

A person in a dark suit is holding a tablet. The tablet screen shows a blue-themed control panel with various gauges, sliders, and buttons. The background is a blurred industrial setting with large white pipes. A dark blue curved banner is at the bottom of the image.

Transforming Businesses with Artificial Intelligence

Executive summary

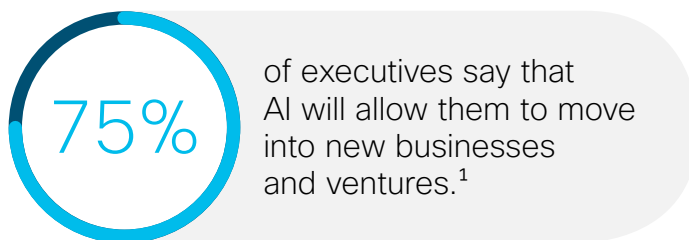
Not so long ago, technology that could learn and solve problems on its own was found only in science fiction. Today, devices with these advanced capabilities are emerging all around us, representing the latest wave of rapid progress. Artificial intelligence (AI) is redefining our way of life, enabling machines to do what people once thought only humans could do. It is also revolutionizing the way we do business.

Businesses need AI and ML so that they can:

- Make their infrastructure intelligent to drive insights and better decisions
- Improve their security posture to secure every endpoint
- Enrich every customer experience to deliver more engaging, personalized products and interaction
- Transform processes and business models to drive efficiency and productivity
- Hire, retain, and empower talent to improve workforce efficiency and engagement

Cisco's leadership position as one of the largest market shareholders in areas such as the network, security, cloud, analytics and collaboration, enables us to approach AI-ML with a holistic perspective toward driving business outcomes. Drawing on our organization's wide visibility of data, Cisco is building AI-ML capabilities across its portfolio of products and solutions in networking, security, data center, cloud, analytics, and collaboration.

In this paper, we will explore how AI will form the foundation of this new world and show how Cisco's products and solutions can help provide advanced intelligence across the value chain.



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What is artificial intelligence and machine learning?

We're entering an exciting new era in technology that is bringing transformative change to the way we live, work, and play. Decades ago, the PC era brought computers and all their capabilities to a wide audience. Then we witnessed the rise of the Internet, which brought more knowledge to people faster than ever before. Next came the rise of mobile and cloud ecosystems, which is putting the Internet in the palm of people's hands, expanding the processing power of their devices, and scaling what they can store to formerly unimaginable levels. Now we are about to move to a new era, which we're calling the era of intelligence.

Imagine a world where every car is connected and communicating with the cars and traffic signals around it to automatically optimize traffic flows using analytics of vehicle volumes and speeds. Or a city where sensors and guides can provide freedom of movement to the visually impaired. Consider the possibilities if every robot in a manufacturing facility were connected and providing data about product volumes for just-in-time ordering of raw materials, and metrics to enable proactive, preventive maintenance to eliminate downtime.

These breakthroughs aren't far off. They will be powered by AI. It's clear that AI is driving powerful transformations across a variety of industries. Machine learning (ML) is a subset of AI and a central enabler of its capabilities.

Artificial intelligence is still a new and amorphous field, but one widely agreed-on definition is "a system capable of rationally solving complex problems or taking appropriate actions to achieve its goals in whatever real-world circumstances it encounters."² In short, it's a computer that can solve problems without direct assistance from a person.

There are two essential kinds of problems AI can solve. The first involves scenarios where theoretical modeling can be applied to approximate and predict behavior. The second focuses on problems where diligent parametric observation provides enough data to fit a mathematical formula. The first type of problem, known as knowledge engineering, involves coders and experts who team up to explicitly program human expertise into a computer so it can act independently. The second scenario, machine learning, focuses on training algorithms—often called learners—to discover their own problem-solving methods with massive amounts of data.



AI and ML is redefining businesses

Companies in every vertical are employing AI and ML to unleash a variety of benefits. Let's take a closer look at how AI and ML is transforming businesses.

Digital production assistants build cars of tomorrow

Automobile manufacturer BMW is harnessing the potential of AI in innovative automation and flexible assistance systems in production. At its factory in Leipzig, Germany, lightweight robots work directly on the production line together with the human workforce. Their versatility, modest space requirements, and high level of safety grant people access to areas that used to be off limits to everyone except robots.³

BMW is also applying AI to support the driverless cars of the future. It has stated that its aim is for its vehicles to achieve full "level 5" autonomy by 2021. Level 5 autonomy tops the scale defined by the U.S. Department of Transportation. It indicates that a vehicle will be capable of driving with no human input or supervision and operate at least as effectively as a human driver—in any conditions and on any road.⁴

Intelligent production management systems boost uptime

Procter & Gamble, which operates 130 plants worldwide, has had success integrating AI and other smart factory technologies into its manufacturing operations. The tools have helped the company cut unplanned downtime by 10 to 20 percent.⁵

"There's nothing for us that could be more strategic to the company than to really drive better efficiencies and a better end-to-end operation in our supply chain," said Jim Fortner, P&G's vice president for information technology and services.

Maximizing supply chain efficiency is a powerful benefit not only for P&G, but manufacturers in all industries. The market for smart manufacturing tools is expected to hit \$250 billion by the end of 2018, according to research company TrendForce.

Hedge funds redefine trading

Financial services players have access to rich sources of data. To make the most of it, today's data-centric hedge funds increasingly rely on AI to support innovative new trading engine models. For example, Hong Kong's Aidya identifies and executes trades entirely on its own, drawing on multiple forms of AI, including one inspired by genetic evolution and another based on probabilistic logic.

Each day, after analyzing everything from market prices and volumes to macroeconomic data and corporate accounting documents, these AI engines make their own market predictions and then "vote" on the best course of action.⁶



What is motivating the emergence of AI and ML?

AI and ML have rapidly progressed over the past few years. According to Forbes, 2017 marked a period of meteoric rise of this technology.⁷ ML in particular is playing a prominent role in digital transformation for several reasons, such as the falling cost of data storage. Commodity hardware, the spread of open-source technology such as Hadoop, and the growth of the cloud are making it very cheap to store data, resulting in the rise of big data. Much of this data provides excellent training material for learners and is being packaged for easy use in resources such as ImageNet and data.gov.

In the past, training an ML system was often too computationally expensive. Fortunately, improved CPUs, GPUs, and cloud computing have massively reduced the price of compute power. Mathematical advances have also made training neural networks easier and more effective.

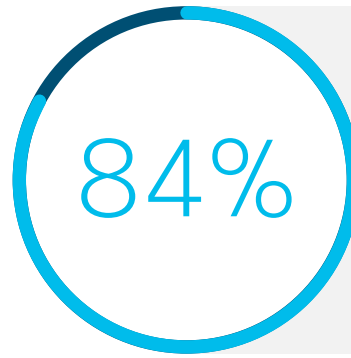
A public-private ecosystem including universities, companies, and government has also encouraged rapid progress in the field. The combination of these trends has created a prime environment for the growth of machine learning.



Why do you need AI and ML?

Data is the lifeblood of business. It helps drive insights and better decisions; improve processes; and offer a deeper understanding of customers, partners, and business. AI and ML enables us to learn from data, identify patterns, and make smarter decisions that augment human capabilities. This capability empowers organizations with new ways to grow revenue, attract and retain customers, and become more operationally efficient. AI and ML can help automate tasks and accelerate untapped insight in previously unexplored areas.

Together, AI and ML enable you to:



of executives say AI will enable them to obtain or sustain a competitive advantage.⁸

Make your infrastructure intelligent

In this increasingly connected world, data is more important than ever, and more organizations are looking to unlock its full value using contextual awareness of apps, users, threats, and location. They need predictive and prescriptive insights to respond to market changes faster. They are seeking more adaptive processes and technologies to understand their customers and business processes better. These priorities all require an intelligent infrastructure.

One of the main values of artificial intelligence is its ability to unlock in-depth insights and intelligence from your organization and your business processes. When you gather data from the people, processes, and things that reside on your network and analyze that data by looking at patterns, you can better identify emerging customer needs, uncover trends, and innovate faster than your competitors. The more data you can collect and analyze, the more opportunities will open up for you.



By 2020, insights-driven businesses will steal

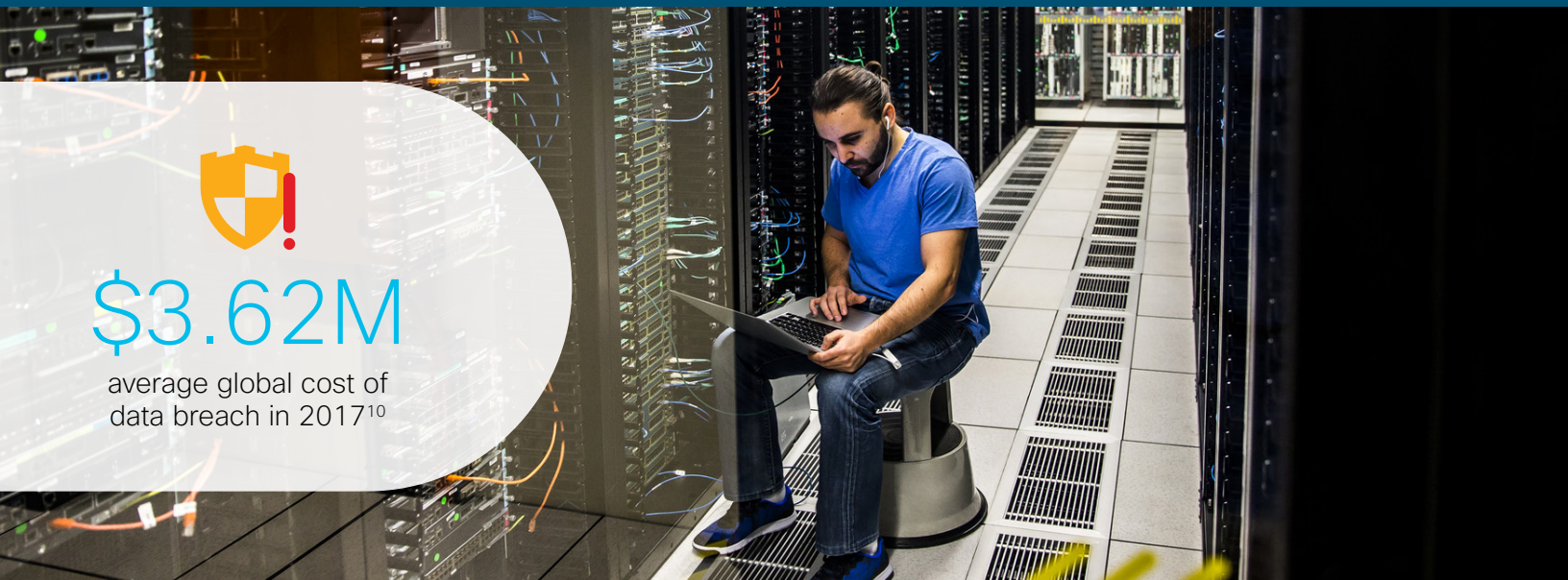
\$1.2T

per annum from their less-informed peers⁹

Improve your security posture

Security is a fundamental part of every digital business transformation strategy. The threat landscape is changing fast, as the growth in connected devices creates exponentially more targets, and attacks become more sophisticated. As the IoT continues to mature, your potential exposure to threats is growing as well.

Organizations are already beginning to use AI to bolster security and offer more protection against sophisticated hackers. AI helps by automating complex processes for detecting attacks and reacting to breaches. These applications are becoming more and more sophisticated as AI is deployed for security.



Improve customer experience

In a world of always-on digital services at your fingertips, customers have much higher expectations of the organizations they do business with. While product and cost leadership strategies have been used to great effect in the past to outsmart competition, the quicker pace of innovation and outsourcing have made them easy to duplicate. Capturing the customer's unwavering loyalty by providing a delightful experience has become the primary factor in winning and retaining business, and maintaining credible, sustained differentiation.

Chatbots answer customer's questions and directs them to the right area using AI. AI has also improved natural language interfaces and made it easy for the customer to speak to an Interactive Voice Response (IVR) system. Every customer is different, and AI helps firms understand their distinct needs and preferences, and provide a personalized experience.



8 out of 10

businesses have already implemented or are planning to adopt AI as a customer service solution by 2020¹¹

Transform processes and business models

As more and more devices get connected, companies have the potential to access and collect data from every extremity of their value chains. This creates the potential for new ways of doing business and the ability to disruptively transform existing processes and business models. The result is faster time-to-market, leaner operations, and greater agility to respond to market changes.

Machine vision is one of the applications of AI. Devising cameras many times more sensitive than the human eye is impressive, but it's actually the easy part of this technology. What AI adds is the increasingly useful ability to make sense of the images. AI is also increasingly important in predictive maintenance for equipment, with sensors tracking operating conditions and performance of factory tooling, learning to predict breakdowns and malfunctions, and taking or recommending preemptive actions.



By 2035, AI technologies are projected to increase business productivity by up to¹²

40%

Hire, retain, and empower talent

Today's workforce is multi-generational, with each group having unique motivations, values, and workstyles. Workers want to be more engaged, empowered, and inspired at work. They tend to be more emotionally invested and focused on creating value every day. And they're looking for companies that provide the tools and culture to allow them to be more productive and responsive.

AI can help HR to hire and retain talent, make processes more efficient, and provide better employee experience. It can predict and shape HR performance. AI can also create interactive tests and assessments to match test takers' personal learning styles and engagement levels. It can also make information delivery to the employee extremely customizable.

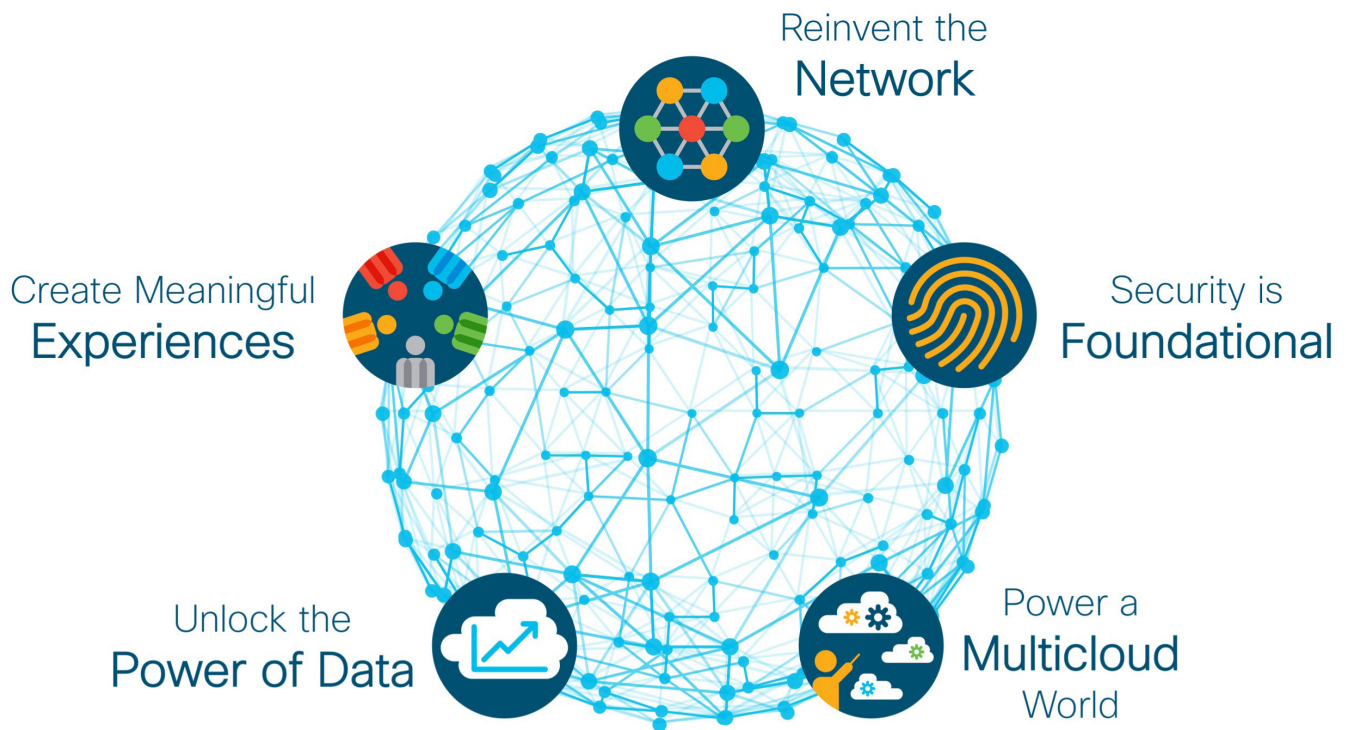


95%

of recruiters believe AI can greatly enhance talent acquisition and retention¹³

Cisco drives AI and ML innovation

Cisco's leadership position by virtue of being one of the largest market share holders in B2B areas such as the network, security, cloud, analytics and collaboration, enables us to approach AI-ML in a holistic perspective toward driving business outcomes. Drawing on this wide visibility of data, Cisco is helping customers reinvent their network, make security foundational, power a multi-cloud world, unlock the power of data and create meaningful experiences by harnessing the power of AI and ML.



Reinvent the network

Cisco is reinventing networking with the network intuitive. Cisco employs ML to analyze huge amounts of network data, from telemetry to traffic patterns, and understand anomalies as well as optimal network configurations. Ultimately, Cisco will enable an intent-based, self-driving, self-healing network. The network will redirect traffic on its own and heal itself from internal shocks, such as device malfunctions, and external shocks, such as cyberattacks.

Digital Network Architecture (Cisco DNA™) Center

Cisco DNA Center is a centralized management application. It includes ML software that observes the configuration, telemetry, and traffic patterns of WAN deployments and recommends optimization and security measures based on them. Cisco DNA Center simplifies network management, uses automation to lower OpEx, uses assurance and analytics to improve network performance, and enhances security to reduce risk. It lets organizations predict performance through ML to correlate user, device, and application data for contextual business and operational insights.

Encrypted Traffic Analytics

Cisco Encrypted Traffic Analytics is a form of advanced threat analytics designed to detect and analyze encrypted traffic and threats without using decryption. It is a new technology that uses data available from Cisco's latest networking gear and advanced analytics, including machine learning. It is a network-based security solution that monitors encrypted traffic flows on the network. By modeling the pattern of encrypted communication, it identifies activity indicative of ransomware attacks, advanced persistent threats, malware infections, illicit crypto-mining, and other threats.

Application Centric Infrastructure (ACI)

Cisco ACI, the industry leading software defined networking (SDN) solution enables application agility and data center automation. Customers can build multi-cloud networks with a consistent policy model. With ACI Anywhere, customers have the flexibility to move applications seamlessly without compromising high availability and creating a single fault domain environment.



Make security foundational

To help safeguard organizations in a constantly changing threat landscape, Cisco is using AI and ML to support comprehensive, automated, coordinated responses between various security components.

Cisco Umbrella™

To secure the business running on the network and multi-cloud environment, Cisco utilizes machine learning to automatically identify and contain threats. Cisco Umbrella is our cloud security platform for the network. Our unparalleled machine intelligence enables us to uncover malicious domains, IPs, and URLs before they're even used in attacks. Then, we use the power of fleet learning to convert the discovery of a malicious agent on one network to blacklist it on all Cisco Umbrella customers.

Talos™

Talos is the Cisco threat intelligence organization, an elite group of security experts devoted to providing superior protection for our customers, products, and services. Its detection research provides vulnerability and malware analysis that helps enhance all Cisco security products. Threat intelligence correlates and tracks threats, enabling Cisco to turn attribution information into actionable threat intelligence, to protect our customers quickly and effectively.

Cloudlock®

Cisco Cloudlock is the cloud-native cloud access security broker (CASB) that helps accelerate use of the cloud. Cisco Cloudlock secures cloud users, data, and apps, combating account compromises, data breaches, and cloud app ecosystem risks, while facilitating compliance through a simple, open, and automated API-driven approach. Cloudlock employs advanced ML to detect anomalies in IT environments across SaaS, PaaS, IPaaS, and IDaaS by adaptively learning user behavior.

Cognitive Threat Analytics

Cognitive Threat Analytics is a cloud-based product that uses machine learning and statistical modeling of networks. It creates a baseline of the traffic in your network and identifies anomalies. The product also analyzes user and device behavior, and web traffic, to discover command-and-control communications, data exfiltration, and potentially unwanted applications operating in your infrastructure.

Cisco Stealthwatch®

Stealthwatch applies intelligence across the network, data center, and cloud. It uses machine learning to discover advanced threats and malicious communications. The machine learning engine processes massive amounts of data in near real time to discover critical incidents with high confidence, and can suggest clear courses of actions to remediate quickly. Stealthwatch employs multiple layers of processing, where a combination of techniques from artificial intelligence, machine learning, and mathematical statistics helps the network to self-learn its normal activity so it can identify malicious activity.

Cisco Advanced Malware Protection (AMP)

Cisco AMP is built on unmatched collective security intelligence. This intelligence is collected from Cisco Security Intelligence Operations and the Sourcefire Vulnerability Research team, then pushed from the cloud to the AMP client so that the user always has the latest threat intelligence. Its ML engine applies heuristic approaches to detecting malicious software. The solution identifies broad classes of threats based on generic characteristics rather than pinpointing a single threat.



Power a multi-cloud world

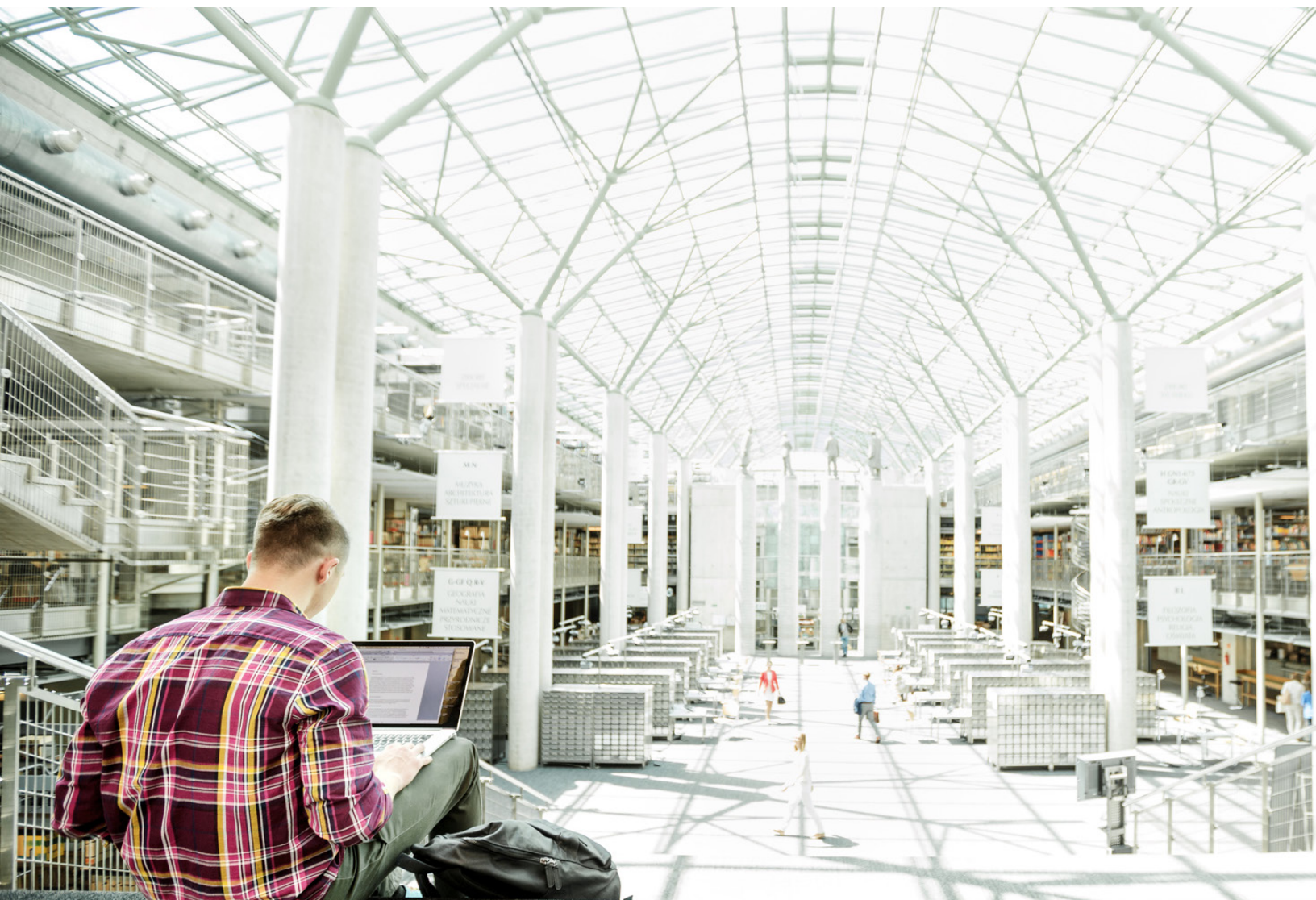
With the help of machine learning, Cisco is learning and analyzing network traffic patterns by collecting data from various sites. It is offering recommendations to deliver a single user experience across clouds, including one policy and one instance of security.

Cisco Intersight™

Intersight™ enables transparency and management in all of an organization's data centers from a central source. It combines the simplicity of SaaS with actionable intelligence. The Intersight recommendation engine provides actionable intelligence for IT operations management. Insights are driven by analytics and machine learning that enable a new level of systems management. Intersight is a new advancement in ITOM tools. Its ML capabilities also offer proactive guidance to secure and optimize the data center and identify possible points of failure so they can be corrected before issues occur.

Cisco UCS and HyperFlex Servers

Cisco UCS helps change the way IT organizations do business. It combines industry-standard, x86-architecture servers with networking and storage access into a single unified system. UCS brings increased productivity, reduced total cost of ownership, and scalability into your data center. Cisco HyperFlex enables multi-cloud IT with an adaptive platform that powers any application anywhere with the simplicity of hyper-converged infrastructure. We have UCS and HyperFlex systems that support AI-ML workloads that are very data intensive.



Unlock the power of data

Cisco is focused on delivering insight and recommendations at the network layer, the data center layer, and the application layer to optimize for latency, reliability, power, and operating expense. Our next goal is full auto tuning that will make sure of fast movement of data across the network, using the fewest possible resources.

DNA Analytics and Assurance

DNA Analytics and Assurance provides contextual insights across users, devices and applications. It assures network performance by using advanced correlation and ML algorithms to analyze data, identify outliers and provides recommendation, driven by 30 years of Cisco domain expertise and constantly evolving best practices, on identified issues.

Tetration Analytics™

Cisco Tetration is designed to address security and operational challenges for a multi-cloud data center. It uses machine-learning, behavior analysis, and algorithmic approaches to offer a holistic workload-protection strategy and network-performance insights. This approach allows customers to gain application insights, auto generate whitelist policy and enforce a consistent policy to enable zero-trust model. The platform also tracks process-behavior deviations, identify software vulnerabilities in a multi-cloud infrastructure allowing you to reduce attack surface and identify indicators of compromise much faster.

Network Assurance Engine

Network Assurance Engine (NAE) transforms operations in data center networks to a fundamentally more proactive model. Built on Cisco's patented network verification technology, it is the most comprehensive assurance engine that mathematically verifies the entire network for correctness, giving operators confidence that their network is always operating consistent with intent.

AppDynamics

AppDynamics monitors applications and discovers and baselines end-to-end business transactions so IT teams can instantly identify and remediate performance bottlenecks that could affect the business. It uses machine learning to deliver contextual insights about application and business health, predicts performance deviations, and alerts before impact.

Kinetic

Cisco Kinetic platform helps to extract, compute, and move data from your connected things to various applications. The data produced by all your things is a high-value asset that can change the trajectory of your business—if you can make full use of it. But that can be challenging when you're working with disparate things and a variety of applications that may live in edge or fog nodes, your data center, private clouds and/or public clouds. Cisco Kinetic makes it easy to connect distributed devices ("things") to the network—then extract, normalize, and securely move data from those devices to distributed applications.



Create meaningful experiences

Cisco is using AI in our products as well as our internal operations to improve employee and customer experiences. Our initiatives focus on making our collaboration products and solutions simple, automated, and intuitive.

MindMeld

At Cisco, we are calling our ML-enhanced collaboration experience Cognitive Collaboration. It features two primary components: bots and computer vision. Cisco customer-facing bots are built on the MindMeld technology. MindMeld ML algorithms enable complex, human-like natural language search and navigation. They support dynamic user flows and dialogues for conversational UI, as well as voice assistants. These tools can be used for food ordering, music or video discovery, or even travel booking. Cisco ML algorithms are also in the process of being integrated into Cisco video conferencing products.

Webex Endpoints

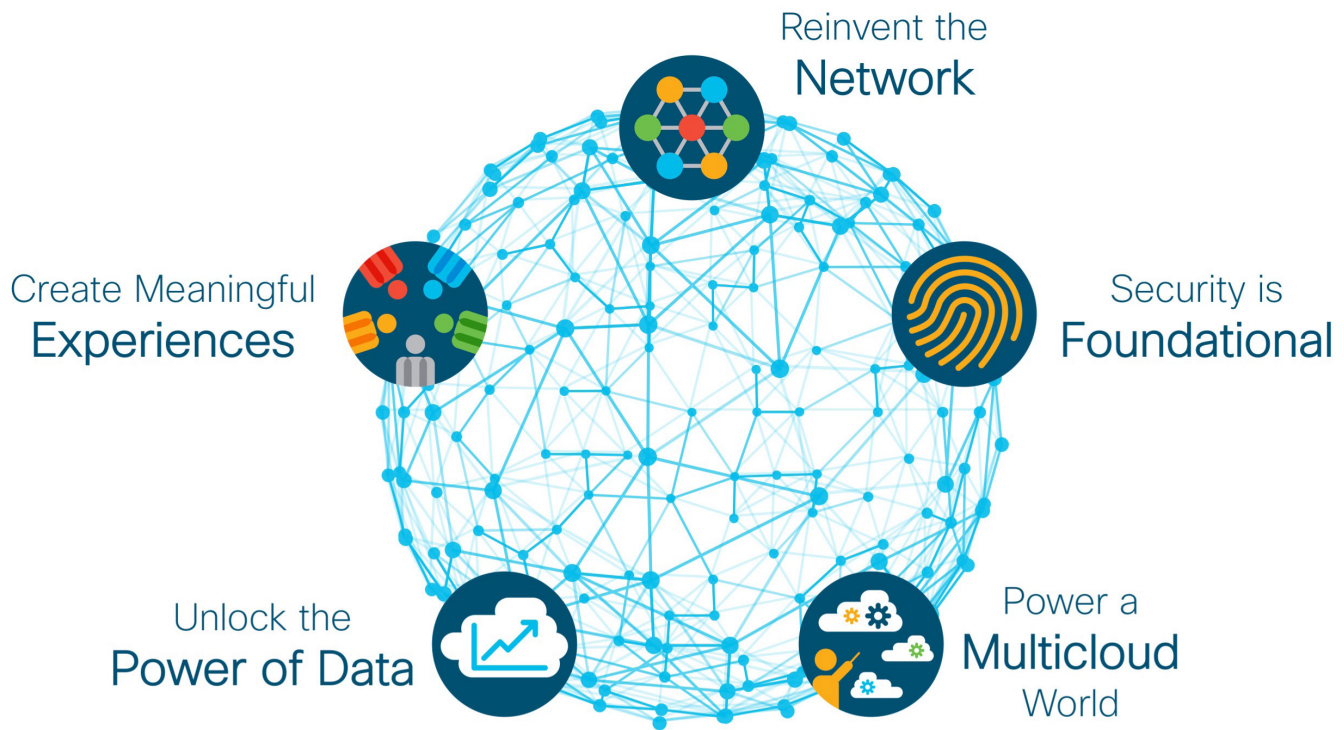
The Cisco vision for Webex Teams and Webex Boards includes a variety of AI and ML enhancements. For example, Cisco is making the bot chat assistant more intelligent, so interactions can be automated and predicted. Cisco is also enhancing Webex Teams with a customer care bot to predict and solve customer issues easily and quickly. Additional enhancements include AI capabilities such as automatic detection of people in the room for intelligent camera framing, voice recognition to place calls using voice commands, and face recognition to identify meeting attendees.



Start your transformation with AI

As the new era of intelligence takes shape all around us, the possibilities are endless for organizations to apply AI and take their business processes to the next level. Cisco's products and solutions can help you deploy advance intelligence across your value chain to make your infrastructure intelligent, improve your security posture, enrich your customer's experience, transform your processes and business models and hire, retain, and empower talent.

To start your transformation and learn more about how to harness the power of AI-ML visit:
www.cisco.com/go/intelligence.



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