ADLINK
LEADING EDGE COMPUTING

Private 5G is the Final Piece to the Smart Factory Puzzle



ADLINK MicroRAN Actualizing Low-Touch Smart Factories

MicroRAN Use Case

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In the ever-evolving landscape of industrial applications, integrating private 5G marks a transformative era for smart factories. Industries must realize the immense potential and critical importance of leveraging private 5G networks to propel smart manufacturing and drive unprecedented efficiency, connectivity, and innovation advancements. Notably, with the increasing significance of AI, the necessity for a heightened speed link emerges where high-speed networks serve as a crucial cornerstone for enhanced production quality and fortified security measures.

ADLINK's Smart Factory Blueprint

The anatomy of a smart factory powered with private 5G extends beyond mere abstraction. ADLINK, a global automation manufacturing company, tangibly realized the blueprint of an effective smart factory.

Distilling our expertise, ADLINK outlines 5 pillars that shaped our smart factory:

Data Acquisition:

AI-enhanced optical inspection technology to improve product quality

Data Insights:

Real-time production information analysis and visualization to maximize capacity utilization and support global supply chain management

Preventative Maintenance:

Visualizing equipment data for preemptive detection of equipment replacement needs to reduce downtime

Automated Production:

eamless collaboration between robotic arms and Automated Mobile Robots (AMRs) to enhance efficiency and productivity

Digital Twin:

Digital simulation of the factory helps to mitigate potential risks while remote services facilitate collaborative collaboration and remote auditing builds consumer trust

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Digital Twin,
an overlooked powerhouse

The digital twin, highlighted as the fifth pillar, commands special attention as an often overlooked yet powerful tool in an effective smart factory. Functioning as a digital simulation of the factory that requires a high-speed 5G network, these twins are constructed through real-time data integration, IoT sensors, and advanced modeling. They offer numerous benefits to the smart factory, including:

Efficiency	Improved efficiency through real-time monitoring and analysis of manufacturing processes to identify inefficiencies and bottlenecks
Predictive maintenance	Predictive maintenance through monitoring the condition of machinery and equipment using data from sensors
Resource management and supply-chain optimization	Resource management and supply-chain optimization by tracking the use of energy and raw materials for waste reduction, improved logistics, and efficient inventory management
Remote monitoring and control	Remote monitoring and control to help reduce the need for on-site personnel
Training tools	Training tools for employees by offering a virtual environment for practicing with various components before engaging with physical equipment

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Challenges in Building a Smart Factory

Despite the evident advantages of private 5G networks, many industries are slow to adopt this technology in their industrial setting due to the substantial existing infrastructure, the cost of upgrading outdated equipment, and the critical need for seamless operation with minimal downtime. Simultaneously, the hesitation to embrace private 5G in industrial applications stems from a risk-averse mindset prevalent in the manufacturing sector.



For industries transitioning to smart factories, several pain points arise:

- **Budget Constraints and Increasing Expenses:**
  Developing a low-touch factory with a limited budget while balancing the challenge of increasing expenses associated with labor and energy
- **Network Bandwidth Stability:**
  Ensuring acceptable and stable network bandwidth for the smooth operation of production lines while optimizing connectivity to support various manufacturing processes
- **Data Integration Across Disparate Connections:**
  Facilitating seamless integration of data from different sources and various I/O technologies
- **Wireless Security Concerns:**
  Protecting sensitive industrial data and ensuring the integrity of communication channels through a wireless transmission channel
- **Challenges in Implementing Plans:**
  Implementing sustainable plans to overcome the complexities of legacy systems and incorporating innovative technology

In essence, the transition to smart factories requires a meticulous equilibrium between financial considerations, seamless technological integration, and robust security measures. As the industrial landscape transforms, addressing these crucial pain points becomes increasingly pivotal for a successful digital evolution in manufacturing facilities. Fortunately, ADLINK's MicroRAN solution provides the strategic remedy to the challenges posed by factory digital transformation.

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Navigating Challenges with ADLINK's MicroRAN



Budget Constraints and Increasing Expenses

Addressing the challenge of budget constraints in low-touch factories becomes paramount in the face of escalating labor and energy expenses. Implementing automated production processes is a cost-effective solution to counterbalance the financial limitations of increasing labor costs. In an ideal scenario, a "low-touch" factory minimizes human intervention and physical contact through production processes. Leveraging automation, AMRs, and cutting-edge digital technologies becomes pivotal in reducing or eliminating the necessity for direct human involvement in tasks characterized by repetition, labor intensity, or susceptibility to errors. This approach is also particularly beneficial for handling hazardous materials and increases workplace safety. Notably, ADLINK's MicroRAN solution has demonstrated a remarkable reduction in labor costs of up to 50%. This underscores the effectiveness of adopting advanced technologies in optimizing operational expenses. Considering the economic implications, the choice between Wi-Fi and Ethernet connections proves pivotal in constructing a cost-effective factory compared to the pricier 5G connection. Conveniently, ADLINK's MicroRAN series is designed to provide end-to-end connectivity, providing clients with the flexibility to choose 5G, Wi-Fi, and wired Ethernet.



Network Bandwidth Stability

An optimal solution to address the challenge of network bandwidth stability while maintaining the seamless operation of production lines in industrial settings lies in deploying an integrated private 5G platform. This all-in-one platform offers enhanced network and connectivity architecture. It efficiently manages critical functions such as production planning, process control, product tracking, performance monitoring, and quality assurance. Additionally, high-speed private 5G connected systems can benefit from smoother operations and reduced operational costs through real-time monitoring and control that facilitate data-driven decision-making across the manufacturing environment, including efficient allocation of resources such as workforce, machinery, and raw materials. Smart factories powered by digital technologies such as IoT, sensors, data analytics, and high-speed 5G connectivity epitomize this paradigm shift. Particularly, ADLINK's MicroRAN has the unique ability to manage devices and allocate tailored bandwidths to meet specific applications. Its universally connective architecture is forward and backward-compatible. It accommodates both existing devices and new deployments, establishing it as a versatile solution across diverse network environments while guaranteeing product lines' smooth and uninterrupted operation.



Data Integration Across Disparate Connections

In critical applications, 5G technology emerges as a game-changer, ensuring seamless data handover for mobile devices while eliminating potential latency or data loss concerns. Addressing the intricate landscape of disparate connections, ADLINK's MicroRAN stands out by effectively managing various devices, spanning 5G, Wi-Fi, and Ethernet. This versatility empowers factory managers with the flexibility to strategize and accommodate different devices at distinct operational stages. As mentioned previously, MicroRAN is uniquely equipped with universal connectivity. Thus, it can adeptly navigate data handovers, whether transitioning from a 4G to a 5G network or shifting between LAN and cellular connectivity. Ultimately, ADLINK's MicroRAN ensures the uninterrupted flow of data and positions itself as a reliable solution that harmonizes with the evolving technological landscape.

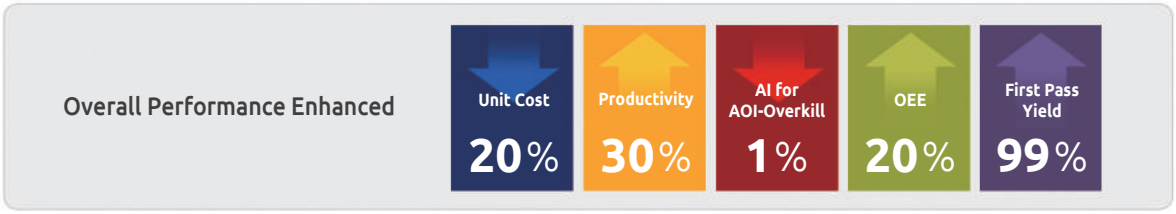
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Wireless Security Concerns

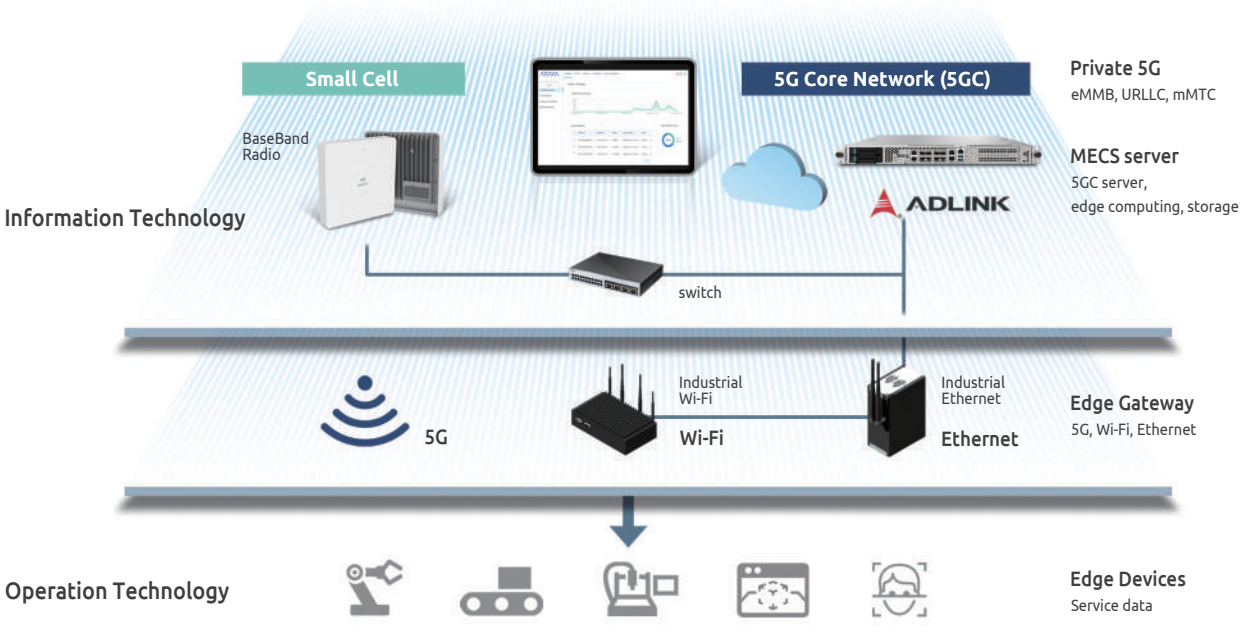
Data security is a paramount concern where safeguarding sensitive industrial data and ensuring the integrity of wireless communication channels is of utmost importance. Recognizing this urgency, ADLINK, a trusted partner for numerous Tier 1 companies, opted for private 5G, which mitigates the risk of data leakage and provides granular control through a centralized 5G management platform. This platform allows precise assignment and regulation of private 5G connections based on devices, locations, and timing. The MicroRAN series, integral to ADLINK's private 5G network solutions, elevates wireless security and conveniently offers multiple levels of security, starting from SIM-card access. It also employs policy-based access control, empowering administrators to selectively allow or block access to specific lists and files while imposing limits and filters on traffic. This robust security approach ensures that client groups remain isolated through segmentation or DNN access policies and minimizes the access surface while enhancing overall threat control. Leveraging advanced measures such as ACL, URL filtering, and a firewall, ADLINK's MicroRAN sets a new standard for wireless security, offering a robust shield for critical industrial data.

Challenges in Implementing Plans

Finally, to actualize the deployment of a smart factory with innovative technologies and implement sustainable strategies that can navigate the complexities associated with legacy systems, ADLINK's MicroRAN stands out for its user-friendly management and deployment capabilities. The entire platform is centrally controlled through a single Human-Machine Interface (HMI), which ensures easy oversight. Moreover, MicroRAN is optimized to autonomously detect and troubleshoot any issues that may arise, streamlining operations and enhancing overall efficiency. This comprehensive solution is tailored to meet the evolving demands of modern manufacturing while providing a solution that is both cutting-edge and user-centric.



ADLINK's MicroRAN Architecture and the Edge Server



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ADLINK's MicroRAN architecture comprises three core components: the core server, a small-cell unit, and the 5G management software built into a compact, user-friendly, all-in-one solution. Within the architecture, the ubiquitous embedded computer serves as the heart of the factory and holds the key to many of the pain points previously mentioned.



ADLINK's MECS-6120 Edge computing platform

The core server in the ADLINK MicroRAN series is ADLINK's MECS-6120 1U 19-in edge computing platform, designed with an Intel Xeon D microprocessor. Its distinctive characteristics set it apart from conventional servers:

- **Edge Computing Focus:**

  Tailored specifically for edge computing, the MECS-6120 boasts low Electromagnetic Interference (EMI) and acoustic noise. Its compact form factor and easy maintenance make it ideal for proximity to operational activities.

- **Rugged Design:**

  The server's robust design enables operation in harsh environmental conditions, withstanding shock, vibration, and corrosion. Operating efficiently within a temperature range of -5 to +55°C ensures reliability in challenging scenarios.

- **Flexibility for 5G BBU Demands:**

  The MECS-6120 is adept at meeting the demands of 5G Baseband Unit (BBU) requirements. It offers clock synchronization capabilities with GOS/Beidou, IEEE 1588v2, and RS422. Additionally, PCIe expansion includes 1x PCIe x16 Gen3 and 1x PCIe x8 Gen3 FHFL, providing the necessary flexibility for diverse connectivity needs.

Unlock the Full Potential of 5G with ADLINK

ADLINK is the cornerstone for private 5G solutions, offering application-ready solutions to system integrators through an extensive global distribution network. Our collaboration with international partners has resulted in MicroRAN solutions tailored for smart factories in small and medium-sized enterprises, addressing diverse regional requirements, including core management functions and commercial 5G frequency bands. Affirming our commitment to product quality and integrity, we have personally implemented and validated the MicroRAN solution in-house, guaranteeing its slim, secure, and universal connectivity.

For more information on our MicroRAN series and other embedded computer products, we welcome you to contact our dedicated team. Your needs are our priority, and we look forward to assisting you in unlocking the full potential of our innovative solutions.

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