The Adaptation of a Web Information System: a Perspective of Organizations

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Introduction

- Web Information System (WIS)
  - is a hybrid between a hypermedia and an information system
    - Important requirement: dynamic adaptation of content structure, navigation primitives, and presentation styles.
- WIS is adaptive if it is able to modify delivery of contents and services according to the context of the client.
- WIS usage context
  - is considered as a set of properties that describe the environment, where the user interacts with a WIS,
    - time, place, device, user.
- Profile
  - is a representation of an autonomous aspect of the WIS usage context.
- Configuration
  - is a specification how information has to be delivered to the user

Existing approaches

- Many architectures and approaches exist for the WIS adaptation
  - based on different understandings of context, profile, and configuration.
  - different properties of each notion are considered.
- The approaches to the development of flexible and cost effective systems should also be considered
  - Software product line approach (SPL)
  - Software as a service (SaaS)
    - defined as a "software deployed as a hosted service and accessed over the Internet"

Software as a service (SaaS) approach

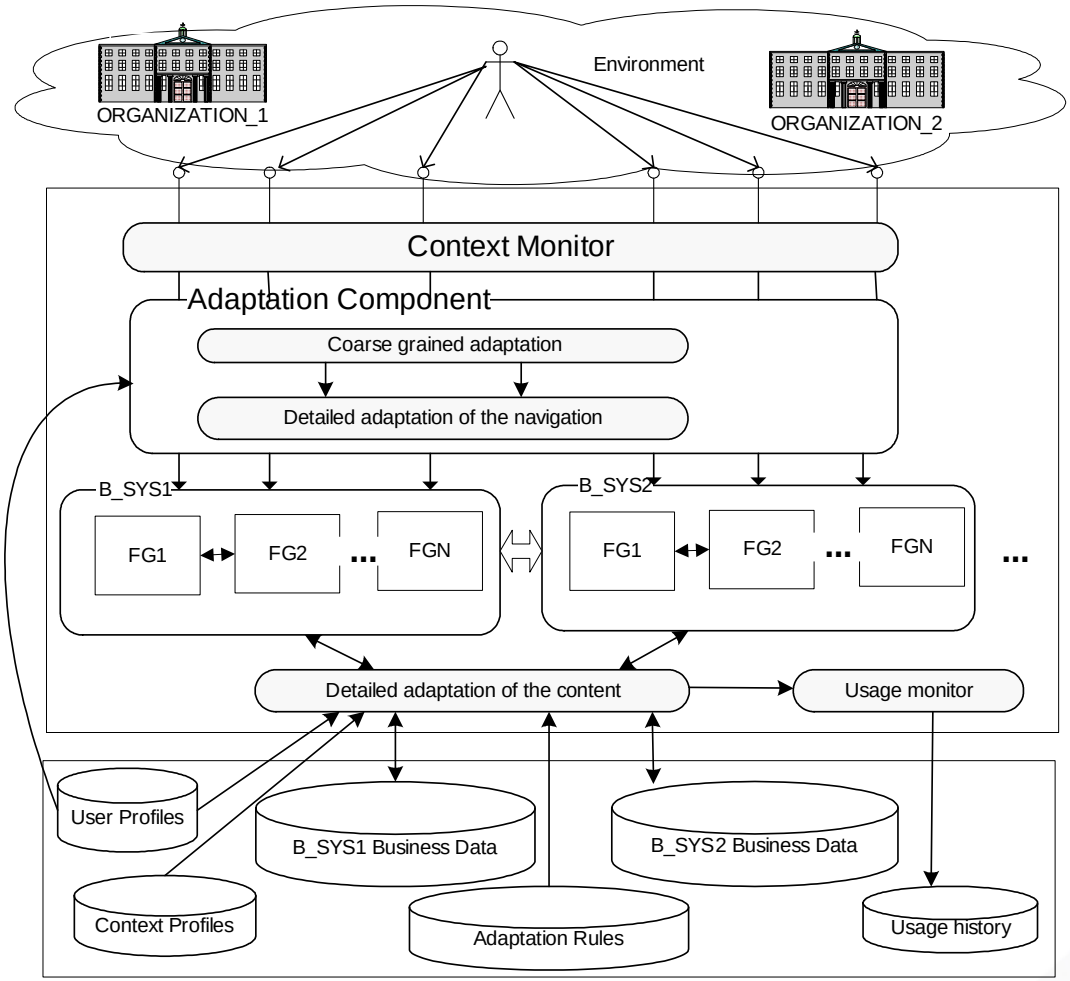
- SaaS introduces a new way of providing the access to the software.
  - services support business processes common for different organizations
  - organizations subscribe to use the software and pay for the usage
  - service vendor hosts the SaaS application on their servers and maintains the software and infrastructure
  - a cost efficient solution for small and medium size organizations.
- SaaS applications can be provided at different maturity levels
  - configurable, multi-tenant single instance solution.
- The multi-tenancy
  - users from different organizations use the same application instance, but data are distinguished between tenants of the service.

Proposed architecture

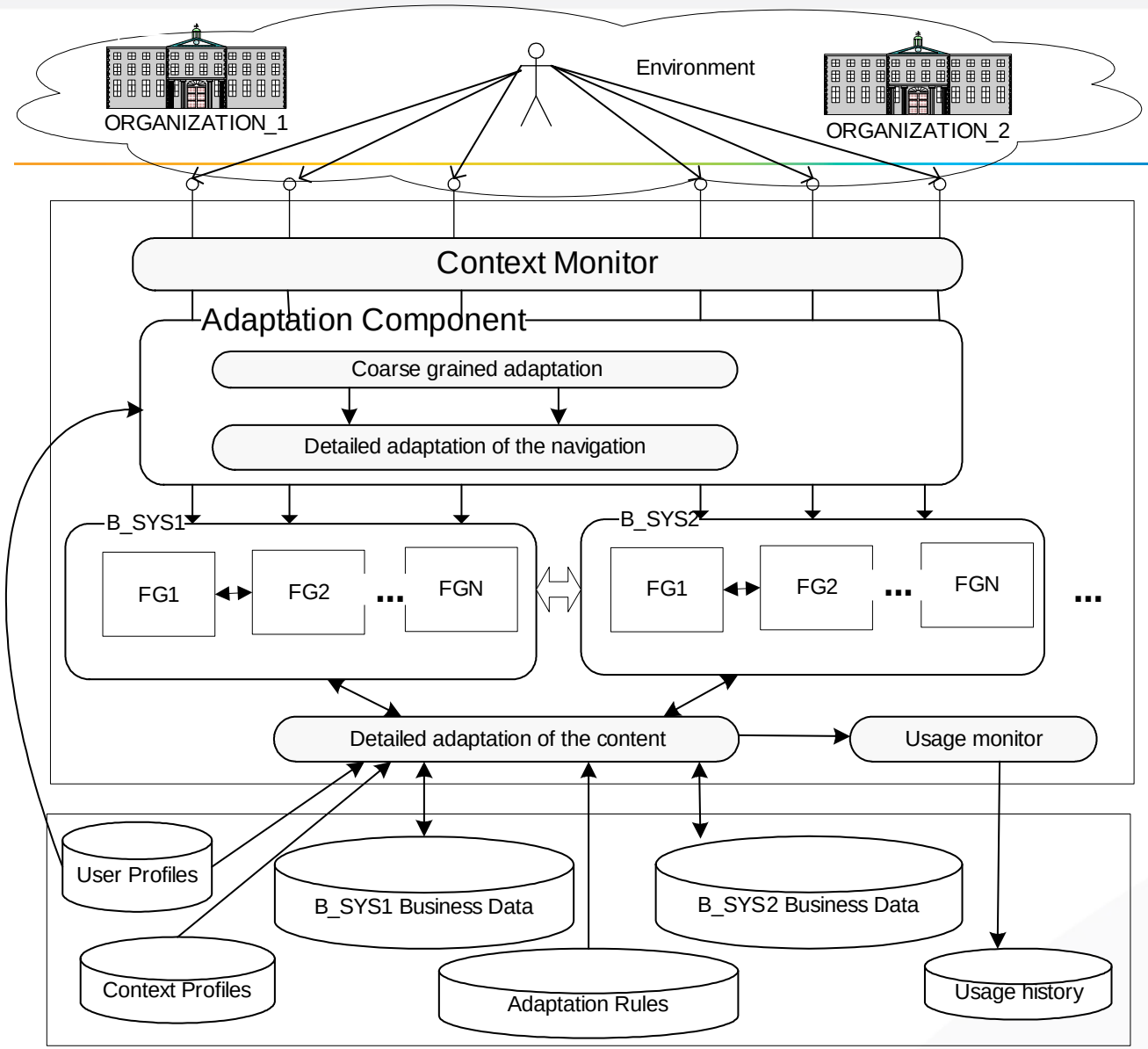
- To effectively solve the problems concerning configuration and multi-tenancy, the SaaS applications need architectures designed for these purposes.

- Our proposed architecture:
  - based on multi-tenancy, single instance approach
  - two level adaptation is introduced.
    - Organizations and also the users get their own adapted instance of the WIS

The adaptation architecture of WIS

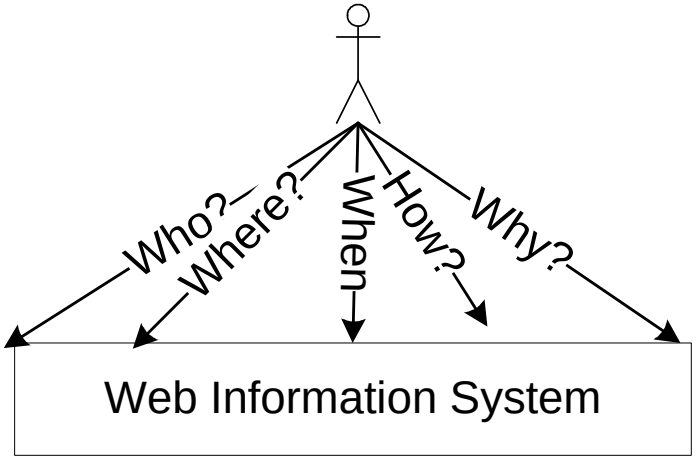


- Context monitor
- Data layer
- Adaptation component
- Usage monitor



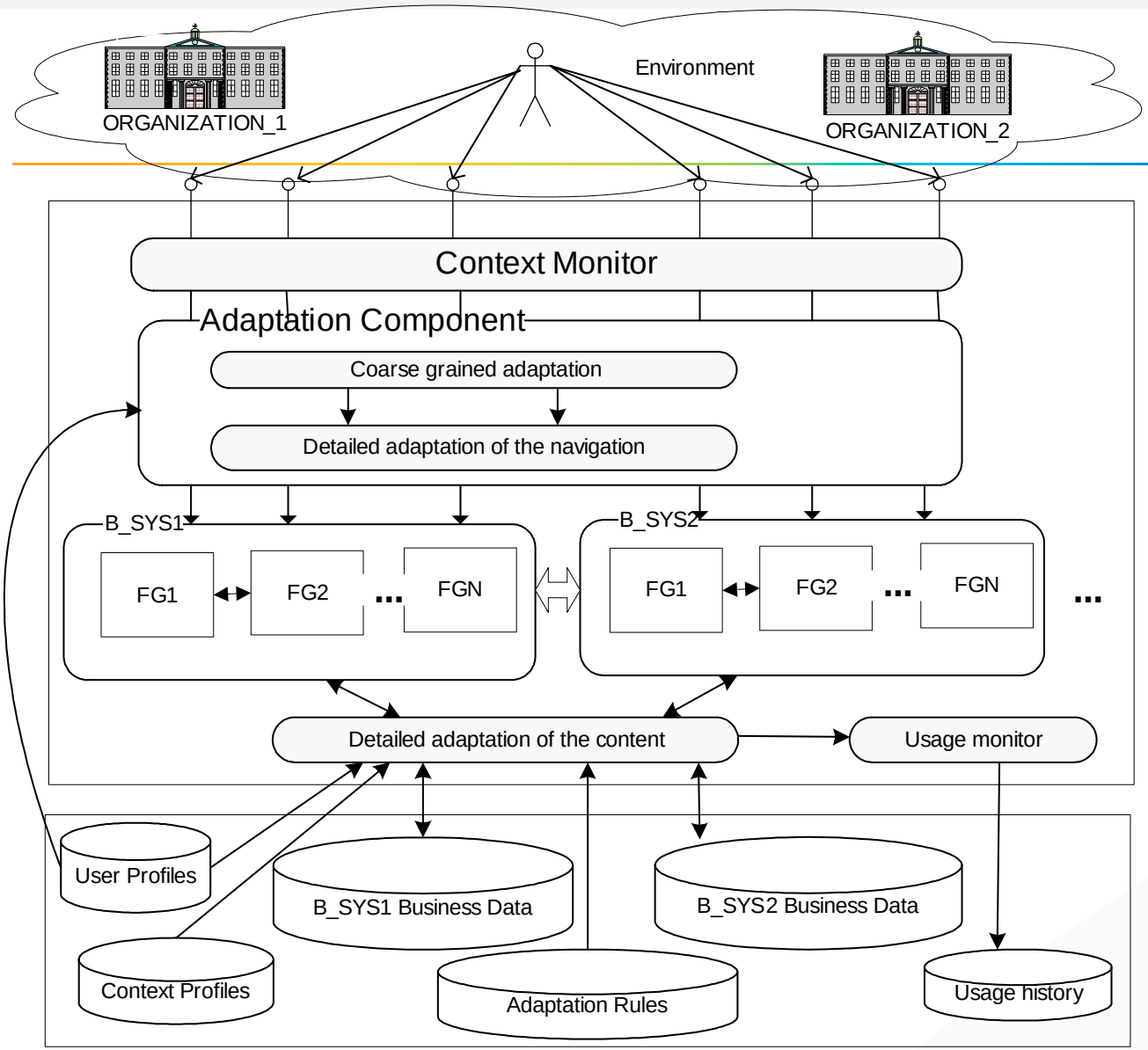
- Context monitor
  - identifies the context properties of the system usage in the time, when the user connects to the WIS

Context Monitor



Who? -user properties- identity, professional characteristics
Where? - place, which identifies the systems accessibility
When? - time - date, clock
How? - media used and its properties e.g. mobile devices
Why? - the goal of the performed action

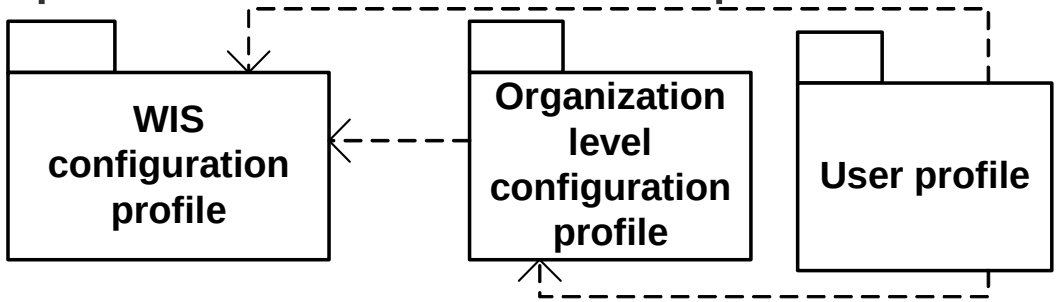
- the goal is:
  - to recognize the properties of the environment
  - to forward these properties to the adaptation component to adapt the WIS according to the particular environment



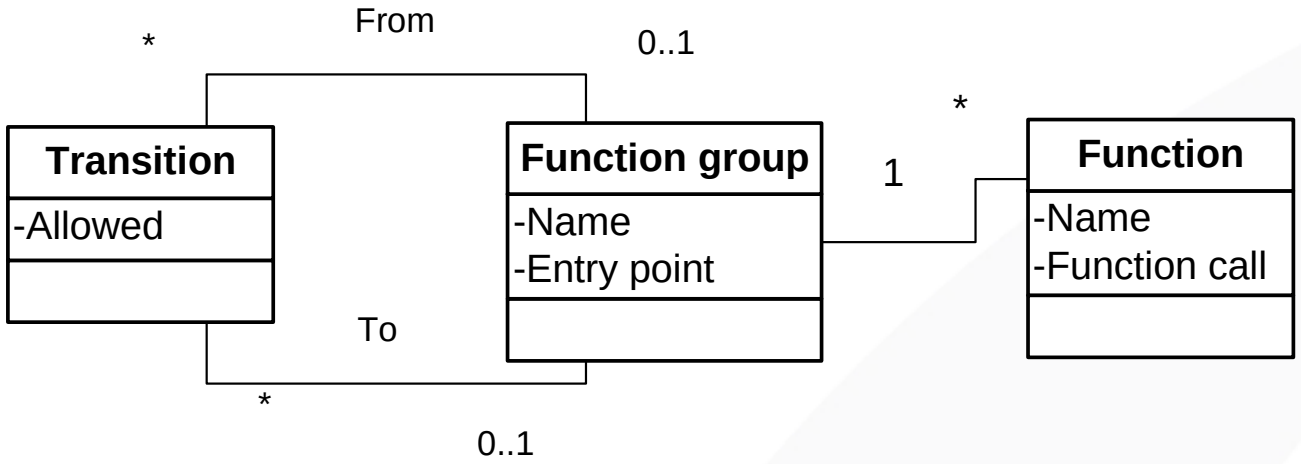
- data layer
  - contains profiles that are used in both adaptation levels and the business data

Profiles used in the proposed architecture (I)

- The package diagram is used to describe dependencies between profiles.

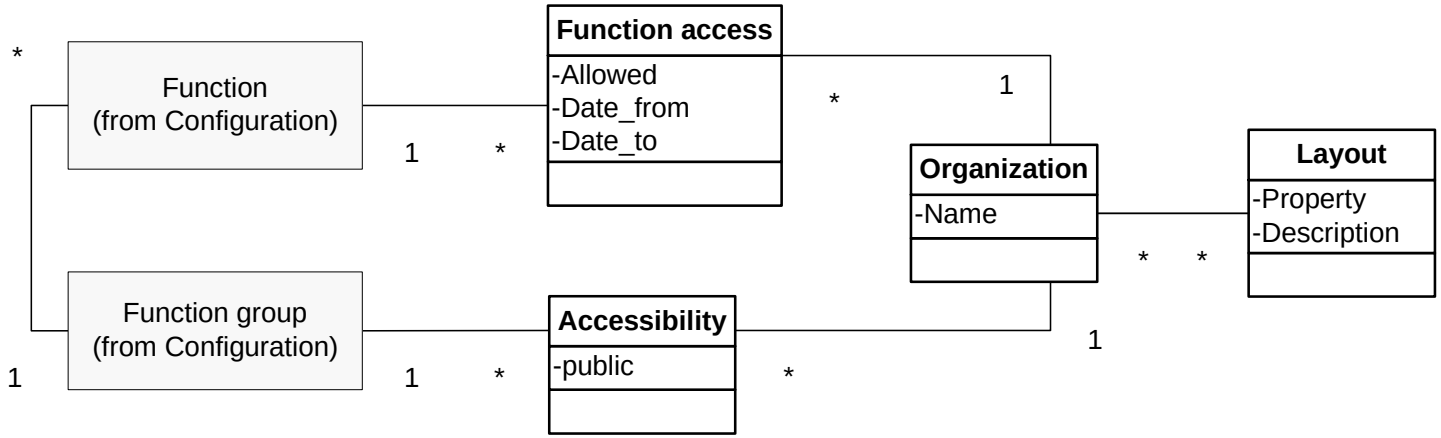


- WIS configuration profile

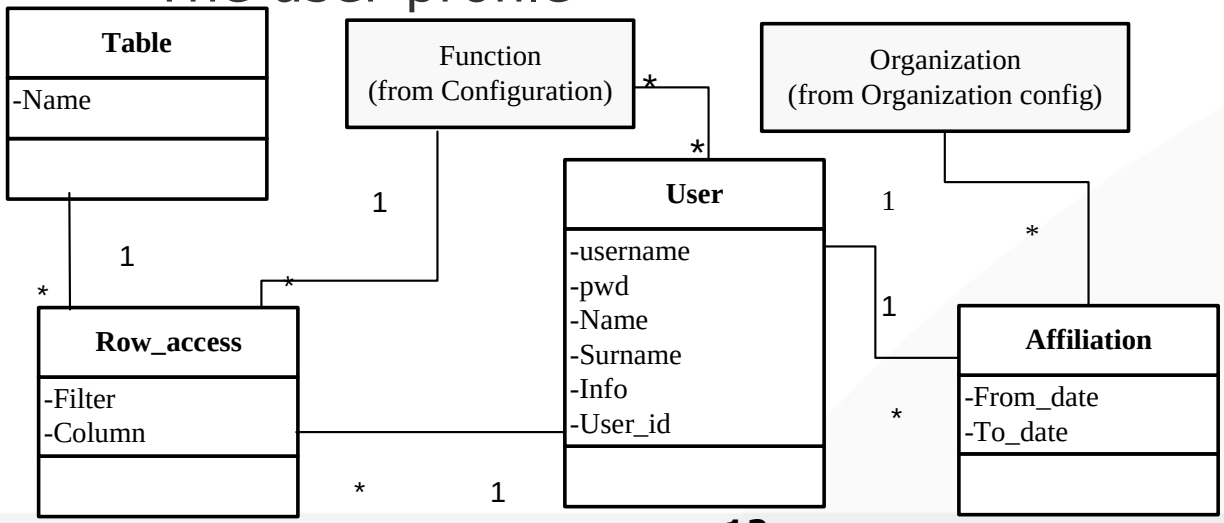


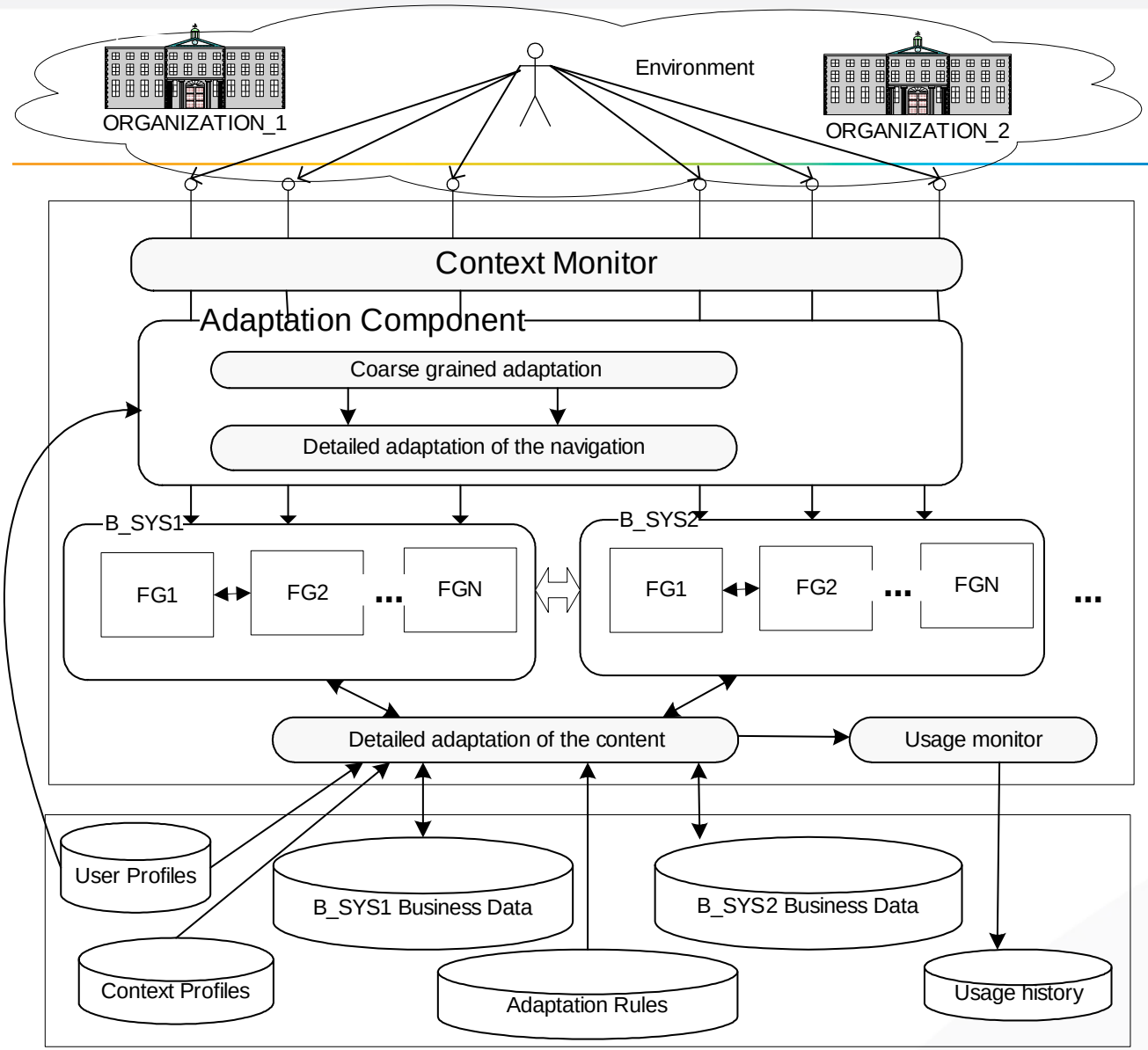
Profiles used in the proposed architecture (II)

- The configuration profile for the organization



- The user profile





- Adaptation component
  - The adaptation component performs the adaptation in two levels

Two level adaptation

- Coarse level adaptation
  - According to the profiles, this process establishes an organization level instance of WIS.

- Detailed level adaptation
  - is based on the information stored in the user profile.
  - two steps:
    - Detailed adaptation of the navigation
    - Detailed adaptation of the content
  - constructs an instance of WIS for the particular user

Coarse level Adaptation

- is performed by the following operations:
  - The construction of initial configuration
  - The adaptation in organization level
  - The joining of instances of function groups
  - The selection of allowed function groups
  - The adaptation of layout

Coarse level Adaptation – operations (I)

- The construction of initial configuration
  - *start_config* – creates initial configuration (IC)
  - uses configuration profile of WIS;
  - IC consists of all Function groups described in the profile.
- The Adaptation in Organization Level
  - *adapt_org* (*IC, user, time*) - adapts IC according to the organization level profile.
  - IC is checked, if all function groups and functions are accessible to the particular organization.
  - The adapted instance IS_org is the result of this operation.
    - If the user belongs to more than one organization, then according to the profile of the user, adapted instances are made for each such organization: e.g. *IS_org1* and *IS_org2*.

Coarse level Adaptation – operations (II)

- The Joining of Instances of Function Groups
  - *FG_union (IS_org1, IS_org2).*
  - operation is defined:
    - only for instances of the same function group, and
    - only in the case, when the user belongs to both organizations having *IS_org1* and *IS_org2*
  - The joined instance *IS_org1_org2* will consist of
    - joined function groups and
    - function groups allowed for each organization.

Coarse level Adaptation – operations (III)

- The Selection of Allowed Function Groups
  - is used, when the user belongs to more than one organization
  - used after adapt_org and FG_union
  - *FG_select (entry point).*
  - Entry point – attribute of function group and describes the way and place how user enters the system
- Let us assume that
  - an entry point belongs to a function group *FGk*.
  - *Tij* is a transition from *FGi* to *FGj*, defined in the configuration profile of WIS.

- it is possible to define a transition chain TCk*,* which consists of sequential transitions *Tij* between function groups starting with function group *FGk*.
  - The number of different possible chains is predefined within the configuration profile of WIS.

- The result of *FG_select (entry point)* is the adapted joined WIS instance *IS_org1_org2*, which contains all function groups that are accessible with any of transition chains *TCk*.

Coarse Level Adaptation – operations (IV)

- The Adaptation of Layout
  - *adapt_layout*
    - when the user belongs to more than one organization, the layout properties are used according to the organization, which owns the entry point used by the user

Detailed Adaptation

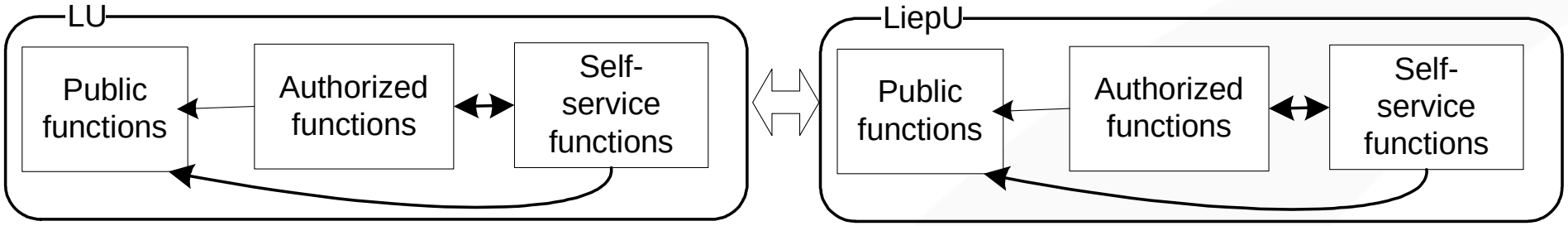
- detailed adaptation of the navigation
  - *adapt_navig* (user)
  - finds out from the user profile the user rights to the functions.
  - Is made within the framework of the adapted WIS organization level instance
  - The result is an adapted instance „IS_user”.
- detailed adaptation of the content
  - *adapt_data* (user).
  - finds out from the user profile the user restrictions to the data
  - the adapted „IS_user” is supplemented with the content corresponding to the restrictions defined for the user.

The Case Study of WIS Adaptation (I)

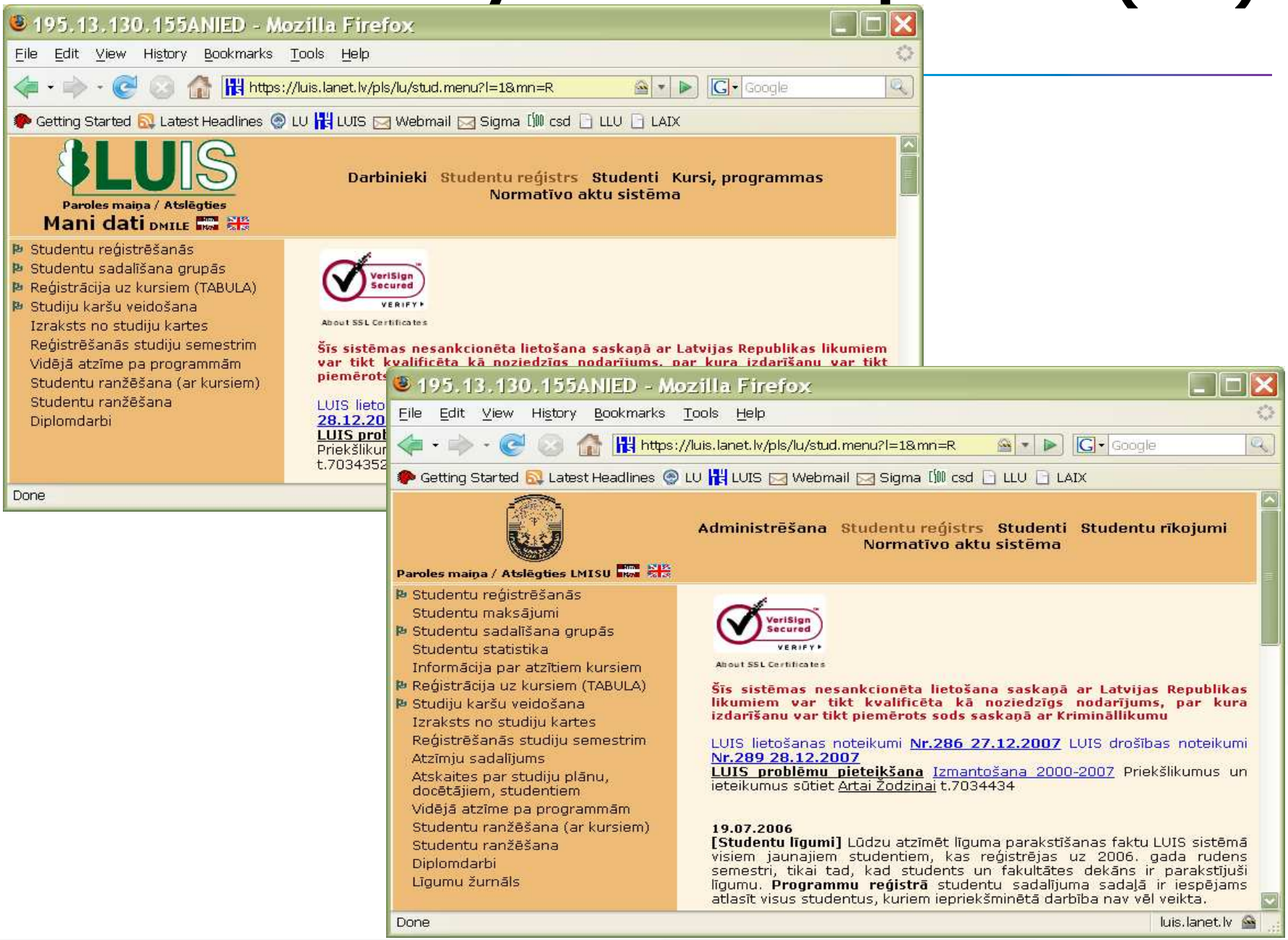
- The usage of the adaptation architecture for Universities (UWIS).
- Three function groups are defined in the configuration of the UWIS:
  - *FGa* - the group of authorized functions.
    - users should have access to data of other employees or students within the responsibilities of users' work.
  - *FGs* - the group of self-service functions.
    - user can perform functions only with his personal data
  - *FGp* - the group of public functions.

The Case Study of WIS Adaptation (II)

- Let us consider a case, when the user is an employee at the Liepaja University (LiepU) and she studies at the University of Latvia (LU). Both universities use UWIS.
- The context monitor identifies the entry point, the user, and the time, when the UWIS is accessed.
- The adaptation component constructs two instances of UWIS with all three function groups according to UWIS configuration profiles of LU and LiepU
- The instances of UWIS contain also the predefined transitions between function groups, the arrows in the picture denote the directions of transitions



The Case Study of WIS Adaptation (III)



Results, Conclusion and Further Work (I)

- Our architecture is being used in two WIS
- The first project is UWIS, where 12 universities are using each an adapted instance of the system
- All universities (12) use the authorized function group, 8 universities use the public part of the system, but 10 universities use the self-service functions

Results, Conclusion and Further Work (II)

- Entry points into function groups in the picture shows all entry points into the UWIS system:
  - one common entry point into authorized function group
  - entry points into self-service function groups of each particular university. These entry points into self-service groups serve also as entry points to public functions of each university
- The second implementation of proposed architecture is used for the car registration WIS in Latvia

Results, Conclusion and Further Work (III)

- We provide a view on the problem of WIS adaptation, looking from perspective of organizations that are interested in an adapted WIS for their needs, if a unified system to support similar business processes is used.
- We introduce two levels of adaptation – organization level adaptation and detailed adaptation for the user,
- We support the situation, when users can work with many instances of the system adapted for different organizations, which are integrated into one instance for a particular user.
- Some aspects of adaptation provided in the architecture were out of the scope of this paper, for example, the process execution monitoring to provide more effective WIS.

Thank You!