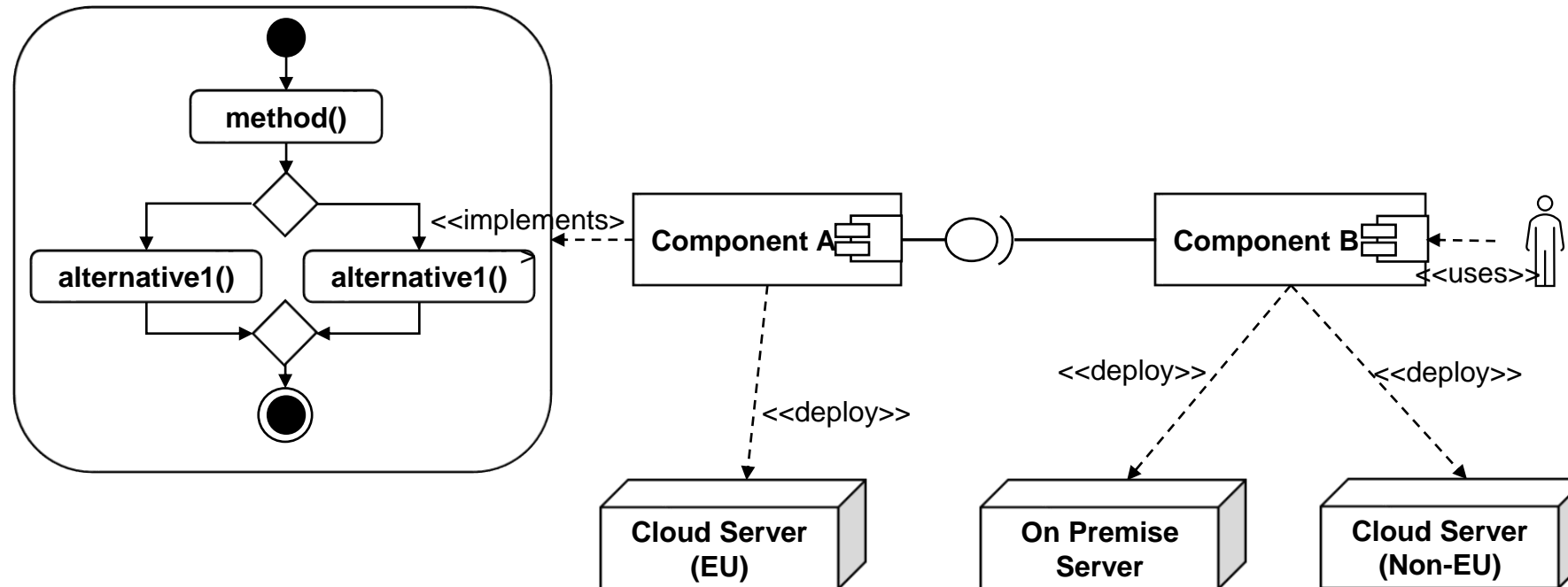


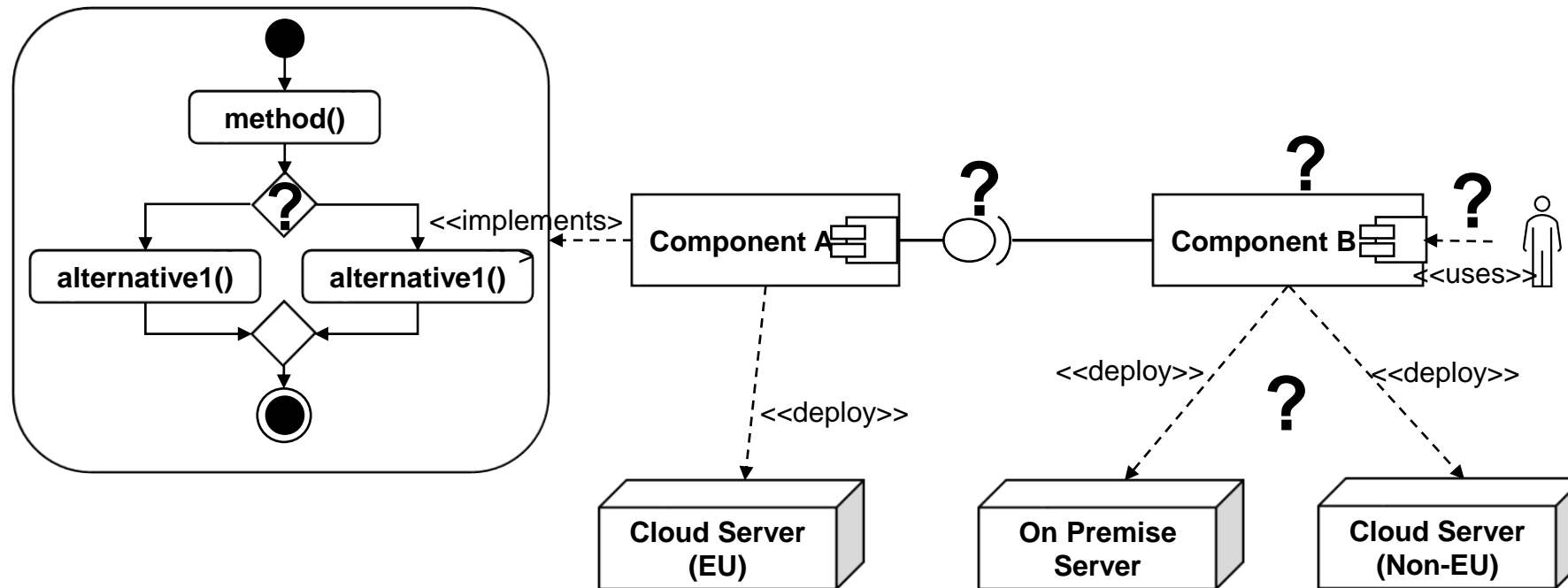
Architecture-based Uncertainty Impact Analysis for Confidentiality

Architectural Review
Niko Benkler

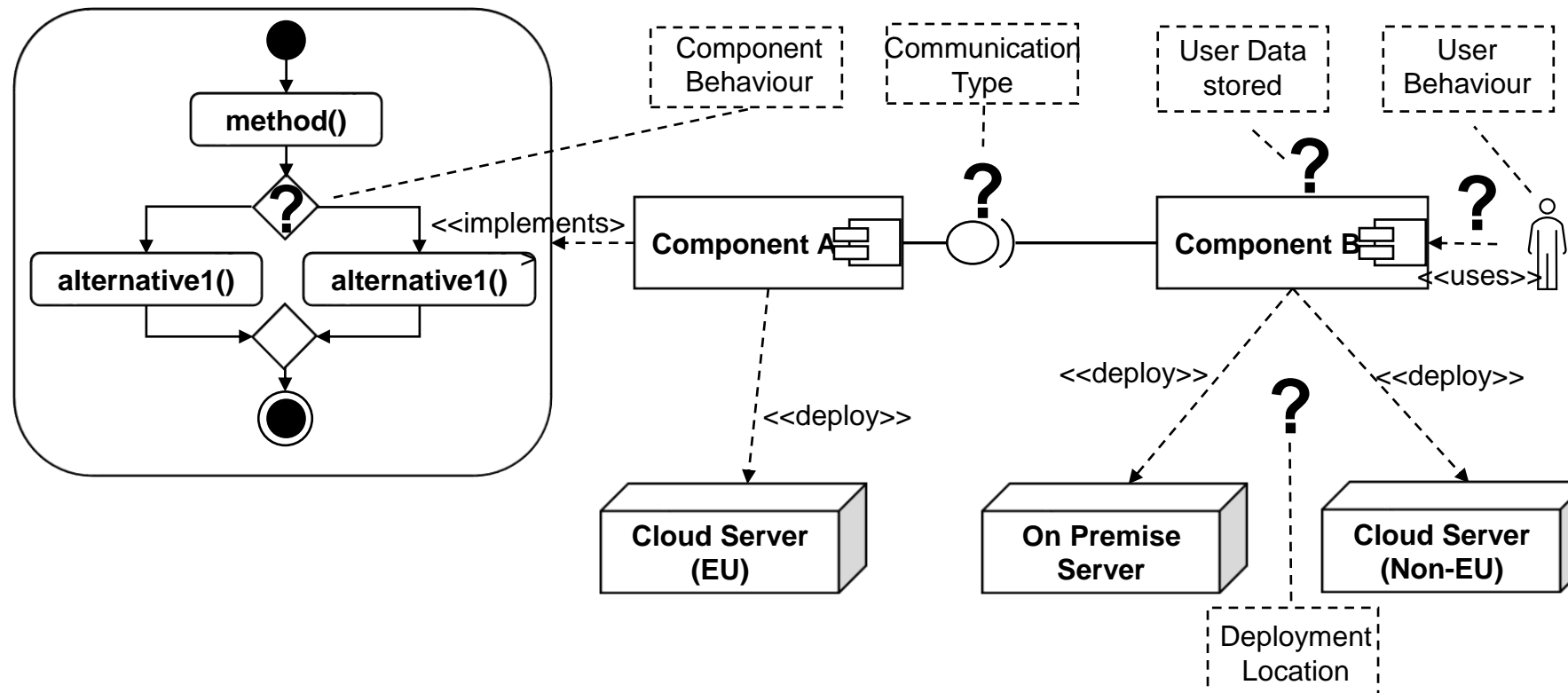
Motivating Example



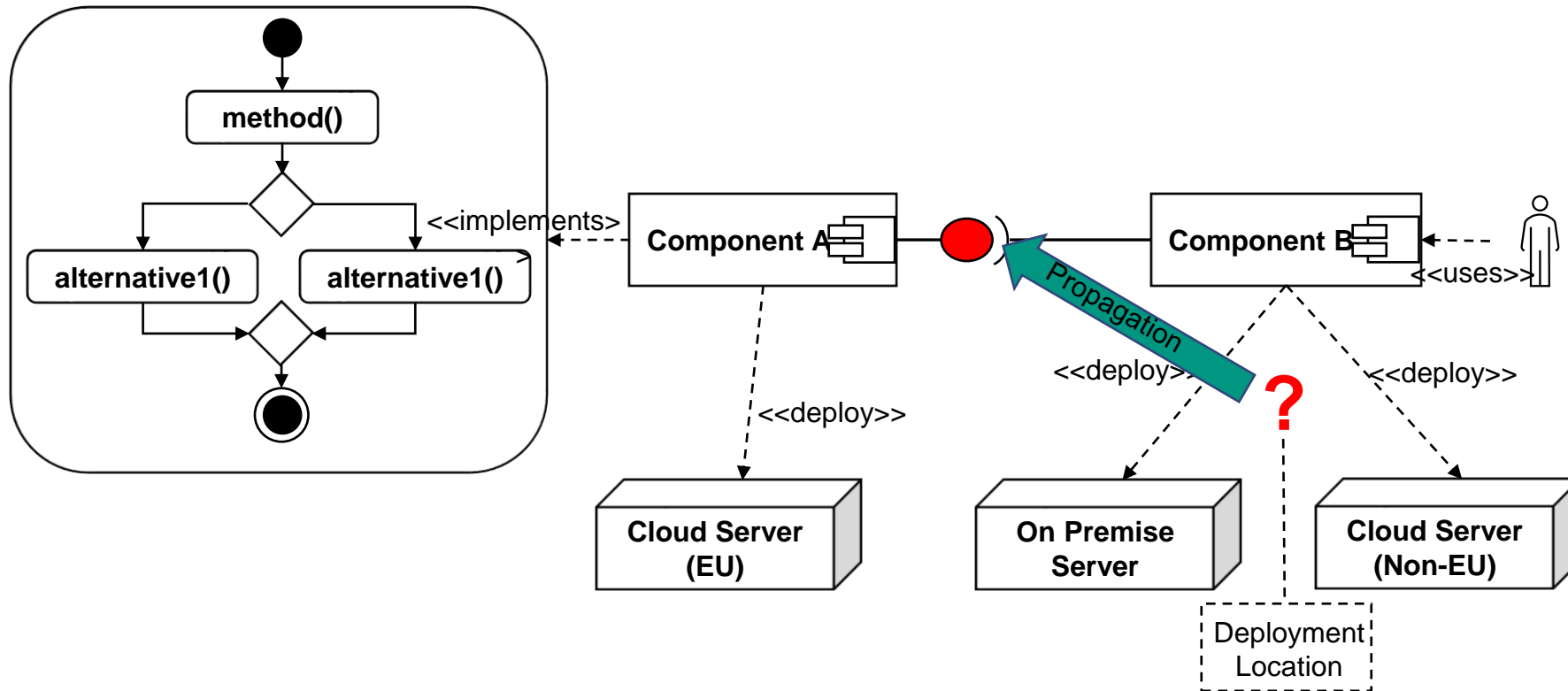
Motivating Example: Find Uncertainties



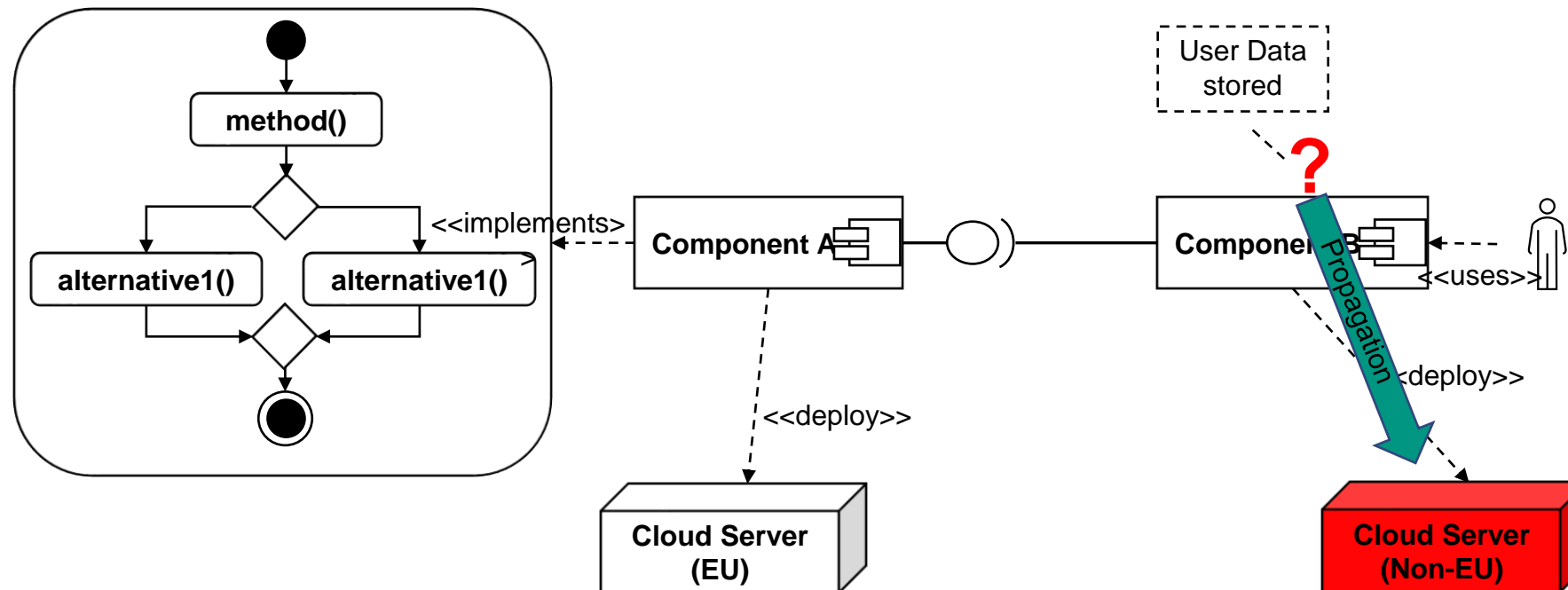
Motivating Example: Represent Uncertainties



Motivating Example: Uncertainty Propagation

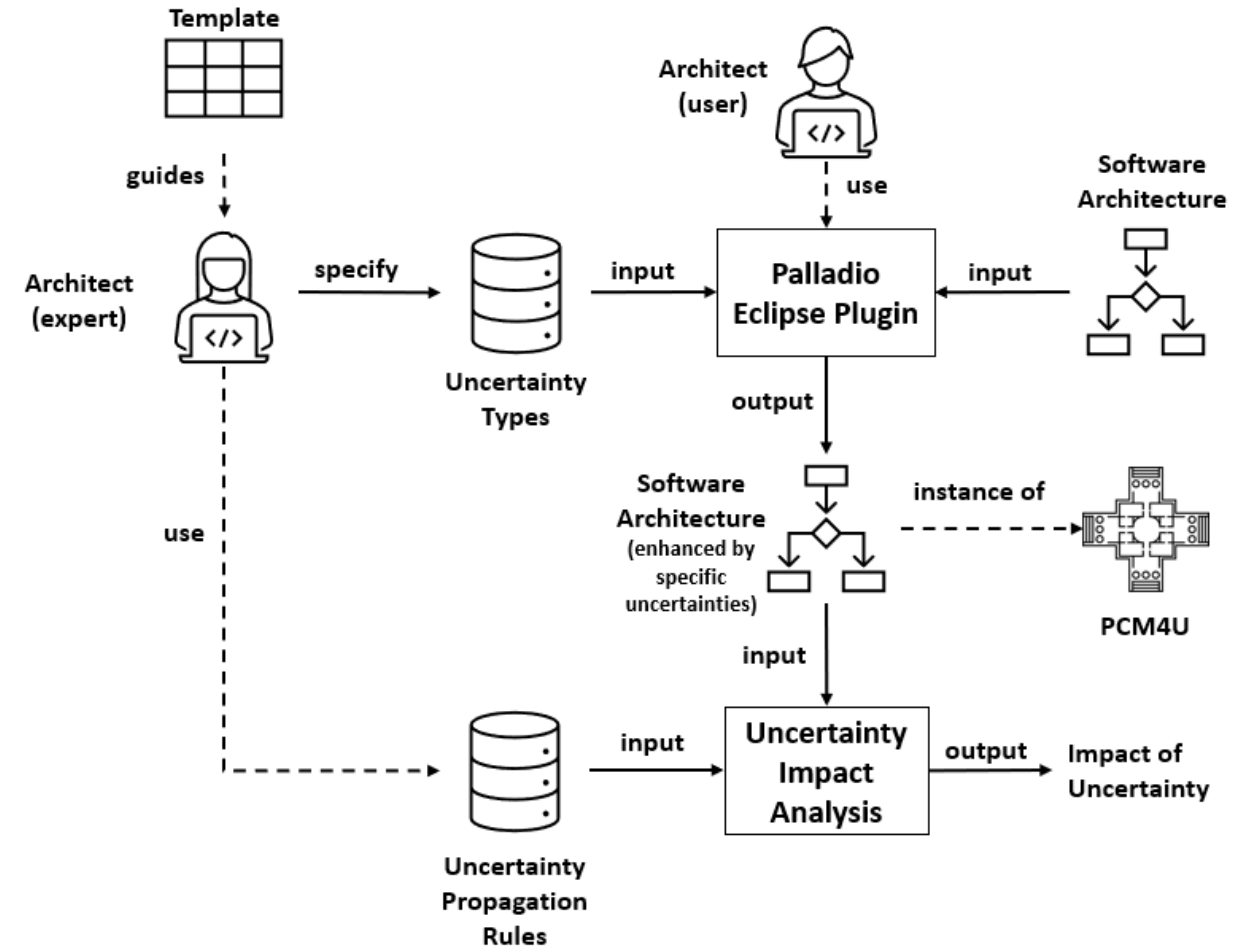


Motivating Example: Represent Uncertainties



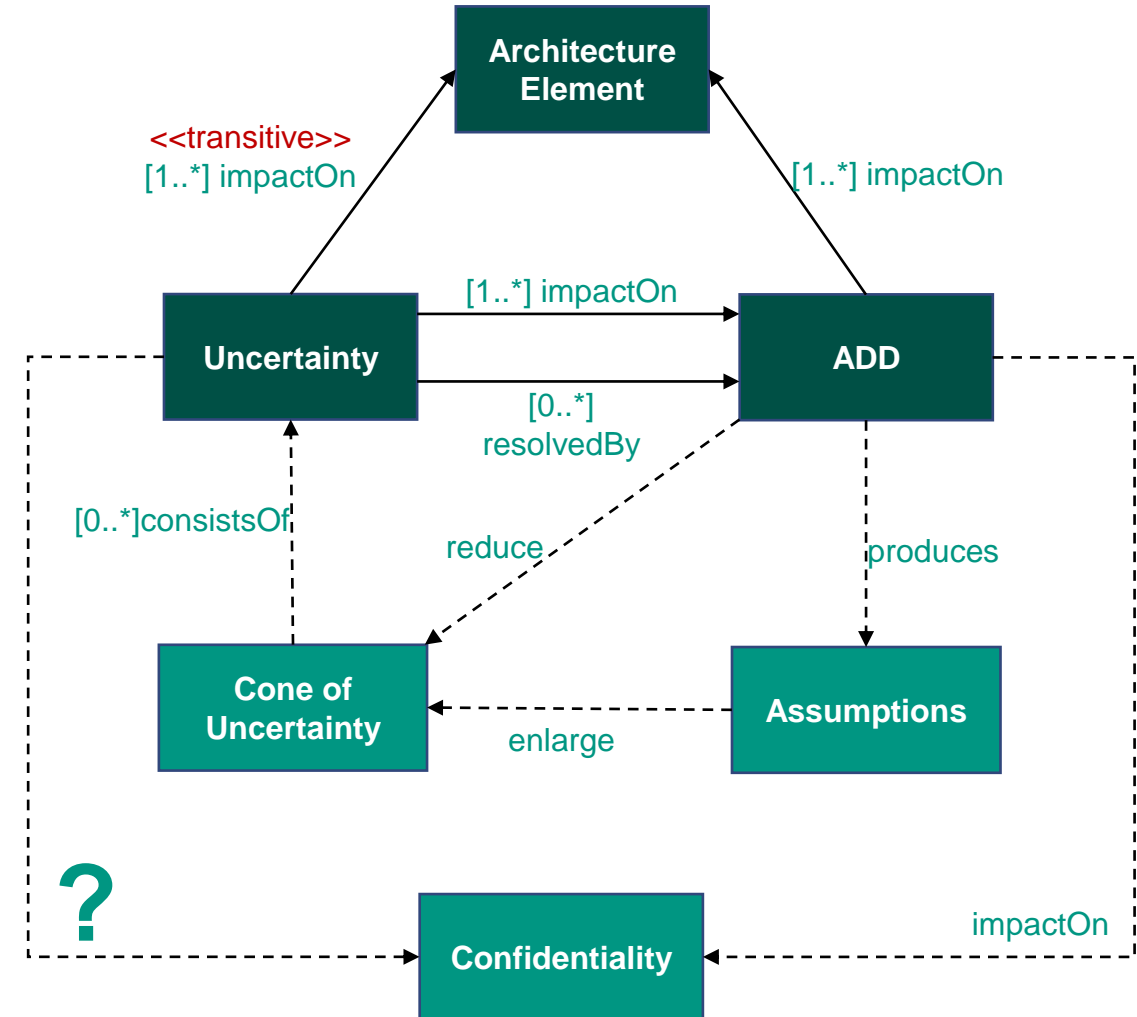
Concept Overview

- Expert: Specify uncertainty types
 - Guided by template
- User: Instantiate uncertainties
 - Tool Support, enhance architecture
- Uncertainty Impact Analysis
 - Propagate uncertainties
 - Based on pre-defined rules
- Retrieve statements of impact with regard to confidentiality
 - Direct impact (via template)
 - Indirect impact (via propagation)



Uncertainties in Software Architectures

- Jansen et al.: SWA = Set of ADD
 - Extract Uncertainties from existing ADDs
- Ex.: Communication Type
 - Resolvable, Design Time
- Ex.: Deployment Location
 - Partially resolvable (Assumption)
 - Deployment Time
- Ex.: Human Behavior
 - Not resolvable, Runtime
- Goal:
 - Assignment:
 - Uncertainty ↔ Palladio Element
 - Transitively via ADDs



Categorise Uncertainties

- Related work
 - Taxonomies for Self-adaptive Systems and others
 - None explicitly for uncertainty at architecture level
- Contribution: Template
 - Combines existing taxonomies + additional knowledge
 - Structure
 - ADD (1 : n) Uncertainties
 - -> Extract possible impact (See .xls file)
 - Architectural-based categories (ADD assessment)
 - ADD Class: Structural decision, behavioural decision, ...
 - ...
 - Uncertainty related categories
 - Location: Component, Interface, Context, ...
 - Manageability: Fully reducible, partial reducible, irreducible
 - Severity of the impact on confidentiality: High, Low, None
 - ...

Represent Uncertainties

■ Multi-Level Modelling

- We provide model (M2) for Experts (M1) AND Users (M1): $M2 \rightarrow M1 \rightarrow M1$
- (See next slide)

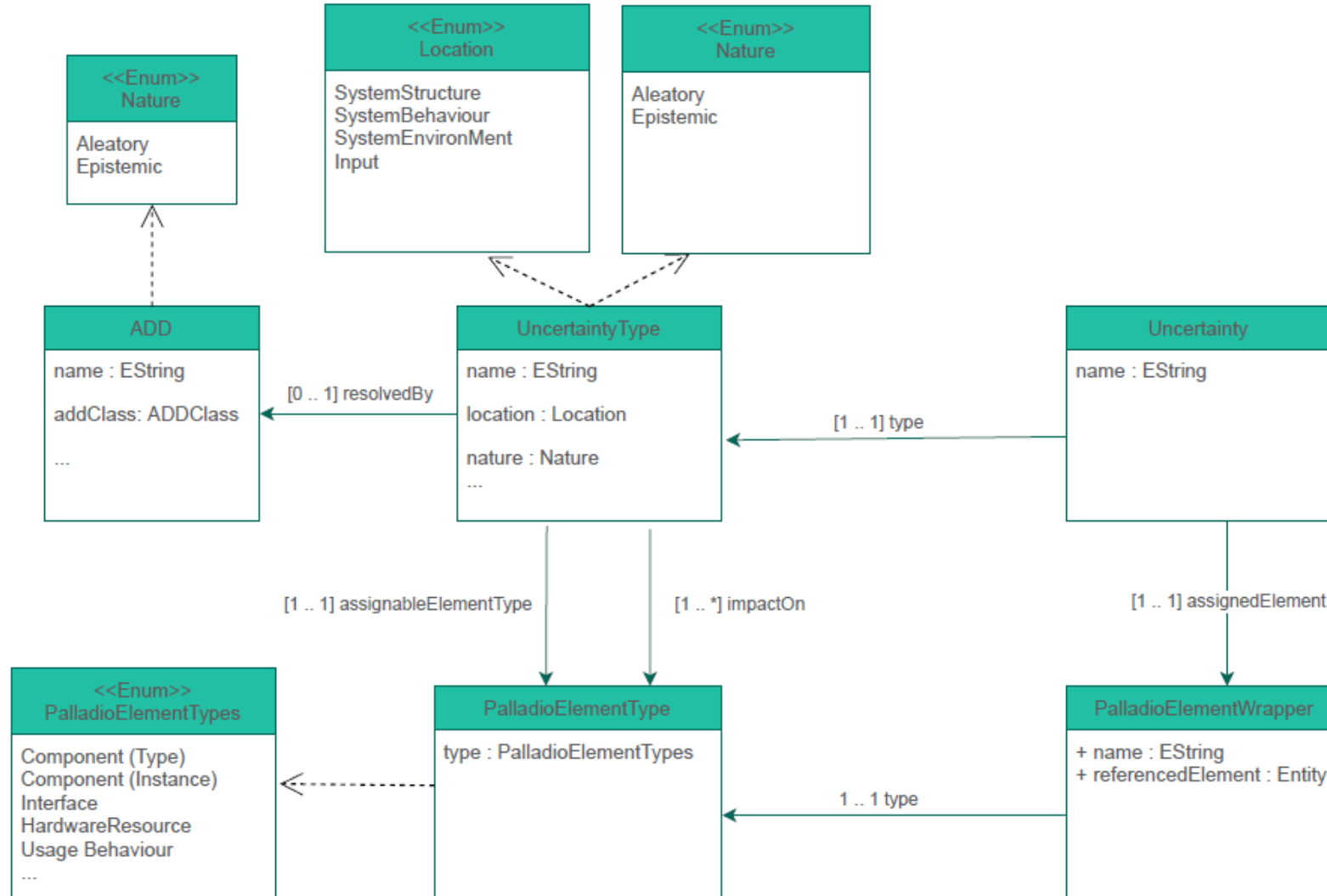
■ Experts

- Use template to identify and categorize uncertainties
- Define uncertainty types
 - Including attributes (nature, manageability, level, ...)
 - Representation: Assignable Palladio element type
 - Propagation rules: Palladio element types (defined via <<impact on>>)

■ Users

- Instantiate uncertainties (direct impact)
- Assign uncertainties to concrete Palladio elements

Represent Uncertainties: Model



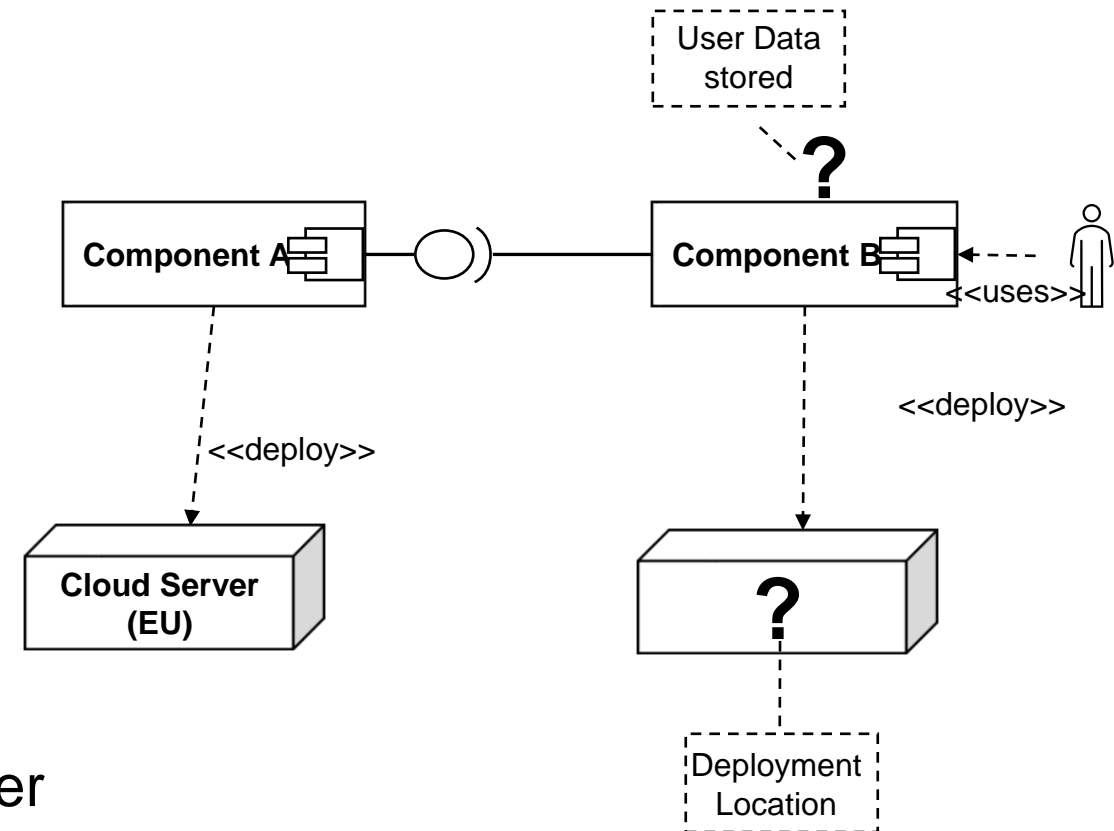
Represent Uncertainties: Example

■ Uncertainty Types:

- Defined by Experts
- T1: DeploymentLocation
 - Assignable Element: ResourceContainer
 - Impact: Interface (Communication)
 - Nature: Epistemic, ...
- T2: UserDataStored
 - Assignable Element: Component
 - Impact: DeploymentLocation
 - Nature: Epistemic, ...

■ Instantiated Uncertainties

- Defined by users in actual architectures
- U1: DeploymentLocation → Specific container
- U2: UserDataStored → Component B

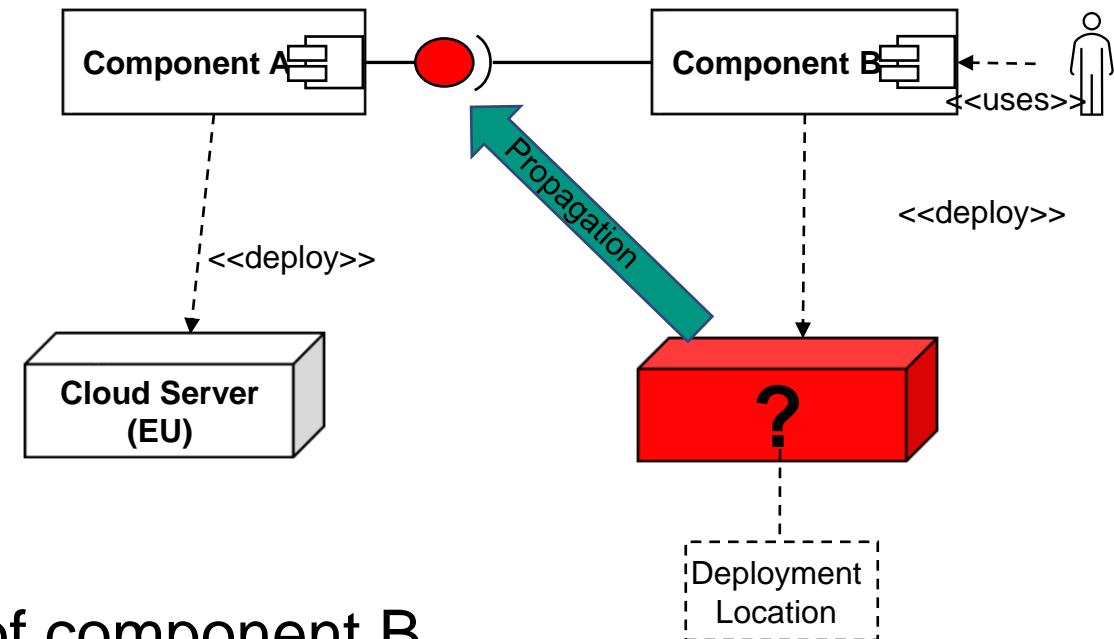


Uncertainty Propagation Rules

- Us: Pre-define propagation rules
 - Starting Palladio element & ending Palladio element
 - Algorithm to traverse Palladio models
 - Re-Use of KAMP-Approach?
 - Collect impacted elements
- Experts: Assign rules to uncertainty types
 - Type of starting element & ending element extracted from template
- User: Start Uncertainty Impact Analysis (UIA)
 - Assign instantiated uncertainty to Palladio elements
 - Start UIA → get impacted elements

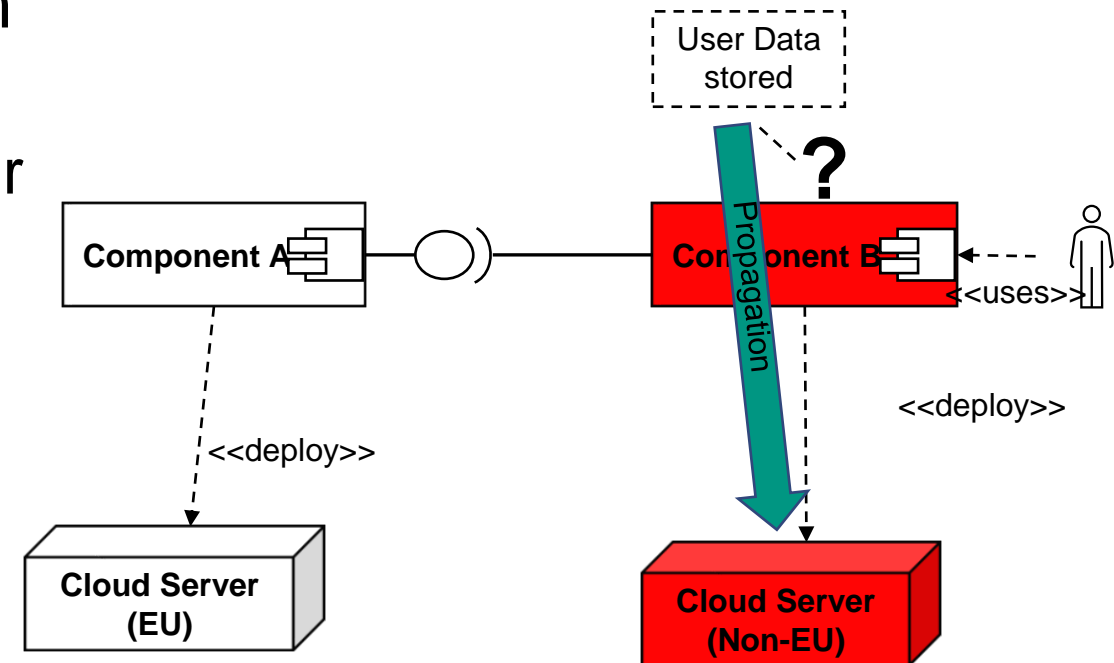
Uncertainty Propagation Rules: Example

- DeploymentLocation → CommunicationType
 - DeploymentLocation: Resource container
 - CommunicationType: Interfaces
- Rule:
 - ResourceContainer
 - Assemblies
 - (CompositeComponents)
 - BasicComponents
 - Interfaces
- Application of Rule:
 - Specific resource container to interface of component B



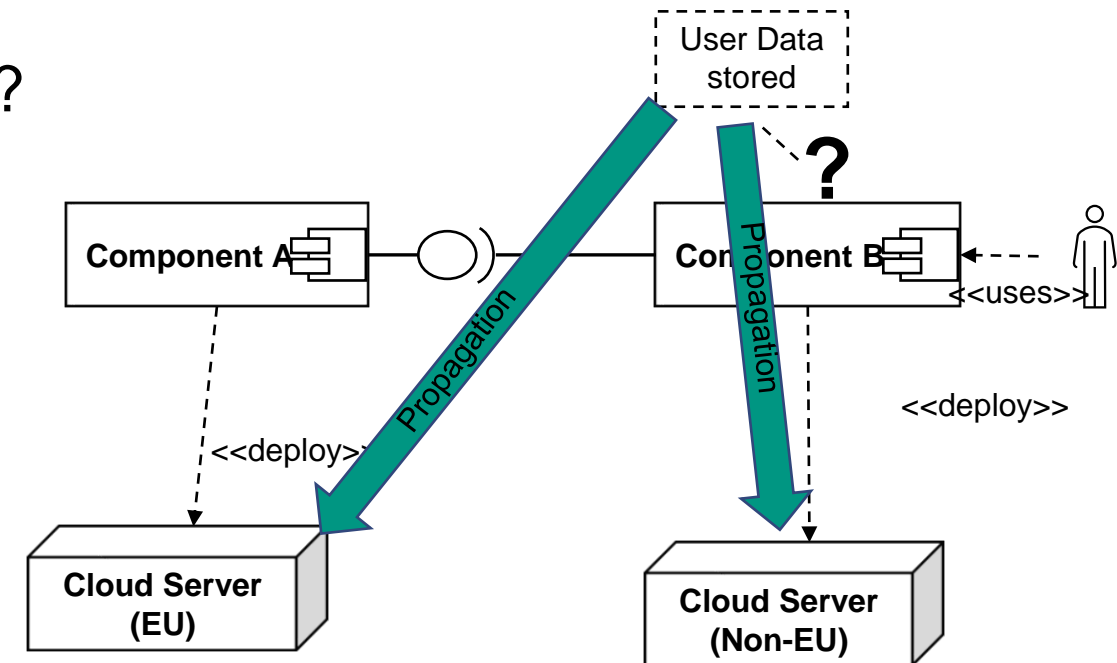
Uncertainty Propagation Rules: Example

- UserDataStored → DeploymentLocation
 - UserDataStored: Basic component
 - DeploymentLocation: Resource container
- Rule:
 - BasicComponents
 - (CompositeComponents)
 - Assemblies
 - ResourceContainers
- Application of Rule:
 - Specific component to resource container where it is deployed



Uncertainty Propagation Rules: Problem!

- “Depth” of propagation
 - What if data is transmitted via Interfaces?
 - Propagation to other components
- Problem:
 - Uncertainties might have impact on “everything”



Retrieve general Statements

- Use Uncertainty Impact Analysis Plugin to get information about...
 - Direct impact:
 - Presence of uncertainty with predefined impact assessment (categories/template)
 - Indirect impact:
 - Propagation of uncertainty to other (less obvious) architecture elements
- → statements regarding impact on confidentiality