4 Secure Architectures

Java Sicherheits-Architektur

Ursprünglich (JDK 1.0): Sandkasten-Modell.

Zu simplistisch und restriktiv.

JDK 1.2/1.3: feinere Sicherheitskontrolle (signing, sealing, guarding objects, . . .)

Aber: komplex, also Verwendung fehleranfällig.

Java Sicherheits-Politiken

Berechtigungseinträgen bestehen aus:

- Schutzdomänen (URL's und Signaturschlüssel)
- Ziel-Resourcen (z.B. Dateien auf lokaler Machine)
- zugehörige Berechtigungen (z.B. read, write, execute)

Signed und Sealed Objects

Brauchen Integritätsschutz für Objekte, die zur Authentisierung verwendet oder zwischen JVMs ausgetauscht werden.

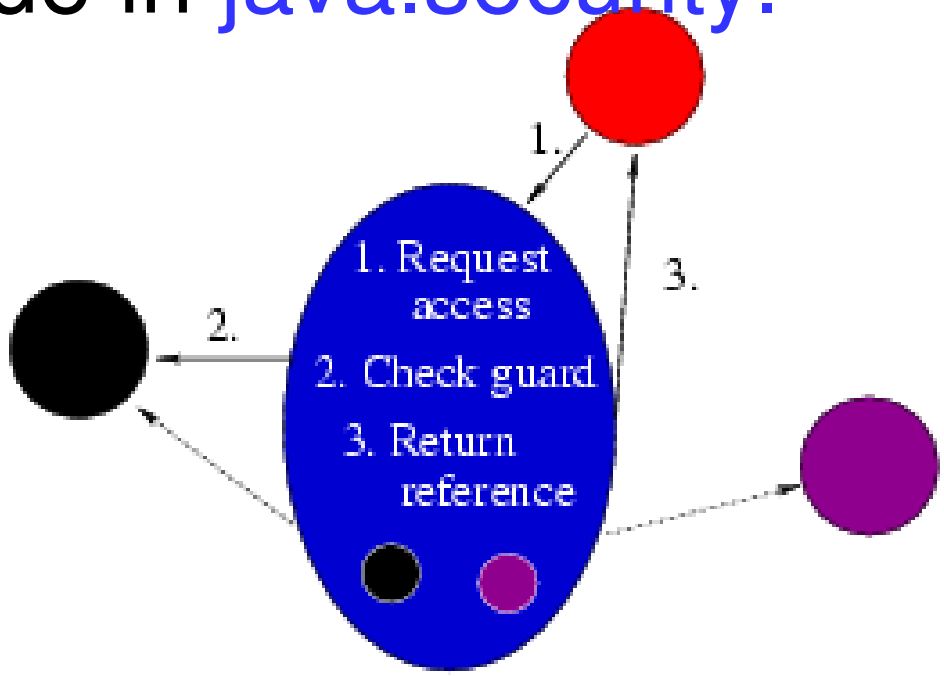
SignedObject enthält Objekt und seine Signatur.

Für Vertraulichkeitsschutz: SealedObject ist verschlüsseltes Objekt.

Guarded Objects

java.security.GuardedObject schützt Zugang zu anderen Objekten.

- Zugang über getObject Methode.
- checkGuard Methode in java.security.Guard kontrolliert Zugang.
- Gibt Referenz oder SecurityException.



Aufgabe 8

a) Warum ist dieser Mechanismus nicht völlig sicher (Hinweis: Referenz) ? [3 P.]

b) Wie könnte man ihn erweitern, um dieses Problem zu begrenzen ? [3 P.]

Problem: Komplexität

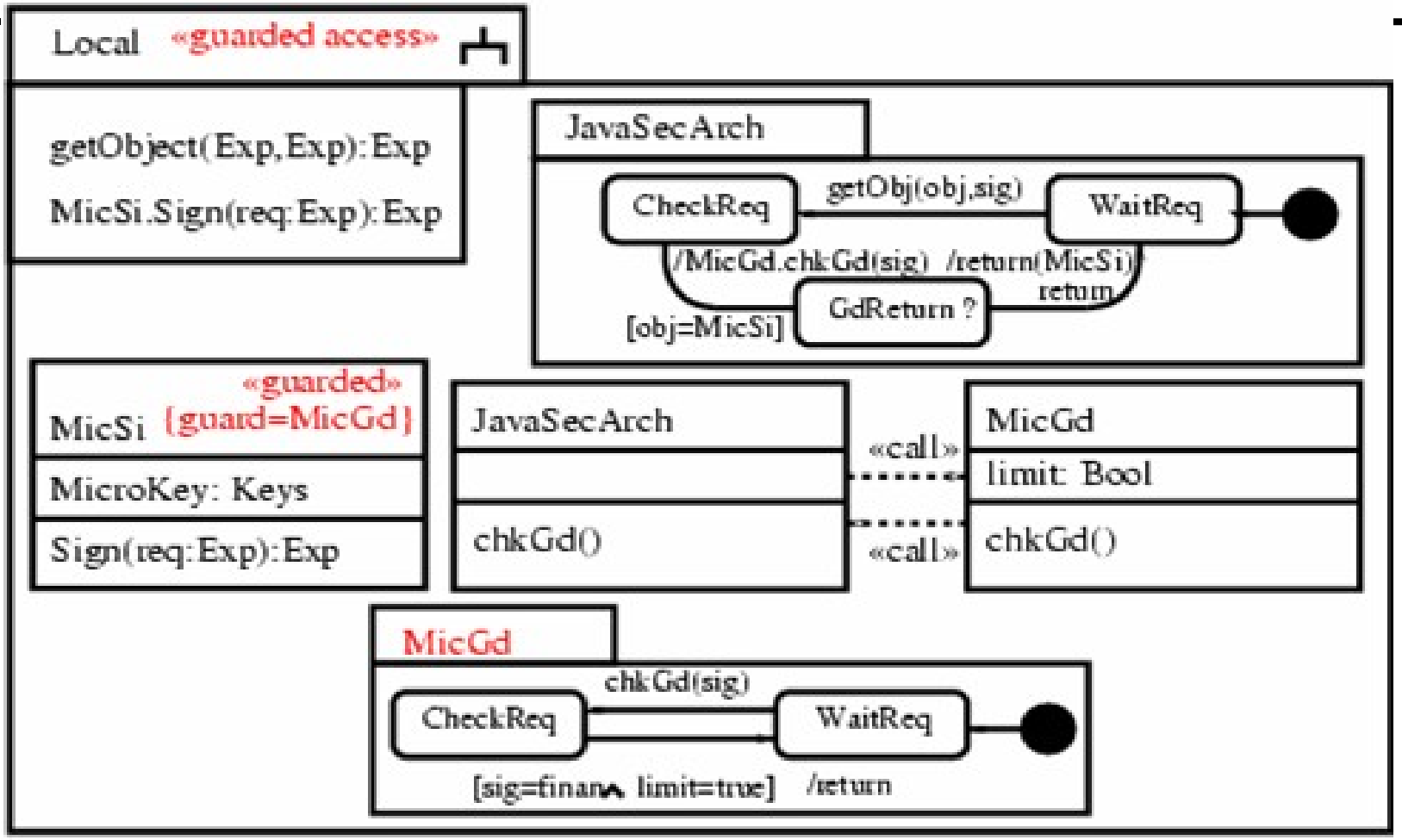
- Rechtevergabe abhängig von Ausführungskontext.
- Zugangskontrollentscheidungen bezüglich verschiedener Threads.
- Können verschiedene Schutzdomäne betreffen.
- Methode doPrivileged() unabhängig von Ausführungskontext.

Gibt Werkzeuge zur Überprüfung.

Entwurfsprozess

- Zugangskontroll-Anforderungen für sensitive Objekte formulieren.
- Guard objects mit Zugangskontrollen definieren.
- Überprüfen dass Schutz der guard objects hinreichend.
- Überprüfen dass Zugangskontrolle konsistent mit Funktionalität.
- Überprüfen dass mobile Objekte hinreichend geschützt.

Secure Use of Java Security Arch.



Enforces overall security policy ?

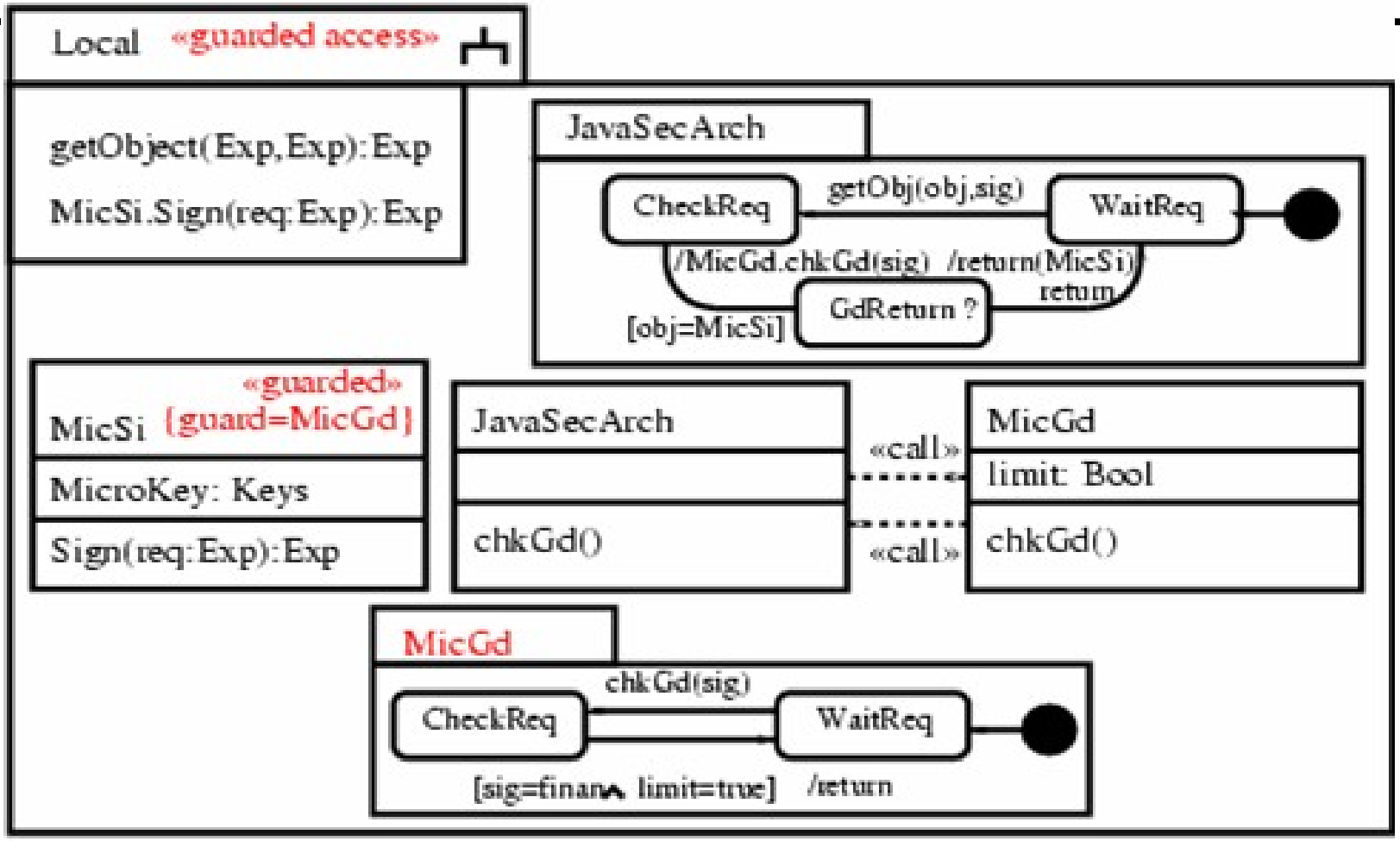
<<guarded access>>

Ensures that in Java, <<guarded>> classes only accessed through {guard} classes.

Constraints:

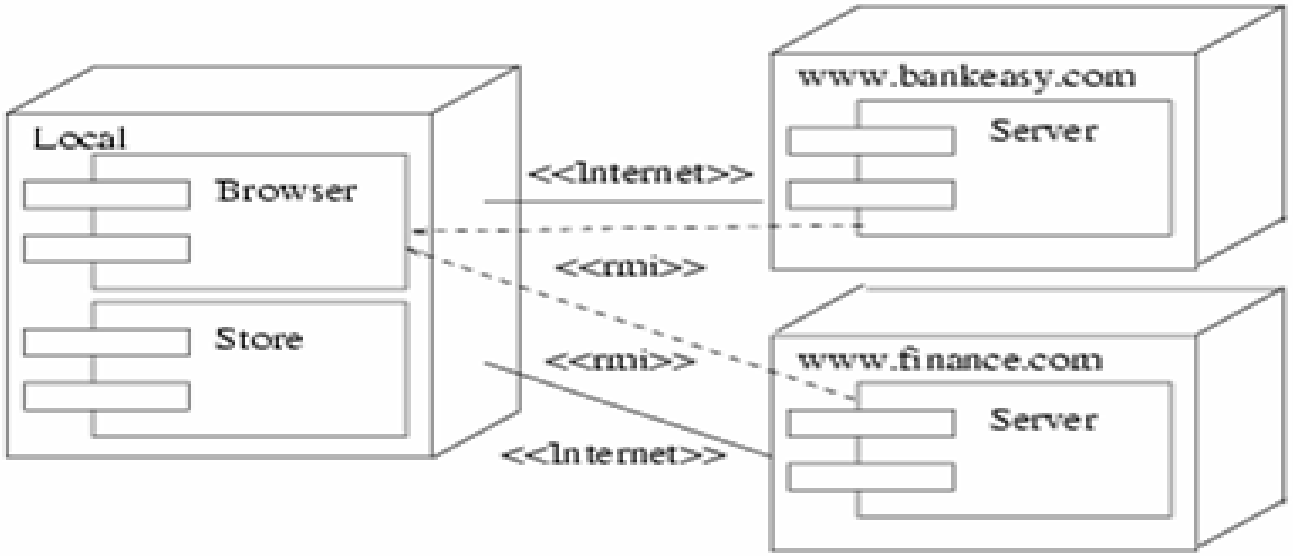
- References of <<guarded>> objects remain secret.
- Each <<guarded>> class has {guard} class enforcing security policy.

Example <<guarded access>>



<<guarded access>> fulfilled.

Example: Financial Application



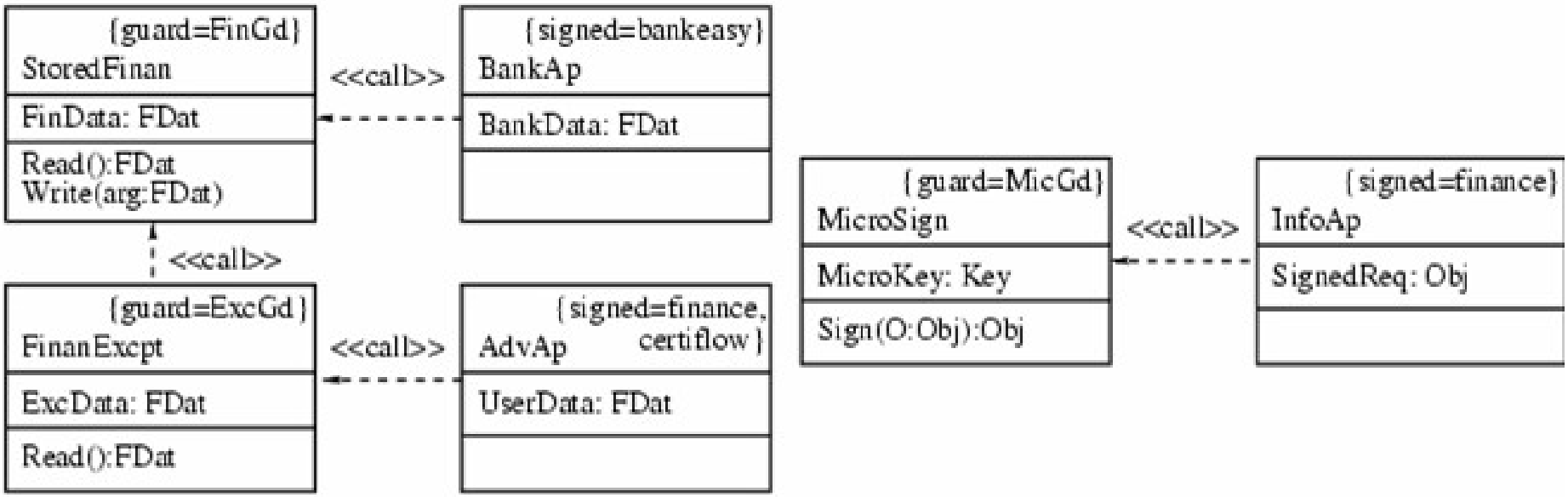
Internet bank, Bankeasy, and financial advisor, Finance, offer services to local user. Applets need certain Privileges (step1).

- Applets from and signed by bank read and write financial data between 1 pm and 2 pm.
- Applets from and signed by Finance use micropayment key five times a week.

Financial Application: Class Diagram

Sign and seal objects sent over Internet for Integrity and confidentiality.

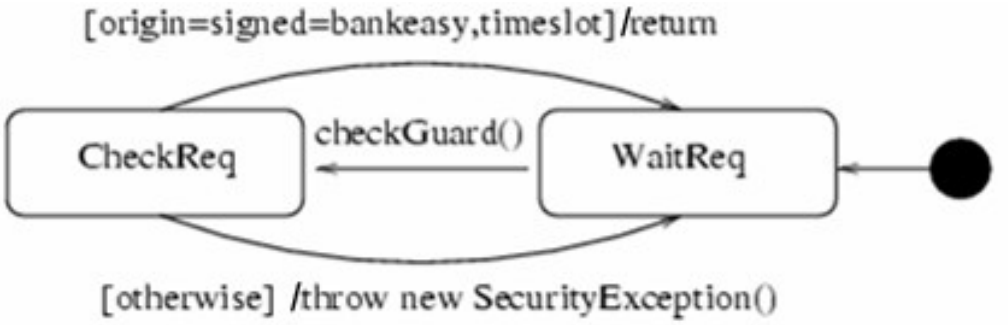
GuardedObjects control access.

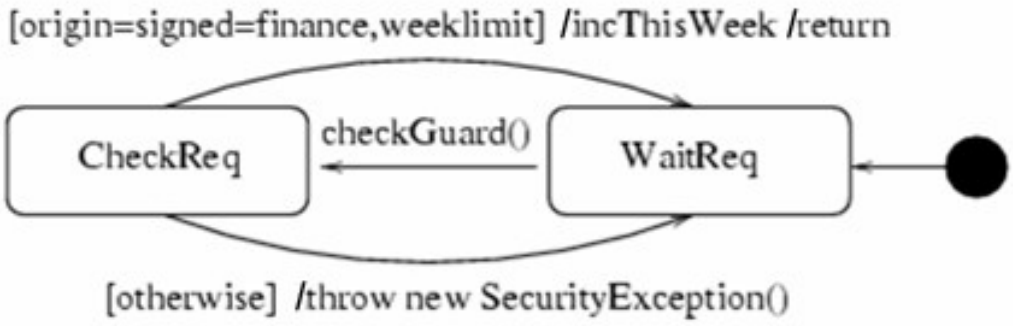


Financial Application: Guard Objects (step 2)

timeslot true between 1pm and 2pm.

weeklimit true until access granted five times; inc ThisWeek increments counter.





Financial Application: Validation

Guard objects give sufficient protection (step 3).

Proposition. UML specification for guard objects only grants permissions implied by access permission requirements.

Access control consistent with functionality (step 4). Includes:

Proposition. Suppose applet in current execution context originates from and signed by Finance. Use of micropayment key requested (and less than five times before). Then permission granted.

Mobile objects sufficiently protected (step 5), since objects sent over Internet are signed and sealed.

CORBA Zugangskontrolle

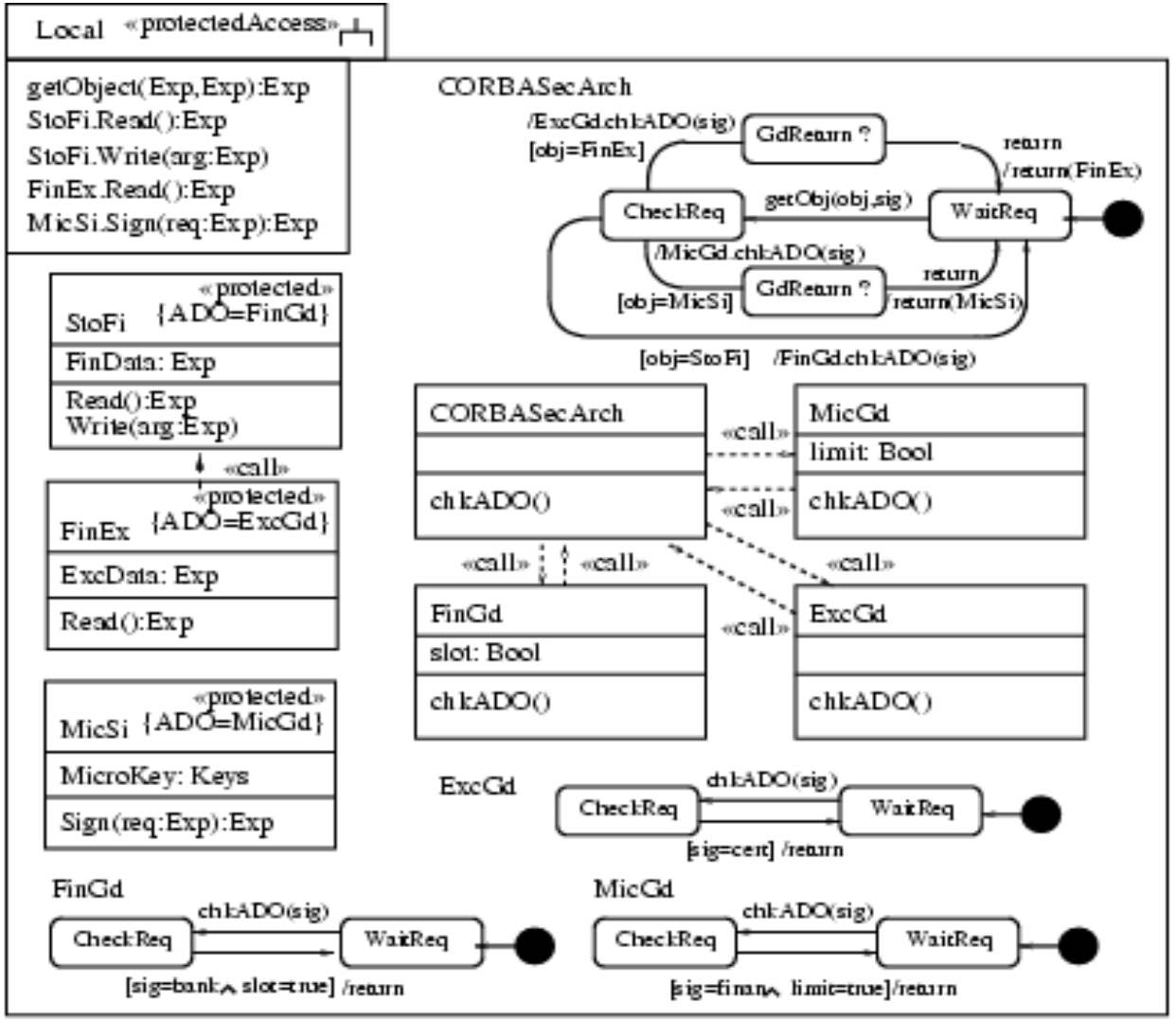
Objektzugangs-Politik kontrolliert Zugang von Client zu Objekt über gegebene Methode.

Realisiert durch ORB und Security Service.

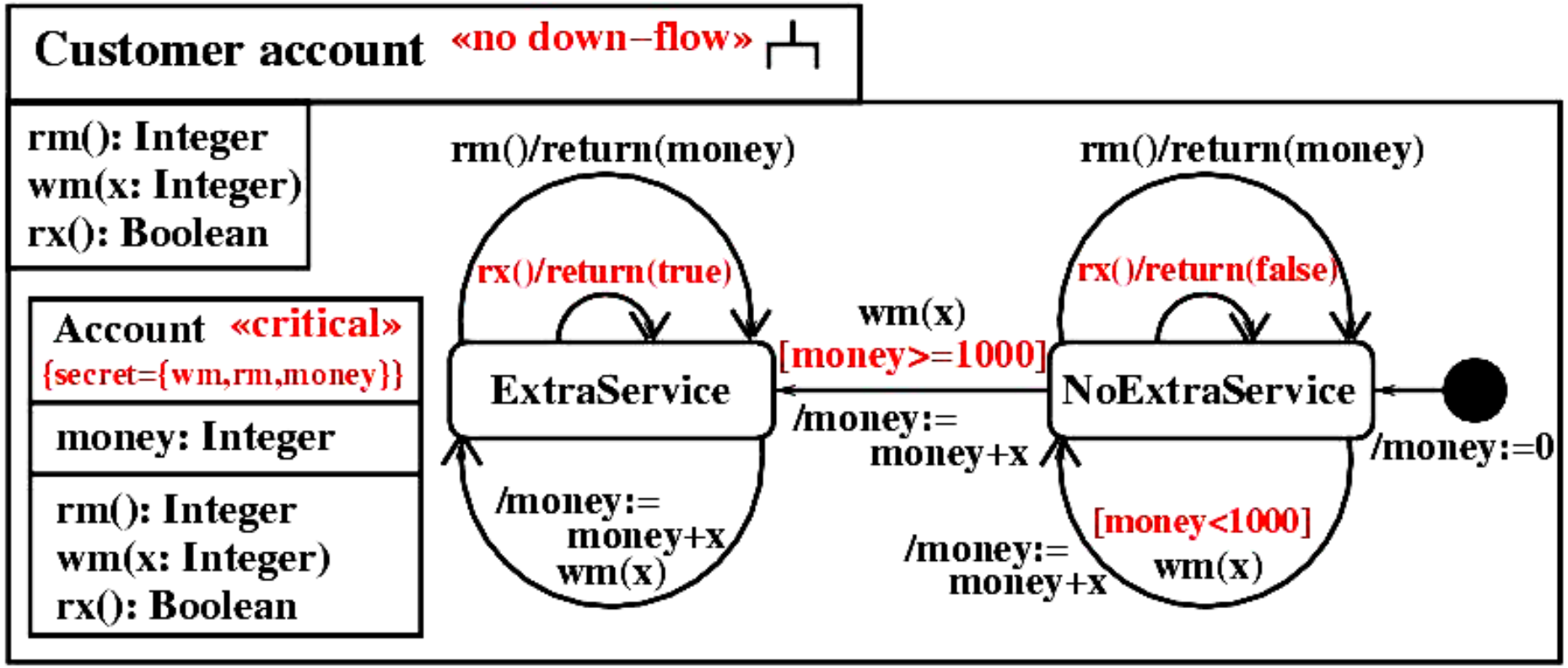
Access Decision Functions entscheiden ob Zugang erlaubt. Abhängig von

- aufgerufener Operation,
- Privilegien des Principals in dessen Vertretung der Client agiert,
- Kontrollattribute des Zielobjektes.

Example: CORBA Access Control with UMLsec



Secure Information Flow



No partial leakage of secrets ?

<<no down–flow>>

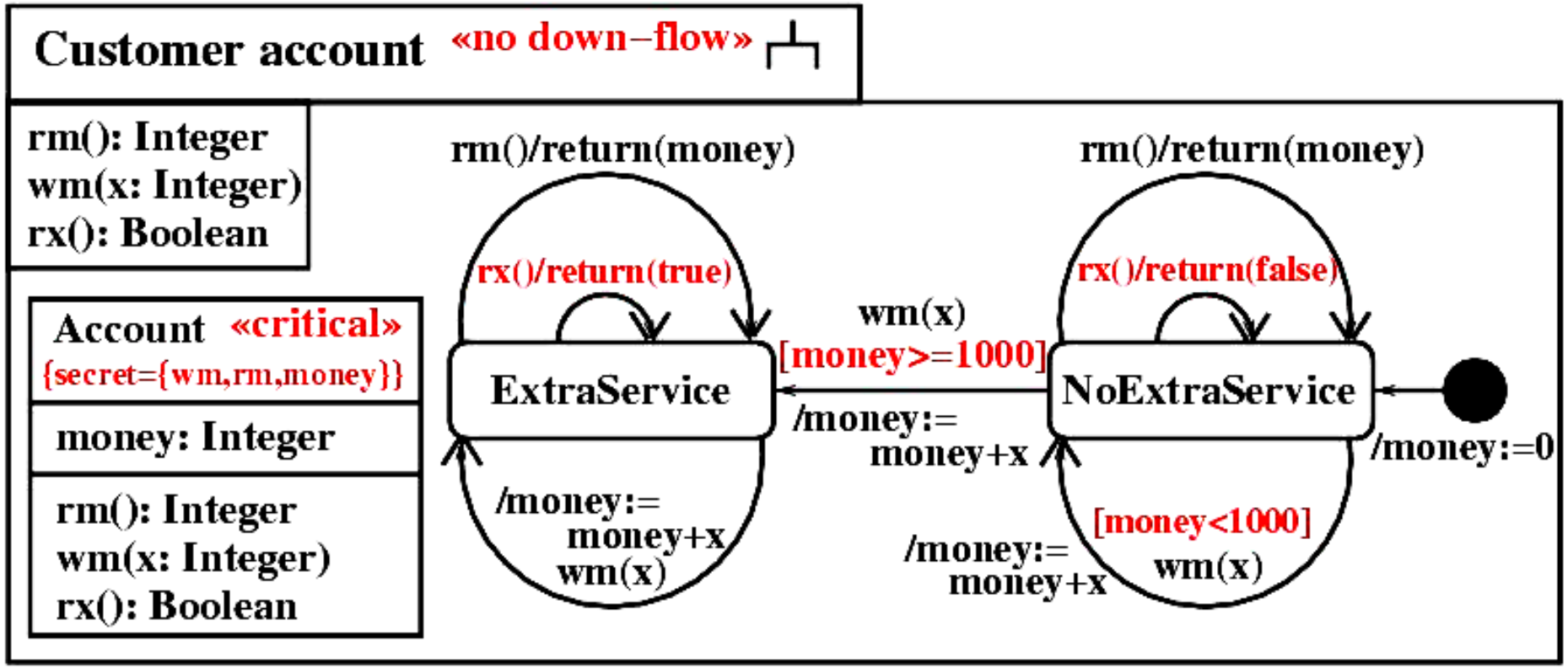
Enforce secure information flow.

Constraint:

Value of any data specified in {secrecy} may influence only the values of data also specified in {secrecy}.

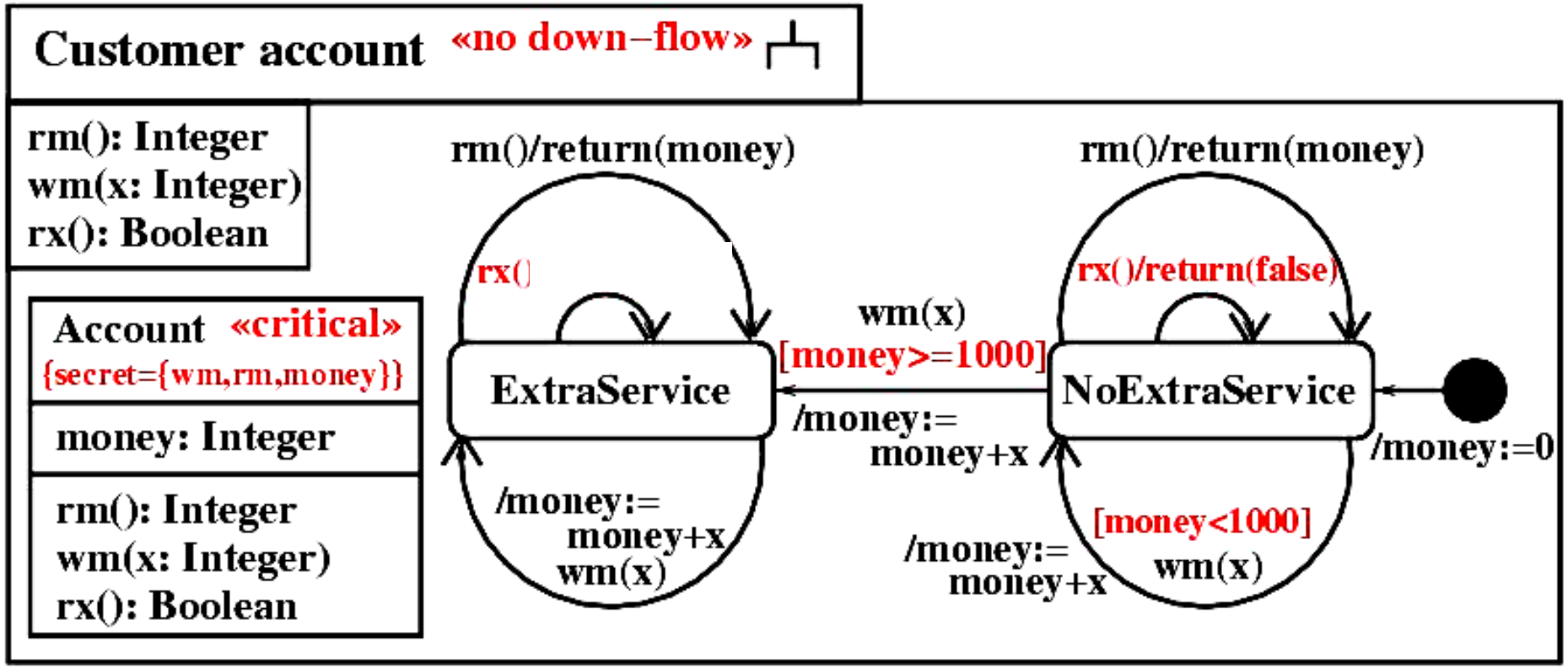
Formalize by referring to formal behavioural semantics.

Example <<no down-flow>>



<<no down–flow>> violated: partial information on input of secret wm() returned by non-secret rx().

Aufgabe 9



Modifikation: Im Zustand ExtraService wird auf rx() kein Rückgabewert zurückgegeben. Ist <<no down-flow>> nun erfüllt (mit Begründung) ? [4 P.]

Secure Use of Cryptography

«data security»

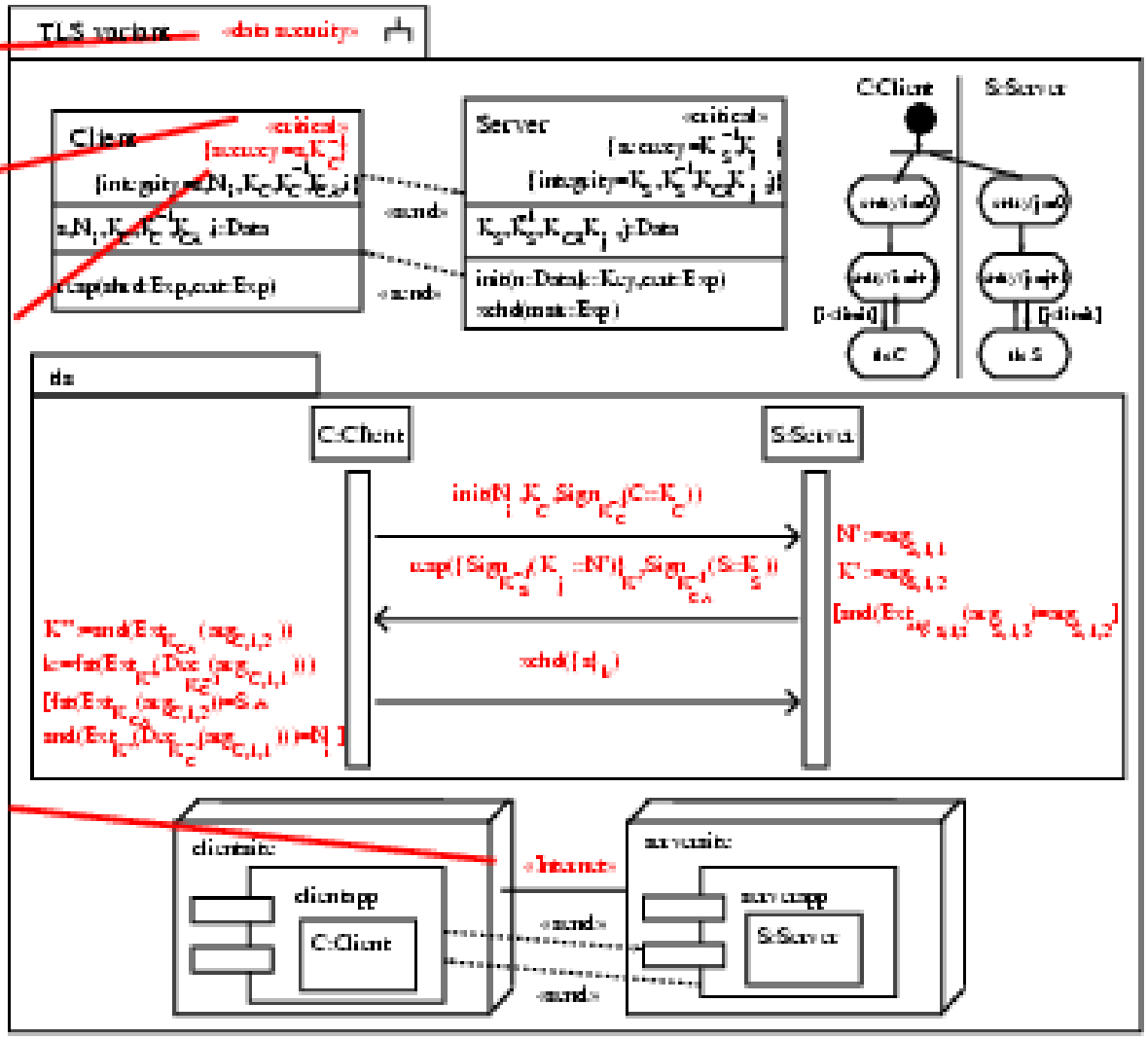
«critical»

$\{secrecy = \{s, K_C^{-1}\}\}$

Variant of TLS (INFOCOM`99).

Cryptoprotocol secure against default adversary ?

«Internet»



<<data security>>

Security requirements of data marked <<critical>> enforced against threat scenario from deployment diagram.

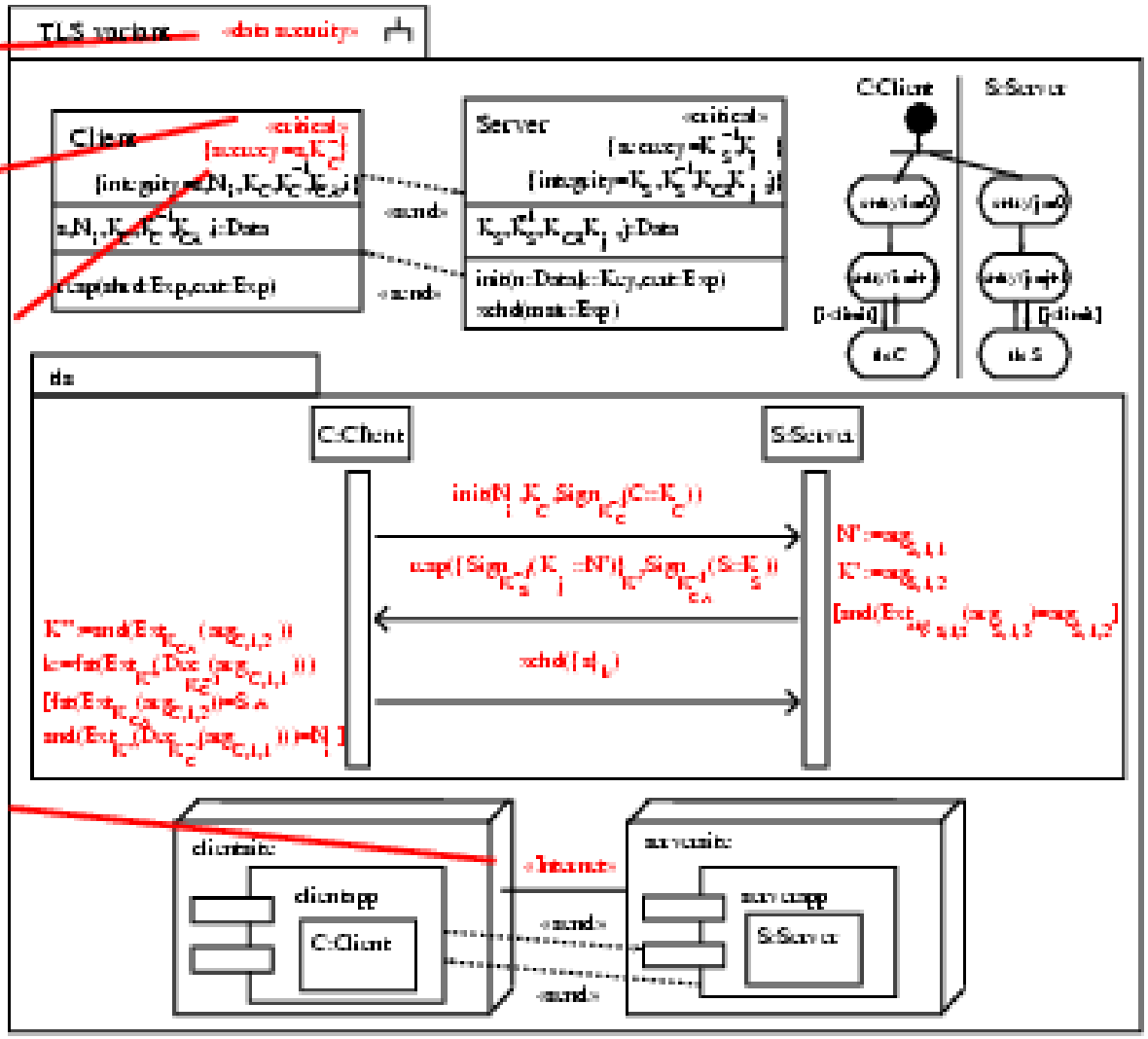
Constraints: Data marked {secrecy}, {integrity}, {authenticity}, {fresh} fulfills respective formalized security requirements.

Example <<data security>>

«data security»

«critical»

$\{secrecy = \{s, K_C^{-1}\}\}$



Variant of TLS (INFOCOM`99).

Violates {secrecy} of s

against default adversary.

UMLsec Intro: Overview

Security requirements: <<secrecy>>,…

Threat scenarios: Use $\text{Threats}_{\text{adv}}(\text{ster})$.

Security concepts: For example <<smart card>>.

Security mechanisms: E.g. <<guarded access>>.

Security primitives: Encryption built in.

Physical security: Given in deployment diagrams.

Security management: Use activity diagrams.

Technology specific: Java, CORBA security.