Architecture of Information Enterprises: Problems and Perspectives

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April 15, 1998

Why Information Enterprises?

- Chief Information Officer (CIO) $\geq$ $200,000
- CIOs turn over every two years: due to burn-out and project failures.
- The top issue important for CIOs:
  - building “responsive” information infrastructures
- “The issue of the century”

Overview

- Information enterprises
  - What it is
  - Main problems in constructing them
  - Constrains and goals
- [Information] enterprise architecture
- Approaches to solve the main problems
  - Practitioners
  - Scientists
- Further directions

Defining Information Enterprise

- Enterprise is the system of systems.
- AN INFORMATION ENTERPRISE IS AN ORGANIZATIONAL SCOPE UPON WHICH A COMMON SET OF INFORMATION TECHNOLOGY POLICIES CAN BE IMPOSED.
- An enterprise in a scope hierarchy:
  - Software program, example – “ls”
  - Information system – distributed file system
  - Information Enterprise – campus information systems
  - Global scope – the Internet

The Main Problems

- ✔ The built systems do not fit together well.
- ✔ Integration of new systems is painful.
- Maintenance is expensive.
- ✔ Maintenance exponentially increases with the number of systems.
- No scalability.

Constrains & Goals

- Constrains
  - On-going “architecture maintenance”
  - Information infrastructure reuse.
  - Change in business and administrative work-flow accommodation.
- Goals
  - To learn laws governing information enterprises like today we know some laws of nature according to which we develop our cities and other urban areas.
  - To have such an enterprise that will allow quick re-aligning when the business work-flow changes.
  - ”Chicken Little” approach – create adaptable enterprises that support gradual migration and system evolution.

Enterprise Architecture

- Architecture is “the art or practice of designing and building structures” (16-th century).
- Software Architecture (David Garlan & Dewayne Perry):
  - THE STRUCTURE OF THE COMPONENTS OF A PROGRAM/SYSTEM, THEIR INTERRELATIONSHIPS, AND PRINCIPLES AND GUIDELINES GOVERNING THEIR DESIGN AND EVOLUTION OVER TIME.
- Differences with Information Enterprise Architecture
  - Enterprise architecture has to produce specifications for each of its systems.
  - Business work-flow is the only way to express enterprise requirements today.

State of the Practice: Zachman's Framework

- A common ground for enterprise architecture view.
- Matrix 5x6: 5 different views (Scope, Owner, Designer, Builder, Sub-contractor, Product) for each of 6 different aspects (What, How, Where, Who, When, Why).
- Use *conceptual graphs* for describing data entity-relation view (what) and computational view (how), and some other less formal representations.
- Drawbacks
  - No way to insure consistency across all views and presentations.
  - Neither does it provide a means to "map" one cell into another.

State of the Practice: RM-ODP

- Adopted in the mid 90's by ISO jointly with ITU-T.
- Influenced by Zachman's framework, object orientation, and formal methods.
- Goal: common well defined language of terminology and notations for a distributed system and its environment.
- Different views of a distributed system: enterprise, information, computational, engineering, technology.
- Recommends to use formal notations: Specification and Description Language (SDL), LOTOS, and Z.
- Known and used much better in Europe and Australia then in North America.

Approaches: State of the Science

1. ARCHITECTURAL STYLE is a collection of patterns and idioms that constrain the design space, permitting developers to ignore complications and alternatives that are not relevant to the system they are developing.

2. QUANTIFIED DESIGN SPACE targets the problem of prioritizing and quantifying specified properties of a software system. It is on design space and quality functional deployment (QFD).

3. ARCHITECTURE DEFINITION LANGUAGES.

Proposed Directions

1. Develop enterprise architecture definition language:
   - Precisely describe architecture of an enterprise
   - Accumulate and communicate common knowledge and experience
   - Directly derive specifications for the systems on an enterprise
2. Learn how to derive information enterprise requirements from a company business model.
3. Develop a means of prototyping and modeling an enterprise.

✘ Find complexity measures of information enterprise :)

Conclusions

- In this presentation
  - What is an information enterprise
  - The main problems
  - Enterprise architecture
  - The current state of practice and science
  - The future directions
- So far practitioners, made more progress than scientists in the area of IEs.
  - Problems and challenges for SE
  - It is now your turn