IT QM Part2 Lecture 6

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Dr. Withalm Mar 3, 2009

IT QM Bratislava

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Lectures at the University of Bratislava/Spring 2008

21.02.2008	**Lecture 1 Impact of Quality-From Quality Control to Quality Assurance**
28.02.2008	**Lecture 2 Organization Theories-Customer satisfaction-Quality Costs**
06.03.2008	**Lecture 3 Leadership-Quality Awards**
13.03.2008	**Lecture 4 Creativity-The long Way to CMMI level 4**
03.04.2008	**Lecture 5 System Engineering Method-Quality Related Procedures**
10.04.2008	**Lecture 6 Quality of SW products**
17.04.2008	**Lecture 7 Quality of SW organization**

Vorlesungen am Technikum - Wien Winter 2008

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30.09.2008	**Vorlesung 1 Der weite Weg zu CMMII-Level 4**
07.10.2008	**Vorlesung 2 System Entwicklungsprozess + Planung**
14.10.2008	**Vorlesung 3 Verfahren 1 (CM, Reviews, Aufwandsabschätzung (Function Point))**
16.10.2008	**Vorlesung 4 Verfahren 2 (Wiederverwendung, Dokumentation, Case- Tools)**
13.11.2008	**Vorlesung 5 Qualität von SW 1 (Testen, Q-Bewertung, Quality in Use,)**
27.11.2008	**Vorlesung 6 Qualität von SW 2 (Quality Function Deployment, Zertifizierung von Hypermedia-Links bei InternetApplikationen, Technology Management Process)**
11.12.2008	**Vorlesung 7 Qualität einer SW-Organisation (ISO 9001, CMMI, BSC)**
	CMMI: Capability Maturity Model
	BSC: Balanced Scorecard

Conclusion of Part 1/1

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- Impact of Quality
  - Quality wins
  - Quality deficiencies
- Standards
  - Quality definition
- Evolution from quality control to TQM
  - Shewhart, Deming, Juran, Feigenbaum, Nolan, Crosby, Ishikawa
- Evolution of organization theory
  - i.e. Taylorism, System Dynamics, System Thinking, Quality Assurance
- Product liability
- Customer satisfaction
  - Criteria, two-dimension queries, inquiry methods

Conclusion of Part 1/2

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- Quality costs
  - Failure prevention, appraisal, failure, conformity, quality related losses, barriers
- Leadership
  - Behavior, deal with changes, kinds of influencing control, conflict resolution, syndromes to overcome when introducing changes
- Audits
- Quality awards
- Creativity techniques
  - Mind Mapping, Progressive Abstraction, Morphological Box, Method 635, Synectics, Buzzword Analysis, Bionic, De Bono
- Embedded Systems
- FMEA-Failure Mode Effect Analysis

Conclusion of Part 2/1

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- SEM
  - Overview
  - Tailoring
  - Phase Organization
  - Areas of responsibility
- PM
  - Overview
  - Planning (Component, Organization, Volume, Course of the Project, Risk)
  - Tender and Commissions
  - Procurement of HW and SW
  - Project Checks and Project Control (Progress, Effort, Cost)
  - Coordination, Organization, Administration
  - PROWEB

Conclusion of Part 2/2

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- CM
  - Configuration Identification
  - Configuration Control
  - Configuration Status Accounting
  - Configuration Auditing
  - Interface Control
- Reviews
  - Review techniques
  - Quality of reviews
  - Intensive inspections (Size, Roles, Expenditures, Classification of Errors)
- Expenditure Estimation
  - Estimation Methods
  - Function Point
  - Effort Estimation Meeting
  - Tools and further Methods

Conclusion of Part 2/3

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- Reuse & Reusability
  - Definition
  - System
  - Documents
- Documentation
  - Overview
  - Responsibility
  - Point in Time
  - Checklists for Templates
  - Checklists for Structuring
- Case
  - Applications of Case
  - Case in different Phases
  - Promises of Case
  - Classification
  - Challenges

- Requirements
- Evaluation Criteria
- Tracing Problem
- Introduction
- Experiences

Conclusion of Part 2/4

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- Testing
  - Definition
  - Structuring
  - V-Model
  - Testlevels
  - Types of Tests (Black Box- White Box)
    - White Box (C0, C1, C2)
  - Testcases
  - End of Test Criteria
  - Conducting Tests
  - Test Evaluation
- SW Quality Evaluation
  - Motivation
  - Quality Characteristics (Subcharacteristics, List of Criteria, Evaluation Procedures)
- Quality in Use
  - Needs
  - Needs and Requirements
  - Relationship between different Quality Characteristics)

Today's Agenda

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- Quality Function Deployment
  - Definition
  - Motivation
  - Concept
  - Elements
- Certifying Hypermedia Links for Internet Applications through Statistical Usage Testing
  - Introduction
  - Web Links and Information Structure
  - SW-Quality Certification
  - Certification on link validity for web applications
  - Conclusions
- Technology Management Process

Today's Agenda

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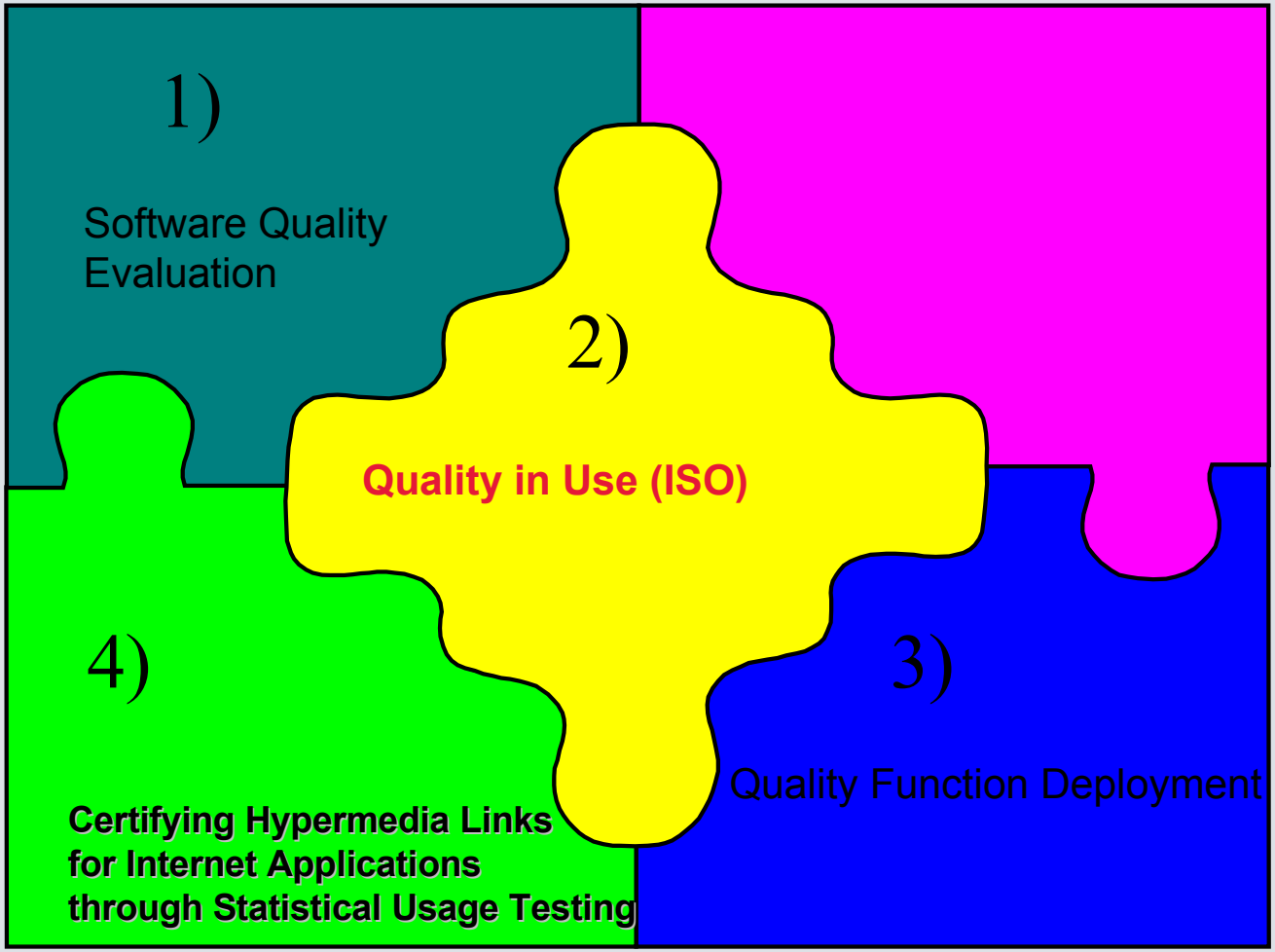
- ISO-9000
  - Motivation
  - Definition
  - Introduction Strategy
  - Certification Expenditure
  - The Way to Certification
  - Background of Certification
  - Benefits & Drawbacks
- CMMI
  - Motivation
  - Definition
  - Characteristics of Mature/ Immature Processes
  - Process Areas
  - How a CMMI works
  - Structure of the Siemens modified Process
  - Presentation of Results
- Balanced Score Cards
  - Motivation
  - Definition
  - Elements
  - Proceeding
  - Example
  - Presentation


1)
Software Quality Evaluation
2)
Quality in Use (ISO)
3)
Quality Function Deployment
4)
Certifying Hypermedia Links for Internet Applications through Statistical Usage Testing

What is Quality Function Deployment?

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Quality Function Deployment

**Interdisciplinary approach in order to focus
the development process
with consistent regarding of customer requirements
over the entire production process**

To the definition of QFD

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Japanese:	**hinshitsu** - quality - features - attributes - qualities	**kino** - function	**tenkai** - deployment - diffusion - development - evolution

English: "A systematic approach to capture the voice of the customer from its earliest point, and convey it into the product, and through the product development process."

To the history of QFD

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	Japan	USA	Europe
1966	Basis concept		
1968			
1970			
1972	1st application		
1974			
1976			
1978	1st book		
1980			
1982	1st SW- application	Basis concept	
1984		1st application	
1986		1st book	
1988		1st SW-Application	
1990	1st SW- book	1st conference	Basis concept
1992	1st conference	QFD-Institute	1st application
1994			QFD-Institute
1996	Academy of QFD		1st book/ 1st SW-Book / 1st conference
1998			

Quality systems in the comparison:
A "new era of the quality"

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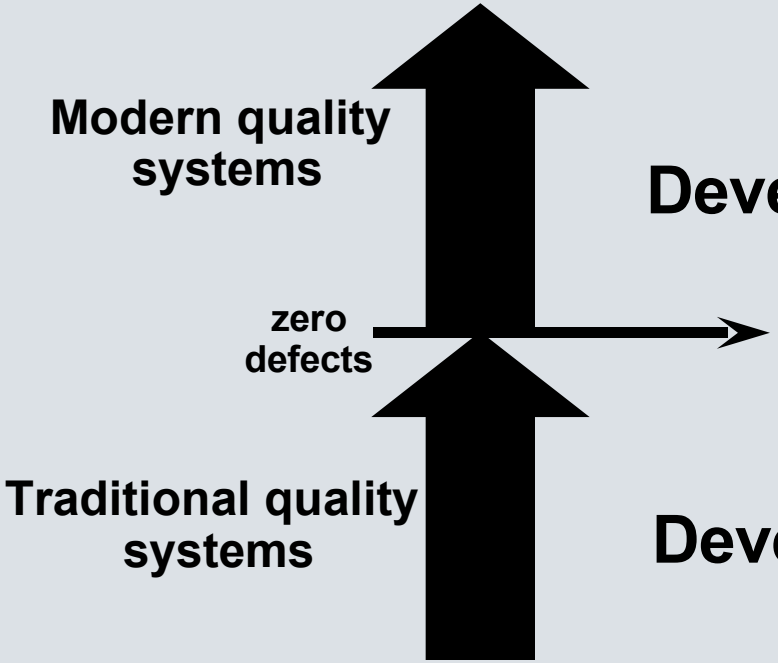

Developing the right product

not well enough!
nothing wrongly<> everything correctly

Developing the product correctly

Problems of the development process

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Strongly expanded technology without considering customer requirement:

- Ignoring the "voice of the customer„
- The actual problems and requirements of the customer are not perceived.

Unsatisfactory interdisciplinary co-operation:

- “Is the message the same when it returns to the customer?”

Lack of adjustment of the system on the competency and/or abilities of the manufacturer:

- “Here is the product, where is the factory?”

Consequences:

- No time-fair approach (time to Market)
- Overloaded products:
  - to high costs

The improved Development Process

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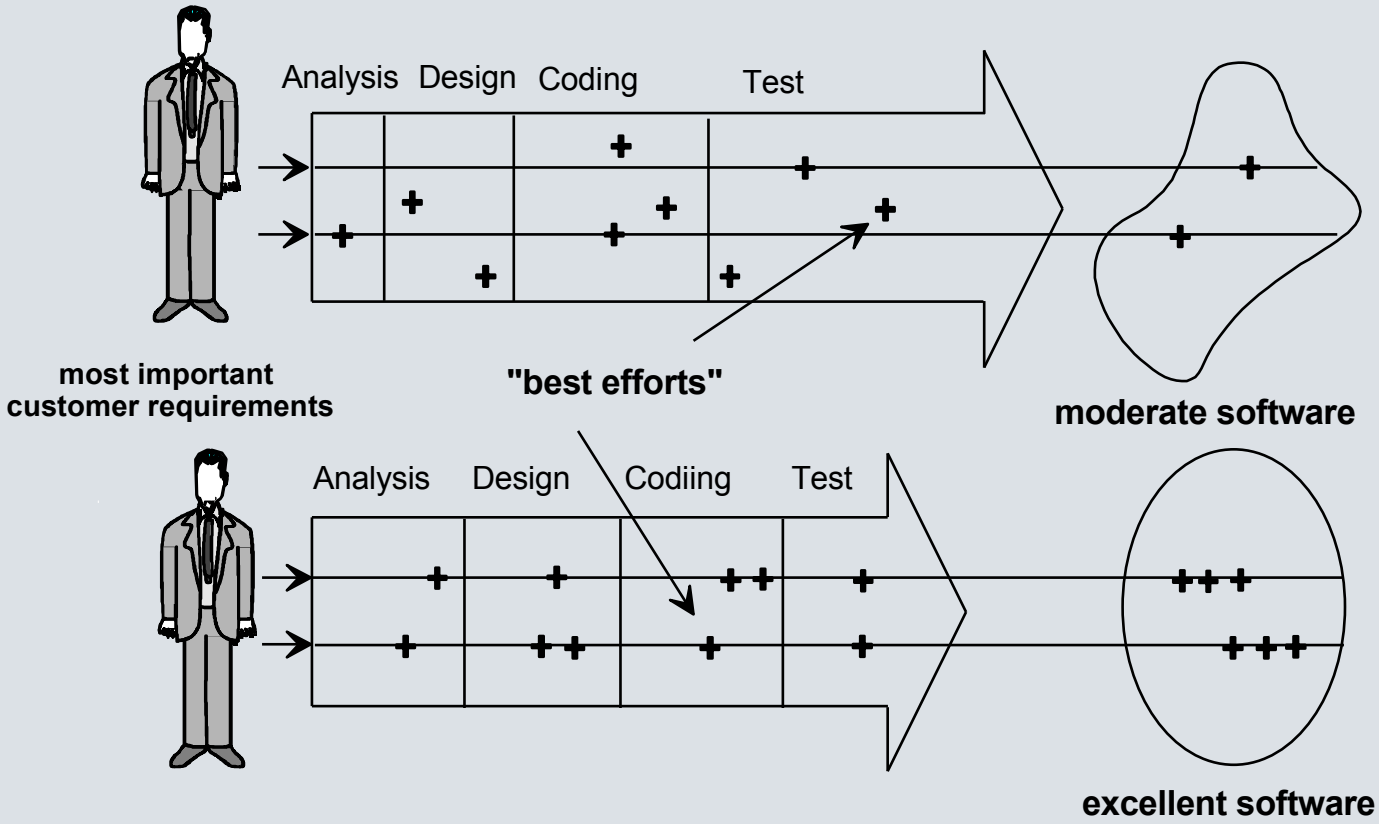

The QFD concept:
Customer analysis, requirement analysis
"House of Quality" and Design

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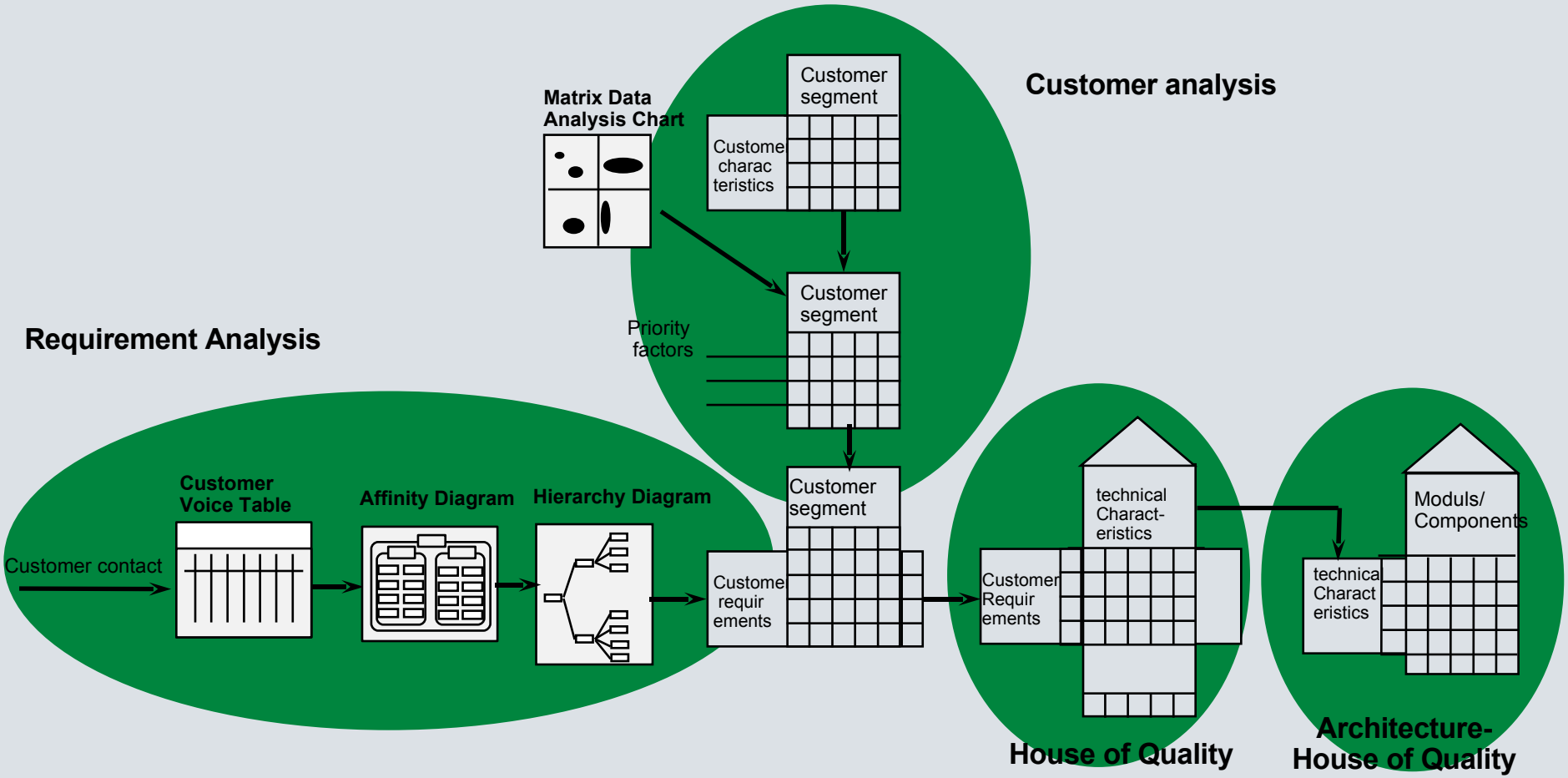

The elements of QFD (I): The customer analysis

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- **Goal:**
  - Evaluation of the customer segment regarding their meaning for the market success of the system which will be provided**:**
- **Procedure**
  - Definition of homogeneous customer segments
  - definition of priority factors
    - e.g. number of customers, purchasing power
  - evaluation of the segments basing on these criteria
- **Use:**
  - the entire market potential is arranged into homogeneous segments, thus one can limit the requirement analysis on representative customer segments
  - criteria of weighting these segments become transparent
  - impact of these weighting criteria becomes transparent
- **Continuation:**
  - the requirements are assigned to the prioritized customer segments and are accordingly weighted

The elements of QFD (II): The requirement analysis

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- **Goal:**
  - obtain "completeness" of requirements
- **Procedure:**
  - Requirements are analyzed under consideration of
    - underlying problems
    - or possible solution alternatives
  - in the team and completed by the mechanism of the Customer Voice Tables
  - topic and hierarchical arrangement of requirements
- **Use:**
  - comprehensive analysis of the requirements within the team:
    - the structures of the requirements are recognized
  - Lack of understanding can be eliminated promptly
- **Continuation:**
  - the requirements are transferred in the House of quality into technical performance characteristics

The elements of QFD (III): The House OF quality

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- **Goal:**
  - Derivative and evaluation of technical performance characteristics, which are necessarily for the fulfillment of the requirements
- **Procedure:**
  - Evaluation of the requirements by comparison in pairs
    - addition by competition comparisons
  - Derivative of technical characteristics and further development-relevant information
    - degree of difficulty, expenditures,...
  - Evaluation of the technical characteristics on the basis of their implication for the system development
- **Use:**
  - Transparent and compressed representation of the information and their relations among themselves
  - Frameworks for structured procedure
- **Continuation:**
  - The technical characteristics and their weightings are transferred into the Design

The elements of QFD (IV): The architecture - House OF quality

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- **Goal:**
  - Align system architecture purposefully at performance characteristics and thus at the customer requirements
- **Procedure:**
  - Specification of architecture
  - Evaluation of the components and architectural concepts..
    - by means of allocation of performance characteristics
- **Use:**
  - Structuring of the procedure
  - Clear and comprehensible representation of the information..
    - thereby improved communication in projects
  - secured basis for further development activities
    - Detailed design, test...
- **Continuation:**
  - Derivative of work packages for the further development

Objective of quality Function Deployment

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Quality Function Deployment is a systematic approach with the goal

- aligning the entire development process to the customer requirements
  - which are relevant for the success of the system.

With QFD

- all involved instances at the development take part in the context of an interdisciplinary co-operation.

This is

- organized by teams.

Used is

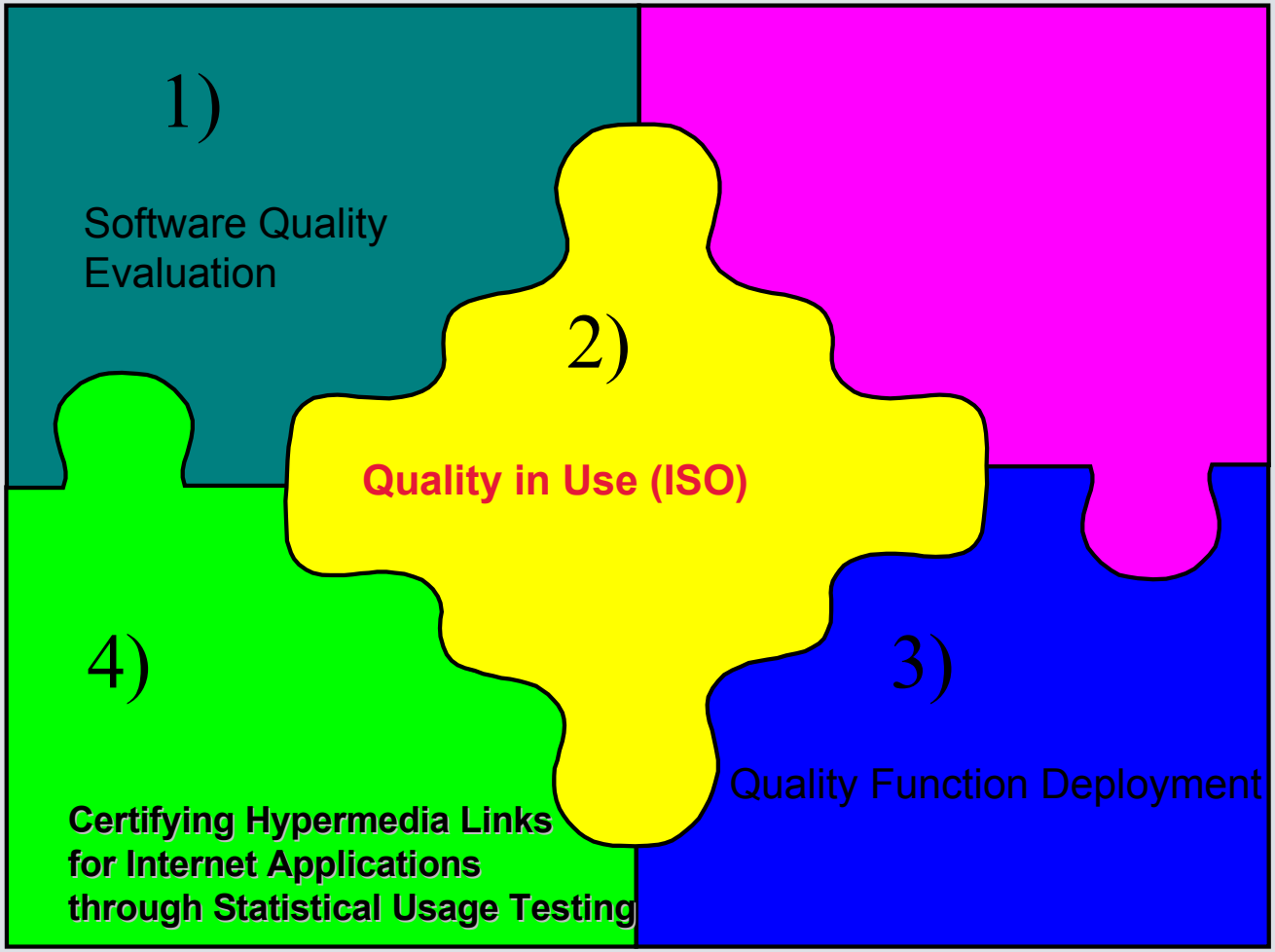
- a formal representation methodology

Purpose is

- to consolidate and to concentrate all information
  - which is of importance for the planning process.
  - and set on visible way in relationship

Thus

- the decision-making process is represented transparency with the system conception
  - so that a fast consent identification is guaranteed.


1)
Software Quality Evaluation
2)
Quality in Use (ISO)
3)
Quality Function Deployment
4)
Certifying Hypermedia Links for Internet Applications through Statistical Usage Testing

Certifying Hypermedia Links for Internet Applications through Statistical Usage Testing/Outline

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1. Introduction
2. Web links and information structure
3. Software quality certification
4. Certification on link validity for web applications
5. Conclusions

1. Introduction

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- internet applications grow explosively
  - number of web-sites is increasing greatly
    - more web-sites emerging will imply more problems to encounter
- in this research
  - rationale for statistical usage testing
    - is investigated and employed to certify links for website

Totavia homepage example

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Navigation map of Totavia

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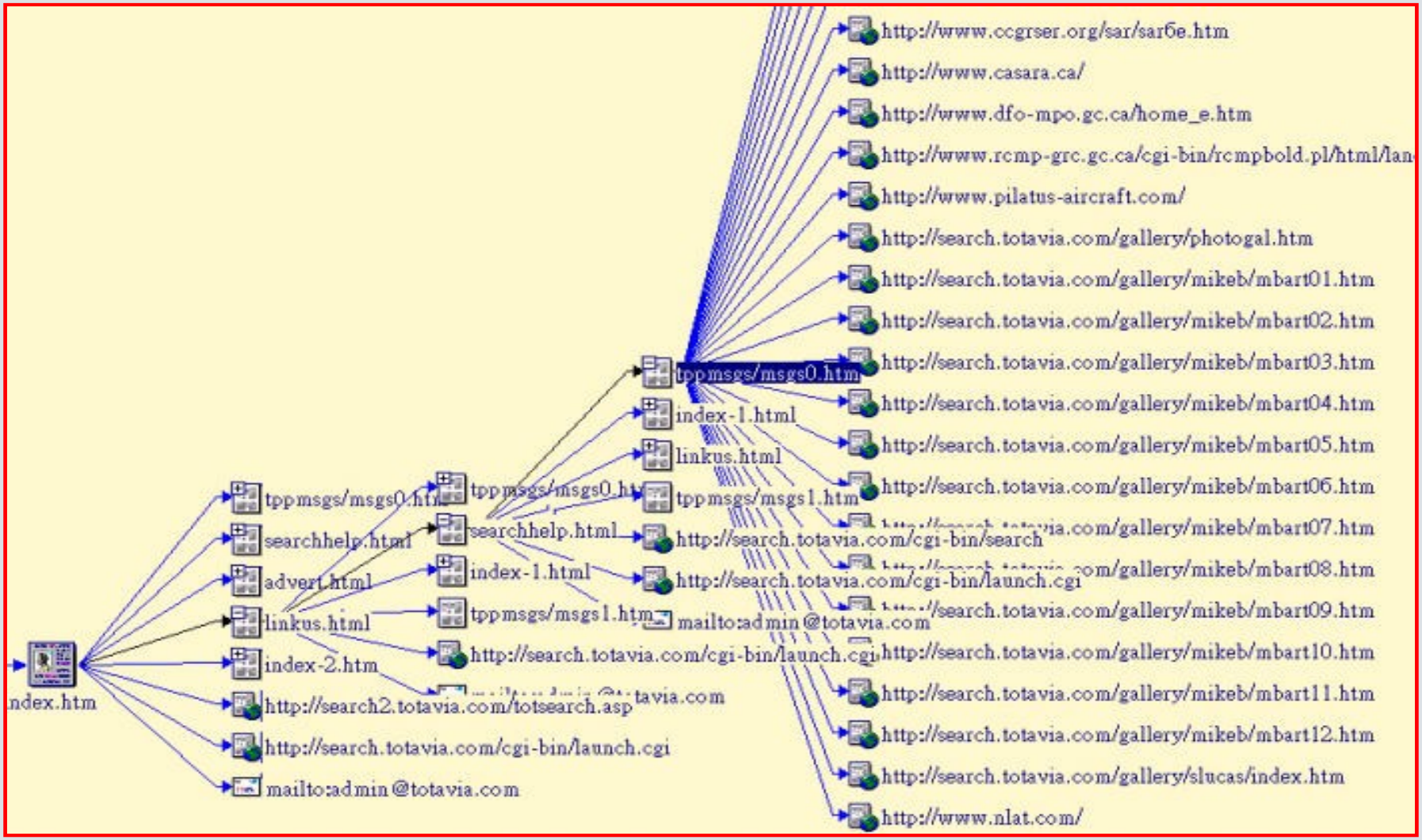

2. Web links and information structure

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1. web linking
2. link validity
3. correctness

1. Web linking

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1. structure link
2. associative link
3. referential link

1. Structure link

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- allow users to
  - understand scale of information space
  - help users navigate effectively all information structure

2. Associative link

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- represent semantic relationship
  - between information elements
    - based on meaning of different information components

3. Referential link

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- provide
  - link between an item of information
  - interpretation of information
- also guide user to
  - view interpretation of the links

2. Link validity

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- information structure on web applications
  - is much related to the following facts
    - link itself is invalid
    - links between the adjacent concepts are missed
    - too many links cause information chunks to be meaningless
    - information structure is hard to maintain due to invalid design

3. Correctness

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- link validity will be limited to the most significant characteristics – correctness
  - may further be considered in two aspects
    - content correctness
    - linking correctness

3. Software quality certification

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1. statistical usage testing
2. software usage model
3. Markovian usage model
4. statistical usage testing procedure

1. Statistical usage testing

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- Rationale
  - lie in fact that the failures occurred most frequently in practical use
    - will be found early during test cycle
- Main benefit
  - make use of statistical inference technique to
    - compute probabilistic properties of testing process
      - Such as reliability, or mean time to failure for the quality certification
- Important application
  - Safety related systems:
    - Safety Plan, Safety Case, Dangerous States

2. Software usage model

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- Characterizes various operational uses of a software system
  - An operational use is a skeleton for the intended use of the software in an intended environment
- Thus all possible operational uses of a software system
  - constitute a population with huge size
- if a usage sample of test cases is drawn statistically from usage population
  - performance on this sample may be used as
    - a basis for the evaluation of software quality
- It is suggested that software testing is rather suitable
  - To be treated as a stochastic process and its usage be modeled by
    - A finite, discrete parameter, time homogeneous , irreducible Markov Chain.

3. Markovian usage model/1

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- Represented by the notation of Markov Chain, a usage model consists of all usage states that are connected by links.
  - These links indicate all possible stimuli and responses with a probability index
- The probability represents the likelihood of choosing one link from a usage state to the other.
- Furthermore test scenarios generated randomly as a sample of population
  - Shows some possible usage paths
    - That will traverse the usage model from start state to the termination state

3. Markovian usage model/2

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- generated test scenarios are formulated as a Markov chain
  - by the following facts
    - occurrence of current state depends only on previous state
    - all usage states are incompatible
    - all probabilities emerging from each state are summed to one.

4. Statistical usage testing procedure

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- software quality certification
  - 1. building usage model
    - define all possible events and their transition distributions
  - 2. generating test cases statistically by associated distribution
  - 3. executing test cases
  - 4. collecting performance information and inter-failure data
  - 5. certifying software by reliability evaluation model

4. Certification on link validity for web applications

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1. building navigation model
2. analyzing navigation model
3. certifying hypermedia links
4. comparison with human testers
5. certification summary

1. Building navigation model

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- begin with statistical usage testing
  - navigation structure must first be built
- we use Microsoft FrontPage that
  - use as a "test wizards" to create
    - all links
    - all buttons
    - FORM-content tests passages

2. Analyzing navigation model

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- built usage model of Totavia web site
  - include 13 states in all
- link certification on web applications
  - analyzed report may be summarized
    - by toolCertify certification tool

Analysis report for Totavia model

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Number of states	13
Number of arcs	62
Expected script length	5.555
Least likely state coverage expected at	11.25
Least likely transition coverage expected at	60.8

3. Certifying hypermedia links

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1. test scripts
2. failure analysis
3. certification result

1. Test scripts

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- based on analysis report
  - necessary number of test scripts
  - theoretically estimate as 61 (60.80)
- several link errors were found as listed in failure analysis table
  - complete coverage for actual transitions
    - increase to 65 test scripts

2. Failure analysis

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- after performing link executions for 65 test scripts
  - two different sources of link errors were found
  - on observing the failure information
    - the nodes from [add site] and [newsgroup]
      - principle causes that made 17 distinct failures

Failure analysis for the Totavia example

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Failure ID	Mean First Passage	Probability of Occurrence	Probability of Occurrence
1	0.00232	0.00232	0.00232
2	426.574	426.574	426.574
3	0.01535	0.01535	0.01535
4	0.00232	0.00232	0.00232
5	431.823	431.823	431.823
6	0.01517	0.01517	0.01517
7	0.00232	0.00232	0.00232
8	426.574	426.574	426.574
9	0.01535	0.01535	0.01535
10	0.00232	0.00232	0.00232
11	432.073	432.073	432.073
12	0.01516	0.01516	0.01516
13	0.00232	0.00232	0.00232
14	429	429	429
15	0.01539	0.01539	0.01539
16	0.00232	0.00232	0.00232
17	431.92	431.92	431.92

3. Certification result

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- certification computation may be performed
  - by analysis result derived from Markov usage model

Certification result for Totavia example

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Script #	Result	MTTF	R	C=95%	C=99%	% States certified	% Arcs certified
55	Fail	4.790564	0.791256	0.011345	0.01491	100	87.09677
61	Pass	4.333069	0.769217	0.010551	0.013867	100	90.32258
62	Fail	4.173298	0.760381	0.010433	0.013712	100	90.32258
63	Pass	4.239091	0.7641	0.010309	0.013549	100	90.32258
64	Pass	4.295225	0.767183	0.010187	0.013389	100	90.32258
65	Pass	4.348002	0.770009	0.010067	0.013231	100	91.93549

4. Comparison with human testers

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- in comparison with certification results derived by proposed mechanism
  - three testers were arranged to validate navigation structure for Totavia example

Test comparisons for the Totavia example

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Method	Number of test scripts	Test coverage (%)	Testing time (minutes)	Number of errors found
The proposed	65	100	18	2
Tester A	30	46.1	35	2
Tester B	30	46.1	42	0
Tester C	30	46.1	38	0

5. Certification summary

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- proposed approach
  - provide quantitatively number of test scripts
  - generate randomly sequences of these test scenarios
    - with desire for obtaining maximal transition coverage

Benefits

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- took about 18 minutes to go through these 65 test scenarios
- found out two link errors
  - was far superior to the test performance acquired by the blind tests

5. Conclusion

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- for software quality certification
  - framework of statistical usage testing is investigated in this paper
  - mechanism for certifying all possible navigation links is developed

The proposed mechanism

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- effective for
  - certifying quickly hyperlink validity
- benefits
  - helping in testing plan and allocating testing resource
  - generating test scripts automatically
  - reaching the maximal testing coverage

Technology Management-Process/1

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- Technology management ensures:
  - the detecting of new technology trends,
  - the selecting of appropriate technologies,
  - the expanding of the know-how required with regard to the selected technologies,
  - the profitable applying of those technologies.
- The phases result from the definition consists of:
  - detecting
  - selecting
  - expanding
  - applying

Technology Management-Process/2

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- Networking involves four steps:
  - **Call for Network** One ore more persons show their interest in a certain subject for which no network exists yet by posting a Call for Network.
  - **Interest Net** A group of people that is interested in a certain subject. The focus is on getting to know each other and everybody's particular strengths. The network finances itself. At least 3 people (typically 5 - 50) are required from at least 2 different subdivisions.
  - **Expert Net** A networking group of experts in a certain subject field offering coaching and consulting within PSE and professional handling of inquiries. At least 3 people (typically 5 - 20) are required from at least 2 different subdivisions.
  - **Support Centers** A core team and a PSE-wide competence network for long-term and strategically important subjects. They offer 3 hours of support for projects without charge; if more time is required, this will be charged to the respective project account.

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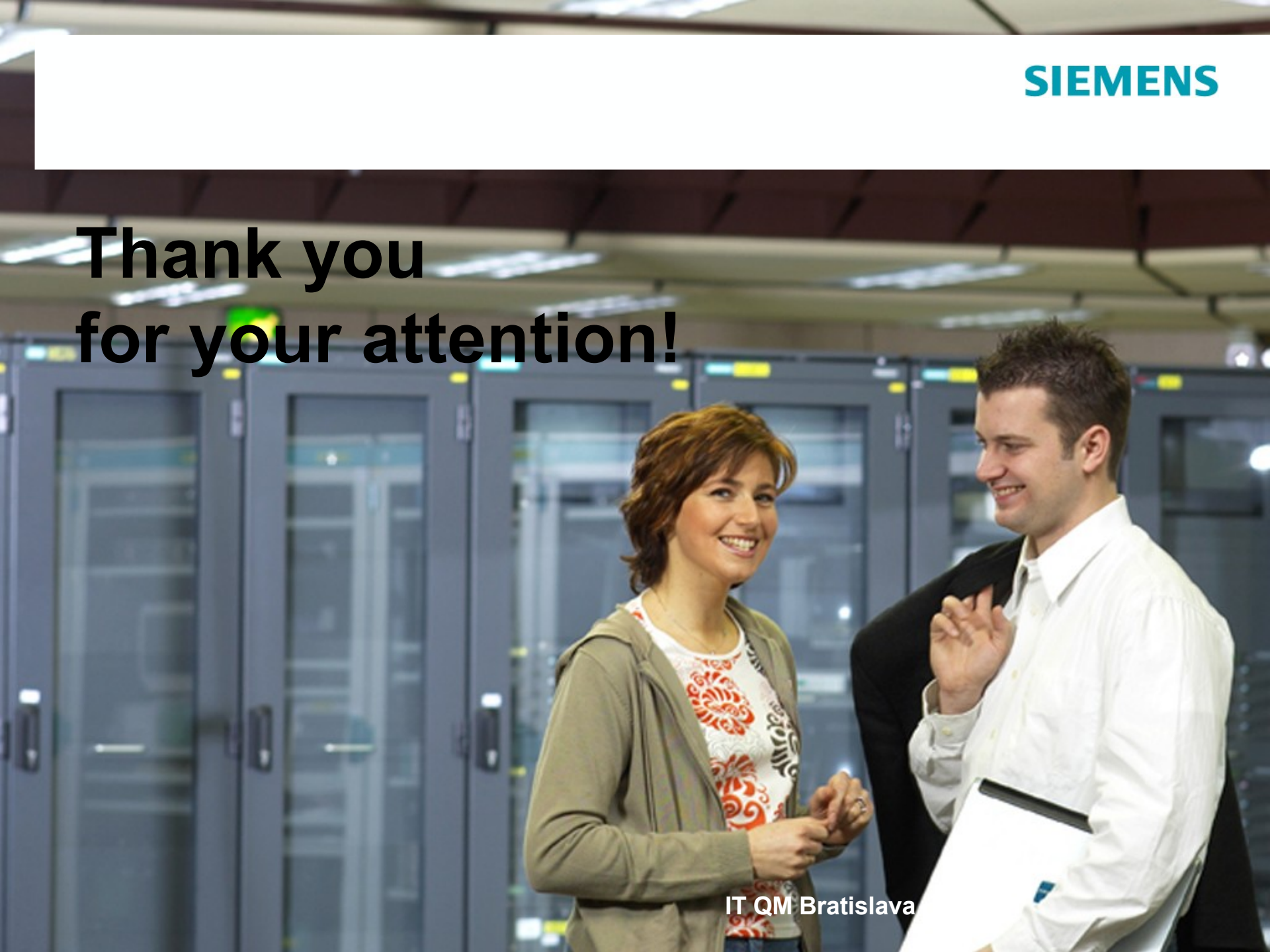
Thank you for your attention!



Farbpalette mit Farbcodes

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Primäre Flächenfarbe:

R 255 G 255 B 255

Sekundäre Flächenfarben:

R 215 G 225 B 225	R 170 G 190 B 195	R 130 G 160 B 165
R 220 G 225 B 230	R 185 G 195 B 205	R 145 G 155 B 165

Akzentfarben:

R 255 G 210 B 078	R 245 G 128 B 039	R 229 G 025 B 055	R 000 G 133 B 062	R 000 G 084 B 159	R 000 G 000 B 000
R 255 G 221 B 122	R 248 G 160 B 093	R 236 G 083 B 105	R 064 G 164 B 110	R 064 G 127 B 183	R 064 G 064 B 064
R 255 G 232 B 166	R 250 G 191 B 147	R 242 G 140 B 155	R 127 G 194 B 158	R 127 G 169 B 207	R 127 G 127 B 127
R 255 G 244 B 211	R 252 G 223 B 201	R 248 G 197 B 205	R 191 G 224 B 207	R 191 G 212 B 231	R 191 G 191 B 191
R 255 G 250 B 237	R 254 G 242 B 233	R 252 G 232 B 235	R 229 G 243 B 235	R 229 G 238 B 245	R 229 G 229 B 229