

High Availability SCADA for OEM Critical Infrastructure and Manufacturing

The Connected Enterprise with Allen-Bradley Logic controllers, Rockwell Software, Stratus ztC Edge High Availability computing platform and ThinManager thin client architecture.

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In the world of information technology (IT) data are protected using the CIA triad – confidentiality, integrity, and availability. Confidentiality is concerned with limiting access to data to only those individuals granted express permission by the data owner. Integrity is the assurance that the data are complete, accurate, and trustworthy. Finally, availability is the assurance that the data are always accessible to the authorized users. The order of importance of three is well suited to business systems like financial, commerce, and healthcare organizations.

Operational technology (OT) on the other hand has different priorities. The components of an industrial process that make up OT assets from sensors to layer three ethernet switches are designed with AIC in mind. Availability of data is paramount, particularly in process and critical infrastructure applications. Integrity is a close second because the process itself relies on the accuracy of feedback from automation components. Confidentiality is important, but does not have as critical role in the safe, efficient process operations and conformance to record keeping. Production data used by operators, maintenance, managers, engineers and regulatory bodies must be accurate and complete for each to perform their respective roles. The operator requires that a human machine interface (HMI) is always running with accurate data. Maintenance personnel and engineers use FactoryTalk® Analytics™ to monitor and optimize process equipment in the Connected Enterprise. Managers and regulators use data to assure that the equipment, facility and public at large are kept safe.

In order to assure high availability of production with data accuracy and completeness, OEMs traditionally rely on redundant hardware and software. In an ever-increasing global economy, competition continues to pressure OEMs to lower the cost of their equipment. At the same time, their customers are demanding smarter, higher productivity systems to help them compete with their competitors in turn. The solution for a cost effective, highly available edge computing solution that assures data integrity is available today. Rockwell Software, Stratus Technologies, and ThinManager thin clients when used together provide this solution. The following pages document the system.

1) The hardware

- Stratus ztC Edge Node 0
- Stratus ztC Edge Node 1
- Allen-Bradley Stratix managed ethernet switch
- Allen-Bradley Logix controller
- Thin client(s)
- Workstation PC for development and commissioning
- Wireless access point (optional)



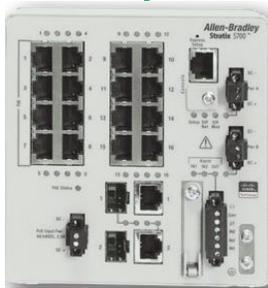
Allen-Bradley 5200 Thin Clients



Stratix 5100 Wireless Access Point



Portable Devices



Allen-Bradley Stratix 5700 switch



Stratus ztC Edge Node 0



Stratus ztC Edge Node 1



Allen-Bradley Logix



Engineering / Maintenance Workstation PC

Rockwell Automation Stratus High Availability System for OEMs

2) The software

Windows Server 2012 R2
FactoryTalk View SE Server 10.00.00
FactoryTalk View SE Client 10.00.00
ThinManager 10.0 SP1
FactoryTalk View Studio Enterprise 10.00.00 (optional)
Studio 5000 Logix Designer 31.00.01 (optional)
SQL Server Express 2012 SP3 with tools (optional)

Server #1	Server #2	Server #3	Server #4
Active Directory	FactoryTalk View SE	FactoryTalk View SE	ThinManager
Domain Controller	Primary	Secondary	Remote Desktop Server

3) The virtual machines. These are hosted on the Stratus ztC Edge system and are automatically replicated between the two nodes to provide the high availability function.

- a. Server #1 Windows Server 2012 R2
 - i. Active Directory Domain Controller
 - ii. DHCP Server
 - iii. DNS Server
- b. Server #2 Windows Server 2012 R2 Primary Application Server
 - i. FactoryTalk Services Platform 3.00.00
 - ii. FactoryTalk Activation Manager 4.03.01
 - iii. FactoryTalk Network Directory
 - iv. FactoryTalk View SE Server 10.00.00
 - v. FactoryTalk Linx 6.00.00
- c. Server #3 Windows Server 2012 SP3 Secondary Application Server
 - i. FactoryTalk Services Platform 3.00.00
 - ii. FactoryTalk Activation Manager 4.03.01
 - iii. FactoryTalk View SE Server 10.00.00
 - iv. FactoryTalk Linx 6.00.00
- d. Server #4 Windows Server 2012 SP3 Remote Desktop Server
 - i. ThinManager 10.0 SP1
 - ii. FactoryTalk Services Platform 3.00.00
 - iii. FactoryTalk Activation Manager 4.03.01
 - iv. FactoryTalk View SE Client 10.00.00
 - v. Studio 5000 Logix Designer 31.00.01
 - vi. SQL Server Express 2012 SP3

Server 1 is configured on the Stratus system to be an automatically load balanced virtual machine. This allows the Stratus to spread the system resources between the two nodes efficiently. The use of a domain for user management is highly desirable from a management perspective. Because every computer in a Windows Domain caches a copy of the users, a short interruption in case of switchover will have negligible impact. The server can also function as a DHCP server so that thin clients, including mobile devices, are assigned an IP address on the equipment network automatically. Optional DNS Server function can be used to resolve computer names in the system to their IP address. This Active Directory Domain Controller may be omitted in applications in which this function is already present, likely in the OT network of the end user.

Servers 2 and 3 provide redundant FactoryTalk View SE HMI, Linx Live Data, and Alarm & Event servers. Server 2 is the location of the FactoryTalk Directory and hosts the FactoryTalk Activations for the applications. In order to assure seamless transition from the primaries to the secondaries, these two virtual machines are intentionally placed on separate Stratus Nodes. If the node that hosts the primary set of servers were to become unavailable, the secondary servers are unaffected and can assume the active roles. Users will see no interruption in HMI functionality, logging of critical process data will not be lost, and alarm functions and history are maintained. After a moment, when the Stratus ztC Edge system makes the VMs from the missing node available again, the redundancy among FactoryTalk servers is restored. Once the Stratus node is present again, the Stratus system automatically synchronizes the VM volumes between the nodes, and moves the VMs back to their assigned node. The automatic nature of these operations means that the OEM does not need to train the end users in replacing a node, or involve IT or OT network professionals. It all happens behind the scenes without the need for downtime to recommission servers.

Server 4 provides the ThinManager server function and the Remote Desktop Server function. Thin clients in the system may attach to this server and automatically receive the content specific to their needs and user privileges. The equipment HMI for example might be an Allen-Bradley 5200 Thin Client that serves as the Operator HMI terminal for the equipment. Thin Manager can provide the appropriate FactoryTalk View SE Client to the 5200. Different terminals such as a tablet used by maintenance personnel can be provided with content at higher privilege and addition functionality, like Studio 5000 Logix Designer to monitor or even modify the logic running in the Logix controller.

Server 4 also hosts the primary data log repository, in this case Microsoft SQL Server. These databases keep process data records and FactoryTalk Alarm and Event history. If the node that hosts this VM becomes available, FactoryTalk View SE switches to a secondary backup path automatically. As soon as the Stratus provides the VM via switchover, logging will automatically resume to the primary and the FactoryTalk system can be configured to merge the records from the secondary destination to the primary database without user intervention. The Logix controller itself has buffered any Alarm and Event records during the interruption and will automatically merge these into the database as soon as it is once again available.

In an application that features FactoryTalk Historian SE, Servers 2 and 3 can act as Historian Data Interface nodes to provide redundant paths to FactoryTalk Live Data. The Historian Server can be located on an external PC if that function is provided by the end user, or alternatively on Server 4. In either case, no records will be lost due to the ability of the Interface Nodes to buffer records in the

event that one Interface node or the other or even the Historian Server should be unavailable during a switchover event.

By designing a system that follows the concepts presented here, an OEM can provide a cost-effective high availability edge computing solution. For critical infrastructure and manufacturing applications the requirements of uninterrupted operation and compliance to record keeping standards is possible with Rockwell Automation hardware and software, ThinManager thin client system and Stratus ztC Edge High Availability computing platform.