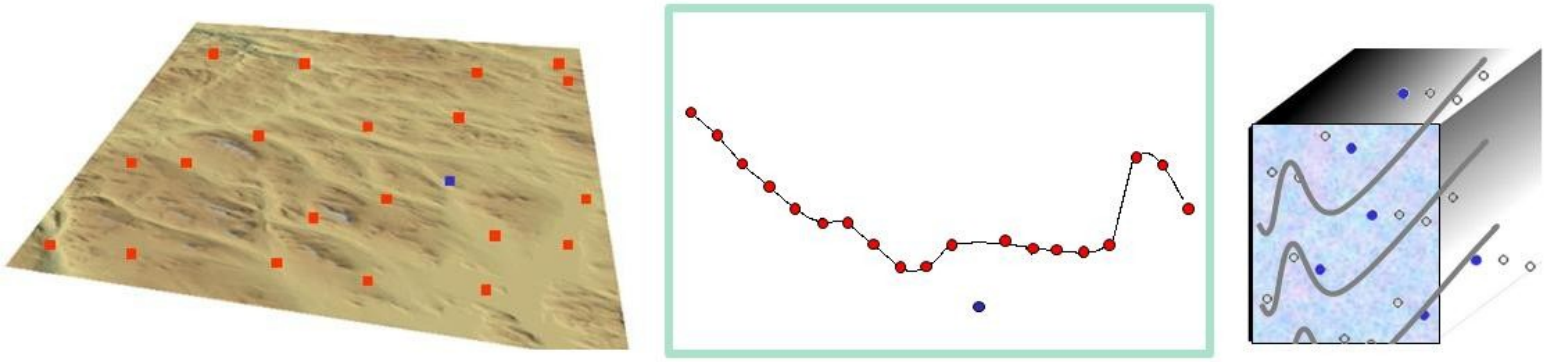
Norwegian Meteorological Institute
met.no

QC2

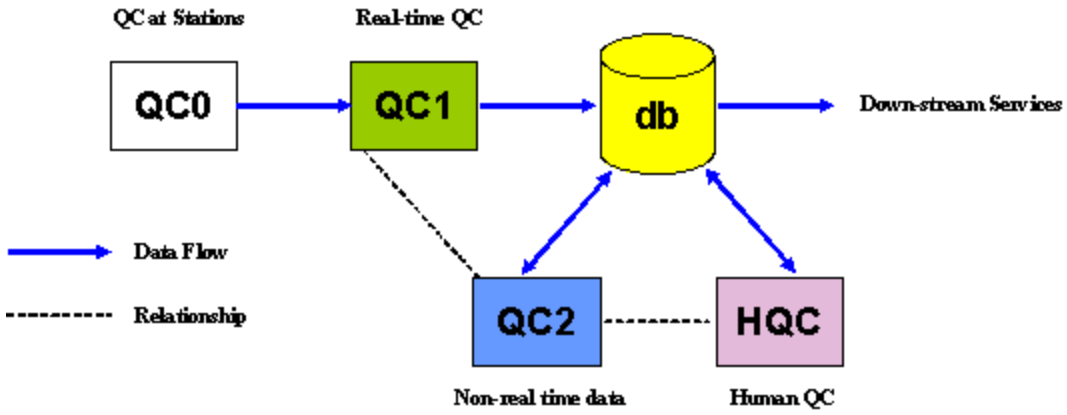
automatic quality control methods applied in non-real time



KVALOBS MEETING 2010, 23-24 November, SMHI,Norrköping

Introduction/Overview

- Overview of QC2
- Current status at met.no
- Future plans



Objectives

- Use QC2 methods to further improve quality control of data and check QC1 results
- For some special cases provide new corrected values
- Support tasks that are well-defined and laborious for HQC

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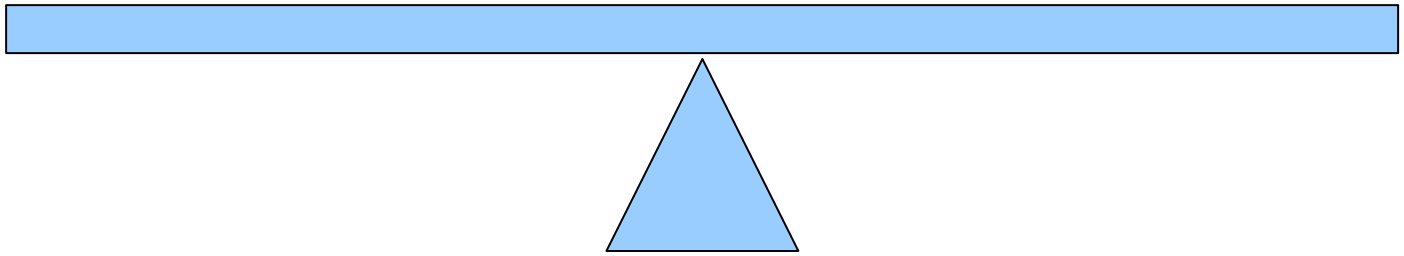
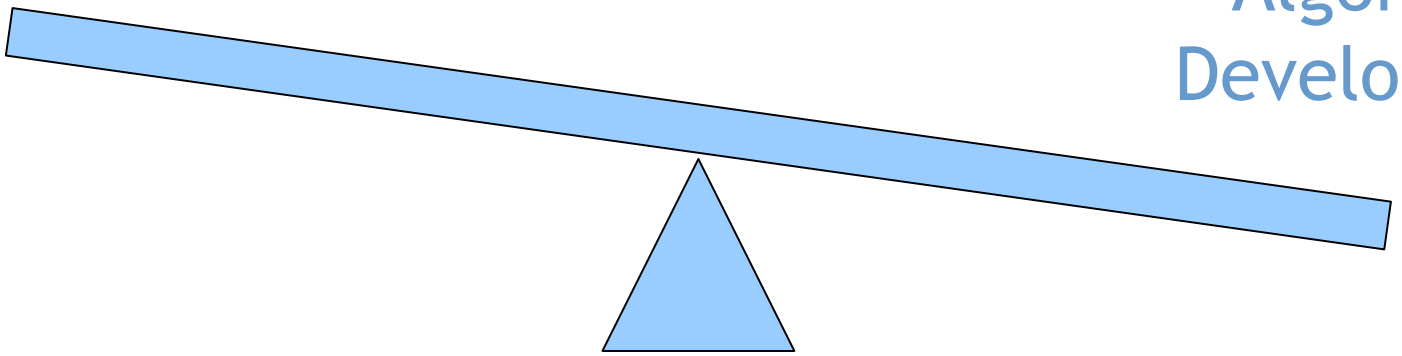
System Development

Algorithm Development

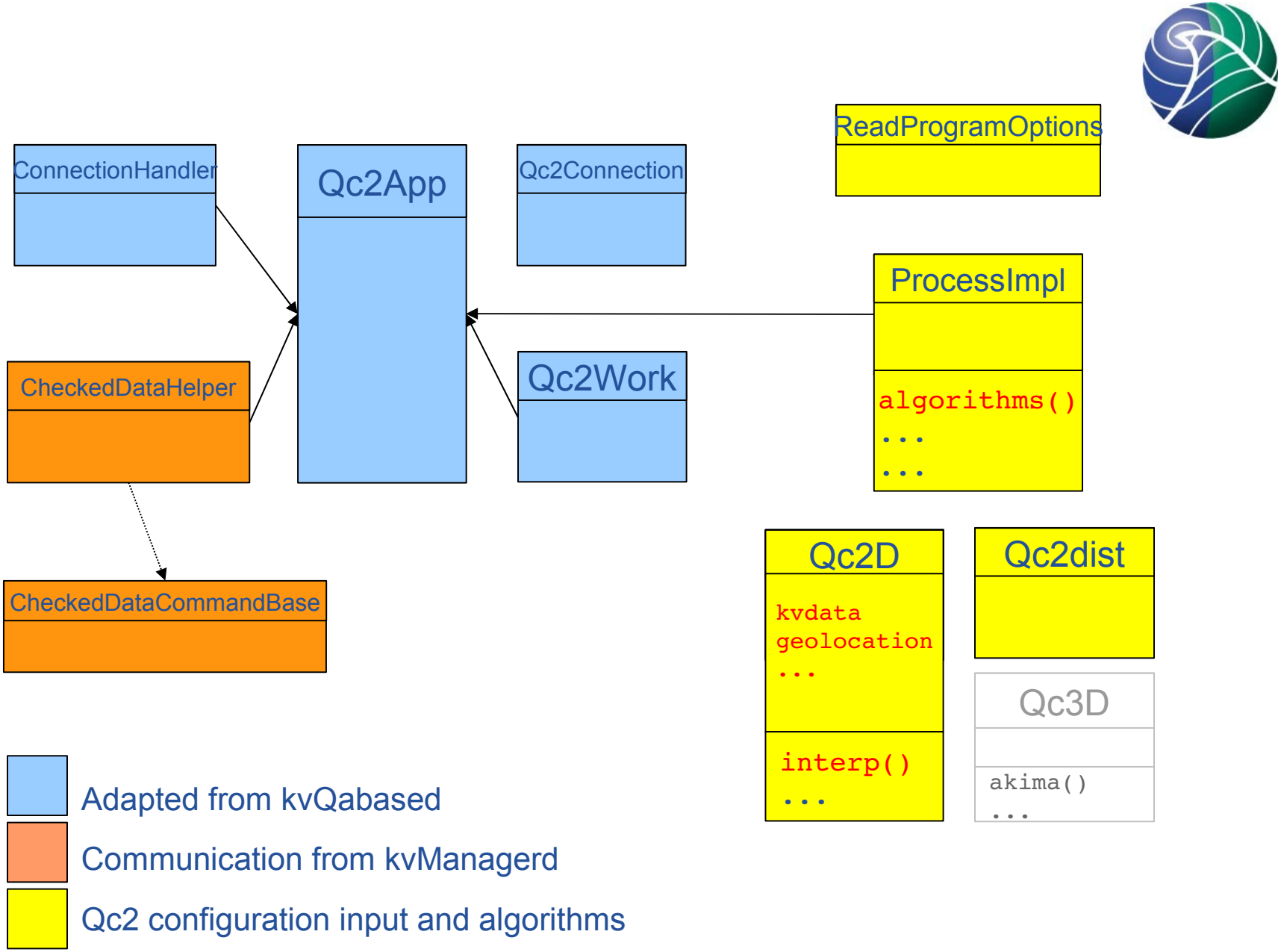


System Development



Algorithm Development

Qc2 met.no implementation is based on kvalobs Qc1 C++ components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Qc2App
Qc2Connection
ReadProgramOptions
ProcessImpl
algorithms()
...
...
CheckedDataHelper
Qc2Work
CheckedDataCommandBase
Qc2D
kvdata
geolocation
...
interp()
...
Qc2dist
Qc3D
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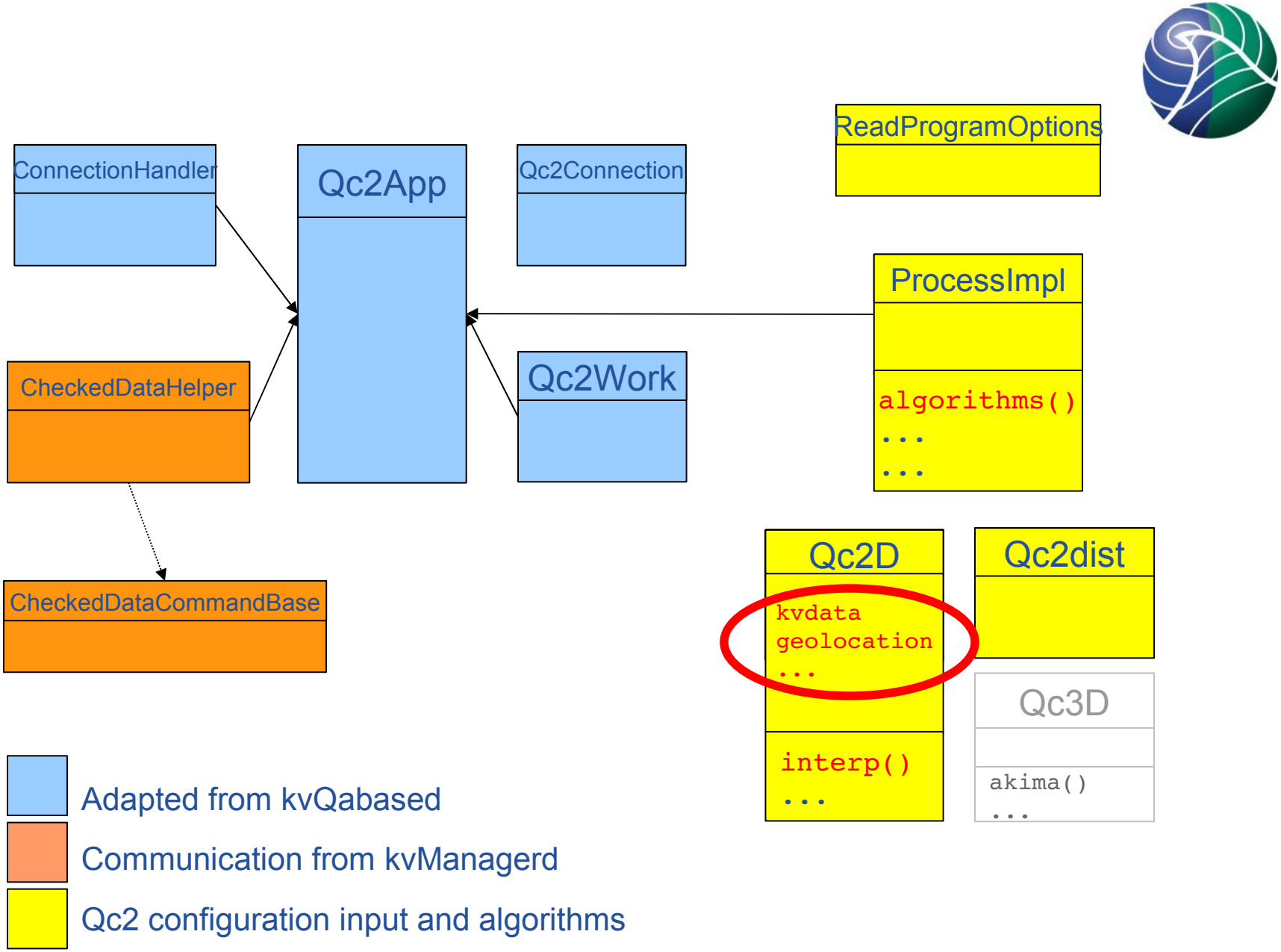
Communication from kvManagerd
Qc2 configuration input and algorithms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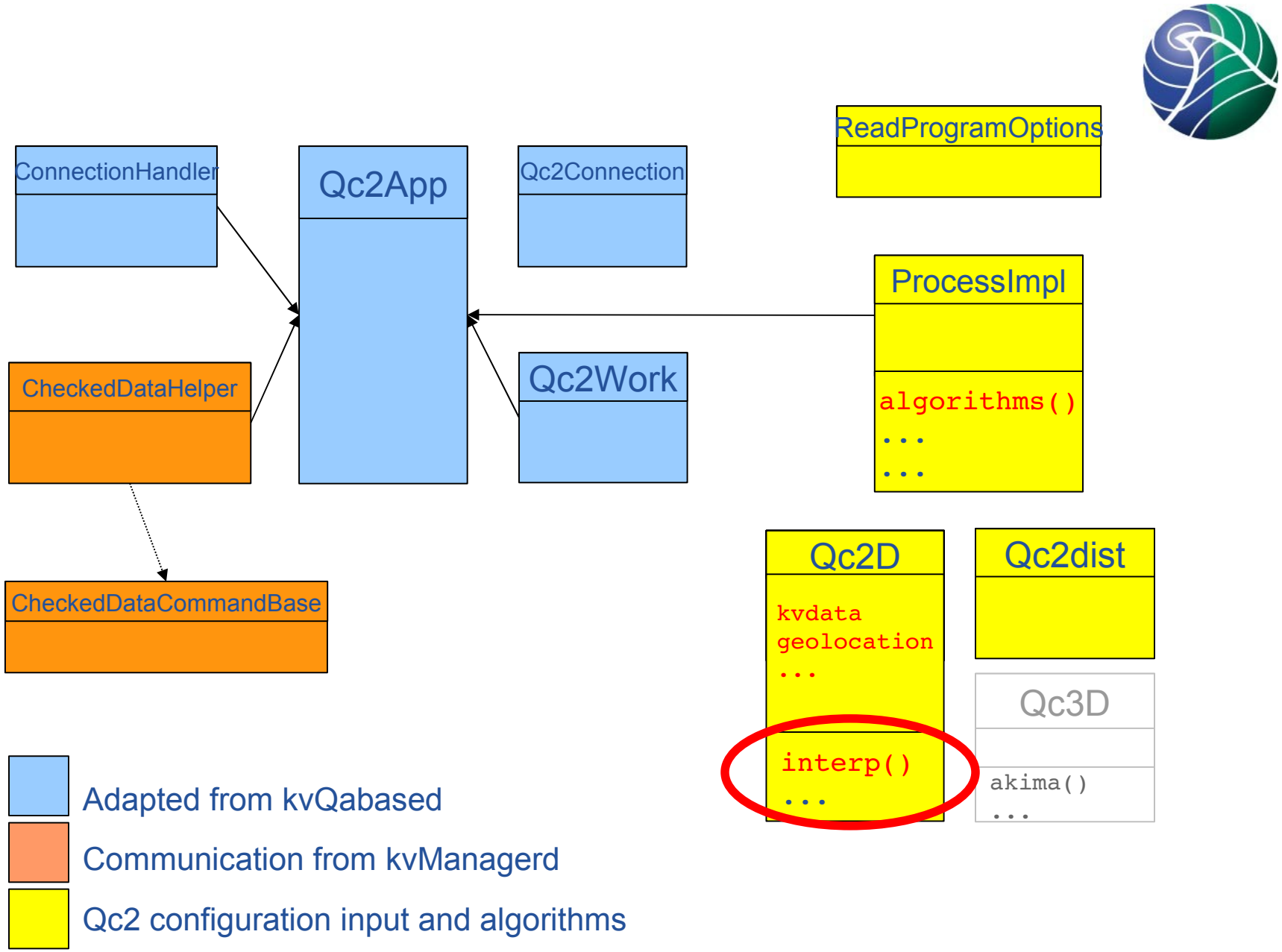
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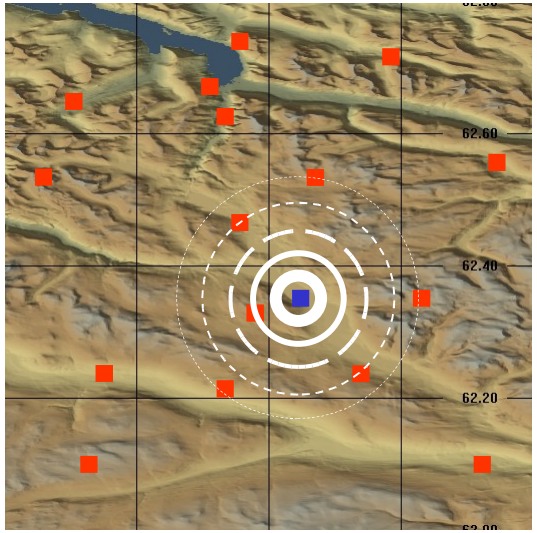
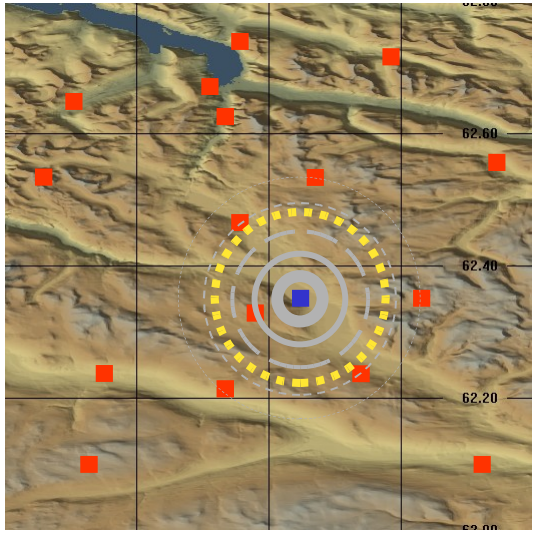
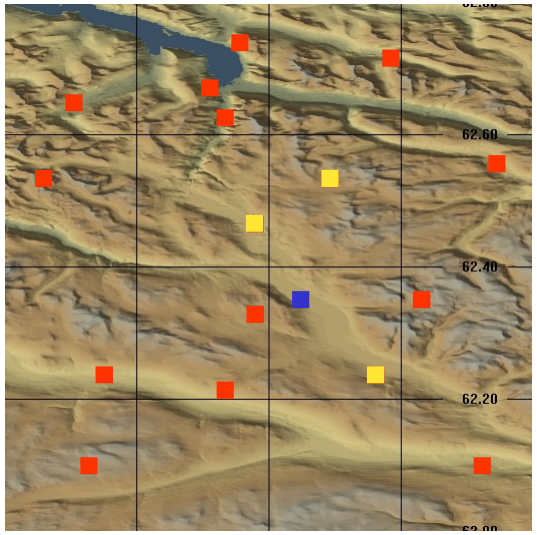
$1/R^2$



R < limit

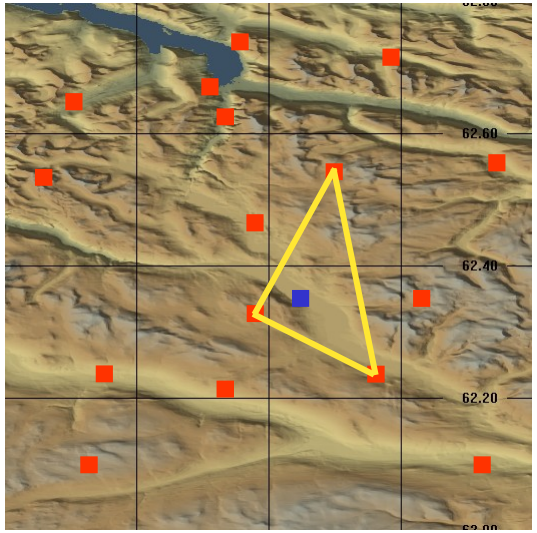


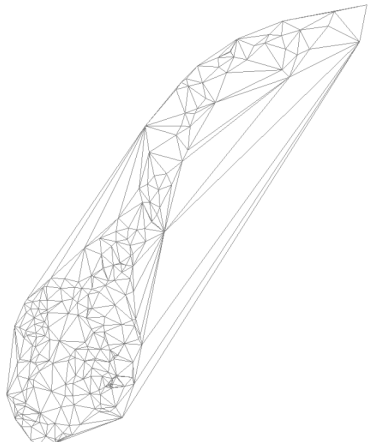
Preferred Neighbours



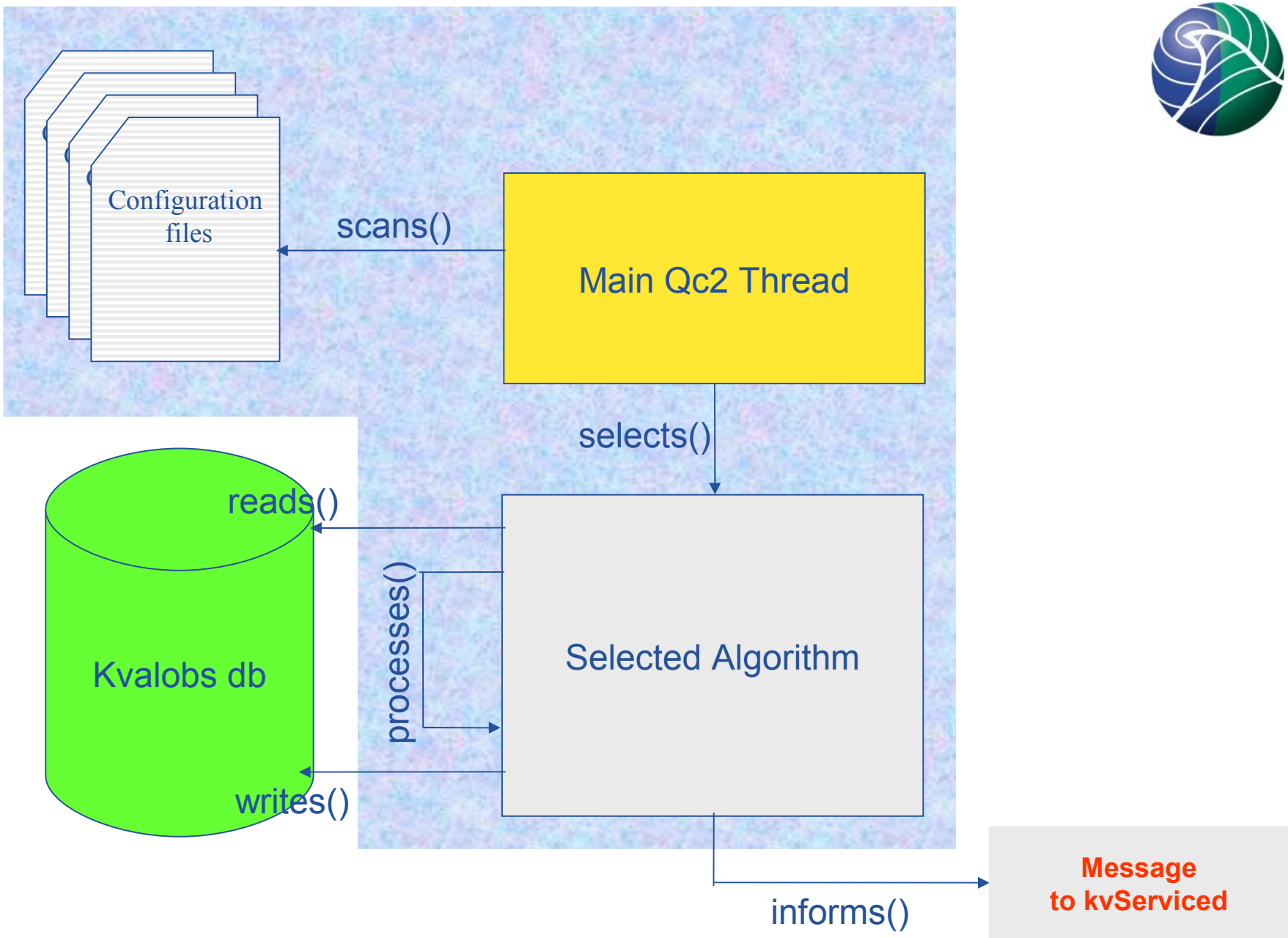
Maintain station list to use for each node

Triangulation and Linear Interpolation





System overview and communication



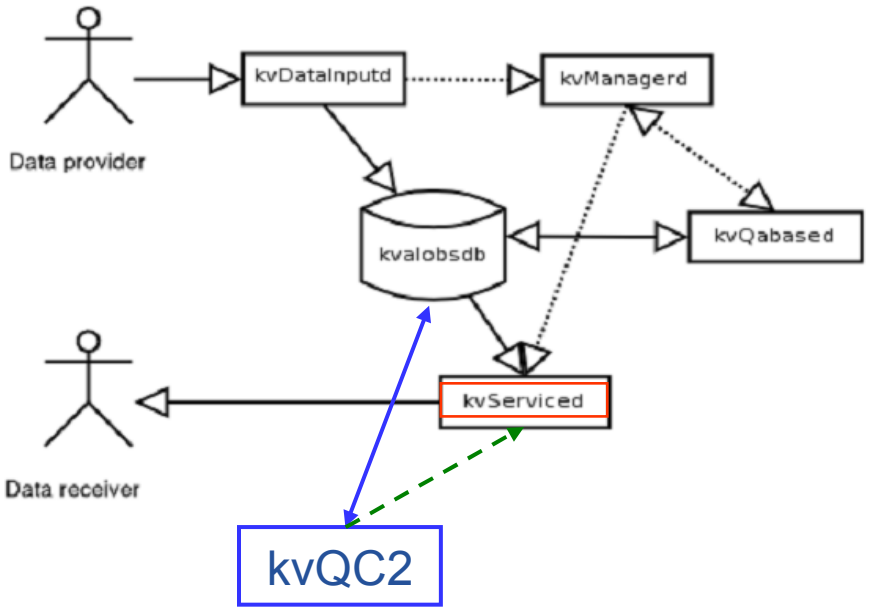
met.no Qc2 Framework

Boost program_options ...

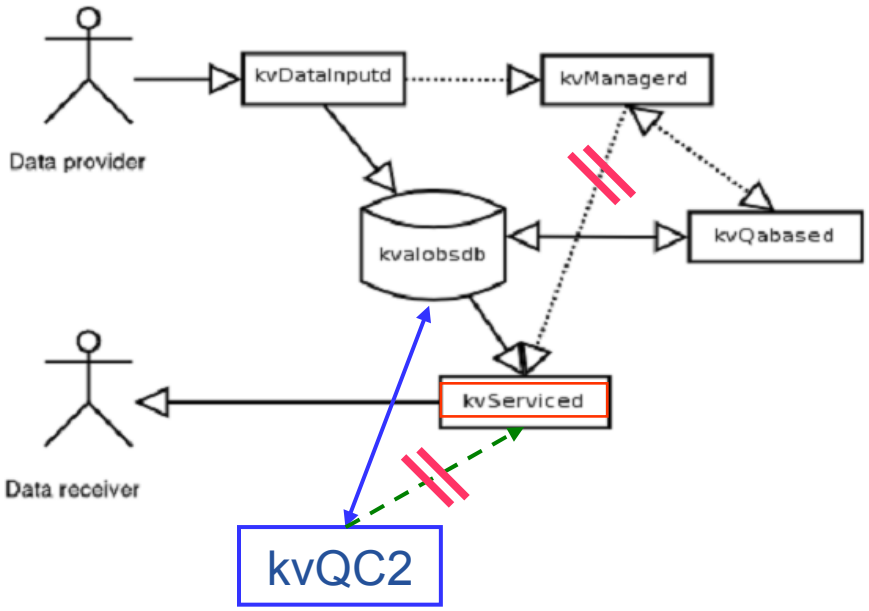
```
# AlgCode 10 corresponds to
# https://svn.met.no/kvoss/kvQc2/branches/kvqc2-1.0.1/src/algorithms/SingleLinear.cc
# Performs simple linear interpolation for a single point replacement.
# If the result is outside an available max min range, the nearest of the
# max or min values are used.

AlgoCode=10

# Time to run the algorithm
RunAtHour=23
RunAtMinute=5

# Check data from the last three days
Last_NDays=3

#[Specific Data Type and Paramters ids etc.]
ParamId=211
MaxParamId=215
MinParamId=213

# Only write back the result if not previously controlled
W_fhqc=0

#Flag to set if value is corrected
S_ftime=1
change_fmis=3->1
change_fmis=0->4

# Filters on the neighbouring points used in the interpolation
Not_ftime=1
Not_fnum=6   # This is to cut out the data with large values
U_0=1
U_0=2
U_0=3
U_0=4
U_0=5
U_0=6
U_0=7
NotU_2=2
```

- Algorithm to run determined by a code number
- Time (UTC) when to run the algorithm
- Time interval processed (can be and explicit start and stop time)
- Parameter on which to run the algorithm
- This algorithm also allows a cross-check with max and min data (optional)
- Flags to check before writing the new correction back
- If successful, the controlinfo flags to set
- Various filters to apply to the neighbours used in the interpolation.

Communication



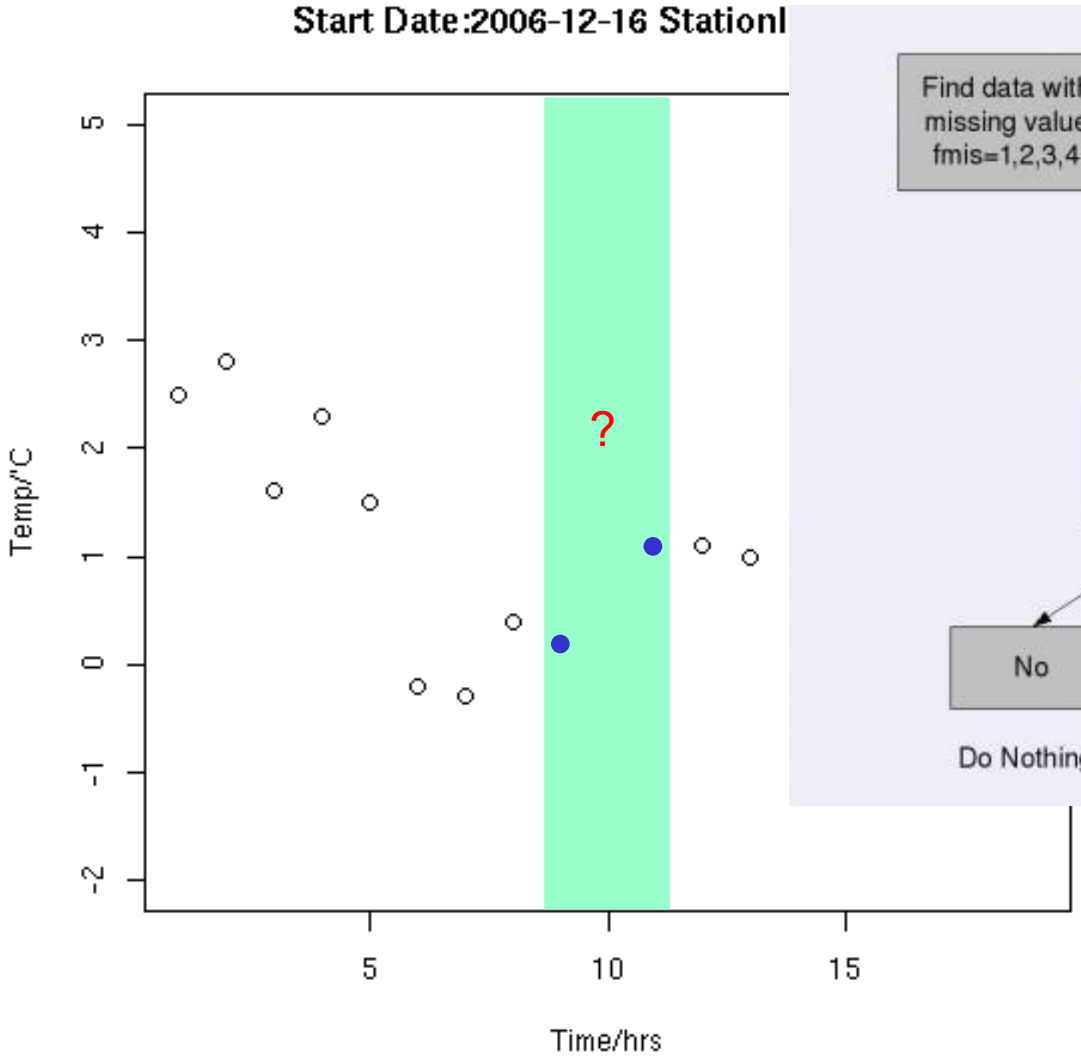
Communication ...

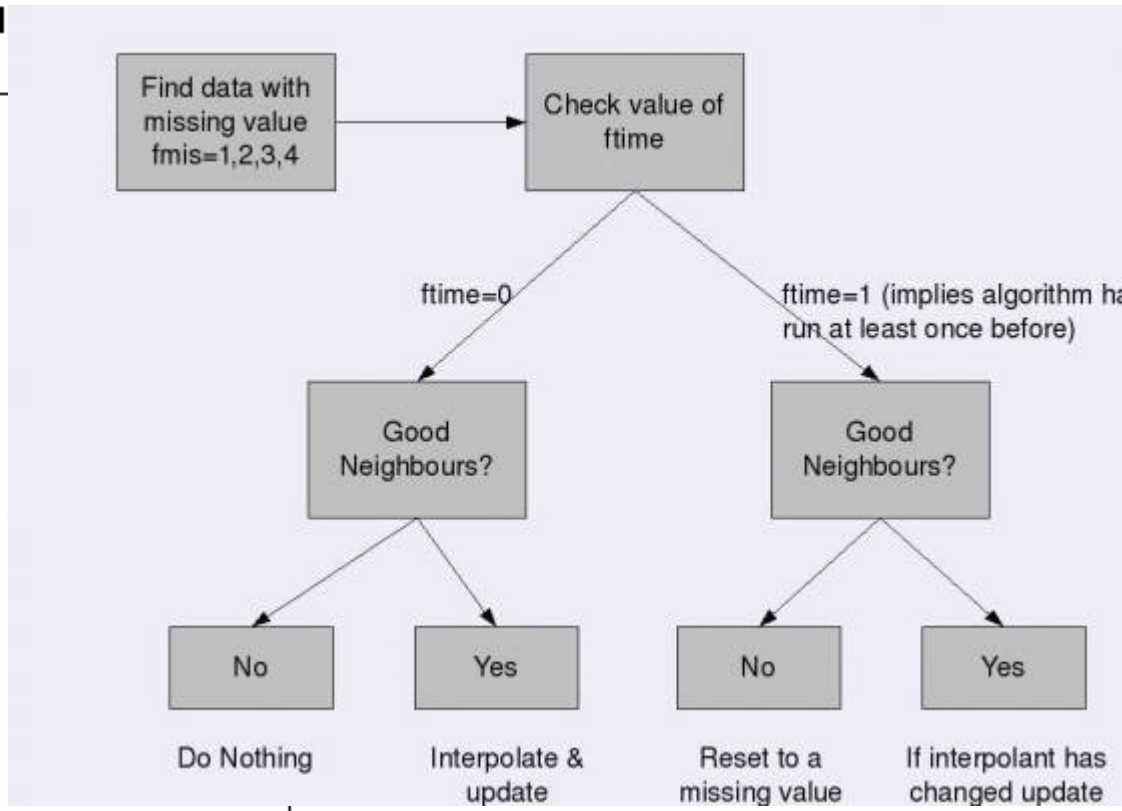


Status at met.no

- First QC2 system in the production environment
- Single-point linear interpolations of missing values in operation (time only)
- Converged on flagging for the new algorithm required flag document updates
- A number of initial bugs under eradication
- Redistribution of accumulated precipitation next (includes spatial interpolation)
- All visible under http://kvalobs.wiki.met.no [svn, bugzilla, documentation]

Single Point Linear Interpolation





Original data

```
7120;2025-09-17 09:00:00;8.7;211;2010-09-17 09:03:50;330;0;0;8.7;0111000000000010;7000000000000000;
7120;2025-09-17 10:00:00;-32767;211;2010-09-17 10:32:33;330;0;0;-32767;0100003000000000;7899900000000
7120;2025-09-17 11:00:00;9.5;211;2010-09-17 11:03:44;330;0;0;9.5;0110000000000010;7000000000000000;
```

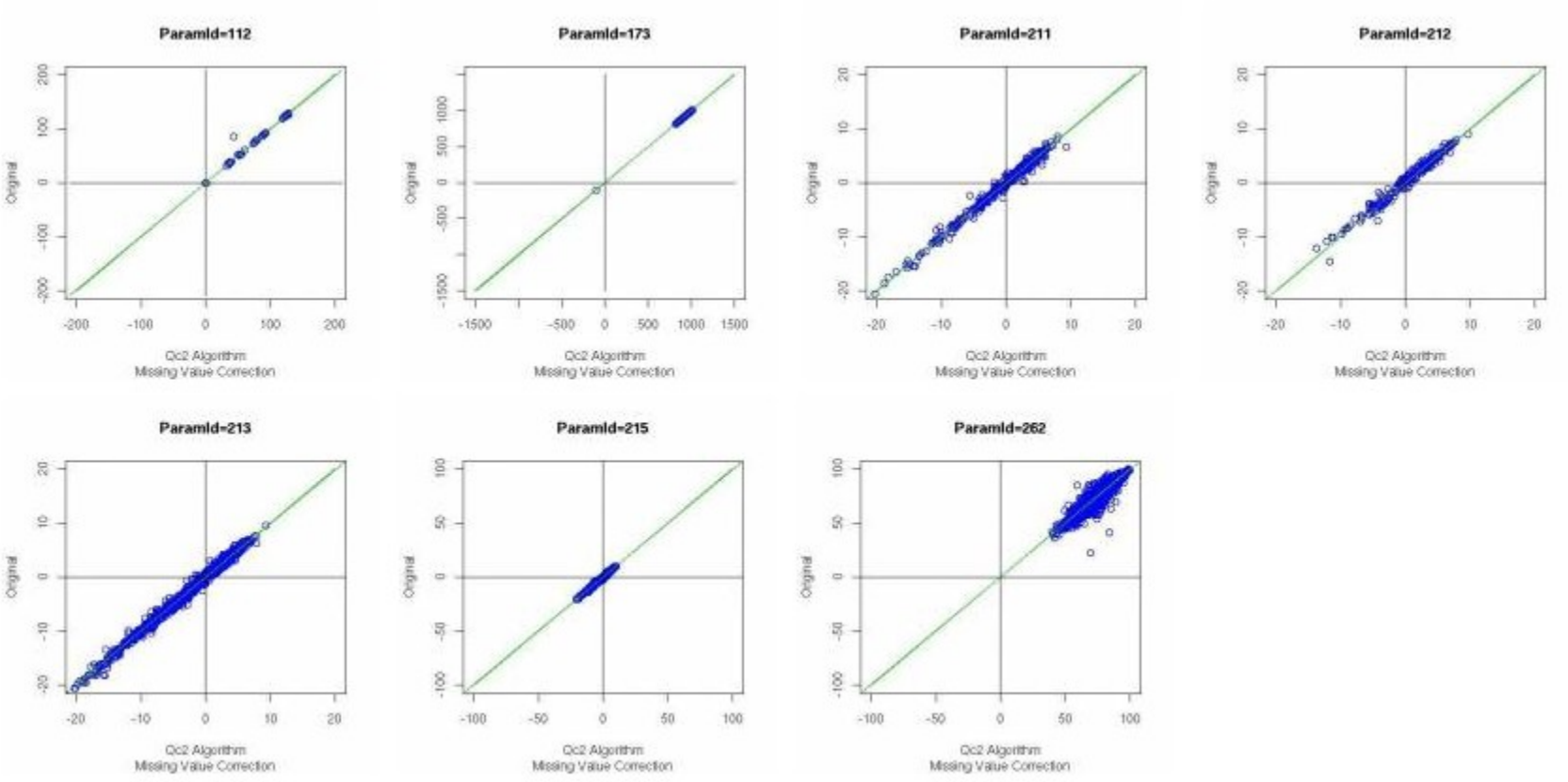
stationid	obstime	original	corrected	controlinfo	useinfo	cfailed
87120	2025-09-17 10:00:00	-32767	-32767	0100003000000000	7899900000000000	
87120	2025-09-17 10:00:00					
87120	2025-09-17 10:00:00	-32767	9.1	0100001100000000	5894900000000000	QC2d-2
87120	2025-09-17 10:00:00					
87120	2025-09-17 10:00:00	-32767	7.3	0100001100000000	5894900000000000	QC2d-2,QC2d-2
87120	2025-09-17 10:00:00					
87120	2025-09-17 10:00:00	-32767	-32767	0100003100000000	5899900000000000	QC2d-2,QC2d-2,QC2d-2

Neighbour Value Changes

Neighbour Quality becomes suspicious

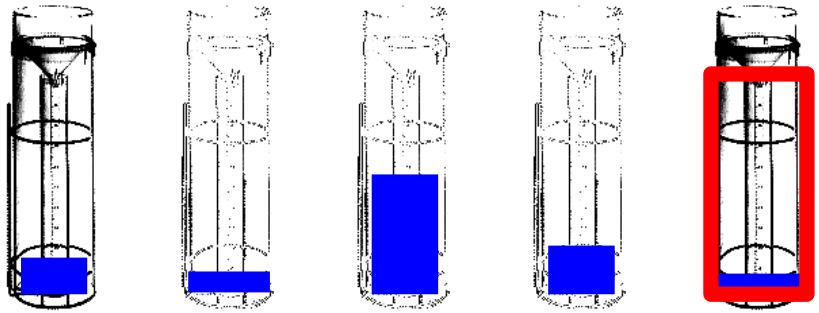
Note: this slides shows the results of an algorithm test where the neighbours used for an interpolation are changed. This is detected and the corrected value is updated by the algorithm

Apply to many parameters:



Algorithms

Redistribution of accumulated precipitation (includes spatial interpolation)



Distribution based on observations at **nearest neighbours**

Future PLans

- ... so far effort has been on bringing QC2 into operations.
- Develop more “controls” as opposed to “corrective functions”
- Improve architecture
  - multi-thread
  - dynamic library of QC2 controls
- Add radar and satellite data
- Once an algorithm is validated no impediment to re-implement

Discussion ...

Thank you!