

A Historical Perspective on Visual Modelling

John Krogstie

Syllabus: Parts of 2.2 and 2.3 in [Krogstie: Model-based development and evolution of information systems: A quality approach](#)

Additional material (not syllabus): Janis A. Bubenko jr: [From Information Algebra to Enterprise Modelling and Ontologies – a Historical Perspective on Modelling for Information Systems in Conceptual Modelling in Information Systems Engineering](#). Krogstie, John; Opdahl, Andreas Lothe; Brinkkemper, Sjaak (Eds.)

Lecture 2: Historical background

TDT4252, Spring 2014



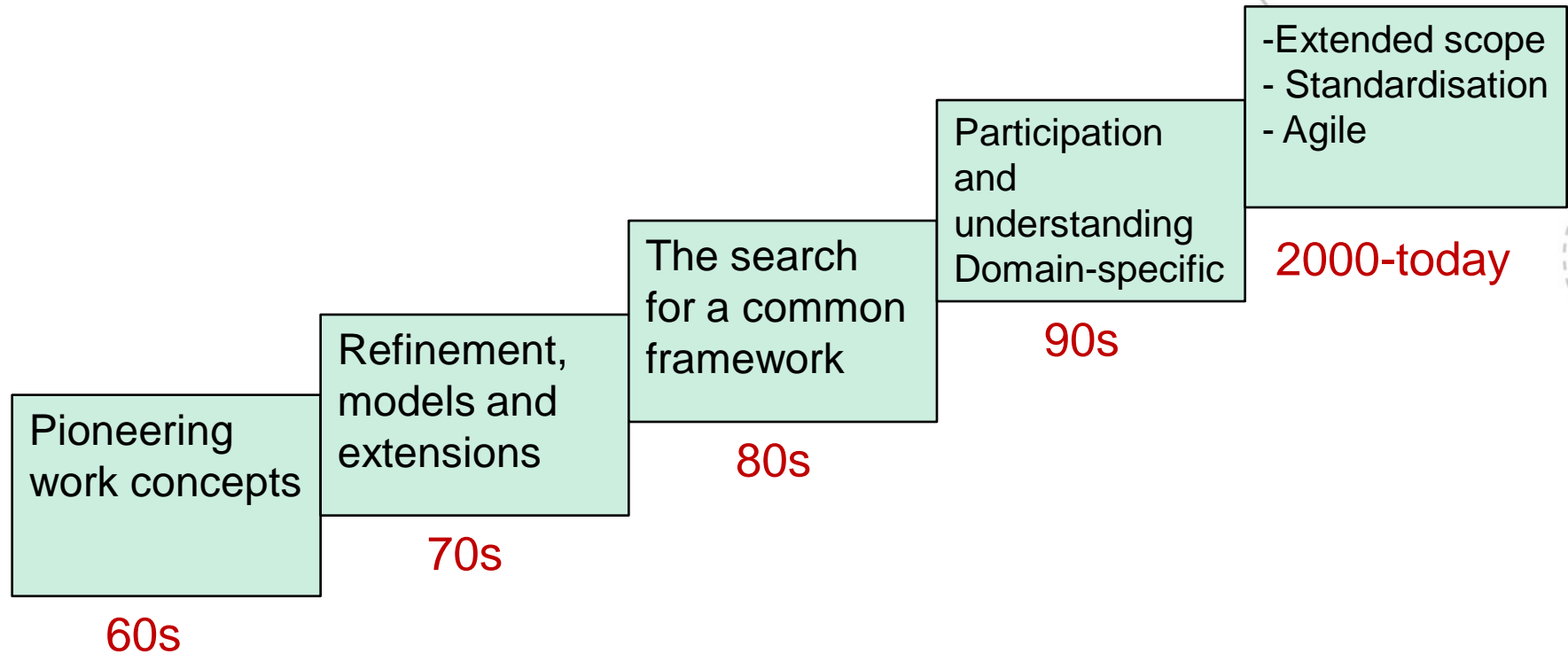
NTNU – Trondheim
Norwegian University of
Science and Technology

Why do we look upon the historical development in the field?

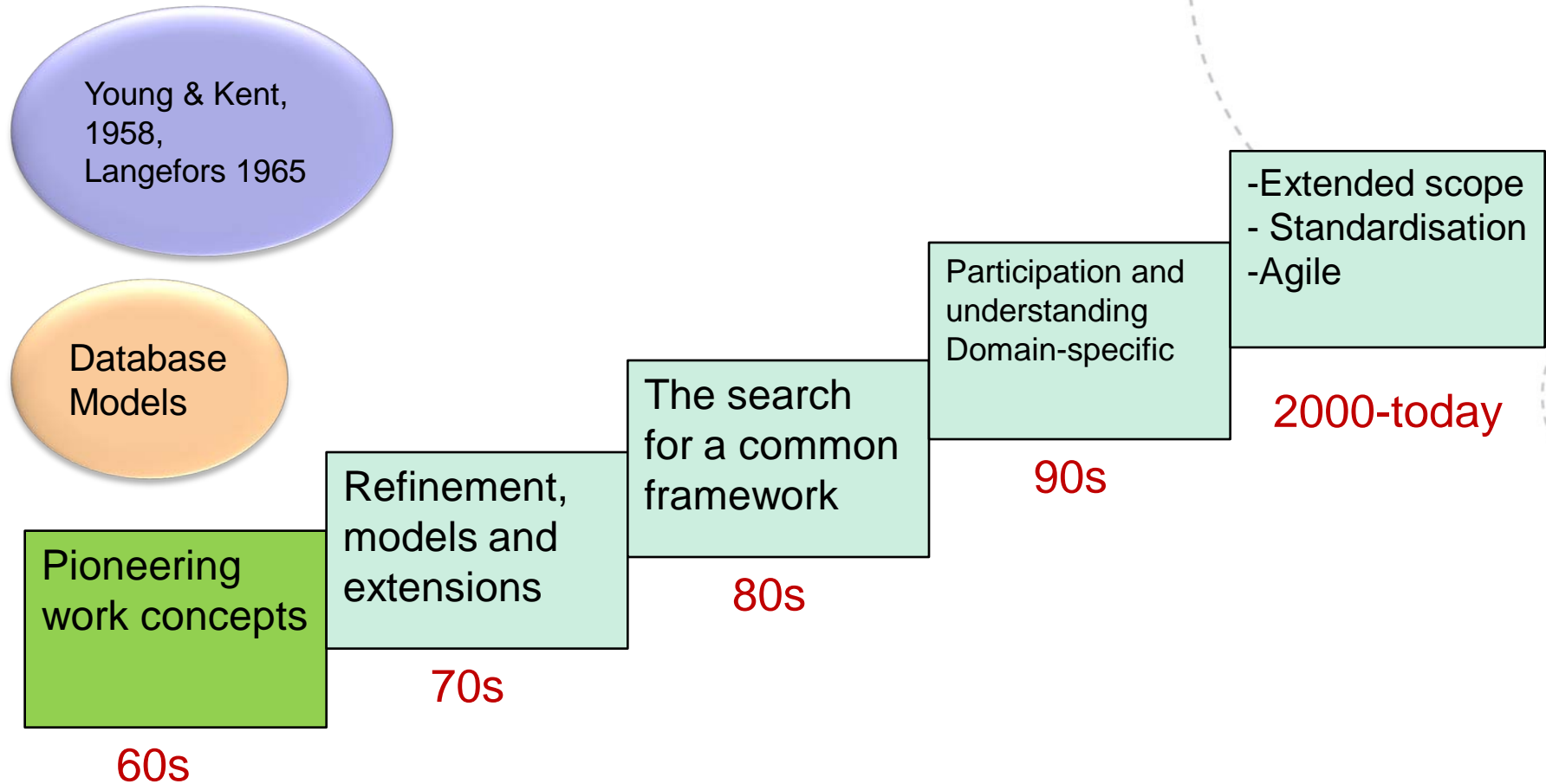
- Visual (conceptual) modeling has evolved over a long time, following the development of IT in general back to the 50ties
- Some core ideas was investigated already 50 years ago
- The approaches and notations used today have their roots in and are highly influenced by the previous work
- Principles in this lecture, more on the concrete notations next week



Modelling during five decades



Modelling during five decades



Focus of early approaches to modelling

- What were modelled were **data and operations on the data**.
- There was a focus on representing the domain in **strict, formal, computer-independent terms**.
- Data were modelled using abstract **concepts**.

Young and Kent (1958)

“Abstract Formulation of Data Processing Problems”

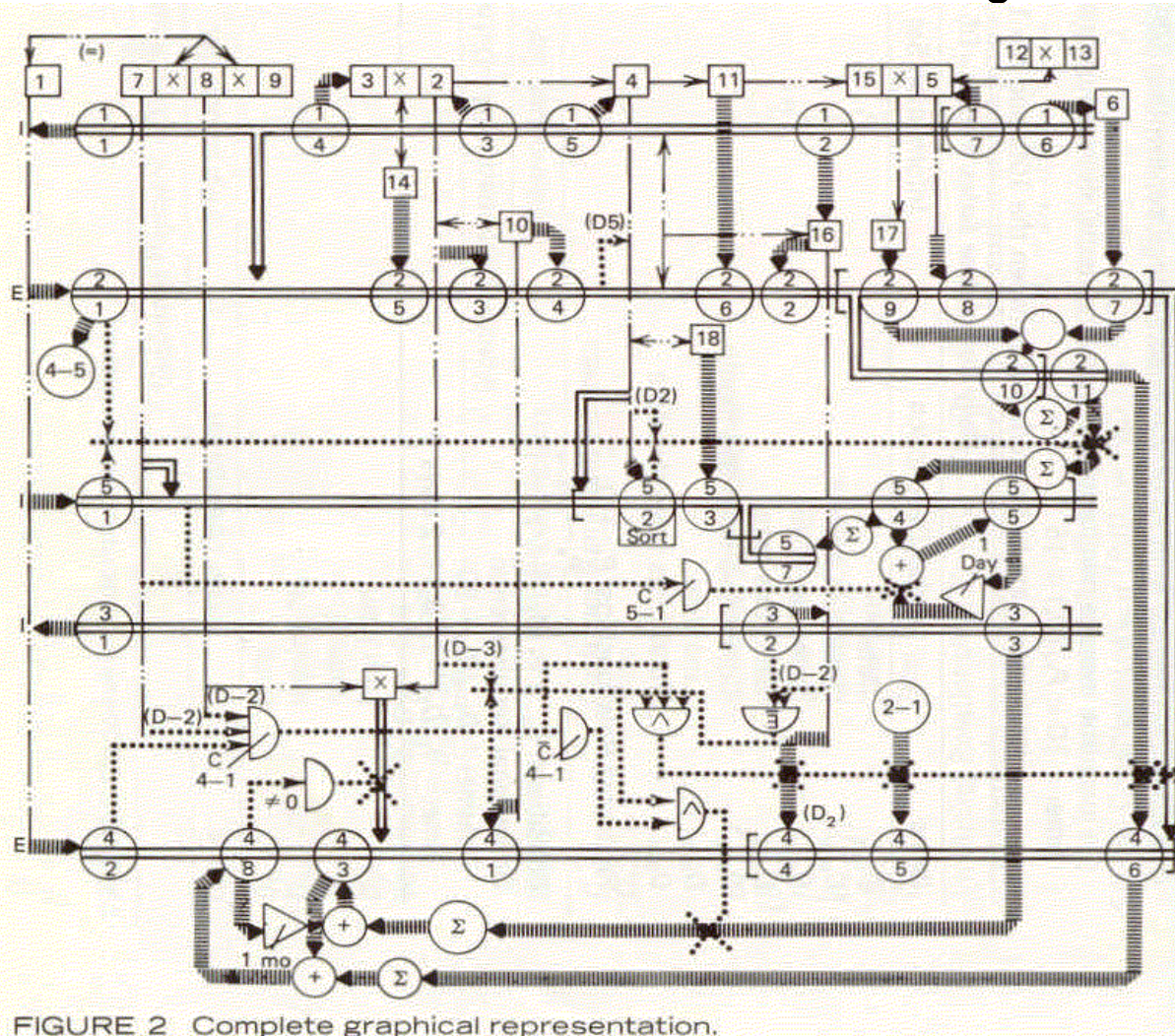


FIGURE 2 Complete graphical representation.

•... a way of designing different alternative implementations

- Information set/item
- Defining relationship
- Producing relationship
- Conditions
- Temporal aspects



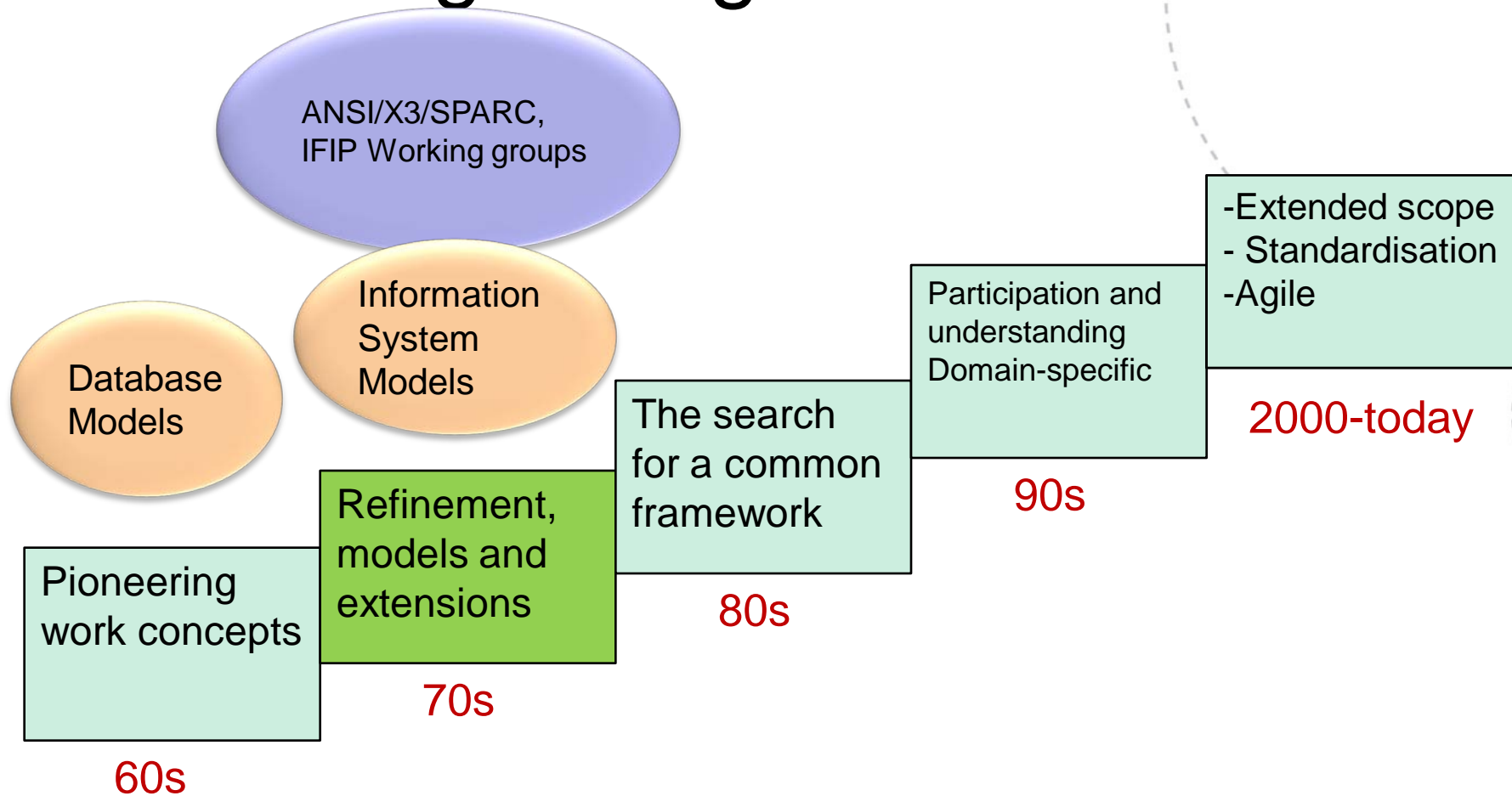
NTNU – Trondheim
Norwegian University of
Science and Technology

Børje Langefors – Different method areas

- Methods for analysis and description of information systems at an elementary, “problem oriented” level (the “infological” realm)
- Methods for design and analysis of computerised information systems on a “product-oriented” level (the “datalogical” realm)
- Methods for implementation of the information system on computer hardware and choice of hardware.
- Methods for management and control of organisations



Modelling during four+ decades



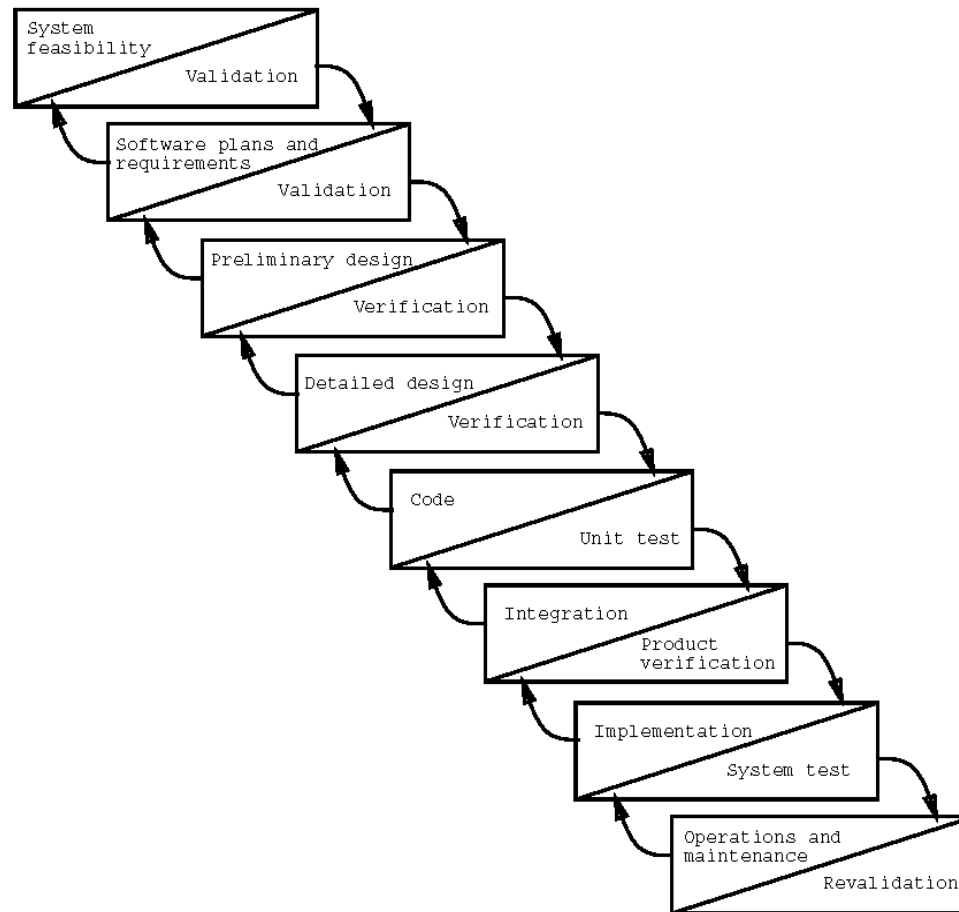
The period 1970-80

"refinement and extensions"

- The waterfall project model
- The 1975 ANSI/X3/SPARC (Standards Planning and Requirements Committee) report: the three schema approach
 - External
 - Conceptual
 - Internal
- IFIP WG 2.6 series: "Modelling in Database Management Systems" (1974)
- IFIP TC 8 on Information Systems (1976)
- Structured analysis and design

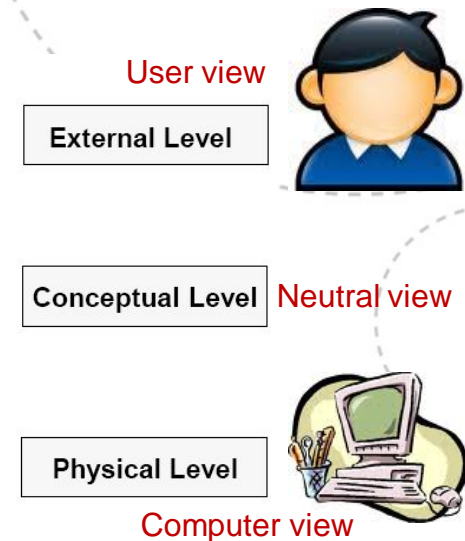
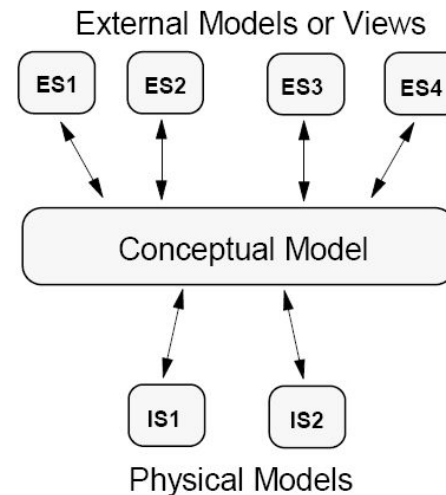


Eksempel on Waterfall-orientert method



ANSI/X3/SPARC, 1975

- The three-schema approach offers three types of schemas with schema techniques based on formal language descriptions:
 - **External** schema for **user views**
 - **Conceptual** schema **integrates** external schemata
 - **Internal** schema that defines **physical storage** structures

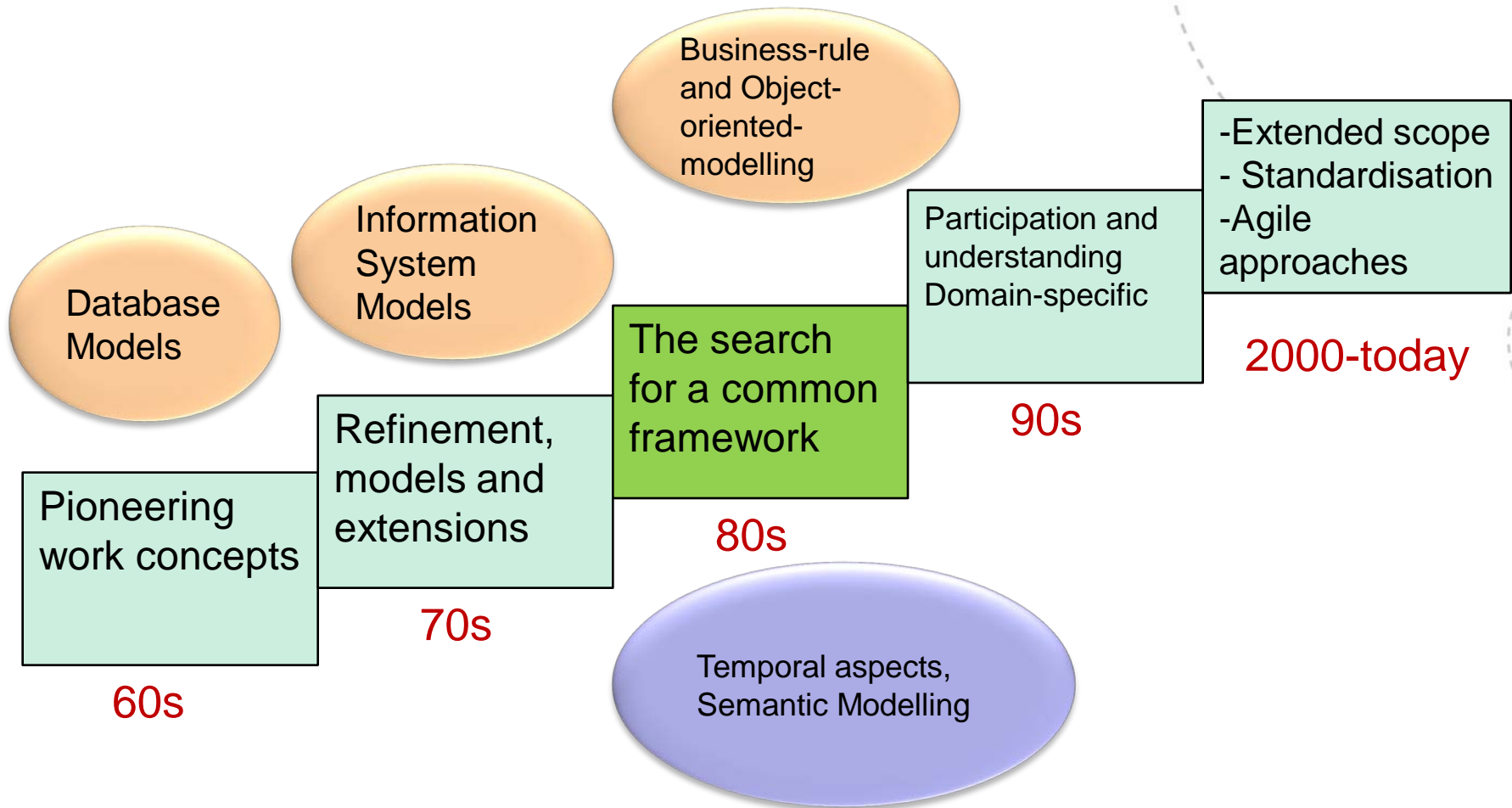


SA/SD – semi- formal modelling languages used introduced in the seventies

- Structured analysis (SA) combines a number of modelling approaches:
 - Entity relationship (ER) diagrams (Chen 1976) model entities and the relationship between these entities.
 - Data flow diagrams (DFD) (Gane and Sarson 1979) document the overall functional properties of the system.
 - State transition diagrams (STD) may be used to specify the time-dependent behaviour (control structures) of the system.
 - Process specifications can be written in a variety of ways: decision tables, flowcharts, graphs, ``pre" and ``post" conditions (rules), and structured English.
- Structured design (SD) is defined as ``the determination of which modules, interconnected in which way"



Modelling during four+ decades



Ambitions of the 80's

- To improve expressiveness of the modeling languages, and have better use of abstraction mechanisms
- To harmonise different notions and methods.
- To enhance the requirements capture and validation stage of the systems life-cycle, and go beyond the limitations of the waterfall-model
- To provide computerised assistance to the process of developing a specification.
- To pay attention to human, cognitive, linguistic and social aspects of information systems.



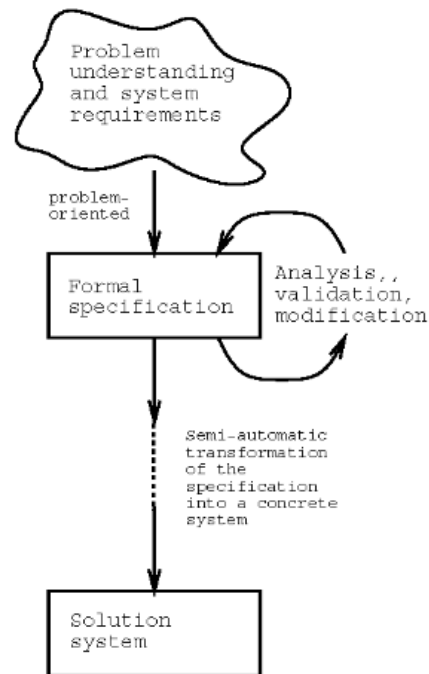
Critique of the waterfall-model

- 1982-83 [Balzer:83, Gladden:82, McCracken:82]
 - The phases are artificial constructs, ``one specific kind of project management strategy imposed on software development
 - An executing system is presented first at the end of the project.
- Systems developed using the conventional methodology is often difficult to change, resulting in poor support for system evolution.

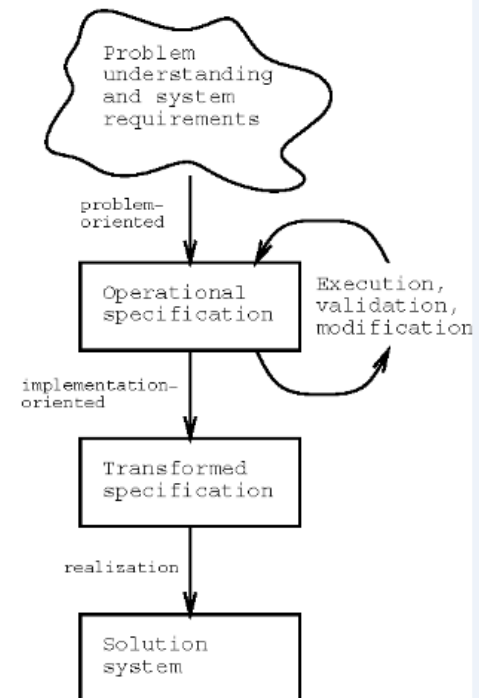


Alternatives to waterfall-model

- Prototyping (Rapid or evolutionary) [Taylor:82]
- Incremental development [Davis:88]
- Transformational development [Partsch:86]
- Operational development [Zave:84]
- Spiral model [Boehm:88]

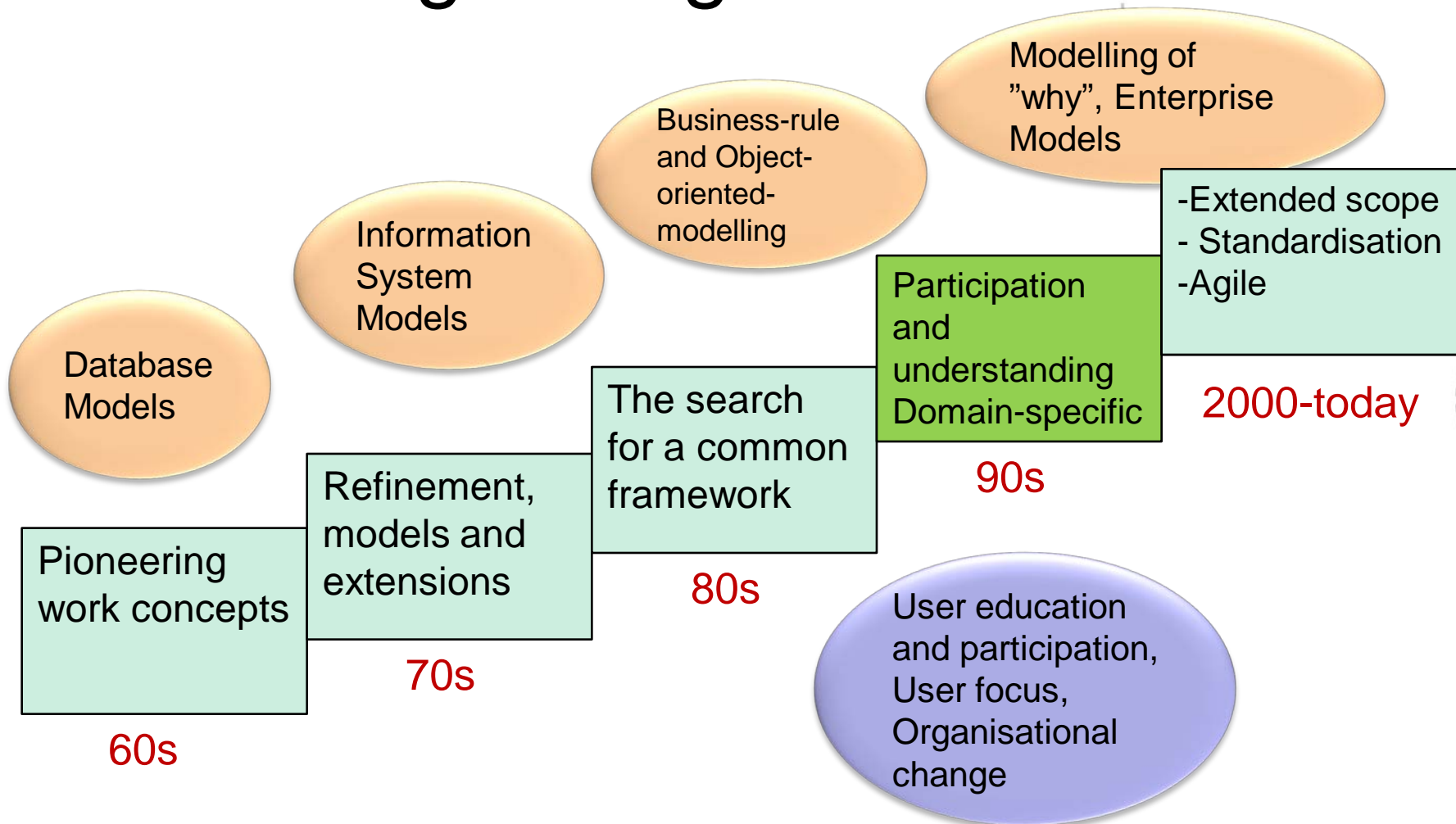


a) Transformational life-cycle model



b) Operational life-cycle model

Modelling during four+ decades



Modelling in the 90's:

focus on organisational aspects, participation, and understanding

Why are we modelling?

How are we modelling?

... "the understanding and support of

- i) Human activities at all levels in an organisation.
- ii) Change, be it of the product, of the process or of the organisation.
- iii) Complex user organisations, and individual users"

The 90's: Widening the scope

- Interoperable systems
- Semantic heterogeneity
- Non-functional requirements
- Business and enterprise modelling/engineering
- Modelling of intentions and actors
- Participative modelling
- Domain-specific modeling



Domain-specific languages (DSL) and domain specific modelling(DSM)

- to adapt the modelling language used to the domain to be modelled and the stakeholders' knowledge of this domain

Two usage-areas of DSM:

- Enterprise modelling, primarily supporting sense-making and communication on the enterprise level
- Software development, support code-generation for new software systems

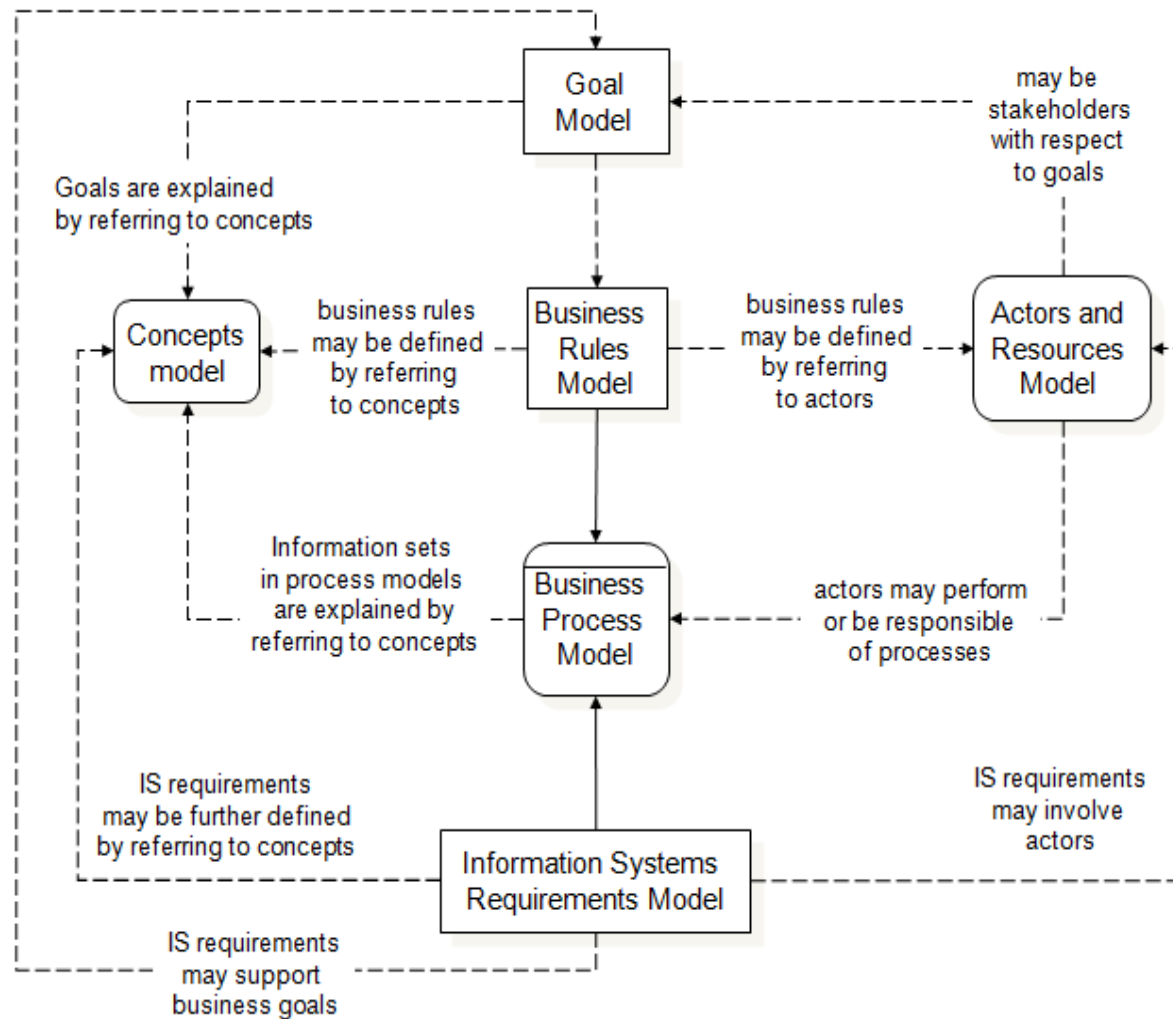


Enterprise Modelling

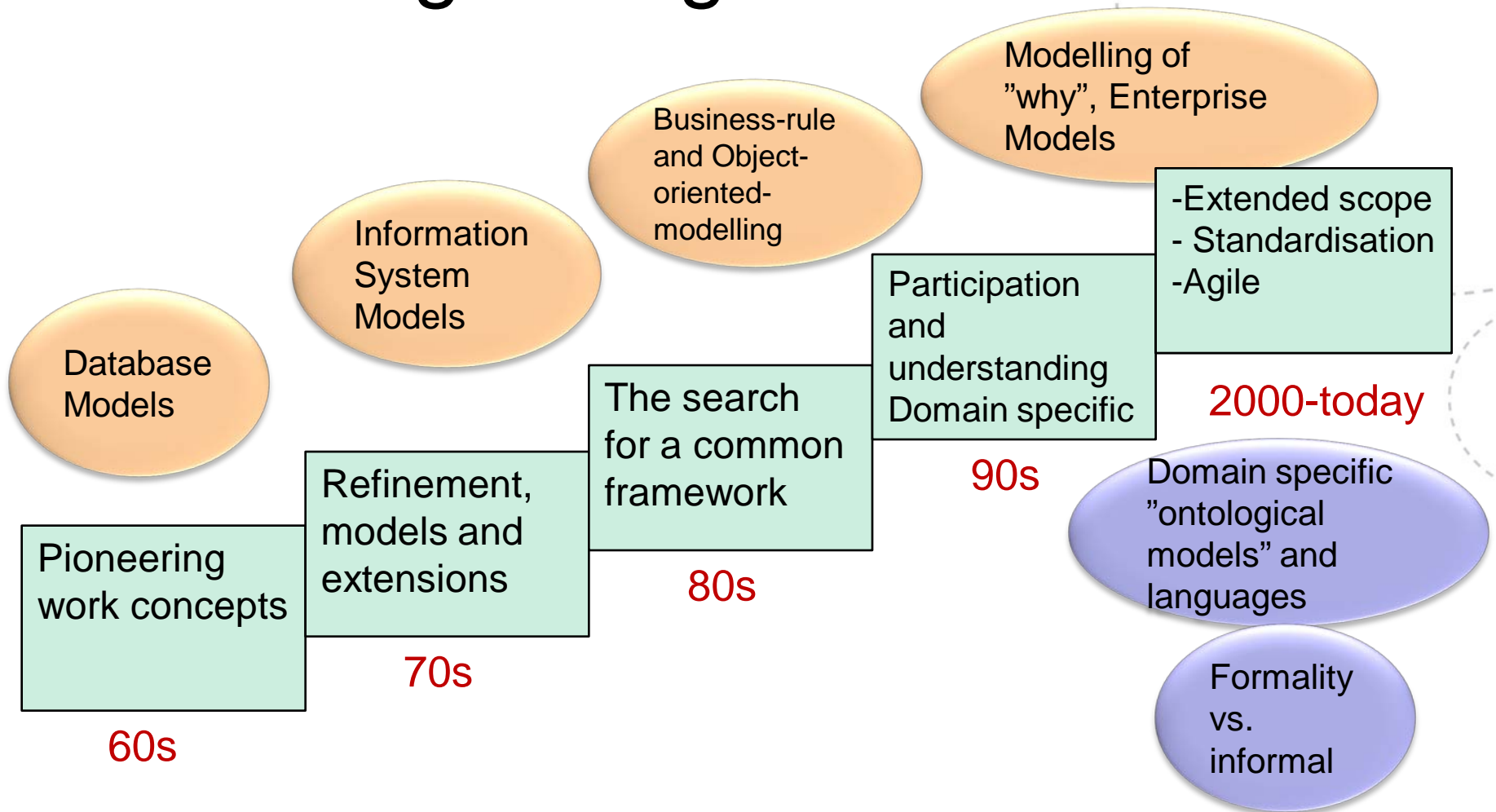
- The purpose of modelling is not only IS design.
- Models not only address “what?” and “how?”, but also “why?”.
- Integrates data and process models of the business with objectives, goals, actors, business rules and information system requirements.
- Provides traceability from information system solutions to business objectives.
- Improves the quality of modelling and the models by making it a “participatory” activity.



Modeling perspectives in enterprise modeling – EKD example



Modelling during four+ decades



What additional aspects do you think is important to model today?



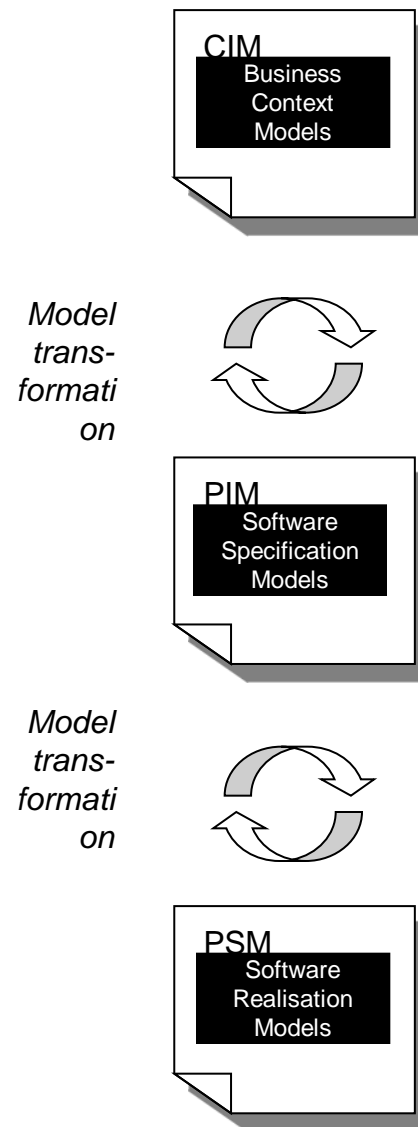
NTNU – Trondheim
Norwegian University of
Science and Technology

Current Trends

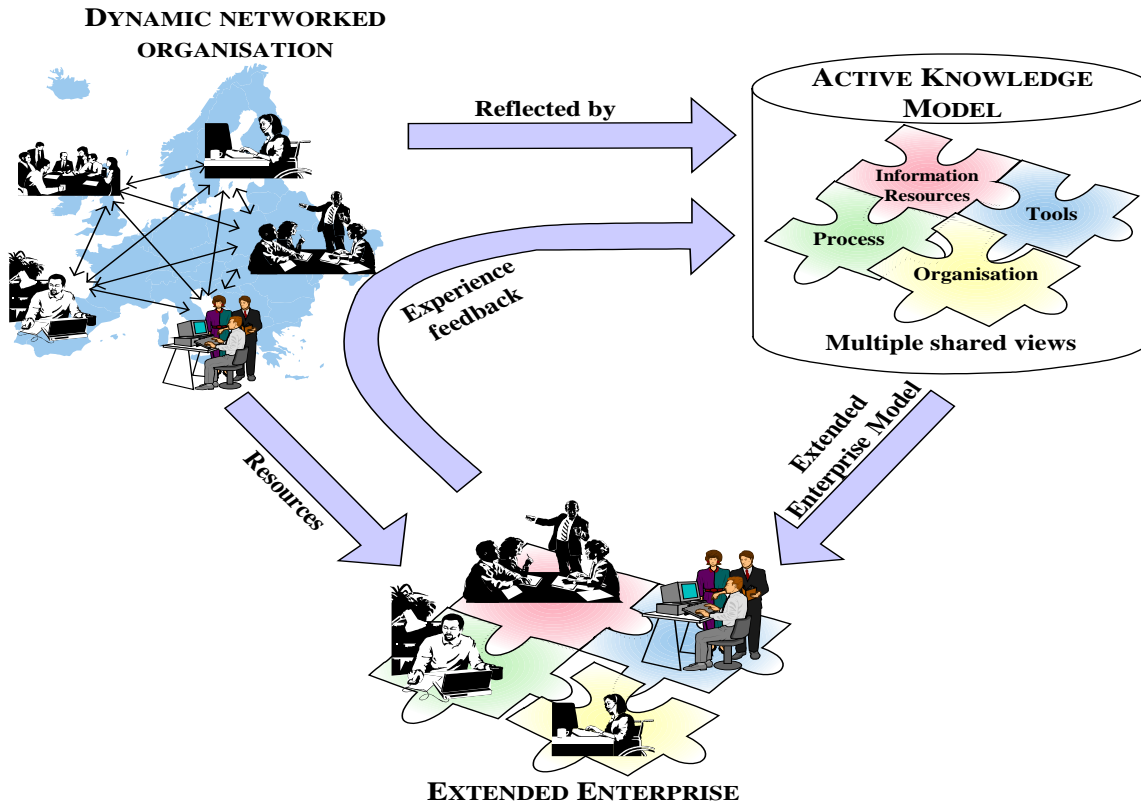
- Modelling social aspects and communities
- Modelling of context (such as location)
- Enterprise Models in Enterprise Architecture
- Active Knowledge Models / Interactive models to support agile/dynamic situations
- Semantics, ontologies
- Model-Driven Software Engineering/ Model Driven Architecture (MDSE/MDA)
- Interoperability and standardisation (UML, BPMN, Archimate)



MDA as a transformational approach, sharing the distinction between the infological and datalogical levels of Langefors

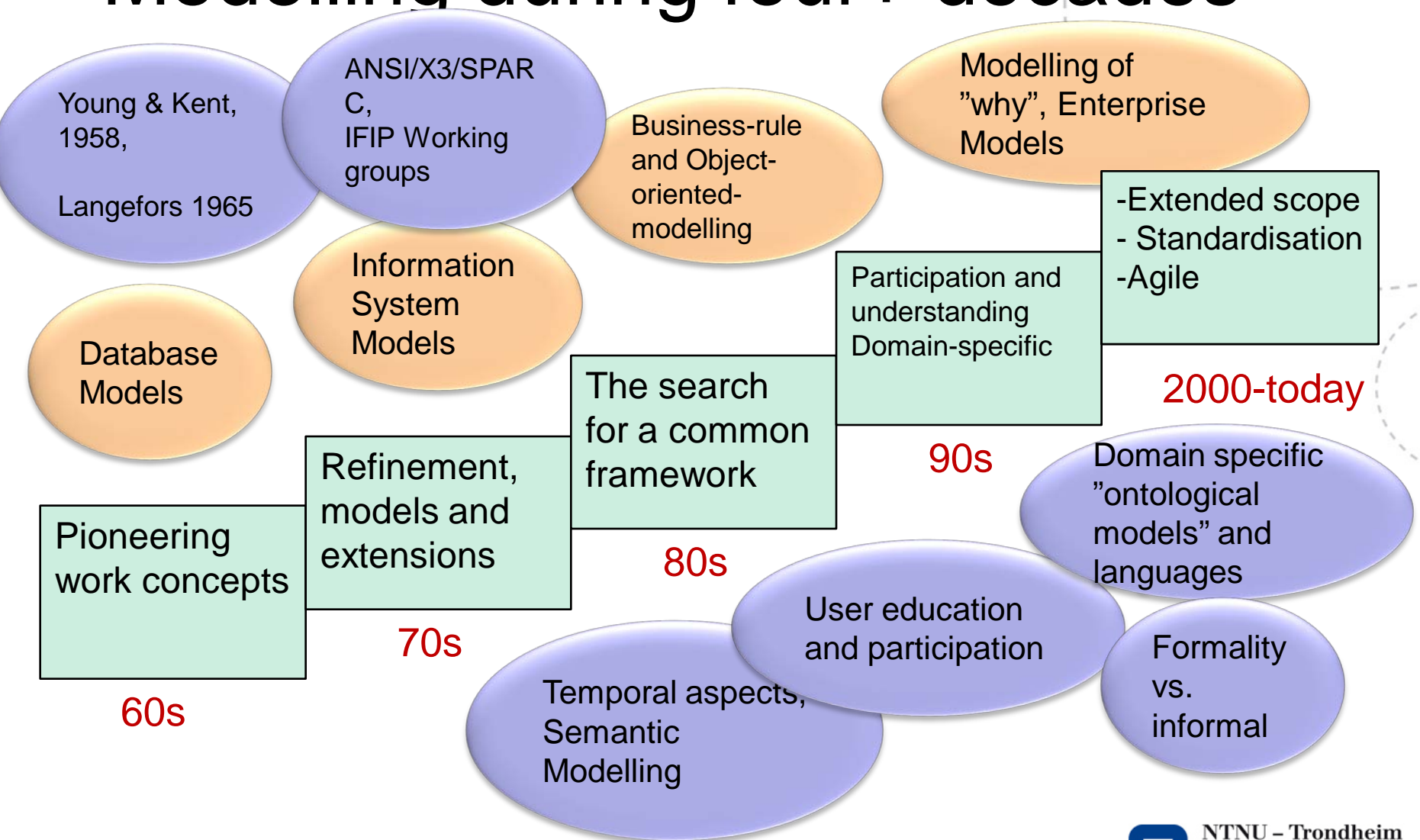


Active Knowledge Models – an example of agile use of modeling



- Models to support dynamic co-operation among knowledge workers
- Use of interactive models as dynamically evolving enterprise model supporting planning and work performance

Modelling during four+ decades



Summary

- Starting from very simple well-bounded conceptual descriptions of information and database systems, modelling has evolved into less well-defined domains.
 - Our needs for modelling and expectations of models have evolved.
 - Stakeholder involvement
 - Focus on dynamics and interactive models.
- Supporting systems that can evolve as our needs evolve.



A Historical Perspective on Visual Modelling

John Krogstie

Lecture 2: Historical background

TDT4252, Spring 2014



NTNU – Trondheim
Norwegian University of
Science and Technology