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The bridge to possible

ACI for Manufacturing

Rob Colby, Gary Morris, Pat Guerin, Chris Benson

CSSSPG-2200

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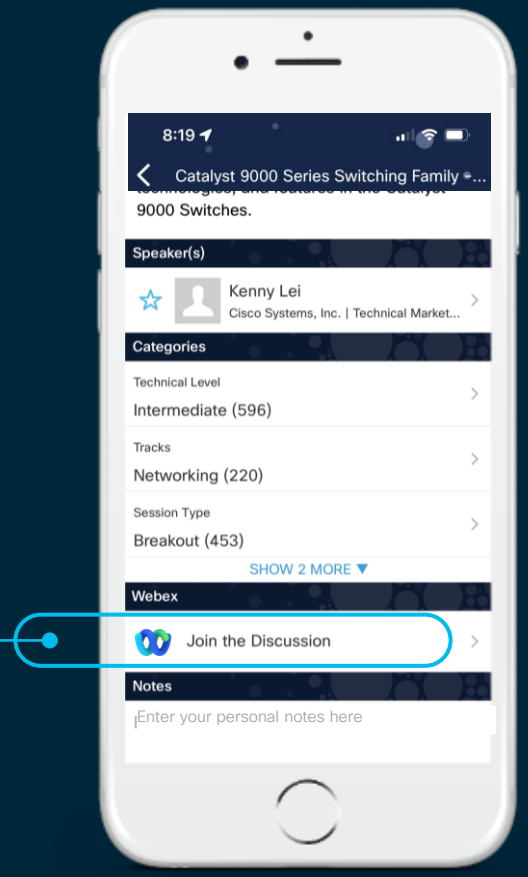

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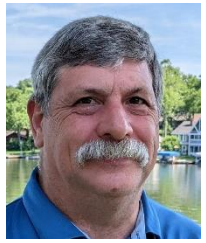
Agenda

- About the Presenters
- What is an Intel Factory?
- Challenges on the Factory Floor
- Why we Chose ACI/Nexus
- The Challenges Addressed
- What's Next

Who Are We?

Rob Colby is a Principal Engineer in IT responsible for Manufacturing Network and IoT Infrastructure. Rob joined Intel in 1999 and since then has driven a wide variety of factory infrastructure programs that solve complex challenges within Intel. Rob is currently a voting member of the IoT and Fog committee and holds sixteen US patents.



Gary Morris is a Senior Infrastructure Architect in Intel's lead Technology Development Factory. Gary Joined Intel in 1992, and since that time has brought forward many innovations that have continued to keep Intel on the forefront of automation infrastructure. Gary has been a key visionary for how ACI technologies can expand beyond the data center to solve factory challenges

Pat Guerin is a Senior Network engineer in IT responsible for the design and operation of Intel's Manufacturing and Industrial Control Networks. Pat joined Intel in 1999 and has since been the driving force in adopting new architecture solutions for the Factory floor.

Chris Benson is a Senior Network Engineer in the Manufacturing Network group. Chris has been working on Intel in Intel IT since 2001. Chris has led the early ACI design efforts and the transition to the automation first mind set in ACI Deployments

What is an Intel Factory?

Manufactures Intel's leading edge semiconductor chips

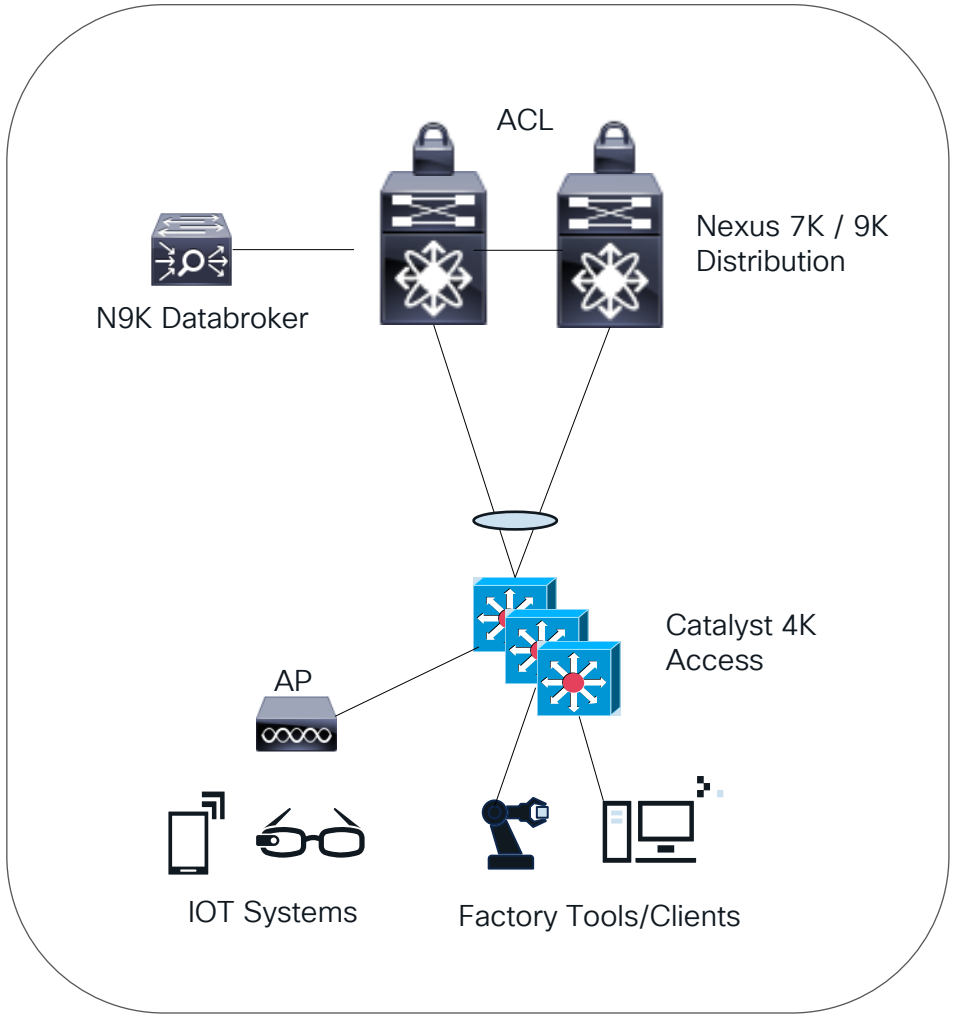
Each factory "shell" is its own factory network for process equipment

Multiple factory shells per location, with dual DC's per "campus"

Network designed to protect WIP at all costs

- 24x7x365 – zero downtime tolerance
- High security/segmentation to protect process equipment
- Very rare planned downtimes (less than 1 per year)

Factory Floor Classic Network Challenges



TCAM	- No space for complex ACL controls - Limits # of deployable VLAN's - Weekly TCAM management - Forced site "TCAM splits"
Segmentation	- PVLAN control is a ridged strategy - 1:1 ACL to subnet complicates growth
Automation	- Per switch manual CLI configuration - Lack of API access for automation - Manual Host onboarding - Difficult to keep Copy Exactly
L4-7 Inspection	- All or nothing L4-7 protection - Difficult to scale DPI
Failure Domain	- Large impact/failure Domain - Difficult negotiating downtime

Intel Cisco Factory Floor ACI Journey

Year	ACI Activity
2018	• ACI selected for Next Gen Data Center • First Data Center ACI Fabric deployed in Arizona
2019	• Cisco BU / Intel architectural reviews and ref. designs for factory floor • Proof of Concept in Cisco San Jose
2020	• Cisco SVS – Build out Factory environment and extensive validation testing • Cisco SVS – Brown Field Migration validation
2021	• Finalized Factory ACI design • Intel Production Pilot – success
2022	• Intel brings up its newest high volume Factories on ACI (Oregon and Ireland)

Multi-year Intel and Cisco collaboration to ensure ACI meets critical needs of a Factory

Why ACI for Intel Manufacturing Floor

- Product Maturity
- Group Based Policy for more efficient TCAM usage
- Highly Automatable, with centralized configuration
- Built in fabric level fault visibility
- Flexible micro-segmentation – scales to Intel's needs
- Robust East/West policy controls – including service graph

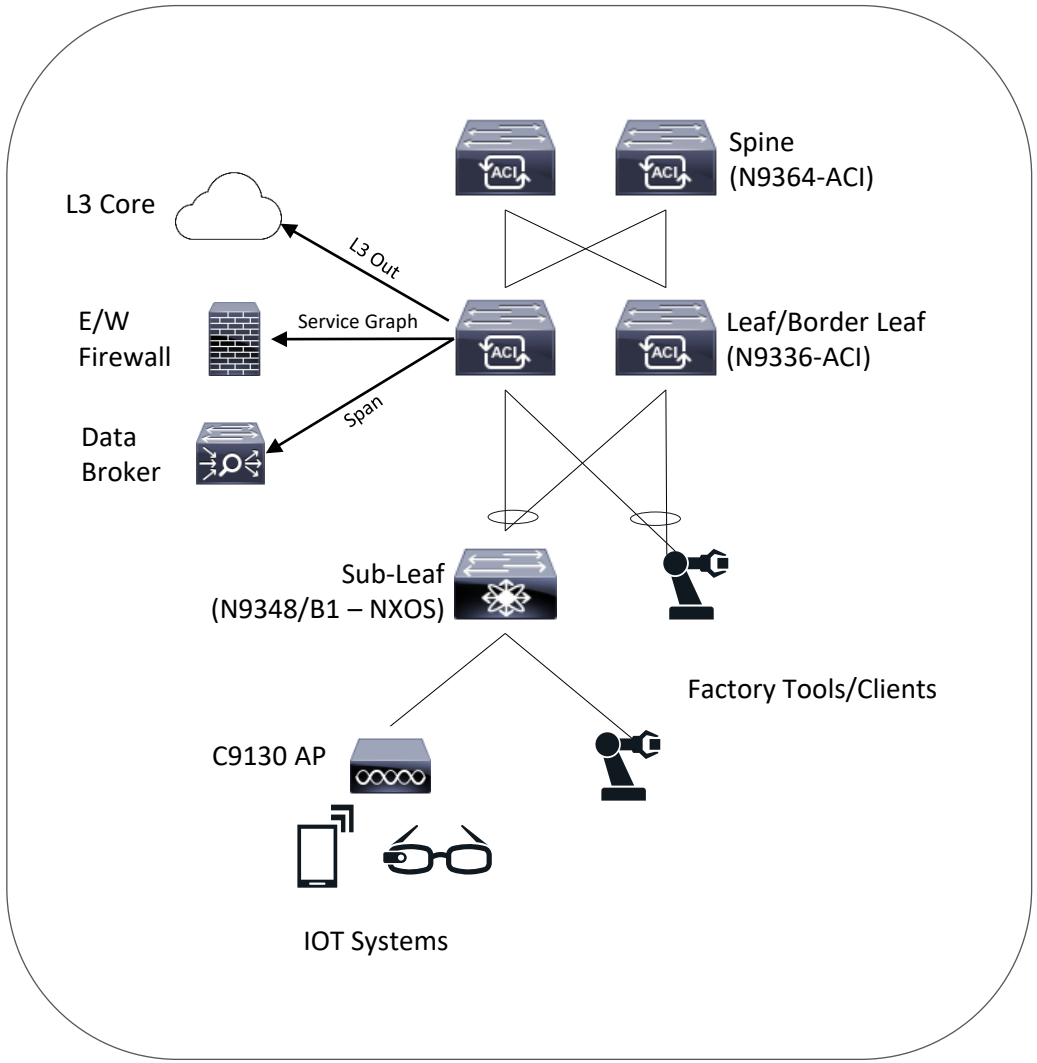
Why the Nexus 9K

- Maturity, Stability, Scalability
- High performance – up to 800G platform
- Flexibility for both ACI and NXOS – (sub-leaf and migration)
- ISSU enables zero downtime architecture during change
- Future features such as streaming telemetry
- Better “per port” price point and better power efficiency

Factory Floor ACI Network – Overview

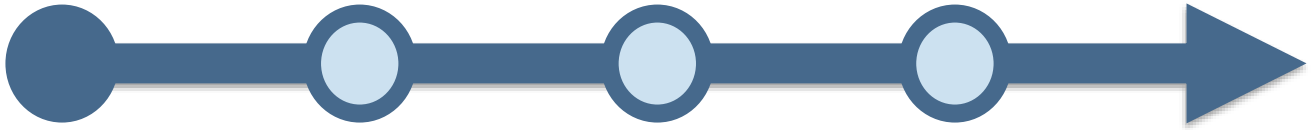
Today:
2 sites
716 Process Tools/Clients (growing)

Per Fabric
150 EPG/µEPG's
140 contracts



TCAM	- EPG Based Policy – removes IP address element - ACI is 100x times more efficiency with TCAM
Segmentation	- EPGs/uEPG migrations without readdressing - Segmentation regardless of Subnet/VLAN - Sub-leaf PVLAN -> ACI µEPG with IP attribute - Inherited contracts for common services
Automation	- Production Ansible online w/ Rundeck front end - Github / peer review of code - Full factory build completed in 14h - Centralized "global object" DB
L4-7 Inspection	- Selective traffic redirection for DPI as needed - No impact to redirect flows - Security appliance imports EPG endpoints via API
Failure Domain	- Much smaller footprint for impact/failure - ISSU minimizes change windows

What's Next?



Next in Design

- Automate everything
- Remote Leaf for high volume traffic
- SCADA/ICS
- Container integration
- Telemetry / Analytics / Application visibility

Next in Execution

- Accelerating ACI global adoption (ramp/learning)
- Brownfield migration
- Automate everything !

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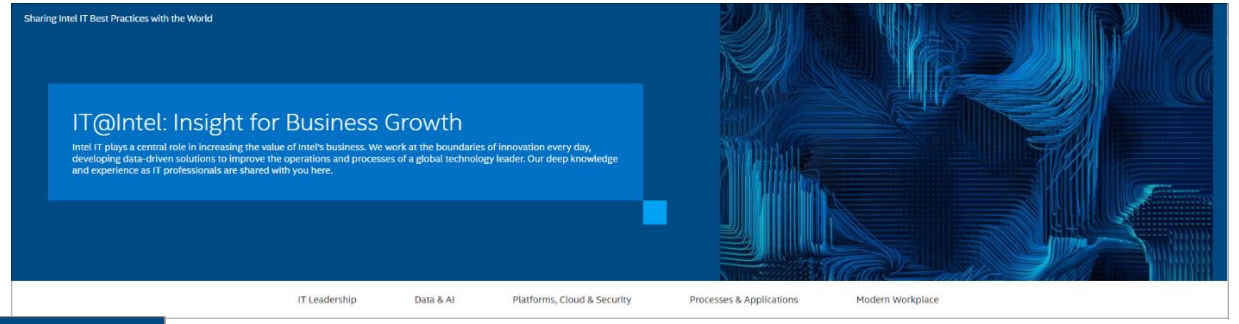
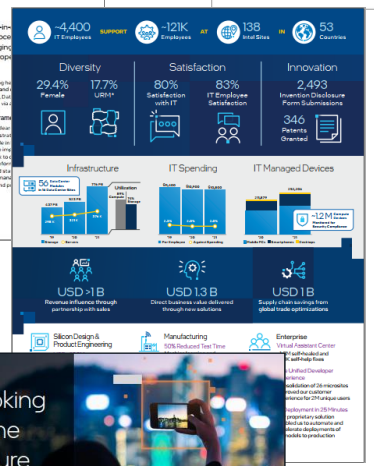
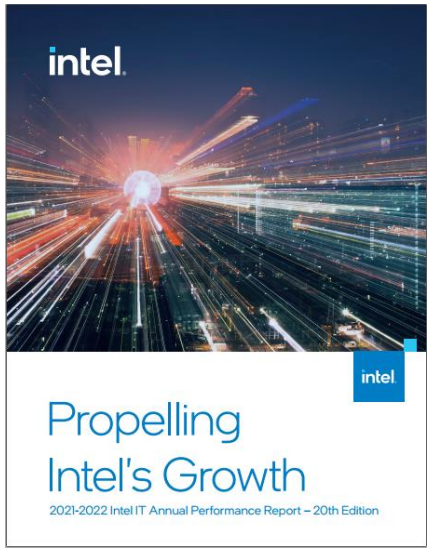
Sharing Intel IT Best Practices with the World







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