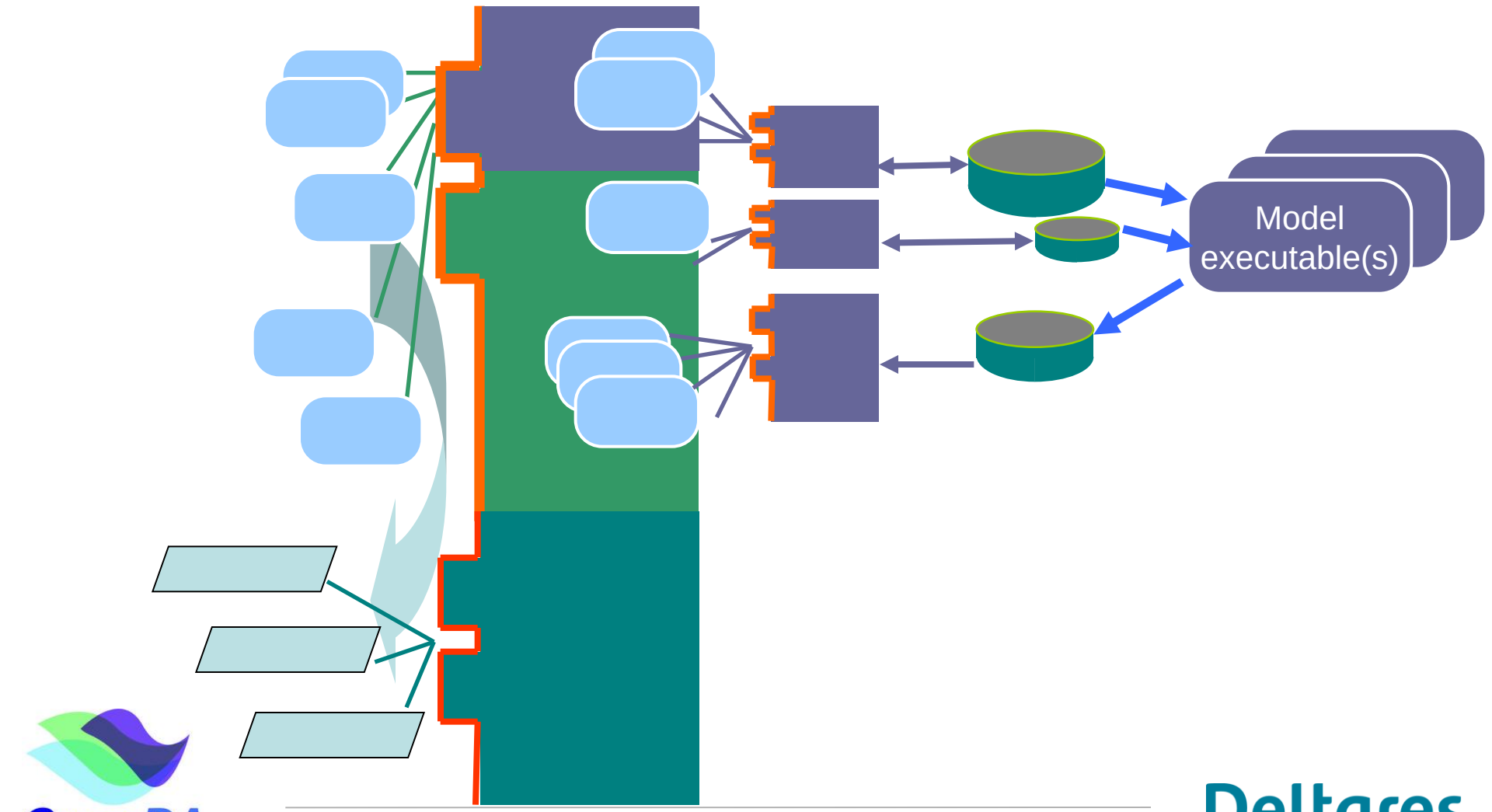
BB wrapper configuration



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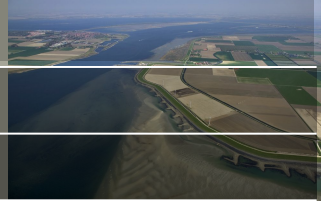
BB wrapper configuration



ModelConfig

- What are the actual names of:
  - the (cloned) model directory
  - the input and output file(s)
- Which Exchange Items do I want to 'expose'?
  - maybe renamed
  - maybe only a part of the item

WrapperConfig

- What actions must be taken to:
  - Initialize the model
  - Let the model compute
  - Finish the model
- What DataObjects do I have?
  - Input File(s)
  - Result File(s)

StochModelConfig

- Which Exchange Items must be used for parameters, the state and the prediction?
- What are the uncertainties of the parameters?
- What Noise Models are added to the state, and to which exchange item must the noise be added?

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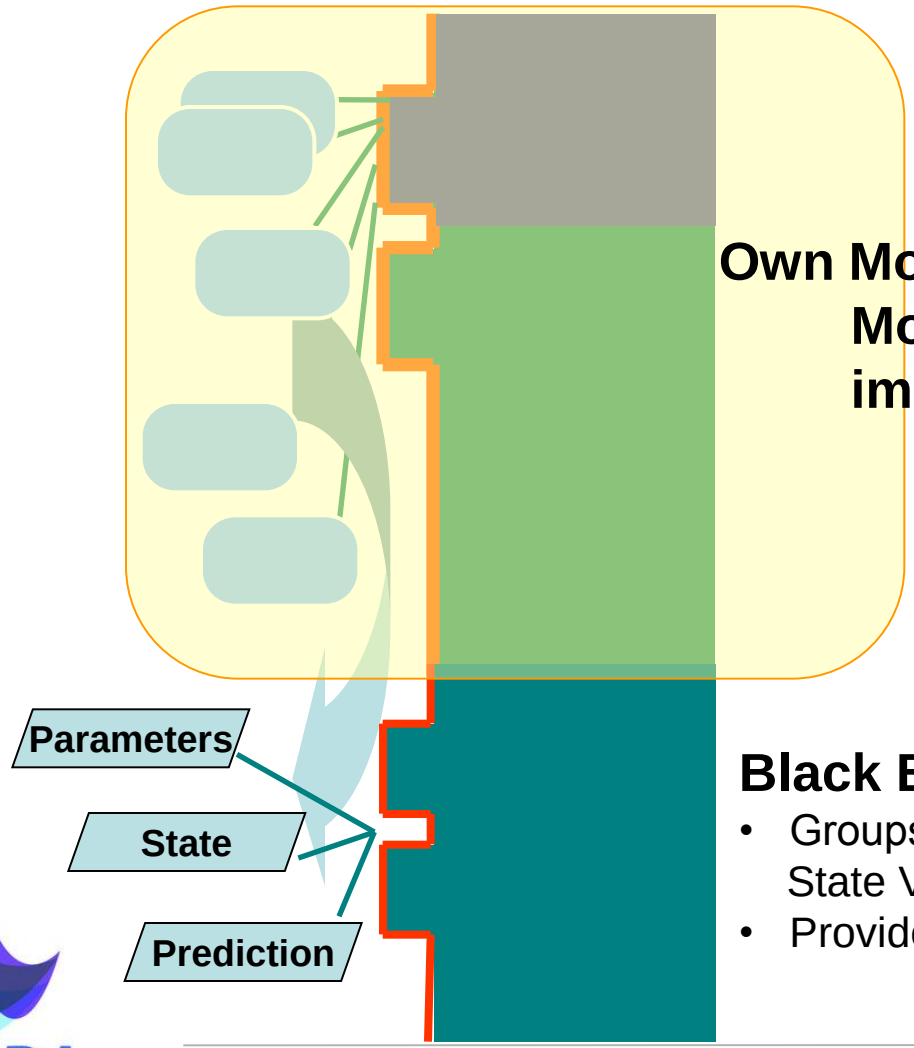
BB wrapper config, using stochastic part only



Own ModelFactory / ModelInstance implementation

Black Box StochModelInstance

- Groups EI's into Parameters vector, State Vector and Predictor vector
- Provides Uncertainty Information

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BB wrapper config, using stochastic part only

My Config File

- For my ModelFactory
- That creates my ModelInstances, with my Exchange Items

StochModelConfig

- Which Exchange Items must be used for parameters, the state and the prediction?
- What are the uncertainties of the parameters?
- What Noise Models are added to the state, and to which exchange item must the noise be added?

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