FACTORS THAT INFLUENCE CHOICE OF SOFTWARE ARCHITECTURE

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ERICSSON NIKOLA TESLA
- IDENTITY CARD

› **ERICSSON NIKOLA TESLA** is a part of a global Ericsson corporation and operates within Ericsson Region West and Central Europe

› **BUSINESS:** Supplier of modern information and communications products, solution, software and services

› **LEGAL STATUS:** joint-stock company

› **COMPANY INITIAL CAPITAL :** HRK133,165,000

› **MANAGEMENT:** MSc Gordana Kovačević

› **NUMBER OF EMPLOYEES:** 1,652 *(Dec. 31, 2009)*

› **ADRESS:** Zagreb, 45 Krapinska

Split, 39 Poljička cesta

› **WEB:** www.ericsson.com/hr

OWNERSHIP STRUCTURE

1,56%
49,37%
49,07%

■ ERICSSON
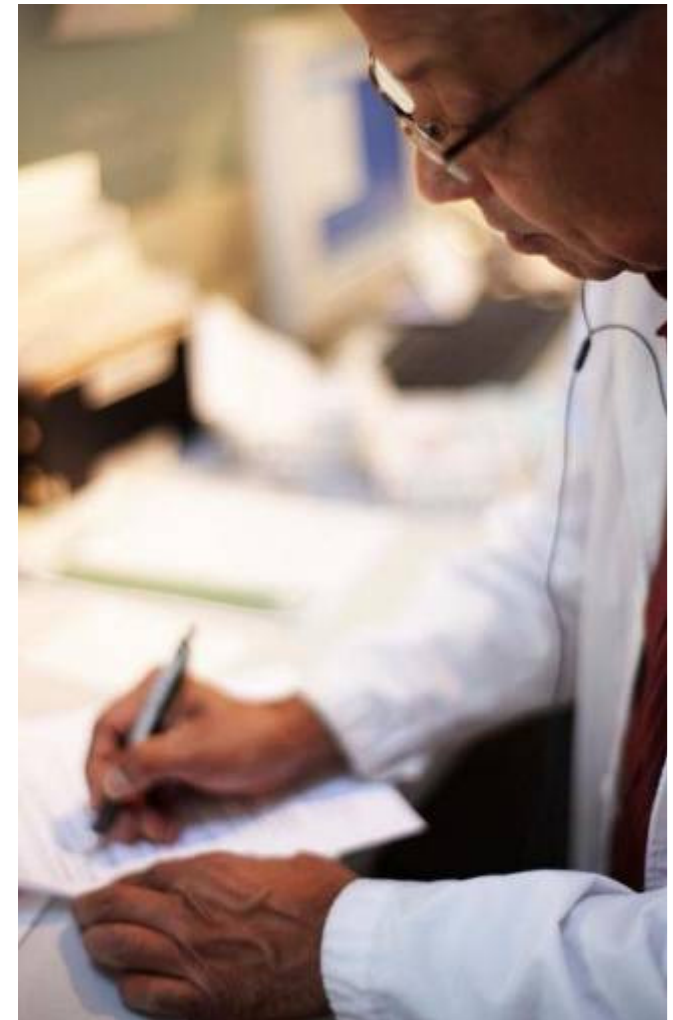■ TREASURY SHARES
■ OTHER SHAREHOLDERS
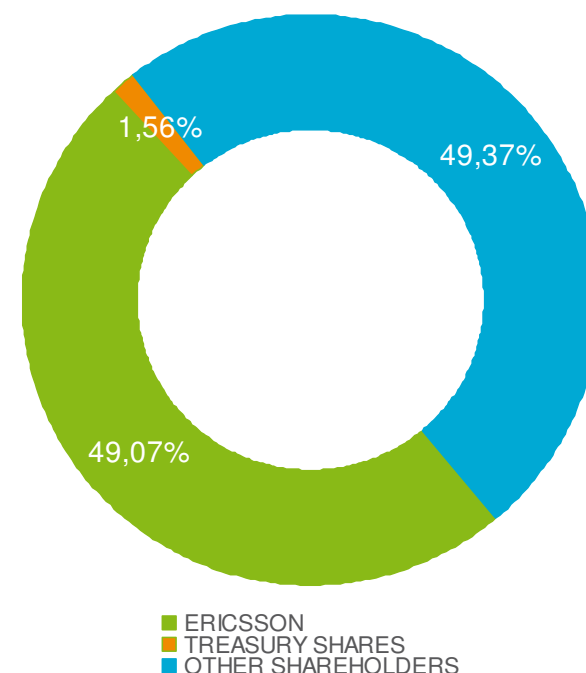
> WHAT IS SOFTWARE ARCHITECTURE?
WHY IS IT IMPORTANT?

WHAT IS SOFTWARE ARCHITECTURE? - THEORY

> Software architecture is the structure or structures of the system, which comprise software elements, the externally visible properties of these elements, and the relationships among them.

Bass, L.; Clements, P.; & Kazman, R. *Software Architecture in Practice, Second Edition.* Boston, MA: Addison-Wesley, 2003.
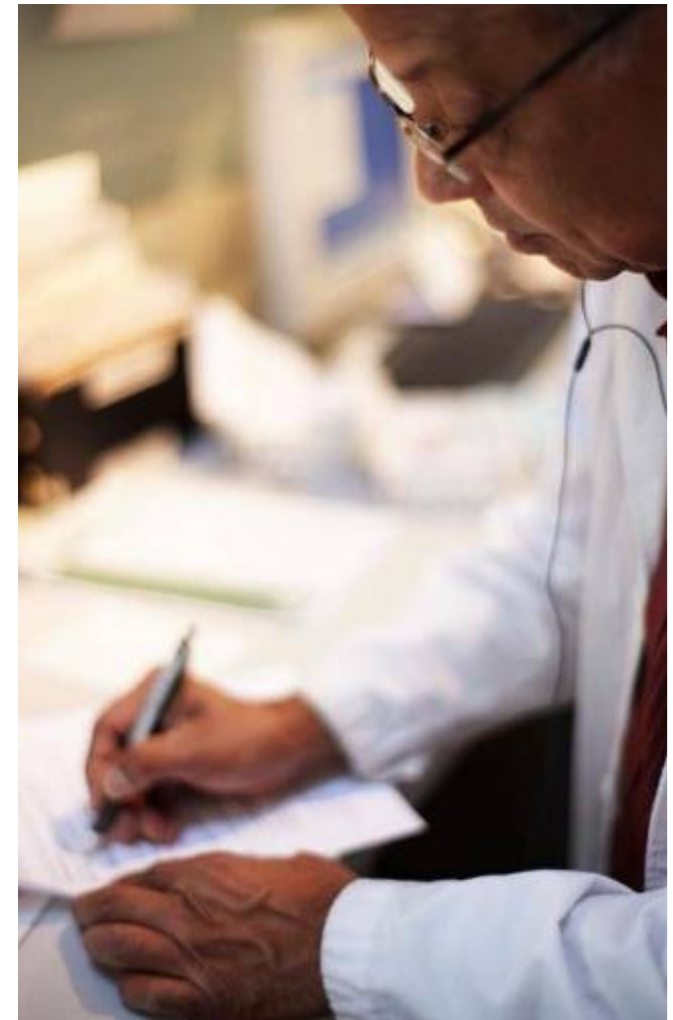
WHAT IS SOFTWARE ARCHITECTURE?
- PRACTICE

> The architecture of complex software or systems is a collection of hard decisions that are very expensive to change.

Twice as many problems are outcome of "omission" rather then of "commission." That is, problems arise because of decisions or investigations that were never made rather than those that were made and lead to undesirable consequences.

Bass, L.; Clements, P.; & Kazman, R. *Software Architecture in Practice, Second Edition.* Boston, MA: Addison-Wesley, 2003.

SOFTWARE PROCESS STEPS RELATED TO SOFTWARE ARCHITECTURE

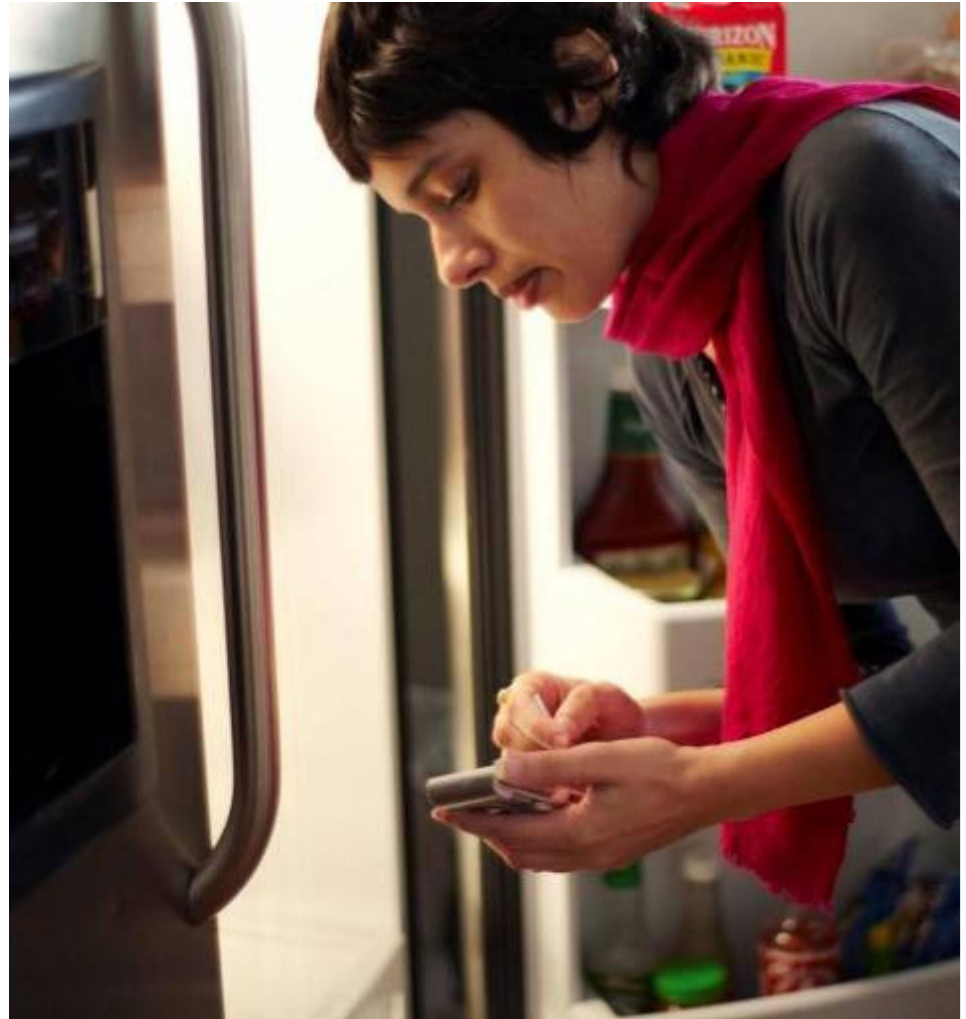- Creating the business case and understanding requirements

- Creating or selecting the architecture

- Communicating the architecture

- Analyzing or evaluating the architecture

- Implementing based on the architecture

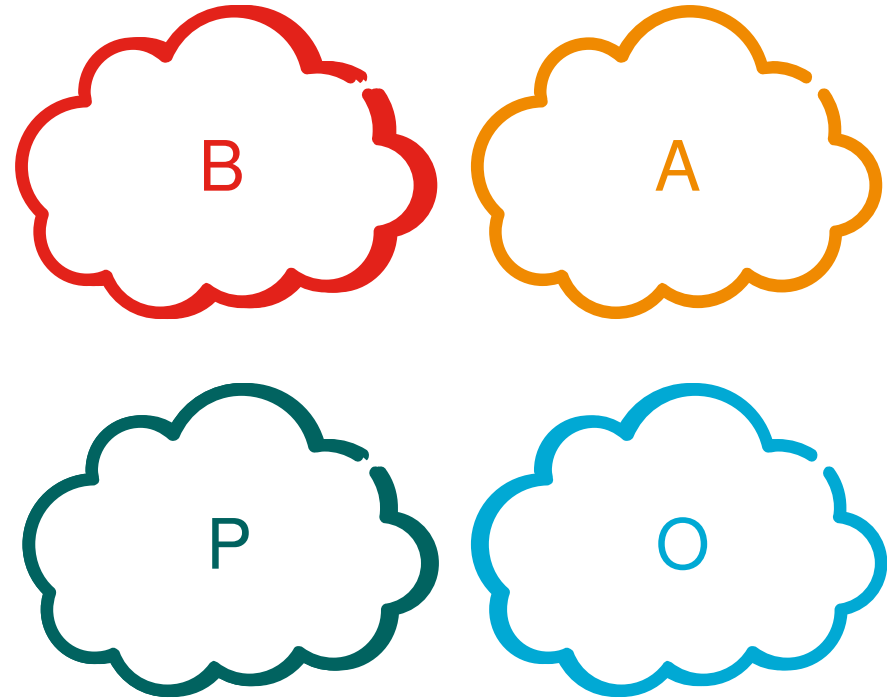- Ensuring conformance to the architecture

ANALYZING ARCHITECTURE

MANY ARCHITECTURES SATISFY
GIVEN SET OF REQUIREMENTS.

HOW TO CHOOSE THE BEST ARCHITECTURE?

BUSINESS, ARCHITECTURE, PROCESS, ORGANIZATION

› The BAPO reasoning framework places architecture in the context of business, process and organization

FACTORS INFLUENCING ARCHITECTURE

› Architect's background and experience

› Structure of software development organization

› Goals od software development organization

› Different stakeholders and their requirements

TO UNDERSTAND THE INFLUENCE OF THE REQUIREMENT ON DESIGN DECISIONS, STAKEHOLDERS MUST BE IDENTIFIED

EACH STAKEHOLDER HAS A DIFFERENT SET OF CONCERNS
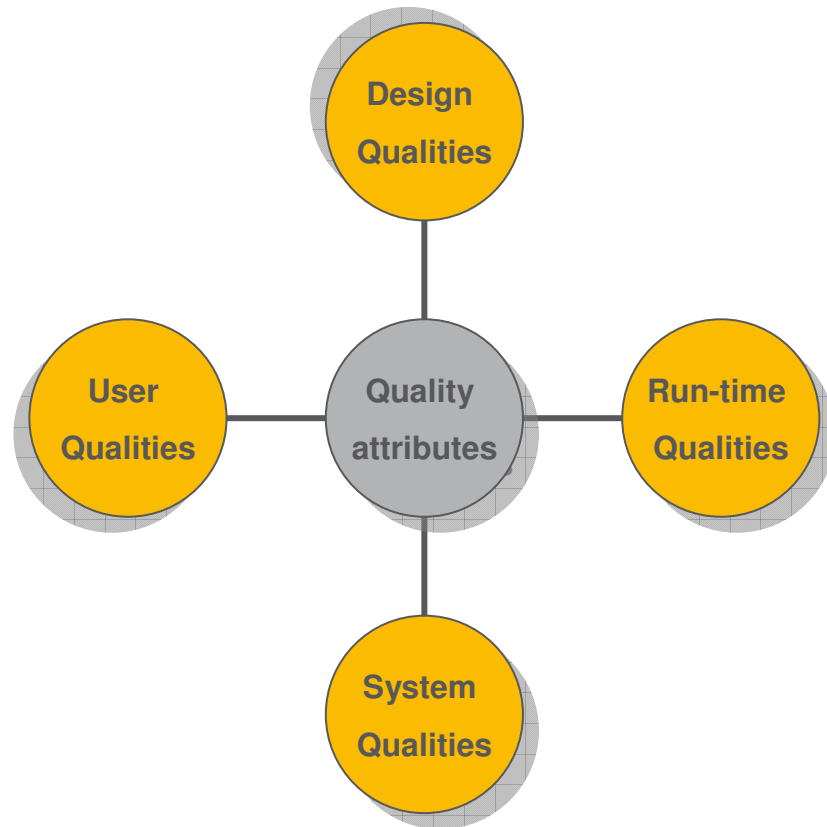
QUALITY ATTRIBUTES IMPORTANT TO DIFFERENT STAKEHOLDERS

## IF WE ACCEPT THE IMPORTANCE OF QUALITY ATTRIBUTES...

› Our customer has to tell us what he wants

› Our architect and designers must understand it

› Our programmers have to achieve it

› Our testers have to test for it

RUN-TIME QA

We can measure how well a system exhibits these by watching the system in operation

NON RUN-TIME QA

We can measure these by watching a team in operation

QUALITY ATTRIBUTES IMPORTANT TO DIFFERENT STAKEHOLDERS

- Design Qualities
- User Qualities
- Quality attributes
- Run-time Qualities
- System Qualities

Quality attributes are the overall factors that affect run-time behavior, system design, and user experience.
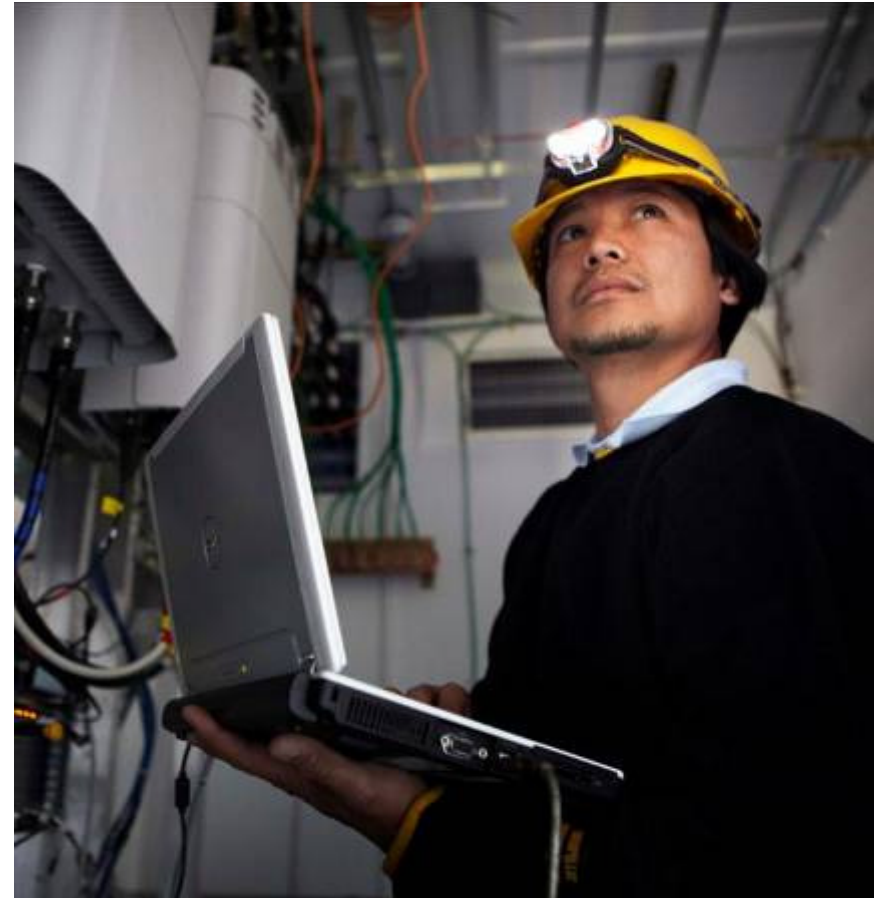
QUALITY ATTRIBUTES IMPORTANT TO DIFFERENT STAKEHOLDERS

DESIGN QUALITIES

Conceptual integrity defines the consistency and coherence of the overall design.

Maintainability is the ability of the system to undergo changes with a degree of ease.

Reusability defines the capability for components and subsystems to be suitable for use in other applications and in other scenarios

RUN-TIME QUALITIES

Availability defines the proportion of time that the system is functional and working.

Performance is an indication of the responsiveness of a system to execute any action within a given time interval.

Reliability is the ability of a system to remain operational over time.

Security is the capability of a system to prevent malicious or accidental actions

Interoperability is the ability of a system to operate successfully with other external systems

SYSTEM QUALITIES

Supportability is the ability of the system to provide information helpful for identifying and resolving issues when it fails to work correctly.

Testability is a measure of how easy it is to create test criteria for the system and its components, and to execute these tests in order to determine if the criteria are met.

USER QUALITIES

Usability defines how well the application meets the requirements of the user and consumer by being intuitive, easy to localize and globalize, providing good access for disabled users, and resulting in a good overall user experience.

ANALYZING OR EVALUATING ARCHITECTURE

Architects typically consider multiple competing designs.

Candidate architectures are evaluated according to their ability to support desired quality attributes.

One method for comparing architectures is the Architecture Tradeoff Analysis Method (ATAM*).

ATAM is a method for evaluating software architectures relative to quality attribute goals [Clements 02].

ARCHITECTURE TRADEOFF ANALYSIS METHOD

› **Performance:** These risk themes mention problems with achieving performance goals. Is-sues that arose in this category included
  - not knowing performance requirements
  - not performing any performance modeling or prototyping
  - unfamiliarity with infrastructure choices
  - not using known performance mechanisms

› **Requirements:** These risk themes refer to problems caused by either uncertainty over requirements or by rapidly changing requirements. Issues that arose in this category included
  - lack of attention to important concerns of key stakeholders
  - lack of consistent marketing input
  - emerging requirements
  - disagreement among the stakeholders as to the use of the system
  - unclear requirements in certain areas

› **Unrecognized Needs:** These risk themes refer to problems arising from the failure to consider some important aspect of the architecture necessary for successful system construction. Issues that arose in this category included
  - too many uncertainties (which will threaten the project schedule)
  - no overall consideration of many issues
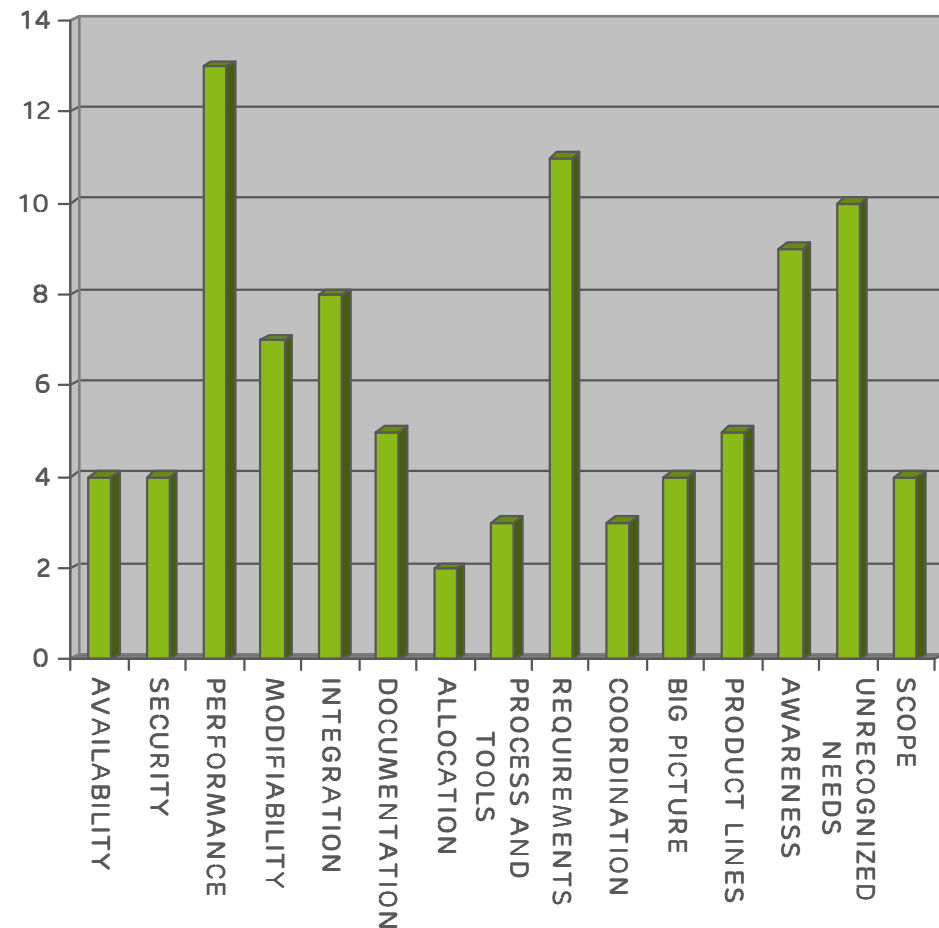
› PRACTICAL EXAMPLE

JOINT INFORMATION SYSTEM FOR LAND REGISTRY AND CADASTRE

› «ORGANIZED LAND» is the national real property registration and cadastre program of the Government of the Republic of Croatia, encompassing the overall activities implemented by the Ministry of Justice and State Geodetic Administration with the objective of streamlining and regulating the real property registration in the Republic of Croatia.

JOINT INFORMATION SYSTEM FOR LAND REGISTRY AND CADASTRE

› The basic objective of „ORGANIZED LAND" is to create the REAL PROPERTY REGISTRATION AND CADASTRE JOINT INFORMATION SYSTEM (JIS), or rather establish a common database of the cadastre and land registries and a single application or keeping and maintaining the afore-mentioned data.

› This will yield numerous benefits for the users such as the time needed to access the data and make a registration will be reduced and the citizens will be able to see at one place the ownership structure of a real property and its location in space

TO LEARN MORE…

[To learn more about the Project, please visit www.uredjenazemlja.hr]

CREATING THE BUSINESS CASE AND UNDERSTANDING REQUIREMENTS

CUSTOMER REQUIREMENT	SUPPORTING FEATURE
Standardized set of business processes to be used in all Land Registry and Cadastre offices.	The **workflow engine** used in JIS guides users in Land Registry and Cadastre offices in performing their daily tasks.
No redundant maintenance of the same data in both Registers. No divergence of data between the registers over the course of time.	Land registry and cadastral data **are kept in the same database** (LDB). Each register is responsible for maintaining only a subset of data in LDB while both registers can view all the data.
Increased availability of Land Registry and Cadastre.	External users **can access services** of Land Registry and Cadastre via Public Information Application **regardless of their location or operating hours of the Land Registry or Cadastre offices**.
Reduced total cost of ownership	The JIS is based on state-of-the art technologies and will replace various systems currently in use in Land Registry and Cadastre offices today. This will **make maintenance and upgrades easier and reduce associated costs**.
Increased security in real property transactions.	The **use of smart cards** for access to the system and electronic signatures for signing **electronic documents** reduces the chance of fraud in real property transactions.

KEY REQUIREMENTS

To enable flexible support for process workflow, IBM FileNet P8 Platform is used. IBM FileNet P8 Process Engine manages all aspects of JIS business processes.

All data is kept in one central database and to make maintainance and upgrades easier the solution is centrally managed and based on thin clients.

Electronic processing of documents is based on IBM FileNet P8 Content Engine. Electronic documents are digitally signed and stored ad PDF files.

REMEMBER: ORGANIZATION BUSINESS GOALS INFLUENCE ON THE CHOICE OF SOFTWARE ARCHITECTURE
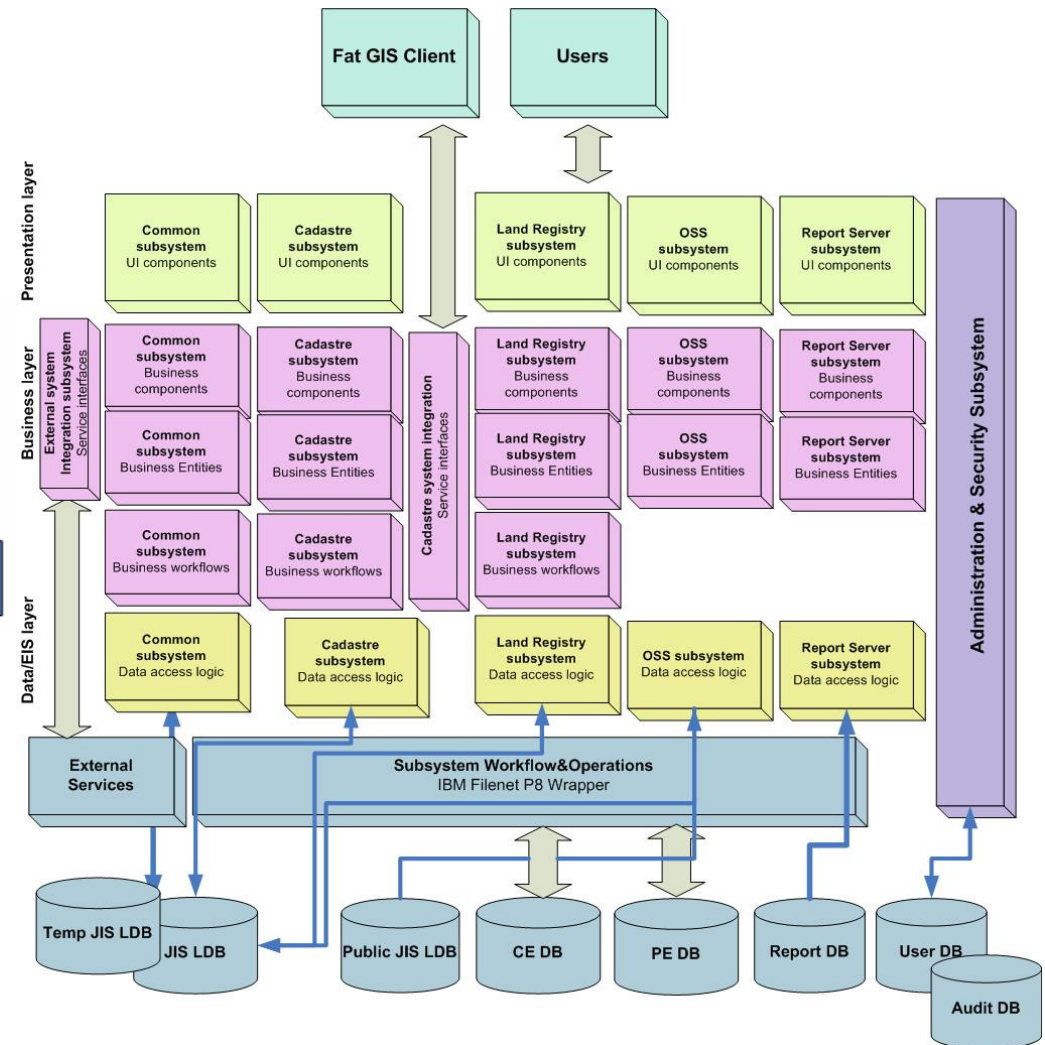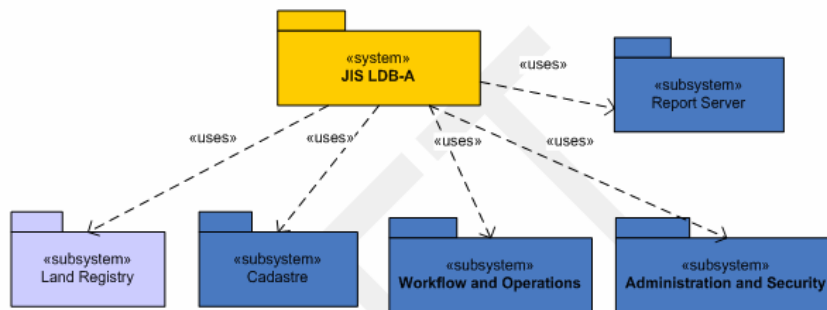
DRAFTING THE ARCHITECTURE

KEY DESIGN PRINCIPLES

› Separation of concerns
› Single Responsibility principle
› Principle of Least Knowledge
› Don't repeat yourself
› Minimize upfront design

http://msdn.microsoft.com/en-us/library/ee658124.aspx

DRAFTING THE ARCHITECTURE

› Three-tier architecture has become "de-facto" standard

CHOOSING SPECIFIC TECHNOLOGIES (E.G. FOR PRESENTATION LAYER)

Client platform requirements

Deployment and update requirements

User experience requirements

Performance requirements

Offline requirements

CHOOSING SPECIFIC TECHNOLOGIES (E.G. FOR PRESENTATION LAYER)

SOLUTION

PORTAL-BASED THIN CLIENT BASED ON EXT-GWT TECHNOLOGY.

The **Google Web Toolkit (GWT)** is an open source Java software development framework that allows creation of Ajax applications in Java. With GWT, AJAX front-end is written in the Java programming language which GWT then cross-compiles into optimized JavaScript that automatically works across all major browsers. The main reason for choosing Google Web Toolkit was the need for rich web application and together with greatly improved performance, reduced bandwidth, reduced web server load, and a pleasantly fluid user experience.

Response time to user input in JIS: maximum of 3 (three) seconds for at least 80% of all alphanumerical data entry transactions; maximum of 6 (six) seconds for 100% of all such transactions.

Target multiple client platforms, the target browser type is Internet Explorer 7.0

Provide centralized management with respect to user authorization, application deployment, update...

Provide a rich user experience as current users are used to work in fat clients (desktop applications).

Providing support for offline access to data and services is not a requirement.

CHOSEN TECHNOLOGIES

PRESENTATION LAYER

› **Operating System:** IBM AIX 5.3L
› **J2EE Compliant Application Server:** Oracle BEA
  Portal Server 9.2 with Oracle BEA Application Server 9.2

› **Technologies:**
  - **J2EE 1.4, JSE 1.5.12**
  - Geoserver, EXT GWT 1.x, Jasper Reports
    3.7.0, Java Applet

BUSINESS LOGIC

› **Operating System:** IBM AIX 5.3L
› **J2EE Compliant Application Server:** Oracle BEA
  Application Server 9.2
› **GIS Server Engine:** ESRI ArcGIS Server 9.2
› **RDBMS:** Oracle RDBMS 10g Enterprise Edition
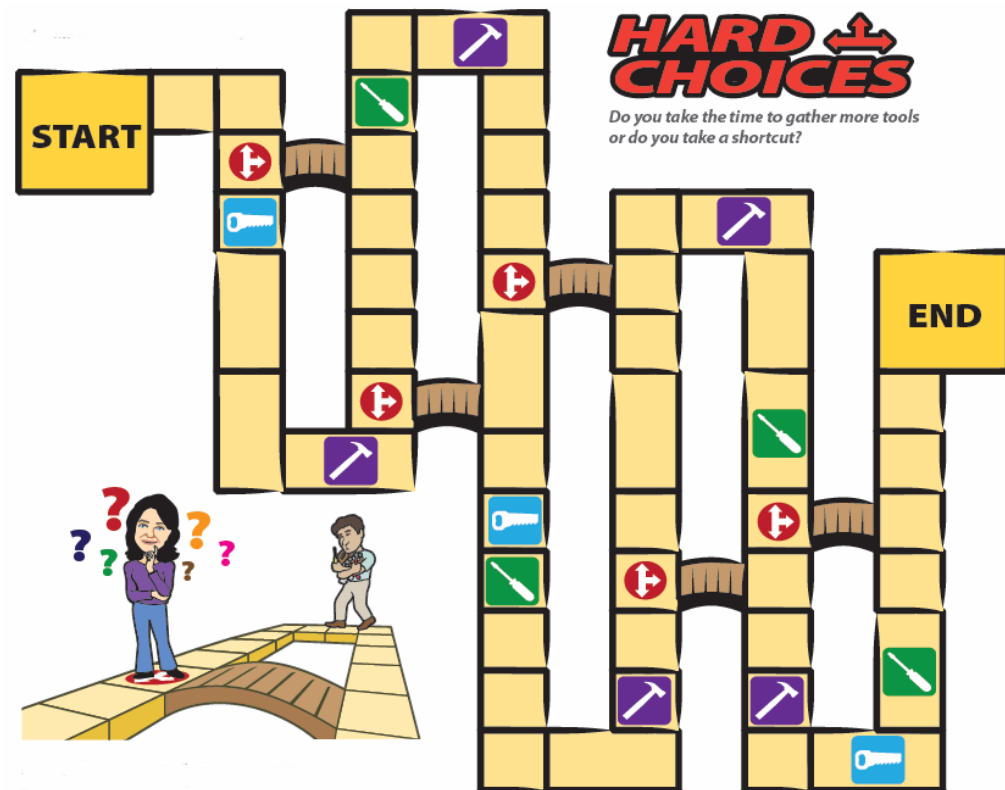› **Directory Server:** IBM Tivoli Directory Server 6.0

› **Technologies:**
  - **J2EE 1.4, JSE 1.5.12**
  - Spring Framework 2.5.x, IBM Filenet P8
    Platform 4.0

DECISIONS, DECISIONS, DECISIONS....

"Stay committed to your decisions, but stay flexible in your approach.

Tom Robbins