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Peering Through the Haze: Privacy and Monitoring in the Cloud Computing Paradigm

LDRD
LABORATORY DIRECTED RESEARCH & DEVELOPMENT

Early Career R&D Program

Sandia National Laboratories
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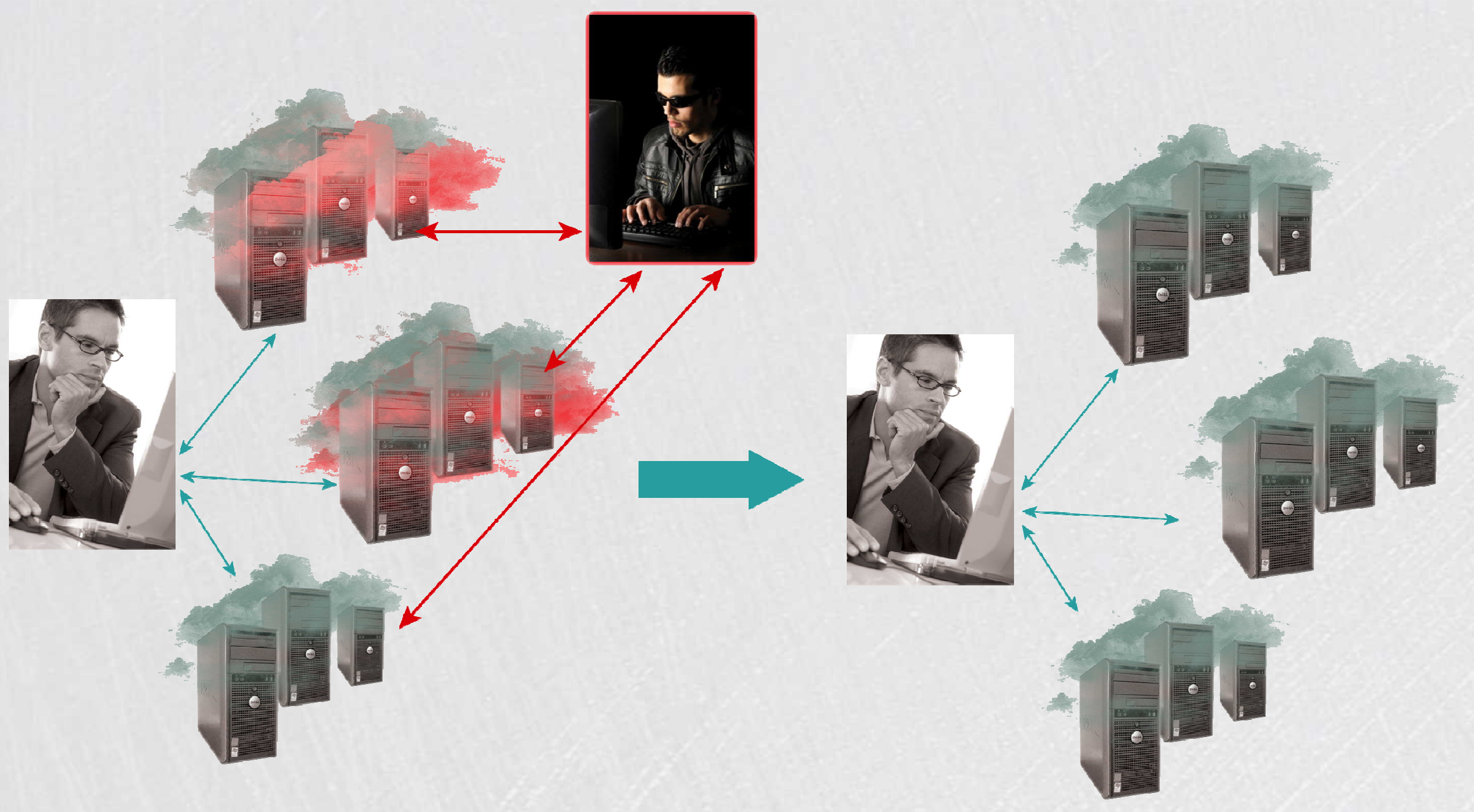
Problem

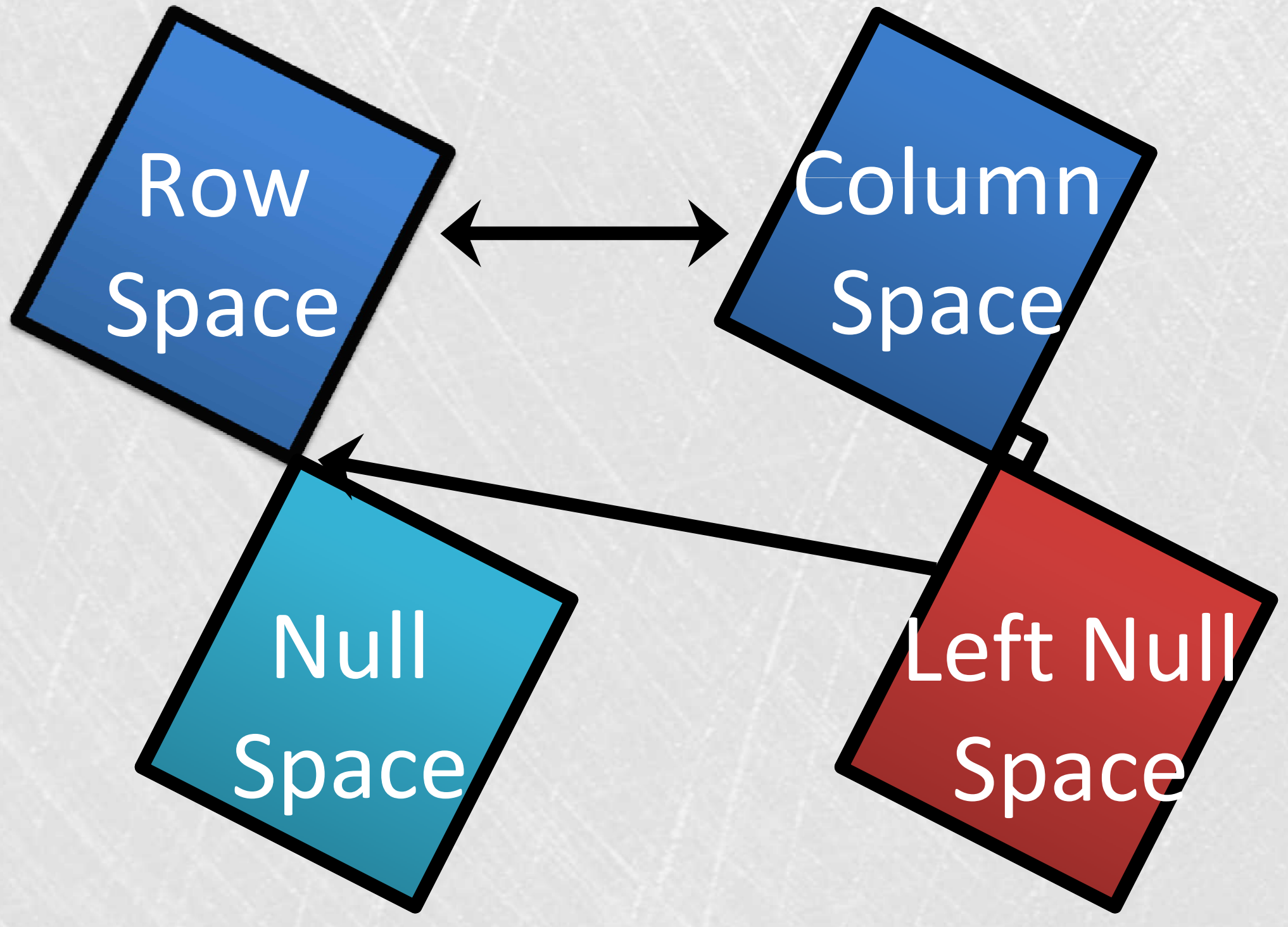
As the federal government moves towards cloud computing, one of the greatest obstacle to successful adoption is data and user security



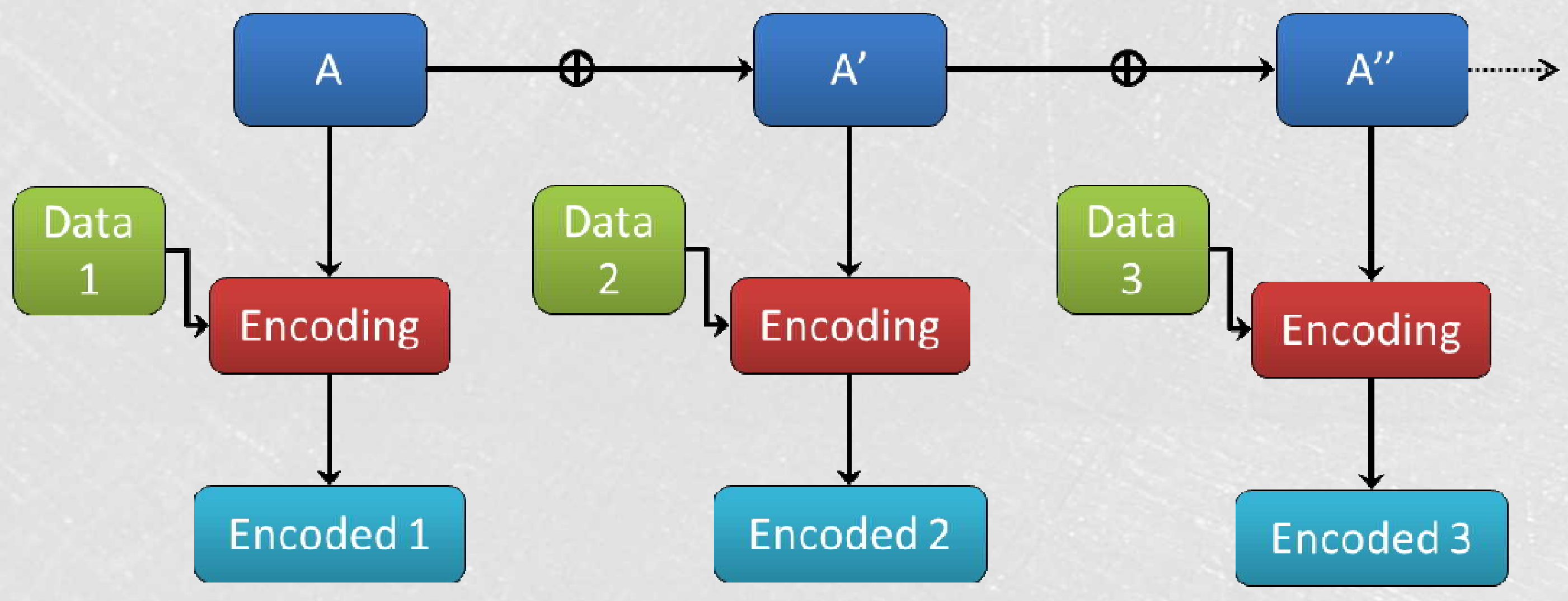
Research Objective: Develop cloud computing solutions that maintain data and user integrity across multiple service providers even when under attack

Approach

Using Algebraic Subspaces to Improve Cloud Security – Wheat and Chaff (W&C)

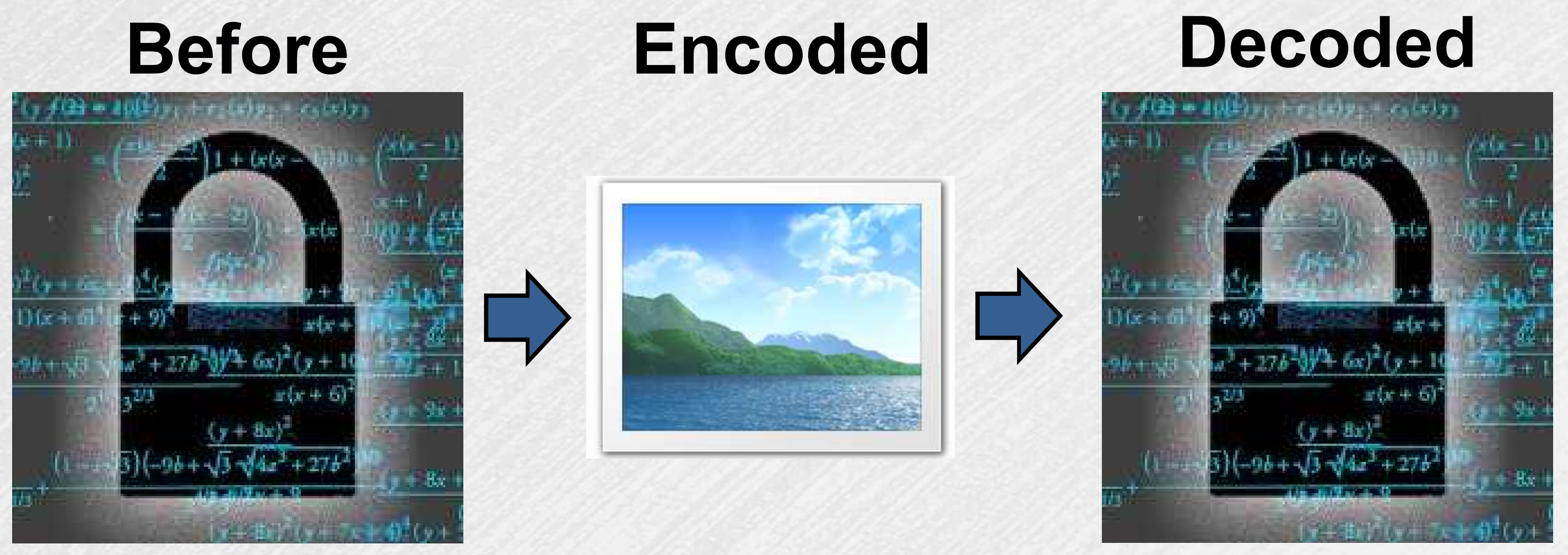


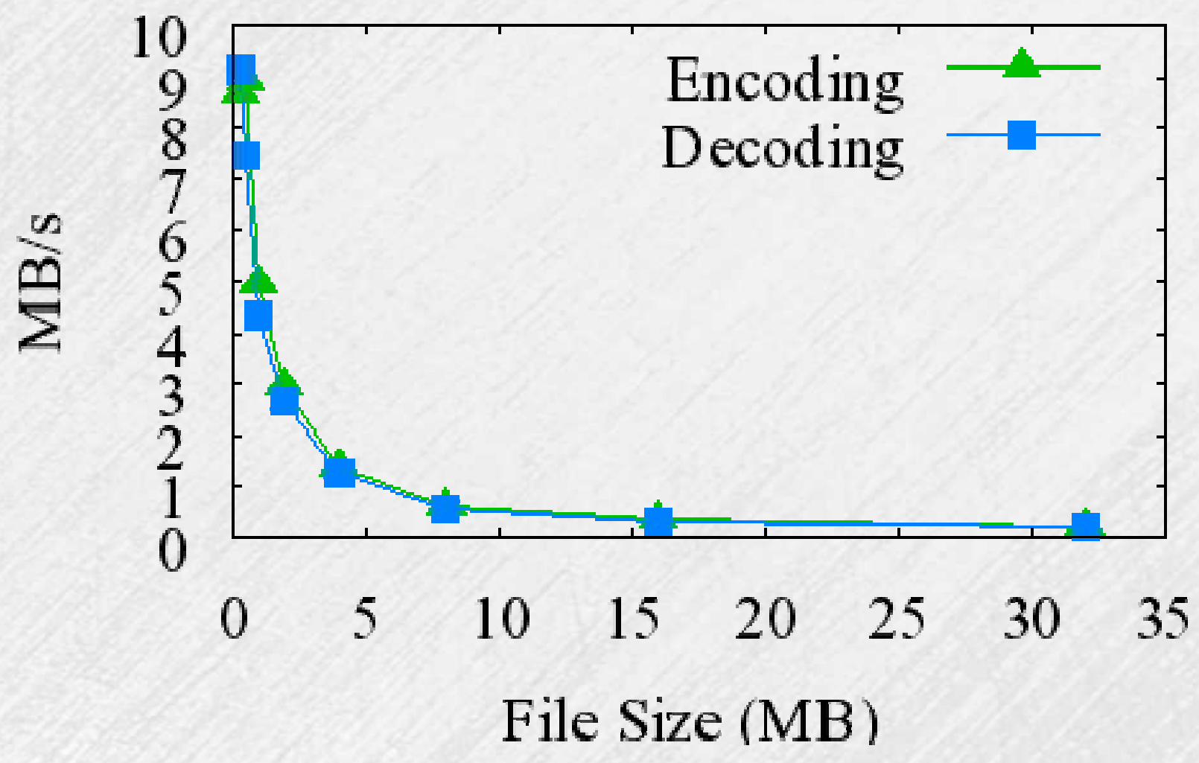
- Generate random encoding matrix A
- Chaff data is derived from the left null space of is incorporated into the encoding to allow SLA verification
- Data is encoded and generated matrices and rows are divided between providers
- Use Matrix Block Chaining (MBC) to intelligently partition the data and efficiently encode



Results

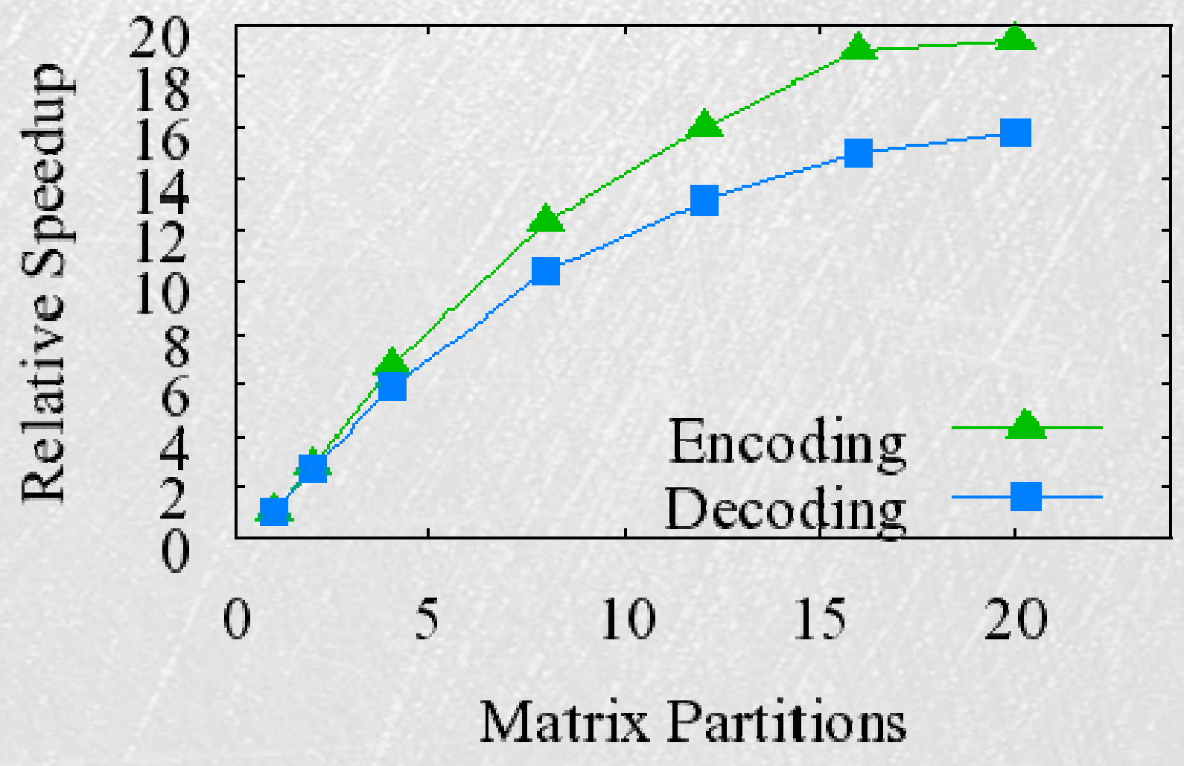
Baseline





- Data of any type of data can be encoded using W&C
- Data is unrecognizable when encoded
- Decoded data is identical to original
- Encoding and decoding have similar performance
- Performance degrades as the file size increases

Improving Protocol Performance Using MBC



- Increasing the number of partitions can yield a significant performance boost
- Optimal processing block size is ~0.5-1MB

Significance

- Created a secure encoding scheme to provide data confidentiality and SLA verification for data stored on one or more untrusted cloud providers
- Potential national security impact as multiple government agencies could benefit from this work as they move data and services to a cloud computing environment.
- Results have been published in open conferences, furthering Sandia's recognition in the cloud computing domain

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