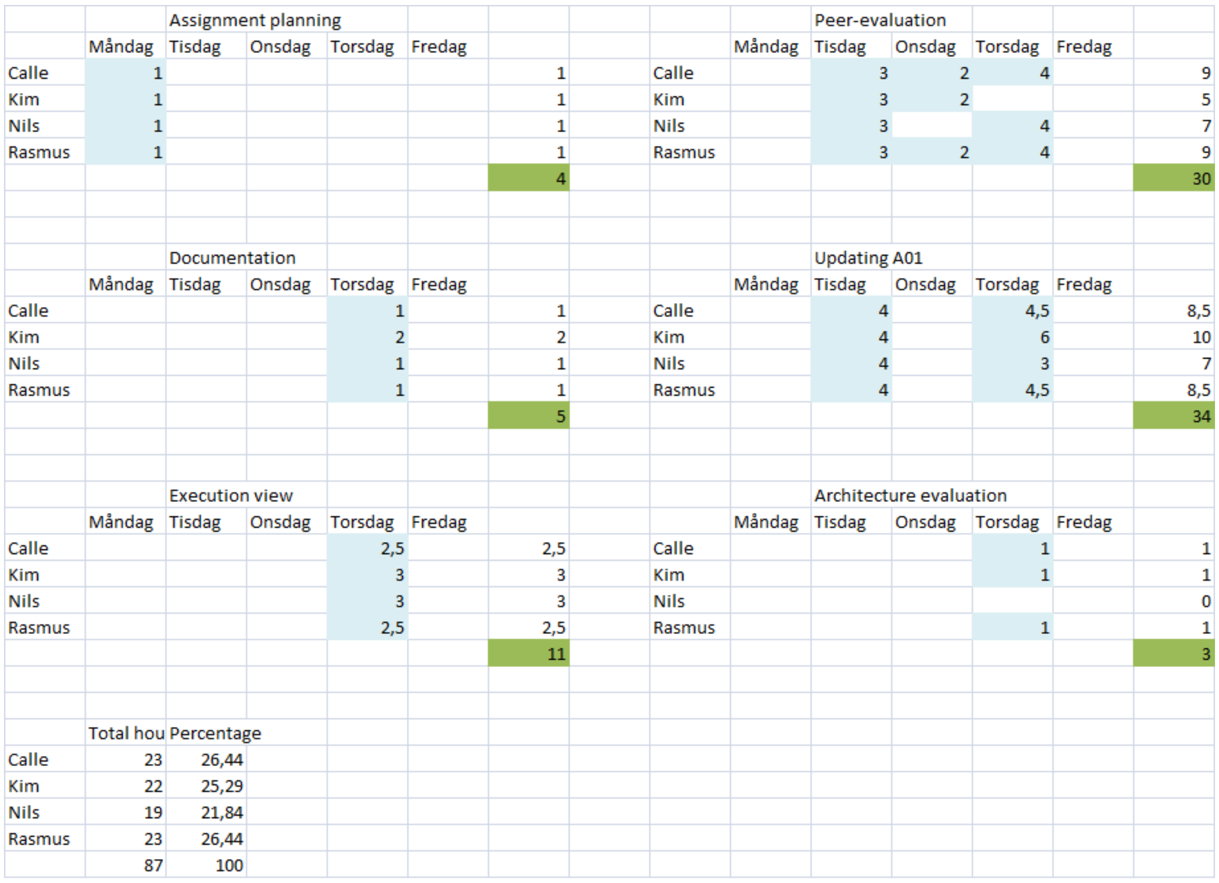
GA02 Deliverable

M.U.P

massively underdeveloped project



		Assignment planning				
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Calle	1					1
Kim	1					1
Nils	1					1
Rasmus	1					1
						4

		Peer-evaluation				
	Måndag	Tisdag	Onsdag	Torsdag	Fredag	
Calle		3	2	4		9
Kim		3	2			5
Nils		3		4		7
Rasmus		3	2	4		9
						30

		Documentation				
	Måndag	Tisdag	Onsdag	Torsdag	Fredag	
Calle				1		1
Kim				2		2
Nils				1		1
Rasmus				1		1
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		Updating A01				
	Måndag	Tisdag	Onsdag	Torsdag	Fredag	
Calle		4		4,5		8,5
Kim		4		6		10
Nils		4		3		7
Rasmus		4		4,5		8,5
						34

		Execution view				
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Calle				2,5		2,5
Kim				3		3
Nils				3		3
Rasmus				2,5		2,5
						11

		Architecture evaluation				
	Måndag	Tisdag	Onsdag	Torsdag	Fredag	
Calle				1		1
Kim				1		1
Nils						0
Rasmus				1		1
						3

	Total hou	Percentage
Calle	23	26,44
Kim	22	25,29
Nils	19	21,84
Rasmus	23	26,44
	87	100

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Updated A01

Technological factor tables:

**** Organizational factors described (which was not asked for this assignment), but no tech. factor table!***

We have taken out the organizational factor we had included and created out technological factors from decisions and assumptions we have made.

**** General: create separate tables for product and technology factors; now it's very difficult to follow what you have considered and what not***

We have created separate tables for the product and technology factors.

Product factor tables:

**** The factor tables do not conform to what is proposed by Hofmeister: what do the "components" and "stage" attributes mean?***

The tables have been converted to follow the standard proposed by Hofmeister. The "component" and "stage" attributes were written as answer to a question Hofmeister suggested asking oneself when identifying and creating factors. These answers, however, was as commented never to be documented in Hofmeisters suggestions.

**** P4.1.1-P4.1.4: what is described is rather maintainability, not availability***

The factors have been been moved to the category Service since this is the category hosting maintenance factors according to the Hofmeister model.

**** Not many factors (except functional features) identified***

We have looked over our table in relation to Hofmeisters suggested categories and identified new factors in some categories where we previously had few or no factors

Strategy tables:

**** Strategies should be explained, not only referenced to a book. What is the idea of the strategy? --> Hence not clear whether the strategies address the issue and how.***

We have expanded the explanation of the strategies and tactics used.

Strategy mapping to conceptual view:

**** There is no mapping between the designed components and the proposed strategies, i.e. strategies are not traceable to design decisions!***

There is now a description of each component with linking to which strategy or decision that influenced its creation.

Conceptual view:

**** Unclear components, control flow not clear***

Updated the conceptual view with a description of each component and how it link to strategies and architecture decisions.

**** Notation not followed***

We have revamped the conceptual view to more closely fit the notation.

Introduction

The assignment consists of creating and documenting an architecture for a predefined system and in doing so learn how to transform quality goals into a practical solution.

The system is an automated test bench for use on various kinds of software. It will feed predefined input into the tested system and verifies the output, reporting any deviations. The system need to be easy to maintain and adding new features such as input types, emulation mechanics and testing techniques with minimal effort and cost.

It also needs to log all the testing data and generate this as a report containing test statistics, how to recreate the errors and the type of errors encountered.

The idea is that the system will be used in maintenance departments of software organizations with a demand for advanced and automated testing.

Assumptions

We have assumed that:

- All standard computers have an operative system that is either Windows, Linux or MacOS.
- A standard computer has at least a Giga bit network card, DDR2 memory, 2 Ghz single core.
- We do not emulate any software within the system, instead we channel the information through the system between the tested system and the exterior software.
- The MIB will be maintained for 20-30 years.
- The MIB will be developed by a competent team with the required skills to implement it.
- The Development does not have a tight schedule nor any specific budget constraints.
- An avarage software system will use 3-5GB of RAM.

System analysis

Factors

TechnologicalFactor	**Flexibility and Changeability**	**Impact**
T1: General-purpose hardware		
T1.1 Memorytype		
The system should use at least DDR2 type memory	The requirements of the tested system can exceed the requirements of the MIB	Higher system costs
T1.2 Networkbandwidth		
The system should use at least a network card which supports at least 1Gbps	The requirements of the tested system can exceed the requirements of the MIB	Higher system costs
T1.3 Processor requirement		
The system should use at least one single core processor with a clock of 2 Ghz	The requirements of the tested system can exceed the requirements of the MIB	Higher system costs

T3.1 Operating system		
The system should be able to run on Windows, Linux or MacOS	The system might not be needed to run on different operating systems	The system will not need to be platform independent

Product Factor	**Flexibility and Changeability**	**Impact**
P1: Functional features		
P1.1 Various Input		
Simulatingvarious inputs types	None	None
P1.2 Identify and Validate		
Identify output data and compare it to expected output	None	None
P1.3 Emulate Hardware		
Emulate various different hardware applications	Hardware emulation could be removed	Components handling the emulation of hardware would have to be removed. Limitedchangeto the rest of the system
P1.4 Emulate Software		
Emulate various different software applications, platforms and protocols.	Software emulation could be removed	Components handling the emulation of software would have to be removed. Limitedchangeto the rest of the system
P1.5 Logging the test		
The system should log all the test data passing through the MIB	None	None
P2: User interface		
P2.1 Adapting to new functionality		
The user interface should be possible to adapt to added functionality such as new input types etc.	Addition of new functions after the system has been completed	The user interface will have to be updated to reflect changes in functionality
P3: Performance		
P3.1 Handling highthroughtput		
Handling a throughput of 75Mbps and peek 150Mbps	The required throughput could be made even higher than at this moment	Changes will have to be made in those components that handle data transfering
P4: Dependability		
P4.1 Graceful recovery		
Input and output components should gracefully recover if the tested system crashed	None	None
P4.2 Restarting from checkpoint		

Restarting the tested system from a certain point after a system crash	Latency for restarting the test could be increased to allow different kinds of recovery or the need for restarting from a certain point could be removed	Changes to this factor would only affect the component that is responsible for restarting the tested system
P5: Failure detection, reporting, recovery		
P5.1 Robust system		
Since the system should be automated it have to be robust	The system might not have to be able to run unsupervised	Crashescould be tolerated
P6: Service		
P6.1 Adding new input types		
Adding new input mechanisms	None	None
P6.2 Adding new hardware emulations		
Adding new hardware emulation mechanisms	None	None
P6.3 Adding new software emulations		
Adding new software emulation mechanisms	None	None
P6.4 Adding test types		
Adding new testingtechniques	None	None

Issues

Name: Multiple input issue
Description: The system must support several types of input simulations as well as being able to add new types if the costumer requires it. **Factors:** P1.1.1 Simulate various input types P4.1.1 Adding new input mechanisms
Solution: Making the interface between the module handling input and the sub modules for different input types work the same no matter what input type it is.
Strategies/Tactics: "*Generalize the module*" from "*Software Architecture in Practice Second Edition*" Chapter 5.3 Len Bass, Paul Clements, Rick Kazman 2003. By ensuring that the input type does not affect the functionality of the methods in the different modules it will be possible to add several different kinds of input.

Name: Multiple hardware emulations issue
Description: The system must support several types of hardware emulations as well as being able to add new types if the costumer requires it. **Factors:** P1.1.3 Emulate various hardware devices P4.1.2 Adding new hardware emulations
Solution: Explore standards for hardware communications currently used or in development to support most hardware emulations without impacting the system.
Strategies/Tactics: "*Maintain semantic coherence*" and**"***Anticipate expected changes"* from *"Software Architecture in Practice Second Edition"* Chapter 5.3 Len Bass, Paul Clements, Rick Kazman 2003 By ensuring that each module is strictly separated from the others a change in one hardware emulation will not interfere with the other emulations and it would thus enable the addition of new modules without too much fuss.

Name: Multiple software emulations issue
Description: The system must support several types of software emulations as well as being able to add new types if the costumer requires it. **Factors:** P1.1.4 Emulate various software applications P4.1.3 Adding new software emulations
Solution: Explore standards for software communications currently used or in development to support most software emulations without impacting the system.
Strategies/Tactics: "*Maintain semantic coherence*" and "*Anticipate expected changes*" from "*Software Architecture in Practice Second Edition*" Chapter 5.3 Len Bass, Paul Clements, Rick Kazman 2003 By ensuring that the software emulations are strictly separated it will be possible to add new emulations without being hindered by already existing emulations.

Name: Multiple testing techniques issue
Description: The system must support several types of testing techniques as well as being able to add new types if the costumer requires it. **Factors:** P4.1.4 Adding new testing techniques
Solution: Keeping the semantics of the testing modules coherent so that further testing techniques can be added with minimal changes to the current structure
Strategies/Tactics: "*Maintain semantic coherence*" and **"***Anticipate expected changes"*from *"Software Architecture in Practice Second Edition"* Chapter 5.3 Len Bass, Paul Clements, Rick Kazman 2003 By making sure that each testing technique is separated from the others the addition of new techniques would not disturb the already existing techniques.

Name: Not crashing with tested system issue
Description: The MIB must not crash just because the tested system crashes. This means that the input must be stalled until the tested system is running again. **Factors:** P4.2.1 Reliable input and output components
Solution: If a crash occurs the wrapper around the tested system will send a message to the data broker stating that further testing must halt until the system is running again. This will stop further data transfers from crashing the rest of the system.
Strategies/Tactics:

Name:
Creating report issue

Description:
The MIB needs to be able to create a report once the testing is done. This report must contain data from both the output component as well as the log for all the test data.
Factors:
P1.1.2 Identify and compare output
P1.1.5 Logging all test data

Solution:
There must be a connection between the component handling the output verification and the component that logs all the test data so that data can be sent between them to be combined into the final report at the test end. This will be handled by the data broker

Strategies/Tactics:

Name:
Keeping the system running through a test crash

Description:
The MIB needs to be able to standby further testing if the tested system crashes until it has been restarted from a earlier point.
Factors:
P4.2.2 Restart tested system on crash

Solution:
A component wrapped around the tested system will record the state of the tested system at regular intervals. If a crash occurs the component will restart the system using the latest checkpoint as reference.

Strategies/Tactics:
“*Checkpoint/Rollback*”from *"Software Architecture in Practice Second Edition"* Chapter 5.2 Len Bass, Paul Clements, Rick Kazman 2003
A checkpoint records the state of the system and will be loaded on the event of a crash.

Name:
Running system on all standard computers with required performance

Description:
The MIB needs to be able to run on all standard computers on the market which have enough performance to run both the MIB itself and the tested system.
Factors:
O3.1.1 Development platform

Solution:
Making the MIB cross-platform compliant

Strategies/Tactics:

Name: Data transfer
Description: Data and messages need to be sent between several components that do not have knowledge of each other **Factors:** P3.1.1 Large throughput of data P1.1.5 Logging test data
Solutions: We will implement a central data broker that will handle transferring data between components.
Strategies/Tactics: “Broker pattern” A Broker works as the postal service, sending messages between the different components and the system. This keeps the coupling low.

Name: Multiple crash issue
Description: When the tested system crashes repeatedly so that the test can’t continue the testing needs to be terminated **Factors:** P4.2 Restarting from checkpoint P5.1 Robust system
Solutions: The wrapper around the tested system will keep track of which checkpoint was the last to be used to restart the tested system. If the same checkpoint is used more then a predefined amount this will signal that the testing needs to be terminated. The wrapper then send a message to stop the testing up to the message handler in the data broker.
Strategies/Tactics:

Conceptual view description
Here follows short descriptions of all the components of our conceptual view and their link to the strategies we decided on.

User Interface
The user interface that the tester will use to setup the test bench before the testing can begin. It will also be responsible for showing the final report of once the test is done.

I/O
This component handles the different types of predefined input and output using two sub-components, one for input and one for output

Input
This part of the component handles the predefined input. It uses different modules for each input-type that in turn have a common interface such as was decided by the strategy mentioned in the issue-card for *"Multiple input issue"* , strategy: **"***Generalize the module".*

Output
This part of the component takes care of validating the output from the tested system against the predefined output. Like the input component it will houses separate modules for each type of output validation and in turn have a common interface. It will also create the final report once the data log has been received, which is mentioned on the issue-card *"Creating report issue".*

Data Broker
This component is responsible for transferring data between the other modules. It houses two components, the data distributor and the message handler. The data distributor sends data between the components that do not have knowledge of each other making it a central part of the construction. The message handler takes care of telling the system to halt further testing in case of a crash in the tested system. It will also send a message to resume testing once the tested system has been restarted. The issues mention on the following issue-card are relevant for this component:

“Data transfer”, “Creating report issue”, “Not crashing with tested system issue”

Emulation
This Component holds the two separate components for handling software-interfaces and hardware emulation.

Software
Component for the different software-interfaces that will channel different types of software data. The issues mentioned in the issue-card *" Multiple software emulations issue"* will be handled here by maintaining semantic coherence between the interfaces and by exploring standards in software communications.

Hardware

This component does the emulation of the different hardware devices, one separate structure for each device. Like the software component mentioned above it will solve the issues of the issue-card *" Multiple hardware emulations issue"* by maintaining semantic coherence between components and by exploring standards for hardware communication.

Datalog component

This component receives all the data from the testing and categorizes it, then stores it so that it can later be made into the final report by the output-component which is mentioned by the issue-card *"Creating report issue".*

Test wrapper

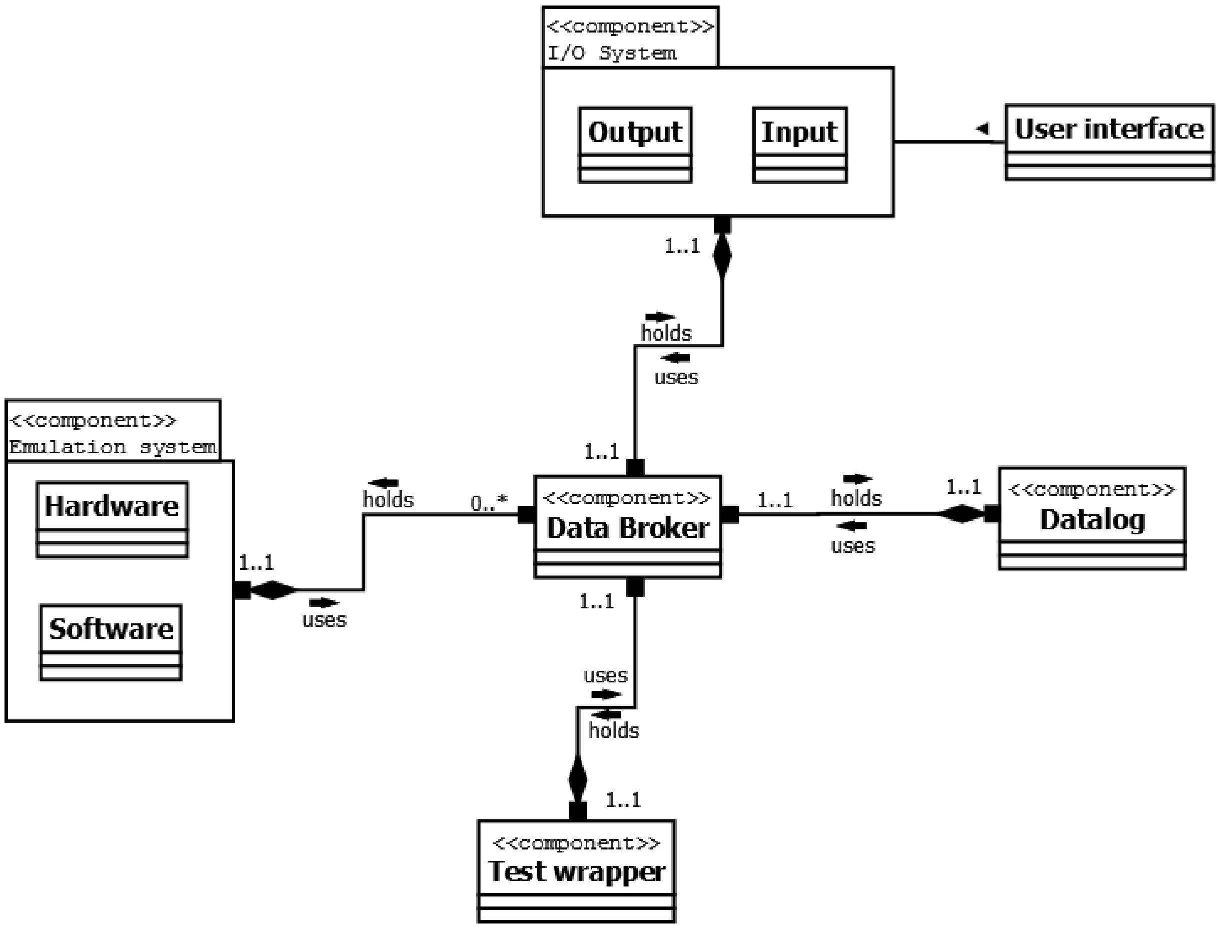
This component functions as a wrapper for the tested system as well as storing a checkpoint with the status of the tested system. With this the tested system can be restarted with minimal latency if it crashes. It will also send a message to the data broker to halt the testing until the tested system has restarted. This solves the issue mentioned in the issue-card *"Keeping the system running through a test crash"* by using the strategy mentioned in the same card,

Strategy: *"Checkpoint/Rollback"*.

The semantics in the wrapper will also be kept coherent so that new testing techniques can be added, thus solving the issue mention in the issue-card *"Multiple testing techniques issue" with its strategies:*

"*Maintain semantic coherence*" and **"***Anticipate expected changes"*

Conceptual View



Module view description

Emulations

This layer gathers the modules that emulate hardware and channel the data from software. We took the decision that these will benefit from ease of communication as well as similar data transfer to the rest of the system since an emulated software might be required to send data to software and vice versa. Data to the rest of the system is sent through the data transfer module. This layer and its modules are a product of the following issue-cards:

- *"Multiple software emulations issue"*
- *"Multiple hardware emulations issue"*

Testing

This layer holds the modules tightly connected with the actual system to be tested. When the tested system crashes the wrapper will need quick access to the checkpoint module so that the system can be restarted with minimal latency. Data to the rest of the system is sent through the data transfer module. This layer and its modules are a product of the following issue-cards:

- *"Keeping the system running through a test crash"*
- *"Not crashing with tested system issue"*
- *"Multiple testing techniques issue"*

Data Log

Here all the data from the testing is categorized and stored into a storage-module until it can be sent up to the report module at the end of the test. Data to the rest of the system is sent through the data transfer module. This layer and its modules are a product of the following issue-cards:

- *"Creating report issue"*

Data Channeling

Holds the data broker subsystem that handles transferring data between different parts of the system that do not have knowledge of each other as well as the message handler that takes care of informing the rest of the system in case of a crash in the tested system. This layer and its modules are a product of the following issue-cards:

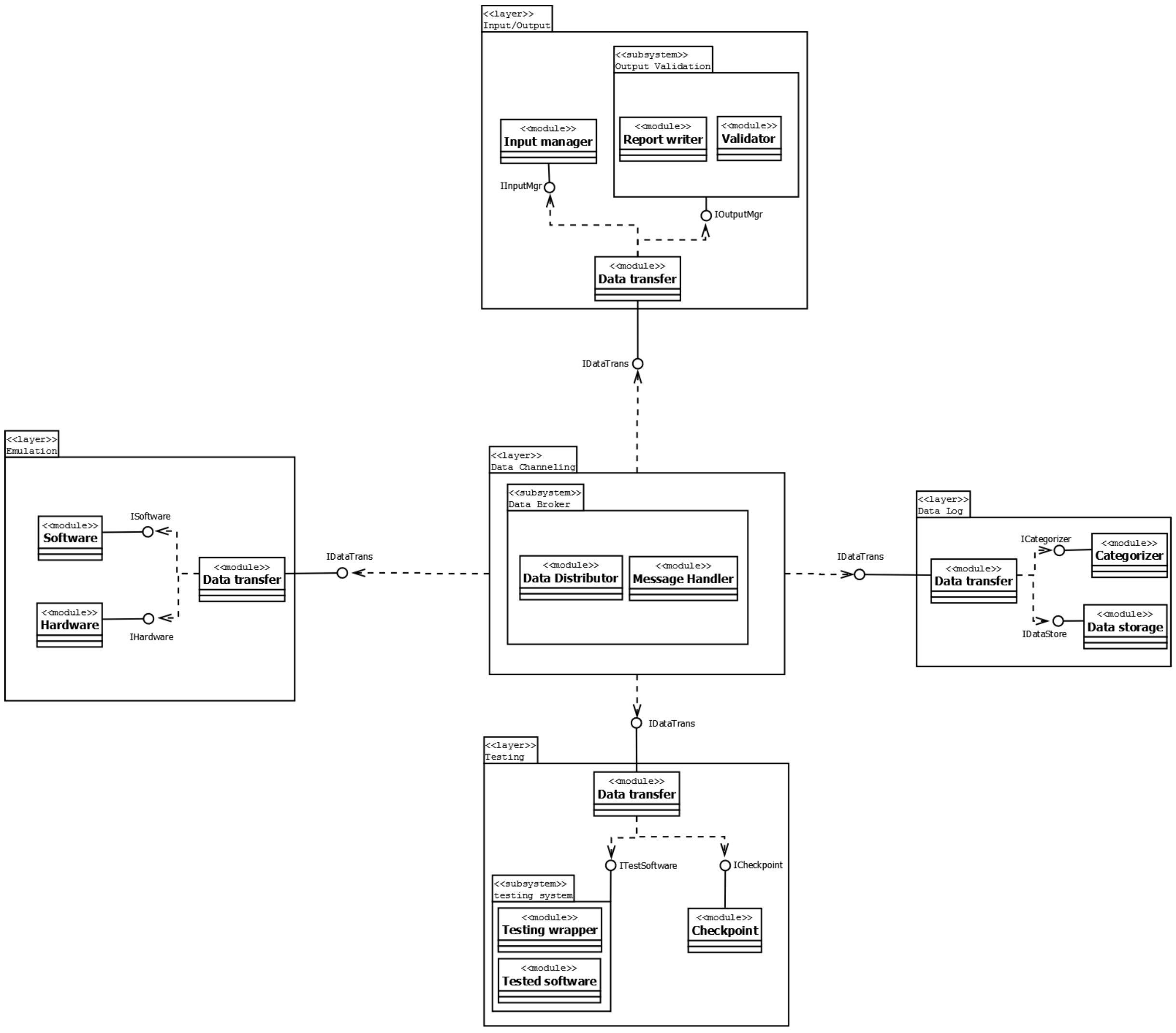
- *"Data transfer"*
- *"Not crashing with tested system issue"*
- *"Creating report issue"*

Input/Output

This layer hold the module for the Input managing as well as the subsystem for validating the output and writing the report. We put the report module and the validation module in the same subsystem since the output will not have to be validated until the end of the test for the report. This layer and its modules are a product of the following issue-cards:

- *"Multiple input issue"*
- *"Creating report issue"*

Module view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Input/Output
<<subsystem>>
Output Validation
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Input manager
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Report writer
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Validator
IInputMgr
IOutputMgr
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Data transfer
IDataTrans
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Emulation
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Software
ISoftware
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Hardware
IHardware
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Data transfer
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Data Distributor
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Message Handler
IDataTrans
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Data transfer
ICategorizer
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Data storage
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Testing
<<module>>
Data transfer
ITestSoftware
ICheckpoint
<<subsystem>>
testing system
<<module>>
Testing wrapper
<<module>>
Tested software
<<module>>
Checkpoint

Execution view description

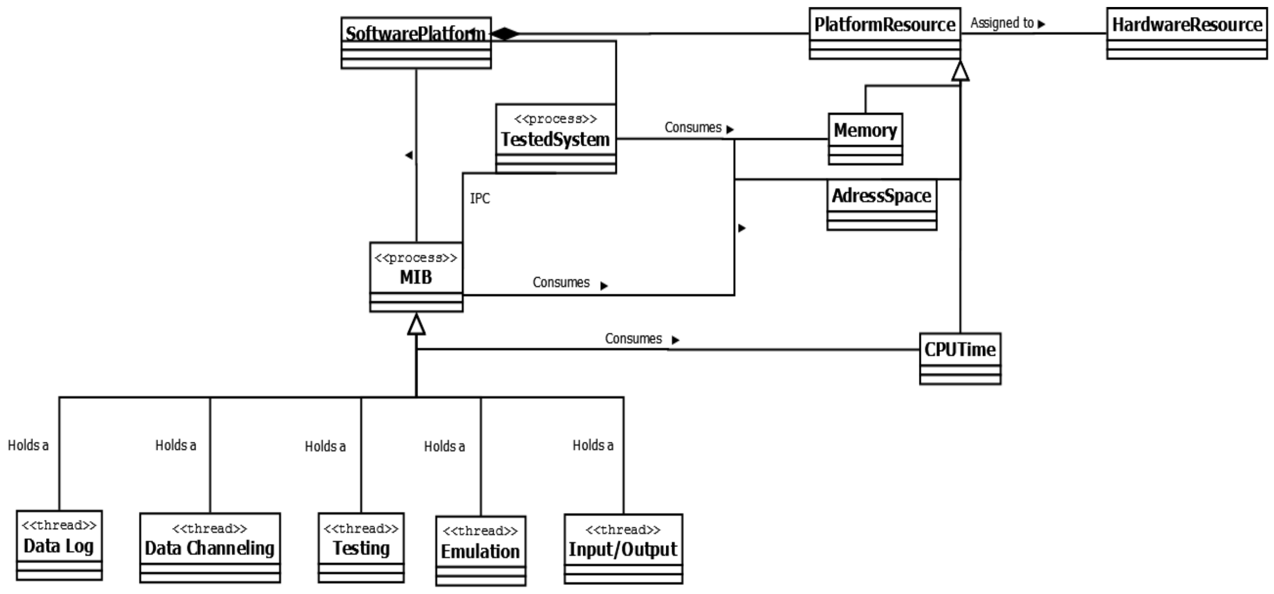
The software platform will house two processes. One for the MIB itself and one for the tested system. These will communicate via IPC(intraprocess communication). The MIB will have one thread for each major component in the system so that they can work independently. We also mapped which resources each entity needs. The processes consumes Memory and Address-space where as the threads consume CPU-time.

In the diagram we have first described this relationship as well as the relationship with the platform resources. After this we have divided each thread-entity into single diagrams containing those modules that are coupled to that entity thus giving a better view that is not to cluttered.

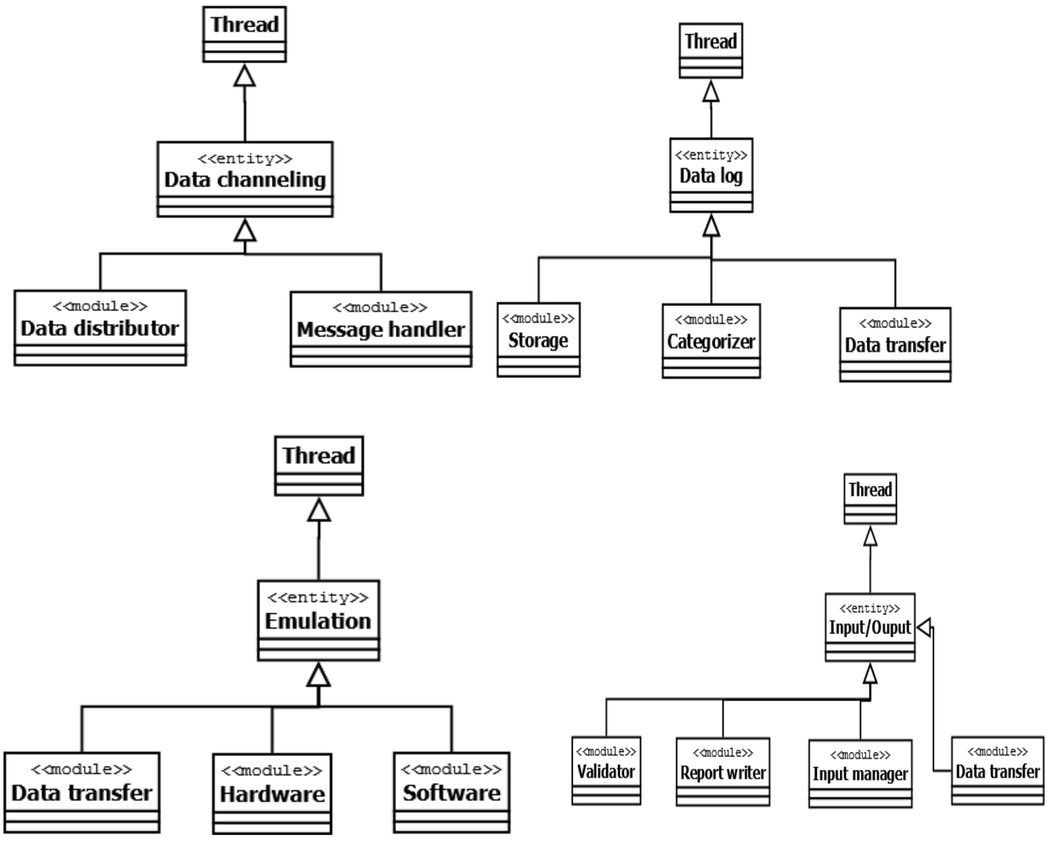
The division on the thread are based on the division already made in the conceptual and the module view. Components and modules that will work closely together are grouped on the same thread.

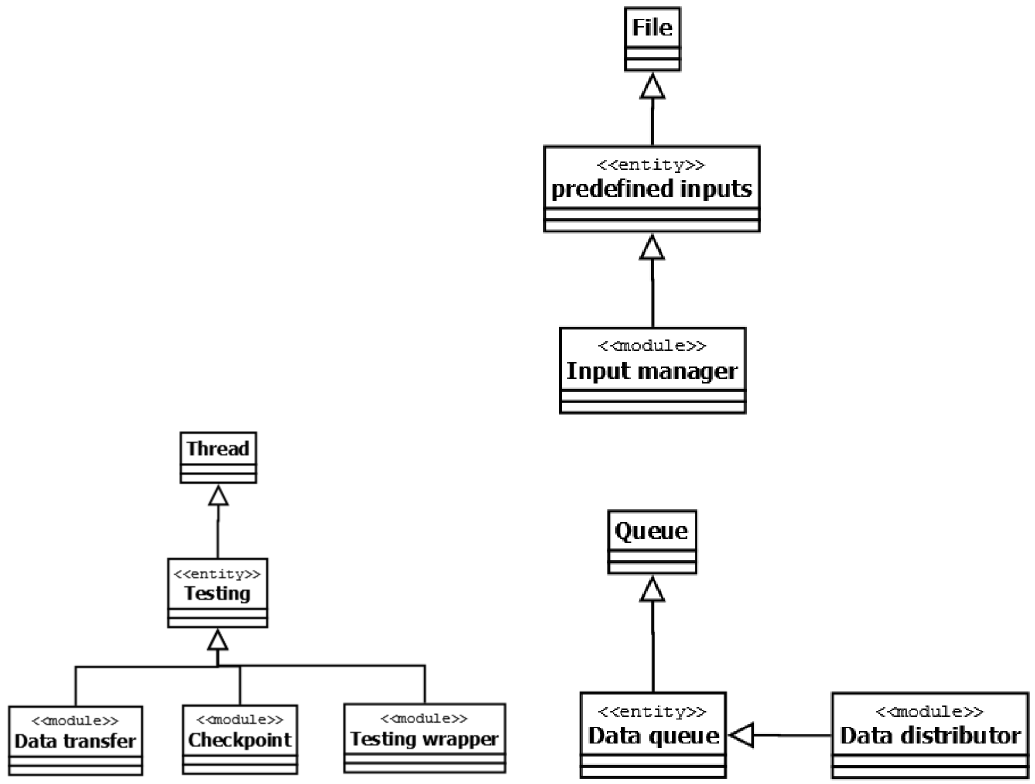
We also have two separate entities for specific requirements on the MIB. One file-entity for the input manager since this module will require file handling. One Queue for the Data distributor so that it can handle the vast amounts of data that will be sent simultaneously over the MIB(From the data broker strategy).

Execution view



Execution view entities




File
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predefined inputs
<<module>>
Input manager
Thread
<<entity>>
Testing
<<module>>
Data transfer
<<module>>
Checkpoint
<<module>>
Testing wrapper
Queue
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Data queue
<<module>>
Data distributor

Method of evaluation

What method did we choose?

The BTH method.

Why did we choose this method?

We choose the BTH method since it was a method we were familiar with and all other methods we could find were too time consuming or required a much bigger development team than we had.

Other methods we considered.

We looked at ATAM and CBAM. The reason for these two being considered were that they are the only two methods described in the main course literature.

Why we did not choose them.

We did not choose ATAM because it required to much time (about four weeks) and bigger development team.

CBAM was not chosen because it mainly concerns itself with profit and budgeting. And these factors are not relevant for this school project.

Scenarios

System dependability

The tested system uses as much as 10 gigabyte of primary memory.

According to our research this is not currently a feasible quantity of required primary memory for a standard program. This made us add an assumption about the tested systems primary memory requirements.

The tested system crashes during testing

The testing wrapper will acquire the last saved state of the tested system from the checkpoint module and then restore the tested from there.

The tested system crashes during testing and keeps on crashing at the same moment every time.

This scenario made us add a new issue-card, ”Multiple crash issue”. The tested system wrapper counts crashes and mapping them to checkpoints. When a predefined amount of crashes has occurred bound to the same checkpoint the MIB terminates the test and notes this in the log.

Input types

Inputstream from a blueray

Our input system can handle the streaming from a blueray and the transfer rate can be a maximum of 54 MB/s from a blueray which is well below the system capacity.

Maintainability

The customer returns after buying the system and requests two new system techniques.

This is solved by maintaining good semantics throughout the wrapping module as well as anticipating expected changes in testing techniques. Thus changes will be localized to the testing wrapper.

The customer returns after buying the system and requests three new input-types.

By generalizing the input modules we make it easy to make new input-types.

The test is finished and the output needs to be validated.

When the testing is completed the testing data will be transferred from the data log to the output validation subsystem there the output will be validated in the validation-module against predefined output. And then all the data as well as the validated output will be compiled into the final report by the report-module.

Evaluation Conclusion

We have found that, with our current knowledge of architecture structures and the results of the self evaluation, our immediate structure upholds the quality requirements set by the system description. As such we found no reason doing an architecture transformation.