

Industry White Paper

Ensuring system availability in RSVIEW™ Supervisory Edition applications



Bringing Together Leading Brands in Industrial Automation

Ensuring system availability in RSVIEW Supervisory Edition applications

Rockwell Software, Visualization business unit

What is redundancy?

In the strictest sense of the word, “redundant,” as defined in Webster’s Dictionary means, “a back-up system duplicating the function of a device.” Redundant components, then, are alternate components that can be used when primary components fail. In the context of HMI systems, redundancy provides a means of ensuring system availability.

The level of system availability—none, some, and complete—increases with the number of redundant system components. To increase the level of system availability, consider these system components:

- **To protect against PLC® failures**, use redundant programmable logic controllers (PLCs). For example, Rockwell Automation’s ControlLogix™ platform allows transferring control from a primary PLC to a redundant PLC when a failure occurs.
- **To protect against PLC network failures**, install redundant PLC networks, for example, use Rockwell Automation’s ControlNet™ network.
- **To protect against information network failures**, install a redundant Ethernet network with a duplicate domain controller, network cables, and network interface cards (NICs).

RSVIEW™ Supervisory Edition requires a reliable information network to allow RSVIEW SE components to communicate across a distributed application. In addition, RSVIEW SE requires a domain controller to authenticate users who log into the system. If the domain controller fails while a user is logged in, cached credentials allow that user to continue working without interruption. Users who have previously logged into the system from a computer can log in again *from the same computer*, using cached credentials, while the domain controller is unavailable. However, a domain controller must be available for new users to log in and to allow the RSVIEW SE Signature Control to authenticate users on demand. For information about configuring redundant domain controllers, consult Microsoft documentation or your IT department.

- **To protect against host computer hardware failures**, provide backup computers to host application software such as RSVIEW Supervisory Edition.
- **To protect against software failures**, configure redundant RSVIEW, FactoryTalk™, and RSLinx™ application servers.

While all of the elements listed above contribute to the goal of a highly available automation system, this paper discusses how to protect against software failures by taking advantage of redundancy features built into RSVIEW Supervisory Edition (RSVIEW SE). These features minimize operation disruptions and data loss when system failures occur.

Specifically, this paper addresses the following topics:

- **Protecting against software failures**
- **Considering redundancy options**
- **Planning a redundant system layout**
- **What happens if ...**
- **Configuring a redundant RSVIEW SE system**
- **Licensing in a redundant system**

Protecting against software failures

A distributed HMI system includes both server components and client components. The client components provide the interface used by the human operators of the system, typically via graphic displays that are updated dynamically. These graphic displays depict the current state of the manufacturing system and allow operators to monitor and control its operation. The dynamic information in these graphic displays, including animated pictures, alarm summaries, updating tag values, and real-time and historical trends, is provided by the server components in the HMI system. Servers also log historical data and perform other behind-the-scenes monitoring and control functions.

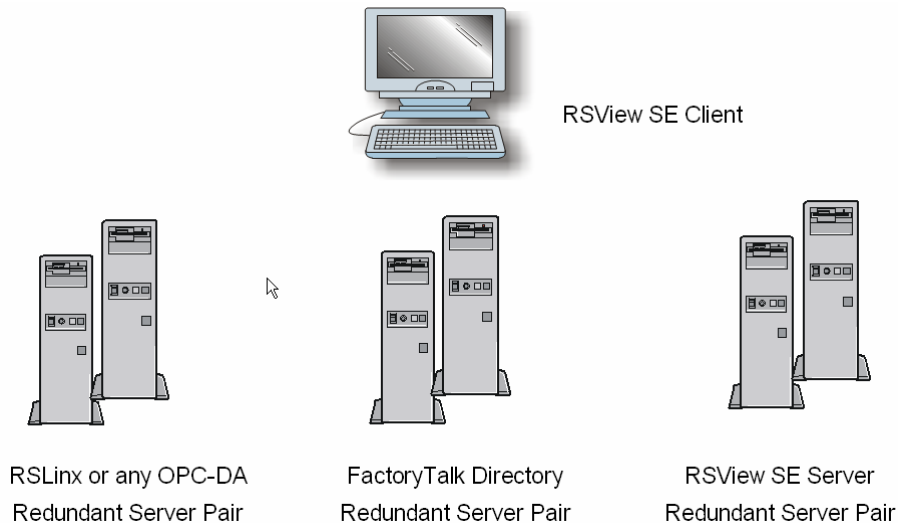
For operators to maintain visualization and control of their manufacturing system, the server components must provide a continuous flow of information to the client components. This is why software redundancy is so important. To help ensure that critical data remains available to clients, even during server disruptions, RSVIEW Supervisory Edition—enabled by the FactoryTalk integrated architecture—provides built-in redundancy features, including:

- In the worst case scenario, clients detect loss of communications with the primary server within 5 seconds, and then switch over to backup servers in fewer than 30 seconds. Typically, clients detect that a server has failed in fewer than 5 seconds and fail over (connect to a secondary HMI server) in fewer than 5 seconds. This means that, depending on the application they are connected to, clients might not see any interruption in the operation of their application.
- Redundant capabilities provided by RSVIEW SE and FactoryTalk are completely automatic and transparent to clients. During server failure detection and switch-over, operators need not take any action or restart client software to continue using the system.

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- During the failover process, operators can continue to interact with servers that are still online. Display fields that show data from the failed server show a wire-frame view, so that operators do not rely on tag values that might be incorrect.
 - Once the system switches to backup servers, clients continue functioning normally.
 - When the primary server becomes available again, the system can automatically switch back to it.
 - An RSView Supervisory Edition system includes three types of servers, and each of these types can be made redundant through standard configuration options.
 - **FactoryTalk Directory Servers.** The FactoryTalk Directory Server is a shared software component that works like an electronic address book, allowing parts of an application to find each other on a computer or across a network. All of the computers participating in a distributed application must point at the same FactoryTalk Directory Server.
 - **RSView SE Servers.** RSView SE Servers, also sometimes called HMI servers, store HMI components, such as graphic displays, and serve these components to clients. RSView SE Servers also store tag databases, detect alarms, and log historical data. A single computer can host up to five RSView SE Servers. A single application can include up to 10 RSView SE Servers.
 - **Data Servers.** Data servers, such as RSLinx, allow clients to access information in programmable controllers, in other hardware devices, and from other data servers that comply with the OPC-DA (OLE for Process Control – Data Access) 2.0 specification. A single application can include up to 25 data servers.

Considering redundancy options

All three types of servers associated with an RSVIEW SE system can be hosted on the same, or on different, computers on the network, allowing for many different ways of configuring redundant systems.



Redundant FactoryTalk Directory Servers

If the FactoryTalk Directory Server becomes unavailable while an application is running, the application continues to operate normally, and continues reading and writing values, acknowledging alarms, opening and closing displays, and so on—even if redundancy is not configured and a backup FactoryTalk Directory Server is not available on the network. This is because a copy of the FactoryTalk Directory Server information is cached locally on each computer connected to it, as a result of which the client computer can continue to resolve tag addresses. However, while the FactoryTalk Directory Server is unavailable, an application's structure cannot be modified: for example, operators cannot add or remove areas, data servers, or RSVIEW SE Servers.

For best performance from your redundant system, we recommend setting up redundancy for FactoryTalk Directory.

To allow modifying an application's structure even if the computer running the FactoryTalk Directory Server becomes unavailable, set up a redundant FactoryTalk Directory Server on a different computer. Since each computer in a distributed application needs to know where the network-wide FactoryTalk Directory Server is located, configure all computers to use the same primary FactoryTalk Directory Server computer. A single backup computer on the network could host a secondary FactoryTalk Directory Server for the entire system. With redundancy configured, if the primary FactoryTalk Directory Server fails, the system automatically switches all clients to the designated secondary server. When the primary FactoryTalk Directory Server

comes back online, the system automatically switches back to use it instead of the secondary server.

Redundant RSVIEW SE Servers

RSVIEW SE Servers can be set up to fail over to a secondary server if the primary server fails. When the primary server becomes available again, it automatically reassumes responsibility for HMI server activities. When setting up redundant RSVIEW SE Servers, keep the following points in mind.

- **Synchronizing alarms.** RSVIEW SE Servers manage the synchronization of alarms, so alarm states are kept synchronized between the primary and secondary servers. For example, if the primary server has five unacknowledged alarms when failure occurs, the secondary server will show the same five alarms as unacknowledged when failover is complete. Alarm states are also kept synchronized when the system switches back to the primary server.

While the primary RSVIEW SE Server is active, the secondary server runs the alarm monitoring system in a backup mode, so alarm states are synchronized even if you have not set up the secondary server to start alarm monitoring on demand.

This backup mode that runs on the secondary server does not detect alarms; it only keeps alarm states synchronized. To ensure that alarms are detected at the secondary server when it becomes active, include the AlarmOn command in the secondary server's On Active macro. To stop alarm monitoring at the secondary server when the system switches back to the primary server, include the AlarmOff command in the secondary server's On Standby macro. This prevents alarm monitoring from running on both servers simultaneously, which would place unnecessary overhead on the system.

For alarm states to synchronize properly, the clocks on the primary and secondary RSVIEW SE Servers must be kept synchronized to a time server. If the clocks on the computers are not synchronized, multiple alarms or inconsistent information could be displayed in an alarm summary when failover occurs.

- **Logging activity and alarm data.** We highly recommend that in any distributed system you send activity and alarm information to a central ODBC database, such as Microsoft SQL Server, for logging. These system-wide logs can then be made secure and redundant through database functionality. We also recommend configuring RSVIEW SE's local activity and alarm logs to buffer information in the event that communications with the ODBC database are lost.

Even if your RSVIEW SE Server is not set up with redundancy, we recommend that you log activity and alarm information to an ODBC database. Because activity log files are stored on every computer on which system activity is generated, sending the alarm and activity log files to an ODBC database provides you with one place to look for activity and alarm information when diagnosing problems.

When the primary server is active, the secondary server is loaded and the project is loaded. However, components such as event detection, alarm monitoring, and data logging do not have to be running unless the secondary computer becomes active. This option is user configurable. (See [Step 7 • Configure redundancy properties for RSView SE Servers](#) on page 22.)

- **Synchronizing memory tag values, derived tags, and data log files.** To keep these elements synchronized, run the same derived tag components and data log models on both primary and secondary computers. Memory tags can be kept synchronized if their values are the result of derived tags.
- **Managing events.** While events, triggered by an event detector, are not specifically synchronized between primary and secondary RSView SE Servers, it is possible to manage which server is responsible for detecting and executing events, so that only one server is active at a time. To handle the situation where an event is executing when a primary RSView SE Server fails, issue the EventOn command (to start event detection) only on an active HMI server, and always issue the EventOff command (to stop event detection) on a standby server. To do this automatically, you can issue these commands in the HMI server's On Active or On Standby macros.
- **Executing commands and macros.** If a primary HMI server fails when a command or macro is executing, the execution stops during failover to a secondary HMI server. To continue, re-issue the command or macro when the failover process finishes and the secondary server becomes available.

Because uptime during operation is crucial in a control system, RSView SE provides redundancy during runtime operations. However, configuration changes are not synchronized automatically. As part of maintaining a redundant system, develop a planned schedule for copying project files from primary HMI servers to secondary servers. Either copy project files manually, or duplicate the project changes on each HMI server computer. As a planned activity, this routine maintenance does not affect the operation of the system.

Redundant data servers

Primary data servers, such as RSLinx or any OPC-DA data server, can be configured to fail over to backup servers when a primary server fails. As part of configuring redundant data servers, specify whether, after a failed primary server is repaired, the system should automatically switch back to the primary server or continue using the secondary server. This option allows you to avoid unnecessary interruptions in the flow of data from servers to clients.

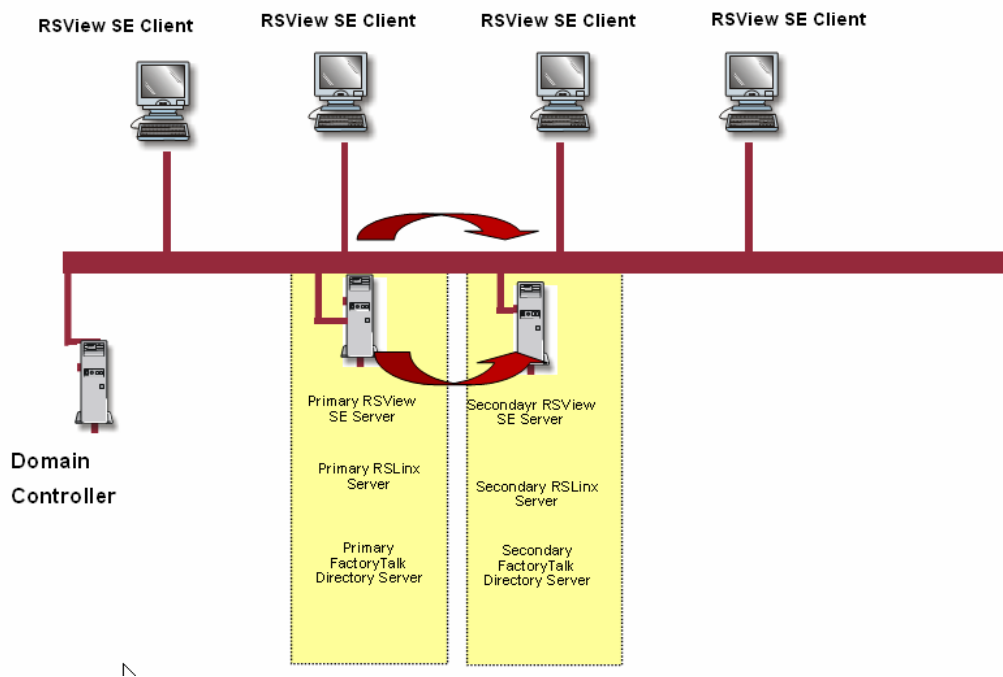
To minimize the time required to complete a failover, the system creates OPC groups containing the necessary tags on both the primary server and the secondary server. However, those groups and tags are activated, or scanned, only by the active data server, so no additional communication load is placed on PLCs by configuring a redundant data server.

Planning a redundant system layout

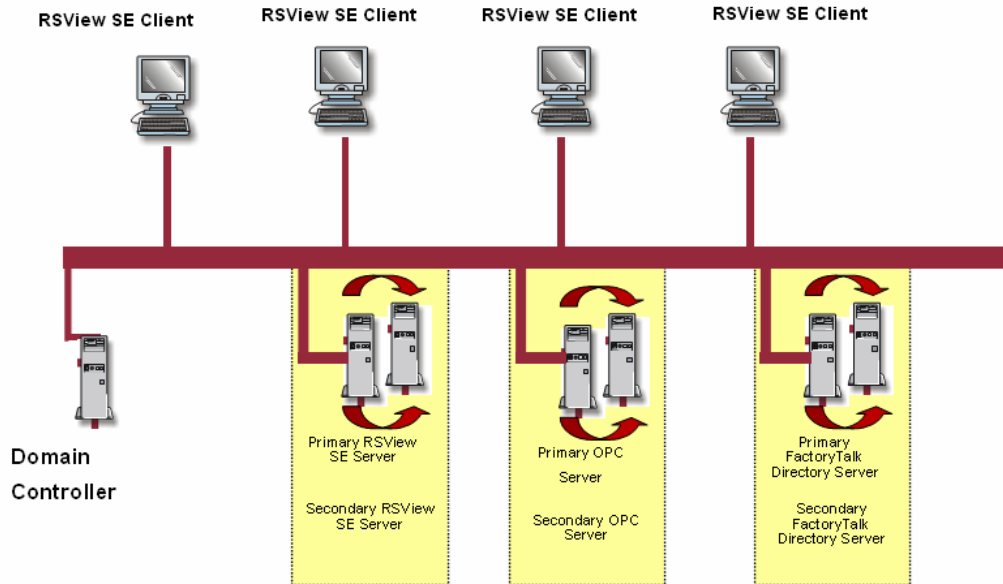
Because all three types of servers involved in a distributed HMI system are separate entities, they can be hosted on any computers on the network. This allows for a great deal of flexibility in designing a redundant architecture.

An application with a single HMI server

For example, in a system that contains only a single HMI server, with a single line or process to control, the primary FactoryTalk Directory Server, RSView SE Server, and RSLinx Server could all be hosted on the same computer, with an identical backup computer hosting the secondary servers.



Or each of the primary and secondary servers could be installed on separate computers, as shown below:

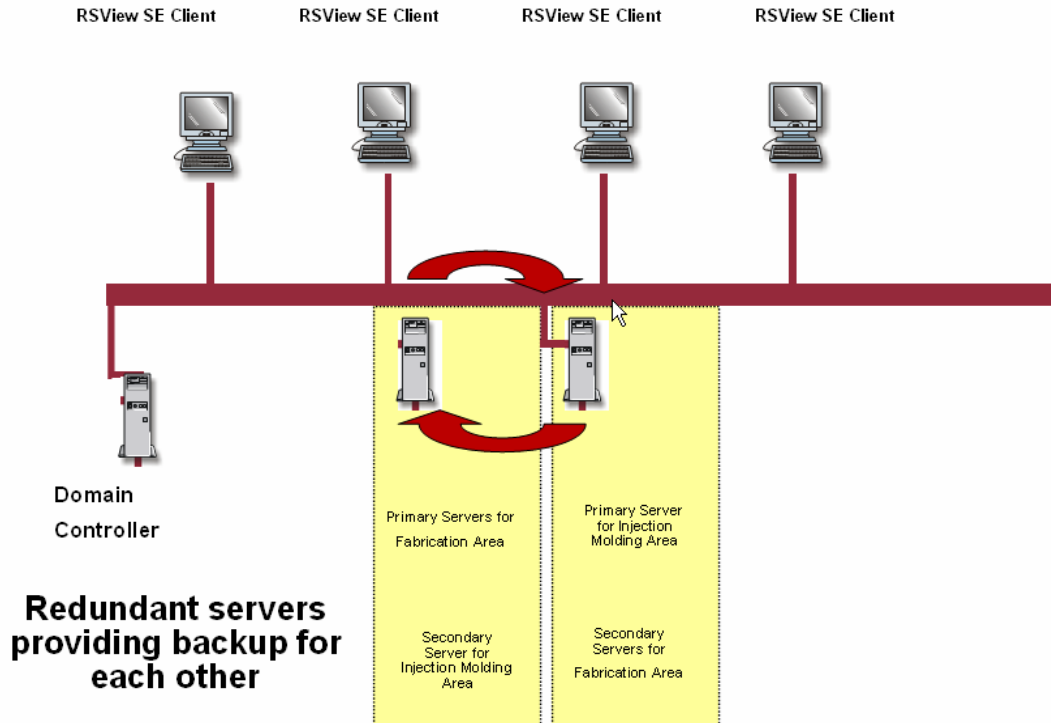


The configuration shown above is not always necessary. Depending on your application's size and computing needs, and your redundancy needs, you might be able to install all three servers on a single pair of redundant computers.

In particular, FactoryTalk Directory Server does not usually need to be installed on its own hardware, because the FactoryTalk Directory Server software is not computing intensive. We do recommend that you install FactoryTalk Directory on a computer that is usually in a running state, for example a computer hosting an RSVIEW SE Server or RSLinx Server.

An application with two HMI servers

In an application that includes two HMI servers, with two lines or processes to control, two computers could host all of the servers for both lines; one hosting the primary server for line 1 and the secondary server for line 2, and the other hosting the primary server for line 2 and the secondary server for line 1.

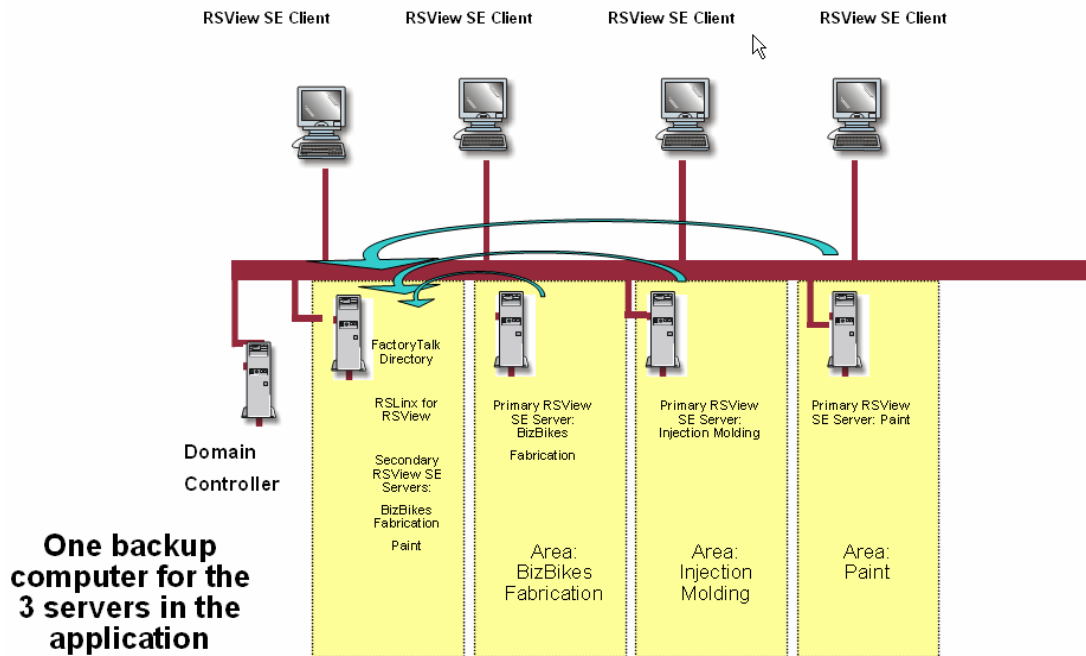


An application with up to five HMI servers

Because RSView SE can host up to five RSView SE Servers (each serving a different HMI project) on one computer, a single computer can be the secondary server for more than one primary RSView SE server.

For example, in an application with five RSView SE Servers, one computer could act as the secondary server for all five primary servers, or for five RSView SE Servers and three data servers, or any other combination.

This is advisable only if the secondary computer does not also perform processor- or disk-intensive tasks like data logging, processing derived tags, or detecting and triggering events. Because the HMI projects are loaded into memory on a secondary computer as soon as it is configured to be a secondary RSView SE Server, ensure that the secondary computer has enough RAM to host the total number of HMI projects that will be loaded.



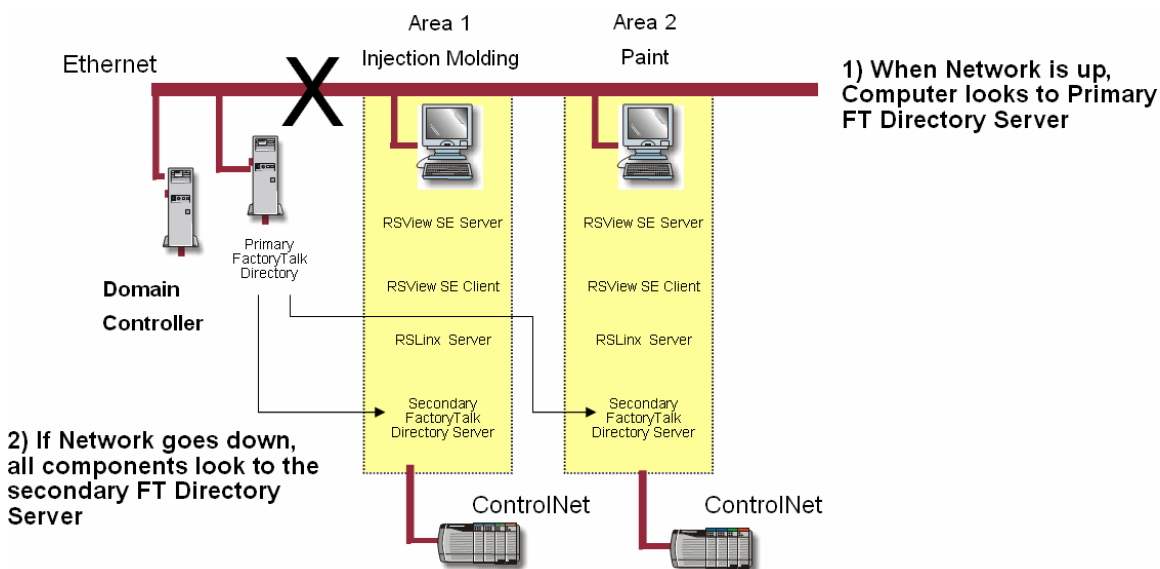
Because all parts of an RSView SE Station are always installed on the same computer, RSView SE Station cannot be used in a redundant configuration.

A distributed application that can run as a set of stand-alone applications

Often the control network and the HMI network are separate—for example, the control network could be ControlNet, and the HMI network is usually Ethernet.

If you want your application to continue to run as a stand-alone application if the HMI network goes down, install a ControlNet network card and an Ethernet network card on the computer. Connect the computer to both networks, and then set up the computer to host the RSView SE Server, the RSView SE Client, the data server, and the secondary FactoryTalk Directory.

If the HMI network fails, the application continues running on the computer as a stand-alone application. This means that you cannot access tags or alarms from other HMI servers but you can still update tags or alarms from the local HMI server. Graphic displays, macros, and client keys from other HMI servers are available only if they were accessed before the HMI network failed, because these parts of an application are cached automatically whenever they are accessed by clients.

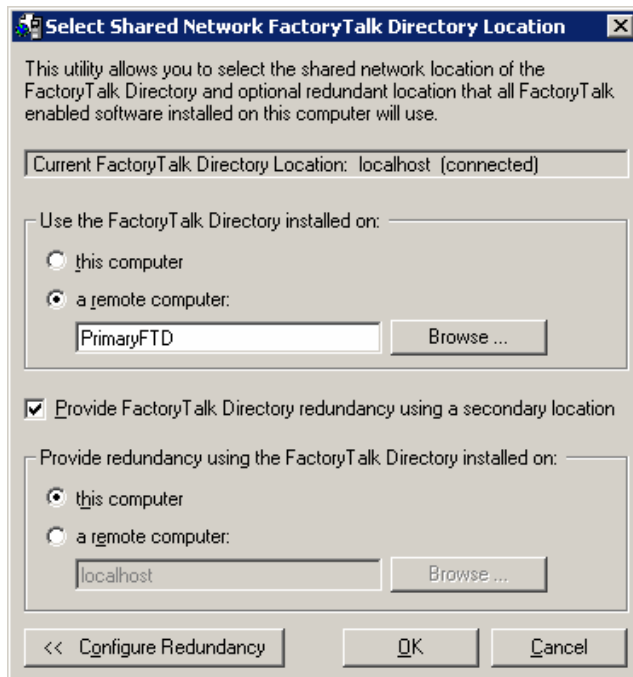


In this case, you cannot provide redundancy for HMI servers or data servers because the redundant server would remain inaccessible if the HMI network failed.

For best performance from your redundant system in the event of failures other than those of the HMI network, we recommend setting up redundancy for FactoryTalk Directory.

To set up the software, follow these steps:

1. On each computer participating in the application install the RSView SE Client, the RSView SE Server, the data server, and the FactoryTalk Directory software. All of these computers must be in the same Windows domain.
2. On a separate computer in the same Windows domain, install only the FactoryTalk Directory software. This computer will be the primary FactoryTalk Directory Server.
3. Copy the configuration files from the primary FactoryTalk Directory Server to all of the computers you set up in step 1. For details, see [Step 2 • Copy the FactoryTalk Directory application files to a backup computer](#) on page 18.
4. On each of the computers you set up in Step 1, run the utility called Select Shared Network FactoryTalk Directory Location. Type the name of the primary FactoryTalk Directory computer you set up in step 2.



5. Click the **Configure Redundancy** button to expand the dialog box to include the redundancy options.
6. Select the check box, **Provide FactoryTalk Directory redundancy using a secondary location**, and then click **this computer**.

What happens if ...

To understand how redundancy affects the operation of the system, consider some scenarios.

FactoryTalk Directory is down, and redundancy is not set up for it

In this scenario, RSView SE Clients continue to function normally, provided that the application was opened at least once on the computer hosting the RSView SE Client before the primary FactoryTalk Directory Server went down. If a client computer did not open the application before the FactoryTalk Directory Server went down, the application is not accessible to the RSView SE Client running on the computer.

When a client computer opens the application, the information stored by the FactoryTalk Directory Server is copied to the client computer, and stored in a cache. Clients that have a cached copy of the FactoryTalk Directory Server continue to see graphic displays and update tag values, even if the displays and tags the client is accessing have not been accessed before. Any tags, displays, or other components that are added to the system while the FactoryTalk Directory Server is down are also immediately accessible to the client.

However, while FactoryTalk Directory is down, you cannot use RSView Studio to modify the application's structure, for example by adding or removing areas, data servers, or HMI servers.

For best performance from your redundant system, we recommend setting up redundancy for FactoryTalk Directory.

The primary FactoryTalk Directory goes down, and the secondary FactoryTalk Directory becomes active

In this scenario, redundancy has been set up for FactoryTalk Directory.

When the primary FactoryTalk Directory computer goes down and the secondary FactoryTalk Directory becomes active, all RSView SE Clients, RSView Studio, and the RSView Administration Console can continue to access the system normally. Graphic displays, tags, and other components that are added to the system are immediately accessible to all clients.

While one FactoryTalk Directory Server in the redundant pair is active, you can continue to modify the application's structure, for example by adding or removing areas, data servers, or HMI servers.

When the system switches back to the primary FactoryTalk Directory Server, all changes that were made to the application's structure are not automatically copied to the primary FactoryTalk Directory Server. You must copy the changes manually, as described in [Step 2 • Copy the FactoryTalk Directory application files to a backup computer](#) on page 18.

You do not have to point the primary and secondary FactoryTalk Directory Servers at each other. Only clients need information about where the primary and secondary FactoryTalk Directory

Servers are located. Use the utility called Select Shared Network FactoryTalk Directory Location to point clients at the primary and secondary FactoryTalk Directory Servers. However, if you have clients running on the secondary FactoryTalk Directory Server, click This computer in the Redundancy part of the Select Shared Network FactoryTalk Directory Location dialog box.

The network includes one primary FactoryTalk Directory Server, and multiple secondary FactoryTalk Directory Servers: the primary FactoryTalk Directory Server goes down

The network layout described in this scenario is a special case. It is useful when you expect the HMI network to be unreliable, because it allows you to maintain a reduced level of system operation if the HMI network fails but the control network remains available, and every client computer is connected to both networks.

Any computer connected to the application can be a secondary FactoryTalk Directory Server, but a particular computer can only be configured to have one primary and one secondary FactoryTalk Directory Server.

When the HMI network fails, every client computer continues running as a stand-alone application on the network. Clients can continue to open graphic displays and tags located on the same computer, but cannot open graphic displays or tags located on other computers on the network.

If you make changes to the application's structure while the primary FactoryTalk Directory computer is down, these changes will appear to be lost when the primary FactoryTalk Directory becomes available. You must copy the changes from the secondary FactoryTalk Directory where they were made to the primary FactoryTalk Directory manually, as described in [Step 2 • Copy the FactoryTalk Directory application files to a backup computer](#) on page 18.

Configuring a redundant RSVIEW SE system

Redundancy options can be configured at any time in an RSVIEW SE system. No special redundancy programming is required when developing RSVIEW applications. Simply develop and test an RSVIEW application using RSVIEW Studio, and then follow the steps outlined below.

1. Install the necessary RSVIEW SE software on the backup computers set aside for redundant operation.
2. Copy the FactoryTalk Directory application files to a backup computer.
3. On each participating computer in the network, specify the name of the FactoryTalk Directory backup computer.
4. Copy RSVIEW SE Server configuration files to a backup computer.
5. Copy the data server configuration files to a backup computer.
6. From RSVIEW Studio, configure data server properties to specify the name of the computer where the redundant data server is located.
7. From RSVIEW Studio, configure redundancy properties for RSVIEW SE Servers.

Step 1 • Install RSView SE software on the backup computers

Install the appropriate software on each of the computers set aside for redundant operation:

- On the **FactoryTalk Directory Server** backup computer, install the FactoryTalk Directory software.
- On the **RSView SE Server** backup computer, install the RSView SE Server software.
- On the **RSLinx or OPC-DA data server** backup computer, install the RSLinx for RSView software, or install the software for the OPC server you are using.

Step 2 • Copy the FactoryTalk Directory application files to a backup computer

After installing the FactoryTalk Directory software on a backup computer, copy the following folder from the primary computer to the backup computer:

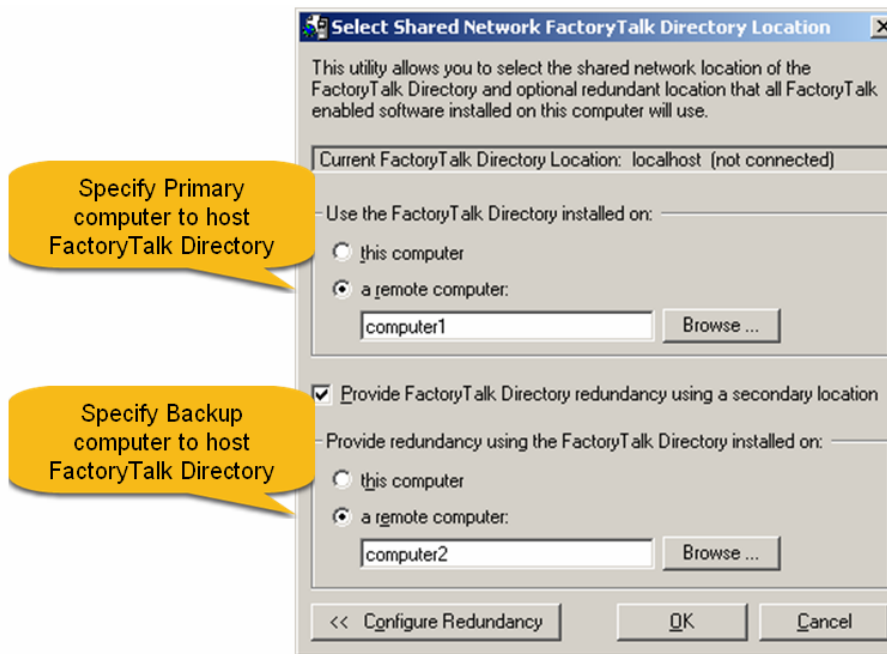
\Documents and Settings\All Users\Application Data\Rockwell\RNA Server\Global\

This folder contains the FactoryTalk files for distributed applications.

By default, the Application Data folder is hidden. To see it, from the Windows Explorer, select **Tools > Folder Options > Show hidden files and folders**.

Step 3 • Specify the name of the FactoryTalk Directory backup computer

1. On **each computer on the network** participating in the distributed application, specify the name of the FactoryTalk Directory Server backup computer.
2. From the Windows **Start** menu, point to **Rockwell Software > Utilities > Specify FactoryTalk Directory Location**.
3. In the Select Shared Network FactoryTalk Directory Location window, specify the names of the primary and secondary computers.



Step 4 • Copy RSView SE Server configuration files to a backup computer

After installing the RSView SE Server software on a backup computer, copy the HMI project folder from the primary computer to the backup computer. The HMI project folder contains the RSView SE Server's configuration files.

The HMI project folder has the same name as the HMI server in the application, and is located in the following folder:

\\Documents and Settings\\All Users\\Documents\\RSView Enterprise\\SE\\HMI Projects\\

Step 5 • Copy the data server configuration files to a backup computer

After installing the RSLinx for RSView software, or the software for your OPC server, on a backup computer, copy the data server's configuration files from the primary computer to the backup computer. Each computer must host identical data server configuration settings, including topics, networks, and other settings.

If you are using RSLinx, on the **RSLinx primary computer**, run the RSLinx Backup Restore Utility to back up configuration files. Then on the **RSLinx secondary computer**, run the utility to restore the configuration. From the Windows **Start** menu, select **Rockwell Software > RSLinx > Backup Restore Utility**.

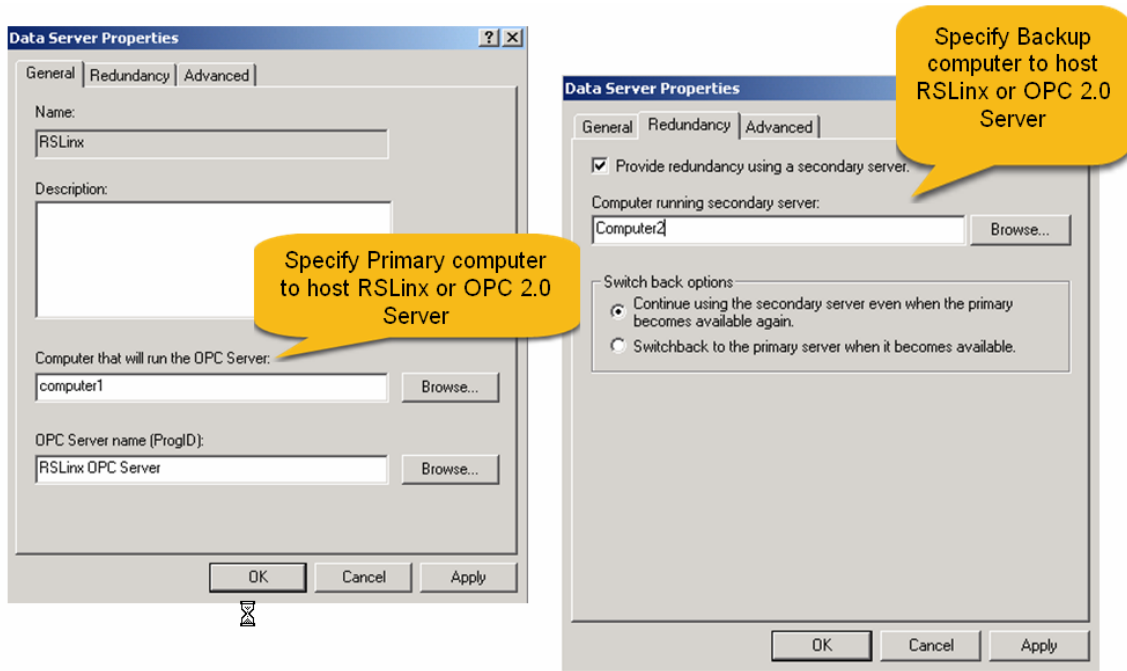
Step 6 • Specify the location of the backup data server

After setting up a redundant data server on a backup computer, configure data server properties to specify the location of the backup computer.

1. On the computer on which RSView Studio or the RSView Administration Console is installed, open the application.
2. Right-click the Data Server icon, and then click **Properties**.
3. On the **General** tab, specify the name of the primary computer hosting the RSLinx or OPC-DA 2.0 data server.

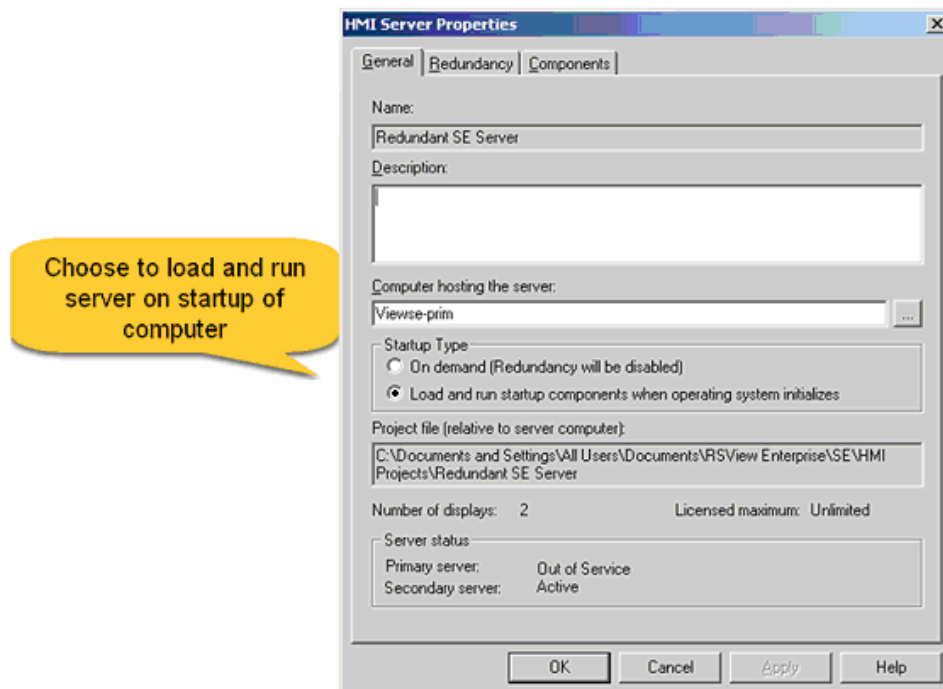
4. On the **Redundancy** tab:

- select the check box **Provide redundancy using a secondary server**
- in the box, **Computer running secondary server**, specify the name of the backup computer hosting the secondary data server
- select a switch back option



Step 7 • Configure redundancy properties for RSView SE Servers

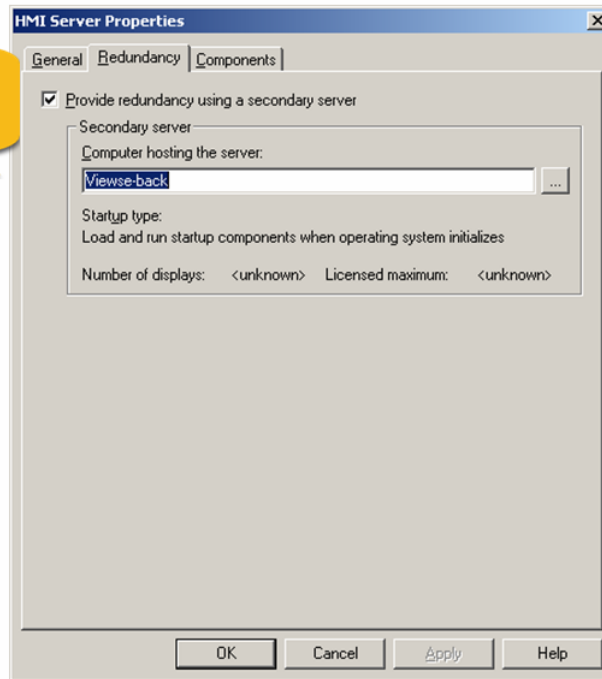
1. On the computer on which RSView Studio or the RSView Administration Console is installed, open the application.
2. Right-click the HMI Server icon, and then click **Properties**.
3. In the HMI Server Properties dialog box, click the **General** tab, and then click **Load and run startup components when operating system initializes**. You cannot set up redundancy for an HMI server that is set to start up on demand.



4. On the Redundancy tab:

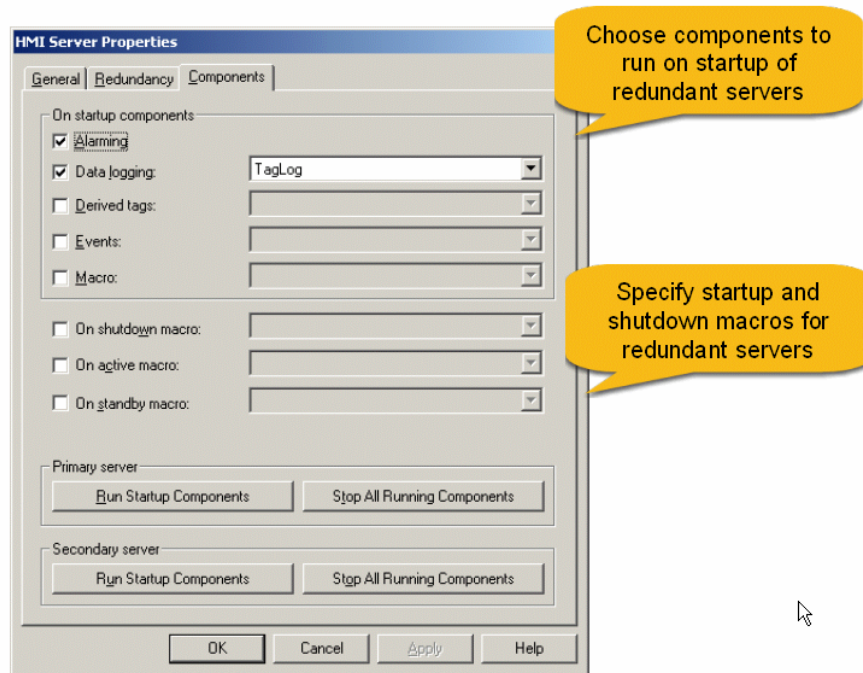
- select the check box, **Provide redundancy using a secondary server**
- in the box, **Computer hosting the server**, type the name of the **backup computer** that is hosting the secondary RSVIEW SE Server

Specify Secondary computer to host RSVIEW SE Server



5. On the **Components** tab, select which components should start up when the primary and secondary RSView SE Servers become active, or go on standby. You cannot specify different startup components for the primary and secondary servers.

If you choose not to run components when the servers start up, you can specify macros to start the components only when the server is the active server. For details, click the **Help** button at the bottom of the HMI Server Properties window.



6. Repeat steps 1 through 5 for each backup RSView SE Server in your application.

It is not necessary to set up server redundancy on RSView SE Client computers—all RSView SE Server redundancy options are configured only on the computers hosting RSView SE Servers.

Licensing in a redundant system

FactoryTalk Directory Servers

The FactoryTalk Directory Server is part of the RSVIEW Supervisory Edition integrated architecture and does not require a separate license.

RSVIEW SE Servers

RSVIEW SE Servers require licenses for the both primary servers and the secondary servers. Floating licenses are not supported for RSVIEW SE Servers.

OPC Servers

OPC server licensing depends on the OPC server being used. RSLinx requires a license for each instance that is running. However, RSLinx for RSVIEW is included with RSVIEW SE Servers at no additional cost: if you install RSLinx on the same computer as an RSVIEW SE Server, RSLinx uses the RSVIEW SE license, which means you don't need to purchase additional RSLinx licenses. However, to set up a redundant system using RSLinx Gateway, you must purchase two RSLinx Gateway licenses.

RSVIEW SE Clients

In a distributed system, you can use two licensing mechanisms for RSVIEW SE Clients: dedicated licenses and floating licenses. Dedicated licenses are installed on the computer hosting the client, but floating licenses are installed on the computer hosting FactoryTalk Directory Server.

FactoryTalk Directory Server does not hold licenses; rather, the computer on which FactoryTalk Directory Server is running, does. As a result, FactoryTalk Directory Server redundancy does not ensure redundant licenses. We recommend using dedicated licenses in a redundant system to ensure that RSVIEW SE Clients always have access to licenses, independent of other computer failures.

However, should you decide to use floating licenses installed on the FactoryTalk Directory computer, be aware of the following scenarios:

- If the FactoryTalk Directory Server software fails, but the computer hosting it remains available, licenses continue to be available to RSVIEW SE Clients.
- RSVIEW SE Clients obtain their licenses from the primary computer hosting FactoryTalk Directory services. If the primary computer is not available, the clients will not be able to obtain licenses.

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- If the primary computer fails after RSView SE Clients have obtained licenses, those clients continue to hold their licenses and operate normally. Only licenses not currently used by clients will be unavailable if the primary computer fails. When a client logs off, however, its license is released. The client will not be able to obtain another license until the FactoryTalk Directory computer becomes available again.

Rockwell Software

For more information about the latest pricing or a demonstration of any Rockwell Software package, please contact your local Rockwell Automation Sales office or Allen-Bradley distributor. For the very latest about Rockwell Software products, visit us at:

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