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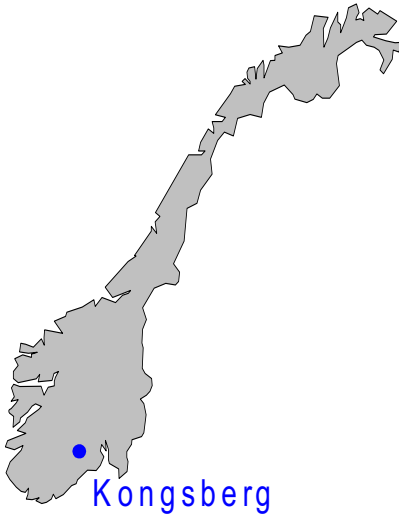
Creating and Applying A3 Architecture Overviews: A Case Study in Software Development

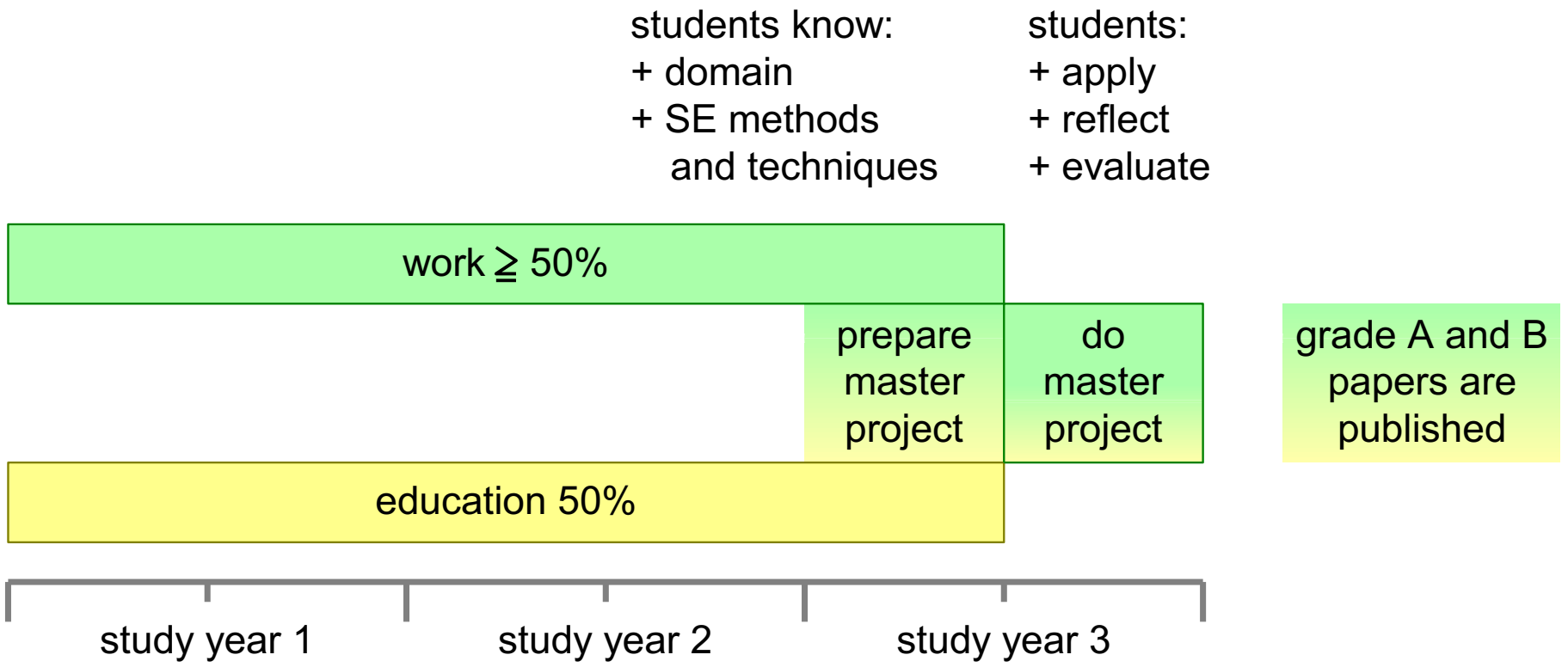
Anders Viken and *Gerrit Muller*

www.incose.org/symp2018

Technology park Kongsberg



Research Model Master Students Systems Engineering in Kongsberg, Norway

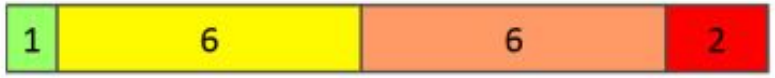



Creating and Applying
A3 Architecture Overviews:
A Case Study in Software Development
Kongsberg Maritime
K-YardTool Software
Research Findings
Future Research
State Of Art
Case Study
Reflection / Conclusion
HSN
Anders Viken 2017

Evaluation – Company Internal Tools and Documentation

I feel that the mentioned tools and similar KM tools are well documented.

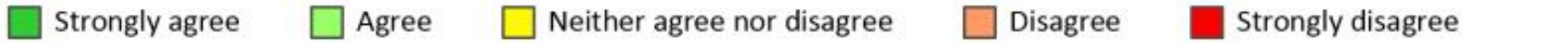
When doing troubleshooting, the documentation provided with the tools often help me solve my problems/answer my questions.



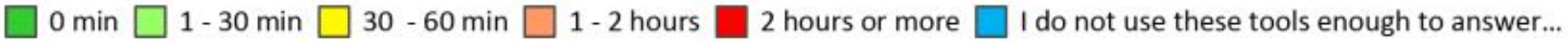
When using a new tool for the first time, the documentation provided with the tool often help me understand how to use the tool.

The engineers in KM have enough knowledge about how to use these tools.

I am not dependent upon experienced engineers when using the tools mentioned and similar tools.

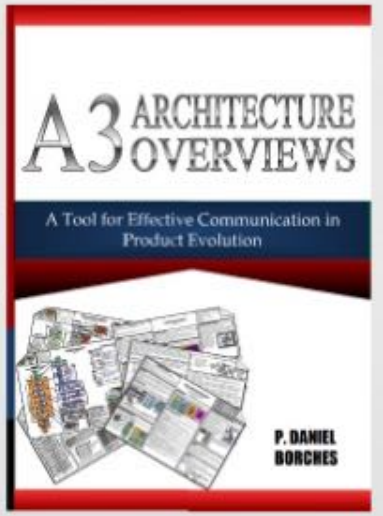


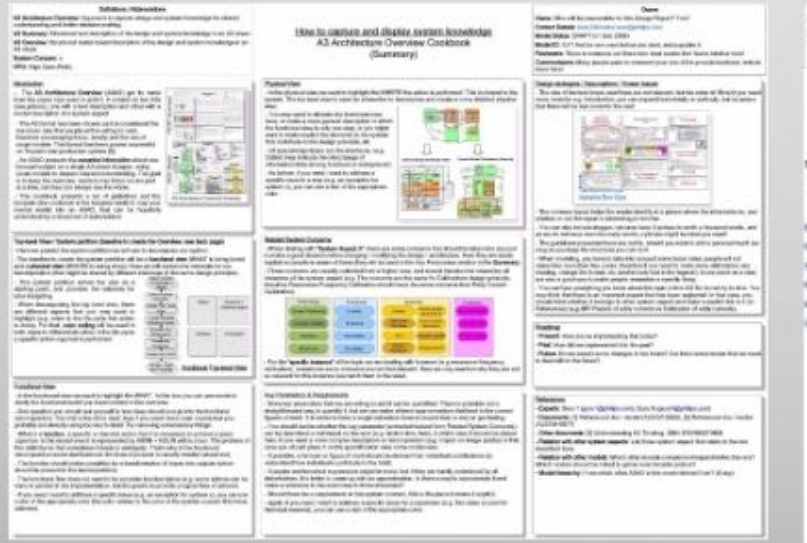
When working in projects, how much time do you spend each week troubleshooting/finding information/asking coworkers about the mentioned tools and similar KM tools?

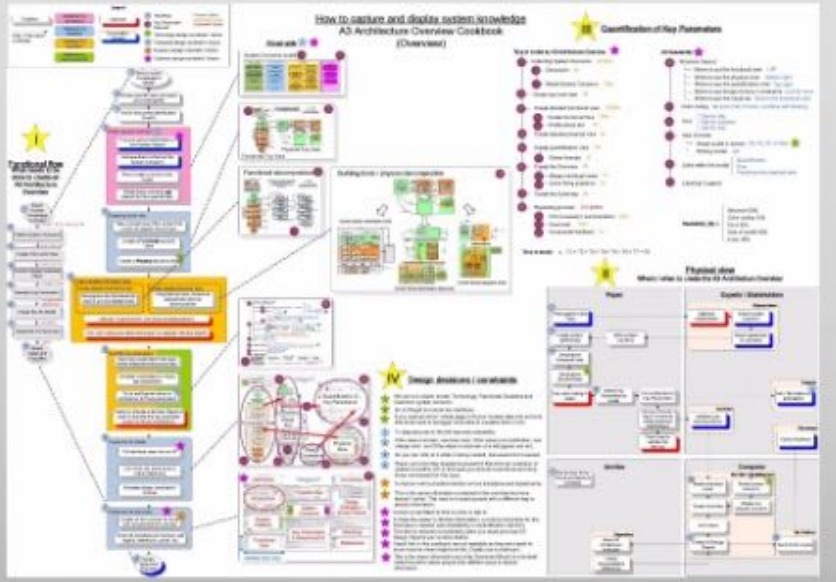


How do you rate your current knowledge regarding when and how to use the tools mentioned and similar KM tools?

State Of Art - A3 Architecture Overviews

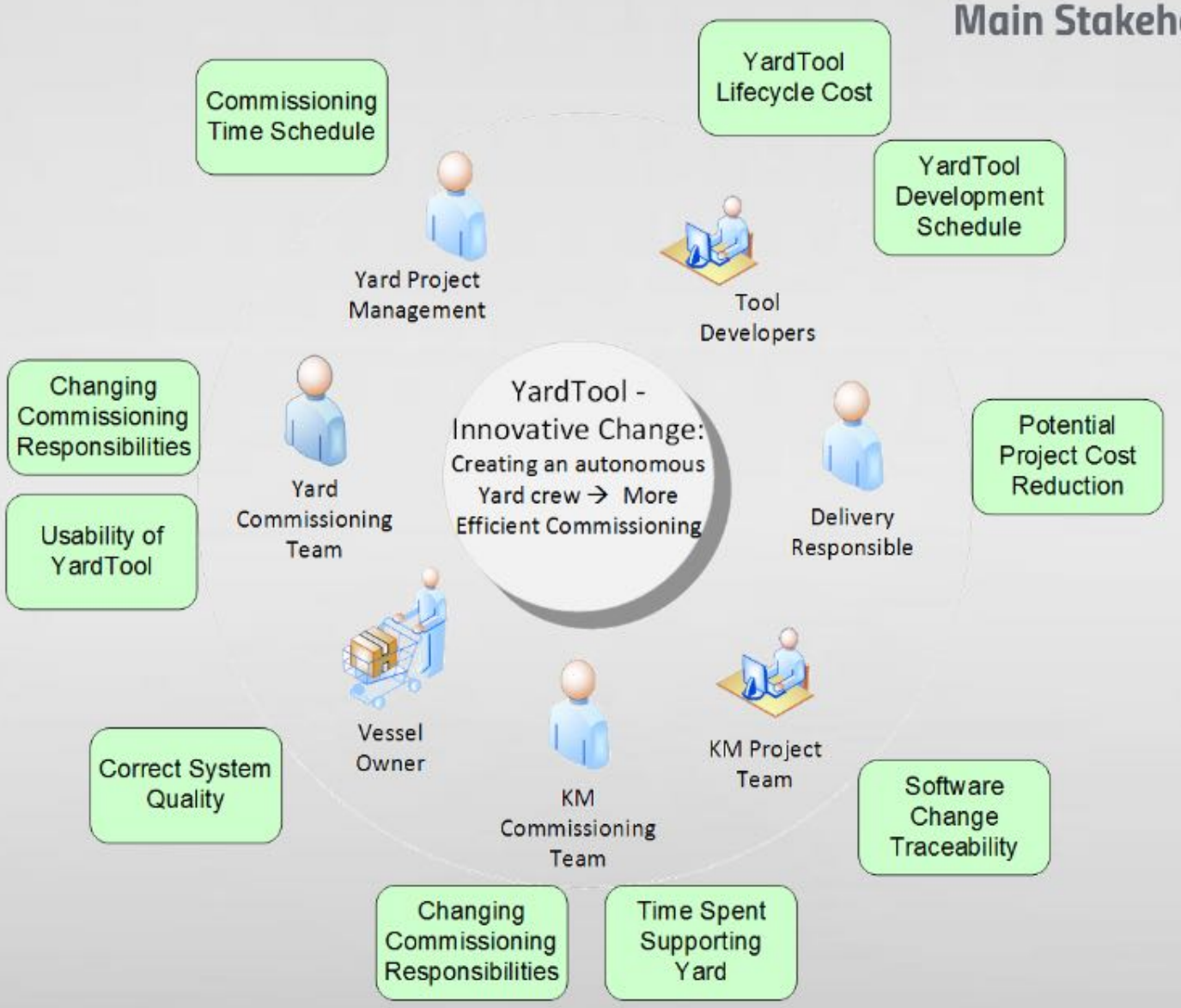


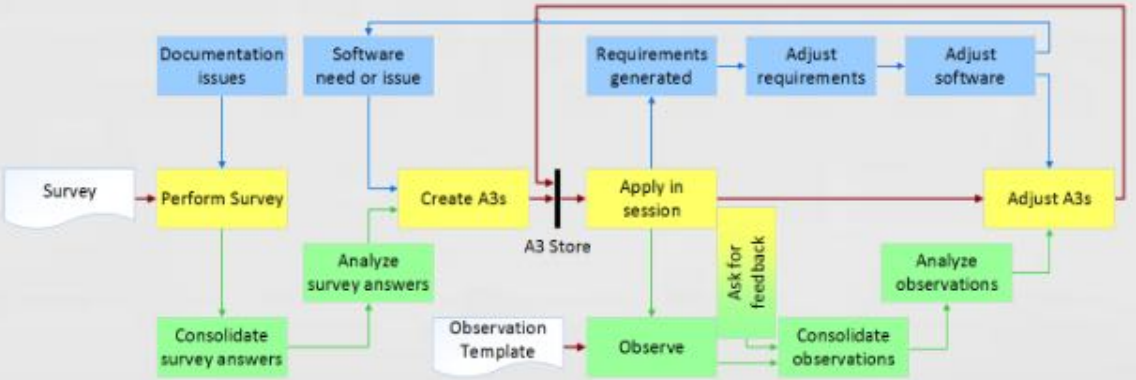




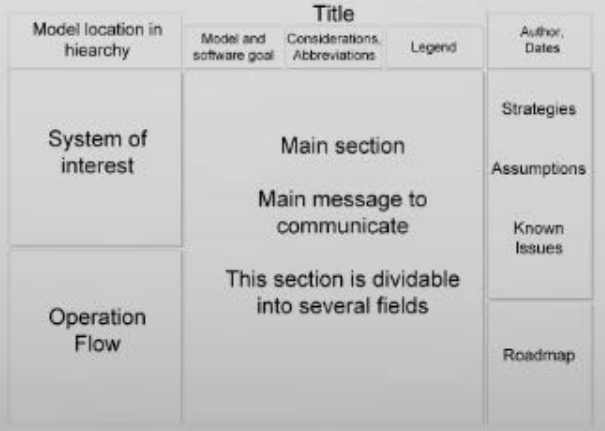
K-YardTool

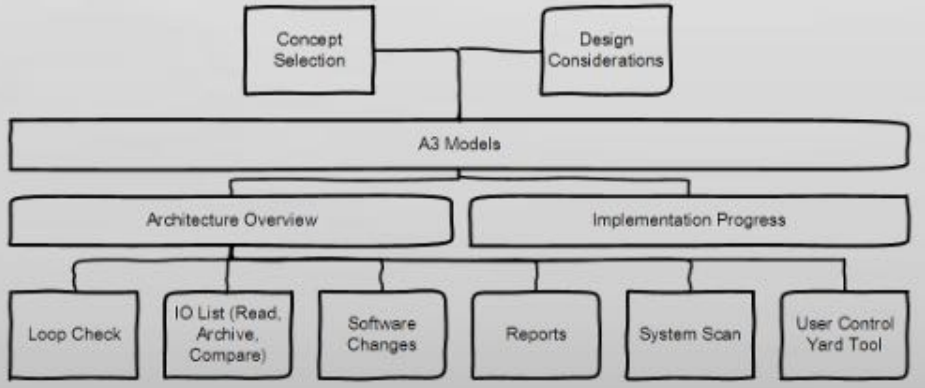
Goal: 500 hours
Timeframe: 5 months (prototype)
Main Stakeholders: Korean Engineers





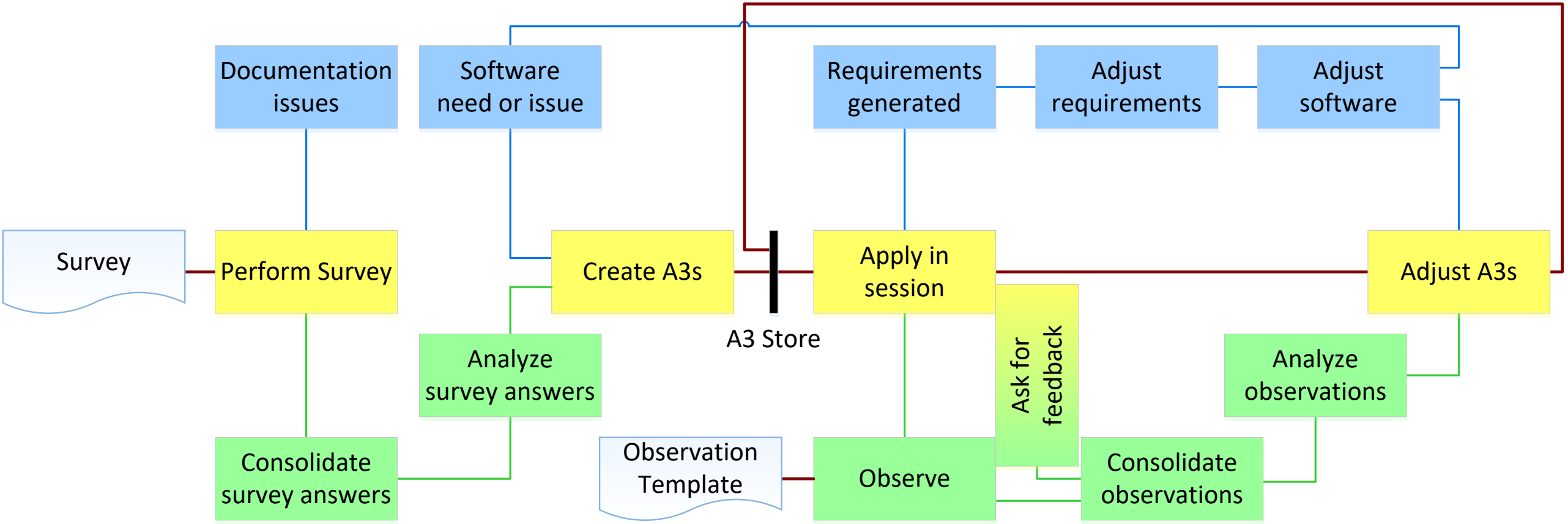
- How do A3s **facilitate stakeholder communication**?
- How can A3s be used to **capture feedback** in different meeting locations and situations?
- How well does the A3 format **encourage reading and writing of documentation**?
- What factors can **prevent the success** of implementing A3s in an organisational context?





Session attributes – Session number ___ - date __.__.	
Kind of session:	Communicate information/status
	Brainstorming/generate ideas
	Decision making
	Solve/discuss problem(s)/issue(s)
	Planning
	Team building/training
	Presentation
	Further development of the A3
Physical location of session:	Defined meeting room
	Colleague's own office
	Coffee break location/landscape
Planned session or not:	Planned
	Unplanned
A3 model ID:	
A3 system of interest:	
A3 model purpose:	
A3 usage time with stakeholders:	
Number of participants	
Did everyone understand the A3?	
Did it answer some of the stakeholder questions?	
Did it create any new questions or concerns?	
Were any new requirements discovered?	
Models changed/added after session:	
Observation recordings:	

Research Approach



Title

Model location in hiearchy

Model and software goal

Considerations, Abbreviations

Legend

Author, Dates

System of interest

Operation Flow

Main section

Main message to communicate

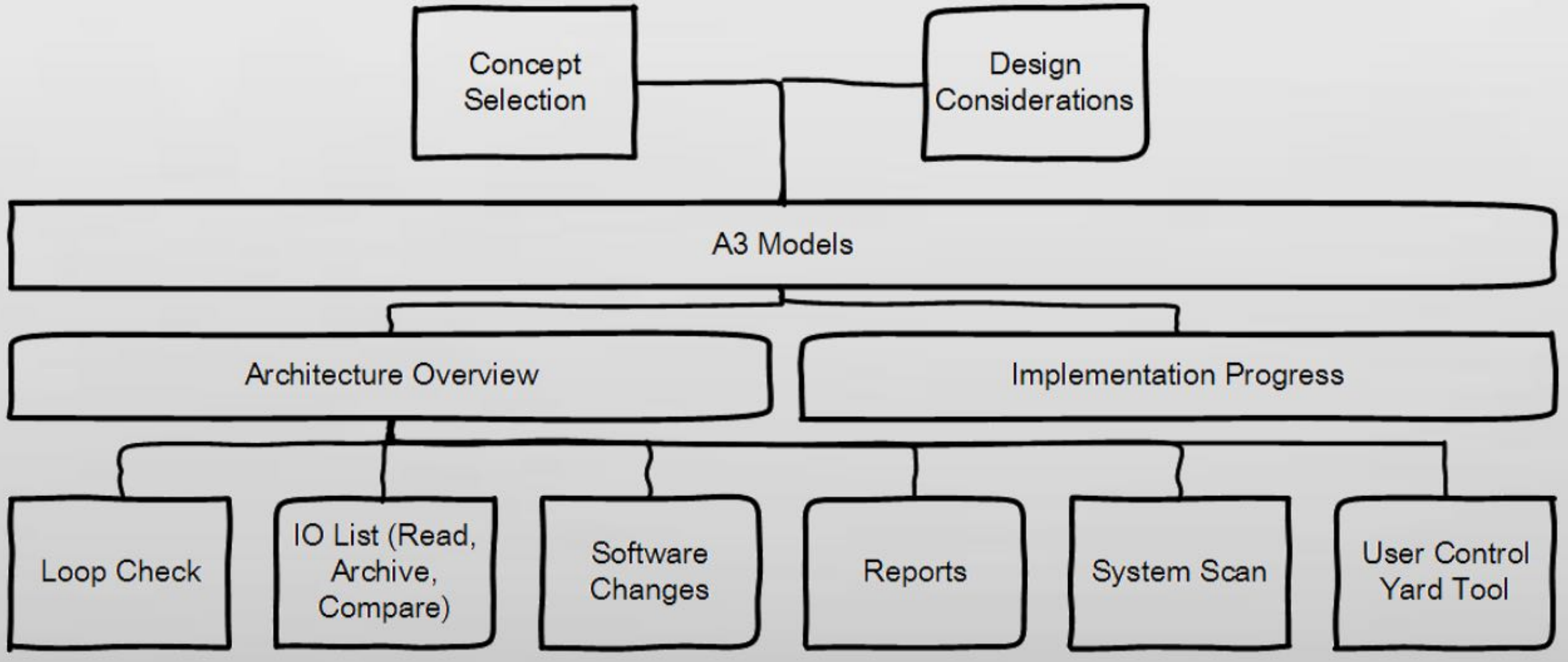
This section is dividable into several fields

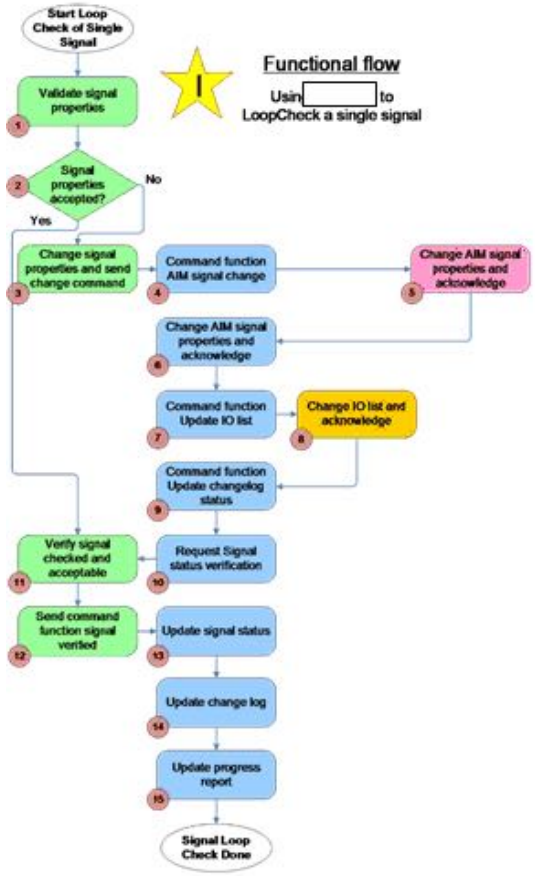
Strategies

Assumptions

Known Issues

Roadmap


Concept Selection
Design Considerations
A3 Models
Architecture Overview
Implementation Progress
Loop Check
IO List (Read, Archive, Compare)
Software Changes
Reports
System Scan
User Control Yard Tool



I Functional flow

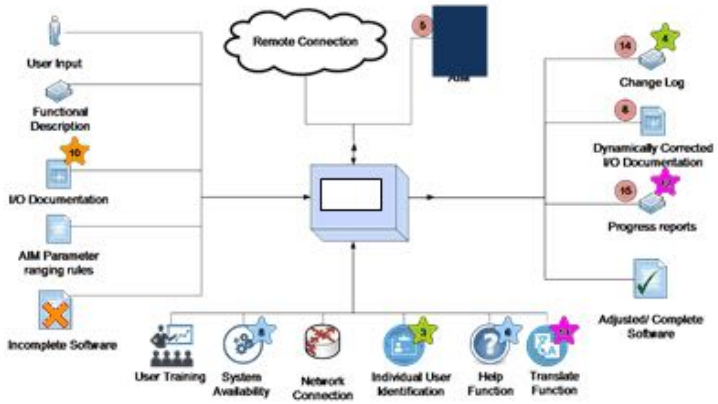
Usin to LoopCheck a single signal

II Design decisions / constraints

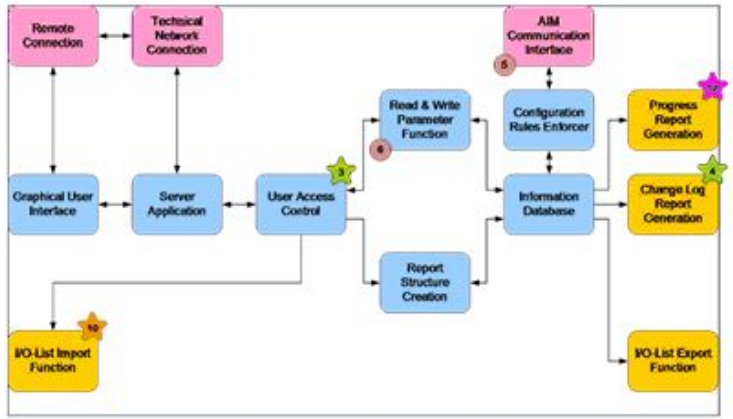
1. The operator shall be reminded every 30 minutes to save PS files
2. must have a diff check function between PS files and Yard tool
3. ust allow access only to autorized users
4. hall generate a change log with relevant information
5. Certified shipyard personnel saves minimum 2 minutes (on average) per signal change
6. hall have a help function
7. hall have a process wizard for loop checking
8. stallation must not take more than 60 minutes
9. hall only display changeable functionality
10. ust be able to accept multiple IO-list formats
11. The software shall be made in a modular way
12. ust generate a progress report showing total number of signals to be checked versus signals actually checked
13. ust have the ability to operate on multiple languages
14. If more than 100 changes are detected, user gets a message to approve and sign the change log

Main considerations when designing

III Functional Black Box View

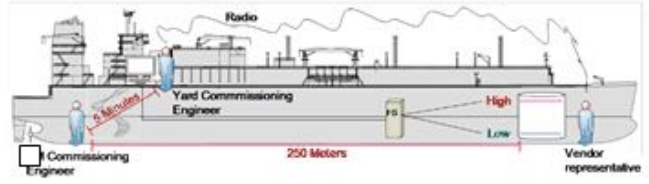


IV Functional White Box View

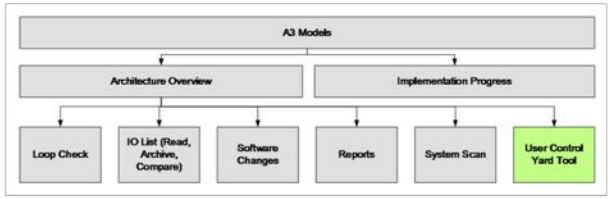


Owner
Name: Anders Viken
Contact Details: anders.viken@
Model Status: DRAFT (v0.3 Nov 2016)
Reviewers:
Commentators: Gerrit Muller

Legend
Function
Data / information exchange
Operator
YardTool
Dynamic Documents
YardTool Interfaces
Function / Operation Identifier
Technical design constraint / choice
Non-functional design constraint / choice
Business design constraint / choice
Customer design constraint / choice



K-YardTool – User Access Control



Software Function Goal
Make sure that selected program functionality has user access control.

Model Goal
Validate the user access control functionality in K-YardTool.

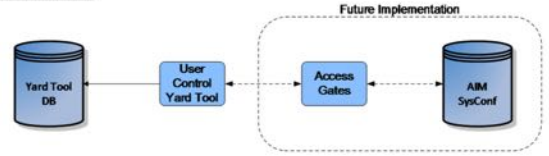
Considerations
This model may not illustrate all functionality in K-YardTool, as the software is continuously developed.

Abbrevations

Legend
99 Operation Step ID
Start/End
Decision
Process

Owner
Name: Anders Viken
Contact Details: anders.viken@km.kongsberg.com
Model Status: DRAFT (v1 Feb 2017)
Model ID: A3-L2-UserControl
Reviewers:
Commentators:

System of Interest



Access Properties Table

ID	Name	KM	Yard	Guest	Group1	Group2	View Affected	Change in view when right not given
1	Change Delivery Folder						Settings - Settings Main	Buttons in view not clickable.
2	Import IO List						IO List OverView	Import New IO List Button Not Clickable
4	Write to IO List						-	No Change in YardTool 1.0
8	Spare Calculation						Spare Calculate - Main	Calculate Button not clickable.
16	Loop Check						Loop Check - Main	Not possible to change signal loop check indication
32	Get Data From Config DB						SW Changes - Main	Buttons in view not clickable.
64	Create New Users						Settings - Create New User	View not accessable (menu button hidden)
128	Delete Users						-	View not accessable (menu button hidden)
256	Edit Users						Settings - Change User Info	View not accessable (menu button hidden)
512	Create Work Order						-	No Change in YardTool 1.0
1024	Reply to Work Orders						-	No Change in YardTool 1.0
2048	Hardware Scan						System Scan - Scan Settings	Buttons in view not clickable.
4096	Create Reports						Reports - All views	Report Button in top menu hidden.
8192	Change User Group Rights						Settings - Access Control Settings - Create User Group	View not accessable (menu button hidden)
16384	Clear Database						Settings - Clear Database	View not accessable (menu button hidden)

Design strategies

When K-Yardtool is started the first time,
3 users are created
- Kongsberg
- Yard
- Guest

3 User Groups are created
- Kongsberg
- Yard
- Guest

New users and user groups can be added as needed.

Assumptions

Known Issues

No known issues.

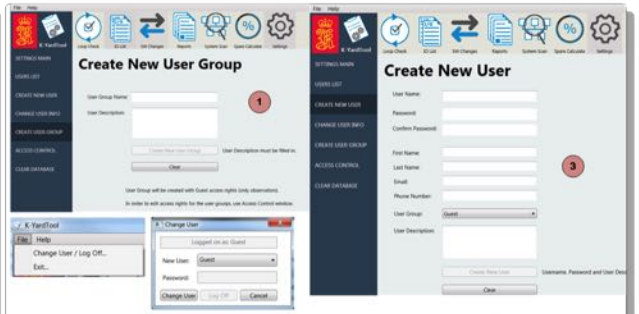
User Groups

Kongsberg User Group
- All Rights.
- Not possible to change user access control for Kongsberg Group.

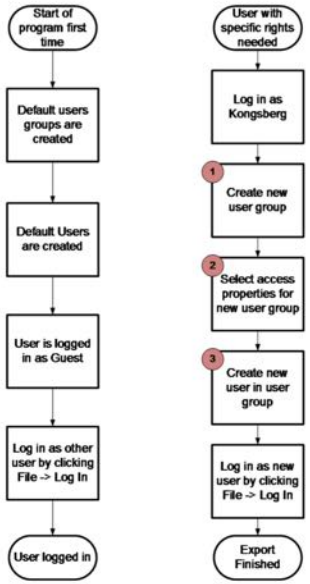
Yard User Group
- Some Rights, see table above
- Kongsberg user can choose what yard users are allowed to do in K-Yardtool.

Guest User Group
- Only observing rights.
- Kongsberg user can add additional rights for Guest users if needed.

Other User Groups
- It is possible to create new user groups.
- After a user group is created, user access control can be set as wanted. By default, only Kongsberg user can create new user groups and change access control



Operation Flow



Roadmap

- Present:

Users with rights in K-YardTool is separate from users with rights in AIM.

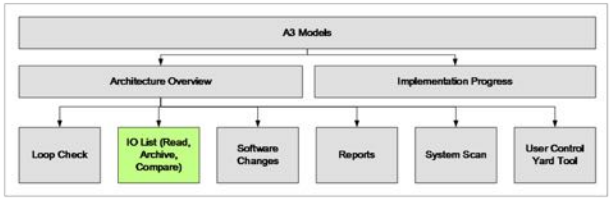
- Future:

(Should be discussed if needed)
Get users with rights from AIM, and use the same users in K-YardTool.

Observation template

Session attributes – Session number ___ - date __.__.		
Kind of session:		Communicate information/status
		Brainstorming/generate ideas
		Decision making
		Solve/discuss problem(s)/issue(s)
		Planning
		Team building/training
		Presentation
		Further development of the A3
Physical location of session:		Defined meeting room
		Colleague own office
		Coffee break location/landscape
Planned session or not:		Planned
		Unplanned
A3 model ID:		
A3 system of interest:		
A3 model purpose:		
A3 usage time with stakeholders:		
Number of participants		
Did everyone understand the A3?		
Did it answer some of the stakeholder questions?		
Did it create any new questions or concerns?		
Were any new requirements discovered?		
Models changed/added after session:		
Observations/recordings:		

K-YardTool – IO-List Import



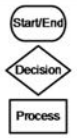
Software Function Goal
Import IO-lists to K-YardTool database by mapping columns in the IO List.

Model Goal
Validate the IO-List import, archive And compare functionality in K-YardTool.

Considerations
This model may not illustrate all functionality in K-YardTool, as the software is continuously developed.

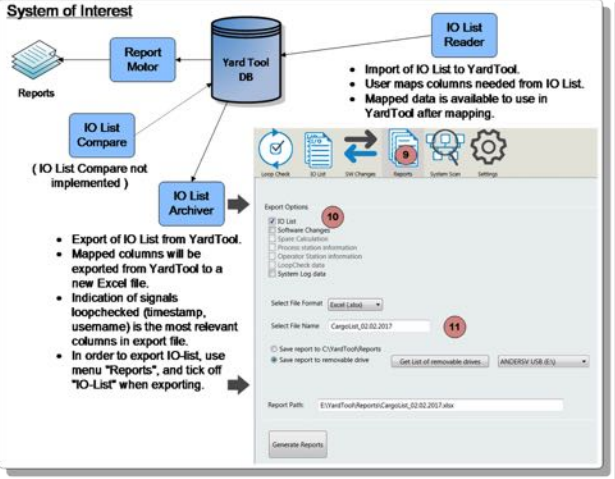
Abbrevations
GUI: Graphical User Interface
OCT: Offline Configuration Tool (KM Internal)

Legend
99 Operation Step ID



Owner
Name: Anders Viken
Contact Details: anders.viken@km.kongsberg.com
Model Status: DRAFT (v5 Feb 2017)
Model ID: A3-L2-IoList
Reviewers:
Commentators:

System of Interest



IO List Import GUI

Mapping Options

Name	Example Value
AIM SW Module	PM.TIA.HCTR1_U
AIM SW Module Terminal	ProMeas
Alarm Delay	1,2,3,4,5, …
Alarm H	-2, -1, 0, 1, 2, …
Alarm HH	-2, -1, 0, 1, 2, …
Alarm L	-2, -1, 0, 1, 2, …
Alarm LL	-2, -1, 0, 1, 2, …
Barrier Term A	1,2,3,4,5, …
Barrier Term B	1,2,3,4,5, …
Barrier Term C	1,2,3,4,5, …
Barrier Term Card	Name of card
Barrier Term D	1,2,3,4,5, …
Break Limit	
Cabinet	FS54-2
Cable Name	(IS),HLTY10SI
Cable Number	A-CBL-2
Card Type	RMP420-32
Cargo Or Machinery List	Cargo
Command Group	Common
Cross Term A	1,2,3,4,5, …
Cross Term B	1,2,3,4,5, …
Cross Term C	1,2,3,4,5, …
Cross Term Card	Name of card
Cross Term D	1,2,3,4,5, …
Data Type	AI, AO, DI, DO, …
Detect Break	
Detect Short	
Digital Alarm	
Eng High Range	-2, -1, 0, 1, 2, …
Eng Low Range	-2, -1, 0, 1, 2, …
Eng Unit	A, bar, deg, …
Equipment Description	NO.1 HD COMPRESSOR VCS
Equipment Tag	8-TX-CT21
HW Loop Typical	AI-15, DI-01, AI18(3w), …
ID From IO List	1,2,3,4,5, …
Inverted	0, 1, Yes, No, TRUE, FALSE, …
IO Block	FS54-2_U30
IO Channel	1,2,3,4,5, …
IO Driver	RBUS, Profibus, …
IO Tag	PM.CB.HC1CT1.YIRM
IO Type	4-20mA, PT100, N.O, N.C, …
IS	0, 1, Yes, No, TRUE, FALSE, …
Loop Monitoring	
No of Wires	2,3
P&ID	Name of drawing
Power	I, E, Internal , External, …
PS	31, 32, 51, PS31, PS031, …
Rev	1, 2, A-1, A-2, …
Rev Note	Changed, added, deleted, ….
Scale High	-2, -1, 0, 1, 2, …
Scale Low	-2, -1, 0, 1, 2, …
Short Limit	
Signal Description	CLOSED
Signal Direction	In, Out
Signal Type	Digital, Analog
Slot	Pos (U), 1, 2, 3, 4, …
Supplier	Name of Supplier
Term A	1,2,3,4,5, …
Term B	1,2,3,4,5, …
Term Block	X1, X2, X3, X4, X
Term C	1,2,3,4,5, …
Term D	1,2,3,4,5, …
Used	1, 0, Y, N, Yes, No

Design strategies

Importing is done in "IO List" window, exporting is done in "Reports" window.

Mapping of IO-List columns similar to mapping in OCT software.

After mapping the list on first import, the same mapping will e used when updating list.

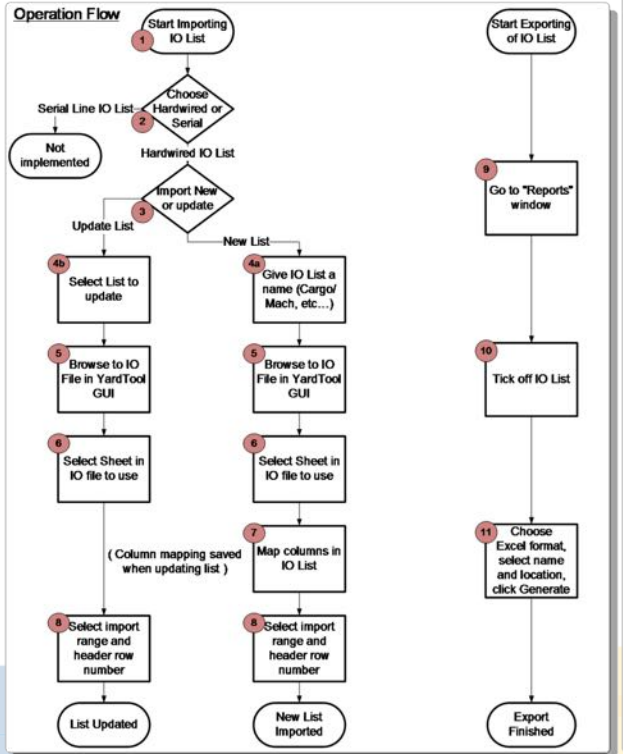
Assumptions

Assuming that the users do not need to import more information than the column mapping options available.

Known Issues

Not possible for user to undo an import if wrong list is imported when updaing list. Data will be lost.

Operation Flow



Roadmap

- Present:

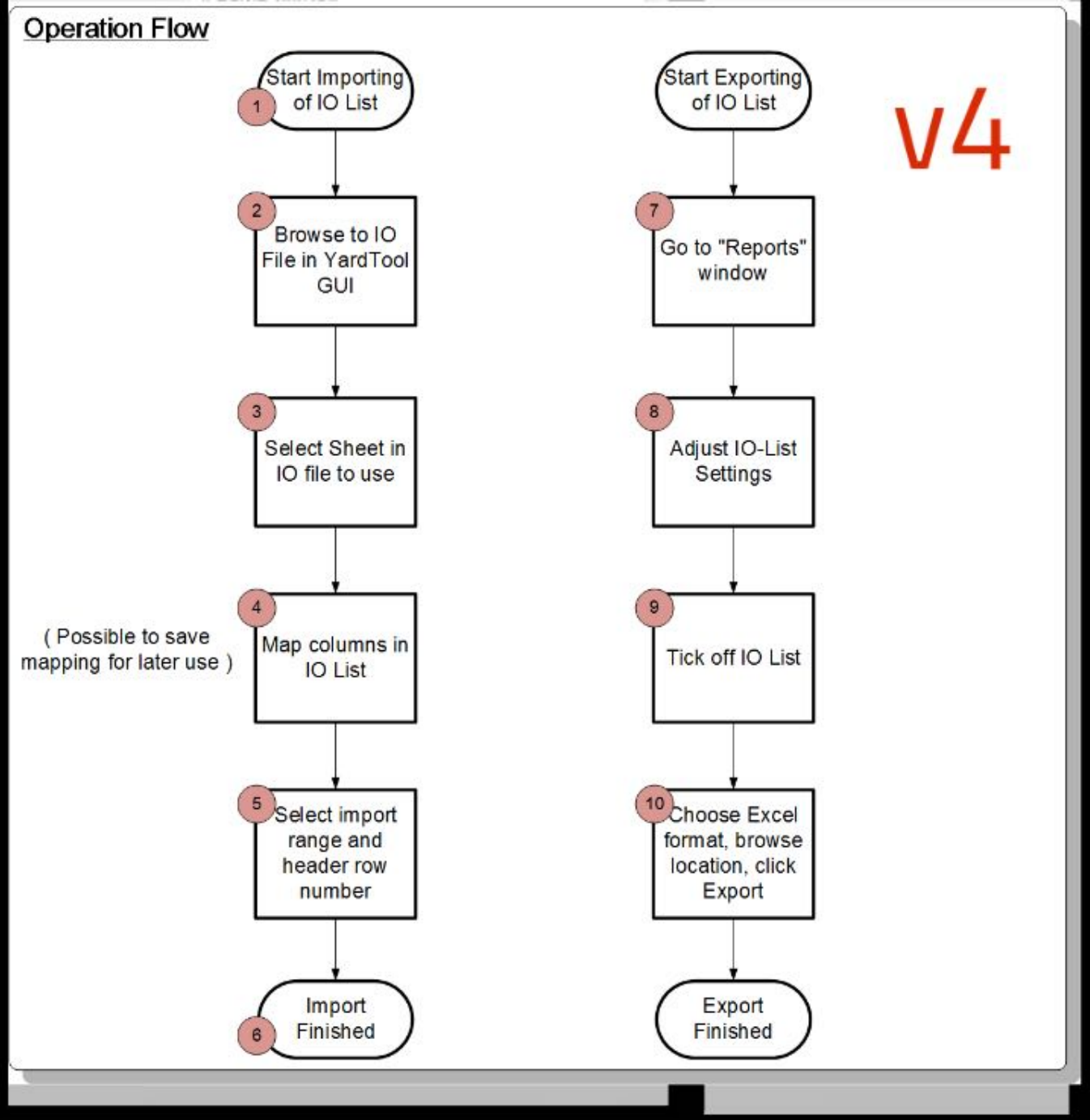
Import list,
Archive list to YardTool Database,
Use data from IO-List when working with YardTool,
Export IO list to excel after loopchecking.

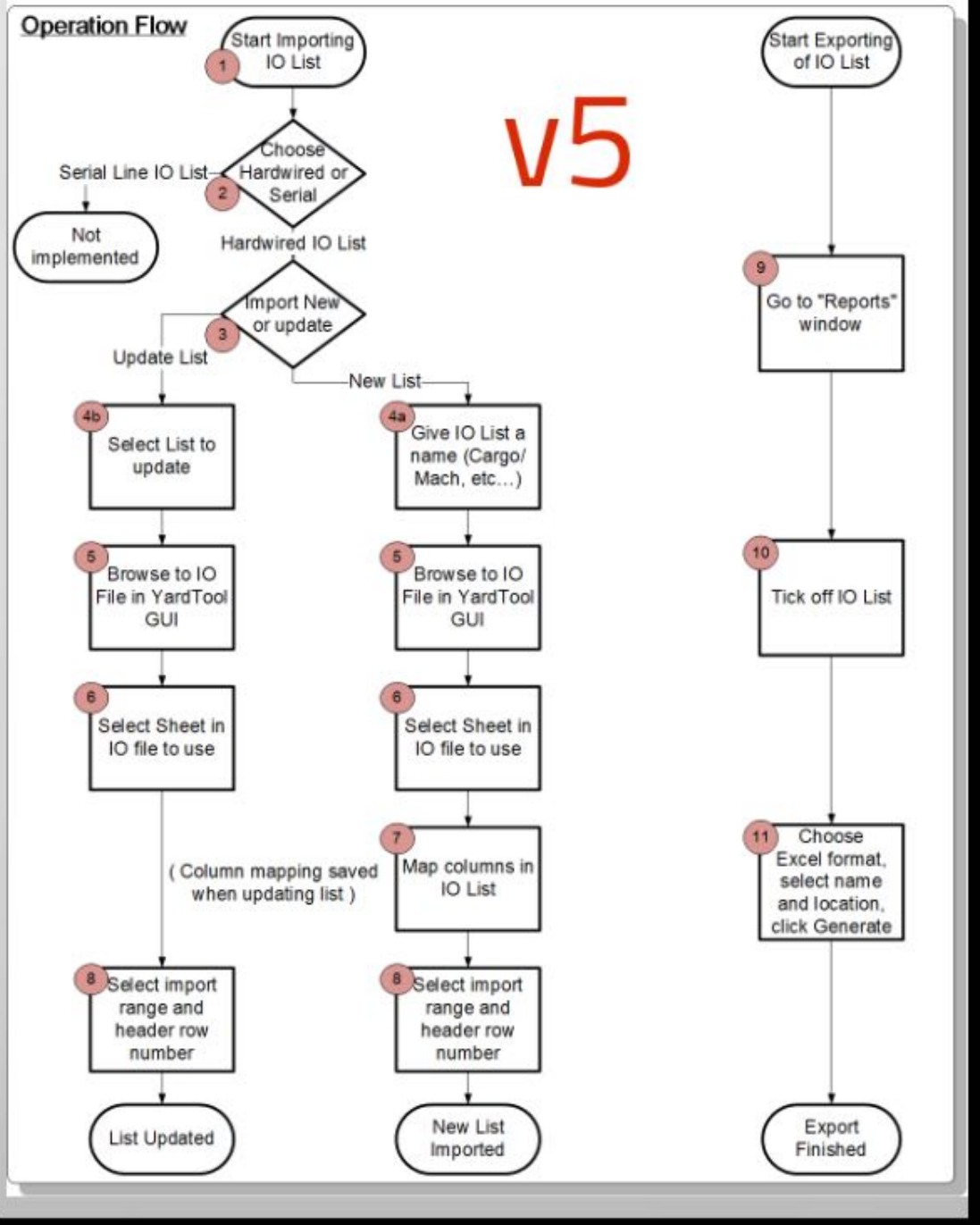
- Future:

Mark Changes in IO List.
Log changes in IO list.
Count Added/Removed/Changed signals.

AIM SW vs IO List Compare.

Auto Mapping of IO-List when importing.


Operation Flow
Start Importing of IO List
Browse to IO File in YardTool GUI
Select Sheet in IO file to use
(Possible to save mapping for later use)
Map columns in IO List
Select import range and header row number
Import Finished
Start Exporting of IO List
Go to "Reports" window
Adjust IO-List Settings
Tick off IO List
Choose Excel format, browse location, click Export
Export Finished
v4


Operation Flow
Start Importing IO List
Choose Hardwired or Serial
Serial Line IO List
Not implemented
Hardwired IO List
Import New or update
Update List
New List
Select List to update
Browse to IO File in YardTool GUI
Select Sheet in IO file to use
(Column mapping saved when updating list)
Select import range and header row number
List Updated
Give IO List a name (Cargo/ Mach, etc…)
Browse to IO File in YardTool GUI
Select Sheet in IO file to use
Map columns in IO List
Select import range and header row number
New List Imported
Start Exporting of IO List
Go to "Reports" window
Tick off IO List
Choose Excel format, select name and location, click Generate
Export Finished
v5

Evaluation / Research Findings

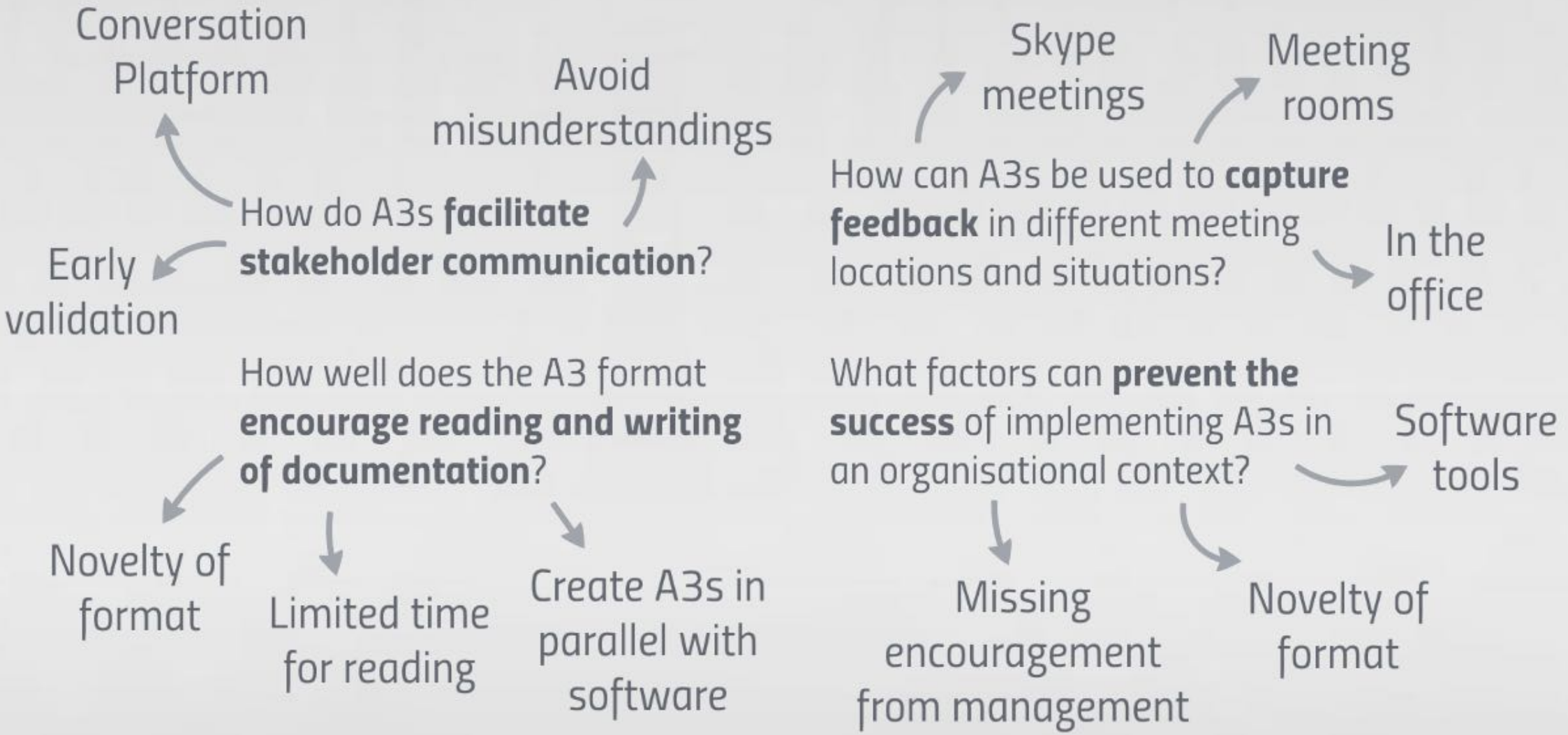
How do A3s **facilitate stakeholder communication**?

How well does the A3 format **encourage reading and writing of documentation**?

How can A3s be used to **capture feedback** in different meeting locations and situations?

What factors can **prevent the success** of implementing A3s in an organisational context?

Evaluation / Research Findings



Reflection

- Qualitative study
- Relevant stakeholders should be involved early
- More stakeholders should be involved (end users)
- Results of effort not measured

Conclusion

- A3s can improve communication in a project.
- Good interaction with A3s in different settings.
- A3s could encourage reading and writing of documentation.
- Encouragement from management plays an important role.

Future Research

- Cookbook or a set of templates customized for software development
- Look further into how new technology can facilitate interactive A3 Architecture Overviews
- Use A3s during the whole life-cycle of a system