

NAVIGATING COMPLEX BUSINESS AND TECHNOLOGY HURDLES OF AI-ENABLED WORKLOADS

Accelerating Time to Market through Partnership

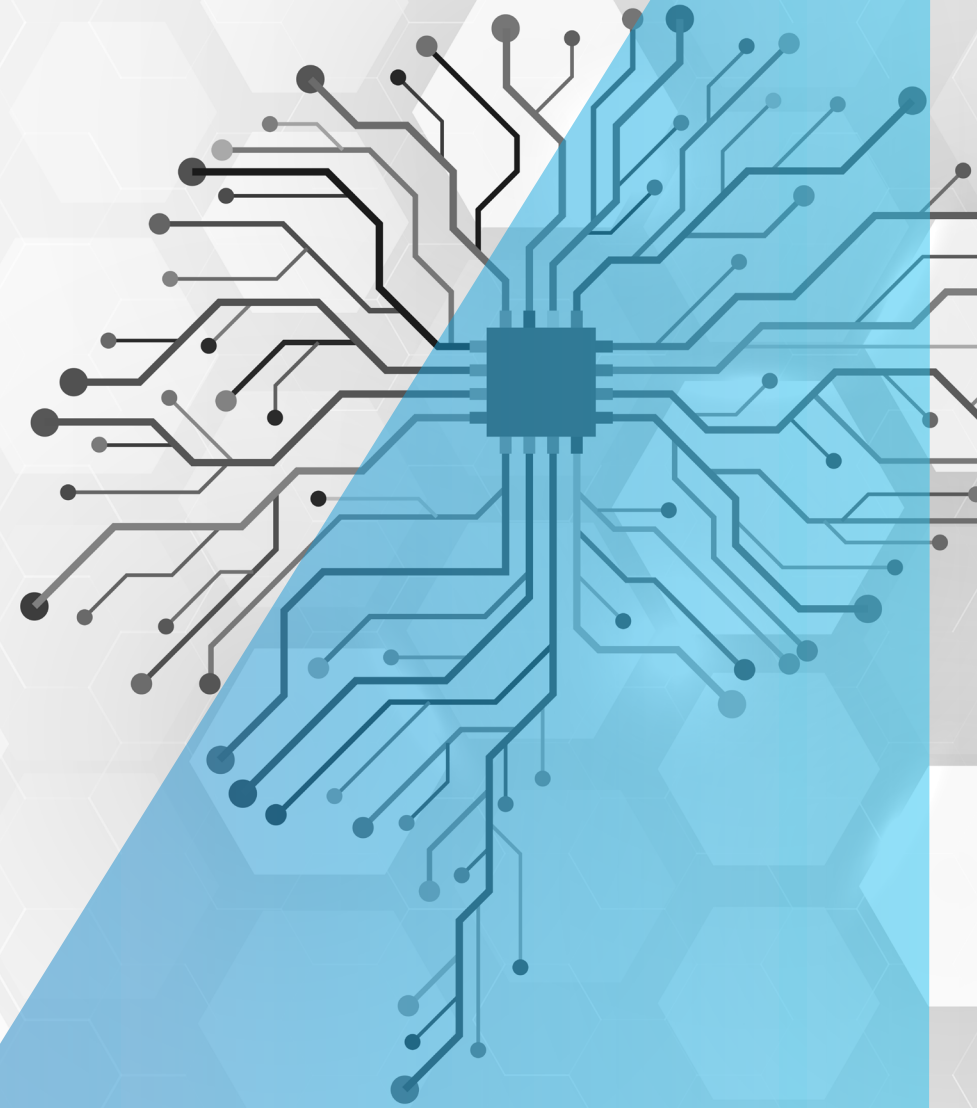
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 **NVIDIA**

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Introduction

As artificial intelligence (AI) solutions enter the mainstream across numerous industries, solution builders must understand each industry’s unique requirements to ensure that bespoke options are production-ready. Original equipment manufacturers (OEMs) can take several routes to market, although not all are equal. This paper examines the best practices that OEMs should consider as they bring their AI-enabled products to market.

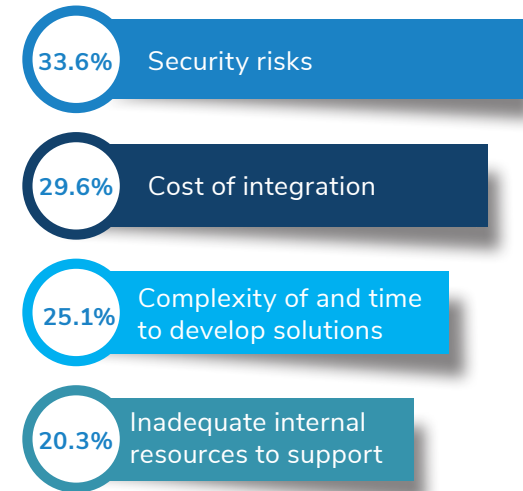
Investments in AI solutions continue to grow

Research suggests that AI has the potential to increase worldwide economic output by US\$13 trillion by 2030. (Source: McKinsey) A recent Frost & Sullivan survey of more than 1,600 organizations indicated that nearly 90% of respondents intend to increase their AI/machine learning (ML) investment over the next two years.

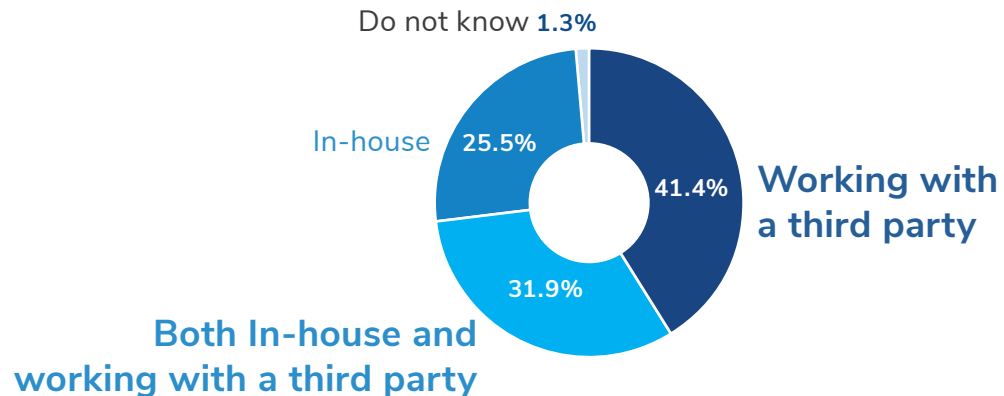
TOP REASONS FOR INVESTING IN AI



TOP CONCERNS REGARDING AI AND ML



MEANS OF DEVELOPING AI SOLUTION



AI is Everywhere and it's Revolutionizing Everything

Leading solution builders integrate AI into their products to strategically differentiate their solutions and to add incremental revenue streams. They've realized the importance of co-designing their AI solutions with technology partners that have both the capability and the expertise to develop and implement AI solutions at scale. These leaders are uncovering multiple opportunities to bring transformative solutions to a variety of vertical industries.



Banking/Finance

- Real-time fraud detection, anti-money laundering
- Credit application scoring algorithms/approvals
- Intelligent customer service chatbots
- Alternative data analysis for algorithmic trading/ risk management
- Intelligent trading assistants/ robo-advisors



Education

- Individualized learning/ intelligent tutoring systems
- Smart content platforms
- Real-time translation of globalized education material
- Virtualized learning environments/ virtual facilitators
- Career path prediction



Energy & Utilities

- Smart energy metering
- Cognitive power plants (load forecasting, yield optimization)
- Autonomous resource exploration
- Facilitation and direction of energy trading
- Energy theft prevention



Government / Smart City

- Intelligent security cameras
- Computer vision/smart municipal parking systems
- Air quality monitoring/ pollution reduction
- Smart urban traffic management/public transportation operations management
- Social and financial/ budgeting analysis, predictive models



Healthcare

- Predictive models for population health
- Imaging analytics for diagnosis and pathology (e.g., tumors, sports injuries)
- Virtual service delivery (e.g., telehealth, mobile health) and procedures (e.g., teleoperated surgery robots)
- Clinical setting optimization (e.g., smart hospital data acquisition/Analysis/decision support)
- Rapid and exhaustive drug discovery



Manufacturing

- Predictive maintenance of manufacturing systems
- Quality inspection/ automated optical inspection
- Automated manufacturing process optimization
- Intelligent, real-time security (cyber, physical)
- Supply chain optimization



Retail

- Stock optimization (eliminating overstock/out-of-stock)
- Voice-based product search (natural language processing for customer product queries)
- Virtual fitting rooms/ mirrors and product recommendations
- Cashierless and cashless stores
- Intelligent upsell /cross-sell (e.g., next best offer) aligned to customer



Transportation

- Autonomous vehicles
- Law enforcement (e.g., distracted or impaired driving detection)Virtual fitting rooms/mirrors and product recommendations
- Facial recognition, security assurance at entry/exit ports, checkpoints
- Safeguard vulnerable road users (prediction of pedestrian/cyclist movement)
- Smart roads



Travel & Hospitality

- Operational analytics, occupancy rate, and load factor optimization
- Virtual concierge, guest service chatbots
- Hotel energy management and predictive facilities maintenance
- Robotic baggage handling
- eCommerce and payment fraud detection



Logistics

- Automated warehouses
- Supply chain management and optimization
- Route optimization
- Supplier selection and supplier relationship management
- Language translation (e.g., NLP for compliance and auditing)

Source: Frost & Sullivan.

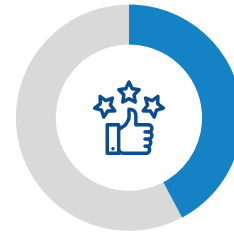
Solving Real World Problems with AI

Solution builders are embedding AI into their products enhance their customers' strategic and operational capabilities to solve real-world problems. Customers want AI capabilities that enhance user experience, boost creativity, and support innovative products and services. They will rely on their technology partners to supply them with AI enabled computing hardware and devices that meet increasingly complex workload requirements.

Anticipating and bringing to market AI-powered solutions

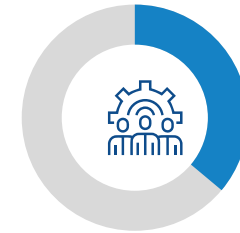
Customization and time to market can dictate a winner, yet few OEMs are equipped to navigate the technological complexities of AI-driven workloads. The right partner can help an OEM respond quickly to each customer's unique business challenges, whether it be meeting stringent regulatory requirements in healthcare, ensuring data security across an entire smart city ecosystem, or maintaining optimal performance in an automated factory.

CAPABILITY ENHANCEMENTS EXPECTED OF AI-ENABLED PRODUCTS



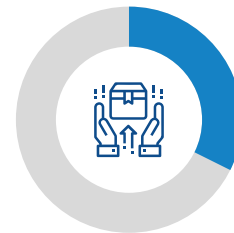
44.2%

Improving customer experience and satisfaction



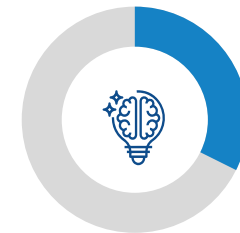
41.4%

Improving operational efficiencies



33.3%

Launching new products and services



33.3%

Boosting creativity and innovation



25.0%

Rapidly responding to market demand & disruption

AI in Healthcare and the Health Sciences

AI-enabled solutions can help healthcare and life sciences companies improve patient outcomes, make medical procedures more efficient, and expedite the development of new therapies and treatments. AI can enhance remote patient monitoring, pharmacy automation, mobile asset tracking, patient flow, and other critical services. Tightly aligned hardware and software components ensure superior performance and compliance with stringent data privacy, security, and residency requirements.

Imaging analytics can accelerate cardiovascular diagnosis

When a patient comes into an emergency room complaining of shortness of breath, a chest X-ray is a common test to detect heart problems. Time is of the essence in a busy critical care environment, but a busy radiologist with a backlog of images may not be able to perform an immediate visual assessment; a supporting AI technology would be able to quickly analyze X-ray imagery and help a clinician prevent a condition from worsening.

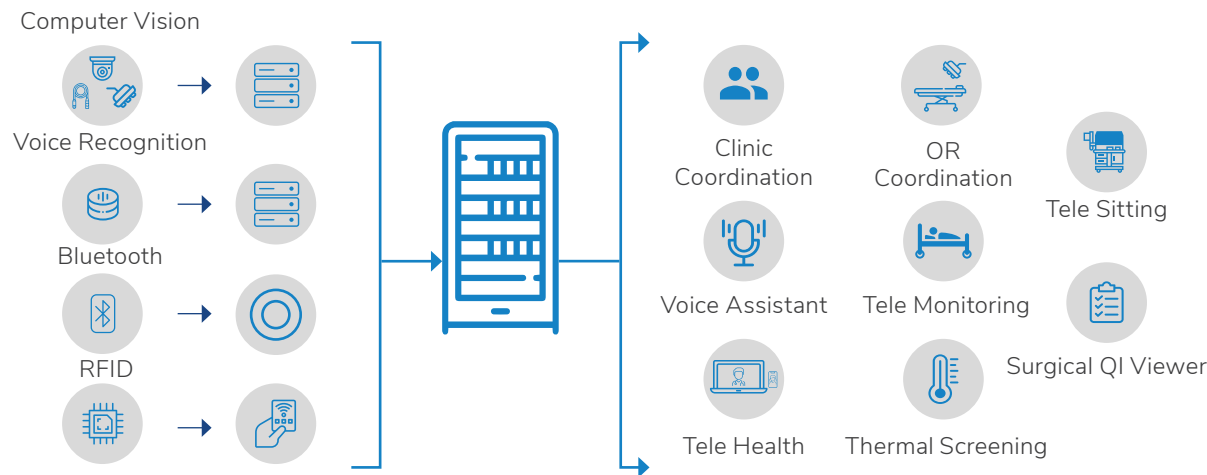
Robot-assisted surgery improves patient outcomes

Integrating AI and robots in surgical processes can amplify a surgeon's effectiveness. Data from pre-op medical records can be analyzed by algorithms to assist a team in planning procedures and guide the team as they perform them. Medtronic's Mazor platform, for instance, can provide multiple monitoring angles and navigation guidance in real-time, giving surgeons another tool when performing procedures.

AI-assisted drug discovery means effective therapies are developed faster

High-throughput screening combines AI with automated, high-speed data analysis to accelerate the discovery of and, ultimately, the approval process for promising new therapies. Today, the sense of urgency is stronger than ever to develop effective pharmaceutical treatments or repurpose existing drugs to combat new health threats.

THE SMART HOSPITAL FRAMEWORK



Source: Frost & Sullivan.

Smart Hospitals are in the Vanguard of Advancements in Healthcare

Frost & Sullivan projects that by 2025, 1 in 10 hospitals globally will have some degree of underlying digitized network in place to interconnect assets. These so-called "smart hospitals" will be able to optimize, redesign, or build new clinical processes, management systems, and potentially even infrastructure.

AI in the Public Sector for Smart and Safe Cities

Companies that are designing products for the public sector are finding many applications for AI-enabled solutions under the “smart and safe city” banner, including traffic flow improvement, cyclist and pedestrian safety, and air pollution mitigation. AI capabilities combined with networks of devices and sensors create edge-to-cloud platforms that gather massive amounts of data and employ predictive analytics to guide city planners and administrators on decisions that improve municipal services and citizen well-being.

City planners can predict traffic flows to eliminate congestion

Verizon is attaching AI-powered smart camera arrays to urban vantage points (e.g., street lights) in U.S. cities as part of Internet of Things (IoT) platforms that use the company’s networks. The platforms capture multiple video data streams that depict real-time traffic levels across a city. Automated traffic mitigation measures employ deep learning algorithms to predict conditions later in the day based on factors including number of vehicles and direction of travel, allowing operators to proactively shape traffic flows to reduce or prevent congestion.

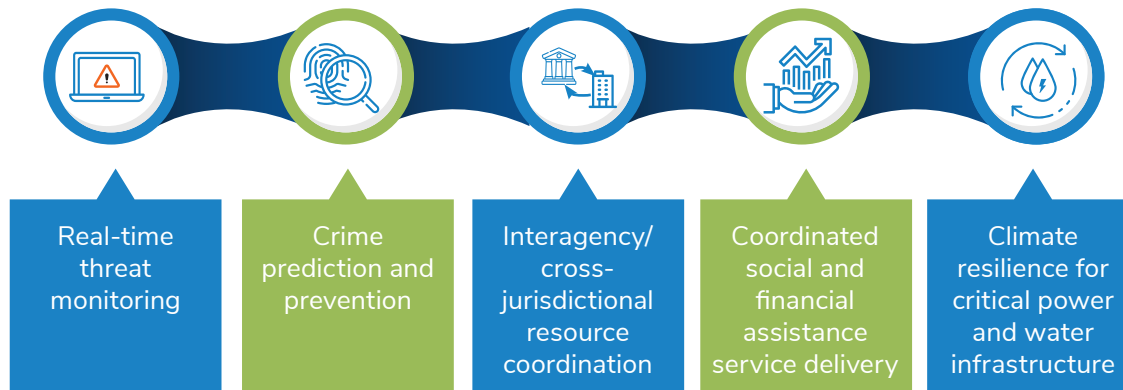
AI enables bicyclists and pedestrians to ride ‘waves’ of momentum

AI-powered edge devices gather images of vehicles, bicycles, and pedestrians moving along busy urban corridors and use algorithms to predict their interplay. Signaling devices, for example, can be dynamically adjusted to slow vehicles and give priority to cyclists at a busy intersection or give a large group of pedestrians enough time to safely reach the other side of a crosswalk.

AI can reduce air urban pollution

Breeze Technologies, a German company, developed an AI-powered system that gathers vast amounts of data from citywide sensors and transports it to the cloud, where deep learning algorithms analyze air quality data in real time to provide on-the-spot estimates of pollution levels and recommend specific actions, targeted at specific locations, to improve air quality.

SAFE CITY SOLUTIONS TO HARD PROBLEMS



Frost & Sullivan predicts that spending on smart city technology will increase from \$96 billion globally in 2019 to \$327 billion by 2025, with additional opportunities emerging in the safe city realm for public health, security, and social services.

Source: Frost & Sullivan.

AI in the Smart Factory

Solution builders targeting the manufacturing industry will link advanced algorithms and analytics with the IoT and sensors to create smart factories. Once-siloed assets will become part of cyber-physical ecosystems and bidirectional or circular business models that supplant traditional linear processes. These factories of the future will use digital twins to simulate production lines in order to identify and correct problems before they occur.

Steel mills 'discover' ways to improve

A partnership between Noodle.ai and Big River Steel created a steel mill that continually senses, learns, and improves its processes. Large volumes of data collected from sensors throughout the mill are analyzed and used to predict demand and optimal production conditions. The system also can prescribe actions to maximize yields and improve quality and safety.

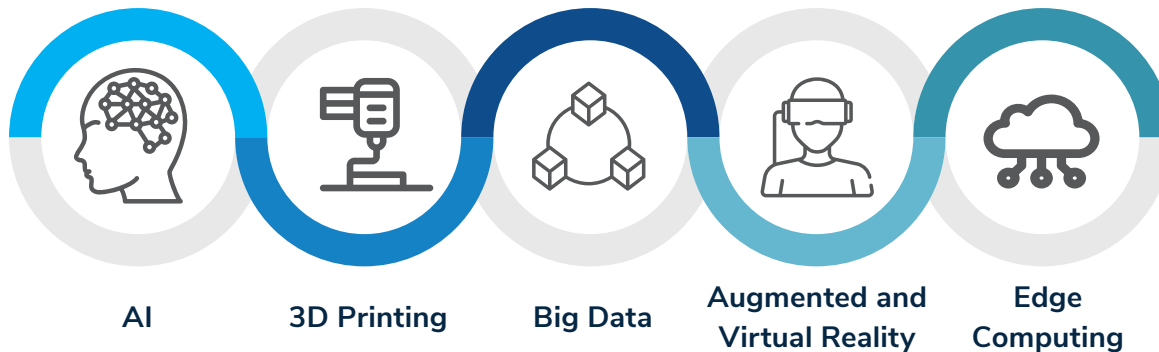
Intelligent quality control and preventative maintenance boost manufacturing efficiency

Total productive maintenance is an AI-enabled practice that optimizes machine assets and processes to increase production yield and safety. AI can be paired with thermal cameras, for example, to recognize stress fractures, leaks, or slight temperature changes in bearings on a conveyer system and alert operators so that a problem can be addressed before it worsens. AI-enabled thermal vision also is used in quality control to inspect manufactured parts.

AI protects factories from cyber threats

As manufacturing shifts to the Industry 4.0 paradigm, the line between information technology and operational technology is blurring. Automation and the IoT in today's factory create openings for cyber-attacks. The front line of protection includes AI-enabled security systems that are able to learn the profiles of every user, device, and process in the manufacturing environment. When the system detects anything that does not fit the profile, it can analyze the anomaly, determine the threat level, and alert operators in real time about the next best action.

FIVE KEY TECHNOLOGIES IN THE SMART FACTORY



AI in manufacturing is rapidly moving toward human-machine interface. Industry 4.0 will give way to Industry 5.0 as people and intelligent machines collaborate to create products that are mass-customized and fabricated on-demand close to the end customer. Tomorrow's factories will be planned around providing outcome-based services, which means that products will be designed with underlying intelligence and communications capabilities.

Source: Frost & Sullivan.

Implications for OEMs Building AI-Enabled Solutions

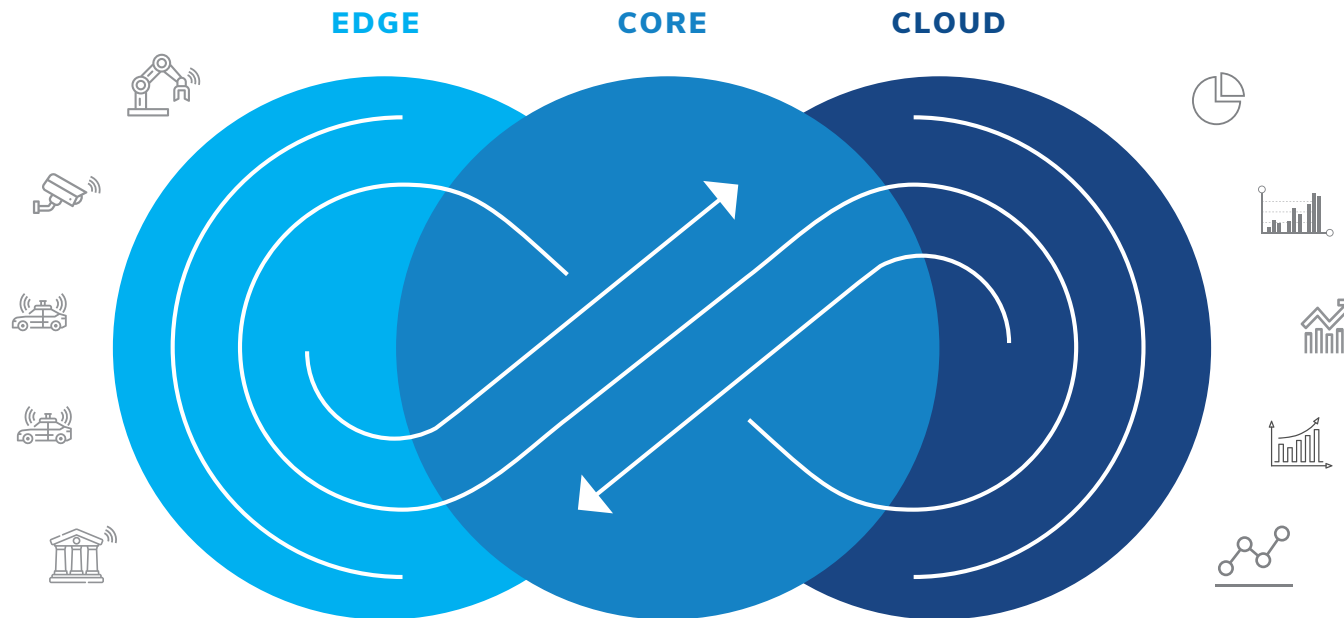
Solutions that leverage advanced technical architectures will be deployed in businesses, in homes, and in the field. This is the edge, where an entirely new set of problems will occur and must be solved. The challenge for designers will be how to solve them.

From Data to Decisions

When designing solutions for the edge, OEMs can harness AI technology so that businesses can predict trends, identify and create new opportunities, produce actionable insights, and generate additional revenue.

Edge solutions process data where it is created rather than pushing processing to the core of the network or in the cloud. This has the advantage of faster results, as well as lowering data transport costs and enabling near-real-time decisions. As AI-enabled edge solutions gather more and more data and intelligent algorithms quickly and iteratively process that data, the solutions can learn and make more precise and accurate predictions and problem-solving suggestions. Still, the edge is part of a larger intelligent ecosystem that includes AI capabilities at the core and in the cloud.

MAKING THINGS SMARTER ACROSS THE INTELLIGENT ECOSYSTEM



Source: Dell Technologies

Considerations When Designing AI Solutions for the Intelligent Ecosystem

Designing AI-enabled solutions for the edge starts by considering what data to use for analysis and how individual decision makers will use the results of the analysis to solve hard problems. Additional considerations involve the velocity of data gathering, data cleaning, and data ingestion.

The use cases presented earlier in this paper highlight the advantages that AI-enabled edge solutions can bring. As use cases become more complex and require more sophisticated solutions, the demands placed on these solutions will correspondingly increase. OEMs designing for these complex cases will have to invent more powerful and agile enterprise-grade solutions that provide high availability and a high fail-safe ratio.

AI-optimized hardware, such as GPUs, ingests and processes large volumes of data in various formats streaming in at high velocity. **GPUs** are generally viewed as the optimal means of running an AI workload; their key ability lies in handling large amounts of computational work quickly. GPUs are particularly well-suited for neural network uses, deep and machine learning, and image processing. The intricacy of natural language processing and understanding is well served by GPUs' multi-step, multi-algorithm processing, and parallel processing.

When the amount of data processing and computing power exceeds the capabilities of the edge, the core and cloud come into play. **AI in the core and cloud** is well-suited for processing the large amounts of data used to train AI models and becomes an important element of solution design. In hybrid or multi-cloud environments, data could be drawn from several sources; OEMs will have to consider designing capabilities into their solutions that can access data from different places.

Solution designers must also consider building products that meet **enterprise-level requirements**. This means that AI-enabled solutions are fail-safe and rugged to maintain consistent performance levels, withstand harsh elements, and be tamper proof and secure, all while ensuring operational continuity in critical working environments. In some use cases, such as banking and finance, healthcare, and government services, enterprise-level solutions must comply with applicable laws and qualify for regulatory approval.

Bridging Capability Gaps with a Dell Technologies and NVIDIA Partnership

AI designers need the right technology partners to make their ideas a reality, giving them the freedom to focus on marketing and further innovation while the partners handle the actual solution manufacturing.

ENTERPRISE CLASS SOLUTIONS

Dell Technologies OEM Solutions and NVIDIA offer market-ready programs with existing solutions that can be quickly leveraged to meet an OEM's unique needs. With AI-ready platforms and NVIDIA-Certified Systems with solutions for AI workloads from the [NVIDIA NGC](#) software catalog, Dell Technologies and NVIDIA understand OEMs' business needs.

LEADING EDGE ACCELERATORS AND SOFTWARE

Dell Technologies has invested heavily in solutions that incorporate leading-edge GPU accelerators and software from NVIDIA. Dell Technologies OEM Solutions engineering teams have designed and

built multiple solutions to meet a variety of customers' needs. Many have been purpose-built to meet stringent industry certification requirements. OEMs can be confident that fixed configurations can be manufactured at scale on a global level in Dell factories.

VAST ECOSYSTEM OF PARTNERS

Dell Technologies OEM Solutions works with a vast ecosystem of partners to test, validate, and certify software and hardware solutions to ensure interoperability and ease of management. Dell Technologies has the means to source and vet other technologies to meet an OEM's specific needs, and rearchitect software to be cloud native and manage AI-driven workloads. NVIDIA's strength is showcased in the new [NVIDIA A100 Tensor Core GPU](#) that delivers unprecedented acceleration at every scale for AI, machine learning, and high-performance computing. As the engine of the NVIDIA data center platform,

A100 can efficiently scale up to thousands of GPUs or, using Multi-Instance GPU (MIG) technology, can be partitioned into as many as seven isolated GPU instances to accelerate workloads of all sizes.

Partnering with Dell and NVIDIA offers the combined benefit of long-standing Tier 1 expertise in the manufacture of enterprise-grade devices, existing reference designs, and proven engineering. Their enterprise-class solutions are tried, tested, and proven to perform reliably in demanding settings.

SIGNIFICANTLY REDUCING TIME TO MARKET

A technology partner must be capable of supporting robust production and certification requirements. Not only have Dell Technologies OEM Solutions and NVIDIA demonstrably reduced R&D and manufacturing costs, but they have also acted as a time saver by significantly reducing OEM time to market.

ESSENTIAL CRITERIA TO CONSIDER IN EVALUATING A PARTNER INCLUDE:



Technology expertise in designing, engineering, building, and deploying AI solutions.



Understanding of and experience in solving unique, complex business challenges.



Proven success in bringing solutions to market and certified systems validated for performance, functionality, scalability, and security.

NEXT STEPS



Find out more: delltechnologies.com/oem



Find out more: nvidia.com/en-us/industries/smart-cities/

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