Developing the GUI for the control room of SKA

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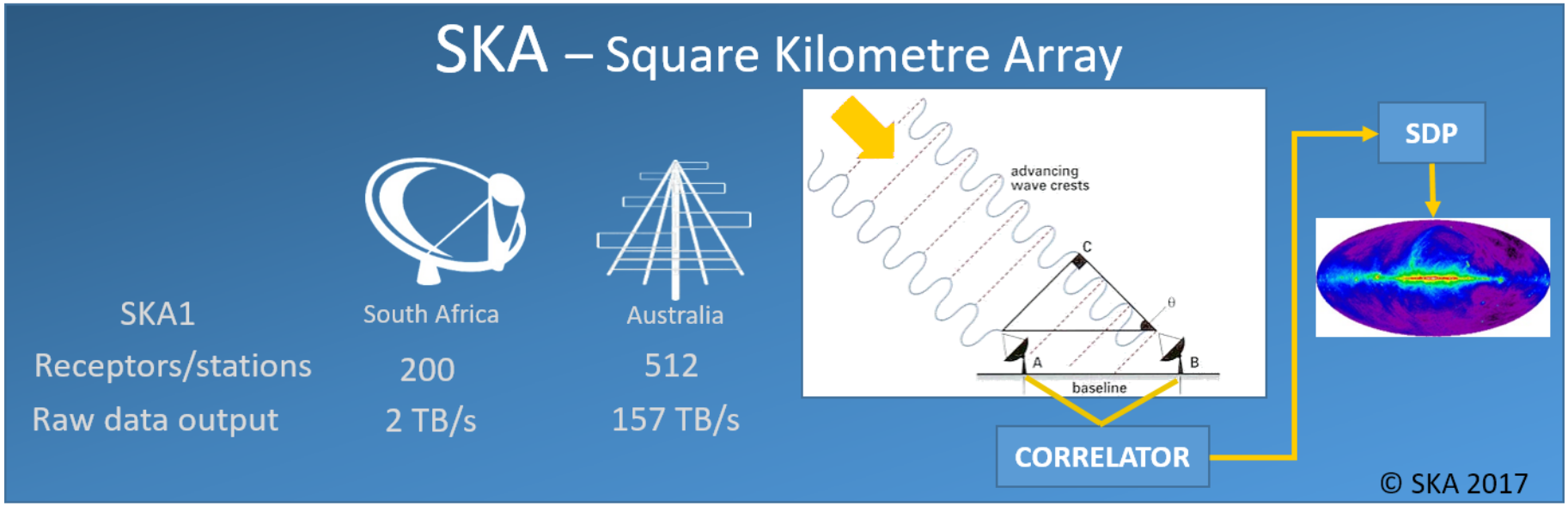
2017 ICT Workshop

Goal

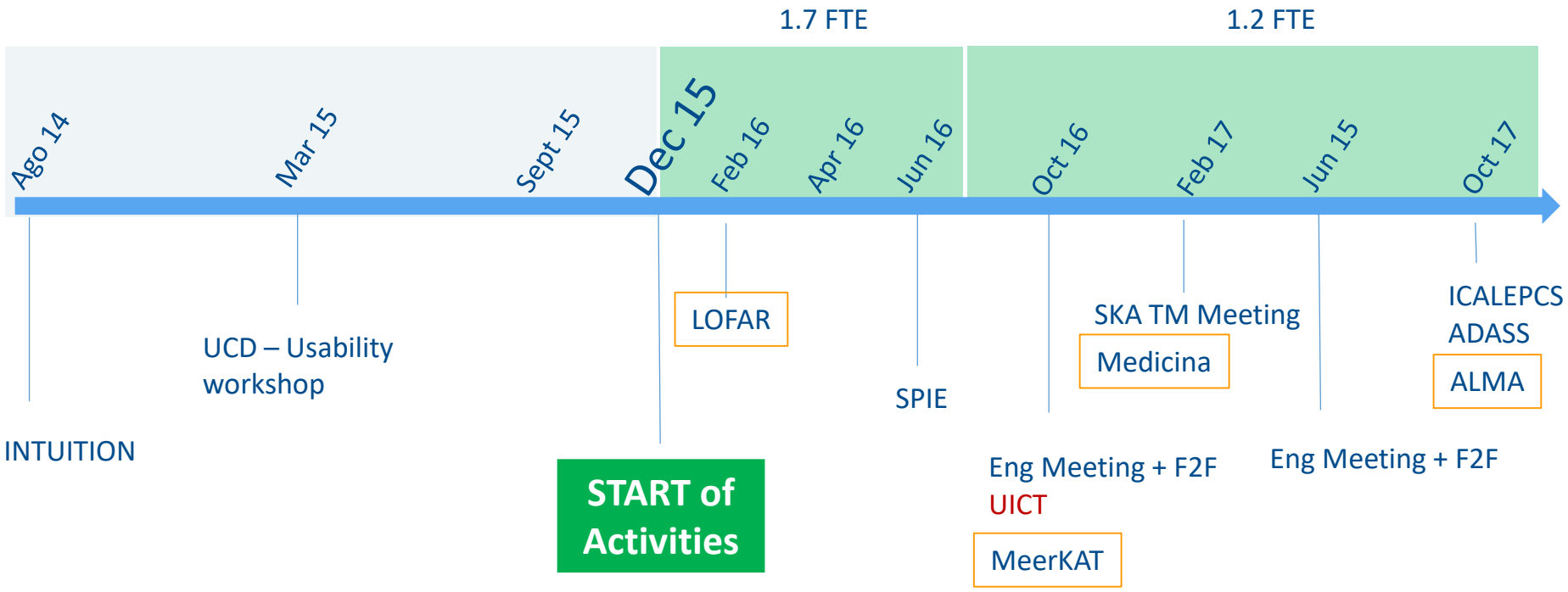
To develop the UIs for the CONTROL ROOM of the WORLD'S LARGEST RADIO TELESCOPE

Amount of information to be visualised
Complexity of the system
Possibly stressful situations

Automated System
Information from many different sources
Information to be analysed from different perspectives



History


1.7 FTE
1.2 FTE
Ago 14
Mar 15
Sept 15
Dec 15
Feb 16
Apr 16
Jun 16
Oct 16
Feb 17
Jun 15
Oct 17
INTUITION
UCD – Usability workshop
START of Activities
LOFAR
SPIE
Eng Meeting + F2F
UICT
MeerKAT
SKA TM Meeting
Medicina
Eng Meeting + F2F
ICALEPCS
ADASS
ALMA

UICT Charter

- To provide strategic support (definition of goals, identify gaps, risks analysis and mitigation)
- To refine and harmonize documents, methods, artifacts

from the **user** point of view

Results

- Visited 4 telescope sites.
- 6 + 2 Reports on the outcomes of the site visits.
- Usage Scenarios.
- Sketches & Storyboards.
- Task models.
- Contributed to the architecture and to the alarm system.
- 5 CDR Deliverables.
- 3 + 2 Articles in Conference Proceedings (SPIE, ICALEPCS - oral, ADASS, SPIE).
- Tasked with the definition of User Roles for SKA

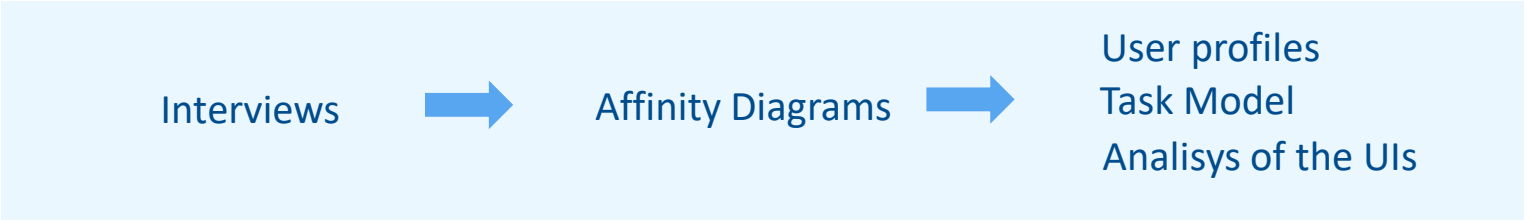
User Centered Design

Appropriate Analysis	Artifacts that present solutions	Usability Evaluation
Semi-structured Interviews	Content Modelling	User Testing
Affinity Diagrams	Sketching and Storyboarding	Heuristic Evaluation
User Profiling	Prototyping	
Personas		
Scenarios		
Tasks Model and Essential UCs		

Semi-Structured Interviews

- Interviewed personnel at **LOFAR** and **MeerKAT, Medicina RT, ALMA**
  - Field trips (2016, 2017)

- With the aim of understanding
  - Which **roles** can a person in the control room play
  - What are the **relationships** between these roles
  - What are the followed **procedures** (for scheduling, for responding to alarms..)
  - What are the **operator's tasks**
  - Which are the **strengths and weaknesses** of the used UIs



User Profile - Operator

We want to learn who the users are and how they interact with the system.

Context (within which the role is played)

Control room, quiet, mice, keyboards, visual and audible inputs.
Interacts with Scientists, Subsystem Experts, Software people - phone, chat, by person.
Mainly experts or intermediate users; novices have to be trained.

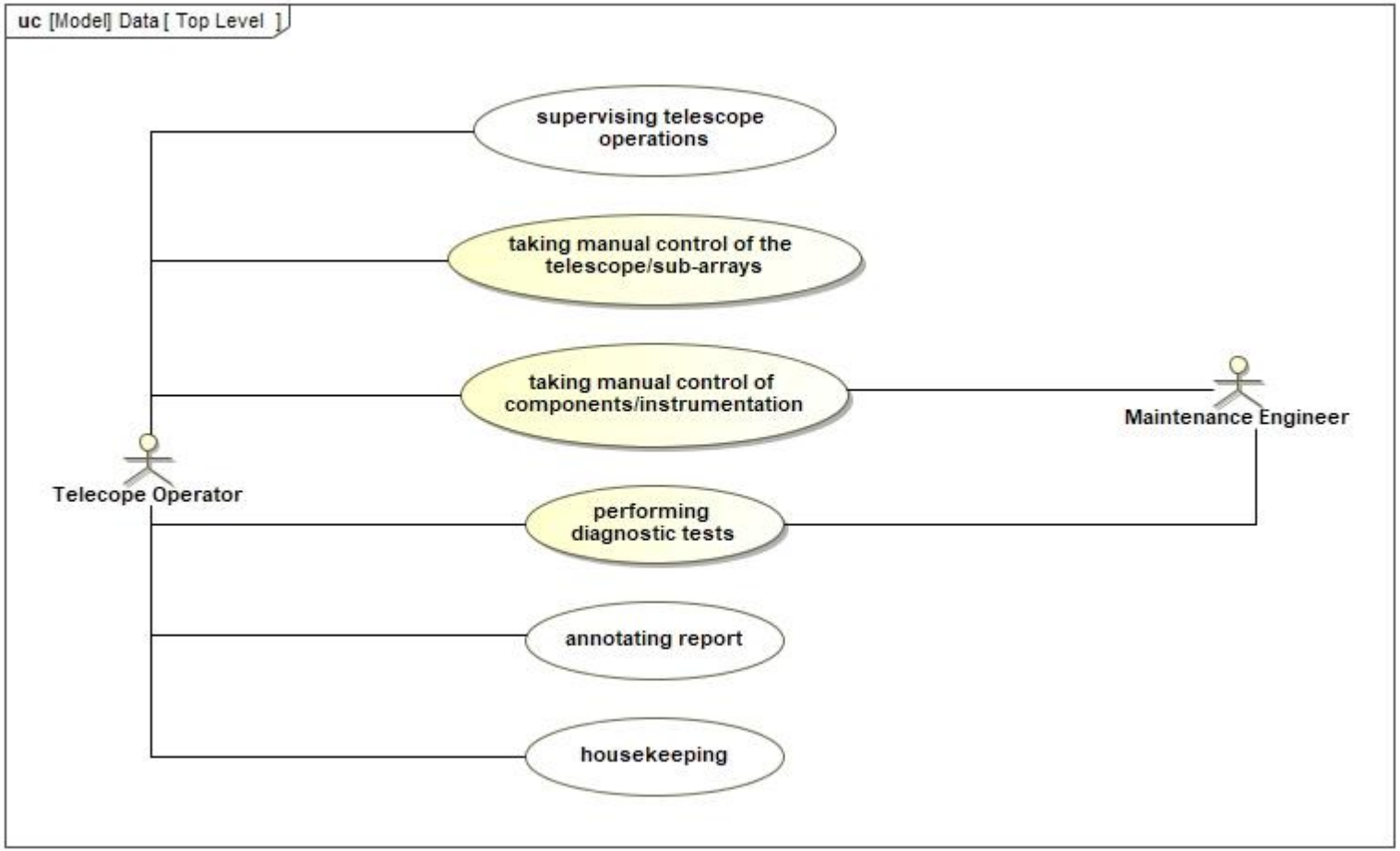
Characteristics (of performance of role)

Intensity of interaction: continuous during monitoring, occasional high intensity tasks.
Part of the Operator's work repeats.
High amount of information, high complexity.

Usability requirements

Reliability of the system - Effectiveness - Fault tolerance/protection

Task Model


uc [Model] Data [Top Level]
supervising telescope operations
taking manual control of the telescope/sub-arrays
taking manual control of components/instrumentation
performing diagnostic tests
annotating report
housekeeping
Telecope Operator
Maintenance Engineer

Scenarios

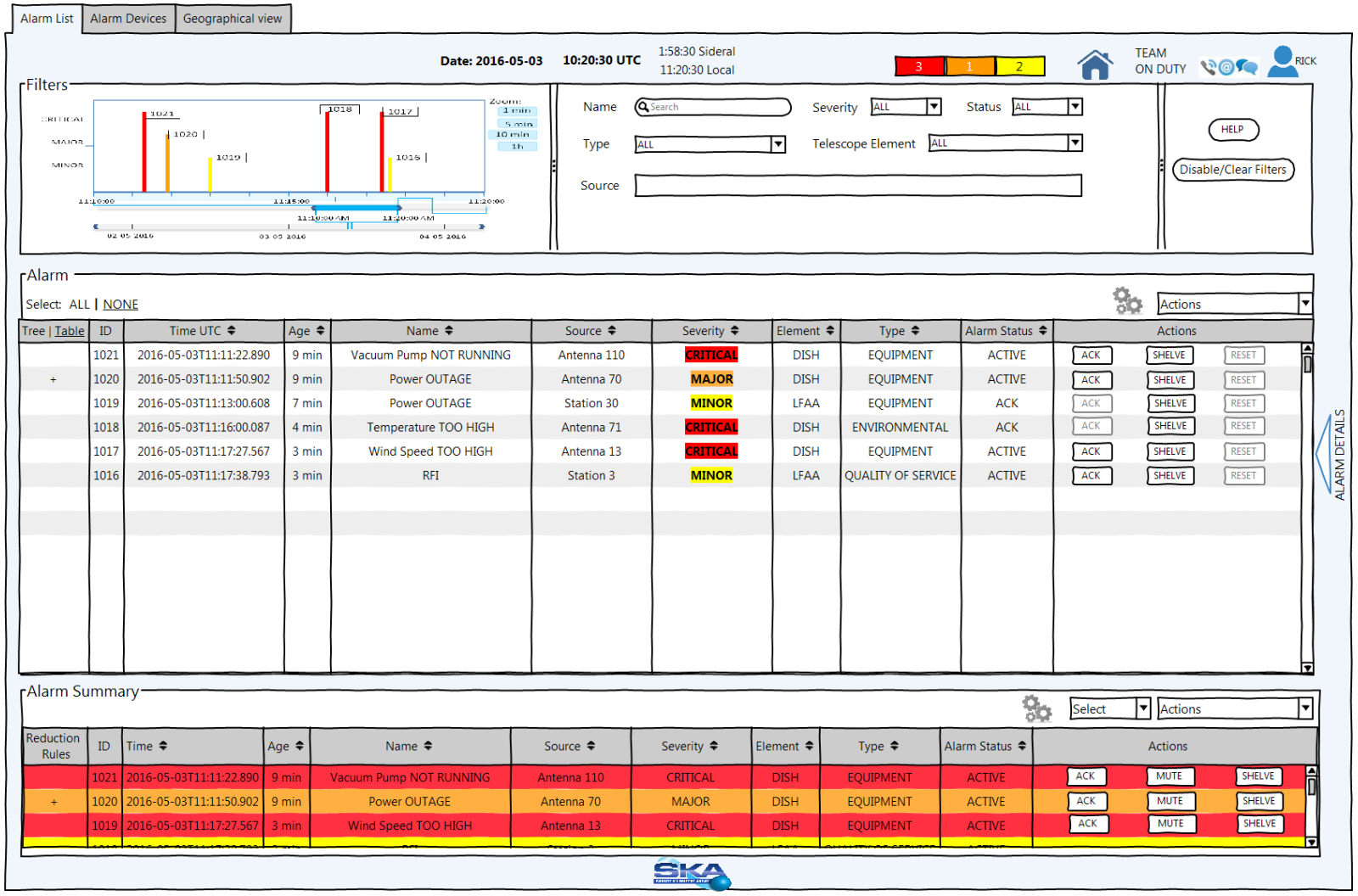
3 different scenarios have been developed so far:

- Handling many alarms
- Assess the impact of failures on observaions
- A day as usual scenario

Feedback and Comments:

- Who will be doing diagnosis of a failure: operators, engineers, tools, or a mix of these?
- Will the operator be able to configure alarms / define short term alarms?
- It is not clear what kind of interaction between ILS and TM is needed.
- A problematic concept is “short term scheduling” and who does it. Is it a human? a system?
- How **would** the UI help an operator to assess the degradation of quality in affected observations?

Sketches & Storyboards

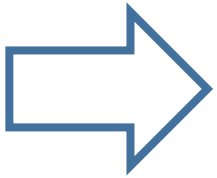


Sketches & Storyboards

Analisys of the UIs

Allows to **Highlight Critical Issues** of the UI of precursors of SKA.

- Scalability
- Fragmentation
- Estendability
- Gaps
- Based on text



Poor USABILITY

EFFECTIVENESS

EFFICIENCY

SATISFACTION

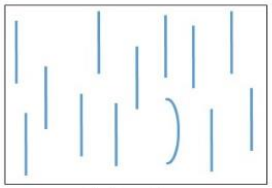
OVERALL PROBLEM: lack of a rapid and efficient way to access all the information needed:

- To diagnose a problem and
- To understand its impact on the observation that is being carried on.

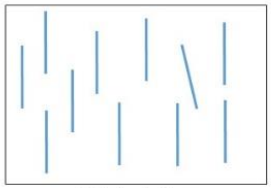
IMPLICATION for SKA: Good development process of UIs is needed

Analisys of the UIs

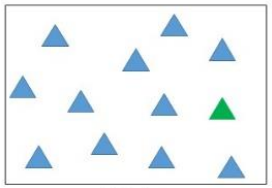
Visualization Principles



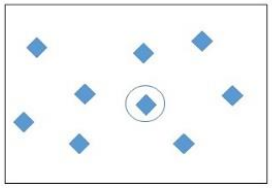
1. Curvature



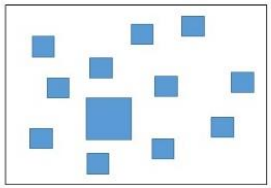
2. Orientation



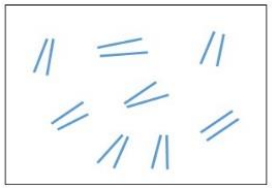
3. Color



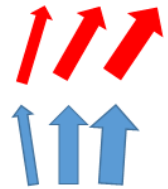
4. Added mark



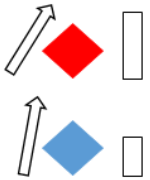
5. Size



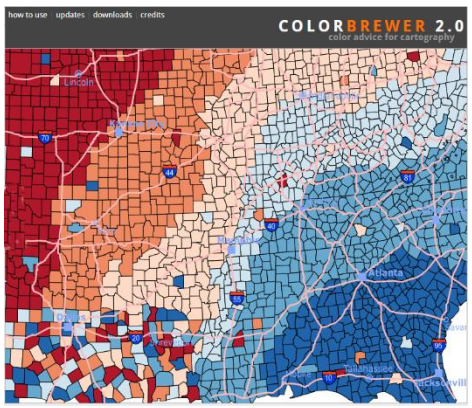
6. Parallelism

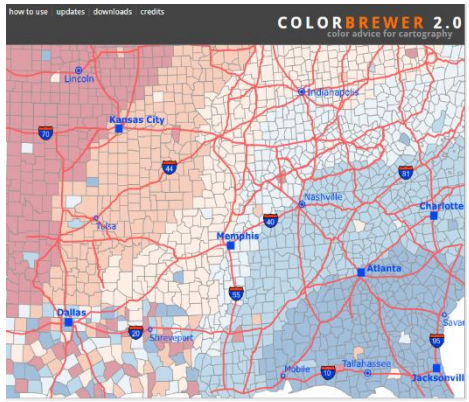


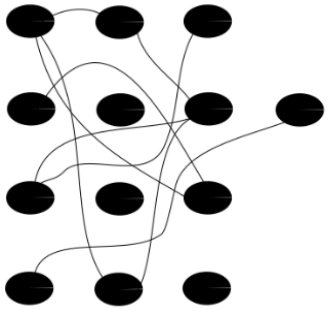
Direction -> Arrow direction
Temperature -> Arrow colour
Pressure -> Arrow width

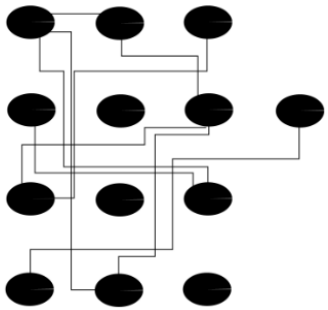


Direction -> Arrow direction
Temperature -> Diamond colour
Pressure -> Bar hight









Conclusions

The adoption of UCD practices is a long process; now its importance has been established. It was critical to start thinking back to 2014

- Good Feedback from UICT, SKAO, TM Members, Reviewers
- Our work highlights missing requirements, new use cases, open questions, possible critical issues for SKA
- Our work should be of interest for a broad set of stakeholders
- Stakeholders: TM, but also Scientists, CSP, SDP, SKAO

Thank you for your attention

User Profile - Operator

Context (within which the role is played):

Physical environment: control room environment, quiet
Relationship with indirect users in role: Commissioners/Astronomers, Software Developers, Subsystems Experts, by person, at the phone, using a dedicated chat.
Distribution of user skills: mainly experts or intermediate users; novices have to be trained.

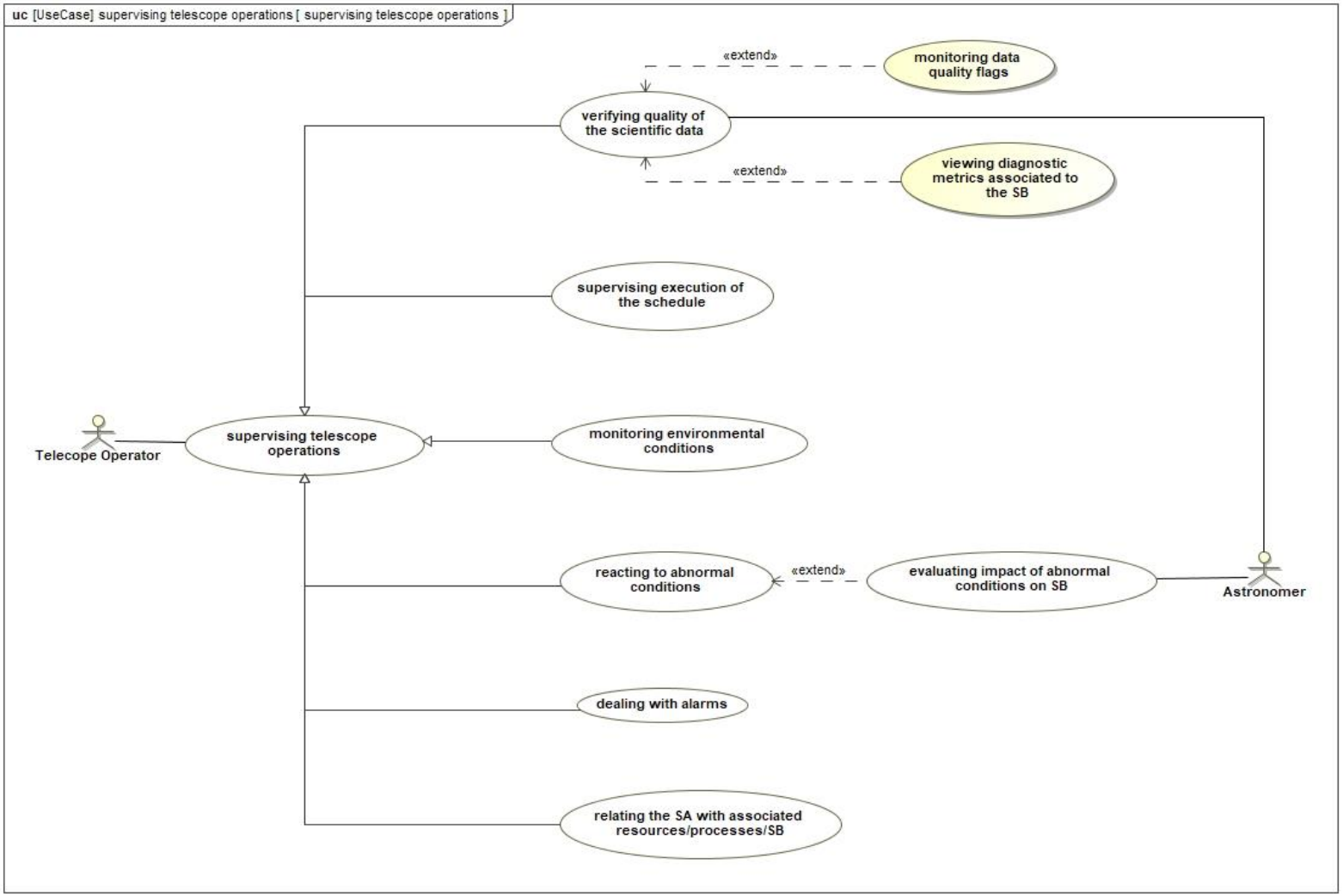
Characteristics (of performance of role):

Intensity of interaction in the role: continuous during monitoring, with occasional high intensity tasks; has to handle 10 alarms/hour on average.
Predictability of interaction in the role: part of the Operator's work repeats
Volume and complexity of information handled in the role: high amount of information, high complexity

Usability requirements:

Reliability of the system: present only relevant information, in a very clear and unambiguous way, as complete as possible.
Effectiveness: the UI should rely on appropriate visualization techniques to enable operators in making the appropriate decision.
Fault tolerance/protection: appropriate confirmation of actions should be considered to avoid slips for critical actions

Task Model


uc [UseCase] supervising telescope operations [supervising telescope operations]
«extend»
monitoring data quality flags
verifying quality of the scientific data
«extend»
viewing diagnostic metrics associated to the SB
supervising execution of the schedule
Telecope Operator
supervising telescope operations
monitoring environmental conditions
reacting to abnormal conditions
«extend»
evaluating impact of abnormal conditions on SB
Astronomer
dealing with alarms
relating the SA with associated resources/processes/SB