Cyber and Emergent Technologies

Current and Future Ramifications

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Biographical Sketch

- Dr. Joshua Alton Sipper is currently assigned to the Air Force Cyber College as a Professor of Cyberwarfare Studies. He completed his Doctoral work at Trident University in September of 2012, earning a Ph.D. in Educational Leadership (emphasis, E-Learning Leadership). Dr. Sipper's previous degrees were obtained from Troy University (M.Ed. Education) and Faulkner University (B.S. English). Dr. Sipper is a veteran who served honorably in the U.S. Air Force in the intelligence career field, and worked for Lockheed Martin in a similar capacity on the U2 program. More recently, Dr. Sipper shifted his focus into the cyber realm as a Systems Engineer for General Dynamics at the Air Force's 26th Network Operations Squadron, followed by an eight-year stint as a civil servant in the Air Force cyber career field at the Curtis E. LeMay Center for Doctrine Development and Education. Dr. Sipper currently serves as a Professor of Cyber Warfare Studies at the Air Force Cyber College, Air War College, Air University, Maxwell AFB. Dr. Sipper's research interests include cyber ISR, policy, strategy, and warfare.

Cyber and Emergent Technologies

Current and Future Ramifications

- Introduction
- AI and ML
- Emergent Security
- Quantum Computing
- Nanotechnology

Introduction

- We are on the cusp of many advances in technology
- Developing in parallel
- Numerous interdependencies
- Creation of new capabilities
- Creation of new realities (i.e., the Cyber Meta-reality

AI and ML

- Both are still developing
- Human-machine teaming…increased need for synthetic/autonomous agents (AA)
- Filtering, parsing, decision-making
- European Parliament published a report with “recommendations to the Commission on Civil Law Rules on Robotics”

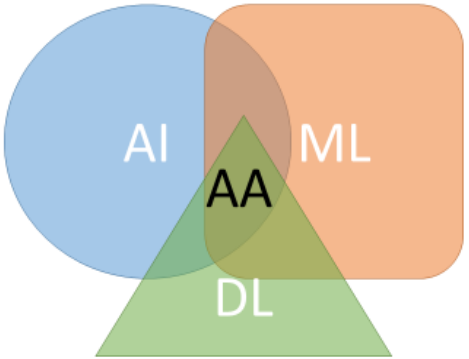
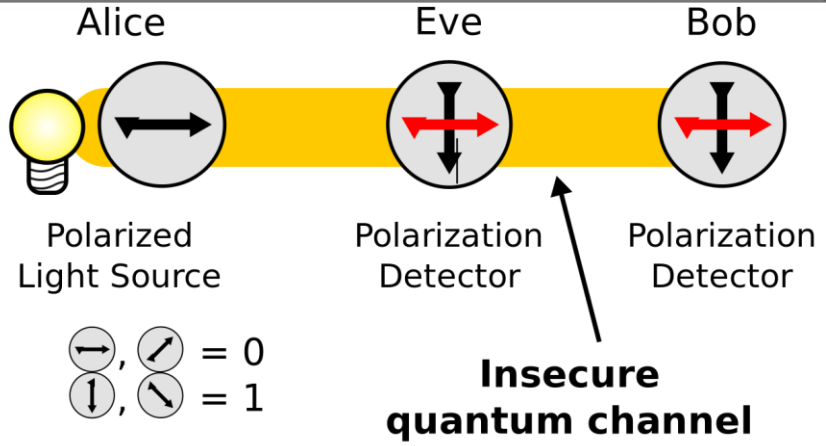


Figure 2. Artificial Intelligence, Machine Learning, Deep Learning Overlap for Autonomous Agents

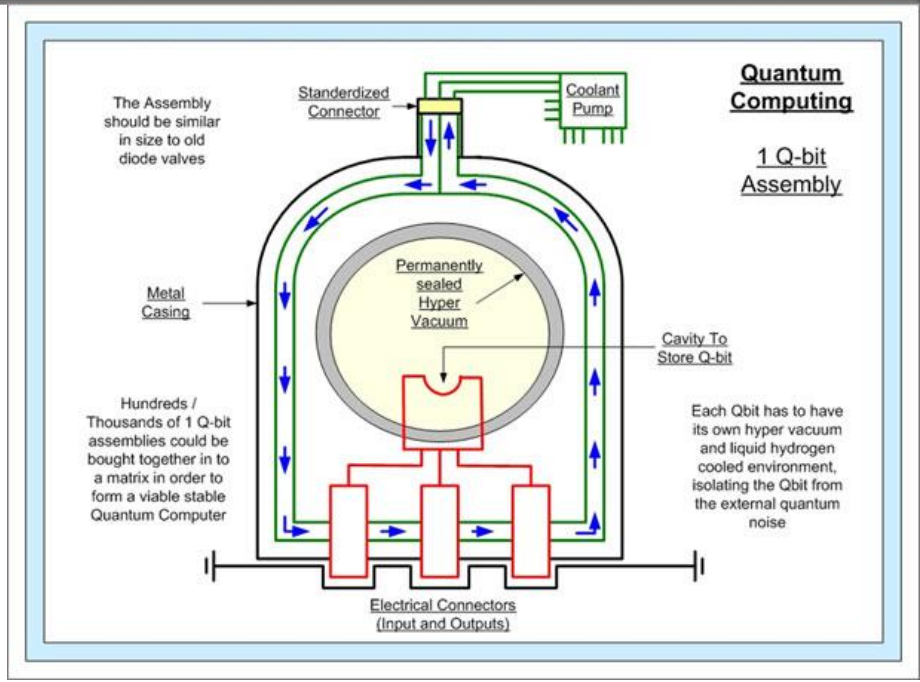
Emergent Security

- Quantum Encryption
  - Quantum key distribution
  - Quantum entanglement
- Multi-factor authentication
  - location, possession, access, proximity, behavioral, confirmation, witnessed, and radio



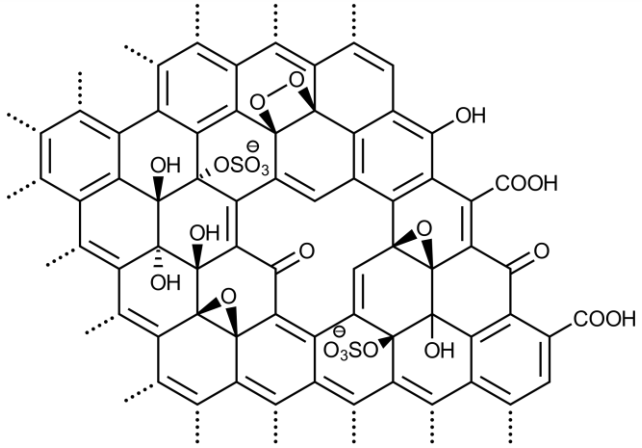
Quantum Computing

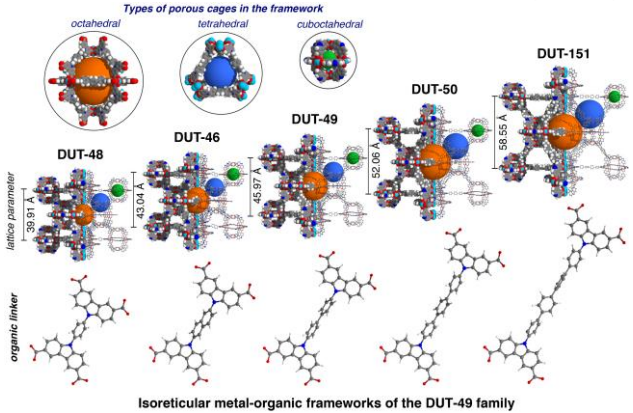
- Five important concepts:
  - Quantum system
  - Superposition quantum states
  - Quantum circuitry
  - Quantum entanglement
  - Quantum teleportation
- Quantum speedup
- Current quantum research



Nanotechnology

- Increasingly smaller tech
- Non-linear waves
- Direct AI/ML application
- Graphene structure and subatomic manipulation
- Metal-organic frameworks
- Key enabling tech (KET)





Conclusion

- All capabilities and technologies coalescing
- Very interdependent
- Will need people who know how to use to greatest effect
- Will introduce more problems in addition to solutions