



## W2 - Understand and Implement High Availability

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CLX Redundancy Product Manager

# Agenda

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1. High Availability Definition

2. Session Agenda

3. CLX Hardware Redundancy

4. Agenda Item

2. Agenda Item



# What it is High Availability

- **High availability** is a system implementation that ensures a certain absolute degree of operational continuity during a given time period. (Mission Period)
- High availability is more than Redundancy!
- **Availability** is the readiness for a system to perform when needed.
  - Availability refers to the ability of the user community to access the system, whether to submit new work, update or alter existing work, or collect the results of previous work. In a control system environment, availability also means the control system is performing it's function while doing any of the above things.
- **Availability** is measurable
  - Represented as a %
  - Commonly known as “number of nines”

# System Availability

- High availability techniques are used to...
  1. Prevent unplanned outages
  2. Modify a running system
- All system outages fall into two major categories
  - **Unplanned System Outages (failures)**
    - Unplanned outages are the result of uncontrollable random system failures associated with *faults* occurring within hardware or software components.
    - Unplanned outages are the most costly, with the highest gains being achieved when steps are taken to avoid this type of outage. Unplanned outages can be minimized through component redundancy, system design, reliable components, etc.
  - **Planned System Outages (maintenance)**
    - A planned outage should be scheduled to have a minimum availability impact on a system. Planned outages are the result of maintenance events revolving around repair or upgrade operations. Repairs are intended to remove faulty components and restore a system to a functional state.

# Availability has Metrics

Availability %	Probable Downtime per Year		
99%	3.65 days		
99.9%	8.76 hours		Standard ControlLogix
99.99%	52.6 minutes		
99.999%	5.26 minutes		Redundant CLX
99.9999%	30 seconds		

1 day every 3 years

Standard ControlLogix Controllers can provide Availability > 99.9%

Redundant ControlLogix Controllers can even exceed 99.999%

# Agenda Sample

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## 2. Session Agenda

# Objectives

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- Help to understand the positioning of our redundancy and hot back-up solutions for higher controller availability.
  - This presentation does not cover safety system solutions. The solutions discussed here are for standard high availability.
- Differentiate solutions to help you select the most appropriate solution based on customer requirements.

# Terminology

## Terminology\*

- Redundancy/Hot Backup
  - Bumpless\*, automatic switchover of systems, with no loss of data
  - Typically requires little or no special user programming
  - Automatic Download to secondary Processor\*\*
- Warm Back-Up
  - Ability to assume control upon failure of primary controller without human intervention. Data values and outputs may bump to a previous value on a switchover.
  - Requires special user programming
- Bumpless
  - Communications – During a switchover the communications do not drop off and cause the module to shut off. This can be done by setting a module to “hold last state” or to not have the communications drop.
  - Revert to old state – When the new primary takes over the output will be in the state the old primary had it set to.

\*Note that these are not necessarily industry standard terms, and some customers may use them differently.

\*\* Usually a key requirement for a Hot Backup system

# Redundancy Options

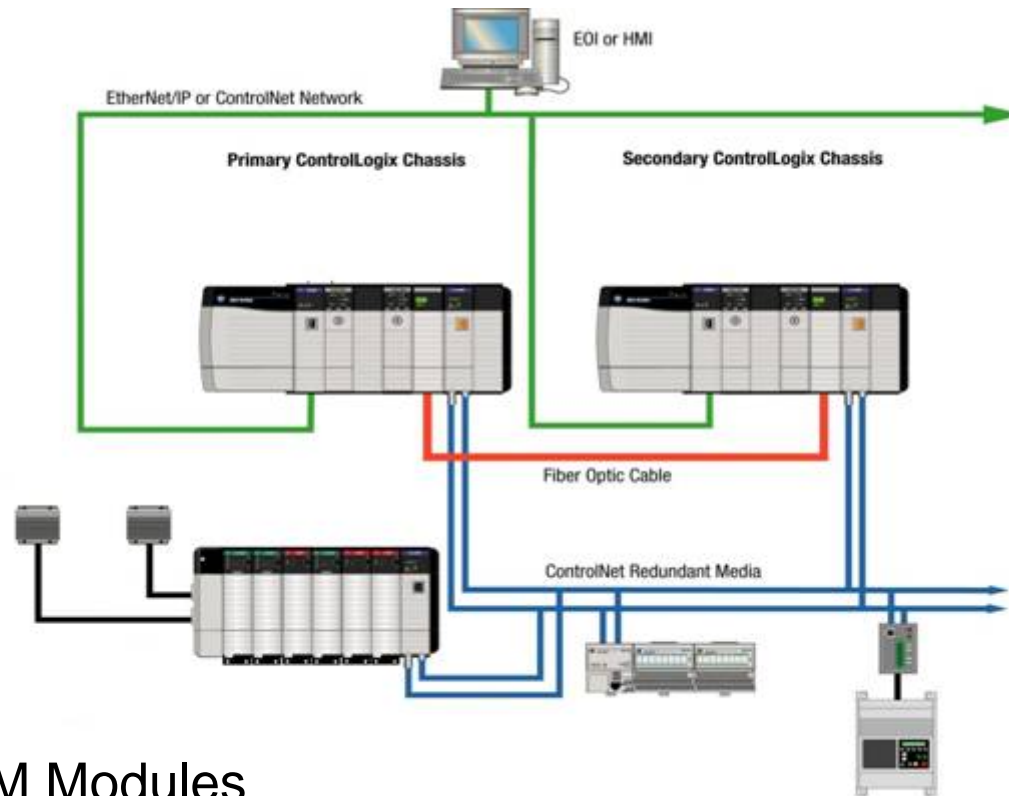
- Rockwell Automation has multiple Backup Options:
  - ControlLogix Hardware-based redundancy
    - Uses 1756-RM modules
  - CompactLogix EZ-Backup
    - Uses 1769-SDN modules on DeviceNet
  - CompactLogix Backup
    - Uses ControlNet or EtherNet

# Agenda

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## 3. CLX Hardware Redundancy

# ControlLogix Hardware-based Redundancy Overview



- Uses 1756-RM Modules
- I/O on ControlNet – Version 18.50 will introduce Ethernet/IP I/O

# Main Redundancy Features

- Optimized for availability of control.
- Absolutely no user programming required to implement.
- Bumpless switchover guaranteed for any outputs controlled by logic in the highest priority task.
- I/P addresses and ControlNet node numbers swap automatically.
- Switchover within approximately 20 msec for 1756-RM bases system.
- Works with current standard hardware.
- Switchovers are transparent to any devices networked to the redundant controller chassis.
- Transparent download of program from primary to secondary controller.
- On-line workstation configuration/ commands/ edits to primary are automatically forwarded to secondary.
- Both processors are synchronized, Only one program to maintain.
- SIL2 approvals.

# ControlLogix Redundancy Module (1756-RM)

- Single slot ControlLogix Redundancy Module
  - Provides a single slot 1756 ControlLogix footprint
  - Provides improved throughput capacity over 1757-SRM
    - Provides faster switchover times
    - Can support Higher Capacity Communications Modules
      - 1756-CN2(R), 1756-EN2T
  - Fiber optic cable connection between primary / secondary RM modules
    - 1756-RMC1 (1m), RMC3 (3m) , RMC10 (10m)
    - Cables from the SRM cannot be connected to a RM
  - Supported in Redundancy Versions 16.54 and Higher
  - In the future, a pair of 1757-SRMs can be replaced with a pair of 1756-RMs
- 1757-SRM firmware support will be discontinued after V16.56



# Why a user picks CLX hardware redundancy

- Ease of use
  - Absolutely no user programming required to implement
  - Single check box configuration
- Bumpless switchover
  - Outputs are maintained and do not revert to an old state
- I/P addresses and ControlNet node numbers swap automatically
  - HMI's do not require any special programming to handle a switchover
- Fast Switchover
  - As fast as 20 msec for 1756-RM bases system
- Uses standard hardware
  - No special processor required. Easy to go from non redundant to redundant
- Transparent
  - Other devices on network do not see the redundancy system
- Automatic download to secondary controller
  - Both processors are synchronized, Only one program to maintain

# V16 Redundancy

## 2 Different Platforms for Redundancy

### 16.56 Standard

- Single (1756-L6x, 1757-SRM, and up to 7 1756-CNB/R Series D/E or 1756-ENBT, 1756-EWEB) OR (1756-L6x, 1756-RM, and up to 7 1756-CNB/R Series D/E or 1756-ENBT, 1756-EWEB)
- This platform targets:
  - users who are expanding existing systems or delivering on existing purchase specifications
  - users who only use field proven technology
  - users who are upgrading existing systems at V11 or higher without shutting down or who require the existing hardware to be used
  - users that need Socket capability with 1756 EWEB modules
  - users that want to migrate to 1756-RM modules from 1757-SRM modules

### 16.80 Enhanced

- Up to two 1756-L61, L62, L63, or a single L64, 1756-RM, and up to 7 1756-CN2/R Series B or 1756-EN2T.
- This platform targets:
  - new installations
  - users who need CIP Time Synchronization with EN2T in local Redundant Chassis
  - users who need reduced switchover time (as fast as 20 ms)
  - users who want to use two L6x (L61,L62,L63) or an L64
  - users who want greater communications capacity with EN2T and CN2 Series B
  - a single CN2 can take the place of two or three CNB modules

# SRM Silver Series and Version 16.56

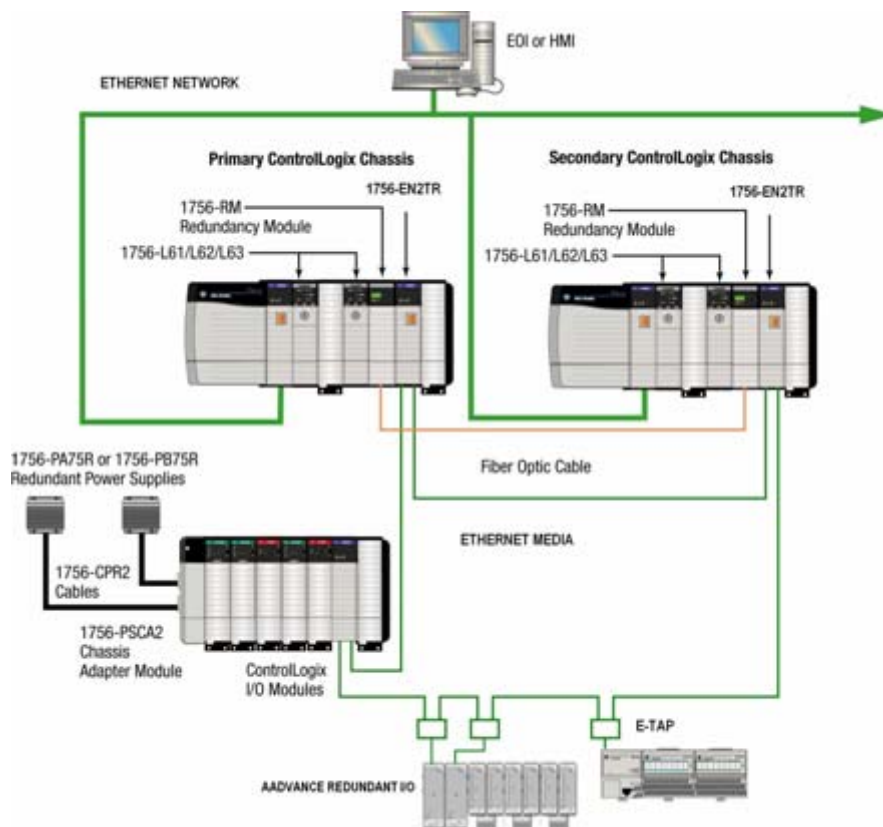
- 1757-SRM entered Silver Series 10/1/2009
- Last Time Buy date is 3/31/2010
- What happens after 3/31/2010
  - Validated Industries can still purchase SRM modules
  - Repair Services will still be available
  - Approval is needed from Product Manager to purchase
- Previous slide said 16.56 can allow SRM modules OR RM modules
  - Can be used to migrate from SRM's to RM's and not change communications modules
  - Must be in pairs
  - Fiber cable must be replaced
    - SRM used SRC cable. RM uses RMC cable.
  - Step forward credit available
- Questions?

# What's New and Upcoming in V18 ControlLogix Redundancy

## New & Future Products

- V18.50 Scheduled for Summer 2010
  - Support for Ethernet I/O.
  - EtherNet Ring Protocol
  - Support for L7x processor.
  - Partial Import Online.
  - New Redundant I/O Platform with redundant EtherNet adapters
  - Support for 1756-EN2TR and 1738-ETAP
  - All V17 features are included in V18.5x

The Standard platform will not be supported in 18.50. The SRM, ENBT, CNB, and/or EWEB do not move forward into V18.5x



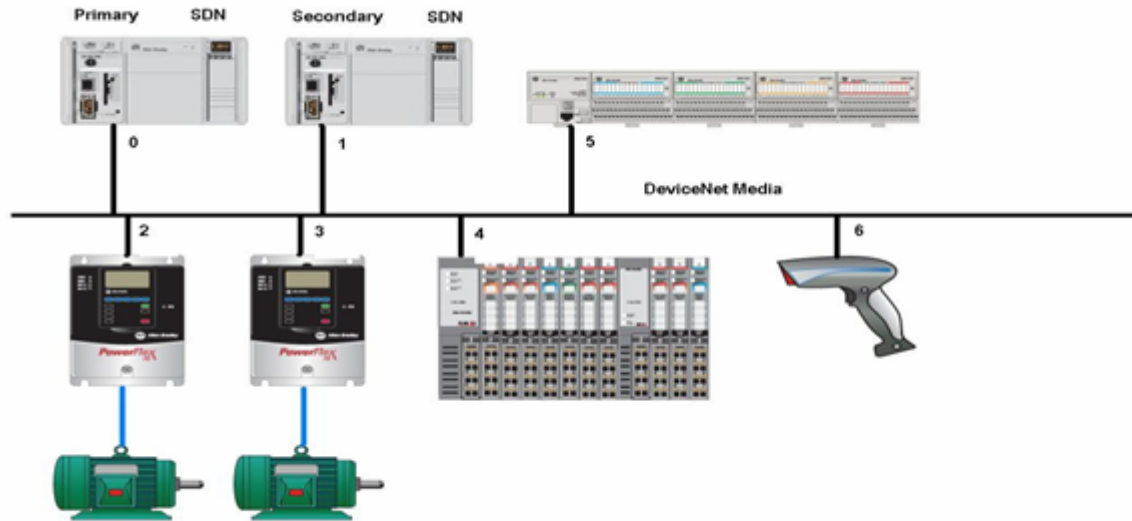
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## 4. CompactLogix EZ Backup

# CompactLogix EZ Backup using DeviceNet

## Architectural Overview



- Uses 1769-SDN for Backup Control
- Works with ALL CompactLogix Controllers – L2xE, L32C, L35CR, L3xE, L4x

# CompactLogix DeviceNet EZ Backup Functional Overview

- Simple, Low-cost Backup for Small Systems
  - Fast Switchover - <50ms with small systems
  - Both processors scan but are not synchronized
  - User Program must synchronize state variables (e.g. counters)
- No additional purchased SW or HW expense beyond second controller and SDN
  - Uses standard Hardware
  - Requires 1769-SDN FW Rev 3.002 and CompactLogix V16 and above
- All Backup Functionality is in the 1769-SDN
  - Only the primary controllers send output data to the I/O devices. A virtual switch in the 1769-SDN scanner module is used to switch outputs between primary and secondary controllers.
  - Set both node addresses to Same Value (i.e. Node 0)
  - Reserve "node address + 1" (i.e. Node 1 reserved)
- Use CIP Generic MSG to set Heartbeat Attribute (e.g. 16ms) in 1769-SDN
  - A non-zero value enables Backup Mode.
  - Heartbeat Attribute determines Switchover Time. Loss of 2 heartbeat messages causes switchover (e.g. 2 x 16ms = 32ms)
- Both scan lists must be identical else an error is flagged
  - Processor programs can be different
  - First 1769-SDN Scanner to go online becomes the Primary

# For More Information

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- See publication 1769-UM009D
- Contact Dave Heller 440 646-3815  
[dwheller@ra.rockwell.com](mailto:dwheller@ra.rockwell.com)

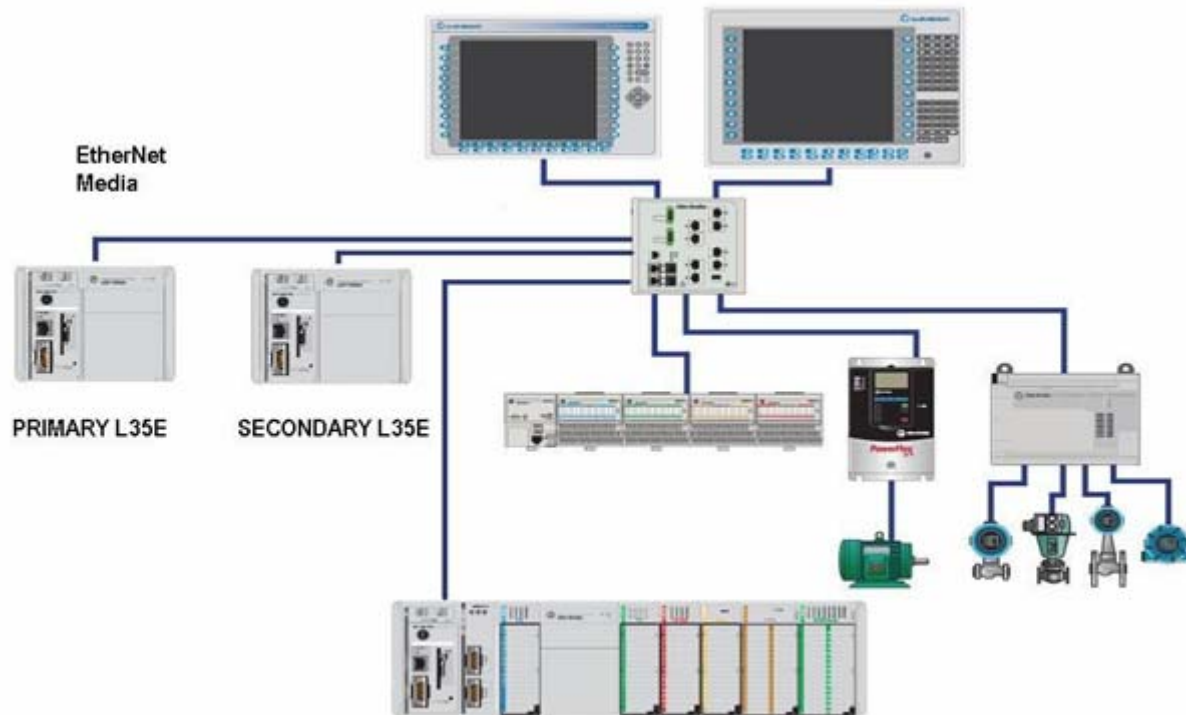
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## 5. CompactLogix Backup

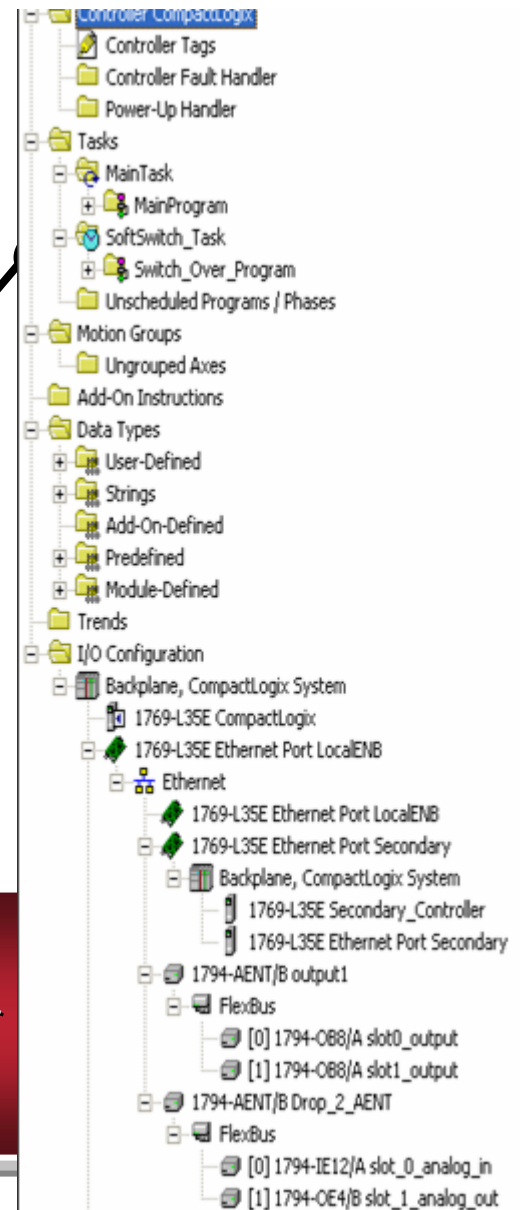
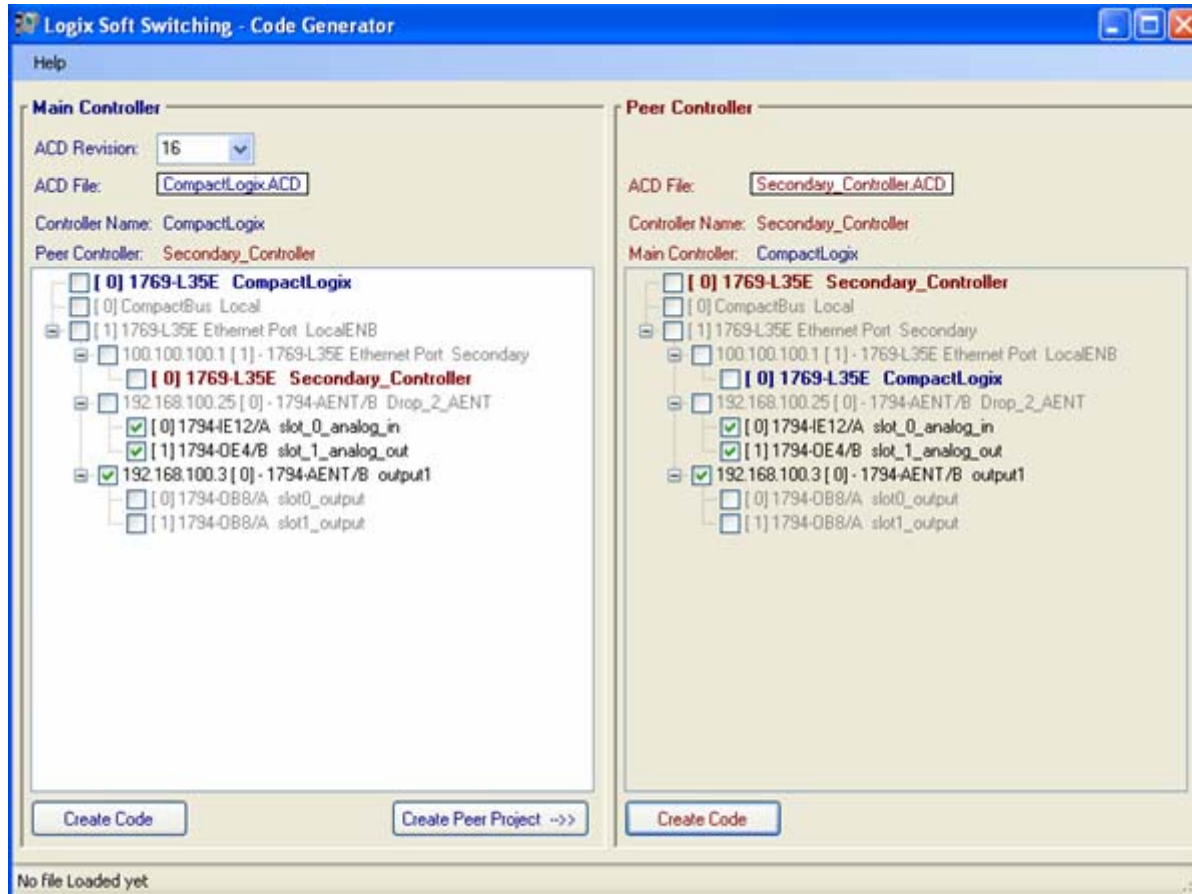
# CompactLogix Backup (Warm)

Ethernet shown. Can also be done by using ControlNet process



- No special hardware required. All backup functionality is in the controllers
- Works with ALL Logix Controllers – L2xE, L32C, L35CR, L3xE, L4x, L6x

# Software Output Switching application generator utility



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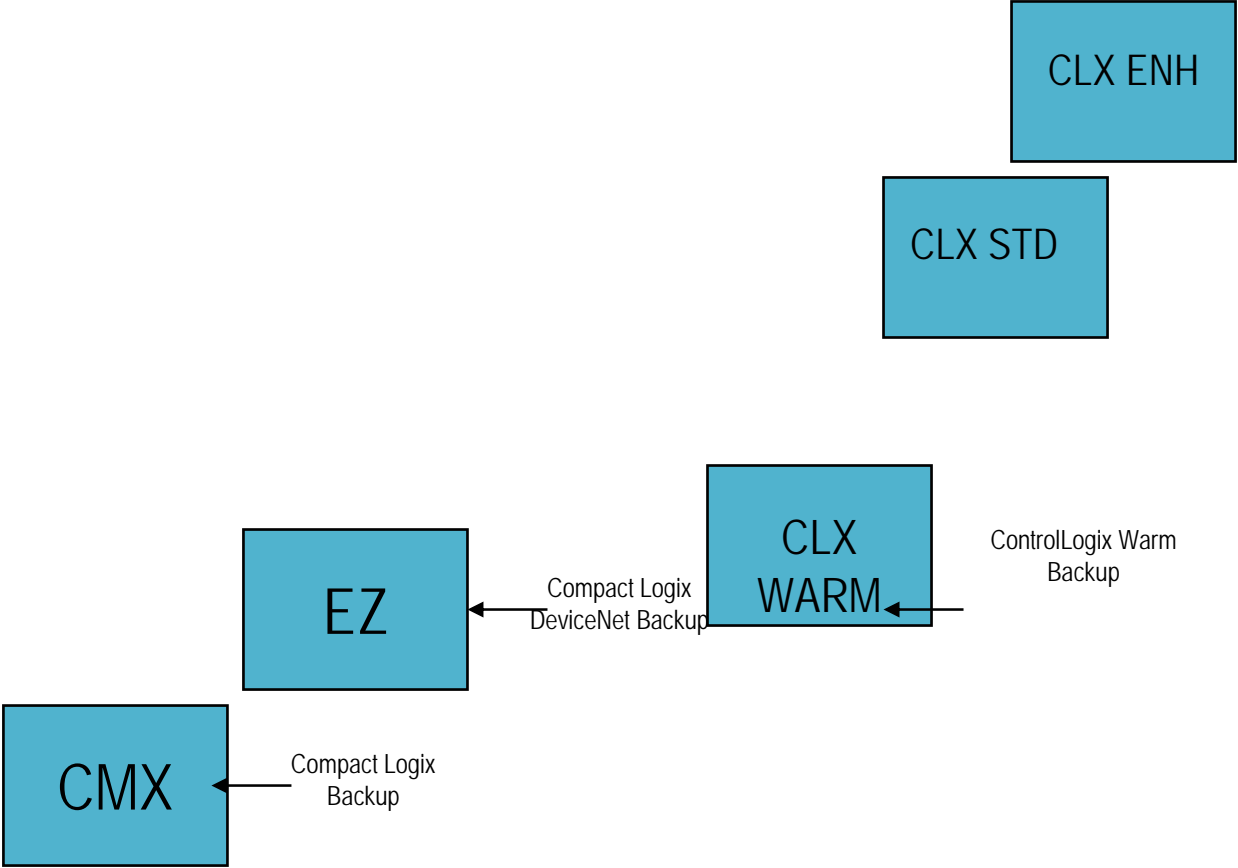
Eliminates Code mistakes that leads to improper

# Feature Comparison

	I/O Network	Hardware Required	Special Programming	P/C tags	Runtime Update	Auto Data Sync	Switchover Time
CLX Redundancy	CNET	1756-RM	NO	YES	YES	YES	~20ms
EZ Backup	DNET	1769-SDN	MINOR	YES	NO	NO	<50ms
CMX Backup	CNET, ENET	NONE	YES <sup>UTILITY</sup> PROVIDED	YES	NO	NO	>250ms

# Product Positioning

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- Cost +



# In Summary

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- All applications offer backup capability
- Each has strengths and weaknesses
- Choose the one that fits your needs the best

# Backup Solutions Demo

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- Note:
  - Demo is done on CLX hardware
  - EZ back up is CompactLogix hardware only
  - CMX backup can be either CMX or CLX

# Services & Support - We're Here to Help.

Global Resources, Local Support Where can I get help with the backup solutions we discussed

Online &  
Phone Support

Training Services

## Knowledgebase

Online answers to technical questions  
Email Support, Live Chat, Support Forums  
Local language support  
[www.rockwellautomation.com/support](http://www.rockwellautomation.com/support)

Onsite Support

Commercial Engineering

To learn more, contact your local  
Rockwell Automation sales office or authorized Allen-Bradley distributor.



Questions?  
Thank you for participating!

For more information contact:  
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[asorbello@ra.rockwell.com](mailto:asorbello@ra.rockwell.com)

Please tidy up your workstation  
before leaving