Security Evaluation of Service-oriented Systems with an Extensible Knowledge Base

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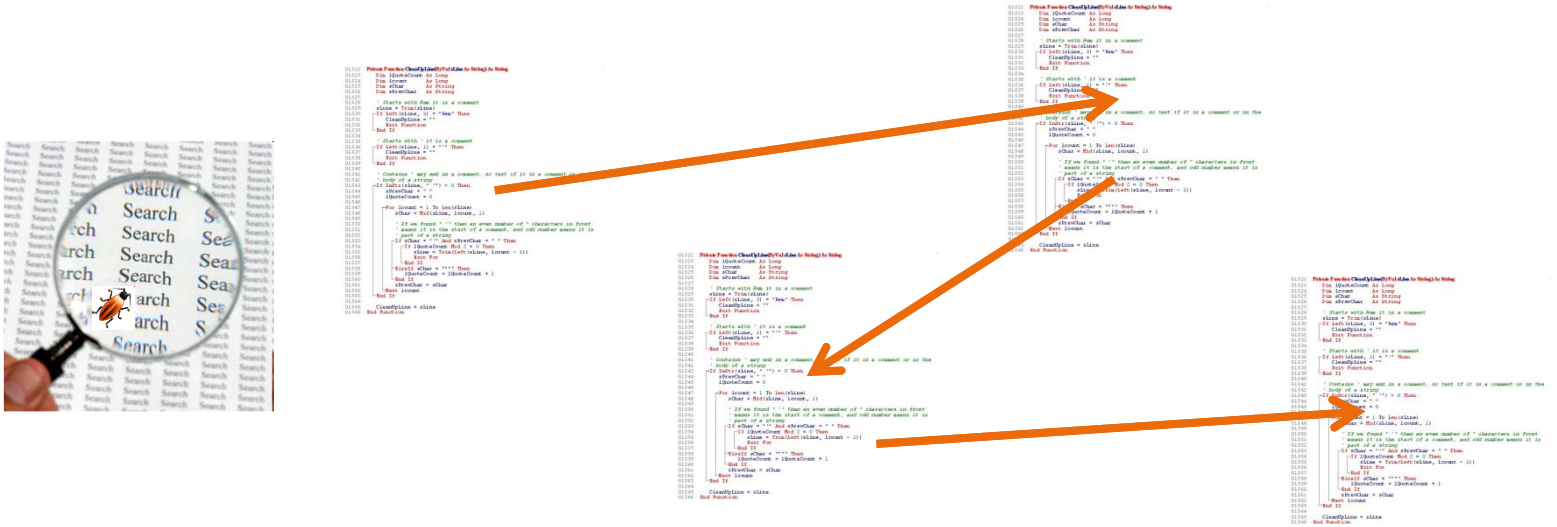
AGENDA

- Motivation
- Project Overview
- SiSOA Method
- Exemplary Security Evaluation
- Future Work
- Conclusion

Motivation

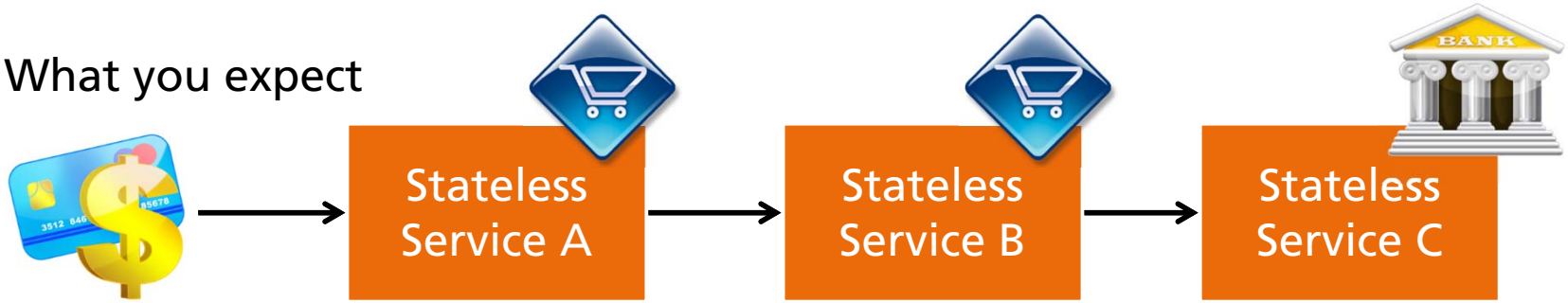
- Security problems can be distributed all over the system, especially in SOA



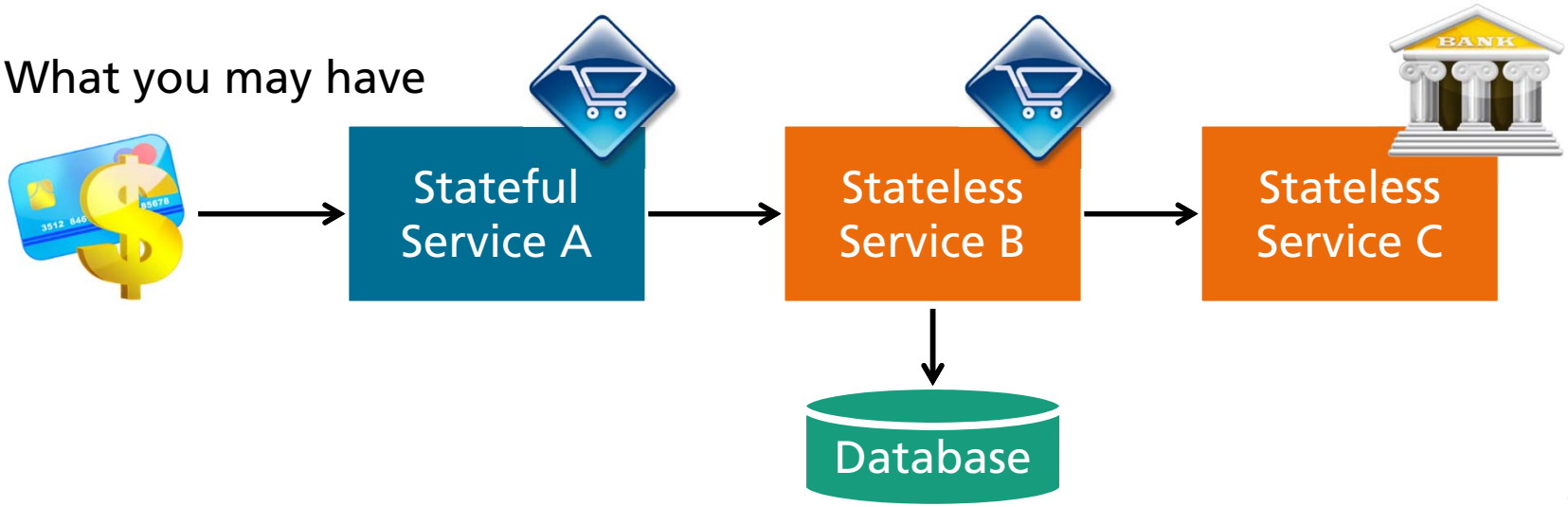
- Aggregate security related information on a more abstract level
  - e.g. on architectural level ➔ big picture

Motivation

- What you expect



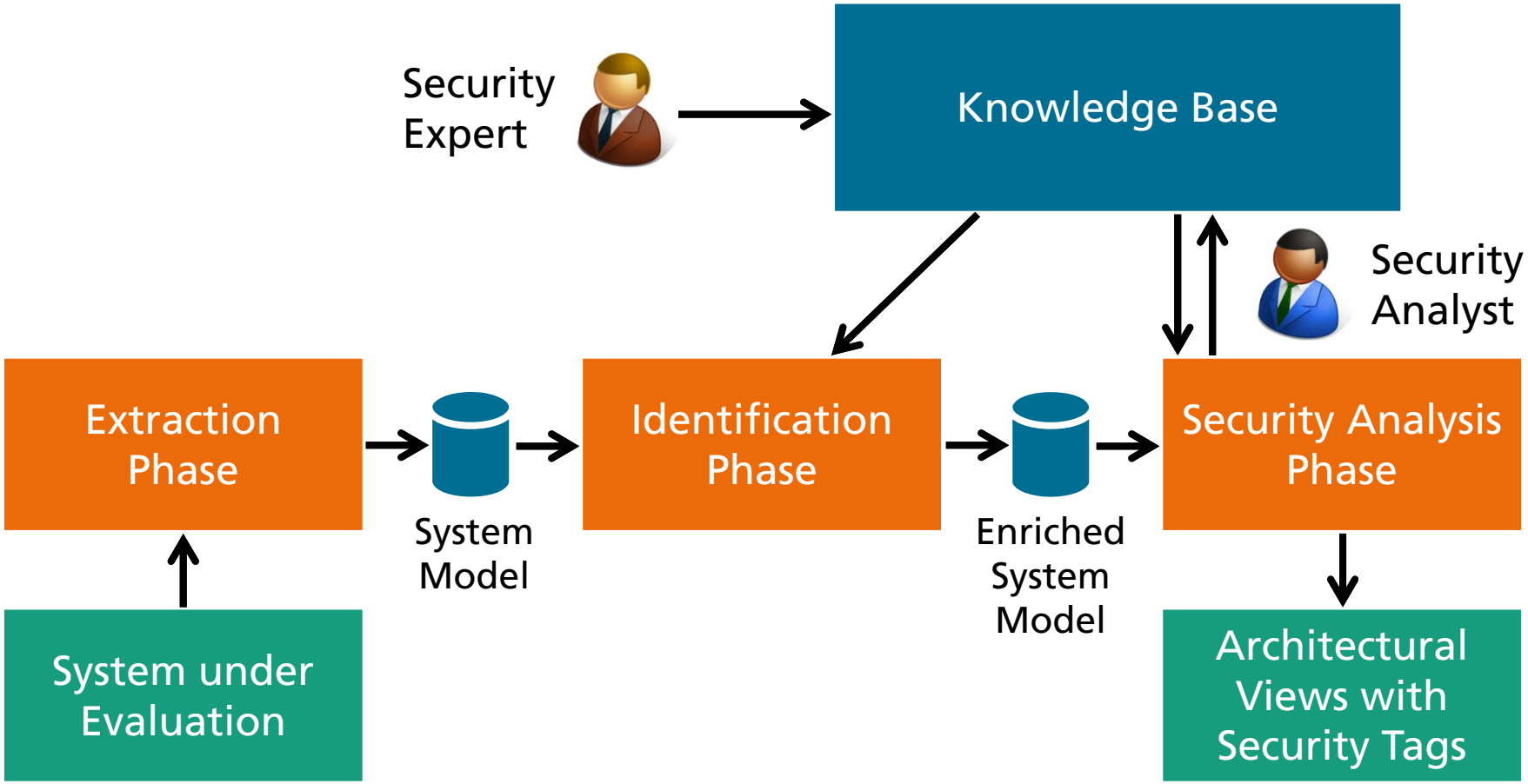
- What you may have



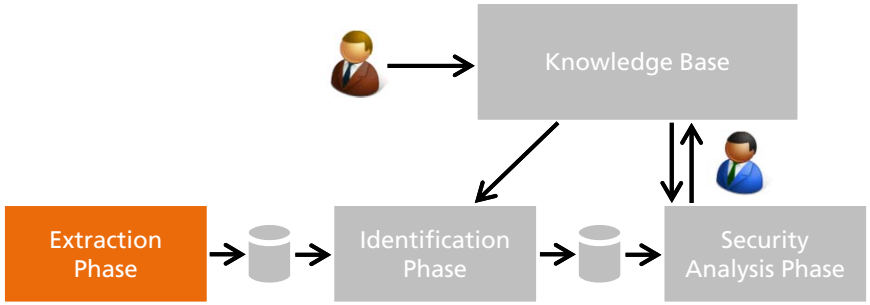
Project Overview

- SiSOA project
  - security evaluation of SOA applications on architectural level
- Goals
  - displaying static security features and issues on architectural level
  - gather and reuse security knowledge
  - tool supported security analysis
- Non-goals
  - automatic security assessment: detailed manual inspection indispensible

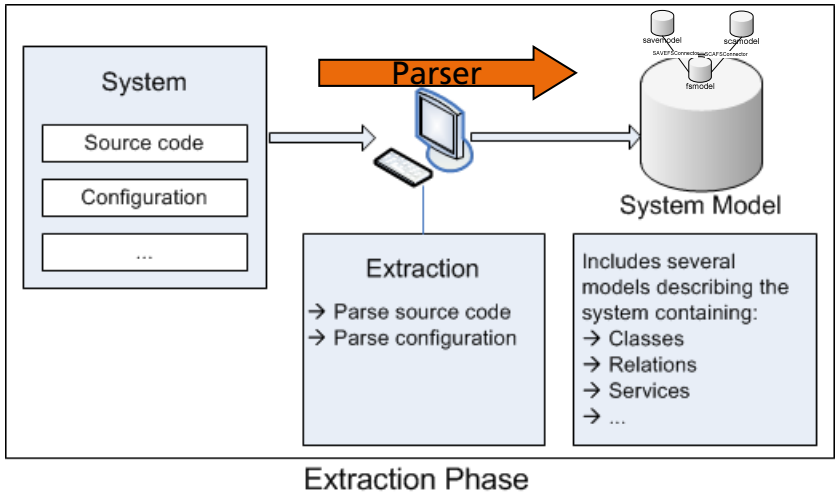
The SiSOA-Method
Overview



The SiSOA-Method
Extraction Phase



- *Artifact: Element that can be aggregated to a security feature or issue*
- Parse source code and configuration files
- Put system structure into system model (SAVE tool)
- Fill system model with artifacts:
  - imports
  - call relations
  - exceptions
  - annotations
  - …



Extraction Phase

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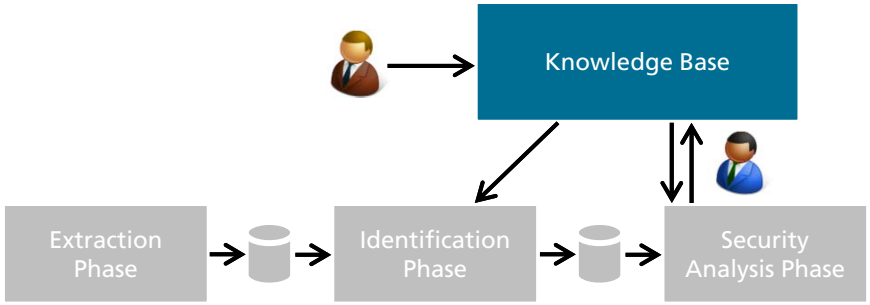
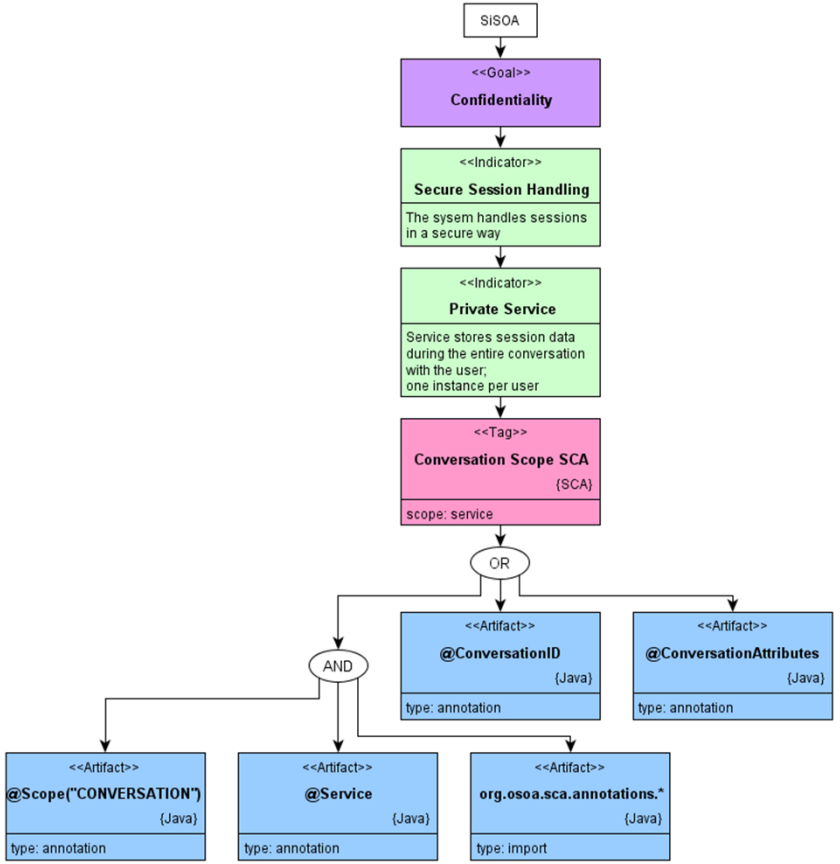
The SiSOA-Method Knowledge Base



- *Security Tag: Marker for security features or issues*
- Tree-like structure
- Security Tags / Security Tag Rules
  - Aggregate artifacts
  - Boolean operators
  - Weightings
- Security Goals and Indicators
  - Indicate security features/issues
  - Categorize security tag rules
  - Help to find adequate tag rules in the knowledge base



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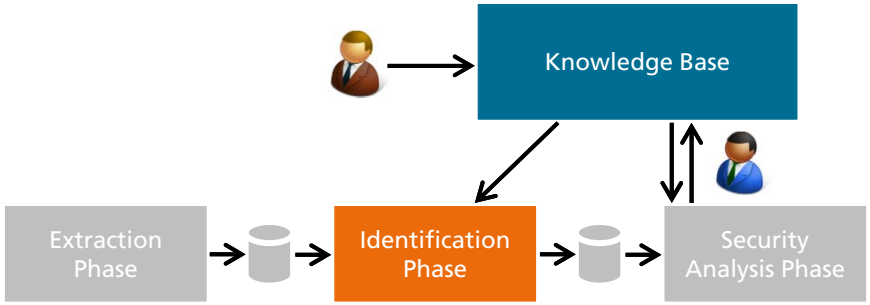
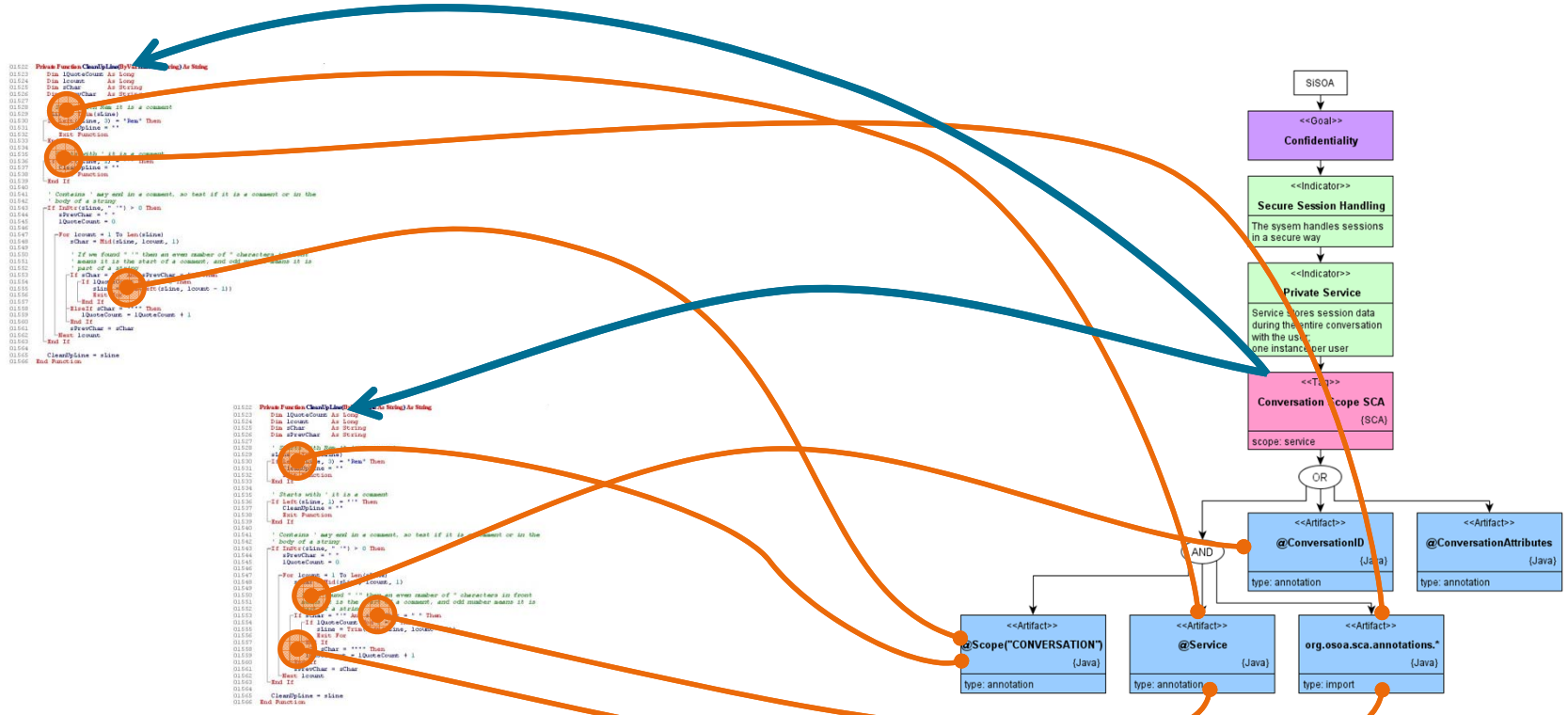
The SiSOA-Method Identification Phase





System Model

Security Tag Rule

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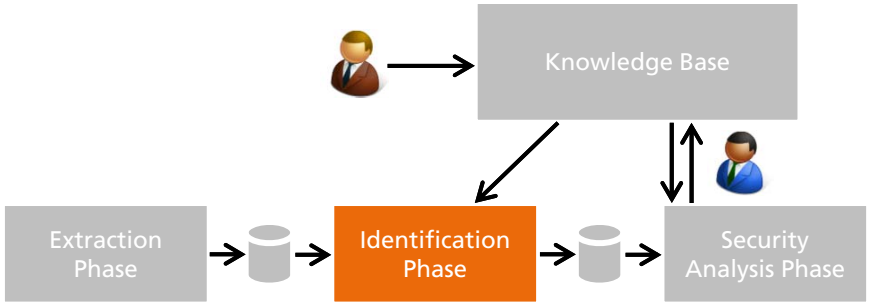
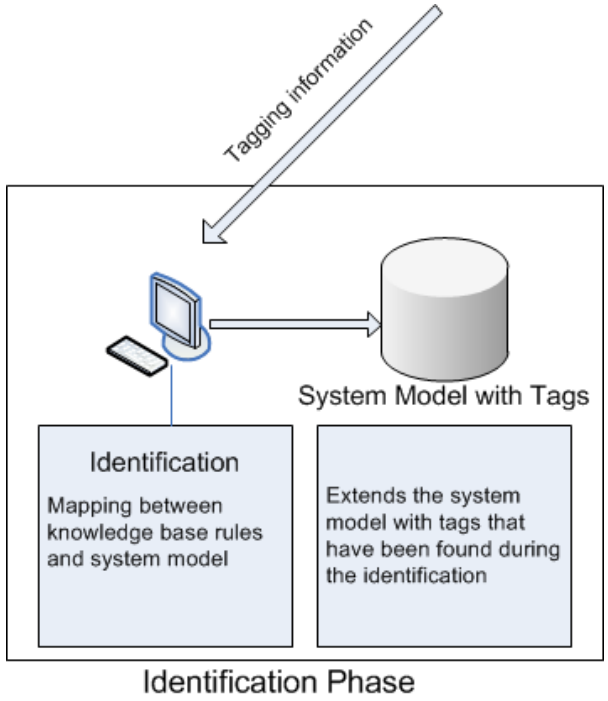
The SiSOA-Method Identification Phase

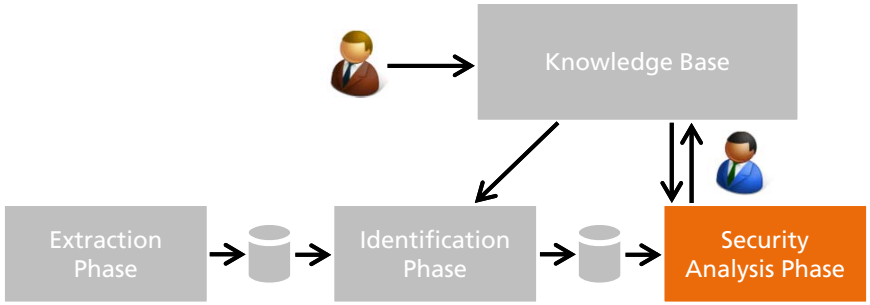


- Mapping of artifacts and security tag rules
- Enriching the system model with tags

- Use of metrics to calculate
  - Credibility of tags
    - Probability that a security tag is placed correctly
  - Severity of tags
    - Quality of the security tag rule

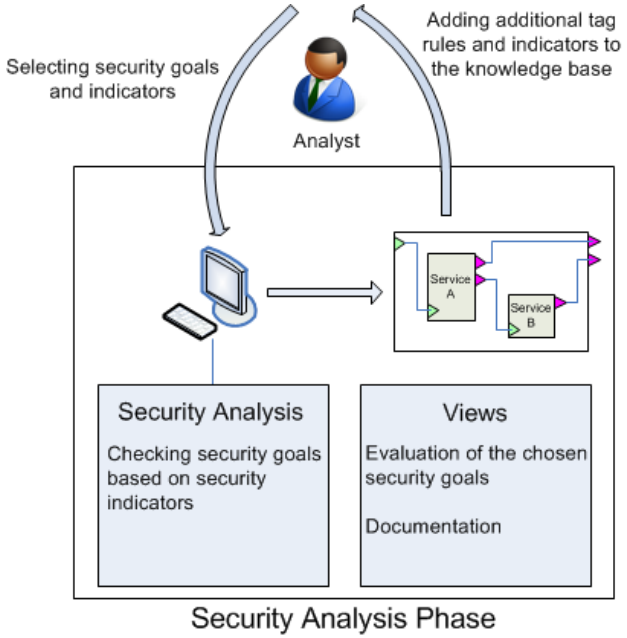


The SiSOA-Method
Analysis Phase



- Views with assigned tags can be generated:
  - Class view
  - Service view

- Analysis features:
  - Adding or changing tags
    - In the model
    - In the knowledge base
  - Rerun identification (after adding or changing tags)
  - Different filters



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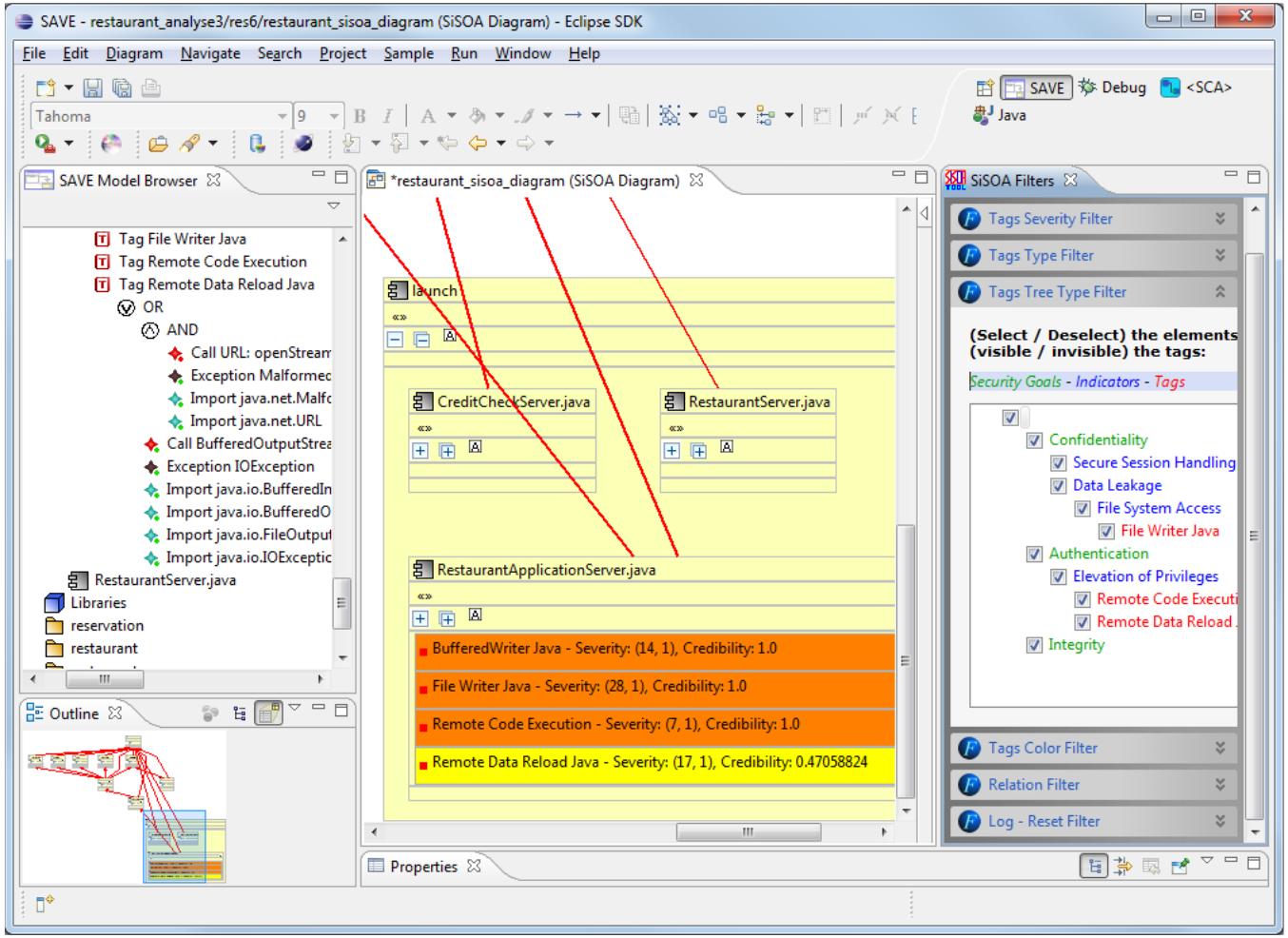
The SiSOA-Method Analysis Phase

- Class view:
  - classes
  - packages
  - relations
  - security tags



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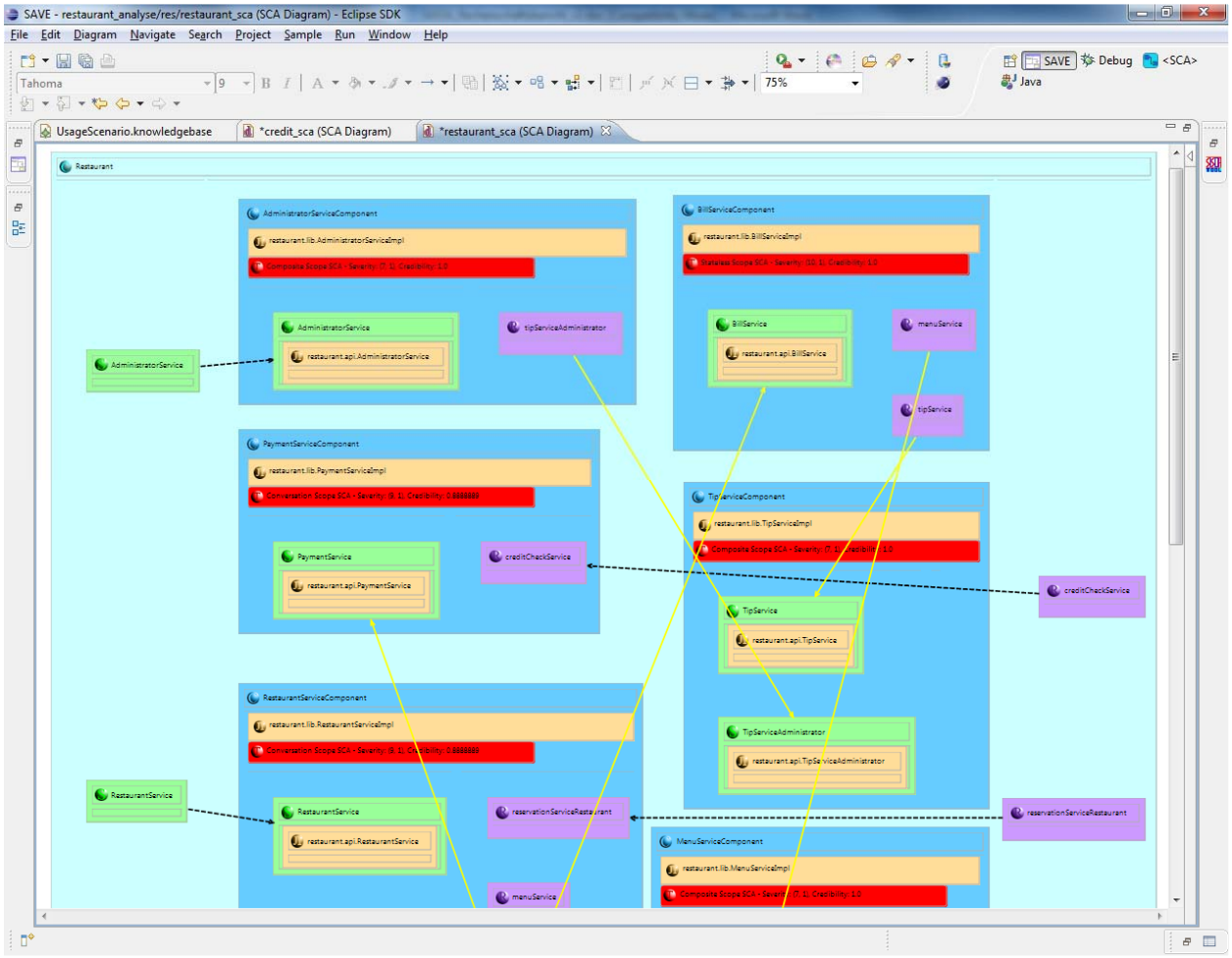
The SiSOA-Method Analysis Phase

- Service view:
  - services
  - service interfaces
  - trust zones
  - security tags



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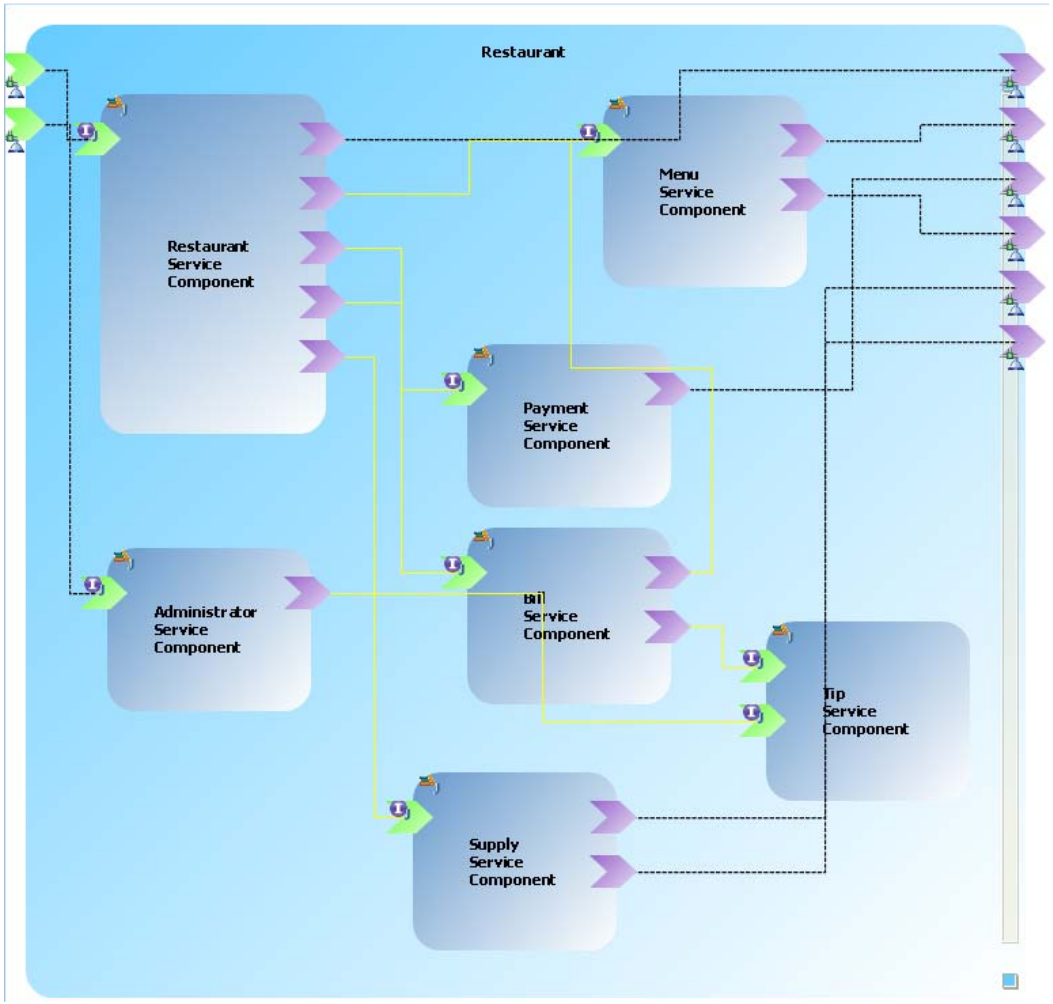
Exemplary Security Evaluation

- Toy Example
  - Restaurant SOA application
- SOA Framework SCA (Service Component Architecture)
- Features:
  - order food
  - make reservations
  - pay bill with credit card
  - …



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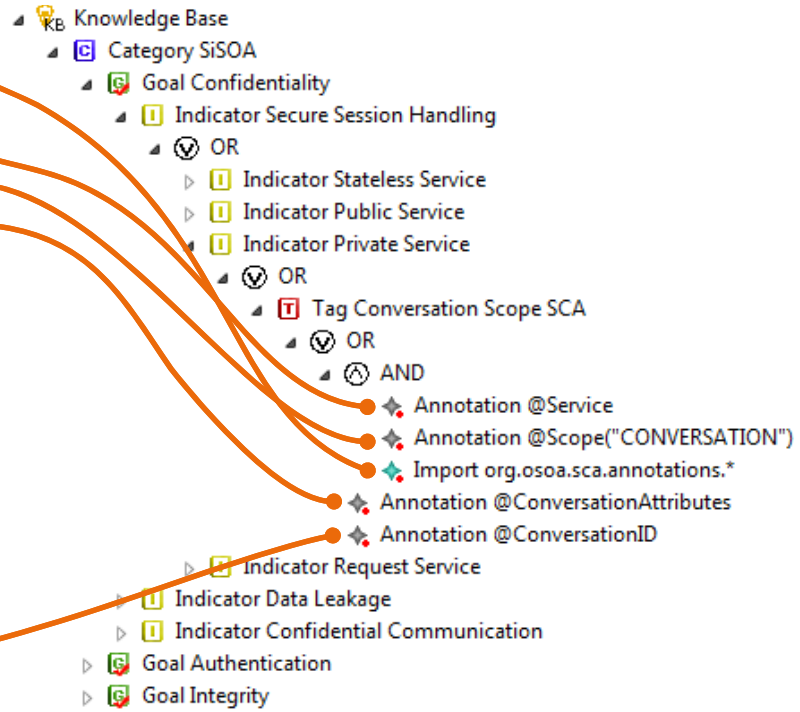
Exemplary Security Evaluation

- Problem: Information Disclosure
  - Services that process credit card information should not share them
- Several service scopes in SCA
  - **Stateless**: does not store data between two requests
  - Stateful: does store data between two requests
    - **Composite**: one instance for all users
    - **Conversation**: one instance per user
- We need stateless or conversation scopes

Exemplary Security Evaluation

```
package credit.lib;

import credit.api.CreditCheckService;
import org.osoa.sca.annotations.ConversationAttributes;
import org.osoa.sca.annotations.ConversationID;
import org.osoa.sca.annotations.Scope;
import org.osoa.sca.annotations.Service;
[...]

@Service(CreditCheckService.class)
@Scope("CONVERSATION")
@ConversationAttributes(maxAge="30 minutes",maxIdleTime="20 minutes")
public class CreditCheckServiceImpl implements CreditCheckService {

private int creditCardNumber;
private int securityCode;
[...]

@ConversationID
private String ConversationID;
[...]

public boolean checkCreditCard(int creditCardNumber, int securityCode)
this.creditCardNumber = creditCardNumber;
this.securityCode = securityCode;
if (creditCards.containsKey(creditCardNumber) &&
     creditCards.get(creditCardNumber) == securityCode)
      return true;
else
      return false;
}
[...]
```



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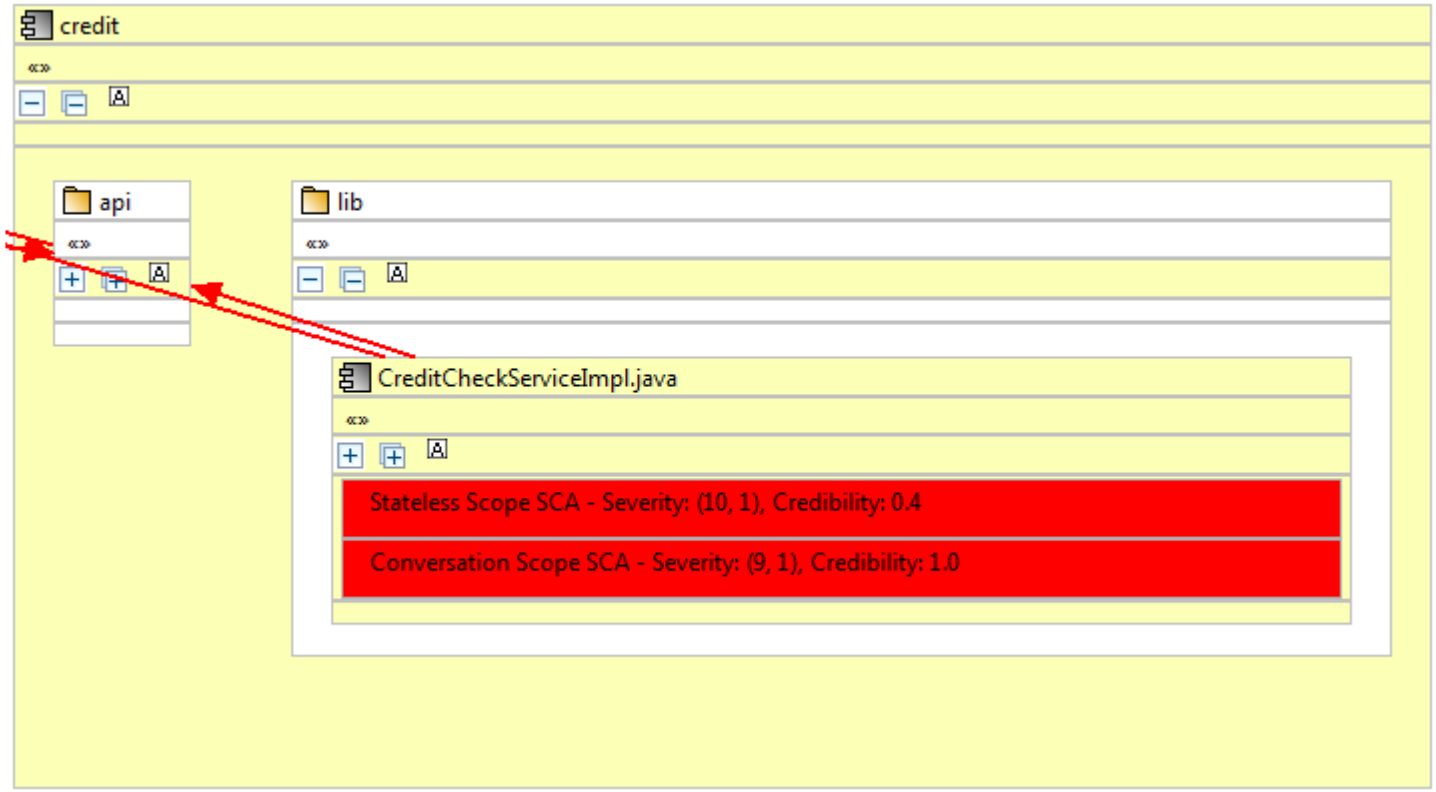
Exemplary Security Evaluation

- Conversation Scope has been found in CreditCheckServiceImpl.java



Future Work

- Filling the knowledge base with more security related rules
- Gain practical experience with the SiSOA method
- Evaluation, especially of
  - the methodology itself
  - the used metrics and weightings
  - the gathered security knowledge in the Knowledge Base
- Adapt the prototype to more SOA technologies

Conclusion

- SiSOA method can aggregate security features/issues on architectural level
- Method supports experts during security analysis

- Method is as good as the provided information in the Knowledge Base
- Knowledge Base can never be exhaustive

- Method is also applicable on non-SOA applications

Thank you for your attention
Any questions ???

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