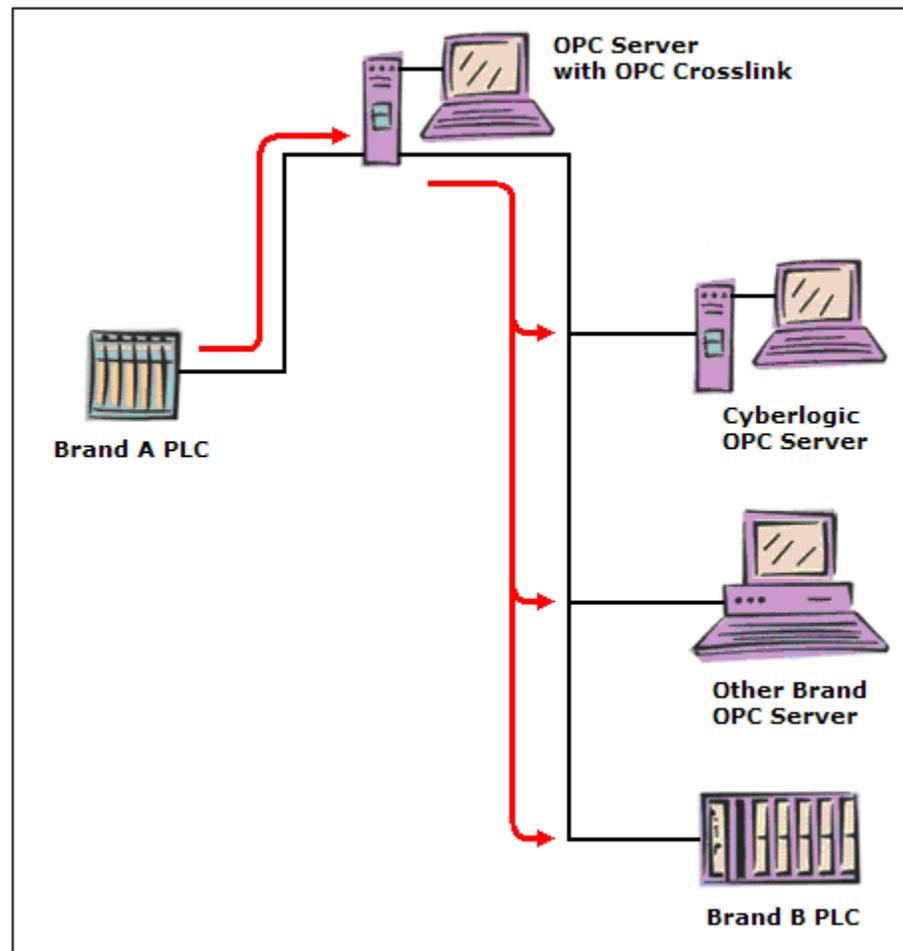


### KB2010-08: OPC CROSSLINK TUTORIAL

OPC Crosslink is a feature available exclusively for Cyberlogic's OPC server. With it, you can pass data from any OPC DA server or supported PLC to any other OPC DA server or supported PLC. The OPC servers and PLCs can be of different families, from different manufacturers, communicating over different networks, and can even be of different specification levels. With OPC Crosslink, any devices that can communicate with a Cyberlogic OPC server can exchange data with each other.

OPC Crosslink is a standard feature of the DHX OPC Enterprise Suite, MBX OPC Enterprise Suite, OPC Crosslink Suite, OPC Crosslink Premier Suite and OPC Crosslink Enterprise Suite.



OPC Crosslink is not a separate product, but rather is an integrated feature of the Cyberlogic OPC server. This provides you with several benefits:

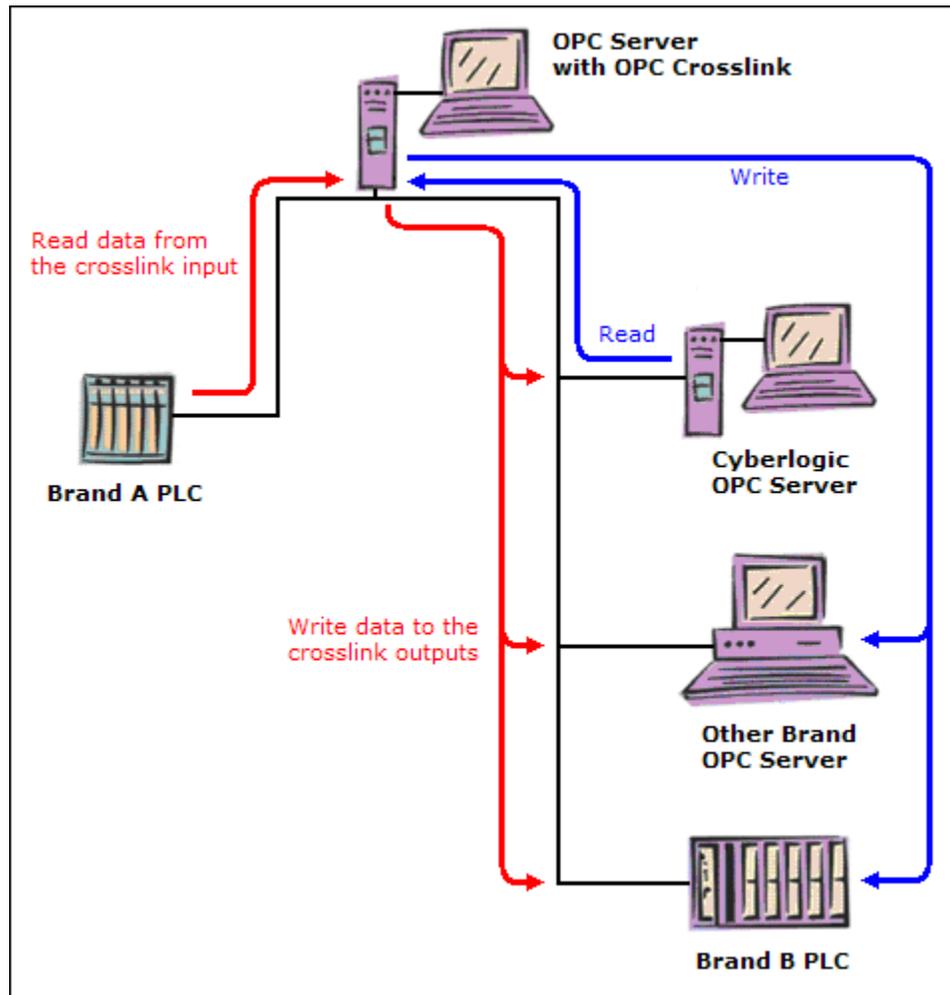
- The data exchanges are handled inside the OPC server. This reduces the load on the system, minimizes network traffic, and improves performance.
- The standard redundancy features of Cyberlogic's OPC server also apply to OPC Crosslink. You can configure redundant paths for the input data, output data, and trigger control data. Doing this maximizes the overall reliability of your system.
- You configure OPC Crosslink with the familiar Cyberlogic OPC Server Configuration Editor. You don't have to learn to use a new editor, and you won't have extra configuration files to backup, maintain and support.

## What products can I pass data between?

You can read data from and write data to any combination of:

- Any OPC Data Access server that meets the OPC Foundation specifications.  
Cyberlogic's OPC server complies with OPC DA specifications 3.0, 2.05a and 1.0a, so it will communicate with any OPC server that meets those spec levels. The other OPC server can be on the same machine as the Cyberlogic OPC server, or on a remote computer connected through an Ethernet TCP/IP network.
- Any Allen-Bradley controller, connected via any A-B network that is supported by the DHX OPC Server.  
The supported controllers include the PLC, SLC, ControlLogix, MicroLogix, FlexLogix and CompactLogix families. These can communicate over Data Highway, Data Highway Plus, DH-485, ControlNet, Ethernet, EtherNet/IP or DF1.
- Any Modicon controller, connected via any Modicon network that is supported by the MBX OPC Server.  
The supported controllers include the 184, 384, 484, 584, 884, 984, Micro 84, Modcell, Quantum, Momentum, Premium and M340 families, along with any Modbus-compatible third-party device. These can communicate over Modbus (RTU or ASCII), Modbus Plus or Ethernet.

## How do I define and control the transfers?



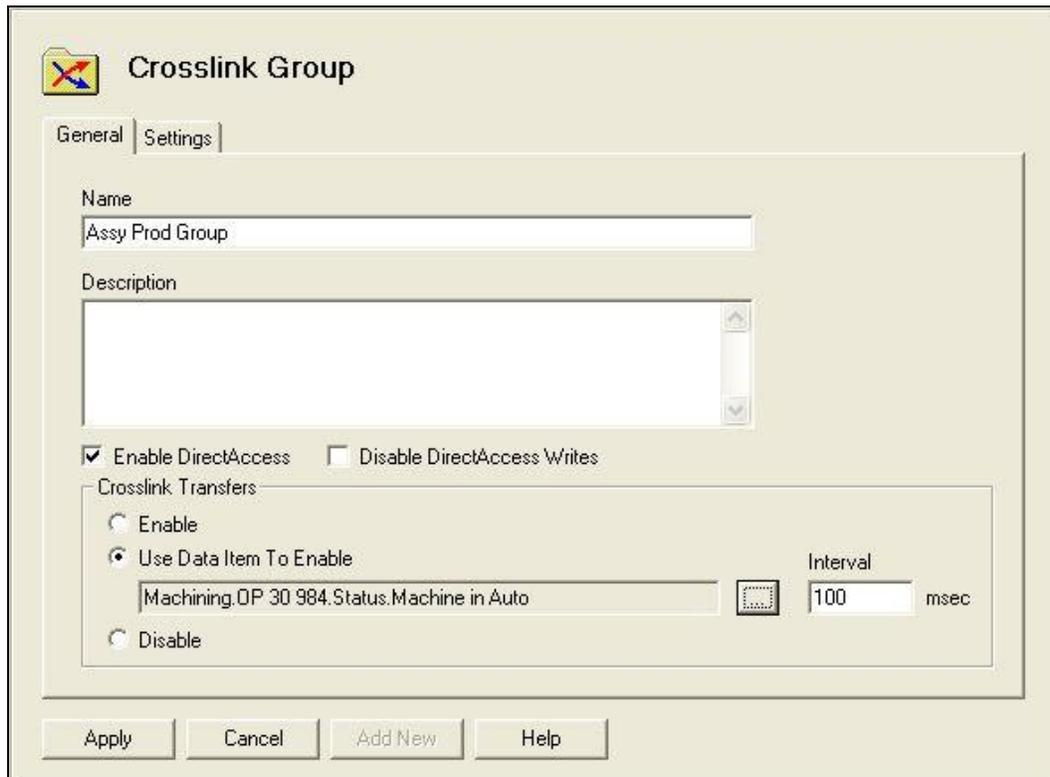
You create *crosslinks* to define the data transfers. Each crosslink consists of a source, called a crosslink input, and one or more destinations, called crosslink outputs. The figure shows two crosslinks, one in red and the other in blue.

The crosslink input for the red crosslink is a bit or register in the Brand A PLC. The crosslink will write the value of that crosslink input to three crosslink outputs, which are bits or registers in the Cyberlogic OPC Server, the Other Brand OPC Server and the Brand B PLC.

The crosslink input for the blue crosslink is a data item in the Cyberlogic OPC Server. Its value will be written to two crosslink outputs, one in the Other Brand OPC Server and one in the Brand B PLC.

You create *crosslink groups* to control the data transfers. All of the crosslinks in a group share the same enable and trigger criteria. The crosslinks transfer their data when the group is enabled and one of the transfer triggers occurs.

## How are the crosslink groups enabled?



The screenshot shows the 'Crosslink Group' dialog box with the 'General' tab selected. The 'Name' field contains 'Assy Prod Group'. The 'Description' field is empty. Under 'Enable DirectAccess', the 'Enable DirectAccess' checkbox is checked, and 'Disable DirectAccess Writes' is unchecked. In the 'Crosslink Transfers' section, the 'Use Data Item To Enable' radio button is selected. The data item field contains 'Machining.OP 30 984.Status.Machine in Auto' and the 'Interval' is set to '100 msec'. The 'Disable' radio button is unselected. At the bottom, there are buttons for 'Apply', 'Cancel', 'Add New', and 'Help'.

You configure the crosslink group's enable criteria on its General tab. In the Crosslink Transfers section, you can choose among three options:

- *Enable*: Select this choice to keep the crosslink group always enabled.
- *Use Data Item To Enable*: Select this choice to use the value of a data item to enable or disable the group. You must then specify the data item to use and how often it should be checked.

When the value of the specified data item is zero or false, the crosslink group is disabled. When the value is nonzero or true, the crosslink group is enabled. In the example shown, the crosslink group will be enabled whenever the OP 30 machine is in automatic mode.

- *Disable*: Select this choice to disable the crosslink group. You may want to do this for testing or troubleshooting.

## How are the transfers triggered?

The screenshot shows the 'Crosslink Group' dialog box with the 'Settings' tab selected. It is divided into two main sections: 'Read Inputs' and 'Write Outputs'.  
 In the 'Read Inputs' section, there are two input fields: 'Interval' set to '100' with the unit 'msec' and 'Deadband' set to '0.000' with the unit '% FS'.  
 In the 'Write Outputs' section, there are three checked options: 'On Data Change', 'Use Fixed Interval', and 'Triggered'. The 'Use Fixed Interval' option has a value of '100' msec. The 'Triggered' option has an 'Item ID' field containing 'Machining.OP 30 984.Status.Starved' and a dropdown menu for 'Mode' set to 'False to True'. Below the 'Item ID' field, there are also 'Interval' (100 msec) and 'Deadband' (0.000 % FS) fields.  
 At the bottom of the dialog, there are four buttons: 'Apply', 'Cancel', 'Add New', and 'Help'.

The trigger criteria specify when the crosslinks will transfer their data. There are three ways to do this, and you may configure one, two or all three of them for each crosslink group. If you configure more than one condition, any one of them will bring about a transfer.

- *On Data Change*: Select this method to transfer data whenever the value of the crosslink input changes.
- *Use Fixed Interval*: Select this method to transfer data at the specified interval.
- *Triggered*: Select this method to transfer data when the value of a data item changes.

If you choose this option, you must enter an item ID and select a trigger mode. The mode specifies that the transfer should occur on a "False to True" transition, a "True to False" transition, or on any value change in the trigger item.

### Note

If you use On Data Change, each crosslink in the group will independently transfer its data when its crosslink input value changes.

If you use Fixed Interval or Triggered, all of the crosslinks in the group will transfer data at the same time.

## What Cyberlogic products do I need?

The devices you want to communicate with determine which of three Cyberlogic OPC Server Suites you need.

- *OPC Crosslink Suite* supports OPC DA servers. These OPC servers may be on the local machine, or on remote systems networked via Ethernet TCP/IP.
- *DHX OPC Premier Suite* supports Allen-Bradley controllers and networks, and also OPC DA servers.
- *MBX OPC Premier Suite* supports Modicon controllers and networks, and also OPC DA servers.
- If you want to support both Allen-Bradley and Modicon products, you will need a combination of either the DHX OPC Premier Suite and MBX OPC Server Suite, or the MBX OPC Premier Suite and DHX OPC Server Suite. Both combinations also support OPC DA servers.

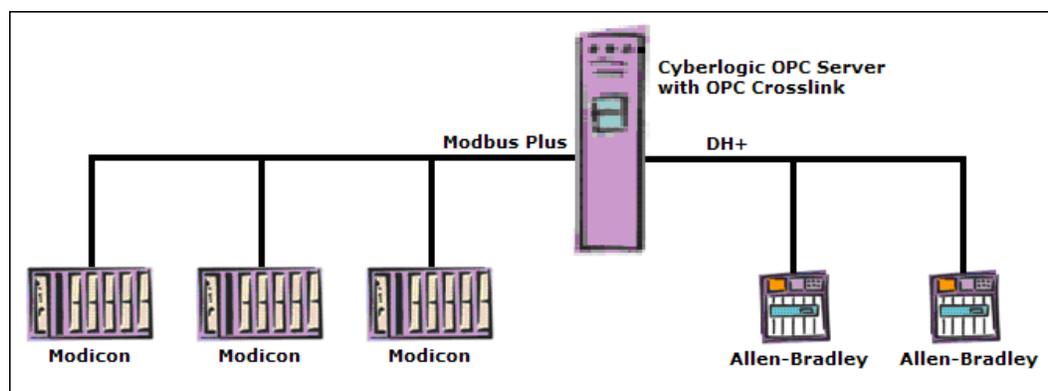
You can download all of these products at [www.cyberlogic.com](http://www.cyberlogic.com) and try them for a two-week evaluation period. After the evaluation period, they will continue to run for two hours at a time until you purchase a license and activate them.

## SOLUTIONS TO COMMON PROBLEMS

OPC Crosslink passes data among all devices that communicate with Cyberlogic OPC servers. This capability allows you to solve many otherwise difficult data transfer problems. Let's look at some examples of how you can use OPC Crosslink in your systems.

### Transfer data between PLCs

OPC Crosslink can transfer data between any PLCs that Cyberlogic's OPC server supports. This allows you to easily pass process data between controllers that normally could not communicate at all.



In this plant, the Modicon controllers cannot communicate with the Allen-Bradley controllers. The two families don't share a common network protocol, and there is no way for either to even set up a message that the other could understand.

However, the Cyberlogic OPC server can communicate over both networks, with all of the A-B and Modicon controller types. This allows you to set up a crosslink that will get data from any of the A-B controllers and write it to one or more of the Modicon controllers. And, of course, you can also read data from the Modicon controllers and write it to the A-B controllers.

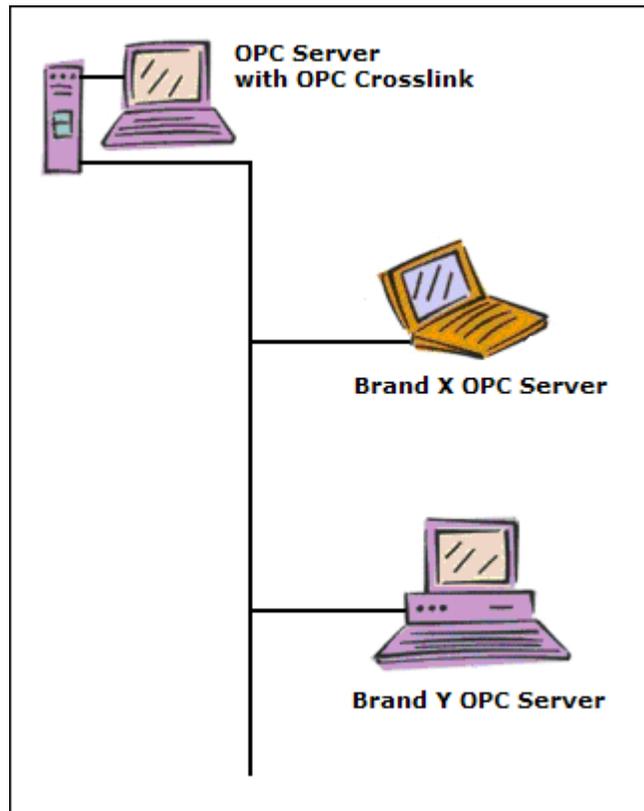
Even if your plant has only one family of controller, you may need to pass data between controllers on different networks. With OPC Crosslink, you can program crosslinks to pass the data as required.

An additional advantage of OPC Crosslink is that you configure all of the transfers in one place. And OPC Crosslink gives you the flexibility to trigger transfers from different controllers at the same time, and to pass data to an unlimited number of controllers with a single transfer.

### Transfer data between OPC DA servers

Some OPC servers can access data directly from other OPC servers, but many cannot. With OPC Crosslink, you can set up crosslinks to read data from any OPC DA server and

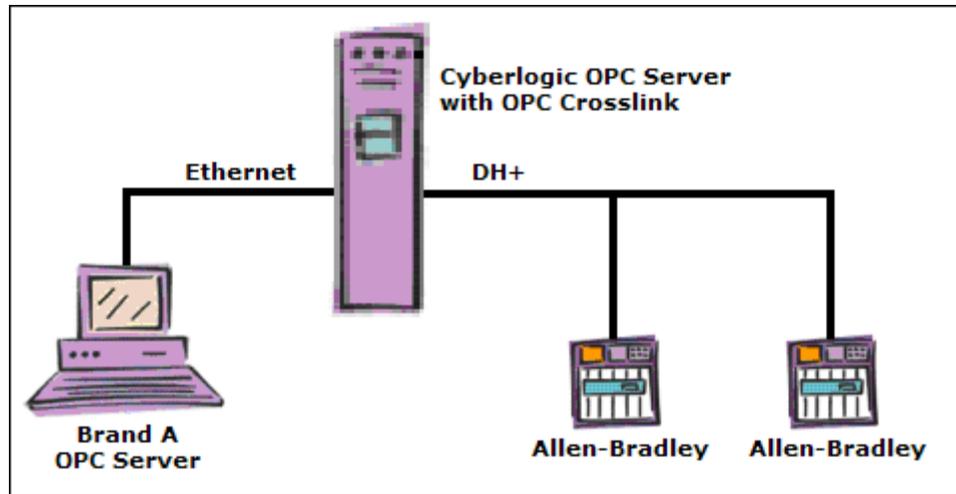
write it to another. Thus, OPC Crosslink provides server-to-server data exchange capability for OPC servers that lack it.



Even if the legacy OPC servers in your plant can communicate directly with other OPC servers, they still may not be able to pass data among themselves. An older OPC server may not support the OPC DA specification level that a more recent OPC server requires. But Cyberlogic's OPC servers support all of the current and previous OPC DA specs. This allows them to read from any OPC server and write to any other OPC server, regardless of their OPC spec levels. By doing this, OPC Crosslink serves as a "spec level bridge" between mismatched OPC servers.

## Transfer data between OPC DA servers and PLCs

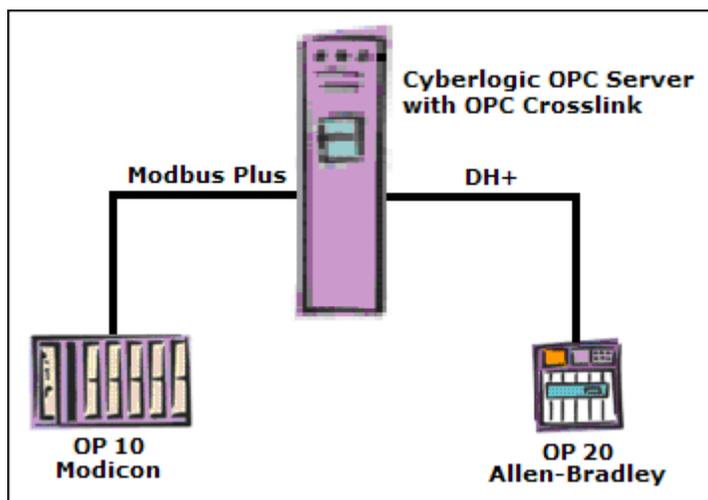
OPC Crosslink can expand the data-gathering capability of your legacy OPC servers. You can configure a crosslink to read data from any Allen-Bradley or Modicon controller over any of the networks those controllers support, and write that data to your legacy OPC server.



In the above figure, the Brand A OPC server cannot communicate over Data Highway Plus, and therefore cannot read data from any of the PLCs on that network. The Cyberlogic OPC server can communicate to them, however, and that allows you to create crosslinks that pass data from those PLCs to the Brand A server.

## SIMPLE CONFIGURATION SESSION

Let's go through a simple OPC Crosslink configuration session. We will configure one crosslink group that contains two crosslinks. As we go, we'll look at the many features that are available to be configured in crosslinks and crosslink groups.



The example we will use is a PLC to PLC data transfer, and the figure above shows our setup. The Cyberlogic OPC server with OPC Crosslink connects to two networks. The first is a Modbus Plus network with a Modicon controller. The other network is Data Highway Plus with an Allen-Bradley PLC.

### ***The Data Transfer Problem***

Each PLC maintains a count of total parts produced by the machine it controls. We want the production counts for both machines to be available in both controllers. The Modicon controller uses register 40010 for the OP 10 production count, and has reserved register 40020 for the OP 20 value. The Allen-Bradley controller has reserved register N7:1 for the OP 10 production count, and uses N7:2 to record the OP 20 total. The two controllers cannot pass these values between themselves, so we will use OPC Crosslink to transfer the data.

### ***Software Requirements***

Because we will communicate with both Allen-Bradley and Modicon equipment, we will install a combination of either the DHX OPC Premier Suite and MBX OPC Server Suite, or the MBX OPC Premier Suite and DHX OPC Server Suite.

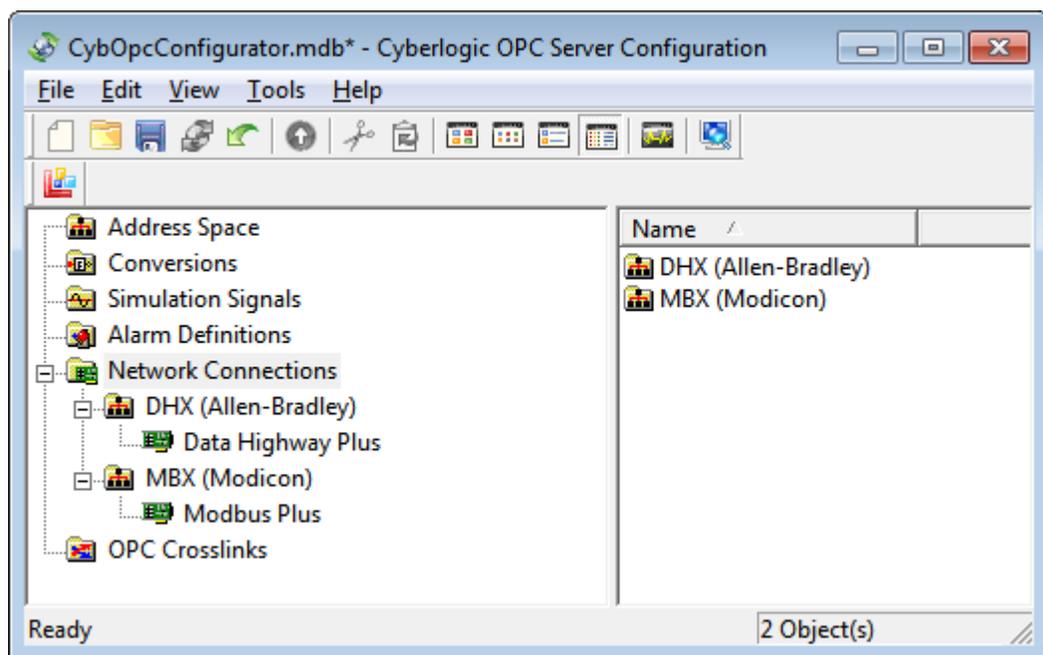
### ***Procedure***

There are four main steps in the configuration:

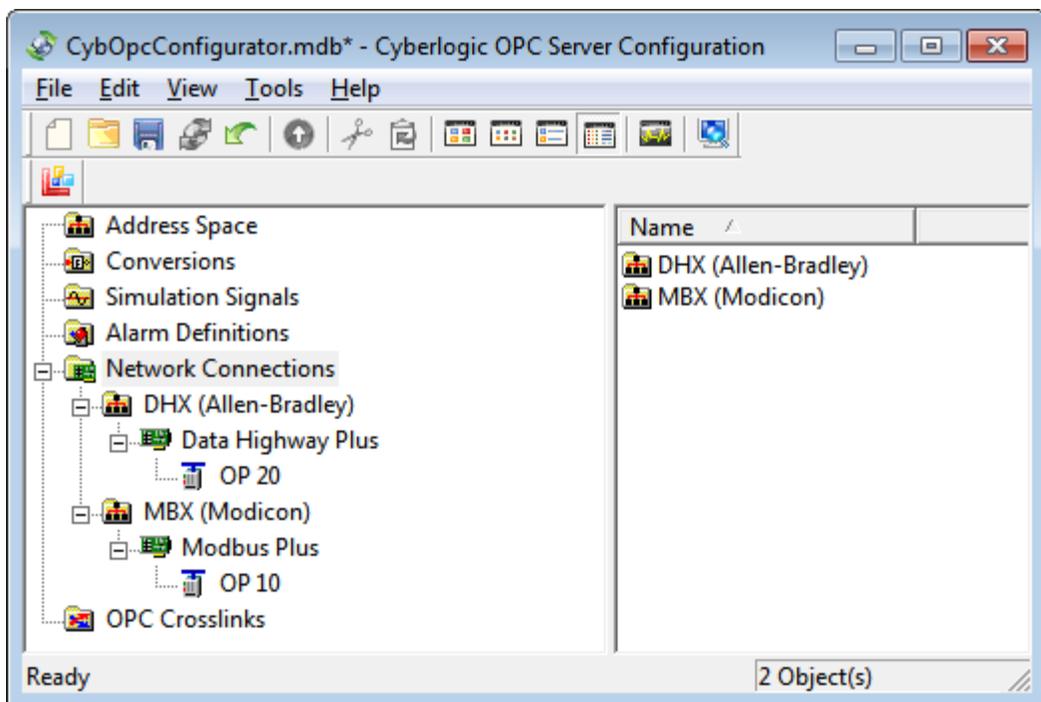
- Connect to the PLCs.
- Configure the Address Space, including the devices, access paths and data items.
- Create the crosslink group.
- Create the crosslinks.

## **Connecting to the PLCs**

You configure the connections to the PLCs just as you would for other OPC server applications. Refer to the help files for the MBX OPC Driver Agent and DHX OPC Driver Agent if you need detailed information on how to do this. For a quick-start guide to setting up this communication, look in the Cyberlogic OPC Server Help.



You need a Modbus Plus adapter card with the MBX Driver to provide Modbus Plus network communication. For the Allen-Bradley network, you need a DH+ adapter card and the DHX Driver. You will use those adapter cards and drivers to construct network connections for Modbus Plus and Data Highway Plus.



Next, you must configure network nodes for both of the PLCs.

#### What else can I do here?

You can also use OPC Crosslink to exchange data with OPC DA servers. We don't need to do that in this example, but your application may require it. If so, this is where you would configure the connection to an OPC server computer and its OPC server. Look in the help file for the OPC DA Driver Agent for details on how to do that.

## Devices, Access Paths and Data Items

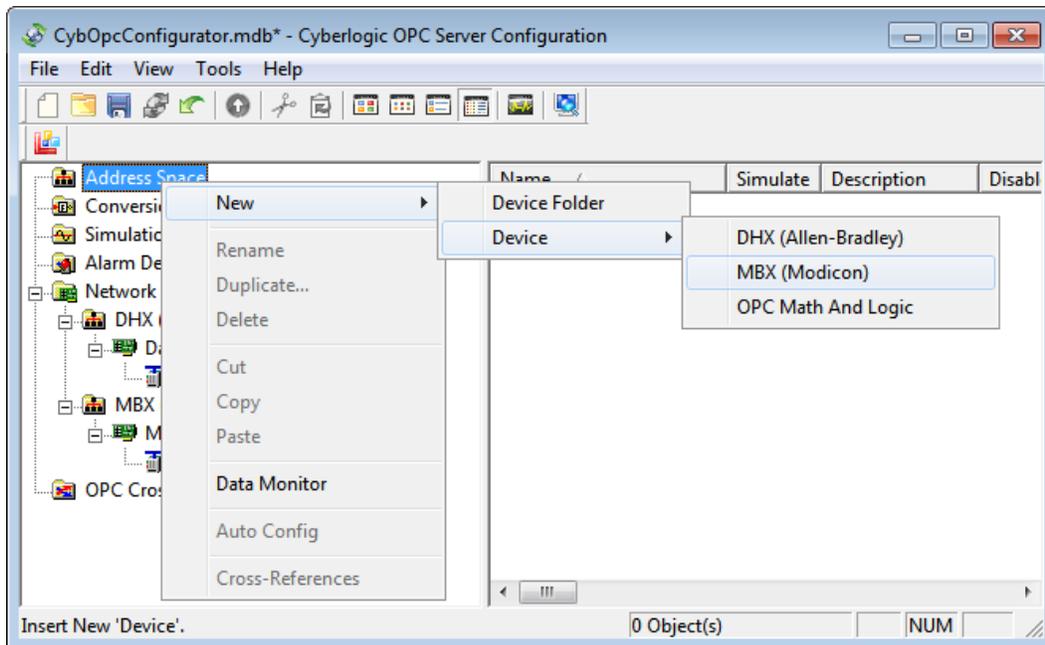
The next step is to create devices with access paths and data items. Once again, you do this the same way as you would for other OPC server applications. You can find detailed information and a quick-start guide in the Cyberlogic OPC Server Help.

#### Note

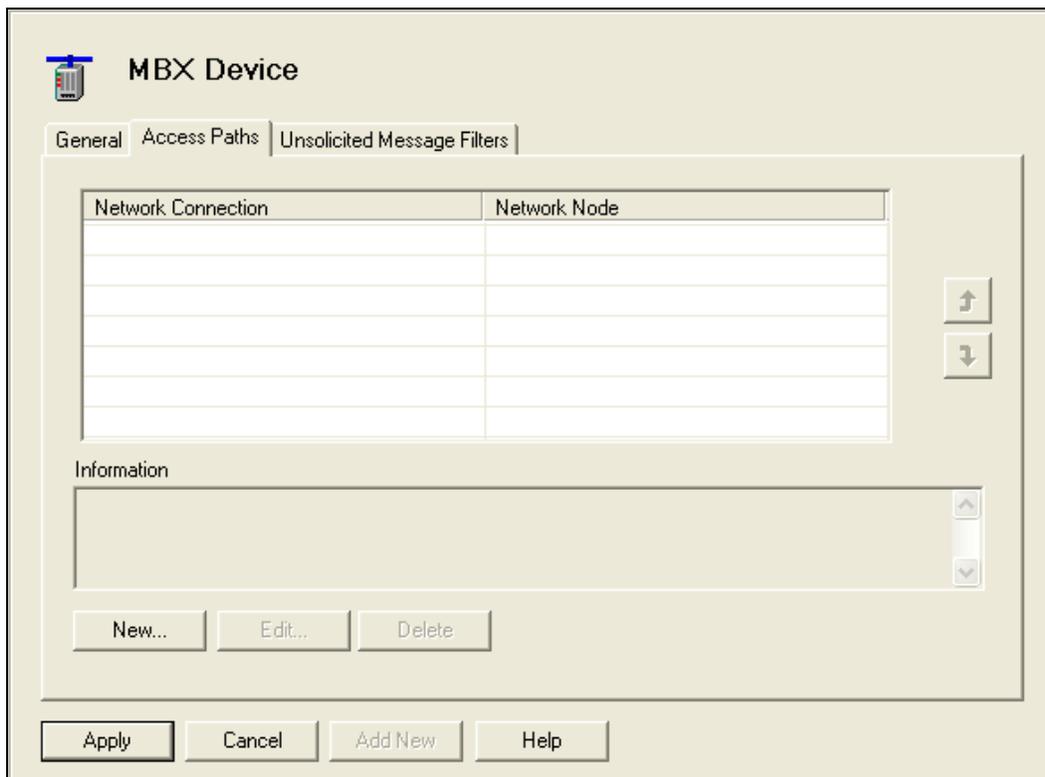
You can use DirectAccess to specify the item IDs that your crosslinks and crosslink groups will use for inputs, outputs, enabling and triggering. If you plan to use DirectAccess, you don't need to configure devices, access paths or data items. However, you won't be able to use some of the Cyberlogic OPC Server features, such as network and device redundancy.

## Creating the Devices and Access Paths

This sample configuration requires two devices, one for the Modicon controller and the other for the Allen-Bradley controller.



To create the Modicon PLC device, right-click on the **Address Space** branch and select **New** and then **Device** and then **MBX (Modicon)**.



Go to the Access Paths tab, where you must add at least one access path. To do this, click the **New...** button. A pop-up window will open to show you the available controllers. Browse through the tree to select the **OP 10** controller.

When you finish with the OP 10 controller, repeat the process for the OP 20 A-B PLC. This time, you must select **DHX (Allen-Bradley)** from the context menu. You must also select a PLC type on the General tab of the new device. Beyond that, the procedure for the A-B device is the same as for the Modicon device.

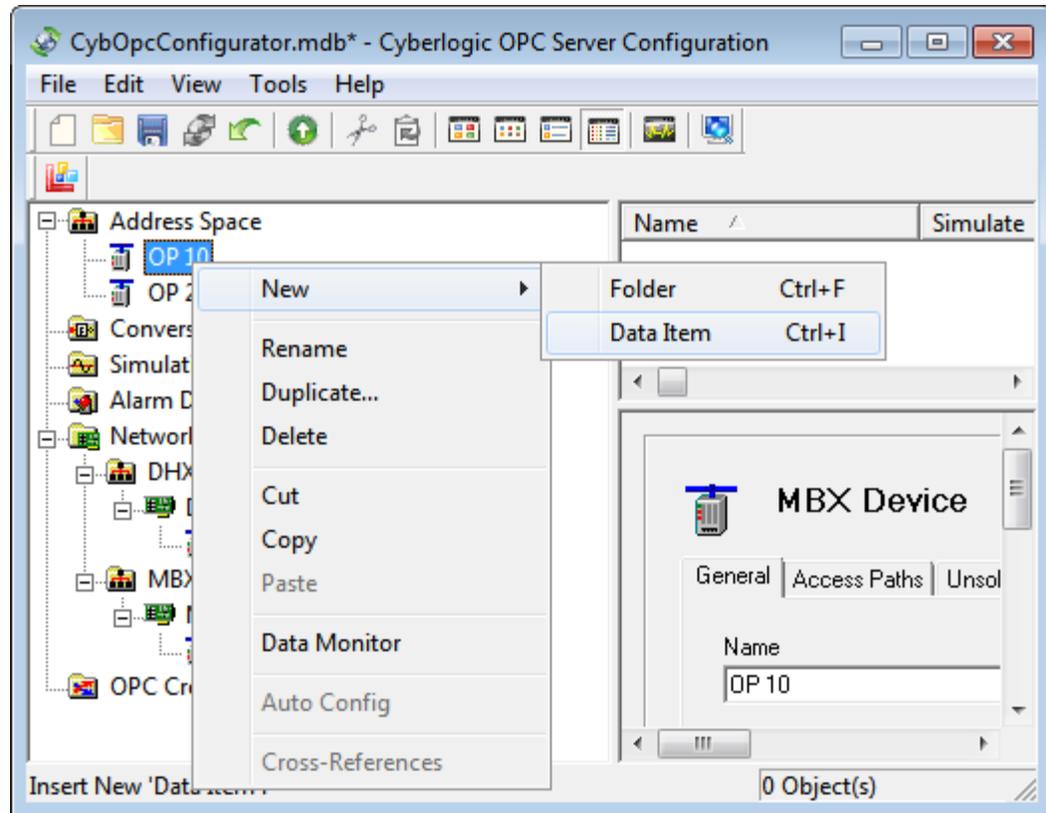
#### **What else can I do here?**

If your plant has primary and backup PLCs, you can configure access paths to both of them. In addition, if you have two or more networks to each PLC, you can configure access paths using each network. The Cyberlogic OPC server will decide which of these access paths to use, thereby providing PLC and network redundancy. The controllers and networks in this setup don't have backups, so we will use only a single access path for each device.

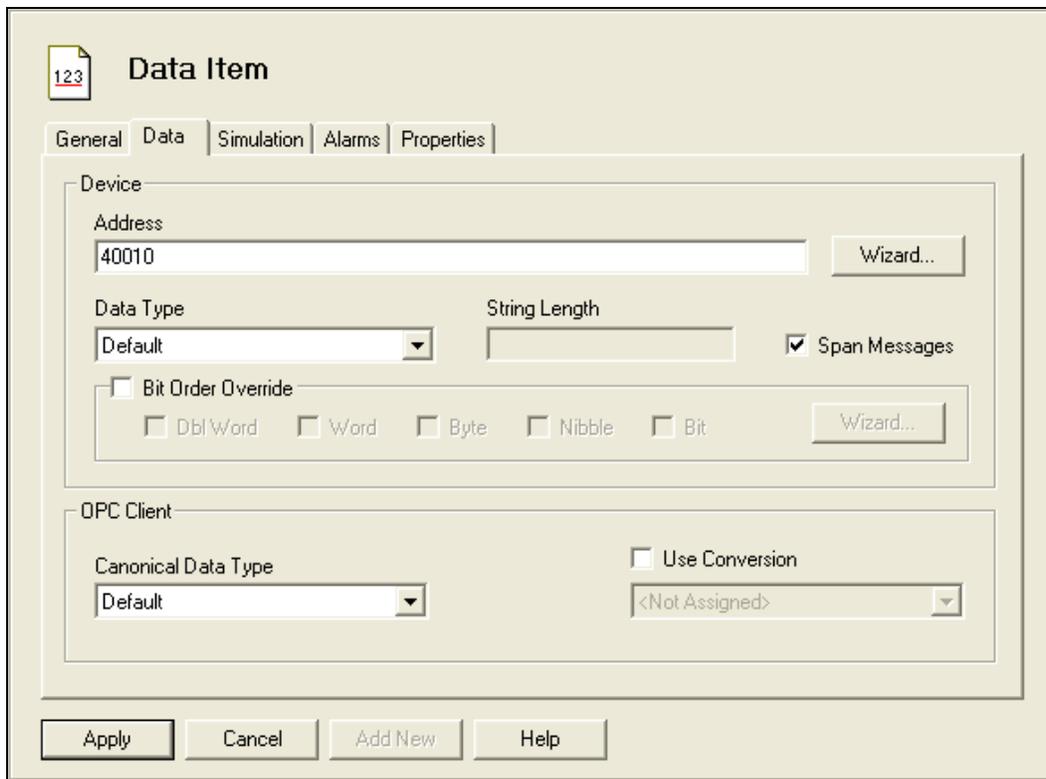
If your application requires passing data to or from OPC DA servers, you would use the same procedures to create the OPC server devices with their access paths.

## **Creating the Data Items**

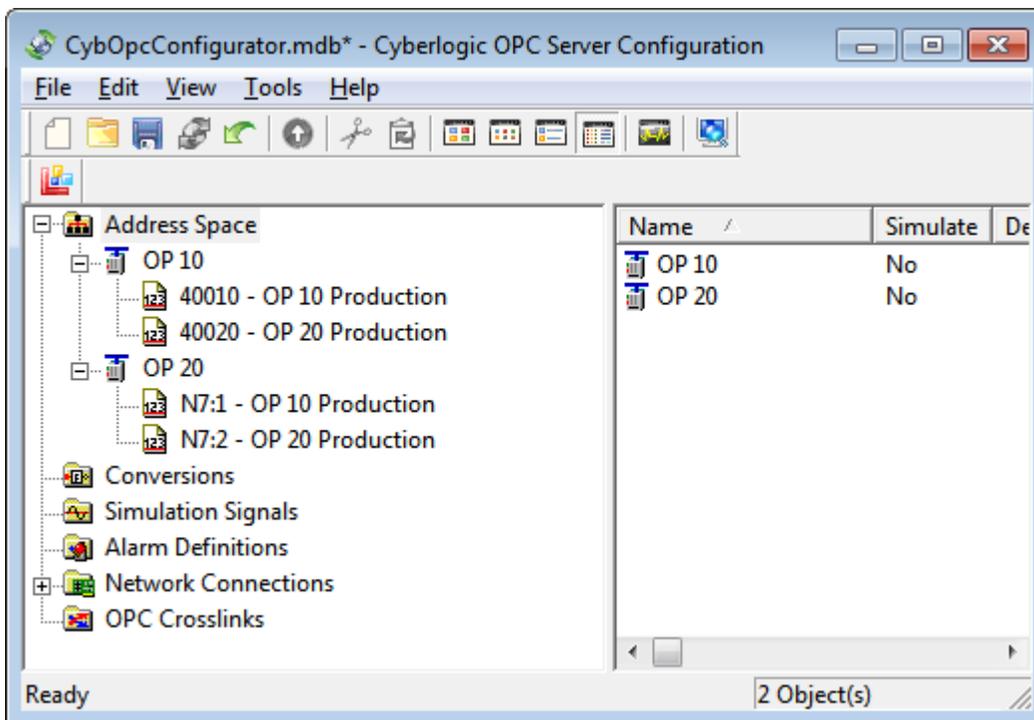
The data items you create will depend on the data you want to send, and on the enable and trigger criteria you want to use. For this example, we need registers 40010 and 40020 in the Modicon controller, and N7:1 and N7:2 in the A-B controller.



Right-click on the **OP 10** device and select **New**, and then **Data Item** from the context menu.



Go to the **Data tab** and enter **40010** in the Address field.

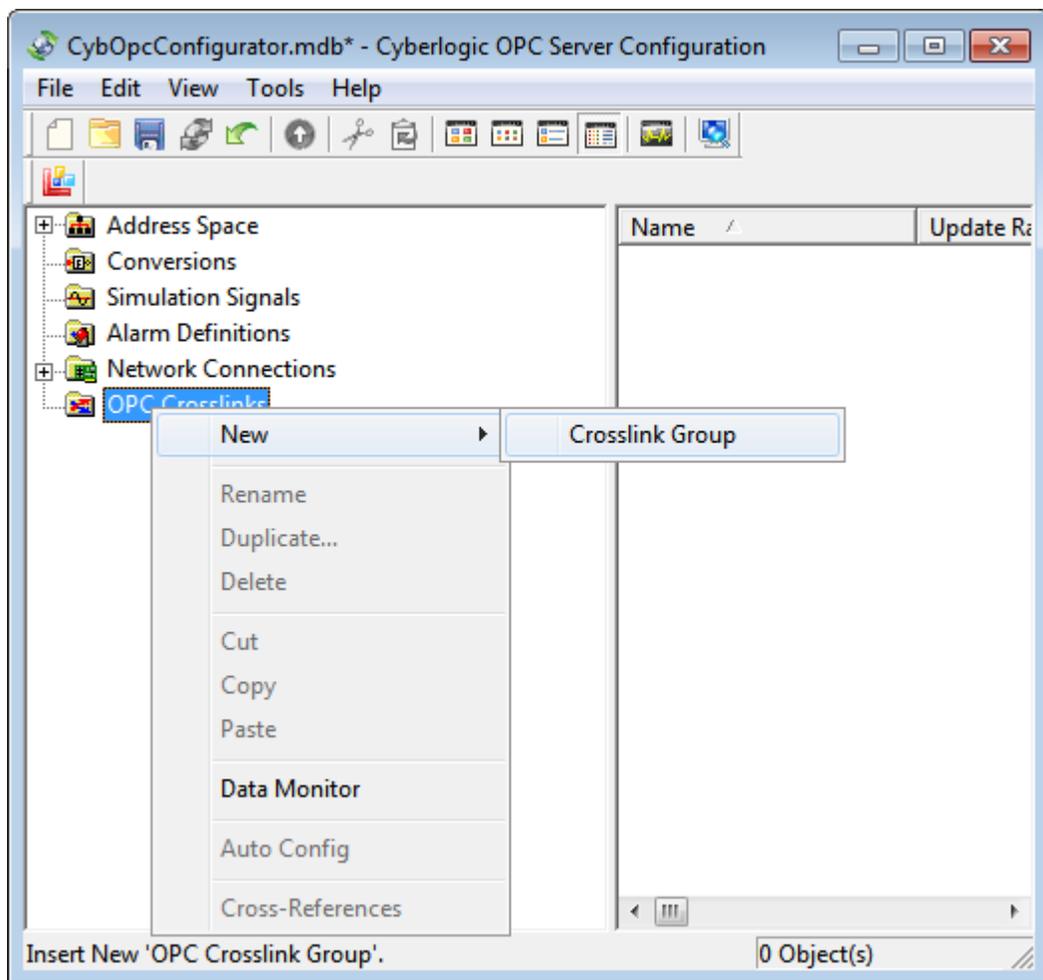


Repeat the procedure for register 40020 and the two OP 20 registers. The result will look like the figure above.

## Creating the Crosslink Group

The crosslink group controls the crosslink transfers. This is where you specify when to enable the crosslink transfers and when to trigger them. Thus, while the crosslinks determine *what* data to transfer, the crosslink groups determine *when* to transfer the data. By grouping crosslinks that share the same enable and trigger criteria, you can set and modify these criteria quickly and efficiently.

For this exercise, we will use one crosslink group. It will always be enabled, and the data will be transferred every ten seconds.



Right-click on the **OPC Crosslinks branch** and select **New** and then **Crosslink Group** from the context menu. This will create a new crosslink group.

## The General Tab

The screenshot shows a dialog box titled "Crosslink Group" with a folder icon. It has two tabs: "General" (selected) and "Settings". The "General" tab contains the following fields and options:

- Name:** A text box containing "Production Counts".
- Description:** A large empty text area.
- Enable DirectAccess:** A checked checkbox.
- Disable DirectAccess Writes:** An unchecked checkbox.
- Crosslink Transfers:** A section containing:
  - Enable:** A selected radio button.
  - Use Data Item To Enable:** An unselected radio button, followed by an empty text box and a browse button (...).
  - Interval:** A text box containing "100" followed by "msec".
  - Disable:** An unselected radio button.

At the bottom of the dialog are four buttons: "Apply", "Cancel", "Add New", and "Help".

Select the **General** tab and enter a name and description for the crosslink group. We'll call this group **Production Counts**.

Select **Enable** in the **Crosslink Transfers** section, so that the transfers will always be enabled.

### What else can I do here?

Select **Use Data Item To Enable** if you want to be able to enable and disable the crosslink group at run time. You must then specify a data item, and the value of that data item will control the enable status of the group.

Select **Disable** if you want to disable the crosslink group. You might want to do this for testing or if you want to run the OPC server before you complete the configuration.

## The Settings Tab

On the Settings tab, you can specify how you want to trigger the crosslinks to write their data. There are three ways to do this; our configuration will use a fixed interval of ten seconds.

In the **Write Outputs** section, check the **Use Fixed Interval** box and enter **10000** milliseconds as the interval.

Click **Apply** to complete the configuration of this crosslink group.

### What else can I do here?

Select **On Data Change** if you want the crosslinks to transfer their data whenever the value of the crosslink input changes.

Select **Triggered** if you want to specify a data item that will trigger the crosslink data transfers when the trigger item's value changes.

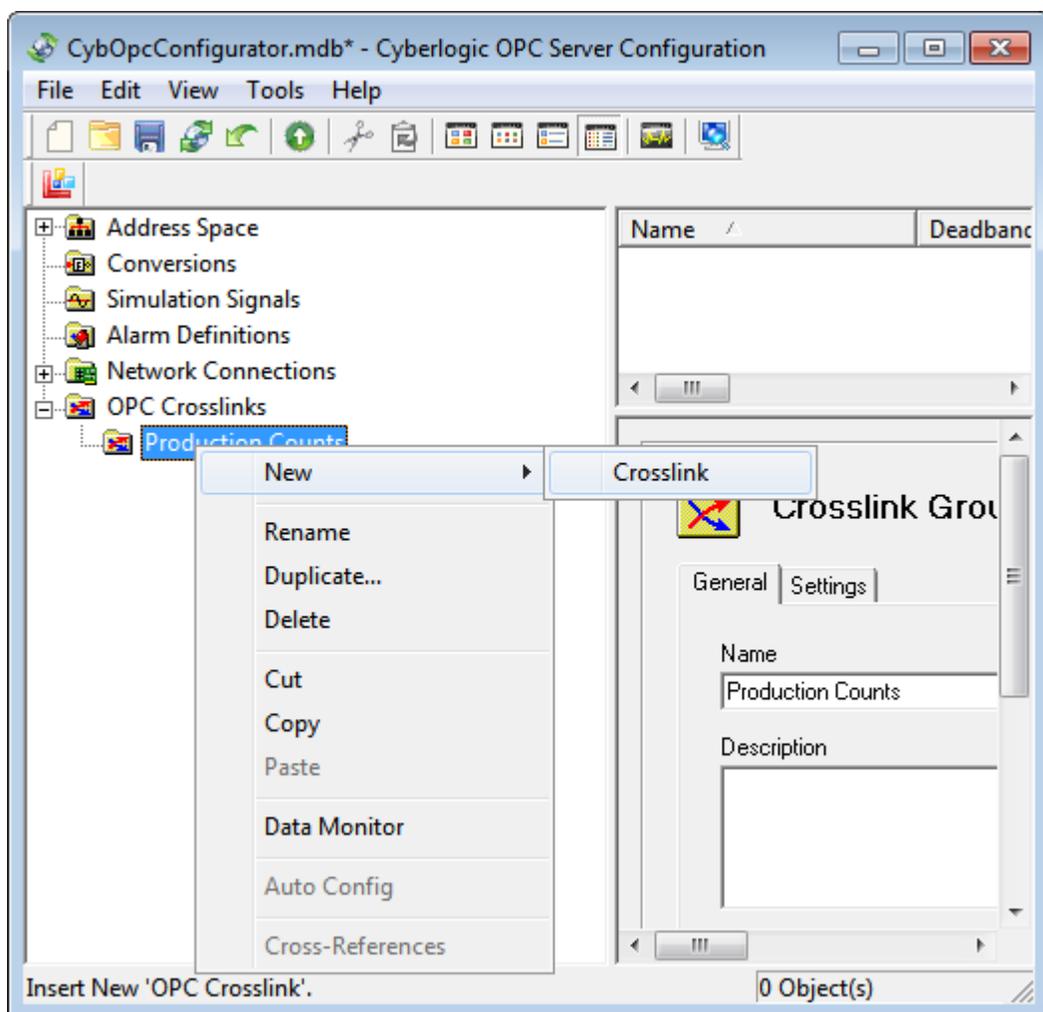
You can select any one, two or all three of these methods. If you select more than one, the crosslinks will transfer their data when any of the specified conditions occur.

## Creating the Crosslinks

You create the crosslinks within the crosslink group. There is no limit to the number of crosslinks within a group, but each group must have at least one crosslink. In this sample project, we will create two crosslinks in the crosslink group we just configured.

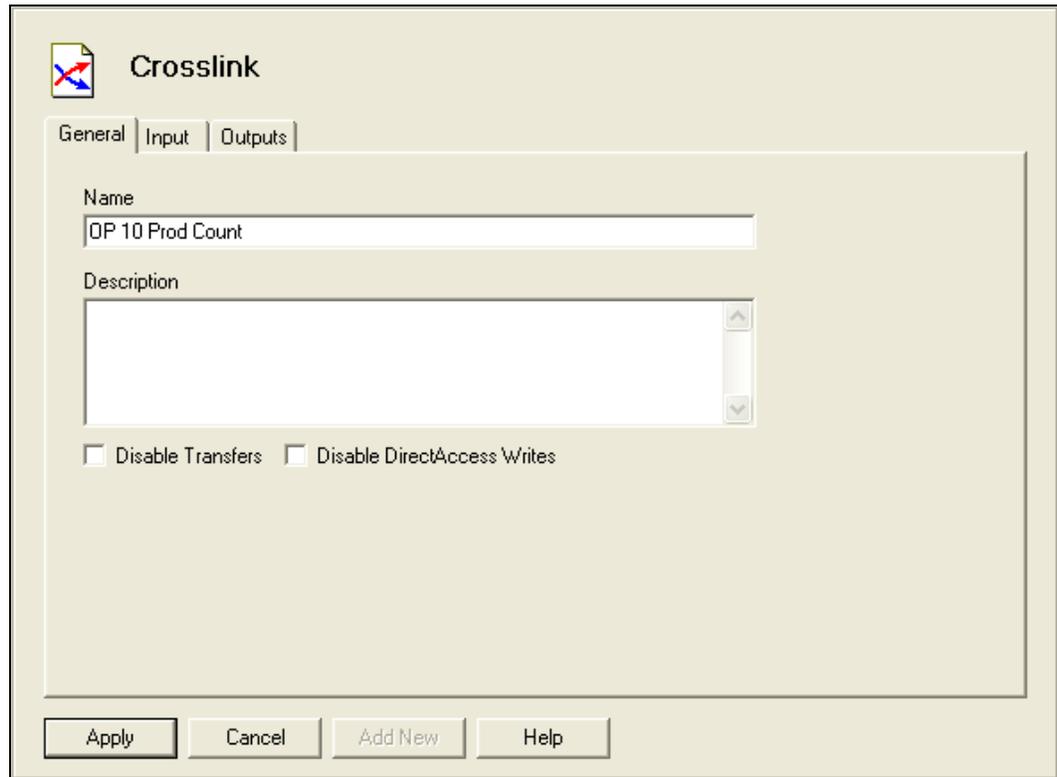
Each crosslink must have one input data item and at least one output data item. When the transfer is triggered, the crosslink will write the value of the input data item to each of its output data items.

For this example, one crosslink will use the OP 10 production count register in the Modicon controller as its input data item and the OP 10 production count register in the A-B controller as its output data item. The other crosslink will use the OP 20 production count register in the A-B controller as the input data item, and the OP 20 production count register in the Modicon controller as the output data item.



Right-click on the **Production Counts** crosslink group and select **New** and then **Crosslink** from the context menu.

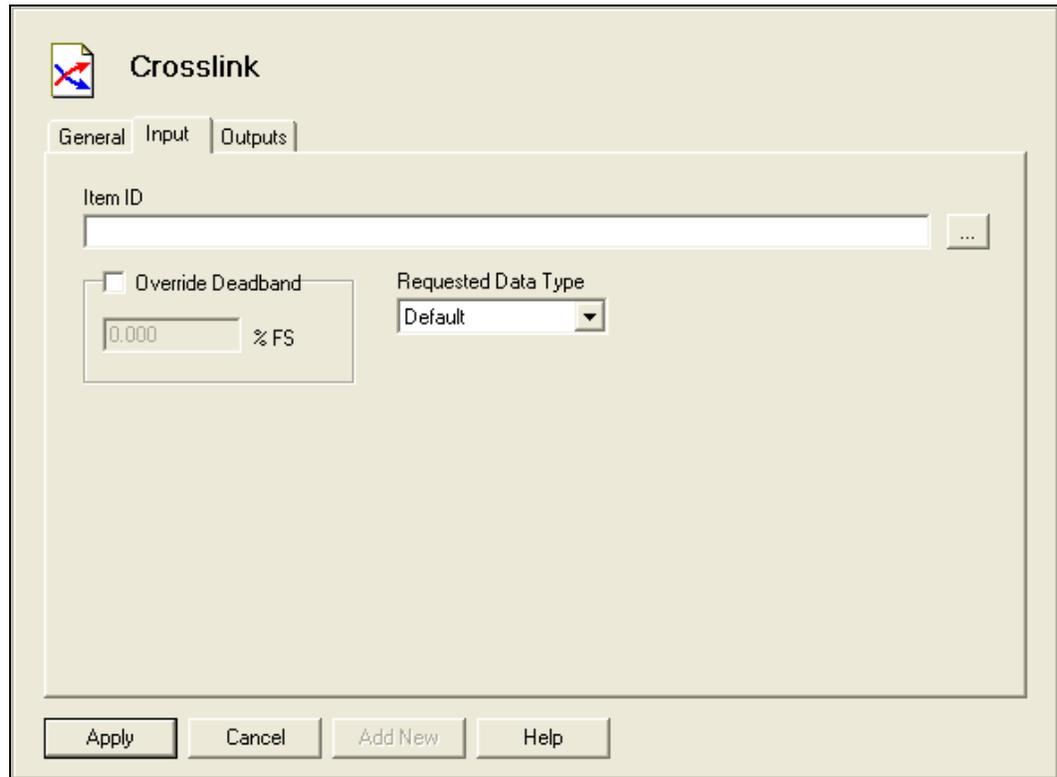
## The General Tab



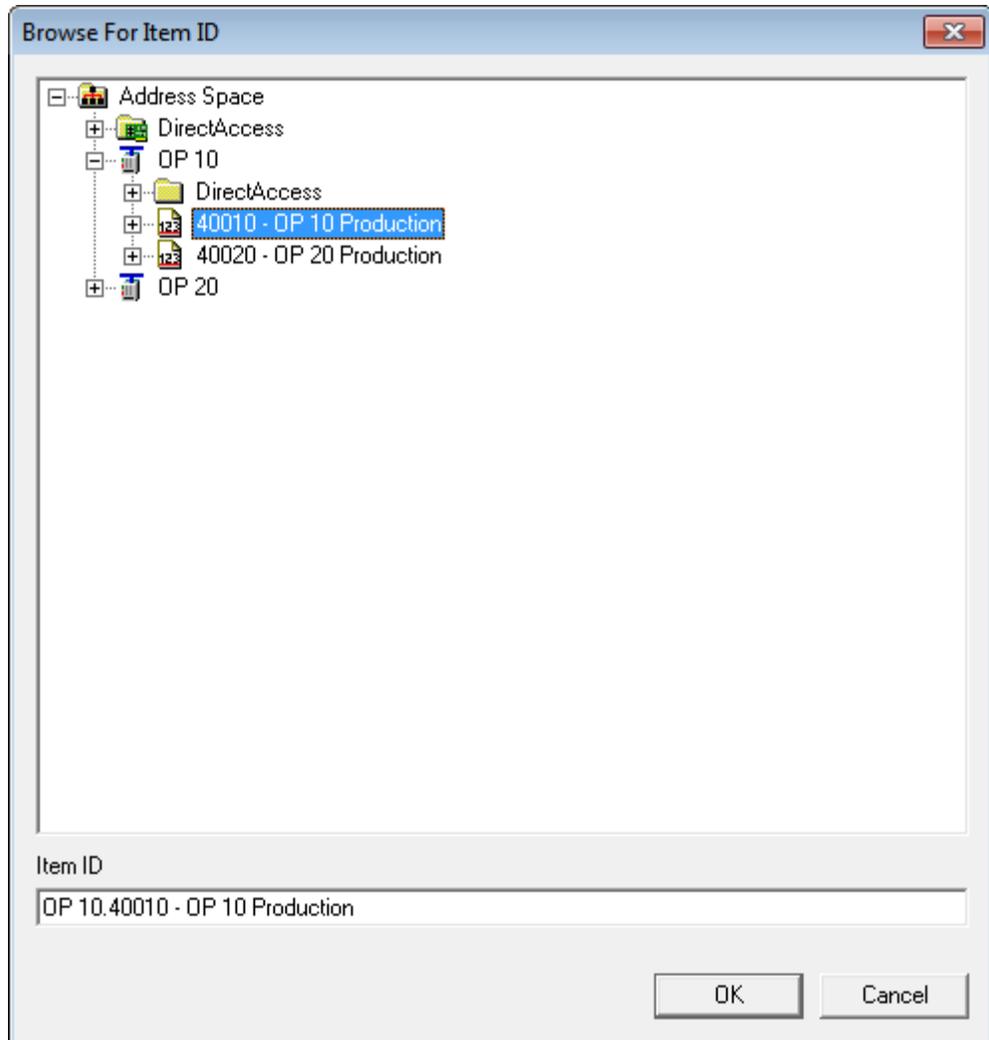
The image shows a software dialog box titled "Crosslink". It has three tabs: "General", "Input", and "Outputs", with "General" selected. The "Name" field contains the text "OP 10 Prod Count". The "Description" field is empty. Below the fields are two checkboxes: "Disable Transfers" and "Disable DirectAccess Writes", both of which are unchecked. At the bottom of the dialog are four buttons: "Apply", "Cancel", "Add New", and "Help".

On the General tab, name the crosslink ***OP 10 Prod Count***.

## The Input Tab

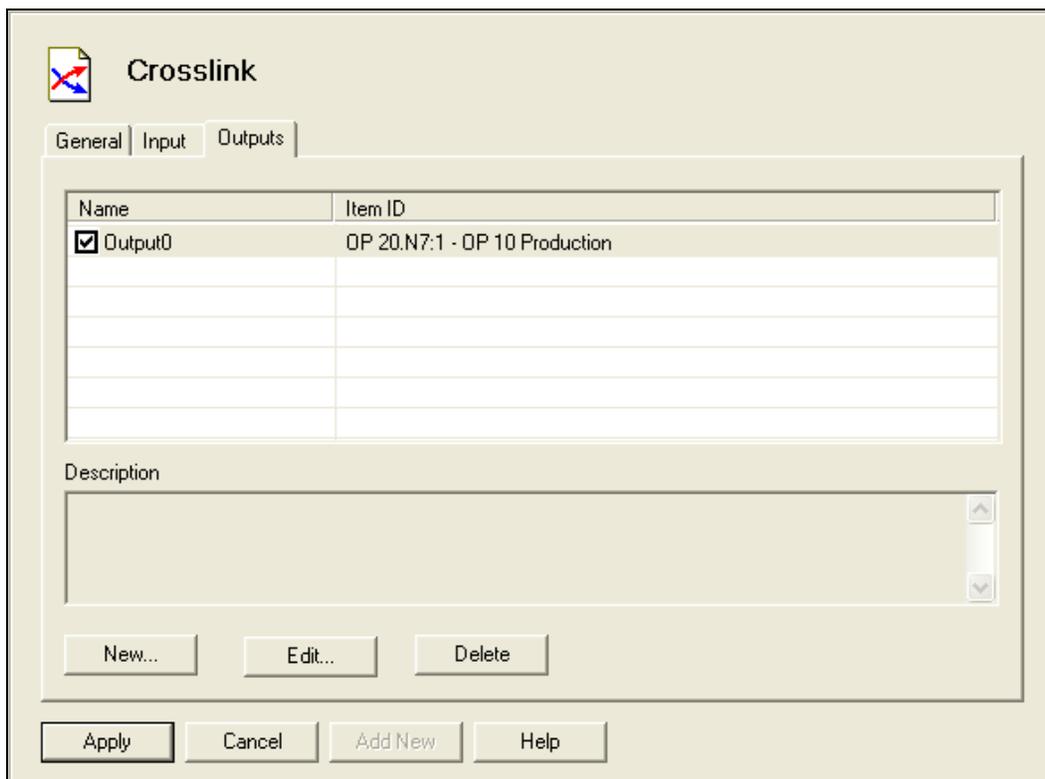


Select the ***Input*** tab and click the browse button to specify the crosslink input.



Select the data item **40010 - OP 10 Production** in the **OP 10** device. Click **OK** to accept your selection and close the browse window.

## The Output Tab



Select the **Outputs** tab and click **New...** to specify the crosslink output. The editor will again open a browse window.

Use that window to select data item **N7:1 – OP 10 Production** in the **OP 20** device, and then click **OK** to close the window.

Click **Apply** to save the crosslink.

### What else can I do here?

The crosslink we created has only one output, but you can configure as many outputs as you wish. When the crosslink triggers, it will write the crosslink input's value to all of the outputs at once.

Each crosslink output has a name, and these names default to Output0, Output1, and so on. If you use more than one output, it will be helpful to give them more descriptive names.

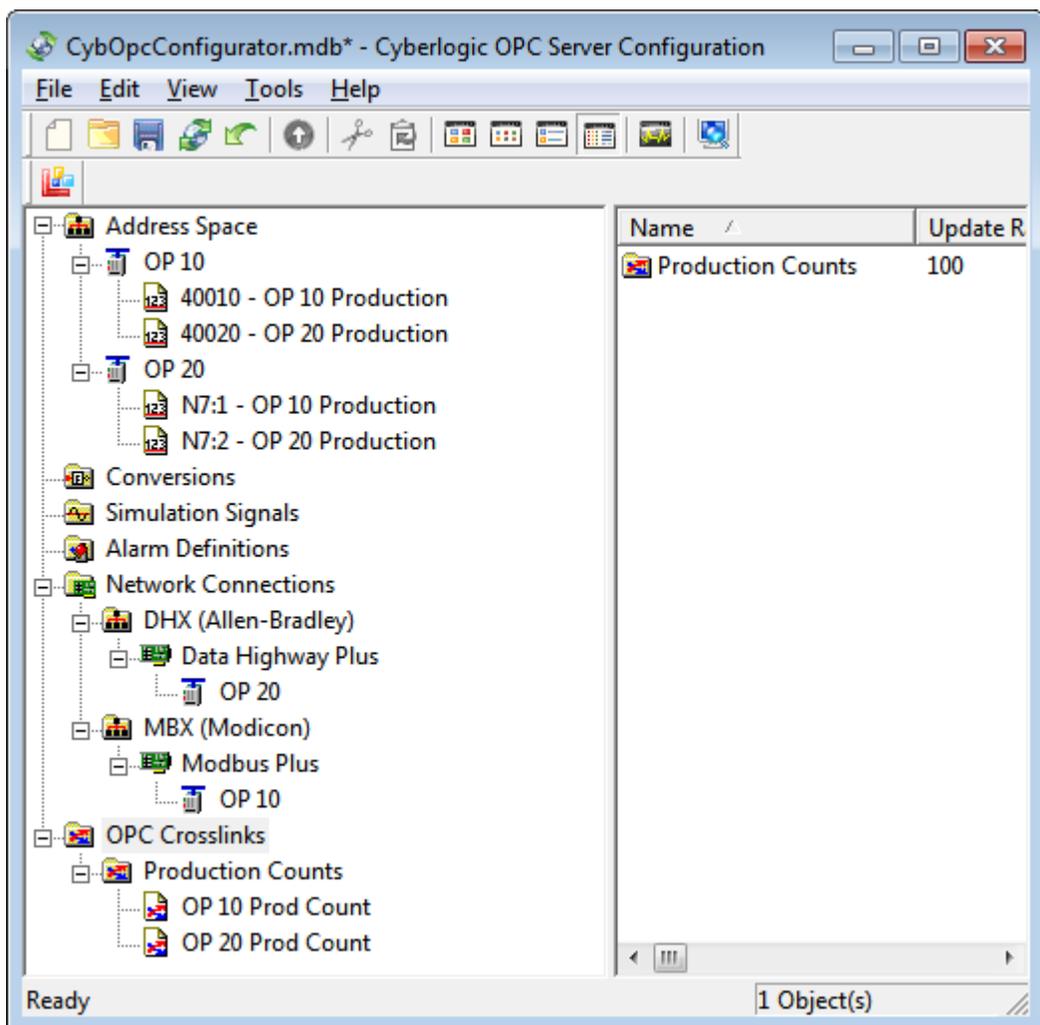
The check box beside each crosslink output indicates whether or not it is active. If the box is cleared, the output is inactive and the crosslink will not write to it.

## Completing the Configuration

Repeat the procedure to create the second crosslink with the following configuration:

- Name the crosslink ***OP 20 Prod Count***.
- For the crosslink input, use ***N7:2 – OP 20 Production***, which is located in the ***OP 20*** device.
- For the crosslink output, use ***40020 – OP 20 Production***, located in the ***OP 10*** device.

The sample OPC Crosslink configuration is now complete. Your configuration tree should look like the one in the figure below.



## **MORE COMPLEX OPC CROSSLINK CONFIGURATIONS**

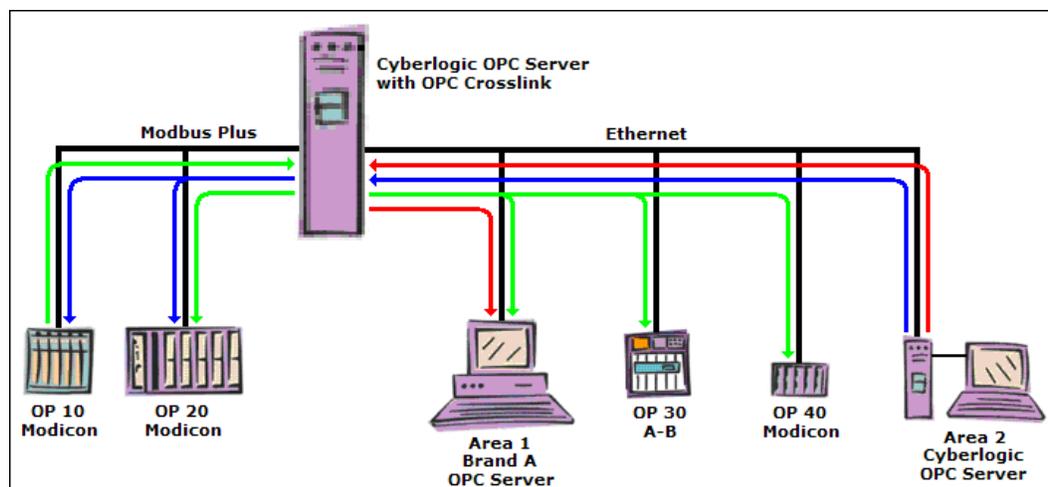
Our sample project showed how to configure a very simple data exchange using OPC Crosslink. Keep in mind, however, that you can configure as many crosslinks as you want, and you can organize them into crosslink groups in whatever way is convenient. You can think of individual crosslinks as simple building blocks that you can assemble into much more complex systems.

This “building block” approach has several advantages.

- No matter how complex your data transfer needs may be, the system is always made up of individual crosslinks. Each one of them performs just a single, easy-to-understand function.
- It’s easy to change one part of the configuration without affecting the rest. You can add, delete or modify crosslinks and crosslink groups, or move crosslinks from one group to another. The changes you make will affect only the items you edit, so you need not worry about unintended side-effects.
- Crosslinks are concerned only with transferring data from one device to another. When you are configuring a crosslink, you don’t have to worry about things like communication ports, network addresses or message blocks. Those are already taken care of elsewhere in the OPC server configuration. That also means that changes you make in the network configuration will not affect the OPC Crosslink configuration.
- All of the configuration is done in one place. You don’t have to configure messages in PLCs or routing tables in bridges, and then figure out how to keep them all backed up and up to date. And you won’t have to learn how to use numerous editors with different programming languages.
- System start-up and troubleshooting is simplified, because you can proceed one small step at a time. You can begin with just a few crosslinks, and then gradually add more. Doing so will not affect what you’ve already done. If problems develop, you can easily disable individual crosslinks or groups while the rest continue to operate normally.

### ***A Complex Example***

To see how this works let’s look at a system with much more complex data transfer requirements. Notice that its OPC Crosslink configuration is built of the same kind of crosslinks and crosslink groups as in the simple example we just configured. The complex system just has more of these building blocks.



This plant has four programmable controllers and two existing OPC servers. The controllers include both Allen-Bradley and Modicon models, and the OPC servers are of different brands as well. OPC Crosslink must also work across a mixture of networks and protocols.

The arrows show the required data flow. OPC Crosslink, running in the Cyberlogic OPC Server we have added, will handle the data transfers. This requires three crosslinks:

- The red arrows represent a crosslink that passes data from the Area 2 OPC Server to the Area 1 OPC Server.

Notice that the Area 1 OPC Server is not a Cyberlogic product. OPC Crosslink can still read and write its data as long as it conforms to the specifications for an OPC DA server.

- The blue arrows represent a crosslink that passes data from the Area 2 OPC Server to the OP 10 and OP 20 programmable controllers.

To configure this, you would create a crosslink that has two output data items, one in the OP 10 controller and the other in the OP 20 controller. Here, the data bridging capability of OPC Crosslink allows this data exchange even though the source OPC server and the target PLCs are on different networks.

- The green arrows represent a crosslink that passes data from the OP 10 controller to the OP 20, 30 and 40 controllers and to the Area 1 OPC Server.

This crosslink has four output data items. Notice that these outputs can be in devices that are on different networks, and that are a mixture of device types and families.

You must create at least one crosslink group to contain these crosslinks. If you want to use the same enable and trigger criteria for all of them, you would place them all in one group. Otherwise, you could create two or three groups, using different enable and trigger criteria as needed.

Over time, your requirements may change. You may add PLCs or OPC servers to your plant, or you may need to transfer additional data among the same devices. You would accommodate these changes by adding more crosslink and crosslink group "building blocks" to the system. As you do this, the existing data transfers will not be affected.

## WHERE CAN I GET MORE INFORMATION?

You can get detailed information on how to install, configure and use OPC Crosslink by referring to the help files for the OPC Crosslink Suite, OPC Crosslink Premier Suite, DHX OPC Premier Suite and MBX OPC Premier Suite.

Cyberlogic's website, [www.cyberlogic.com](http://www.cyberlogic.com), has information on related products, news, software downloads and contact information.

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