Module Modeling and Analysis: Application and Life Cycle Modeling

Gerrit Muller
HSN-NISE
Hasbergsvei 36 P.O. Box 235, NO-3603 Kongsberg Norway
gaudisite@gmail.com

Abstract

This module addresses Modeling and Analysis Fundamentals of Application.

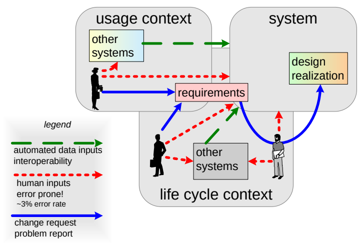
All Gaudí documents are available at:
http://www.gaudisite.nl/

version: 0.3 status: planned March 27, 2021

Contents

Chapter 1

Modeling and Analysis: Life Cycle Models



1.1 Introduction

Life cycle modeling is mostly modeling expected changes during the life cycle and the impact of these changes. We will provide an approach to make life cycle models. This approach is illustrated by means of a web shop example.

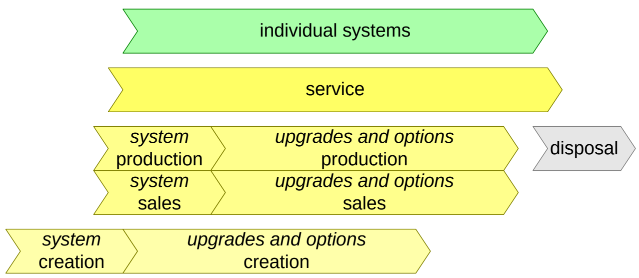


Figure 1.1: Product Related Life Cycles

Several life cycles are relevant. Figure 1.1 shows the related life cycles of product, option and upgrade *creation*, *production* and *sales*, the systems themselves, and the disposition.

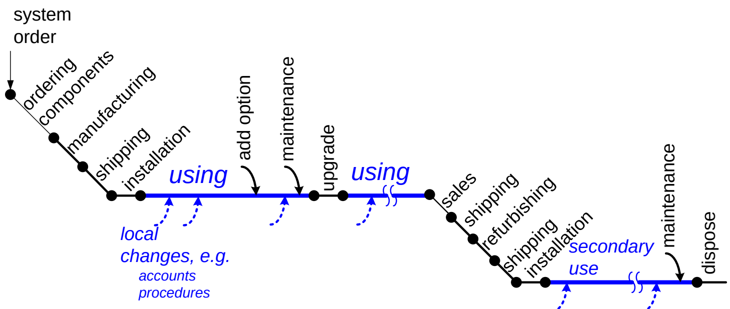


Figure 1.2: System Life Cycle

Figure 1.2 zooms in on the life cycle of individual system instances. Components are ordered and assembled into systems. The real use of the system starts after the system has been shipped and installed. During the use of the system many things happen to the system. The users themselves make small changes, such as adding or updating user accounts or procedures. Options can be added to the system and the system is maintained by service. Some systems are refurbished when they get older to be used again at some different location. Finally the system has to be disposed.

This paper belongs to the modeling and analysis series. It uses the same case example and overall approach.

1.2 Life Cycle Modeling Approach

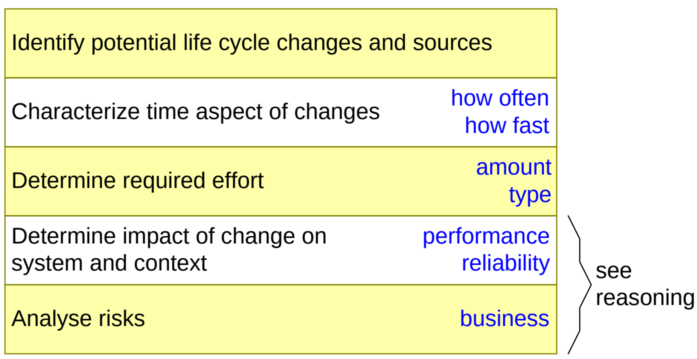


Figure 1.3: Approach to Life Cycle Modeling

Figure 1.3 shows a step-wise approach to make life-cycle models. The following steps are performed:

Identify potential life cycle changes and sources

Characterize time aspect of changes How often do these changes occur, how fast must be responded to these changes?

Determine required effort , the amount and the type of effort.

Determine impact of change on system and context for instance by using qualities, such as performance, reliability, security, cost, et cetera.

Analyse risks for the business. For instance, what is the cost of being several hours or days too late?

The impact and risks analysis is not elaborated in this paper, see *reasoning* and *analysis* papers.

Figure 1.4: What May Change During the Life Cycle?

During the life cycle, many elements may change, for example business volume, product mix, product portfolio, see Figure 1.4 for more examples. The amount of changes depends strongly on the type of business. For example a real estate portal is selling unique products with a lot attribute data per product. A music web shop, such as iTunes, at the other hand is selling the same product many many times. Figure 1.4 shows more variations of web sites.

The source of a data change influences the impact of such a change. A fundamental difference is data input from automated sources, such as data bases of content providers, versus data input by humans. Human inputs are very error prone. About 3 out of 100 human actions are erroneous. Luckily humans are also very flexible, so many errors are repaired immediately. Nevertheless, many errors in the human inputs slip through and enter the system. The amount of errors

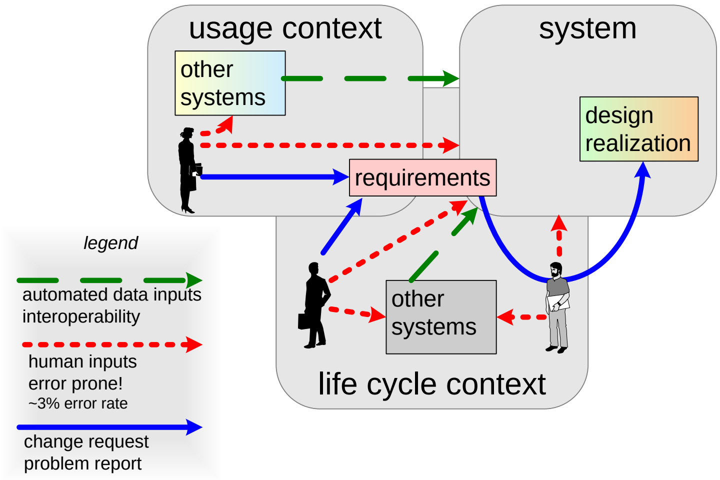


Figure 1.5: Simple Model of Data Sources of Changes

in automated inputs depends on the data quality of the source and on the degree of interoperability ("level of mutual understanding") between the providing and receiving systems.

Figure 1.5 shows possible sources of changes from the usage context and life cycle context. Note that several human stakeholders can also generate problem reports or change requests, resulting ultimately in changes in of the design and realization of the system. Typically the response on problem reports must be fast (days or weeks), while the change request response is normally much slower (months or year). These response times are also a function of the business. For example in the world of the entertainment industry, where television shows use cell phone for interactive inputs, may suddenly require change request response times of days or weeks, rather than months.

Figure 1.6 zooms in one step further on changes that impact the web server of the web shop example. The changes in content are prepared outside of the production system. Most content changes will be provided by different content providers. For example publishers will provide most new books and related attributes for book shops. Human interaction will be limited to selection and the addition of sales information. Nevertheless we should be aware that even the automated input has its quality limits and originates somewhere from humans. Two other sources of changes are configuration related:

the *shop* **configuration** , for example roles, accountabilities and responsibilities of the staff

the *system* **configuration** , for example what servers are used, how are functions and resources allocated.

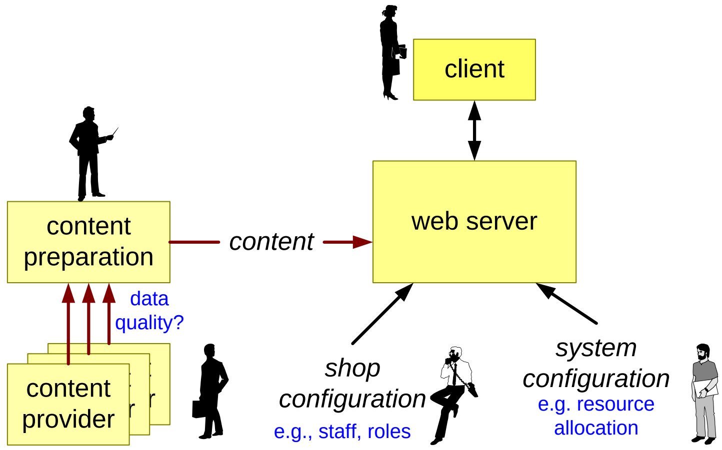


Figure 1.6: Data Sources of Web Server

We have observed that configuration changes are a frequent source of reliability and availability problems. In terms of the popular press this called a computer or software problem. The last source of change in this figure is the behavior of the customers. A sudden hype or fashion may cause a very specific load on the system.

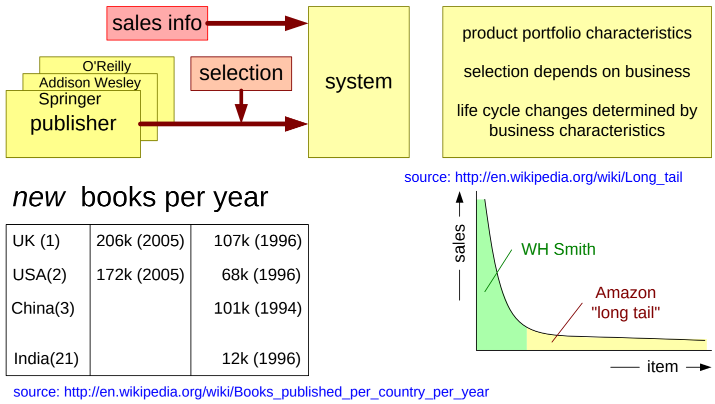


Figure 1.7: Example Product Portfolio Change Books

The modeling becomes much more concrete if we are able to quantify the number of changes. Figure 1.7 shows as an example the quantification of the number of books that is published per year. This data, from wikipedia, shows that UK and USA both publish more than 100k new books per year, together these two countries publish more than 1000 new books per day! The same data source provides data for many different countries. This illustrates the geographic impact on the quantification. India is still a small producer of books, but with more inhabitants than the UK and USA together, it can be expected that this will increase significantly. Note that this short discussion about India is a discussion of a second order effect: the change in the rate of change.

Wikipedia also provides data on the sales frequency of books. The interesting notion of the *long tail* is explained. In the case of book sales the total volume of very popular books is smaller than the long tail of many books with small individual sales. The characteristics of a book shop of popular books is entirely different from a book shop selling a wide variety of less popular books.

internet: broadband penetration

	Q1 '04	Q2 '04	growth in Q2 '04
Asia Pacific total	48M	54M	12.8%
China	15M	19M	26.1%
India	87k	189k	116.8%

http://www.apira.org/download/world_broadband_statistics_q2_2004.pdf

What is the expected growth of # customers?
What is the impact on system and infrastructure?
What is the impact on CRM (Customer Relation Management)?
What is the impact on customer, sales support staff?

Figure 1.8: Example Customer Change

Figure 1.8 provides numbers related to the potential change in the customer base. This figure shows the number of broadband connections in China and India. If people connected to broadband are most probable customers of a web shop, then these numbers provide an indication of a potential shift in the customer base. Note that the amount of broadband connections in China increases with 25% per quarter, while this increase is more than 100% in India. The current situation is that very few Indian people are potential web shop customers, but this number doubles every quarter! Note that the sales volume of the web shop is not only determined by the customer potential. Also market share growth and extension of the product portfolio will increase sales volume and customer base. A web shop in India might start very small and low cost, but it might have to scale up very rapidly!

The growth in the number of customers will trigger other changes:

What is the impact on system and infrastructure? The dimensions of the system have to be adapted to the changed load. In scaling thresholds occur where a more fundamental change is triggered. For example from a single multi-purpose server to several dedicated servers.

What is the impact on CRM (Customer Relation Management)? This might be a trivial function for a few thousand customers, but with tens or hundreds of thousands of customers more support might be necessary.

What is the impact on customer, sales support staff? More customers often has as a consequence that more staff is required: more customer support and more sales managers. An increase in staffing may also trigger changes in the system itself.

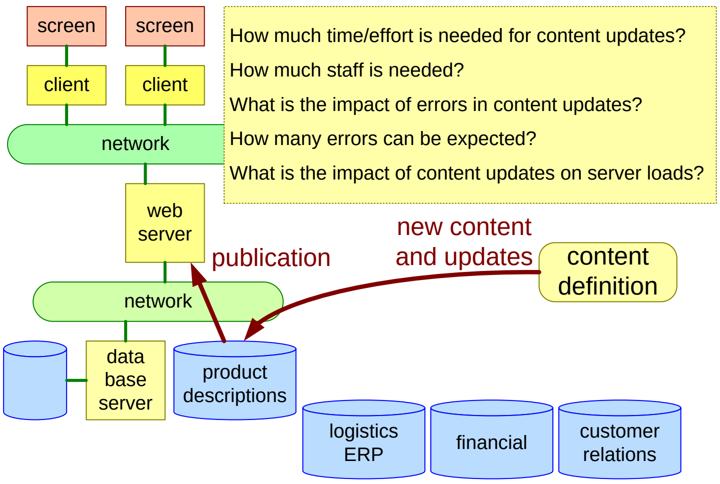


Figure 1.9: Web Shop Content Update

Once changes are identified we can analyze the propagation of these changes, as shown for the customer base. Changes trigger new changes. Figure 1.9 formulates a number of questions to look at this ripple through effect:

How much time/effort is needed for content updates? see below for elaboration.

How much staff is needed? And how many staff and role changes are to be expected?

What is the impact of errors in content updates? So what is the impact on system quality and reliability? What is the process to prevent and cope with errors?

How many errors can be expected? Make the problem more tangible.

What is the impact of content updates on server loads? Do we have to scale the server configuration, due to changes in the content updates?

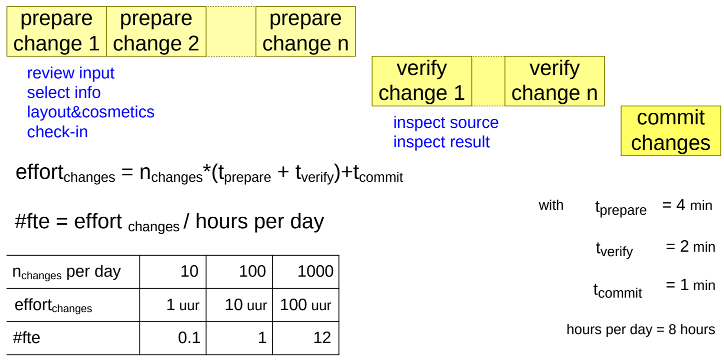


Figure 1.10: Web Shop Content Change Effort

We need a simple model of the update process to estimate the amount of effort to change the content. Figure 1.10 provides such a simple model:

- every change is a sequence of 4 steps:
  - review input
  - select information to be used
  - design layout and apply cosmetics or "styling"
  - check in of the change, an administrative step

  Automated checks will take place concurrently with these steps, ensuring syntactically correct input.

- every change is verified by inspection: the implementation and the result are inspected.
- the complete set of changes is committed.

This simple process model can be used to make an effort model. If we substitute numbers in the formula derived in Figure 1.10, then we can explore the impact of the number of changes on effort and staff size.

The business context, the application, the product and it's components have all their own specific life-cycles. In Figure 1.11 several different life-cycles are shown. The application and business context in the customer world are shown at the top of the figure, and at the bottom the technology life-cycles are shown. Note that the time-axis is exponential; the life-cycles range from one month to more than ten years! Note also the tension between commodity software and hardware life-cycles and software release life-cycles: How to cope with fast changing commodities? And how to cope with long living products, such as MR scanners, that use commodity technologies?

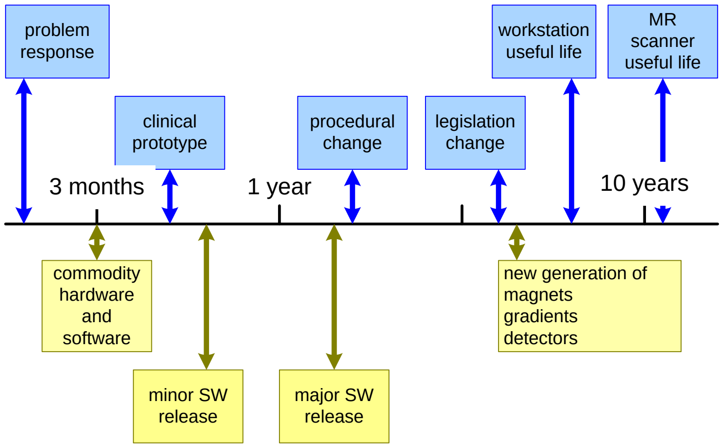


Figure 1.11: Life-cycle Differences for health care equipment

Note that the web shop content life cycle may be shorter than one month in the health care equipment example. Content life cycles may be one day or even shorter.

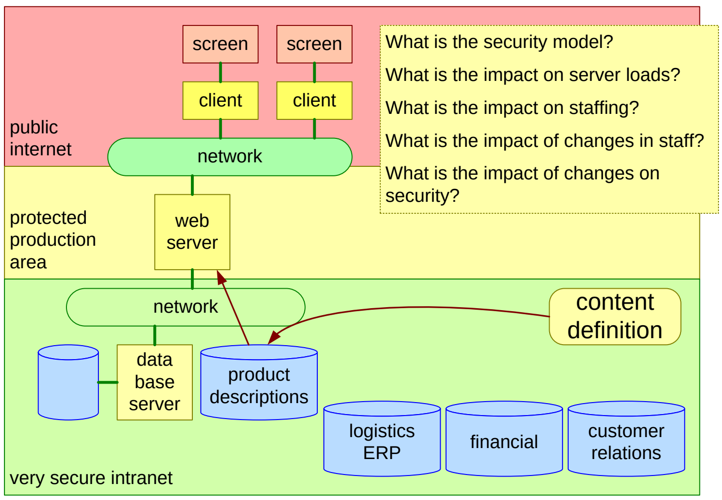


Figure 1.12: Web Shop Security and Changes

One way of modeling and analyzing the consequences of changes is by following the qualities. As an example, Figure 1.12 zooms in on the security aspect of the web ship example. The following questions can be analyzed:

What is the security model? In the diagram it is shown that different security domains are used:

- public internet where the clients are connected
- the production domain with enhanced access control through gateways. The external world has limited access to interact with the production environment of the web shop.
- a very secure intranet environment, where web shop content preparation and web shop management takes place.

What is the impact on server loads? The layers of security and the security based allocation of functions and data may impact the load of the servers.

What is the impact on staffing? The processes to ensure security will have impact on the way-of-working of the staff and the amount of work.

What is the impact of changes in staff? The staff itself has a significant impact on overall security. Changes of the staff itself will trigger second order effects, such as screening and authorization work and blocking moved staff.

What is the impact of changes on security? Any change somewhere in the system might have a side effect on overall security. Security concerns will create a continuous overhead for systems and staff.

new faults = average fault density * #changes

$$\#errors = \sum_{faults} f(\text{severity}, \text{hit probability}, \text{detection probability})$$

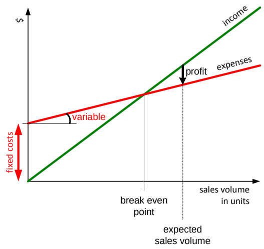
	severity	hit probability	detection probability
Jansen iso *Janssen*	low	high	low
operator iso *sales repr*	high	high	medium

Figure 1.13: Web Shop Reliability and Changes

Figure 1.13 shows an example of reliability modeling. *this needs to be elaborated GM*.

Chapter 2

Simplistic Financial Computations for System Architects.



2.1 Introduction

Many system architects shy away from the financial considerations of the product creation. In this document a very much simplified set of models is offered to help the architect in exploring the financial aspects as well. This will help the architect to make a ”sharper” design, by understanding earlier the financial aspects.

The architect should always be aware of the many simplifications in the models presented here. Interaction with real financial experts, such as controllers, will help to understand shortcomings of these models and the finesses of the highly virtualized financial world.

In Section 2.2 a very basic cost and margin model is described. Section 2.3 refines the model at the cost side and the income side. In Section 2.4 the time dimension is added to the model. Section 2.5 provides a number of criteria for making finacial decisions.

2.2 Cost and Margin

The simplest financial model looks only at the selling price (what does the customer pay), the cost price (how much does the manufacturing of the product actually cost). The difference of the selling price and the cost price is the margin. Figure 2.1 shows these simple relations. The figure also adds some annotations, to make the notions more useful:

- the cost price can be further decomposed in material, labor and other costs
- the margin ("profit per product") must cover all other company expenses, such as research and development costs, before a real profit is generated
- most products are sold as one of the elements of a value chain. In this figure a retailer is added to show that the street price, as paid by the consumer, is different from the price paid by the retailer[1].

The annotation of the other costs, into transportation, insurance, and royalties per product, show that the model can be refined more and more. The model without such a refinement happens to be rather useful already.

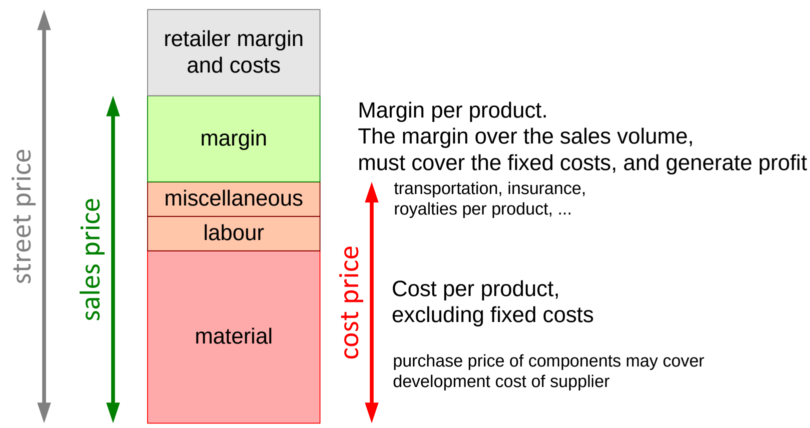


Figure 2.1: The relation between sales price, cost price and margin per product

The translation of margin into profit can be done by plotting income and expenses in one figure, as shown in Figure 2.2, as function of the sales volume. The slope of the expenses line is proportional with the costs per product. The slope of the income line is proportional with the sales price. The vertical offset of the expenses line are the fixed organizational costs, such as research, development, and overhead costs. The figure shows immediately that the sales volume must exceed the break even point to make a profit. The profit is the vertical distance between expenses and income for a given sales volume. The figure is very useful to obtain insight in the robustness of the profit: variations in the sales volume are horizontal shifts in the figure. If the sales volume is far away from the break even point than the profit is not so sensitive for the the volume.

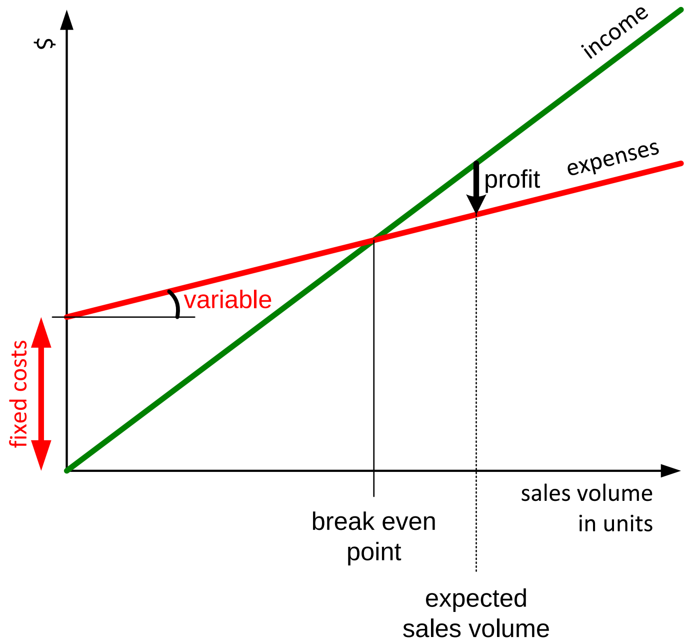


Figure 2.2: Profit as function of sales volume

2.3 Refining investments and income

The investments as mentioned before may be much more than the research and development costs only, depending strongly on the business domain. Figure 2.3 shows a decomposition of the investments. The R&D investments are often calculated in a simple way, by using a standard rate for development personnel that includes overhead costs such as housing, infrastructure, management and so on. The investment in R&D is then easily calculated as the product of the amount of effort in hours times the rate (=standardized cost per hour). The danger of this type of simplification is that overhead costs become invisible and are not managed explicitly anymore.

Not all development costs need to be financed as investments. For outsourced developments an explicit decision has to be made about the financing model:

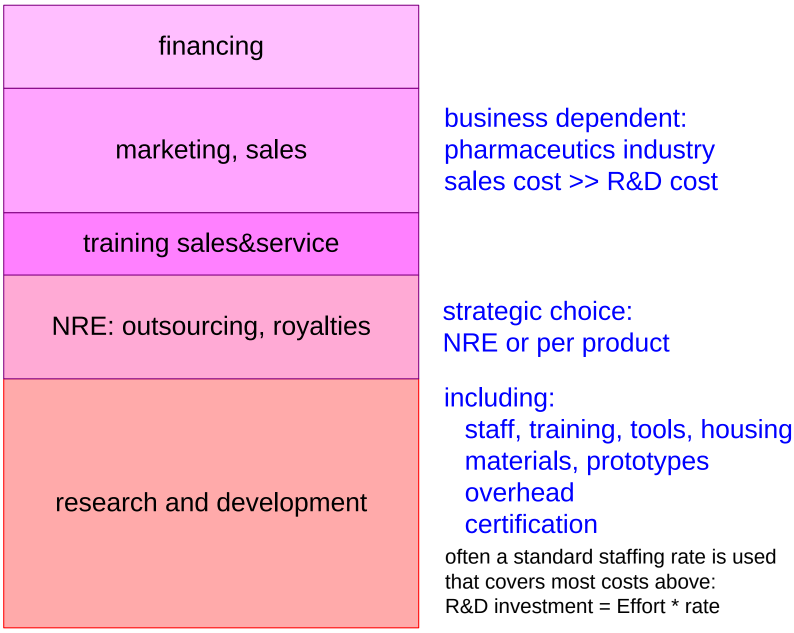


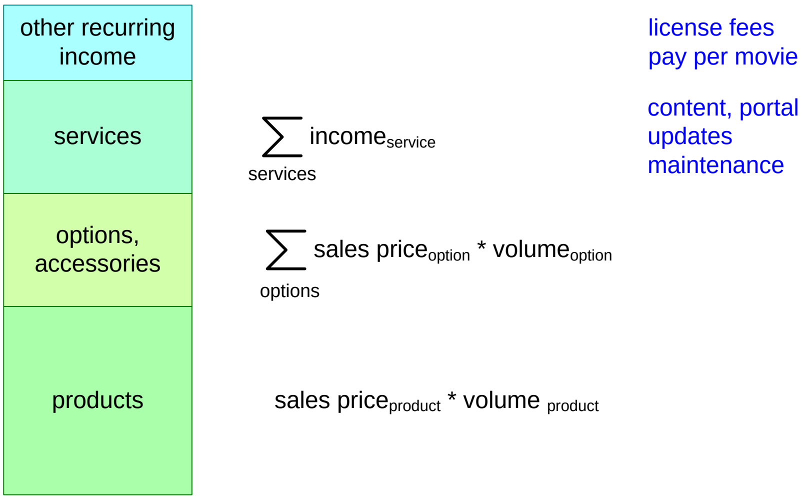
Figure 2.3: Investments, more than R&D

- the supplier takes a risk by making the investments, but also benefits from larger sales volumes
- the company pays the investment, the so called Non Recurring Engineering (NRE) costs. In this case the supplier takes less risks, but will also benefit less from larger sales volumes.

If the supplier does the investment than the development costs of the component are part of the purchasing price and become part of the material price. For the NRE case the component development costs are a straightforward investment.

Other investments to be made are needed to prepare the company to scale all customer oriented processes to the expected sales volume, ranging from manufacturing and customer support to sales staff. In some business segments the marketing costs of introducing new products is very significant. For example, the pharmaceutical industry spends 4 times as much money on marketing than on R&D. The financial costs of making investments, such as interest on the capital being used, must also be taken into account.

We have started by simplifying the income side to the sales price of the products. The model can be refined by taking other sources of income into account, as shown in Figure 2.4. The options and accessories are sold as separate entities, generating a significant revenue for many products. For many products the base products are



$$\sum_{services} income_{service}$$

$$\sum_{options} sales\ price_{option} * volume_{option}$$

$$sales\ price_{product} * volume_{product}$$

Figure 2.4: Income, more than product sales only

sold with a loss. This loss is later compensated by the profit on options and accessories.

Many companies strive for a business model where a recurring stream of revenues is created, for instance by providing services (access to updates or content), or by selling consumables (ink for prink jet printers, lamps for beamers, et cetera).

One step further is to tap the income of other players of the value chain. Example is the license income for MPEG4 usage by service and content providers. The chip or box supplier may generate additional income by partnering with the downstream value chain players.

2.4 Adding the time dimension

All financial parameters are a function of time: income, expenses, cash-flow, profit, et cetera. The financial future can be estimated over time, for example in table form as shown in Figure 2.5. This table shows the investments, sales volume, variable costs, income, and profit (loss) per quarter. At the bottom the accumulated profit is shown.

The cost price and sales price per unit are assumed to be constant in this example, respectively 20k$ and 50k$. The formulas for variable costs, income and profit are very simple:

$$variable\ costs = sales\ volume * cost\ price$$

$$income = sales\ volume * sales\ price$$

	Y1 Q1	Y1 Q2	Y1 Q3	Y1 Q4	Y2 Q1	Y2 Q2	Y2 Q3
investments	100k$	400k$	500k$	100k$	100k$	60k$	20k$
sales volume (units)	-	-	2	10	20	30	30
material & labour costs	-	-	40k$	200k$	400k$	600k$	600k$
income	-	-	100k$	500k$	1000k$	1500k$	1500k$
quarter profit (loss)	(100k$)	(400k$)	(440k$)	200k$	500k$	840k$	880k$
cumulative profit	(100k$)	(500k$)	(940k$)	(740k$)	(240k$)	600k$	1480k$

cost price / unit = 20k$
sales price / unit = 50k$

variable cost = sales volume * cost price / unit
income = sales volume * sales price / unit
quarter profit = income - (investments + variable costs)

Figure 2.5: The Time Dimension

$$profit = income - (investments + variable\ costs)$$

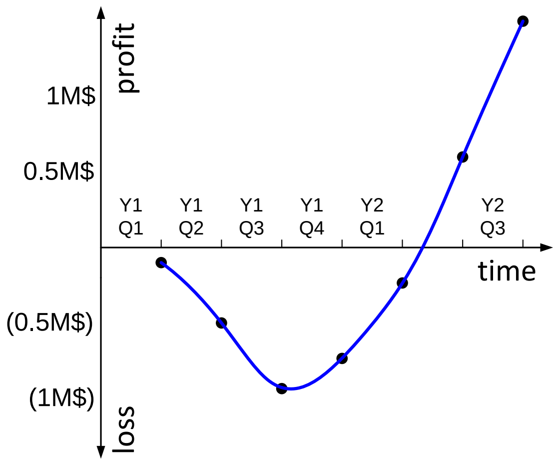


Figure 2.6: The "Hockey" Stick

Figure 2.6 shows the cumulative profit from Figure 2.5 as a graph. This graph is often called a "hockey" stick: it starts with going down, making a loss, but when the sales increase it goes up, and the company starts to make a profit. Relevant questions for such a graph are:

- when is profit expected?
- how much loss can be permitted in the beginning?
- what will the sustainable profit be in later phases?

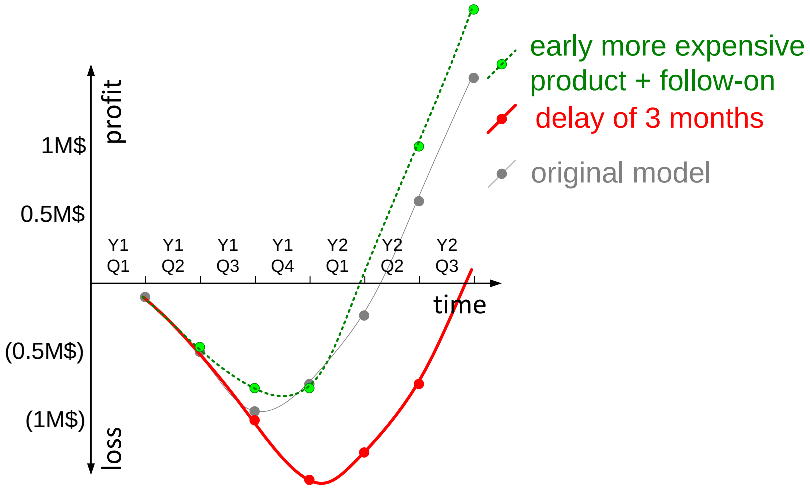


Figure 2.7: What if ...?

These questions can also be refined by performing a simple sensitivity analysis. Figure 2.7 shows an example of such an analysis. Two variations of the original plan are shown:

- a development delay of 3 months
- an intermediate more expensive product in the beginning, followed by a more cost optimized product later

The delay of 3 months in development causes a much later profitability. The investment level continues for a longer time, while the income is delayed. Unfortunately development delays occur quite often, so this delayed profitability is rather common. Reality is sometimes worse, due to loss of market share and sales price erosion. This example brings two messages:

- a go decision is based on the combination of the profit expectation and the risk assessment
- development delays are financially very bad

The scenario starting with a more expensive product is based on an initial product cost price of 30k$. The 20k$ cost price level is reached after 1 year. The benefit of an early product availability is that market share is build up. In this example the final market share in the first example is assumed to be 30 units, while in the latter scenario 35 units is used. The benefits of this scenario are mostly risk related. The loss in the beginning is somewhat less and the time to profit is somewhat better, but the most important gain is be in the market early and to reduce the risk in that way. An important side effect of being early in the market is that early market feedback is obtained that will be used in the follow on products.

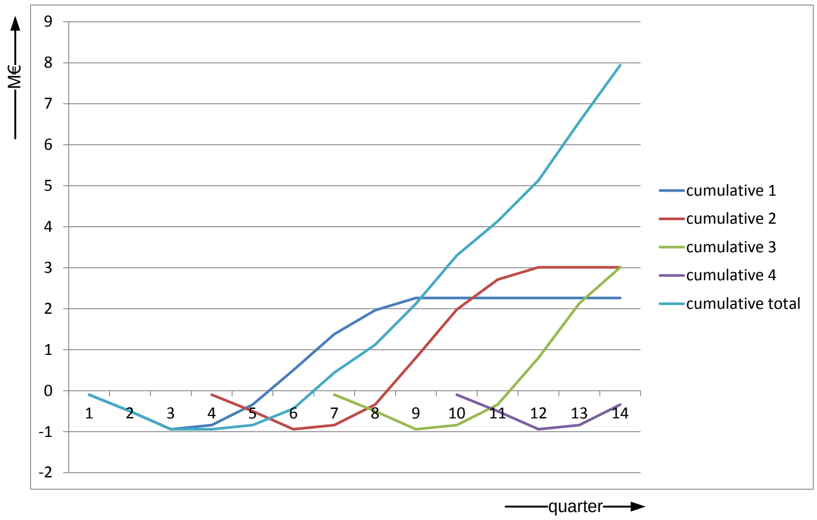


Figure 2.8: Stacking Multiple Developments

In reality, a company does not develop a single product or system. After developing an initial product, it will develop successors and may be expand into a product family. Figure reffig:SFCmultipleDevelopments shows how the cumulative profits are stacked, creating an integral hockey stick for the succession of products. In this graph the sales of the first product is reduced, while the sales of the second product is starting. This gradual ramp-up and down is repated for the next products. The sales volume for the later products is increasing gradually.

2.5 Financial yardsticks

How to assess the outcome of the presented simple financial models? What are *good* scenarios from financial point of view? The expectation to be profitable is not sufficient to start a new product development. One of the problems in answering these questions is that the financial criteria appear to be rather dynamic themselves. A management fashion influences the emphasis in these criteria. Figure 2.9 shows a number of metrics that have been fashionable in the last decade.

The list is not complete, but it shows the many financial considerations that play a role in decision making.

Return On Investments is a metric from the point of view of the shareholder or the investor. The decision these stakeholders make is: what investment is the most attractive.

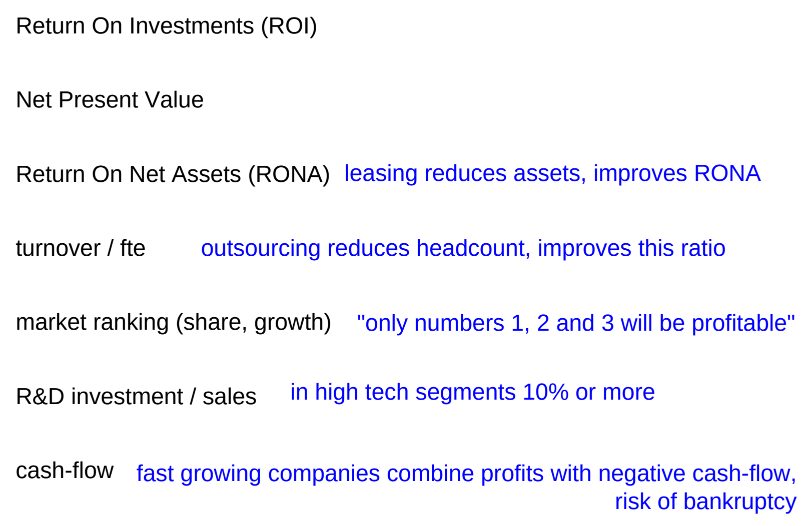


Figure 2.9: Fashionable financial yardsticks

Return On Net Assets (RONA) is basically the same as ROI, but it looks at all the capital involved, not only the investments. It is a more integral metric than ROI.

turnover / fte is a metric that measures the efficiency of the human capital. Optimization of this metric results in a maximum added value per employee. It helps companies to focus on the core activities, by outsourcing the non-core activities.

market ranking (share, growth) has been used heavily by the former CEO of General Electric, Jack Welch. Only business units in rank 1, 2 or 3 were allowed. Too small business units were expanded aggressively if sufficient potential was available. Otherwise the business units were closed or sold. The growth figure is related to the shareholder value: only growing companies create more shareholder value.

R&D investment / sales is a metric at company macro level. For high-tech companies 10% is commonly used. Low investments carry the risk of insufficient product innovation. Higher investments may not be affordable.

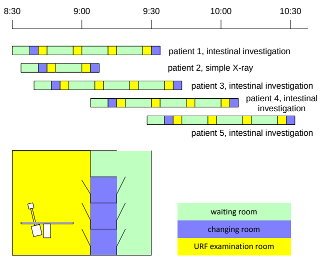
cashflow is a metric of the actual liquid assets that are available. The profit of a company is defined by the growth of all assets of a company. In fast growing companies a lot of working capital can be unavailable in stocks or other non salable assets. Fast growing, profit making, companies can go bankrupt by a negative cash-flow. The crisis of Philips in 1992 was caused by this effect: years of profit combined with a negative cash-flow.

2.6 Acknowledgements

William van der Sterren provided feedback and references. Hans Barella, former CEO of Philips medical Systems, always stressed the importance of Figure 2.2, and especially the importance of a robust profit. Ad van den Langenberg pointed out a number of spelling errors.

Chapter 3

The application view



3.1 Introduction

The application view is used to understand how the customer is achieving his objectives. The methods and models used in the application view should discuss the customer's world. Figure 3.1 shows an overview of the methods discussed here.

The customer is a gross generalization, which can be made more specific by identifying the customer stakeholders and their concerns, see section 3.2.

The customer is operating in a wider world, which he only partially controls. A context diagram shows the context of the customer, see section 3.3. Note that part of this context may interface actively with the product, while most of this context simply exists as neighboring entities. The fact that no interface exists is no reason not to take these entities into account, for instance to prevent unwanted duplication of functionality.

The customer domain can be modelled in static and dynamic models. Entity relationship models (section 3.4) show a static view on the domain, which can be complemented by dynamic models (section 3.5).

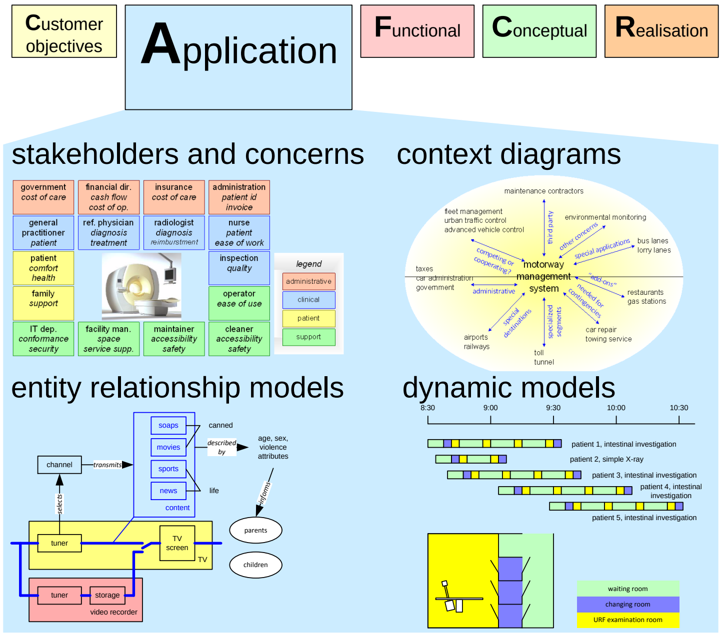


Figure 3.1: Overview of methods and models that can be used in the application view

3.2 Customer stakeholders and concerns

In the daily use of the system many human and organizational entities are involved, all of them with their own interests. Of course many of these stakeholders will also appear in the static entity relationship models. However human and organizations are very complex entities, with psychological, social and cultural characteristics, all of them influencing the way the customer is working. These stakeholders have multiple concerns, which determine their needs and behavior. Figure 3.2 shows stakeholders and concerns for an MRI scanner.

The IEEE 1471 standard about architectural descriptions uses stakeholders and concerns as the starting point for an architectural description.

Identification and articulation of the stakeholders and concerns is a first step in understanding the application domain. The next step can be to gain insight in the *informal* relationships. In many cases the formal relationships, such as organization charts and process descriptions are solely used for this view, which is a horrible mistake. Many organizations function thanks to the unwritten information flows of the social system. Insight in the informal side is required to prevent a solution which does only work in theory.

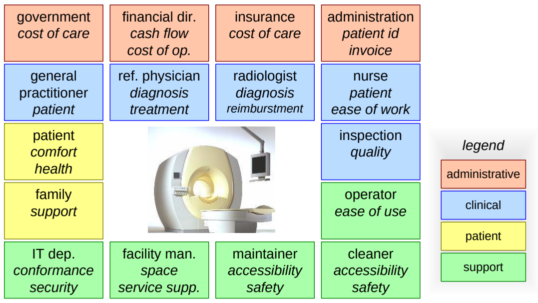


Figure 3.2: Stakeholders and concerns of an MRI scanner

3.3 Context diagram

The system is operating in the customer domain in the context of the customer. In the customer context many systems have some relationship with the system, quite often without having a direct interface.

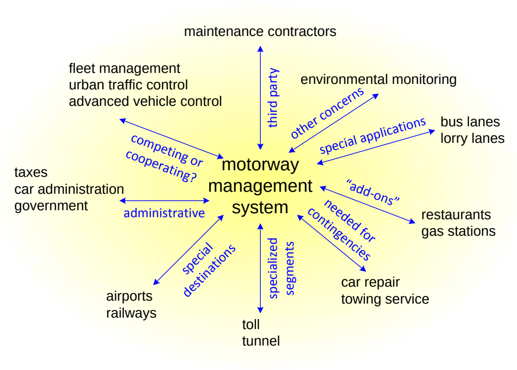


Figure 3.3: Systems in the context of a motorway management system

Figure 3.3 shows a simple context diagram of a motorway management system. Tunnels and toll stations often have their own local management systems, although they are part of the same motorway. The motorway is connecting destinations, such as urban areas. Urban areas have many traffic systems, such as traffic management (traffic lights) and parking systems. For every system in the context questions can be asked, such as:

- is there a need to interface directly (e.g. show parking information to people still on the highway)
- is duplication of functionality required (measuring traffic density and sending it to a central traffic control center)

3.4 Entity relationship model

The OO (Object Oriented software) world is quite used to entity relationship diagrams. These diagrams model the outside world in such a way that the system can interact with the outside world. These models belong in the "CAFCR" thinking in the conceptual view. The entity relationship models advocated here model the customers world in terms of entities in this world and relations between them. Additionally also the activities performed on the entities can be modelled. The main purpose of this modelling is to gain insight in how the customer is achieving his objectives.

One of the major problems of understanding the customers world is its infinite size and complexity. The art of making an useful entity relationship model is to very carefully select what to include in the model and therefore also what **not** to include. Models in the application view, especially this entity relationship model, are by definition far from complete.

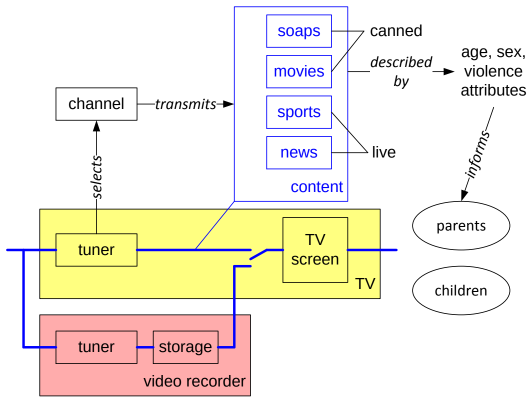


Figure 3.4: Diagram with entities and relationship for a simple TV appliance

Figure 3.4 shows an example of an entity relationship model for a simple TV. Part of the model shows the well recognizable flow of video content (the bottom part of the diagram), while the top part shows a few essential facts about the contents. The layout and semantics of the blocks are not strict, these form-factors are secondary to expressing the essence of the application.

3.5 Dynamic models

Many models, such as entity relationship models, make the static relationships explicit, but don't address the dynamics of the system. Many different models can be used to model the dynamics, or in other words to model the behavior in time. Examples are of dynamic models are shown in figure 3.5

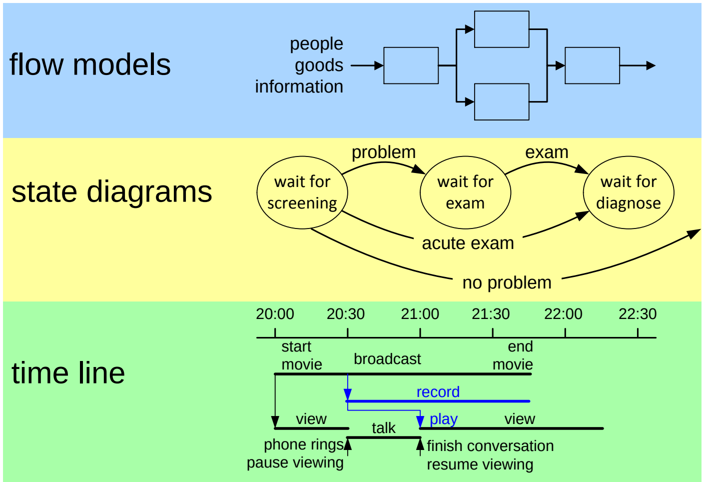


Figure 3.5: Examples of dynamic models

Productivity and Cost of ownership models are internally based on dynamic models, although the result is often a more simplified parameterized model, see figure 3.6.

Figure 3.7 shows an example of a time-line model for an URF examination room. The involved rooms play an important role in this model, therefore an example geographical layout is shown to explain the essence of the time-line model.

The patient must have been fasting for an intestine investigation. In the beginning of the examination the patient gets a barium meal, which slowly moves through the intestines. About every quarter of an hour a few X-ray images-images are made of the intestines filled with barium. This type of examination is interleaving multiple patients to efficiently use the expensive equipment and clinical personnel operating it.

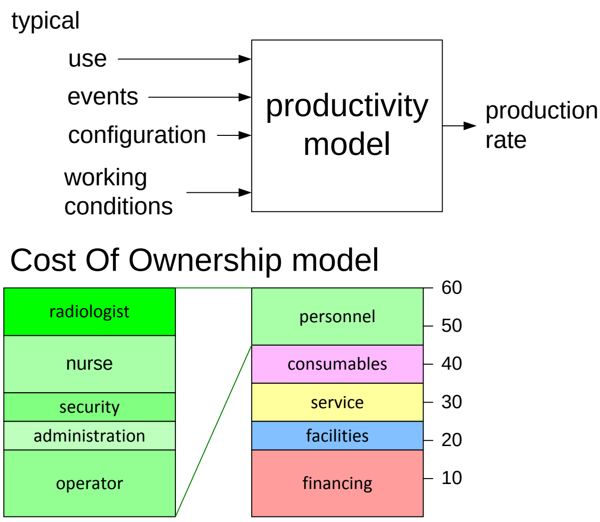


Figure 3.6: Productivity and cost models

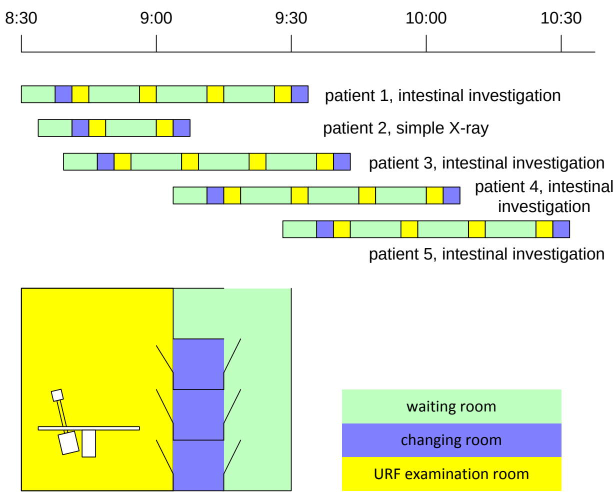


Figure 3.7: Dynamics of an URF examination room

Bibliography

[1] Mark Abraham. Define and price for your market starting at end market values! http://www.sticky-marketing.net/articles/pricing-for-channels.htm, 2001.

[2] Gerrit Muller. The system architecture homepage. http://www.gaudisite.nl/index.html, 1999.

History

Version: 0.3, date: 6 March, 2007 changed by: Gerrit Muller

- added position slide

Version: 0.2, date: 6 February, 2007 changed by: Gerrit Muller

- created text version

Version: 0.1, date: 4 January, 2007 changed by: Gerrit Muller

- added Application Models
- added Life Cycle Models

Version: 0, date: 20 November, 2006 changed by: Gerrit Muller

- created module