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COTS software for the NET-centric C2 decision support and knowledge management

Prof. Ladislav Buřita, Vojtěch Ondryhal
University of Defense, Czech Republic
Department of Communication and Information Systems

Paper outline

- Background
- Research projects - experiments
  - Data Mining
  - Information Retrieval
- COTS - Common characteristics
  - User roles
  - Architecture
- Lessons Learned

Background

- Projects
  - Our experience is based on two research projects which has been solved at the University of Defence;
    - “Planning processes in the MoD”
    - “Communication and information systems (CIS) development and integration in the NATO environment”
  - The goal for researchers is to investigate possible technologies and approaches in partial areas.
- Hypothesis:
  - [A] It is possible to transfer knowledge from ongoing projects to C2 area of interests.
  - [B] COTS (Commercial-Off-The-Shelf - “boxed”) software be utilized in such projects.
- Area of interest
  - Decision support systems - Decision support systems (DSS) are a class of computer-based information systems including knowledge-based systems that support decision-making activities. [wiki]

Decision support systems categories

- A **model-driven DSS** emphasizes access to and manipulation of a statistical, financial, optimization, or simulation model. Model-driven DSS use data and parameters provided by users to assist decision makers in analyzing a situation; they are not necessarily data intensive.
- A **communication-driven DSS** supports more than one person working on a shared task.
- A **data-driven DSS** or data-oriented DSS emphasizes access to and manipulation of a time series of internal company data and, sometimes, external data.
- A **document-driven DSS** manages, retrieves and manipulates unstructured information in a variety of electronic formats.
- A **knowledge-driven DSS** provides specialized problem solving expertise stored as facts, rules, procedures, or in similar structures.

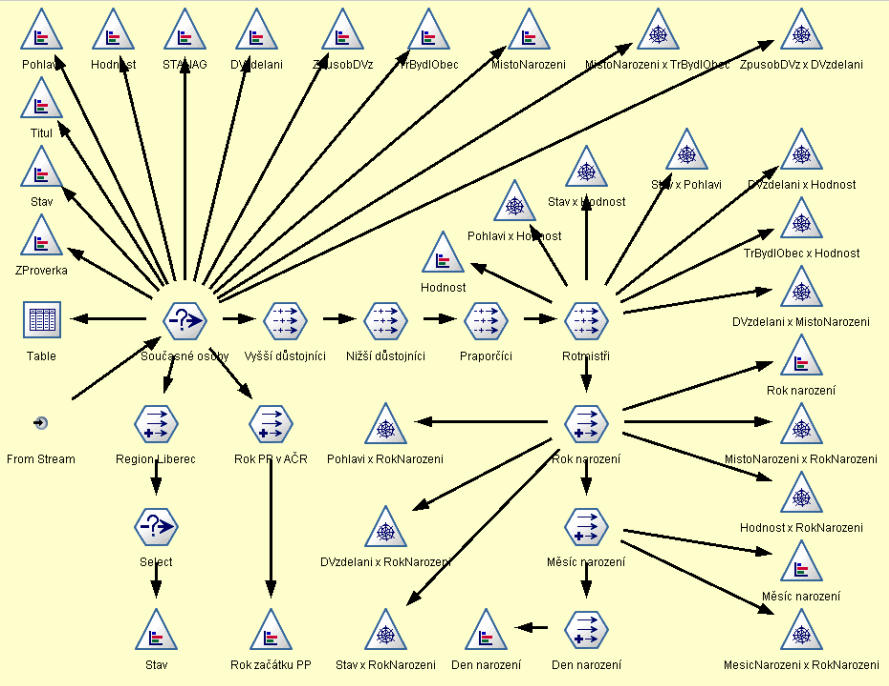
Experiments

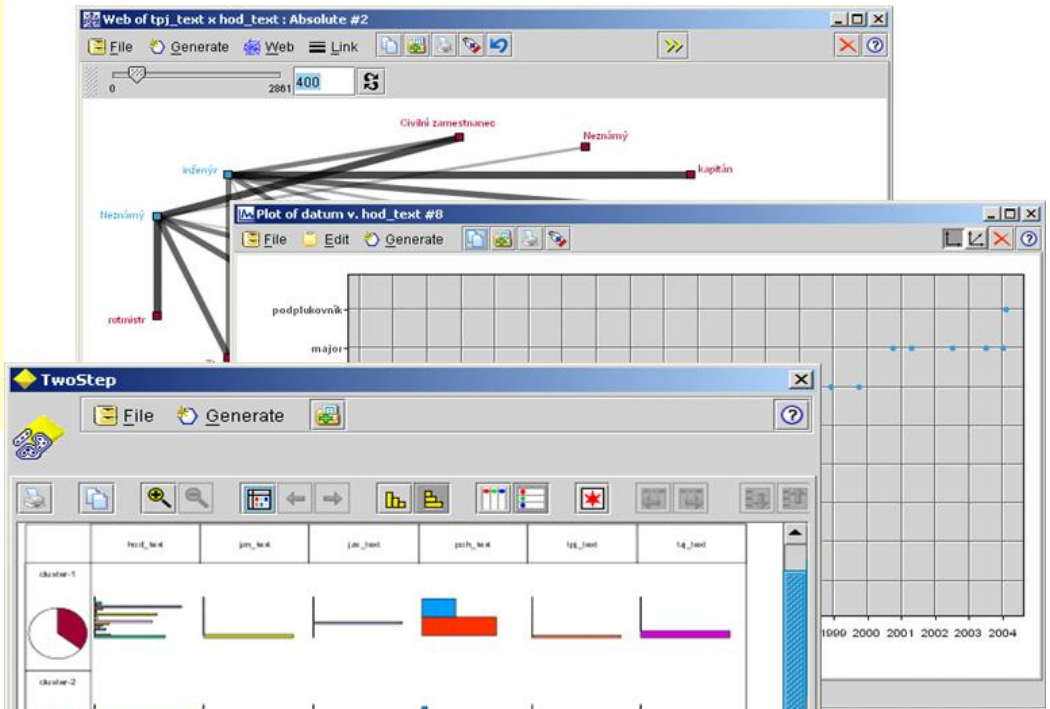
I. Data Mining

- The aim of the project is finding answers for questions in military personnel career beginning with university study (area, results), followed by military service and finished by positions after military retirement.

- Project Phases
  - Data understanding.
  - Data preparation.
  - Model construction.
  - Model validation.
  - Deployment.
- COTS Software: Clementine SPSS (SAS Data Miner, Weka)

- Customization example





II. State security IS based on Semantic Web

- Project goals:
  - To develop the Prototype „Information System in the State Security“, implement and verify them in the ISS environment.
  - To start research of the Semantic WEB, Ontology, etc. for the C2IS interoperability in NATO environment and to become familiar with those technologies.
- Steps
  - Thesaurus development.
  - Thesaurus validation.
  - Ontology definition.
  - Document base creation (about 12 000 documents).
  - Document indexing and establishing relations to ontology.
  - Testing possibility of automated Annotation.
  - Knowledge management system development.
- COTS - ITM Intelligent Topic Manager

- Project Phases:
  - Preparation phase, education in knowledge management, ontology, ITM etc.
  - Installation of DBMS PostrgreSQL, AS JBoss, SW ITM.
  - Ontology research and preparation.
  - Prototype building, implementation and verification.
  - Results demonstration and evaluation phase.
- Method of thesauri design:
  - Preparation of document base (ISS).
  - Thematic vocabulary ad-hoc specification (categories are in the Table 1 in the paper).
  - Analyse of document base (text analysis, harvesting), see Table 1, Figure 5 in the paper.
  - Thematic vocabulary corrections and thesauri definition (categories and subcategories).
- Future work:
  - Ontology definition.
  - Testing possibility of automated annotation.
  - Knowledge management system development

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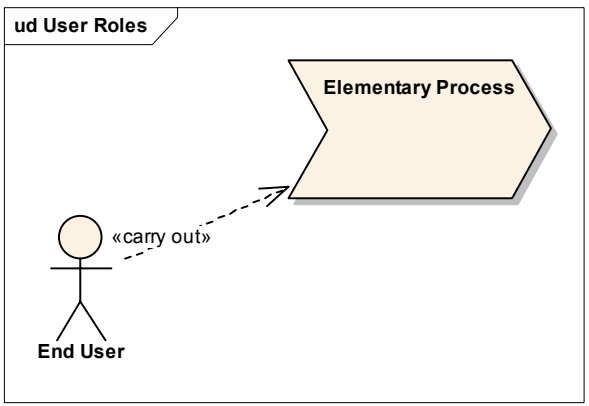
C2 User Roles

End user (Commanders and Staffs)

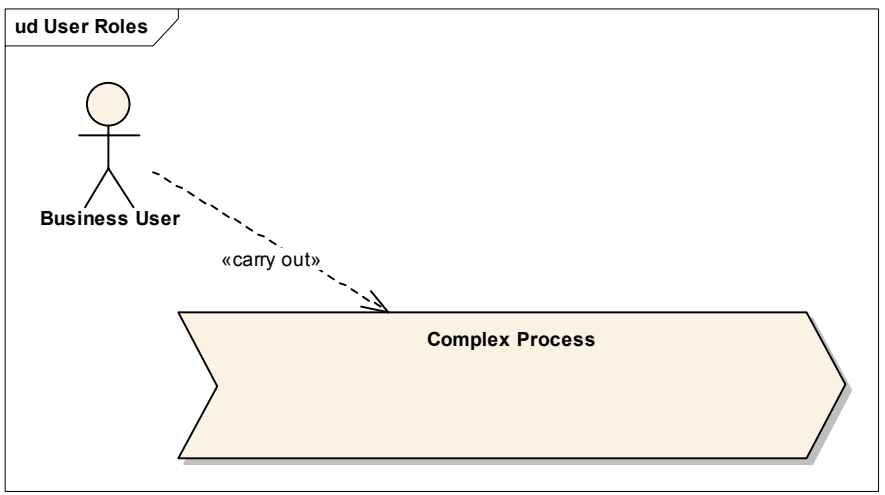
- Use software to fulfil elementary repeatable business processes.
- Ordinarily largest group.
- Application user interface should be simple, resistant to user faults.
- Every unnecessary operation or step implemented takes time.
- Processes cover simple input and update operations, prepared reports and prints.



C2 User Roles

Business users (Analytics in C2 branch)

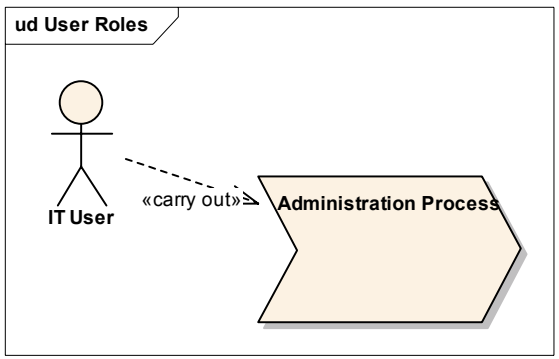
- Require more sophisticated user interface with advanced options.
- They work usually on unique and more complex business processes.
- In some software applications, business user can customize simple business processes for end users (e.g. Clementine).



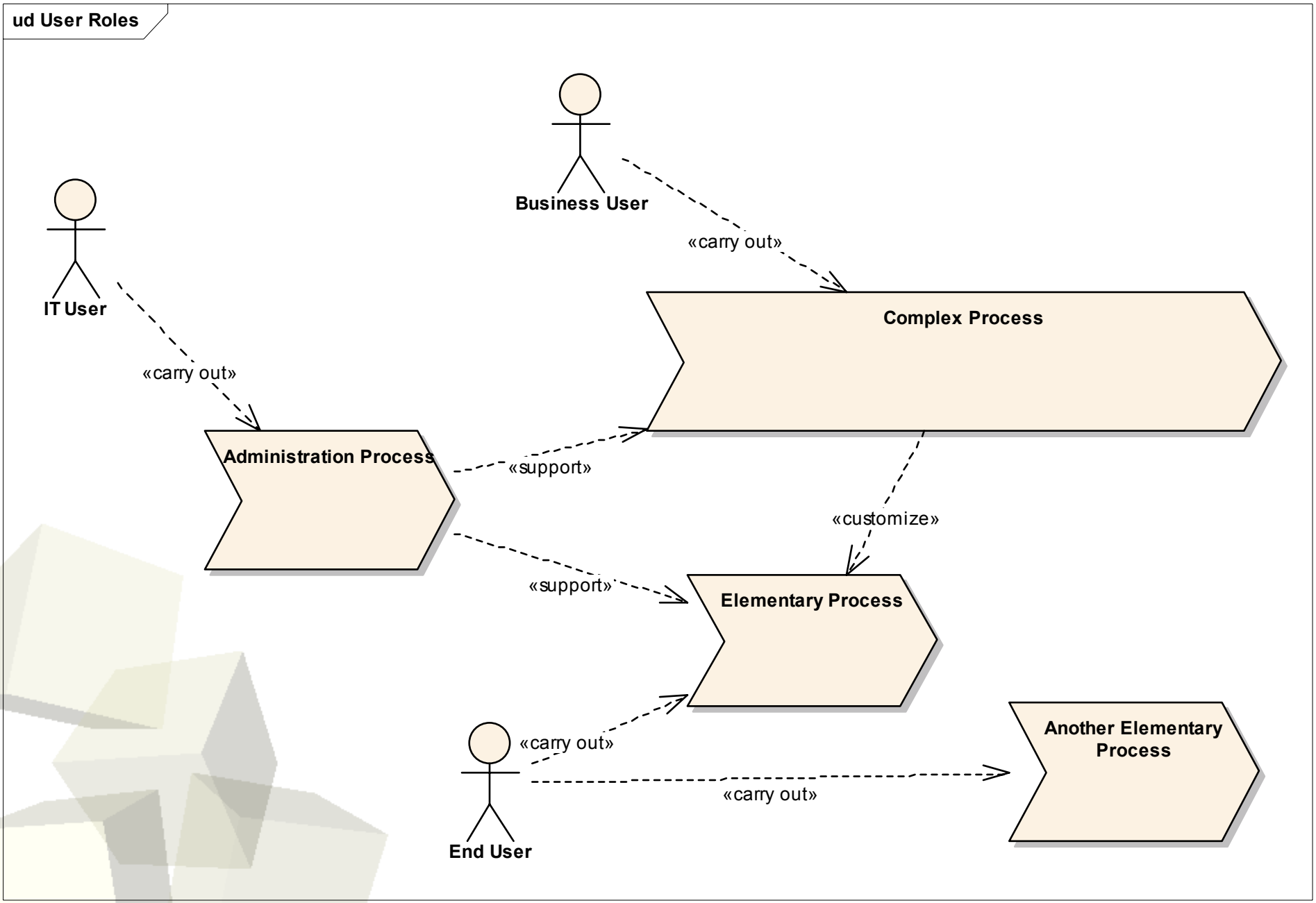
C2 User Roles

IT Users (for C2 systems) are specialists that

- Understand technology used for software creation and are familiar with deployment model of current installation
- They are usually not skilled with business processes. The responsibilities of this user group are:
  - Data backup and if required data recovery.
  - Installations - new end and business users.
  - Security model maintenance. It includes mainly user definition and roles assignment.
  - Log records management.



C2 User Roles - Summary

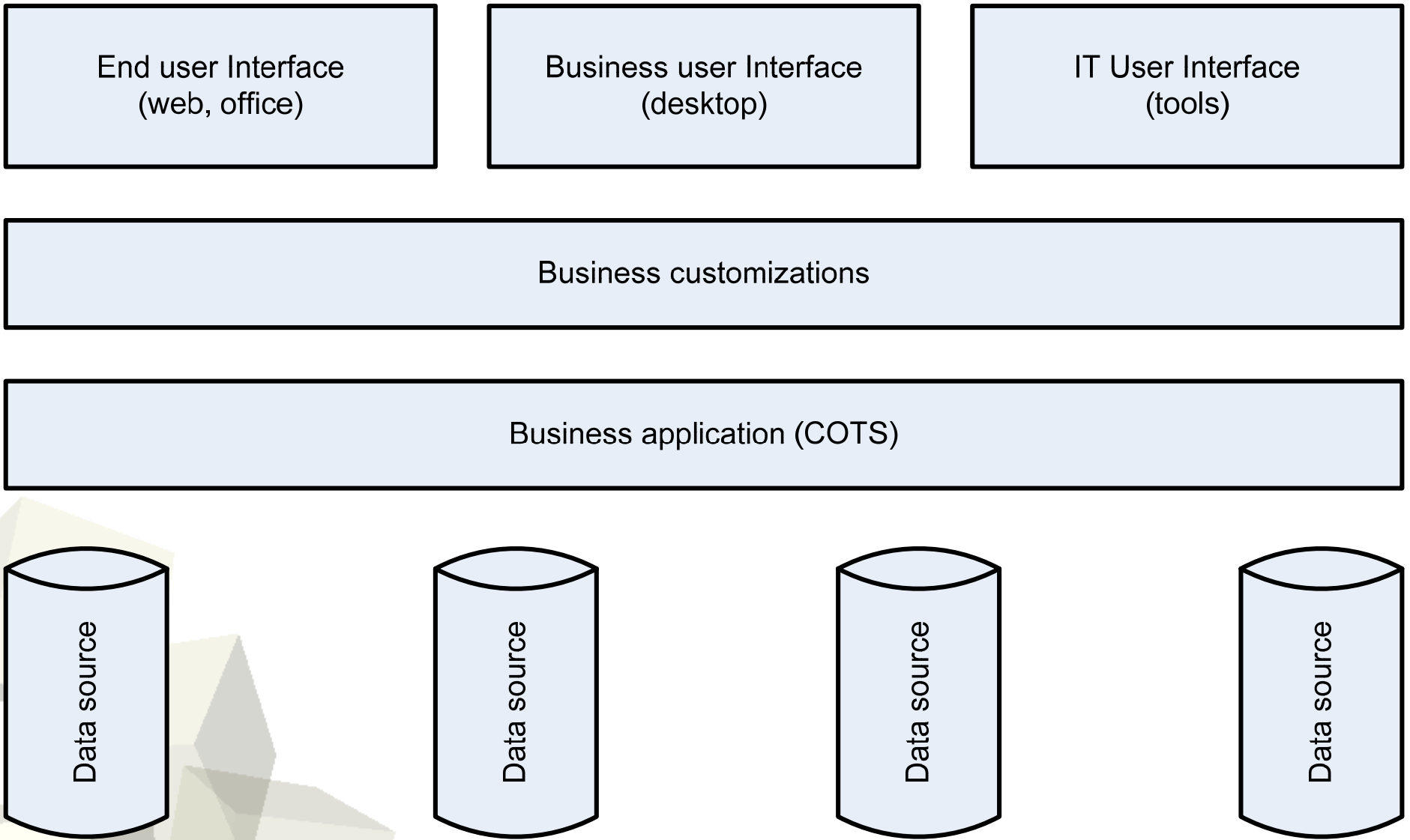


Architecture

- Typical COTS architecture consists of four levels:
  - User interfaces,
  - Business layer (company knowledge base) including settings and customizations,
  - COTS itself.
  - Independent data sources.

- Notes
  - Business customizations and data sources are usually not part of purchased software;
  - It is companies' responsibility sort out these two layers, even before software is implemented.
  - Business customizations reflects existing or presumptive processes in the organization, usually includes workflow possibilities.
  - Data sources exist in a form of separated databases that we should consolidate.

Architecture



Lessons learned and conclusion to the C2 field

- High Expectations of COTS
  - COTS can not be usually installed and run.
  - Business user have to be familiar with COTS.
  - Customization phase is required.
- Procedures, we took during our research, are transferable and exploitable in C2 area.
  - It is necessary to obtain required data, documents and present processes, and then in the same way apply appropriate COTS software.
- COTS (e.g. Clementine) can smartly solve difficult and complex data analysis.
  - The tool transforms analysis tasks to simple data streams covering requests.
  - Reporting and visualization of data mining analysis results is important step for model understanding.
  - Such possibility for straightforward decision support we can utilise in C2 systems.

Lessons learned and conclusion to the C2 field

- New method for ontology preparation in the security area using analytics and text mining Tovek Tools SW was suggested and IS architecture by ITM will be implemented.
  - The method of the thesaurus validation is possible to apply by the development of the C2 ontologies.
- We assume, domain ontology design is required for C2 area.
  - Data sets and documents according to various situations can be automatically identified during commanders' decision-making process.
  - IS in the state security field in our environment is the first step in Semantic Web research for the C2 branch.

Wrap up

- Thank you.
- Contact information:
  - ladislav.burita@unob.cz
  - vojtech.ondryhal@unob.cz
  - http://dcs.unob.cz/~Vojtech.Ondryhal