



Future Technologies Venture, LLC

Connected Factory Webinar

October 2020



Cambium Networks

01

The Connected Factory



The Industrial Evolution

Over 200 Years of Innovation



Industry 1.0

Mechanical Production

Water & Steam Power
Mechanical Loom
The Industrial Revolution

1784



Industry 2.0

Mass Production

Electrical Power
Division of Labor
The Assembly Line

1870



Industry 3.0

Automated Production

Computers/Electronics
PLCs & Robotics
Automation

1969



Industry 4.0

Autonomous Production

Internet of Things
Pervasive Connectivity
Smart Factories

TODAY



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Multiple Business Benefits

Productivity

Increased productivity through a higher level of automation that reduces production time, enables better asset utilization and inventory management.

Flexibility

Increased manufacturing flexibility through machines and robots that can execute the production steps for a large number of products.

Quality

Increased quality of products via sensors and actuators that monitor the current production in real-time and quickly intervene in case of errors.

Speed

Increased speed from the first product or factory ideas to the finished product through consistent data and new simulation capabilities.

Source: Boston Consulting Group

Industry 4.0

Smart-Connected-Autonomous Factories

Automated Guide Vehicles

- ❖ Prior to AGVs, movement of raw materials, finished goods and warehouse mgmt. were done by fleets of fork trucks and drivers
 - Labor intensive/expensive
 - Often with high employee turnover with considerable safety challenges
- ❖ AGVs have automated raw materials, finished goods and warehouse mgmt. workflows
 - Now extending into transportation trailer and loading logistics
- ❖ AGV deployments with WiFi have proven problematic
 - Poor connectivity hand-offs cause delays and sub-optimization of routes
- ❖ A fully autonomous manufacturing environment will require a more robust wireless network using Private LTE, CBRS and eventually 5G



Remote Expert Solutions

- ❖ Remote Expert solutions provide an augmented reality (AR) video solution that allows “remote experts” to assist on-site resources
- ❖ Prior to COVID, companies physically deployed experts on-site to assist, but COVID travel restrictions have shifted this to a virtual environment
- ❖ AR solutions leverage an AR headset, tablet or smartphone that the on-site resources uses to immerse the remote expert – “see what I see” with audio, video and telestration
- ❖ A robust wireless network is required to support remote expert – WiFi may work indoors, but becomes a challenge for outdoor use cases



Smart Factory Use-Cases

Robotics and Drones

- ❖ Robotic and Drone innovations are being leveraged by manufacturers for inspections and inventory in many areas
- ❖ Shifting the cost and safety curve compared to prior methods
- ❖ Example use cases:
 - UAV inspections of hard to reach assets
 - Robot inspection of hazardous areas (high heat, gases, etc.)
 - UAV flyover for inventory of raw material stock piles
 - Robot inventory counting (warehouse, raw materials, etc.)
- ❖ These innovative solutions need a robust and reliable wireless network – often challenging what’s possible with existing WiFi or public LTE coverage



Asset Health

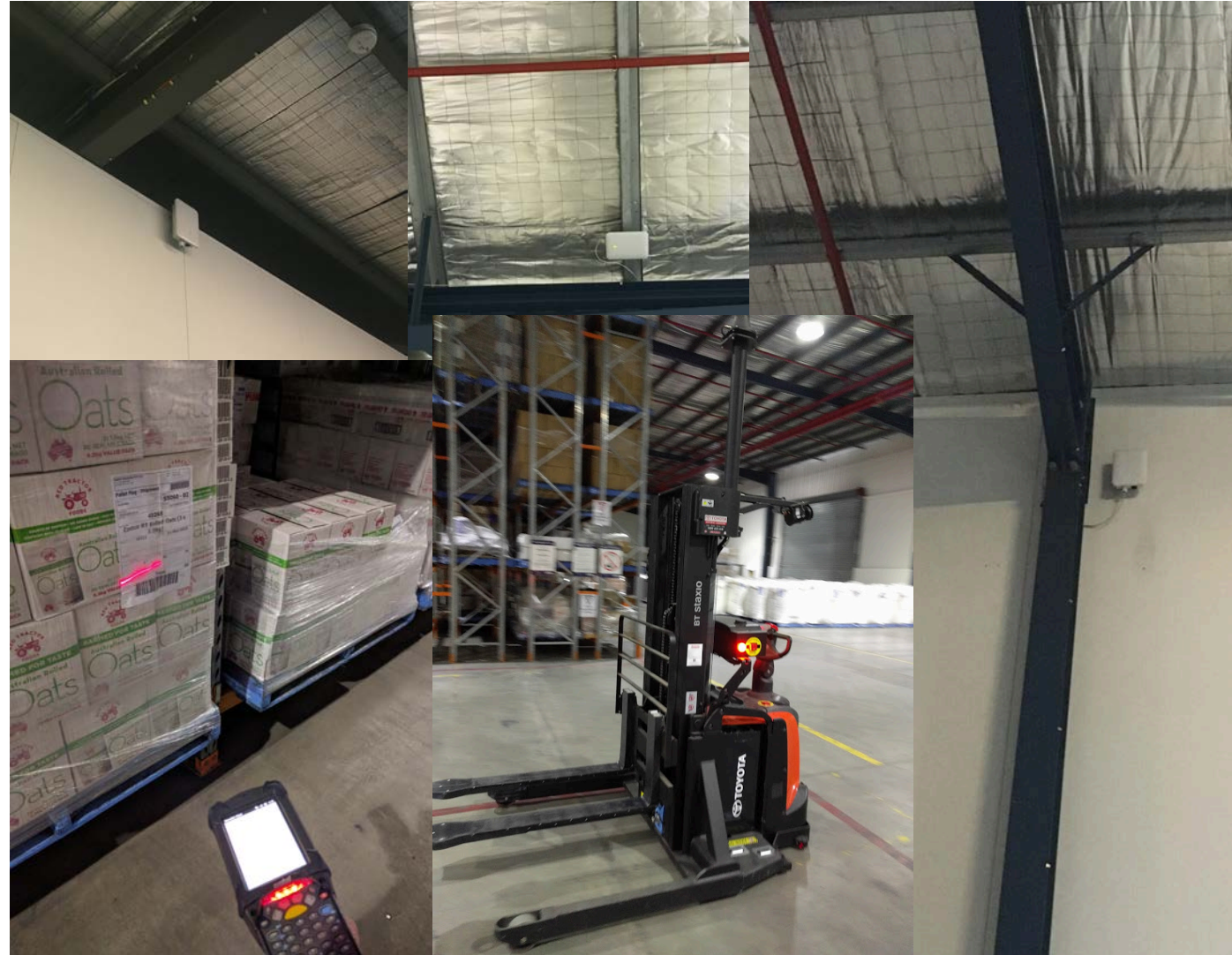
- ❖ Asset Health is a top use case area driving the largest bottom-line Industry 4.0 benefits for manufacturers
- ❖ Unplanned downtime of manufacturing assets is a major financial impact for most manufacturers
- ❖ Shift from reactive maintenance to proactive (predictive) maintenance
- ❖ Use existing process control data plus new industrial IoT sensor data to detect equipment failure days and weeks ahead of events
 - Example use case: Wireless Vibration Monitoring
- ❖ Significant focus on big data, advance analytics and machine learning to drive the value
- ❖ Closed loop processes are important to capture the value – no value if algorithm suggestions are not acted upon



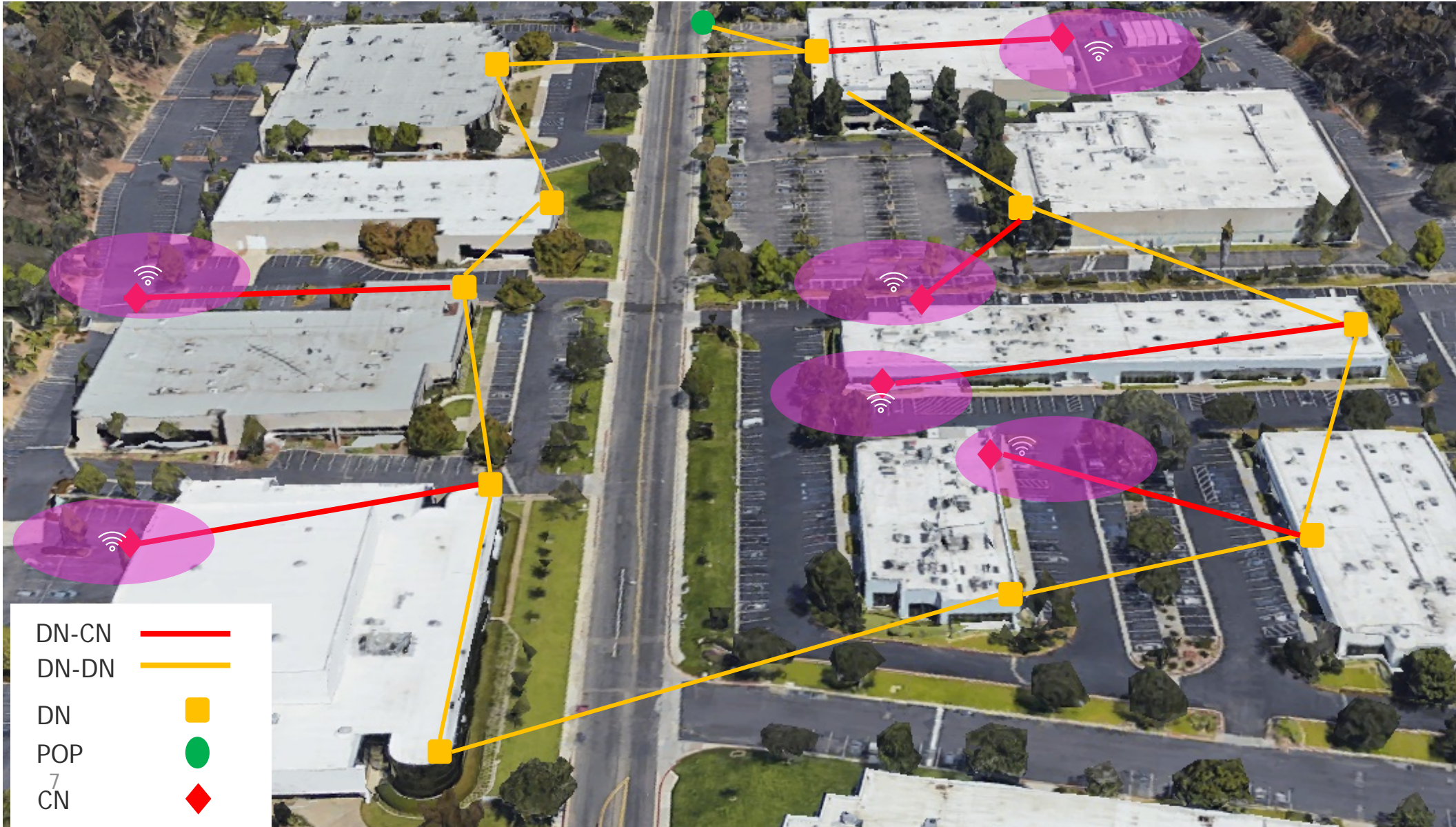
- Packing Specialist in Australia
- Serves pharmaceutical, food systems and retail operations
- 20,000 square meter facility
- Automated unmanned forklifts
- Automation relies on communications infrastructure
- Downtime is not acceptable

“Cambium Networks’ Wi-Fi is easy to manage. With cnMaestro, changes can now be made remotely sparing costly site visits and downtime.”

– Rik Crowder, Site Manager, ANNEX



Campus Area Networking Deployment

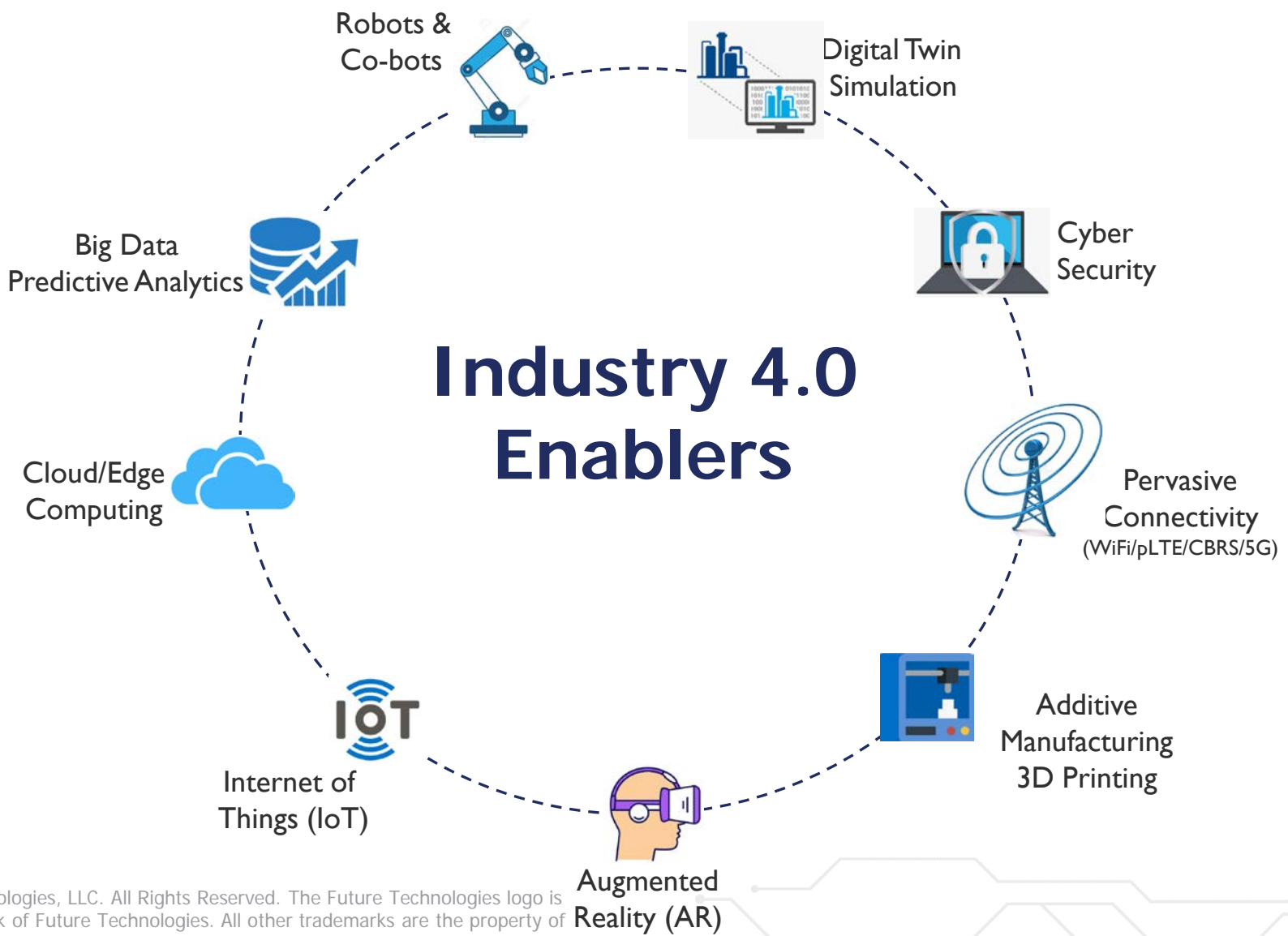


- **Strategy**
Lacking clear business vision, use cases and benefits
- **Security**
Understanding the cyber security and business risks – and mitigations
- **Personnel**
Recruiting, developing and maintaining the necessary talent & partners
- **Technology Decisions**
Managing emerging technologies in various stages of maturity & scalability
- **From Idea to POC to Production**
Moving from experiments and pilots to systematic production rollouts

Industry 4.0

Smart-Connected-Autonomous Factories

Technology Innovation Enablers



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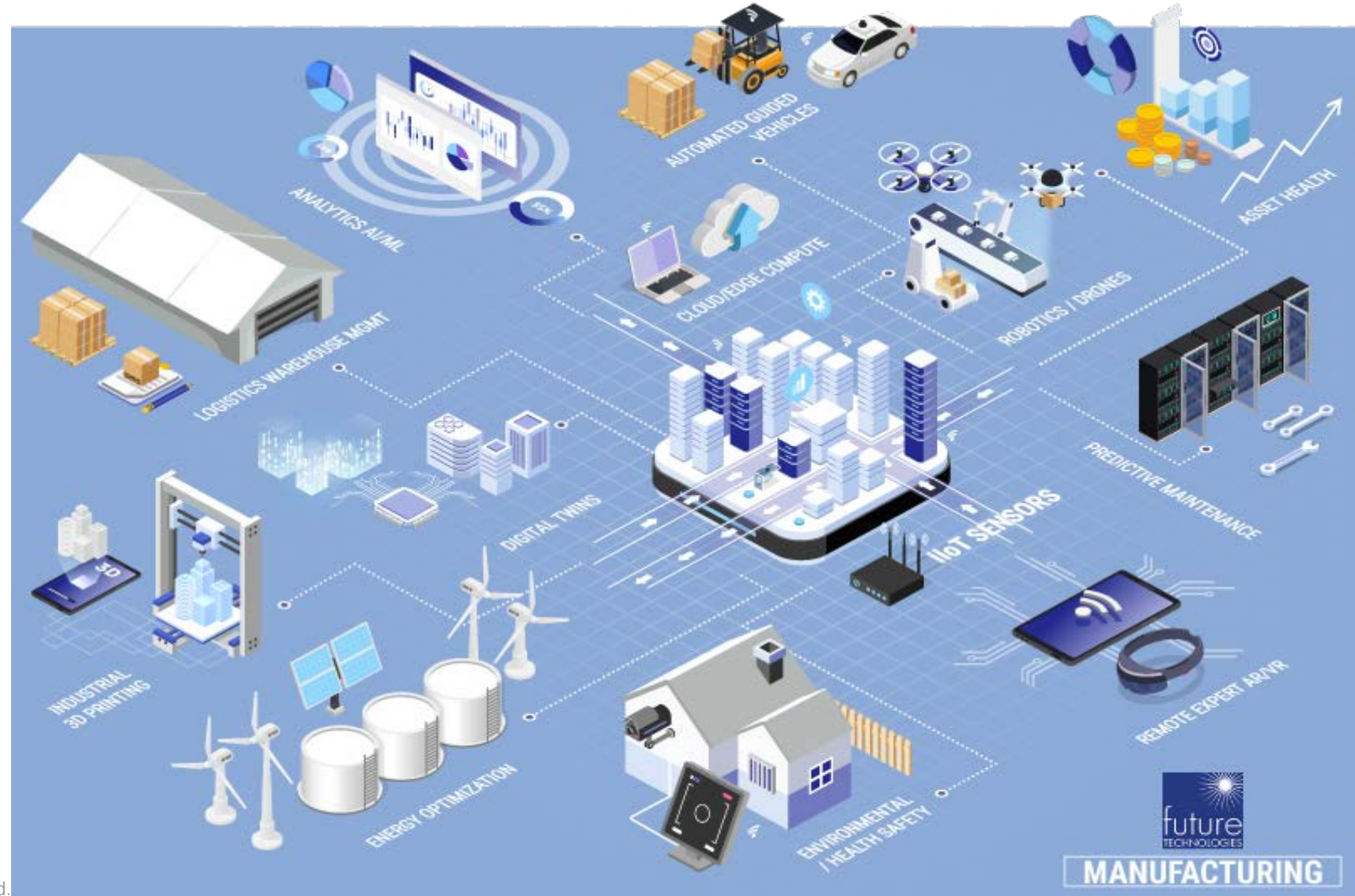
Industry 4.0

Smart-Connected-Autonomous Factories

Use Cases & Technology Solutions

Technology Solution

- ❖ Network Management System(s)
- ❖ Wireline/Switch (LAN, WAN)
- ❖ Wi Fi (Wi Fi 6)
- ❖ SCADA
- ❖ Point to Point
 - ❖ Licensed Microwave
 - ❖ E-Band
 - ❖ V-Band
- ❖ Point to Multi-Point
 - ❖ Low Band (<1 GHz)
 - ❖ Mid Band (2 to 6 GHz)
 - ❖ CBRS
- ❖ Terragraph (60 GHz)
- ❖ LTE / 5G

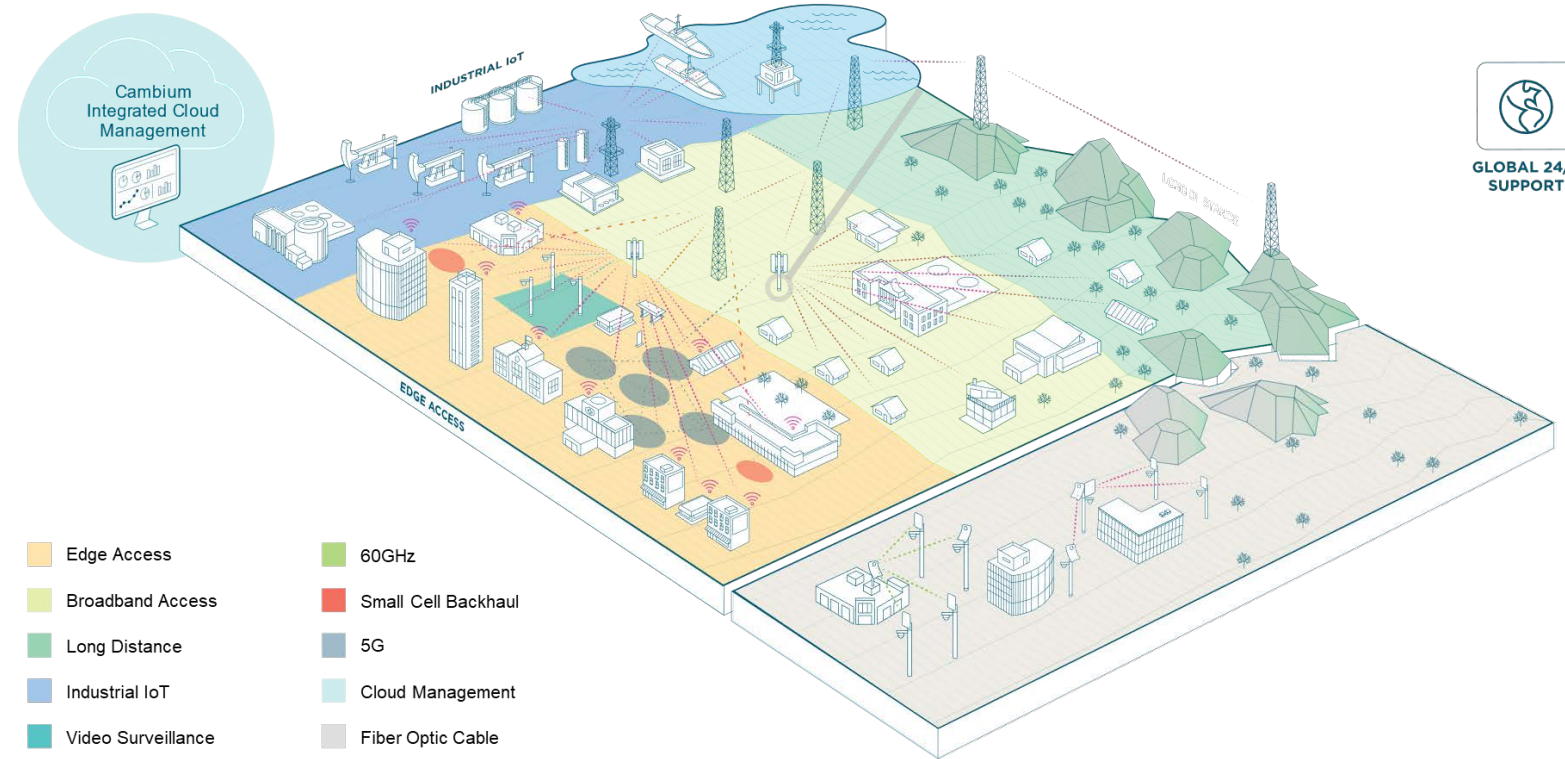


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Cambium Networks' Gb Wireless Fabric

- People Places Things
- 2m to 246km
- Kb to Mb to Gb
- Indoor and Outdoor
- PTP PMP Wi-Fi LTE 5G
- Licensed and Unlicensed
- Single Pane of Glass



Consultative Engagement Approach

MANUFACTURING
LEADERSHIP COUNCIL
NATIONAL ASSOCIATION OF MANUFACTURERS



Digital Readiness Checklist for Manufacturers

Are you prepared to seize opportunities and gain a competitive advantage in the digital era? Use this quick checklist to find out where to focus your time, money and resources.

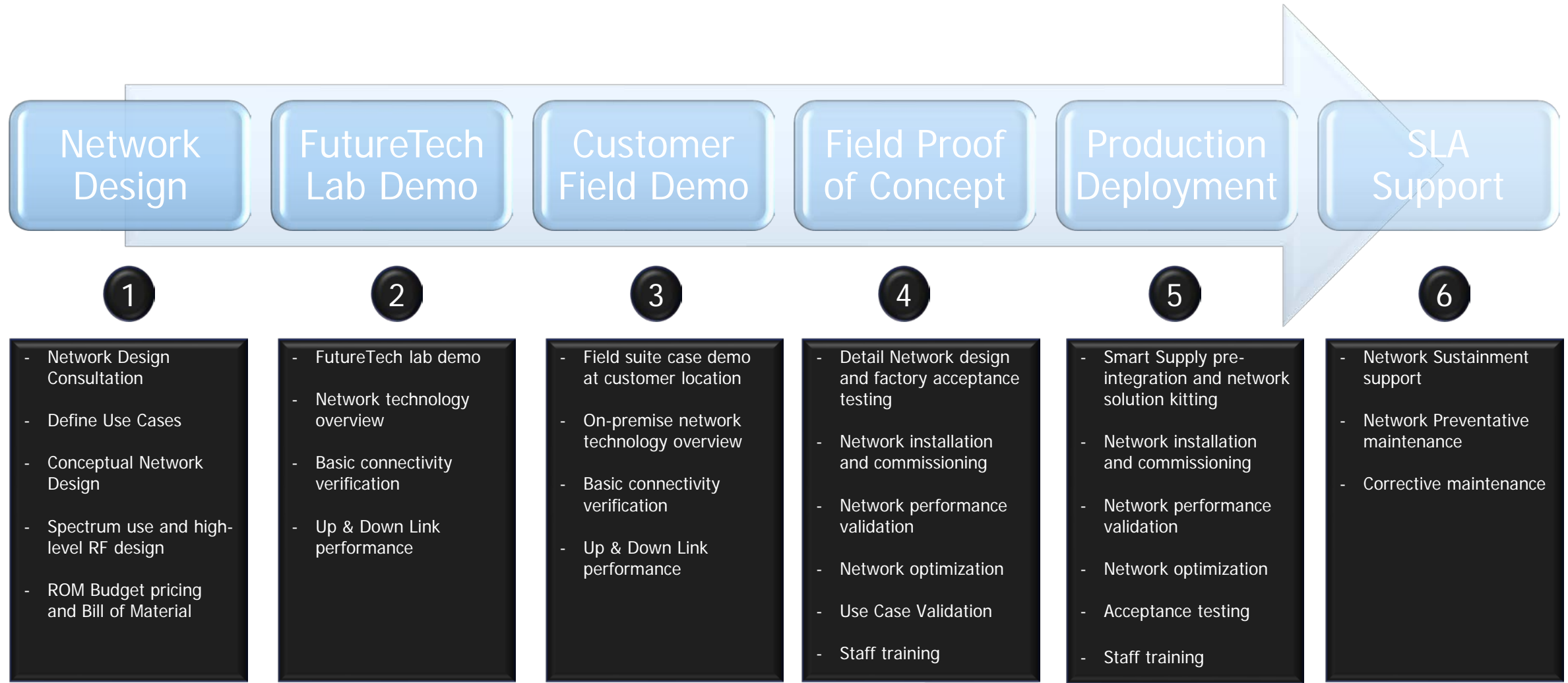
1. Have you eliminated all paper-based processes?
2. Have you automated as many manual processes as are practical for your business right now?
3. Can you view your plant floor operations in real time and control them remotely?
4. Are all your systems integrated end-to-end? (ex: customer relationship management software, manufacturing execution systems, etc.)
5. Have you updated your business models to match your new technology?
6. Can you easily access and analyze your data to improve operations?
7. Does your leadership team have strong awareness around digital technologies?
8. Does your workforce have the skills it needs to pursue the digital future?
9. Does your company have a digital roadmap to guide its future?
10. Do you have a plan to create a networked factory, including legacy equipment?

If you can answer **YES** to most of these questions, great! You are well on your way to seizing opportunities in manufacturing's digital era. Fine tune your efforts by focusing on any areas where you answered **NO**.

[Learn more at MLCREThink.com](https://www.mlcרתhink.com)

If you answered **NO** to most of these questions, that's OK. Many manufacturers are just starting to drive major changes in innovation, efficiency and productivity. The important thing is to take deliberate steps forward so you don't get left behind.

Network Deployment Engagement Approach



Thank You

For more information about the presentation, please contact:

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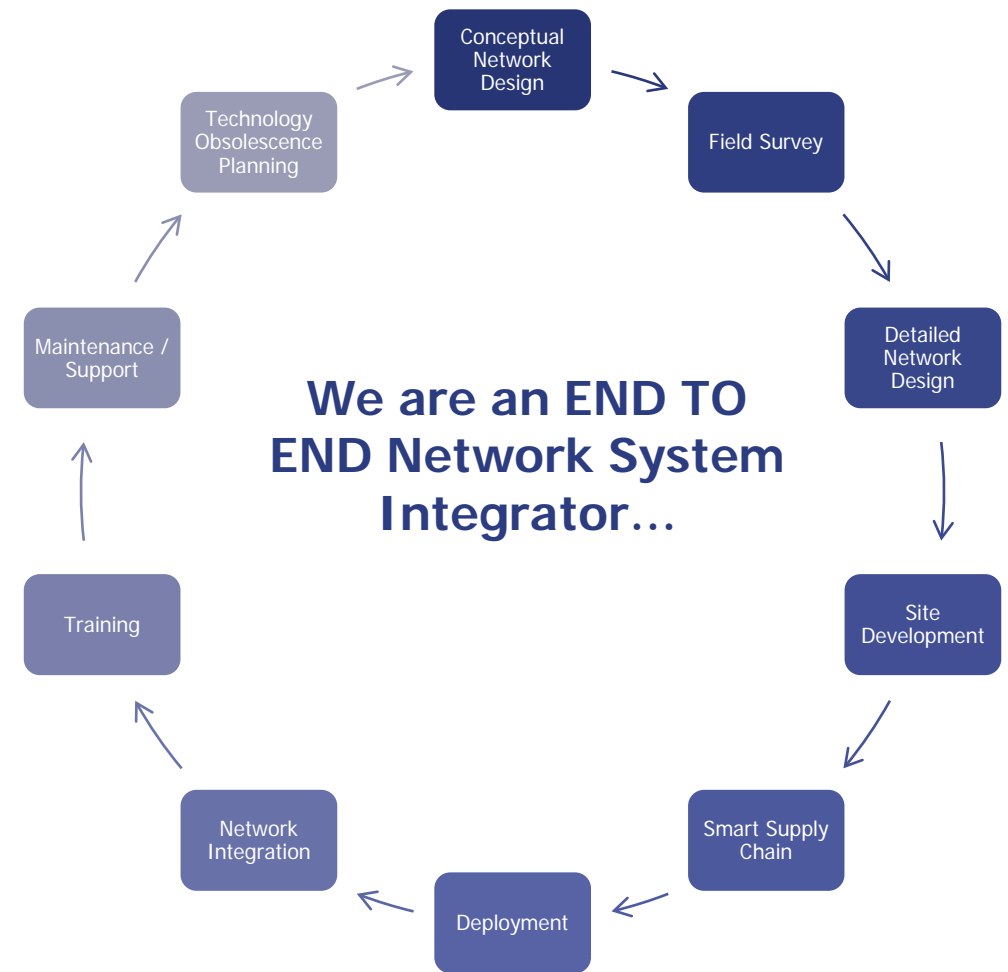


Appendix

Back up Slides - Future Technologies

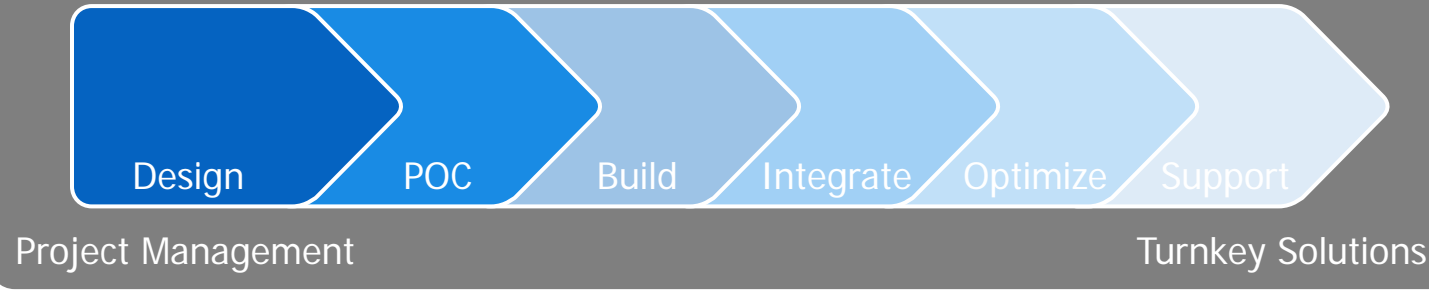
Who is Future Technologies?

- ❖ **Founded – 1999**
- ❖ **Footprint & Scale**
 - >3,000 executed projects annually
 - Deployments throughout all 48 Continental US States
- ❖ **Health & Safety**
 - Full time Director of Health & Safety
 - National Training Center – Atlanta, GA
 - Industry Certifications
 - OSHA 10/30, RF Awareness, Safety LMS, First Aid/CPR, Drug Free Workplace, Background Checks
 - Specialty Certifications
 - MSHA, E-Rail, TWIC, SafeLand USA, ISNET
- ❖ **Project Management Office (PMO)**
 - Project Management
 - Construction Management
- ❖ **Engineering**
 - Systems, Wireless (RF), Wireline, Network, A&E
- ❖ **Field Resources**
 - Tower, Ground, Integrators, Field Engineers
 - >75 W-2 In House Field Tech Engineers

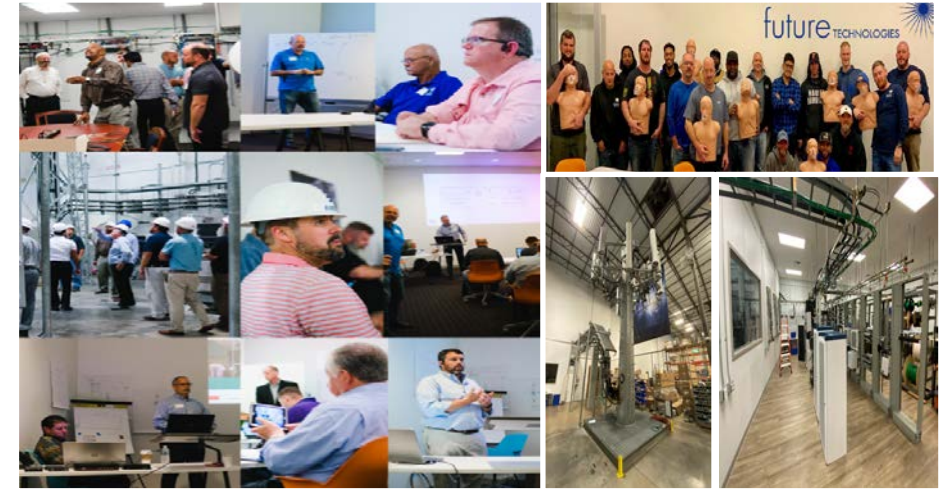


Capabilities

End to End Delivery Capabilities



20+ years of experience delivering complex network systems. Our clients select Team Future Tech as their partner of choice to safely deploy and maintain their networks.



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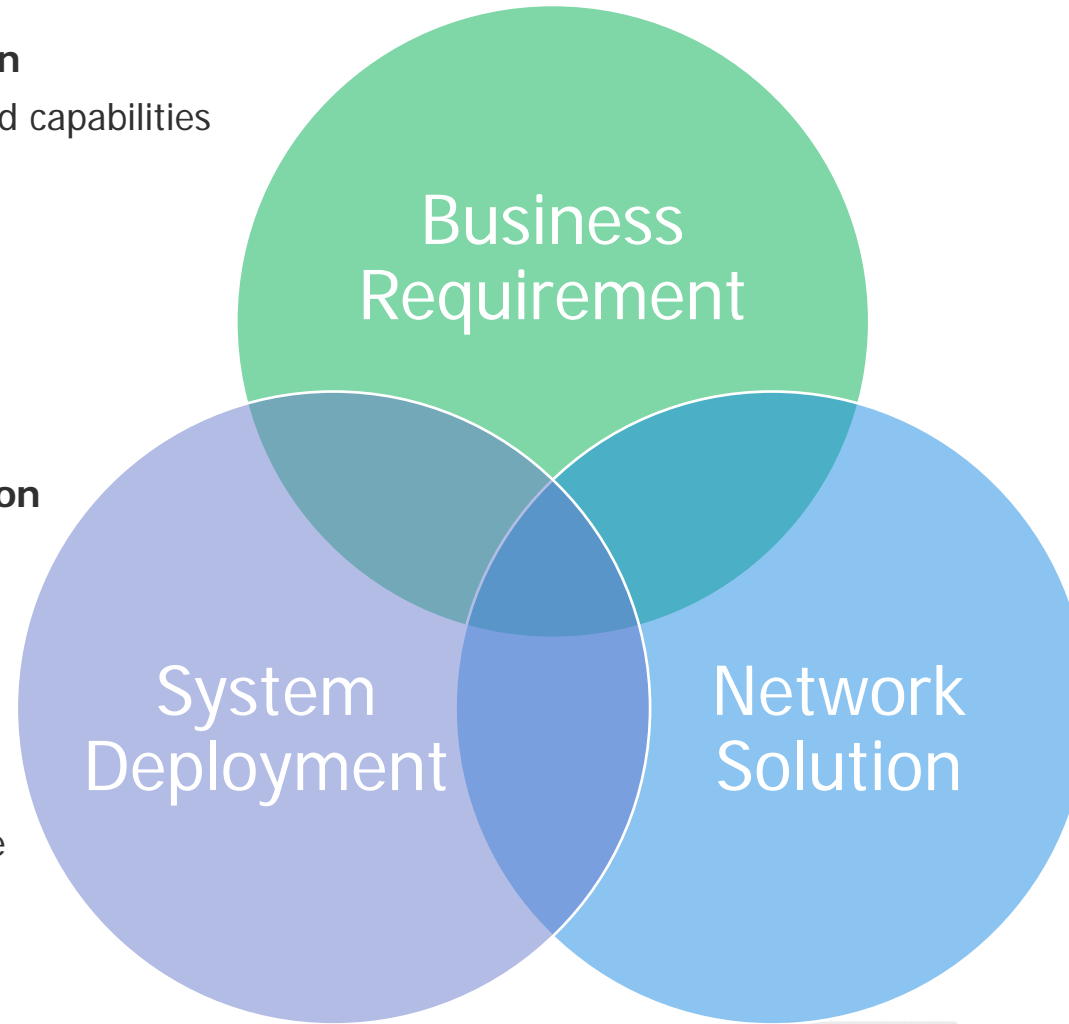
Consultative Engagement Approach

❖ Customer Requirement Definition

- Understand current network and capabilities
- Review Business Use Cases
 - Current and future
- Security Requirements
- Establish requirements

❖ Field Survey & Network Evaluation

- Evaluate existing assets
 - Physical & Logical
- Site Survey
 - Line of Site
 - Construction Feasibility
- Define existing IT infrastructure interface requirements
- Provide recommendations for network asset locations



❖ Conceptual Network Design

- High Level Network Architecture
- Transport Planning
 - Fiber & Wireless
- Network Access Planning
 - RF Planning
 - Network Parameters
- TCO & ROI Modeling

❖ Detailed Network Design

- Final Network Architecture
- Final RF Design
- Final Wireline Design
- Finalized Bill of Materials
- Network sustainability, performance maintenance, and scalability