Cisco Connected Grid

Deliver More Value from Your Operations Over a Single, Intelligent, Secure Platform

Connected Energy Networks Business Unit

TO BE KEPT CONFIDENTIAL UNTIL JANUARY 17, 2012
Cisco Connected Grid Portfolio

- Data Center and Control Center
- Transmission and Substation Networks
- Field Area Network

IP/MPLS

- Grid Operations Inter Utility and Network

IPv6

- Customer Premise

Network Architecture, Management, Security & Services
What We’re Announcing

Cisco GridBlocks™ Reference Architecture

NEW

Connected Grid Field Area Network Solution
Cisco 1000 series Connected Grid Routers (CGR 1240 and CGR 1120)
CGR modules for RF Mesh, WiMax and 2G/3G cellular
Network Management System (CG-NMS), Device Manager and Reference Design

NEW

Connected Grid Substation Offerings
CGR 2010 WAN modules for DSL, ISDN and 3G/4G/LTE wireless networks
Enhanced cyber security capabilities

EXPANDED

Connected Grid Services
Business and Technical Architecture Services
Visualization and Design Tool

EXPANDED
Top Business and Technology Priorities
What Our Customers are Saying…

1. Managing CapEx/OpEx by consolidating multiple communication networks

2. Achieving interoperability across standards based networks and operational systems

3. Leveraging legacy installed base while migrating to standards based networks

4. Implementing pervasive network security

5. Scaling network management tools to large distributed networks

6. Managing complexity of technology transition

Utilities need a comprehensive architectural approach creating new value and helping to manage costs via a multi-service platform
Cisco GridBlocks
Reference Architecture

• Starts with an 11 tier reference model of communications for the whole power delivery chain

• Forward-looking view of end state for utility communications networks, platforms, and security

• Contains abstract architecture for each tier: components, structure, properties, and standards

• Framework for products, services, ecosystem partner solutions, and implementations
Substation GridBlock

**Substation Network**

**Station Bus**
Station bus behind electronic security perimeter for NERC/CIP compliance

**Multi-Service Bus / FAN Aggregation**
Multi-service Ethernet ring to facilitate various traffic types while keeping logically segregation w/station bus traffic

**Substation Network**

IEC 61850 Station Bus
- Primary WAN
- Secondary WAN
- MPLS PE Router
- ESP
- CE Router
- Distributed Controller
- RTU, DFR
- IED
- Process Bus to Switchyard Devices

**IEC 61850 Station Bus**

**Substation Network**

**Multi-service Bus**
- Fiber
- WiMax
- To Field Area Router via WiMax or Fiber

**Multiservice Bus**
- Physical Security
- Remote Workforce Management

NEW
# Benefits of GridBlocks Architecture

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<th>Aspects</th>
<th>Benefits to Utilities</th>
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| Comprehensive and unified set of network architectures for all tiers, across all organizational boundaries | • Access to large advanced network architecture knowledge base  
• Roadmap to preserve legacy value, avoid stranded assets  
• Open standards to future-proof communications investments  
• Identifies synergies and convergence opportunities  
• Helps navigate the maze of applicable standards |
| Detailed network security interlay | • Incorporation of comprehensive network security  
• Enablement of present and future security regulatory compliance |
| Integrated networking compute and storage | • Synergies for the modern utility ICT/OPS environment  
• CapEx optimization |
| Distributed processing / distributed intelligent platform | • Support present and emerging measurement, control and data management applications for future proofing |
| Advanced, focused network services and interfaces | • Enable Utility networks to become the agile platform for energy innovation and adoption to new technology / business models and regulation |
**Challenges:**

- Many legacy utility networks have been built to support single applications such as AMI or capacitor control, etc. leading to higher OpEx/CapEx
- Attempts to use special-purpose networks for multiple applications have significant limitations
- Multiple, siloed communication systems create stranded investment and future-proofing risks

**Opportunity:**

A robust, single communications infrastructure provides investment protection and supports multiple applications and services, increasing ROI over time
Connected Grid Field Area Network Solution
Lower CapEx/OpEx on a Multi-Service Platform

- Customer Portal
- MDM
- Load Control
- SCADA
- DMS
- CIS/Billing
- AMI Head End
- EMS
- OMS

- Substation
  - Cisco 1000 Series
    - Connected Grid Router
  - Protection and Control Network

- Residential Metering
- Transformer Monitoring
- Distribution Automation
- EV Charging Infrastructure
- Large C&I Meters
- Work Force Automation
- Distributed Generation
- Distribution Protection and Control Network

- Gateway
- RF/PLC Mesh

- Customer Portal
- MDM
- Load Control
- SCADA
- DMS
- CIS/Billing
- AMI Head End
- EMS
- OMS

- Cisco 1000 Series
- Connected Grid Router

- Protection and Control Network

- New Value from Functional Integration
- Cost Saving from Converged Platform
Cisco 1000 Series Connected Grid Routers
Field Area Routers and Modules

CGR 1240
Outdoor Pole Mount

CGR 1120
Indoor Din-Rail Mount

WAN Connectivity
CGM-3G - 2G/3G Module
CGM-WIMAX - WiMax

NAN Connectivity
CGM-WPAN - RF Mesh Module

Ruggedized Modular Platforms Designed to Provide
the Foundation for Multi-Service FAN Support
Challenges:
• Becoming more difficult to integrate new applications and systems
• Ability to address security vulnerabilities is limited
• Cost to extract latent value of information from legacy systems is increasing

Opportunity:
A standards-based communications infrastructure enables effective system integration, security, and access to information throughout the grid.
Connected Grid Endpoint Reference Design
Drives Integration Across the Vendor Ecosystem

- Open standards-based IPv6 to enable integration across diverse systems
- Connected Grid Endpoint Reference Design adds security, management, and quality of service at a large scale
- Cisco will license reference design to other vendors
- Industry engagement to establish interoperability
Challenges:

• Legacy systems have not provided full ROI and must be extended.
• Must have ability to accommodate a variable mix of legacy and new technology.
• Cannot easily replace critical devices that may not support advanced services and protocols.

Opportunity:
Network solutions that support both legacy and new systems simultaneously to maximize investments.
Connected Grid Substation Solution
WAN Interface Leverages and Extends Install Base

Ensures investment protection for existing and next gen WAN
- Supports existing DSL and ISDN connections
- Support 2G/3G wireless connections
- Support new 4G / LTE wireless technologies

Extends multi-service network from enterprise to substations

Enables security, QoS, and management policies for
- Operational communications (SCADA)
- Non-operational communications (telemetry data, voice over IP, video)
Challenges:

• Older data acquisition and control systems lack cyber security protection and jeopardize new systems
• Regulatory jurisdiction and requirements are expanding
• Application level security inefficient as it must be reconfigured for new applications

Opportunity:
Leverage an architectural approach to integrated security addresses evolving security requirements
Secure Device Identity via X.509 Certificates

Strong user identities with Role-Based Access Control (RBAC)

Mutual Authentication, Authorization and Accounting for each user and device (centralized and distributed authentication service)

Electronic Security Perimeter

Ethernet switch security

Security GridBlock
Access Control

Control Center, SCADA
- SCADA
- EMS

Security Services
- Directory Services
- Certificate Authority
- Identity Services Engine
- Access Control

Management, NOC
- NMS
- SIEM
- Media Server
- Video Analytics

Data Center, Enterprise Apps
- DB

Utility Private WAN (MPLS, SDH/PDH)
Service Provider WAN (MPLS/GPRS/3G/4G)

RTU, Relay, PMU
Teleprotection Relay
Protection and Control

Substation Automation Network

HMI
Multi Service
Distributed Services
Fan AGG
**Challenges:**

- Patchwork approach to network management does not scale to large numbers of endpoints.
- Difficult to visualize the communications network in relation to the power grid.
- Traditional approaches limit critical monitoring and troubleshooting capabilities.

**Opportunity:**

Unified network management tools can manage millions of endpoints and enhance observability between the communications network and the power grid.
Connected Grid Network Management
End-to-End Monitoring and Control

The **Connected Grid NMS Solution** provides grid operators:

- Scalable, Utility Ops communication management
- Enterprise-class visibility for up to 10M endpoints
- Secure network commissioning, monitoring and life cycle management via well-defined interfaces
- Integration with Utility Operations and Enterprise Bus

The **Cisco Connected Grid Device Manager** provides:

- Device level network monitoring and troubleshooting
Challenges:

• Unable to evaluate multiple communication technology options and address evolving standards

• Difficult to identify communication infrastructure investments that can be leveraged across multiple projects

• Cannot view portfolio holistically to avoid stranded assets while future-proofing new investments

Opportunity:

Customized architectural solutions and services to address business and technology priorities as well as constraints
Connected Grid Architecture Services
Prioritization and Design of Communications Infrastructure

Holistic assessment of current and future states for business and technical architectures
- Perform portfolio-level solution analysis on shared multi-layer infrastructure
- Assist with prioritization and sequencing of investments
- Utilizes proven methodology and experience in designing large, mission-critical communication networks

Deliver an optimal architectural design for deployment
- Based on utility prioritized use cases and business requirements
- Leverages GridBlocks architecture
- Help utility engineers develop plans for ongoing support, monitoring and optimization
Architecture Design and Deployment

CHALLENGE

• Develop architectural design to meet both present and future needs
• Modernize existing systems providing SCADA and telephony services for the high voltage substations

SOLUTION

• Services developed a highly modular, flexible, converged architecture built on a single standard (IEC 61850)
• Deployed access and distribution layer networks based on Cisco Connected Grid switches

RESULTS

• Modular approach will drive cost savings, will enable phased implementation of substations and provided tools to support business case
• Reduced costs and improved security with highly available LAN infrastructure within new major substations

“Cisco Services’ has recently worked with Ausgrid to understand the requirements for electricity substations today and as we move towards a more complex and integrated future environment. Their work is assisting us to transform the electricity network into a smarter grid. We highly value their ongoing partnership and commitment to our company and the industry.”

Adrian Clark
Chief Technology Officer
Ausgrid
Connected Grid Validation and Design Tool
Rapid Design, Test and Monitoring of Substation Networks

Designed specifically for utility operators

- Supports multiple levels of the automation architecture
- Provides and interface enabling engineers to dynamically discover, design, model, and test the local area network (LAN) both before and after deployment
- Helps engineers visualize communications network in context of completed Common Information Model (CIM) energy delivery network design and IEC 61850 protection schema design

Benefits to Utilities:

- Identifies security requirements as part of modeling process
- Enables creation of standard deployment plan through design and configuration templates
Substation Visualization and Design Tool

**CHALLENGE**
- Complexity of automating large scale digital substation deployment
- Difficulty for Electrical Engineer to visualize the communication network and track changes in the substation
- IEC 61850 standard compliance validation from IED vendors

**SOLUTION**
- Visualize communication network in context of CIM Mode (Energy Delivery Network) and the IEC 61850 (Protection Schema)
- Enable engineers to discover, design, model, and test the Substation LAN before and after the deployment

**RESULTS**
- Reduce deployment errors
- Help create standard deployment plan and efficiently test and monitoring each system upon activation
- Reduce time and cost for deployment and on-going maintenance

“Cisco’s Visualization and Design Tool helps validate and keep track of configuration changes, which meet our operational needs very well.”

Lu Hong
Director, Automation Dept.
State Grid Corporation of China
Cisco Connected Grid Customer Snapshot
Thank you.