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Recent Progress on the Convergence of the Internet of Things and Artificial Intelligence

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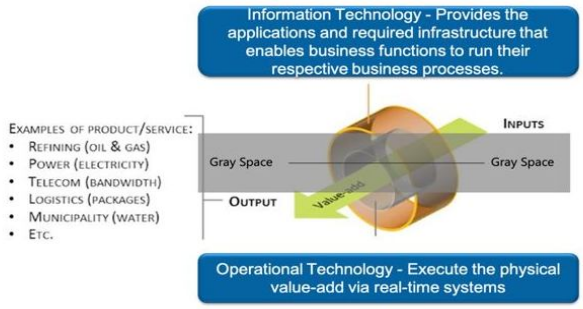
Abstract: ***Artificial Intelligence of Things (AIoT) is the natural growth for both Artificial Intelligence (AI) and Internet of Things (IoT) as they are mutually gainful.. AI raise the value of the IoT through Machine Learning by transforming the data into useful information, although the IoT increases the value of AI through connectivity and data exchange. Hence, InSecTT – Intelligent Secure Trustable Things, a pan-European effort with 52 key partners from 12 countries (EU and Turkey), gives intelligent, secure and trustworthy systems for industrial purposes. This results in global cost-efficient solutions of intelligent, end-to-end secure, authentic connectivity and interoperability to bring the Internet of Things and Artificial Intelligence in sync. InSecTT targets at creating trust in AI-based intelligent systems and solutions as a major part of the AIoT. This paper provides an overview regarding the concept and ideas behind InSecTT and introduces the InSecTT Reference Architecture for infrastructure organization of AIoT use cases.***

I. INTRODUCTION

Internet of Things (IoT) make possible the interconnection between billions of devices, industrial machines, processes, and users to exchange data beyond any central coordination. However, handling large amounts of data is excessively complex in the storage, processing, and inferencing processes. So, artificial intelligence (AI) has become the most promising composite with IoT for better use, storage and bypass the uncertainty management in decision making. AI in IoT is playing a important role and can improve the value of distinct types of data sensed and collected by IoT devices. For proper usage of this diverse type of data will offer an efficient solution for the development of products and services to attain the user's expectation from different sectors. Even though the various advantages of the integration of AI with different intelligent systems for several industrial applications, the relevant application of AI poses several challenges with respect to data quality, data volume, integration, and accuracy of the inferences drawn from the gethered data. In the latest decades, machine learning (ML) based methods and technologies have arrive in AI and the convergence of ML and IoT will accompaniment each other to produce a greater impact and availability of different services together with healthcare, supply chain, transportation, and power sectors.

II. IT/OT ORGANIZATIONS LEAVE AN ABUNDANCE OF GRAY SPACE

Information technology or "IT" commonly gives the applications and infrastructure that facilitate business functions to run their individual business processes. Operational technology or "OT," in order, executes the physical value-add via real-time systems.



Respective Functions of the IT and OT Organizations

Historically, the scope and ownership of IT lid the spectrum of systems that support centralized corporate functions as finance, HR, supply chain, order management, sales, etc. These functions and their processes contributr to have commonality across industries. However, OT consist the spectrum of systems that deal with the physical transformation of products and services. These task-specific and often mission-critical systems are greatly customized for individual industries. They commonly fall under the domain of a centralized (global) engineering services group or de-centralized (plant-level) engineering group.

ARC has observed that the confluence and overlap of IT and OT groups, driven greately by the digital transformation of industry in late years, has created organizational confusion around ownership and responsibility. This historical view is somewhat concerned by technology change and convergence, centralization vs decentralization, and the popularity of significant "gray-space" of common technologies betwixt each area.

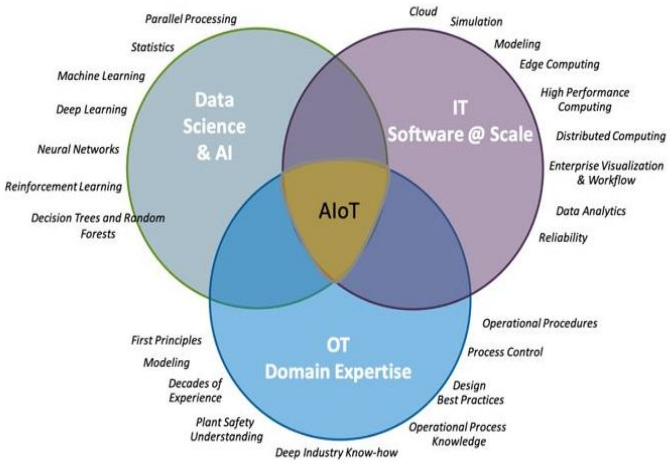
III. CONVERGENCE OF AI AND INDUSTRIAL IOT

Industrial companies are facing for better ways to connect their workforce to decision tools and digitally boost or augment work and business processes. At the center of industrial technology strategies, leaders are fronting to make better use of industrial data already collected and help distinct persons within the organization make better decisions that enhance business performance. We see this dynamic beyond all aspects of manufacturing, from design engineering to operations and maintenance to supply chain and human resources.

After all , foraging AI requires data science capability, adding additional complexity to an before complex environment. An AI system built for industrial processes without acceptable knowledge of a plant or process or without appropriate controls and systems could create a probably dangerous situation by introducing sincere errors and impacting plant decision making.

Industrial manufacturing has not commonly built organizational capability in data science. While engineering roles are skilled in analyzing large amounts of data, setting up and building production-grade machine learning environments is not easily accomplished.

AIoT is the convergence of AI and the IoT, collecting intelligence from the edge to the cloud in industrial environments, taking transforming the data into useful information for an enhanced decision-making process, with processing done in a location where it is most desired. The base of Industrial IoT is the ability to collect extensive quantities of data at high frequency and making these unified datasets mobile and accessible across the organization for critical decision making. AIoT is the democratization of AI and machine learning in the industrial domain by impending data science with IT providing software at scale and OT domain expertise.



The Convergence of IT-OT-AI: Democratizing and Embedding AI

Artificial Intelligence is the brain of a system, while the Industrial IoT (Internet of Things) functions like the digital nervous system.Once, this digital nervous system was primarily based entirely on traditional systems and architectures, such as control systems, networks, and process historian infrastructure. But today, the industry is borrowing again from IT and ways and architectures developed for enterprise systems including the cloud. These systems make it easier for the industry to inlay AI into operational technologies by leveraging a scalable data infrastructure to power Industrial AI models from training to productization and allow users to solve industrial problems beyond significantly adding data science capabilities to industrial organizations.

IV. CHALLENGES AND OPEN ISSUE

Commonly speaking, the convergence of IoT and AI has brought a series of opportunities for both social and economic developments. Scenarios such as smart homes, intelligent transport, and smart manufacturing are all representatives that are successfully determined by advanced AI tech-nologies. However, it is worth noting that the con-vergence of IoT and AI also targetting to open issues and challenges.On end, the security and privacy issues are the most basic challenges at the time the convergence. As this the fact that data serves has the basis part of both IoT and AI, leaks of sensi-tive information will go through from greater risks and threats. In appropriate, with the vulnerabilities and weaknesses of AI algorithms, there are more exposure regarding security and privacy concern. How to guarantee security from end to end is one of the issues that should be emphasized at the time of the con-vergence between IoT and AI.

Beside, the convergence of AI may threat existing IoT architecture. The tradition-al IoT only target on establishing inter connect-tions between busted things, while with the convergence of AI, IoT needs to pay much more attention to intelligence. Hence, it will drive a new movemet of industrial revolution, in which countries and companies all required to formulate strategies in order to achive advantages in the future market competition.

A. Conclusion

ARC Advisory Group research finds interest in AI in manufacturing to be strong; yet, a recent digital transformation study of 157 process manufacturers detect barriers to organizational accountability, change leadership, and capability. This disconnect between ambition and ability is source for industrial companies to explore ways to emulate application of AI through Industrial AI, just as Industrial IoT has democratized the access to data.The junction of AI and Industrial IoT technological forces gives inaugraul to a new digital solution category -- the Artificial Intelligence of Things (AIoT) -- that centers on unlocking the untapped business value in industrial data. This category depicts the combination of AI technologies with the Industrial IoT to faciliate the next generation of Industrial AI infrastructure, allowing organizations to enable seamless human-machine workflows, harmonize industrial data management, and rapidly transform raw data into actual business outcomes.Today, the industry stands at a tipping point – they must tap into the upsetting power of these technologies to transform their business operations and redefine their sustainable competitive advantage or else risk discontinuance. As AI and Industrial IoT converge into AIoT, the information technology (IT) and operations technology (OT) functions are also converging -- unlocking further opportunities and challenges.

Drivers for AI and Industrial IoT convergence place an emphasis on using data already gathered. ARC Advisory Group recommends industrial users consider the following business drivers to justify an AIoT strategy.

Driver	Benefit
Improve the capability of IT and OT organiza-tions	Address acceleration of digital transformation and Industrial IoT while avoiding duplication of effort
Implement new tech-nologies and AI	Improve business performance, margin optimiza-tion and operational excellence
Developing skills and competency	Address technology change, micro-learning
Extracting more value from systems	Leverage data and infrastructure already being gathered
Improve the capacity for internal customers	Better absorb technology and accelerate work pro-cess change

Drivers for AIoT Convergence

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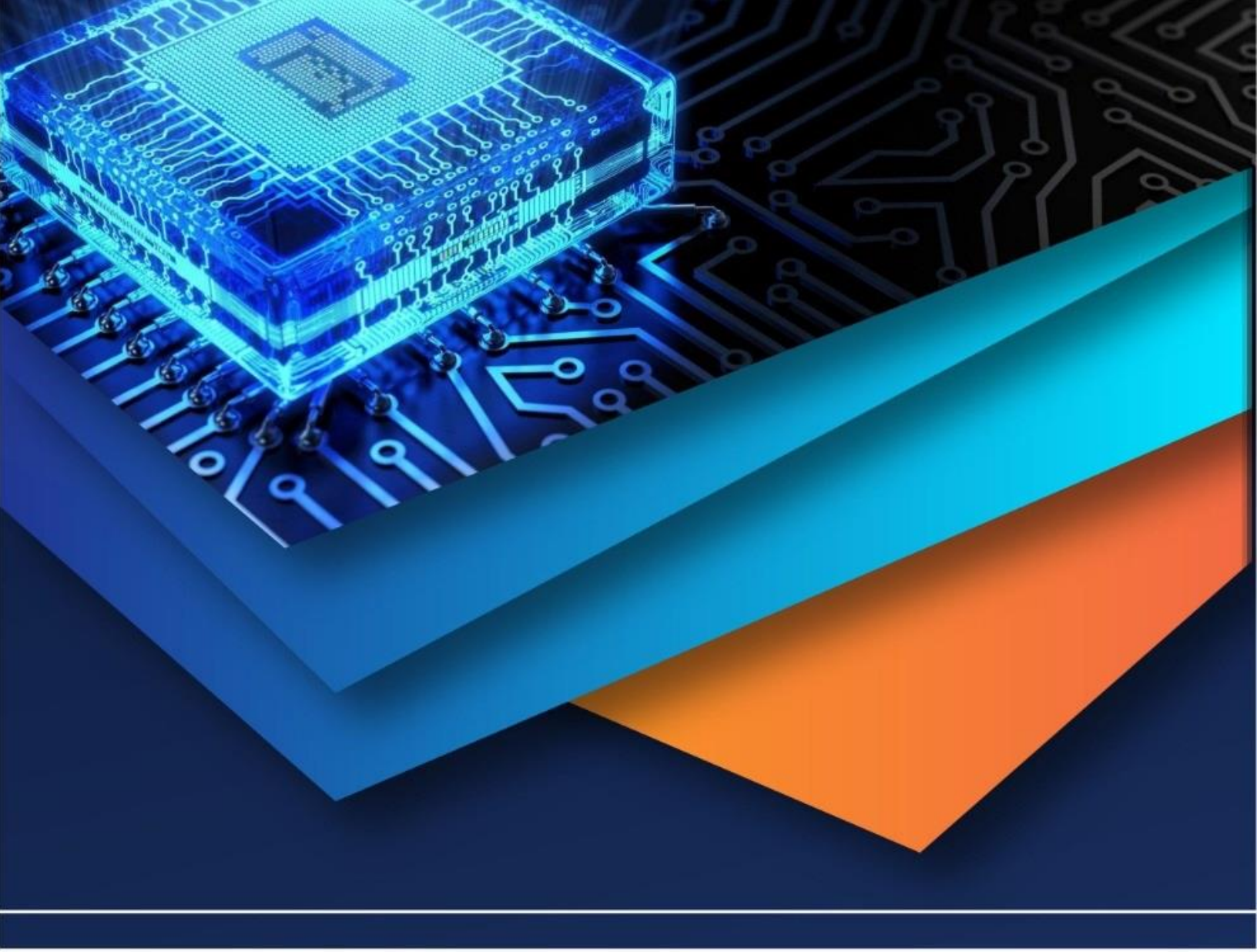

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