DISTRIBUTED RESILIENT AND EMERGENT INTELLIGENCE-BASED ADDITIVE MANUFACTURING

NSF E-RISE RII Award #OIA-2417062

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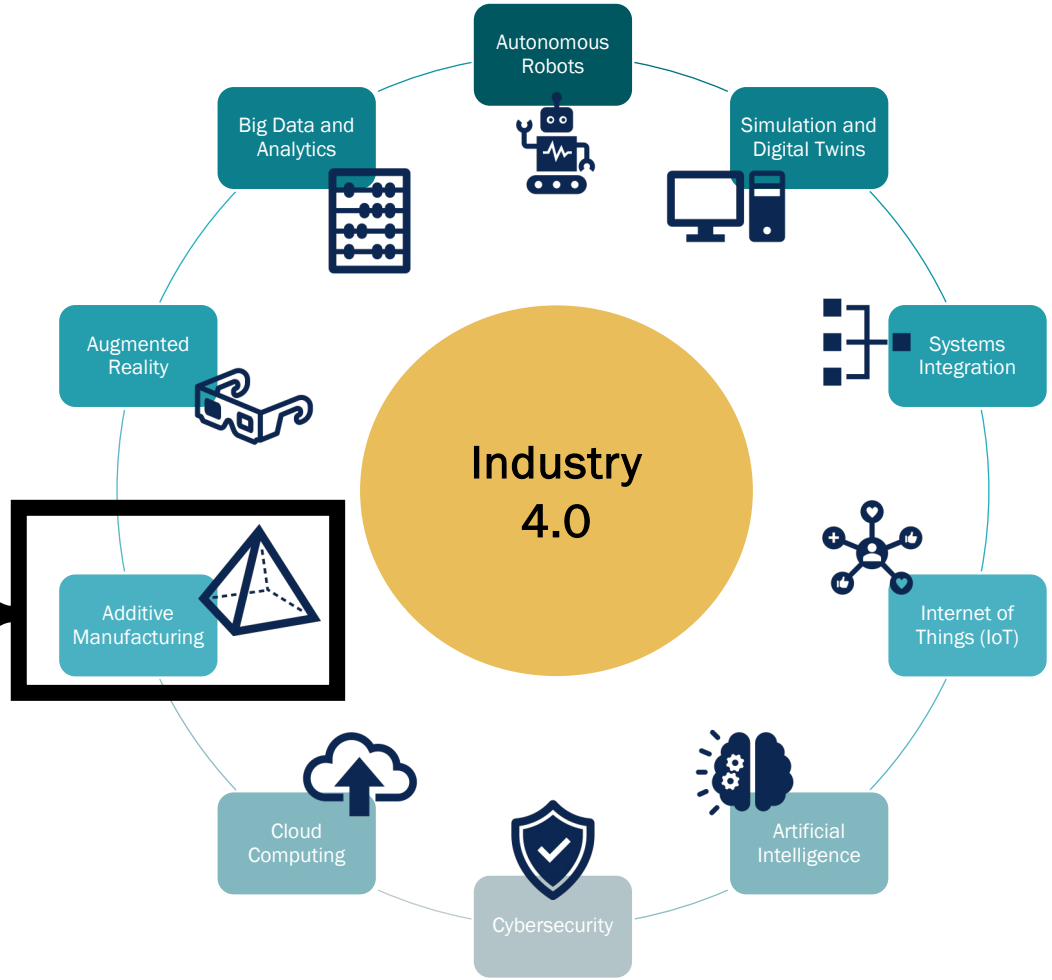
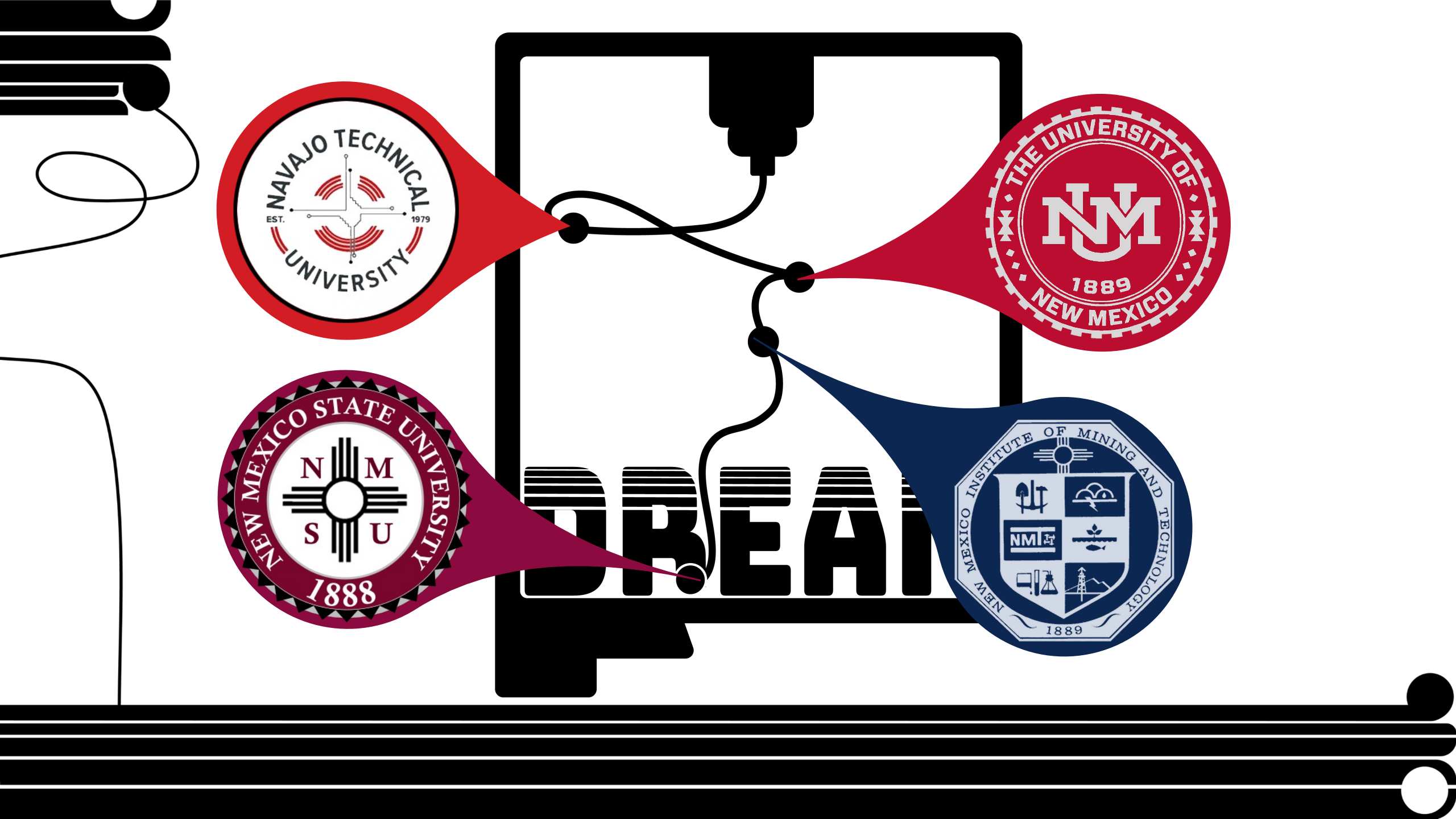
NEW MEXICO IS POISED FOR BREAKTHROUGHS IN INDUSTRY 4.0 USING ADDITIVE MANUFACTURING

- **Accelerated need for Industry 4.0 capabilities:**
  Resilience, customizability, scalability, and sustainability of resources and productivity

- **Competitive Edge for Small and Medium Enterprises of NM:**
  Additive Manufacturing enables speed, flexibility, freedom of design, and the ability to support distributed manufacturing & assembly.

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$7M Investment

in

Distributed Intelligent Additive Manufacturing (DIAM)

Collaboration Between

4 New Mexico Research Institutions

working toward

4 Research Goals

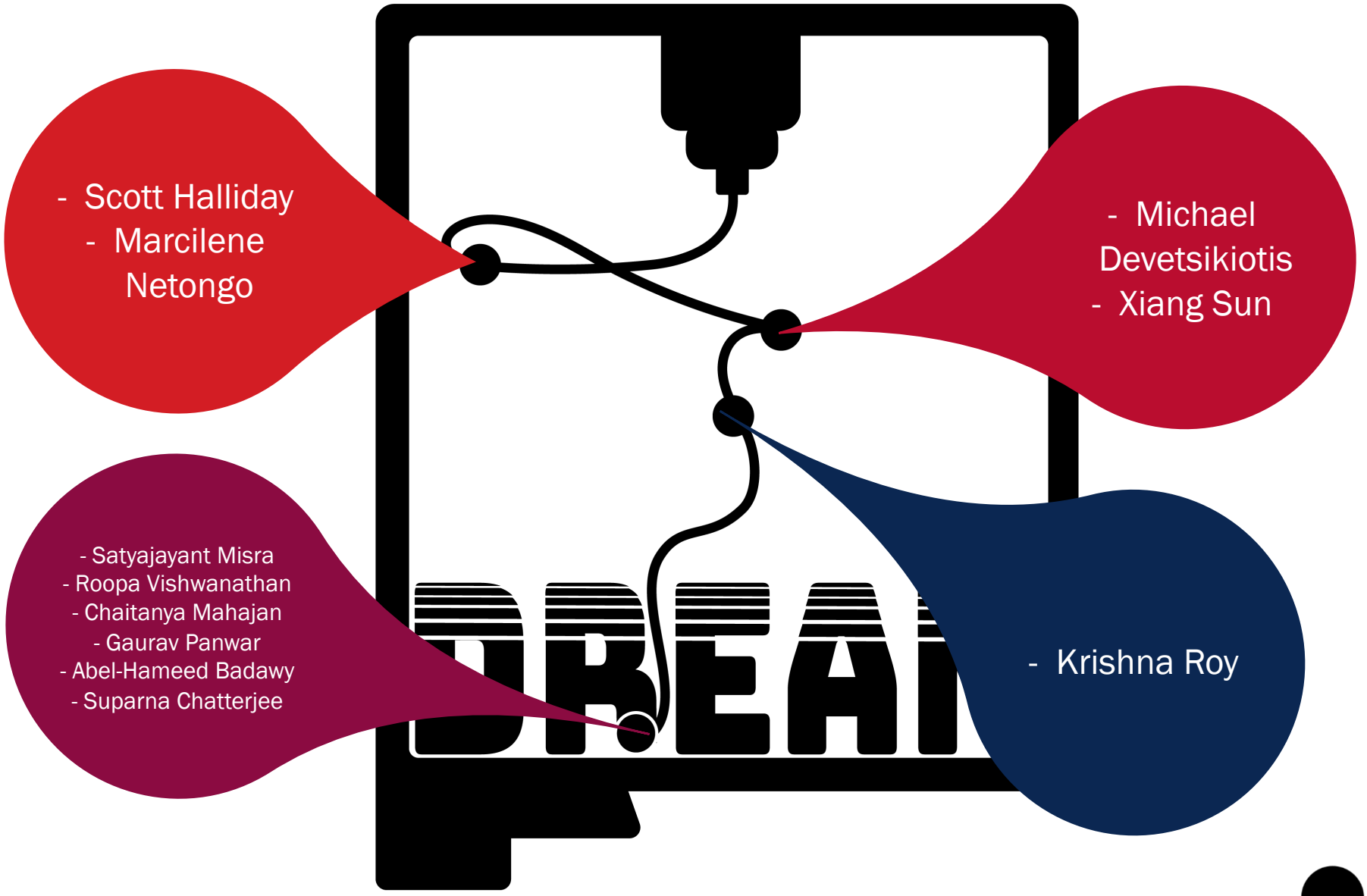
and

2 Education & Workforce Development Goals

11 University Faculty

with expertise in

Advanced Manufacturing, Cybersecurity, Distributed Networking Systems, Industrial Engineering, Artificial Intelligence, and STEM Education



MEET THE TEAM:

VISION:

BUILDING DISTRIBUTED ADDITIVE MANUFACTURING SYSTEMS THAT ARE OPTIMIZED, SECURE, AND RESILIENT AND DEVELOP THE NEXT-GENERATION STEM WORKFORCE

Research Goals

1. Cloud-Edge Continuum Architecture
2. Secure & Trustworthy Distributed Environment
3. Verifiability and Auditability
4. Validation: Testbed and Digital Twins

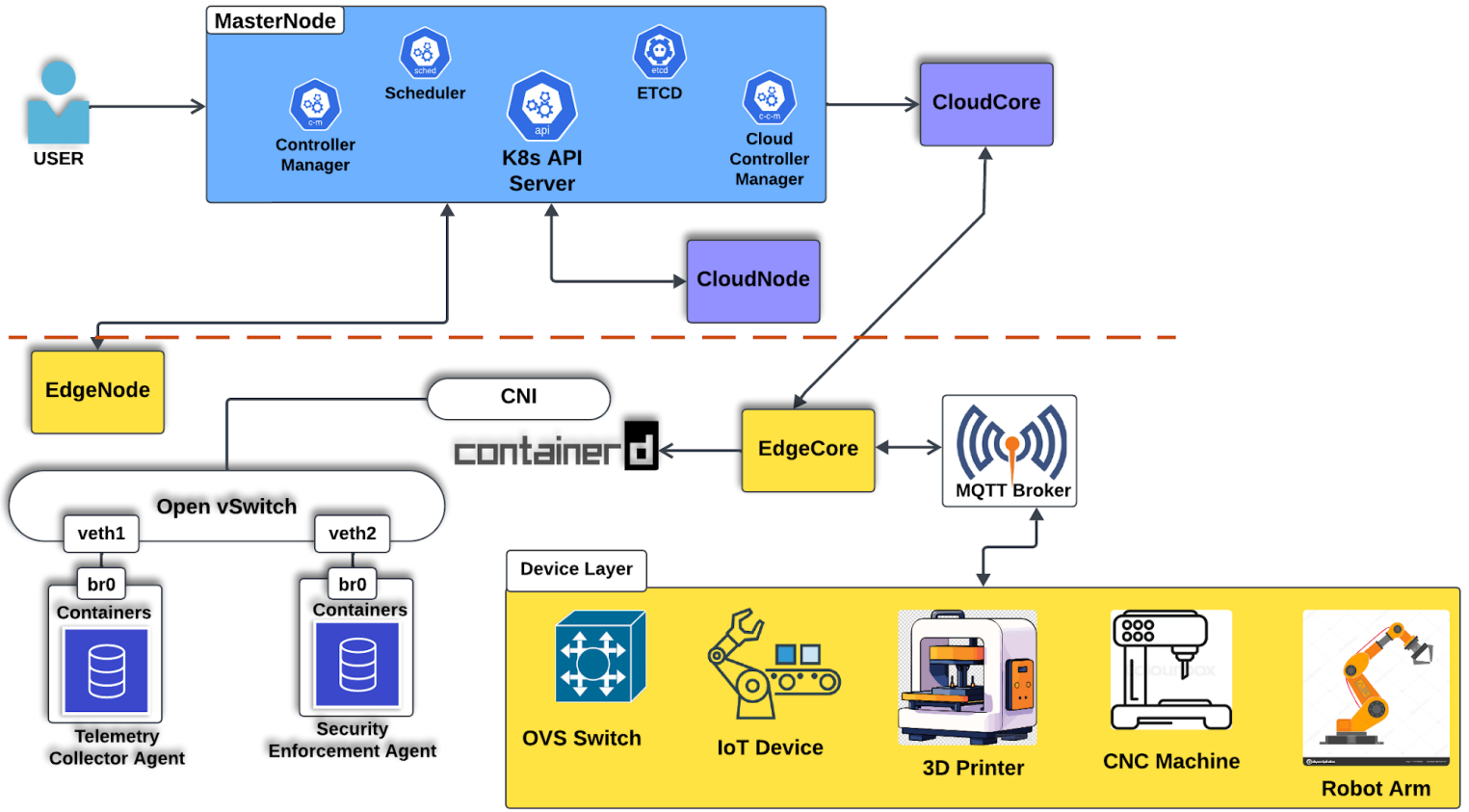
Education and Workforce Development Goals

1. Increase Research Capacity
2. Engage, Train, and Retain Students in STEM

CLOUD-EDGE CONTINUUM ARCHITECTURE

RESEARCH GOAL 1

1. Scalable Network Architecture
2. Dynamic Network Slicing for 5G and Beyond
3. Multi-agent SDN based Core Network
4. Semantic Internet of Things (IoT) for Intelligent AM

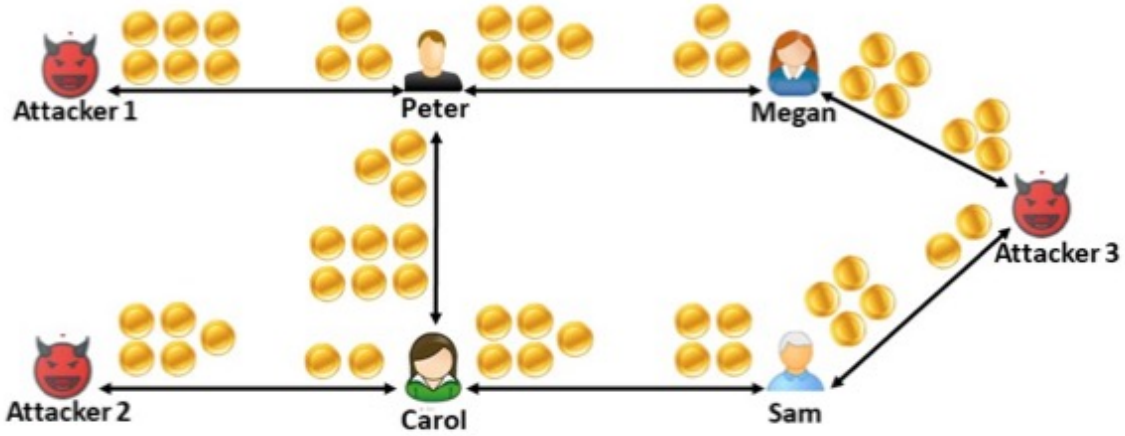


Objective 1.1: Scalable Network Architecture

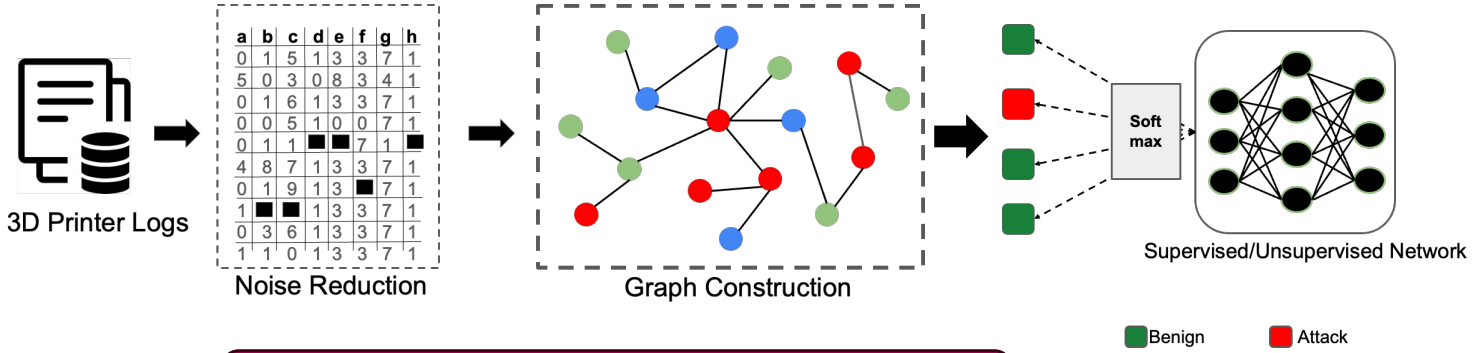
SECURE & TRUSTWORTHY DISTRIBUTED ENVIRONMENT

RESEARCH GOAL 2

1. Supervisory techniques to address Trojans and Side-Channel Attacks
2. Efficient Authentication Protocols and Access Control Models for DIAM
3. Graph-based DIAM Monitoring System for Intrusion Detection



Objective 2.2: Cybersecure Authentication for Peer-to-Peer networking

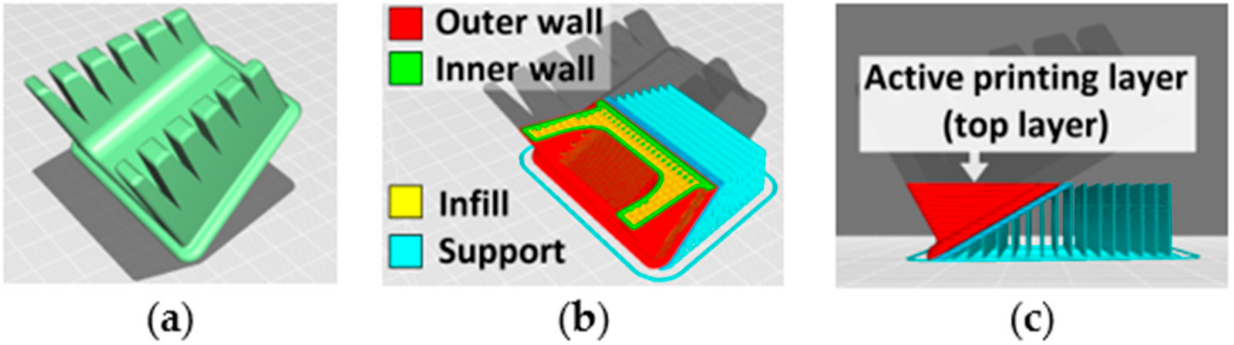


Objective 2.3: Graph-based AI network supervision

VERIFIABILITY & AUDITABILITY

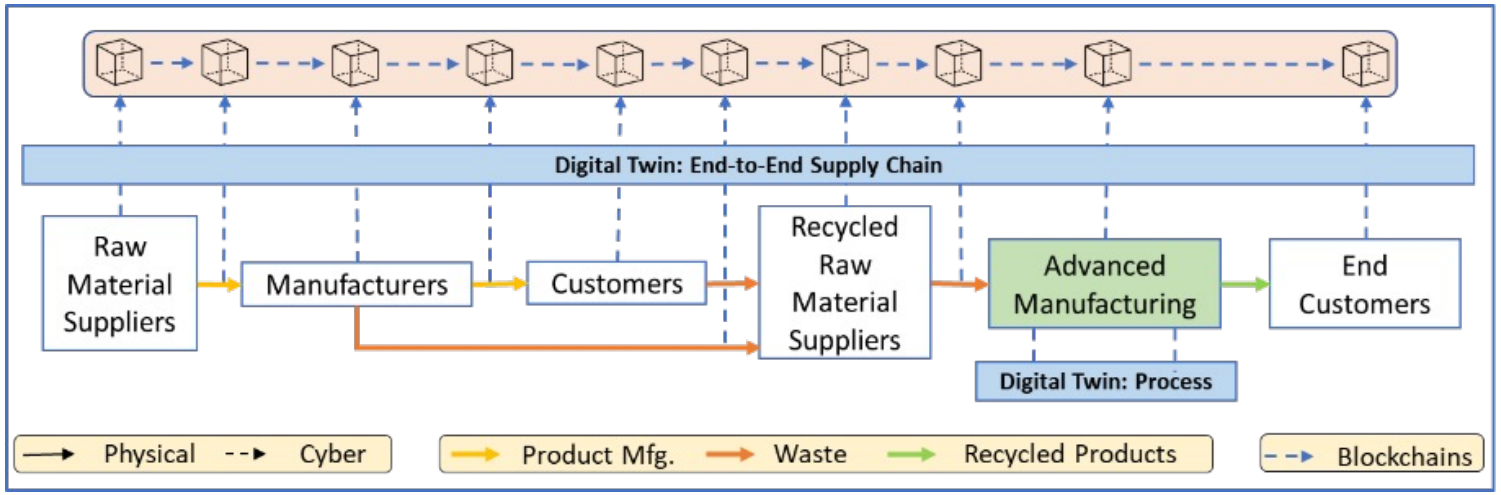
RESEARCH GOAL 3

1. Implement Verifiable Edge Computing
2. Verifiable and Efficient Distributed Machine Learning for Quality Control and Process Improvements
3. Design Blockchains for Supply Chain Provenance, Visibility, and Auditability



From **Synthetic-to-Real Composite Semantic Segmentation in Additive Manufacturing**
J. Manuf. Mater. Process. **2024**, *8*(2), 66; https://doi.org/10.3390/jmmp8020066

Objective 3.2: Machine Learning for Quality Control

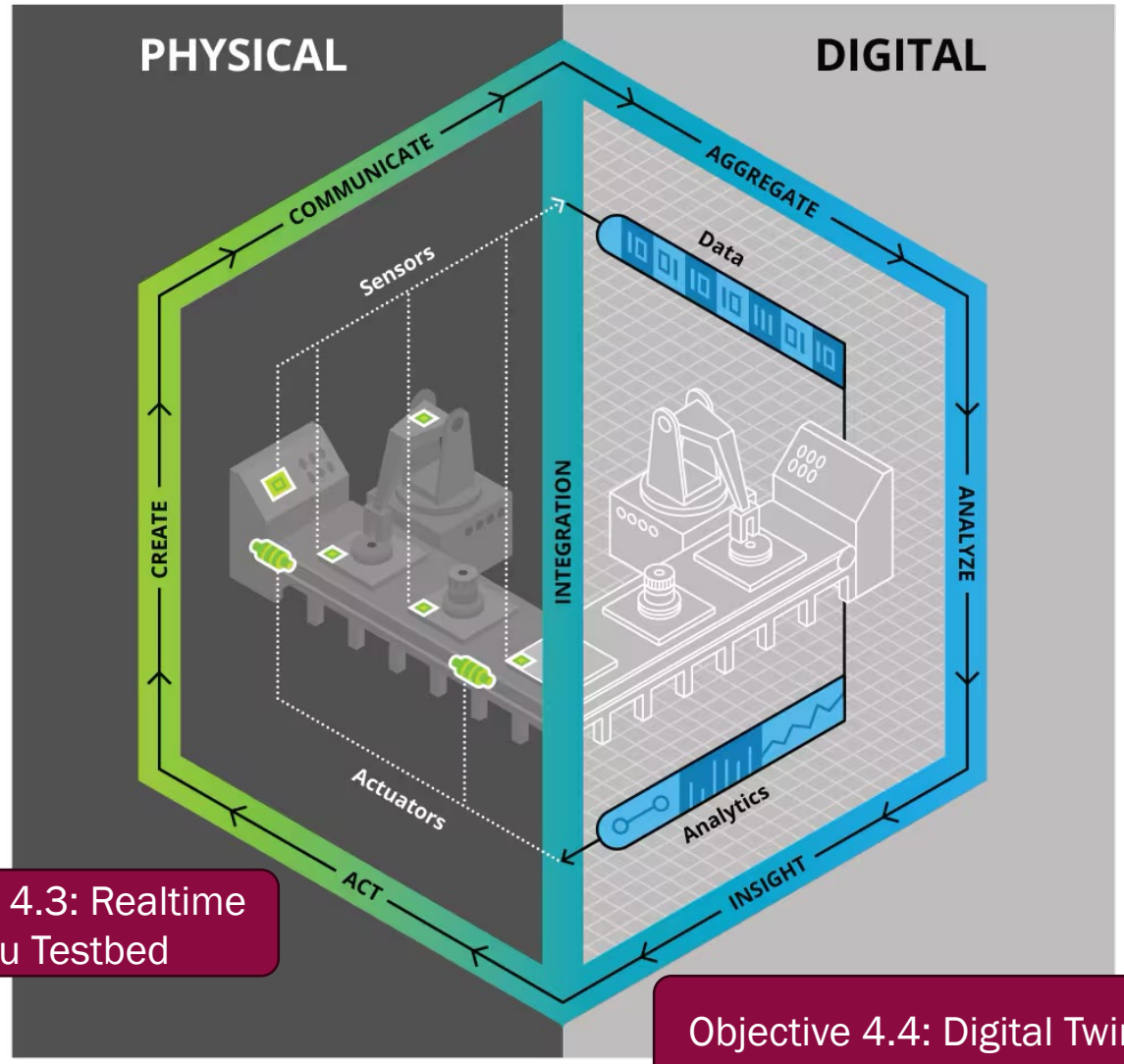


Objective 3.2: Industry 4.0 Supply Chain Provenance, Visibility, and Auditability using Blockchains

VALIDATION TESTBED & DIGITAL TWINS

RESEARCH GOAL 4

1. Deploying Distributed Cloud-Edge Continuum Testbed
2. Test Security Posture in Deployment
3. Demonstration of Realtime In-situ Quality Control Using Testbed
4. Digital Twin Design



Objective 4.3: Realtime In-situ Testbed

Objective 4.4: Digital Twin Design

From **Industry 4.0 and the digital twin**
Deloitte University Press. **2017** **dupress.deloitte.com**

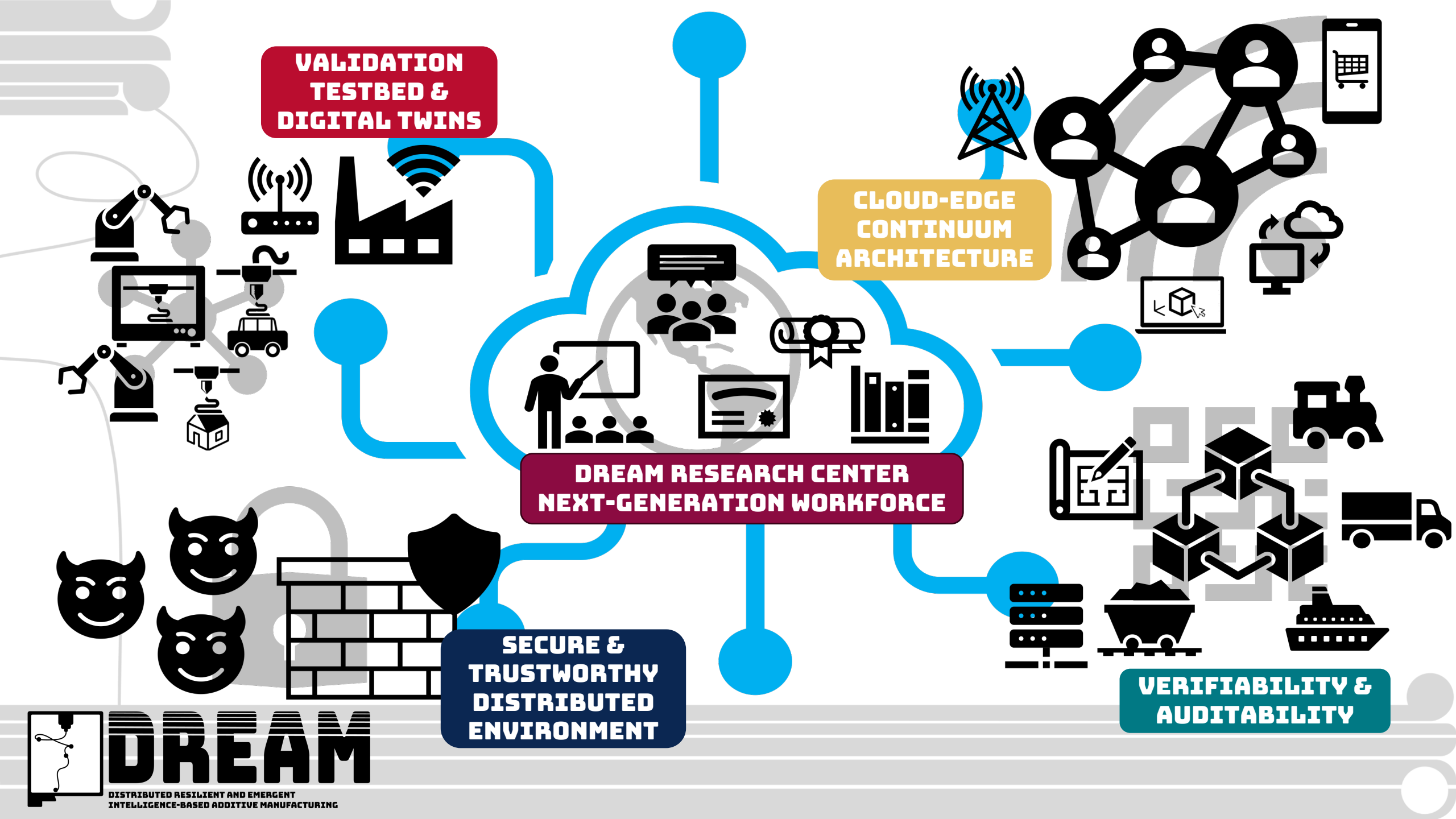
EDUCATION & WORKFORCE DEVELOPMENT

INCREASE RESEARCH CAPACITY

1. Fill key gaps in faculty research expertise
2. Early Career Workshops
3. Developing Science Communication to the Public

ENGAGE, TRAIN, AND RETAIN STUDENTS IN STEM

1. Support Cybersecurity at NTU
2. Creating a Pipeline for Student Opportunities
3. Micro-credential in Cybersecurity for Manufacturing
4. Creating K-12 Pathways for Advanced Manufacturing



DREAM

DISTRIBUTED RESILIENT AND EMERGENT INTELLIGENCE-BASED ADDITIVE MANUFACTURING

THANK YOU!

Questions?
More info at: dream.nmsu.edu

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