Decentralized Jini Security

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Presentation outline

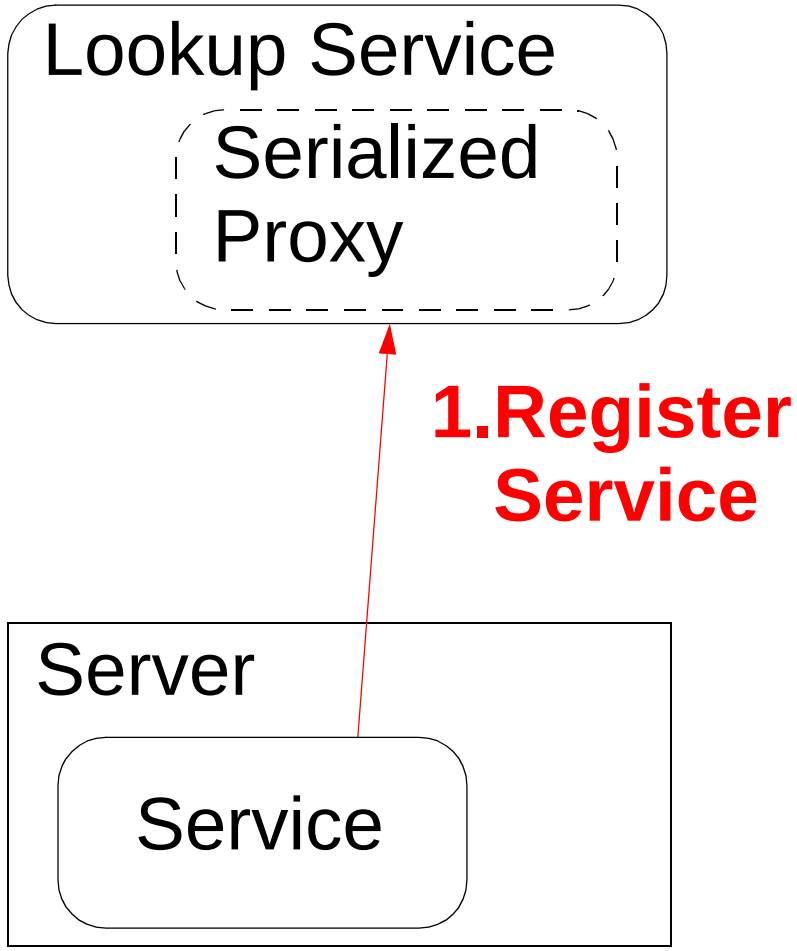
- Background and Goals
- Brief introduction to Jini
- Security in the current Jini Architecture
- Introduction to Trust Management
- The Proposed Architecture
- Conclusions

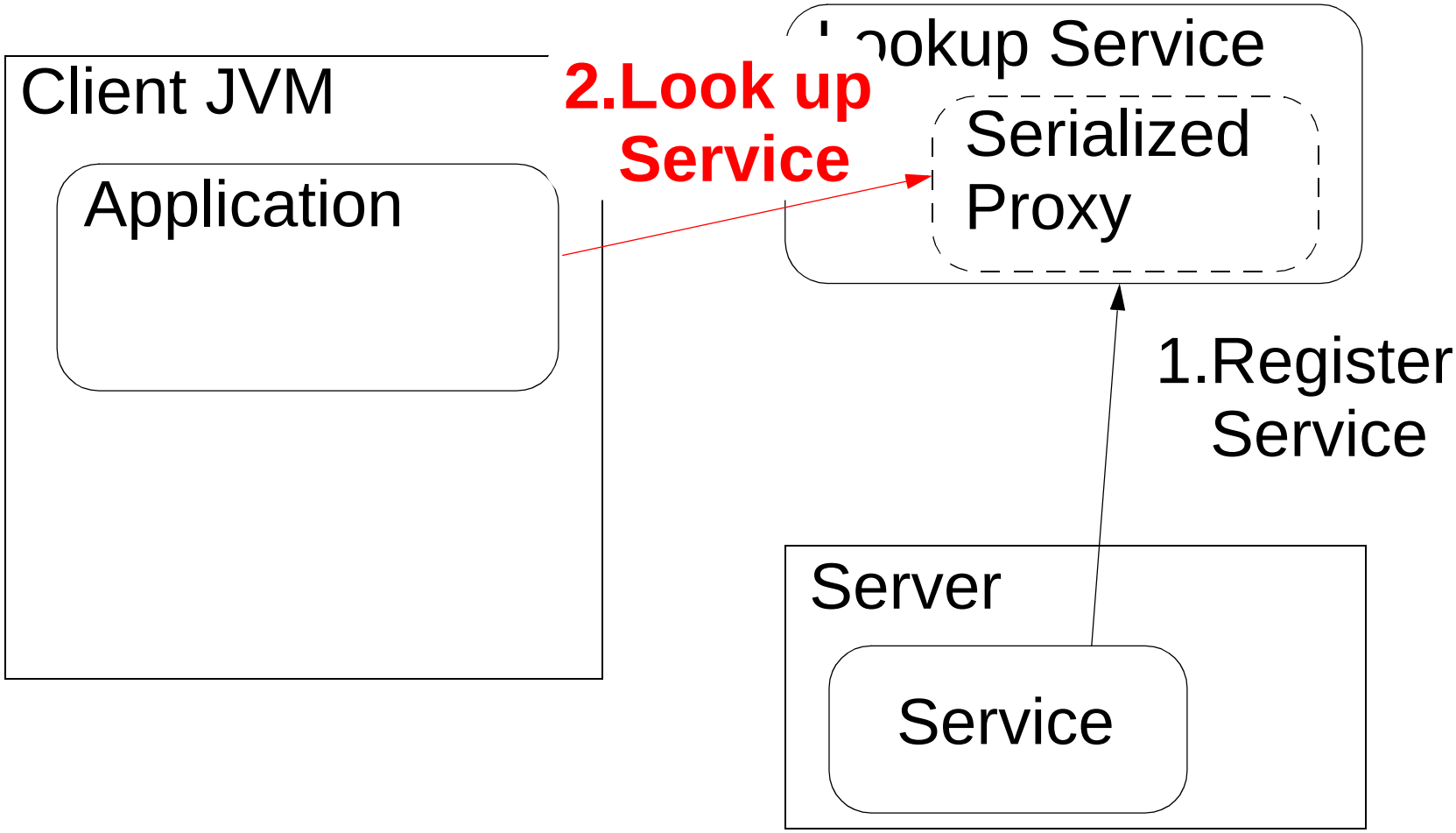
Background and Goals

- Research on security in ad hoc networks
- Our prior work: Combining Java 2 Security & SPKI
- Goals of this work
  - A security architecture for Jini
  - No centralized components — fully decentralized
  - Integration into the Java 2 Security model
  - Protocol independency

Brief introduction to Jini

- A decentralized, ad hoc network service architecture
  - Requires no pre-established infrastructure
  - Allows applications to work under partial failures
- Services are build upon leases, events, transactions
  - Services register themselves to a Lookup Service
  - Any node may provide a Lookup Service
- Protocol independence using proxy objects


Lookup Service
Serialized
Proxy
1.Register
Service
Server
Service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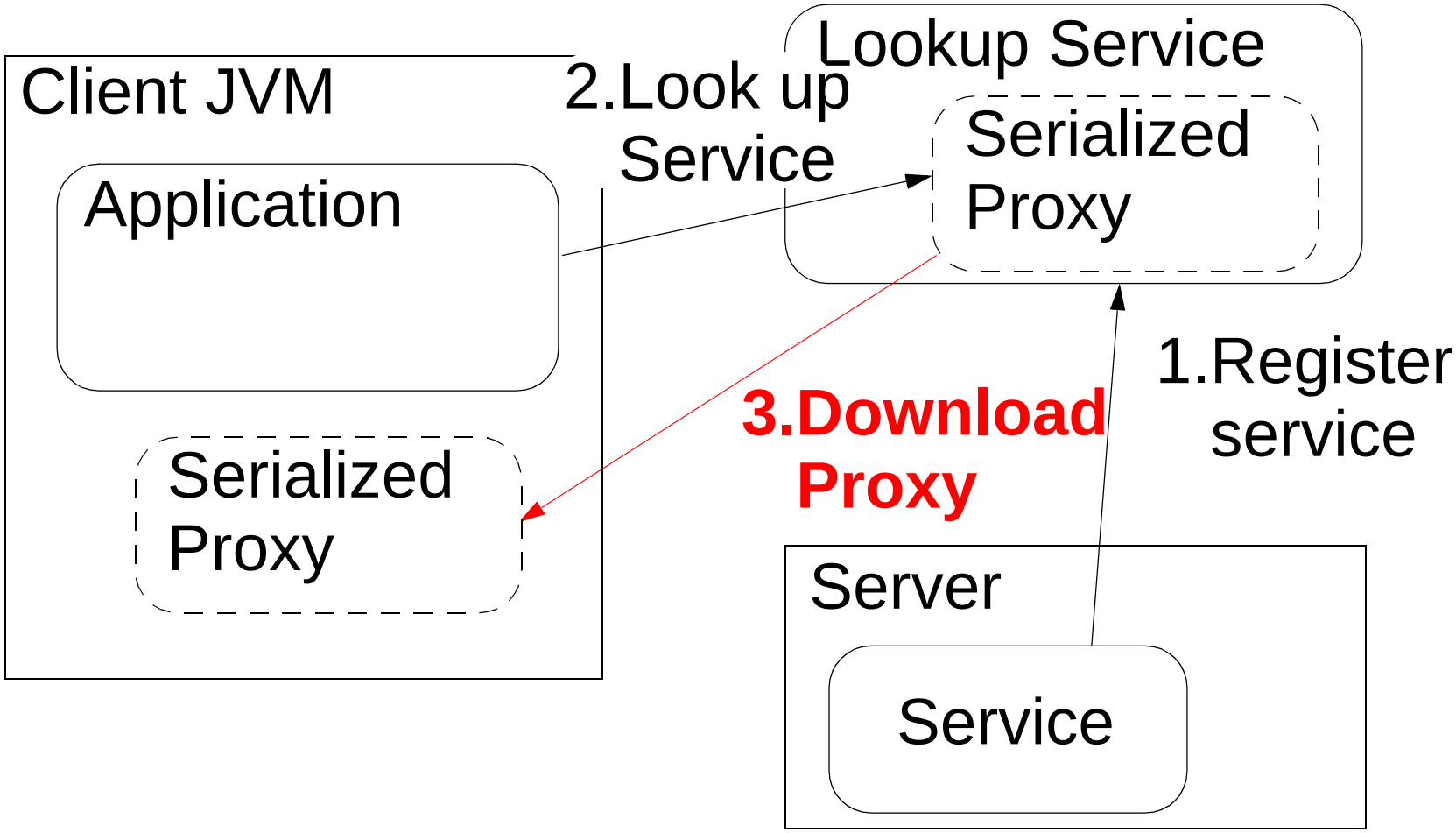
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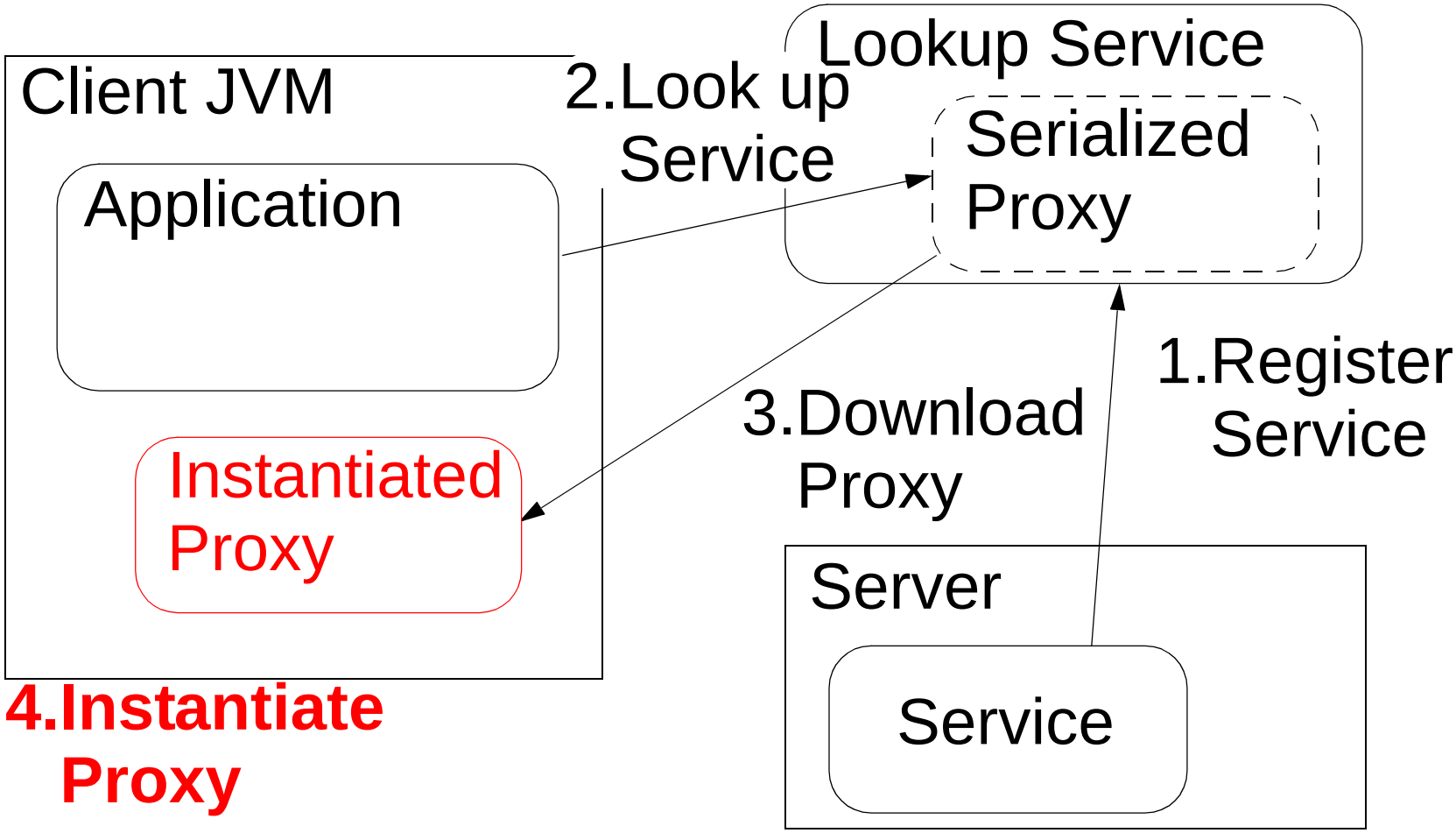
Lookup Service
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1.Register Service
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Instantiated Proxy
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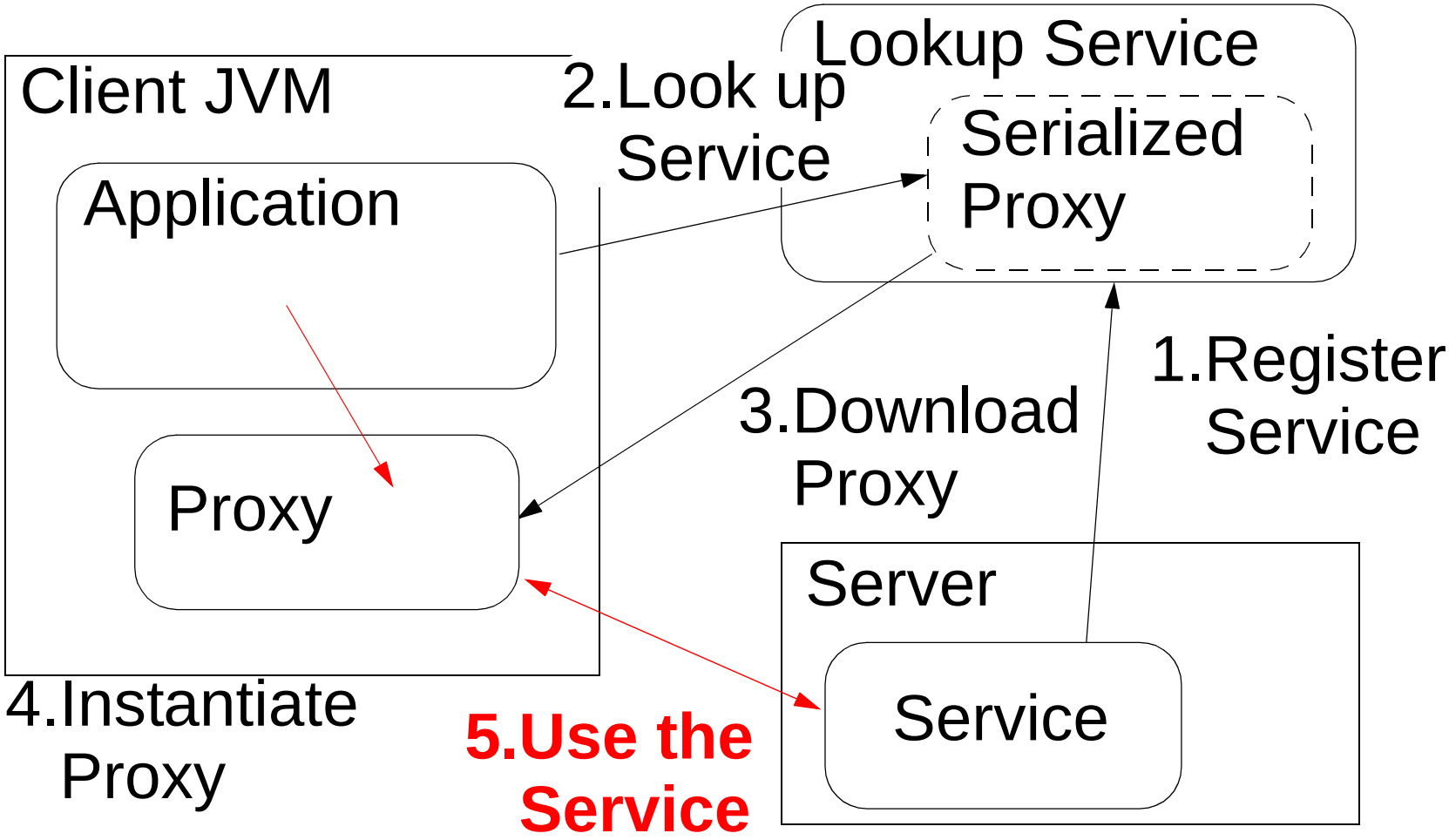
4.Instantiate Proxy


Lookup Service
Client JVM
2.Look up Service
Serialized Proxy
Application
1.Register Service
3.Download Proxy
Proxy
Server
Service
4.Instantiate Proxy
5.Use the Service

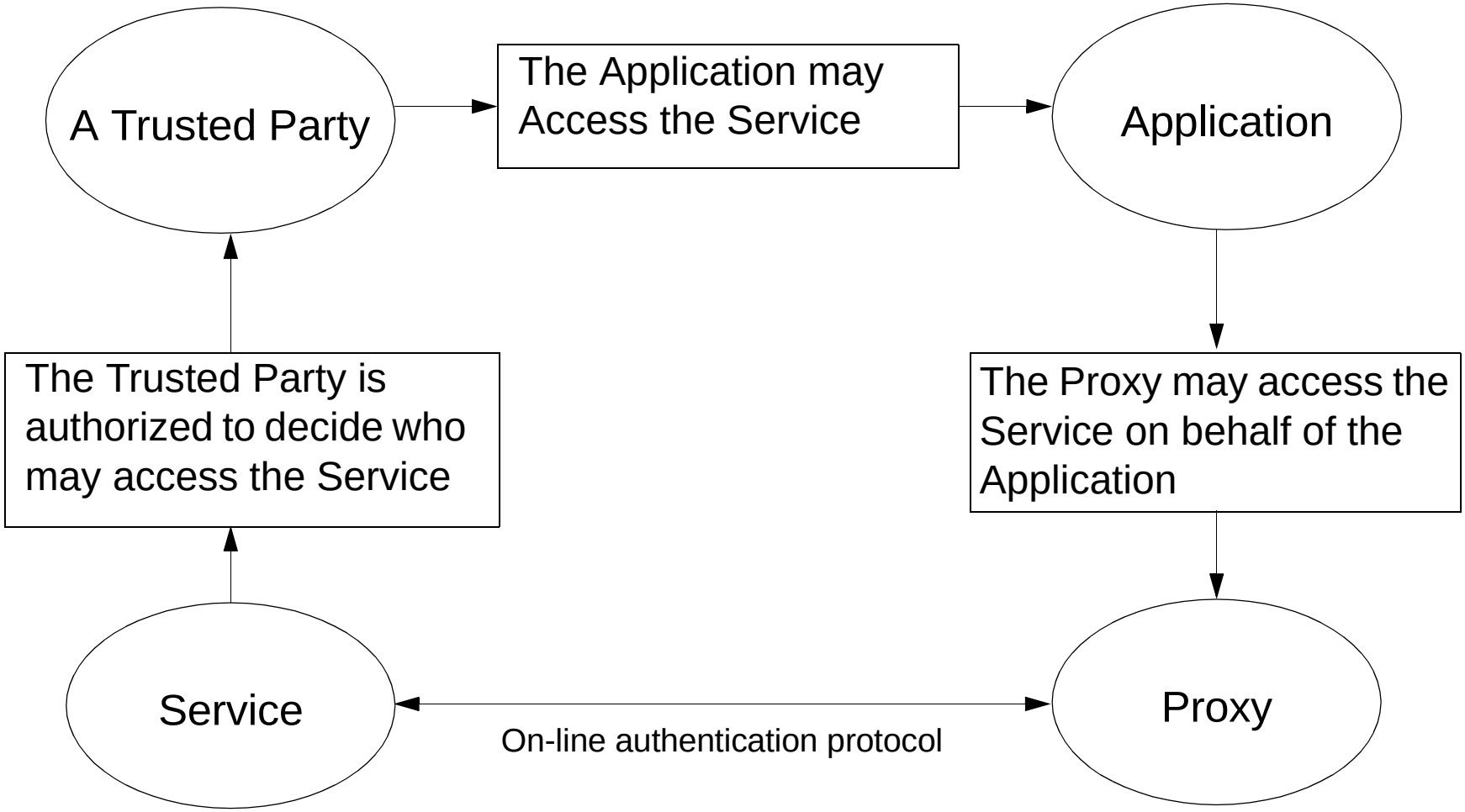
Security in the current Jini Architecture

- The current Jini architecture has no security features beyond those of Standard Java 2 SE
- Other solutions need centralized components
  - Additionally, they often have very restricting trust assumptions, unsuitable for ad hoc environments
- Maybe some day RMI security API will help
  - Not likely in the near future, though

Introduction to Trust Management

- All principals (servers, applications, proxies) are identified by public keys
  - These keys can be anonymous or temporary
  - Key lifetime depends on its purpose
- Authority can be delegated via *Certificate Chains*
- There are a number of existing Trust Manatement systems: PolicyMaker, KeyNote 2, SPKI

Certificate Chains



Presentation outline

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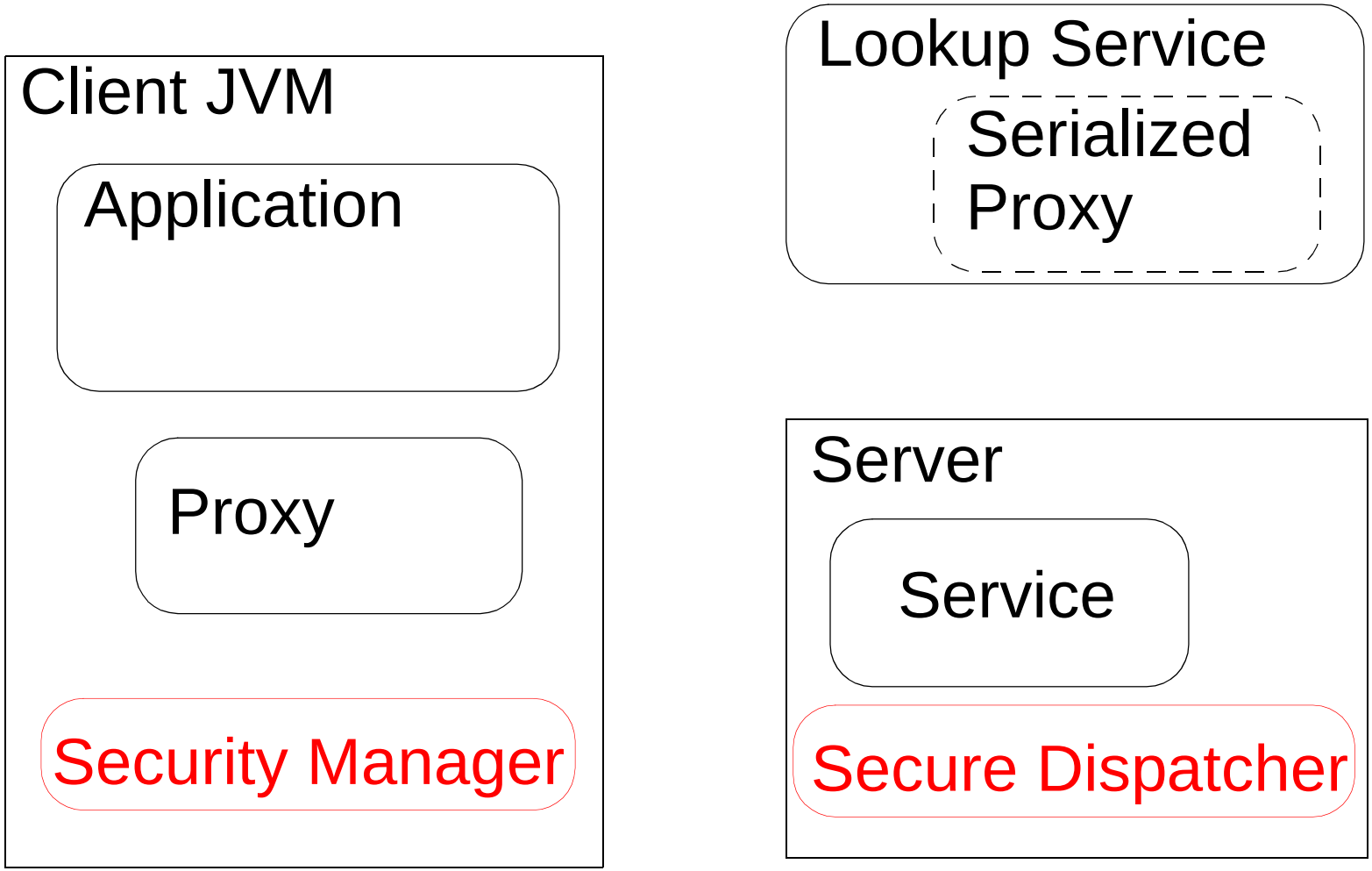
- The Proposed Architecture
  - New functions
  - New steps
  - Benefits
  - Limitations & Future Work
- Conclusions

The Proposed Architecture

- No centralized security servers or CAs
  - Fully peer-to-peer ad hoc structure
- No unnecessary “identities” or “names”
  - All parties are identified by public keys
- Clients JVMs can run partially trusted applications
  - Java 2 Security Architecture + decentralization
- Avoid modifications to JDK and Jini


Client JVM
Application
Proxy
Security Manager
Lookup Service
Serialized
Proxy
Server
Service
Secure Dispatcher

New functions

- Sign proxies / proxy verify signatures
- Generate a temporary key pair for a proxy
- Delegate authority to a proxy’s key
- Sign arbitrary data with a proxy’s key
- Get the public key of a service
- Verify certificate chains

New steps

0. The service signs proxy before registering it

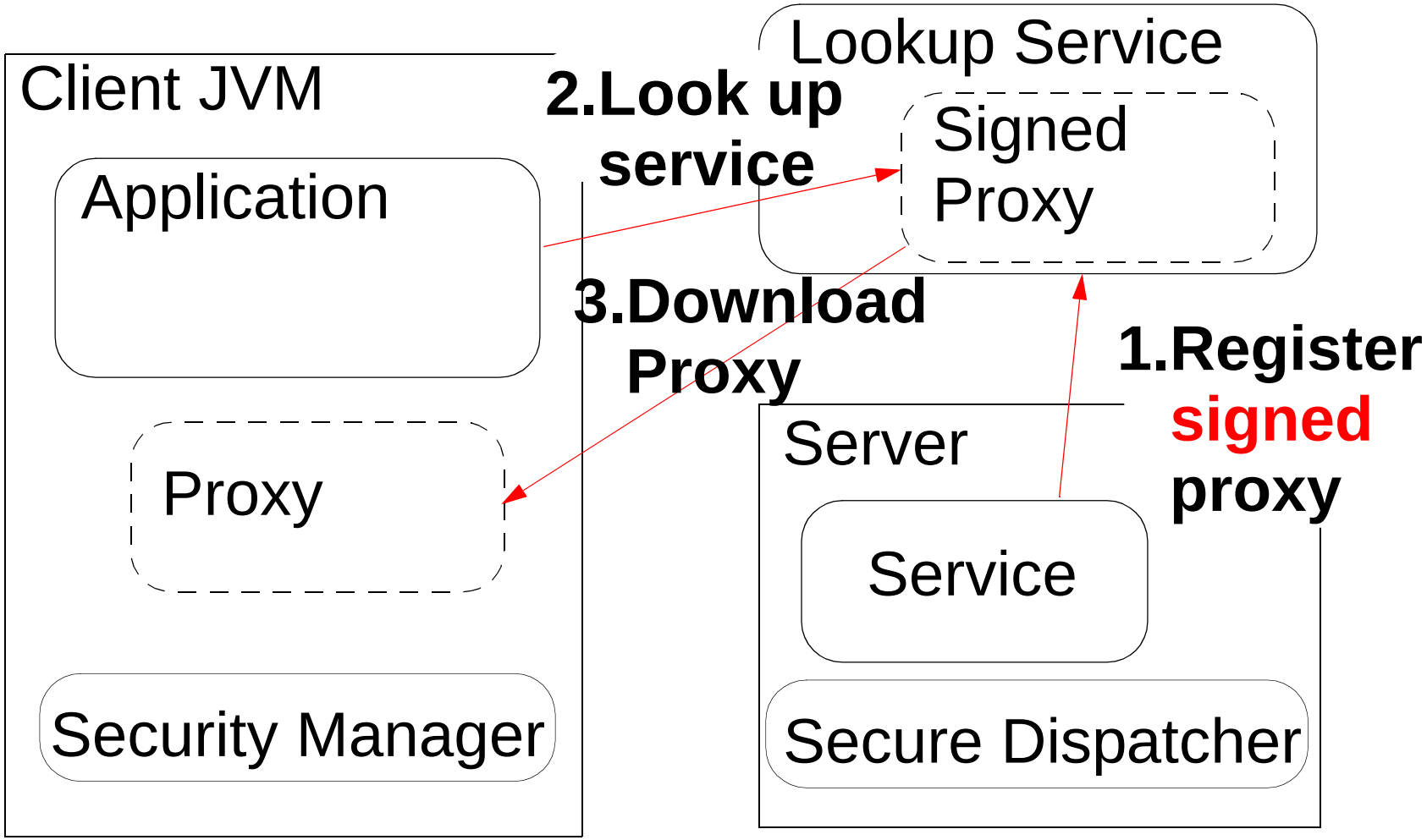
3’. The security manager authenticates the proxy

4’. The application accepts & authorizes the proxy

4”. The proxy requests for delegation

5’. The proxy authenticates itself to the dispatcher

5”. The dispatcher checks certificate chains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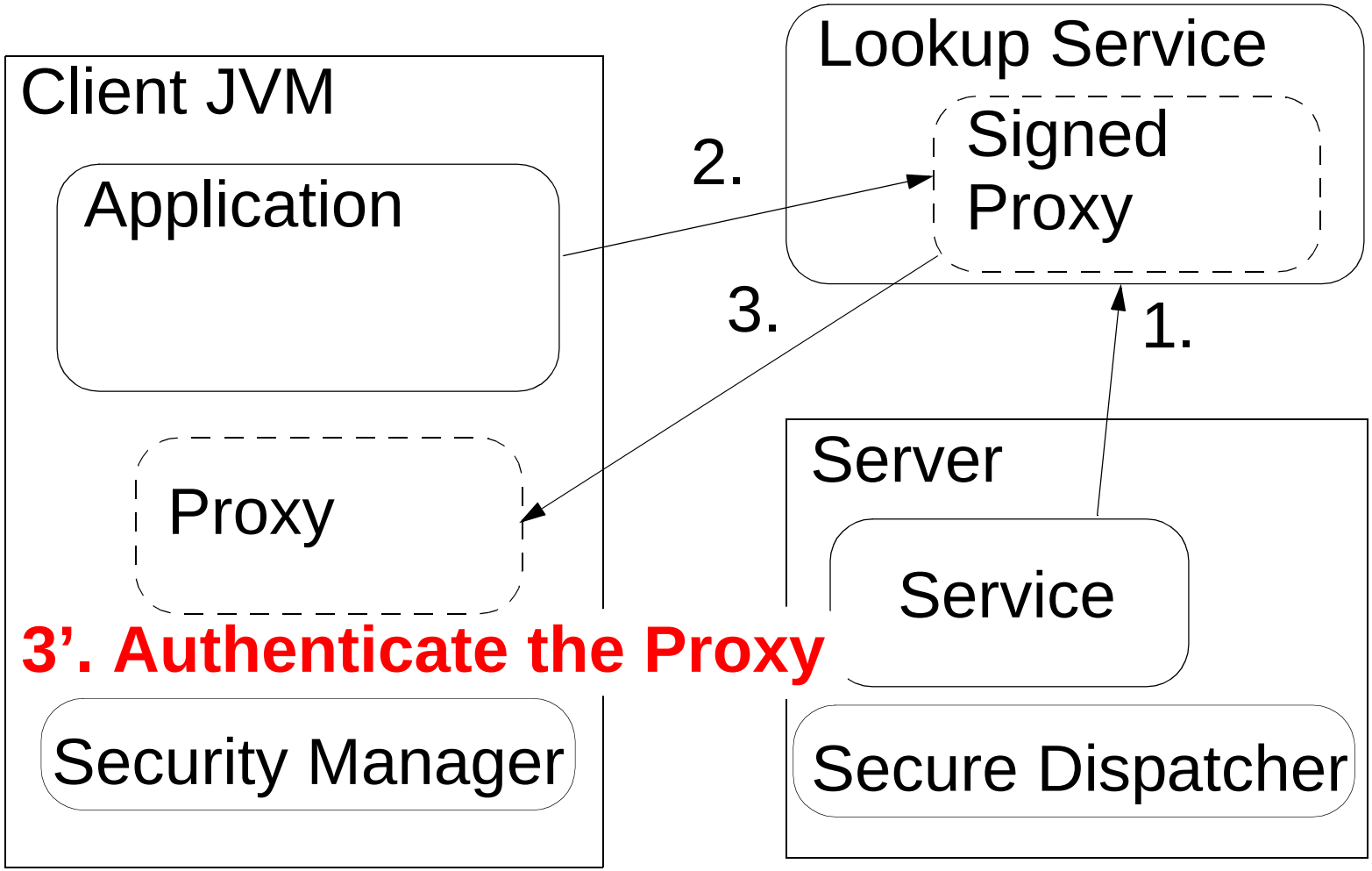
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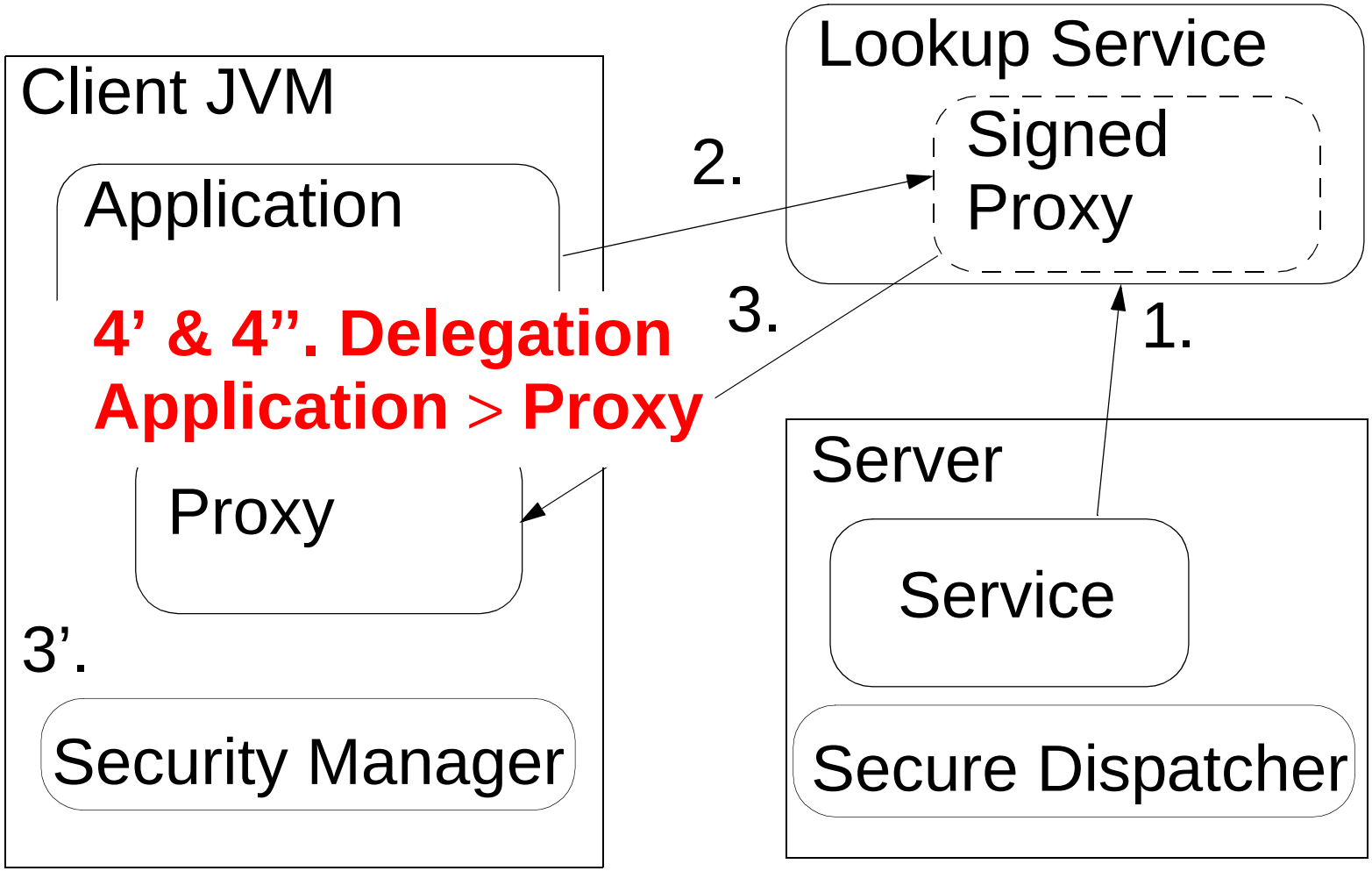
3'. Authenticate the Proxy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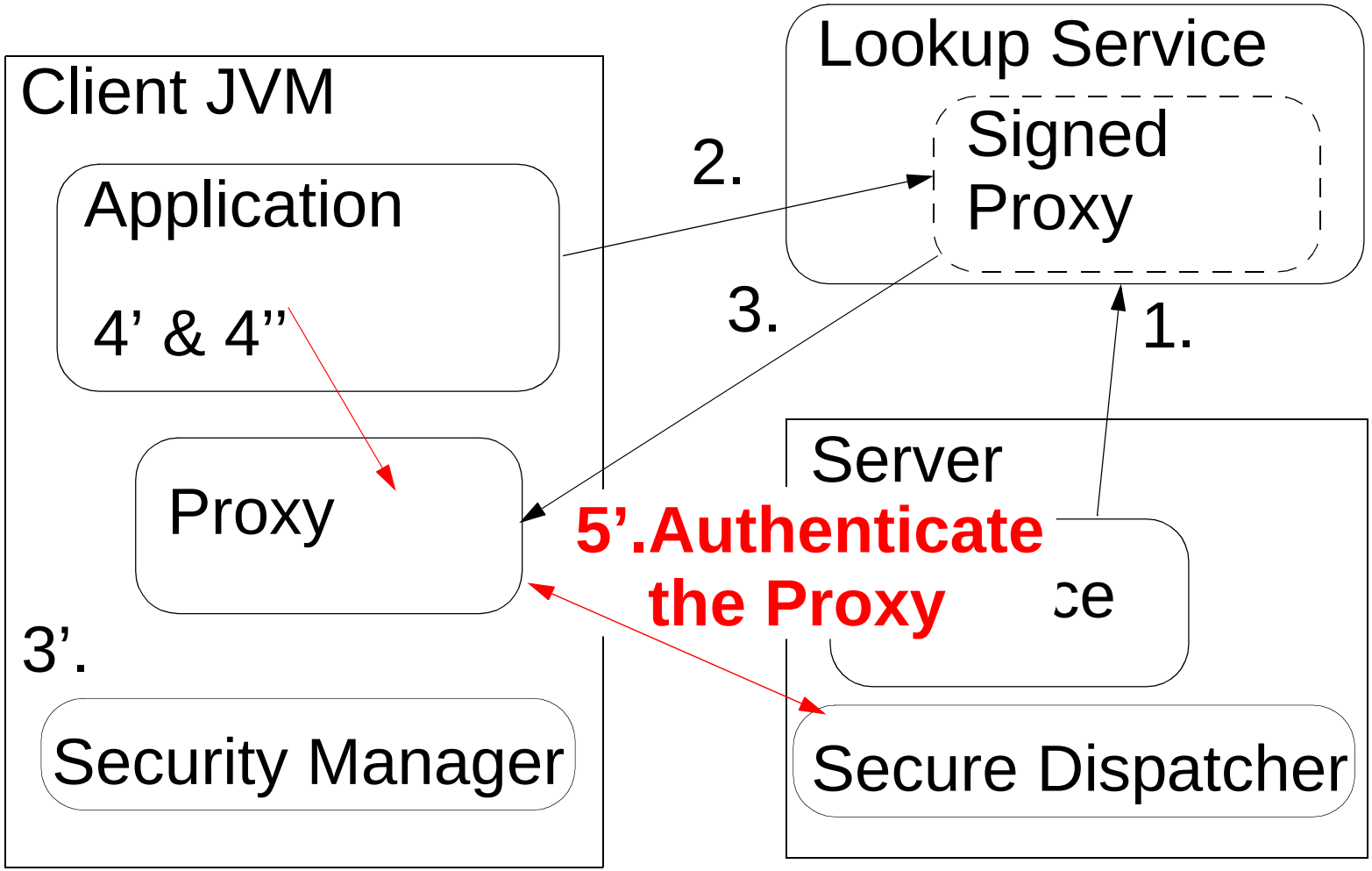
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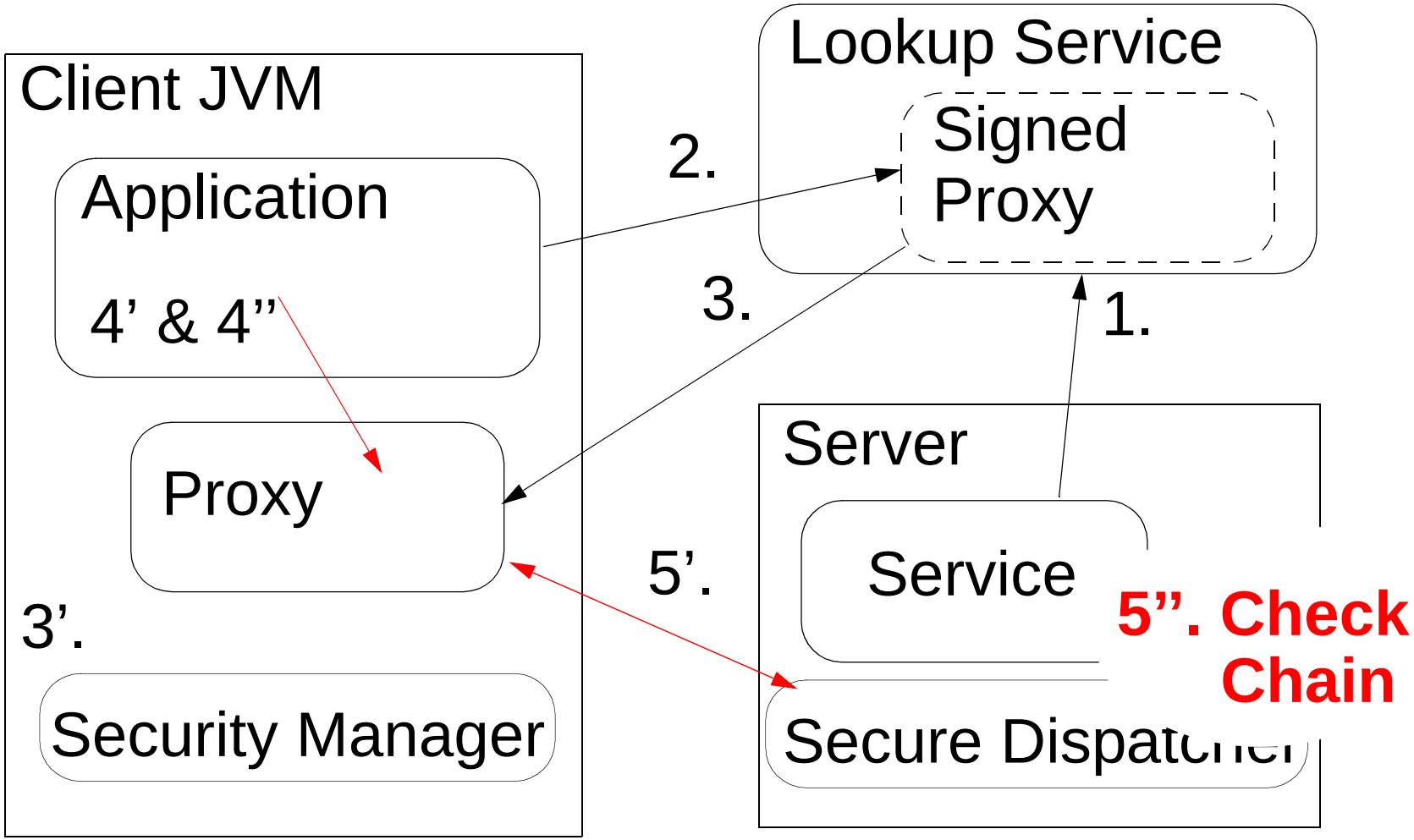
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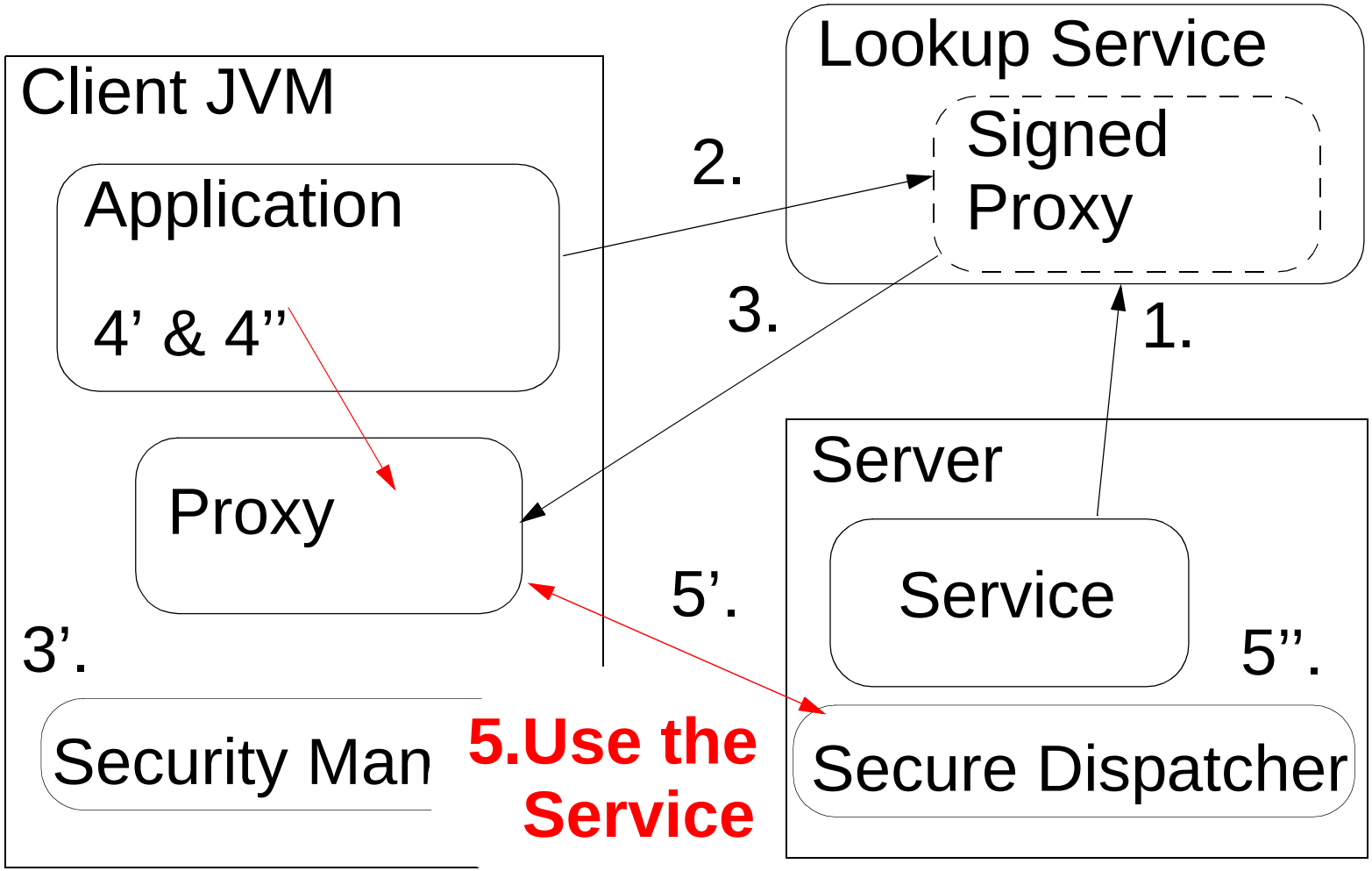
5''. Check
Chain
Secure Dispatcher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Secure Dispatcher
5.Use the
Service

Benefits

- Minimal implicit trust assumptions;
  can be used in different environments
- Allows application specific “authentication UI”
- Preserves most of the protocol independence
- Integrates quite well with Java 2
  security architecture
- No modifications to JDK or Jini

Limitations & Future Work

- Only public keys, not interoperable with existing authentication systems (like JAAS)
- The proof-of-concept implementation requires some mixing of application and security code
  - This deficiency could be removed by adding new Jini libraries and integrating to JAAS

Conclusions

- Centralized CAs are not the only solution to problems with downloaded code
- Trust management systems provide flexible solutions to distributed security problems
  - Identifying principals with public keys, and associating permissions directly with the keys
- More details in the form of Pasi Eronen's Master's Thesis available at http://www.iki.fi/pe/publications/

Questions and/or Comments?

- http://www.iki.fi/pe/publications/