The Future of Wireless & 5G
from a Deployment Perspective

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1. The Wireless World Yesterday, Today and Tomorrow
2. The Future of 5G Architecture
3. 5G Deployment Readiness Factors
The History of Industrial Revolutions

1st 1784
Mechanization, water power, steam power

2nd 1870
Mass production, assembly line, electricity

3rd 1969
Computer and automation

4th 2015
Cyber Physical Systems
The History of Wireless Technology

1980: First UK mobile phone call
- 1G - TACS
  - 75 Kbps

1990:
- 2G - GSM/GPRS/EDGE
  - 1 Mbps or 900%

2000:
- 3G spectrum auction
- 3G - WCDMA/HSPA/HSPA+
  - 12 Mbps or 1,100%

2010:
- 4G - LTE/LTE Advanced
  - 1Gbps or 8,000%

2020:

2030:
Global Initiatives & Trends

- 2011 - Germany establishes Industry 4.0
- 2015 - China creates their 2025 plan
- 2018 - South Korea host the Winter Olympics in PyeongChang
- 2020 - Japan host the Summer Olympics in Tokyo
- 2022 - China host the Winter Olympics in Beijing
- 2030 - Sensory Connected Absolute Truth Society
US Counties that gain access to broadband services see on average a 1.8% increase in employment.

Texas ranks 46th as the most connected State with 56% broadband coverage & average speeds of 45Mbps.

The US is ranked 16th in the world for broadband connectivity.

3 million jobs added to the US economy by 5G and potentially 22 million globally.

5G can add $500 Billion or 3% to US GDP.

$275 Billion Expected US Investment to deploy next Generation Networks over the next 7 years.
Over 100 Billion Connected Devices and 1 Trillion network sensors

Each Autonomous Vehicles will send 25Gb of data per hour to the cloud (12HD movies)

All homes and enterprises will require high speed broadband connectivity or else...

AI, VR, AR, live gaming and high definition video streaming user experiences
More efficient Energy distribution and consumption through remote control and automation

$305 Billion in health care cost savings from connected devices & better rural coverage

Millions of Cameras for Surveillance along with a dedicated LTE First Responder Network

Humanoid and Robotic engineered systems and algorithms to enhance process flows
The Key Layers of 5G Architecture

User, Micro, Macro & Core:

- **USER**: Application or GUI Interfaces at Point of Presence
- **USER**: Device or Connected “Thing” & Mesh Networks
- **USER**: Security and Extreme Edge Computing

- **MICRO**: Distributed Network Nodes – DAS, Street Furniture & WIFI Hot Spots
- **MICRO**: Picocell, Femtocell & Small Cell Processing & Data Storage
- **MICRO**: Front Haul – Fiber or Fixed Wireless to Edge of Network

- **MACRO**: Baseband Sites – Towers, Rooftops, Billboards
- **MACRO**: Mini Data Centers, BTS Pools and Server Farms
- **MACRO**: Network C-RAN, SDN & NFV

- **CORE**: Back Haul – Microwave, Fiber & Ethernet
- **CORE**: Big Data or Network Operating Centers
- **CORE**: Long Haul - Fiber, Satellite & Weather Balloons
5G IoT Ecosystem
GOVERNMENT
Public / Private partnerships that utilize a regulatory environment that accelerates the deployment of broadband technology and infrastructure so all people have the access they desire and can afford.

INDUSTRY
Build sustainable & resilient business models that leverage and support government and educational investment in future infrastructure to create job and GDP growth.

EDUCATION
Create educational tracks that enhance today’s workforce through R&D labs and a re-tooling of existing labor units that allow the USA to be a leader in the advancement and deployment of 5G architecture and networks.

5G Key Stakeholders Must Collaborate
5G Deployment Readiness Factors

Key Inputs to **Efficient** Deployment Models

- Labor – Engineering, Real Estate, Construction & Net Ops
- Equipment – Crew, Field, Office and Testing
- Materials – Civil, Tower and A&L, Electrical & Fiber

Critical Success Factors to **Effective** Deployments

- Safety – OSHA, FCC, DOL, ASSE, ANSI & TIA Standards
- Quality – Customer MOP’s, NWSA & TIRAP Training Programs
- Speed – Industry Benchmarks for Crew Output by Project Type
5G Labor Readiness Factors

Engineering
Solution architects as dedicated problem solvers with knowledge of multiple technologies and the most efficient application of each to the specific use case

Real Estate
Zoning experts with pole attachment, street furniture, lease & ROW franchise negotiation skills for Micro, Macro and Core network agreements

Construction
Must maintain ALL industry safety certifications as well as detailed knowledge of Small Cell, Macro & Fiber installation, testing and quality standards

Network Operations
As the 5G architecture moves data storage, processing and fiber to the edge, first responders must be localized in order to support tighter SLA’s for network outages
5G Equipment Readiness Factors

Technicians & Foremen
Must have proper Industry Safety equipment as well as any OEM or customer required installation tools for Micro, Macro and Core

Project Manager & Coordinators
Real time data capture requirements will demand better back office applications, virtual tools and scorecard reporting

Office

Reporting and COP Issues

Crew

Troubleshooting and Optimization Issues

Field

Testing

Small Cell, Macro & Fiber Issues
Construction Managers
Small Cell, Macro or Fiber SOW's determine the “truck roll” type, crew configuration and equipment required

Engineering and Network Operations
Sweep, PIM, Fiber Optic and other testing requirements driven by multiple frequencies, antenna and micro equipment types as well as Edge computing architecture

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5G Material Readiness Factors

**Tower and A&L**
Structural Tower Modifications, Carrier Upgrades, Tower Top RRU’s & Hybrid cable along with backpack Micro pole attachments to support 5G

**Civil**
Edge network designs will place cabinets on pads or platforms at the base of utility poles, street furniture & towers with power and fiber conduit connection points

**Electrical**
Small Cell, Macro and In building Hetnet structured and Hybrid cable and power requirements will multiple inventory SKU’s to support accelerated node deployment

**Fiber**
Densification requires thousands of route & strand miles of fiber but the cable type determines the scalability and lateral splice complexity of the existing Fiber networks
Each firm must adhere to Safety regulations, be accountable and compliant to OSHA, DOL, ASSE, ANSI and TIA standards. All stakeholders must account for the cost of safety as a basic component of their business model and therefore price deployment services accordingly.

Leveraging training programs through NWSA, TIRAP and W4W as well as investing in quality control systems will build a high performing dedicated workforce and create loyal customers through elevated trust and confidence. In addition, to offset concerns of the pending labor shortage we have to focus on doing it right the first time in order to increase output.

Safety certified crews that are well trained on the correct installation procedures and those that are willing make quality a priority from day one will be the most productive and highest paid.
Conclusion

- 5G will create digital equality resulting in Big Data creation and the fastest transfer of knowledge in the history of the world
- Government, Industry and Education must collaborate to accelerate wireless innovation and 5G deployments
- A stronger ecosystem of vertical industry partnerships will support knowledge sharing and create deployment efficiencies
- Flexible, agile and scalable organizations that embrace deployment readiness factors will be the industry leaders
- In order to compete and WIN globally, we must begin NOW to create the most advanced broadband workforce on the planet
- 5G represents a technology pivot point equal to the birth of the internet
Thank You

Texas State Wireless Association

A Nonprofit Professional Wireless Organization with the purpose of developing a local identity for the wireless industry within Texas.

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