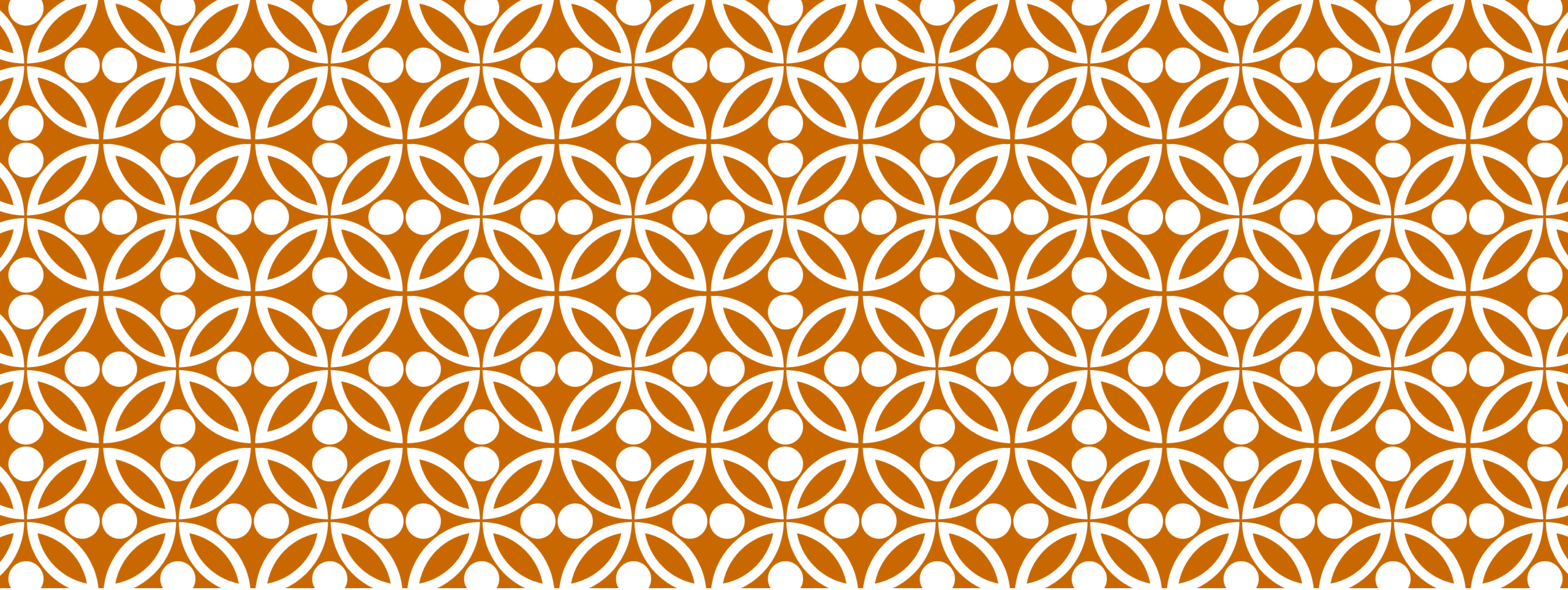


SWE411 Principles of Software Architecture

Dr. Nissreen El-Saber

WEEK 5

MORE INTO VIEWS AND VIEWPOINTS

RECALL VIEW AND VIEWPOINT

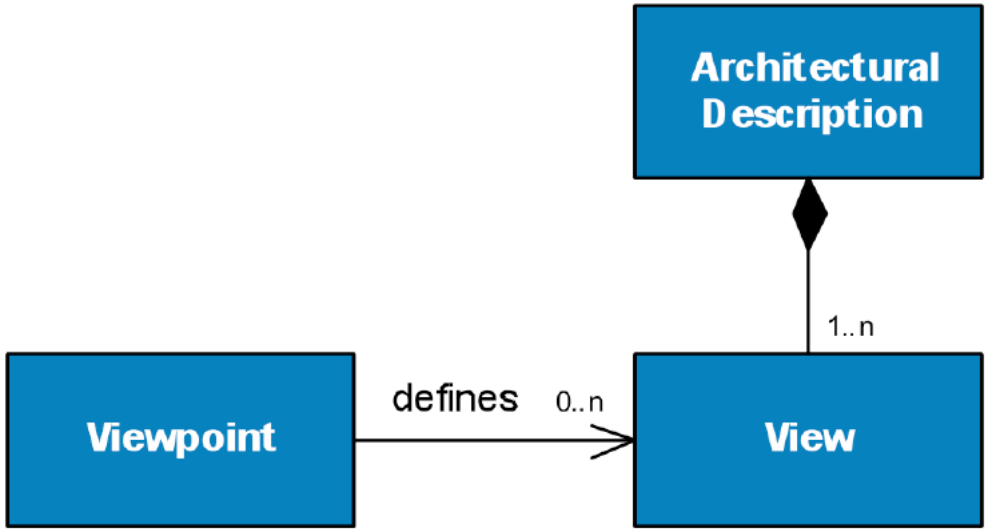
The use of Viewpoints and Views is an existing approach, that we have used successfully, for dealing with complex architectural structures.

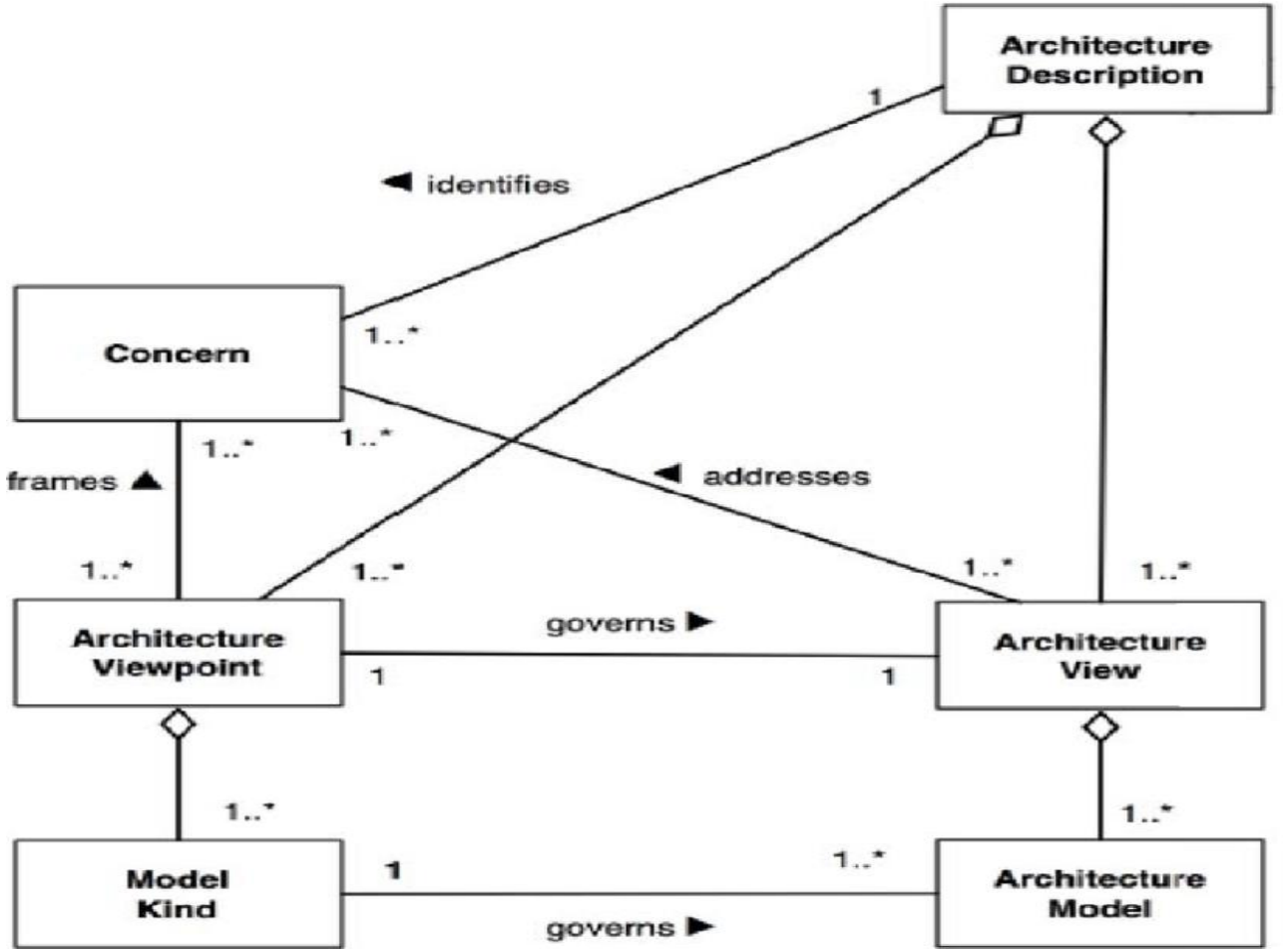
Both ideas are simple but have proved to be effective:

- **Views** are used to structure the architectural description into a number of pieces, each describing one aspect of the system (the functional structure, the deployment environment, the development constraints and so on). The architectural description is made up of a set of views.
- **Viewpoints** provide templates for the views and as such a particular viewpoint is used to develop each view. A viewpoint provides the architect with guidance by defining what the corresponding view should or may contain, how to represent it, how to go about developing it, potential problems to be aware of and their solution, and so on.

The relationship between view and viewpoint is similar to that of object and class.

Using viewpoints and views helps to organise both the process being followed (the viewpoints providing implcit structure and explicit guidance) and the artefacts produced (the views being an organisation of the architectural description).





PIONEERS

The architectural viewpoints idea isn't all that new, having academic roots back in the 1970s from **David Parnas** and more recently in the 1990s from **Dewayne Perry** and **Alex Wolf**. Widespread awareness of viewpoints started to spread in the mid-1990s and since then a number of sets of viewpoints have been developed.

- David Parnas
- Alexander L. Wolf
- Dewayne E. Perry
- Dewayne E. Perry, Alexander L. Wolf, 1992, Foundations for the Study of Software Architecture, ACM SIGSOFT SOFTWARE ENGINEERING NOTES vol 17 no 4. (in the resources).
- David Garlan and Mary Shaw, 1993, An Introduction to Software Architecture, Advances in Software Engineering and Knowledge Engineering, Volume I, edited by V. Ambriola and G. Tortora, World Scientific Publishing Company, New Jersey. (in the resources).

SAMPLE SETS OF VIEWPOINTS

- **4+1 – Philippe Kruchten and the Rational Corporation**, published in IEEE Software in 1995, probably the earliest mainstream description.

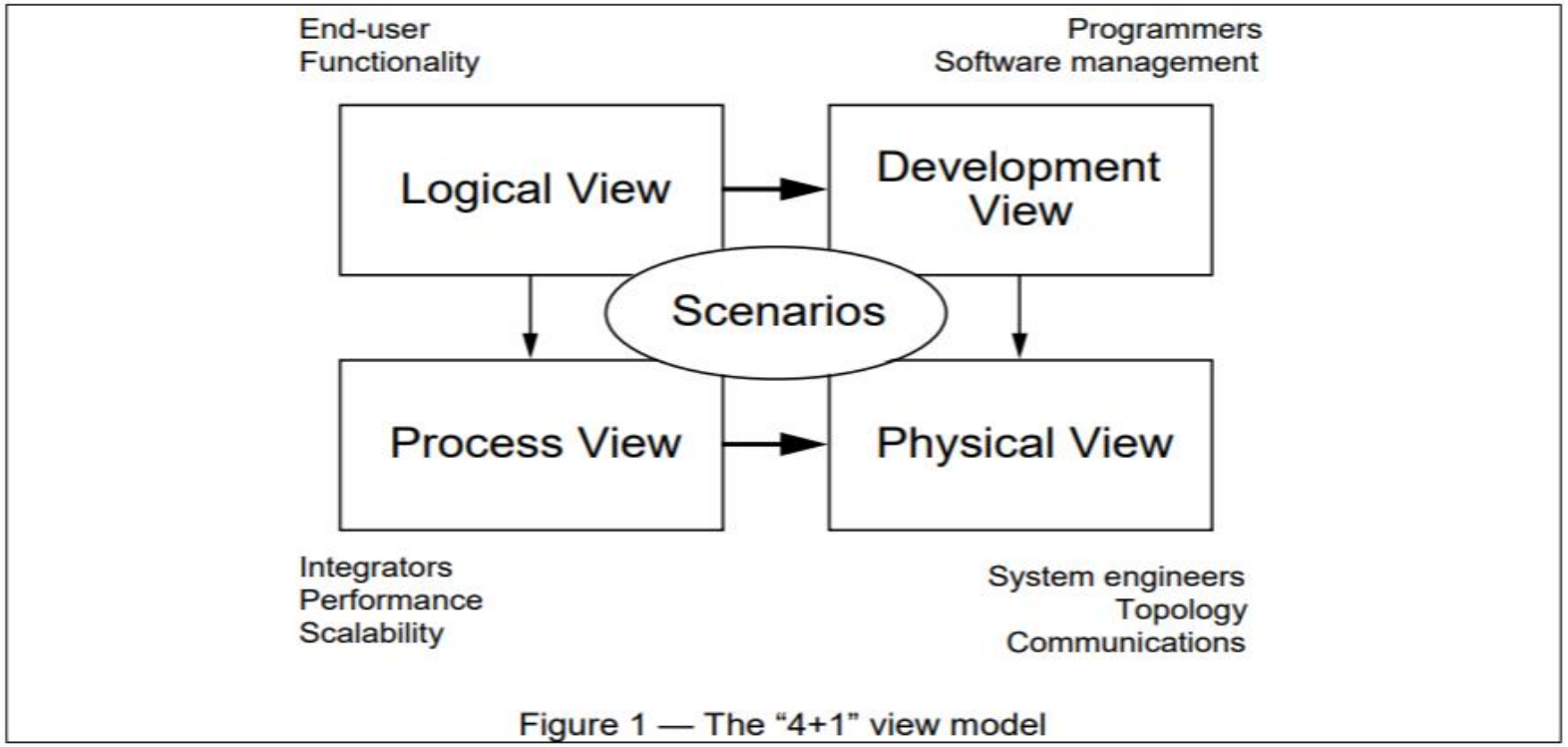


Figure 1 — The "4+1" view model

SAMPLE SETS OF VIEWPOINTS

- **Reference Model of Open Distributed Processing (RM-ODP)** is an ISO standard for describing distributed object systems and their viewpoint set was published as part of the standard in 1995 too.

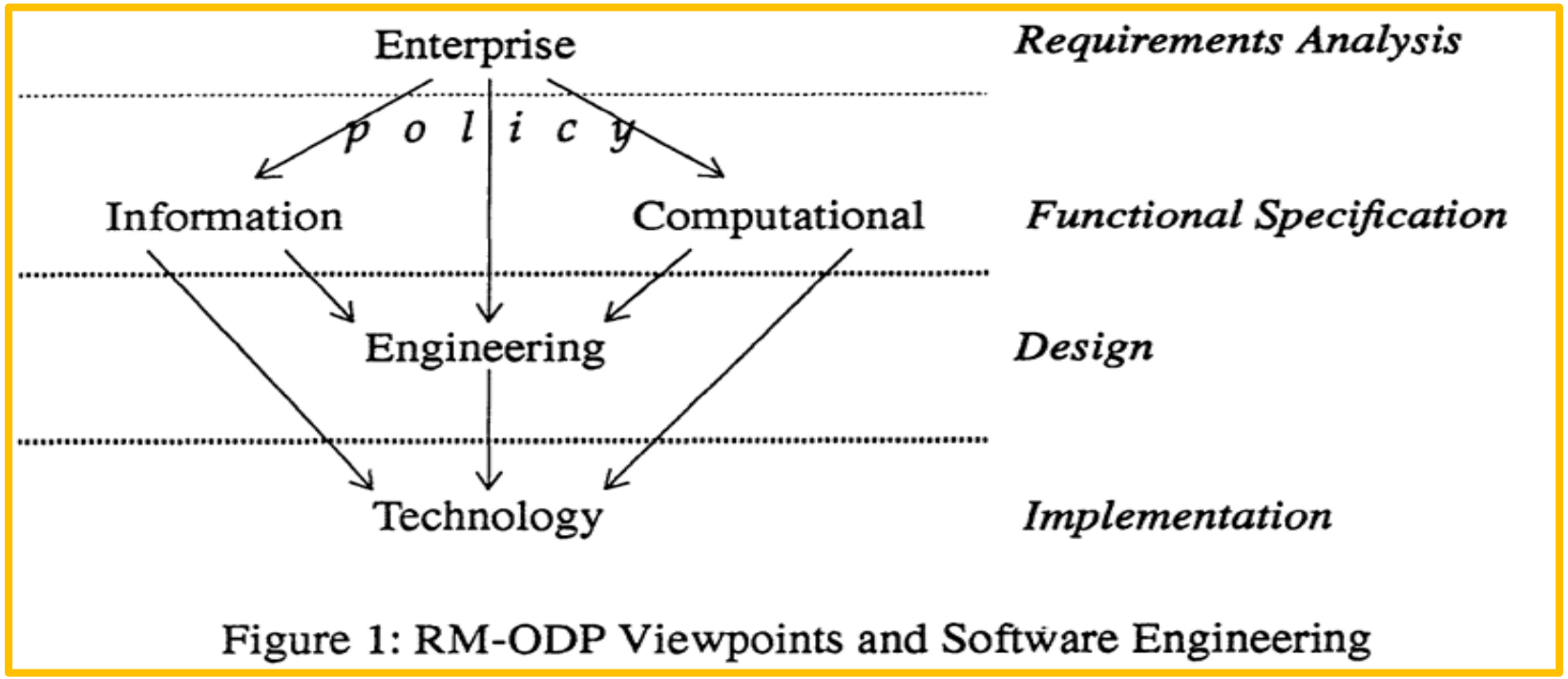
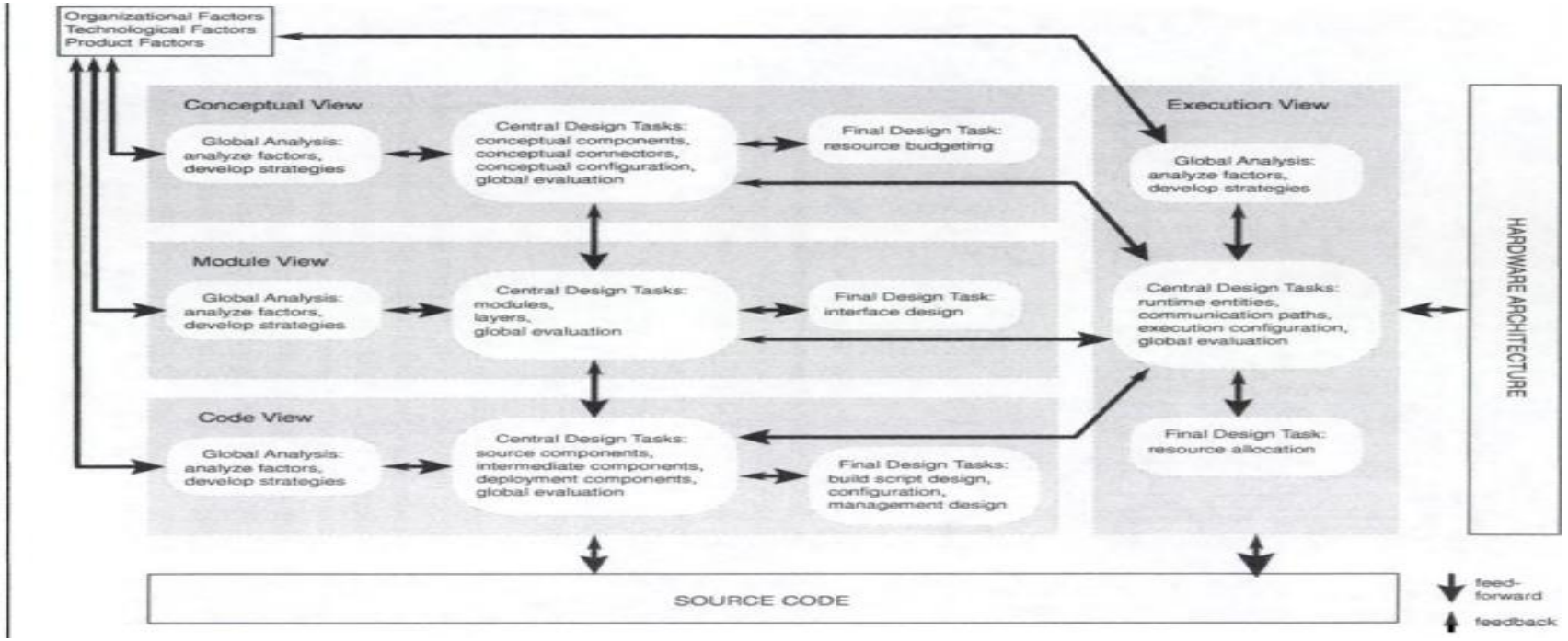


Figure 1: RM-ODP Viewpoints and Software Engineering

Kerry Raymond et al. (eds.), Reference Model of Open Distributed Processing (RM-ODP): Introduction. 1995. Open Distributed Processing Springer Science + Business Media Dordrecht. (in resources)

SAMPLE SETS OF VIEWPOINTS

- **Christine Hofmeister, Rod Nord and Dilip Soni** defined a set for real-time and embedded systems while working at Siemens Research, based on the way that Siemens software architects worked. Documented in their book "Applied Software Architecture" in 1999.



For more details, see the online version of the book:

https://www.google.com.eg/books/edition/Applied_Software_Architecture/3klAPCIB3hQC?hl=es&gbpv=1&dq=inauthor:%22Christine+Hofmeister%22&printsec=frontcover

… SAMPLE VIEWPOINTS

- **Jeff Garland and Richard Anthony** defined a set of viewpoints for information systems, using UML as the base description notation across the views, documenting the set in their book "Large Scale Software Architecture" in 2003.

For more details, see the online version of the book:

https://www.google.com.eg/books/edition/Large_Scale_Software_Architecture/_2oQLLSqZ88C?hl=es&gbpv=1&dq=large+scale+software+architecture&printsec=frontcover

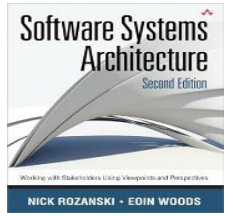
Table 1.1 Conceptual and analysis viewpoint summary

Viewpoint	UML diagram type	Description	Chapter
Analysis Focused	Class	Describe system entities in response to a scenario. Often referred to as a view of participating classes or VOPC.	6
Analysis Interaction	Interaction	Interaction diagram between objects for analysis.	6
Analysis Overall	Class	Combination of all classes from all focused analysis viewpoints.	6
Context	Use Case	Show the external system actors and the system under design.	6

Table 1.2 Logical design viewpoints

Viewpoint	UML diagram type	Description	Chapter
Component	Component	Illustrate component communications.	7
Component Interaction	Interaction	Interactions among components.	7
Component State	State/Activity	State transition/activity diagram for a component or for a set of components.	7
Layered Subsystem	Package	Illustrate layering and subsystems design.	8
Logical Data	Class	Show critical data views used for integration.	9
Subsystem Interface Dependency	Class	Illustrate subsystem dependencies and interfaces.	8

… SAMPLE VIEWPOINTS



- **Eoin Woods et al** defined a set of viewpoints, based on the 4+1 set in the book "Software Systems Architecture: Working With Stakeholders Using Viewpoints and Perspectives" in 2005. Conceptually, our set is like G & A's, being practitioner focused, the result of our own experience and aimed at information systems, although the set is a lot smaller.

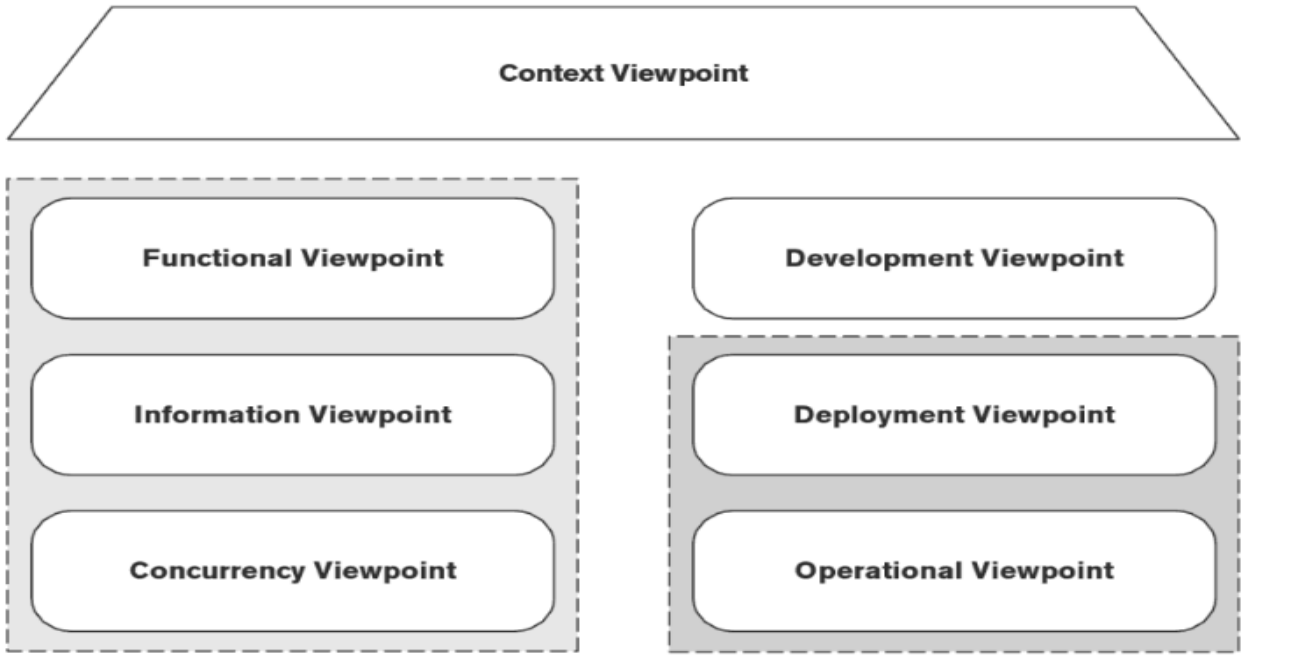


FIGURE 3–2 VIEWPOINT GROUPINGS

For more details, see the online version of the book:

https://www.google.com.eg/books/edition/Software_Systems_Architecture/ka4QO9kXQFUC?hl=es&gbpv=1&dq=Software+Systems+Architecture:+Working+With+Stakeholders+Using+Viewpoints+and+Perspectives&printsec=frontcover

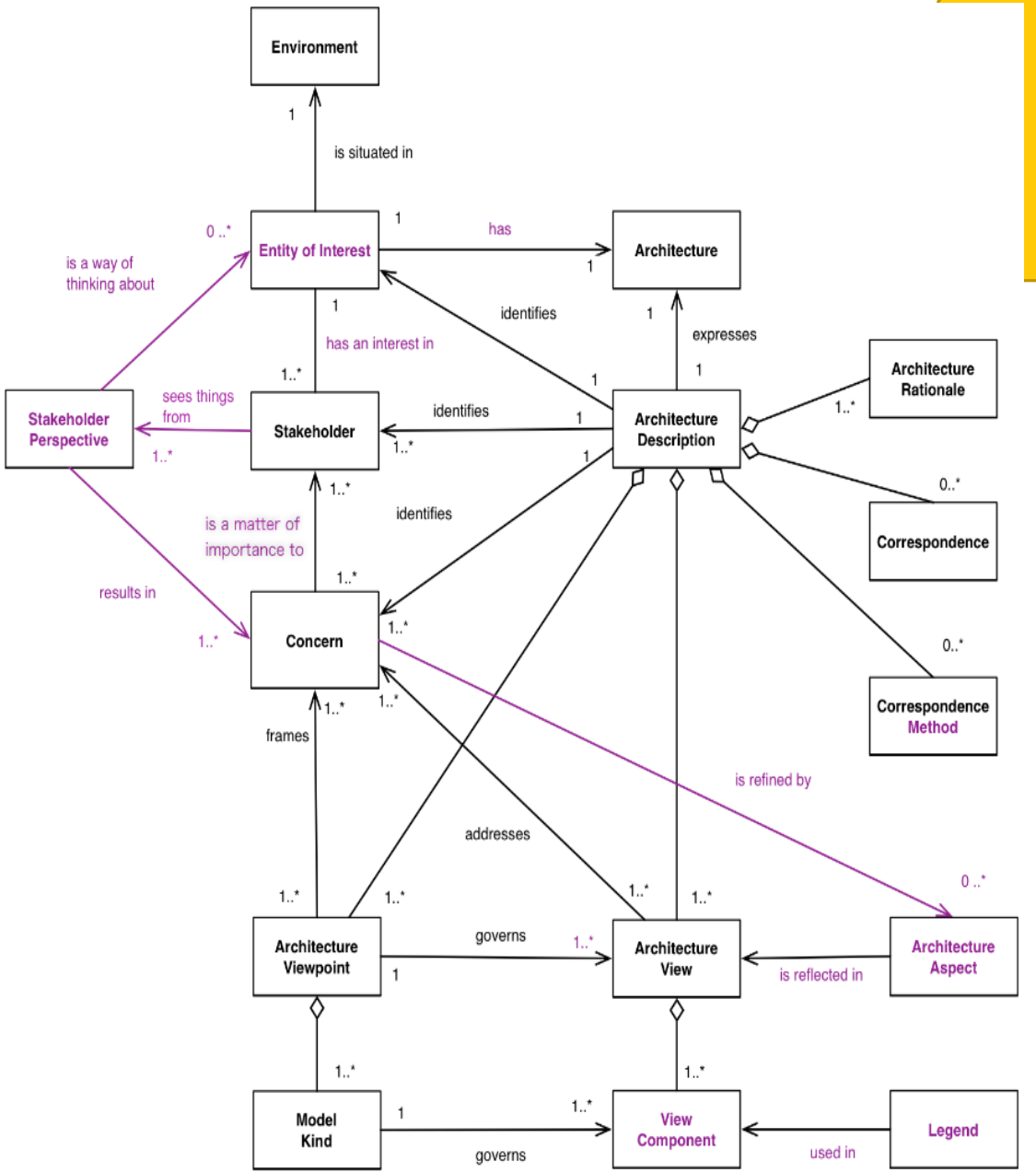
… SAMPLE VIEWPOINTS

- **A Conceptual model** for how viewpoints and views relate to each other and their environment (systems, architects, stakeholders and so on) forms the basis of ISO Standard 42010 (which is a development of the previous IEEE Standard 1471).

For more details, see the online version:

https://www.iso.org/standard/74393.html

http://www.iso-architecture.org/ieee-1471/cm/



QUESTIONS?