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TECHNICAL EXCELLENCE AND INNOVATION

Whole System Life Cycle Management with Blockchain and Digital Twins

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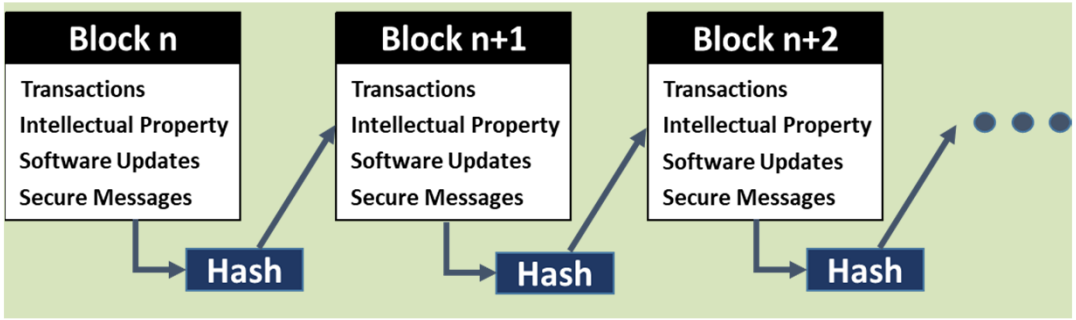
TECHNICAL EXCELLENCE AND INNOVATION

- ***DESE Research, Inc. – www.dese.com***
  - Leader in development of innovative, high technology products
  - Supporting our Nation since 1982
  - Extensive experience in providing advanced engineering, scientific and technical support to government and industry customers
  - Headquarters alongside Redstone Arsenal in Huntsville, Alabama
- ***Blockchain Technology Solutions Group***
  - Completed multi-year effort for US Army at Redstone Arsenal
    - Developed prototypes using multiple commercial blockchain technologies for a variety of use-cases
  - Currently working new multi-year effort to transition successful prototypes for production use

"Developing and fielding a defense system is a complicated and often contentious process involving the coordination between a vast array of organizations and entities, often with misalignments in goals and objectives."

1. **Blockchain serves as an enabling technology for the concept of Digital Twins**
2. **System and component-level digital twins provide unprecedented visibility into logistics, performance, and change-management**
   - **Use Case – Component failure analysis**
3. **Barriers to adoption of blockchain**
4. **Industry Success Stories**

How can Blockchain help?



- Blocks contain data (usually transaction-based)
- Linked cryptographically through signature or hash
- Transactions added to new blocks through some means of multi-node consensus
  - Proof of Work
  - Proof of Elapsed Time
  - Proof of Stake

- **Historical transactions cannot be altered or deleted**
- **Changes must abide by rules of the network**
- **All participants have a copy that is updated in real-time**
  - **no centralized database**
- **Cannot solve all problems related to data security**

1. Blockchain serves as an enabling technology for the concept of Digital Twins

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Usage of Digital Twins in Systems & Mission Engineering

Physical Existence

Mission Computer Replaced →

System Maintenance Performed →

← Missile Fired

← Uplink Antenna Calibrated

Real Events

Digital Existence

Mission Computer Replaced →

System Maintenance Performed →

← Missile Fired

← Uplink Antenna Calibrated

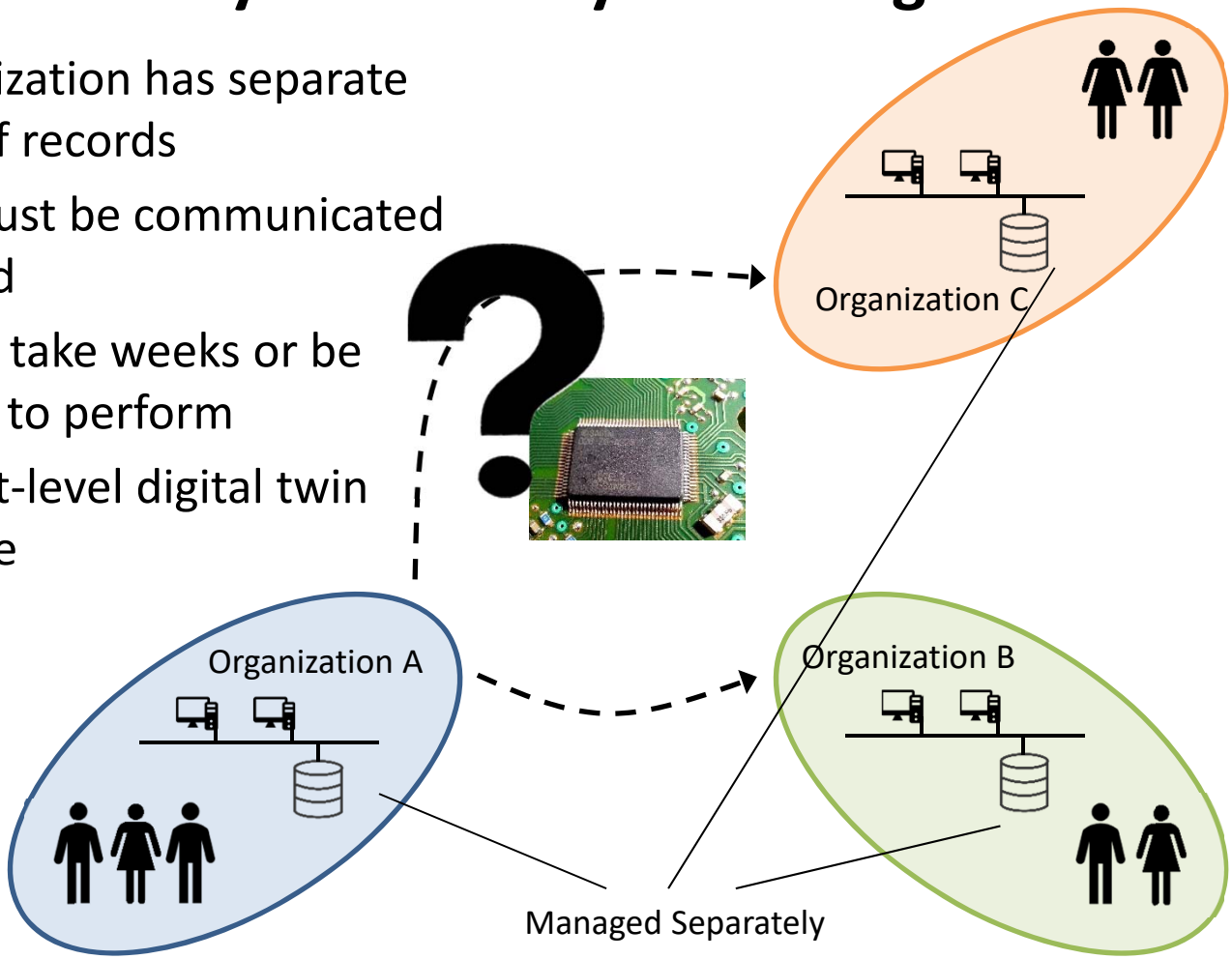
Transactions Stored on Blockchain

2. System and component-level digital twins provide unprecedented visibility into logistics, performance, and change-management

- Digital Twins provide digital equivalent of physical existence
- Cannot be lost, deleted or altered without specific permission or intent
- Component/System history and configuration become immortal entities bound to real-world objects
- True cross-organizational ownership and accountability
- Decommissioning or demilitarization of a system does not lead to lost data
- Applicable both within acquisition, deployment, and retirement phases

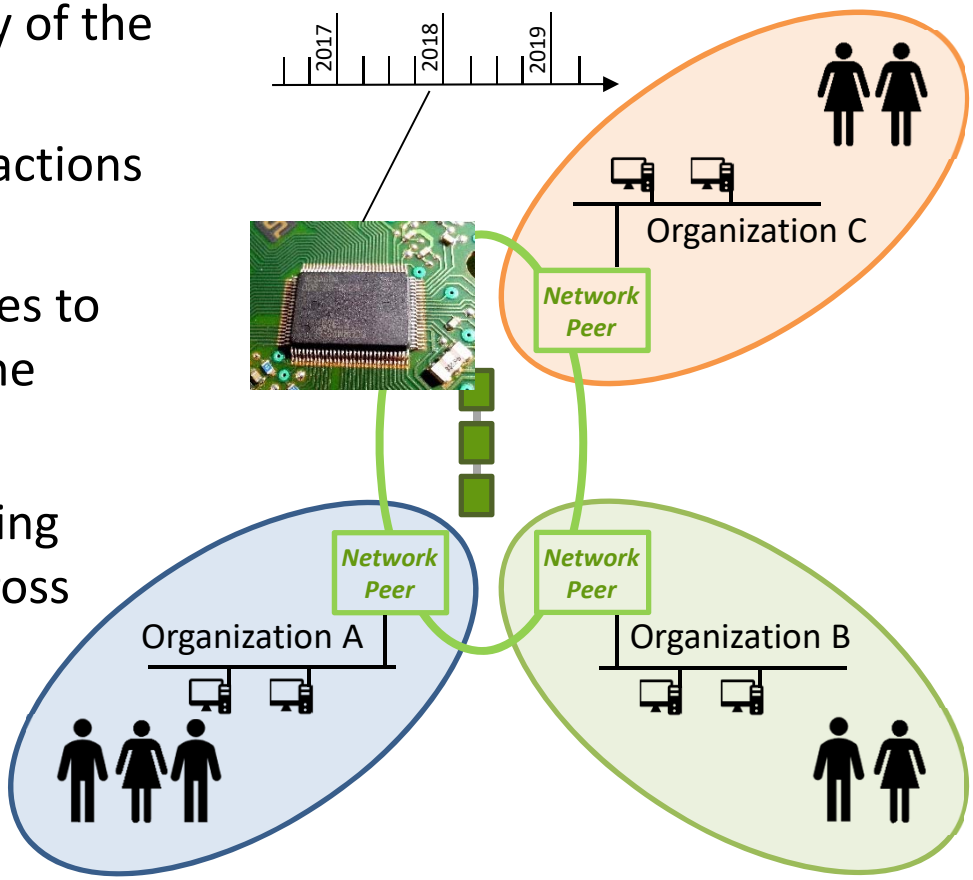
Use case – Component Failure Analysis
Isolated System Life Cycle Management

- Each organization has separate database of records
- Changes must be communicated out-of-band
- Audits may take weeks or be impractical to perform
- Component-level digital twin not possible



Use case – Component Failure Analysis
System Life Cycle Management using Digital Twins

- Each organization has a copy of the blockchain/database
- Peers synchronized as transactions approved
- Digital Twin shows all changes to specific component over time
- Instantaneous audits
- Provides continuously evolving snapshot view of system across time



3. Barriers to Adoption of Blockchain

- Transition of existing practices and procedures
- Acceptance for use by entire consortium without central authority or oversight
- Companies wishing to protect their Intellectual Property and Trade Secrets do not wish to participate in technology promoting the sharing of information

4. Industry Success Stories

- ***Supply Chain Security and Authenticity***
  - ***Maersk – Cross-Border Supply Chain***
  - ***Everledger – Diamond mining***
  - ***Food Safety***
- ***Financial Dispute Resolution***
- ***Healthcare***
- ***Air Traffic Control***

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