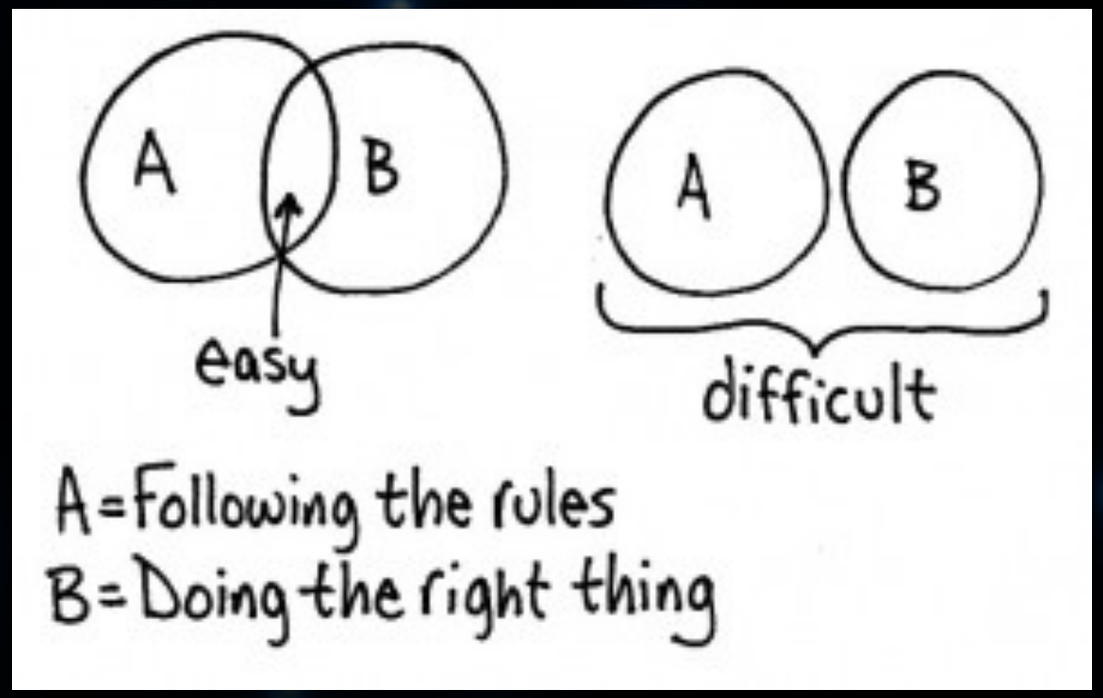
Following the Rules:
The Advantages of a Systematic Modelling Framework for Large Projects

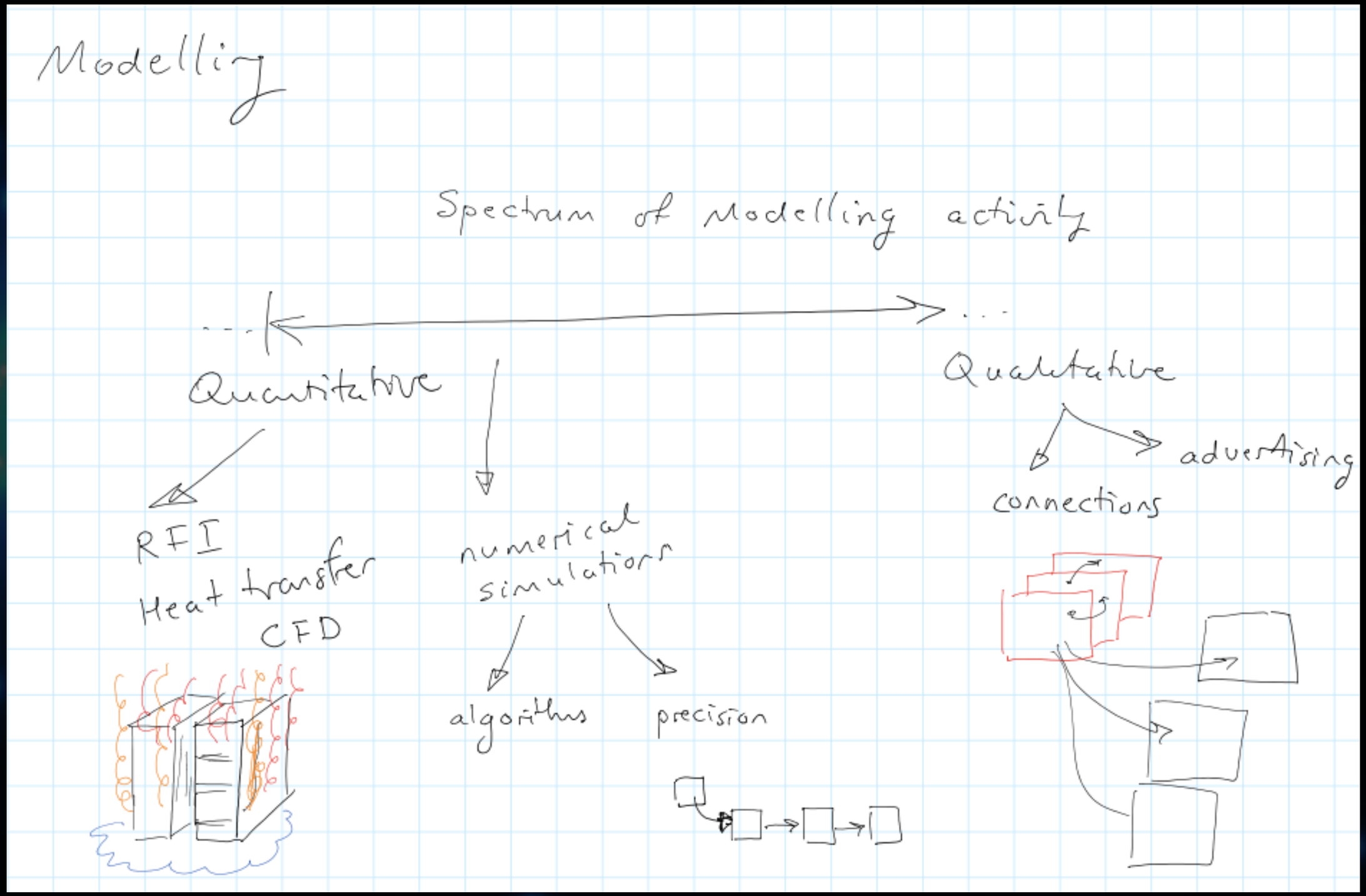


Computing for SKA 2015
Auckland University of Technology

De-risking

- SKA is a big project.
- The challenges are less technical,
- And more related to funding (Hi MBIE!), schedule, culture, organisation.
- But we can use modelling (and simulation) to help

What is modelling & why do we need it?



Challenges…

- **Fragmentation & diversity of modelling activities & tools**
  - **Multitude of models, thermal, throughput, RFI, mixed**
- **Platforms – Win, *nix**
- **Licensing – funding is a barrier to get everyone using the same tools**
- **Geographic separation**
- **Long-term transfer & maintainability**
- **Problem: Can't realise project without formal approach; too big to dive in and start building things. Need to:**

  document requirements & specifications with minimal ambiguity, force definition

  simulate to test against requirements – fitness of solution

…Solutions

- **Reduce risk (of not meeting requirements)**
- **Reduce cost (NRE and maintenance)**
- **Reduce time to first light**
- **Above achieved by shrinking feedback loops**
- **Collect domain-specific expertise; sig. proc., thermal, precision...**

Settling on Tools

- **No Magic Cameo Systems Modeler – SysML**
- **MATLAB – computational modelling, simulation**
- **Simulink – signal processing models, wrap up MATLAB. Visual**
- **Git – version control**

SysML, the Systems Modelling Language

- **General purpose systems modelling language**
- **Supports specification, analysis, design, verification & validation**
- **Extension of a subset of UML to suit SE: less SW-centric, adds requirement and parametric diagrams**
- **Easier to learn & apply**
- **Standard data format (XMI, XML Metadata Interchange)**
- **Don’t be afraid! There’s no mystery to it.**

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CSP_ProductTree]

Diagram n
Author
Creation d
Modificatio

«block»
«se2.physical»
Clock and Timing

clk_low clk_mid clk_sur

«block»
«se2.physical»
Local Monitoring and Control

lmc_low lmc_mid lmc_sur

«block»
«se2.logical»
CSP

cor_sur cor_bf_mid ps_mid pt_mid

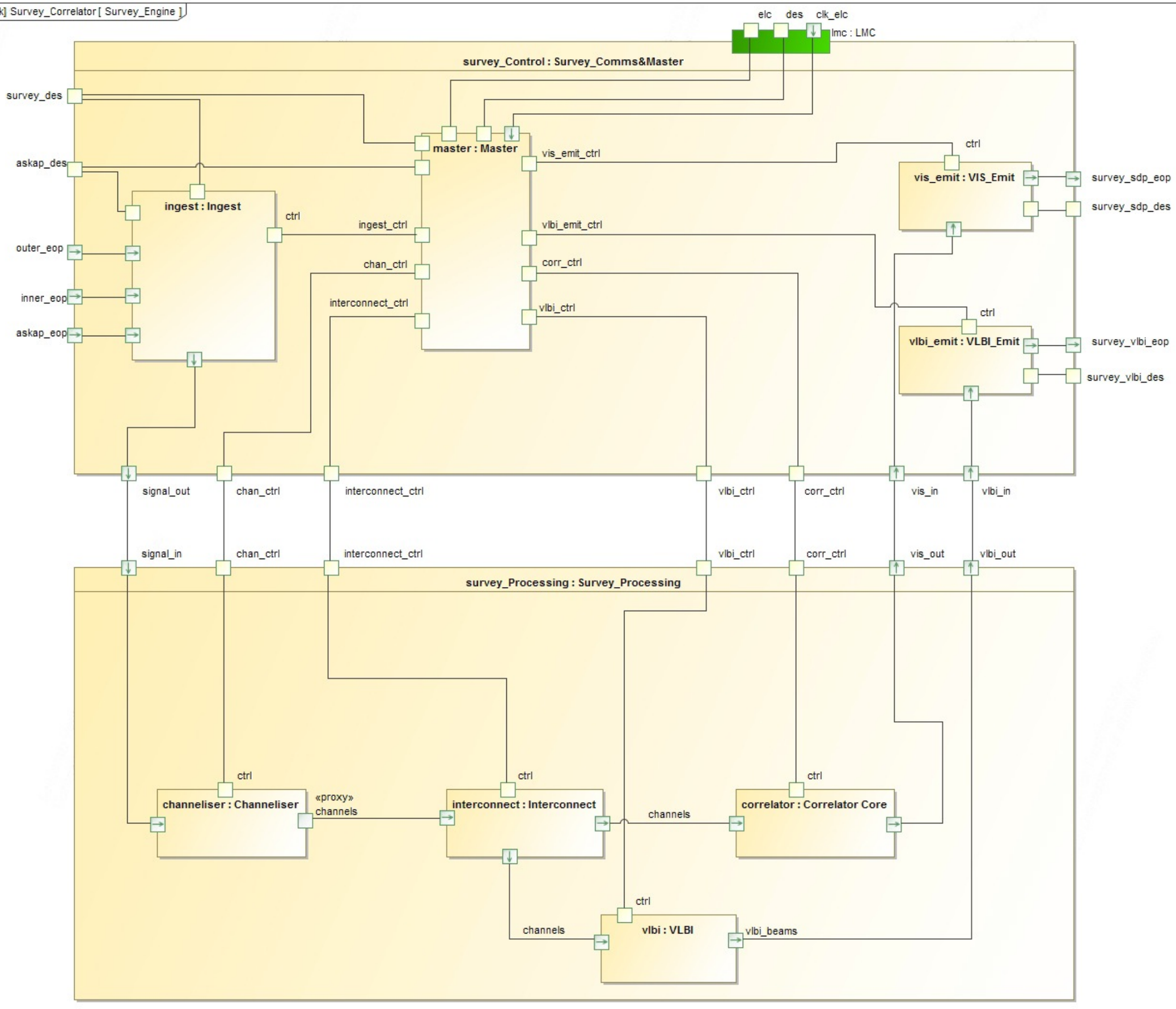
«block»
«se2.physical»
Survey Correlator

«block»
«se2.physical»
Mid Correlator and Beamformer

«block»
«se2.physical»
Mid Pulsar Search Engine

«block»
«se2.physical»
Mid Pulsar Timing

Diagram name	Survey_Engine
Author	bradford
Creation date	26/08/14 4:52 PM
Modification date	21/10/14 5:09 PM



Suffixes for interfaces classes:

_des	:	Data Exchange Specification
_elc	:	Electronic
_ell	:	Electrical
_emc	:	Electromagnetic
_eop	:	Electro-optical
_fld	:	Fluid
_mec	:	Mechanical
_thl	:	Thermal

CSP is the leading party for interfaces with INFRA, TM and external VLBI equipment.

Matlab & Simulink

- Multi-domain modelling
  - Model-based design of dynamic systems
  - Design, simulate, implement and test control, signal processing, communications and other time-varying systems

- Simulink
  - Block diagrams, easy to visualise

SKA1 Survey Baseline Distances, R = 6371000

x 10^4

dish #

10 20 30 40 50 60 70 80 90

dish #

5 4.5 4 3.5 3 2.5 2 1.5 1 0.5

Distance (m)