



دانشگاه کردستان  
University of Kurdistan  
زانکۆی کوردستان

# Review of UML Diagrams

Sadegh Sulaimany  
info@Bioinfotmation.ir



Unified  
Modeling  
Language

Software Architecture Course

# Initial assessment

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1. What is new in UML 2.5?
2. What UML activity diagram is about?

# Agenda

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- › UML history
- › UML diagrams
- › UML vs. ERD
- › UML Tools
- › UML Research?

# UML

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## › Unified Modeling Language

- a general-purpose, developmental modeling language
  - › in the field of software engineering
- is intended to provide a standard way to visualize the design of a system
  
- Developed at Rational Software in 1994–1995
  - › In 1997 was adopted as a standard by the Object Management Group (OMG)
  - › In 2005, UML was also published
  - › by the International Organization for Standardization (ISO) as an approved ISO standard



# OMG

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- › Object Management Group<sup>®</sup> (OMG<sup>®</sup>)
  - is an international, open membership, not-for-profit technology standards consortium.
  - OMG standards are driven by vendors, end-users, academic institutions and government agencies.

# UML versions



ABOUT ▾

CERTIFICATIONS ▾

RESOURCES ▾

## HISTORY

### FORMAL VERSIONS

VERSION	ADOPTION DATE	URL
2.5.1	December 2017	<a href="https://www.omg.org/spec/UML/2.5.1">https://www.omg.org/spec/UML/2.5.1</a>
2.4.1	July 2011	<a href="https://www.omg.org/spec/UML/2.4.1">https://www.omg.org/spec/UML/2.4.1</a>
2.3	May 2010	<a href="https://www.omg.org/spec/UML/2.3">https://www.omg.org/spec/UML/2.3</a>
2.2	January 2009	<a href="https://www.omg.org/spec/UML/2.2">https://www.omg.org/spec/UML/2.2</a>
2.1.2	October 2007	<a href="https://www.omg.org/spec/UML/2.1.2">https://www.omg.org/spec/UML/2.1.2</a>

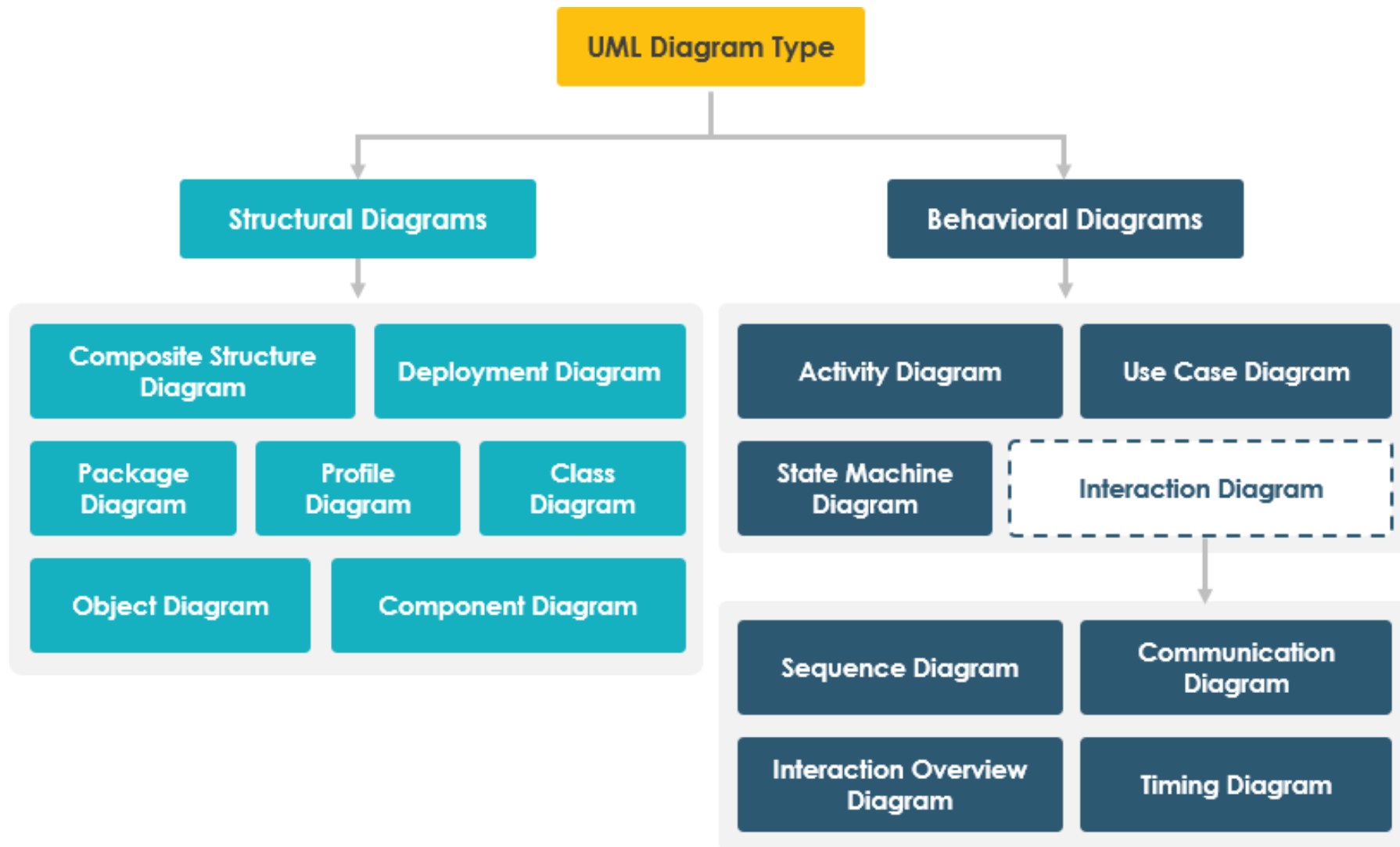


# Main purposes of UML

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- Provide users with a ready-made, expressive visual modeling language
  - so they can develop and communicate meaningful models in a collaborative team effort.
- Provides extensibility and specialization mechanisms for core concepts.
- Independent of a specific programming language and development process.
- Provides a formal foundation for understanding modeling languages.
- Encourage the development of the market for object-oriented tools.
- Support for higher level development concepts
  - such as collaboration, frameworks, patterns and components.
- Integrate Best Practices.

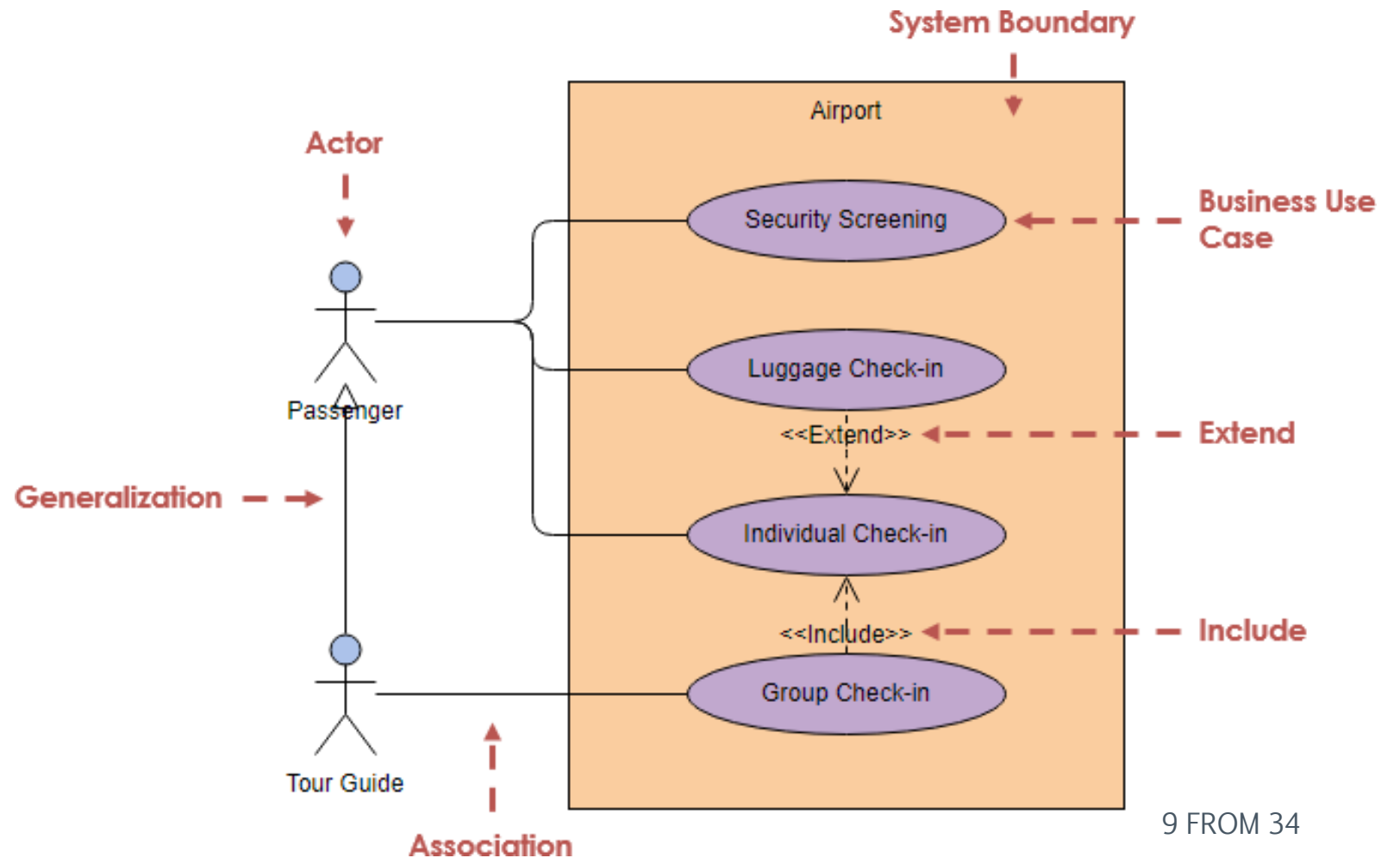
# 14 Types of UML Diagrams





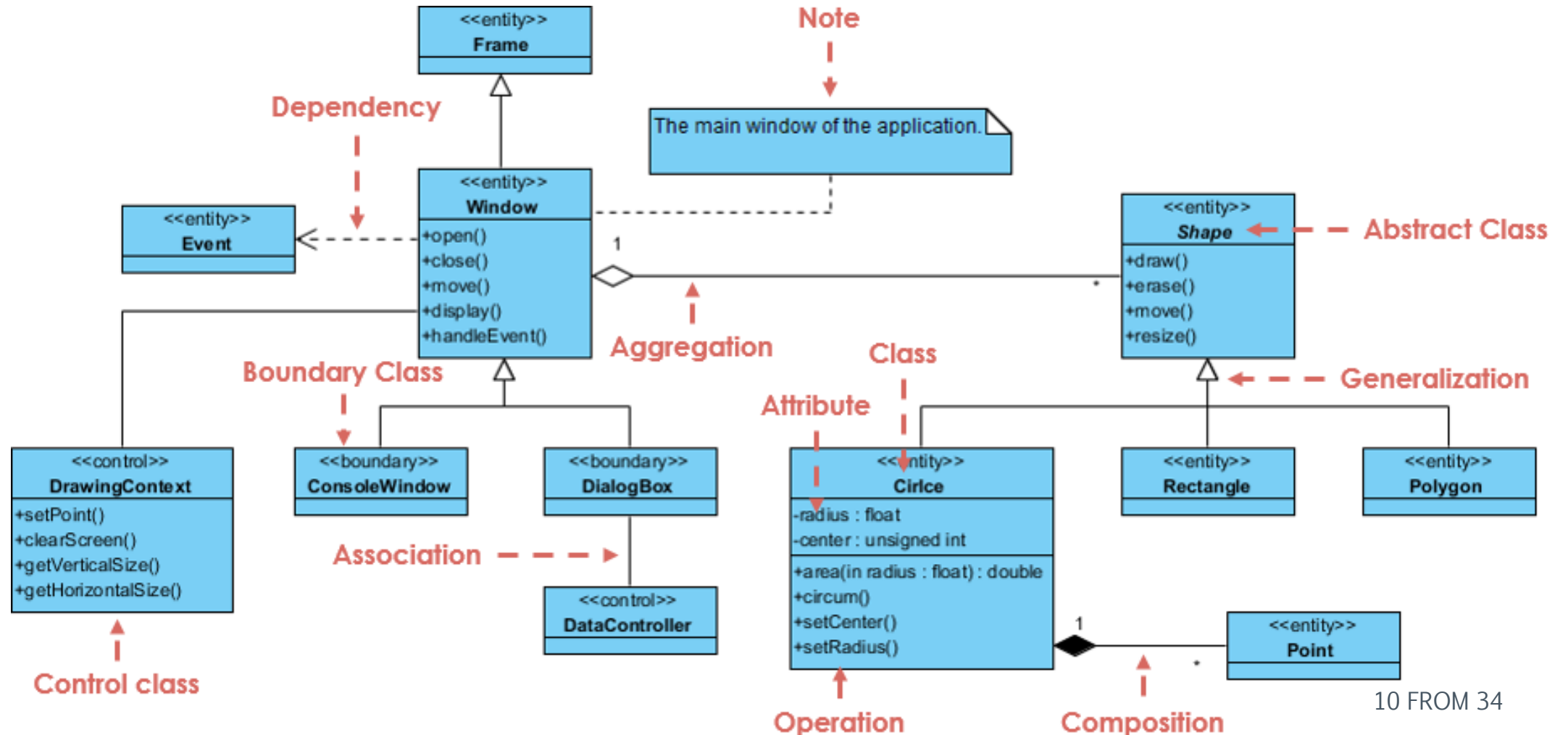
# 1. Use Case Diagrams

- consists of use cases, roles, and the relationships between them.
  - > It shows how users interact with the system and defines the specifications of the use cases



# 2. Class Diagram

- › a static diagram that describes the structure of a system by showing its classes and their properties and operations, as well as the relationships between objects.

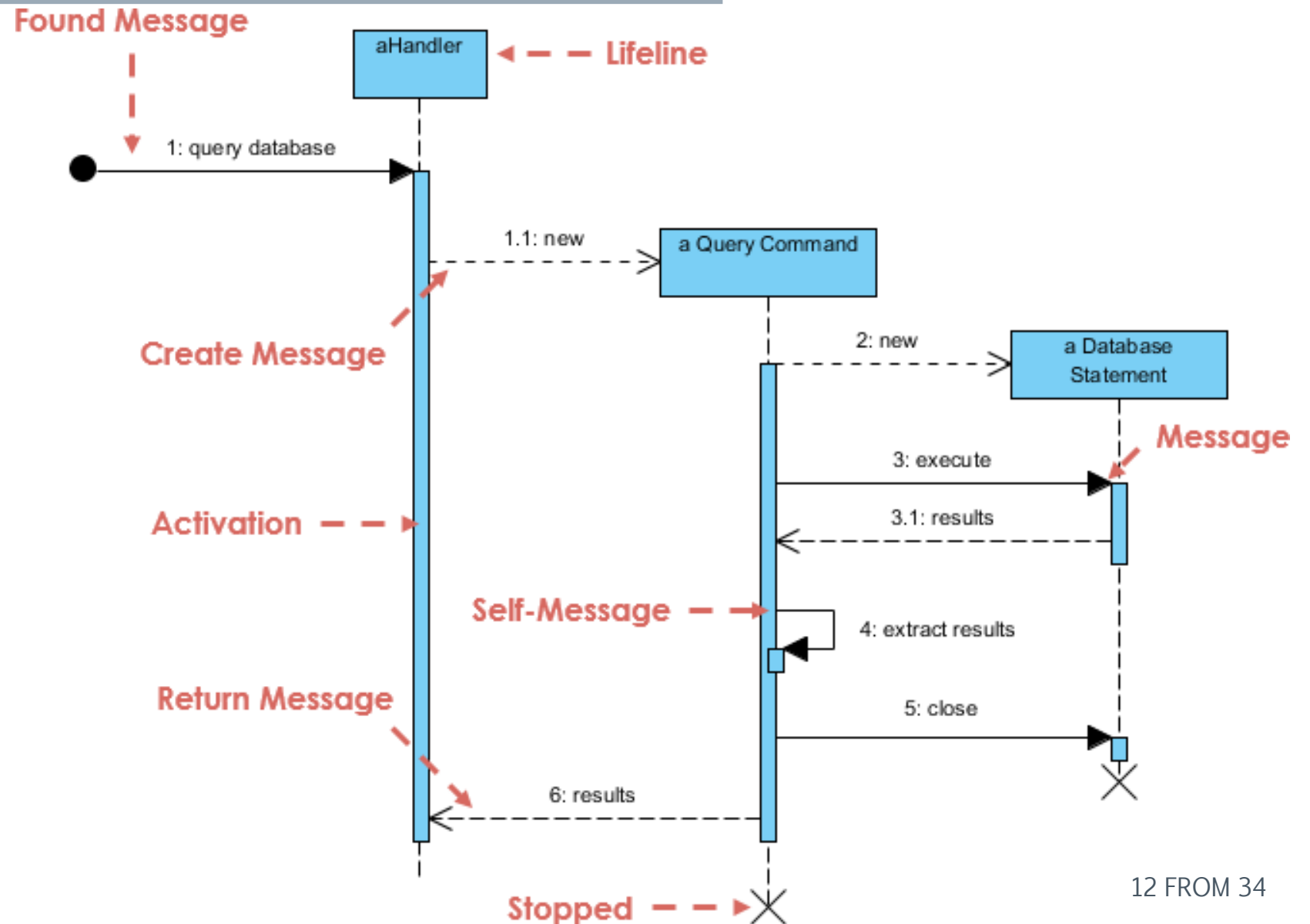


# 3. Sequence Diagram

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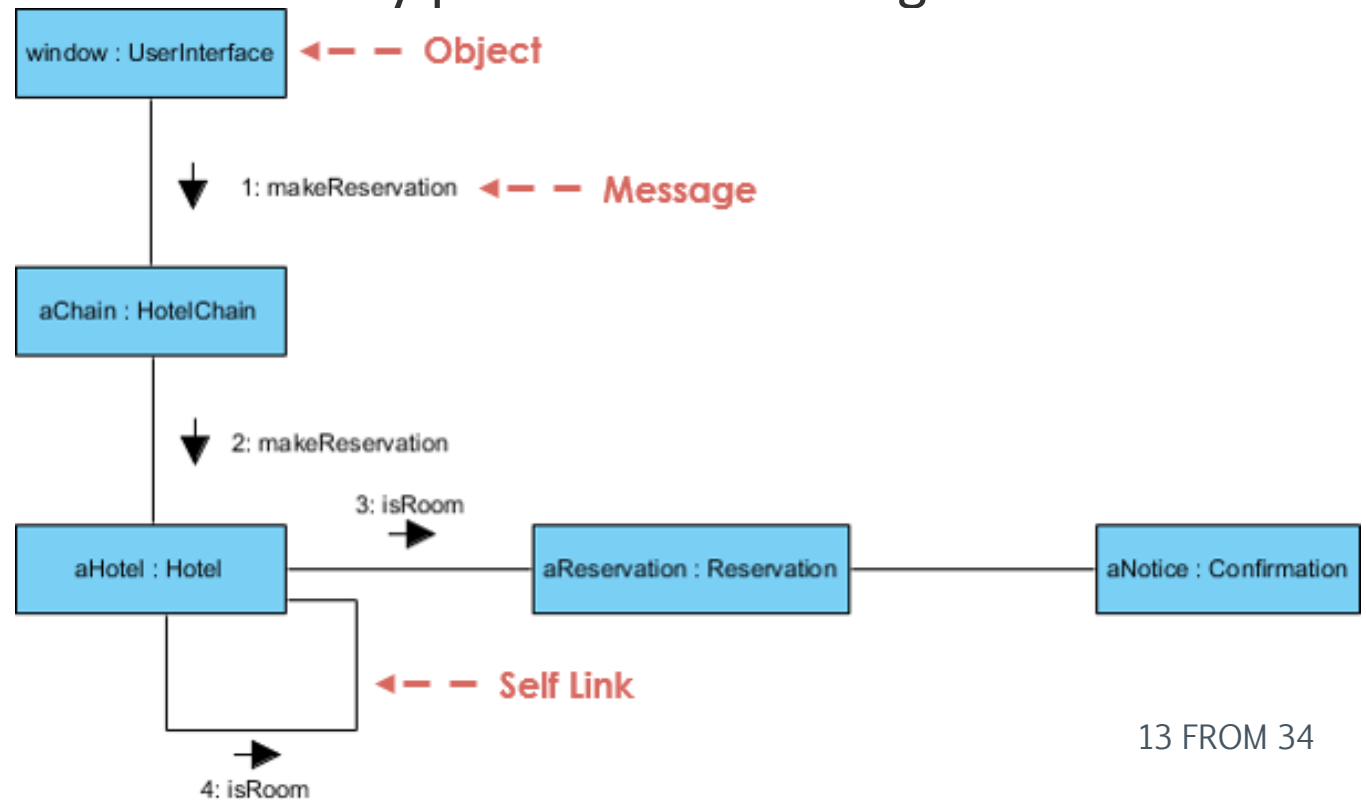
- › is a model for communication between objects in a sequential manner
  - It shows the exact order of objects, classes and roles and information involved in a scenario. It consists of vertical lines belonging to lifelines and horizontal lines of messages.

# 3. Sequence Diagram



# 4. Communication (Collaboration) Diagram

- › shows the interaction between objects and parts in the form of messages, which are represented by lifelines.
- A communication diagram is a modified form of a UML sequence diagram, but differs from it in that its elements do not need to be horizontally ordered and can have any position in the diagram.

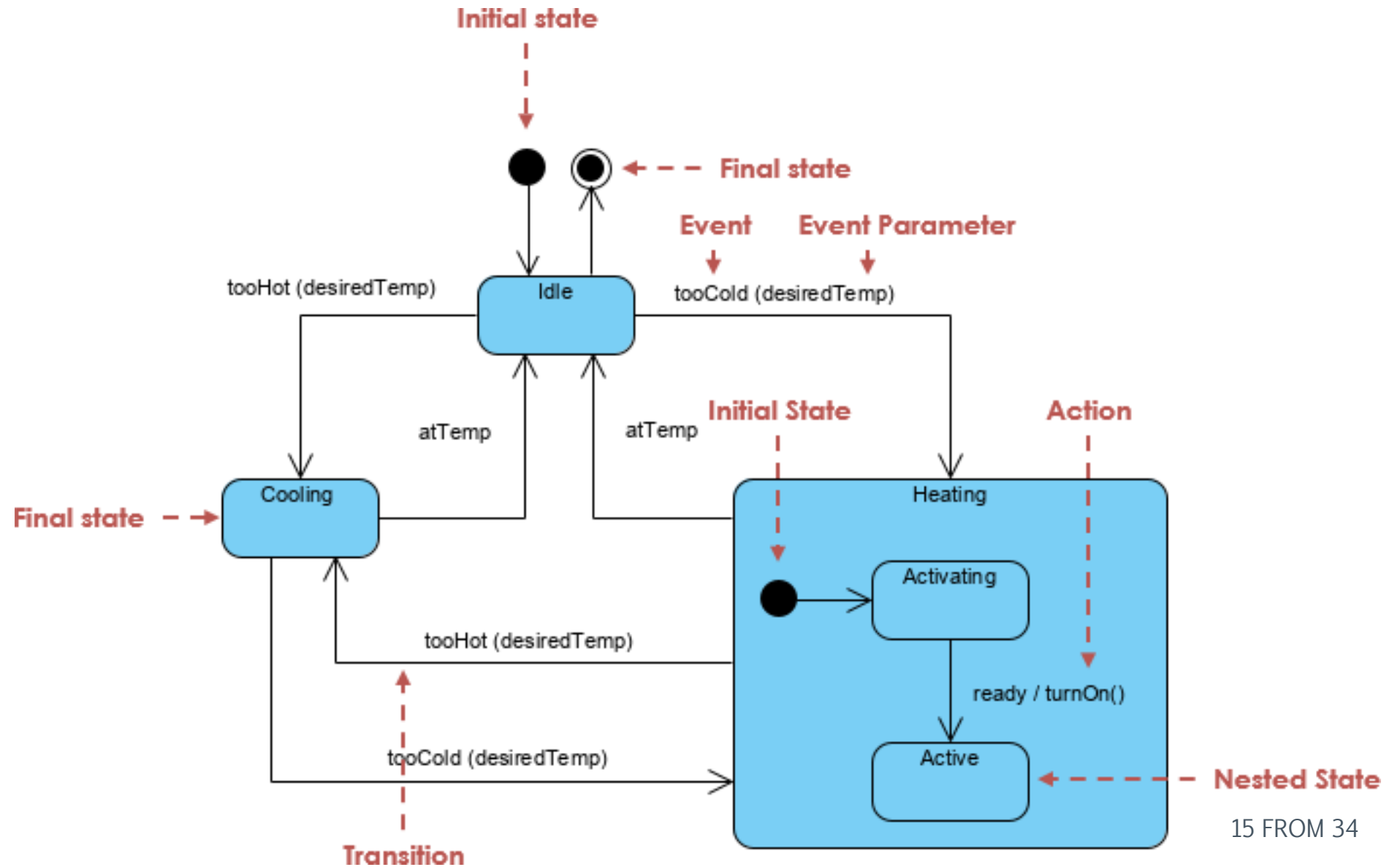


## 6. State Machine Diagram

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- › describes the state of an entity (device, process, program, software, module, etc.) and the transitions between states.
  - The conditions specify when a transition from one state to another can be used.

# 6. State Machine Diagram



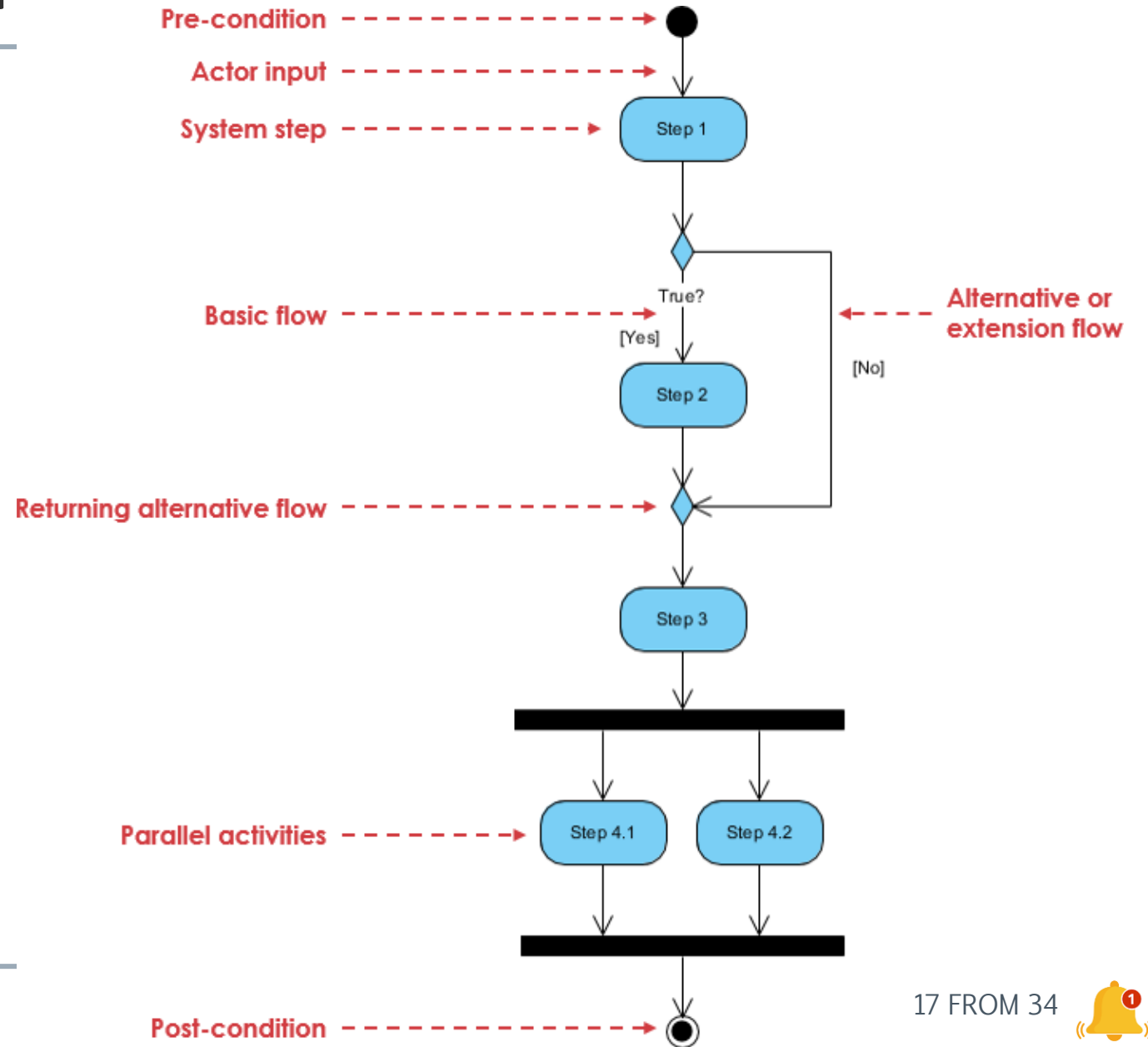
# 5. Activity Diagram

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- › shows a scenario in terms of the flow of actions
  - graphical representations of workflows of stepwise activities and actions with support for choice, iteration and concurrency
  - used by developers to understand the flow of programs on a high level.

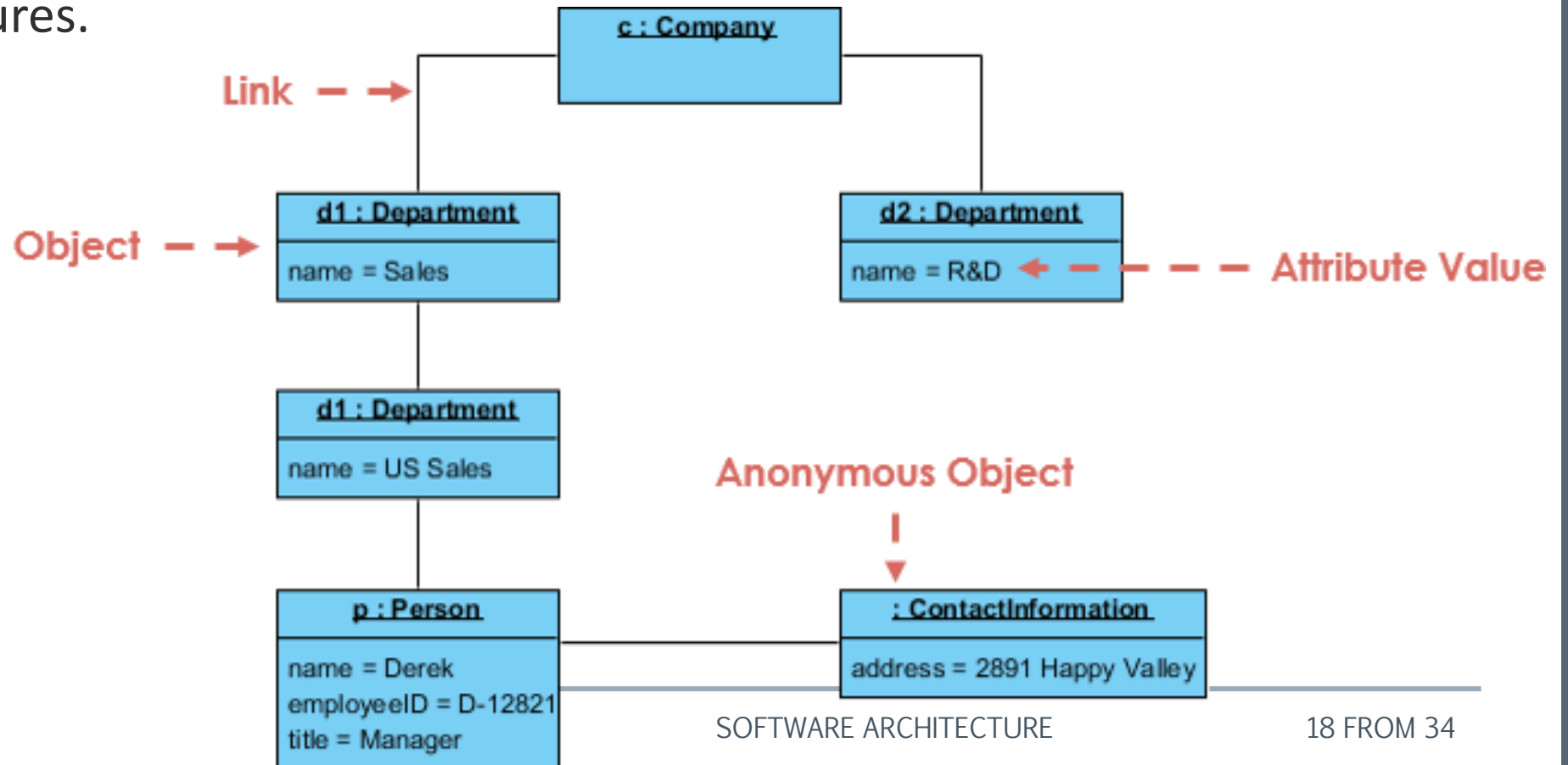


# 5. Activity Diagram



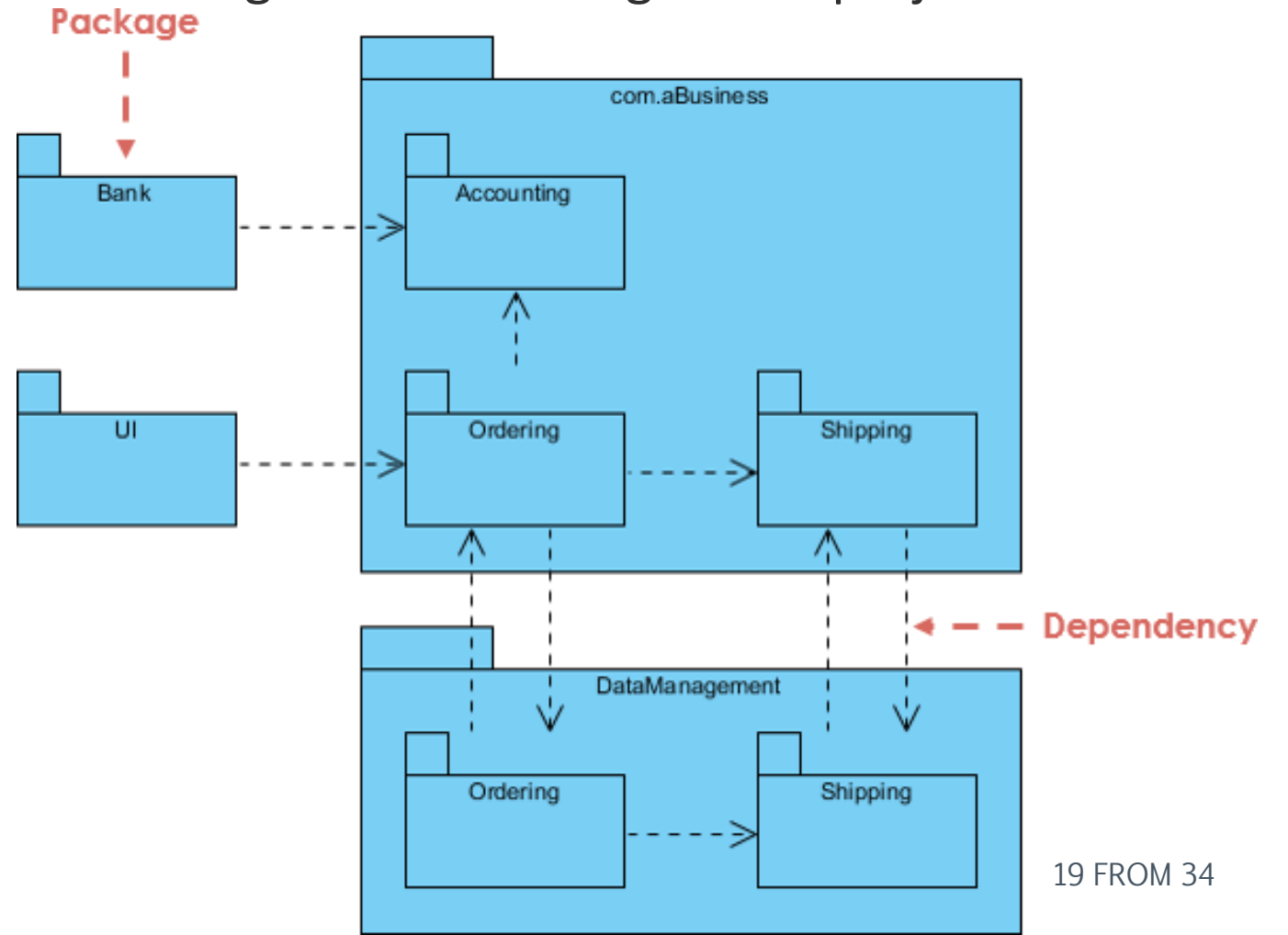
# 7. Object Diagram

- › is a structured UML diagram
  - It describes a system or its parts at a particular time. It models instances, their values and relationships. It can be used to show examples of data structures.



# 8. Package Diagram

- › shows the dependencies between packages in a model.
  - It describes the structure and organization of large-scale projects

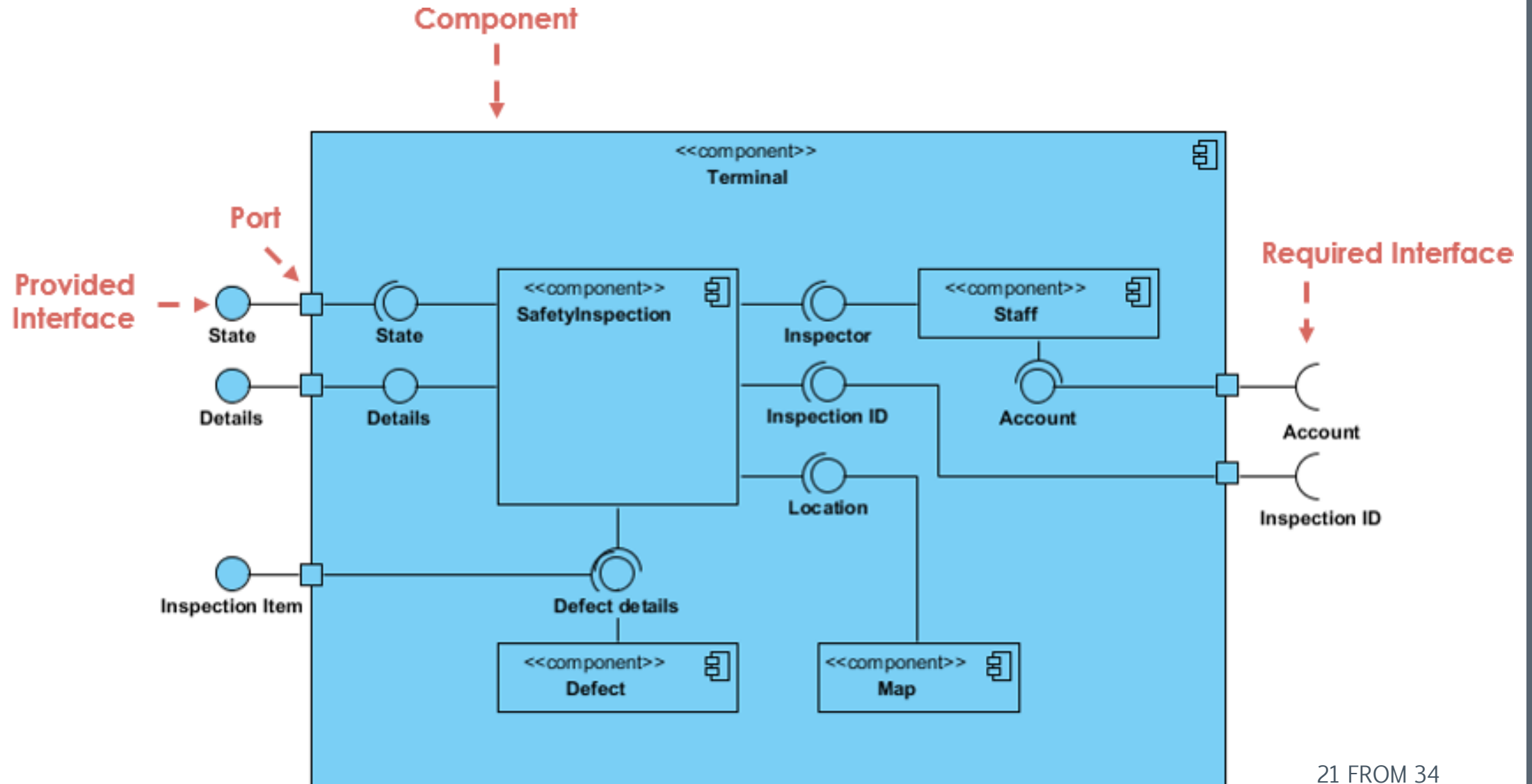


# 9. Component Diagram

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- › provides a view of a complex system
  - It describes the interfaces provided and/or required by the various parts of the system and the relationships between the parts. These parts are represented by components and other artifacts.

# 9. Component Diagram

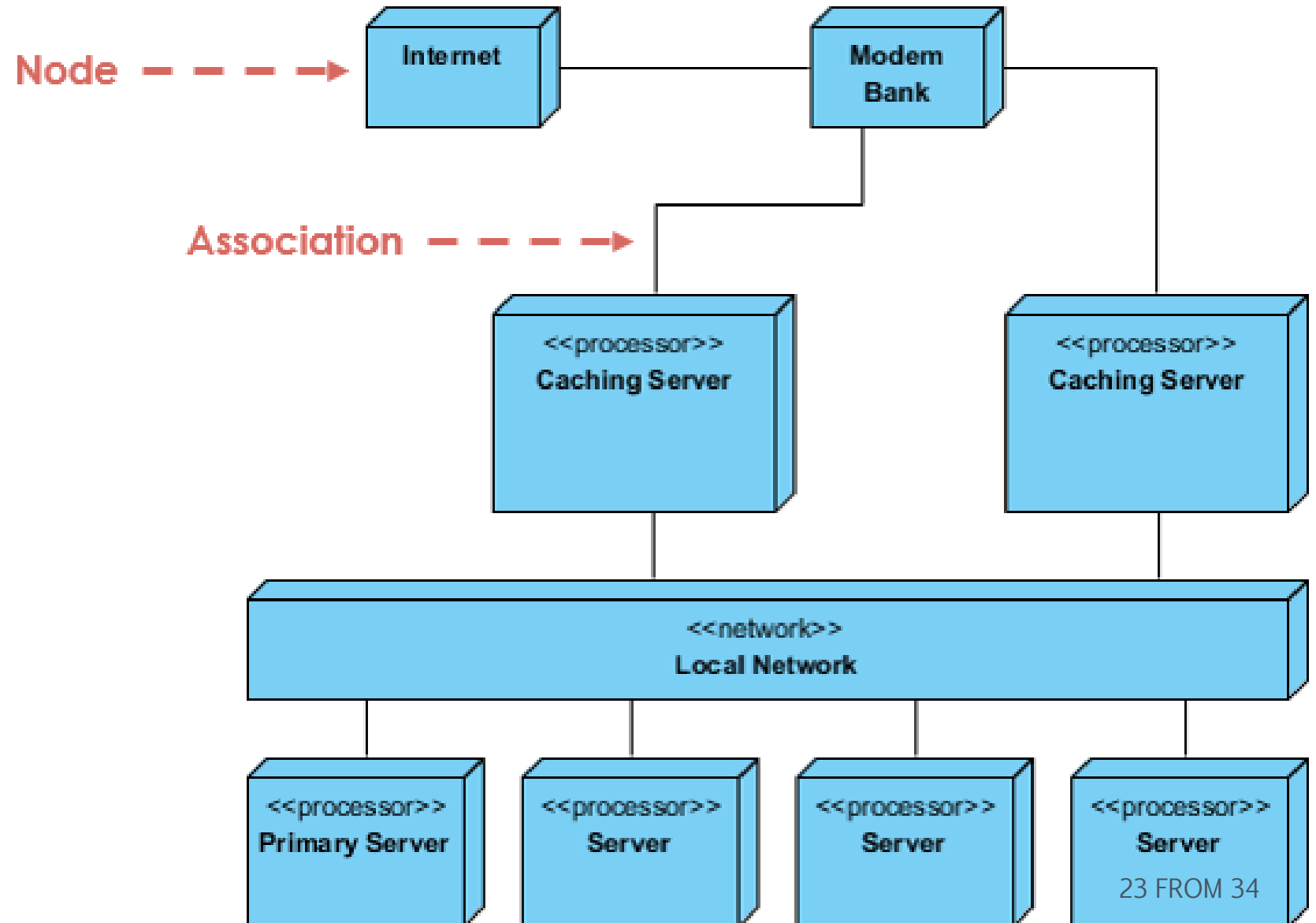


# 10. Deployment Diagram

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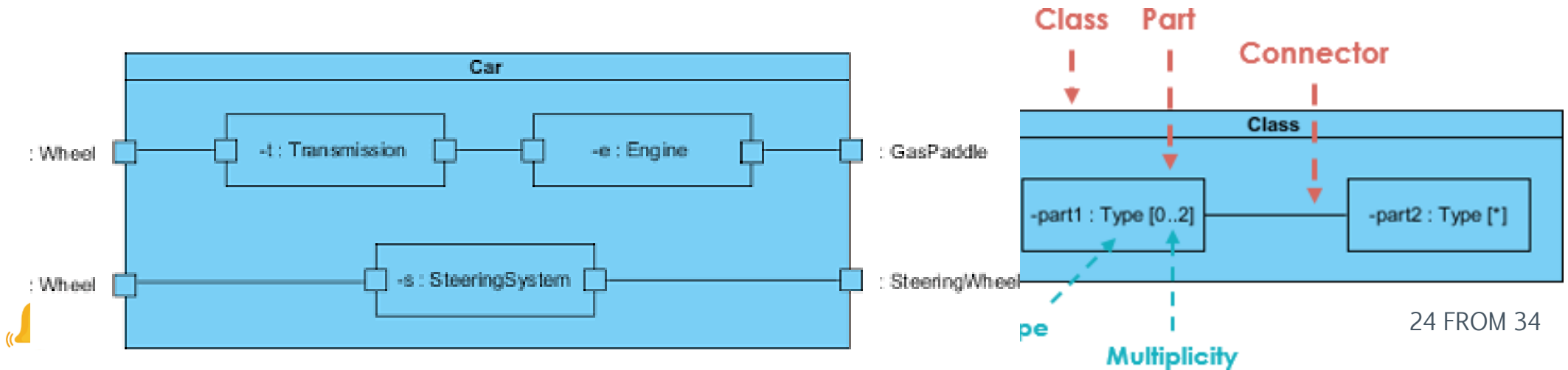
- › describes the deployment of artifacts on a network node
  - It is used to show the location of artifacts (software, systems, modules, etc.) on physical nodes (hardware, servers, databases, etc.) and the relationships between specific parts of the solution.

# 10. Deployment Diagram



# 11. Composite Structure Diagram

- contains classes, interfaces, packages, and their relationships
- provides a logical view of all, or part of a software system.
- It shows the internal structure (including parts and connectors) of a structured classifier or collaboration.
- performs a similar role to a class diagram, but allows you to go into further detail in describing the internal structure of multiple classes and showing the interactions between them.
- You can graphically represent inner classes and parts and show associations both between and within classes.



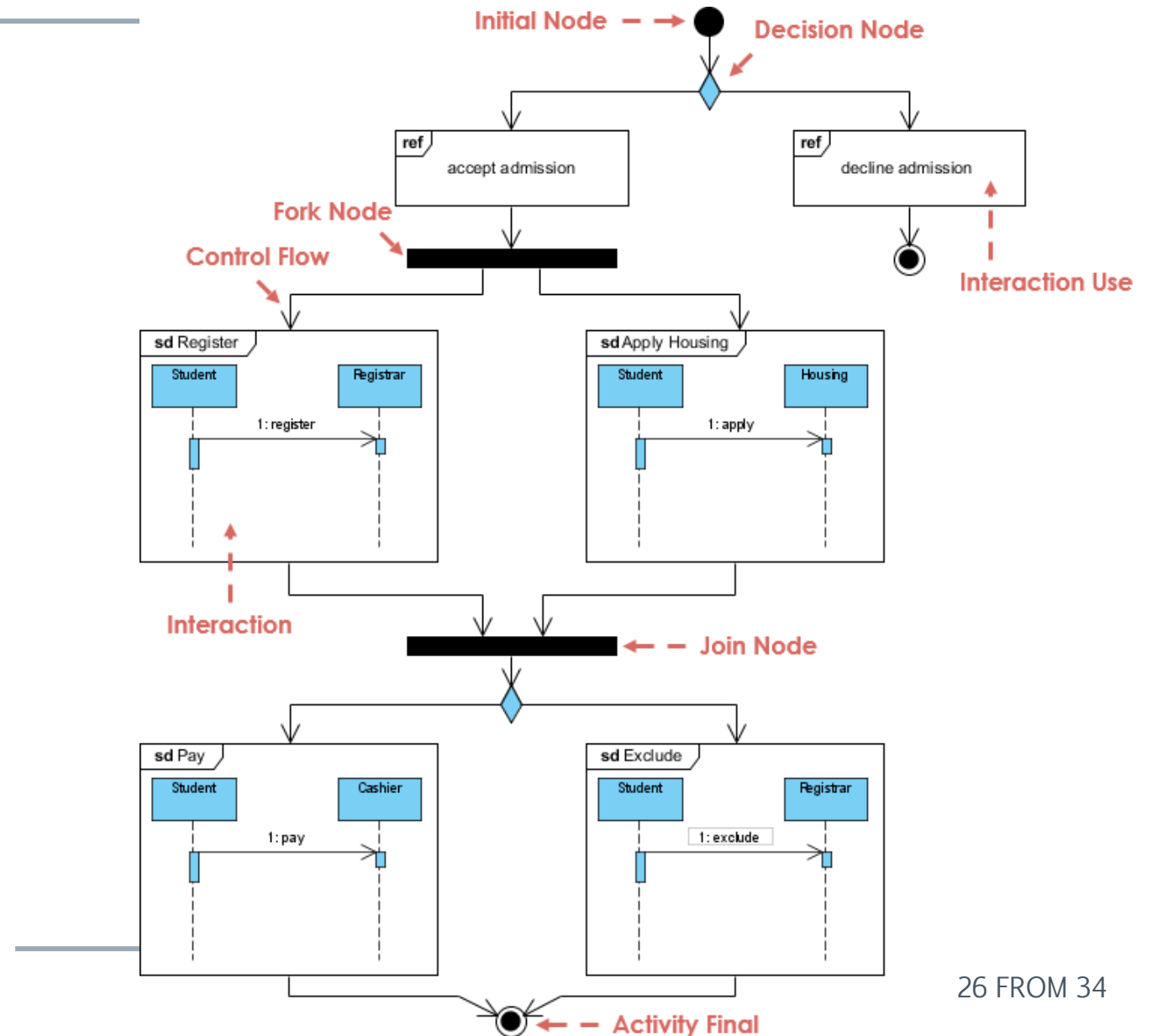


# 12. Interaction Overview Diagram

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- › provides a high level view of the interactions in a system or subsystem.
  - It describes processes in a similar way to activity diagrams, but it uses other interaction diagrams and interaction references rather than action nodes.

# 12. Interaction Overview Diagram

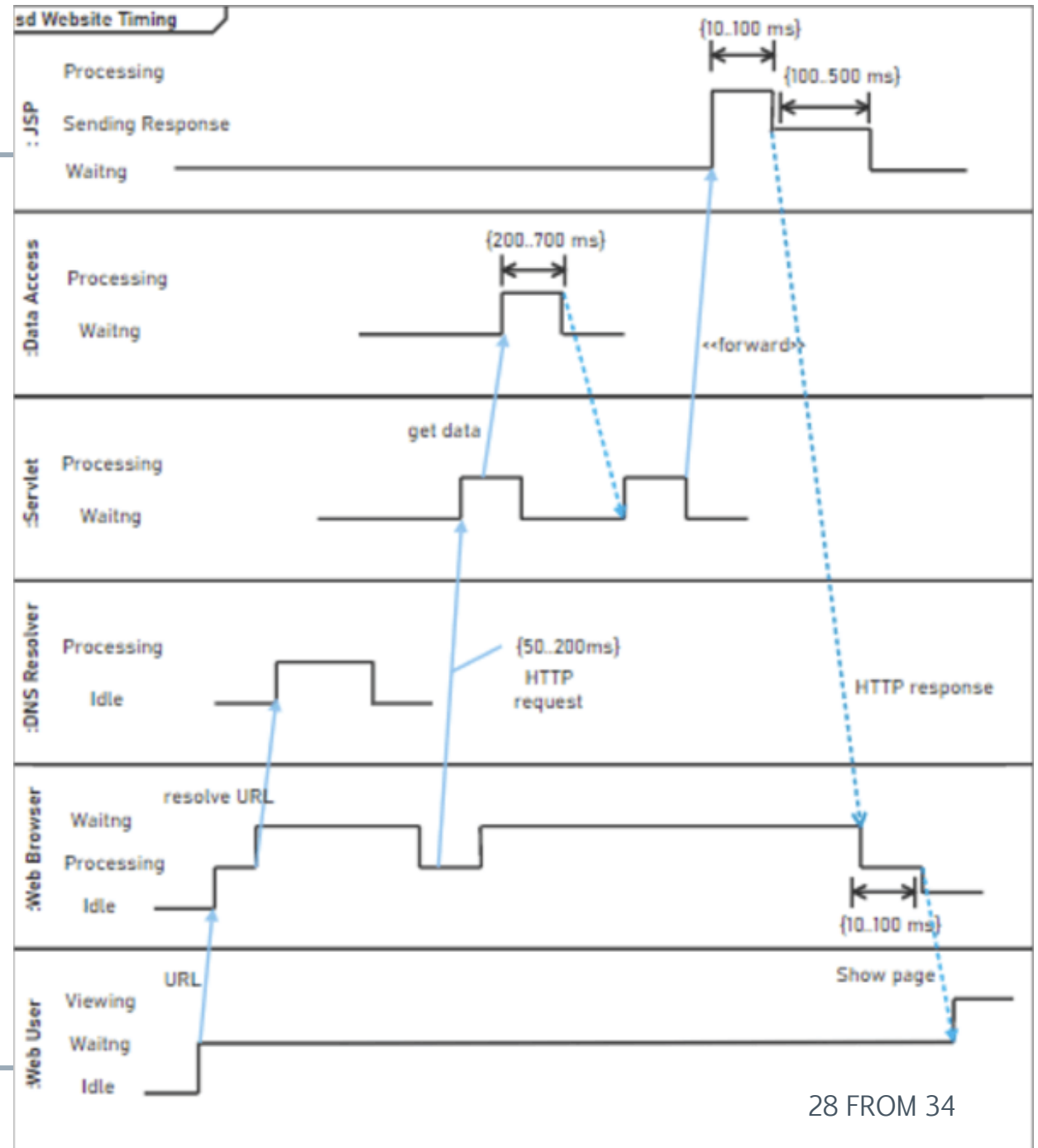


# 13. Timing Diagrams

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- › focuses primarily on time
  - are somewhat similar to sequence diagrams, as they represent the object's behavior in the given time.
  - The timelines are stacked vertically, with time increasing from left to right.

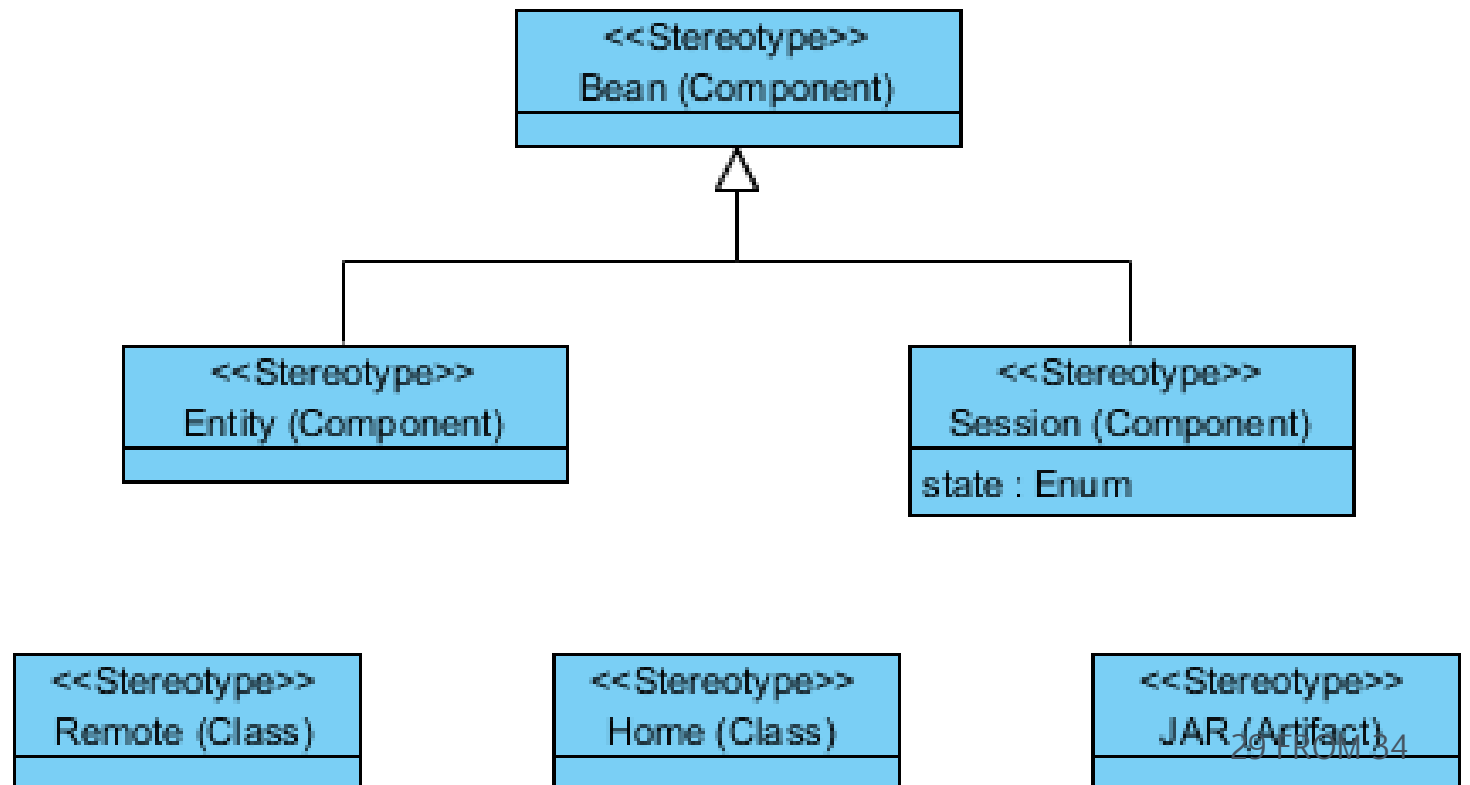
# 13. Timing Diagrams



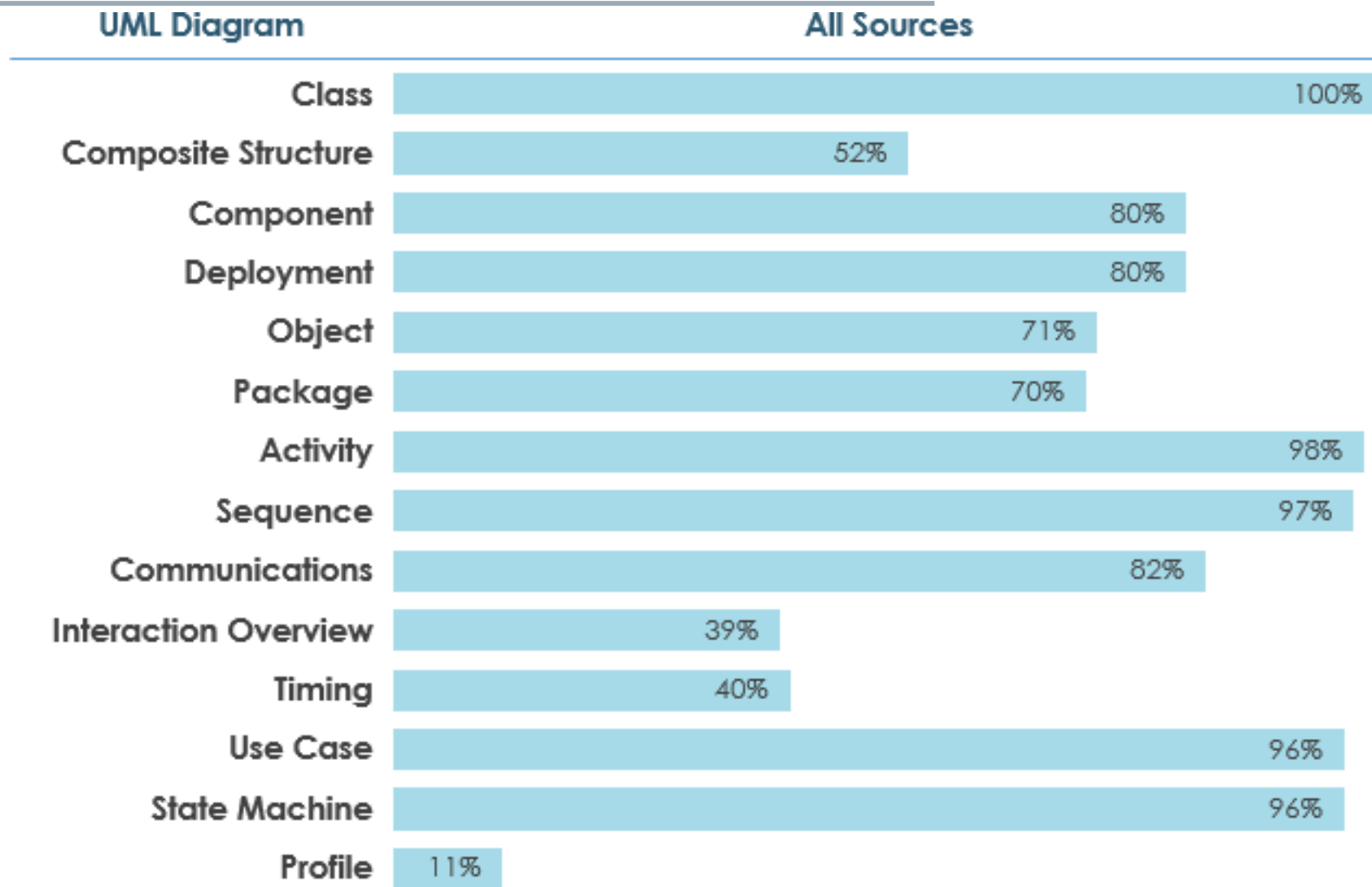
# 14. Profile Diagram

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- › describes and defines extensions to the UML language.
  - The extension mechanism allows you to adapt the language to a specific domain or platform.
  - Extensions are defined by stereotyping.

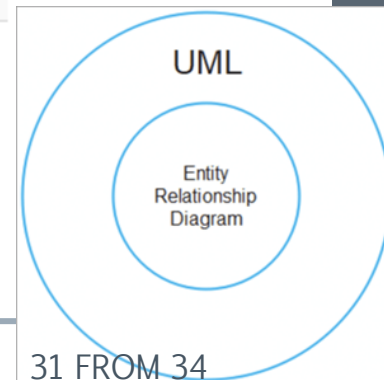


# Diagram frequency use





















# UML Vs. ER Diagram

	Unified Modeling language (UML)	Entity Relationship Diagram
<b>Definition</b>	UML diagrams represent the main objects used in software development, and allow visualization of these objects. This is also referred to as a blueprint for how an application will be built.	In ER diagrams, the objects and their relationships are represented graphically.
<b>Relationships</b>	UML diagrams are supersets of ER diagrams.	The ER diagram corresponds to the UML diagram.
<b>Usage</b>	Design and tracking the entire software architecture are done with it.	In it, database designs and implementations are handled.



# UML tools

 Visual Paradigm Proprietary software	 StarUML GNU General Public License	 Software Ideas Modeler Freeware
 ArgoUML Eclipse Public License	 Enterprise Architect Proprietary software	 UModel
 Papyrus Eclipse Public License	 MagicDraw Proprietary software	 Astah* Professional
 PlantUML GNU General Public License	 NClass GNU General Public License	 GenMyModel Freeware
 Micro Focus Together Proprietary software	 JetUML GNU General Public License	 Rational Rhapsody
 Umbrello UML Modeller GNU General Public License	 Objecteering	 Poseidon for UML

- Everybody test a tool, all the class provide a comparative report





# UML research?

- Everybody report a desired related paper

The screenshot shows a Google Scholar search interface. The search bar contains the text 'uml'. Below the search bar, the results are categorized under 'Articles' with a count of 'About 29,500 results (0.05 sec)'. On the left side, there are filters for 'Any time', 'Since 2023', 'Since 2022', 'Since 2019', and 'Custom range...'. There are also options to 'Sort by relevance' (selected), 'Sort by date', 'Any type', and 'Review articles'. At the bottom of the filters, there are checkboxes for 'include patents', 'include citations' (checked), and 'Create alert'. The search results list three articles:

- Model-based testing using UML activity diagrams: A systematic mapping study**  
T Ahmad, J Iqbal, A Ashraf, D Truscan... - Computer Science Review, 2019 - Elsevier  
... We present a comprehensive overview of the existing approaches on model-based testing using UML ADs. We conclude that (1) UML ADs are not being used for non-functional testing, ...  
☆ Save 🔗 Cite Cited by 70 Related articles All 8 versions
- UML diagrams in software engineering research: a systematic literature review**  
H Koç, AM Erdoğan, Y Barjakly, S Peker - Proceedings, 2021 - mdpi.com  
... with the UML. The constraints of a system are also shown with the UML [4]. Hence, many researchers who work as software engineers publish papers about how UML diagrams are ...  
☆ Save 🔗 Cite Cited by 20 Related articles 🔗
- Combining UML and ontology: An exploratory survey**  
MM Mkhinini, O Labbani-Narsis, C Nicolle - Computer Science Review, 2020 - Elsevier  
... To better identify the relation between ontologies and the different UML diagrams or the UML language in general, we ask the following question: «What elements of the UML standard ...  
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Below these, there is a fourth article partially visible:

- UML Modeling and Black Box Testing Methods in the School Payment Information System**  
IR Munthe, BH Rambe, R Pane, D Irmayani... - Jurnal Mantik, 2020 - iocscience.org  
... Model UML is ... UML is a computer modeling and visual communication language that uses diagrams and text support. The use of UML is thus not restricted to a single method, but UML ...

Question?

Bioinformation.ir

info@Bioinformation.ir