

The convergence of 5G and Distributed Interactive Learning Systems

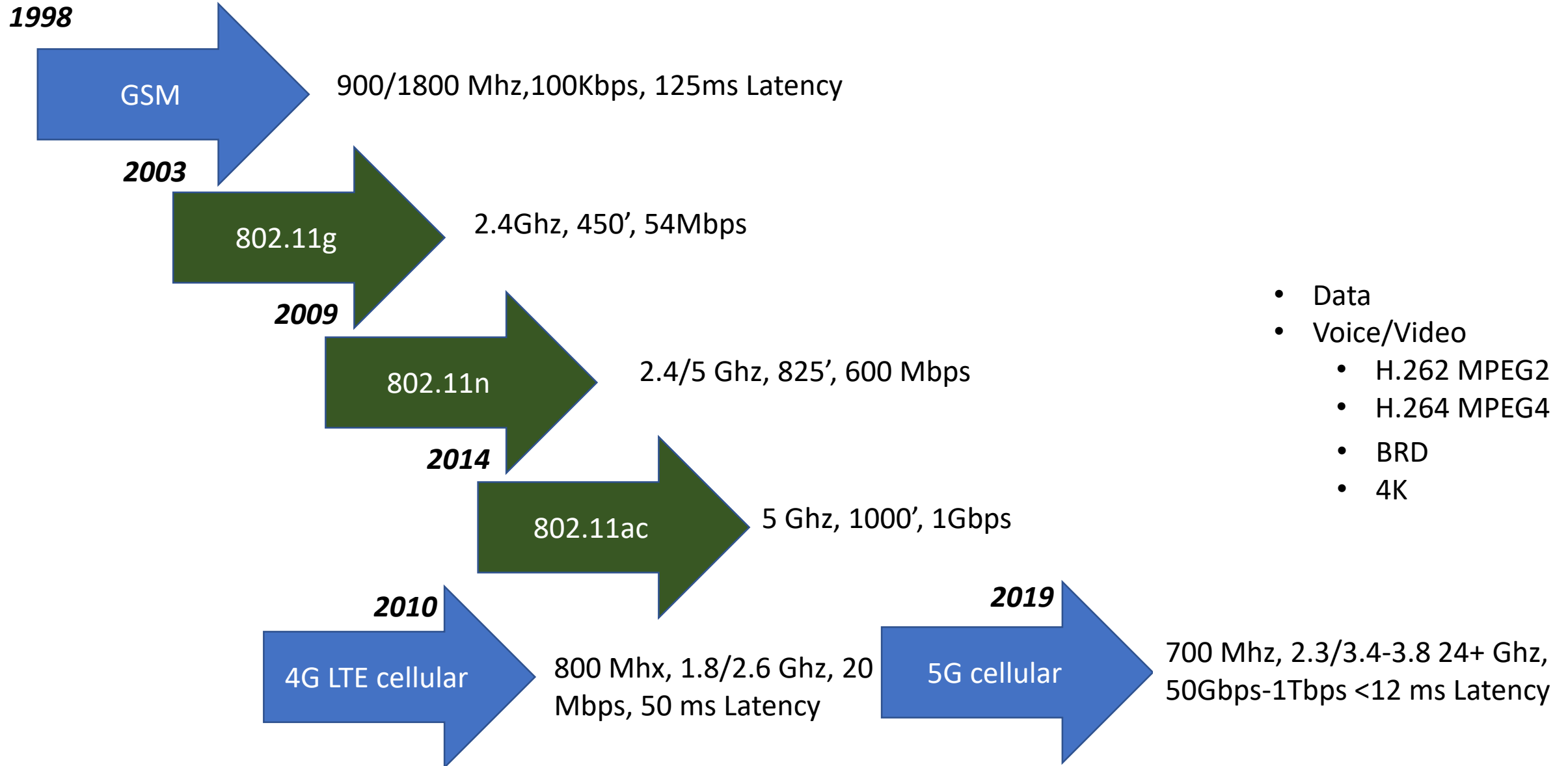


C Co 2-124 Inf @ a CTC Exercise



AFRL WPAFB

History of Wireless Communications in Live/Virtual Training





What does 5G bring to the table?

- 100x increase in bandwidth
- MIMO
- 5G base stations run at full duplex
- Lower Latency
- 1000x subscribers than 4G LTE
- But we must consider:
 - SHF is extremely line of sight and low burn-through
 - Technology at the front of the bathtub curve
 - More efficient Beamforming is lower range/coverage (esp than WiFi)

Edge Computing

- Bringing processing power closer to the end-user minimizing latencies caused by distance.
- Migrate computational intensive tasks from VR devices to more resourceful cloud/fog servers
- Offload AR/VR headsets – longer battery times / lighter weight
- Artificial Intelligence, Analytics, Physics
- Increase local fidelity
 - A Trade space between CPU/Hardware bus speed and Network Speed



Content Streaming

- Quicker Downloads
- Near-immediate transfer of information
- Traditional Classroom Content moves to the cloud
- High fidelity sims require higher resolution video
 - Data streaming couldn't maintain frame rate at HD resolution
- How does this change the role of the teacher?



Mobile Learning Devices

- Trade off between locally or remote installation of content
- Bandwidth limited
- Advantages of Streaming
- Content Updates
- Device Portability
- Configuration Management
- Device Management
- User Management



Increased capabilities for LVC Exercises

- Machine to Machine communications
- Increased Sensor Capabilities
- More Data collected enables richer models of performance
- Data Fusion for Position and Orientation Sensors
- Interest Area Management for sensor and engagement simulation



Squad Advanced Marksmanship Trainer

Three Flat Screens



U-Shape



Training:

- Individual Tasks up to 15 soldiers
- Specific Collective Tasks

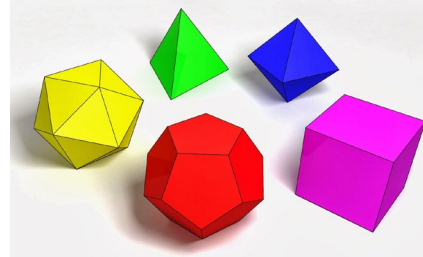
Training:

- Collective Tasks up to 5 soldiers

- Untethered Weapons require recoil (CO2) and wireless SAT
- GIFT- Intelligent Tutor with Squad Performance Model based expert model to evaluate learner performance
- Advanced Sensors
 - Shot placement and aim trace
 - Eye tracking
 - Motion and Position
 - Other

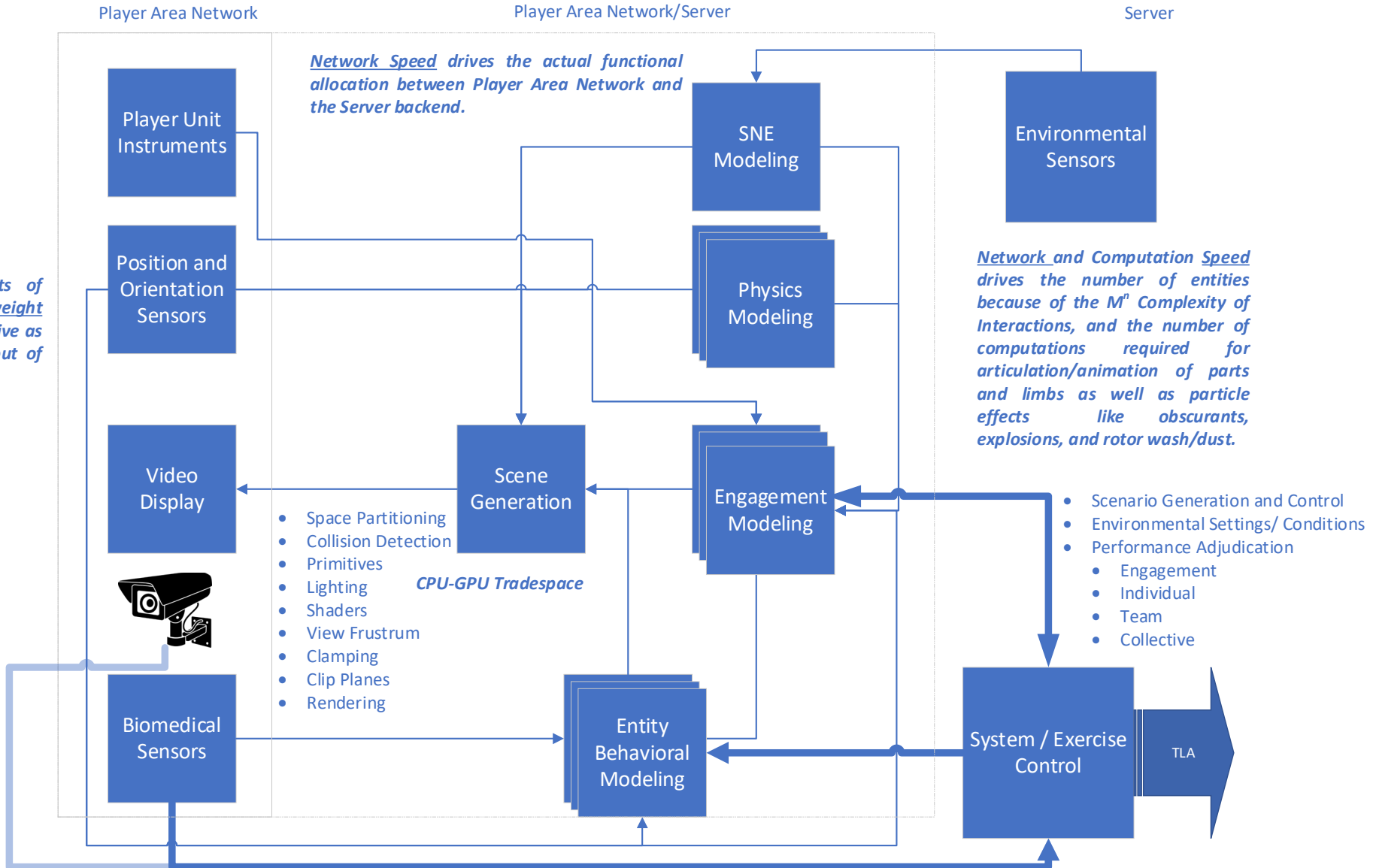
Physics of Virtual and Instrumented Ranges


- Cover and Concealment are rarely geometric primitives
- E-M Environment
- Latency Sensitivity
 - Cybersickness
 - Fair Fight
- Computational Complexity
 - Movement
 - Sensors
 - Engagement
- **Power and Heat Constraints**
 - Battery Life
- **Weight and CoG Constraints**
 - **Workplace injuries**
 - **Fatigue**
 - **Habit Transfer**
- Engagement Accuracy and Precision
 - CEP for small arms 0.2mrad, '11 digit' MGRS precision
- Task Complexity
 - What does "correct" look like at the T&C level?





Principal constraints of Battery Life and weight make us want to drive as much as possible out of the PAN layer





Knock On Opportunities

- Move *Learning* from Live to Virtual
 - Enhanced support of mobile Just in Time Learning
 - Move Live Range Functions to Server layer
 - Process More Entities and Automated AAR
 - Larger Synthetic Exercises/Blend Virtual and Live
 - Better Estimates of Readiness
 - Less Travel Expense