Solution Guide:

High Availability for EcoStruxure™ Building Operation with ztC Edge

In Brief

This document has been written to describe a combined solution that partners Schneider Electric EcoStruxure systems with ztC Edge computing platforms from Stratus Technologies. An example of this solution has been tested and validated in the Schneider Electric EcoStruxure Buildings Lab.

EcoStruxure Buildings Labs

EcoStruxure Buildings Labs are based in the Schneider Electric Andover Research & Development Center located in Andover, MA USA. They are funded by the Digital Energy Division. There are two labs under the EcoStruxure Buildings Lab umbrella; a Solution Lab and an Interoperability Lab. The role of the Interoperability Lab is to provide tested building blocks that can be used alone or in the Solution Lab. The Solution Lab provides validated solutions for the Building segment markets using tested building blocks from the Interoperability Lab.

EcoStruxure Buildings Lab personnel test, validate, and document integrated solutions that meet the needs of Schneider Electric customers. These solutions target specific vertical applications within a variety of markets. Our goal is to facilitate the integration process by recommending network architectures and proposing components. We also provide examples of integration procedures, relevant data points, and best practices for implementation.

Solution Guides for Buildings

Solution Guides describe integrated building solutions designed to meet the needs of Schneider Electric customers. They provide systems integrators with the information they need to determine if a solution makes sense for an application. EcoStruxure Building Lab personnel evaluate each solution to confirm that it provides the features and functionality as described. Solution Guides are like TVDA documents (Tested, Validated and Documented Architecture), which are also produced by EcoStruxure Building Labs personnel. TVDA solutions, however, are fully tested and validated within the Solution Lab.

Stratus Technologies

Stratus Technologies is a leading provider of a wide range of solutions that enable the rapid deployment of always-on computing infrastructure. Their products (hardware and software) help ensure uninterrupted operation of critical business systems in a wide variety of industries, including financial services, manufacturing, public safety, healthcare, retail, and transportation.

Who do I contact for assistance with this solution?

Schneider Electric provides branch and channel partners with planning and implementation assistance for EcoStruxure Buildings Lab solutions. To request help, send an email to Product Support specifying the solution name and the type of assistance you require. Product Support will relay your request to the appropriate support team.

For support inquiries, contact your local **Customer Care Center.** Visit schneider-electric.com and select the "Support" tab, then select your country of origin.

Access Customer Care directly from the **"mySchneider"** mobile app; download it now onto Apple or Android devices.

About this Document

This document was written for the Schneider Electric channel. Its goal is to describe a combined solution that partners Schneider Electric building management systems with ztC Edge computers from Stratus Technologies. An example of this solution has been tested and validated in a Schneider Electric Digital Buildings Lab.

This document provides systems integrators and project engineers with the information necessary to evaluate the feasibility of similar solutions and to make design decisions. The following items are included:

- System architecture
- Key component descriptions
- EcoStruxure Buildings Lab validated system

This document was written as a complement to existing product documentation and provides references to such documents where appropriate.

Readers possessing a solid understanding of Schneider Electric EcoStruxure systems will benefit the most from the information provided.

Disclaimer

This document does not attempt to describe the proposed solution in its entirety. Users are solely responsible for compliance with national and international safety laws and regulations. Users are also responsible for the provision and maintenance of system cybersecurity. Solution functionality depends on specific versions of software and hardware as described and may change as products are upgraded. Performance measurements do not guarantee future performance. This document does not replace any specific product documentation.

Revision History

Date	Authors	Revision	Description
4.30.2019	JM, KK	1.00	Initial release
5.14.2019	JM, KK	1.01	Updated images
9.12.2019	SL	1.02	Updated document comments

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1 Introduction

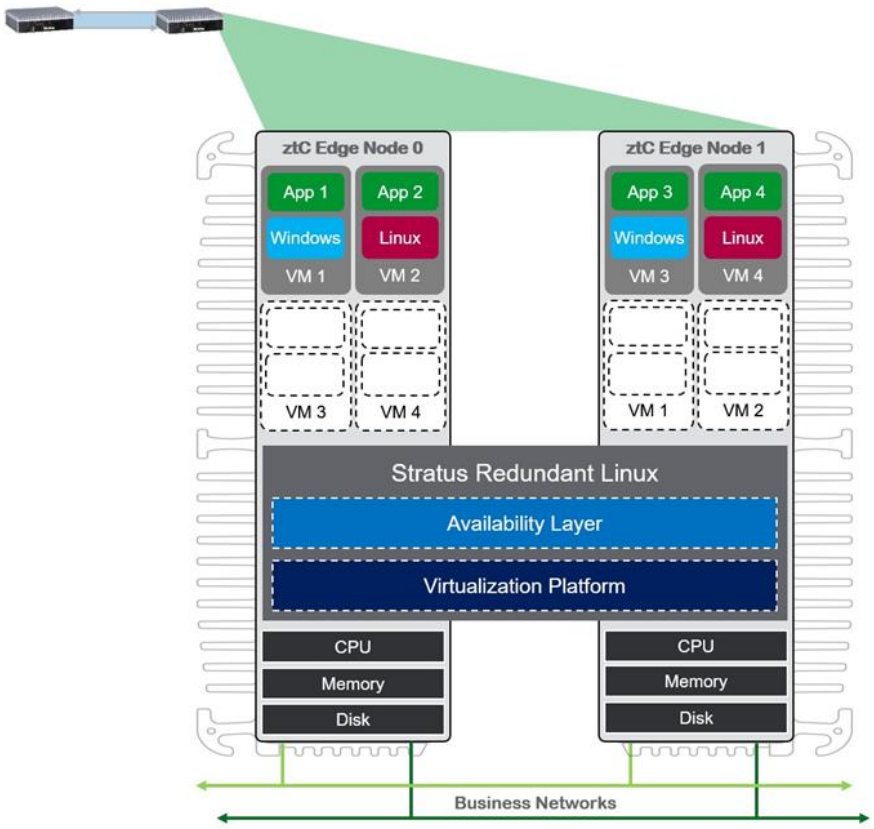
This solution provides the means to deploy Schneider Electric building management systems in a highly available (HA) configuration. An HA deployment ensures that the system's' database server(s) continue functioning during a server loss via ztC's redundant server technology.

1.1 ztC Edge

Stratus Technologies' ztC Edge computer is a compact, rugged, secure industrial computer that simplifies the delivery of highly available business-critical applications. Features like built-in virtualization, automated virtual machine (VM) restart and data protection, and automated local site recovery, help system integrators and project engineers quickly and easily design and implement highly available systems.

Highly available systems are those that through some combination of greater reliability and resilience, offer significantly reduced unplanned downtime for applications running on those systems. Using strategies and technologies like redundancy, clustering, and virtualization, the inherent risks associated with physical electro-mechanical component failure can be mitigated.

ztC Edge provides a highly available platform for edge computing services by using a unique availability engine and virtualization, that automatically mirrors all data unto redundant nodes, migrates VM instances in the event of a node failure, and automatically restarts them. The result is minimal downtime, and minimal data loss.



Key items to note about ztC Edge:

- Rugged, solid state, industrial form factor has no moving parts and is IP40 rated
- Supports standard open virtualization formats OVF / OVA for Windows and Linux virtual machines (VM)
- Automatically restarts VMs in the event of a node failure
- Data is automatically mirror on both nodes
- System Key Performance Indices (KPIs) are visible via dashboards.

Stratus Technologies

For nearly 40 years, Stratus Technologies has been offering customers a wide range of solutions that enable the rapid deployment of always-on computing infrastructure. Their products (hardware and software) help ensure uninterrupted operation of critical business systems in a wide variety of industries, including financial services, manufacturing, public safety, healthcare, retail, and transportation.

Stratus also offers comprehensive training and technical support services to its global customer base. In addition, their team of technical consultants offers system assessment, design, and integration services. Additional information about Stratus is available on their website: http://www.stratus.com.

1.2 ztC Edge and SE Building Management Software

ztC Edge provides a redundant, highly available platform on which any virtualized Windows or Linux - based applications can run. By operating Schneider Electric building management system software on this platform, the applications and their data are automatically protected, and services remain accessible in the event of a node failure. ztC Edge accomplishes this by actively monitoring resource usage and node health, proactively migrating VMs if necessary, and restarting VMs in the event of an unanticipated node failure. In laboratory tests, ztC Edge consistently restored EcoStruxure BMS services in under 5 minutes, when node failures were simulated.

Optional single node deployment

For some building management scenarios, a longer delay between server failure and restoration may be tolerated. In these cases, simple, cost effective approaches to protecting the building management system database (such as automatic back-up) may be appropriate and can be supported through an optional single node ztC Edge deployment. Single node deployments can be easily upgraded to a redundant HA system.

Examples of Building Management System Software:

- EcoStruxure Building Operation Enterprise Server, Reports Server
- EcoStruxure Security Expert (SE)
- Andover Continuum Database
- Power Monitoring Expert (PME)
- Data Center Expert (DCE)
- Microsoft SQL Server

2 Market Overview

2.1 Integrated Solution Customer Benefits

Integrating Schneider Electric building management systems with Stratus ztC Edge protects customers from the downtime and data loss associated with server failure. In the event of such failure, this solution offers the following benefits to customers:

- System redundancy is transparent to end-users; failover does not interfere with users' ability to monitor and control building parameters
- Failover to backup node occurs automatically with no loss of building management data
- System redundancy is restored automatically when recovery from power or network loss occurs, or replacement components are brought online.
- The steps required to install and configure BMS software applications on this system are no different than those required for supported off-the-shelf Windows and Linux systems.

2.2 Target Applications and Customers

This solution makes the most sense for customer applications that require high levels of building systems availability, and/or those that require fully automated handling of server or component failures. Some examples include:

- Pharmaceutical and manufacturing
- Validated systems (21 CFR Part 11)
- Hospitals
- Government agencies
- Airports and other highly secure facilities
- Data centers
- Other critical buildings.

2.3 Use Case Examples

This solution has been successfully implemented in a number of customer applications, the characteristics of which include the following:

- As a Building Owner I would like to have a highly available system such that operating data is always available to comply with government regulations.
- As the Security Director, our physical security system up time is paramount to the safety and integrity of the occupants & residents of the campus.
- As a Data Scientist I would like the operational data to not be lost when the systems are interrupted so I have consistent data to use on Analytics of the building.

3 Solution Overview

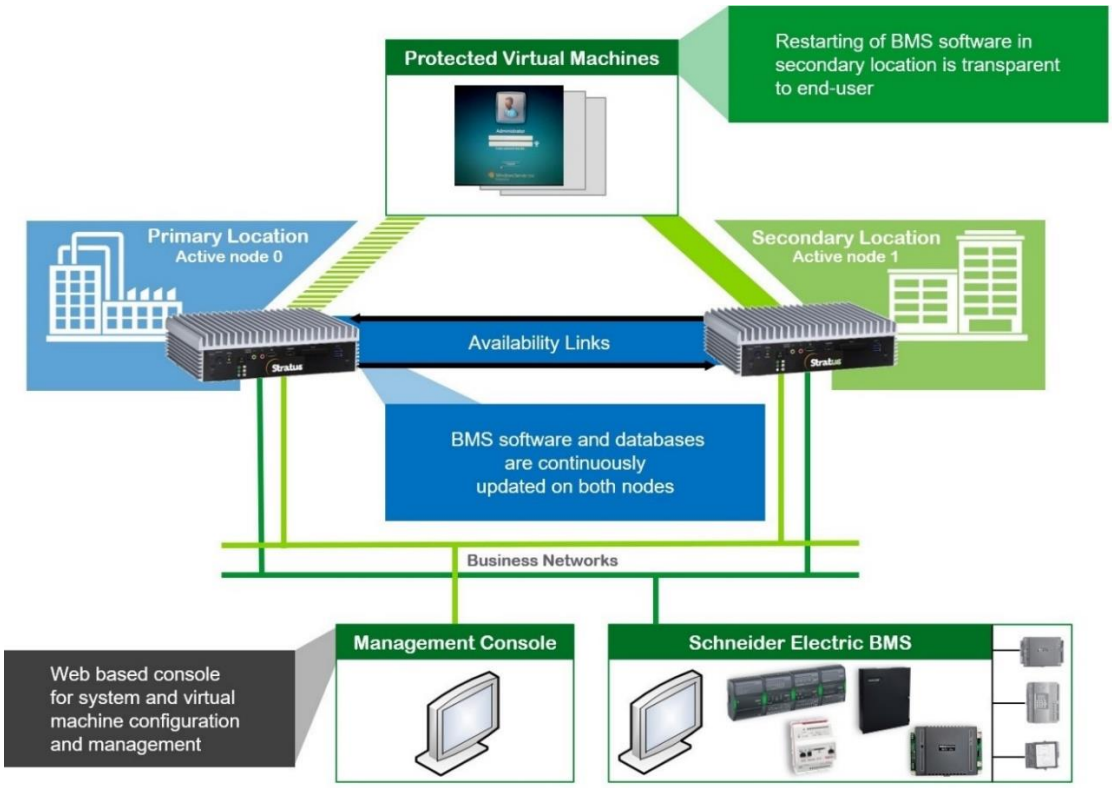
Schneider Electric's building management systems (BMS) are designed such that building control continues even when controller to server communication is disrupted. The BMS server consists of a database of alarm and historical data, as well as system parameters and programs. When a server (or its network connection) fails, the collection of data from building controllers halt until the problem is resolved. For data critical applications, this solution provides an environment capable of preventing the data loss that often results from these types of failures.

3.1 How it works

This solution uses Stratus' ztC Edge solution to establish a highly available Windows-based virtual environment suitable for building management software applications and data storage. Its design incorporates the redundancies and automated recovery necessary to minimize downtime resulting from critical component or node loss.

Software applications installed on virtual machines are protected via dedicated, redundant connections called Availability Links. The data that's generated and used by the software applications are continuously mirrored across the two nodes of a ztC Edge system through these links. Through continuous monitoring of the entire system, ztC Edge detects failures and seamlessly redirects resource usage or primary control to one node or the other as needed. In the event of a memory, disk, or networking failure in one node, the system can automatically use the equivalent resources in the other node to support the application and virtual machine. In the event of a CPU or entire node failure, virtual machines are automatically restarted if necessary, alarms sent, and services resumed. When a power or network issue is resolved, or repaired equipment comes back online, ztC Edge restores redundancy without user intervention. ztC Edge makes it possible for system administrators and end-users to simplify their interaction with the system, treating it as if it were a single server, without the underlying redundancies.

3.1.1 System Architecture



As the diagram above illustrates, this solution is not overly network intensive. It requires network connections that are dedicated to supporting availability, but all other functions (including management) can be accessed through the existing business network. Each network has redundant links using different Network Interface Card (NIC), cabling, and routing (i.e. one direct, one via the cloud). ztC Edge uses its availability links for intra-node communication and to mirror Protected Virtual Machine (PVM) contents. One or more production networks provide the necessary connections to system workstations and corporate networks, and to both ztC Edge and BMS management consoles.

The typical configuration (depicted above) consists of two ztC Edge nodes with point-to-point Availability Link connections that meet the required network latency specifications described in ztC Edge's technical documentation (https://www.stratus.com/solutions/platforms/ztc-edge/), and a single Management Console for configuration. The two nodes can be installed in a control panel, on a wall, or in a server room, using its DIN rail or wall mount componentry. The typical Schneider Electric deployment consists of two panels, with one ztC Edge system (one node in each panel), to eliminate single points of failure for the BMS or Access Control System (ACS). Several factors, as described below, determine whether additional components are required.

Description of factors affecting system architecture:

Node Placement: System requirements can vary depending on the relative distance between the two nodes of a ztC Edge system. The nodes may be placed side-by-side, but more typically, they are deployed one node per panel, with the two panels located in separate areas (e.g. different rooms, floors, or even buildings). By separating active and backup nodes, the likelihood that both will be impacted by a single environmental or local site failure is reduced.

Nodes that are placed in different locations within the same site are also typically deployed with their own routing and LAN connections, as well as different primary and backup power sources (UPS). Some BMS applications may require that nodes or systems that are placed in different sites be connected via a WAN. In both of these instances, quorum services are required (see below).

Quorum Services: ztC Edge's quorum service software is highly recommended for most BMS and ACS applications. Quorum services manage failover scenarios and prevent a problem known as "split-brain", where a network failure can result in duplicate VMs operating independently of each other on the two nodes of a ztC Edge system.

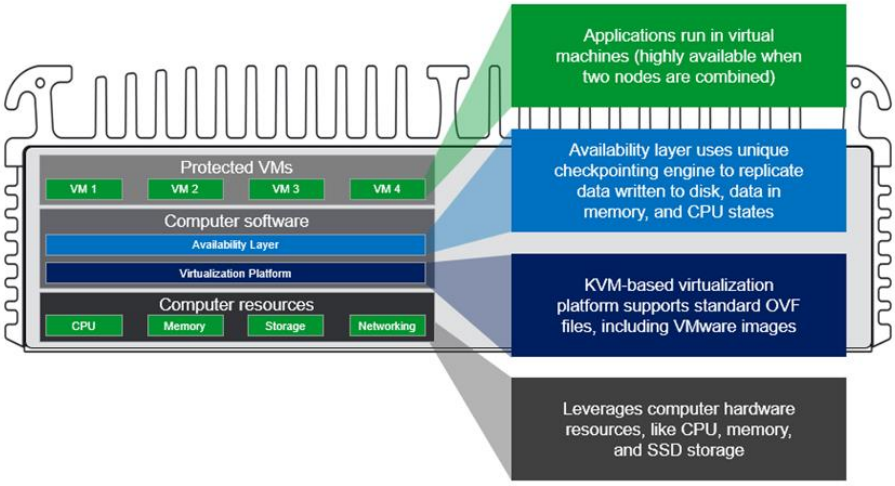
Quorum services are required for systems that:

- Deploy nodes that are physically separated and connected using availability links longer than 30 feet
- Have Availability Link connections via LAN or WAN (used, for example, when host servers reside in separate physical locations).

Quorum services must be implemented in a redundant fashion. The software is installed on two separately located computers that rely on unique power sources. Each computer requires a separate network connection to the Production LAN, along with a gateway connection to each Availability LAN.

3.1.2 Inside the Server

Virtual Machines: ztC Edge uses its own built-in virtualization platform (based on KVM) to support virtual machines that house server applications. Each virtual machine (VM) functions as an independent computer, with its own operating system and installed applications. The virtualization platform also provides each VM with access to the resources of the ztC Edge's nodes; such as CPU, RAM, storage devices and network connections.



Protected Virtual Machines: All VMs created using ztC Edge, or those OVF or OVA formatted images imported into ztC Edge, are automatically protected by ztC Edge's availability layer:

- ztC Edge continuously monitors the primary node (the one running the VM with the BMS application) and seamlessly transfers to or restarts the VM in the alternate VM in the event of a critical failure. Transfers occur in a manner that is transparent to the user. Restarts are automatic and result in a minor service outage while the application is restarting.
- All data written to disk is automatically mirrored across both nodes in a ztC Edge system. In the event of a disk failure or catastrophic node failure, the VM can use the data in the surviving disk drive or node. The result is no data loss.
- ztC Edge shields the end-user from the complexity associated with managing a highly available, redundant system. Redundant nodes are presented as one computer, with a single IP address, MAC address, and hostname. Using a simple web browser-based interface, the ztConsole, system administrators can manage system resources and configure protection parameters.

BMS Software and Data: Building management system software applications reside within a protected virtual machine. Examples include workstation software, data archives, graphic files, and databases.

The procedures for installing software applications or virtual appliances on a Stratus system are no different than for any standard off-the-shelf system. Applications need only be installed on a single virtual server (VM), as ztC Edge automatically copies any change in the VM to all nodes.

3.2 What you need

This solution requires specialized expertise in addition to what the typical BAS Engineer may possess. The process of architecting this system requires additional knowledge and experience with the following technologies:

- ztC Edge
- Networking with redundancy and security
- Virtual machines (OVA/OVF images if importing)

Potential sources for this expertise include:

- **Stratus Technologies and Schneider Electric Professional Services:** Assistance with ztC Edge system architecture, configuration, and installation needs are available, on a contract basis, from both Stratus and Schneider Electric. Certified installers from both companies have hands-on experience implementing this solution at customer sites.
- **Customer IT Department:** An end-user's IT personnel may contribute expertise in a variety of ways, including knowledge of site-specific networking standards and requirements that must be adhered to.

In addition to the building management system software, the following components are required to implement this solution:

3.2.1 ztC Edge

This solution requires a ztC Edge system. Included with each system are two nodes, with integrated virtualization and availability software. The ztC Edge system contains all of the necessary computing resources (including DIN rail and wall mount kits, power supplies, and ethernet cabling) required to deploy a protected, highly available BMS solution.

For those end users that do not need a highly available BMS, the solution can be deployed as a single node option. In this case, VMs are configured to run on a single ztC Edge node, without automated failover. If deployed in this manner, it is recommended that additional steps be taken to backup and recover system data, should a node fail, and you require service restoration.

3.2.2 Quorum Service Computers

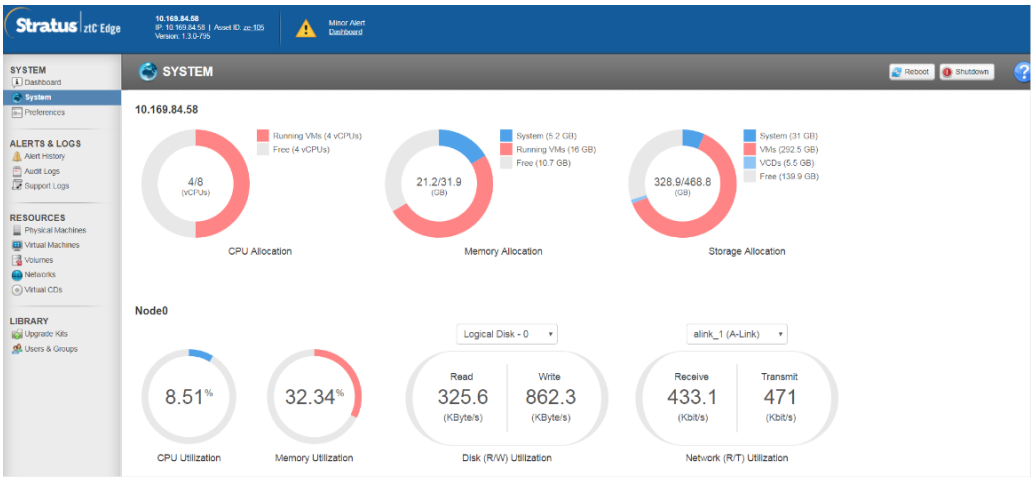
Quorum services, when required, are established by installing the ztC Edge Quorum Service software on any Windows-based computer capable of communicating with the VMs running on the ztC Edge system. Each quorum service computer, of which there are two, is tasked with managing virtualization host behavior in response to a system failure.

Quorum service is required for all deployment scenarios but one – a system in which two nodes have point-to-point Availability Link connections of thirty feet or less in length.

Quorum service software can coexist with other Windows-based applications on the same computer.

3.2.3 ztC Management Interface (ztConsole)

The purpose of the ztConsole is to provide users with a single location to monitor, configure, and manage virtual machines and ztC Edge system resources. The dashboard is accessible via a Windows-based computer that's connected to the business network, and a flash enabled web browser.



All of the essential information about ztC Edge VMs and system resources can also be monitored in real time using the EcoStruxure BMS or ACS dashboards. An Integration between EBO and ztC is available upon request. Using a Smart Connector Extension allows you to get relevant data points like CPU usage, memory usage, drive space failures, etc. from the virtual ztC environment into the building management system. By creating this tight integration, the BMS environment can now monitor and Alarm the overall runtime environment it is dependent on.

3.3 Steps to take

This section provides an overview of the process of implementing this solution.

- **Set up ztC Edge:** Startup the ztC Edge system by following the instructions in the quick start guide. A network administrator may need to be contacted for IP addresses and business network settings.
- **Import or create VMs:** Import the BMS VM images into the ztC Edge system (if they have not already been pre-loaded). Use the ztConsole interface to confirm the resources assigned to the VMs. Typically, at least one VM is dedicated to BMS software and databases.
- **Set up quorum services:** Install the quorum service application, and configure redundant quorum services for the ztC Edge nodes.
- **Launch the BMS services:** Start the BMS applications on the protected VMs and complete its configuration.

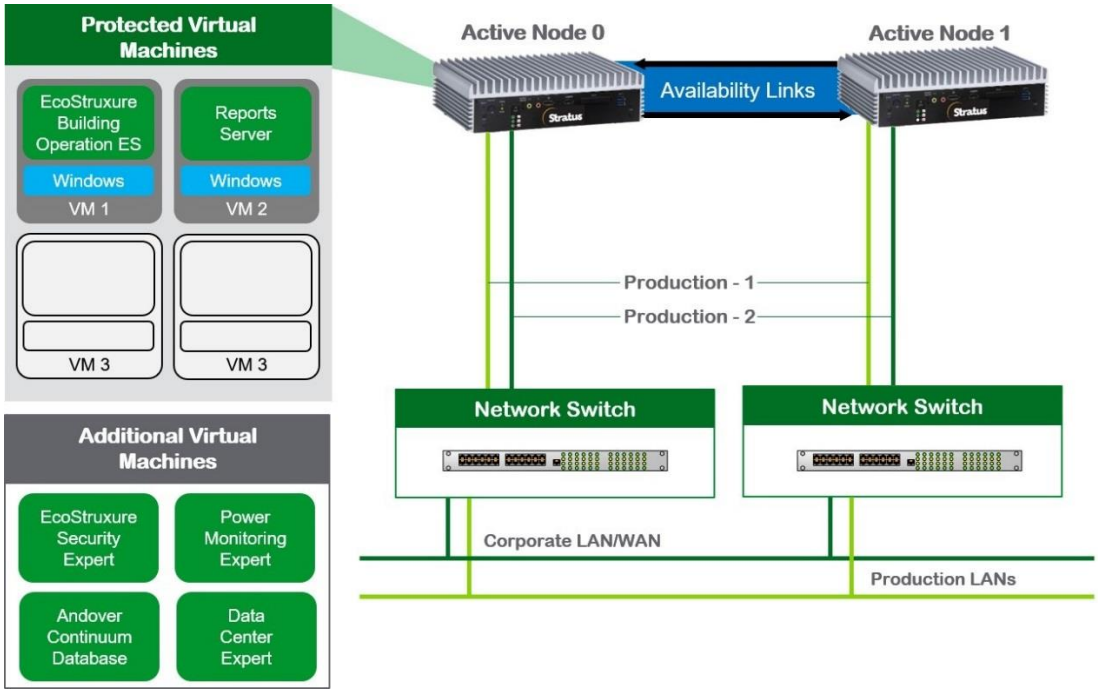
For detailed instructions, refer to the appropriate installation and user manuals.

https://www.stratus.com/solutions/platforms/ztc-edge/

https://www.stratus.com/services-support/downloads/

4 Validated System

4.1 Validated System Architecture



4.2 Validated System Components

The components used to test this solution include:

Component	Version
EcoStruxure Enterprise Server and Reports Server	3.0.1
EcoStruxure Security Expert	4.2.259
Data Center Expert (DCE)	7.6
Power Monitoring Expert (PME)	9.0 CU1
Andover Continuum CyberStation	2.03.0
ztC Edge 100i	SRL 1.3

5 Frequently Asked Questions

Does this solution require the purchase of multiple licensed copies of each software application, one for each ztC Edge node they will be installed on?

Software license policies vary with the type of application and the supplier. When installing any of Schneider Electric's workstation applications on a ztC Edge system, a single licensed copy is sufficient. However, applications such as CyberStation, that may still make use of a hardware license key, must also have a USB over IP concentrator. The purpose of the concentrator is to provide a USB port to receive the license key. Through the concentrator's network connection, each VM is granted access to its respective license key. The AnywhereUSB® Concentrator from Digi has been tested and proven to work in this scenario.

For more information: http://www.digi.com/products/usb/anywhereusb#overview.

How does this approach compare with failover and clustering solutions, such as Microsoft Cluster Server?

ztC Edge is similar in functionality to failover and clustering software but leverages virtualization technologies and Stratus's unique checkpointing engine. It also ships with both virtualization platform and availability layer preloaded. The result is a highly available platform that's less complex and less costly to set up and configure, as well as a more resilient computing solution.

Where can I get more information on Stratus and ztC Edge?

Additional information is available on the Stratus Technologies website: http:www.stratus.com/ztc-edge

Who do I contact at Schneider Electric for assistance with this solution?

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Access Customer Care directly from the **"mySchneider"** mobile app; download it now onto Apple or Android devices.

Stratus Service Portal

ztC Edge is certified to run EcoStruxure software as validated in section 4. Customers will receive L1 and L2 support from Schneider Electric, with back end L3 support provided by Stratus.

For more information, or to access Stratus's online self-help resources and knowledgebase, customers can register for access to Stratus's Customer Service Portal using their product registration information.