

# NIST's Views on Standardization of Advanced Cryptography

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**ZKProof Policy @ DC**

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(\*) Thanks to Luis Brandao.

# Outline

1. NIST
2. Advanced Cryptography: PEC
3. Advanced Cryptography: MPTS and ZK

(Slides will be publicly available)

Crypto = Cryptography. NIST = National Institute of Standards and Technology. PEC = Privacy-Enhancing Cryptography.

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# NIST: Laboratories → Divisions → Groups

- ▶ **Non-regulatory** federal agency (@ U.S. Dept. Commerce)
- ▶ **Mission:** ... innovation ... industrial competitiveness ... measurement science, standards and technology, ... economic security ... quality of life.



NIST name and address plate (source: nist.gov)

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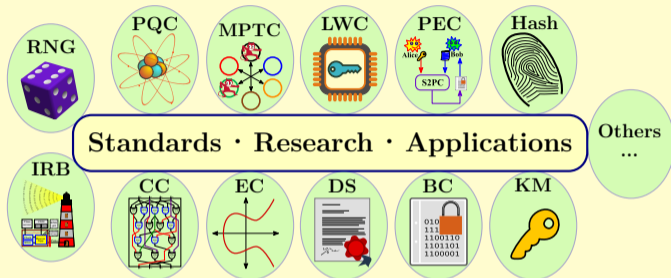


INFORMATION  
TECHNOLOGY  
LABORATORY

→ **Computer Security Division (CSD):**

→ **Cryptographic Technology Group (CTG):** *research, develop, engineer, and produce guidelines, recommendations and best practices for cryptographic algorithms, methods, and protocols.*

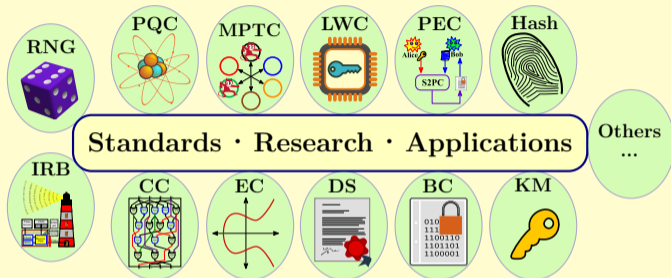
# Activities in the “Crypto” Group



Legend: **BC** = Block Ciphers. **CC** = Circuit Complexity. **Crypto** = Cryptography. **DS** = Digital Signatures. **EC** = Elliptic Curves. **FIPS** = Federal Information Processing Standards. **IR** = Internal or Interagency (denoting that the public NIST report was developed internally at NIST or in an interagency collaboration, respectively). **IRB** = Interoperable Randomness Beacons. **KM** = Key Management. **LWC** = Lightweight Crypto. **PEC** = Privacy-Enhancing Crypto. **PQC** = Post-Quantum Crypto. **RNG** = Random-Number Generation. **SP 800** = Special Publications in Computer Security. **TC** = [Multi-Party] Threshold Crypto).

More details at <https://www.nist.gov/itl/csd/cryptographic-technology>

# Activities in the “Crypto” Group



- ▶ **Public documentation:** FIPS; Special Publications (SP 800); NIST Reports (IR).
- ▶ **International cooperation:** government, industry, academia, standardization bodies.

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- ▶ What are the risks?
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- ▶ Should we be pursuing new standards for **quantum-breakable** primitives?

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1. Accompany the progress of **emerging *PEC tools***.



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PEC tools

STPPA (series of talks)

PEC use-case suite

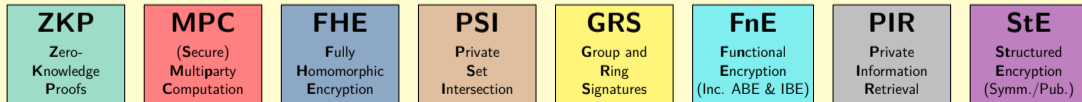
Threshold schemes

ZKProof collaboration

Encounter metrics

Email list (PEC Forum)

<https://csrc.nist.gov/projects/pec>



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3. **Exploratory work** to assess potential for recommendations, standardization; ...

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**ZKP**  
Zero-  
Knowledge  
Proofs

**MPC**  
(Secure)  
Multiparty  
Computation

**FHE**  
Fully  
Homomorphic  
Encryption

**PSI**  
Private  
Set  
Intersection

**GRS**  
Group and  
Ring  
Signatures

**FnE**  
Functional  
Encryption  
(Inc. ABE & IBE)

**PIR**  
Private  
Information  
Retrieval

**StE**  
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I think “all of the above” is the right approach. But this requires NIST being able to read these external gauges. **An alternative: “do not lead, follow other standard development organizations”.**

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# Process

## ▶ Goals

- Collect and curate **reference material**.
- **Devise recommendations**.
- **Gain trust through transparency**.

## ▶ Not a competition

## ▶ Ample room for participation: Give feedback → Submit → Analyze

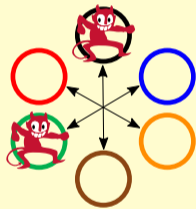
# NIST Call for Multi-Party Threshold Schemes

- ▶ NISTIR 8214C: Initial public **draft** (**Jan 2023**)  $\Rightarrow$  Revised version (**late 2023**).
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Calling for submissions of threshold schemes



(And gadgets for modular use)

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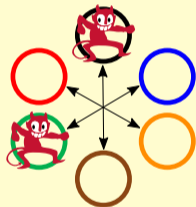
Calling for submissions of threshold schemes for:

- ▶ [Cat1] Selected NIST-standardized primitives
- ▶ [Cat2] Other primitives (including FHE, IBE/ABE, ZKP)  
(And gadgets for modular use)

FHE = Fully-homomorphic encryption.

IBE/ABE = Identity/Attribute-based encryption.

ZKP = Zero-knowledge proof.



# Ongoing work on Zero-Knowledge Proofs

## Engagement with ZKProof

- ▶ Since 2019: Contribution to [Community Reference](#) document.
- ▶ Since 2019: Participation in the ZKProof Editors team
- ▶ Since 2023: Participation in the ZKProof Standards Committee

The “**NIST Threshold Call**” has a **ZKP subcategory**.

- ▶ Focused on **ZKPs of knowledge** of secret keys ...
- ▶ ... but we expect ZKP submissions to be applicable to broader use-cases
- ▶ Submission deadline will be set to 2nd semester of 2024



# Thank you!

## *NIST's Views on Standardization of Advanced Cryptography*

Presented at ZKProof Policy @ DC | November 30<sup>th</sup> @ Washington DC (USA)

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Threshold Call  
(Draft)



MPTS 2023  
(Sept. 26–28)



MPTC-Forum  
(email list)



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