Lecture 3
Requirements Discovery & Analysis
Use Cases

Com S/SE 4090/5090
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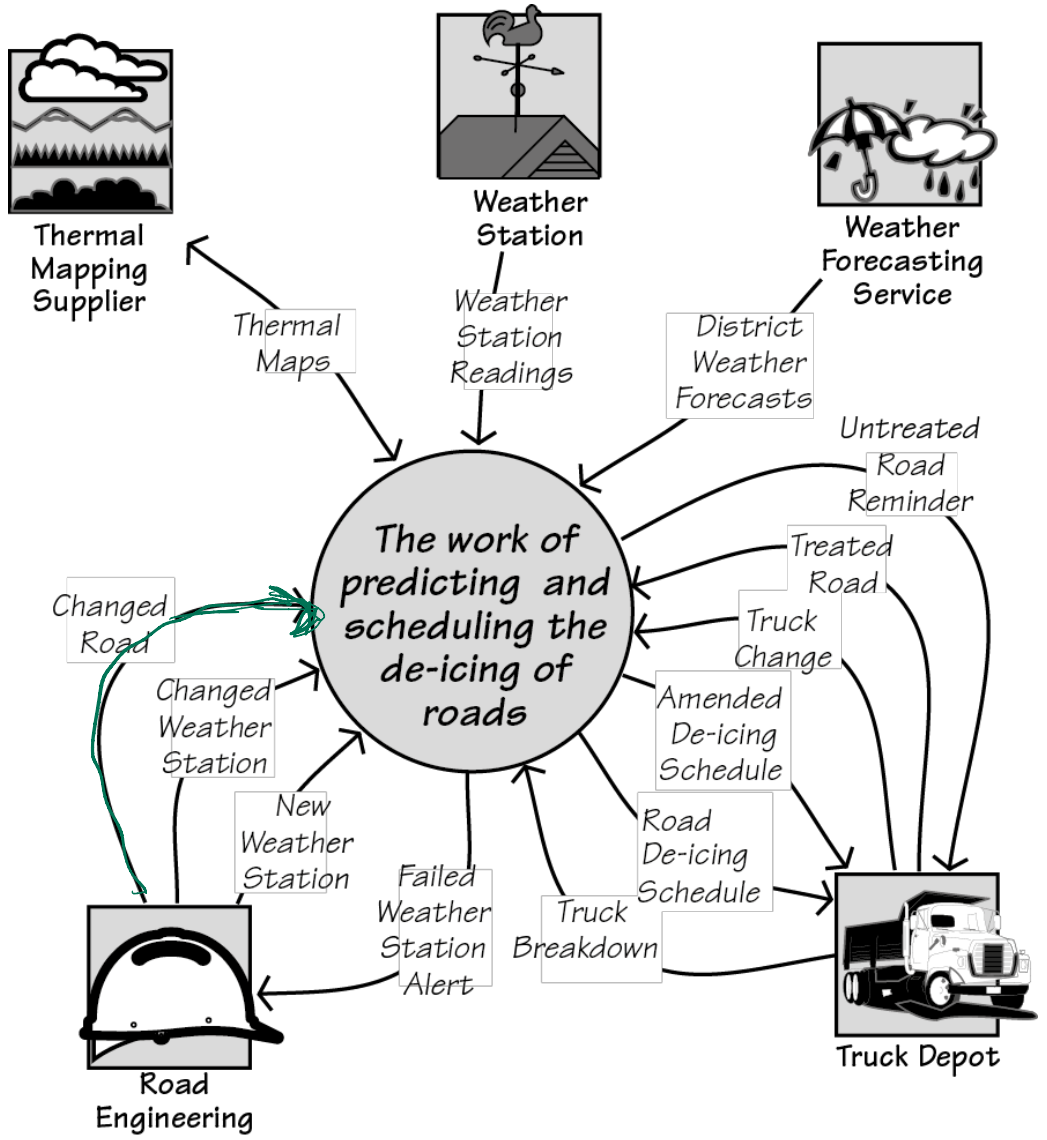
Reading assignment: Chapter 4, Robertson & Robertson

- Reminder: Textbook has useful end sections
  - appendix with some additional perspective on topics described in text
  - glossary of terms used
- Groups will be posted on Canvas

Figure 4.2

The context diagram showing the scope of the work. The central area of the diagram represents the work you are about to study, and the product you eventually build becomes part of this work. The outside world is represented by the adjacent systems—Weather Station, Truck Depot, and so on. The named arrows represent flows of information between the adjacent systems and the work.



Review: **Context diagram**

Software product you'll build is within & *part of* the work's scope

Each arrow is a data flow *event* (input or output) from/to an adjacent system in the work's context

Data triggers the work, and perhaps the software, to do something

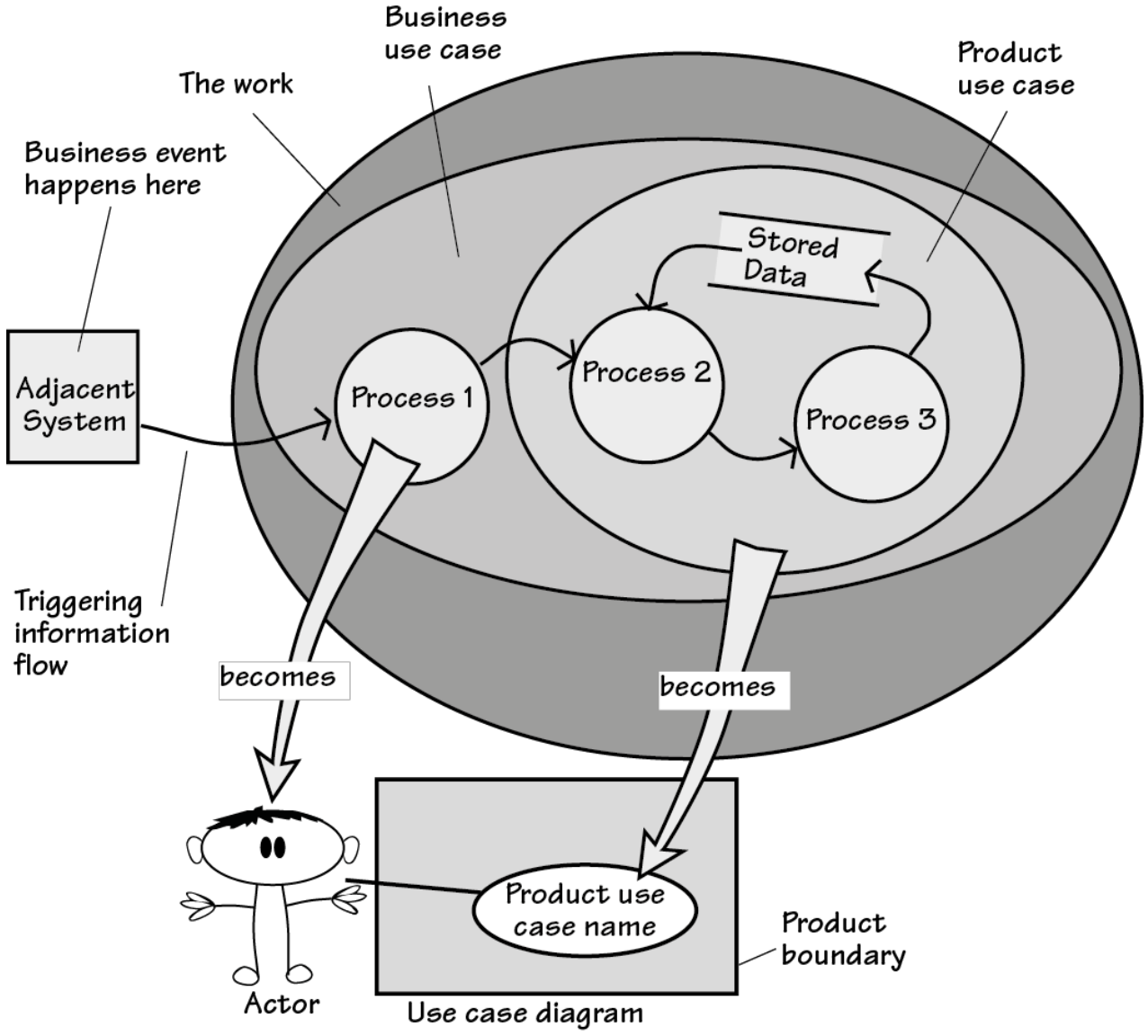
Chap. 4: Business & Product Use Cases

- Scope the work to be done ("predicting & scheduling the de-icing of roads") by partitioning it into use cases
- Use case: unit of functionality
- Use case diagram is a summary of the use cases
- Business use case: response of the work to a business event
  - Ex: Truck Depot reports a problem with a truck
  - Used in out-sourcing: client does *Business* Use Case diagram to describe needs; developer does *Product* Use Case diagram to describe what software does
    - *Check your understanding*: map each arrow (input/output information flow) in Fig. 4.8 forward to its triggering business event in Table 4.1.
- Ask: How much of the business use case is to be done by the software product use case?
  - Some of it may be done by humans or in software

Figure 4.11

The business event is some happening in the adjacent system. The resulting information flow notifies the work of the event and triggers a response (the *business use case*).

After study, the requirements analysts and the interested stakeholders decide how much of the business use case is to be handled by the proposed product (the *product use case*). Whatever is immediately outside the scope of the product becomes the actor, who manipulates the functionality of the product use case within the product.



Product Use Case Diagram

- Product use case:

  the part of the business use case handled by the automated system (the software product)

- Product use case diagram shows:
  - boundary between actors & software product to be built (rectangle)
  - product use cases (ellipses)
  - usage (lines)
  - actors: people or adjacent systems that interact with software product (in "Adjacent Systems & External Technology" in Chap. 8)

Product Use Case Diagram

- Advantages?
- Limitations?

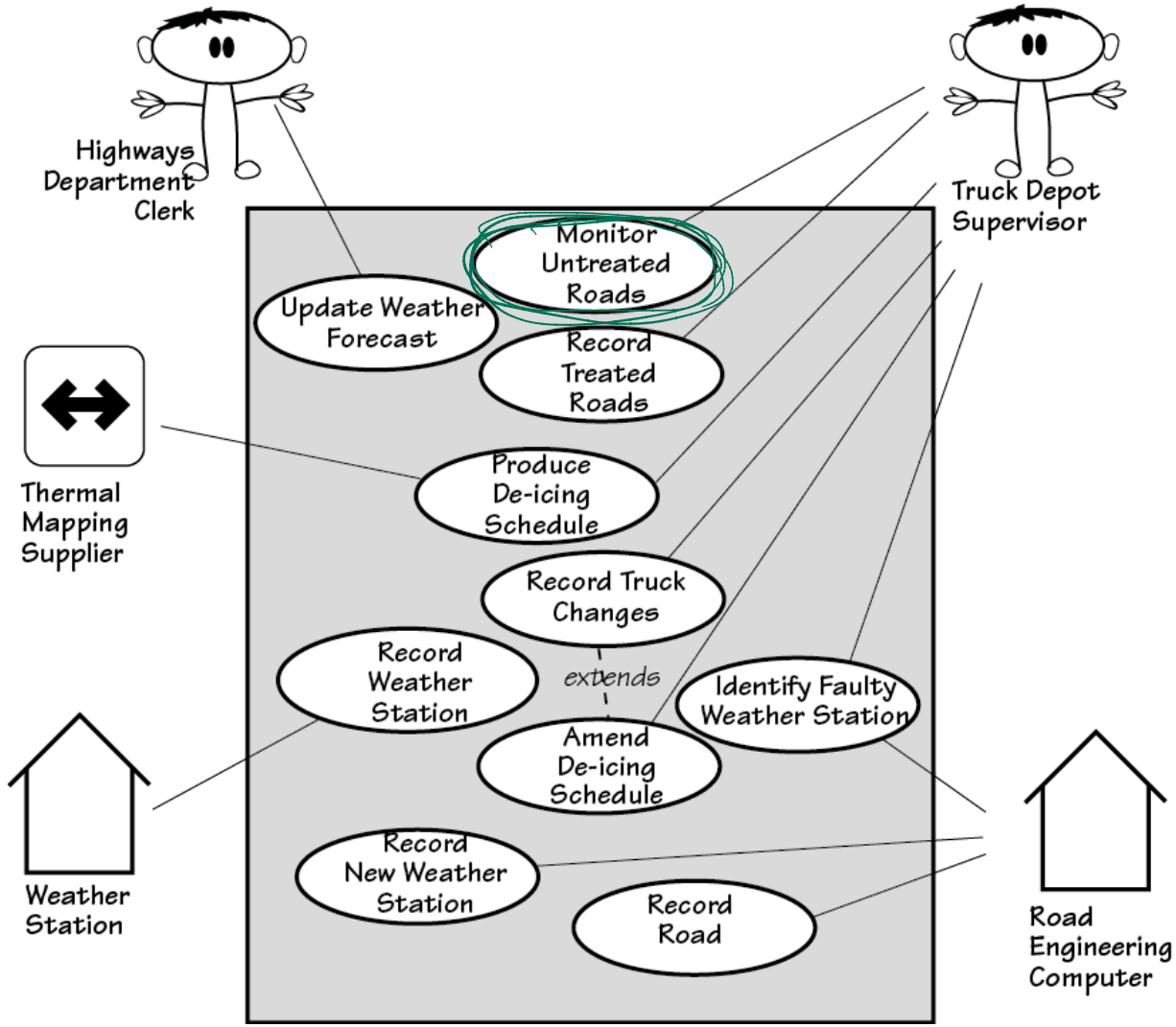
Product Use Case Diagram

- Advantages:
  - High-level & informal model helps in discovering & reaching agreement on clients' needs
  - Popular & easy to prompt discussion of requirements with stakeholders
  - Some regulators require them
  - Helps in planning: builds, tests, prototypes, changes
- Limitations:
  - Some functional requirements will be **missing**
  - From the users' perspective, so internal processing requirements not included
  - Most non-functional requirements & constraints will be missing
- Solution [Wiegers & Beatty]:

  Use simple use case diagram, together with Functional Requirements

Figure 4.12

The **product use case diagram** for the IceBreaker product, showing the product use cases, the actors involved in each product use case, and the product's boundary. The different notation used for the actors indicates the way they interact with the product. (These distinctions are explained in Chapter 8, where we look at starting the product.)



Check your understanding:

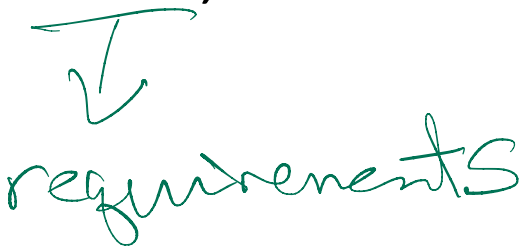
Map each Event in Table 4.1 forward to its Product Use Case in Fig. 4.12 (here).

Which use case is missing?

→ Traceability

Models

- We use models to help find the real requirements
- Models are *abstractions* focusing on a particular view of the product or the reality
  - Ex: Context diagram
  - Ex: Product use case diagram
- Simple models such as these are powerful ways to discover clients' & stakeholders' needs, as well as hidden constraints on your design



The Economist June 11th 2022

Flood warnings

Earthshaking

A better way to warn of flash floods

ON JULY 14TH 2021 a flood tore through the Ahr valley, in north-west Germany. None of the towns upon which it visited death and destruction had had warning of how bad it would be. That warning should have been supplied by automatic flood-level gauges sited upstream, in the river itself. It would have permitted evacuation of houses in particular danger. But the gauges were destroyed by the torrent before they could supply meaningful information.

Relying on instruments which are, by their very location, vulnerable to being swept away, is hardly an ideal approach to tracking impending floods. But Michael ion, in Vienna, that a network of seismometers of a sort more usually employed to record earthquakes might do the job.

Research by Dr Dietze and others had already established that seismometers several kilometres from fast mountain rivers can detect the violence with which the waters of a swollen stream pound the banks, and also the din of millions of pebbles, boulders and other debris bouncing along the bottom during a flood. However, when they studied this particular seismometer's output, he and his colleagues also saw a third, more gradual effect: a tilting of the ground on which the instrument was resting. This was caused by deformation of the local crustal rocks as a result of the sheer weight of the bulge of water speeding through the valley. They had seen something similar before, but only as a consequence of typhoons hitting small islands.

Together, says Dr Dietze, these three signals provided a wealth of information, albeit retrospective, about the flood's behaviour from the moment it came within listening range, about 2km upstream, until it had passed the point closest to the seismometer, after which grid power failed

and the measurements stopped. Both the tilting and the vibrations revealed the flood's direction; the debris noise gave an indication of how much damage to river banks and buildings the passing surge might inflict; and variations in the amplitude of the seismic waves, as the amount of attenuating rock between source and the seismometer changed, made it possible to estimate the speed with which the water mass was travelling downriver.

having several scattered instruments would also allow a flood's front to be located and tracked. It would permit, too, a fair assessment of the amount of water in the bulge behind that front to be calculated.

If this multi-instrument arrangement had been in place last July it could have given the town worst affected, Bad Neuenahr-Ahrweiler (pictured), 30-45 minutes of notice before the flood arrived, and also an estimate of its peak level. At about €3,000 per instrument, this would probably be a good investment for the future in the Ahr valley, and is also worth considering elsewhere.

wikipedia

Practice: develop a 1st-draft **Product Use Case Diagram** for the proposed seismometer-based flood warning system