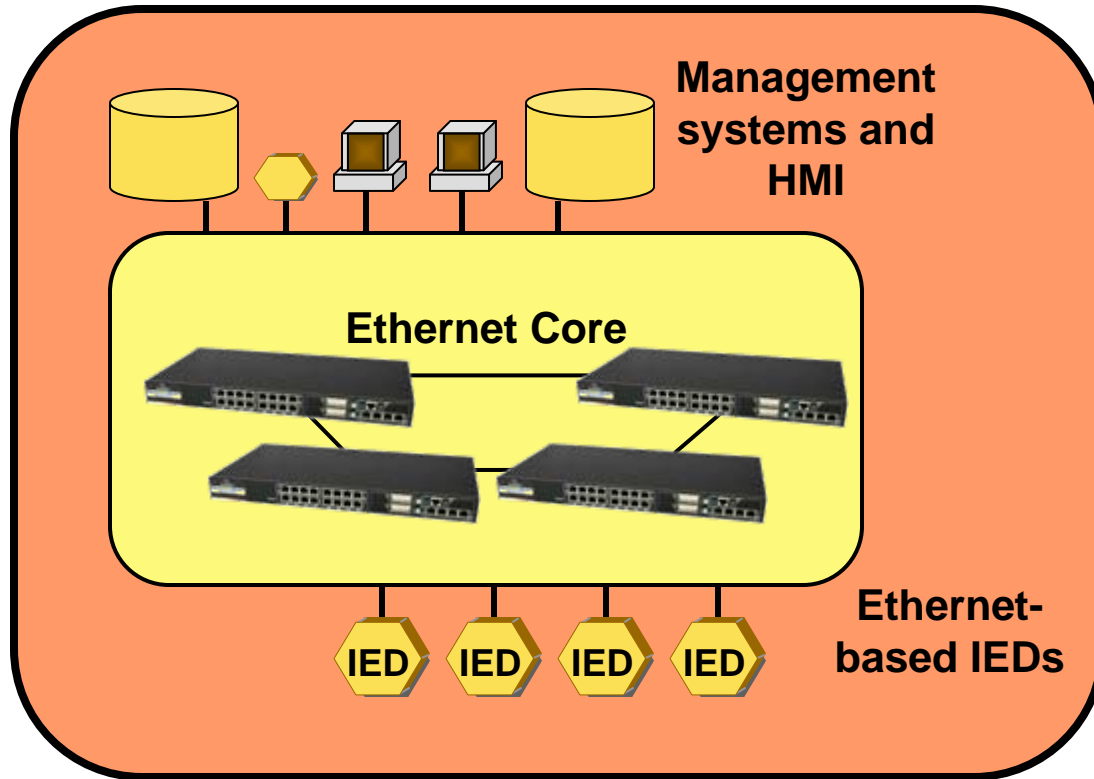


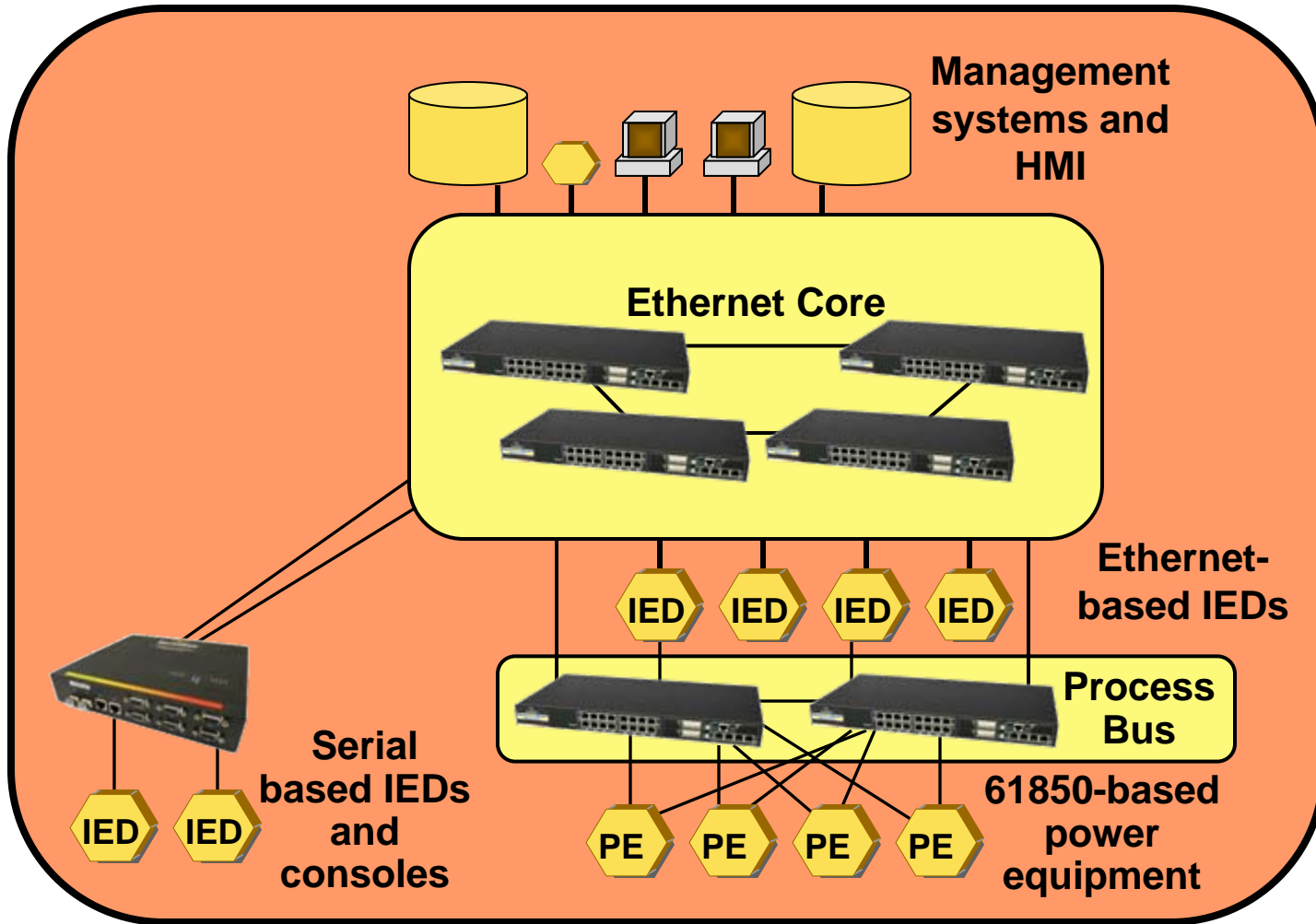
Utilizing IEC 61850, Ethernet and IP Standards for Integrated Substation Communications

Rajesh Kukreja
GarrettCom, Inc.

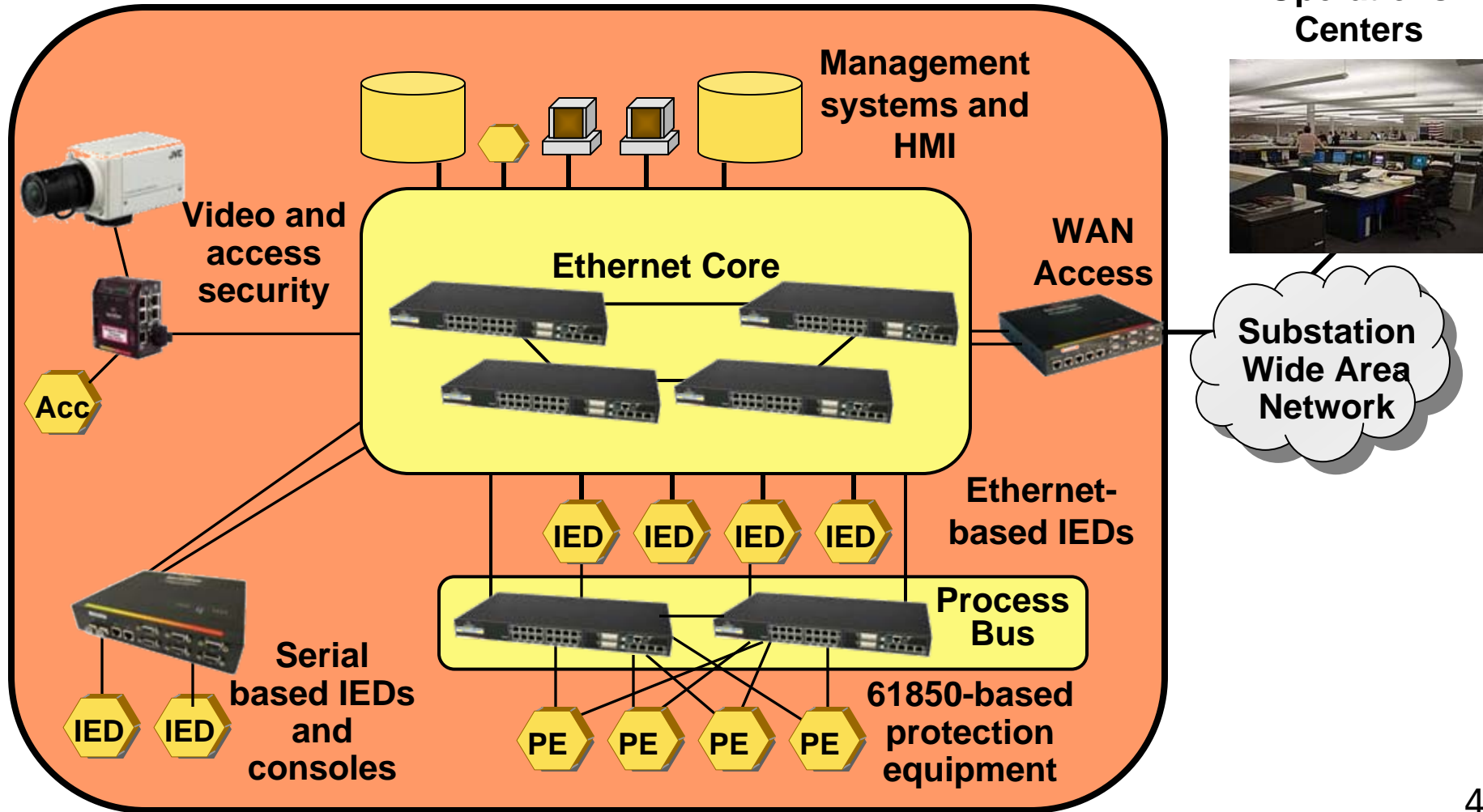




Ethernet-based Network Integration

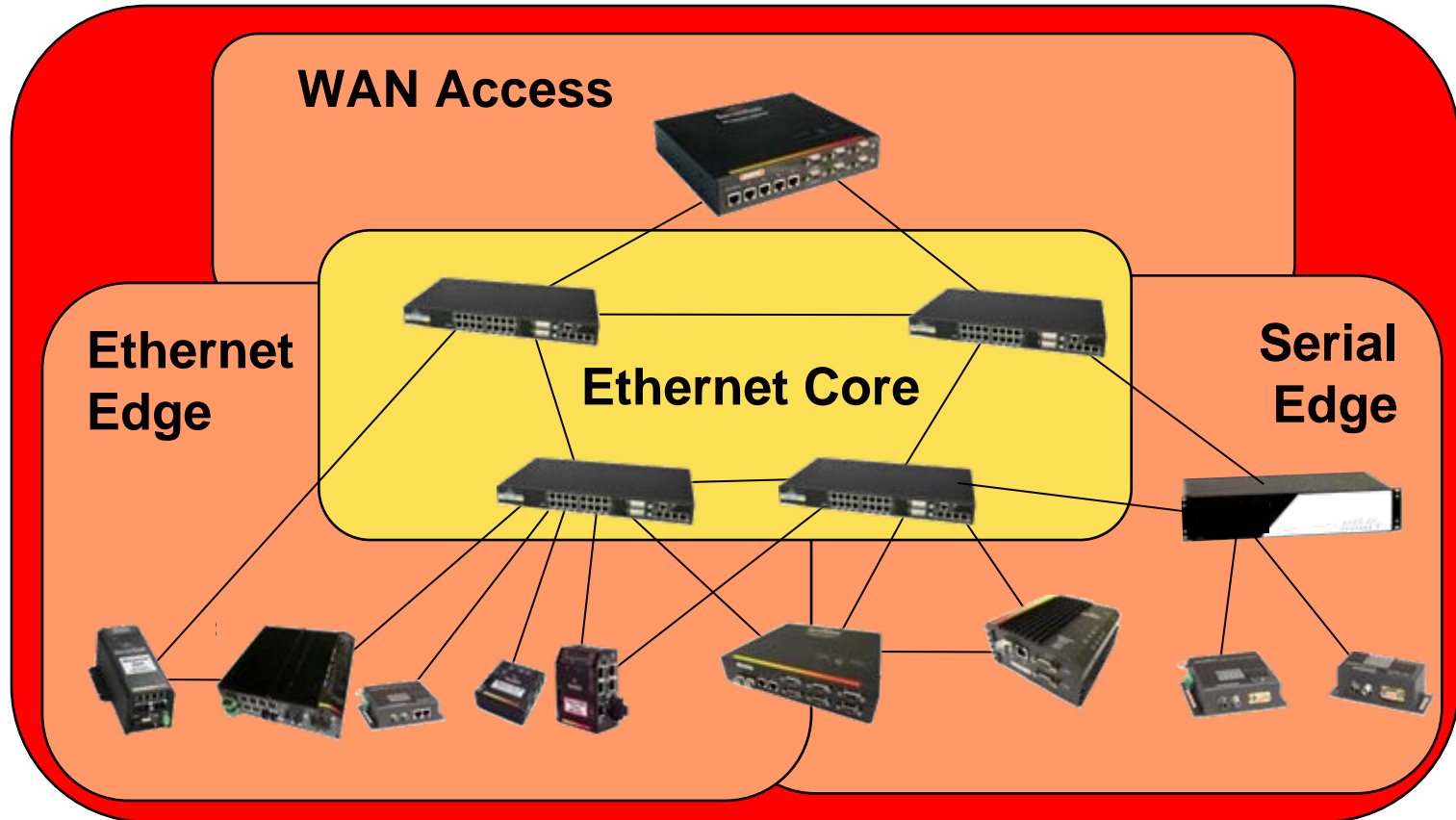


Ethernet-based Network Integration



- **Flexibility**
- **Ease of use / Manageability**
- **Reliability**
- **Security**

Integrated solutions require multiple products



➤ **Configurability**

- Support diverse interfaces

➤ **Scalability**

- Utilize broad set of interoperable products

➤ **Interoperability**

- Standards-based with multiple vendors

➤ **Functional Integration**

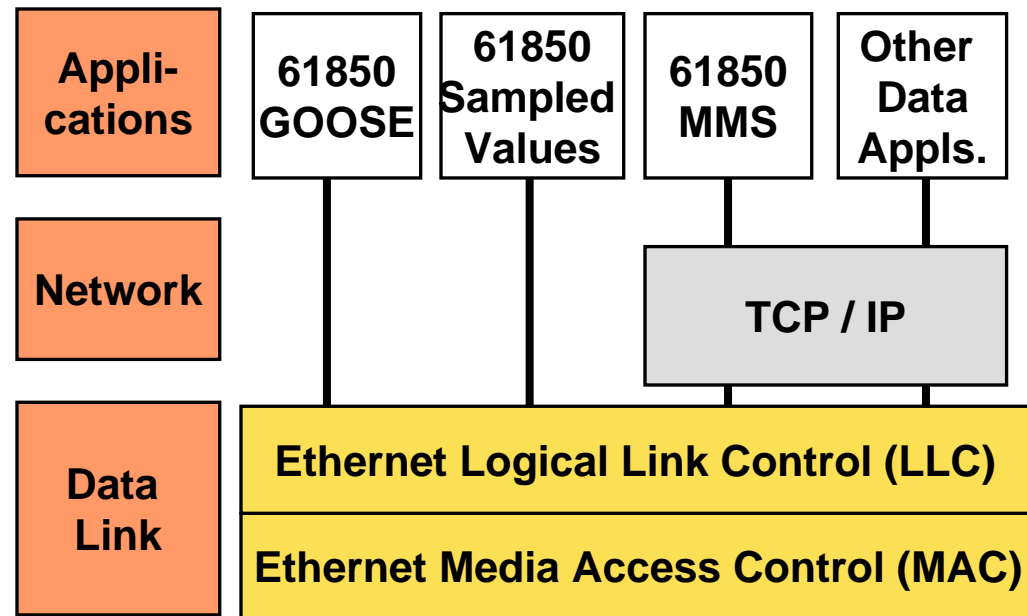
- Multi-protocol support; multi-function products

➤ **Bandwidth Sharing**

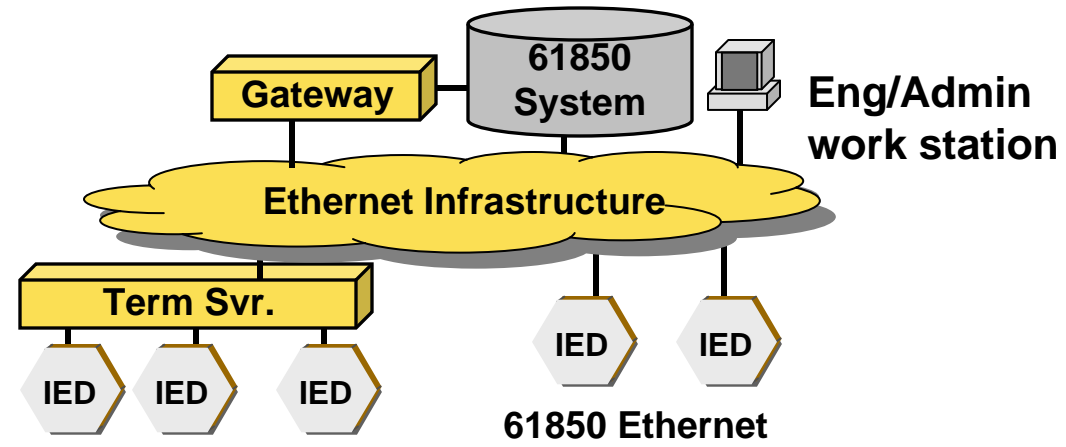
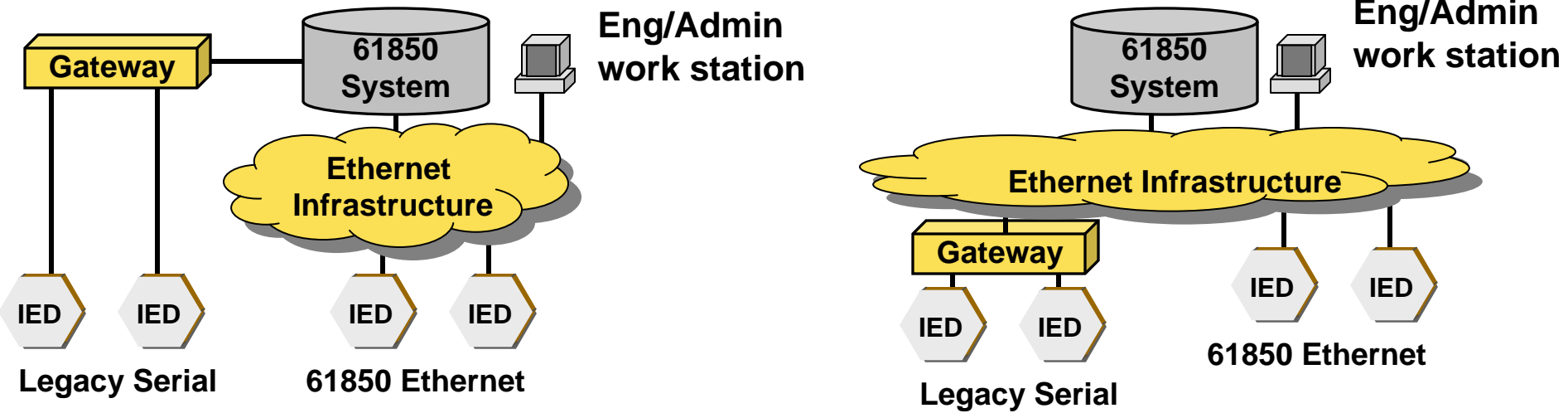
- Prioritization for critical traffic

Prioritization of Mixed Traffic Types

- Requires hardware-based 802.1p, 802.1Q QoS in Ethernet switches
- VLANs help administer QoS
- Consider serial, video traffic also



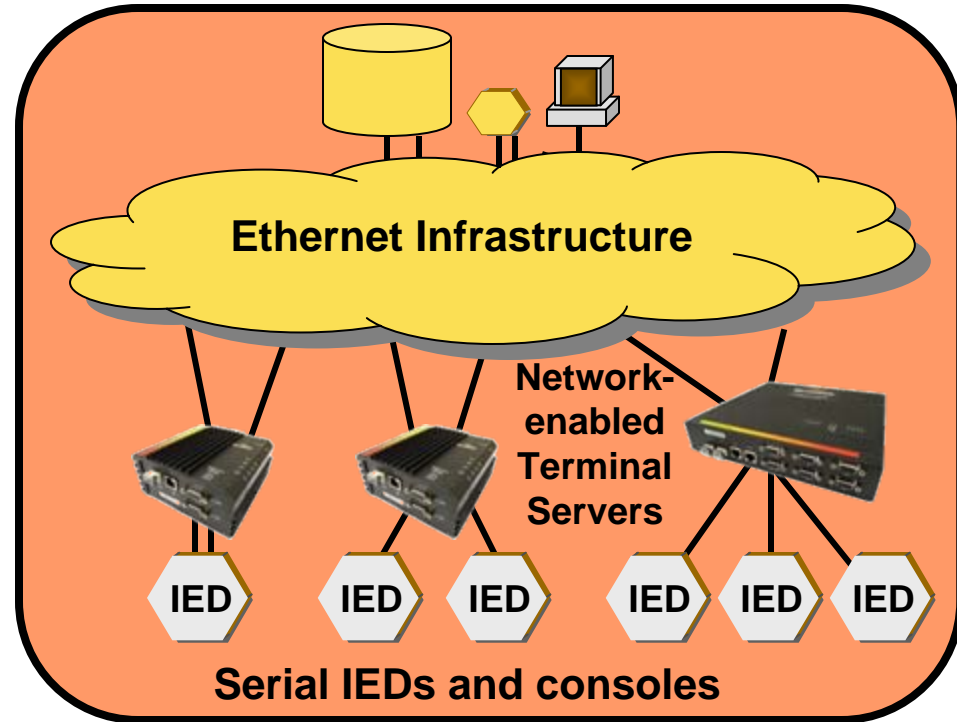
Serial Control and Console Integration over Ethernet



Serial: Console, ModBus, Legacy

The "Dynamic Serial Edge"

- IP/Ethernet-enabled Serial devices
- Leverage high performance, resilient Ethernet infrastructure
- Distribute over local Ethernet fiber to remote devices
- Dual connectivity to core for resiliency





Ease of Use / Manageability

- Graphical User Interface
- Command line interface
- Scripting
- Standards-based SNMP
- Syslog
- SNTP time synchronization
- Diagnostic tools

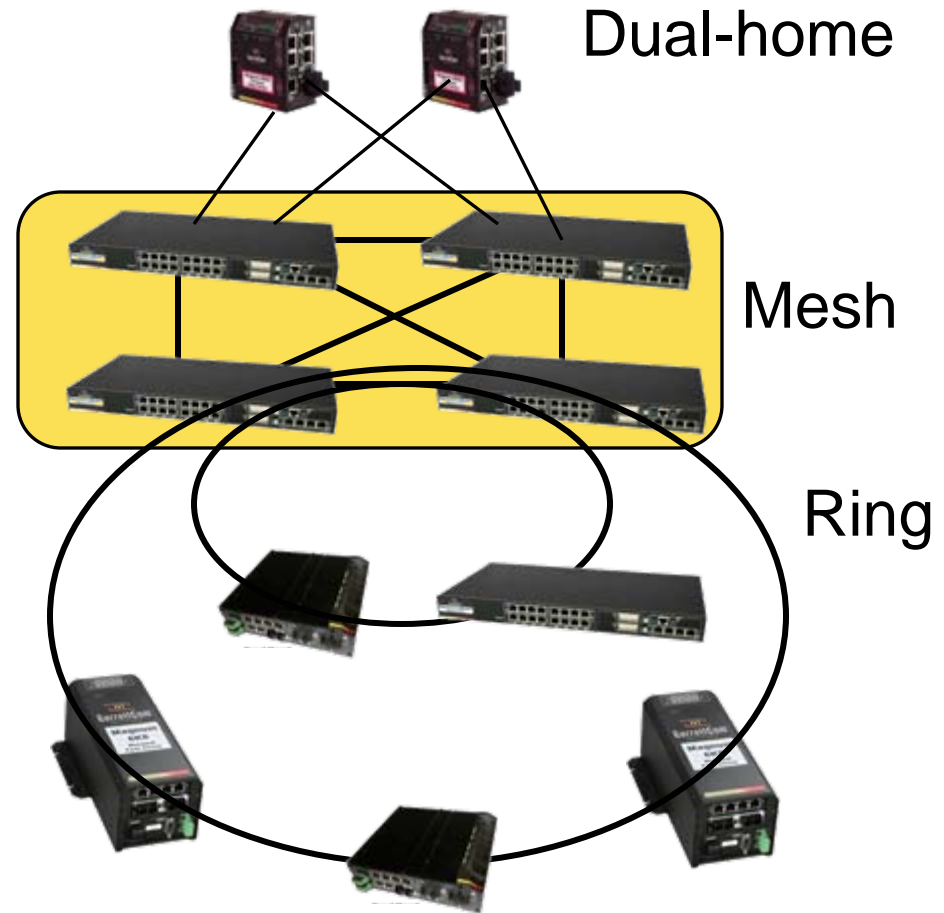
- Product reliability
- Ethernet network reliability
 - Fiber media
 - Protected topologies
 - High performance network recovery software
- Higher-level networking protocols
 - Multi-master topologies, including Serial-IP
 - Dynamic IP routing
 - MPLS support

- 61850-3 standards for substation ESD/EMI hardening
- Extended EMI for “no frame loss” performance
- Extend operational temp to -40 to +85°C
- Manufacture to ISO 9001:2003 Quality with every box cycle-tested

IEC 61850-3

ESD (61000-4-2)	Contact	8kV
	Air	15kV
Radiated RF (61000-4-3)		20V/M
Fast Transient (61000-4-4)	I/O ports	4kV
	Power ports (HV and LV)	4kV
Surge (61000-4-5)	I/O ports	4kV
	Power ports (HV and LV)	4kV
Conducted RF (61000-4-6)	I/O ports	10V
	Power ports (HV and LV)	10V
Magnetic Field (61000-4-8)		30A/m
Voltage Dips & Interrupts (61000-4-11)	HV power ports	Pass

- Support standard RSTP per 802.1w for interoperability
- Provide enhanced RSTP for constrained ring topologies (e.g., S-Ring)
- “Dual-homing” for simple resilient connections, including unmanaged edge switches



➤ Electronic Perimeter Security

- Firewall, VPNs (IPsec and SSL)

➤ LAN Security

- VLANs, MAC security, 802.1x port security (RADIUS)

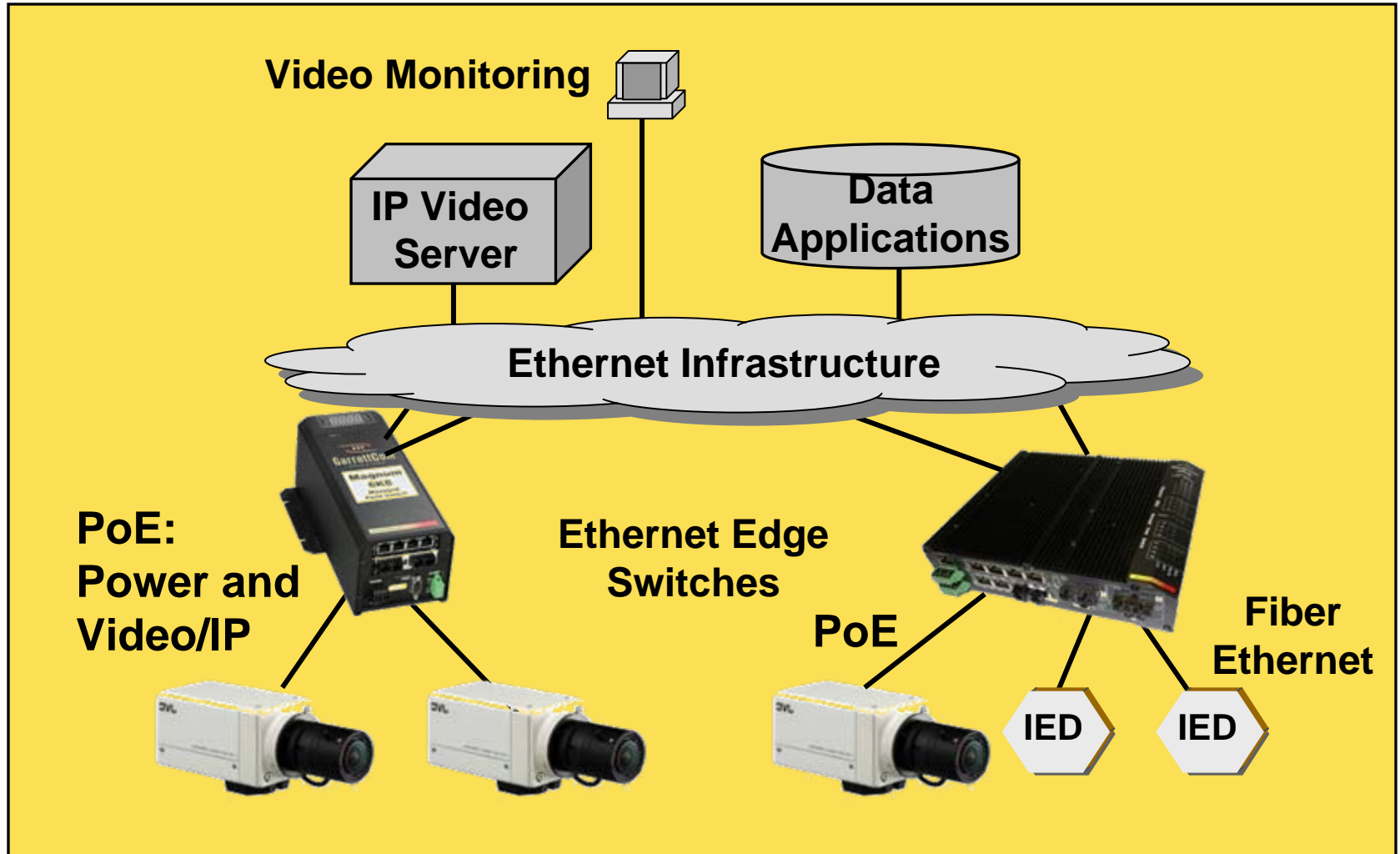
➤ Management Security (O,A&P)

- SSL/SSH, SNMPv3, Authentication, Encryption, Logging, Password security, TACACS+

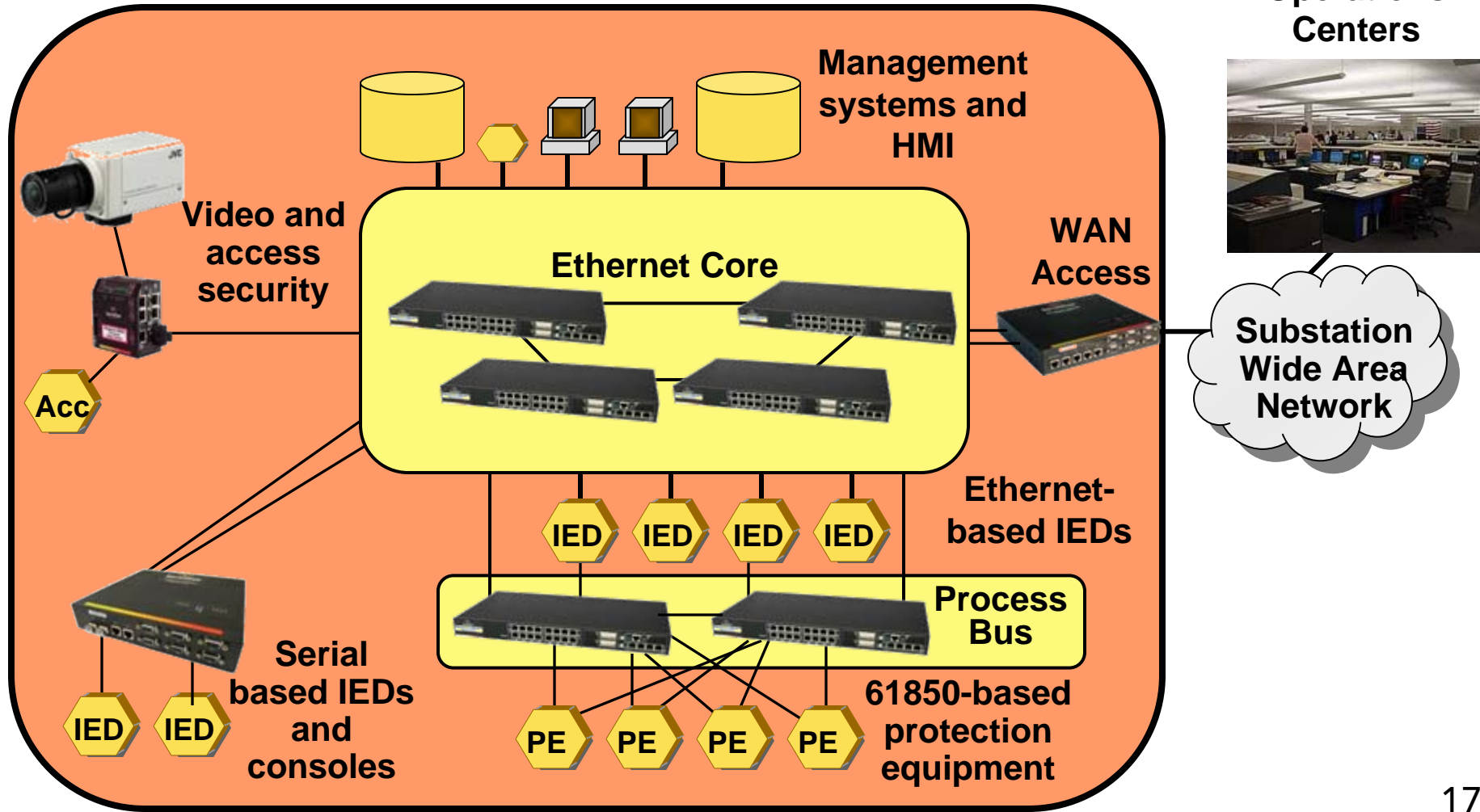
➤ Physical Security

- Emphasis on PoE and IGMP enhancements in support of surveillance

Video Surveillance with PoE



Ethernet-based Network Integration



Planning for Successful Integration of Substation Networks

- Ethernet is core for 61850 substation LAN
- Ethernet serves as universal core for serial, IP video and WAN access applications
- Plan ahead for shared network evolution based on fundamental principles
 - Flexibility
 - Ease of use / Manageability
 - Reliability
 - Security



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