Architectural Framework

CS6.401 Software Engineering

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SERC

Software Engineering Research Centre
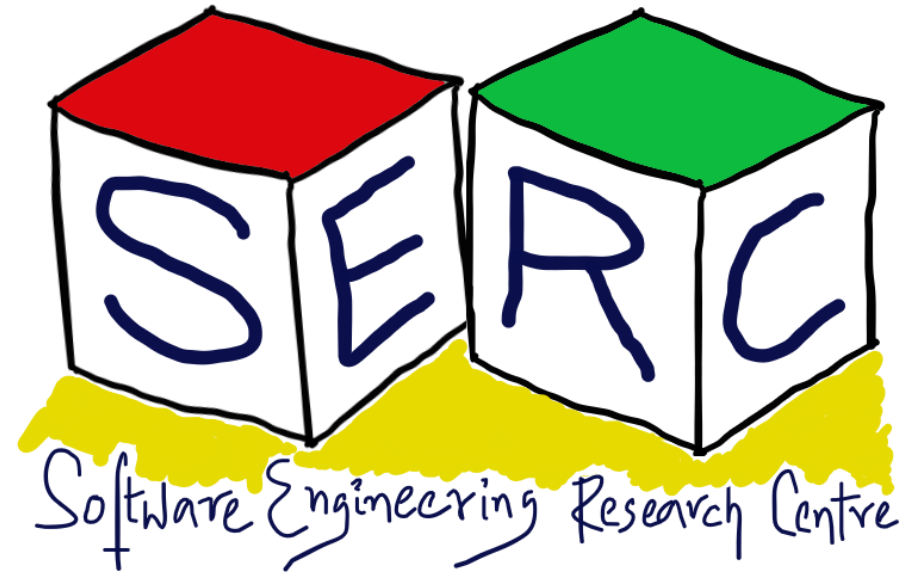
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HYDERABAD

Acknowledgements

The materials used in this presentation have been gathered/adapted/generate from various sources as well as based on my own experiences and knowledge -- Karthik Vaidhyanathan
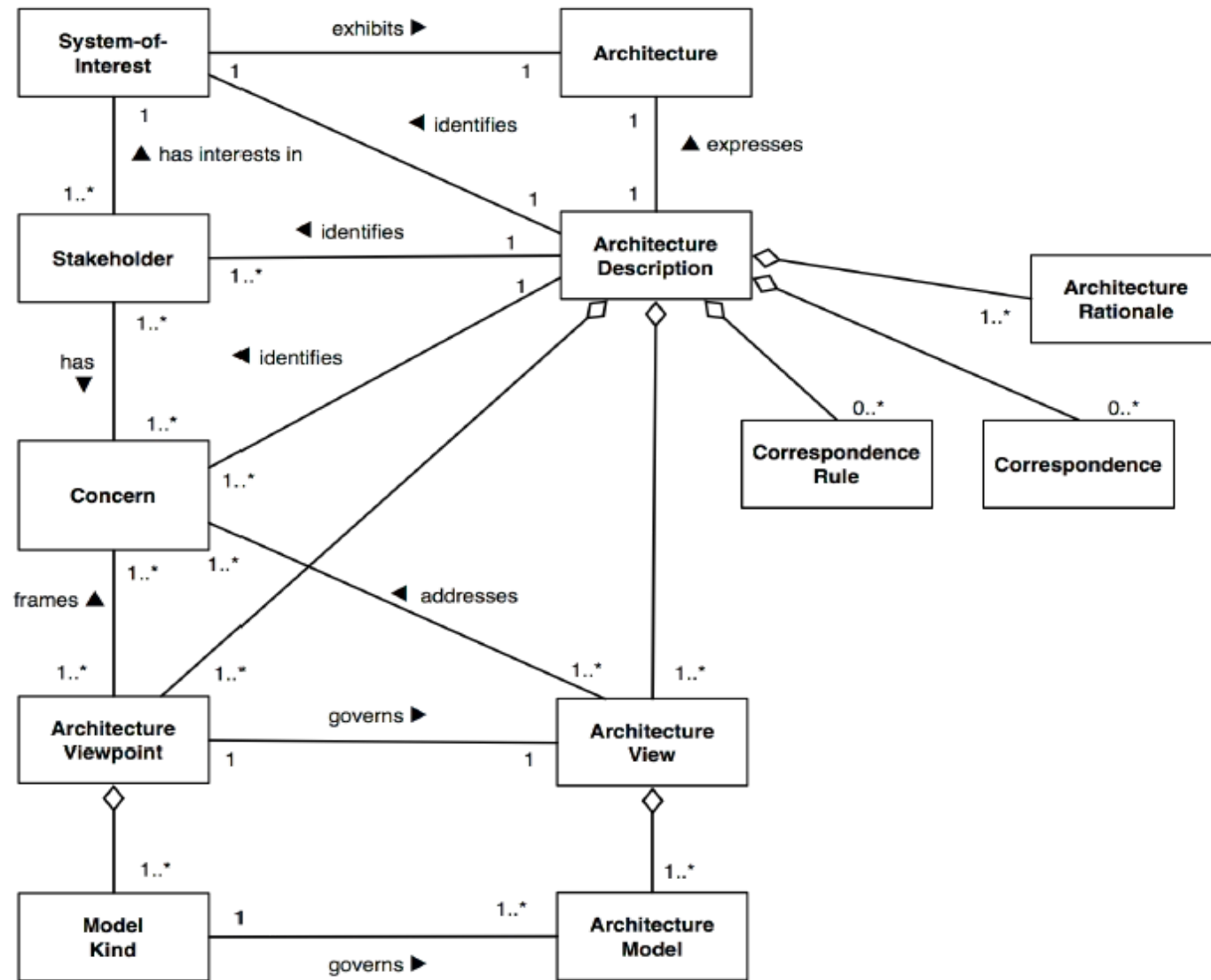
Sources:

1. Software Architecture in Practice, Len Bass, 3rd edition
2. ISO/IEC/IEEE 42010, Systems and Software Engineering – Architecture Description
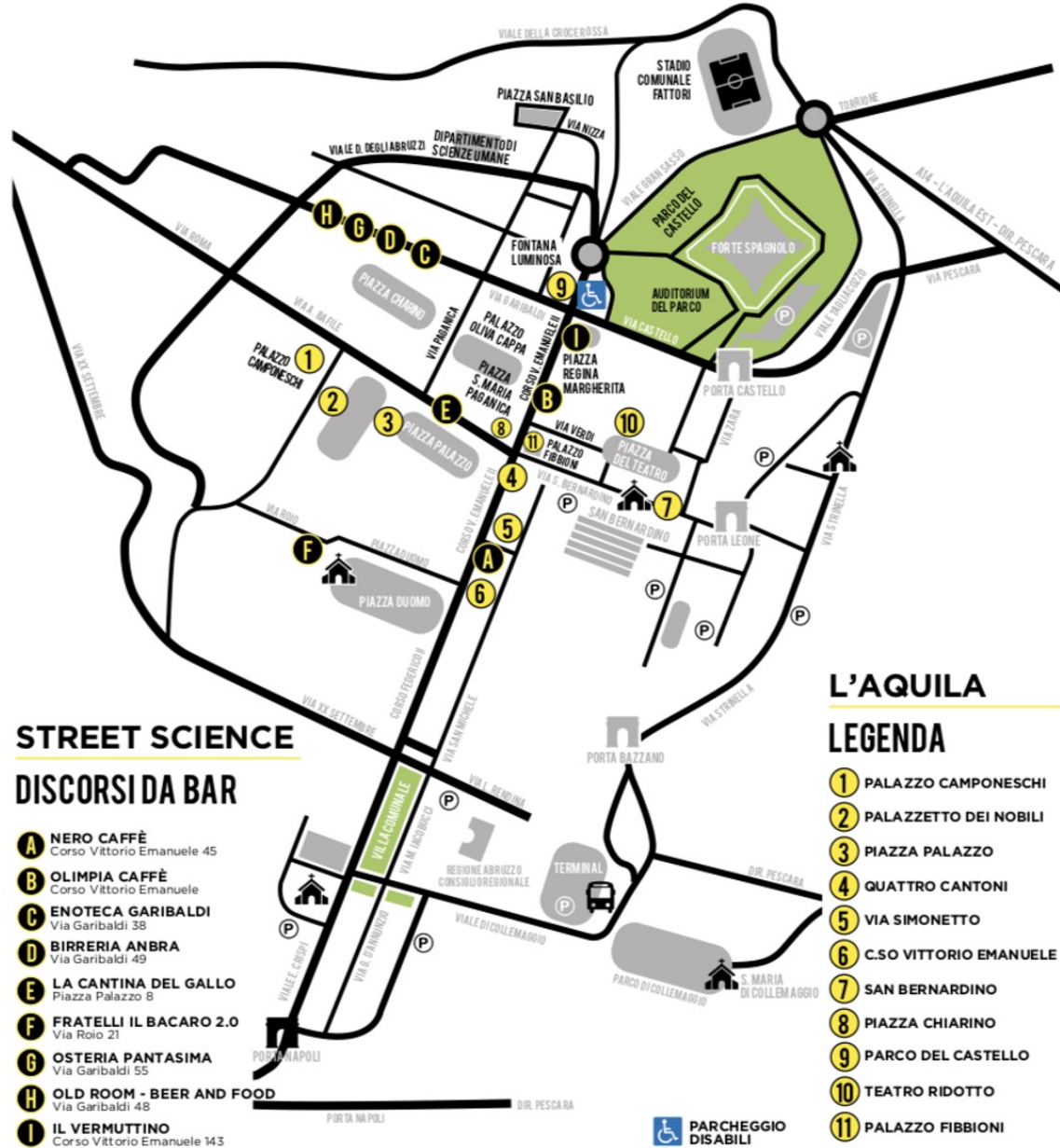
Architecture Description

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Apply IEEE 42010 to NdR Case Study

NdR: European Researchers Night

The NdR Case

Key Observations

1. Around 35K visitors per year

2. Late hours are more crowded than early hours

3. Weather affects user's preferences

Goal

1. A solution for crowd management

2. Automated venue and parking lot management

Constraints

Limited power and service accuracy constraints

Lets get the requirements right

Functional and Non-functional Requirements

Functional Requirements

FR1: The app shall allow users to register to the NdR event

FR2: The app shall allow users to provide their preferred events

....

Extra(Non)-functional Requirements

NFR1: The app must provide 1 second response time or less in web browsers

NFR2: The app should be able to support 1000 users/second while maintaining optimal performance
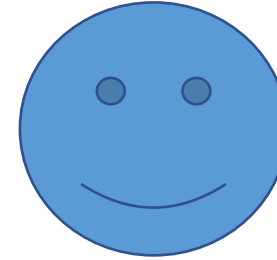
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Who are the stakeholders?
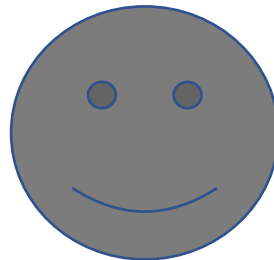
Stakeholders

Software Developers

IoT Engineers

Urban planning

Software architect(s)

Many more....
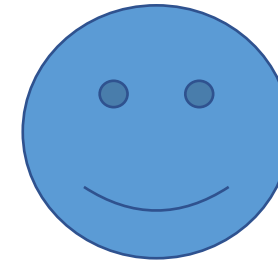
Concerns

Language choice, the modules, Interactions, …
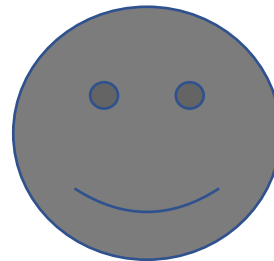

Software Developers

Memory, Battery, platform …

IoT Engineers

Space constraints, Location for sensors,

Urban planning

Software architect(s)

System performance, Integration, Management,…

What can be the viewpoints and views?

Can we create some models for each view?

End-user
Functionality

Programmers
Software management

Logical View → Development View

Scenarios

Process View → Physical View

Integrators
Performance
Scalability

System engineers
Topology
Communications
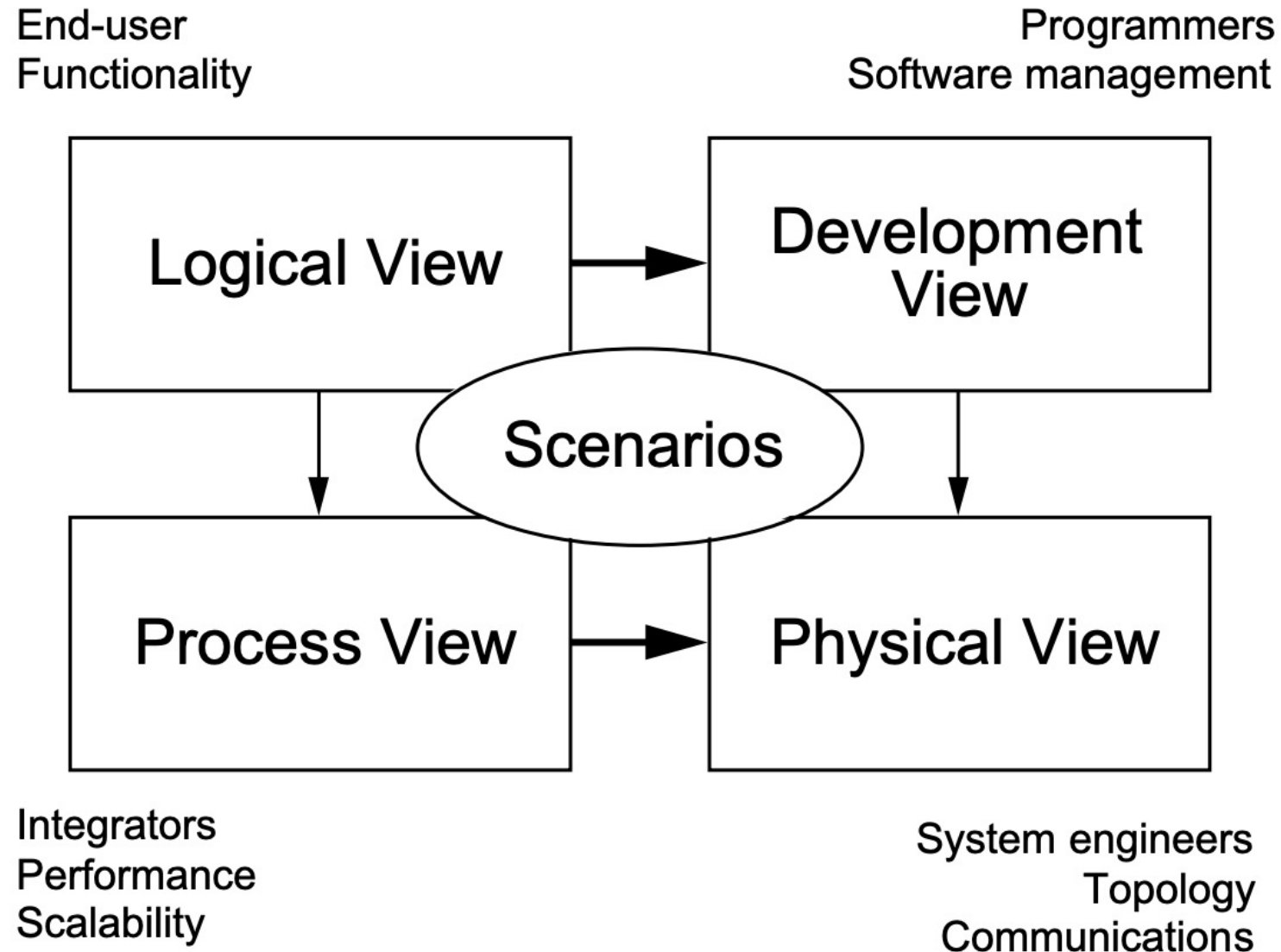
What are some scenarios?

What can be some scenarios?

Book venue

Get recommendations

Check availability

Get confirmation

Check weather

Book parking lots

Many more…each can be associated to a type of user

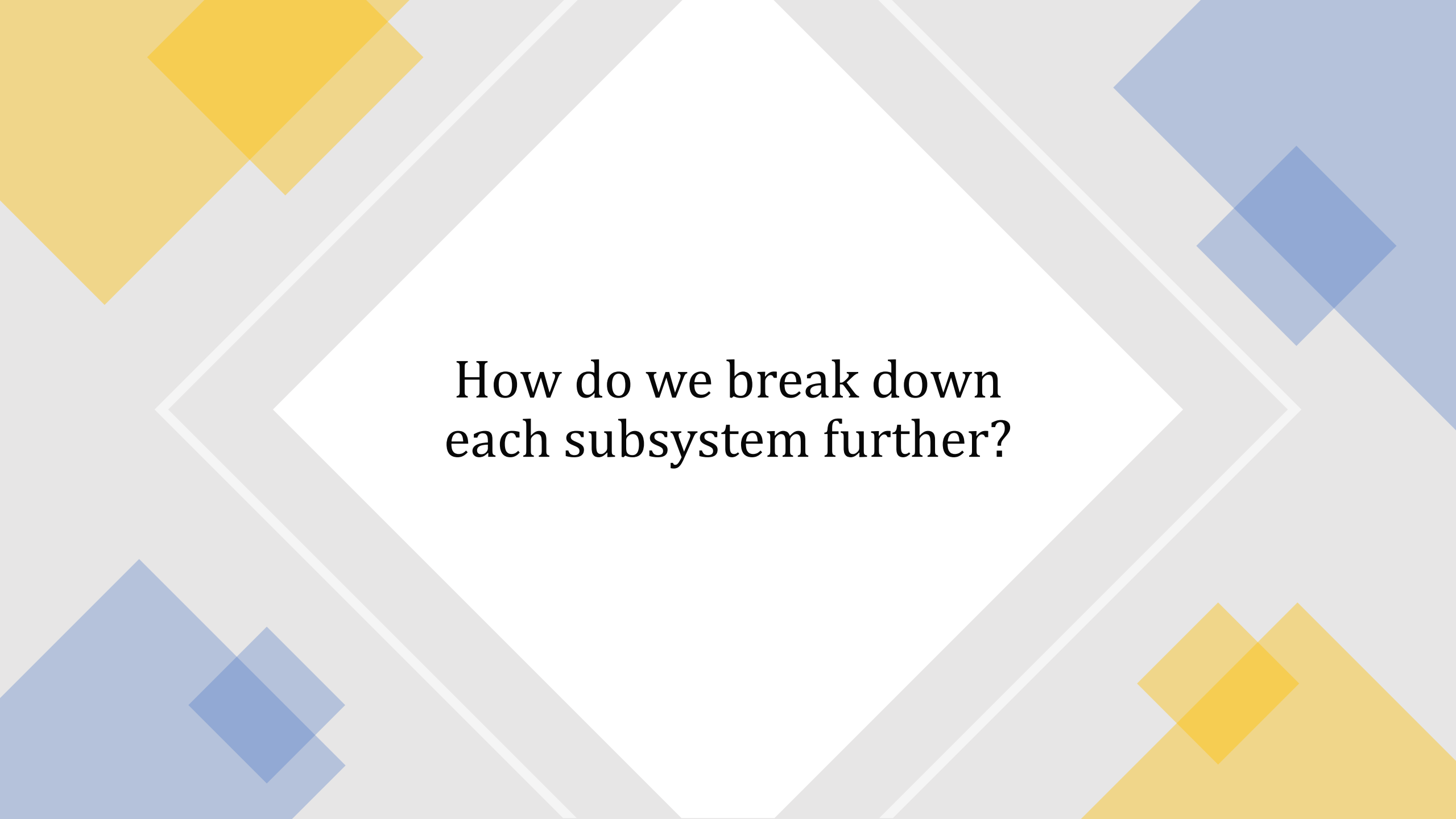# Can we break this into multiple systems?

Subsystems in NdR System

IoT System

Booking System

Weather System

Analytics System

How do we break down each subsystem further?

IoT system

Sensor Controller

IoT middleware

Database

Visualization Engine

Booking System

We can go further

NdR Backend

Venue Booking Manager

Parking Lot Booking Manager

Recommendation Generator

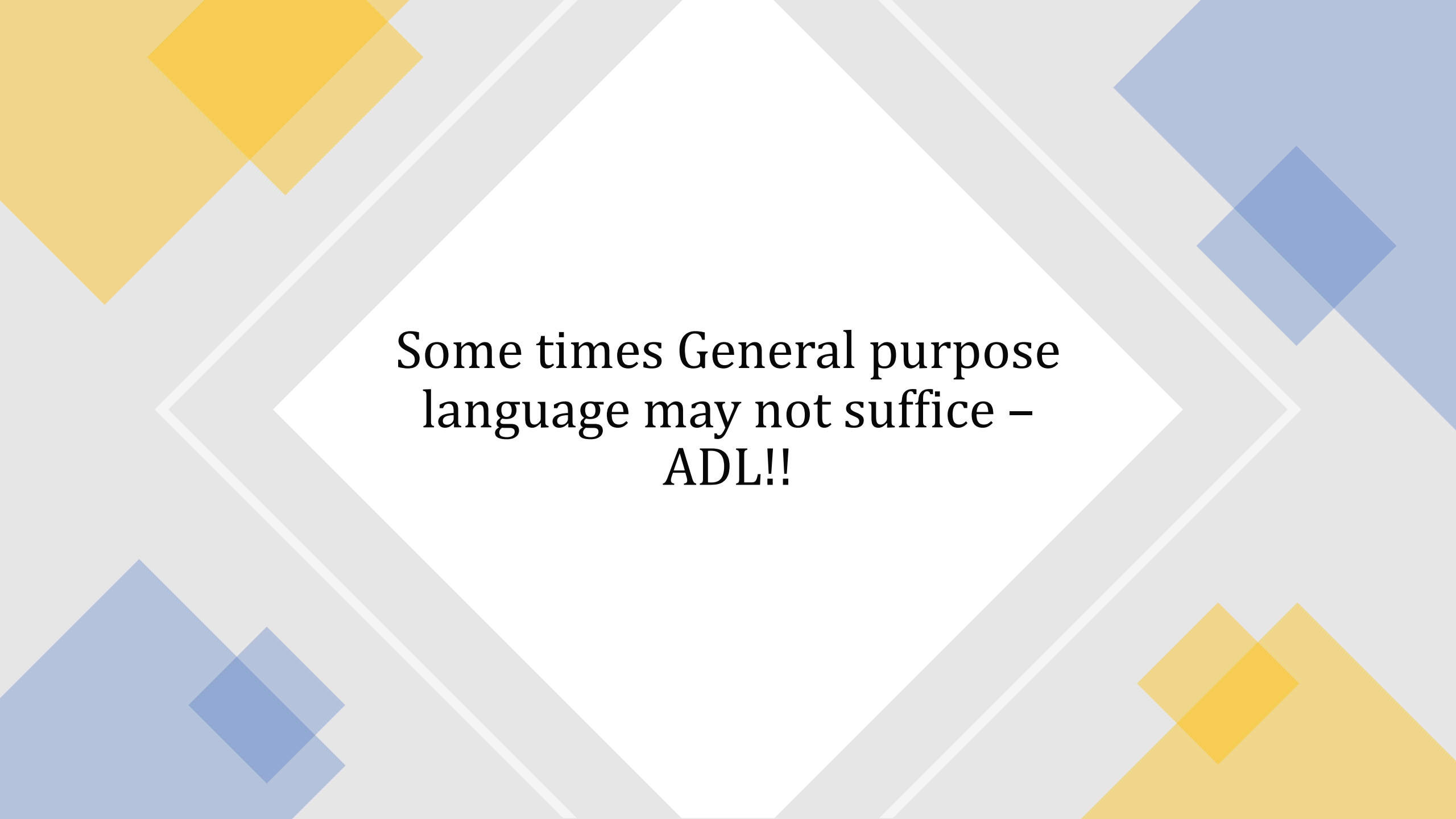**Payment Manager**

And many more..can you name?

Further breakdown? – Think of classes…

How to model? – UML, C4Model,…..

C4Model

- Created by Simon Brown, Independent consultant (specialization: Software architecture)

- Overcome the challenges of UML, more intuitive language

- Visualize architectures in terms of Context, Containers, Components and Code

- Very developer friendly approach to software architecture diagramming

More information: c4model.com

Some times General purpose language may not suffice – ADL!!

Is Software Architecture just some box and arrow?

*"Aside from providing clear and precise documentation, the primary purpose of specifications is to provide **automated analysis** of the document and to expose various kinds of problems that would otherwise go undetected"*

- Perry and Wolf, 1992

*"An architectural system representation is often essential to the **analysis and description** of the high-level properties of a complex system"*

– Garlan and Shaw, 1994

Architecture Description Languages

An Architecture Description language (ADL) or an Architecture Definition Language is a

- Formal specification language

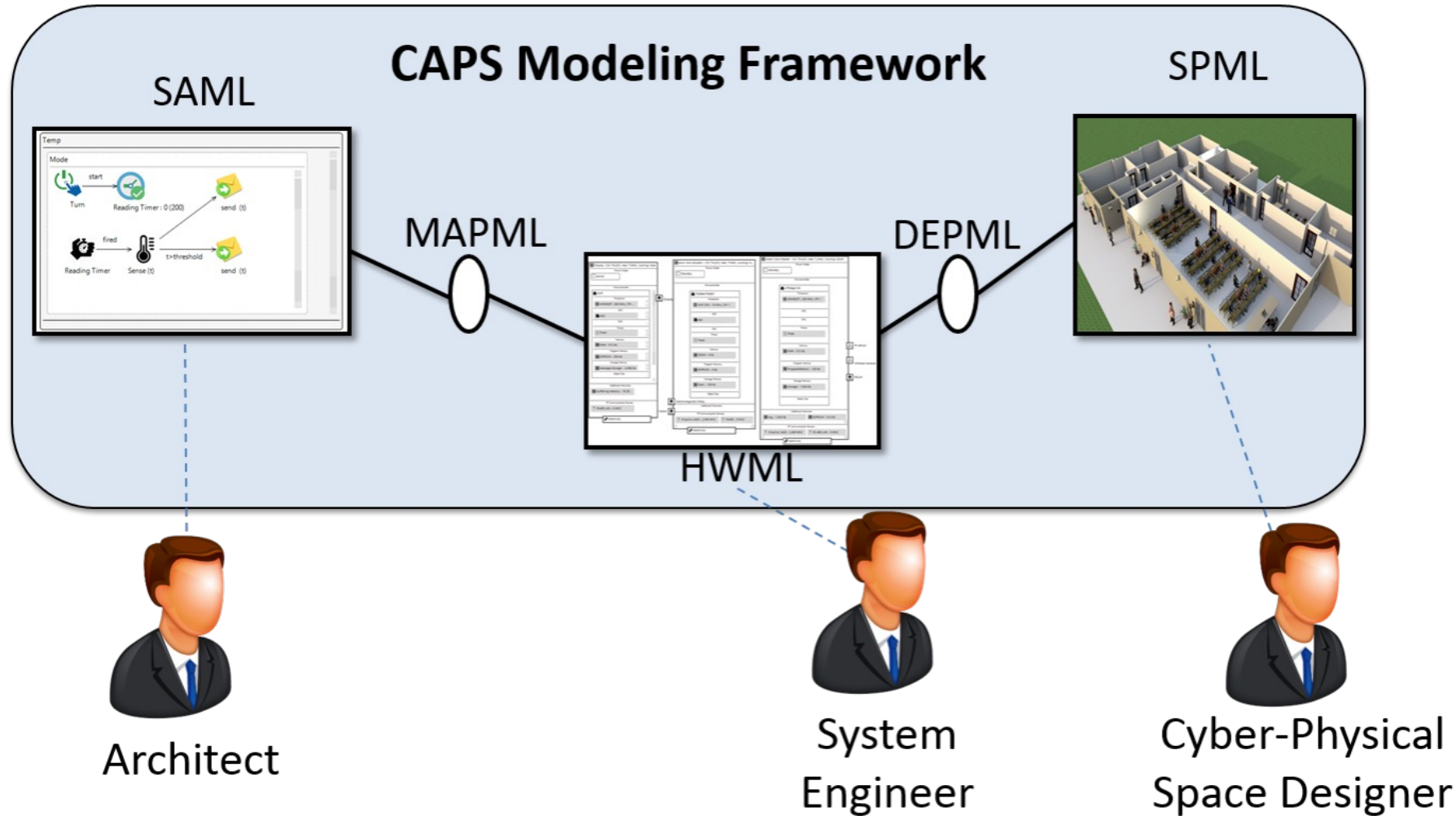- For describing the structure and behavior of a software system

Some popular ADLs: Darwin, ACME, AADL,…..
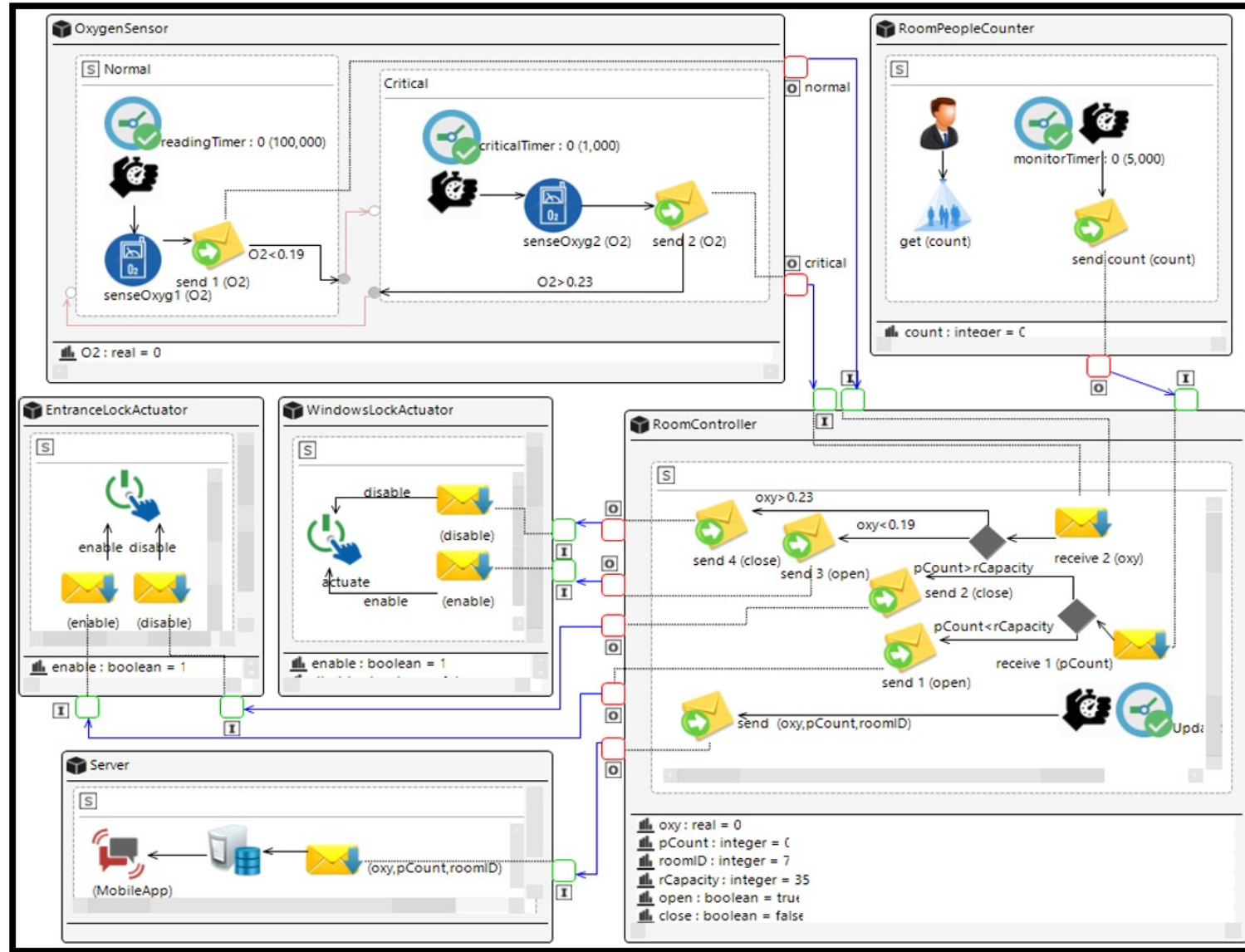
Architecture Description Languages - CAPS

- Evaluate the systems early in the design process before the system or prototypes are built [IoT Systems]
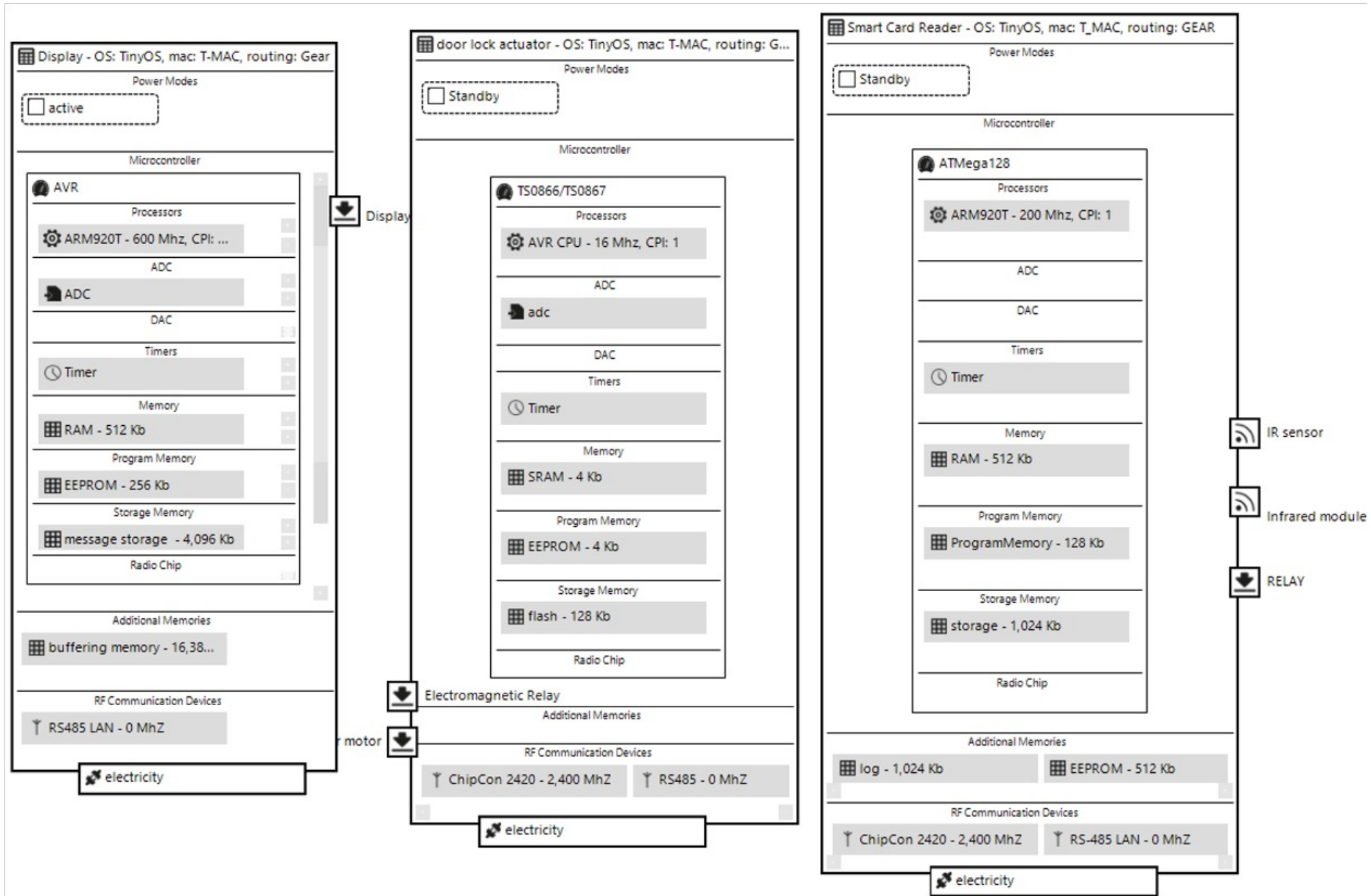- Avoiding costly redesign/re-development cycles

CAPS Modeling Framework

Multi-view Modeling Framework

SAML – Software view, HWML – Hardware view, SPML – Space view

Software Architecture Modeling Language
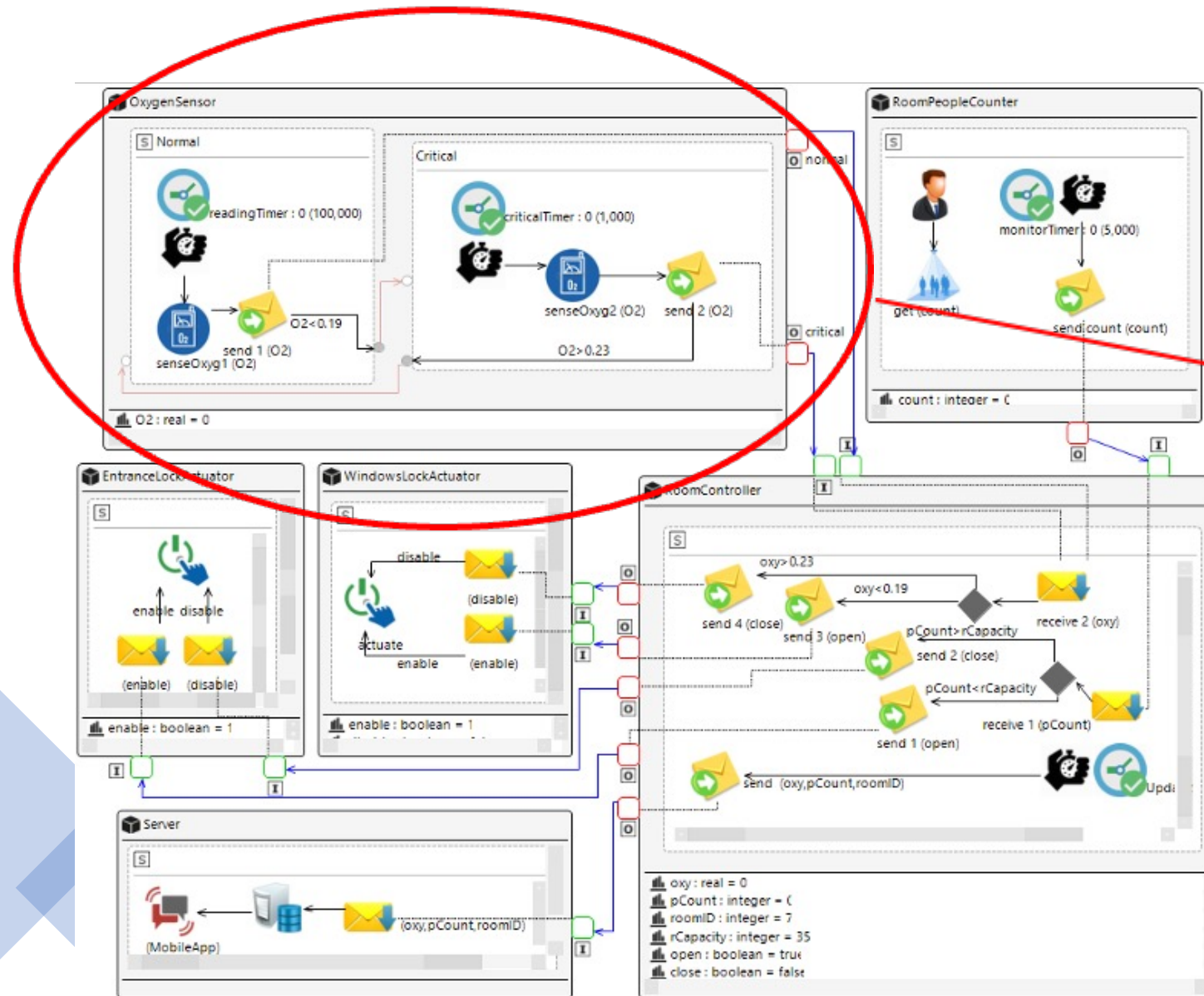
Hardware Modeling Language

Space Modeling Language

This will be converted to an xml model

Space Modeling Language

Code Generation

How do you guarantee quality – Can we think of tactics?

Thank You

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