

# Architecture of Distributed Systems

Homework Assignment 2

R. H. Mak



**TU** / **e**

Technische Universiteit  
**Eindhoven**  
University of Technology

Where innovation starts

# Assignment

In this assignment, you have to deliver a rudimentary architectural description for a system. For the system to be described, you have a choice out of the following two options:

1. The TU/e parking system
2. An imaginary “retailer” system

For the first system, you can inspect the physical facilities on the campus and read the TU/e webpages that describe parking regulations. Some (pointers to) details are given on slides 6 – 8.

For the retailer system, the desired functionality is described in a “retailer story” on slides 9 – 10.

# Hand-in format

Your description should have the form of a PowerPoint presentation of at most 15 slides (title-page included) that

- includes a title page with
  - your names, student identity numbers, assignment identification.
- includes one or more overview slides that
  - name and motivate the architectural/interaction style(s) that you have adopted (or think best fit for the chosen system),
  - identify possible stakeholders and their concerns (if necessary on a per model basis),
  - identify and motivate the viewpoints that are considered.
- discusses a number of extra-functional requirements
  - you can think of security, availability, scalability, maintainability but are free to choose your own.
- contains a number of models
  - you need not be exhaustive, but should strive to cover some variety of aspects of the architecture and indicate the view(s) to which a model belongs and the concerns it addresses.

# Guidelines

1. The architecture description for the parking system need not accurately reflect the true system architecture, since that one is unknown (both to you and to me), but merely needs to be plausible, (requiring some rationale for your design) and address proper concerns of relevant stakeholders. It should, however, be realistic in its description of the elements that are visible to you, both physically on the campus at the entrance/exit gates and through TU/e web-page descriptions.
2. The retailer story is far from complete. You are at liberty to modify or add to the story as you think fit to get an interesting architecture, provided you explain properly. Also pay attention to the context of the system, i.e., functionality that can be obtained from third parties.

# Constraints

1. In principle, you are free to choose between the TU/e parking system and the retailer system. However, students that follow this course for a second time, must choose a system that they have not discussed in a previous year. This holds for all students in a group! If this presents a problem, consult the responsible lecturer.
2. The 15 page limit is hard!
3. To preserve readability of your slides, you are not allowed to go below: font size 16 .  
This font size lower bound is also a hard!

# TU/e parking system (page 1)

As of April 2015 parking on the TU/e campus is no longer free for employees (or anybody else as a rule, although exceptions are made).

Together with the introduction of the accounting system for payment, the entry and exit gates for the campus have been extended with a facility for license plate recognition, that both controls the gate barriers as well as automatically feeds the accounting system with the required parking time data.

At the same time, the older “protocols” for entering and exiting the campus by car are still in place, namely using a personal campus card, or drawing a ticket upon entry and validating it, by paying at a payment-booth, upon exit.

Currently, also a traffic guidance system indicating the number of free parking slots at various Campus locations is in place.

# TU/e parking system (page 2)

More information about the rules and working of the system can be found at

1. <https://www.tue.nl/universiteit/over-de-universiteit/bereikbaarheid-tue-campus/bereikbaarheid-route-en-plattegrond-tue-campus/op-tue-campus/parkeren-op-tue-campus/parkeren-voor-bewoners-tue-campus/tarieven-betaling>
2. [https://static.tue.nl/fileadmin/content/universiteit/Over de universiteit/Route Plattegrond/Parkeren/Parking\\_regulations.pdf](https://static.tue.nl/fileadmin/content/universiteit/Over_de_universiteit/Route_Plattegrond/Parkeren/Parking_regulations.pdf)

Payment for parking facilities is outsourced. to “Heerlijk Parkeren”

3. website <http://www.heerlijkparkeren.nl> (Dutch only, ☹)
  - Contains a.o. a reference to a manual page that gives some insight in the administrative process.

# TU/e parking system (page 3)

In addition to the format requirements on slide 3 and the general guidelines on slide 4, your description must satisfy the following requirements.

1. It needs to address the control of the entry and exit-gates.
2. It needs to address the accounting for payment.
3. It needs to address information needed about and provided to employees. Think of information about campus cards, license plate information, free parking slots or accounting overviews. See the next slide for an example of the latter.

Moreover, due to the variety of entry/exit protocols, there are many (undesired) scenarios possible that

1. make it very hard to determine the exact amount to be paid and
2. make it very hard enforce that that amount indeed will be paid.

You are required to describe at least one such scenario and show its impact on the architecture you propose.



# Screenshot (H)eerlijk parkeren: my parking history (2015)

Just to give you some idea of user interaction with the accounting system.

mijn gegevens **mijn historie** mijn tegoed mijn locaties

 

**mijn historie** [Uitloggen](#)

Op deze pagina kunt u uw parkeertransacties inzien.

Parkeeroverzicht

Locatie	Binnenkomst	Vertrek	Duur	Prijs	BTW
Campus	10-07-2015 14:52	10-07-2015 18:04	03:12	0.00	0.00
Campus	10-07-2015 08:43	10-07-2015 13:07	04:24	2.00	0.35
Campus	03-07-2015 16:22	03-07-2015 18:12	01:50	0.00	0.00
Campus	03-07-2015 08:45	03-07-2015 13:27	04:43	2.00	0.35
Campus	26-06-2015 16:43	26-06-2015 18:36	01:54	0.00	0.00
Campus	26-06-2015 08:30	26-06-2015 13:37	05:07	2.00	0.35
Campus	22-06-2015 08:30	22-06-2015 18:03	09:33	2.00	0.35
Campus	19-06-2015 10:08	19-06-2015 13:26	03:19	2.00	0.35

[Vorige](#) [Volgende](#) [Afdrukken](#)



Note that there is no charge for *second visits* on the same day. Moreover, since I have 9 free entries this year, “mijn tegoed” will show that my account has not been charged for any of the remaining 5 first visits either. (Beware an old overview rules may have slightly changed in the mean time)

# Retailer story (page 1)

A nation-wide retailer with a large number of local branches, say a department store or supermarket, decides to tag all its products with a QR-label. By doing so, the conventional bar-code applications such as

1. scan the items from a customers shopping cart at the cash register and generate a bill
2. get an instantaneous and accurate overview of the number of items per product left in stock, and automatically reorder new product items from the respective suppliers

become possible. Given the wide availability of smartphones amongst its customers, however, the retailer sees additional advantages in the usage of QR-labels which can be exploited by making a smartphone app and a web service available to its customers.

## Retailer story (page 2)

These facilities allow a customer to scan the QR-tag with her smart-phone while shopping, whereupon the app contacts the web service

3. to provide the customer with additional product information
4. to provide the retailer with the location, i.e., the specific branch, where the customer scans the product. (For the latter, the app may need to use the GPS-facilities of the smart-phone, or the customer may need to scan an additional QR-label identifying the branch).

By comparing the customers' information retrieval with the actual sales of the product at a branch, the retailer obtains geographically-based statistics indicating, for instance,

5. how popular the product is in specific regions of the country
6. how effective the additional information is for selling the product in a region.

Also additional phone apps of usage in the shop may be envisioned.

## Retailer story (page 2)

Ensure that your architecture pays proper attention to goals of the system that are local and pertain to the individual branches and the goals that are nation wide. Pay attention to the interaction between headquarters and branches that is needed to coordinate the various services delivered by your system.