Проектирование вычислительных систем

(фрагмент курса: Архитектурное моделирование вычислительных систем)
Лекция 5: Архитектура.

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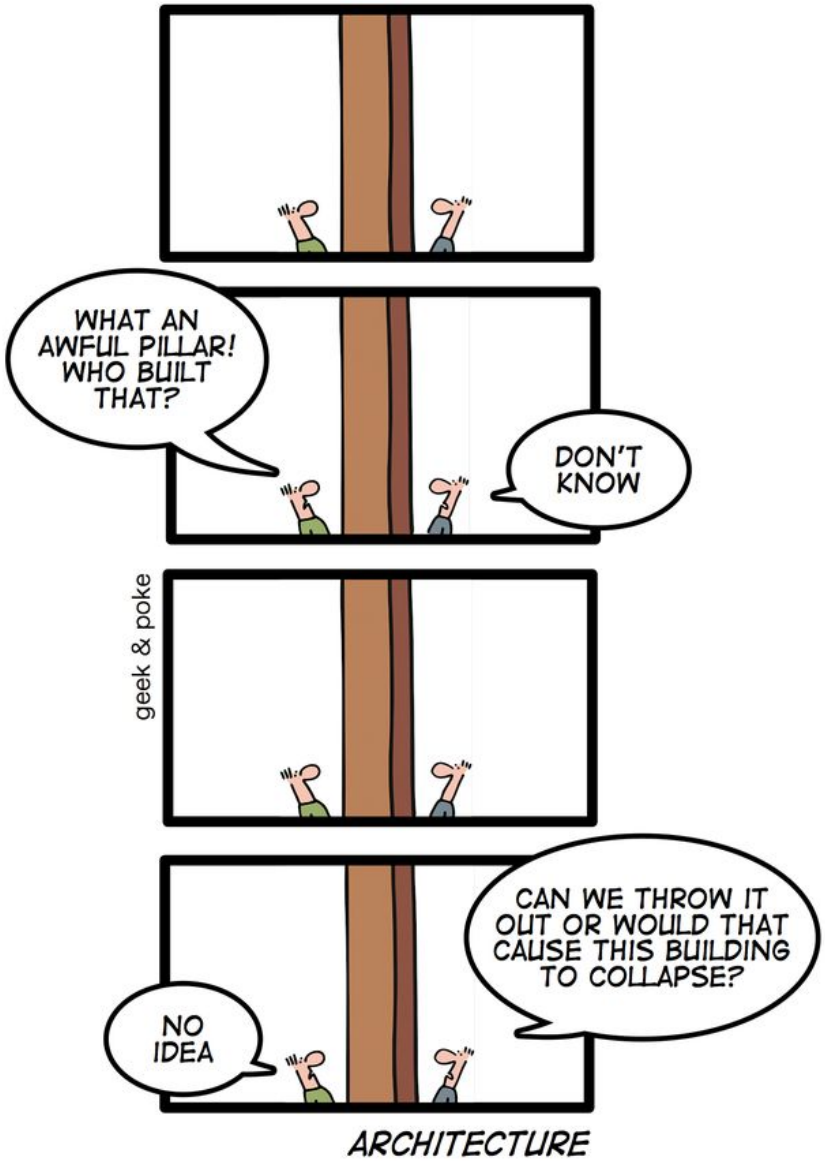
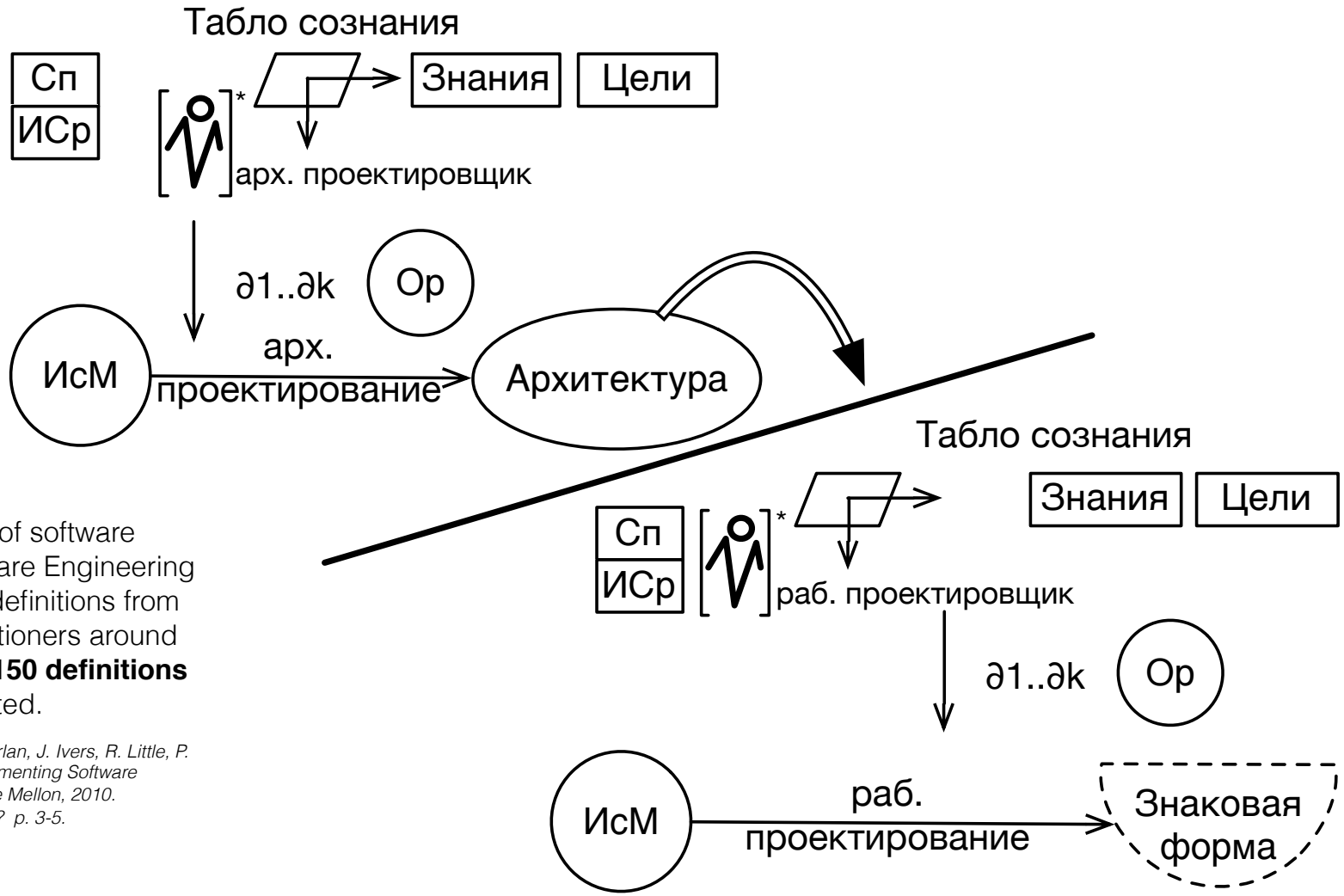
Университет ИТМО / 2018

Гипотеза об архитектурном проектировании





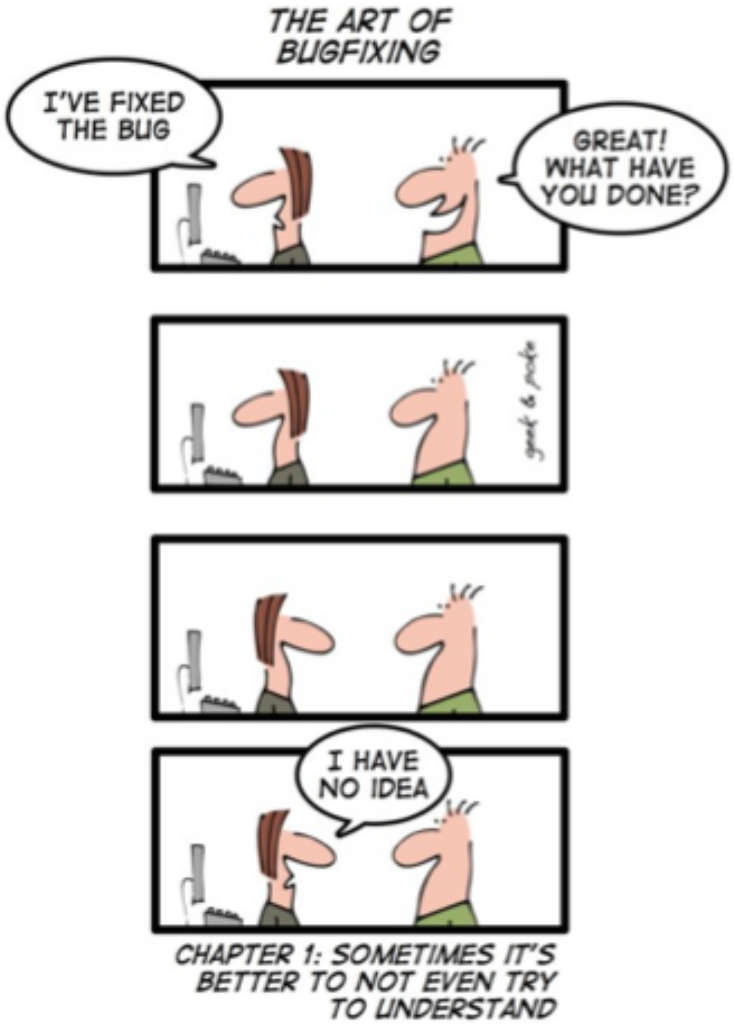
No universal definition of software architecture exists. The Software Engineering Institute's Web site collects definitions from the literature and from practitioners around the world; so far, **more than 150 definitions** have been collected.

— P. Clements, F. Bachmann, L. Bass, D. Garlan, J. Ivers, R. Little, P. Merson, R. Nord, and J. Stafford, Documenting Software Architectures, Second edi. Carnegie Mellon, 2010. What Is Software Architecture? p. 3-5.

Архитектурное и рабочее проектирование

Объяснения ошибок

- “Орфографическая”, “грамматическая”, “пунктуационная” или “стилистическая” ошибка.
- Ошибка входных данных.
- Ошибка вида: “я об этом не подумал” или “а разве можно по другому?”
  - Не беру в голову.
  - Идеальная модель.
  - Искать где светлее

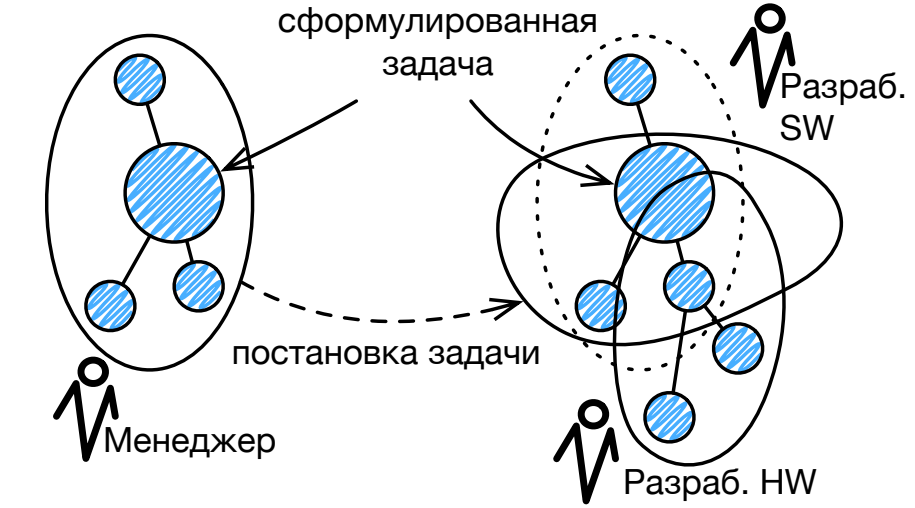


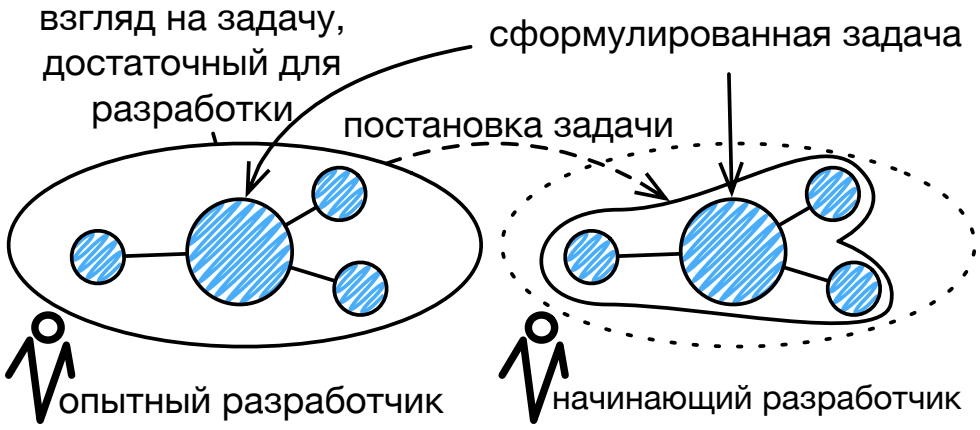
Проблема постановки задачи

Some of the critical questions for the success of system may be missed.

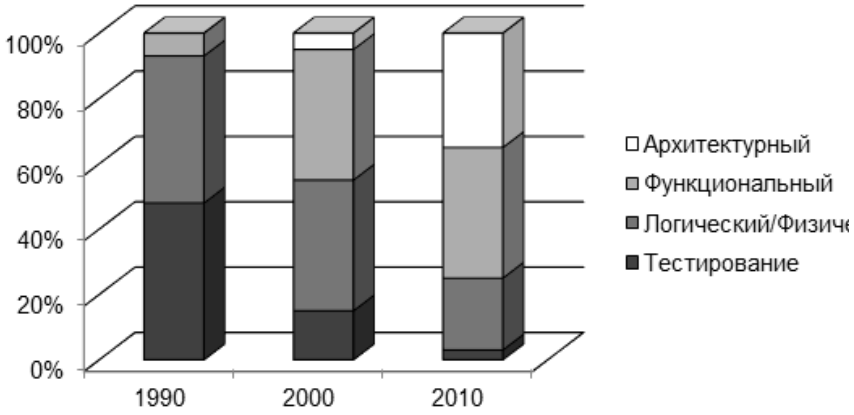
Causes:

- Question is beyond the competence of the developer.
- Template design dominates.
- Artificial narrowing of design requirements.
- Substitution of one task to another.
- Inefficient arrangement of priorities at designing of the target ES and its toolchain.

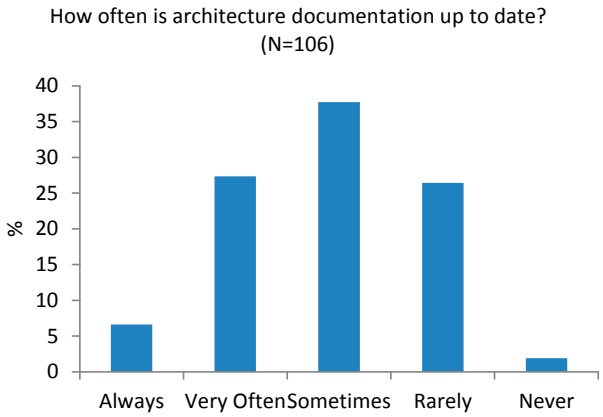


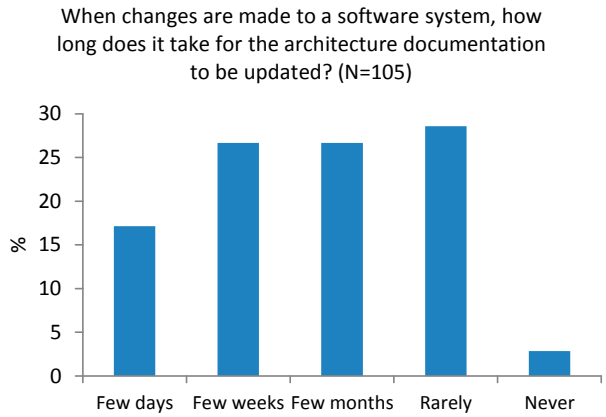


— *A. Platunov, A. Kluchev, and A. Penskoi, "Expanding Design Space for Complex Embedded Systems with HLD-methodology," in 2014 6th International Congress on Ultra Modern Telecommunications and Control Systems and Workshops (ICUMT) - Telecommunications, 2014, pp. 253–260.*

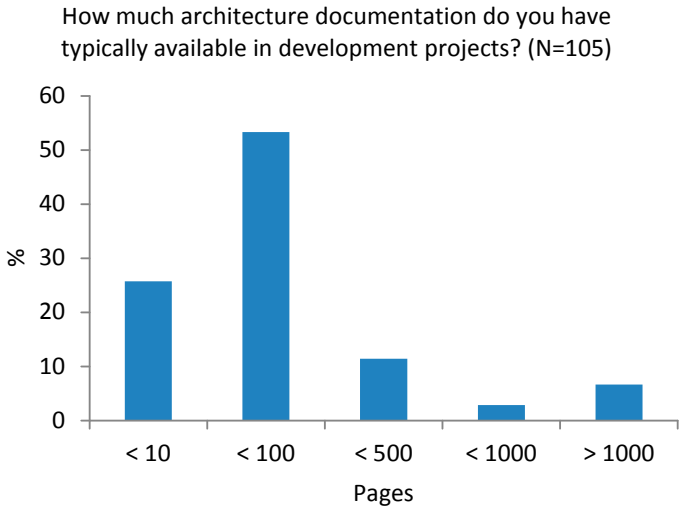


— *А. Е. Платунов, "Теоретические и методологические основы высокоуровневого проектирования встраиваемых вычислительных систем," Университет ИТМО, Санкт-Петербург, 2010.*

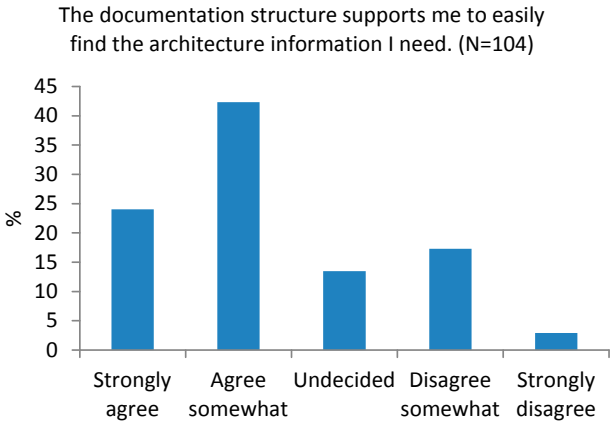


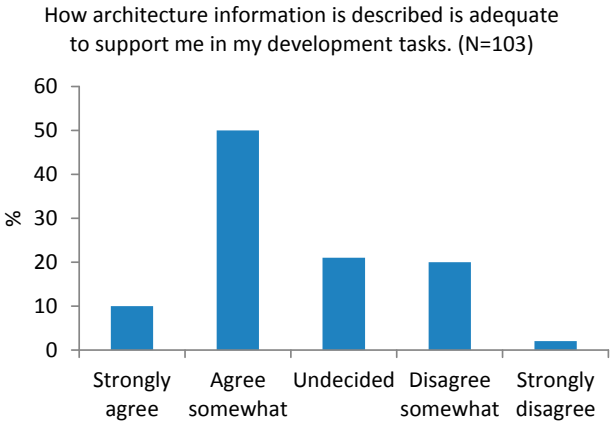


— *Figure 6. Up-to-dateness of architecture documentation*



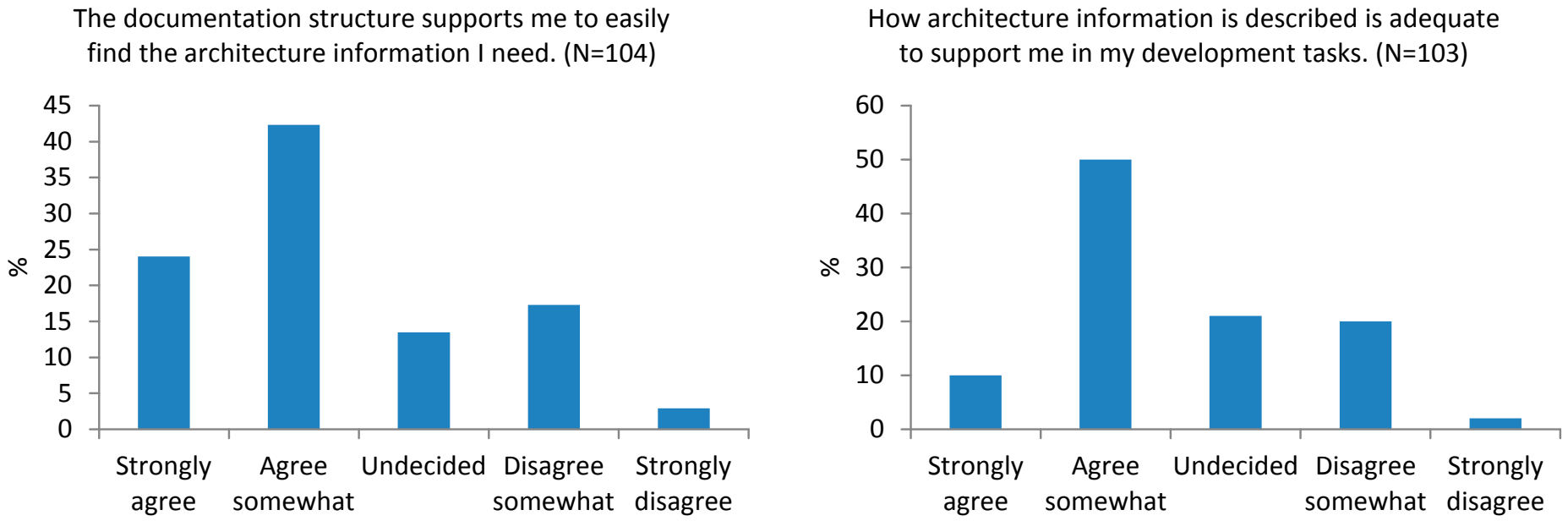
— *Figure 5. Amount of architecture documentation.*





— *Figure 7. Adequacy of amount of architecture documentation provided*

— *D. Rost, M. Naab, C. Lima, and C. von Flach Garcia Chavez, "Software architecture documentation for developers: a survey," in Proceedings of the 7th European Conference on Software Architecture, 2013, vol. 7957, pp. 72–88.*



— Figure 10. Perceived adequacy of representation of architecture information

— D. Rost, M. Naab, C. Lima, and C. von Flach Garcia Chavez, "Software architecture documentation for developers: a survey," in Proceedings of the 7th European Conference on Software Architecture, 2013, vol. 7957, pp. 72–88.

Types and cost of errors in ES

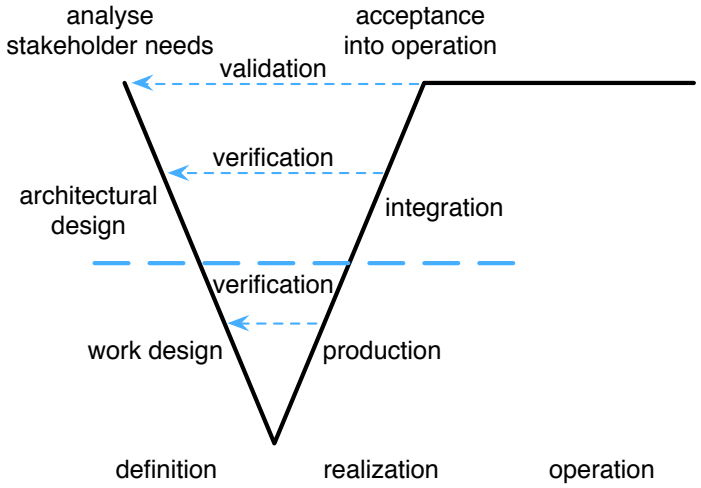
Problem types:

- Requirements translation (36%).
- Logic design (28%).

Stage in the life cycle, on which they are correct:

- 48% — integration.
- 15% — software integration.
- 13% — flight test.

From design and requirement phase cost may rise for 1-2 order.



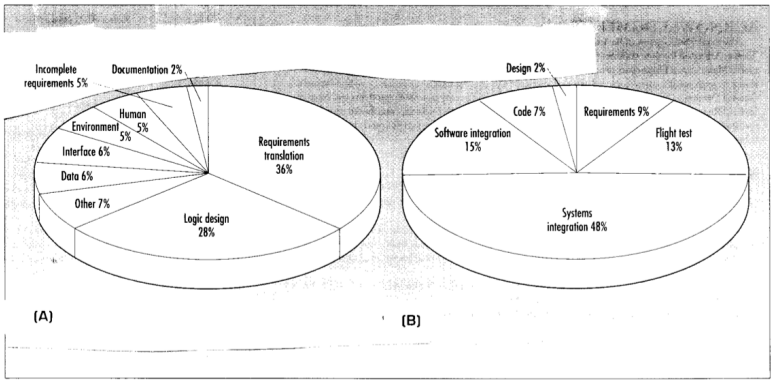
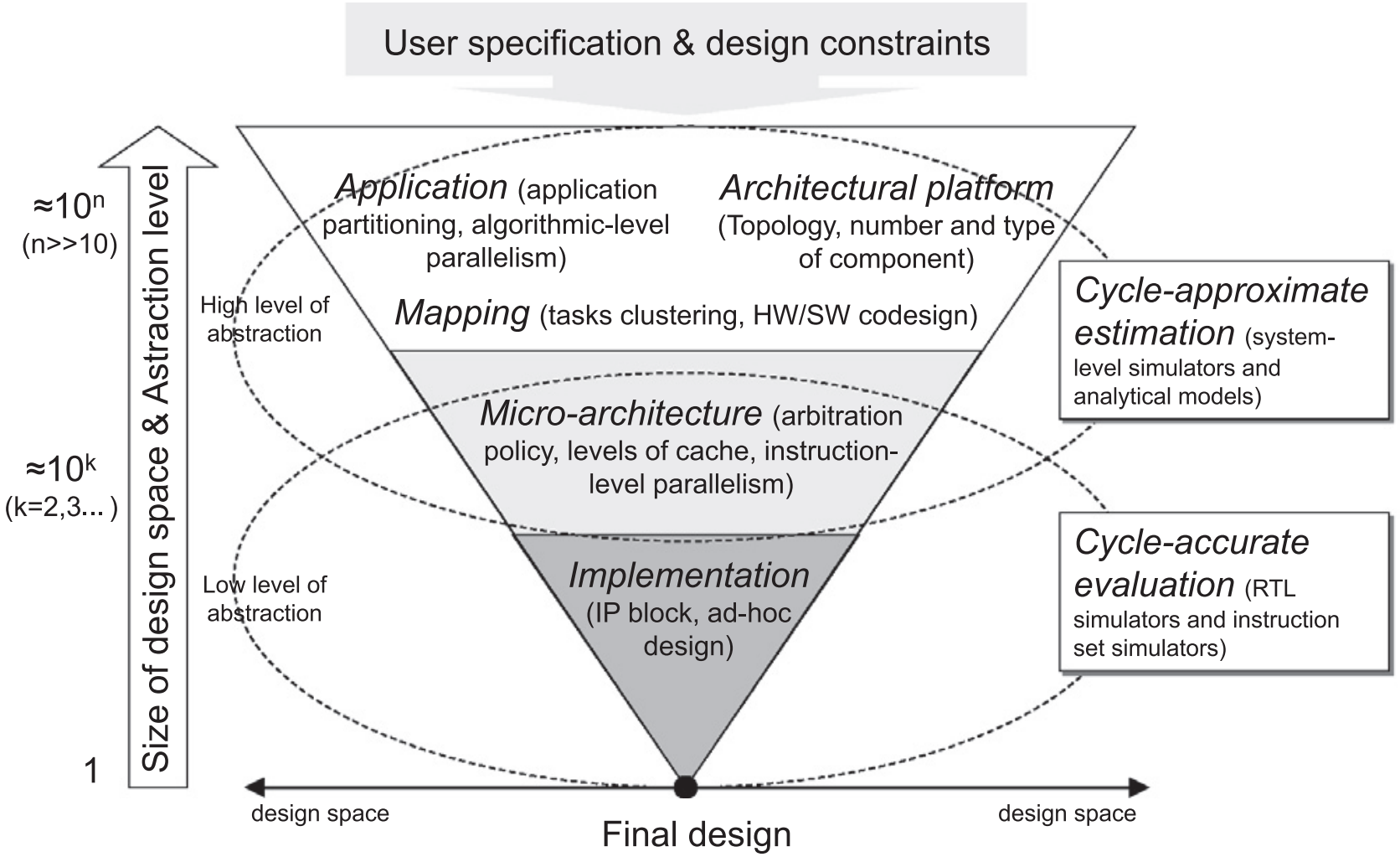


Figure 5. As this example from a US Air Force project shows, you can classify defects by (A) problem type and (B) by the phase in the life cycle in which they are corrected. In this case, 48 percent of defects were fixed at systems integration; 13 percent at flight tests. The cost to fix defects is highest in these two phases. The software was released with six percent of problems unresolved; these problems will likely surface in the field.

— F. T. Sheldon, K. M. Kavi, R. C. Tausworthe, J. T. Yu, R. Brettschneider, and W. W. Everett, "Reliability measurement: from theory to practice," IEEE Softw., vol. 9, no. 4, pp. 13–20, 1992.



Исследование пространства проектных решений

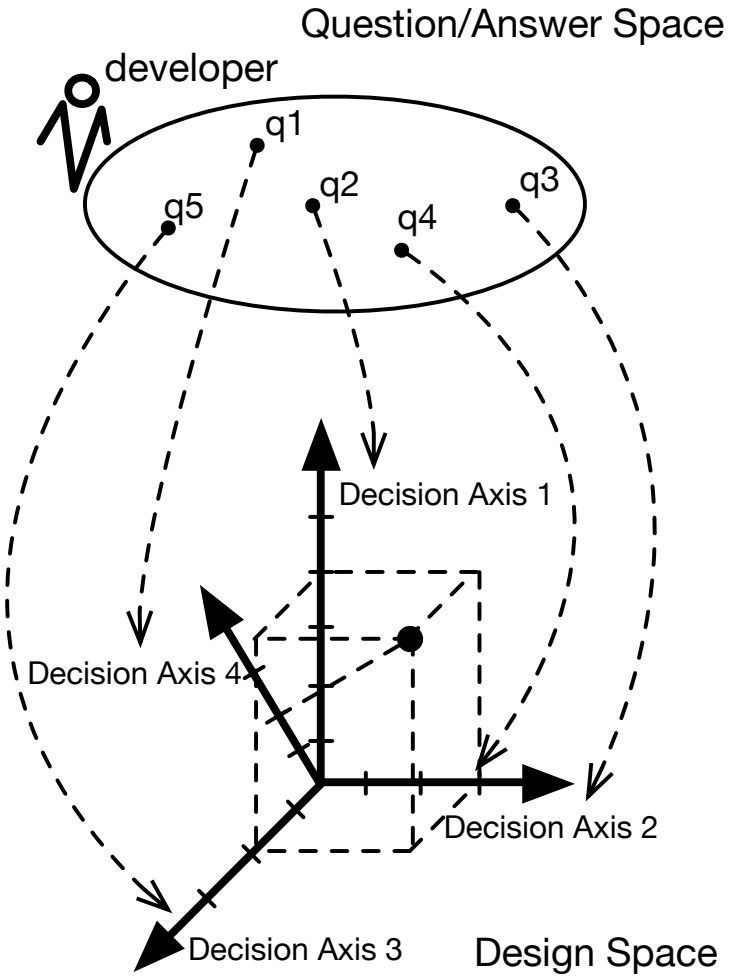
Jia Z.J. et al. A two-phase design space exploration strategy for system-level real-time application mapping onto MPSoC // Microprocess. Microsyst. 2014. Vol. 38, No 1. P. 9–21

Question & Answer / Design Space

Question & Answer space — set of questions about the system, the answers to which determine its success.

Design space — space of the technical solutions/mechanisms that determine the organisation of the ES.

Spaces are mutually defined.



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Question & Answer / Design Space

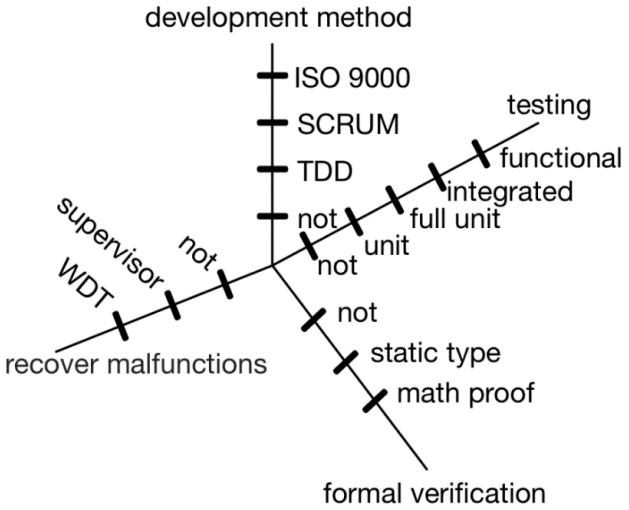
Project space is a set of axes (categories) of project decisions, which define the decision search space.

Project space can be defined as unified both within the project and every aspect in particular.

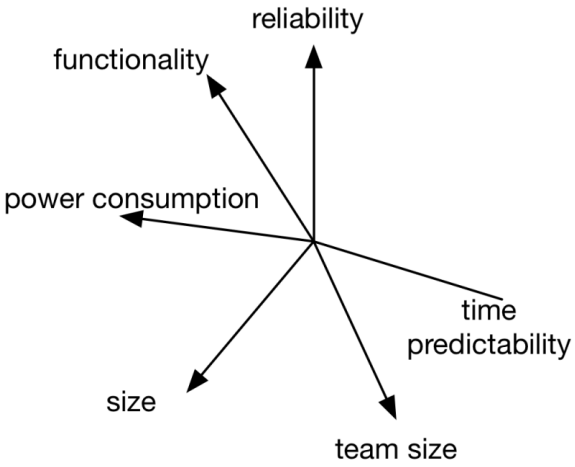
Project space fixates every technical project decision, including:

- aspect space composition;
- system's characteristics;
- development techniques;
- target ES elements.

By choosing the points on axes, the designer forms system's description, sufficient for implementation with the predicted characteristics by the certain team.



Project space of ES SW reliability aspect



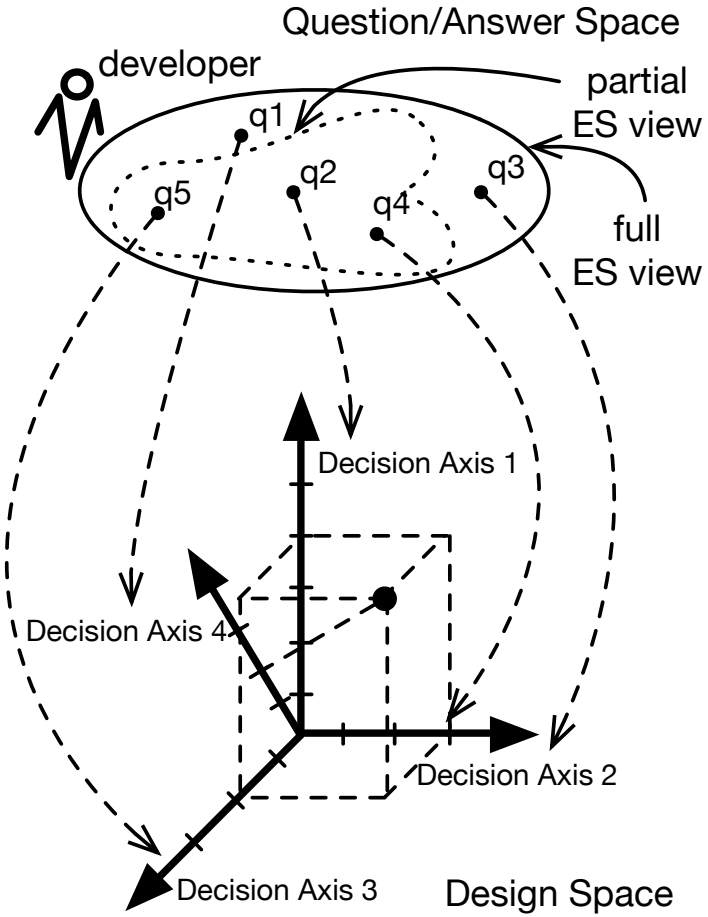
Project space of technical requirements

Работа с пространством проектных решений

Self study question space usually leads to an increase in "density" and not expand their circle.

How expand partial view to full view:

- Expanding question space.
- Expanding design space.



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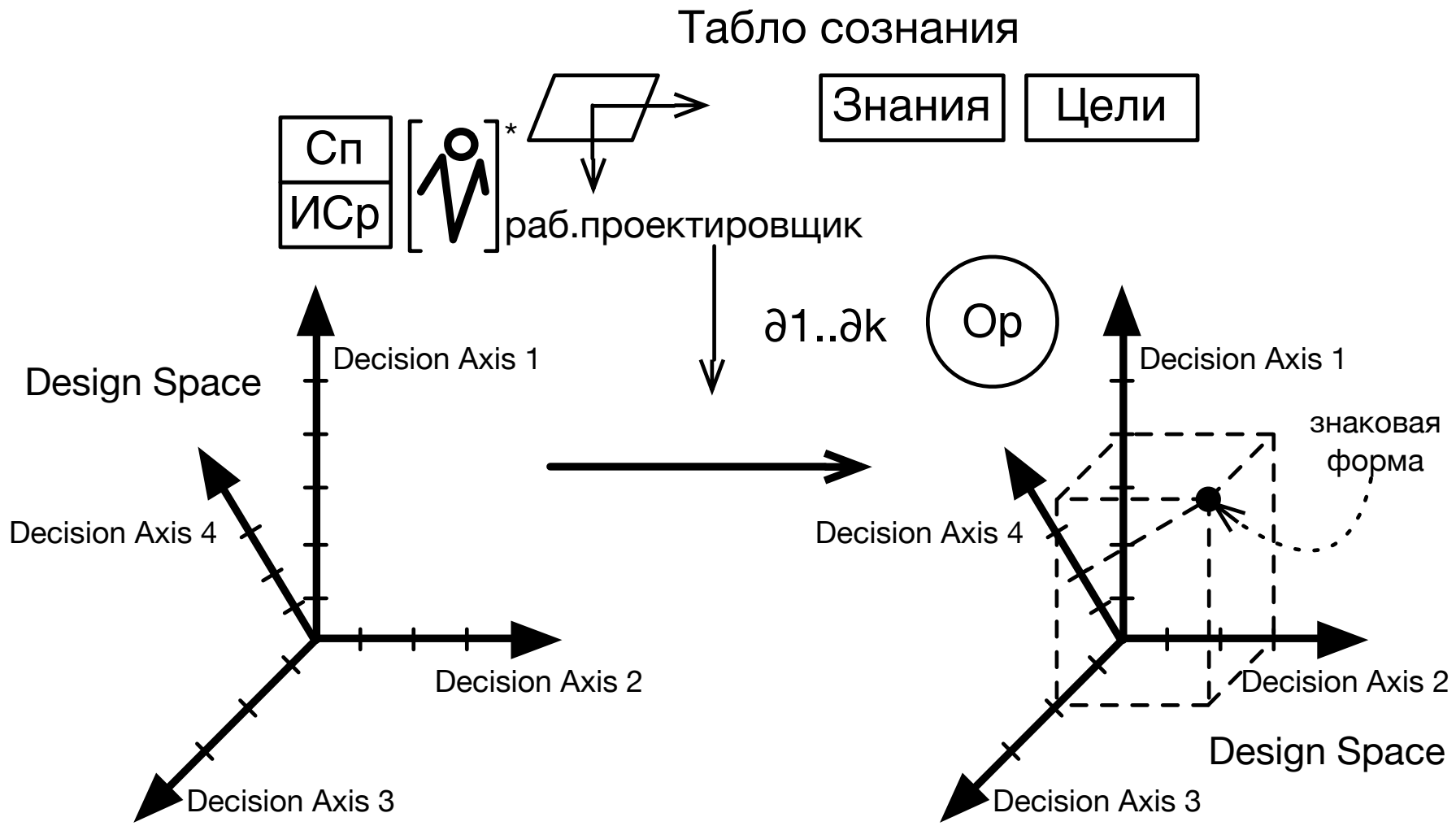


Деятельность проектировщика

- Архитектура — элемент горизонтальной кооперации.

- An **architecture** is the set of **significant decisions** about the **organization** of a software system, the **selection of the structural elements** and their **interfaces** by which the system is composed, together with their **behavior** as specified in the collaborations among those elements, the **composition of these structural and behavioral elements** into progressively larger subsystems, and the **architecture style** that guides this organization — these elements and their interfaces, their collaborations, and their composition.

  - *— G. Booch, J. Rumbaugh, and I. Jacobson, Unified Modeling Language User Guide, First Edit. Addison Wesley, 1998, p. 512.*

- **Architecture** — The **logical** and **physical structure** of a system, forged by all the **strategic and tactical design decisions** applied during development.

  - **logic** – информационная составляющая системы, определяющая функционирование системы (для базы данных – схема таблиц, для ООП – схема классов).

  - **physical** – постоянная составляющая ВС, обеспечивающая её функционирование (для базы данных – организация кластера, для ООП – виртуальная машина, сборщик мусора.).

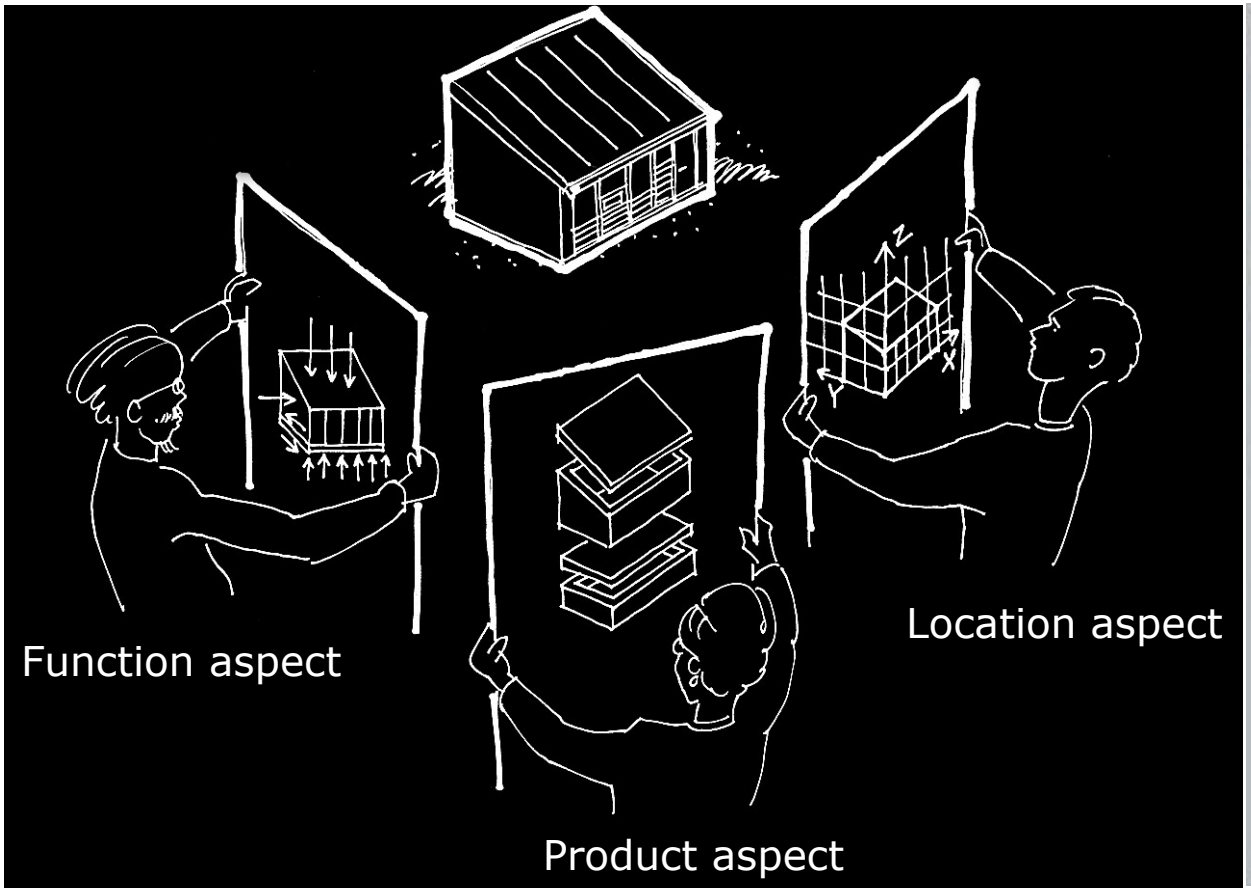
  - *— Г. Буч, Объектно-ориентированный анализ и проектирование с примерами приложений на C++. Санта-Клара, Калифорния, 2008, pp. 1–359.*

Архитектура — всё важное.

— Народное творчество.

Software architecture is the set of design decisions which, if made incorrectly, may cause your project to be cancelled.

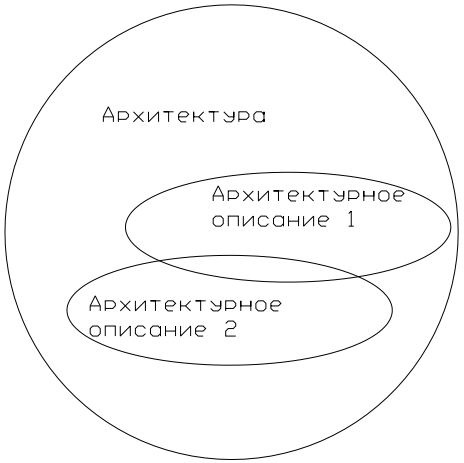
— Eoin Woods (Software Architect, Investment Bank, London, UK), http://www.sei.cmu.edu/architecture/start/glossary/community.cfm



“Всё важное” зависит от наблюдателя

— H. Balslev, “The world’s leading coding technique. An introduction to ISO/IEC 81346.” 2013.

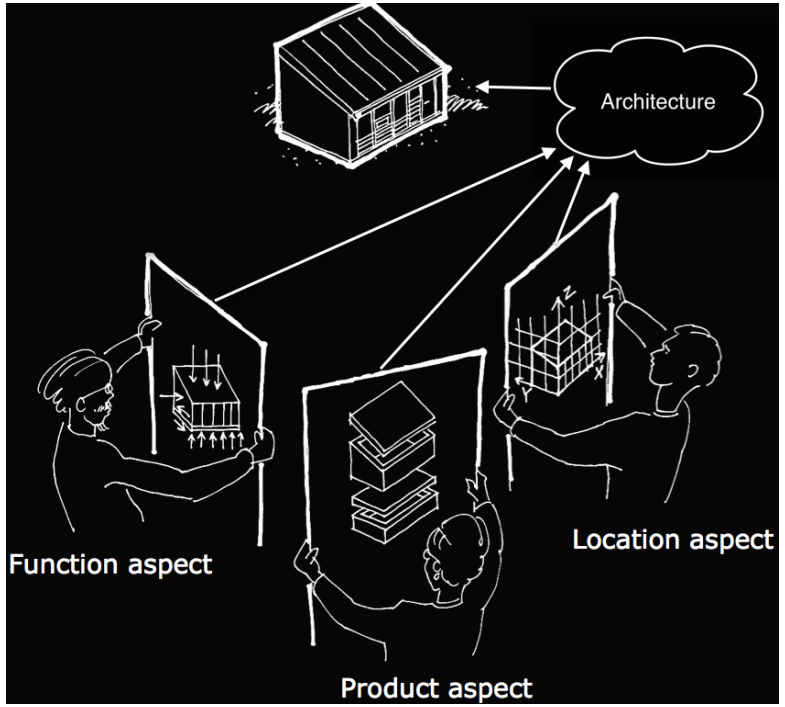
Архитектура

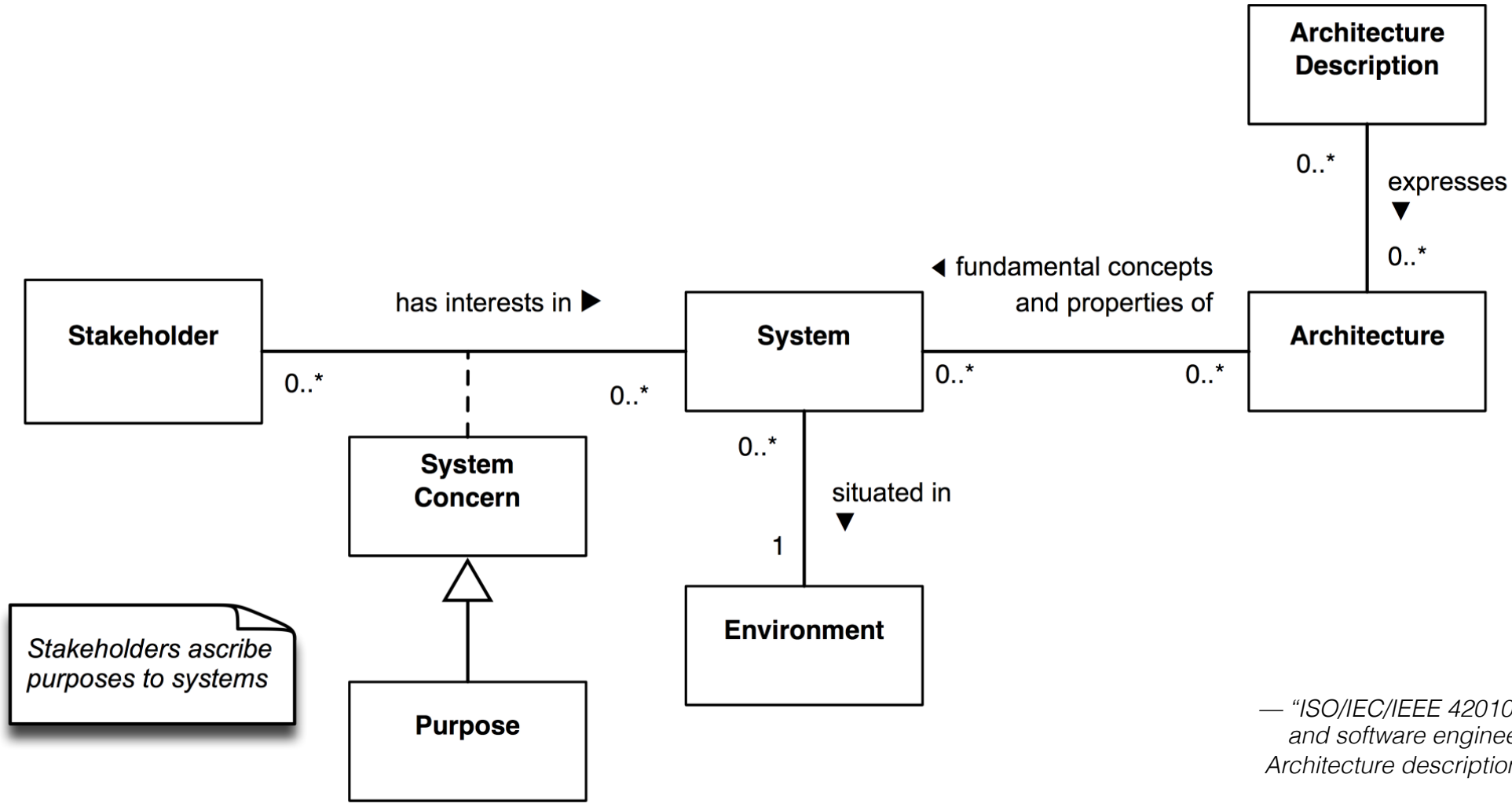


ISO/IEC FCD 42010 — Architecture description (IEEE 1471 — Recommended Practice for Architecture Description of Software-Intensive Systems):

Architecture (of a system) — fundamental concepts or properties of a system in its environment embodied in its elements, relationships, and in the principles of its design and evolution.

Architecture description — work product used to express an architecture.



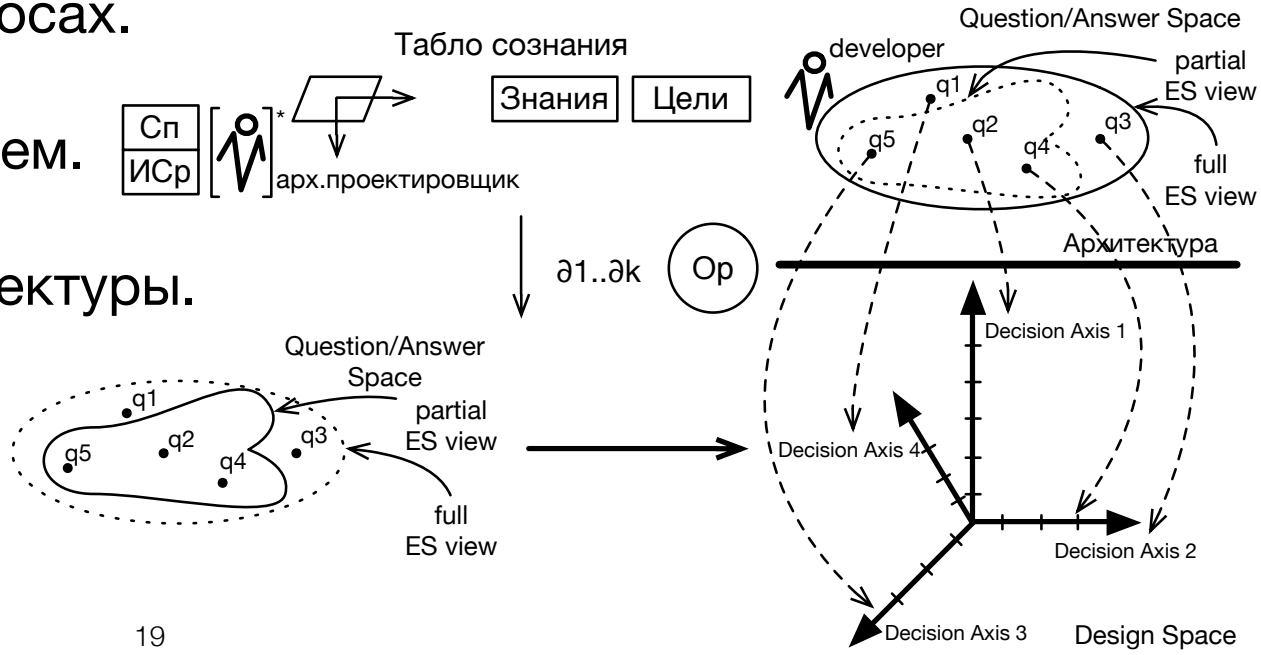


— "ISO/IEC/IEEE 42010 Systems and software engineering -- Architecture description," 2011.

Онтологическая схема архитектуры

Под **архитектурой** понимается **совокупность** наиболее общих и важных (концептуальных) **технических решений**, отражающих **назначение** и **принцип функционирования** вычислительной системы, где термин «техническое решение» следует понимать так: **однозначно трактуемая единица**, использующая реализуемые элементы.

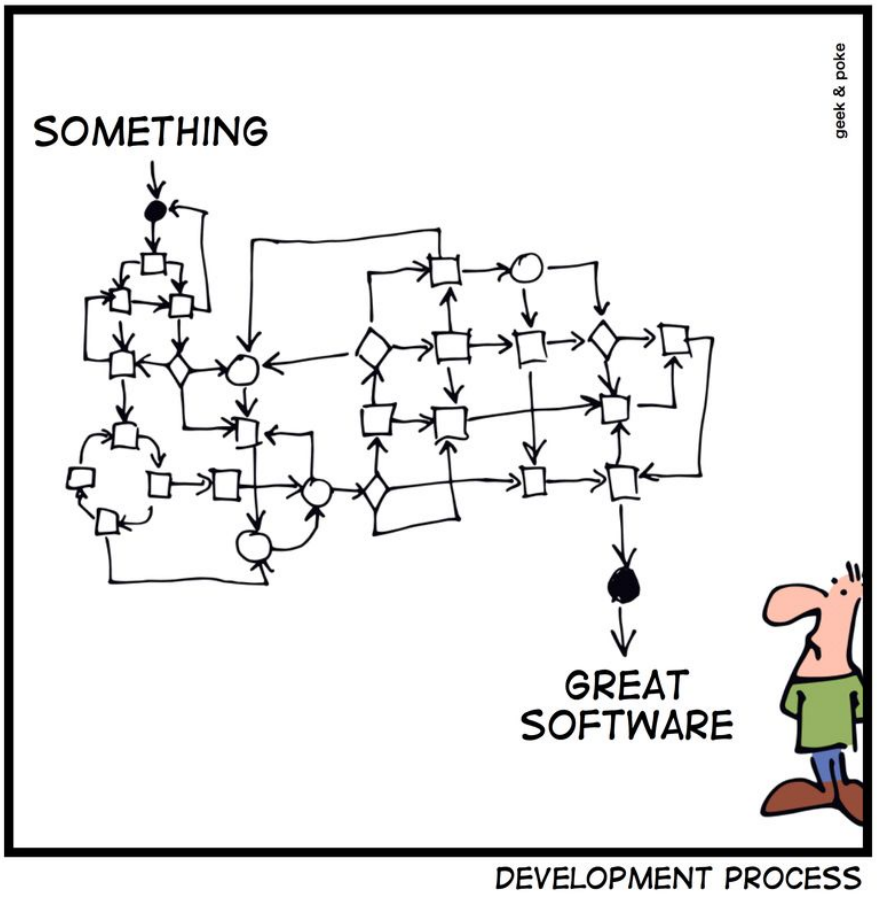
- Акцент на технических вопросах.
- Связка с рабочим окружением.
- Акцент на назначение архитектуры.



— А. Е. Платунов, "Теоретические и методологические основы высокоуровневого проектирования встраиваемых вычислительных систем," Университет ИТМО, Санкт-Петербург, 2010.

- **Архитектура** с позиции инженера в области ВТ — **совокупность походов/практик/техник, технологий и технических решений**, позволяющие провести систему по её **жизненному циклу** (или интересующей части) с заданными характеристиками **конретному** коллективу, включая этапы:

- формирования требований;
- формирования моделей;
- реализации системы;
- интеграции/поставки системы;
- поддержки;
- вывода из эксплуатации.



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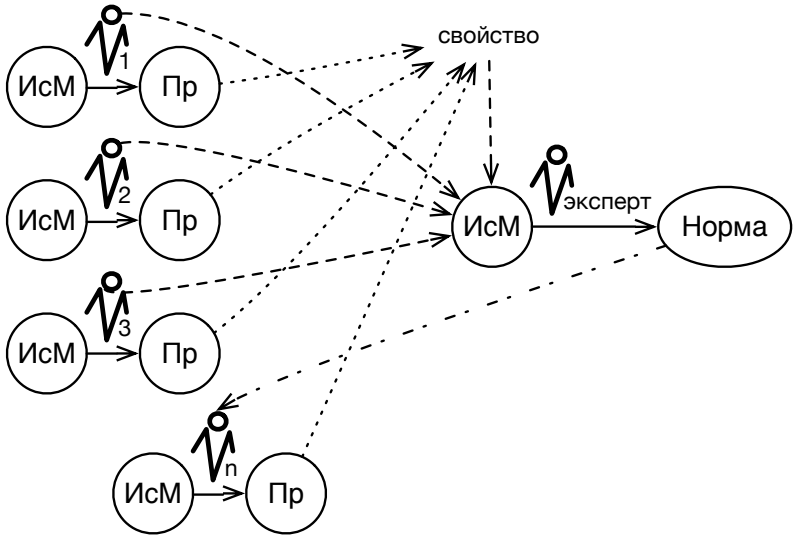

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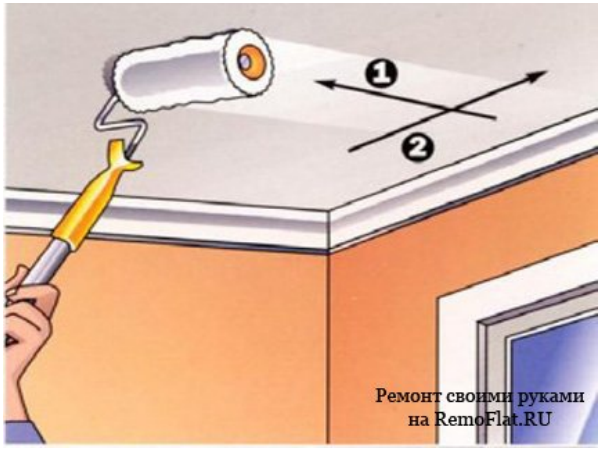
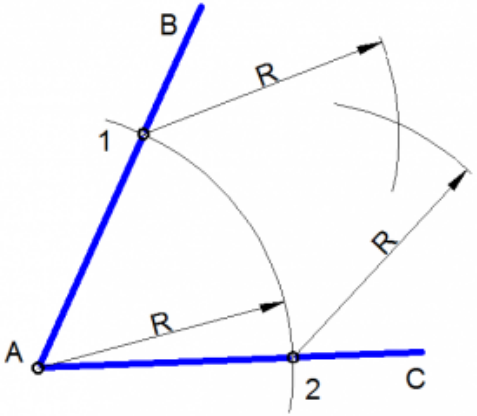
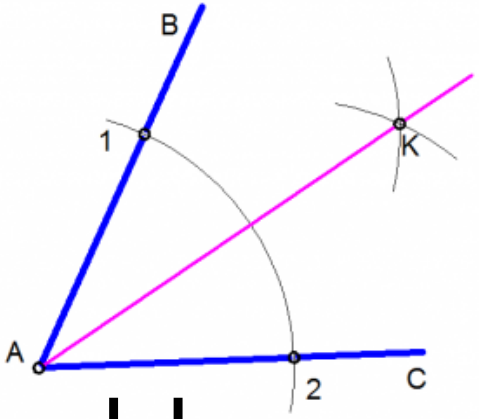


Фиксация результата через процесс

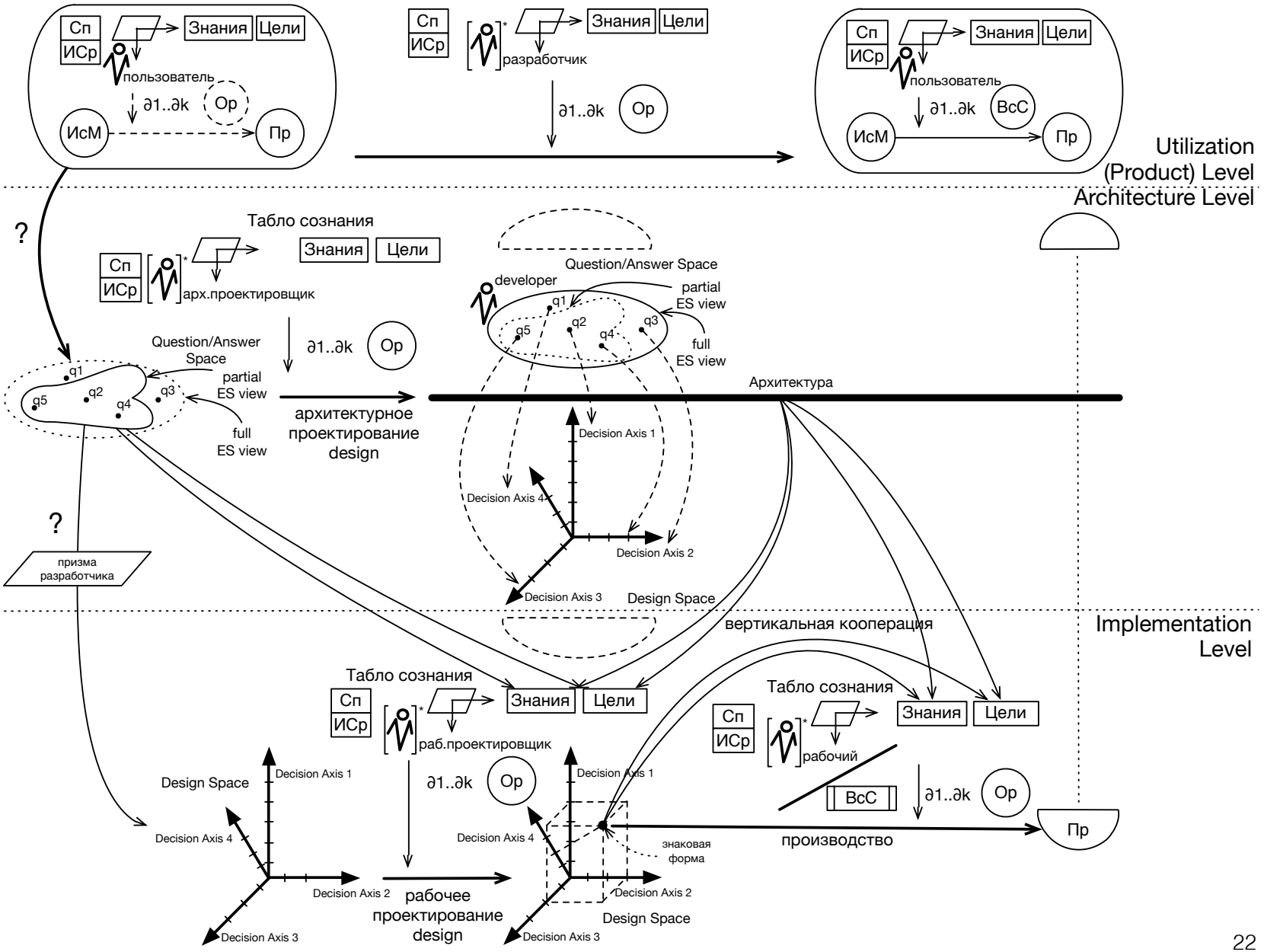




Норма

Процесс

Задача?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