



PcVue

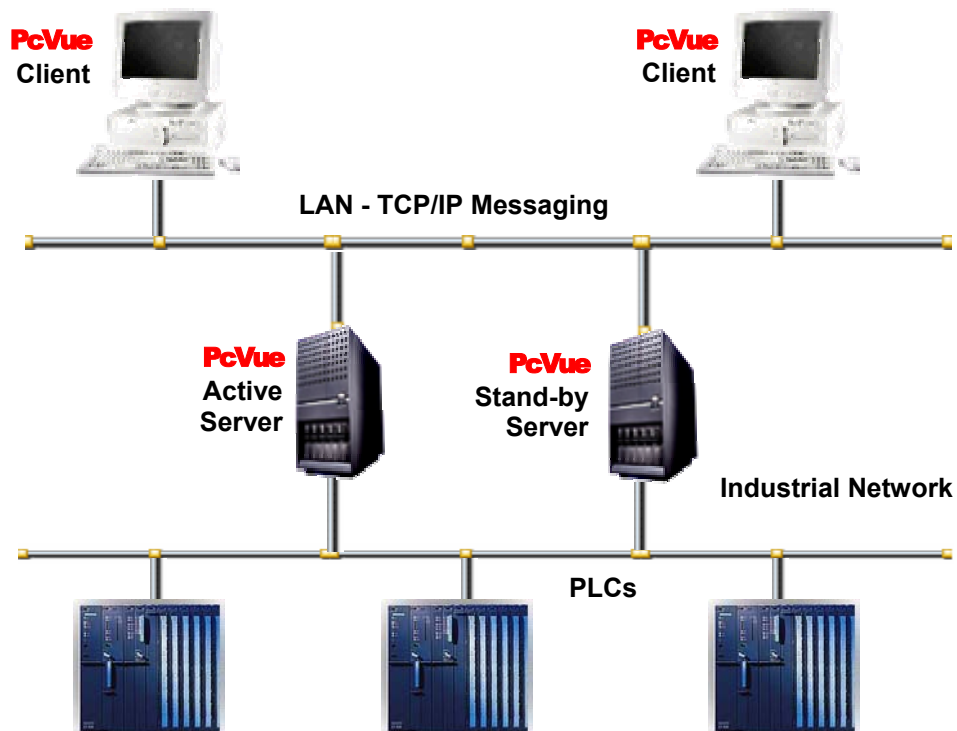
Redundancy Features

In response to certain users' needs to supervise major installations, **PcVue** was designed to support applications distributed across many stations.

The demand for continuous availability of information resulted in **PcVue** being given comprehensive features for handling redundancy.

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Multi-Station Configurations



When an application is distributed across several stations connected by a local area network, a station's database variables can be related to those of another station and their real time properties become common.

Any two stations exchange information by maintaining a connection through the local area network. The station that starts the conversation is called the Client. The station that replies is called the Server. A station can be both a Client and a Server for communicating with other stations.

In a complex Client/Server architecture, each station is likely to consume some or all of the information held by the other stations.

The data flow between a Client and a Server is bi-directional, so that a change in a variable's value in a station is always published to the equivalent variables on the other stations.

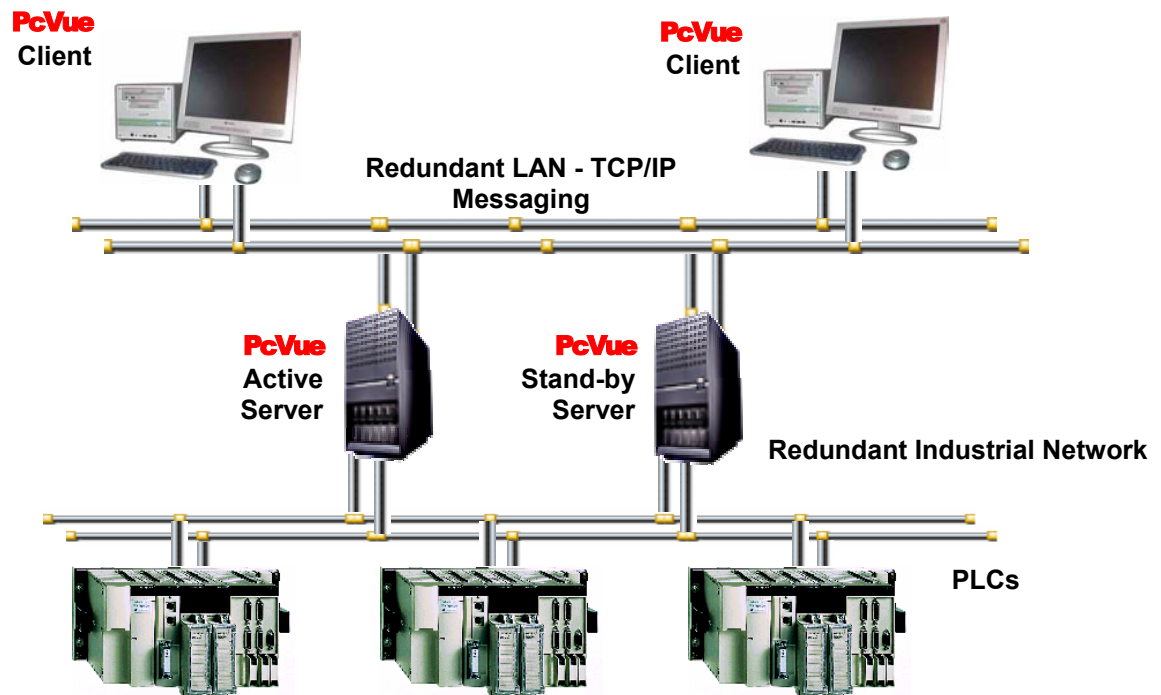
For example the Server can have an equipment variable related to a PLC. If this variable has a control attribute, a user can change its value from the Server and send it to the PLC. The equivalent variable located on a Client station also has this control attribute. A user can thus change its value from the Client station, the changed value being sent to the Server and from there to the PLC.

In the event of a network break between a Client and a Server, the Client side variables become invalid and commands are no longer sent.

The transport mechanisms for information exchange among **PcVue** stations are based on standard network architectures employing NETBIOS or (from **PcVue** version 8.0 onward) WinSock interfaces.

In the case of the NETBIOS interface, the communication is effected on the network by using NetBEUI, TCP/IP or SPX/IPX protocols.

Network Architecture



The network architecture defines the Client and Server function(s) of each **PcVue** station, every association of Servers and the connections between Clients and Servers. If user rights allow, it can be configured from any station of the network.

Each station must have at least one identifier on the network.

Status of a redundant architecture

The Supervisor provides a range of status variables for the operating conditions of the stations in a redundant architecture. Once these variables are created, **PcVue** automatically updates them each time that a change of state occurs.

The variables are used for two purposes:

- In mimics, to give the user a summary of the operating conditions of the system.
- In programmed mode, to customise control of the redundancy processes for particular situations.

What is an association (cluster)

The concept of an association or cluster simplifies the multi-station configuration and maintenance of an application employing the redundancy processes. It is a group of two or more Server stations working together to provide a redundant service.

From the Client station's point of view, an association appears as a single entity to which it is subscribed. Thus whichever Server produces the data, the Client has only one subscription.

Association of data acquisition Servers

An association of Servers for data acquisition (or communication) is not limited in the number of stations it can comprise.

The data acquisition Servers are connected simultaneously to the industrial network and to the local area network. When only one station communicates with the equipment and publishes the data to the other stations, the association is described as a single active producer. Otherwise – when multiple stations communicate with the equipment – the association is said to have multiple active producers.

Association of historical Servers

An association of historical Servers consists of two **PcVue** stations at most (as from **PcVue** version 8.10).

The historical Servers are only connected to the local area network and they are active simultaneously. This association always has multiple active producers working in parallel so that each of the Servers writes the data to its database.

Configuration of network properties

The network properties define a station's connection parameters on the network as well as identifying its role as Client, Server or both.

Each station can be connected with up to four independent networks.

The properties of Client and Server are defined separately for each network. For example, a station can be a Client on one network and a Server on another.

The Clients are configured in relation to an association rather than to any one of the Servers. The association automatically routes real time data between each Client and an active Server.

Media Redundancy

To publish the data securely, **PcVue** supports the bi-medium option between the data acquisition Server stations and the Client stations.

Since it supports separate network adapters, any loss in data acquisition automatically causes switching of the communication from one adapter to another.

Equipment Redundancy

When communication with the equipment is managed natively by **PcVue**, access to the PLC equipment can also be redundant.

According to the application's needs, this makes it possible to manage standby equipment or several connections to the same equipment.

With a serial connection, when communication with the equipment is lost, that equipment's variables become invalid and the application must deal with switching to the standby address.

With a TCP/IP configuration, the equipment can have up to four connection points that are automatically used when communication is faulty on the active address.

The equipment variables only become invalid if access via the four addresses fails.

Multiple Active Servers for Data Acquisition

In the case of an architecture with multiple active acquisition Servers, all of the Servers communicate simultaneously with the industrial equipment.

This architecture requires either a multi-master industrial network or industrial equipment that supports two or more physical network connections. Usually this architecture uses two Servers though there can be three or more. The application is identical on each Server.

Normal operation

When running normally, the two Servers communicate with the industrial equipment. The Clients subscribe to one of the Servers via an association.

Server failure

When a Server fails, the Clients subscribed on it switch automatically to the next Server in the association.

Restarting the Server

When the Server that failed is working again, the Client stations do not automatically revert to it.

Rather, to avoid the 'ping-pong' effects that would result from a series of failures, various network procedures can be applied:

- To let the association continue to operate.
- To return the communication back to the restored Server (after the person in charge has checked its stability).
- To leave it to the person in charge of the system to decide on a convenient period for reverting to the original configuration.

Single Data Acquisition Server

In the case of an architecture with a single active Server, only one of the **PcVue** Servers communicates with the industrial equipment at a time, although the other Servers remain permanently connected to the industrial network.

The Server that communicates with the industrial network is called the active Server. The other Servers are called passive.

This architecture is recommended for the following conditions:

- With single-master industrial networks such as Modbus. It is then best to use several independent interface boards on the equipment for the transitional phases of the redundancy processes.
- When uniform time-stamping of the data is an important factor. (The data values are only time-stamped by the active Server.)
- When it is necessary to minimise the traffic on the industrial network.

The applications are identical on each Server.

Normal operation

The active Server communicates with the industrial network and, in an event-driven manner, publishes data changes simultaneously to the passive Servers and all of the Clients.

The passive Servers initialise their communication with the equipment, but do not handle requests. This process reduces the switching times when redundancy is invoked.

All of the passive Servers in effect subscribe as Clients on the active Server.

Server failure

When the active Server fails, i.e. when it is no longer accessible by the other stations, a passive Server becomes active. The communications with the equipment become active on this Server and the new architectural configuration is published to all the stations of the network.

The Clients subscribe automatically to the new active Server via the association.

If the active Server loses its communication with the PLCs, yet remains accessible by the other stations, the application must force another active Server to take over from it. That action forces the previously active Server into passive mode.

Similarly, if the communication on the passive Server's industrial network is not working during the switchover (i.e. a double failure), the variables subscribed on that Server and on the Clients subscribed to it are made invalid.

Restarting the Server

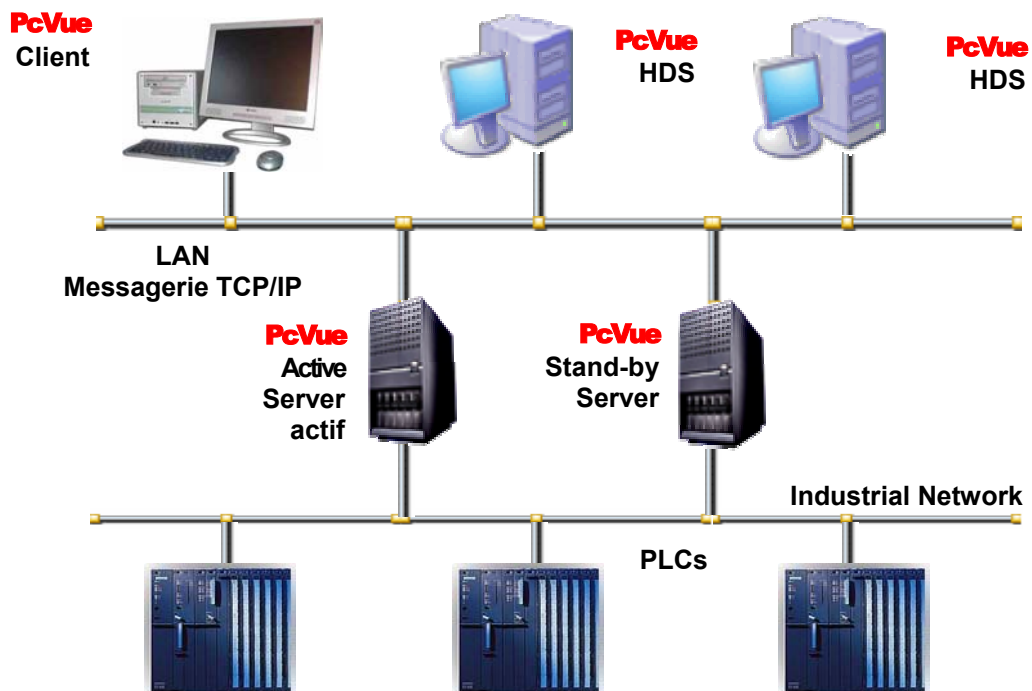
When a Server restarts, there are these possible scenarios:

- No other Server is working: The new Server starts the communication on the industrial network so as to refresh its equipment variables and it becomes the active Server. All the Clients on the network automatically subscribe to it.
- An active Server is already running: The new Server automatically becomes passive and it subscribes as a Client to the active Server.
- If the Server that re-starts does not see the active Server because its connection to the local area network is not working (e.g. with a failed Ethernet card), it is initialised as an active Server.

Reconnecting the Server

When active Servers are reconnected, only the Server with the lowest Numbered identifier stays active.

Historical Servers



The Historical Servers are used to record the event logs, trends and log files. In simple projects, these data are recorded on the hard disk where the project resides. The data are also time-stamped on the local system.

In the context of a multi-station system, it is possible to centralise the data recording on one of the stations (the historical Server) and to make them available for re-reading by all the other stations. The Client/Server storage units support this facility.

To improve total availability of the installation, two **PcVue** historical Servers can be configured to record historical data in parallel on several databases. The two Servers are then active simultaneously and they record the same data.

When they are configured into an association of historical Servers, each **PcVue** Client makes an initial request to the Servers in the association and elects a Main Server according to the availability of each Server.

In the consultation phase, the Clients switch automatically to the other Server of the association when the Main Server is no longer accessible, eventually after testing on each medium of a bi-medium network.

When these databases are of the MSDE or SQL Server types, the **PcVue Database Manager** enables you to configure (directly in these components) the replication procedures for the data so as to smooth out intermittent failure of any one of the databases.

The stored procedures (jobs) for maintaining the consistency of the Servers are carried out independently of **PcVue** so as to ensure automatic consolidation of missing data. They can be started by any of the Servers.

You can run the **Database Manager** so that it configures procedures to be run immediately (replicating on request).

The replication is carried out in parallel with the standard accesses on the databases. It is best to configure cycles of replication fairly close together so as to limit the time required for synchronising the databases.

You can configure the historical Servers on the same stations as the data acquisition Servers to minimise overheads.

Optimisation Procedures

When a Client/Server supervisory application becomes too large, two factors should be taken into account:

- Whether to increase the number of Client stations.
- Whether to increase the number of variables.

These two factors have a direct impact on the volume of message traffic that requires significant processing by the Servers when the redundancy procedure is activated. Traffic volume is likely to delay the stabilising of the whole system and to compromise control of the local installations.

Pre-subscription of message transport among stations

PcVue includes a process of pre-subscription among the Client stations and Servers as follows:

- When a Client station starts, it sends its subscriptions to the association that is responsible for applying them to the active Server.
- Immediately, a second subscription is initialised for the standby Server but not activated.

- If redundancy is invoked, a switching process occurs for the standby Server, without generating inappropriate messages on the network between the Clients and the Servers.

The Client stations then benefit from the switching of the Servers with a minimum of delay, irrespective of the number of stations, without affecting the HMI or the concurrent processing.

Dynamic subscription

Some variables are not permanently needed on the system, such as equipment configuration parameters when they are not visible to the user.

Alarms, on the other hand, require continuous refreshment.

This attribute of continuous scrutiny can be specified for each variable. A process of subscription and de-subscription is applied dynamically as follows:

- The Client station produces a subscription request for the active Server in the association.
- If this variable is not already subscribed for the PLC equipment, that is put into effect.
- For each variable, the Server permanently holds a list of all Client stations for which it is subscribed.
- When all the Client stations have de-subscribed from a variable, the Server stops publishing it.
- If the redundancy procedure is invoked, the list of subscriptions is transmitted simultaneously to the active Server station and standby stations.

Virtual equipment

When there is a large quantity of identical equipment in an installation, e.g. control devices from the same maker, it is possible to configure a virtual item of equipment whose physical address is specified by user request.

The database of configuration parameters is then reduced by specifying only one model of control device.