The use of MARS at Bureau of Meteorology

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Data Assimilation Group

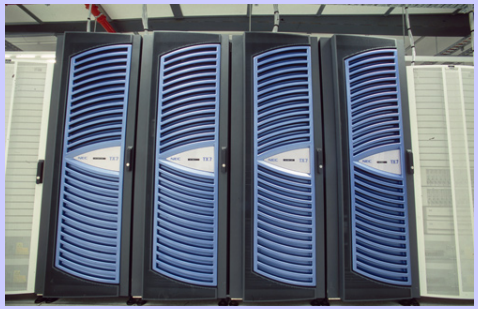
Agenda

- BoM IT infrastructure
- Data management requirements
- MARS

IT infrastructure

- NEC SX6 supercomputer
- HP/IBM mid-range servers
- SAN
- STK SILO (2x5000 cartridges)

HPCCC SX-6



- **28 Nodes (23 for BoM) - 224 processors**
- **112 GBps Bisection Bandwidth**
- **22 TB User Capacity on SX-GFS**
  - **Hosted by 2 x NEC TX7/16 Servers**
- **6 TB Systems Disks Local to Nodes**

BoM Modelling

(Current Operational and Quasi-Operational Systems)

- Short Range
  - TXLAPS PT375L19 Regional 3 day prediction system
  - LAPS PT375L19 Australian Region 3 day prediction system
  - LAPS PT125L19 Australian Region 2 day prediction system
  - MESOLAPS PT05 2 day prediction system
    - Melbourne-Tasmania, Sydney, SE Queensland, Adelaide, Perth
  - TCLAPS PT15 Tropical Cyclone 2 day prediction system
  - AAQFS Australian Air Quality Forecast System
    - Melbourne and Sydney
- Medium Range
  - GASP T239L29 Global 10 day prediction system
  - GASP 33 member T119L19 Ensemble Prediction System

BoM Modelling (2)
(Current Operational and Quasi-Operational Systems)

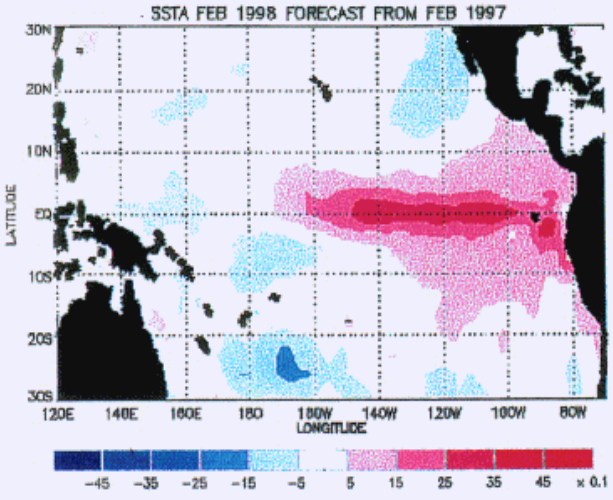
- Seasonal
  - POAMA (Predictive Ocean Atmosphere Model for Australia)
    - coupled atmosphere-ocean 9 month forecast system
    - T47L17 BMRC atmospheric model
    - ACOM-2 (Australian Community Ocean Model 2)
- Decadal and Climate Change
  - AMIP2 (Atmospheric Model Intercomparison Project)
  - CMIP (Climate Model Intercomparison Project)
  - CFMIP (Cloud Feedback Intercomparison Project)
  - C20C (Climate 20th Century International Project)

BoM Modelling (3)

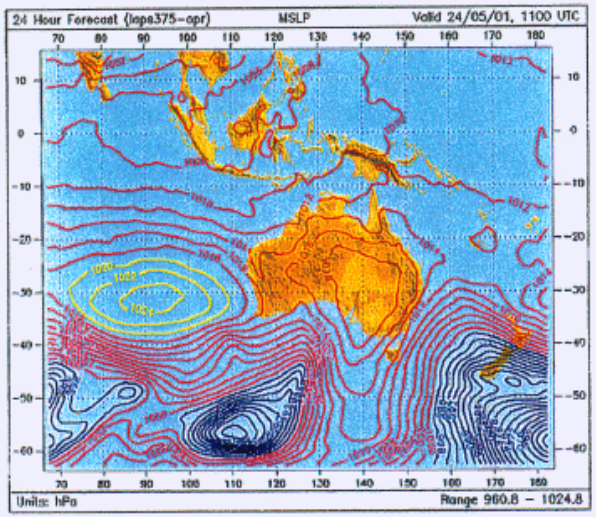
(Current Operational and Quasi-Operational Systems)

- Emergency Response Systems
  - RA V Regional Specialised Meteorological Centre (RSMC)
  - HYSPLIT Version 4 Base
    - Roland Draxler at NOAA's Air Resources Laboratory (Draxler 1997)
    - Contribution from BMRC (Draxler and Hess 1997, 1998).
- WAM - Wave Ocean Model

BMRC Atmospheric Model

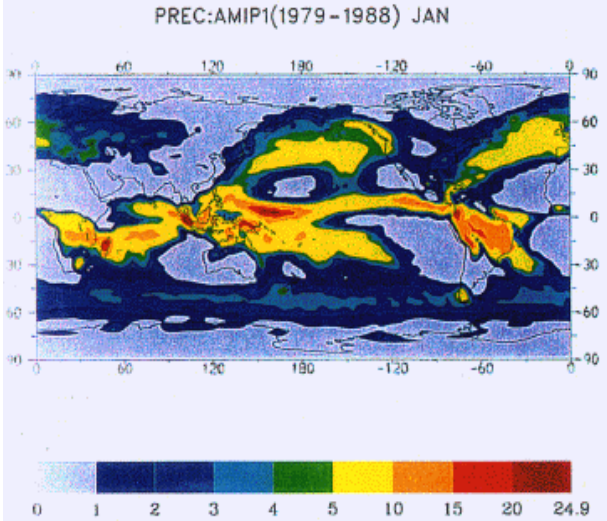


seasonal forecasting
(coupled)

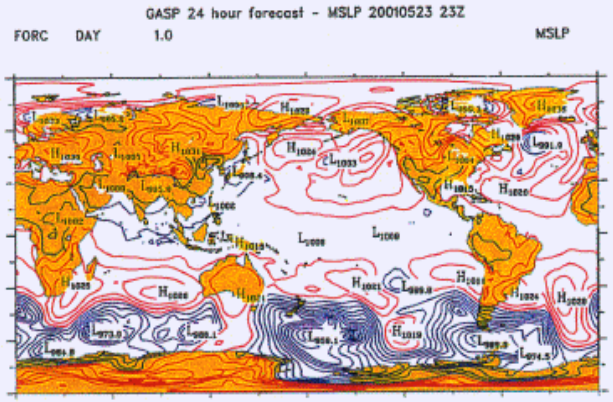


regional forecasting

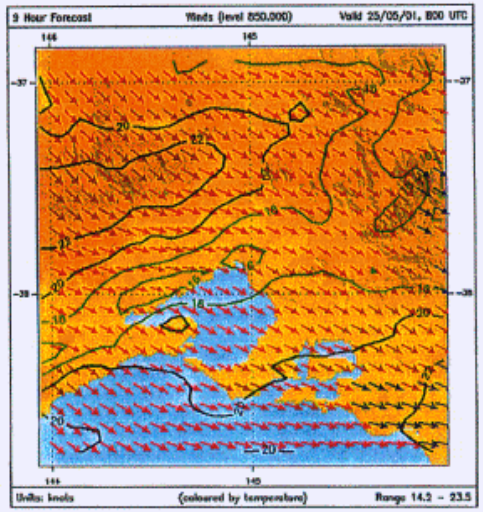
BAM



climate and climate change
(coupled)

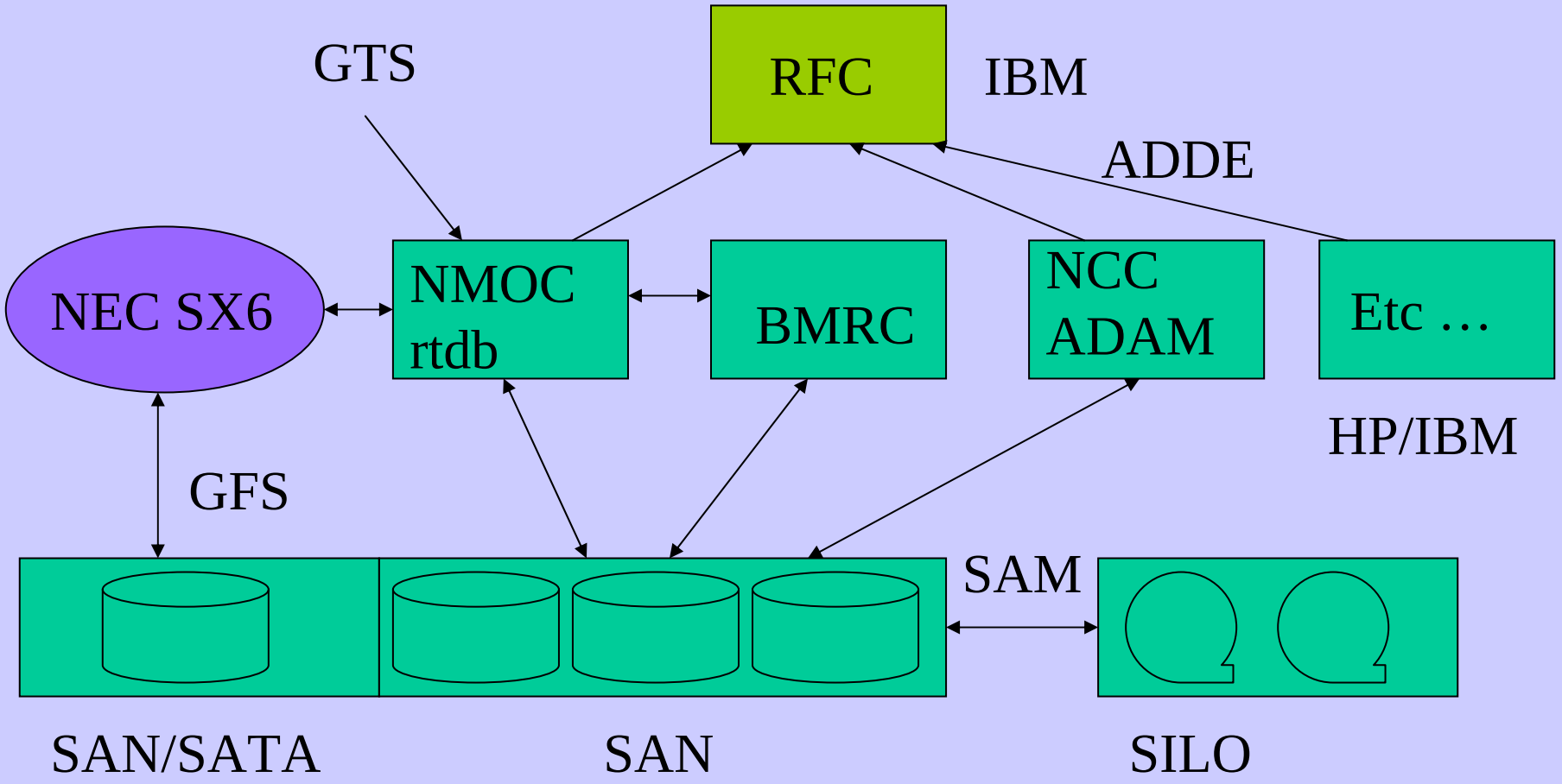


medium range forecasting

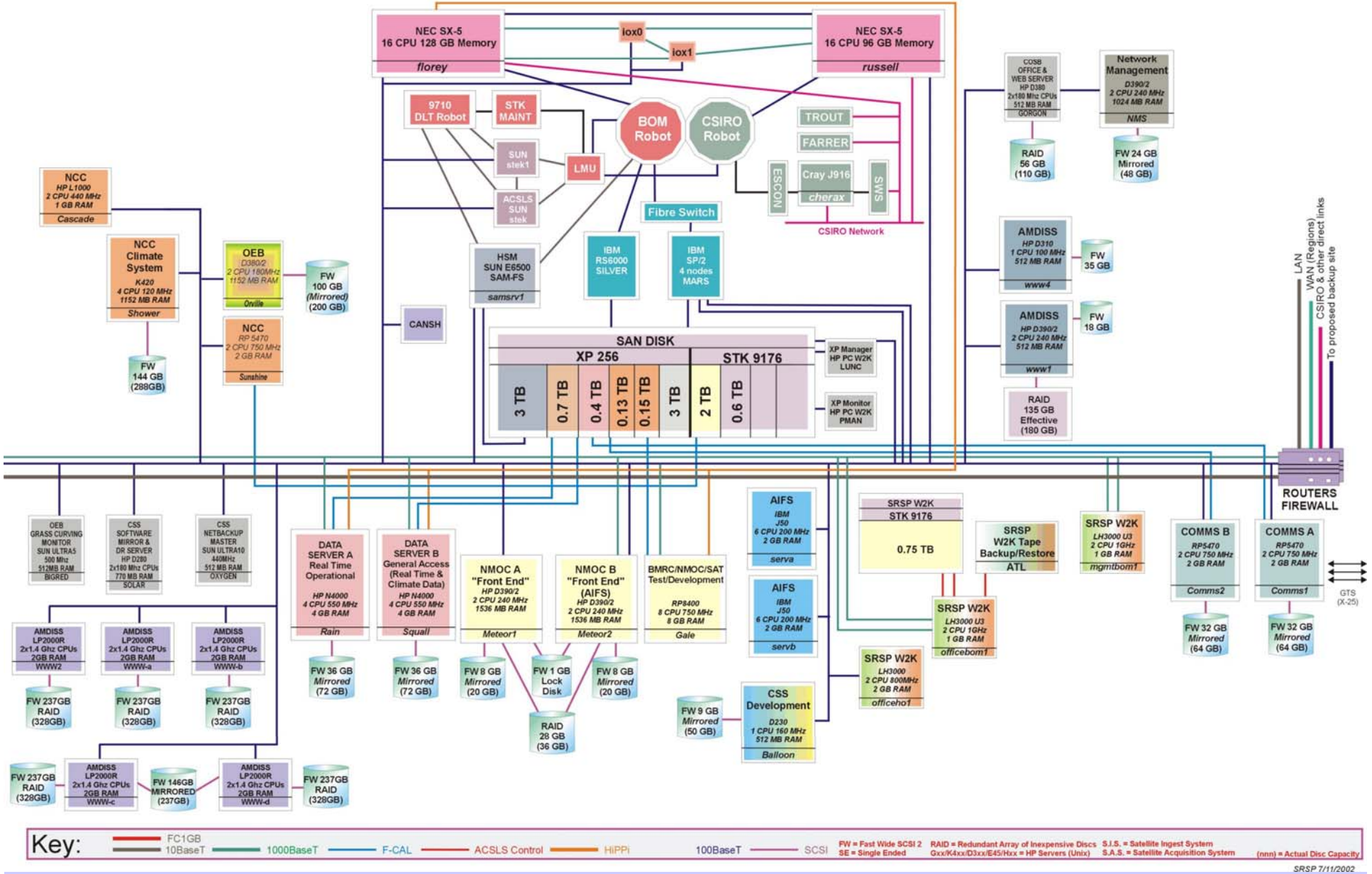


mesoscale forecasting

IT infrastructure



CURRENT CCF SCHEMATIC (CRITICAL SYSTEMS)
OCTOBER 2002 - 150 Lonsdale Street



IT infrastructure

- Independent data management in key divisions
- NMOC: ORACLE/rtdb
- BMRC: SamFS/STK SILO
- NCC: ORACLE/ADAM
- RFCs: rtdb/ADDE
- Etc

Data Management issues

- BMRC perspective
- Rtdb 10-day archiving window not suitable for research and RFC case study
- SamFS not suitable for operational applications
- Desirable to have common data management system for both NMOC and BMRC
- Extending to other Bureau divisions

Data Management requirements

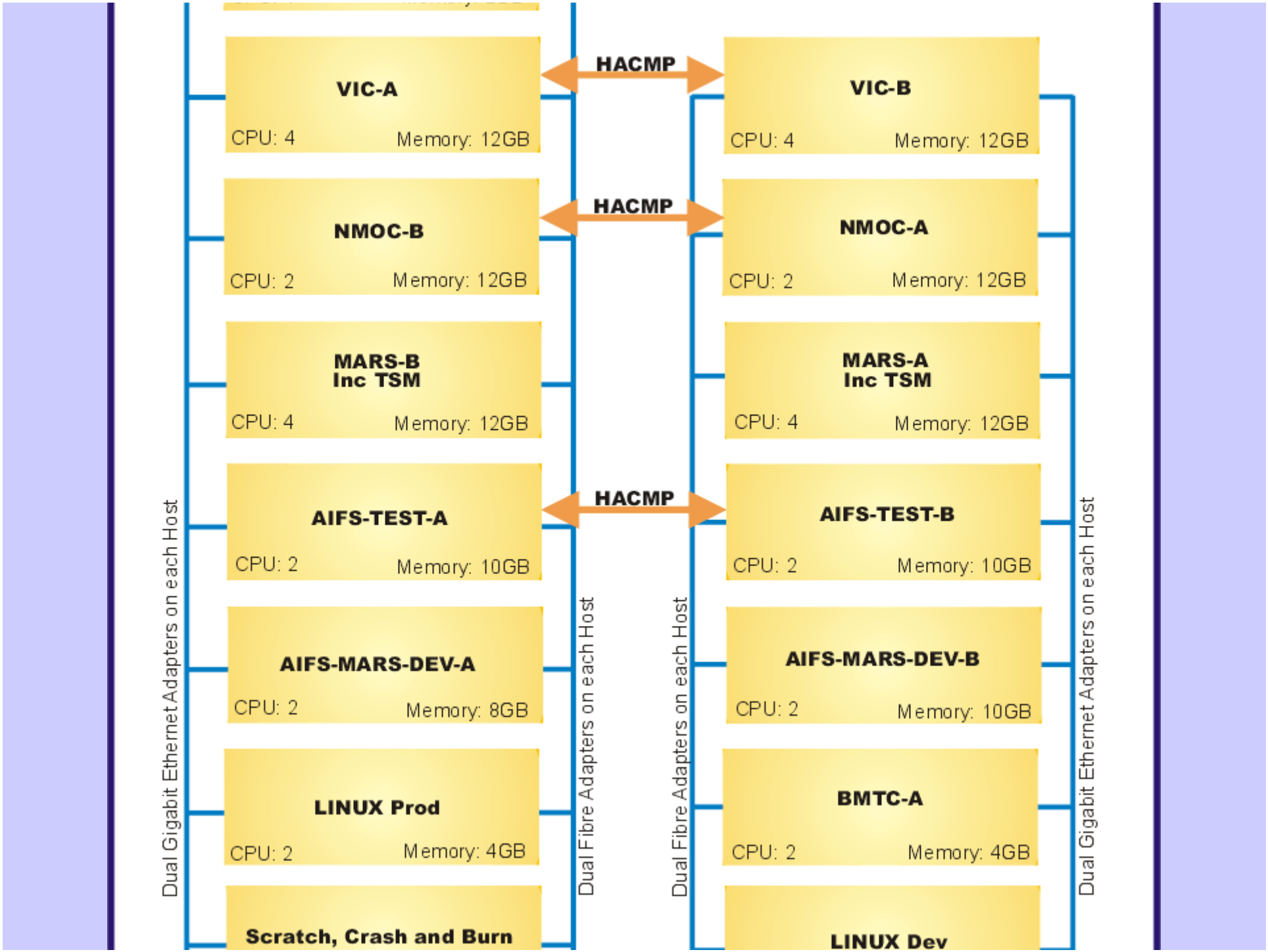
- Seamless access of all data to all users
- Common method in data access
- Minimise data duplication
- Improve data distribution and presentation
- Ensemble products

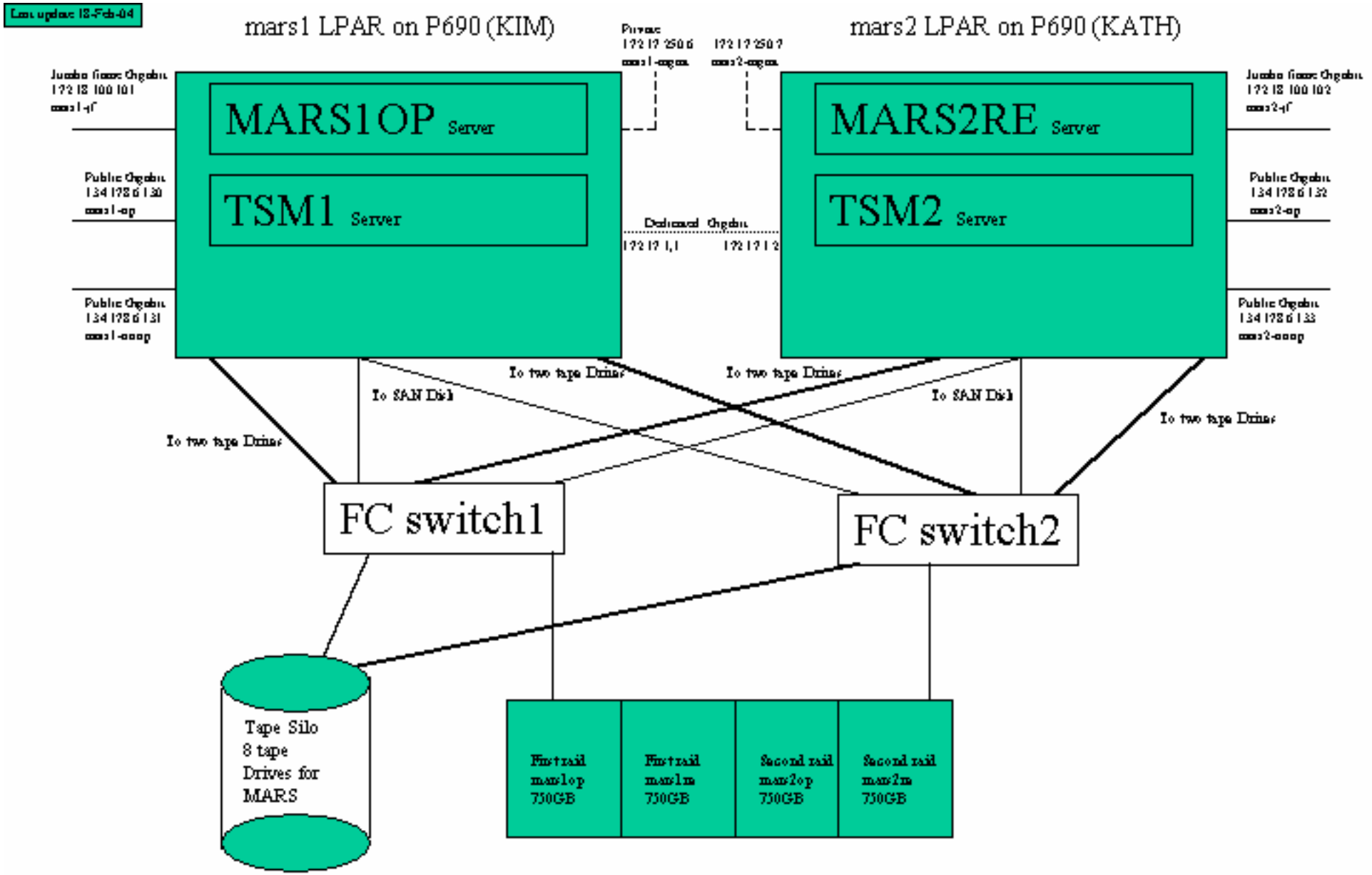
MARS at the Bureau - features

- Location independence
- Data independence
- Seamless, content-based data access
- Multi client/server configuration
- Data subset

MARS at the Bureau - history

- 1997: agreement reached with ECMWF to provide MARS software to the Bureau
- 1998: prototyping on RS6000
- 2000-2004: full implementation on SP2
- 2004-: semi-operational on P690


VIC-A
CPU: 4
Memory: 12GB
HACMP
VIC-B
CPU: 4
Memory: 12GB
NMOC-B
CPU: 2
Memory: 12GB
HACMP
NMOC-A
CPU: 2
Memory: 12GB
MARS-B
Inc TSM
CPU: 4
Memory: 12GB
MARS-A
Inc TSM
CPU: 4
Memory: 12GB
AIFS-TEST-A
CPU: 2
Memory: 10GB
HACMP
AIFS-TEST-B
CPU: 2
Memory: 10GB
AIFS-MARS-DEV-A
CPU: 2
Memory: 8GB
AIFS-MARS-DEV-B
CPU: 2
Memory: 10GB
LINUX Prod
CPU: 2
Memory: 4GB
BMTC-A
CPU: 2
Memory: 4GB
Scratch, Crash and Burn
LINUX Dev
Dual Gigabit Ethernet Adapters on each Host
Dual Fibre Adapters on each Host
Dual Fibre Adapters on each Host
Dual Gigabit Ethernet Adapters on each Host



MARS at 700 Collin Street

MARS strategies at the Bureau

- Minimal changes
  - Configurations
  - GRIB/BUFR definitions for local data
- Clients on key Bureau systems
- Utility programs
  - Data format conversion
  - Interface to local software systems
  - Support for research archive

MARS at BoM – utility programs

- Data format conversion
  - NetCDF ⇐=> GRIB
  - Box/HDF ⇐=> BUFR
- Local tables
  - GRIB Ids
  - BUFR subtypes
- Research experiment DB

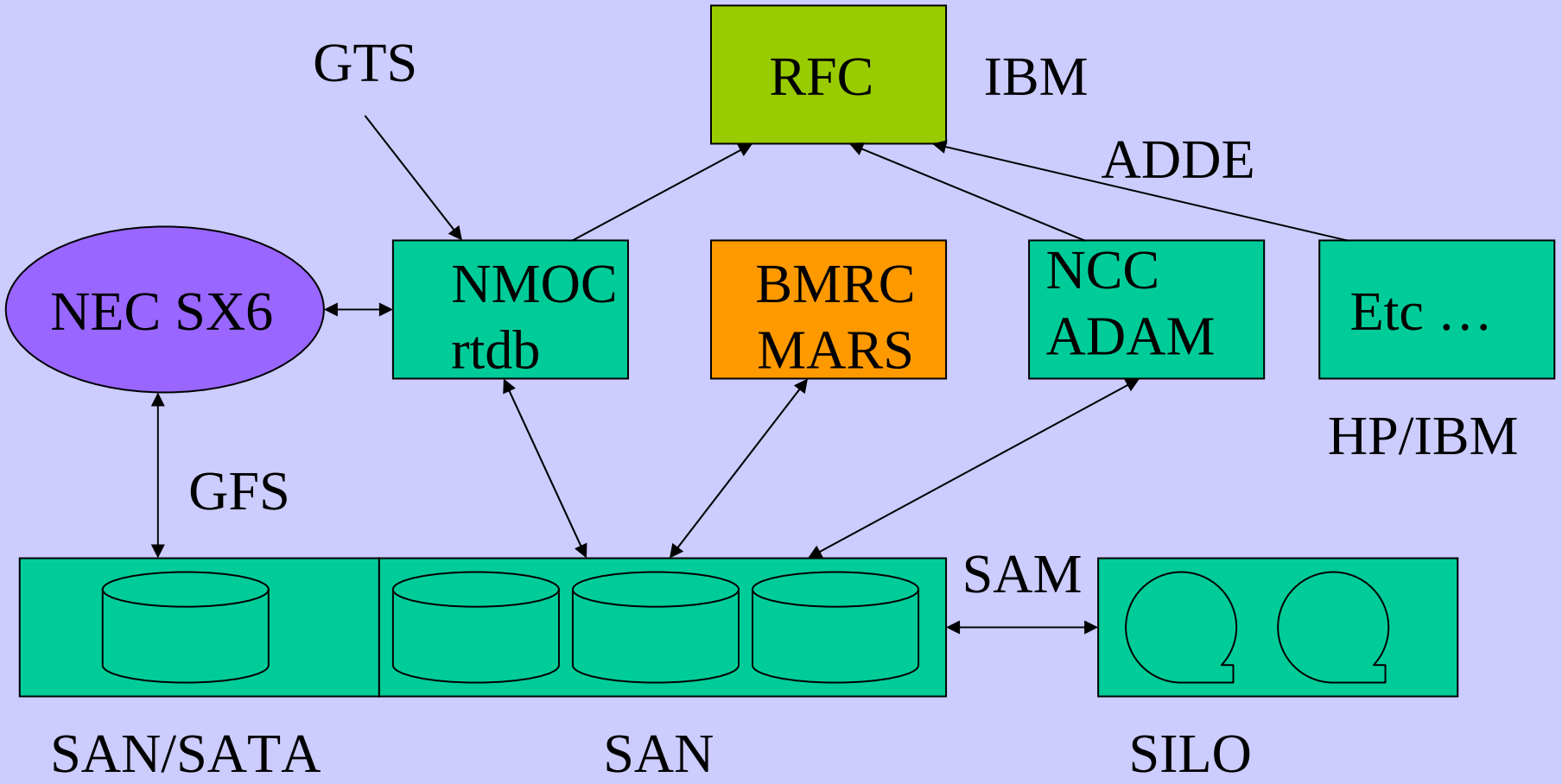
008g

```
008g  jzp

Wed Aug 24 14:41:41 2005
========================



Wed Aug 24 14:47:44 2005
========================

008g - experiment L33check
The same as L33e6fixml (007b) but with
NEWSIG_TYP = 'replic'   ! replicate model levels
NEWSIG__NPBL = 8        ! number of levels to replica
NEWSIG_ZS = 200         ! only do if model levels > 7

This is an attempt to fix crashes due to crazy extra
strong inversions over antarctic.
```

MARS at the Bureau - data

- NWP models (raw + post-processed)
  - GASP/LAPS (+ ensembles)
  - MesoLAPS
  - Overseas models
  - Research
- Oceanographic
- Observations
- ERA40/TOGA

MARS at the Bureau



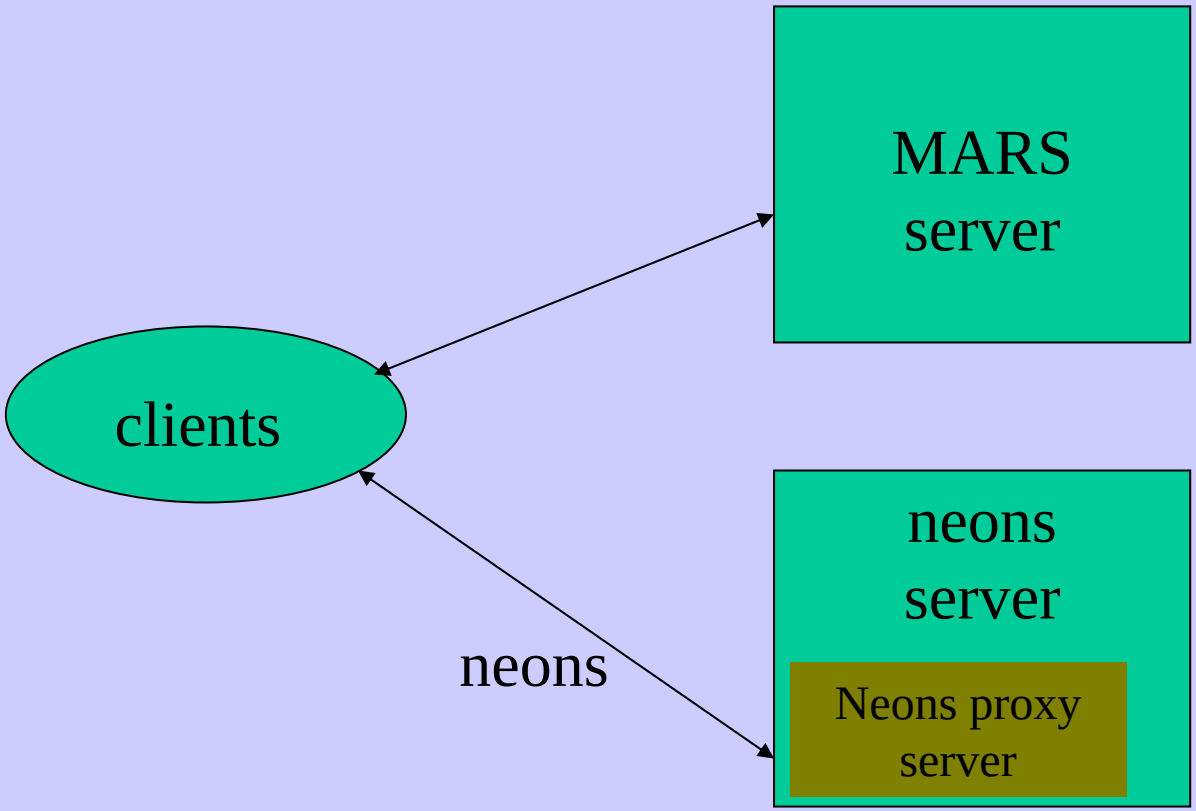
MARS at the Bureau

- One more data archive
- Mixture of data in SamFS and rtdb
- Seamless access
- Interactive/batch/web access
- Integration into other Bureau’s systems
- Framework for unified data access

Neons/rtdb interface - NMOC

- Neons/ORACLE proxy server
- Utilising generic open/read/write/close methods in MARS client software
- Additional keywords/values
- Handles both gridded and obs data
- Neons gridded data ⇐=> GRIB

Neons/rtdb interface



Neons/rtdb interface

```
Retrieve,
    Database        = neons,
    Stream          = GASP,
    Dbgeom          = global_181x360,
    …
    Param           = T,
    Levtype         = HT_SFC,
    Levelist        = 2
```

rtdb catalogue

- ECSP
- FIRE_WEATHER
- GASP
- GASP2
- GASPFG
- GASPFG2
- GEXM
- JMAGSM
- LAPS_PT375
- LAPS_PT375_TEST
- MESO_LAPS_PT050
- MESO_LAPS_PT125
- METANAL
- RAINANAL
- SST
- TCLAPS
- TXLAPS_ANAL
- TXLAPS_ATEST
- TXLAPS_PT375
- TXLAPS_TEST
- UKGC
- USAVM
- WAM

Intended MARS usage

- ORACLE/rtdb to be operated as is, ie. With 10 days time window
- ORACLE/rtdb is efficient for the receiving of
    - _ obs
    - _ overseas model data in segments
- Data to be aged off to MARS
- Seamless and unified access to current and historical data
- ORACLE usage under review

McIDAS interface for Regional Forecast Centres

- MARS client imbedded in Mcidas ADDE server
- Modifications to

  Configuration files

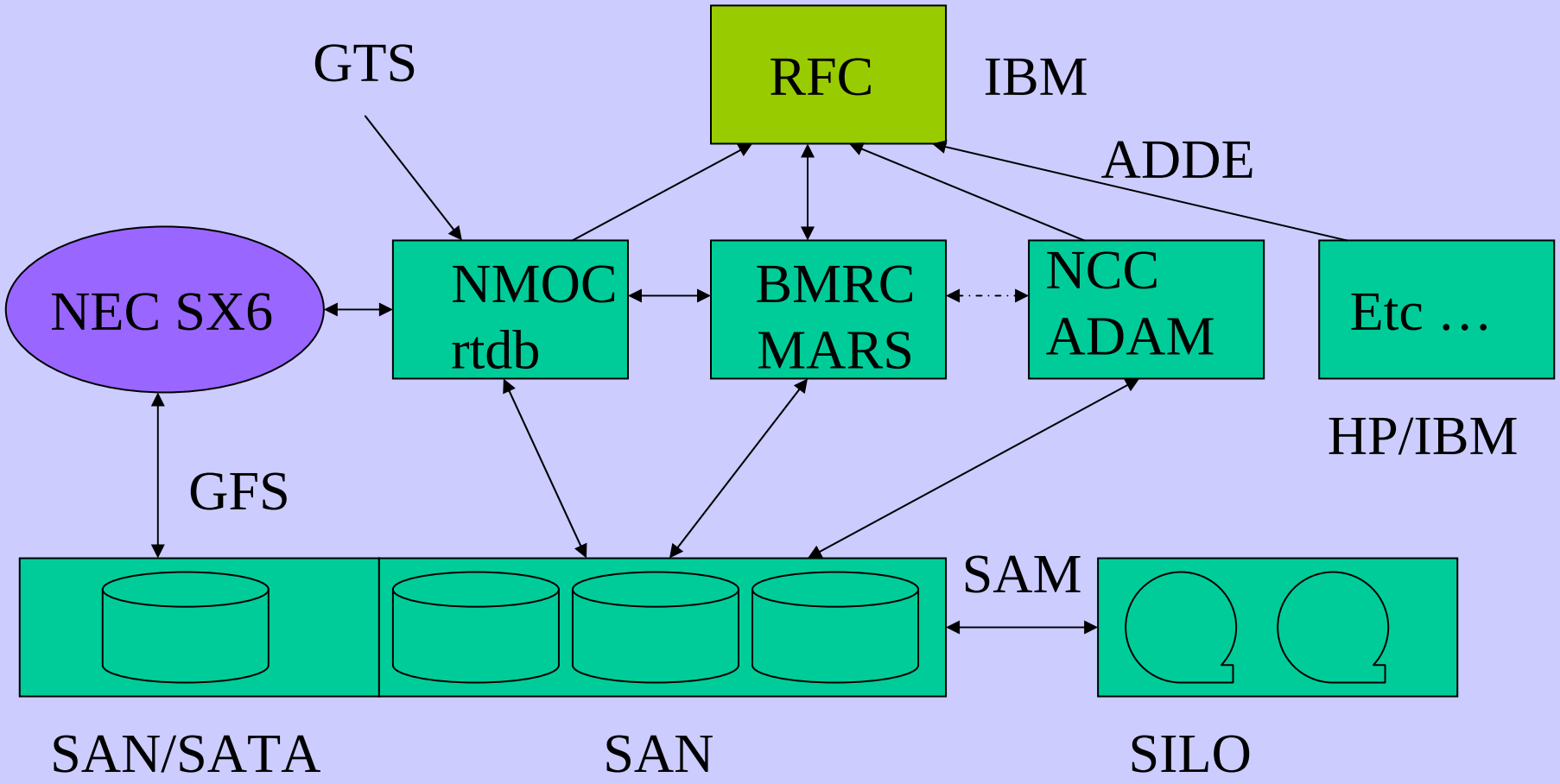
  GRIB to Mcidas file format conversion

GRDDISP MARSA/GASP_AN PAR=T LEV=1000

MARS interface to post-processing package

```
TITLEA  = 'Bureau of Meteorology  -  NMOC GASP T239L33 FORECAST'
TYPEA   = 'MARS'
TAPESA  = 'operations'
STREAMA  = 'GASP'
EXPVERA = 1
BDATEA  = 20050108
BTIMEA  = 00
OFFSETA = 0.
FIELDA1 = 'MSLP','THICK'
SUBPA   = 1,5
DERFLD  = 'THICK',41,0,3,0,'HT','.LEVEL02',
                'HT','.LEVEL01',':MINUS',10.0,':DIVIDE','.END'
HPOVLY1 = 'MSLP','THICK'
HPCINT  = 'MSLP',1000.,4.,'THICK',1000.,4.
HPROJ   = 'LC'
ENDOFDATA
```

SamFS interface – for BMRC

- SAM proxy server for gridded model data
- No demand

MARS at BoM – current status