

# HYCON 2 TOOLBOX

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# OUTLINE

- Motivations for the H2T
- Development of the H2T
- Future work and live demo

# NEED FOR AN UNIFIED FRAMEWORK

- Variety of tools for large-scale networked systems
- Models can be extremely different
  - Dynamics: linear/nonlinear/hybrid
  - Coupling variables: local inputs/outputs/states
  - Features of communication channels: delays/packet drops



# NEED FOR AN UNIFIED FRAMEWORK

- Controllers structure variety
  - Centralised
  - Decentralised
  - Distributed
  - Hierarchical

# NEED FOR AN UNIFIED FRAMEWORK

- Largely complementary Matlab toolboxes
- H2T: upper layer to provide interoperability
  - Simple access to low level function
  - Limited learning curve

# SUPPORTED TOOLBOXES

- WIDE (Decentralised and Wireless Control of Large Scale system ) - IMTL
- MPT (Multi Parametric Toolbox) - ETHZ
- PnMPC (Plug-and-Play MPC) - UNIPV



# SUPPORTED TOOLBOXES

- WIDE (Decentralised and Wireless Control of Large Scale system ) - IMTL
  - Centralised, decentralised/distributed control schemes
  - Explicitly accounting for networking effects
  - LMIs based MPC implementation

# SUPPORTED TOOLBOXES

- MPT (Multi Parametric Toolbox) - ETHZ
  - High speed centralised explicit MPC
  - Real-time implementation
  - Polyhedral computation tools
  - HYSDEL to MPC



# SUPPORTED TOOLBOXES

- PnMPC (Plug-and-Play MPC) - UNIPV
  - Decentralised MPC for large-scale systems
  - Easily add or remove subsystems
  - Zonotopes handling and invariant sets computation

# CANDIDATE TOOLBOXES

- RACT (Randomised Algorithms Control Toolbox) - CNR
  - Robust control for uncertain systems
- MCN (Multi-Hop Control Network Toolbox) - UNIVAQ
  - Wireless multi-hop networks

# H2T STRUCTURE

- Unique modelling framework: 1smode1 WIDE
  - Compositional features
  - Flexibility
  - Compatibility with the Control System Toolbox



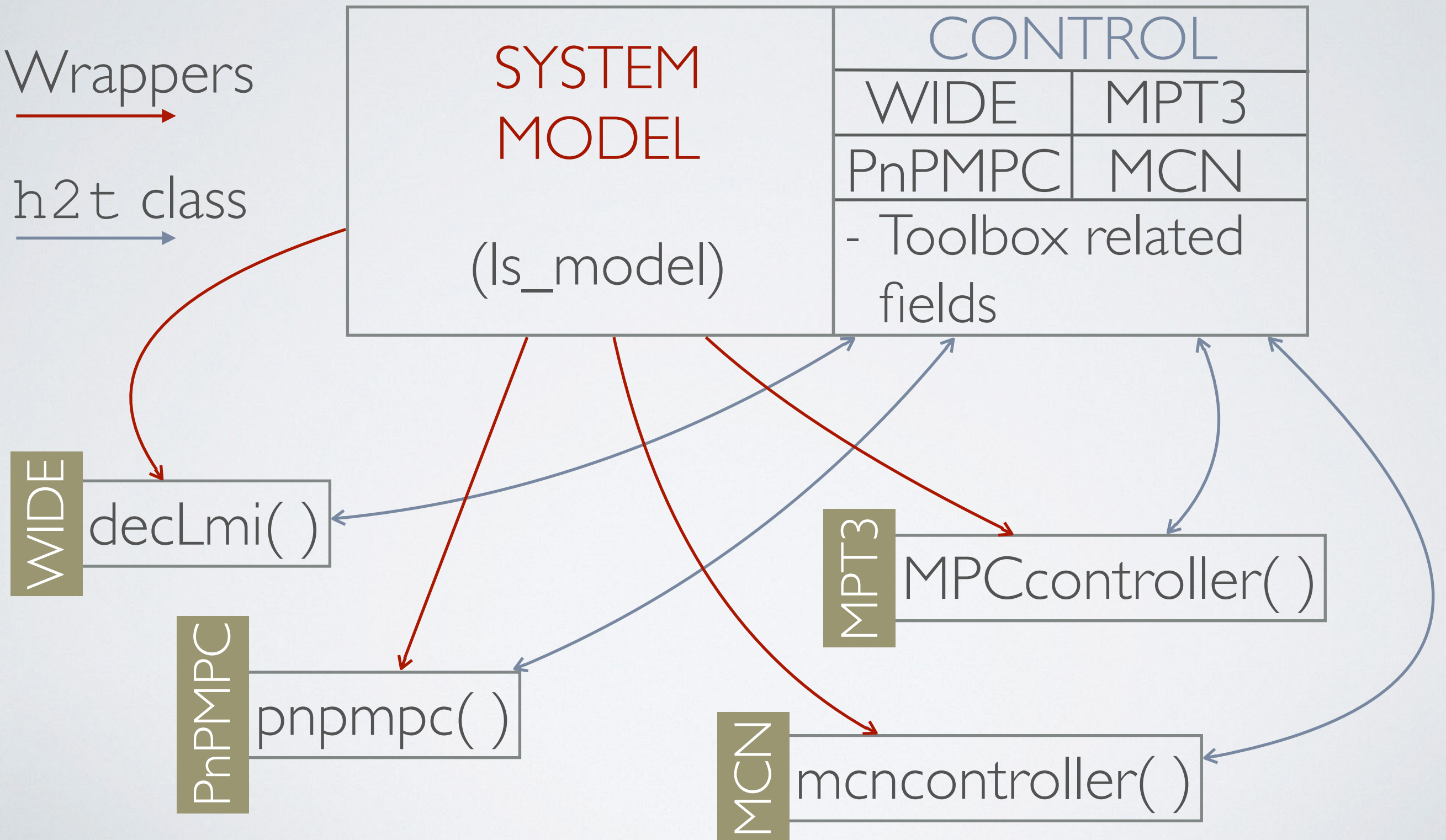
# H2T STRUCTURE

- Control design common interface
  - Wrappers from `lsmodel` to low-level toolboxes
  - `h2t` class: middleware between the user and the supported toolboxes

# H2T WORKFLOW

- Model definition
- Control parameters specification
- Build a controller for the desired low-level toolbox

# TOOLBOX INTEGRATION





# H2T METHODS

- `checkParameters (low_level_toolbox)`
  - required and optional parameters
  - help page hints
- `setParameters (param_label, value)`
  - consistency check
- `buildController (low_level_toolbox)`
  - wrapper function call

# FUTURE WORK

- Modular structure to easily support new toolboxes (MCN will be the next)
- Upgrade to define subsystem using the `ss` function
- Definition of a unified simulation framework (*simulation wrapper*)