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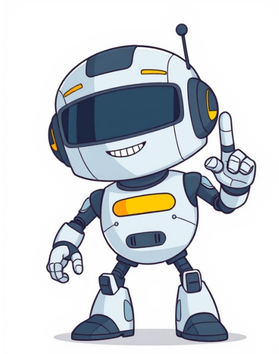

La transformacin digital es una iniciativa de estrategia empresarial que incorpora la tecnologa digital en todas las reas de una organizacin. Evala y moderniza los procesos, productos, operaciones y pila tecnolgica de una organizacin para permitir una innovacin continua, rpida y orientada al cliente. Hoy en da, los clientes esperan poder hacer sus negocios, realizar su trabajo y vivir sus vidas utilizando los ltimos avances en tecnologa. Esperan esta capacidad dondequiera que estn y cuando quieran, utilizando el dispositivo de su eleccin y con toda la informacin de apoyo y el contenido personalizado que necesitan al alcance de la mano. El objetivo definitivo de la transformacin digital es cumplir con estas expectativas.La implementacin de la transformacin digital de cada organizacin es diferente. Puede comenzar con un nico proyecto tecnolgico focalizado o como una iniciativa global para toda la empresa. Puede ir desde la integracin de tecnologa digital y soluciones digitales en procesos y productos existentes, hasta la reinvencin de procesos y productos o la creacin de flujos de ingresos completamente nuevos mediante el uso de tecnologas an emergentes.Pero los expertos coinciden en que la transformacin digital se basa tanto en latransformacin empresarialy en la gestin de los cambios como en la sustitucin de procesos analgicos o la modernizacin de las TI existentes. Aunque a menudo est dirigido por el director de sistemas de informacin (CIO) de una empresa, requiere que todo el equipo directivo se alinee con las nuevas tecnologas y metodologas basadas en datos que pueden mejorar la experiencia del cliente, capacitar a los empleados y alcanzar los objetivos empresariales.Pero lo ms importante es que las empresas deben crear un marco de transformacin digital y supervisar las mejoras mediante el seguimiento de indicadores clave de rendimiento (KPI) para comprobar si el trabajo produce resultados. Los primeros ejemplos de transformacin digital que llegaron a los titulares (Uber, AirBnB, Netflix) utilizaron tecnologas mviles y decloud computingpara redisear las transacciones y, a veces, revolucionar sectores enteros. La pandemia del COVID-19 impuls innovaciones transformadoras para apoyar en mayor medida el trabajo remoto e hbrido. A da de hoy, las organizaciones estn aplicando lainteligencia artificial(IA), laautomatizaciny otras tecnologas para optimizar losflujos de trabajo, personalizar las experiencias de los clientes, mejorar la toma de decisiones y responder con mayor rapidez y eficacia a las interrupciones del mercado y a las nuevas oportunidades.La transformacin digital puede ayudar a las empresas a aumentar la fidelidad de los clientes, atraer a empleados con talento, fomentar la ventaja competitiva y crear valor empresarial.Un estudio de McKinsey revel que, entre 2018 y 2022, los lderes digitales obtuvieron alrededor de un 65% ms de rentabilidad total anual para los accionistas que los "rezagados" digitales.1 En la transformacin digital, los dominios son esencialmente objetivos o palancas para la transformacin. La mayora de las estrategias de transformacin digital se dirigen a uno o varios de estos dominios:Modelos empresariales y operativosProcesosProductosExperiencia del empleadoExperiencia del cliente La transformacin del modelo empresarial es un cambio fundamental en la forma en que una organizacin ofrece productos, servicios y valor a sus clientes, inversores o partes interesadas. Algunos ejemplos son:Entregar vdeo a travs de streaming digital, en lugar de discos fsicos (Netflix, Hulu)Permitir que cualquier persona con un coche pueda ganar dinero conduciendo, sin necesidad de comprar un permiso (Uber, Lyft)Permitir a los clientes depositar cheques sin tener que ir al banco (depsito mvil)Las organizaciones persiguen la transformacin del modelo empresarial por varias razones, por ejemplo, para satisfacer las expectativas cambiantes de los clientes, impulsar las ventas en declive o diferenciarse en un mercado altamente competitivo. Tambin podran ver una oportunidad de desbaratar un mercado o una industria a su favor con un nuevo modelo de negocio, o tener la necesidad de responder a un competidor disruptivo. Si bien la transformacin del modelo empresarial acapara los titulares, la optimizacin de los procesos empresariales es un impulsor de la transformacin digital cada vez ms comn. La optimizacin de procesos puede incluir:Consolidar flujos de trabajo aislados o redundantesCrear flujos de trabajo inteligentes mediante el uso de la IASustitucin de tareas manuales por IA y automatizacinLa optimizacin de procesos puede ayudar a las organizaciones a reducir los costes, disminuir el desperdicio (tiempo, esfuerzo y materiales), hacer un mejor uso del capital humano y ayudar a todas las partes interesadas a tomar decisiones ms inteligentes con mayor rapidez. Las organizaciones estn incorporando la innovacin digital en sus productos y en la forma en que estos se desarrollan, producen y entregan.Los ejemplos ms obvios tienen que ver con la incorporacin de la tecnologa digital en los productos cotidianos que satisfacen las necesidades de los clientes. Los automviles, por ejemplo, se transforman continuamente de esta manera. Las innovaciones van desde la posibilidad de ver y manejar un smartphone desde el salpicadero de un coche, pasando por sensores que evitan colisiones y cambios de carril involuntarios, hasta vehculos que incorporanvisin por ordenador, geolocalizacin,machine learningyautomatizacin de procesos robticos(RPA) para funcionar con una intervencin humana mnima o nula.Al implementar elInternet de las cosas (IoT), la tecnologa operativa y la automatizacin en la planta de produccin, los fabricantes pueden acelerar la produccin, reducir errores y defectos y prescindir del trabajo manual. Al adoptar prcticas giles o DevOps, las organizaciones pueden acelerar el desarrollo de software. Las empresas tambin pueden aadir valor y diferenciacin competitiva al ofrecer tecnologa junto con sus servicios existentes, como lo demuestran las aplicaciones de seguimiento que ofrecen las empresas de transporte y los vendedores de pizzas. La experiencia del empleadoes un enfoque holstico degestin del talentoque ayuda a garantizar que los empleados tengan las herramientas necesarias para tener xito y prosperar en el trabajo. Sin duda, la experiencia de los empleados repercute en la contratacin, la moral, la productividad y la retencin de los empleados, pero tambin puede tener un impacto directo, positivo o negativo, en la experiencia del cliente, el rendimiento empresarial y la reputacin de la marca.Los esfuerzos de transformacin digital para mejorar la experiencia de los empleados pueden incluir:Experiencias de usuario innovadoras para los sistemas internos, como las solicitudes de incorporacin, los portales de ventajas para empleados y las comunicaciones internasProporcionar acceso a las herramientas de mensajera y colaboracin ms popularesApoyar el trabajo desde casa o el teletrabajo sin sacrificar las capacidades ni la productividadPermitir que los empleados se conecten de forma segura a los recursos corporativos con los dispositivos que prefieran, incluidos sus propios dispositivos mviles u ordenadores, mediante el uso de polticas e iniciativas de "traiga su propio dispositivo" (BYOD). La experiencia del cliente, o CX, es la suma de las percepciones de los clientes resultantes de todas sus interacciones con una empresa o marca en lnea, en tienda y en el da a da.Al final, todos los viajes de transformacin digital conducen al mbito de la experiencia del cliente. Mejorar continuamente la experiencia del cliente es un imperativo competitivo para la mayora de las organizaciones.En la era digital, la mejora continua de la experiencia del cliente requiere una innovacin digital continua. Los clientes no solo esperan poder realizar negocios en cualquier momento, en cualquier lugar y en cualquier dispositivo, hoy en da tambindependende ello.Planifican sus maanas sabiendo que sus telfonos les dicen exactamente cunto tiempo tardan en llegar al trabajo, y sus tardes sabiendo que pueden encontrarse con el repartidor de comida en la puerta de su casa. Ignoran el horario del call center del servicio de atencin al cliente, sabiendo que pueden obtener respuestas 24/7 de un chatbot. Dejan de guardar los recibos sabiendo que pueden descargar su historial bancario y de tarjetas de crdito a la hora de pagar impuestos (o en cualquier momento).Los clientes confan en estas y en muchas otras innovaciones digitales, y estn dispuestos a contar con otras nuevas. El xito de la transformacin digital posiciona a las organizaciones para anticiparse y ofrecer las prximas innovaciones y experiencias que querrn los clientes. Prcticamente cualquier tecnologa digital puede desempear un papel en la estrategia de transformacin digital de una organizacin, pero estas tecnologas estn ms estrechamente asociadas a las iniciativas de transformacin. Computacin en la nube El cloud computing, el facilitador original de la transformacin digital, permite a las organizaciones utilizar las ltimas tecnologas de TI, aumentar la eficiencia y escalar segn la demanda, al tiempo que se gestionan los costes. Una infraestructura denube hbrida, que combina recursos orquestados de nube pblica y nube privada de mltiples proveedores, proporciona la portabilidad de aplicaciones, la flexibilidad de proveedores y la agilidad de TI necesarias para el xito duradero de la transformacin digital. Tecnologa mvil La dependencia de los clientes de los dispositivos mviles impuls las primeras iniciativas de transformacin digital, transform los modelos empresariales existentes (por ejemplo, los billetes y las carteras mviles) y cre otros totalmente nuevos (por ejemplo, Uber). Hoy en da, los clientes insisten en hacer ms negocios a travs de aplicaciones mviles, ya sea simplemente pidiendo la comida o la cena en su restaurante favorito, o gestionando sus operaciones bancarias e inversiones. Internet de las cosas (IoT) El Internet de las cosas (IoT) es el universo de los dispositivos equipados con sensores que recopilan y transmiten datos a travs de internet. Los dispositivos IoT son el punto de encuentro entre la tecnologa digital y la realidad fsica. Aplicaciones como la logstica de la cadena de suministro y los coches que se conducen solos generan datos en tiempo real que las aplicaciones de IA y anlisis de big data convierten en automatizacin y decisiones. Inteligencia artificial (IA) y machine learning La IA y el machine learning permiten que un ordenador o mquina imite las capacidades de la mente humana. La IA aprende a partir de ejemplos, reconoce objetos, toma decisiones y procesa rpidamente tareas grandes.Las aplicaciones de IA generativapueden responder a las consultas del servicio de atencin al cliente, ofrecer contenido bajo demanda y realizar otras actividades de forma automtica y sin intervencin humana, lo que libera a los empleados para que puedan centrarse en trabajos de mayor valor. La IA tambin permite la personalizacin bajo demanda y a escala en marketing, atencin al cliente, ventas y otras reas de una empresa. Automatizacin Las organizaciones tambin utilizan la automatizacin, y especficamente laautomatizacin de procesos robticos (RPA), para realizar tareas repetitivas como la contabilidad, el envo de facturas o la bsqueda o archivo de registros. A diferencia de la IA, que puede aprender de los datos y realizar tareas con mayor precisin a lo largo del tiempo, la RPA se limita a seguir procesos que han sido definidos por un usuario o programador. DevOps y DevSecOps DevOps acelera la entrega de software de mayor calidad combinando y automatizando el trabajo de los equipos de desarrollo de software y de operaciones de TI.DevSecOpsintegra y automatiza de manera continua la seguridad en todo el ciclo de vida de DevOps, desde la planificacin hasta la retroalimentacin y de nuevo a la planificacin. Las prcticas de DevOps y DevSecOps proporcionan la base de desarrollo gil que las organizaciones necesitan para responder con rapidez a los cambios del mercado e innovar el software continuamente. Digitalizacin La digitalizacin es la conversin de informacin en papel en datos digitales. Tambin es una piedra angular de las iniciativas de transformacin fundacional en la atencin mdica (historiales mdicos electrnicos), la administracin pblica (hacer que los registros pblicos sean ms accesibles y permitir a los ciudadanos realizar solicitudes de servicios en lnea) y otros sectores. Blockchain La blockchaines un libro de contabilidad o registro distribuido, permanente e inmutable de transacciones electrnicas. La blockchain proporciona total transparencia en las transacciones a quienes lo requieren y es inaccesible para quienes no lo necesitan. Las organizaciones estn utilizando la blockchain como base para cadenas de suministro superresilientes y transformaciones de los servicios financieros transfronterizos. Ecosistemas La transformacin digital ha creado muchas maneras en las que las organizaciones pueden asociarse entre s para prestar servicio a los clientes. El auge de los ecosistemas empresariales, impulsados por lasAPIy otras tecnologas avanzadas y una creciente interconexin entre empresas no competitivas. Los proveedores de software pueden permitir a los usuarios iniciar sesin con cuentas de terceros. Por ejemplo, un proveedor de correo electrnico puede crear un mercado en el que los usuarios puedan conectar su software de gestin de tareas o proveedor degestin de la relacin con el cliente(CRM). Gemelos digitales Este nuevo enfoque tecnolgico consiste en crear facsmiles digitales de productos o entornos fsicos para probar formas de mejorar la eficiencia o la eficacia. Por ejemplo, un fabricante puede crear ungemelo digitalde su taller para encontrar formas de mejorar la ubicacin de la maquinaria con el fin de aumentar la produccin o reducir los problemas de seguridad. O un fabricante de productos puede crear rplicas digitales de sus productos para identificar formas de producir otros ms ergonmicos o fciles de usar. Los gemelos digitales ayudan a las organizaciones a mejorar su negocio en el futuro sin sobrecargar las operaciones existentes con mejoras de prueba y error. Los expertos y las organizaciones atribuyen a la transformacin digital todo, desde la mejora de la cadena de suministro y la gestin de los recursos hasta aumentos significativos en la productividad general, la rentabilidad y la ventaja competitiva. Algunas de las ventajas ms citadas son: Mejora de la satisfaccin y la fidelizacin de los clientes Una transformacin digital exitosa puede mejorar la experiencia del cliente y las relaciones con los clientes de una organizacin. Permitir que los clientes interacten utilizando el dispositivo y el canal de su eleccin (portal web, redes sociales, aplicacin), brindar un servicio de atencin al cliente 24/7 a travs de un chatbot, ofrecer contenido personalizado en contexto durante cualquier transaccin... Estas son solo algunas de las formas en que las organizaciones pueden satisfacer y fidelizar mejor a los clientes mediante el uso de la tecnologa digital. Innovacin rpida y continua La transformacin digital debe permitir a las organizaciones innovar continuamente en productos y procesos. La adopcin de una infraestructura multinube hbrida proporciona acceso a las mejores herramientas y tecnologas digitales a medida que van surgiendo. Las prcticas giles y DevOps permiten a los desarrolladores integrar rpidamente estas tecnologas en sus aplicaciones y sistemas. Mayor capacidad de adaptacin al cambio La misma flexibilidad y agilidad que permite una rpida innovacin tambin ayuda a la organizacin a responder ms rpido a los cambios en la demanda de los clientes, a las nuevas oportunidades de mercado y a las amenazas competitivas. En sus inicios, la transformacin digital permiti a los advenedizos revolucionar sectores enteros; hoy tambin ayuda a las organizaciones a responder de forma rpida y eficaz a los posibles disruptores. Flujos de trabajo y operaciones ms eficientes Las herramientas digitales pueden ayudar a las organizaciones a crear flujos de trabajo, procesos e infraestructuras ms optimizados como resultado de sus transformaciones. A travs de la automatizacin y la IA, las organizaciones pueden reducir las tareas laboriosas y liberar a sus empleados vitales para que dediquen ms tiempo a los clientes y otras partes interesadas. Un personal ms comprometido La transformacin digital puede mejorar el compromiso de los empleados de muchas maneras, desde proporcionar acceso a las ltimas herramientas y tecnologas hasta impulsar una cultura de innovacin gil en la que se anime a los empleados a experimentar, asumir riesgos, "fallar rpido" y aprender continuamente. Segn el ltimo metaanlisis Q12 de Gallup, que evala la conexin entre el compromiso de los empleados y los resultados empresariales, las empresas con niveles ms altos de compromiso muestran un rendimiento significativamente superior en todo, desde el absentismo hasta la productividad de las ventas y la rentabilidad.2 Ciberseguridad reforzada La transformacin digital puede descubrir problemas con la tecnologa heredada o medidas deciberseguridadexistentes que ponen en riesgo a una organizacin. La adopcin de las ltimas tecnologas de seguridad puede ayudar a una organizacin a detectar y responder mejor a las amenazas, reducir los ataques satisfactorios y prevenir o minimizar cualquier dao resultante. Nuevas fuentes de ingresos La infusin de las ltimas tecnologas en la cartera de TI de una empresa puede ayudar a crear nuevas oportunidades de ingresos, incluyendo fuentes de ingresos procedentes de sitios web, aplicaciones mviles, ventas adicionales a travs de chatbots y mucho ms. La IA y las mtricas sofisticadas pueden ayudar a identificar nuevas oportunidades de productos y servicios basndose en los comportamientos y patrones de compra de los clientes en el sitio web. Y los clientes podran simplemente estar ms inclinados a comprar a empresas que ofrecen ms opciones para hacer negocios digitales. La mayora de la gente ha ledo o escuchado cmo empresas como Netflix y Uber han trastocado sus modelos de negocio e industrias a travs de la transformacin digital. Pero otras organizaciones tambin tienen historias fascinantes sobreiniciativas de transformacin digitalque revolucionaron sus negocios. Estos son solo algunos ejemplos: Los consumidores siempre han conocido a Audi por fabricar coches bonitos y de altas Capacidades, pero la empresa corra el riesgo de quedarse rezagada frente a las empresas emergentes de coches elctricos a medida que ms gente quera alejarse de los coches de gasolina. El fabricante de automviles alemn no solo quera entrar en el mercado elctrico de forma significativa, sino que tambin quera abrazar la digitalizacin de su oferta a travs de los coches conectados y la conduccin autnoma. Audi tiene muy claro lo que debe hacer para posicionarse en un mercado altamente competitivo impulsado por la sostenibilidad y la comodidad. Ver en persona el nico torneo de tenis de Estados Unidos es una experiencia increble, pero no todos los aficionados al tenis pueden desplazarse hasta Nueva York.El Abierto de Estados Unidos quera asegurarse de que los ms de 15 millones de aficionados pudieran vivir los cientos de partidos del torneo a travs de su aplicacin y su pgina web.Utiliz modelos de IA generativa para convertir ms de 7 millones de puntos de datos del torneo en contenido digital que ofreciera a los aficionados ms contexto sobre el partido que se estaba disputando. El sistema de proveedores sanitarios pblico del Reino Unido necesitaba encontrar un equilibrio entre la prestacin de ms servicios digitales a los clientes y mantener una posicin de seguridad slida. Su socio digital, de datos y tecnologa, NHS Digital, cre un Centro de Operaciones de Ciberseguridad (CSOS) que acta como un punto nico de coordinacin entre el NHS y los socios externos. En la actualidad, supervisa ms de 1,2 millones de dispositivos del NHS en busca de amenazas y bloquea ms de dos mil millones de correos electrnicos maliciosos al ao mediante un filtrado especfico. La compaa alemana independiente de gas y petrleo saba que la IA le ayudara a aprovechar mejor los datos generados por toda la organizacin. Si bien varias unidades empresariales y corporativas internas haban comenzado a utilizar la IA, necesitaba una iniciativa centralizada para implementarla a escala. Puso en marcha AI@Scale, donde los proyectos incorporaron la escalabilidad desde el principio. Una de estas implementaciones automatiz la extraccin de datos de 2000 documentos en PDF, lo que liber a los empleados para que se centraran en tareas de mayor impacto. El conglomerado empresarial manufacturero coreano comprendi que incluso un solo ataque de ciberseguridad satisfactorio podra tener consecuencias devastadoras. Su grupo de innovacin digital de Doosan (DDI) consolid varioscentros de operaciones de seguridad (SOC) regionales en un SOC global y unificado para optimizar su posicin de seguridad e implement la coincidencia de patrones basada en IA. Como resultado, los tiempos de respuesta han disminuido alrededor de un 85%. In the past, the term digital worker described a human employee with digital skills. More recently, the market has defined it as a category of software robots, which are trained to perform specific tasks or processes in partnership with their human colleagues. More specifically, Forrester offers the following definition for digital worker automation: It is a combination of intelligent automation(IA) building blocks, such as conversational intelligence and robotic process automation(RPA), that work alongside employees. They understand human intent, respond to questions, and act on the human's behalf, leaving humans with control, authority and an enhanced experience. IBM Automation observes digital workers, defining them as software-based labor that can independently run meaningful parts of complex, end-to-end processes by applying a range of skills. They apply artificial intelligence capabilities, like machine learning, computer vision and natural language processing to perform a sequence of tasks within a workflow. A digital accounts payable worker can autonomously perform parts of three traditional rolescustomer service representative, billing agent and cash applicator or dispute resolverto complete an order to cash (OTC) process. Becausedigital workers increase the bandwidth of their employees, they have largely been adopted through digital transformation efforts, allowing companies to reallocate their workforce to more strategic tasks. Discover expertly curated insights and news on AI, cloud and more in the weekly Think Newsletter. When initiating a digital workforce, designers consider the processes that can be automated and the human element, specifically how the digital workers can interact with human workers to optimize the intelligent workflow. From there, the process typically follows these steps: Assess the need: The team should identify a process for a digital worker to own. During this stage, you might want to start more simply, such as incorporating intelligent data capture or basic business rules to enable better decision-making, adding complexity gradually. Document the process: Detailed documentation of the process should exist to train new digital workers correctly. Train digital workers: Once a documented process has been identified to transition over to a digital worker, they are trained to handle the tasks within the selected workflow. Bots are also instructed to identify and flag exceptions for their human counterparts, routing more complex use cases to them and freeing them from mundane monitoring activities. Assess performance: During this step, teams can assess the performance of a given digital worker. This approach ensures it has generated an appropriate return on investment (ROI) for the business. By usingprocess mining and process maps, teams can validate training efforts, but they can also use this opportunity to identify bottlenecks, further optimizing the process. Ocash is a digital cash application specialist, the latest recruit for the finance and accounting function. Its often helpful to consider and position your digital workers in the roles that they would fill within your enterprises operations. To create Ocash, the IBM services team began with the workflow outcome in mind. They sourced data from enterprise resource planning (ERP) systems to deconstruct the OTC process and identify its component parts. From there, the team focused on one of the more manual aspects of the process. They automated the tasks where they could, and augmented tasks that still required human workers. Ocash was designed to run tasks that were best suited for automation, calling upon its human colleagues only when needed. But Ocash's designers used these interactions as opportunities to optimize processes. For example, automating the verification of invoice accuracy with a customer at the start of the process can significantly eliminate the number of payment disputes later on. While digital workers can extend beyond digital tasks, they have primarily been used for support work across various business functions. Some examples include: Supply chain: Retailers, such as Amazon, are using robots to assist them in checking stock quantities and pricing. Human resources: Bots can answer benefits questions in real-time, collect employee data and route complex tasks to subject matter experts, evolving the employee experience within companies. Sales and product support: Bots can answer basic product questions to help customer success and sales teams manage prospective and existing clients. They can also route requests by level of urgency, so that high-priority tickets are addressed in a timely manner, improving the overall customer experience. While digital workers provide process efficiency gains, there can be challenges in implementing a digital workforce. Some of these barriers to success include: Not enough tasks to automate, making it difficult to justify the cost of a digital worker. Technology might struggle with some unstructured data sources. Gathering information for documentation purposes can be costly and resource-intensive. Scaling can be difficult if digital workers are not designed to be configurable and adaptable. A digital footprint, sometimes called adigital shadow, is the unique trail of data that a person or business creates while using the internet. Nearly every online activity leaves a trace. Some traces are obvious, like a public social media post. Others are subtler, like the cookies that websites use to track visitors. Every trace a person or company leaves behind, taken together, forms their digital footprint.While internet users and organizations both have digital footprints, they differ in meaningful ways. A persons footprint consists of the personal data they directly and indirectly share. It includes online account activity, browsing history and the details that data brokers collect in the background.An organizations footprint is more complex. It consists of the companys entire online presence, including all its public and private internet-facing assets, content and activity. Official websites, internet-connected devices and confidential databases are all part of a companys footprint. Even employees actionsfor example, sending emails from company accountsadd to an enterprises footprint.This article focuses on organizational footprints.Organizational footprints are growing larger and more distributed, fueled by trends like the cloud boom and remote work. This growth comes with risks. Every app, device and user in a digital footprint is a target for cybercriminals. Hackers can break into company networks by exploiting vulnerabilities, hijacking accounts or tricking users. In response, cybersecurity teams are adopting tools that offer greater visibility into and control over the businesss footprint. Defining an enterprise digital footprint can be tricky because of the number of people and assets involved. The contours of a businesss footprint can change daily as new assets come online and employees use the internet to do routine tasks.Different business units emphasize different aspects of the footprint. Marketers focus on a companys public online presence and branded content. Security teams focus on the organizations attack surface, which is theinternet-connected assets that hackers might attack.To better understand what an enterprise digital footprint can contain, it helps to break it down into anactive digital footprintand apassive digital footprint. A companys active digital footprint consists of all the online activity, assets, and data it directly and intentionally controls. The active footprint contains things like:The companys public branded content, such as websites, social media accounts, blogs, ads and other media.Apps and online services created and controlled by the organization, including client portals and customer accounts on these apps and services.Any internet-facing hardware or software that employees use to conduct company business, such as email accounts, cloud apps, company-owned endpoints, and employee-owned devices used on the corporate networkwithin or outside of theorganizationsbring your own device (BYOD)policy.Data the company owns, including intellectual property, financial data and customer records. A companys passive footprint consists of online activity, assets and data that are connected to the company but not under its direct control. Passive footprints include things like:Vendor activity and assets connected to the company network, such as third-party software packages used in company apps or endpoints that service providers use on company systems.Shadow IT assets, which include all apps and devices used on or connected to the company network without the IT departments approval and oversight.Orphaned IT assets that remain online even though the company no longer uses them. Examples include old accounts on social media platforms or obsolete software still installed on company laptops.Online content produced about the company by people outside the company, such as news articles and customer reviews.Malicious assets created or stolen by threat actors to target the company and harm its brand. Examples include a phishing website that impersonates the organizations brand to deceive customers, or stolen data leaked on the dark web. A companys employees and customers have digital footprints of their own. The data trails they leave behind can form part of the businesss footprint. Customers contribute to the company's digital footprint by interacting with the organization. This includes posting about the company on social media, writing reviews and sharing data with the business. Customers can give data to the business directly, such as by filling out online forms to sign up for subscriptions or entering credit card numbers into online shopping portals. Customers can also contribute through indirect data collection, like when an app records a users IP address and geolocation data. Employees contribute to the enterprise digital footprint whenever they use the company's online assets or act on behalf of the company on the internet. Examples include handling business data, surfing the web on a company laptop or acting as a company rep on LinkedIn. Even employees personal footprints can affect the business. Employees can harm the business's brand by taking controversial stances on their personal social media accounts or sharing information they shouldn't share. The size and contents of a company's digital footprint can affect its cybersecurity posture, online reputation and compliance status. A companys digital footprint can make it a target. Stockpiles of personal data catch the attention of hackers, who can make good money by launching ransomware attacks thathold this data hostageand threaten to sell it on the dark web.Businesses can also anger hacktivists and nation-state hackers when they use online platforms to take stances on political topics.The bigger an enterprise footprint is, the more exposed it is to cyberattacks. Every internet-connected device or app on the company network is a possible attack vector. Vendor assets and activity also open the organization to supply chain attacks.Hackers can use employees personal footprints to breach the network. They can use the personal details people share on social media sites to craft highly targeted spear phishing and business email compromisescams. Even details that seem benign, like an employees phone number, can give hackers a foothold. And if employees practice poor password hygienefor example, using the same password for multiple purposes or not changing passwords regularlythey make it easier for hackers to steal passwords and gain unauthorized access to the network. A businesss public content, news coverage and customer reviews all contribute to its online reputation. If most of that content paints a positive picture of the brand, the company has a positive digital footprint. A positive footprint can drive new business, as many potential customers and clients research companies online before buying anything. On the flip side, a negative footprint can drive business away. Critical news coverage, upset customers sharing their thoughts on social networking sites and low-quality company websites cause negative footprints. Data breaches can also harm a companys reputation. Customers trust the business to protect their online privacy when they share sensitive data. If that data is stolen, people may take their business elsewhere. The personal data a company collects from its customers and employees are part of its digital footprint. Much of this data may be subject to certain data privacy and industry-specific regulations. For example, any organization doing business with customers in the EU must comply with the General Data Protection Regulation, and healthcare providers and others who deal with patients' protected health information must comply with theHealth Insurance Portability and Accountability Act (HIPAA).Regulatory non-compliance can lead to legal action, fines and lost business. Newsmaking cases of non-compliance typically involve large-scale data breaches or cyberattacks. But an organization risks regulatory non-compliance anywhere on its digital footprint. For example, a hospital staffer posting a patient's photo or gossip about a patient on social media could constitute a HIPAA violation. While a business can't control every aspect of its digital footprint, it can take steps to stop malicious actors from using that footprint against it. Tracking the public footprint Some organizations track the public portions of their footprints by setting Google Alerts or other search engine notifications for the company's name. This allows the business to stay on top of news coverage, reviews and other content that can affect its online reputation. Training employees Security awareness training can teach employees how to protect their digital identities for the benefit of themselves and their employer. Hackers have less information to work with when employees know to avoid oversharing and use strong privacy settings.Training can also focus on spotting phishing scams and using company assets appropriately to avoid exposing the network to malware or other threats. As the pace of digital transformation accelerates in the manufacturing and engineering industries, two concepts have gained significant traction: digital twins and digital threads. Both concepts refer to digital representations of physical objects, but they serve different purposes and offer companies unique advantages. Here, we will compare digital twins and digital threads, and discuss potential use cases and benefits. A digital twin is a digital replica of a physical object or system, complete with all the design and operational data of the physical object, including geometry, performance data and behavior models. The purpose of a digital twin is to simulate the behavior of equipment in real-time, allowing engineers and operators to monitor performance and identify system issues/anomalies.Digital twin technology uses Industrial Internet of Things (IIoT) sensors, machine learning and simulation software to collect product data and generate accurate models. Teams can then use the models to predict maintenance needs, simulate changes to the system and optimize processes (e.g., safety protocols, reporting procedures, manufacturing processes, etc.).For example, a digital twin of a wind turbine can simulate the impact of changing wind speed and direction on the turbines performance, helping operators make informed decisions about maintenance and energy production. A digital thread is a digital representation of a products lifecycle, from design to manufacturing to maintenance and beyond, providing a seamless flow of data that connects all aspects of the lifecycle. The purpose of a digital thread is to provide a complete and transparent view of manufacturing systems, enabling efficient collaboration and decision-making across all stages of the process.Digital threads use a variety of technologies, including computer-aided design (CAD) software, product lifecycle management (PLM) systems and Internet of Things (IoT) sensors, to collect and share data across workflows. Digital thread technology optimizes traceability, providing a way to track asset progress and ensure that all stakeholders are on the same page throughout the production process. For example, aerospace companies can create a digital thread to help assemble aircraft with digital engineering. Production teams utilize 3D-model-based systems to guarantee that aircraft are built exactly to engineering specifications and rely on the digital thread to track progress and identify issues and inefficiencies during production. Both digital twins and digital threads utilize virtual representations of real-world assets and processes, but they offer distinct capabilities.Digital twins are scalable, but only to a point. Digital twin technology collects real-time data from a single source/asset. And although a digital twin concept can connect to other twins to simulate entire digital environments, they are most useful in evaluating a specific production environment. A digital thread concept, on the other hand, is limitlessly scalable. Digital threads can connect to (almost) any other enterprise system, including digital twins.As such, digital thread technology may be best suited for operations and/or circumstances where data must be gathered from an array of departments, devices, systems and processes. On the contrary, digital twins will better serve operations that rely primarily on repetitive machine processes within a specific production environment.Both digital twins and digital threads centralize data to some extent. Both collect comprehensive sensor data and aggregate and store that data in an easily accessible data hub. However, digital threads enable teams to take data from digital twins and other sources and centralize the data flow across departments and production silos so that the entire company can access the same information. Data attached to a digital thread also tends to be more consistently accurate, because the automation features of a digital thread concept eliminate the need to manually transmit information between departments and workflows. Digital twins and digital threads help organizations increase system efficiency, reduce production costs, improve product design and limit system downtime. However, the impact of each technology will vary depending on manufacturer needs.Digital twins allow manufacturers to do the following:Engage in responsive monitoring in real timeConduct proactive risk assessments and utilize predictive troubleshooting for organizational assetsAccelerate innovation using digital models and digital mirroringDigital threads help manufacturers in the following ways:Build more agile operations by facilitating a continuous, synchronized data flowIncrease interdepartmental collaboration across assets and systemsOptimize connectivity between manufacturing and engineering processesStreamline product development to reduce production time and get products to market fasterEnsure regulatory compliance by tracking the entire product lifecycle, including design decisions, engineering changes and maintenance records Digital twins and digital threads are essential tools for companies looking to start or accelerate a digital transformation. Using advanced technological tools like IBM Maximo can help organizations get there faster.IBM Maximo is a comprehensive enterprise asset management system that helps organizations optimize asset performance and streamline day-to-day operations. Using an integrated AI-powered, cloud-based platform, IBM Maximo offers comprehensive CMMS capabilities that produce advanced data analytics and support manufacturers looking to make informed decisions about system performance and optimization.Using IBM Maximo software, especially as a complement to existing enterprise resource management (ERP) systems or a manufacturing execution system (MES), can help your facility gain a competitive edge in todays ever-evolving manufacturing marketplace. Related solutions IBM Maximo Application Suite Streamline the maintenance, inspection and reliability of your critical equipment andinfrastructure by leveraging generative AI, advanced analytics and the Internet of Things (IoT). Explore Maximo Application Suite Operations consulting services Transform your operations by using rich data and powerful AI technologies to integrate optimization processes and enable intelligent growth. Explore operations consulting services Asset lifecycle management (ALM) software and solutions Use AI and data insights to optimize asset performance from start to finish. Explore ALM solutions Streamline the maintenance, inspection and reliability of your critical equipment andinfrastructure by leveraging generative AI, advanced analytics and the Internet of Things (IoT). Explore Maximo Application Suite Try it free Digital twins enable continuous monitoring, simulation and analysis of an object, product or system over the course of its lifecycle, from design and production to maintenance and decommissioning. They can also incorporate external processes and critical variables that affect an assets performance. A key feature is real-time, two-way data exchange between the object and its virtual replica, helping ensure that simulated conditions accurately reflect the physical world. Enterprises can also connect multiple digital twins to model more complex systems in service of a larger digital transformation or Industry 4.0 strategy. By providing insight into how an object functions in the presentand projecting how it might behave in future scenariosdigital twins help organizations improve efficiency, accelerate innovation and make data-driven, informed decisions. Common use cases include process optimization, predictive maintenance, supply chain optimization and product development. Many modern digital twin providers, including Siemens, General Electric, Nvidia, IBM, Bentley and Microsoft, offer a full suite of services. Packages might include hardware layers (such as sensor kits), data processors, synchronization services, simulation engines, analytics platforms and visualization dashboards. But enterprises with more specialized applications might instead take a modular approach, choosing several services to match their needs. Digital twins can represent virtually any object, from buildings and bridges to cars, airplanes, historical artifacts and even the earth. They might also model complex systems such as traffic patterns, weather events, healthcare treatment plans and factory operations. Finally, in more experimental contexts, digital twins might be based on real or imagined people, complete with modeled voice, appearance and personality traits. Digital twins are now widely used across industries: A 2023 Strategic Market Research study found that roughly 75% of businesses employ them in some capacity. These initiatives can be costly and resource-intensive. But for many enterprises, they are worth the investment: 92% of companies who deploy digital twins report returns above 10%, while over half report at least 20% return on investment, according to a 2025 Hexagon survey. A physical asset that an enterprise aims to monitor, analyze or simulate in a virtual environmentA virtual model that acts as a digital representation of the real-world object or systemData sources such as sensors or Internet of Things (IoT) devices that continuously record relevant metrics like temperature, pressure or motionA data pipeline that transmits sensor data to the virtual model, keeping it synchronized with its associated physical asset in real timeA feedback loop that sends insights or control signals from the digital twin back to the physical asset to optimize performance, efficiency and decision-makingAn analytics engineoften powered by machine learning or artificial intelligencethat can detect data patterns, simulate future scenarios, perform predictive analysis and assist with asset trackingVisualization interfaces and dashboards that enable teams to interact with a 2D or 3D representation of assets or systems While digital twin workflows vary widely across industries and applications, most include these fundamental steps: An enterprise might begin by equipping a physical object with an array of sensors, which capture its performance, condition and operating environment. In IoT contexts, an organization might deploy smart objects, which often come preinstalled with built-in sensors that can continually collect and share data. In IT settings, teams can build digital representations of applications, software and computers (virtual machines) using virtualization technologies. They can then deploy software agents to collect data at or near the digital asset for monitoring and analysis. A virtual model is a digital replica of an object or system, built using the data gathered from its real-life counterpart. It is embedded with key attributes that help it realistically react to variables such as environmental conditions and interactions with related systems.For example, a digital twin of an airplane turbine not only simulates wear and failure at the same rate as its real-life counterpart but also accounts for aerodynamic forces during flight and the influence of connected engine and hydraulic components. This detailed modeling helps ensure that the digital twin can reliably simulate how its real-life counterpart might respond under a range of conditions. Live data integration enables continuous, real-time communication between the digital twin and its physical counterpart. This dynamic feedback loop can help organizations optimize performance, enhance system reliability and implement predictive maintenancewhen teams anticipate issues ahead of time, reducing downtime and extending asset lifecycles. Enterprises often automate the data exchange process, freeing them up to tackle higher-level strategic tasks. Digital twins enable teams to run safe, cost-effective experiments within a virtual environment. For example, in a manufacturing context, a team can simulate how an assembly line upgrade might affect performance and efficiency. Or it might test whether a more affordable packaging option can withstand the rigors of shipping and distribution. By exploring a range of what-if scenarios, digital twin platforms help teams improve operational efficiency and enhance product quality without the risks and costs associated with real-world testing.Analytics engines can suggest certain operational changessuch as scaling cloud capacity, production volume or team budgetsto help teams optimize performance and spending. They might also integrate with customer relationship management (CRM) platforms and enterprise resource planning (ERP) tools to streamline production workflows and customer funnels. Both simulations and digital twins help teams replicate and test scenarios in a digital environment. But while digital twins mirror a real-life object and its specific traits, simulations often exist entirely in the virtual world without an immediate connection to real-world systems.Put another way, simulations are static; they run predefined scenarios with no built-in mechanism to transmit their findings to a physical system. In contrast, digital twins can dynamically reflect real-time conditions while at the same time sending information to the physical systems they represent.Another distinction is that digital twin solutions can connect multiple assets and systems, instead of evaluating them in isolation. Teams can seamlessly add or eliminate components to mirror real-life scenarios, determining how changes to one asset might impact the wider ecosystem.3D models are static representations of an object at a single point in time. Organizations can use them to understand what an object looks like, but not how it behaves. On its own, a 3D model cant assess future scenarios or represent real-time conditions. However, 3D models often serve as a foundational component of both digital twins and simulations, providing accurate visual and spatial representations of physical assets or processes. Although teams can build connected twins (networks made up of linked digital twins) to capture a wider view of system performance, these networks are typically used to optimize asset lifecycles within a single production environment. Digital threads, meanwhile, are often broader in scope, connecting data across multiple departments, processes and environments to capture an organization-wide view of assets and systems. Digital threads can centralize data from multiple production environments so its accessible to stakeholders across the organization. Ultimately, digital threads are ideal for gaining a holistic view of the organizations interlocking systems, while digital twins are better suited for fine-tuning individual assets and processes. Its common for several types of digital twins, each offering a different layer of magnification, to co-exist within a single production environment. The four main types include: Component twins, also called part twins, replicate individual components, offering a granular level of insight into specific parts. For example, a component twin might use an array of sensors to mirror a valve in an oil pipeline, a motor in a wind turbine or a turbocharger in a car. Asset twins replicate complete functional units, often made up of two or more components, and show how these components interact in real time. Asset twins might replicate an oil pipeline valve system (made up of multiple valves and pipes), a wind turbine drive train (made up of a motor, gearbox and shaft) or a cars turbocharging system (made up of a turbocharger, intercooler and compressor). System or unit twins enable enterprises to understand how assets fit together to form a larger, integrated system. They provide visibility into asset interactions while identifying opportunities for performance enhancements at the system level. System twins might mirror a segment of an oil pipeline (made up of multiple valve and pump systems), a wind turbine (made up of motors, blades and control systems) or a vehicle powertrain system (including the engine, transmission and driveshaft). Process twins provide the broadest view, revealing how systems work together across a production facility, supply chain or operational workflow. Process twins can help ensure that the entire production environment, not just specific components, is operating at optimal efficiency. Process twins might replicate an end-to-end oil distribution network, an energy-generating wind farm or an automotive manufacturing process. Digital twins give enterprises greater visibility into complex systems along with the flexibility to explore multiple operational configurations before committing real-world resources to them. Major benefits include: Digital twin solutions help enterprises experiment with different product designs, workflows and manufacturing processes within a virtual testing environment, accelerating innovation and reducing time to market.For example, aerospace engineers can build digital twins of experimental aircraft, each with different wing and propulsion designs, to determine which iteration shows promise for further development. This approach is far more cost-effective, and safer, than building and testing physical aircraft prototypes for each proposed design. After a new product has gone into production, digital twins can help mirror and monitor systems to achieve and maintain peak efficiency throughout the manufacturing process. Teams can also identify cost-cutting opportunities without interfering with current workflows.For example, an enterprise can test out a more affordable material or manufacturing process in the virtual environmentand determine whether it can maintain performance and emissions standardsbefore rolling it out on a wider scale. Digital twins can also use historical data for predictive maintenance (forecasting which assets are likely to fail before an error occurs). In complex modern systems, a single malfunction or asset failure can cause widespread disruptions, especially if teams struggle to identify the root cause. For example, a small circuit that controls cooling fans in a data center might fail, triggering overheating that takes an entire server rack offline.Digital twins can address this problem by reflecting the real-time condition of individual components, including sensors, circuits and capacitors. By continuously communicating with the physical system, a digital twin can detect early warning signs, such as abnormal temperature spikes, and anticipate imminent failures. This capability helps teams act early, avoiding downtime and costly errors. To remain competitive, enterprises must quickly scale operations to accommodate shifting product demand, economic conditions and strategic priorities. Traditionally, scaling up or down is a slow, arduous process, requiring teams to carefully validate new systems before rolling them out across the organization. Digital twins make this process faster and less risky by providing a virtual environment where teams can safely adjust parameters and test configurations ahead of universal deployment.Digital twins can also connect to live systems, enabling them to continuously transmit scaling adjustments to their physical counterparts in real time. For example, digital twin platforms might use algorithms to automatically add or remove cloud nodes during usage spikes to reduce traffic bottlenecks and maintain stable performance. Many industries rely on digital models to make sense of complex systems, spur innovation, maintain equipment and optimize efficiency. Digital twins are used extensively in the following industries and applications: Organizations can use digital twins to model jet engines, locomotive engines, electricity-generating turbines, utility assets and other power-generating systems. Digital twin platforms can establish time frames for regularly scheduled maintenance, detect hardware irregularities and enable testing of new components. They can also facilitate the transition to renewable energy by monitoring grid demand, simulating new asset configurations and forecasting grid trajectories. Physics-based digital twin systems can help engineers design durable, safe and cost-effective structures, including buildings, drilling platforms, canals, dams and bridges. They can, for example, determine whether a particular bridge can withstand heavy wind, rain and traffic, giving engineers the opportunity to alter their design before construction begins.Digital twins can also provide visibility into already-built structures, for example by revealing how key systemssuch as plumbing, HVAC, electrical and securityinteract inside an office building. These insights can help inform building information modeling (BIM) systems, which use digital representations of a structure to manage its construction and maintenance. In manufacturing, digital twins (often equipped with AI capabilities) can enhance quality control, supply chain management and error detection by providing oversight across a products end-to-end lifecycle. For example, an electronics manufacturer can build a digital replica of a factory floor, reflecting the real-world locations inventory levels, production schedules, equipment statuses and other operational data. Digital twins can generate key health insights through disease progression forecasting, which predicts how patients might respond to various treatment options, and through enhanced diagnosis, which uses highly detailed modeling to pinpoint how interactions between organs and body systems can impact health.They can also help hospitals optimize their operationsincluding staffing, scheduling and equipment maintenanceand can facilitate the transition to personalized healthcare, where treatments are customized to match individual patients needs. Digital twins are used extensively in auto design, both to improve vehicle performance and to increase production efficiency. For example, vehicle designers can conduct extensive safety and emissions testing with virtual replicas before benchmarking real-life vehicles. Civil engineers and urban planning experts use digital twins to simulate how pedestrians and vehicles move through cities. City models often incorporate 3D and 4D spatial data, IoT object data and AI-powered analytics to simulate how new policies, infrastructure upgrades or transportation systems might impact the built environment. Digital twins play a key role in smart cities, which use IoT-connected devices to continuously collect and share data that can be harnessed to improve quality of life and sustainability. The concept behind digital twin technology dates to the 1960s, when NASA built physical replicas of its spacecraft to study how they might respond to different conditions before sending their real-life counterparts into orbit. In 1970, when an onboard explosion threatened the lives of the Apollo 13 crew, NASA relied on these models to explore different rescue scenarios from the ground, according to the administrations Technical Reports Server. While these early efforts used physical copies instead of virtual ones, they paved the way for what would eventually become known as digital twins.In 2002, scientist and business executive Michael Grieves conceptualized a product lifecycle management (PLM) framework that links a physical product with its virtual counterpart through continuous data exchange. Eight years later, NASAs John Vickers officially coined the term digital twin in a NASA technical roadmap, building from Grieves mirrored spaces concept. The digital twin market is rapidly expanding, according to a Fortune Business Insights report. Its expected to grow from USD 24.5 billion in 2025 to USD 259.3 billion by 2032, with industries such as smart cities, aerospace, healthcare and manufacturing driving growth. New and emerging digital twin capabilities include: Generative AI can predict how systems might react in the future based on both historical and real-time datasets. This capability empowers teams to make better-informed operational decisions and investments. AI technologies can also help digital twin systems optimally scale and provision resources without human intervention.Instead of automating only rote, repetitive tasks, AI models can use digital twins to make longer-term, multi-step decisions. For example, they can anticipate how a component failure might cascade through the network, affecting neighboring assets and systems; alert relevant teams each time a component needs maintenance; recommend network enhancements so that failures are less likely to occur; and in some cases, implement operational changes entirely on their own. Like software as a service (SaaS), digital twin as a service (DTaaS) is becoming a popular choice for enterprises. The delivery method enables organizations to quickly implement and scale digital twins through the cloud, without having to program them from scratch or maintain the servers they live on. Developers are designing digital twins capable of mirroring human behaviors and cognition. Digital doppelgngers can be used for both personal applications (such as legacy preservation or audience engagement) and professional ones (such as training employees or automating repetitive tasks).They can also be useful in research contexts. For example, researchers can perform experiments with synthetic users to simulate how real-life humans might respond to new products and features. Enterprises can then aggregate these findings to project population-level trends. Digital transformation is abusiness strategy initiative that incorporates digital technology across all areas of an organization. It evaluates and modernizes an organizations processes, products, operations and technology stack to enable continual, rapid, customer-driven innovation. Today customers expect to be able to conduct their

business, do their work and live their lives by using the latest technology advances. They expect this ability from wherever they are, anytime they want, by using the device of their choice and with all the supporting information and personalized content they need close at hand. The ultimate goal of digital transformation is to meet these expectations.Every organizations digital transformation implementation is different. It can begin with a single focused technology project, or as a comprehensive enterprise-wide initiative. It can range from integrating digital technology and digital solutions into existing processes and products, to reinventing processes and products or creating entirely new revenue streams by using still-emerging technologies.But experts agree that digital transformation is as much aboutbusiness transformationand change management as it is about replacing analog processes or modernizing existing IT. While often led by a companys chief information office (CIO), it requires the entire C-suite to align on new technologies and data-driven methodologies that can improvecustomer experience, empower employees and achieve business goals.But, most importantly, companies should create a digital transformation framework and monitor improvements through tracking key performance indicators (KPIs) to see if the work produces results. The earliest, headline-making examples of digital transformationUber, AirBnB, Netflixused mobile andcloud computingtechnologies to reimagine transactions and, sometimes, disrupt entire industries. The COVID-19 pandemic drove transformative innovations to better support remote and hybrid work. Today, organizations are applyingartificial intelligence(AI),automationand other technologies to streamlineworkflows, personalize customer experiences, improve decision-making, and respond more quickly and effectively to market disruptions and new opportunities. Digital transformation can help companies increase customer loyalty, attract talented employees, foster competitive advantage and build business value.McKinsey research foundthat between 2018-2022, digital leaders achieved about 65% greater annual total shareholder returns than digital laggards.1 In digital transformation, domains are essentially targets or levers for transformation. Most digital transformation strategies target one or more of these domains: Business and operating modelsProcessesProductsEmployee experienceCustomer experience Business model transformation is a fundamental change in the way that an organization delivers products, services and value to its customers, investors or stakeholders. Examples include: Delivering video through digital streaming, instead of physical disks (Netflix, Hulu)Enabling anyone with a car to make money driving, without purchasing a medallion (Uber, Lyft)Allowing customers to deposit checks without visiting the bank (mobile deposit) Organizations pursue business model transformation for any number of reasonsfor example, to meet changing customer expectations, boost flagging sales, or differentiate themselves in a highly competitive market. They might also see a chance to disrupt a market or industry in their favor with a new business modelor have a need to respond to a disruptive competitor. While business model transformation grabs the headlines, business process optimization is an increasingly common digital transformation driver. Process optimization can include: Consolidating isolated or redundant workflowsCreating intelligent workflows by using AIReplacing manual tasks with AI and automation Process optimization can help organizations lower costs, reduce waste (time, effort and materials), make better use of human capital, and help all stakeholders make smarter decisions faster. Organizations are incorporating digital innovation into their products, and into the way their products are developed, produced and delivered. The most obvious examples involve the embedding of digital technology into everyday products that meet customer needs. Automobiles, for instance, are continually transformed in this way. Innovations range from the ability to view and operate a smartphone from a car dashboard, to sensors that prevent crashes and unintended lane changes, to vehicles that incorporatecomputer vision, geolocation,machine learningandrobotic process automation(RPA) to operate with minimal or no human intervention. By implementingInternet of Things (IoT), operational technology and automation on the factory floor, manufacturers can speed production, reduce errors and defects and eliminate manual labor. By adopting agile or DevOps practices organizations can speed software development. Companies can also add value and competitive differentiation by offering technology alongside their existing serviceswitness the tracker apps offered by shipping companies and pizza vendors. Employee experienceis a holistic approach totalent managementthat helps ensure that employees have the tools the need to succeed and thrive at work. Employee experience certainly impacts employee recruitment, morale, productivity and retention, but it can also have a direct impactpositive or negativeon customer experience, business performance and brand reputation.Digital transformation efforts to improve employee experience can include:Innovating user experiences for internal systems such as onboarding applications, employee benefits portals and internal communicationsProviding access to popular messaging and collaboration toolsSupporting work from home (WFH) or remote work without sacrificing capabilities or productivityEnabling employees to connect securely to corporate resources with the devices they prefer, including their own mobile devices or computers, by using bring your own device (BYOD) policies and initiatives Customer experience, or CX, is the sum of customers perceptions resulting from all their interactions with a business or brandonline, in-store and in day-to-day life.In the end, all digital transformation journeys lead to the customer experience domain. Continually improving the customer experience is a competitive imperative for most organizations.In the digital age, continually improving the customer experience requires continual digital innovation. Its not just that customers expect to be able to do business anytime, anywhere and on any devicetoday customersdependon it.They plan their mornings knowing their phones tell them exactly how long it takes to drive to work, and their evenings knowing they can meet the food delivery driver at their door. They ignore customer service call center hours, knowing they can get answers 24/7 from a chatbot. They stop saving receipts knowing that they can download their bank and credit card history at tax time (or anytime).Customers count on these and scores of other digital innovations, and they are ready to count on new ones. Successful digital transformation positions organizations to anticipate and deliver the next innovations and experiences customers will want. Virtually any digital technology can play a role in an organization's digital transformation strategy, but these technologies are most closely associated with transformation initiatives. Cloud computing The original digital transformation enabler, cloud computing enables organizations to use the latest IT technologies, boost efficiency and scale with demand while managing costs. Ahybrid cloudinfrastructure, combining orchestrated public cloud and private cloud resources from multiple vendors, provides the application portability, vendor flexibility and IT agility needed for enduring digital transformation success. Mobile technology Customers dependence on mobile devices drove the earliest digital transformation initiatives, transformed existing business models (for example mobile tickets and wallets) and created entirely new ones (for example, Uber). Today customers insist on doing more business through mobile apps, whether simply ordering lunch or dinner from their favorite restaurant, or managing their banking and investments. Internet of Things (IoT) TheInternet of Things (IoT)is the universe of devices equipped with sensors that collect and transmit data over the internet. IoT devices are where digital technology meets physical reality. Applications like supply chain logistics and self-driving cars generate real-time data that AI and big data analytics applications turn into automation and decisions. Artificial intelligence (AI) and machine learning AI and machine learning enable a computer or machine to mimic the capabilities of the human mind. AI learns from examples, recognizes objects, makes decisions and quickly processes large tasks.Generative AIapplications can answer customer service inquiries, deliver content on demand, and perform other activities automatically and without human intervention, freeing employees for higher-value work. AI also enables personalization on demand and at scaleacross marketing, customer service, sales and other areas of a business. Automation Organizations also useautomation, and specificallyrobotic process automation (RPA), to perform repetitive tasks such as bookkeeping, sending invoices, or looking up or archiving records. Unlike AI, which can learn from data and perform tasks more accurately over time,RPAis limited to following processes that have been defined by a user or programmer. DevOps and DevSecOps DevOps accelerates delivery of higher-quality software by combining andautomating the work of software developmentand IT operations teams.DevSecOpscontinuously integrates and automates security throughout the DevOps lifecycle, from planning through feedback and back to planning again. DevOps and DevSecOps practices provide the agile development foundation organizations need to respond with speed to market changes and innovate software continuously. Digitization Digitizationis the conversion of paper-based information into digital data. Its also a cornerstone of foundational transformation initiatives in healthcare (electronic medical records or EMR), government (making public records more accessible and enabling citizens to make service requests online), and other industries. Blockchain Blockchainis a distributed, permanent and immutable ledger or record of electronic transactions. Blockchain provides total transaction transparency to those who require it and is inaccessible to those who dont. Organizations are using blockchain as a foundation for superresilient supply chains and cross-border financial servicestransformations. Ecosystems Digital transformation has created many ways organizations can partner with each other to serve customers. The rise of business ecosystems, driven byAPIsand other advanced technologies and a growing interconnectedness between noncompetitive companies. Software providers can enable users to sign in with accounts from third parties. For example, an email provider can create a marketplace where users can connect their task management software orcustomer relationship management(CRM) provider. Digital twins This new technology-led approach involves creating digital facsimiles of physical products or environments to test out ways to improve efficiency or effectiveness. For example, a manufacturer can make adigital twinof their shop floor to find ways to improve the location of machinery to increase output or reduce safety issues. Or a product manufacturer can create digital replicas of their products to identify ways to produce ones that are more ergonomic or easier to use. Digital twins help organizations improve their business in the future while not burdening existing operations with trial-and-error improvements. Experts and organizations credit digital transformation with everything from improved supply chain and resource management to significant gains in overall productivity, profitability and competitive advantage. Some of the most frequently cited benefits include: Improved customer satisfaction and loyalty Successful digital transformation can improve an organizations customer experience and customer relationships. Enabling customers to engage by using the device and channel of their choice (web portal, social media, in-app), providing 24/7 customer service through a chatbot, delivering personalized content in context during any transactionthese are just some of the ways organizations can better satisfy and retain customers by using digital technology. Rapid, continual innovation Digital transformation should enable organizations to innovate products and processes continually. Adoption of hybrid multicloud infrastructure provides access to the best digital tools and technologies as they emerge. Agile and DevOps practices enable developers to rapidly integrate these technologies into their applications and systems. Greater resilience to change The same flexibility and agility that enables rapid innovation also helps the organization respond faster to changes in customer demand, new market opportunities and competitive threats. In its earliest days, digital transformation enabled upstarts to disrupt entire industries; today it also helps organizations respond quickly and effectively to would-be disruptors. More efficient workflows and operations Digital toolscan help organizations create more streamlined workflows, processes and infrastructure as a result of their transformations. Through automation and AI, organizations can cut down laborious menial tasks and free up their vital employees to spend more time with customers and other stakeholders. A more engaged workforce Digital transformation can improve employee engagement in any number of ways, from providing access to the latest tools and technologies to driving a culture of agile innovation in which employees are encouraged to experiment, take risk, 'fail fast' and learn continually. According to the latest Gallup Q12 meta-analysis, which evaluates the connection between employee engagement and business outcomes, companies with higher levels of engagement show significantly higher performance in everything from absenteeism to sales productivity and profitability.2 Stronger cybersecurity Digital transformation can uncover issues with legacy technology or existingcybersecuritymeasures that put an organization at risk. Adopting the latest security technologies can help an organization better detect and respond to threats, reduce successful attacks, and prevent or minimize any resulting damage. New revenue streams Infusion of the latest technologies into a company's IT portfoliocan help create new opportunities for revenue, including revenue streams from websites, mobile apps, upselling through chatbots and more. AI and sophisticated metrics can help identity new product and service opportunities based on customers website behaviors and buying patterns. And customers might simply be more inclined to purchase from companies that offer more options for doing digital business. Most people have read or heard how companies like Netflix and Uber have disrupted their business models and industries through digital transformation. But other organizations also have compelling stories aboutdigital transformation initiativesthat revolutionized their businesses. Here are just a few examples: Consumers have always known Audi for making beautiful, high-performance cars, but the company risked falling behind electric car upstarts as more people wanted to move away from gas-powered cars. The German automaker not only wanted to enter the electric market in a significant way but also wanted toembrace the digitizationof its offerings through connected cars and autonomous driving. Audi has a clear understanding of what it needs to do to compete in a highly competitive marketplace driven by sustainability and convenience. Seeing the US only tennis major in person is an amazing experience, but not every tennis fan can make it to New York.The US Openwanted to ensure that the 15 million-plus fans could experience the tournaments hundreds of matches through the US Open app and website.The US Open used generative AI models to turn more than 7 million tournament data points into digital contentthat gave fans more context about the matching being played. The UKs system of public healthcare providers needed to balance providing more digital services to clients while maintaining a strong security posture. Its digital, data and technology delivery partner, NHS Digital,created a Cyber Security Operations Centre(CSOS) that is as a single point of coordination between NHS and external partners. It now monitors more than 1.2 million NHS devices for threats and blocks more than two billion malicious emails a year through targeted filtering. Theindependent German gas and oil companyknew that AI would help it better harness data generated from across the organization. While several internal business and corporate units had begun using AI, it needed a centralized initiative to deploy it at scale. It started AI@Scale where projects incorporated scalability at the start. One such deployment automated data extraction from 2,000 PDF documents, freeing up employees to focus on more impactful work. The Koreanmanufacturing business conglomerateunderstood that even one successful cybersecurity attack might have devastating consequences. Its Doosan Digital Innovation (DDI) group consolidated multiple regionalsecurity operation centers(SOCs) to a unified, global SOC to streamline its security posture and deployed AI-based pattern matching. As a result, response times have decreased by about 85%. Welcome to the Digital Spy forums. If youd like to join in, please sign in or register. Digital Spy Forum and Community, a place to discuss the latest TV, Movie and entertainment news and trends. The Official Christmas Radio Times & and Christmas TV 2025 Thread University Challenge 32 - 2025/2026 Channel 4 to show FX's Say Nothing The Great B&B Challenge - Channel 4 What are you watching on Apple TV? Sci-Fi and Cult on the Freeview Channels Expand for more options. For discussion on the Doctor Who universe, from the TARDIS to your favourite companion and baddie. Build your own Dalek Corriedale - Monday 5th January Unfair Bias Against Amber? Expand for more options. Discuss the BBC's breakout reality TV show here, as well as The Traitors' international versions. CBB 2026 Wishlists Rumours Predictions Expand for more options. Discuss ITV's search for new British talent here! bgt series 19 spoilers Celebrity Apprentice 2025 - BBC ONE Expand for more options. Discuss ITV2's dating reality show. Love Island USA Season 7 on ITV2? Expand for more options. Discuss ITV's masked singing competition, international versions of the show and spin-offs here. Can we get Shona McGarty on the upcoming series? Expand for more options. Racers, start your engines... the place to discuss all things RuPaul's Drag Race-related, including your favourite contestants. RuPauls Drag Race UK - Series 7 - Potential Spoilers/Discussion Thread Married at First Sight UK 2025 - E4 Ariana Grande and Cynthia Erivo cast in movie version of Wicked Last game you bought? Legendary music artists who you really dont like Small scale DAB Expand for more options. What are you reading at the moment? Talk about your favourite books, audiobooks and comics here. Does anyone read books more than once? Burbleby / Chant 2025-26 DS Premier League Prediction Competition Expand for more options. Talk about all things desktop, laptop, notebook or netbook-related, plus Windows, macOS, Linux and Chrome OS. Windows update - repair version Expand for more options. Discuss all things mobile phones here, whether that's networks, services, apps, or handsets, including Apple iPhone, Samsung and other Android devices. Nokia 1616 Expand for more options. Talk about TVs 4K, OLED, QLED and more plus home cinema setups, projectors, speakers and other home entertainment tech. TCL vs Hisense Can I give Virgin broadband more than 30 days to cancel? Digital forensics is the process of collecting and analyzing digital evidence in a way that maintains its integrity and admissibility in court. Digital forensics is a field of forensic science. It is used to investigate cybercrimes but can also help with criminal and civil investigations. Cybersecurity teams can usedigital forensics to identify the cybercriminals behind amalwareattack, while law enforcement agencies might use it to analyze data from the devices of a murder suspect. Digital forensics has broad applications because it treats digital evidence like any other form of evidence.Officials follow specific procedures to collect physical evidence from a crime scene. Similarly, digital forensics investigators adhere to a strict forensics processknown as a chain of custodyto ensure proper handling and protection against tampering. Digital forensicsandcomputer forensicsare often referred to interchangeably. However, digital forensics technically involves gathering evidence fromanydigital device, whereas computer forensics involves gathering evidence specifically from computing devices, such as computers, tablets, mobile phones and devices with a CPU. Digital forensics and incident response (DFIR)is an emerging cybersecurity discipline that combines computer forensics and incident response activities to enhance cybersecurity operations.It helps accelerate the remediation of cyberthreats while ensuring that any related digital evidence remains uncompromised. Digital forensics, or digital forensic science, first surfaced in the early 1980s with the rise of personal computers and gained prominence in the 1990s. However,it wasnt until the early 21st century that countries like the United States formalized their digital forensics policies.The shift toward standardization stemmed from rising computer crimes in the 2000s and nationwide law enforcement decentralization. As crimes involving digital devices increased, more individuals became involved in prosecuting such offenses. To ensure that criminal investigations handled digital evidence in a way that was admissible in court, officials established specific procedures. Today, digital forensics is becoming more relevant. To understand why, consider the overwhelming amount of digital data available on practically everyone and everything. As society increasingly depends on computer systems and cloud computing technologies, individuals are conducting more of their lives online. This shift spans a growing number of devices, including mobile phones, tablets, IoT devices, connected devices and more. The result is an unprecedented amount of data from diverse sources and formats. Investigators can use this digital evidence to analyze and understand a growing range of criminal activities, including cyberattacks, data breaches, and both criminal and civil investigations. Like all evidence, physical or digital, investigators and law enforcement agencies must collect, handle, analyze and store it correctly. Otherwise, data can be lost, tampered with or rendered inadmissible in court. Forensics experts are responsible for performing digital forensics investigations, and as demand for the field grows, so do the job opportunities. The Bureau of Labor Statistics estimates computer forensics job openings will increase by 31% through 2029. TheNational Institute of Standards and Technology (NIST) outlines four steps in the digital forensic analysis process.Those steps include: Data collection Identify the digital devices or storage media containing data, metadata or other digital information relevant to the digital forensics investigation. For criminal cases, law enforcement agencies seize the evidence from a potential crime scene to ensure a strict chain of custody. To preserve evidence integrity, forensics teams make a forensic duplicate of the data by using a hard disk drive duplicator or forensic imaging tool. After the duplication process, they secure the original data and conduct the rest of the investigation on the copies to avoid tampering. Examination Investigators comb through data and metadata for signs of cybercriminal activity. Forensic examiners can recover digital data from various sources, including web browser histories, chat logs, remote storage devices and deleted or accessible disk spaces. They can also extract information from operating system caches and virtually any other part of a computerized system. Data analysis Forensic analysts use different methodologies and digital forensic tools to extract data and insights from digital evidence. For instance, to uncover "hidden" data or metadata, they might use specialized forensic techniques, likelive analysis, which evaluates still-running systems for volatile data. They might employreverse steganography, a method that displays data hidden that uses steganography, which conceals sensitive information within ordinary-looking messages. Investigators might also reference proprietary and open source tools to link findings to specific threat actors. Reporting Once the investigation is over, forensic experts create a formal report that outlines their analysis, including what happened and who might be responsible. Reports vary by case. For cybercrimes, they might have recommendations for fixing vulnerabilities to prevent future cyberattacks. Reports are also frequently used to present digital evidence in a court of law and shared with law enforcement agencies, insurers, regulators and other authorities. When digital forensics emerged in the early 1980s, there were few formal digital forensics tools. Most forensics teams relied on live analysis, a notoriously tricky practice that posed a significant risk of tampering. By the late 1990s, the growing demand for digital evidence led to the development of more sophisticated tools like EnCase and forensic toolkit (FTK). These tools enabled forensic analysts to examine copies of digital media without relying on live forensics. Today, forensic experts employ a wide range of digital forensics tools. These tools can be hardware or software-based and analyze data sources without tampering with the data. Common examples include file analysis tools, which extract and analyze individual files, and registry tools, which gather information from Windows-based computing systems that catalog user activity in registries. Certain providers also offer dedicated open source tools for specific forensic purposeswith commercial platforms, like Encase and CAINE, offering comprehensive functions and reporting capabilities. CAINE, specifically, boasts an entire Linux distribution tailored to the needs of forensic teams. Digital forensics contains discrete branches based on the different sources of forensic data. Some of the most popular branches of digital forensics include: Computer forensics(or cyber forensics): Combining computer science and legal forensics to gather digital evidence from computing devices. Mobile device forensics: Investigating and evaluating digital evidence on smartphones, tablets and other mobile devices. Database forensics: Examining and analyzing databases and their related metadata to uncover evidence of cybercrimes or data breaches. Network forensics:Monitoring and analyzing data found in computer network traffic, including web browsing and communications between devices. File system forensics:Examining data found in files and folders stored on endpoint devices like desktops, laptops, mobile phones and servers. Memory forensics:Analyzing digital data found in a device's random access memory (RAM). When computer forensics and incident responsethe detection and mitigation of cyberattacks in progressare conducted independently, they can interfere with each other and negatively impact an organization. Incident response teams can alter or destroy digital evidence while removing a threat from the network. Forensic investigators can delay threat resolution while they hunt down and capture evidence. Digital forensics and incident response, or DFIR, integrates computer forensics and incident response into a unified workflow to help information security teams combat cyberthreats more efficiently. At the same time, it ensures the preservation of digital evidence that might otherwise be lost in the urgency of threat mitigation. Forensic data collection happening alongside threat mitigation:Incident responders use computer forensic techniques to collect and preserve data while they contain and eradicate the threat. They ensure that the proper chain of custody is followed, preventing valuable evidence from being altered or destroyed. Post-incident review including examination of digital evidence:In addition to preserving evidence for legal action, DFIR teams use it to reconstruct cybersecurity incidents from start to finish. This process helps them determine what happened, how it occurred, the extent of the damage and how to prevent similar attacks in the future. DFIR can lead to faster threat mitigation, more robust threat recovery and improved evidence for investigating criminal cases, cybercrimes, insurance claims and other security incidents.

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