

ArmoredSoftware: Trust in the cloud

Annual Demonstration

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Introduction and Project Goals

- Big Picture

- Implementation

Prototype demonstration and discussion

- Refine big picture to current demo

- Protocol Execution

- Appraisal

- Measurement

- Communication

- Demonstration

Short term goals and milestones

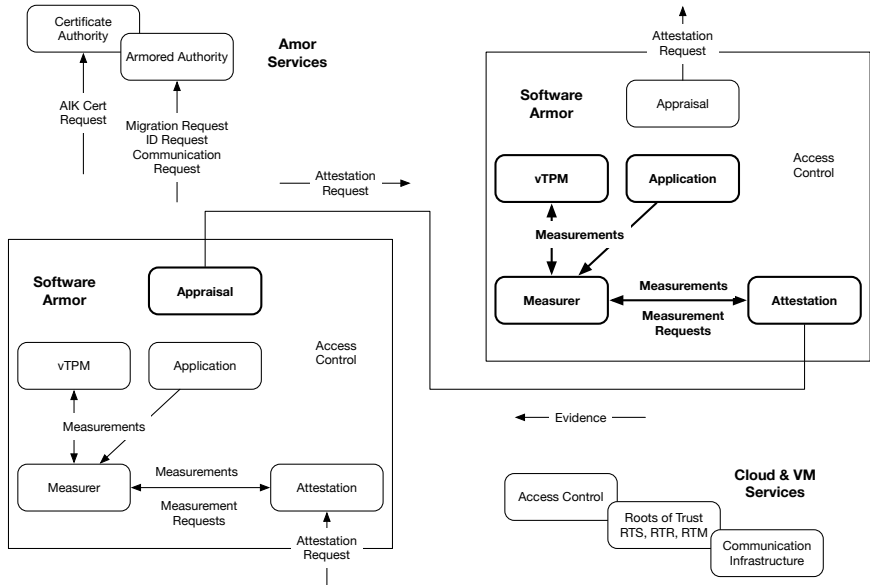
Questions and guidance

Trust in the Cloud

Provide new capabilities that help establish and maintain trustworthy cloud-based application deployment

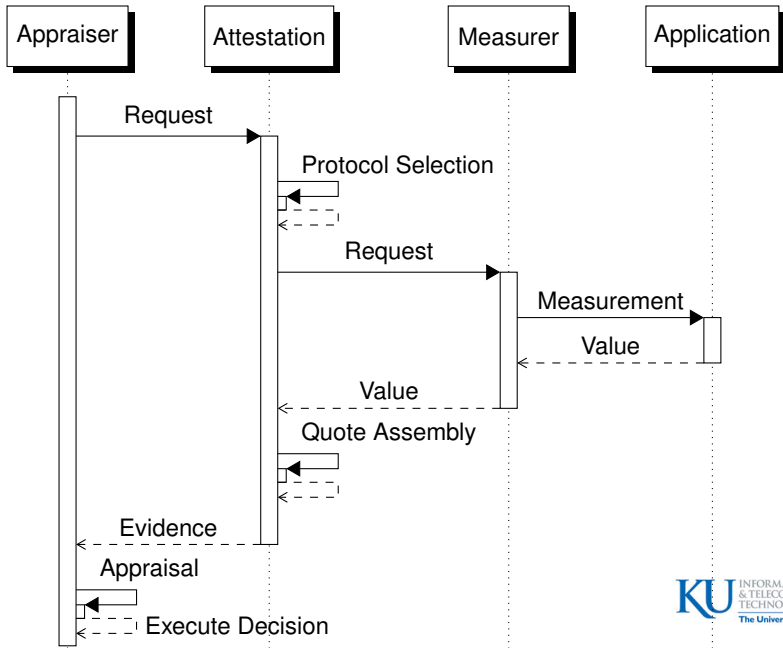
- ▶ Establish trust among cloud components
 - ▶ trust among cohorts of processes
 - ▶ trust among processes and environment
- ▶ Promote informed decision making
 - ▶ data confidentiality can be confirmed
 - ▶ execution and data integrity can be confirmed
- ▶ Autonomous run-time response and reconfiguration
 - ▶ responds to attack, failure, reconfiguration, and repair
 - ▶ response varies based on measurement
- ▶ Lightweight integration with existing cloud
 - ▶ targeting TXT, Xen, Linux, and OpenStack infrastructure
 - ▶ user-space measurement and attestation

High-Level Architecture



- ▶ Standard delivery platform
 - ▶ Xen+XSM VM infrastructure
 - ▶ OpenStack cloud infrastructure
 - ▶ Fedora, HotSpot JVM, GHC
- ▶ Standard communication mechanisms
 - ▶ JSON structures for all exchanged data
 - ▶ *vchan* for on-platform communication
 - ▶ TCP/IP for off-platform communication
- ▶ Trusted Computing Group standards compliant
 - ▶ Trusted Platform Module (TPM) 1.2
 - ▶ TCG vTPM in principle
- ▶ Executable protocol representation
 - ▶ protocol fragments as first-class structures
 - ▶ strand space formal semantics

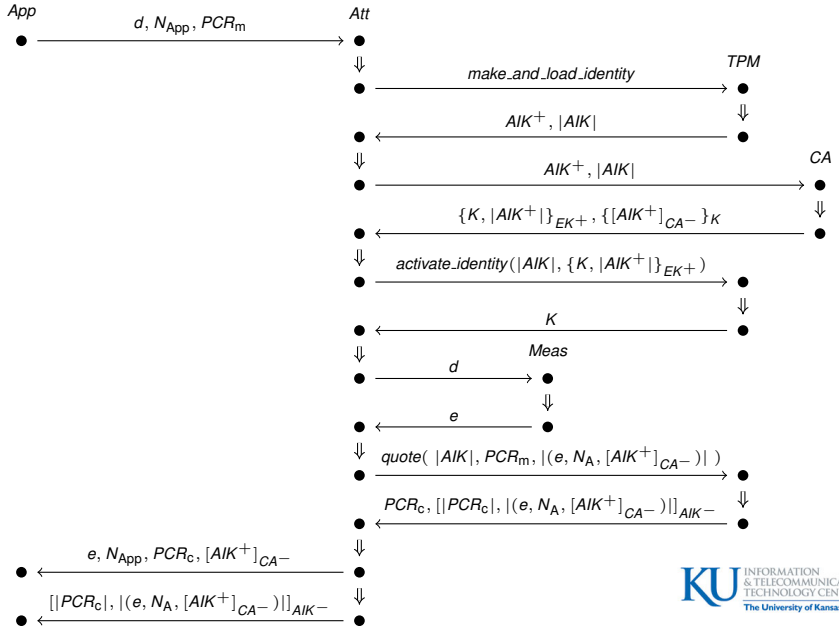
CA-Based Attestation Protocol



What We Are Demonstrating

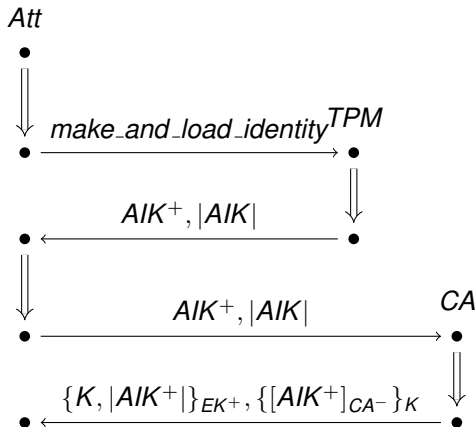
3-4 Slides on Attestation Protocol Execution

Strand Space Diagram

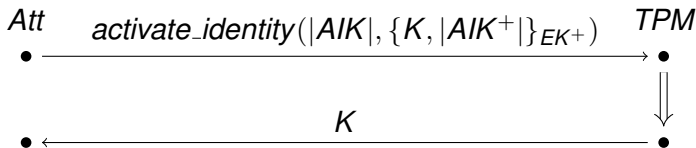


Generating and Certifying an AIK

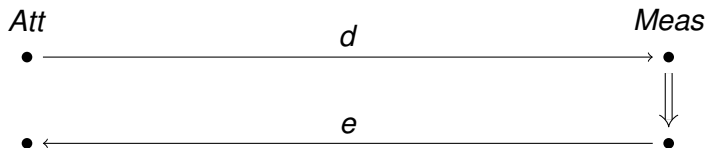
- ▶ Request a new *AIK* from TPM (optional)
- ▶ Receive public *AIK* and hash
- ▶ Request *AIK* signed by CA (*AIK* cert)
- ▶ Receive *AIK* cert encrypted with session key *K*
- ▶ Receive *K* encrypted with private *EK*



Activating the AIK

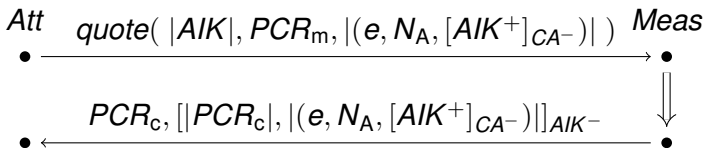


- ▶ Request TPM decryption of the *AIK* cert
- ▶ Receive K used to decrypt signed public *AIK*
- ▶ Only TPM can gain access to K
- ▶ Only TPM can obtain signed, public *AIK*
- ▶ Oddly, No manipulation of the *AIK* in this “activation” process

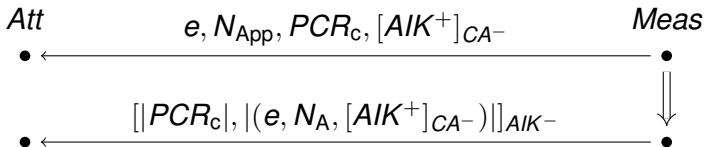


- ▶ Request information from measurer
- ▶ Receive evidence e from measurer
- ▶ d is abstract allowing protocol reuse
- ▶ Most protocols make many requests of the measurer

Generating a Quote



- ▶ Request a quote from the TPM
 - ▶ $|AIK|$ identifies the signing AIK
 - ▶ PCR_m identifies desired PCRs
 - ▶ $|(e, N_A, [AIK^+]_{CA-})|$ guarantees integrity of returned evidence
- ▶ Receive quote from TPM
 - ▶ PCR_c is PCR composite built from requested PCRs
 - ▶ $[|PCR_c|, |(e, N_A, [AIK^+]_{CA-})|]_{AIK-}$ is the signed quote



- ▶ Receive quote from the attestation manager
- ▶ Receive evidence from the attestation manager
- ▶ Evaluate evidence and quote

1-2 Slides on Appraisal

3-4 Slides on Measurement

2-3 Slides on Communication Mechanisms

Step Through Demonstration

Goals and Milestones for 2015

- ▶ Push to the cloud
- ▶ Establish roots of trust and trust argument
- ▶ Executable protocol representation and protocol semantics
- ▶ Operational, integrated vTPM prototype
- ▶ Name Server / Certificate Authority prototype
- ▶ More capable measurement
- ▶ Downloadable demonstration

Questions and Guidance

- ▶ What problems are interesting?
- ▶ What problem would be a nice attention grabber?
- ▶ What should we be watching and integrating with?

References