University of the Aegean

De Facto Joint Research Group

Certificate Revocation: What Is It and What Should It Be

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Overview

- Introduction
- What is Certificate Revocation ?
- Proposed mechanisms for Certificate Status Information
- Evaluation criteria for CSI mechanisms
- The need for an alternative mechanism
- Alternative Dissemination of CSI (ADoCSI)
- Problems to be solved in ADoCSI

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Introduction

1. Is PKI a new era for Network Security?
2. Certificate Revocation? What Certificate Revocation?
3. Certificate Status Information Mechanisms
4. EU Directive: “secure and prompt revocation service”

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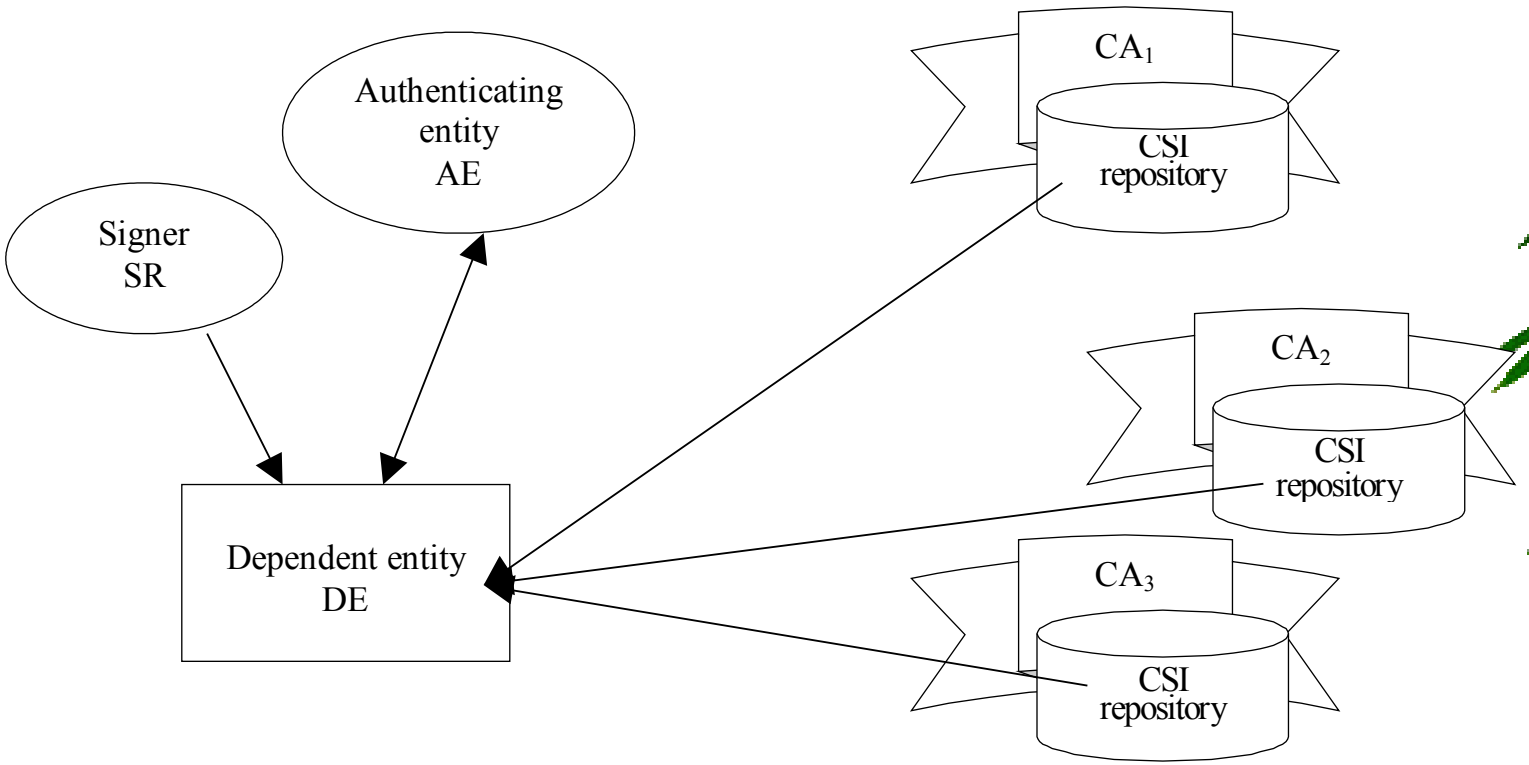
Certificate Revocation



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CSI Mechanisms: CRLs

- Certificate Revocation Lists
- Compare to Black lists: Banks, Cell phone Operators. Dependent entities: merchants (online POS), Banks, other Cell phone operators
- CRL: Signed list containing serial numbers of revoked (/suspended?) certificates, the revocation dates and (optional) reasons

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CSI Mechanisms: CRLs (cont.)

- Delta-Certificate Revocation Lists
- Distribution Points
- Fresh Revocation Information (DeltaCRLs on top of DP CRLs)
- Redirect CRL (dynamic re-partitioning of large DP CRLs)

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CSI Mechanisms: (cont.)

- Enhanced CRL Distribution Options
  - Separate location and validation functions.
- Positive CSI
  - CRLs are all wrong… CSI should contain positive, not negative info. Dependent entity should set ad hoc freshness requirements and certificate holder should provide ad hoc CSI.

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CSI Mechanisms: (cont.)

Online Certificate Status Protocol

- Server returning signed CSI corresponding to CSI requests by dependent entities. Possible OCSP Responses:
  1. “Good”, meaning certificate has not been revoked,
  2. “Revoked”, meaning certificate has been revoked or suspended,
  3. “Unknown”, OCSP is not aware of that certificate

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CSI: Freshness-constrained Revocation Authority

- Repositories of CSI need not be trusted
- Separation of Certification Authority and Authority that issues CSI (Revocation Authority, RevA)
- Dependent entity requires fresh enough CSI from certificate holder

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Evaluation Criteria: Type of Mechanism

- M1: Transparency,
- M2: Offline revocation,
- M3: Delegation of revocation,
- M4: Delegation of CSI dissemination,
- M5: Delegation of certificate path validation,
- M6: Referral capability,
- M7: Revocation reasons.

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Evaluation Criteria: Efficiency

- E1: Timeliness of CSI,
- E2: Freshness of CSI,
- E3: Bounded revocation,
- E4: Emergency CSI capability,
- E5: Economy,
- E6: Scalability,
- E7: Adjustability.

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Evaluation Criteria: Security

- S1: CSI disseminator authentication,
- S2: CSI integrity,
- S3: CA compromise
- S4: RevA compromise,
- S5: Contained functionality,
- S6: Availability.

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The need for an alternative CSI mechanism

- Dependent entities and certificate holders are not necessarily experienced computer-users, nor are they security aware,
- PKI security-related procedures have to be made more transparent, as in the credit card system.

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An Agent-based mechanism

- The transparency criterion has to be met: location, retrieval and validation of CSI has to be made transparent to the dependent entity.
- An Agent-based mechanism could do that, using the aforementioned CSI mechanisms and providing an indirection layer between dependent entity and CSI mechanisms

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ADoCSI: Alternative Dissemination of Certificate Status Information

The agents ADoCSI needs must be able to:

1. Suspend execution and resume it at another execution environment,
2. Retain their state, when transporting themselves to other execution environments,
3. Create child agents and deploy them,
4. Select a network location, out of a list of locations, with the least network congestion,
5. Communicate the retrieved information back to their owner or to their owner's application that spawned the agent.

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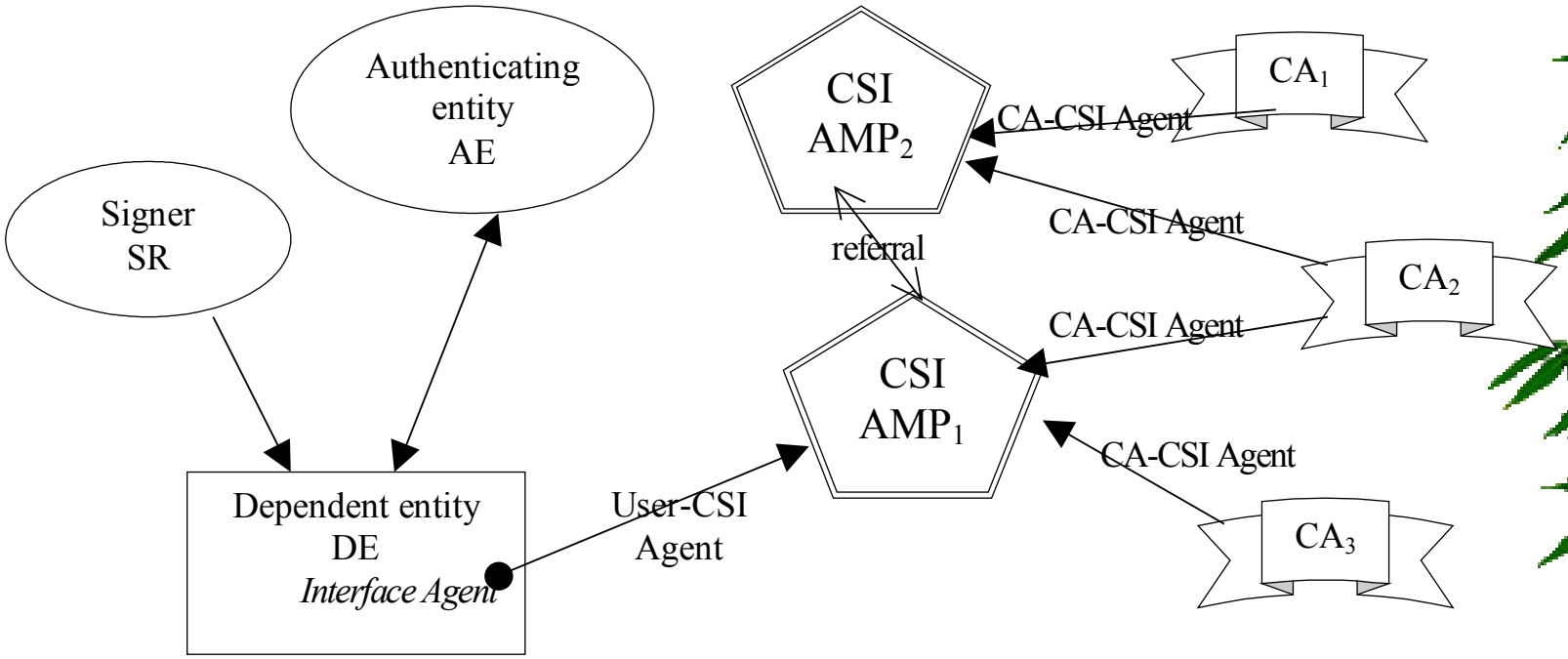
ADoCSI



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ADoCSI (2)

1. Agent Meeting Places (AMP) (also called Agent Platforms)
2. Dependent entity,
3. Authenticating Entity or Signer,
4. Certification Authority Certificate Status Information (CA-CSI) Agent,
5. User Certificate Status Information (User-CSI) Agent,
6. Interface Agent.

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ADoCSI: Problems seeking solutions

ADOCSI researchers must find solutions to a series of problems that emerge from using Agents in CSI, namely :

2. How can the location function be implemented transparently ?
3. How can dependent entities retrieve and validate CSI transparently ?
4. How is a certificate path validated ?
5. What is the way this mechanism interacts with dependent entities ?
6. How are Agents protected from unauthorised modification or replacement ?
7. How can CSI carried by Agents be protected ?
8. How can an Agent tell a fraudulent Agent Meeting Place ?

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ADoCSI: Problems seeking solutions (2)

1. How can AMPs be protected from DoS attacks ?
2. How can dependent entities be protected against User-CSI Agent replay attacks ?
3. How are the Agent Meeting Places protected from malicious Agents ?
4. How can an Agent retrieve CSI for a dependent entity, without letting the AMP know which certificate did it retrieve CSI for ?

A first paper commenting on these issues will soon appear.

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References

- References of general interest (PKI mostly)
- References to certificate revocation resources
- References to papers on securing Software Agents

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