



# The Importance of Hardware in a Software-Defined World

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TECHNICAL SOLUTIONS ARCHITECT



# Agenda

- **Importance of Network Innovation and Flexible Hardware**
- **Using Flexible Platforms for Cisco Software-Defined Access**
- **Ethernet Innovation–Faster and Slower**
  - Ethernet Innovation– **2.5 / 5 x Faster**
  - Ethernet Innovation– **10Mb/s - Again**
- **Summary**

# Importance of Network Innovation and Flexible Hardware



You make networking **possible**

# Innovation in the network

“The network is going to  
be more important than  
it has ever been.”

Chuck Robbins  
CEO  
Cisco

*#WednesdayWisdom*



# The Network. Intuitive.

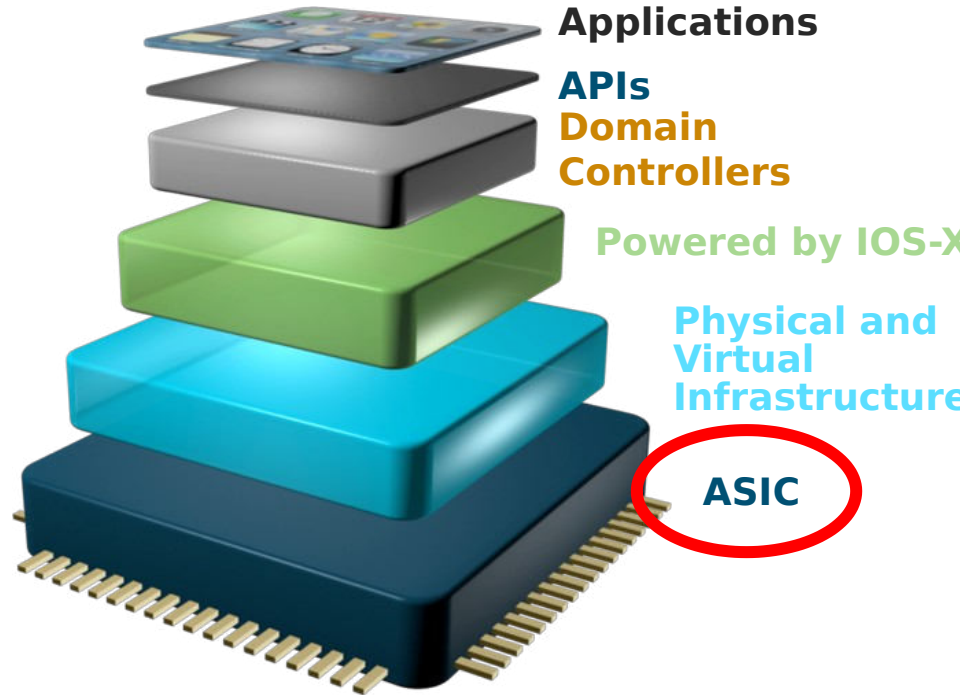
## Principles of Intent-Based Networking

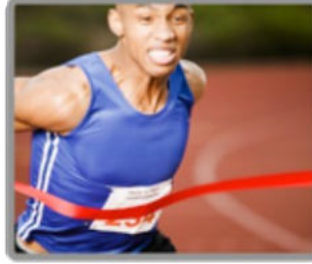


▶ Intent-Based Networking portfolio

▶ Open programmable architecture

▶ Built-in security, streaming telemetry and rich analytics



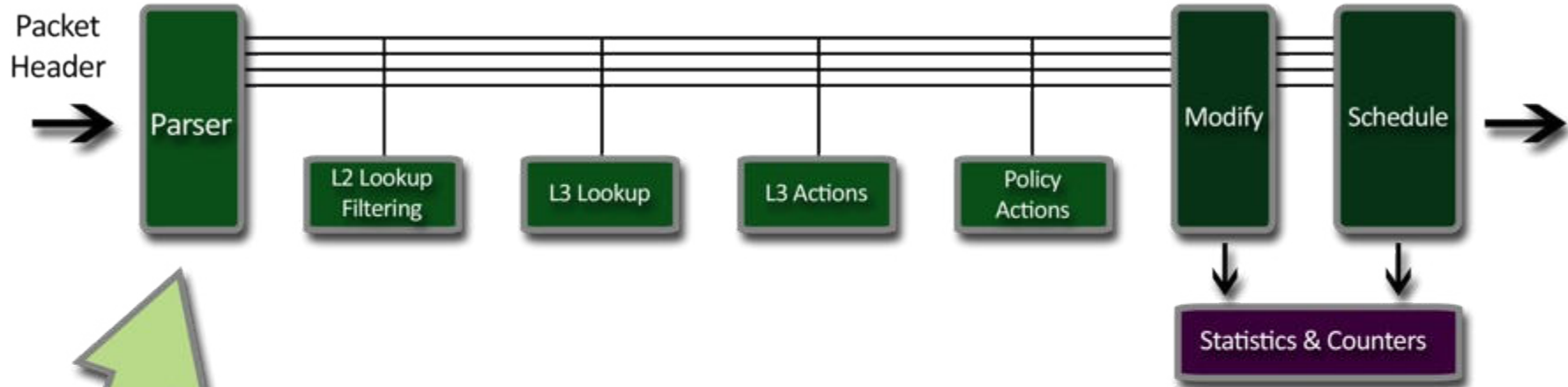


**Why Does  
Cisco Develop  
Our Own Silicon?**



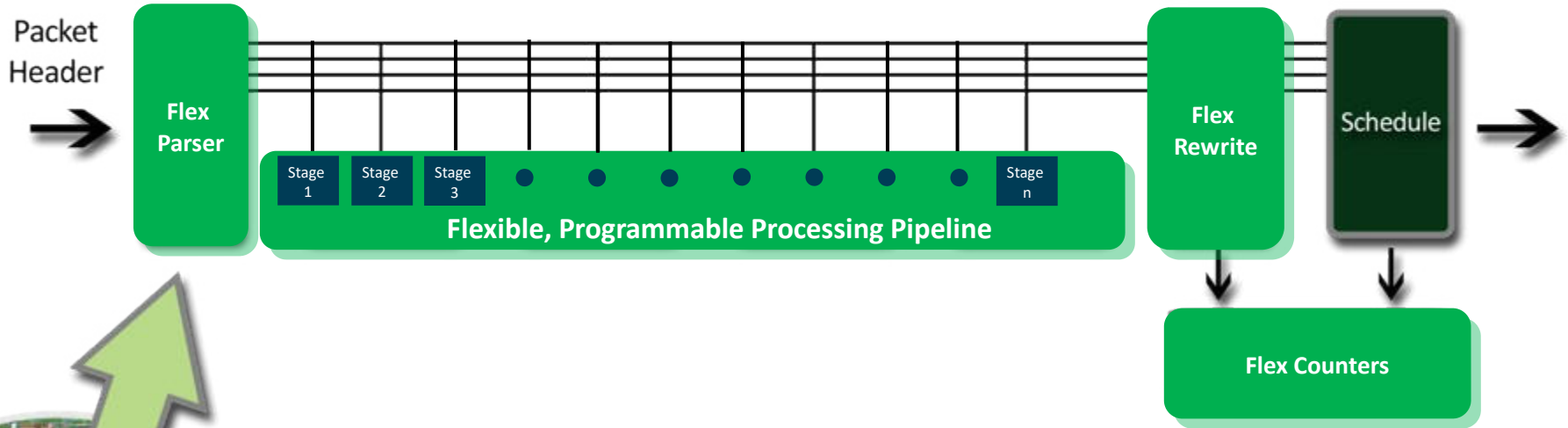
**Simpler Deployment Options**  
**Better Insight and Optimization**  
**Increased Security**  
**Most Appropriate Scalability**  
**Flexibility and Investment Protection**  
*via Programmability*

# Traditional Fixed ASIC Processing Pipeline



Normally the functionality of a networking ASIC pipeline is **FIXED** and has challenges handling **NEW PROTOCOLS ...**

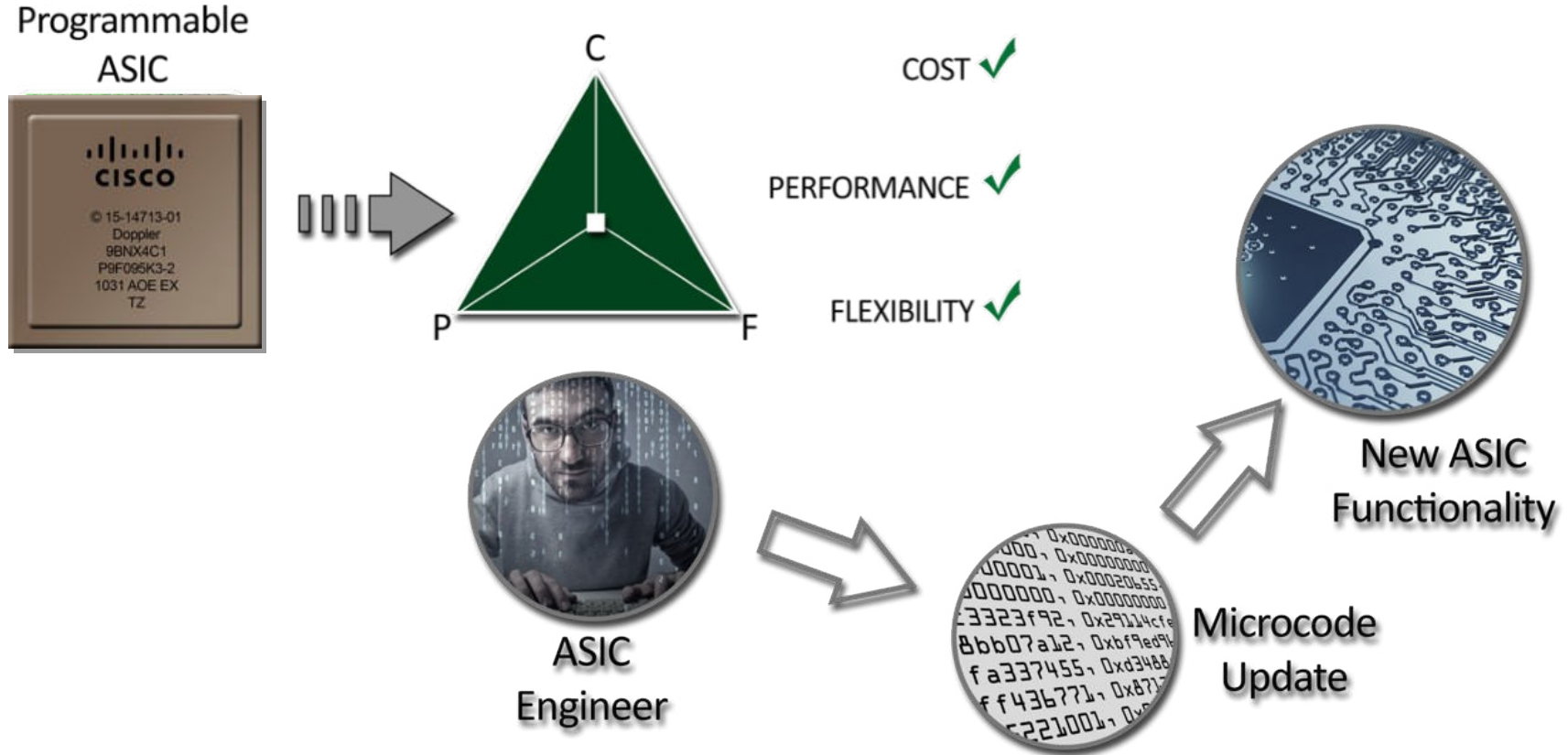
# UADP – Processing Pipeline



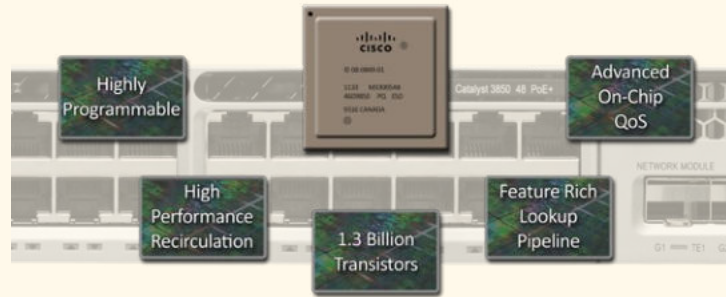
Cisco's UADP ASIC delivers  
**FLEXIBILITY** to evolve with the  
business



# Programmable ASIC Silicon



# Catalyst ASIC Evolution



UNIFIED ACCESS DATA PLANE (UADP)



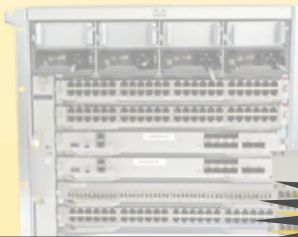
Catalyst 3550  
Circa 2003  
60M transistors  
47,226 lines of code



Catalyst 3750  
Circa 2008  
210M transistors  
86,220 lines of code



Catalyst 3850  
Circa 2013  
UADP 1.0 – 1.3B transistors  
UADP 1.1 – 3.0B transistors  
1,490,000 lines of code



Catalyst 9300 / 9400 /  
9500 – 2017 / 2018

UADP 2.0: **7.46B** transistors  
UADP 3.0 – **19.2B** transistors!  
**2,160,000** lines of code

... and now Catalyst  
9600 / 9200 with  
UADP 3.0 / 2.0 mini!



All Cisco-developed silicon

Driving the benefits of vertical integration –  
Hardware and software working together!

Just like some other famous examples ...

# Catalyst 9K Switches: One ASIC, OS & Licensing

Converged  
ASIC  
UADP  
Family

Converged  
OS  
Open IOS-  
XE

Catalyst 9400

Catalyst 9600



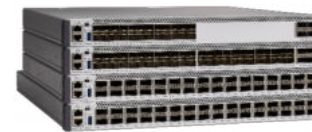
Catalyst 9200



Catalyst 9300



Catalyst 9500



Catalyst 9500 High  
Performance

IOS-XE

Common Software Architecture

UADP Family

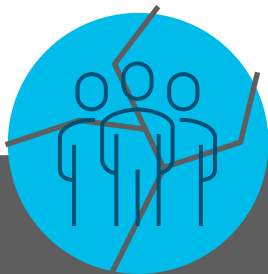
Common Hardware Architecture

# Network Innovation – **Using Flexible Platforms for Cisco Software- Defined Access**



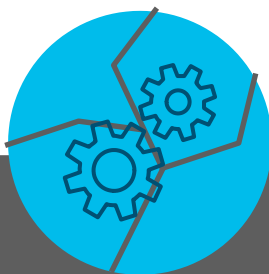
You make networking **possible**

# Key Challenges for Traditional Networks



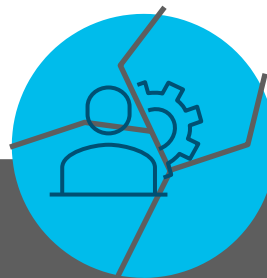
## Secure Onboarding

More users and endpoints  
Policy based on VLANs  
Very hard to Segment



## Complex to Manage

Very little Automation  
Mostly all CLI driven  
Error prone



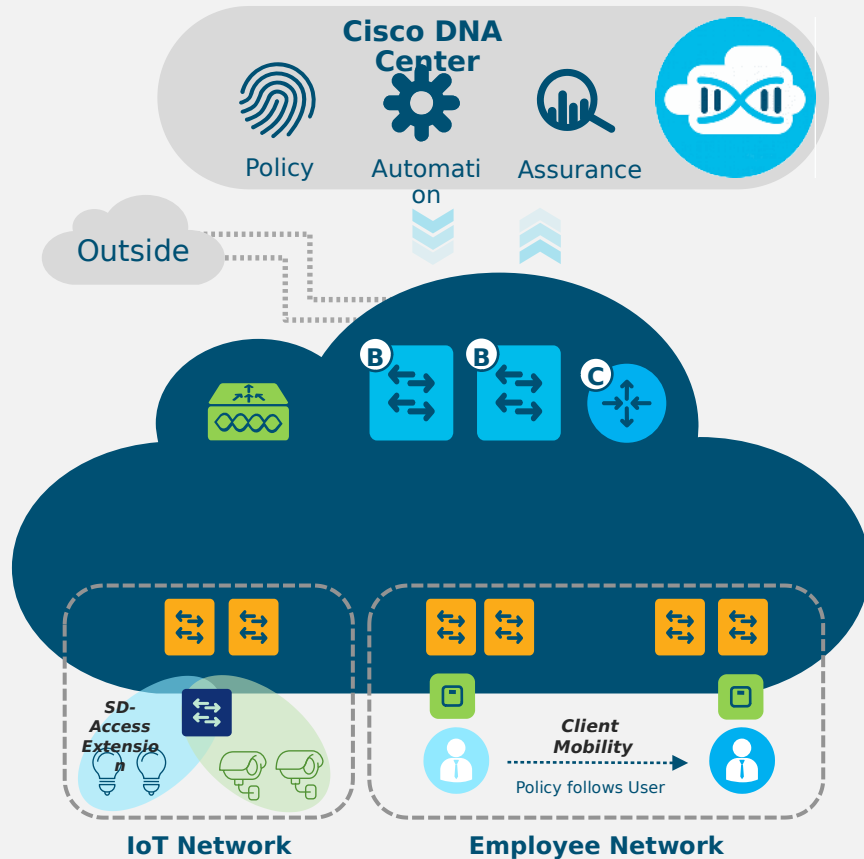
## Slow Issue Resolution

Separated user policies for  
wired and wireless networks  
Different policy definition and  
enforcement points

**Traditional Networks Cannot Keep Up!**

# Cisco Software Defined Access

## The Foundation for Cisco's Intent-Based Network



### One Automated Network Fabric

Single fabric for Wired and Wireless with full automation

### Identity-Based Policy and Segmentation

Policy definition decoupled from VLAN and IP address

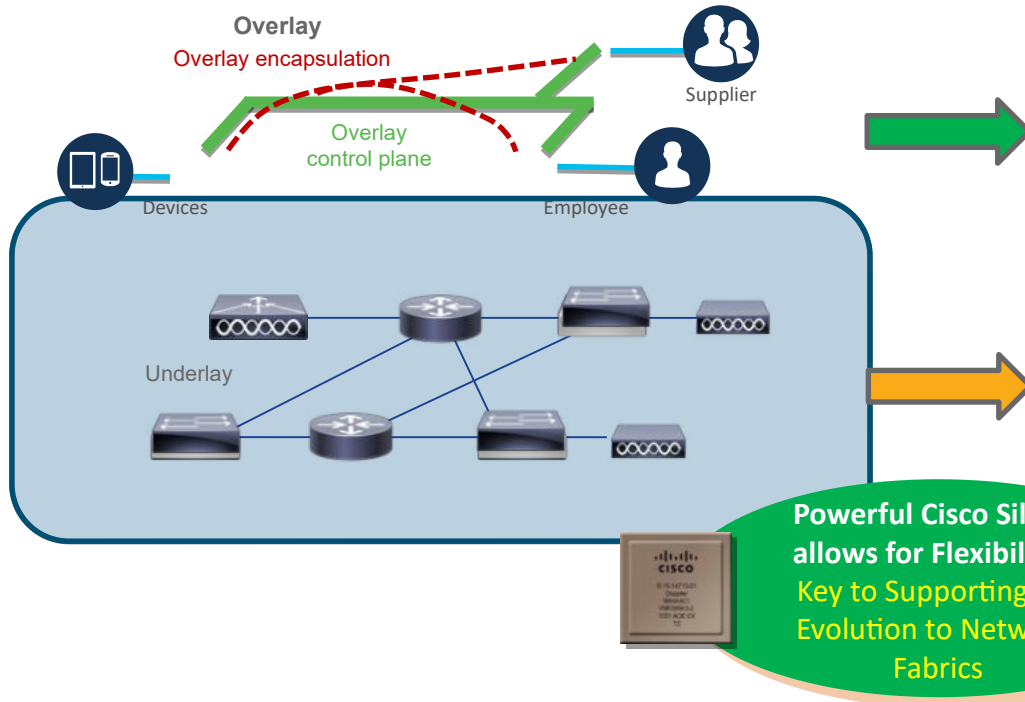
### AI-Driven Insights and Telemetry

Analytics and visibility into User and Application experience

# Cisco DNA Flexible Infrastructure

## Supporting Network Evolution – and **Software-Defined Access**

### Separation of the Forwarding and Services Planes



#### **Fabric Overlay is the Services Plane**

- Connects Users and Devices
- Leverages standard technologies
- **Address Independent End-to-End Policy**

#### **Fabric Underlay is the Forwarding Plane**

- Connects Network Devices
- Leverages existing topologies
- **Simple, best-practice deployment**

# Ethernet Innovation– **Faster and Slower**



You make networking **possible**



# What is Ethernet?



**Ethernet is an innovation brand!**

## **Key Attributes**

**High speed**

**Multiple physical media**

**IEEE 802.3 Standard**

**Interoperability – Plug-n-play**

**Backwards compatibility**

**Source: Bob Metcalfe, Inventor of Ethernet**

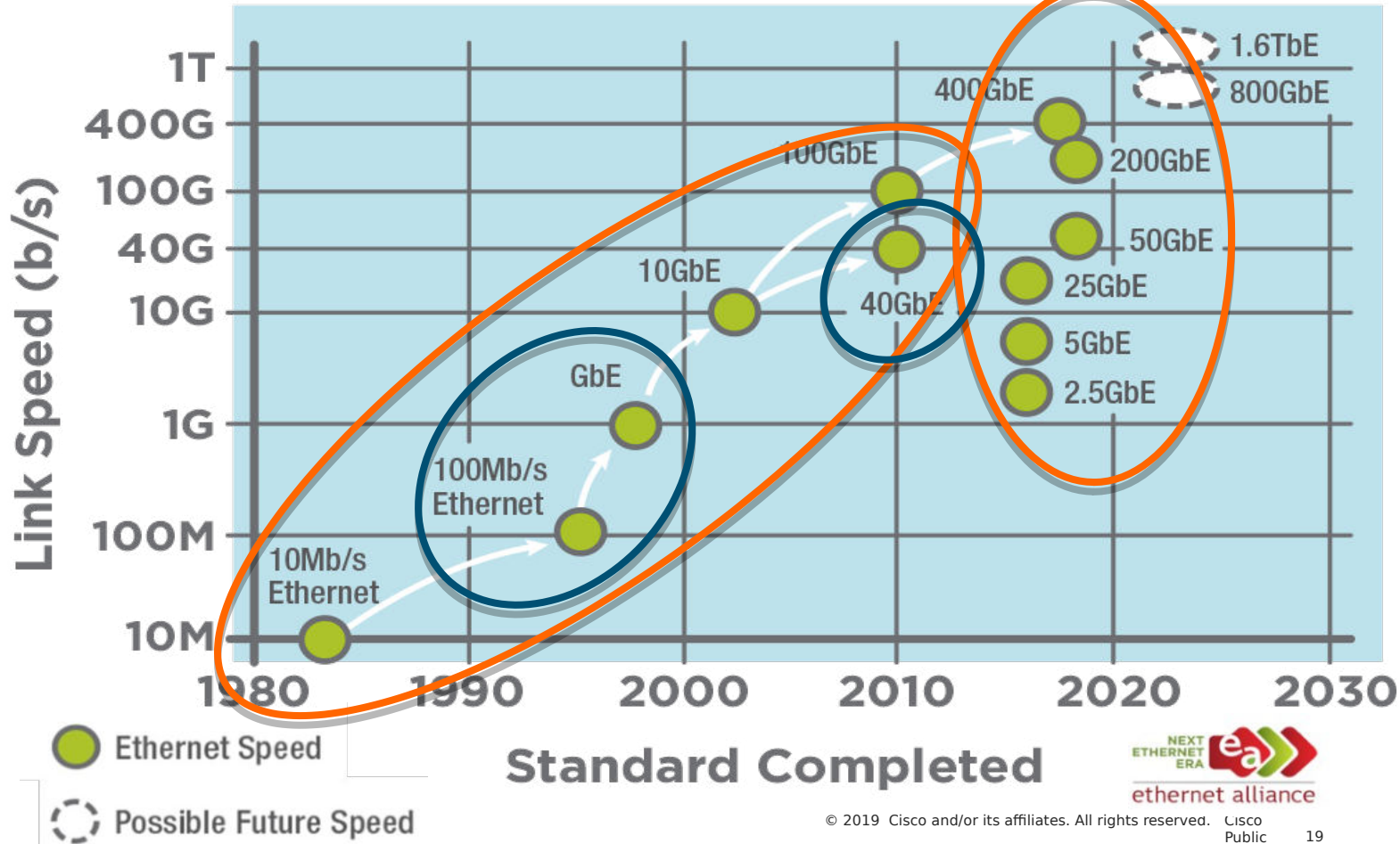
**<http://ethernetalliance.org/tef-2013-the-future-of-ethernet-keynote/>**

# ETHERNET SPEEDS

1980 -  
2016

2016 -  
2018

Not  
2019

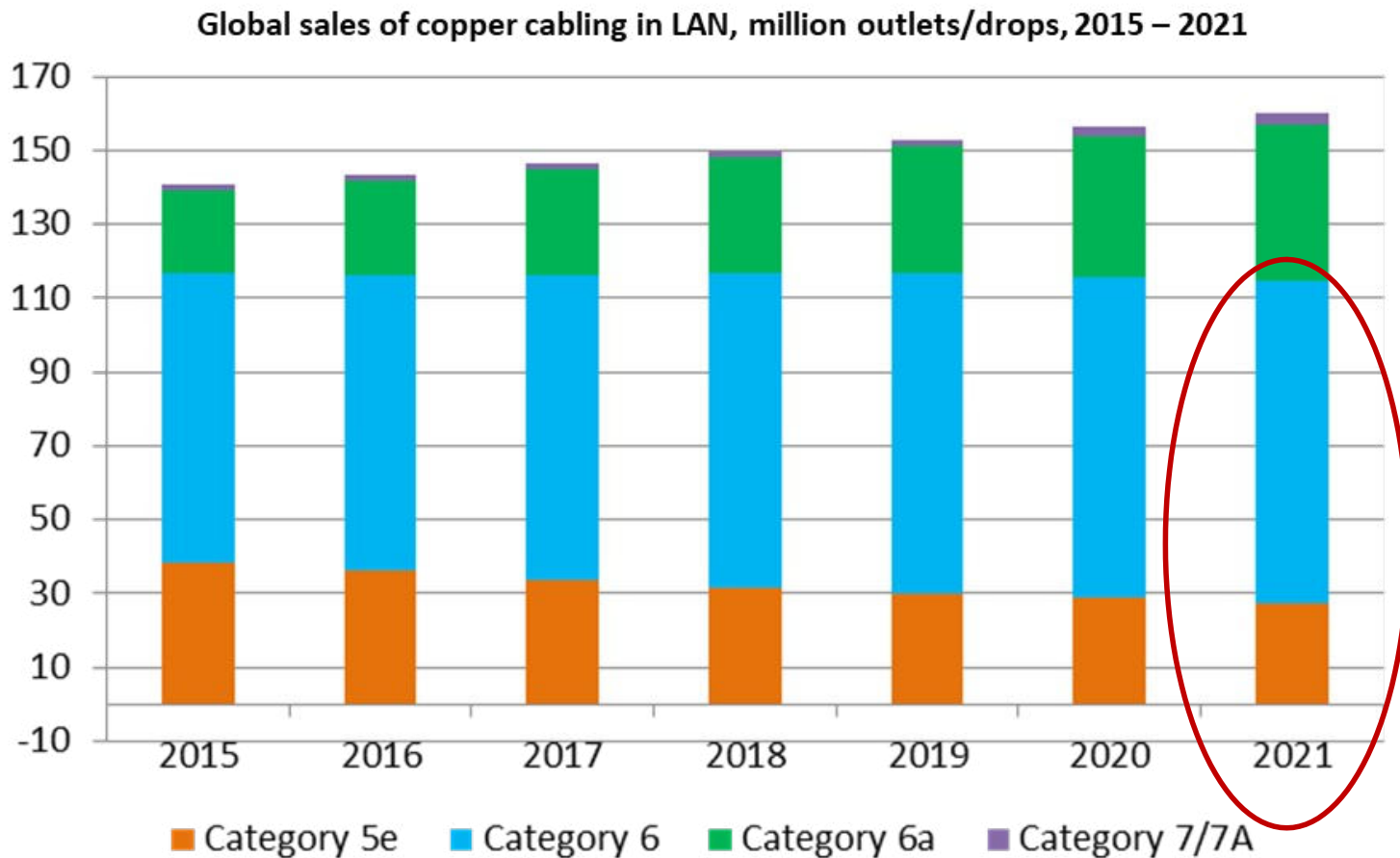


# Ethernet Innovation– **2.5 / 5 x Faster**



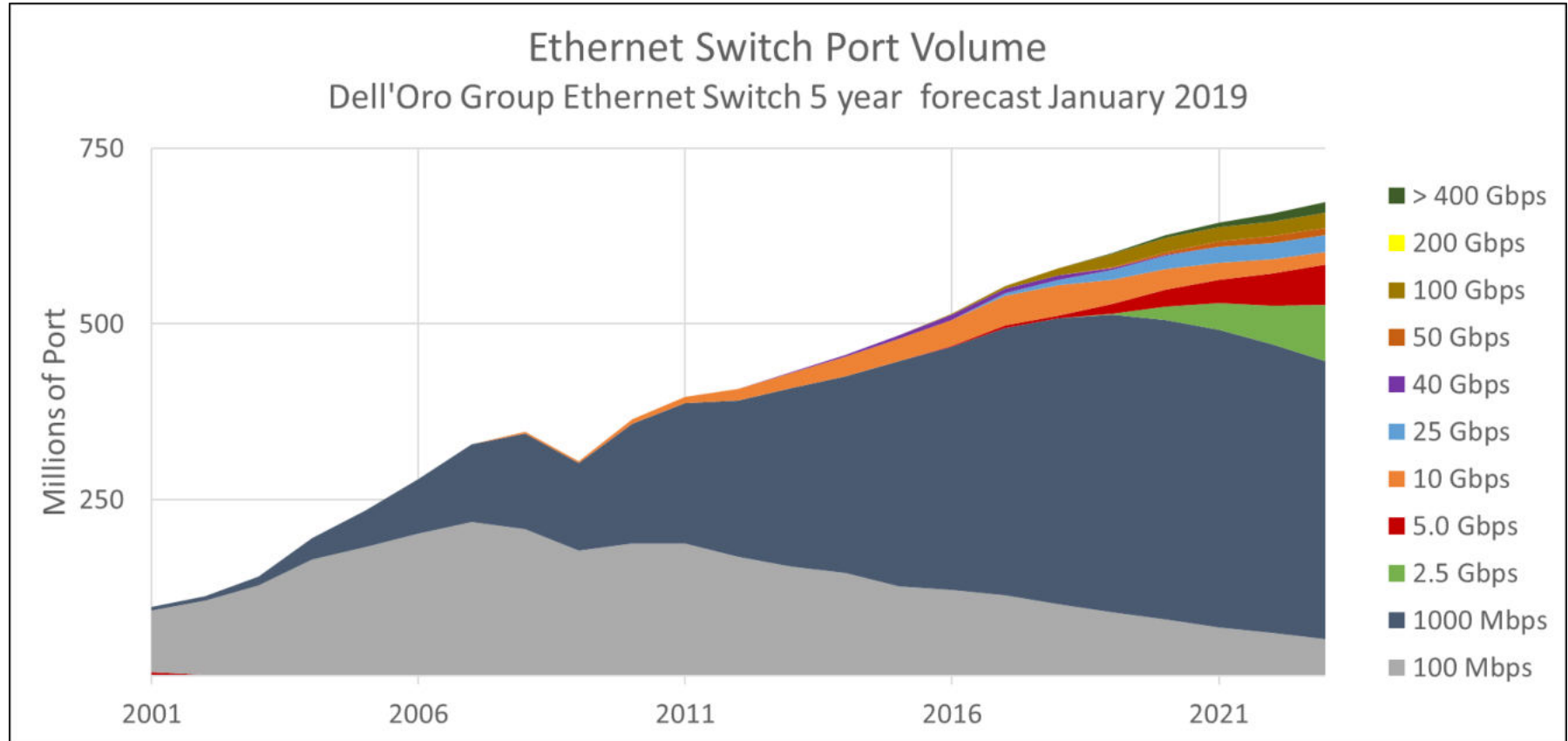
You make networking **possible**

# BASE-T Cabling



Source: BSRIA survey and modelling May 2017

# Ethernet Speed Transitions



# 2.5G/5G BASE-T

IEEE STANDARDS ASSOCIATION

IEEE Standard for Ethernet

Amendment 7: Medium Dependent Sublayer for Physical Layers, and 2.5 Gb/s and 5 Gb/s and 5GBASE-T

IEEE Computer Society

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3 Park Avenue  
New York, NY 10016-5997  
USA

IEEE Std 802.3bz™-2016  
(Amendment to  
IEEE Std 802.3™-2015  
as amended by  
IEEE Std 802.3bw™-2015,  
IEEE Std 802.3by™-2016,  
IEEE Std 802.3bp™-2016,  
IEEE Std 802.3br™-2016, and  
IEEE Std 802.3bn™-2016)

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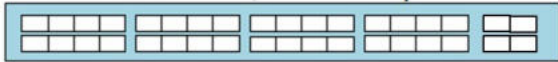
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# Enterprise Switching – Rate Evolution

2014

Distribution



48x10GbE down, 4x40GbE up

Access



48x1000BASE-T down, 4x10GbE up



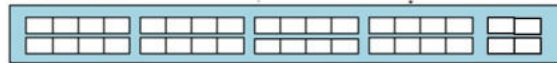
~2017/18

Distribution



48x**25GbE** down, 4x**100GbE** up


Access



48x**2.5GBASE-T** down, 4x**25GbE** up

- 2.5X rate, same network model
- Fits nicely with 802.3bz 2.5G/5GBASE-T

# 25Gb/s SMF Ethernet

IEEE STANDARDS ASSOCIATION 

**IEEE Standard for Ethernet**


**Amendment 11: Physical Layer Parameters for Serial Multi-Lane Ethernet Over Single-Mode Fiber**

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New York, NY 10016-5997  
USA


**IEEE Std 802.3cc™-2017**  
(Amendment to  
IEEE Std 802.3™-2015  
as amended by  
IEEE Std 802.3bw™-2015, IEEE Std 802.3by™-2016,  
IEEE Std 802.3bz™-2016, IEEE Std 802.3bp™-2016,  
IEEE Std 802.3br™-2016, IEEE Std 802.3bn™-2016,  
IEEE Std 802.3br™-2016, IEEE Std 802.3bu™-2016,  
IEEE Std 802.3bw™-2017, IEEE Std 802.3-2015/Cor 1-2017,  
and IEEE Std 802.3bs™-2017)


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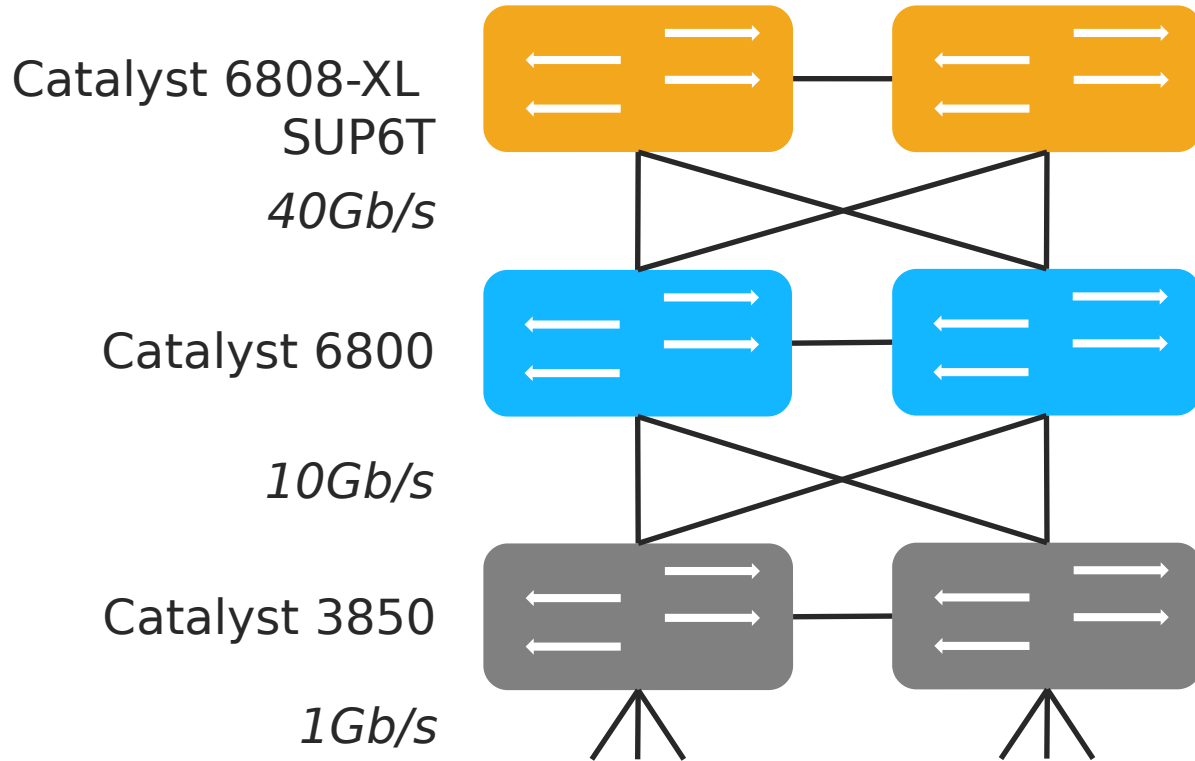
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# 1G / 10G / 40G Campus



# 2.5G / 25G / 100G Campus

## 10/25G transceivers from Cisco



**SFP-10/25G-CSR-S**

- Up to 300m/400m on OM3/OM4
- Dual Rate



**SFP-10/25G-LR-S**

- Up to 10 km on SMF
- Dual Rate

Catalyst 9600

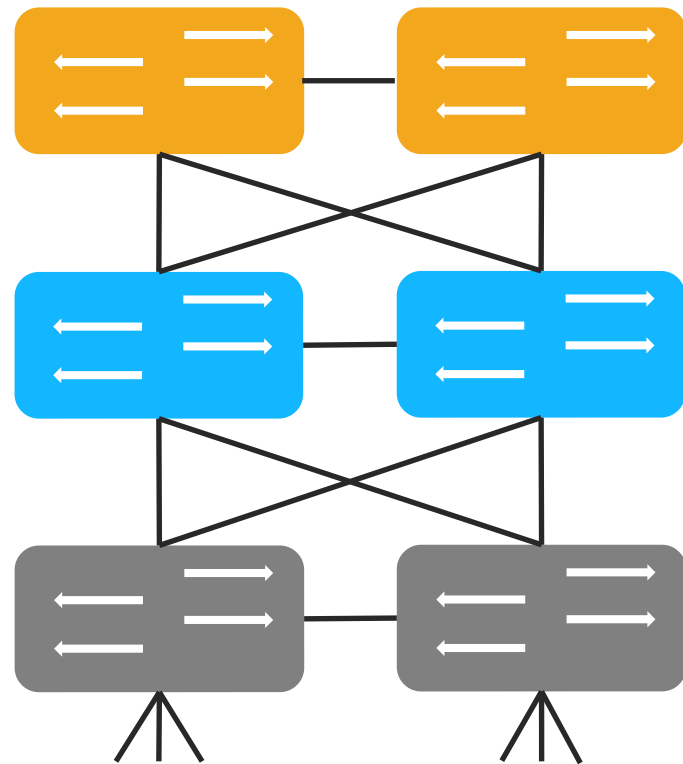
*100Gb/s*

Catalyst 9500

*25Gb/s*

Catalyst 9300

*2.5Gb/s*



# Ethernet Innovation– **10Mb/s - *Again***



You make networking **possible**

# Remember This?

Token Ring Thick Net  
Burroughs Poll/Select  
Hewlett Packard Thin Net  
HDLC VT100 Sperry X.25  
MicroSoft Token Bus  
IBM LU6.2 DEC WANG  
Novell Network AppleTalk TN 3270 RS485  
Novell Apple TD830 Olivetti Decnet  
ISDN Burroughs SNA  
Dial Up UUCP SDLC  
ARCnet RS232  
Banyan Vines



TCP/IP

# Automation

EtherNet/IP

Foundation FieldBus

Mitsubishi Electric

RS232 Yokogawa DALI

Modbus Signify CAN

Schneider Electric

ABB

MOST

FlexRay Endress Hauser

Rockwell Automation

Profibus 4-10mA

PROFINET

Two Wire

FieldComm  
HART  
RS485  
Emerson  
EtherCAT  
IEBUS  
D2B  
Omron  
SCADA  
FDI  
Siemens  
CIP  
Honeywell  
CompoNet  
ControlNet  
DeviceNet  
ODVA  
Pepperl Fuchs  
VAN  
Kone  
DALI  
Signify  
CAN  
Yokogawa  
Mitsubishi Electric  
Foundation FieldBus  
EtherNet/IP



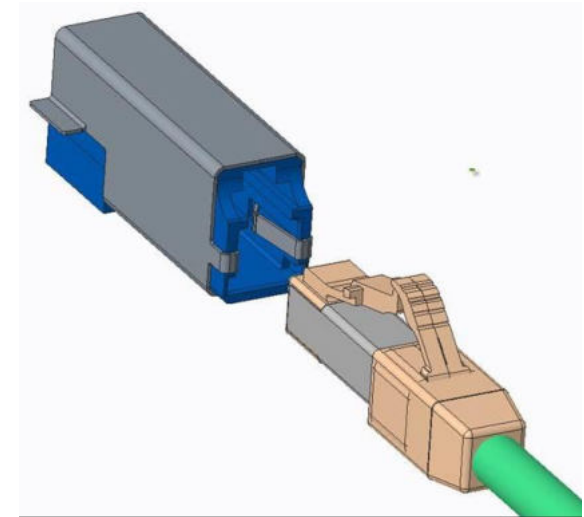
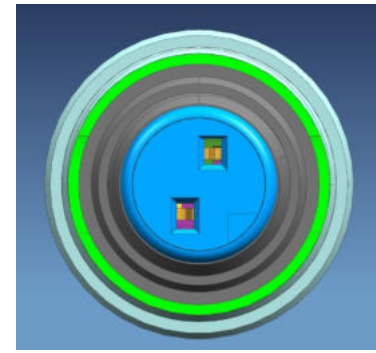
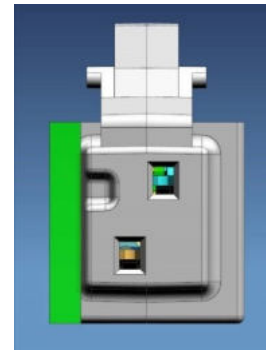
# Example

Panduit World Headquarters  
600,000 feet of 4-pair  
500,000 feet of 1-pair  
What could it have been?



# SPE Overview

- 802.3cg defines 10Mb/s Ethernet over a single balanced pair
- Designed for Building and Industrial Automation
- Key Attributes
  - Power + Data (multidrop power not supported yet)
  - 2 point to point reaches – 15m and 1000m
  - Multidrop – 25m and 8 stations
  - Cable & Cabling Topology Reuse
  - Compact
  - Connectorization
- 802.3cg submitted for publication November 2019, follow-on work in progress



# What can SPE add?

- Simpler installation, operation and trouble shooting
- Higher bandwidth and power delivery enables new functionality
- Cable and cabling topology reuse
- Reduces friction to adopt Ethernet



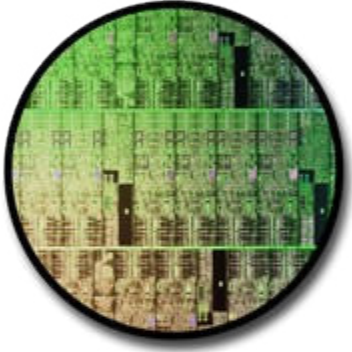


# Summary – **Innovation Access The Network. Intuitive.**



You make networking **possible**

ASICs



*Critical Role of **Flexible Silicon***





Thank you

