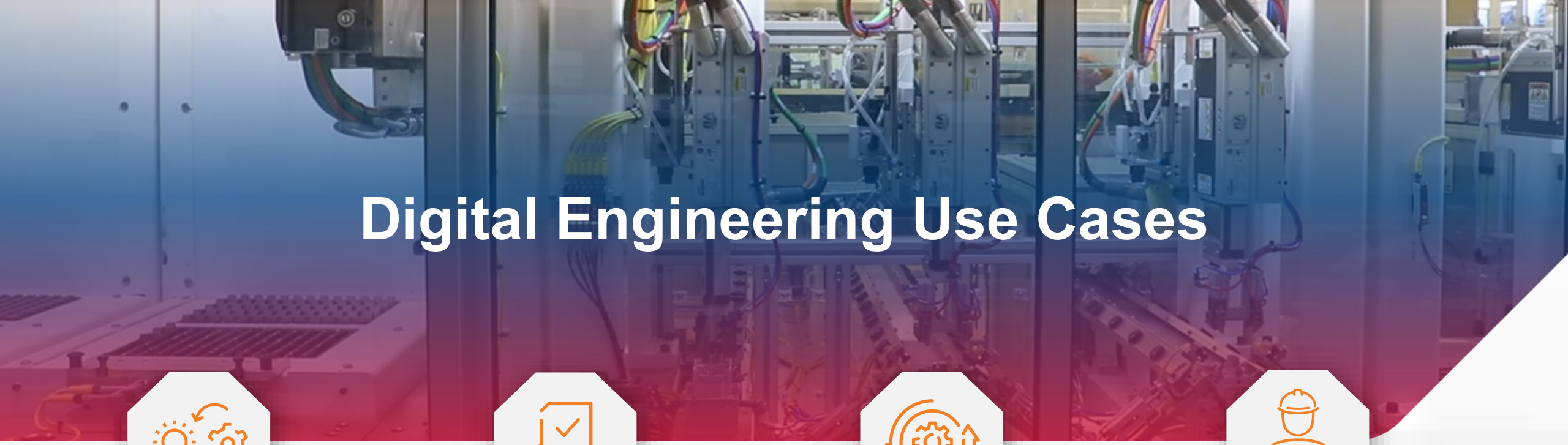
Rockwell Automation

# FactoryTalk® Logix Echo


expanding **human possibility**®



# Digital Engineering Use Cases

## Machine Prototyping

Easily design and build the next generation of machines with confidence

## Virtual Commissioning

Design, test, validate, & commission machines before they go into service

## Throughput Analysis

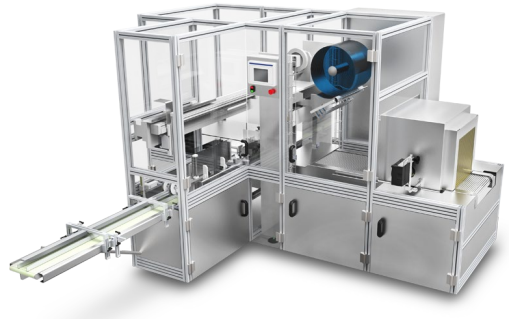
Optimize throughput with real-time 3D simulation of dynamic processes

## Operator Training Simulators

Reduce risk by training your workforce in a safe, virtual environment

# Digital Twin Workflow

Mitigates risks and adds flexibility in your projects

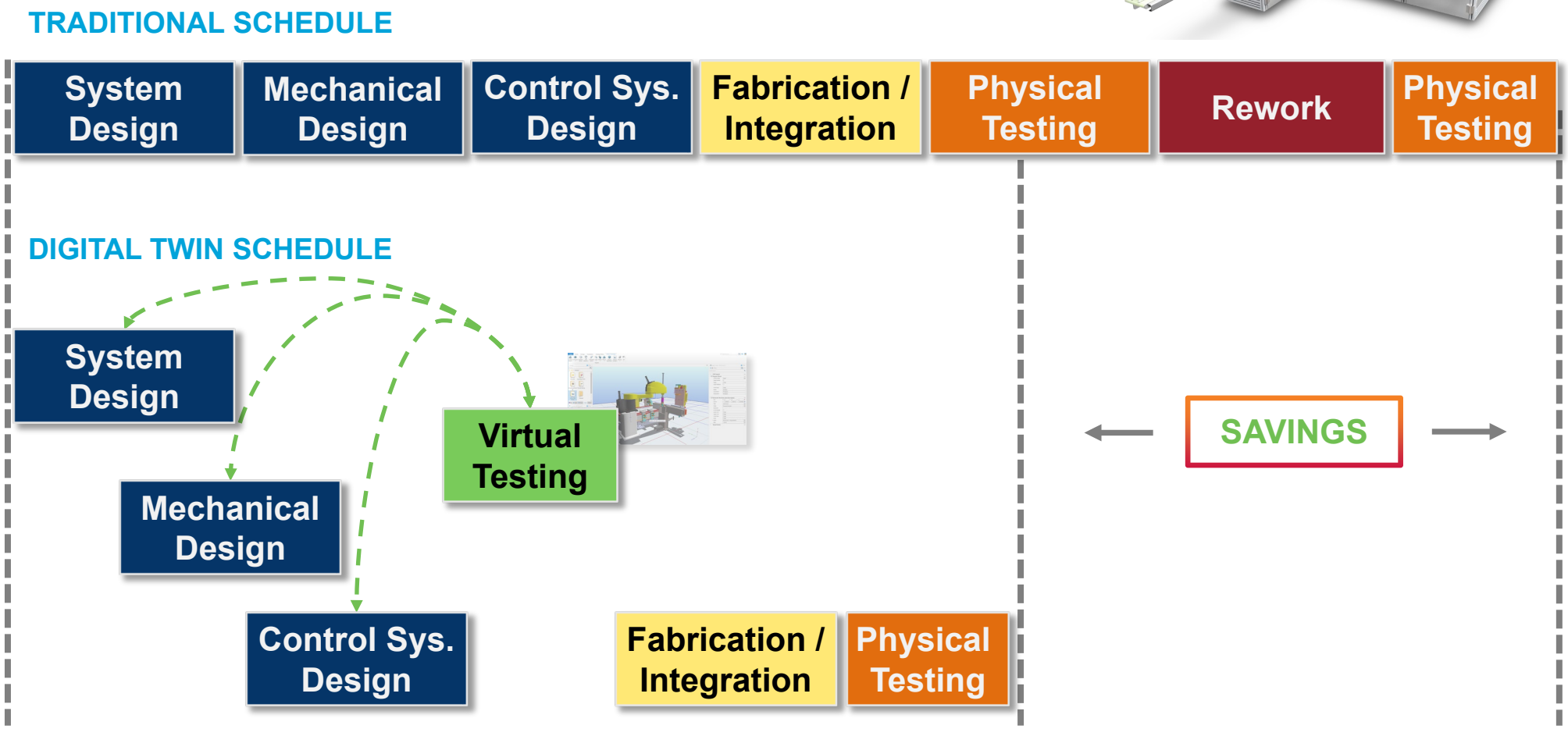


**Improve** project delivery timeline

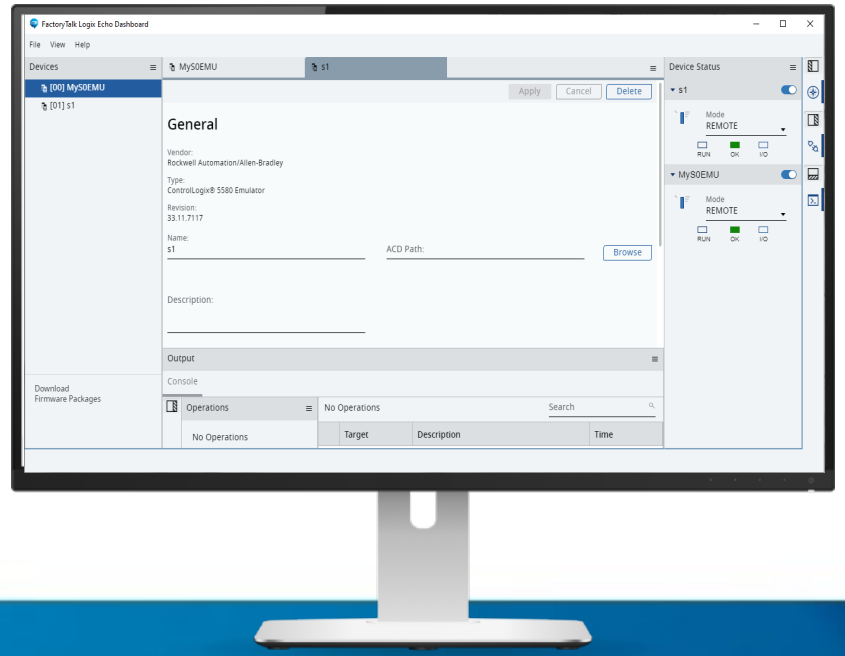
**Improve** quality of design

**Reduce** hardware dependencies

**Reduce** commissioning risks



# Logix Echo




## Emulate ControlLogix® 5580 Controllers

- Fully test your control code in a safe, virtual environment
- The emulated chassis supports up to 17 controllers
- Execute controller project as designed without modifications

## Ethernet Connectivity

- Front port of controller emulated
- Produce/Consume and MSGs between emulated controllers
- Connect to HMI or other software with Class 3 MSGs

## SDK (Public Interface)

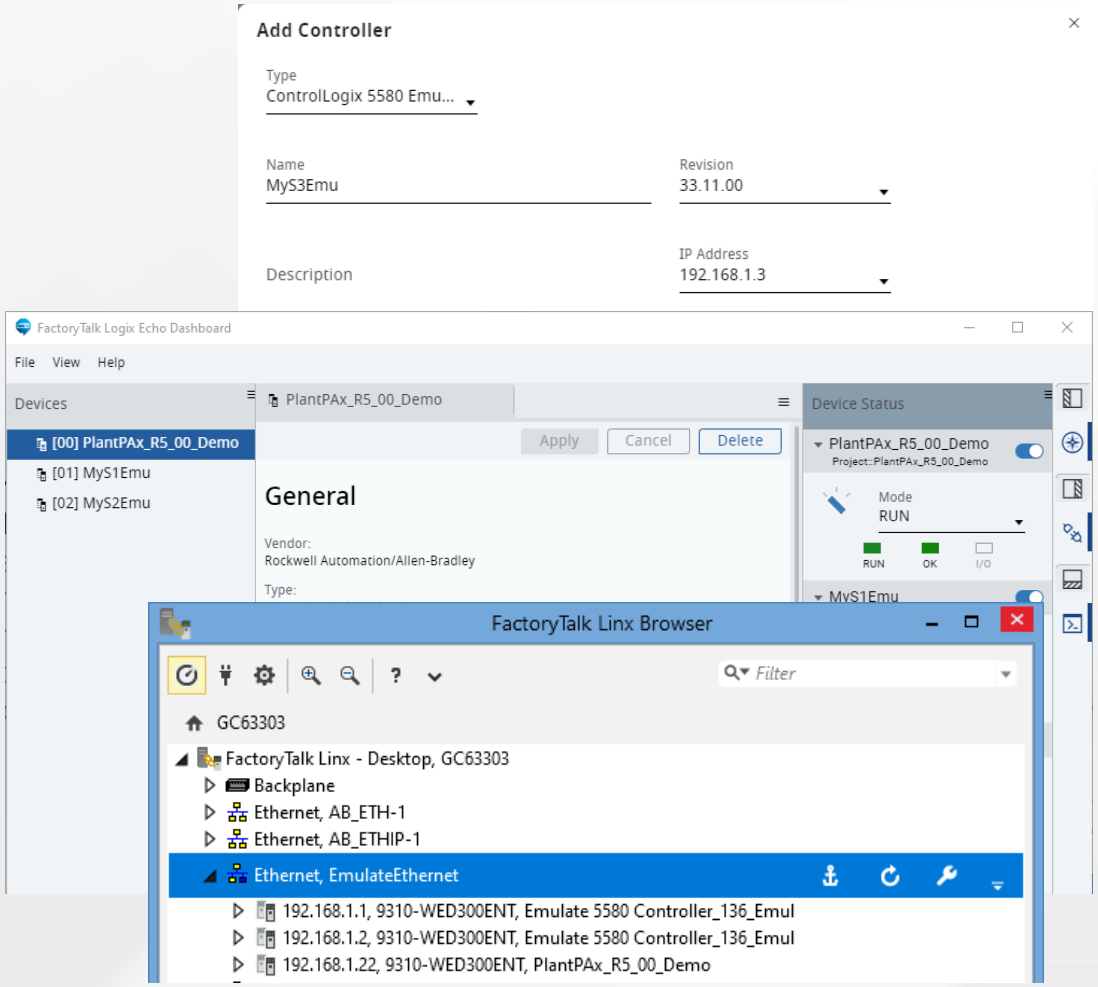
- Interface with high fidelity process simulators and Operator Training Simulators (OTS)
- High-speed data exchange
- Virtual time-scaling
- Snapshots

# FT Logix Echo

Access is Similar to a Physical Controller

## Setting up an emulated controller is fast

- Get the corresponding emulator firmware kit from the PCDC
- Create emulated controller instance with appropriate firmware revision and IP address
- Configured controllers appear in FactoryTalk® Linx software
- Create up 17 emulated controllers in one emulated chassis

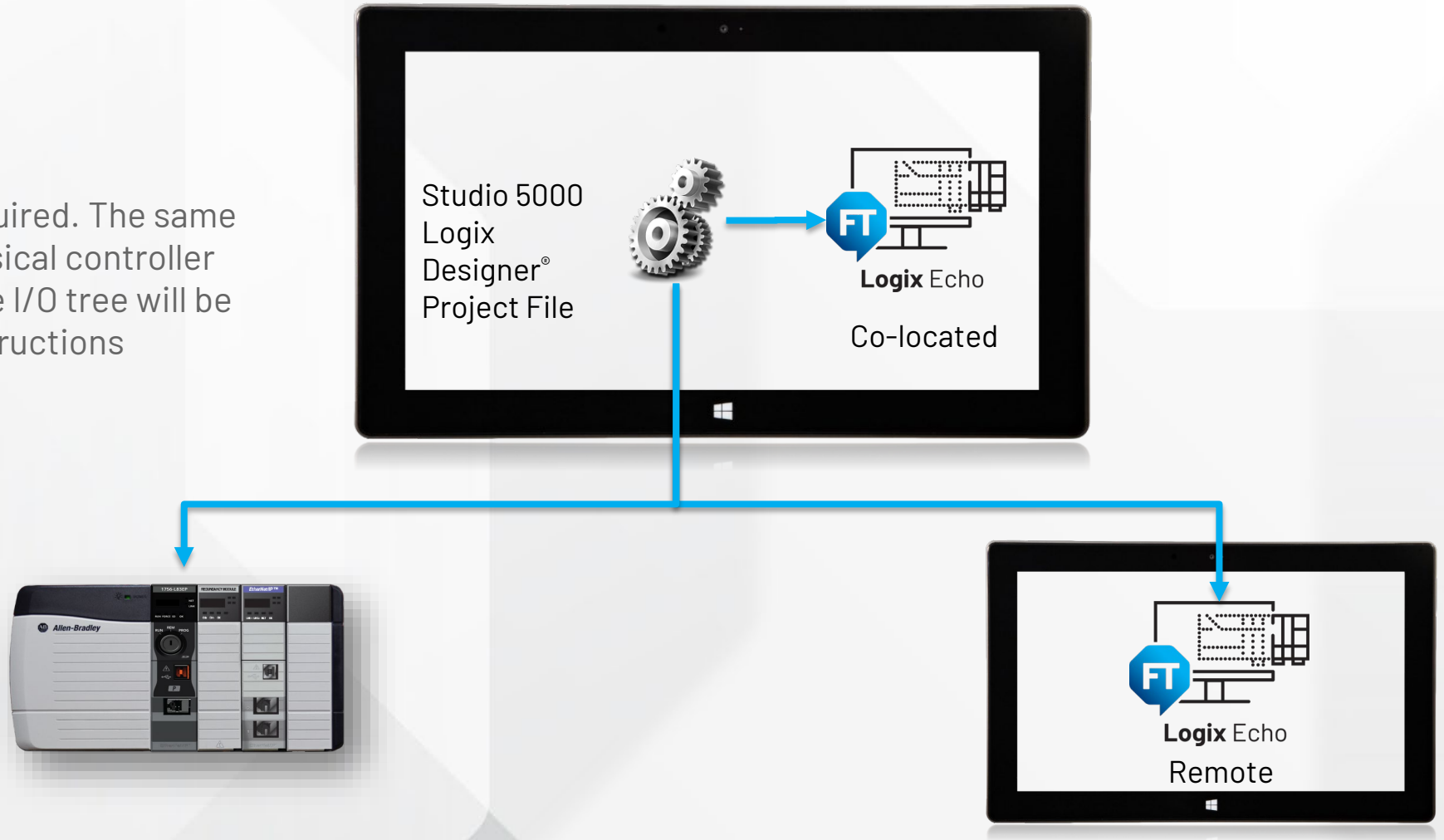


# Logix Echo

Apply Same Project to Physical or Emulated Controller

## Same Project File

No changes to the project file required. The same project file developed for the physical controller will download to the emulator. The I/O tree will be maintained, all languages and instructions supported.



# Logix Echo

## Supported Controllers

### ControlLogix® 5580 Controllers

All -E, -XT, -NSE and –P controllers

Logix Echo

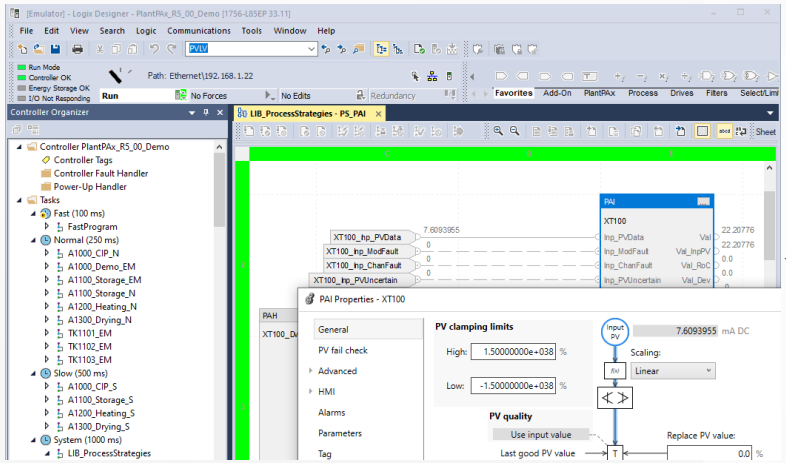
Firmware version 33 or later

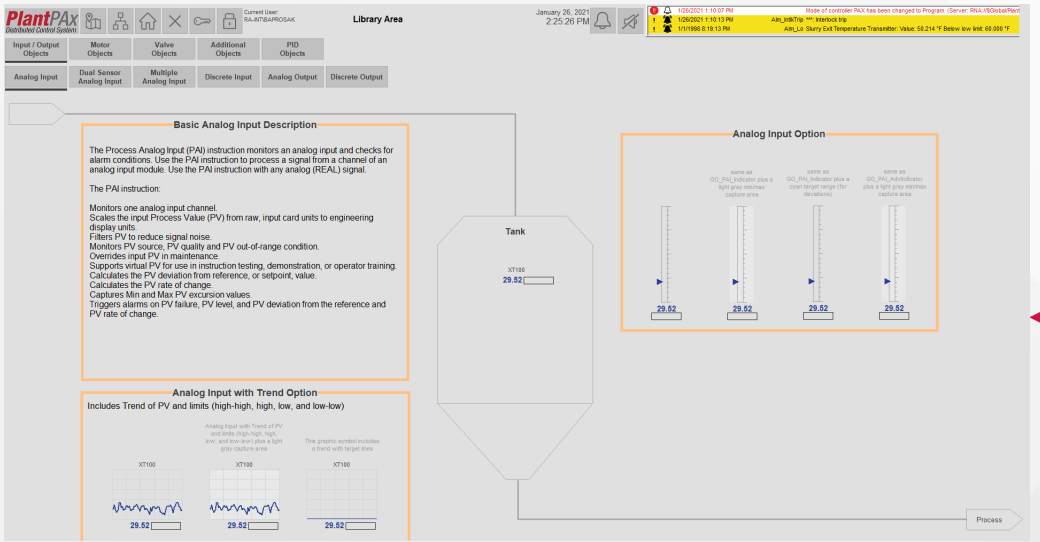
| Catalogs | | | | |
|---|---|---|---|---|
| 1756-L81E | 1756-L82E | 1756-L83E | 1756-L84E | 1756-L85E |
| 1756-L81EK | 1756-L82EK | 1756-L83EK | 1756-L84EK | 1756-L85EK |
| 1756-L81E-NSE | 1756-L82E-NSE | 1756-L83E-NSE | 1756-L84E-NSE | 1756-L85E-NSE |
| 1756-L81EXT | 1756-L82EXT | 1756-L83EXT | 1756-L84EXT | 1756-L85EXT |
| 1756-L81EP | | 1756-L83EP | | 1756-L85EP |

**Future Releases**: GuardLogix® 5580, CompactLogix™ 5380 and Compact GuardLogix® 5380 Controllers

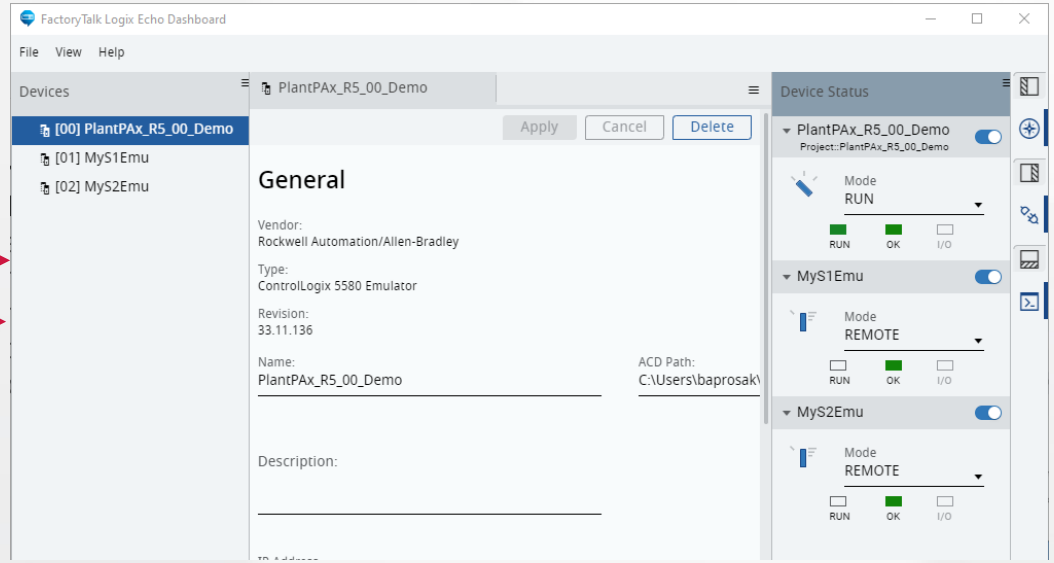
# FT Logix Echo

Simulate Control Code and HMI Interaction All from a Single Workstation or Distributed






**Step 1:** create Logix application and run in Studio 5000® Logix Emulate™



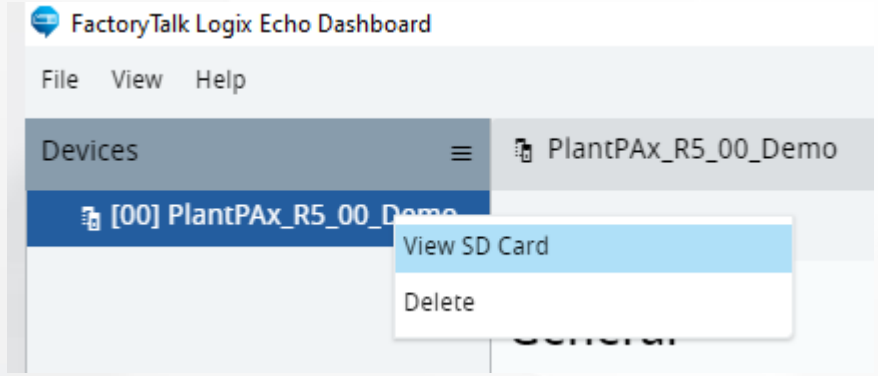

**Step 2:** Existing HMI shortcut(s) will work provided the emulated controller is at same IP as physical controller

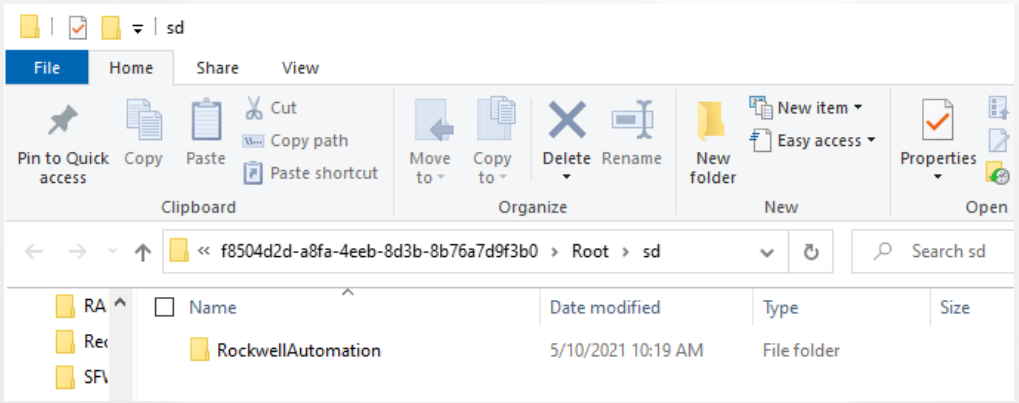
# Logix Echo

Virtual SD Card Support

## Support for SD Cards

- By default, a virtual SD card is attached to a controller (as a folder on your Windows directory)
- You can backup/restore projects, read/write data from the controller applications, log, just as you would with a physical SD card in the controller.
- Unlike the physical controller:
  - Firmware is not stored to the virtual SD
  - The content is stored unencrypted

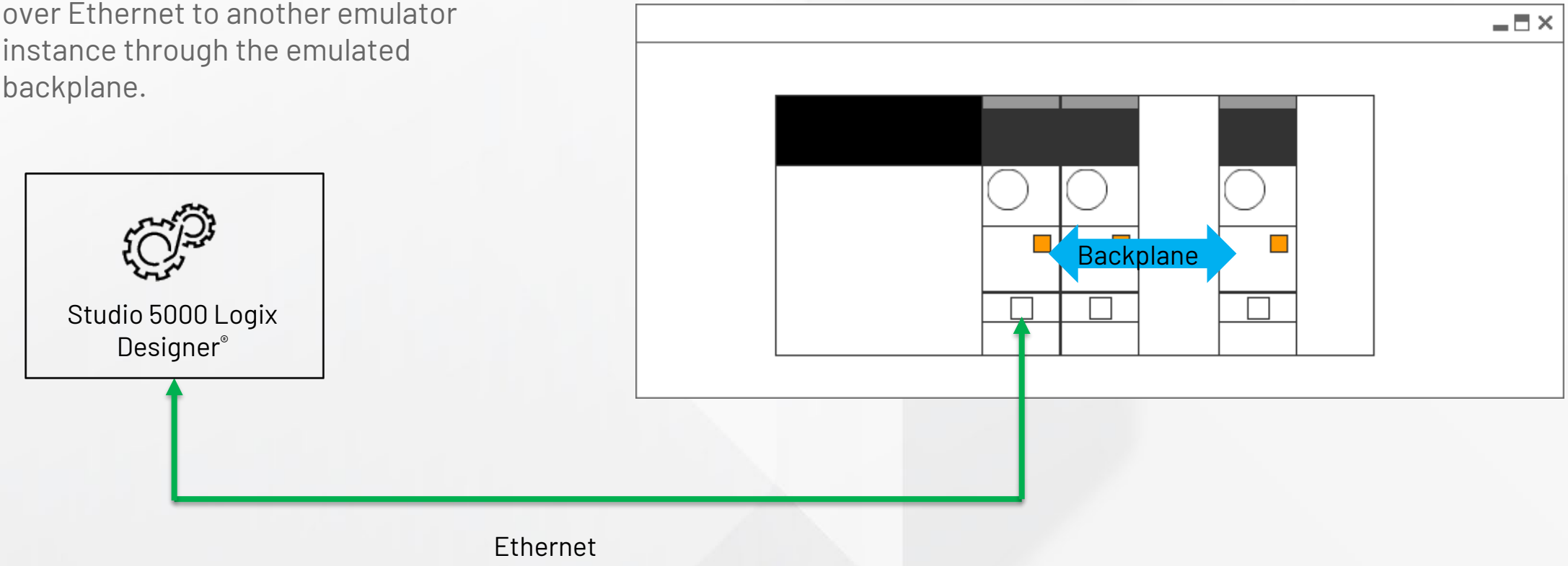


# FT Logix Echo

## Studio 5000 Logix Designer® to Emulator Instance

Studio 5000 Logix Designer® can download over Ethernet. It can also bridge through one emulator instance connected over Ethernet to another emulator instance through the emulated backplane.

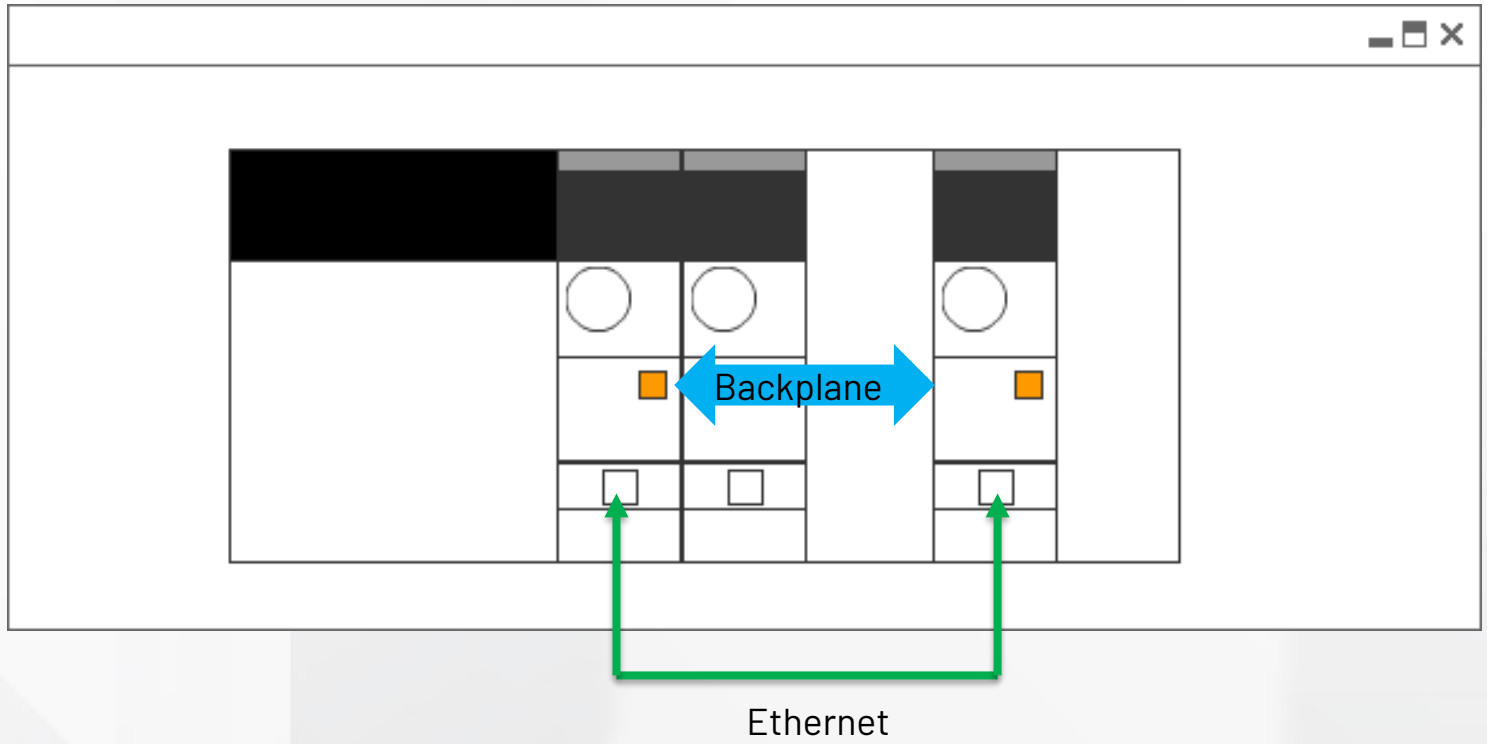


# Logix Echo

## Emulator-2-Emulator Communications

Class 1 (Produce/Consume) or Class 3 (Messages) communication between emulator instances can be established across:

- the emulated back plane
- Ethernet using the EtherNet/IP protocol.

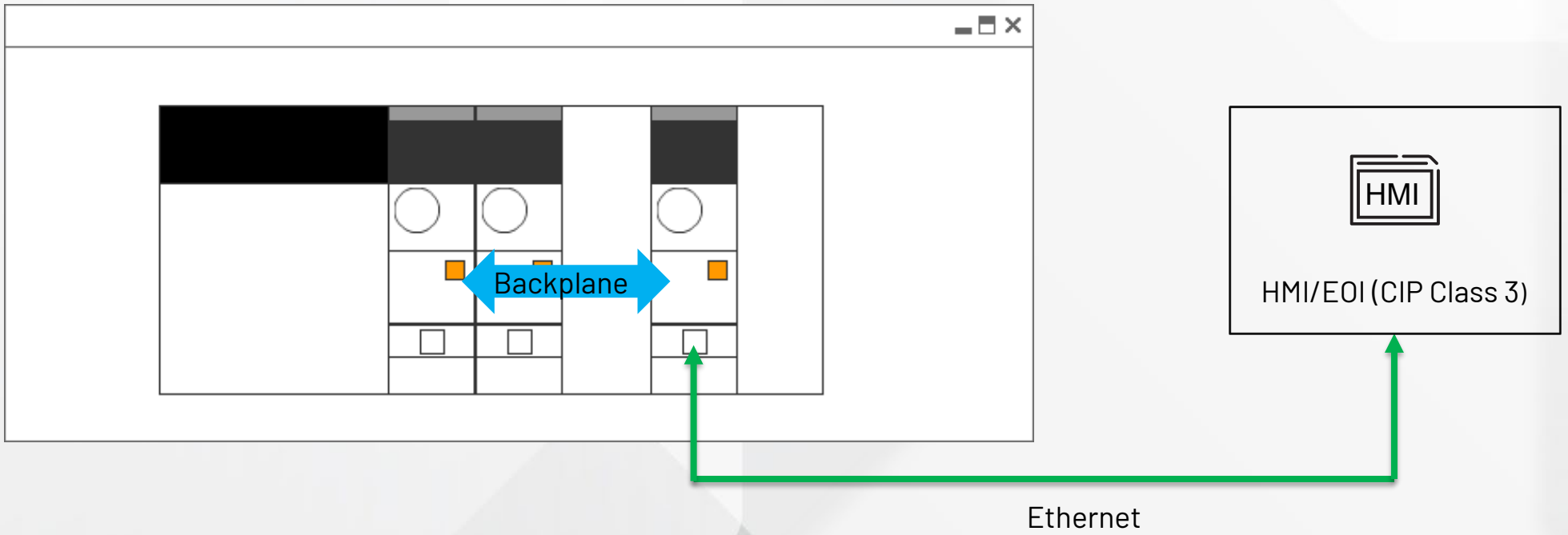


# Logix Echo

## Emulator-2-HMI/Other CIP-based software

Class 3 (Messages) communication between emulator instance and HMI/other CIP-based software:

- Over EtherNet/IP
- Bridged over backplane to EtherNet/IP

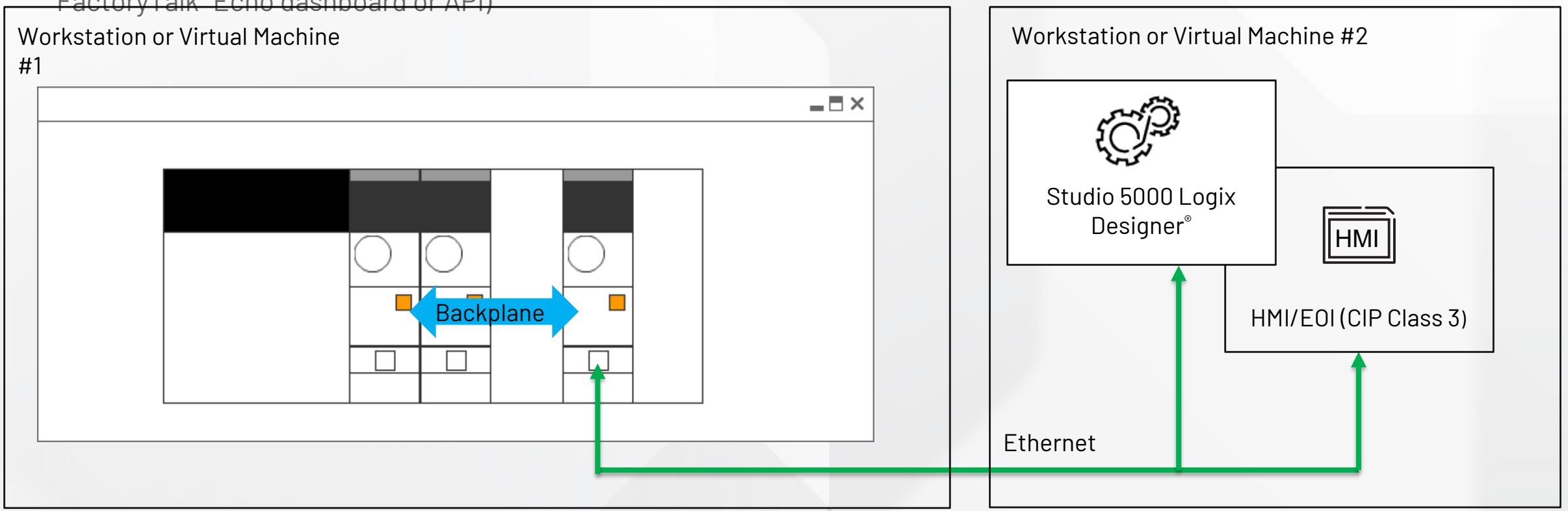


# Logix Echo

## Remote connections to Emulators

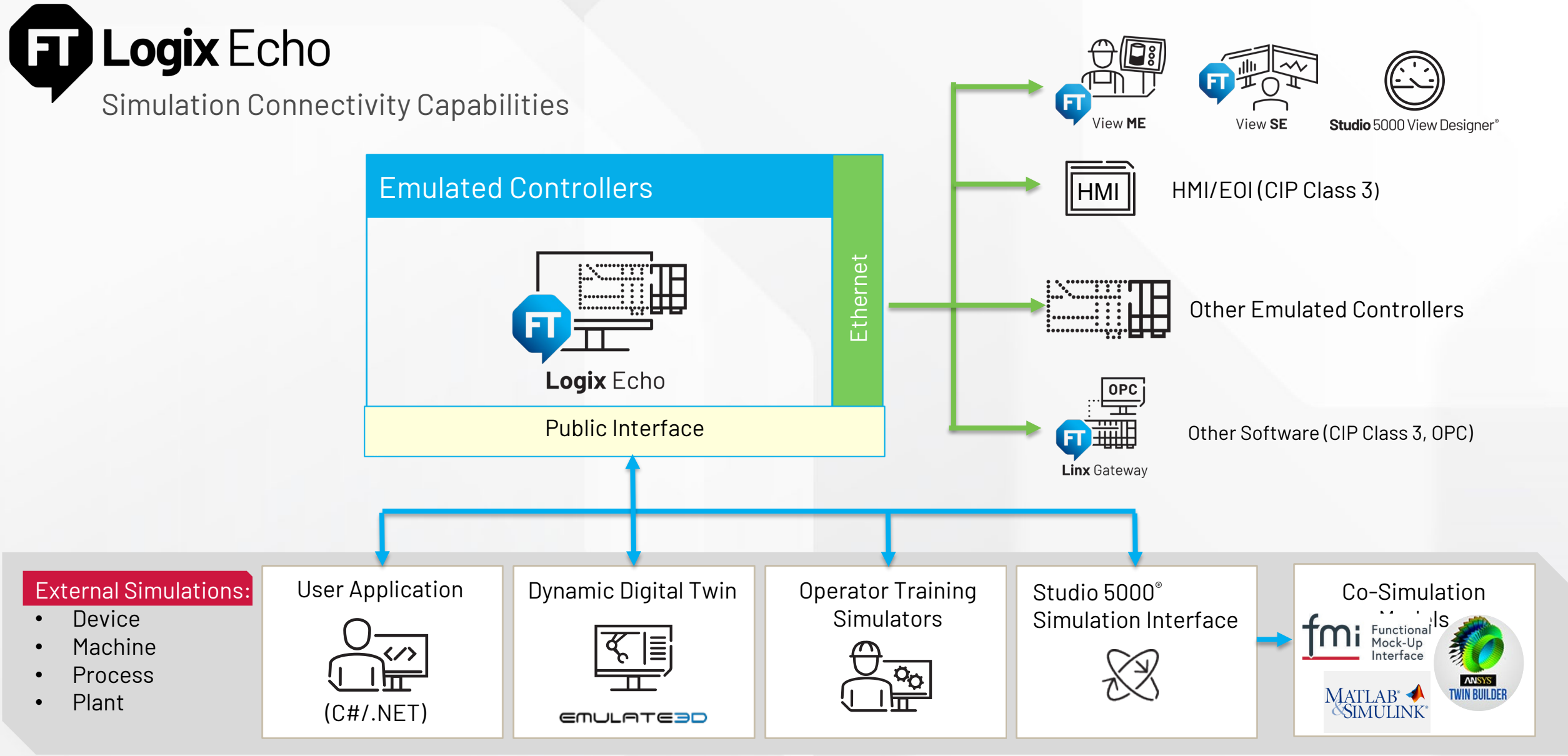
Remote instances of Studio 5000® Logix Emulate™ and HMI software can communicate with the emulator instances over Ethernet.

- When Studio 5000 Logix Designer® is not installed on the same OS as FactoryTalk® Logix Echo certain workflows are disabled that depend on Logix Designer application services (ie Creating an emulator from ACD, program Download through FactoryTalk® Echo dashboard or API)



# Logix Echo

## Simulation Connectivity Capabilities



# FactoryTalk® Logix Echo SDK

Integrate FactoryTalk® Logix Echo into your own Software Applications

User Application

(C#/.NET)

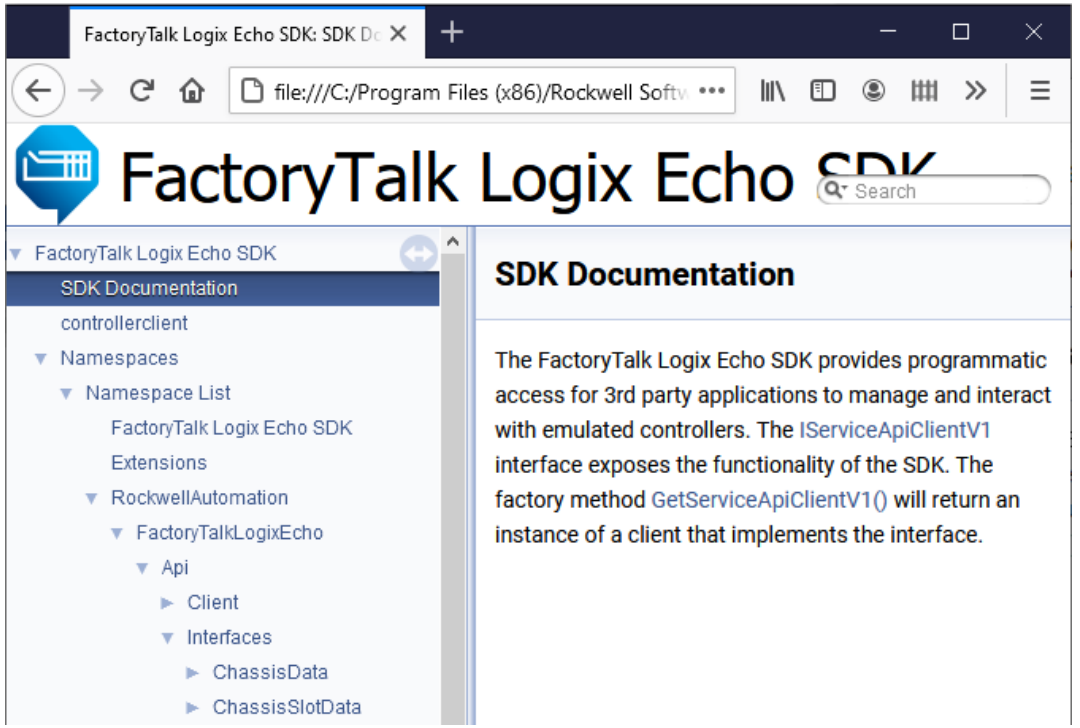
Integrate all FactoryTalk® Logix Echo functionality into your own software application. Use the SDK and API to build applications to connect directly to controllers for simulation and data analysis

**The SDK documentation kit contains:**

- Detailed explanations of all the API functions and their uses with sample code
- NuGet package, which includes .NET Standard 2.0 assemblies which allow access to API. (Installable in any .NET application that supports .NET Standard 2.0)

**Two Sets of APIs:**

- Service API: Use to manage the system and to perform all the functions that can be done from the dashboard
- Controller API: Use to control the execution, scale time, and access tags in an emulated controller



# Logix Echo

Snapshot Capabilities

Operator Training Simulators

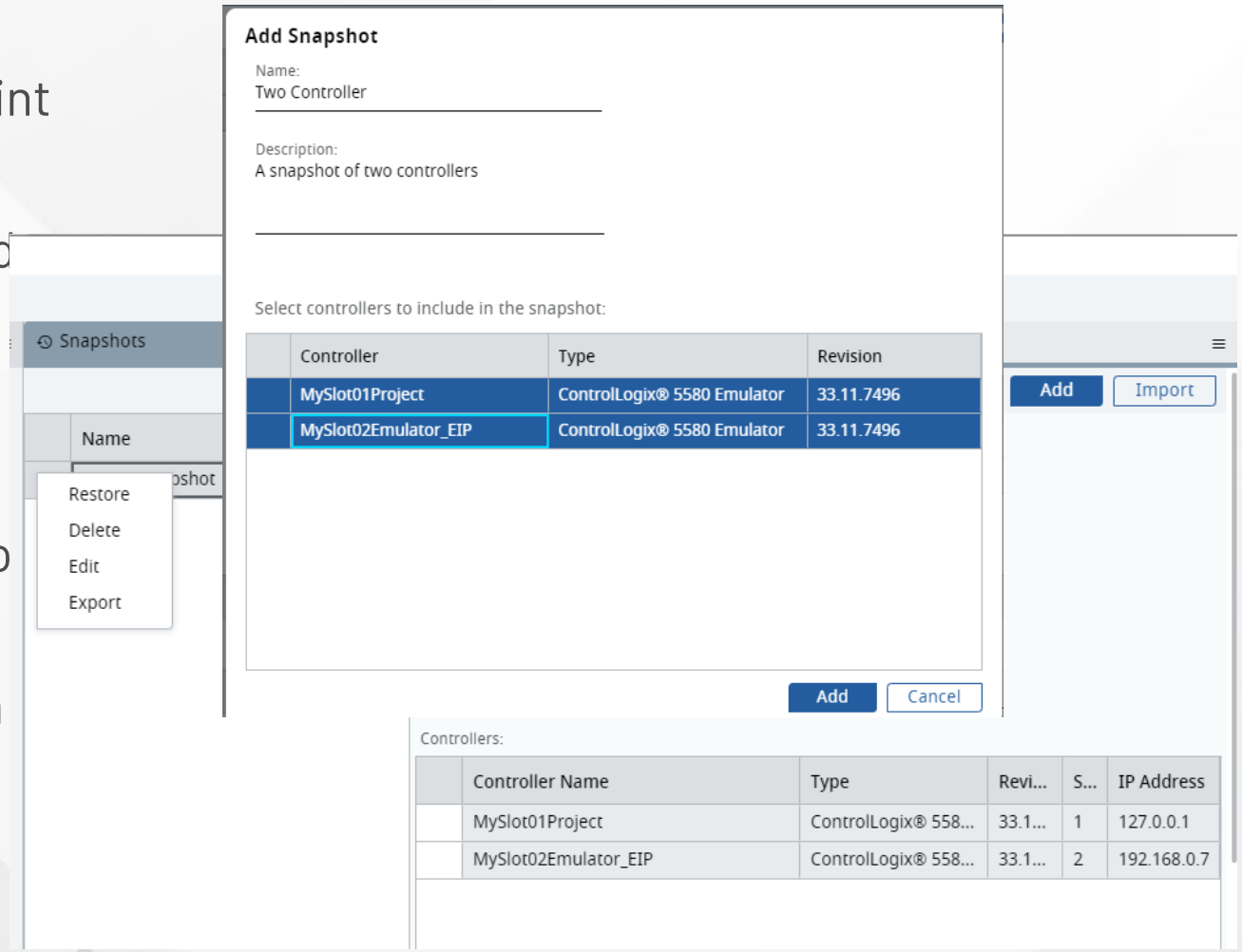
## Snapshot Concept

Save one or more controller's state at a specific point in time which can latter be restored

- Includes controller time, application tag data and execution context

## Use Cases

- Operator Training Simulators: Restore training scenarios that are difficult or time-consuming to recreate
- Automated Testing: Continuously recall a known scenario for testing



Operator Training Simulators

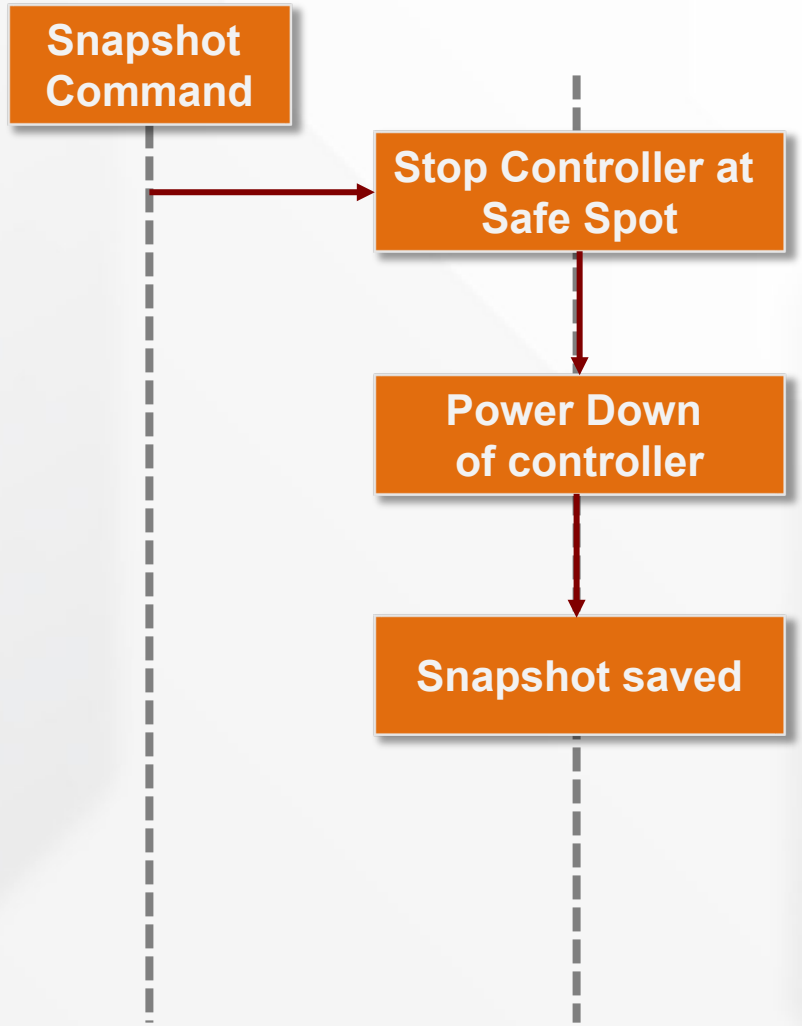
# Snapshot – What happens

## Saving a Snapshot

A “Power Cycle Persistence Snapshot”: We take an entire capture of the controller (static and dynamic data, like what happens during a power down of a physical controller)

## Sequence of Events

- Snapshot Command: To prevent data integrity issues the controller is paused at the end of task scanning (beginning or end of continuous task (or idle if no continuous task)
- The controller powers down to save dynamic and static data
- Power up of the controller (first scan and pre-scan skipped)
- The full state is captured as a snapshot



Operator Training Simulators

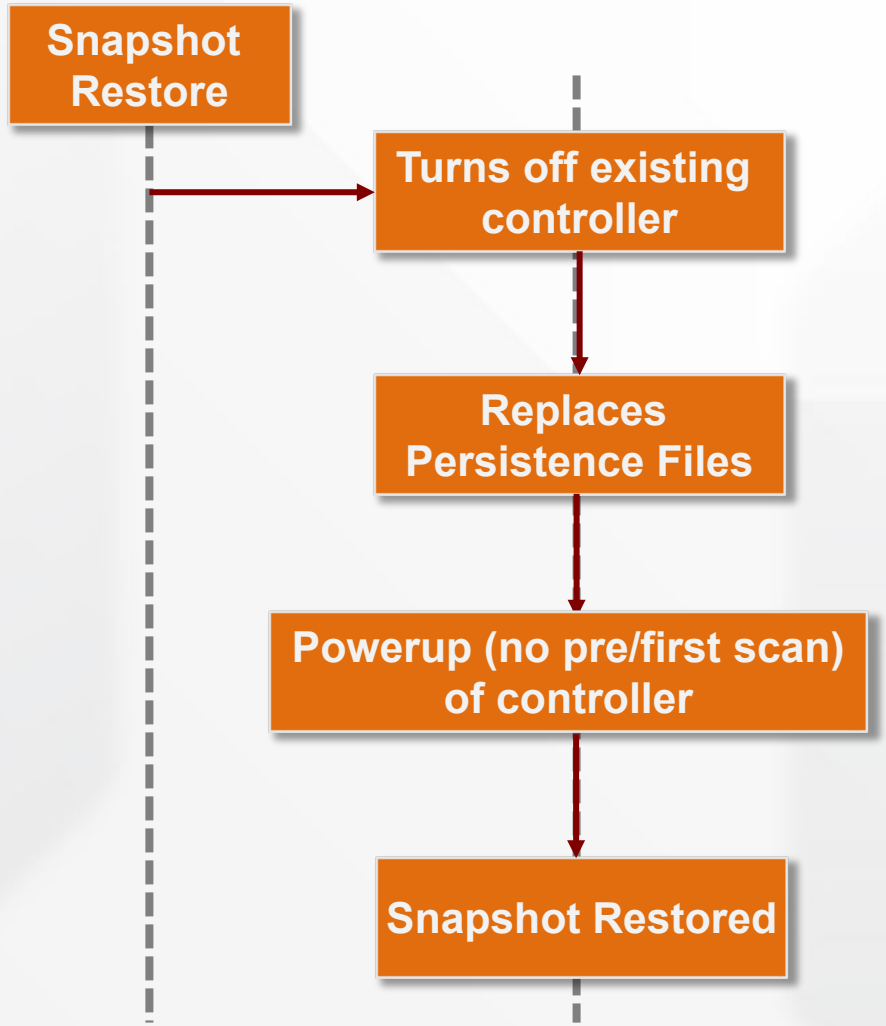
# Snapshot – What happens

## Restoring a Snapshot

Replaces over existing controllers

## Sequence of Events

- Snapshot Restore: Turns off existing controllers. Controllers must be present in target slots of the snapshot restore. Inconsistencies presented to the user.
- The persistence files are replaced with the files from the snapshot
- On powerup the controller restores and resumes user execution, skipping first scan or pre-scan operations
- While the IP address from the snapshot will be applied to the controller, it will not bind to the IP address unless that IP is present on the workstation



# FT Logix Echo

The emulator is designed to be a virtual controller, used in the development, testing and simulation environments

## With an emulator, **you can**:

- Download and run logic written in any Logix language
- Be online with Logix Designer application, and all that entails
- Connect from an HMI [except for HMI Button Control (HMIBC)]
- Produce/Consume tags with other emulators
- Use MESSAGE instructions
- Use virtual axes for motion applications. [Future feature call Axis Test Mode will enable simulation of "real" axes"]
- Download a project configured for redundancy, although it will always behave as a "Primary with no Partner" (simplex mode)

## With an emulator, **you cannot**:

- Connect to physical I/O devices
- Connect motion axes to real drives
- Produce/consume tags with other physical controllers
- Use licensed-based source protection (precompile & encrypt)
- Emulate a true redundancy primary/secondary pair (duplex mode)

FT Logix Echo

Differences between emulated controllers and physical controllers

| Functionality | Emulated Controller Behavior |
|---|---|
| Communication to physical devices | The emulated controller is restricted from establishing connections to physical devices. However, the API can be used to simulate input and output values |
| License-based source protection | Not supported, must be removed before downloading the project |
| SD card encryption | Content on virtual SD card is not encrypted or digitally signed |
| Automatic Diagnostics | Only controller instance diagnostics are collected. No I/O device diagnostics supported. |
| Email | Email functionality is not supported |
| USB port | Not supported |
| Serial Number matching | Ignores serial number matching |

Differences between emulated controllers and physical controllers – Con't.

| Functionality | Emulated Controller Behavior |
|---|---|
| Module discovery | Not supported. |
| Motion support | Motion support is limited to virtual axes and consumed axes only. (Physical axes must be unscheduled). Produce-consume virtual axes supported. |
| Connections between controllers | Produce/Consume messages work between emulated controllers. Other I/O modules in the I/O Tree will show as faulted. |
| Time-scaling | Supported through the API. |
| SNMP | Not supported |
| Redundancy | Operates only as a primary controller. High availability reports success, but the sync. with a second controller/support of sync modules is not available. Scan time does not reflect redundancy impacts. |
| Controller webpages | Not supported |

Differences between emulated controllers and physical controllers – Con't.

| Functionality | Emulated Controller Behavior |
|---|---|
| Fault dumps | Fault dumps are always stored in the virtual SD card directory, even if detached in emulated controller properties.<br>Important: contents are not encrypted |
| HMIBC instructions | HMI Button Control (HMIBC) instructions do not function (no Class 1 connection to HMI) |
| GSV and SSV instructions | Supports Get System Value (GSV) and Set System Value (SSV) instructions for emulated controller instances only. When GSV and SSV instructions target external objects, the instructions return the result for an unconnected device. |


expanding **human possibility**®