Microsoft Research

Summit 2022

Confidential Clean Rooms for Compliant AI

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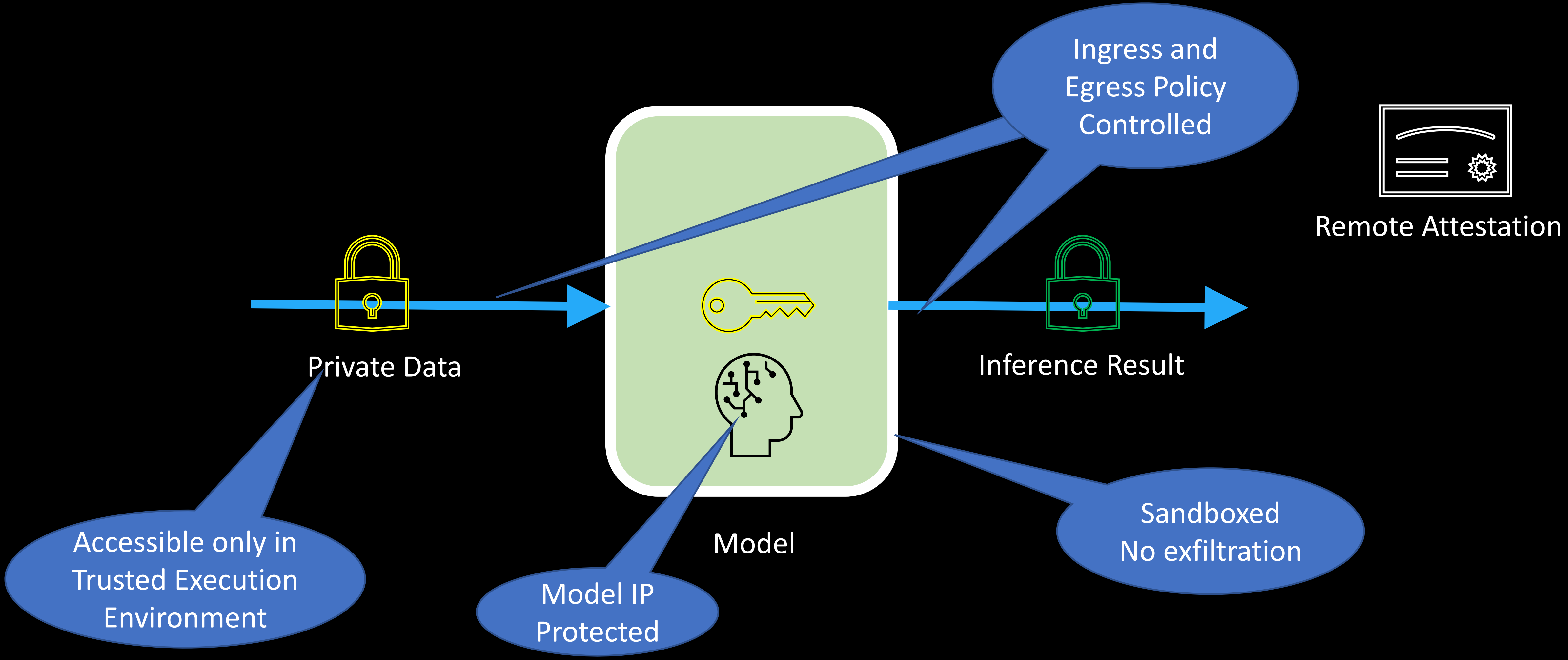
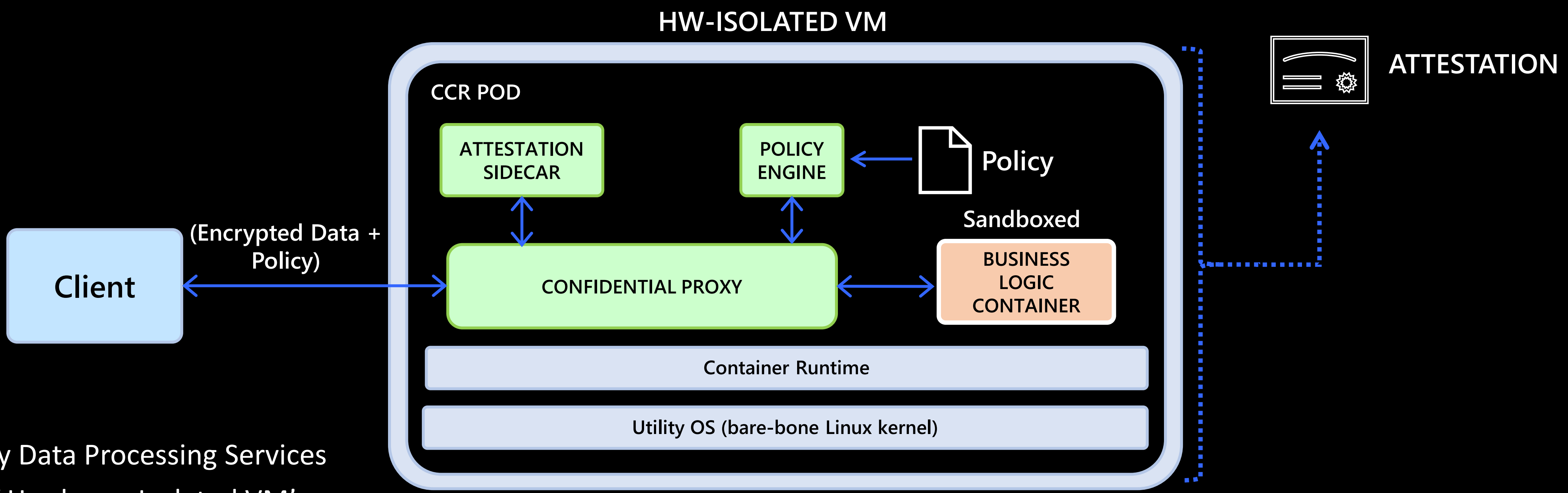
Privacy Preserving Inference



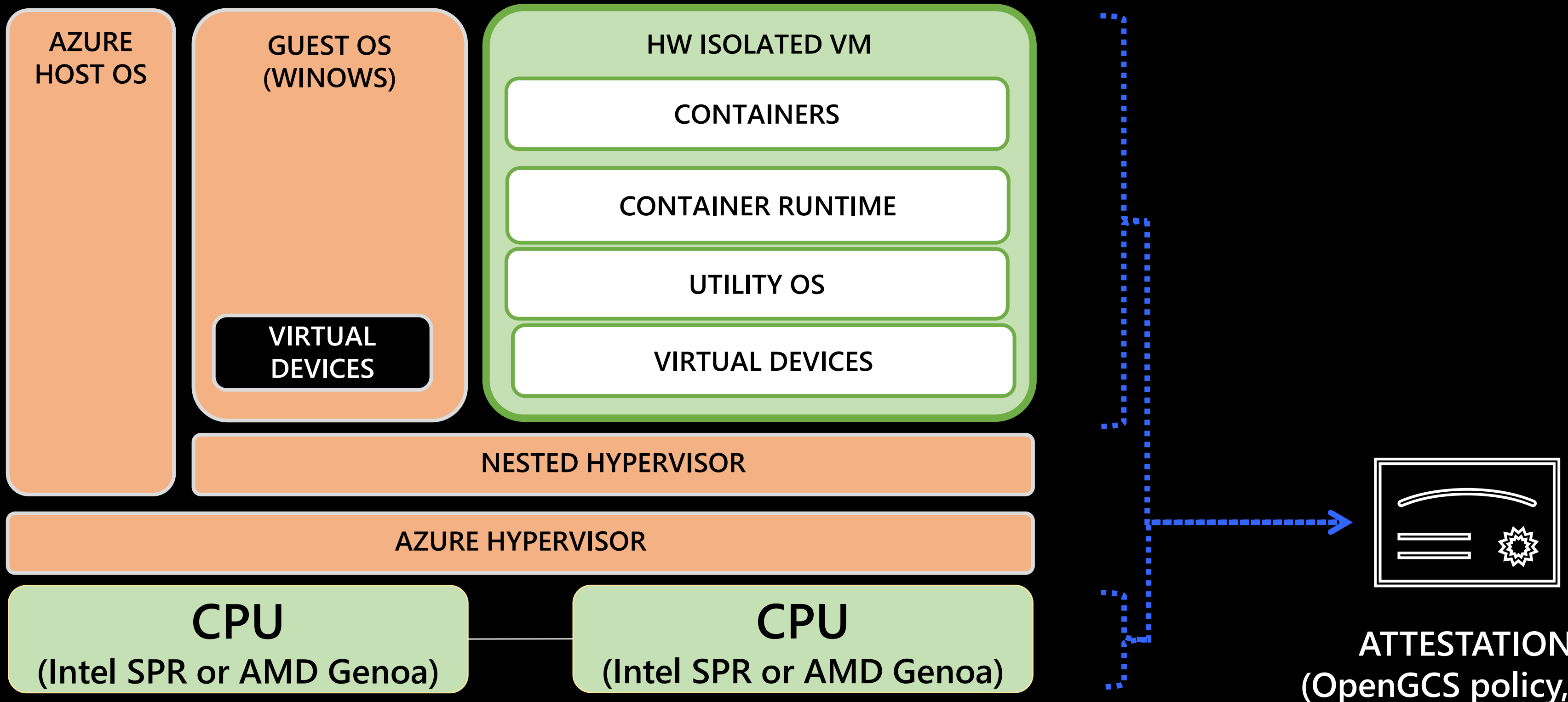
Confidential Clean Rooms



CCR Pod Architecture

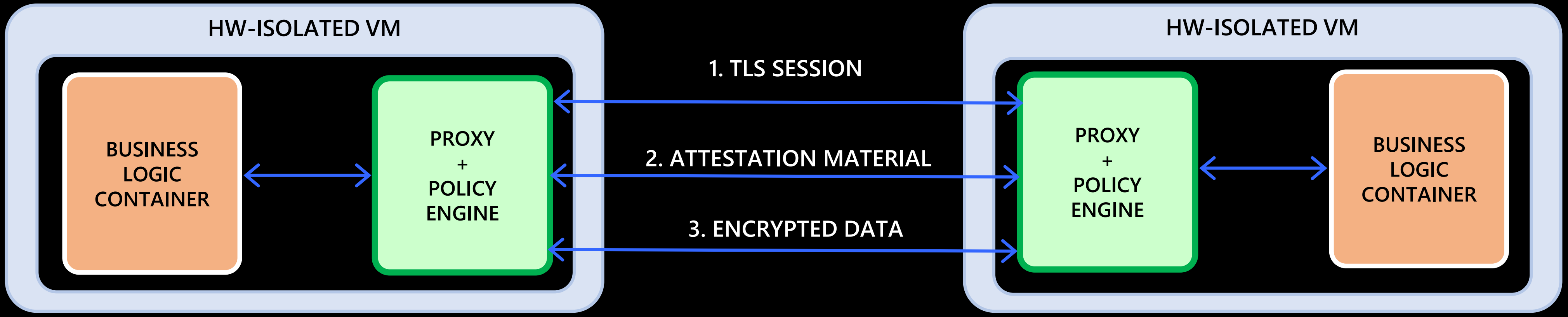
- Trustworthy Data Processing Services
- Built out of Hardware Isolated VM's , e.g., AMD SEV-SNP
- Microservices hosted in *Pods* -- CCR
- Untrusted Business Logic runs in sandboxed containers, e.g., ONNX code of an ML model
- Trusted sidecar containers run attestation of TEE's, configs, etc. , do policy checks, . . .
- Ingress and egress policy checks (OPA + Rego) on data intercepted by a trusted proxy (Envoy)

Confidential ACI (Azure Container Instances)



ATTESTATION
(OpenGCS policy, VM image digests, firmware digests)

Mutually Attested TLS for composition



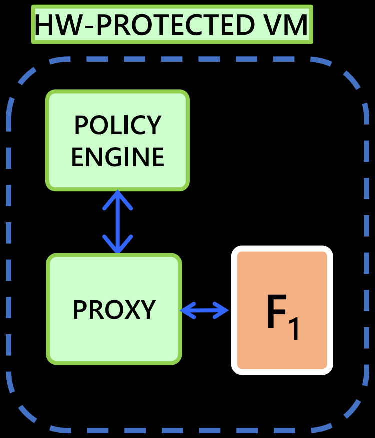
- A standard TLS session is established between sidecar proxies
- Attestation material is exchanged over the TLS session
- Peer’s attestation material is verified by the proxy
- If the verification succeeds, data is transferred using standard TLS encryption
- Otherwise, the connection is closed

What do we get?

- Data decrypted only inside the CCR
  - *Confidentiality* (even from platform)
- Attestation
  - Remote *verification before* processing
- Proxy + Policy checks
  - All *ingress/egress* data intercepted and *checked for compliance*
- Sandboxed business logic container
  - *No exfiltration*
  - *IP protected*
  - *"Lift-and-Shift"*
- Attested TLS
  - *Composability* of confidential microservices
- Envoy proxy, OPA + Rego for policy, Conf. Comp
  - Friendly to cloud native dev ecosystem

Privacy and Policy Compliance

Ease of adoption Usability

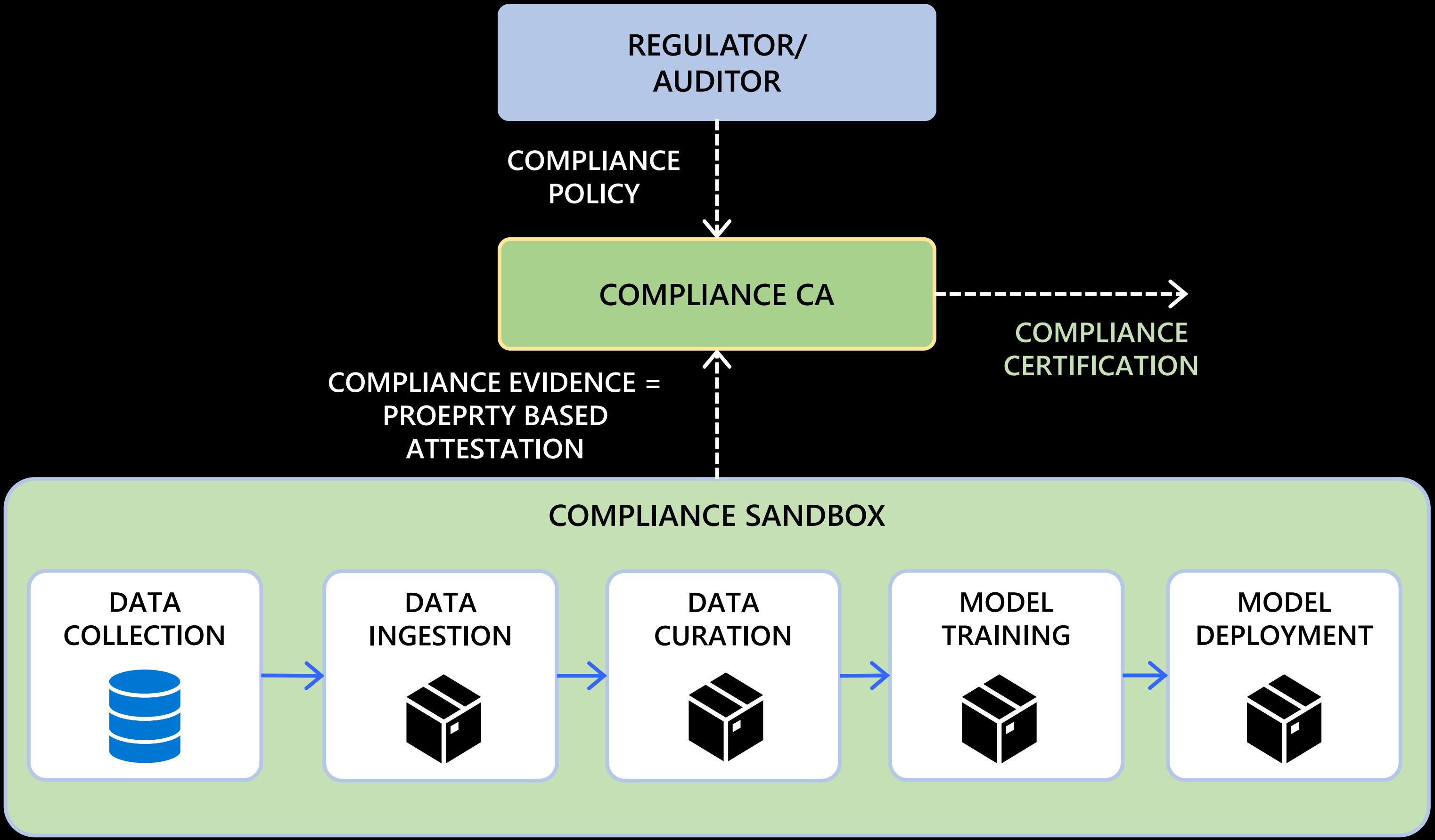


CLOUD NATIVE COMPUTING FOUNDATION

envoy

OPA

Goal: End-to-end Compliance Framework



- Automated
- Online
- Low-trust
- Multi-tenant
- Protects model IP

Progress so far

View confidential clean rooms as next evolution of DEPA
(**D**ata **E**mpowerment and **P**rotection **A**rchitecture)

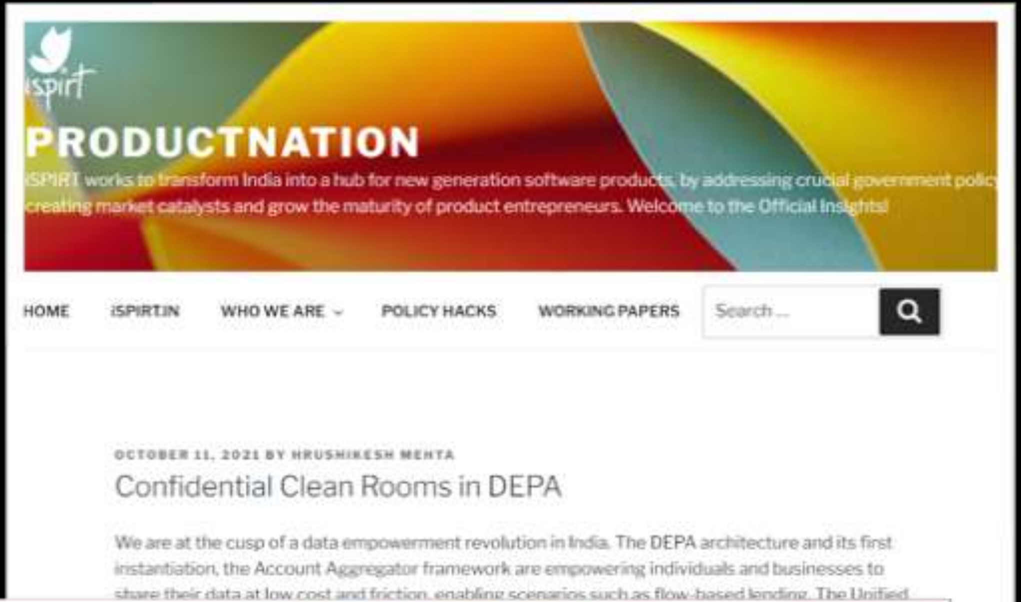
Pilot on *Cash-Flow Lending*

- Demonstrate feasibility and value
- Multiple startups already on-board

Standards/Guidelines

- CCR v1.0, Reference implementation

Work in progress!



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OCTOBER 11, 2021 BY HRUSHIKESH MEHTA

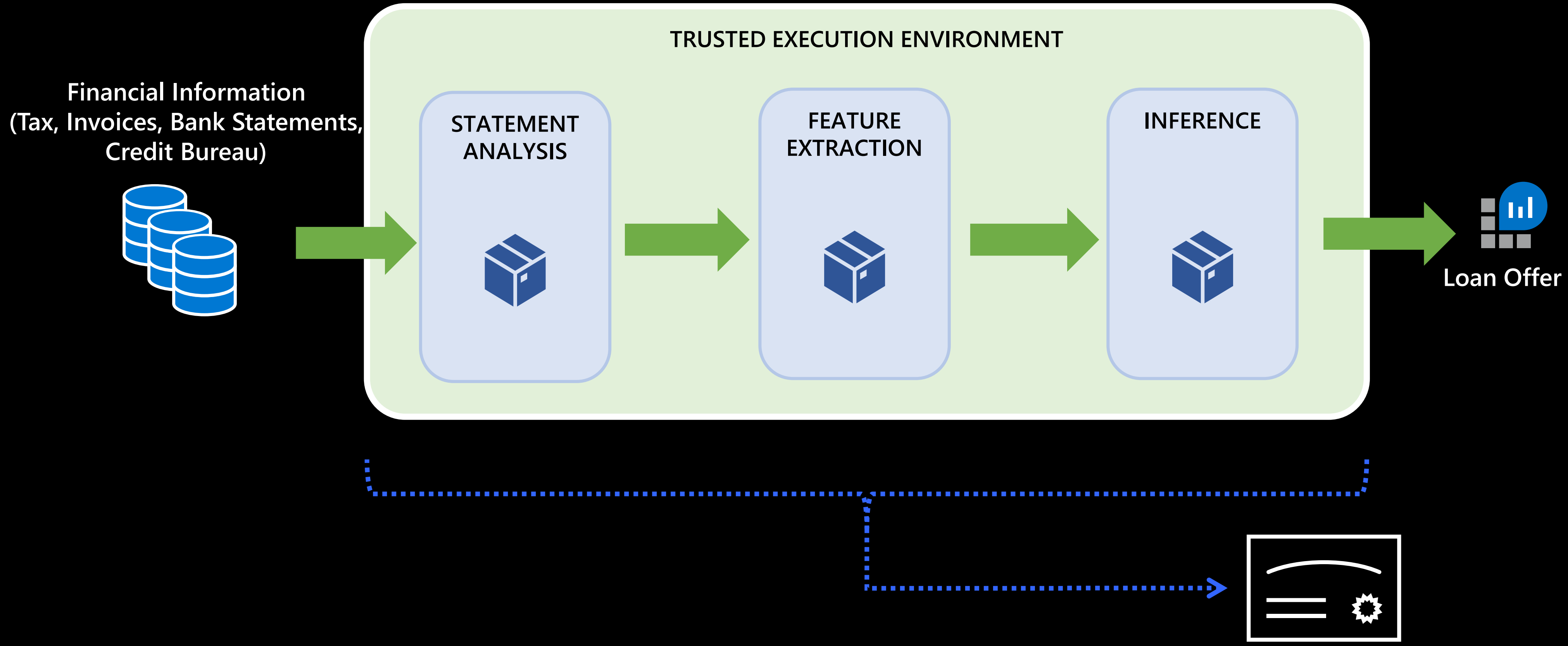
Confidential Clean Rooms in DEPA

We are at the cusp of a data empowerment revolution in India. The DEPA architecture and its first instantiation, the Account Aggregator framework are empowering individuals and businesses to share their data at low cost and friction, enabling scenarios such as flow-based lending. The Unified

Open House on Confidential Clean Rooms - A New Privacy Paradigm #6

OCEN Open House # 6
Confidential Clean Rooms
A New Privacy Paradigm

Example Scenario : Loan Processing



Challenges

- Validating *algorithmic* privacy guarantees of CCR business logic
  - e.g., DP guarantees of a training pipeline,
  - Attribute Inference from a trained model
- Certification + Attestation
  - Trusted Third Party off-line verification and certification
  - Embed that certification in attestation of Confidential Sandboxed Container
- Auditing tools for Privacy of ML models (off-line + certification)
  - Auditing: Bayesian estimation of DP (https://arxiv.org/pdf/2206.05199.pdf)
  - Quantifying membership/attribute inference (Yeom et al.)

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Thank you

Stay in touch: @satya