
BRIDGES TO TOMORROW
ENGINEERING, CYBERSECURITY, AND A FUTURE WORKFORCE
Denver University Bridges to Tomorrow – 2024.02.20

INTRODUCTION

- Business Owner
- Consultant
- Instructor
- Public speaker
- Community builder
- Explorer

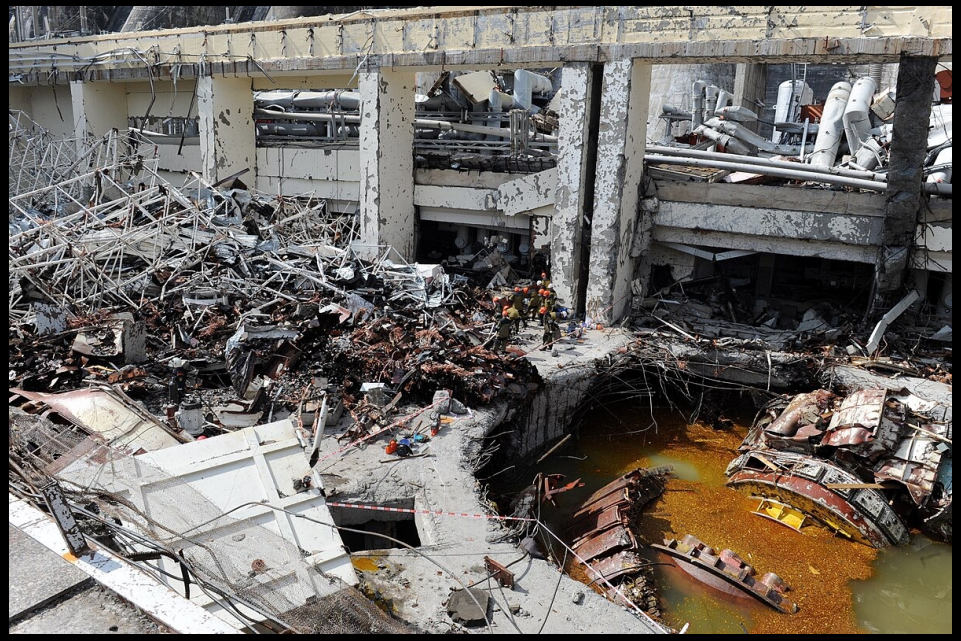
- GCIP, CISA, CRISC, CISSP-ISSAP, SSCP, NSA-IAM, CVI, TCP, SCP
- US Coordinator, Centro de Ciberseguridad Industrial (CCI)
- Former Principal Investigator, US DOE National Electric Sector Cybersecurity Organization
- EnergySec Founder, Former CEO, Director, Instructor, and President Emeritus
- Former SANS ISC456 Instructor: Essentials for NERC Critical Infrastructure Protection
- Instructor, Cyber Information Security Leader (CISL), CSA CPH
- Former utility staff (telecommunications, water & electric)
- One of the original architects of NERC CIP standards for North America
- First NERC CIP auditor in the US
- NERC CTAG, SCWG, SITES, and SPIDERWG contributor
- Speaker/contributor to multiple FERC Technical Committees, NOPRs and Orders
- Contributing author for DHS CISA Cross-Sector Cyber Performance Goals (CPGs)
- Cybersecurity Advisory Team for State Solar, NARUC/NASEO
- National Telecommunications and Information Administration (NTIA) and Idaho National Lab (INL) Software Bill of Materials (SBOM) Energy POC Stakeholders
- DOE Solar Energy Technology Office (SETO) and National Renewable Energy Lab (NREL) Industry Advisory Board (IAB) for the Securing Solar for the Grid (S2G)
- Advisor to multiple industrial hardware and software vendors

A DAY IN THE LIFE

FOUNDATION

- …derived from the Latin *ingenium*, meaning "cleverness" and *ingeniare*, meaning "to contrive, devise."
- …practice of using natural science, mathematics, and the engineering design process to solve technical problems, increase efficiency and productivity, and improve systems.
- …practical way for human society to change, modify and improve the physical world around us so that humans can have a better life.
- …design or build machines, engines, or electrical equipment, or things such as roads, railroads, or bridges, using scientific principles.
- …*someone who makes things work*.

DAYS SINCE LAST ACCIDENT




Safety
Security

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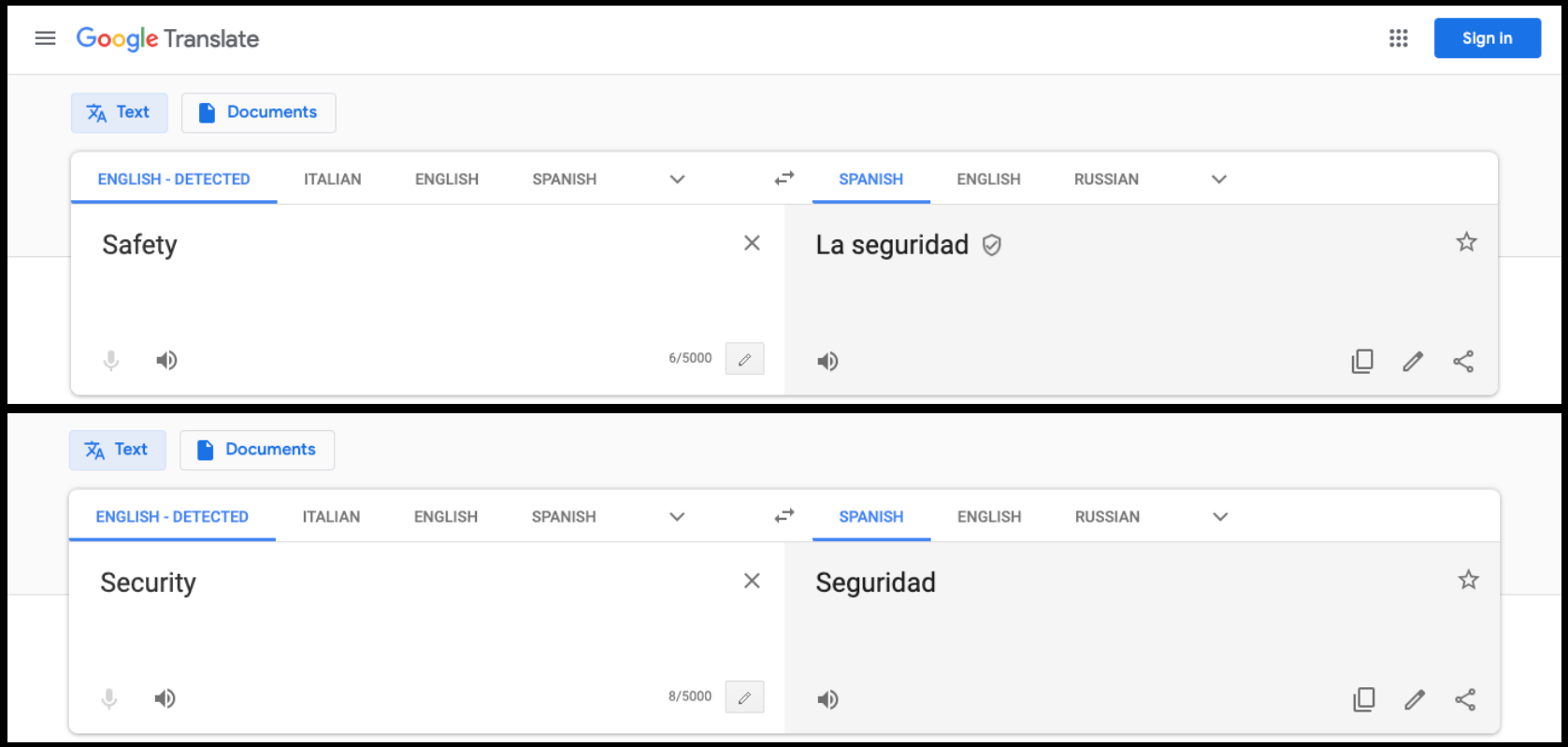
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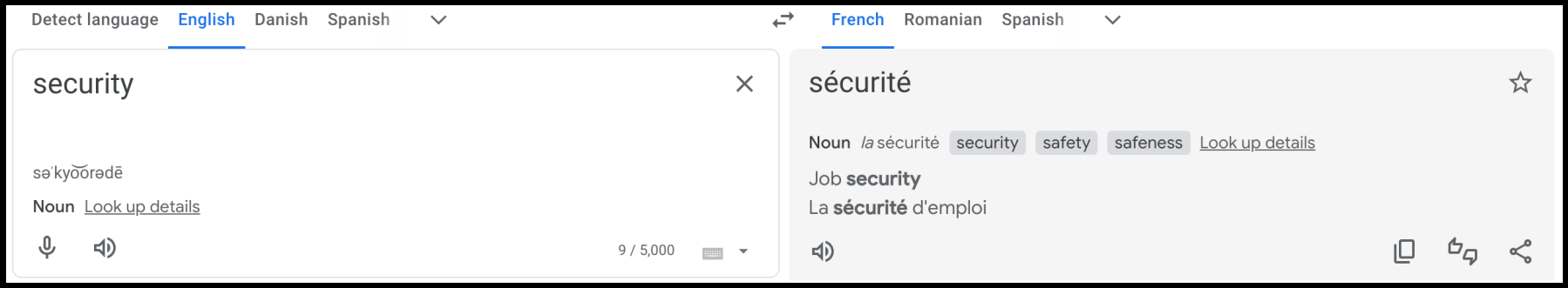
SÉCURITÉ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Ils devraient partir pour leur propre sécurité

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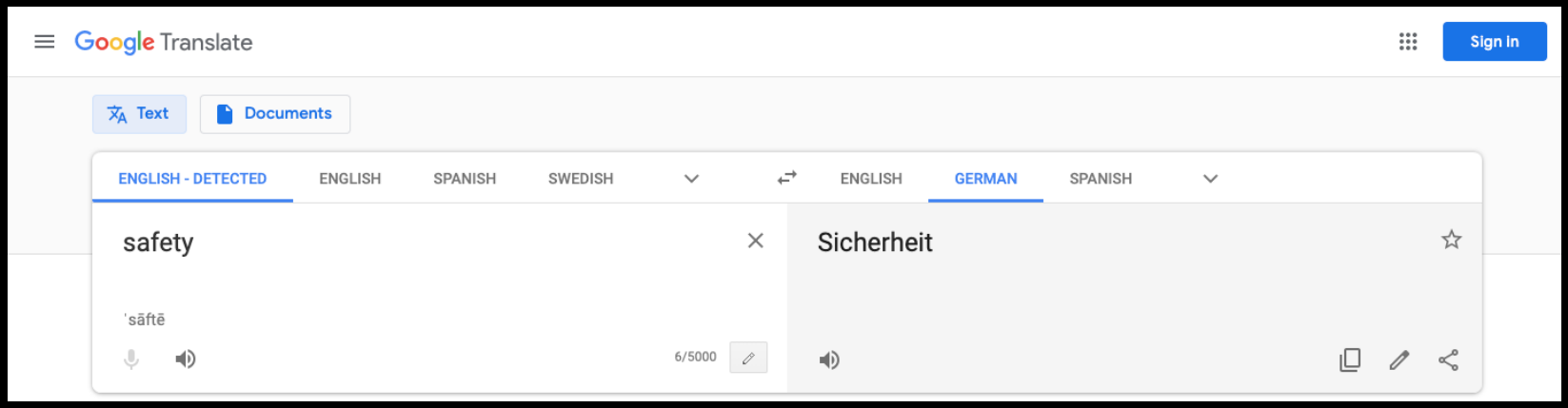
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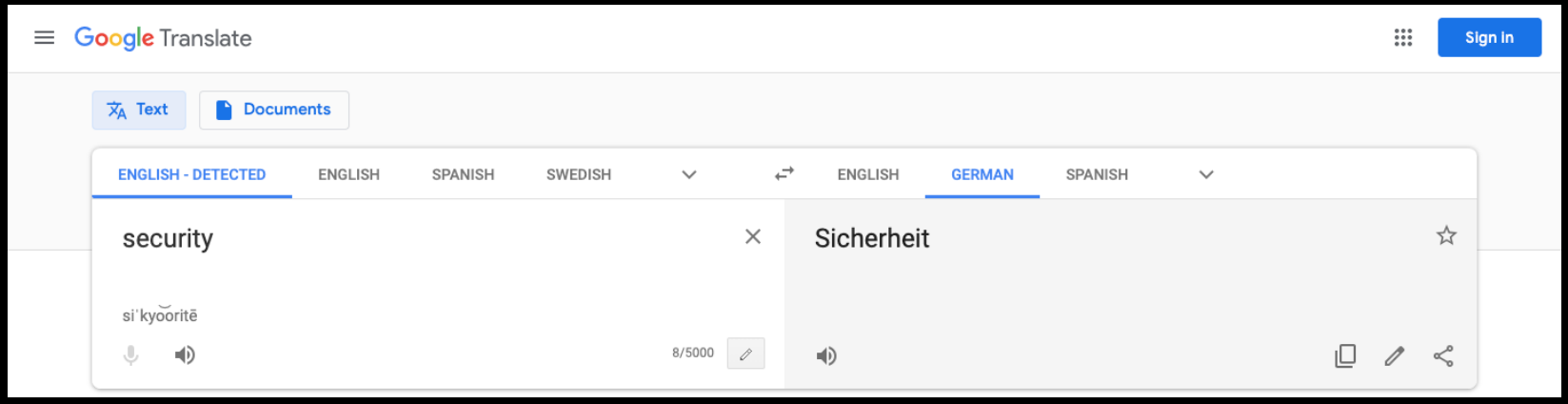
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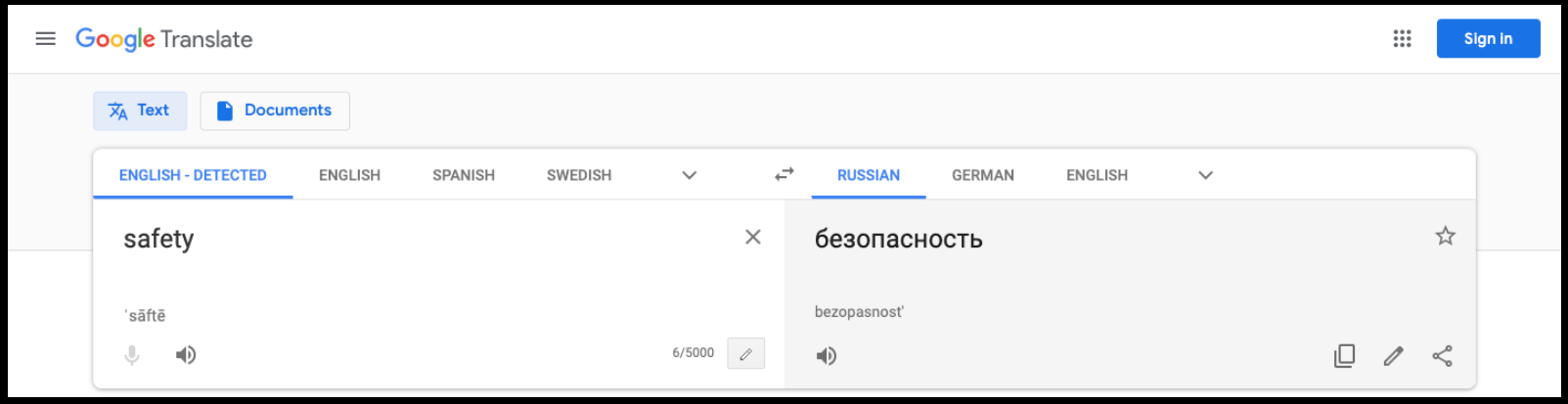
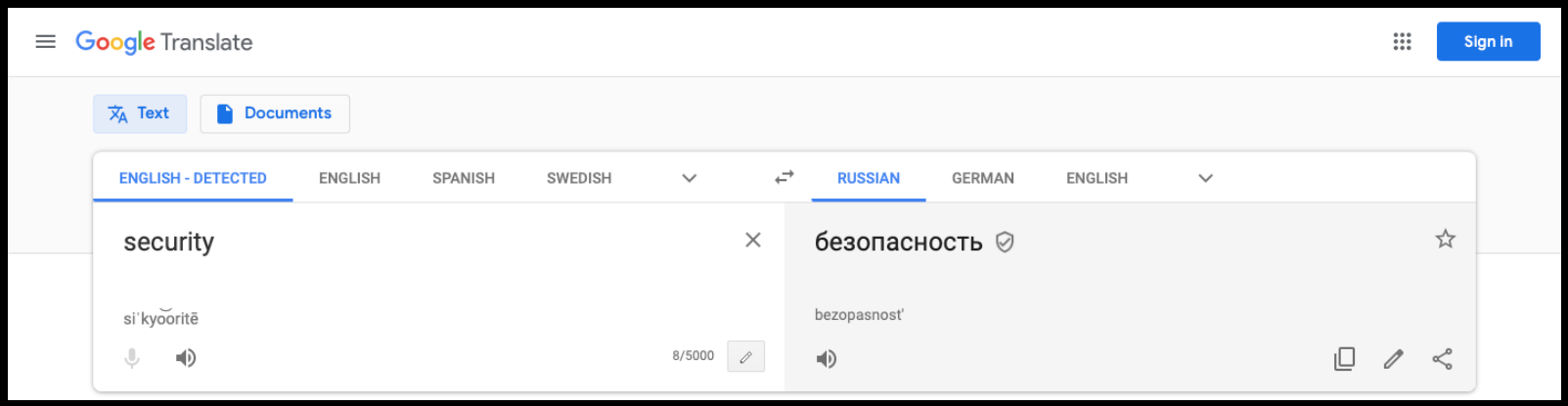




DEFINITIONS

- **Safety**: Relative freedom from danger, risk, or threat of harm, injury, or loss to personnel and/or property, whether caused deliberately or by accident. *See also security*.

- **Security**: The prevention of and protection against assault, damage, fire, fraud, invasion of privacy, theft, unlawful entry, and other such occurrences caused by deliberate action. *See also safety*.

DIFFERENCES - SIMPLIFIED

Safety

- “Accident avoidance”
- Focus on loss or damage to life or property
- Can be the result of a security failure
- Easy to use is often safer to use
- Keeping the product from affecting the environment
- Protecting people from the machines

Security

- “Crime prevention”
- Focus on availability, integrity and confidentiality
- Can escalate into a safety issue
- Easy to use is often exploitable
- Keeping the environment from affecting the product
- Protecting the machines from people

DIFFERENCES - EXAMPLES

- Safety requires emergency exits
- Must be easy to exit by anyone

- Security would prefer a wall instead of an access point
- Should be locked and only authorized personnel with access can enter or exit

TECHNOLOGY PATH

- Safety and security technologies are increasing in use
- Most future technologies will be digital and connected
  - Cyber Informed Engineering (CIE)

- Digital systems bring new risks
  - More attack surface area
  - Access and availability
  - Data integrity: sensor, aggregator, annunciator/alarming
  - Data storage, reconnaissance and inference

SAFETY VS. SECURITY

- Goals can be contradictory
  - Control system access control: group or individual?
  - System complexity: segmentation and more technology
- Does one have more importance than the other?
  - Can take over security interface to disable safety measures
  - Point-to-point connection for safety exploited through security vulnerability to cause harm
- Security must be functional to support safety
- Security is the process for ensuring or enabling safety
- Balancing both should be the objective, but this is very difficult to achieve

ENGINEERING VS. SECURITY

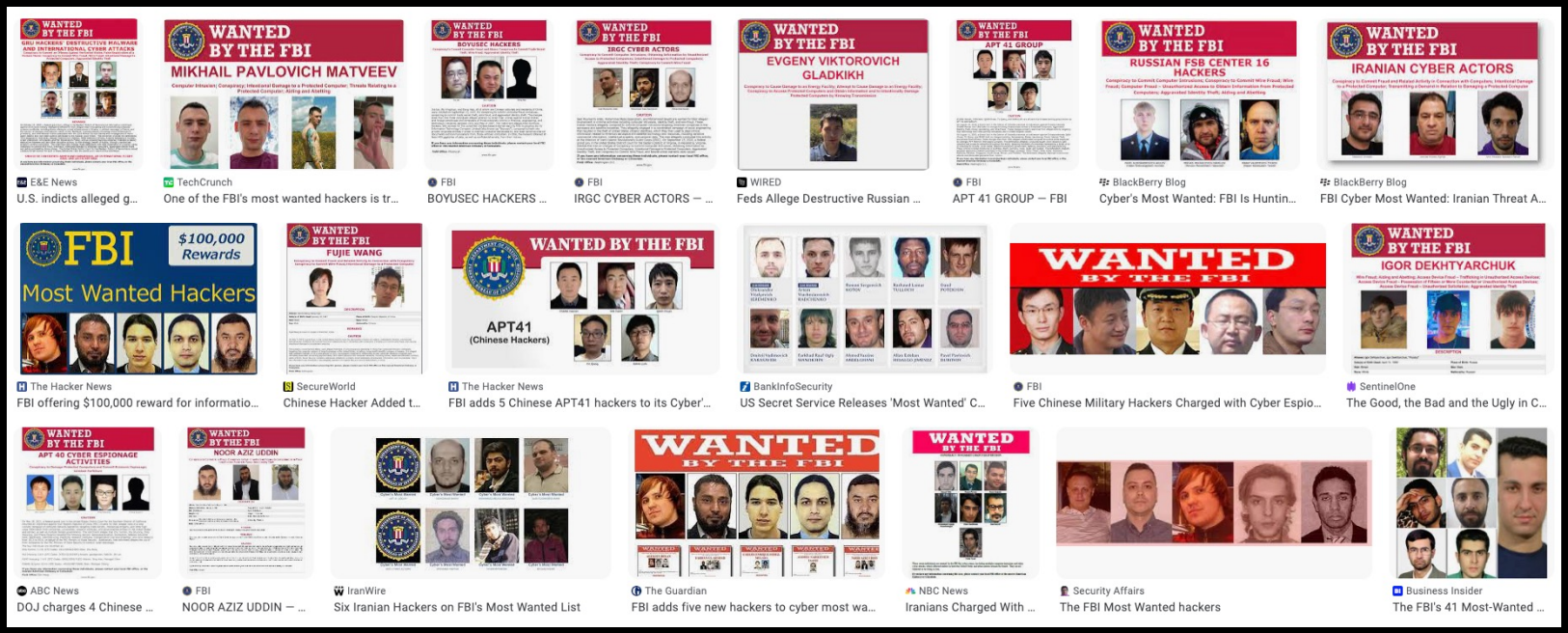
Engineering

- Focuses on designing, building, and maintaining physical systems
- Applies principles from physics, mathematics, and material science
- Concerned with functionality, efficiency, and safety of structures and machines
- Involves problem-solving to meet human needs
- Tangible, physical outcomes

OT/ICS Security

- Prioritizes system availability and physical safety over integrity and confidentiality
- Involves understanding threats specific to industrial environments and processes
- Deep integration with engineering disciplines to understand operational context and potential impacts
- Resilience and rapid recovery to maintain critical operations and minimize downtime

ENGINEERING VS. SECURITY



"Mother nature may be harsh, but she's not malicious…"

ENGINEERING VS. ENGINEERING

- Terminology & jargon
- Project focus & perspectives
- Professional identity
- Problem solving approach
- Scale and precision
- Regulatory & safety standards
- Technology adoption & innovation
- Interdisciplinary projects
- Resource allocation & budgeting
- Regional & geographic
- Demographics
- Language
- Understanding & respecting different expertise

ENGINEERING AND ENGINEERING

The importance of interdisciplinary collaboration

- Better, more holistic project outcomes
- Innovation comes from intersections
- Clear, jargon-free communication, without judgement
- Balance project priorities
- Minimize resource competition; look for opportunities
- Use project management techniques with this focus
- Take the opportunity to learn from other discipline
- Use collaborative technologies

ENGINEERING AND ENGINEERING

- Interdisciplinary collaboration can present challenges
- Creates unique opportunities for innovation and improvement

- SEEK
  - Effective communication
  - Mutual respect
  - Focus on shared goals

ENGINEERING AND SECURITY

- Engineering and security have merged in an approach called Cyber-Informed Engineering (CIE)
- Extends the “secure by design” principle
- Introduces cybersecurity considerations at the earliest stages of system design, long before the incorporation of software and security controls
- Secure the system using the physics and mechanics of engineering controls—not just digital monitoring and controls

ENGINEERING AND SECURITY

- Engineers make some of the best OT/ICS cybersecurity professionals
- Very dynamic environment
- Rewarding sense of purpose and fulfillment
- Higher degree of diversity
- High demand, often with rapid advancement
- High pay scales

SUMMARY

- Interdisciplinary and diverse engineering teams can make the best teams and achieve the most innovative outcomes
- This doesn't come easy, but it is worth it
- Enhancing interdisciplinary and diverse engineering knowledge with security can provide an even better result

RESOURCES

- Cyber-Informed Engineering (CIE) - https://inl.gov/cie/
- CISA ICS/OT security training - https://www.cisa.gov/resources-tools/training/ics-virtual-learning-portal
- Getting started in OT security - https://www.amperesec.com/podcast/breaking-into-ot-security

OPEN QUESTIONS

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