

A clear advantage.

# Modernizing the future of energy

Optimizing Smart Grid performance, protection and profitability with virtualization

November 10, 2021



## Global electrification unlocks opportunities

#### Power sector: Critical drivers and challenges

- Sustainability to reduce carbon emissions
- Distributed energy sources
- Increasing demand
- Appliance sprawl
  - Custom hardware and software tools
  - Limited security and manageability
  - Increased operating and maintenance costs
  - Capital intense





### Extended capabilities maximize performance

#### **Full asset optimization**

- Real-time equipment health and monitoring
- Asset management tools
- Real-time dynamic ratings
- Substation automation

#### Improved decision making

- Probabilistic risk assessment (PRA)
- Predictive maintenance

#### **Extended protection**

- Virtual protective relaying
- Remotely operable cameras (e.g., standard, infrared)





#### Seamless operations and uptime in extreme, unpredictable conditions

## Taking high-performance computing into the field

#### Characteristics

- Meet strict IEEE, IEC standards
  - Shock and vibration
  - Electromagnetic compatibility
  - Temperature extremes
  - Environmental: Humidity, salt fog, dust
- Easy to transport and deploy
- Long operational life
  - Ease of upgrades, rapid technology insertions
  - Configuration management

#### Considerations

- Computational requirements
  - Application(s)
  - Compute power
  - Power supply
  - Thermal management
- Environment
  - Infrastructure
  - Climate and weather
- Redundancy and reliability

### Rugged hardware is the foundation



### The value of virtualization

Consolidate multiple server workloads down to a few servers Reduce physical hardware needs: Initial purchase and ongoing maintenance Run disparate applications separately in respective environments on same server Increase uptime through hyperconverged infrastructure clustering Automatically migrate virtual machines of a failed server to other servers without disruption





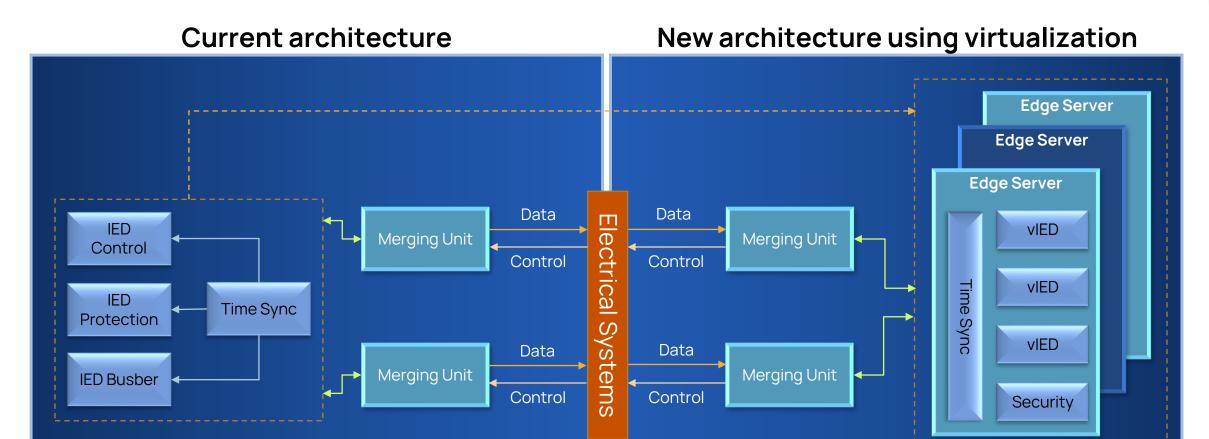








### **Protection AND control virtualization**





#### Cybersecurity

### **Integrated cyber protections**

- Silo applications and services into separate virtual environments
- Implement data at rest encryption for storage
- Isolate network traffic via software-defined networking
- Deploy intrusion detection services and stateful packet inspection firewalls
  - Protect servers against external cyber attacks
  - Monitor traffic between virtual servers to catch breach attempts/threats

#### **Intel Xeon Scalable processors**

- Root of Trust → Chain of Trust
  - Firmware
  - BIOS
  - OS
  - Hypervisor
- Advanced encryption standard (AES)
- Total memory encryption
- Trusted Platform Module (TPM)
- Software guard extensions (SGX)

Secure placement of workloads from edge to cloud



## Rugged, high-performance compute hardware

- Multiple GPU support
- Structural rigidity resists shock and vibration
- Advanced thermal performance
  - Cooling improvements: fans, heat sinks, liquid
  - Operate in extended temperatures: -40°C to +55°C
  - Reduced pressure drop design improves mass flow rate, cooling, reliability
- Electrically filtered I/O for noise and impulse immunity
- Conformal coating prevents humidity damage
- Faraday shield effect reduces EMI signature
- Custom power supplies







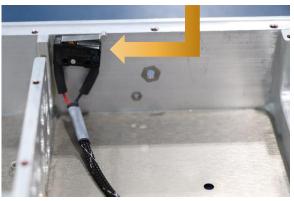


#### Physical security

## Maximum protection from the hardware layer up

- Tamper seals, tamper-resistant lid screws
- TPM
- Chip underfill
- Locking drives
- Chassis intrusion monitor
- Custom BIOS; disable unused ports
- Logging
- Instant secure erase, physical and cyber
- Unique non-interchangeable connectors
- Application revision validation
- Software integrity control
- Supply chain management
- Configuration management

**Tamper-evident switch** 

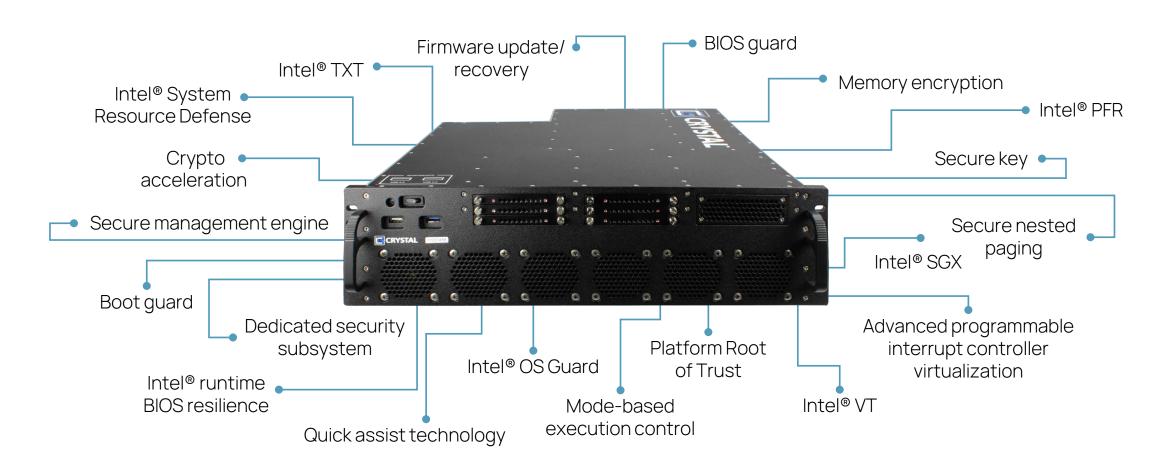


**Tamper-evident coating** 





### Hardware platform to support software integration





Optimized performance, protection and profitability

Consistent, uninterrupted power distribution

+

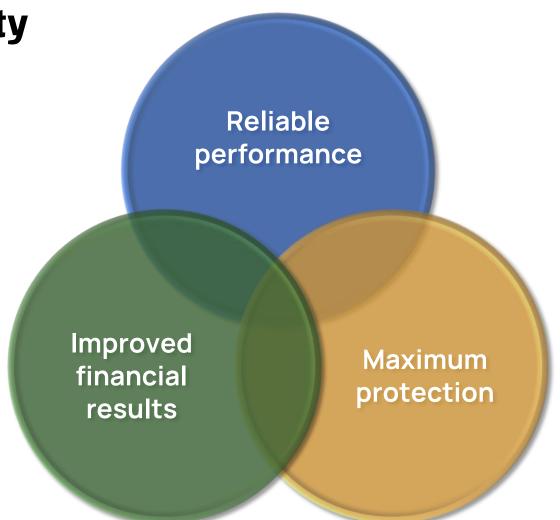
Two-way flow

+

Real-time system testing and updates

+

Preventative maintenance





## Benefits of software-defined control systems

#### **UTILITIES**

Standardize the hardware platform

Improve reliability, safety, security

Decrease operating and maintenance costs

Reduce capital investments

#### **OEMS**

Reduce development cost

Accelerate time to market

Increase profitability

Increase revenue from software and services

Enhance reliability, safety, security, manageability & edge analytics







### **Continue the conversation**



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#### **Crystal Group**

Crystal Group, Inc. is a technology leader in rugged computer hardware, specializing in the design and manufacture of servers, embedded computing, networking devices, displays, and data storage for high reliability in harsh environments.

Committed to solving customers' most difficult challenges, Crystal Group incorporates emerging technologies, cybersecurity, environmental performance and unique requirements to deliver tailored, integrated solutions that achieve today's objectives for tomorrow's success. Because failure is not an option.

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Thank you for joining us!