Session No. 9: Interoperability & Test Labs

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Test beds involving co-simulation of cross-domain functionality

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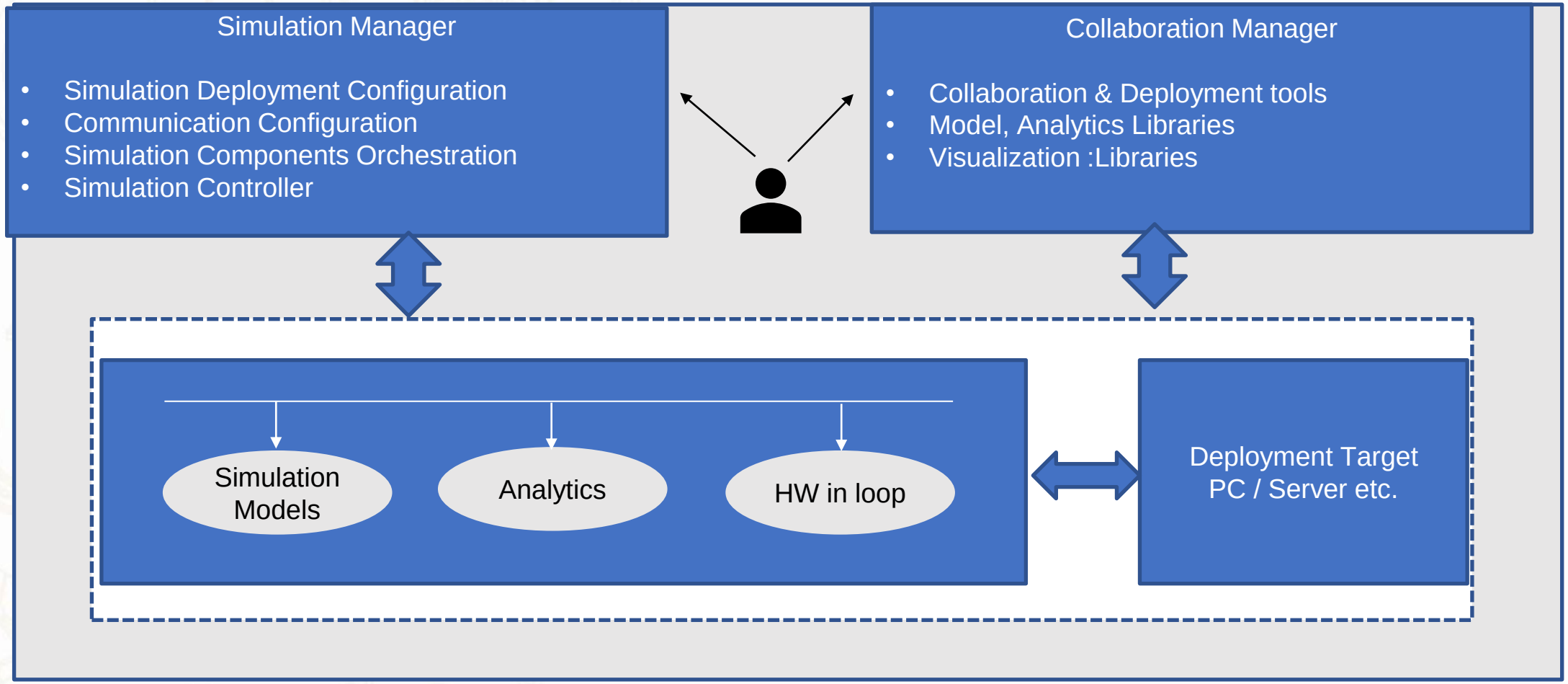
Simulation Testbeds

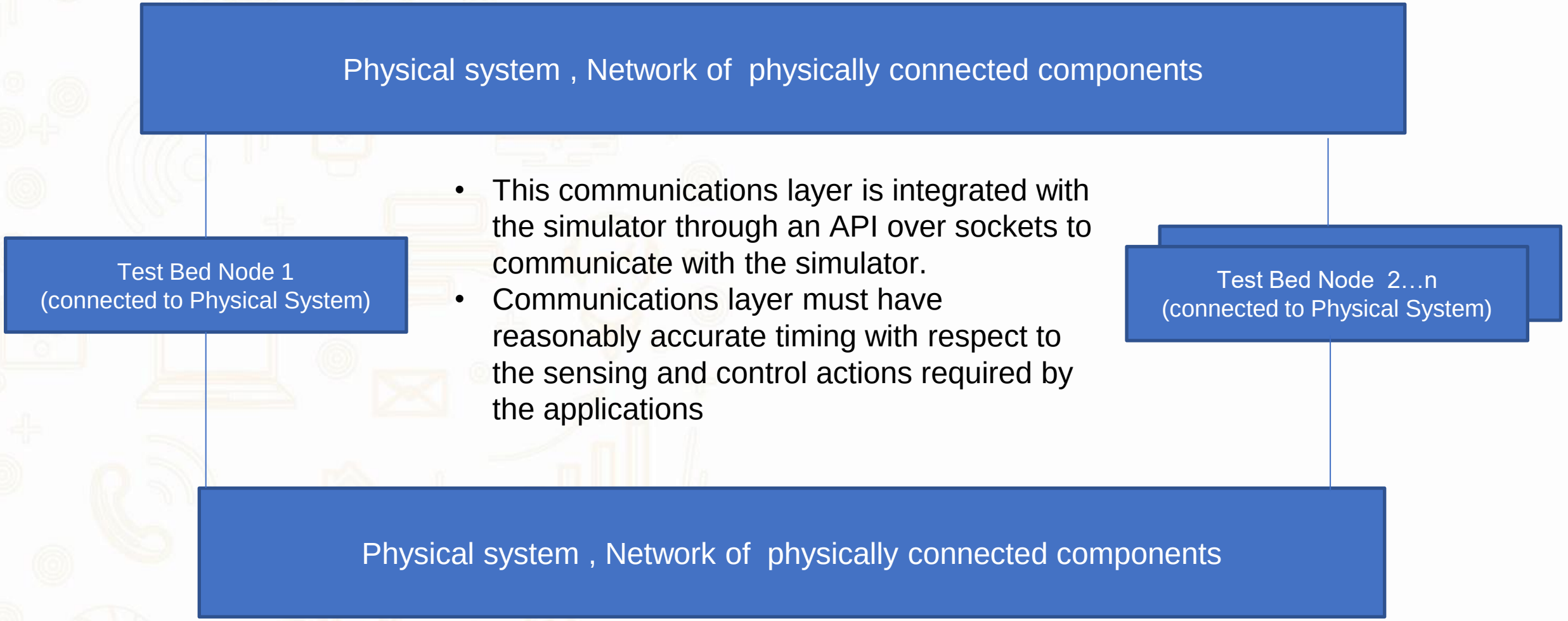
Needs & Challenges

- Analyzing most cyber-physical systems require simulations to address concerns of diverse stake holders like business owners, consumers, regulators, markets etc.
- Design time testing is very important before physical deployment trails on the field
- Simulations are highly dynamic and require tight integration of many interacting physical domains (e.g., electrical, mechanical, thermal, structural, and cyber)
- Current Limitations :
  - tools and expertise in various domains
  - lack the necessary software and hardware infrastructure
- Currently simulations are partitioned to evaluate only some aspects in silos, hence ignore some aspects altogether.
- Cross-domain simulations require a platform that can orchestrate the simulation through multiple tools through custom adaptors
- Runtime component is at least as fast as ”real-time,” (faster than the highest sampling/actuation rate required by the system)
- . Need for cloud-based simulations supporting the communication requirements of the system components in terms of latency and payload

Typical architecture of Cross domain Test beds

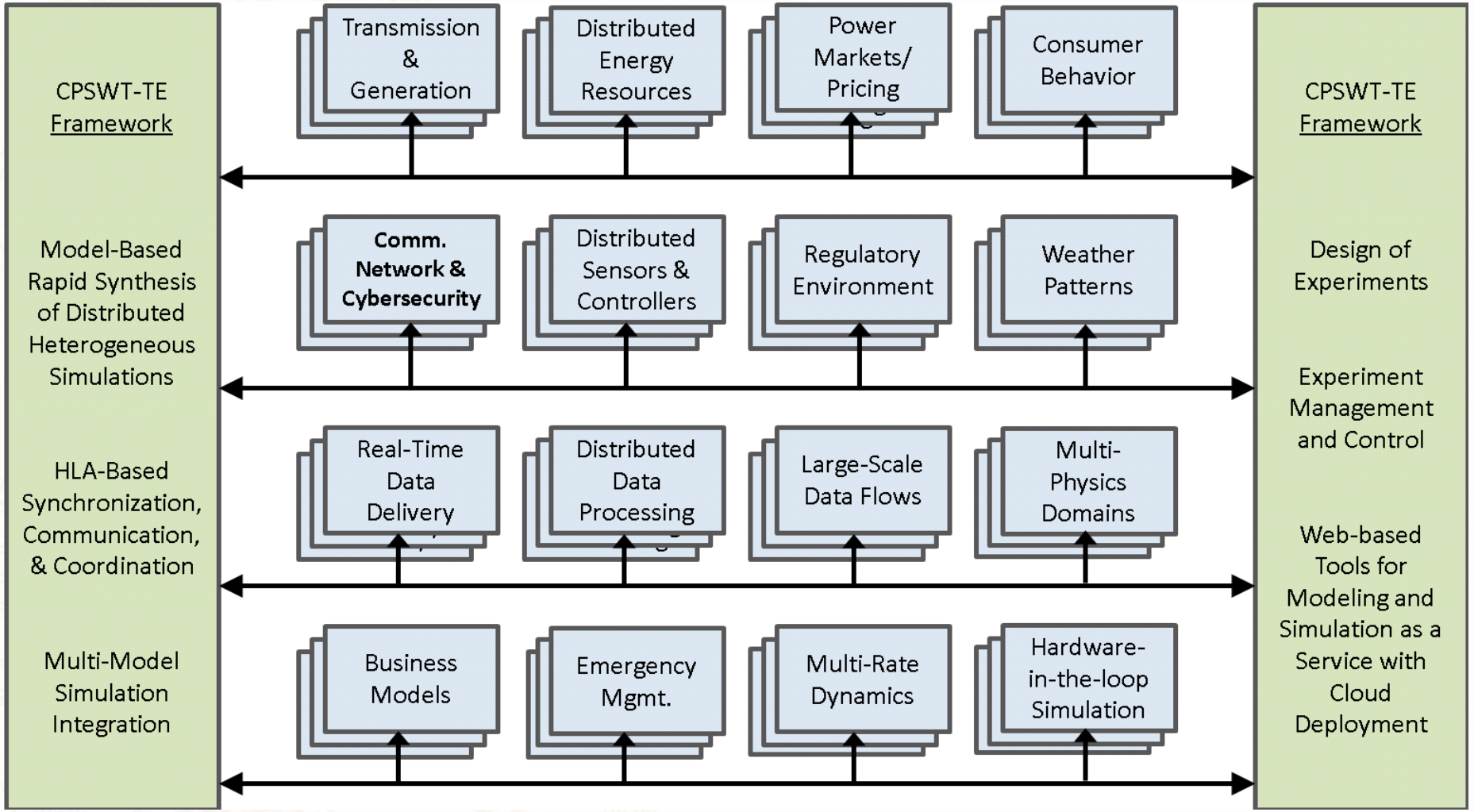


Communication Network Emulators



- This communications layer is integrated with the simulator through an API over sockets to communicate with the simulator.
- Communications layer must have reasonably accurate timing with respect to the sensing and control actions required by the applications

Example – Co-simulation Test bed

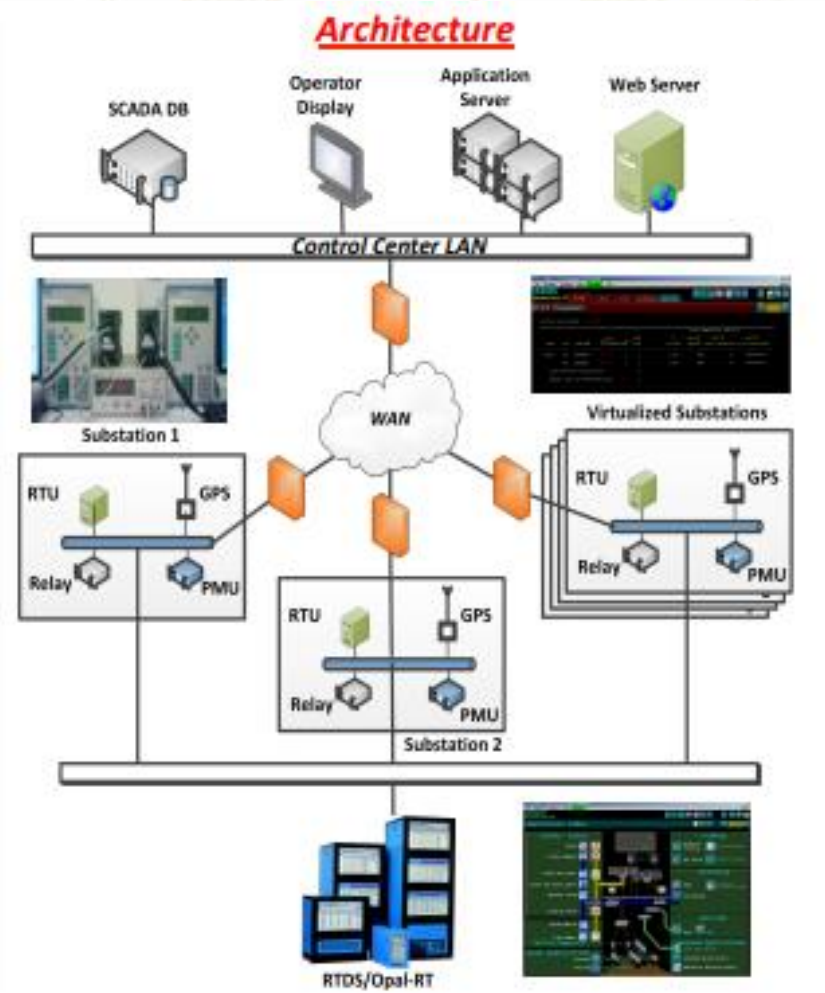


Vanderbilt University Transactive Energy Simulation Test Bed

Ref: NIST-SP-1900-603

Example – Cyber-physical security testbed

Power System & Communications testbed – Iowa State University



- Cyber in the loop Real time simulations
- Real-Time simulators Digilal Simulation of Power System with monitoring, protection, control functions.
- Mulli-area, substation architecture enabled through virtualization.
- Local/wide-area control and protection applications emulated with programmable IEDs and PMUs interfaced with real time digital simulators
- Vulnerability assessment Field devices, Protocols, Software applications
- Risk assessment & Mitigation
- Threat & Vulnerability analysis
- Attack Defense Evaluations

Ref:
https://www.ece.iastate.edu/powercybersec/files/2020/10/ISU_PowerCyber_Testbed_Flyer.pdf

Thank You

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