



Redes industriales para operación minera

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Agenda

- ▶ Mining lifecycle
- ▶ To be or not to be...
- ▶ This is the answer!



Mining lifecycle



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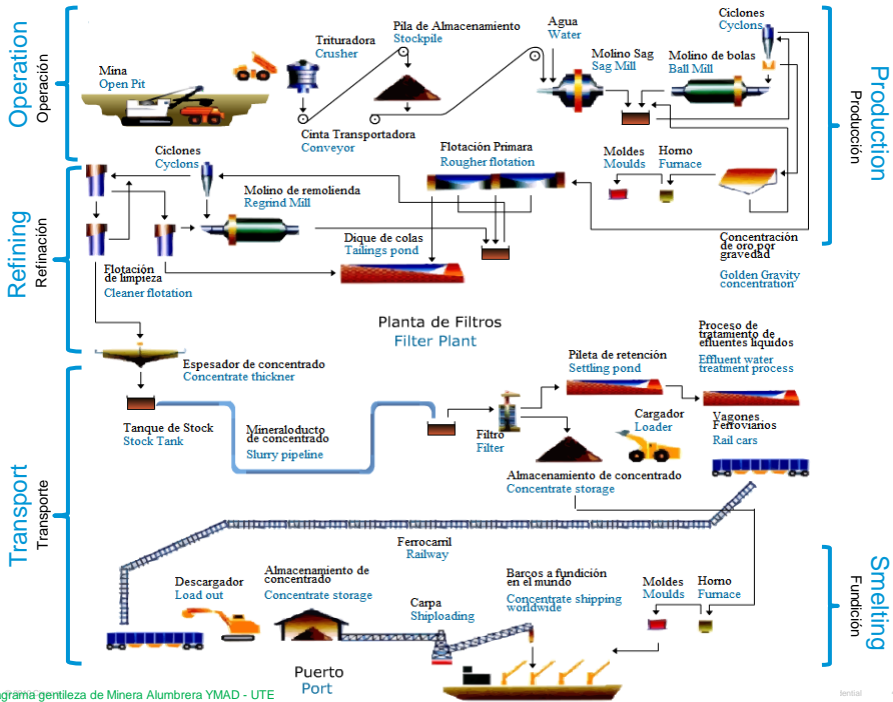


Diagrama gentileza de Minera Alumbreira YMAD - UTE

4

Safety & Security (Seguridad y Protección)

- Training
 - Yearly licenses/permits renewal
 - Safety
- Security Alerts
 - Weather
 - Evacuation and mustering
 - Blasting schedules
- Location
 - Workforce location
 - Asset location
 - Directed messages to workers
- These solutions are based on digital media systems with dynamic content and WiFi



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Operation & Production (Operación & Producción)

- Drill & Blast:
 - Uses 3D mine-planning software
 - GPS based
 - Remote detonation
 - Automated drilling
 - Wireless remote control
- Fleet Management
 - Improves productivity
 - Reduces operational costs
 - Uses GPS technology for real-time positioning
- All of them need WiFi technology to stay in contact with the application servers



Some players are: P&H, Sandvik, Atlas Copco, Bucyrus, Hitachi, Caterpillar, Komatsu, Liebherr, Volvo, Modular Mining, Leyca Geosystems, Mincom, SAP, etc.

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Refining & Smelting (Refinamiento y Fundición)

- Based on control systems
 - Sensors
 - Actuators
 - HMIs
 - Distributed I/O
- Control Networks protocols
 - Modbus, Profibus, Profinet, etc
- Some still based on legacy connectivity
 - RS-232, RS-422, RS-485.
- Most advanced natively based on Ethernet/IP over wired or wireless



Some players are: FLSmidth, ThyssenKrupp, Metso, Sandvik, KPI-JCI, Trio Engineered, ABB, Rockwell Automation, Siemens

Transport (Transporte)

- Slurry pipes transport the product in a mud format and then a filtering process is needed.
 - SCADA networks control the pipeline.
 - MetroE (MPLS like), CWDM, DWDM for data transport over fiber optics with network segmentation.
- Trains transport the product to ports or refineries
 - MetroE (MPLS like), CWDM, DWDM for data transport over fiber optics with network segmentation.



To be or not to be...



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Underlying Trend: Connecting the Point of Activity



Ent. Network

Industrial Infrastructure





Seamless, from the office through the industrial environment

- **One integrated management approach**
- **Consistent architectures**
- **Consistent security model**
- **Shared best practices**

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Benefits of Industrial Ethernet in Mining

<p>Increased Visibility</p> <ul style="list-style-type: none"> ▪ Connectivity to devices and controllers ▪ Manufacturing—enterprise integration 	
<p>Uptime and Performance</p> <ul style="list-style-type: none"> ▪ Security and reliability ▪ Network resiliency 	
<p>Increased Efficiency</p> <ul style="list-style-type: none"> ▪ Standard architecture—integration and support ▪ Scalable network platform—multiple applications 	
<p>Improved Event Response</p> <ul style="list-style-type: none"> ▪ Remote access ▪ Improved diagnostics and support 	

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Challenges with IT/Production Network Convergence

<p>Organizational Issues</p>  <ul style="list-style-type: none"> ▪ Misaligned objectives ▪ Support requirements ▪ Different models and language 	<p>Industrial Applications</p>  <ul style="list-style-type: none"> ▪ Industrial protocols and traffic patterns ▪ Hardened products ▪ Determinism, latency, etc. ▪ Motion control 	<p>Security</p>  <ul style="list-style-type: none"> ▪ Increased risk with COTS technology ▪ Patching issues ▪ Implications of issues ▪ Impact on performance & ease of use 	<p>MFG and IT Skill Alignment</p>  <ul style="list-style-type: none"> ▪ Ease of use ▪ Multiple management tools ▪ Understanding of industrial applications
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This is the answer!



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Logical Architecture

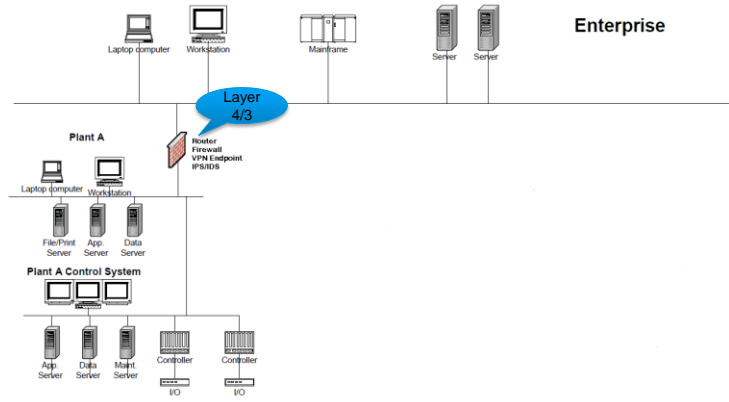
Purdue Reference Model ISA-SP99.00.01-2007

Enterprise Zone	Enterprise Network	Level 5	
	Site Business Planning and Logistics Network	Level 4	
DMZ	Demilitarized Zone—Shared Access		
Manufacturing Zone	Site Manufacturing Operations and Control	Level 3	
	Cell/Area Zone	Area Control	Level 2
		Basic Control	Level 1
	Process	Level 0	

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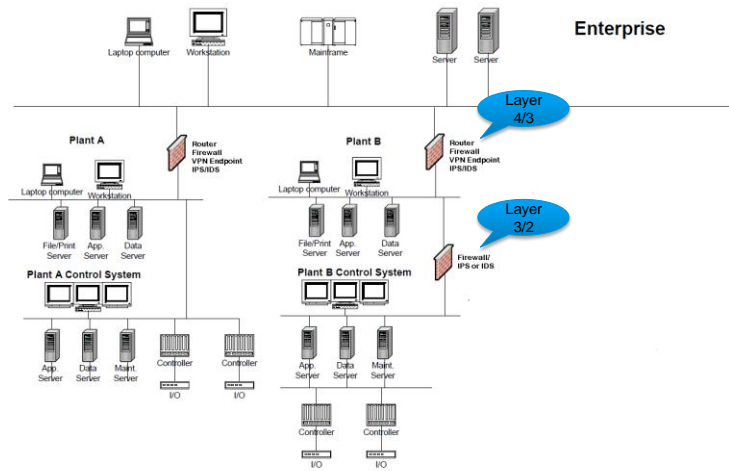
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Simplified Purdue Architecture A



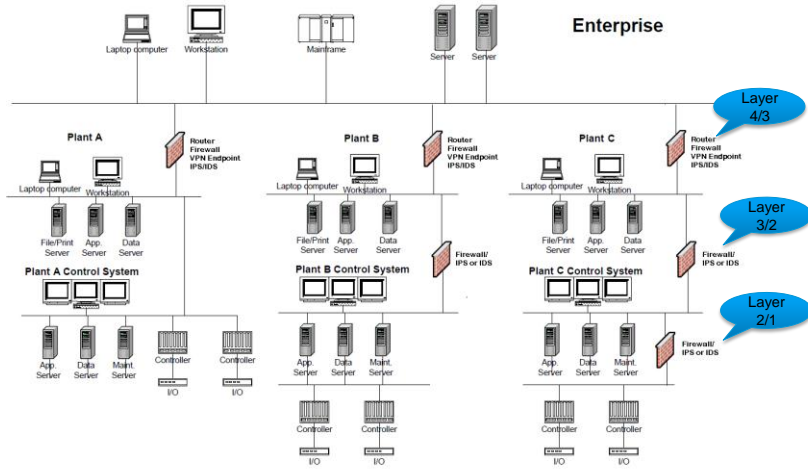
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Simplified Purdue Architecture B



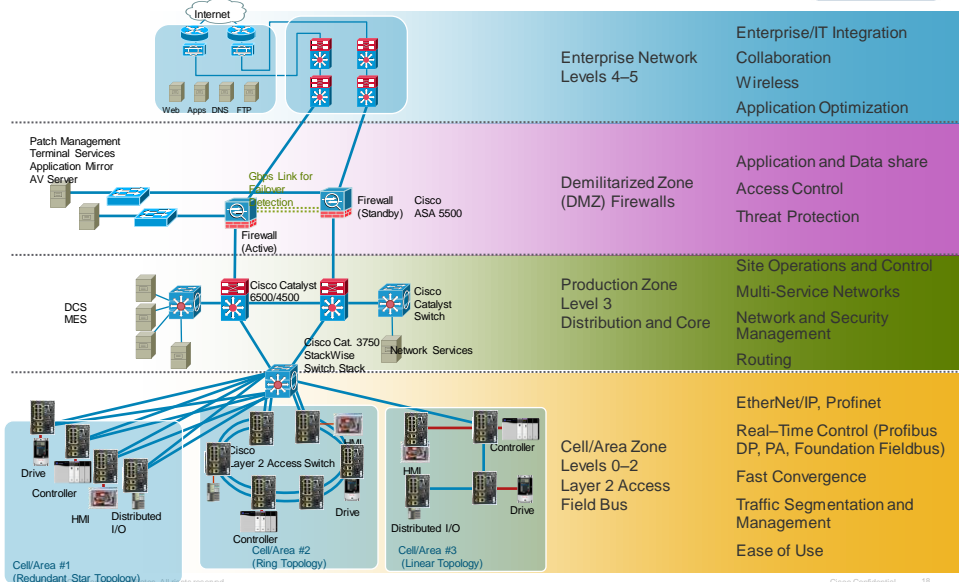
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Simplified Purdue Architecture C



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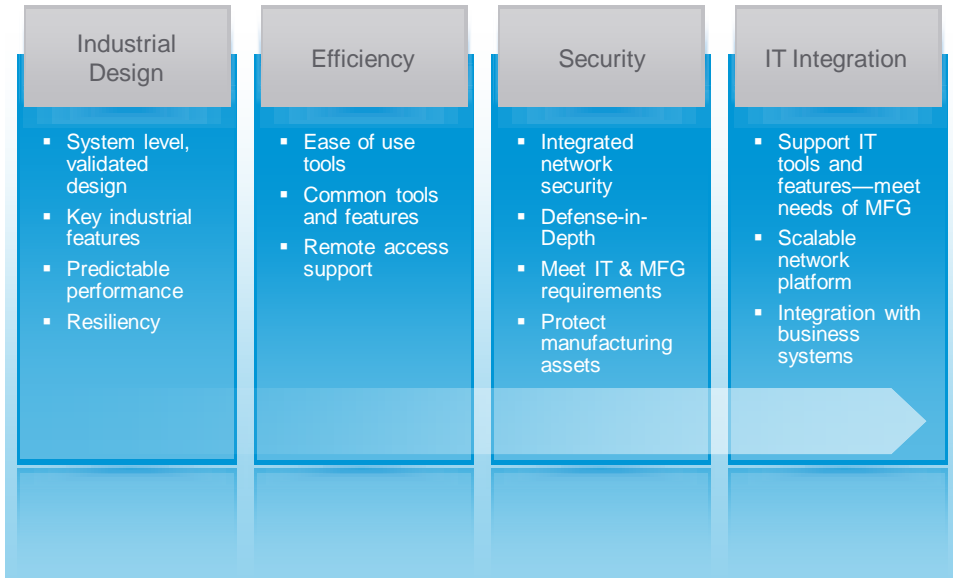
Converged Plantwide Ethernet Architecture



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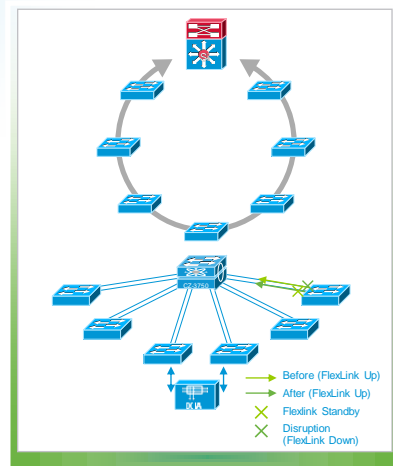
Enabling Plant to Business Convergence

Requirements for a High Performance Industrial Network



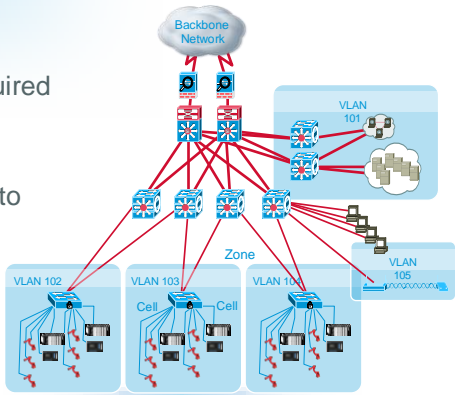
Resiliency for Industrial Applications Supporting Multiple Topologies

- Ring Convergence
 - Resilient Ethernet Protocol (REP)
 - Achieves ~50 ms convergence in large, complex networks
- Redundant Star Convergence
 - Multiple protocol options
 - Convergence times of <100ms for Flexlinks and Etherchannel (some failure modes)
- Tested with Rockwell applications and multicast traffic
- Fast Convergence avoids application reset and improves uptime
- Critical for industrial applications



Using VLANs in an Industrial Ethernet System

- Assign VLANs to devices when traffic patterns are known
- Limit the flow of produce of required devices (example: one VLAN per cell or zone)
- Use L3 switch such as IE 3000 to exchange data between VLANs (ex. PLC interlock layer)

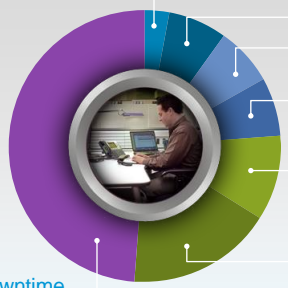


Learn your traffic patterns: safemap.sourceforge.net

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Industrial Security

Source of Industrial Security Incidents
Source: BCIT (2006)



Average Cost of Manufacturing Downtime = \$210,000 per Hour
Source: Infonetics (2005)

Ethernet to the Control Process Network

Built on Cisco Self-Defending Network



Centralized Policy Management and Monitoring

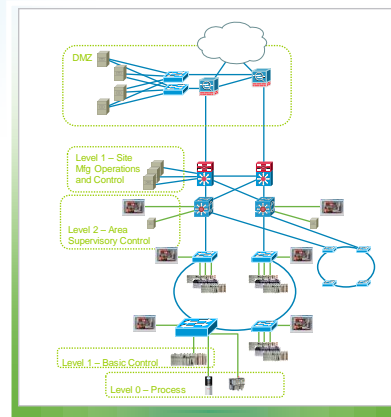
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Security Architecture

Protecting Critical Manufacturing Assets

- Deploy zone concept for enterprise, DMZ and manufacturing areas
- Network infrastructure security
- Port security (MAC filtering, etc.)
- End-Point security (Cisco Security Agent)
- Identity access control with ACLs and firewalls
- Security management for all security devices and services
- Threat control and containment—IPS



Security Services Must not Compromise Manufacturing Operation or Impact Control Traffic

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Cisco IPS Signature Set Coverage

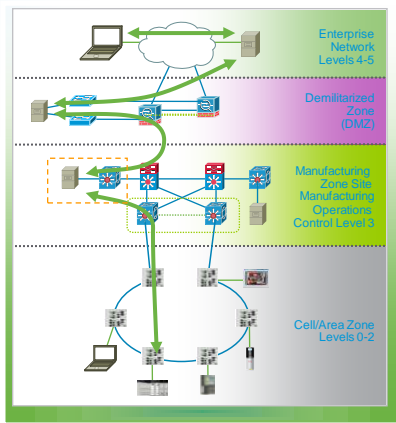
- All types of equip.
 - SCADA
 - DCS
 - PLC
 - SIS
 - RTU
- All major vendors
 - Schneider
 - Siemens
 - GE, ABB
 - Yokogawa
 - Motorola
 - Emerson
 - Invensys
 - Honeywell
- and growing..

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Supporting Manufacturing Applications

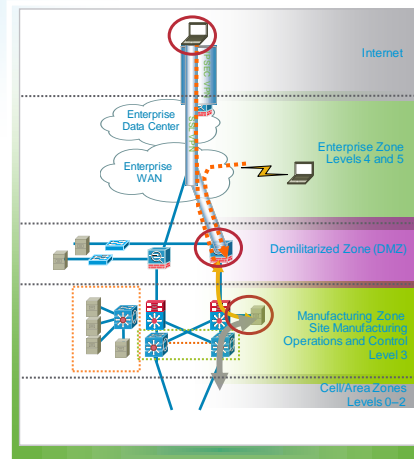
- Industrial applications reside in the manufacturing zone
- Remote Access Server for key applications
- Historian Replica in DMZ
- Supports plant and business information sharing



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Secure Remote Access

- Plant Firewall (ASA 5500)
 - Web portal
 - IPS/IDS
- Remote Access Server
 - Terminal server
 - Manufacturing applications
- Secure Web Portal
 - Web-Based dashboards, trends and reports
- Combine with Collaboration Solutions for Remote Support



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Gracias.
Thank you.
Obrigado.

