

# Blockchain for Defense

AFCEA Technology Committee  
Perspectives



October 2019



22<sup>ND</sup> ANNUAL  
SYSTEMS & MISISON  
ENGINEERING CONFERENCE

## Introduction: AFCEA Technology & Colvin Run Networks



The [AFCEA Technology Committee](#) is a standing committee of [AFCEA International](#). The purpose of the Technology Committee is to enhance AFCEA's outreach to the information technology (IT) communities; cultivate partnerships among government, industry, academic, and scientific leaders; and focus on finding solutions for the IT and related management problems facing government, military, industry, and non-profit sector leaders worldwide.



Colvin Run Networks, Inc. ([www.DataScienceApplications.com](http://www.DataScienceApplications.com)) operationalizes data science to streamline data coordination, validation, and verification processes with distributed ledger technology (blockchain) concepts, data visualization and machine learning methodologies. Colvin Run optimizes high volume transactional ecosystems and complex, mission-critical, data-driven supply chain activities. Applications include trusted microelectronics, logistics / CBM+ enablement, and military big data analytics. The company is named after Colvin Run Mill in Great Falls, Virginia – a nationally significant example of early 20<sup>th</sup> Century automation pioneered in milling and applied across US industry.

## AFCEA Technology Vectors Concept and Background

### Concept of the Vectors Initiative

Leverage expertise and relationships to provide value to Federal IT leaders, conference organizers, and member firms, by:

- Identifying the most relevant emerging technology topics
- Capturing key concepts for each topic in a concise knowledge base
- Identifying points of contacts (committee or external) for each topic

### Mechanisms

- Maintain a list of technology vectors, related sub-topics, and subject matter experts
- Maintain public, distribution-ready materials to present vectors information

<https://www.afcea.org/site/technology-vectors-presentation>

## Blockchain

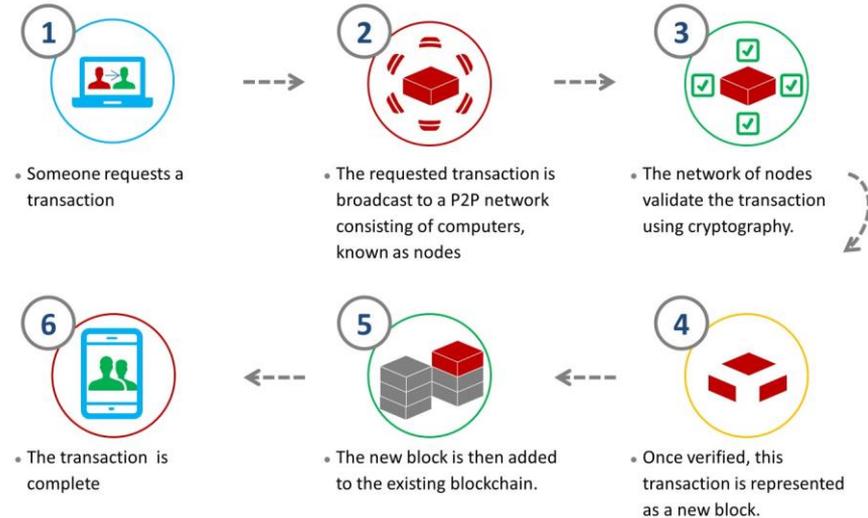
### What Is Blockchain Technology?

A blockchain is a continuously growing list of records, called blocks, which are linked and secured. Each block contains a cryptographic hash of the previous block, destination, timestamp and transaction data. This technology allows efficient, reliable and transparent peer-to-peer transfer of digital assets and thus its potential impact on businesses is immense.

Depending on the decentralized governance, transaction is deemed valid. It is then added to the most recently verified block in the chain, creating a sequential ledger which is viewable by anyone and cannot be altered.

A distributed ledger is a database of transactions that is shared and synchronized across multiple computers and locations – without centralized control. Each party owns an identical copy of the record, which is automatically updated as soon as any additions are made.

### Blockchain technology



## Blockchain

### Why the Tech Matters

- Blockchain can orchestrate and automate interactions with external parties.
- Streamline and integrate disparate systems, reducing data entry duplication and reconciliation.
- Blockchain's verification methods enable near to or real time processing and settlement of transactions without a central 3<sup>rd</sup> party.
- Combining with other emerging technologies become a force multiplier. e.g. combining blockchain, AI, ML, RPA for implementation in HHS applications.

### Implications and Mission Benefits

- Enable secure, standardized data sharing in a trusted, assured, transparent ecosystem
- Reduces the risks associated with traditional/stove-piped database models
- Greater cost efficiencies & structural flexibility from continuous verification
- Robustness from distributed data with a single shared version of the truth
- Improved governance and visibility from shared ledgers and automation using programmatic "smart contracts"

### Adoption Approach/Challenges

- Emerging standards (Note: NIST blockchain paper, along with Congress Promotion Act, both released October 2018)
- Blockchain is confused with cryptocurrency and hard to explain, with developers in short supply.
- Blockchain introduces lower immediate performance, higher complexity, and less privacy of traditional databases in return for increased disintermediation and robustness

### Additional Information and Resources

<https://www.ibm.com/blockchain/platform/>  
<https://en.wikipedia.org/wiki/Blockchain>  
<https://blockchain.ieee.org/>  
<http://www.gbglobal.org>  
<https://www.gsa.gov/technology/government-it-initiatives/emerging-citizen-technology/blockchain>  
<https://csrc.nist.gov/CSRC/media/Publications/nistir/8202/draft/documents/nistir8202-draft.pdf>

## Blockchain Drivers

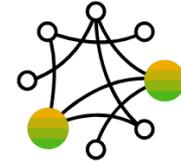
**Security:** The distributed and encrypted nature of blockchain mean it is more resilient and difficult to hack, respectively.



**Automation:** Blockchain is programmable – which will make it possible to automatically trigger actions, events, and payments once conditions are met.



**Fewer Intermediaries:** Blockchain reduces reliance on some types of third-party intermediaries – like clearinghouses, auditing contractors, and information brokers.



**Faster Processes & Scalability:** Blockchain can speed up process execution in multi-party scenarios – and allow for faster transactions with and without humans in the loop.



**Transparency:** Information in blockchains is viewable by all participants and cannot be altered. This will reduce risk and fraud, and create trust



**ROI:** Distributed ledgers will provide quick but lasting ROI by helping agencies create leaner, more efficient, and more profitable processes



<https://www.sap.com/products/leonardo/blockchain/what-is-blockchain.html>

## Blockchain Sub-Elements

PUBLIC	 <b>bitcoin</b> <ul style="list-style-type: none"><li>• Digital Cryptocurrency</li><li>• Mining Verification with specialized equipment</li><li>• Up to 21 Million Coins</li><li>• Decentralized; 23% “lost”</li><li>• \$200Bn Market Cap</li></ul>	 <b>ethereum</b> <ul style="list-style-type: none"><li>• Cryptocurrency with a smart contract platform</li><li>• Ether crypto is a platform component</li><li>• Open-Source / Decentralized</li><li>• \$113Bn Market Cap</li></ul>	 <b>ripple</b> <ul style="list-style-type: none"><li>• Currency exchanges</li><li>• Centralized model on a <i>permissioned</i> network</li><li>• Ripple Labs owns 62%</li><li>• 100 Billion coins minted</li><li>• \$50Bn Market Cap</li></ul>
PERMISSIONED	 <b>HYPERLEDGER</b> <ul style="list-style-type: none"><li>• Consortium hosted by the Linux Foundation, with IBM, Intel, Accenture, etc.</li><li>• Several Open Source protocols purpose-built for enterprise applications</li></ul>	 <b>MultiChain</b> <ul style="list-style-type: none"><li>• Designed for efficient indexing, storing, and retrieval of data on standalone basis</li><li>• Backwards compatibility with Bitcoin Core &amp; bitcoin network</li><li>• Open Source Project</li></ul>	 <b>c.rda</b> <ul style="list-style-type: none"><li>• Specialized Blockchain/ DLT for financial services</li><li>• Run by R3, a consortium of 70+ leading banks</li><li>• In discussions to merge with Hyperledger project</li></ul>

- Public, decentralized blockchains are those most closely associated with tokens or cryptocurrency, where anyone can participate in the consensus-driven ecosystem.
- Private, or “Permissioned”, blockchains are access-controlled, so members must be invited to participate in the governed ecosystem, across multiple parties or systems within organizations.
- Private blockchains are more scalable and controlled, and provide the greatest near-term opportunity for DoD stakeholders. Permission refers to read, write, and/or verify.

## Blockchain

### Technical Principles: **Distributed Consensus**

Physical Transaction



Digital Transaction: Ledger



Decentralized Ledger



#### Insights:

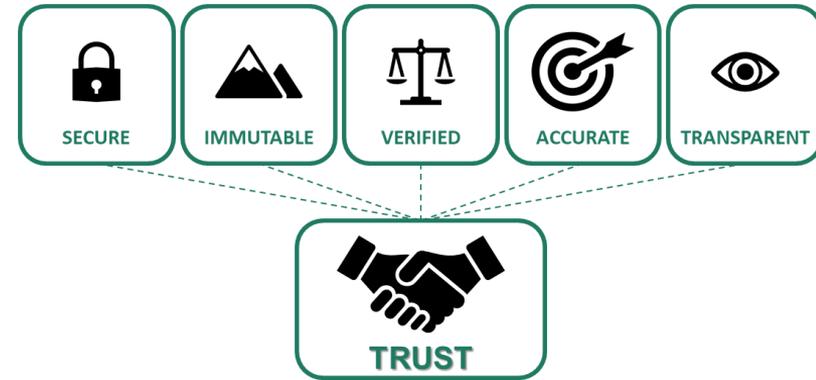
- Blockchain technology offers a way for untrusted parties to reach agreement (consensus) on a common digital history.
- A common digital history is important because digital assets and transactions are in theory easily faked and/or duplicated.
- Blockchain technology solves this problem without using a trusted intermediary.

## Blockchain

### Technical Principles: **Trusted, Verified, Auditable Ledger**

#### **Blockchain Technical Characteristics** of a Trustworthy System

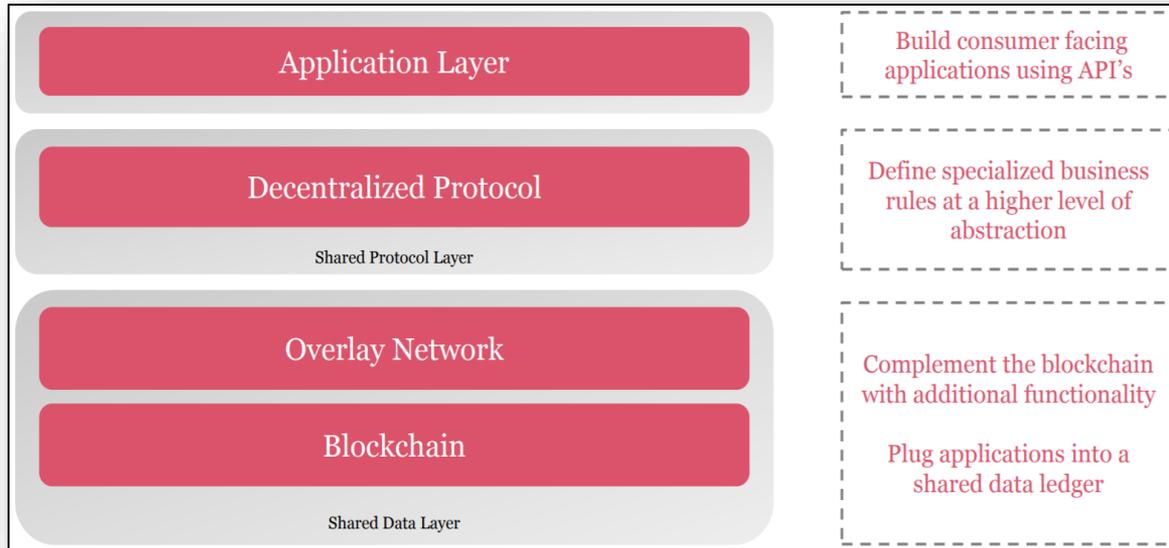
- **Secure:** hashed (encrypted) records are easy to verify given some input, but it's impossible to find the input which produces a known or preexisting hash value
- **Immutable:** blockchain systems are significantly more robust and resilient than traditional systems because there is no single point of failure
- **Verified:** consensus mechanisms enable autonomous governance capabilities, so data write access is controlled
- **Accurate:** users have predetermined controls and data access rights, so data is complete, accurate and consistent
- **Transparent:** a single shared ledger to record transactions reduces the clutter and complications of multiple data sources



Source: Colvin Run Networks

## Blockchain

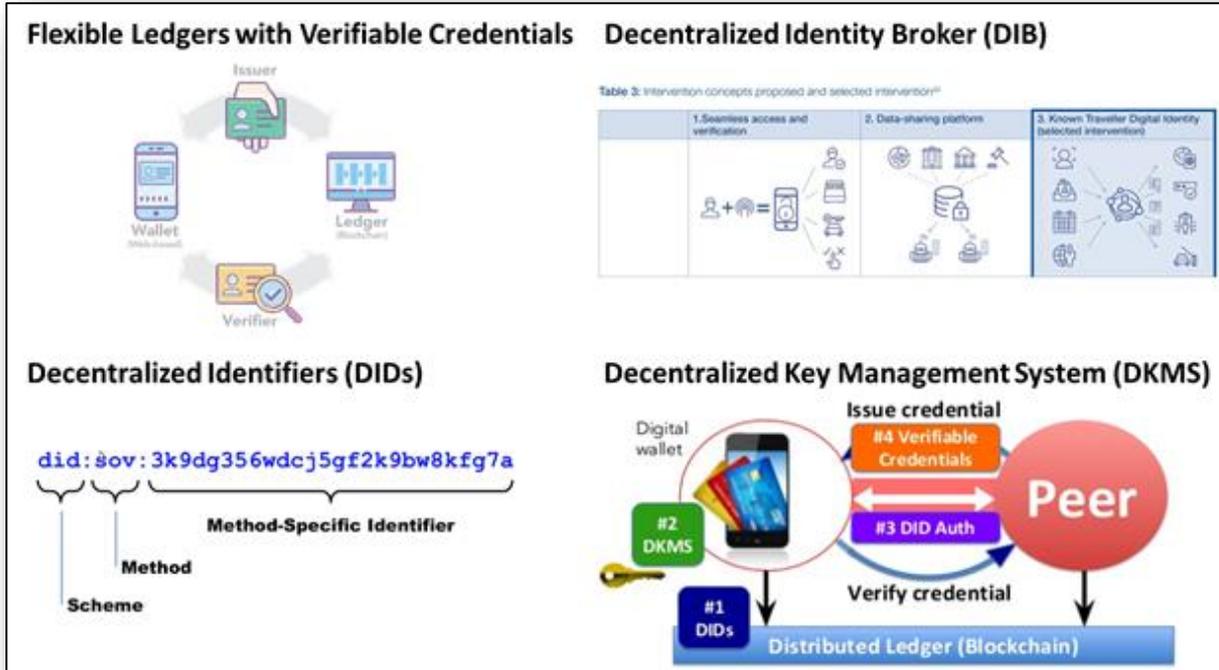
### Technical Principles: **Blockchain is a Foundational Technology**



- Blockchain includes basic infrastructure, but many conceive of it as the entire “blockchain solution”, which includes the blockchain infrastructure, the smart contracts, the APIs, etc. baked into the blockchain layer as depicted.

## Blockchain

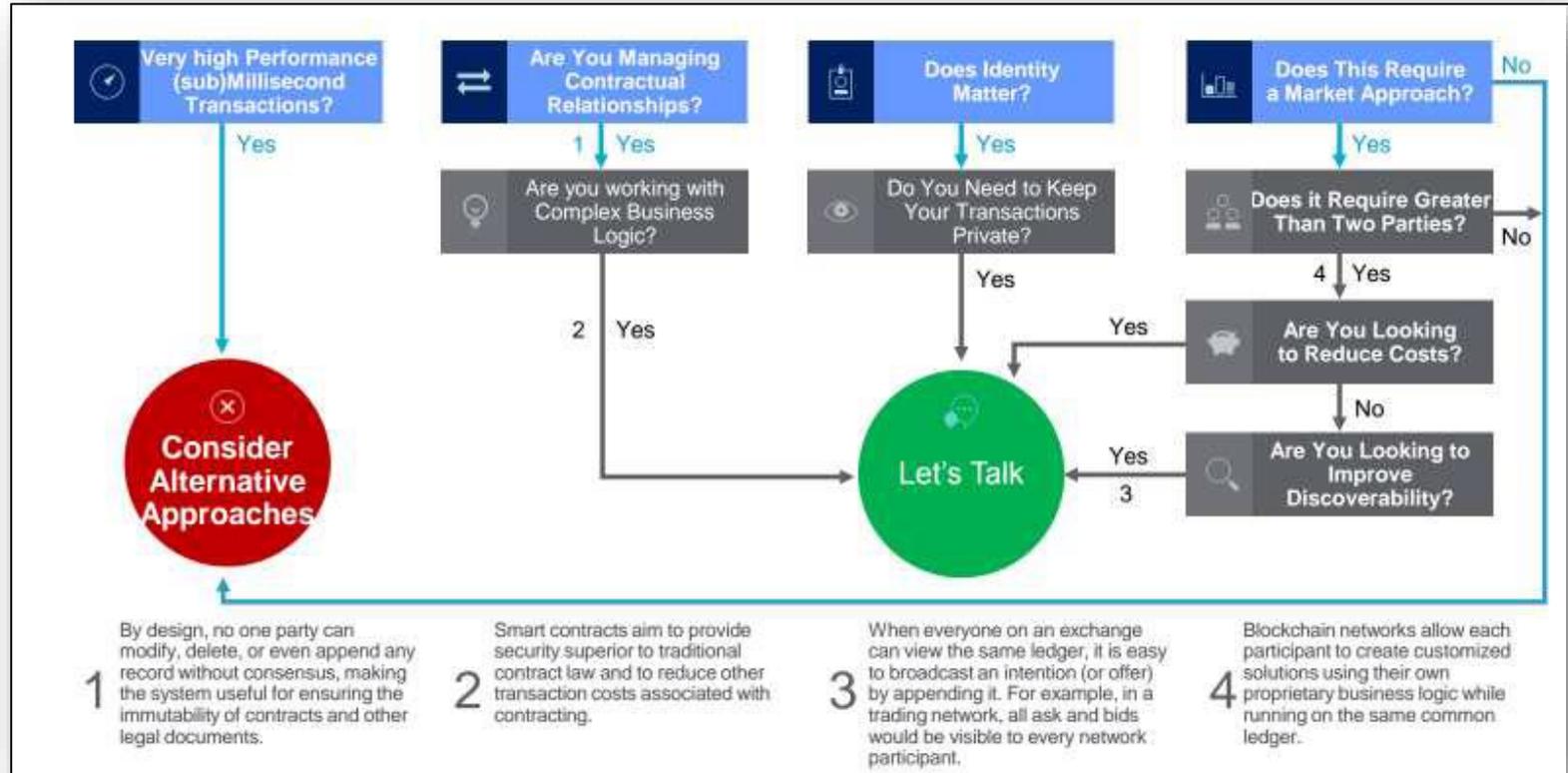
### Federal Scope: **DHS Written Senate Testimony, May 2018**



- Department of Homeland Security has extensively tested and piloted blockchain for a variety of use cases, including NAFTA trade enforcement in late 2018
- DHS sponsored creation of fit-for-purpose blockchain platforms that utilize W3C web open standards
- Most recent grant utilizes blockchain to secure IoT (internet of things) data with limited internet connectivity

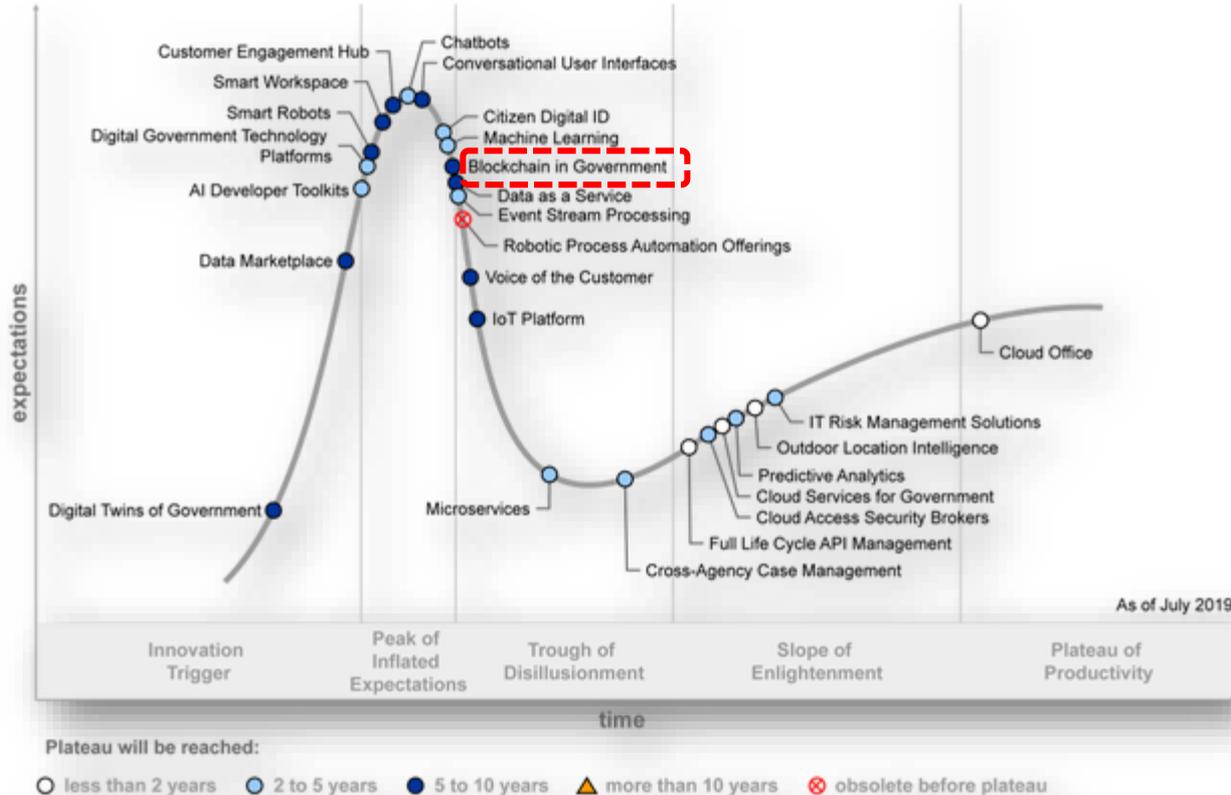
## Blockchain

### Decision Framework: **Do We Need a Blockchain?**



## Blockchain

### Gartner Hype Cycle 2019: **Entering the Trough**



<https://whatsthebigdata.com/2019/09/06/gartner-hype-cycle-for-digital-government-technology/>

## Blockchain DoD Considering Applications **for Armed Forces**

### Military Drone Technology and Communications



Blockchain can record and assure the data collected by AI-powered drones immutably and in real time.

### Blockchain Battleships



Despite its age, the Aegis is a highly sophisticated piece of military technology. However, Aegis is a centralized system, with a single point of failure.

### Decentralizing Weapon Control Systems



Blockchain allows decentralization of computing power across multiple nodes for supply chain risk management, software development, and systems engineering processes.

### Trusted & Assured Microelectronics



DoD is actively evaluating blockchain as a central component, shifting towards quantifiable assurance for military microelectronics components.

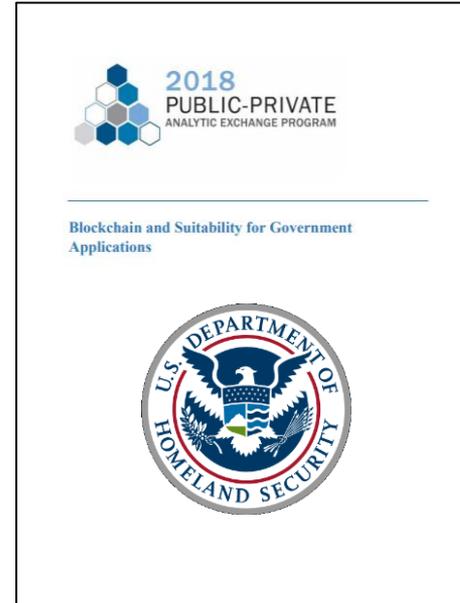
<https://coincentral.com/blockchain-military-applications-the-future-tech-of-the-armed-forces/>

## Additional References



“The Defense Advanced Research Projects Agency (DARPA) is starting to experiment with blockchain to create a more efficient, robust, and secure platform using a blockchain protocol that will **allow personnel from anywhere to transmit secure messages** or process transactions that can be traced through numerous channels of a decentralized ledger.”

<https://media.defense.gov/2019/Jul/12/2002156622/-1/-1/1/DOD-DIGITAL-MODERNIZATION-STRATEGY-2019.PDF>



“The scale of activities required for wholesale implementation of blockchain by the US Government would clearly be far greater - and the implications farther-reaching - than is the case in Estonia, the UAE, or Canada. However, **the magnitude of investments by China and Russia dwarf those of the United States to this point.**”

[https://www.dhs.gov/sites/default/files/publications/2018\\_AEP\\_Blockchain\\_and\\_Suitability\\_for\\_Government\\_Applications.pdf](https://www.dhs.gov/sites/default/files/publications/2018_AEP_Blockchain_and_Suitability_for_Government_Applications.pdf)