Technical Session AP24: Stratus Technologies: Three Rivers Water Authority Modernization

Gary Fort Consulting Systems Engineer
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Stratus Business Overview

4 of the 5 largest global credit card networks use Stratus solutions

Half of the Global Fortune 100 are current Stratus customers

Half of the world’s largest retailers are Stratus customers

Half of the world’s largest beverage companies use Stratus solutions

STRATUS CUSTOMERS

Treat 2 billion gallons of water annually

Transport 1.5 billion air passengers annually

Serve 45 million rail passengers daily

38 years in business

18+ years average availability experience

$8.6T

$843B

200M tons
Stratus is an Edge Computing company

The Edge – 52% of new product sales FY17

<table>
<thead>
<tr>
<th>Safe Supply Chains</th>
<th>Continuous Production</th>
<th>Continuous Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Food and Beverage</td>
<td>Oil and Gas</td>
<td>Water</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Protecting People</th>
<th>Protecting Revenue</th>
<th>Staying on Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electronic Security</td>
<td>Retail</td>
<td>Distribution/Logistics</td>
</tr>
</tbody>
</table>

Why Stratus Wins

- No IT skills required
- No unplanned downtime
- Predictive monitoring
- Standardized and open
- Low TCO
Examples of Changing existing DCS
Why Change your current DCS?

• The knowledge base is shrinking
  – Employee Retirements
  – Employee Turnover

• Operational Product support End of Life
  – On your own with any upgrades
  – Connectivity between old devices and new devices a challenge at best

• Computer Equipment and Operating Systems End of Life
  – Parts impossible to get
  – Operating systems do not support new applications
  – Software knowledge base shrinking

• Cost of existing systems support approaching or exceeding cost of newer equipment

• Competition driven
• Regulatory compliance
• Etc.
Steps to move forward

• Contact the experts.
  – Validate the current infrastructure
  – Set goals for new infrastructure
    • Set obtainable goals for each phase
    • What is important?
      – Just replace existing infrastructure
      – Change operational procedures based on new technology
        » DO NOT force new technology to do it the old way
        • Might be okay for the starting point as part phasing out the old
      – With new technology comes new requirements
        » Simplifying environment
        » Network infrastructure – new data highway
        » High Important is Availability of:
          • Data
          • Interpretation of Data
          • Delivery of Data
          • Presenting data to people who need it
  – Open communications to other departments within of the company
Rockwell/Cisco Converged Plantwide Ethernet Best Practices

Figure 2-3  CPwE Logical Framework

Figure 1-8  Open System Interconnection (OSI) Reference Model

Download Design Guide
What is 99% Availability
Availability Definition:

Percentage calculation
Availability is usually expressed as a percentage of uptime in a given year. The following table shows the downtime that will be allowed for a particular percentage of availability, presuming that the system is required to operate continuously. Service level agreements often refer to monthly downtime or availability in order to calculate service credits to match monthly billing cycles. The following table shows the translation from a given availability percentage to the corresponding amount of time a system would be unavailable.

<table>
<thead>
<tr>
<th>Availability %</th>
<th>Downtime per year (h)</th>
<th>Downtime per month (h)</th>
<th>Downtime per week (h)</th>
<th>Downtime per day (h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>90% (&quot;one nine&quot;)</td>
<td>36.5 days</td>
<td>72 hours</td>
<td>16.8 hours</td>
<td>2.4 hours</td>
</tr>
<tr>
<td>95%</td>
<td>18.25 days</td>
<td>36 hours</td>
<td>8.4 hours</td>
<td>1.2 hours</td>
</tr>
<tr>
<td>97%</td>
<td>10.96 days</td>
<td>21.6 hours</td>
<td>5.04 hours</td>
<td>43.2 minutes</td>
</tr>
<tr>
<td>98%</td>
<td>7.30 days</td>
<td>14.4 hours</td>
<td>3.36 hours</td>
<td>28.8 minutes</td>
</tr>
<tr>
<td>99% (&quot;two nines&quot;)</td>
<td>3.65 days</td>
<td>7.20 hours</td>
<td>1.68 hours</td>
<td>14.4 minutes</td>
</tr>
<tr>
<td>99.5%</td>
<td>1.83 days</td>
<td>3.60 hours</td>
<td>50.4 minutes</td>
<td>7.2 minutes</td>
</tr>
<tr>
<td>99.8%</td>
<td>17.52 hours</td>
<td>86.23 minutes</td>
<td>20.16 minutes</td>
<td>2.88 minutes</td>
</tr>
<tr>
<td>99.9% (&quot;three nines&quot;)</td>
<td>8.76 hours</td>
<td>43.8 minutes</td>
<td>10.1 minutes</td>
<td>1.44 minutes</td>
</tr>
<tr>
<td>99.95%</td>
<td>4.38 hours</td>
<td>21.56 minutes</td>
<td>5.04 minutes</td>
<td>43.2 seconds</td>
</tr>
<tr>
<td>99.99% (&quot;four nines&quot;)</td>
<td>52.56 minutes</td>
<td>4.38 minutes</td>
<td>1.01 minutes</td>
<td>8.56 seconds</td>
</tr>
<tr>
<td>99.995%</td>
<td>26.28 minutes</td>
<td>2.16 minutes</td>
<td>30.24 seconds</td>
<td>4.32 seconds</td>
</tr>
<tr>
<td>99.999% (&quot;five nines&quot;)</td>
<td>5.26 minutes</td>
<td>25.9 seconds</td>
<td>6.05 seconds</td>
<td>864.3 milliseconds</td>
</tr>
<tr>
<td>99.9999% (&quot;six nines&quot;)</td>
<td>31.5 seconds</td>
<td>2.59 seconds</td>
<td>604.8 milliseconds</td>
<td>86.4 milliseconds</td>
</tr>
<tr>
<td>99.99999% (&quot;seven nines&quot;)</td>
<td>3.15 seconds</td>
<td>262.97 milliseconds</td>
<td>60.48 milliseconds</td>
<td>8.64 milliseconds</td>
</tr>
<tr>
<td>99.999999% (&quot;eight nines&quot;)</td>
<td>315.669 milliseconds</td>
<td>26.297 milliseconds</td>
<td>6.048 milliseconds</td>
<td>0.864 milliseconds</td>
</tr>
<tr>
<td>99.9999999% (&quot;nine nines&quot;)</td>
<td>31.5569 milliseconds</td>
<td>2.6297 milliseconds</td>
<td>0.6048 milliseconds</td>
<td>0.0864 milliseconds</td>
</tr>
</tbody>
</table>
IT and OT: two different Requirements.

**Information Technology**
Characterized by:
- Centralized data center
- Expertise always available
- Tools to build with
  - Virtualization
  - Terminal Services
  - Servers
- “Good Enough” availability is fine
  “Recovery Process”

**Operational Technology**
Characterized by:
- Remote deployment
- Low IT expertise
- Integrated Solution
  - Allen Bradley ControlLogix
  - ThinManager
  - Stratus ftServer
- Always-on requirement
  “Fault Tolerant – Failure PREVENTION”

Communicate your availability requirements. Get an SLA for your Operational requirements.
The Challenge for edge computing environments

More and more technology will be deployed where there are fewer and fewer IT skills (or people at all)

More of the applications are becoming “mission critical” driving the need to “mitigate” the risk of unscheduled downtime

Edge computing MUST be simple and fault resilient.
Virtualization
Poll Questions

• Is your company running automation software in a virtualized environment? (Y/N)
• Has your company implemented thin clients for SCADA?
Key Technologies in Modern Computing Infrastructure

Benefits of Server Virtualization
- Consolidation
- Support for legacy OS
- Simplified application deployment using virtual templates
- Lifecycle management
  - Software upgrades
  - Disaster recovery
  - Future hardware upgrades
  - Test environments

Benefits of Thin Clients
- Support for Mobile Devices
- Role based content distribution
- Security
- Lifecycle management
  - Simplified software upgrades
  - Easy Hardware repairs
Consolidation Increases Risk

“If you put all your eggs in one basket make sure you use a strong basket or you’ll end up with a mess.”
Datacenter Solution - VMware high availability clustering

- 2-3 servers
- External storage (SAN)
- Redundant switches
- vCenter Server
- Multiple Licenses
- VMware Essentials Plus License
Stratus Edge Computing Solutions

- Simple
- Higher Availability
- Lower Total Cost
Modern DCS Deployment - Three Rivers Water Treatment

• The challenges:
  – Replace aging Bristol Babcock SCADA system
  – Identify best solutions

• Solution:
  – In 2016, an aging Bristol Babcock SCADA system was replaced with Rockwell Automation® PlantPAx® supplied by Advanced Electrical Technologies. Thin clients and virtual machines running on a Stratus ftServer-based IDC delivered a blazing fast SCADA interconnectivity and reduced TCO.

AET TRRWA
How does this Scale at a Plant Level?

**Typical Bill of Materials:**
- 1 SANS
- 2 Servers
- 2 Sets of Licenses (including OS) per VM
- 2 Ethernet Switches
- Significant Specialized IT Support
- *vCenter Server
- *VMware Essentials Plus License ($4,400)

**Limitations:**
- HA still has minutes of downtime on all applications during a failure/restart
- On Failover, all In-Flight Data is Lost
- Very hard to set up, very hard to maintain
- Costly when you consider everything
- vSphere 4.x and 5.x - VMware FT only supports 1 virtual CPU per protected machine

Note: vSphere 6.0 There are still some restrictions on the number of FT VMs you can have, you can have a maximum of 4 FT protected VMs or 8 FT protected vCPUs per host, whichever limit is reached first. The maximums include primary and secondary VMs.
Columbia Pipeline Group delivers over 1 trillion cubic feet of natural gas per year of natural gas to across 16 USA states through 15,000 miles of natural gas pipeline and 37 storage fields.

- 103 compression stations in North America
- Predictive analytics
- Implemented on Stratus ftServers with VMware virtualization

By modernizing its operational environment with an information-enabled, virtualized system, gas transmission company improved reliability and reduced maintenance costs by $2.3 million per year.

Purchased by TransCanda

Video
- One Stratus box – Simple
- One Set of licenses
- No Specialized IT Skills Needed
- 99.999% Guaranteed Uptime
- No In-Flight Data Loss
- The Only Out-of-the-Box FT solution

Simpler

Proactive Simple IT “lite”

Stratus Technologies

Windows Hyper-V

vmware

redhat LINUX

Video
Application and Data Protection – Computer
Mitigating the Risk of Unscheduled Application and Data availability
Definition:

ftServer:

a purpose built (made or built for a particular need or purpose) computer with redundant components running in lockstep that protects your application(s) from unscheduled downtime.

i.e. **Failure PREVENTION**
Technology Partners

- Joint program to insure processor determinism
- Early access to new processors
- ftServer® Series systems in Intel labs

- Collaborate on OS availability features
- Hardened drivers
- Memory resynchronization
- Support for mission-critical applications
- Collaborative support model
- ftServer systems in partner test labs
Stratus Patented Automated Uptime Layer

Get instant continuous availability with unique combination of hardware-level synchronization and data replication

- Patented lockstep processing ensures no lost transactions
- Multi-path I/O failover prevents data corruption and loss – even data in flight
- No ISV application modifications or failover scripts are required for fault tolerance
Fault Tolerant single system with duplexed hardware

Simplify management and reduce licensing costs – ftServer presents itself to your OS of choice as a single system image

- Single integrated system easier to manage than multiple servers
- Redundant components are presented as a single system – only one OS or application required
- Hardened drivers help ensure system rides through transient memory errors and power spikes
All Components Hot Swappable and Customer Replaceable

Easily maintain and service your system with hot swappable subsystems that eliminate single points of failure

- Failed components are automatically taken offline with zero performance impact
- Subsystems can easily be replaced without powering the system down
- Customer replaceable units are automatically detected and data resynchronized when replaced
Stratus® ftServer - Complete with hardware, software and service
Operationally simple platform that will keep your applications up and running with no downtime or data loss

Operational Simplicity
Serviceability
Longevity
Continuous Availability
$50,000 Zero Downtime Guarantee

A one time payout if Stratus hardware, software or VMware vSphere has unplanned downtime
Stratus Converged Edge System Introduction
Stratus ztC Edge
Highly available multi-function edge appliance

- Redundant computing platform at the Edge
- Geographically Separable
- Zero-touch deployment
- Self-monitoring and self-diagnosing
- Secure remote system health services
- Fan-less, Solid State Design
- Ruggedized design for harsh environments
- Redundant, hot swappable nodes

Target Applications:
- IoT Gateway
- Analytics
- Machine builders

Timeline:
“The new ztC Edge from Stratus Technologies has been developed to provide high availability edge computing for common industrial control applications with little to no IT support requirements.” – Automation World

“The advantage Stratus brings is its zero-touch, fully automated system that can run independent or in conjunction with a data center rack -- rugged enough for OT, but friendly enough for IT.” – IDC

“From the product to positioning to future plans, Stratus is clearly planning to be on the edge for the long term.” – Forbes

“By delivering high availability edge compute solutions, Stratus helps to address the increasing demand for more intelligent systems at the edge.” – ARC Advisory Group
Stratus ztC Edge Solution Introduction

Quickly and easily deliver virtualized applications

- Increase efficiency
- Reduce IT burden
- Minimize downtime risk

Key Features

- Built-in virtualization
- Automated protection
- Automated site recovery
- Hot-swappable nodes
ztC Edge: New zero touch edge optimized solution

Versatile, fully-integrated, self-protecting industrial computing solution that’s ready to use in 30 minutes

<table>
<thead>
<tr>
<th>TECHNICAL SPECIFICATIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating System</strong></td>
</tr>
<tr>
<td>Stratus Redundant OS with Virtualization &amp; Availability platform preloaded</td>
</tr>
<tr>
<td><strong>Supported Guests</strong></td>
</tr>
<tr>
<td>Microsoft Windows Server (2012 R2 &amp; 2016) and Linux variants</td>
</tr>
<tr>
<td><strong>Availability</strong></td>
</tr>
<tr>
<td>System redundancy</td>
</tr>
<tr>
<td>Seamless recovery from system failure</td>
</tr>
<tr>
<td>Automatic second site failover (deployment option)</td>
</tr>
<tr>
<td><strong>Installation</strong></td>
</tr>
<tr>
<td>Customer installable</td>
</tr>
<tr>
<td>DIN rail, wall mount</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
</tr>
<tr>
<td>Virtualization: up to 3 VMs</td>
</tr>
<tr>
<td>Processor: Intel Core i7, 4 hyper threaded cores</td>
</tr>
<tr>
<td>Memory: 32 GB</td>
</tr>
<tr>
<td>Storage: 512 GB SSD</td>
</tr>
<tr>
<td><strong>I/O</strong></td>
</tr>
<tr>
<td>HDMI</td>
</tr>
<tr>
<td>Ethernet: 1GbE, 4 ports (2 available)</td>
</tr>
<tr>
<td>USB: 2 x USB 2.0</td>
</tr>
<tr>
<td><strong>Environmental</strong></td>
</tr>
<tr>
<td>Fanless, solid state design</td>
</tr>
<tr>
<td>Operating temp: -40°F to 140°F (-40°C to 60°C)</td>
</tr>
<tr>
<td>If using provided AC adapter 0°F to 122°F (0°C to 50°C)</td>
</tr>
<tr>
<td>Humidity: 10 – 95% (non-condensing)</td>
</tr>
<tr>
<td>Vibration: 3 Grms (5-500 Hz)</td>
</tr>
<tr>
<td><strong>Dimensions</strong></td>
</tr>
<tr>
<td>280 mm (11.02 in) x 190 mm (7.48 in) x 76 mm (2.99 in)</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
</tr>
<tr>
<td>4.6 kg (10.2 lbs)</td>
</tr>
<tr>
<td><strong>Power</strong></td>
</tr>
<tr>
<td>9 to 36 volts DC; 35 watts</td>
</tr>
</tbody>
</table>
Simplify edge infrastructure management with automated availability support

- Self-monitoring hardware continually checks key parameters
- Self-diagnosing system continually evaluates its health
- Self-healing server automatically takes subsystems offline and online
- Automated alerts keep you informed of escalated issues
- Automated parts replacement eliminates guesswork
## ztC Edge vs. ftServer

<table>
<thead>
<tr>
<th></th>
<th>ztC Edge</th>
<th>ftServer</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Virtualization platform</strong></td>
<td>Pre-installed Stratus Redundant Linux (KVM-based)</td>
<td>VMware ESX, MSFT Hyper-V, or Red Hat KVM</td>
</tr>
<tr>
<td><strong>Physical Cores</strong></td>
<td>4</td>
<td>10, 20, or 28</td>
</tr>
<tr>
<td><strong>Workloads</strong></td>
<td>Moderately sized ICS applications</td>
<td>Larger ICS and MES applications</td>
</tr>
<tr>
<td><strong>Deployment location</strong></td>
<td>Production floor (panel, cabinet, or skid), table, wall or DIN rail mount</td>
<td>Clean room (lab, control room, or data center), server rack</td>
</tr>
<tr>
<td><strong>Form factor</strong></td>
<td>Pair of compact rugged, fan-less, solid state nodes</td>
<td>Single 4U rack mount server</td>
</tr>
<tr>
<td><strong>Physical dimensions</strong></td>
<td>2.99” x 7.48” x 11.02”, 10 lbs., 9-36 VDC (per node)</td>
<td>7.0” x 17.5” x 30.1”, 120 lbs., 100-127 or 200-240 VAC</td>
</tr>
<tr>
<td><strong>Availability level</strong></td>
<td>Fast recovery</td>
<td>Failure prevention</td>
</tr>
<tr>
<td><strong>Installation model</strong></td>
<td>Customer DIY</td>
<td>Partner or Stratus assisted</td>
</tr>
</tbody>
</table>
The Stratus Global Reseller Network

North America
- Rockwell Automation
- Rexel
- CED
- Kendall
- OneSource Distributions
- McNAUGHTON-McKAY
- Electric Company
- YOUR ELECTRICAL CONNECTION
- THE REYNOLD COMPANY
- ELECTRICAL SUPPLY
- NORTH COAST ELECTRIC COMPANY
- WERNER ELECTRIC SUPPLY
- State Electric Supply Co.
- CUSTOMER FOCUSED. QUALITY DRIVEN.
- CODALE ELECTRIC SUPPLY INC.
- NE Electrical Distributors
- EESCO
- BSET border states
- Supply Club LIMITED
- VAN METER
- FRENCH GERLEMAN
- STANION Wholesale Electric Co.
- ELECTROZAD SUPPLY
- SMC
- Westburne
- RUMSEY Quality & Service - Since 1899
- Schaedler yesco
- FROMM
- GERRIE
- FMC Technologies
- irby

Latin America
- Rockwell Automation
- LADDER
- INTERENG AUTOMAÇÃO INDUSTRIAL | EDGE
- Asia
- Rockwell Automation
- Australia
- Rockwell Automation
- NHP
- Rexel

EMEA
- Rockwell Automation
- Routeco

Request Local Introduction
- Email: frank.hill@stratus.com
- Call: +1 267-461-7579
Look for a Stratus Certified Solution Architect…

Learn more about the Stratus Solution Partner Program: www.stratus.com/SP
Questions ?
Look for Stratus at Rockwell Events

Visit www.stratus.com/RA
- Sizing Tool
- Upcoming Events
- Request a Quote
- Case Studies

Learn about the new 100i ztC Edge Solution
- www.stratus.com/resources/video/stratus-ztc-edge-solution/

Become a Stratus Certified Solution Architect
- www.stratus.com/SP
Enter the quantity of each application that will run on the server
If needed you can enter override values for vCPU, Memory and Disk
Enter any additional User-Defined Applications that will run on the server
Enter amount (%) of resources to be held in reserve for future growth
Recommended ftServer model and configuration