Super Intelligence for Manufacturing and Critical Infrastructure Update

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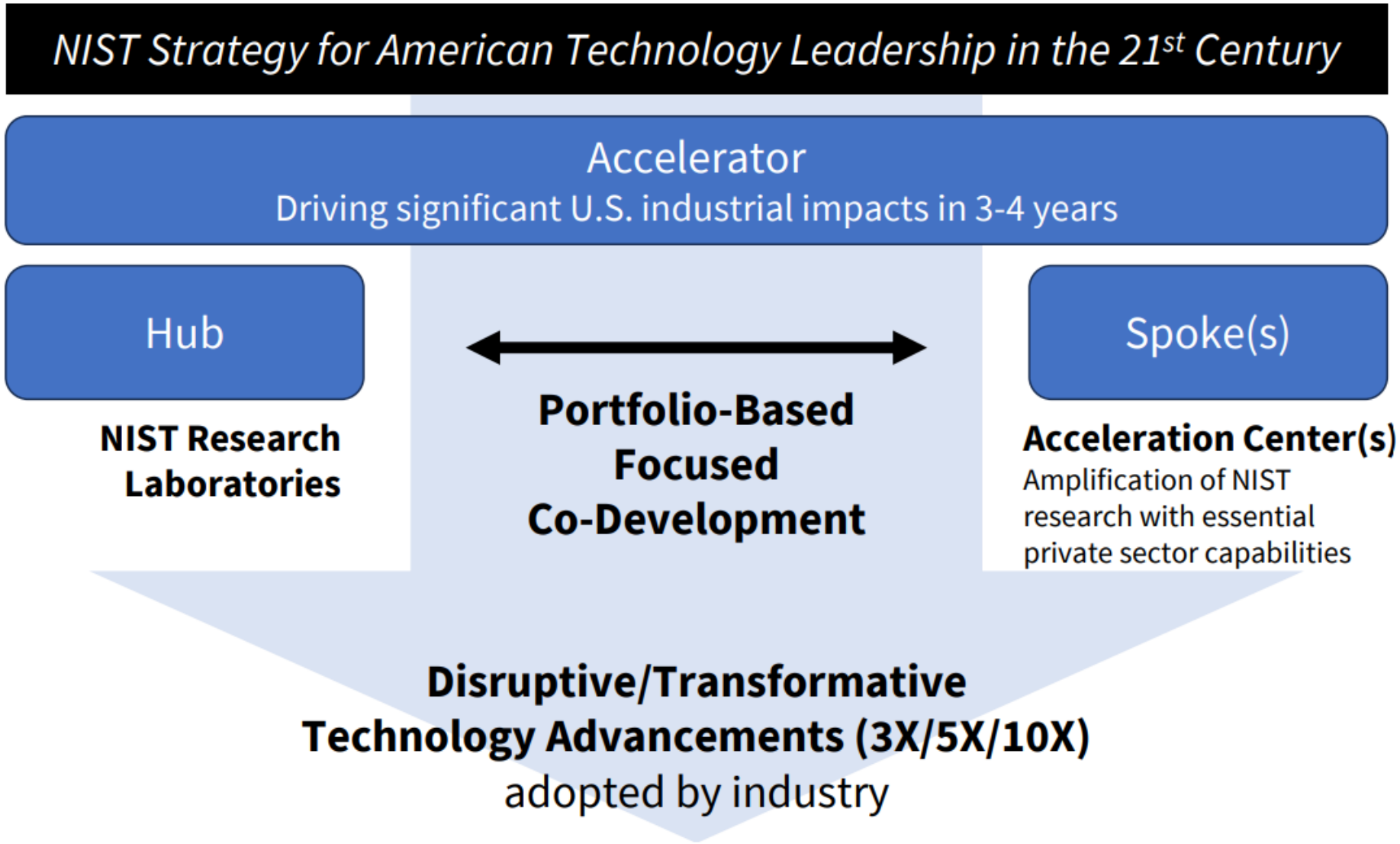
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
U.S. DEPARTMENT OF COMMERCE

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SI Accelerator Recap

- Accelerate development and adoption of **SI-driven autonomous agents** for increased U.S. manufacturing productivity
  - Advance SI-based “human-in-the-loop” robotics and autonomous systems
  - Unleash innovation to adaptably produce cost-competitive, high-value, and customizable American products (e.g., high-mix, low-volume manufacturing)
- Accelerate development and adoption of **SI-based agents** to **secure U.S. critical infrastructure from cyberthreats**
  - Advance SI-based agents for highspeed cyberthreat detection and remediation to protect and secure critical infrastructure grids (power, telecom, water, finance, health)

SI Accelerator Recap



SI Accelerator Workstreams

Improving manufacturing productivity and critical infrastructure security

SI Economic Security Center for:
U.S. Manufacturing Productivity

Design, develop, and implement an integrated ecosystem utilizing **SI-enabled robotics and agentic solutions** to address the challenges US manufacturers face to **reduce changeover time, increase throughput, and maintain quality** for high-mix manufacturing environments.



SI Economic Security Center to:
Secure U.S. Critical Infrastructure from Cyberthreats

Develop and transfer an **SI-enabled orchestration platform** that **protects, sustains, and rapidly restores** critical infrastructure operations



Two complementary missions, one objective: Move SI from NIST research to validated, operational adoption.

Accelerator Engagements

Outreach with stakeholders and potential collaborators



70+ Engagements

Potential industry partners including operators, manufacturers, SI platforms, solution providers



7 Workshops

Industry and academia experts to identify and refine challenges to adoption
Financial experts to model funding and ROI

Challenge Focus Areas

Manufacturing productivity workstream



Manufacturing Challenges

Changeovers — repositioning fixtures, swapping tooling, and validating safety — consume more time than the next production run, prohibiting automation.

HMLV manufacturers are challenged to rapidly adjust their quality inspection processes for new products, designs, and specifications, relying on experienced team members.

Integrating a robotic system into manufacturer's lines requires daily operation and regular maintenance, which SMMs often lack expertise for on their existing teams.

Automating assembly processes, and aligning designs to automated manufacturing, is necessary for scaling production but challenging to execute for small and intricate assembly operations.

Technical Considerations

- Physics- and process-informed synthetic data generation
- Foundation models for manufacturing and robotics
- Rapid creation of realistic, robust simulations
- Robust real-to-simulation transfer
- Integration of agentic SI in manufacturing environments
- Design for automated manufacturing
- Inspection traceability and process improvements

*Focus areas and technical challenges are not exhaustive or fully mapped.

Challenge Focus Areas

Critical infrastructure workstream

Operating Challenges

- Detection provided by commercial solutions is unaware of cyber-physical domain dynamics.
- CI Operators are increasingly challenged to respond to new and evolving threats from Nation state and sophisticated actors.
- Damage to cyber-physical systems can result in extensive recovery times.
- Safety-critical CI operations demand continuous availability and minimal disruption

Technical Considerations

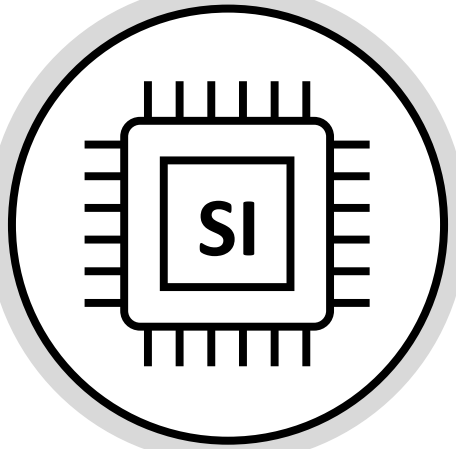
- Multi-modal OT telemetry fusion
- Detecting physical anomalies of OT systems
- Adaptive infrastructure reconfiguration
- Real-time operational safety and resilience
- Flexible architecture for emerging threats
- Technology transfer between lab and live infrastructure
- Limited high-fidelity test environments

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Solutions

Manufacturing Productivity

Integrated and broadly deployable SI-agent enabled autonomous robotic manufacturing solutions to address the challenges US manufacturers face to reduce changeover time, increase throughput, and maintain quality for high-mix manufacturing environments

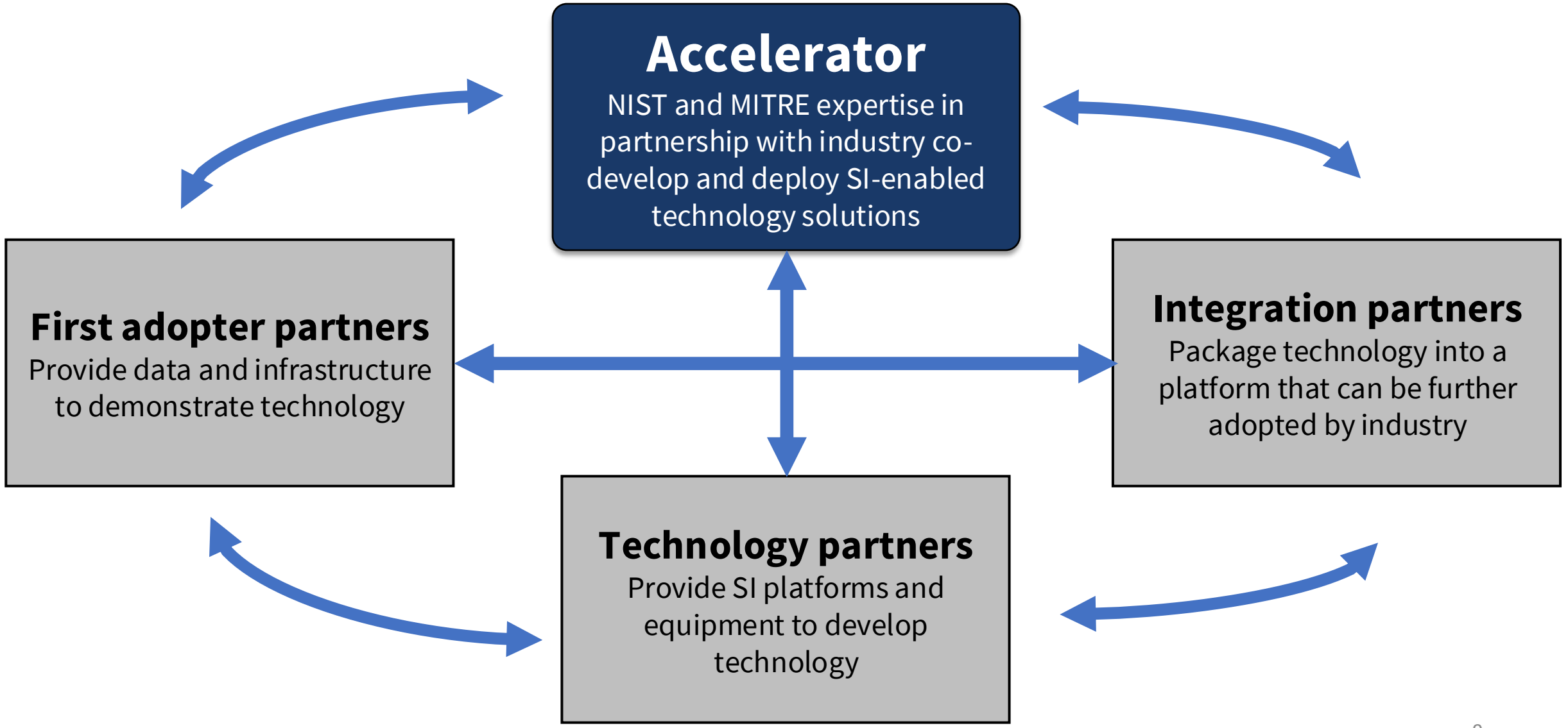


Securing Critical Infrastructure

Broadly deployable SI-agent enabled cyber-physical aware autonomous orchestration engine that enables critical infrastructure operators to contain adversarial attacks by processing complex signals, and generating and executing containment options with human supervision

Partnership Ecosystem

Co-developed technology solutions for industry deployment



Partnerships: Manufacturing Workstream

Engagements with active and potential collaborators



Research Partners

Academia
Expertise in next gen. robots and greenfields, robotic production applications in manufacturing

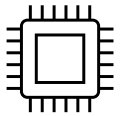
Industry consortia
Extensive manufacturing industry network, production test sites, and early adopters



Platform Partners

Manufacturing Technology Platforms
Established manufacturing ecosystem providers that are typically priced out of SMMs

SI Platforms
Established SI servicers who provide platforms that can be tailored to manufacturers

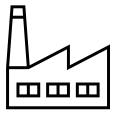


Technology Partners

Assembly Robot Providers
Top 3 US developers of manufacturing robot arms, software, and skills

SI Inspection Software
Established US manufacturing suppliers and startups developing SI-enabled inspection solutions

SI Agentic Software
US startups representing a broad base of MES, ERP extensions with SI to keep production at pace of tech



Adopters Partners

Existing Small & Med Manufacturers
US domestic discrete assemblers in sectors of national interest desiring ~10x throughput increases

Startup Small & Med Manufacturers
New US Startups breaking ground to realize robotic contract assembly

Large Traditional Manufacturers
High-volume inspection and assembly tasks of value-dense products with high manual labor

Partnerships: Critical Infrastructure Workstream

Engagements with active and potential collaborators



Research Partners

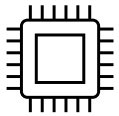
Academia
Expertise in OT systems cybersecurity

National labs
Expertise in OT systems cybersecurity



Platform Partners

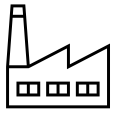
SI platforms
Representing multiple of the top 10 foundation model providers



Technology Partners

OT cybersecurity
Existing technology (COTS) solution providers; cyber telemetry stream

CI OEMs
Represent top 5 critical infrastructure equipment providers



Adopter Partners

Comms providers
Touching 100K route miles and 97% of U.S. business demand

ONG distributors
Representing ~40K miles of pipeline infrastructure and ~35% of U.S. consumption

Water utilities
Testbeds for water utility transition, serving over 320K customers with 400M+ gallons/day

Electric utilities
Key development partners serving 11M+ customers over 260K square miles

What does success look like?

Manufacturing workstream

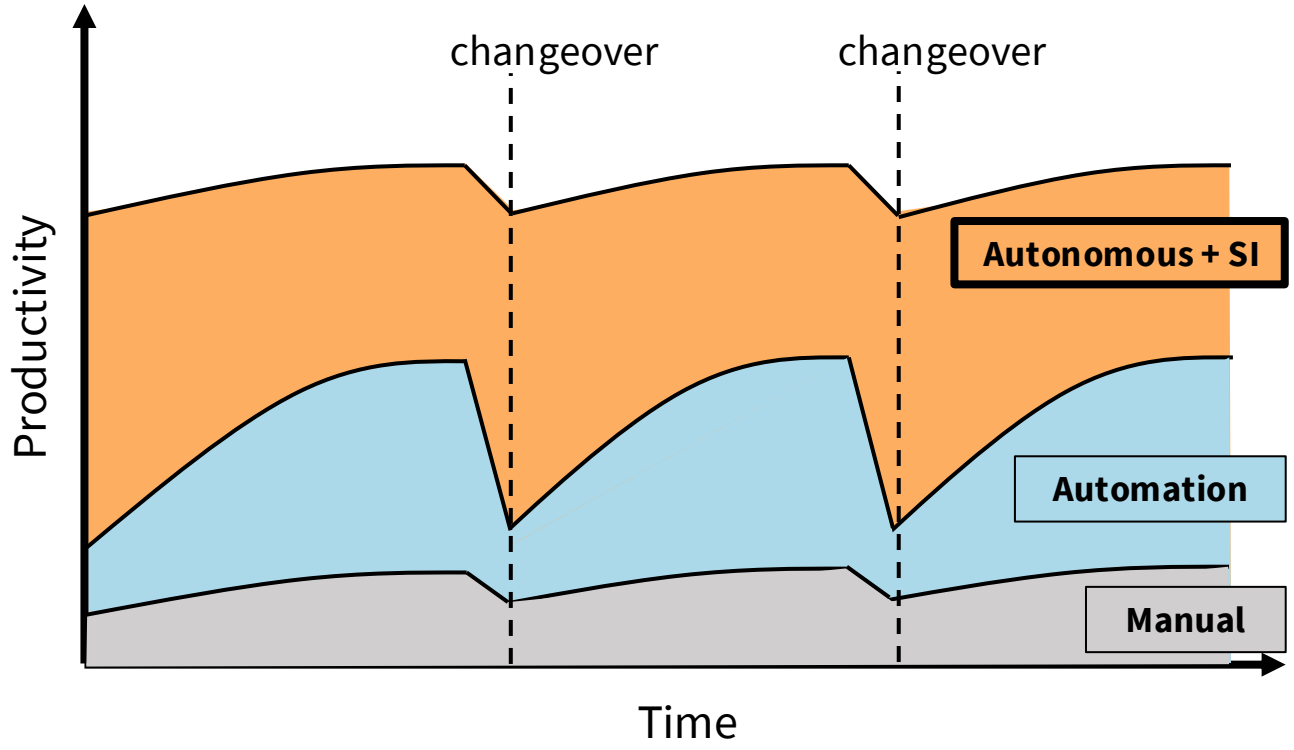
Successful technology

Initial adopters with 3-10x improvement in production capabilities (e.g. failures, errors, defects)

- Faster adaptation to product and process changes
- Better quality with fewer defects and less rework
- Lower engineering and operating effort
- Reliable performance under varied conditions
- Easier integration and reuse across manufacturers

Path to scale

- Solution is made commercially available for adoption by manufacturers beyond the pilot demonstrations
- Solution is adopted in multiple manufacturing industries



Errors+failures+defects+changeover time = productivity

What does success look like?

Critical infrastructure workstream

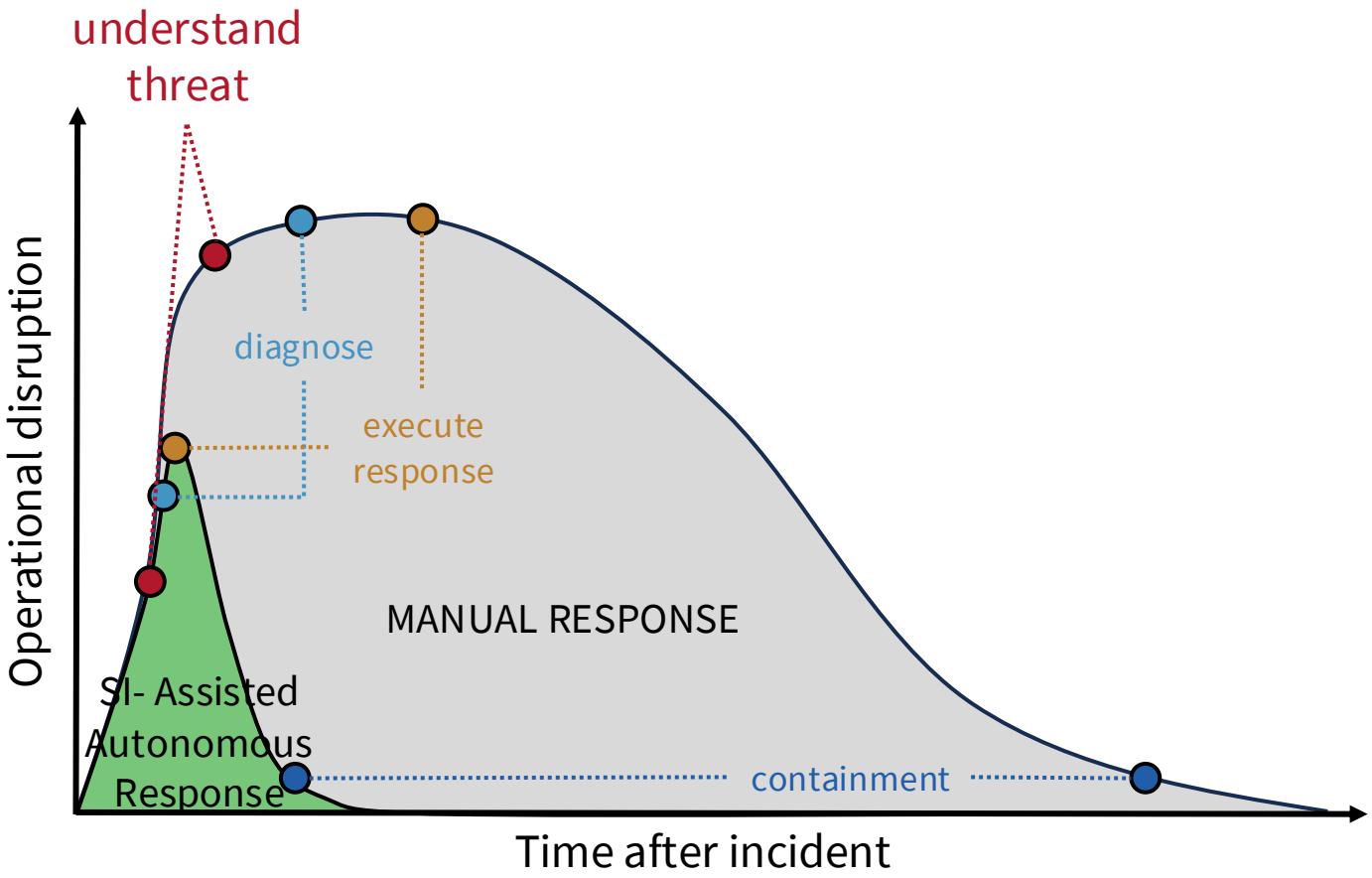
Successful technology

Initial adopters of coordinated containment that protects essential operations in less than 60 min

- Shorter time to characterize and contain cyber incidents
- Essential operations preserved during defensive action
- Shorter time to restore critical services

Path to scale

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Roadmap

From engagement to measurable adoption

Partner discovery

Conduct workshops

Identify use cases

Outreach with potential partners

Onboard collaborators

Co-development with partners

Generate synthetic data

Operational data collection

Model training and selection

Integration with existing products

Demonstration & validation

Test solutions in lab environments

Demonstrate solutions in customer sandbox environment

Pilot in real-world operation

Performance measurements

Path to scale

Questions?


CELEBRATING
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NIST
125 YEARS
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