Proceedings of the 12th EGOWS meeting
11 – 14 June 2001 at MeteoSwiss, Zurich, Switzerland

Participants

Lastname	Firstname	Affiliation	City
Ambrosetti	Paolo	MeteoSvizzera	Locarno-Monti
Brun	Eric	Météo-France	St-Martin d'Hères
Commins	Kieran	Met Eireann	Dublin
Csekits	Christian	Zentralanstalt fuer Meteorologie und Geodynamik (ZAMG)	Wien, Oesterreich
Daabeck	Jens	ECMWF	Reading
Dennerstedt	Kjell	Swedish Armed Forces Weather Service	Storvreta
Favre	Jean Michel	Centro Svizzero di Calcolo Scientifico (CSCS)	Manno
Foreman	Steve	UK Met Office (UKMO)	Bracknell
Gowland	Antony	UK Met Office (UKMO)	Bracknell
Grote	Uwe	NOAA/FSL	Boulder
Hanson	Christopher	EUMETSAT	Darmstadt
Haucke	Sibylle	Deutscher Wetterdienst (DWD)	Potsdam
Heizenreder	Dirk	Deutscher Wetterdienst (DWD)	Offenbach
Huber	Susanne	MeteoSwiss	Zurich
Jacobsson	Caje	Swedish Meteorological and Hydrological Institute (SMHI)	Stockholm-Arlanda
Jobard	Bruno	Centro Svizzero di Calcolo Scientifico (CSCS)	Manno
Kilpinen	Juha	Finnish Meteorological Institute (FMI)	Helsinki
Kjaer	Ove	Danish Meteorological Institute (DMI)	Copenhagen
Kling	Kees	KNMI	Almere
Koppert	Hans-Joachim	Deutscher Wetterdienst (DWD)	Offenbach
Korsmo	Helen	Norwegian Meteorological Institute (DNMI)	Oslo
Koza	Benny	Danish Meteorological Institute (DMI)	Copenhagen
Kristufek	Zdenek	Czech Hydrometeorological Institute (CHMI)	Prague
Larsson	Anders	Swedish Meteorological and	Norrköping

		Hydrological Institute (SMHI)	
Maresca	Giovanni	Italian Air Force Meteorological Service (CNMCA)	Pomezia
Pesata	Karel	Czech Hydrometeorological Institute (CHMI)	Prague
Robinson	Shelley	UK Met Office (UKMO)	Bracknell
Schulze	Juergen	Norwegian Meteorological Institute (DNMI)	Oslo
Spaniel	Oldrich	Slovak Hydrometeorological Institute	Bratislava
Stoll	Magali	Météo-France	Toulouse
Strajnar	Uros	Hydrometeorological Institute of Slovenia	Ljubljana
Stroh	Karl-Wilhelm	German Military Geophysical Office (GMGO)	Traben-Trarbach
Tamayo	Jorge	INM	Valencia
Thomas	Stéphane	Météo-France	Toulouse
Trevelyan	Peter	UK Met Office (UKMO)	Bracknell
Voidrot	M-Francoise	Météo-France	Toulouse
Voisard	Christophe	MeteoSchweiz	Zurich
de Morsier	Guy	MeteoSwiss	Zurich
de Vreede	Ernst	KNMI	De Bilt

Conference programme
Abstract are plain text, Proceedings in pdf format

	Monday 11. June 2001	
09:00 -09:45	Registration and coffee	
09:45	Opening of the meeting	Chairman P. Ambrosetti
09:45 -10:00	Welcome address	D. Keuerleber, Director MeteoSwiss
10:00 -10:45	Keynote J.M. Favre and B. Jobard, CSCS Proceeding	J.M. Favre / B. Jobard, CSCS
10:45 -11:00	General information	M. Arpagaus (MeteoSwiss)
	Session 1: Visualization	Chairman P. Ambrosetti
11:00 -11:30	Recent Developments of Workstation software at FMI Proceeding	J. Kilpinen (FMI)
11:30 - 2:00	Recent Developments at INM Abstract	J. Tamayo (INM)
12:00 -12:30	Recent Developments in Visualisation Technique at Italian Met Service Proceeding	G. Maresca (CNMCA)
12:30 -14:00	Lunch	
	Session 2: Recent developments	Chairman G. de Morsier
14:00 -14:30	Magics and Metview (ECMWF) Proceeding	J. Daabeck (ECMWF)
14:30 -15:00	Nowcasting Modules at the Austrian Meteorological Service (ZAMG) Proceeding	Ch. Csektis (ZAMG)
15:00 -15:30	KNMI's Graphical Interaction Projects Abstract	D. Blaauboer (KNMI)
15:30 -16:30	Install SW for Demonstration	
16:30 -	Ice Breaker	
	Tuesday 12. June 2001	
	Session 3: New Plans	Chairman J. Kilpinen
09:00 -09:30	Operational and Planned Java Applications at DWD Proceeding	H. Koppert (DWD)
09:30 -10:00	Synergie 3.4 Release and Future plans Abstract	M.F. Voidrot (Météo-France)
10:00 -10:30	Progress of Operational IT Systems Proceeding	S. Foreman (UK Met Office)

10:30 -11:00	Coffee Break and Group Photo	
11:00 -11:30	Linux based Weather Forecasting System for the NWS Proceeding	U. Groote (NOAA/FSL)
11:30 -12:00	Modernisation of the Workstation at KNMI	K. Kling (KNMI)
12:00 -12:30	Visualisation in Swedens new Joint Technical System (SMHI & Armed Forces Weather) Abstract	K. Dennerstedt (SMHI)
12:30 -14:00	Lunch	
14:00 -17:00	Demonstration session/Visit of Forecasting room	
	Wednesday 13. June 2001	
	Session 4: Production	Chairman J. Daabeck
09:00 -09:30	Production Tools Orientations in Météo-France Abstract	M. Stoll (Météo-France)
09:30 -10:00	SPOT - System for Production and Monitoring TAF Proceeding	O. Kjaer (DMI)
10:00 -10:30	TIPS 4-6 Status and Functionality (DNMI) Abstract	J. Schulze (DNMI)
10:30 -11:00	Coffee Break	
11:00 -12:30	Workshop in three groups	
12:30 -14:00	Lunch	
14:00 -16:30	Demonstration session/Visit of Forecasting room	
16:30 -	Social Event	
	Thursday 14. June 2001	
	Session 5: Miscellaneous	Chairman J. Daabeck
09:00 -09:30	A Data Warehouse System for the Meteorological Data of MeteoSwiss Abstract	Ch. Häberli (MeteoSwiss)
09:30 - 10:00	Operational Applications Related to the Local Model at MeteoSwiss Abstract	G. de Morsier (MeteoSwiss)
10:00 -10:30	Horace User Services (UK Met Office) Abstract	S. Robinson (UK Met Office)
10:30 -11:00	Coffee Break	
11:00 -12:00	Reports of the working groups, plenar discussion	Chairman S. Foreman
12:00	Closure of the meeting	Chairman P. Ambrosetti

Advanced techniques for flow visualization on dense numerical grids

Jean Favre & Bruno Jobard
Scientific Visualization Group
Swiss Center for Scientific Computing
{jfavre, bjobard}@cscs.ch
www.cscs.ch

Abstract

Numerical vector fields represent an important component of flow simulations. In meteorology for example, the wind's direction and velocity play an important role to understand the characteristic of a forecast. Traditionally, vector arrows are displayed at the locations of the grid points. This technique, trivial to implement suffers from a lot of limitations (regular sampling, grid density, large dynamic range all introduce artifacts). Streamlines representing the instantaneous directions of the flow can also be used, but they are difficult to place and interpret. For example, the visual effect can be disappointing because of divergence in the field. We will review these problems, and introduce the most recent flow visualization techniques producing effective renderings of flow fields. Enhanced placement of arrows and streamlines are performed to automatically improve static representations. The availability of fine-grain numerical outputs (e.g. Swiss Model of grid resolution of 7 kms) motivates the use of dense representations, computed with texture-based techniques. Recent developments allow the creation of animations of textures, clearly showing the evolution of time-dependent vector fields. These animations are easily shared and remotely visualized on the Web.

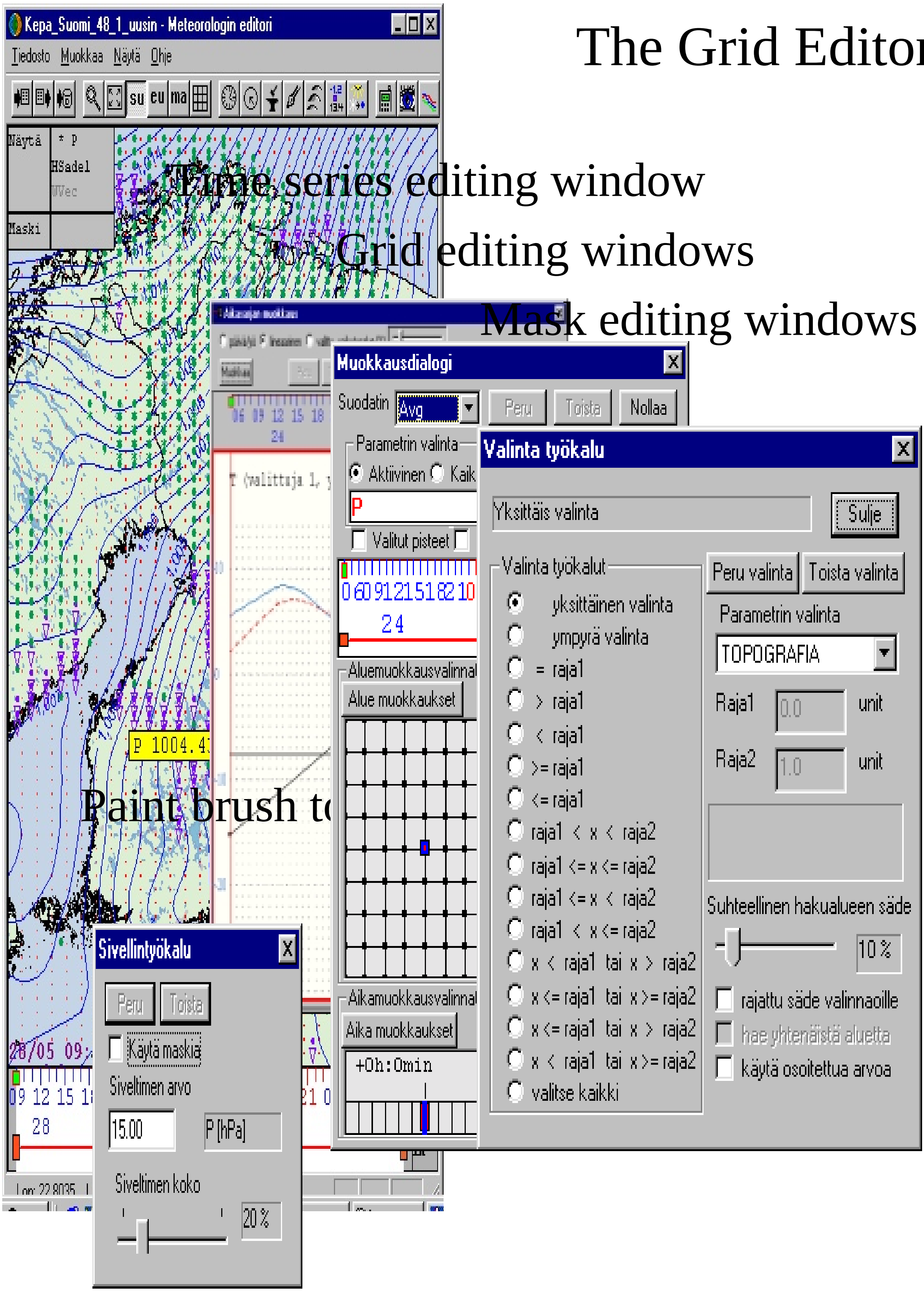
The Grid Editor

Time series editing window

Grid editing windows

Mask editing windows

Paint brush t

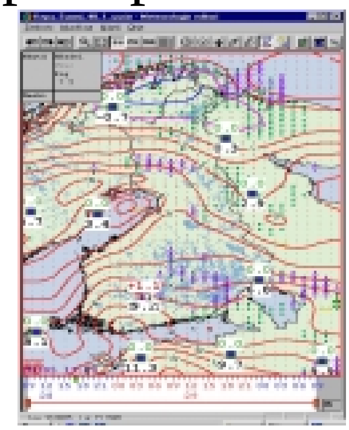


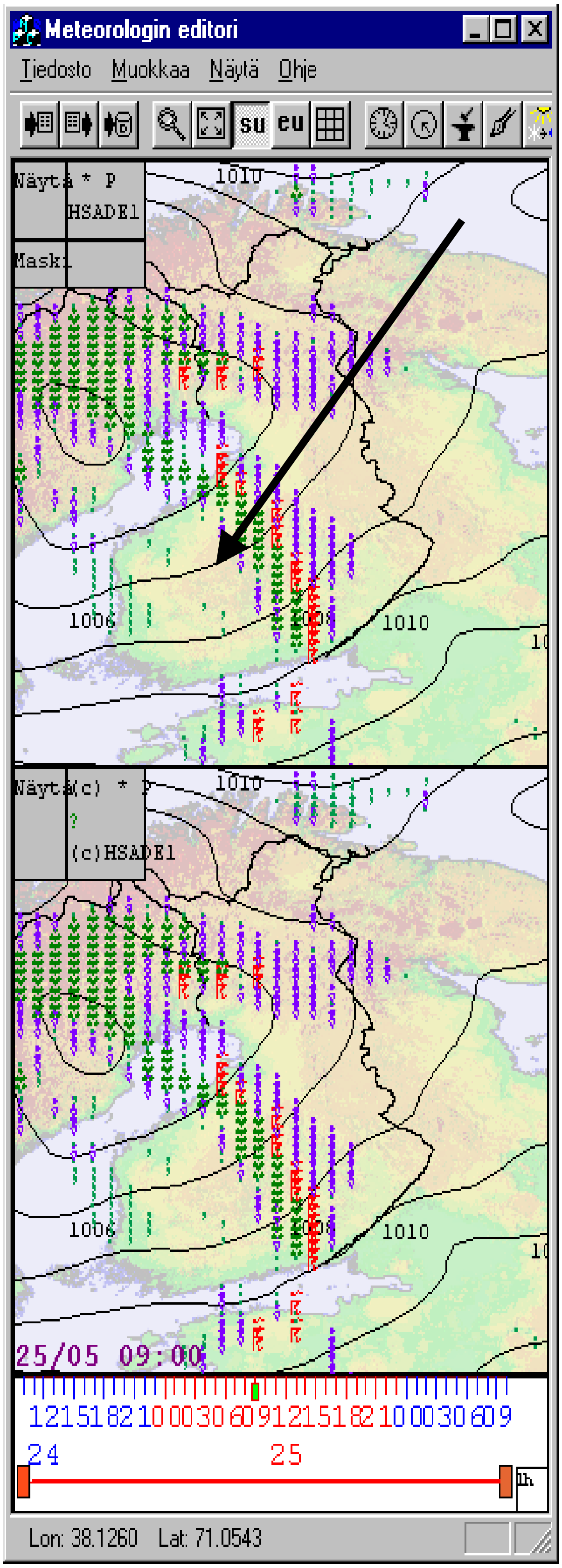
The Grid Editor

- Hourly data from Finland and a dozen of parameters (any areas possible)
- The idea of the editor is to edit time-series of different variables using masks or combinations of masks
- Different masks like topography, land/sea distribution, distance from coast etc. are combined with the actual variables

- Control point editing; a new feature

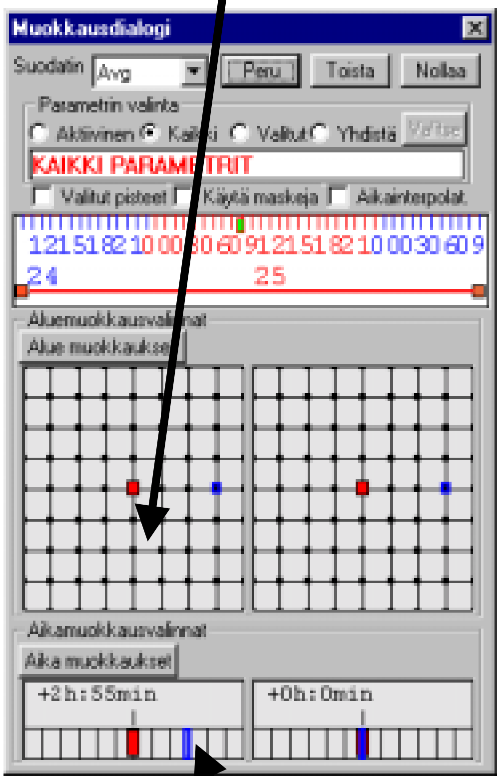
- Smoothing and time shifting features
- Combination or radar precipitation and model output data





Area editing:

the whole grid can be moved to any direction (at the beginning and ant the end); smoothing also available

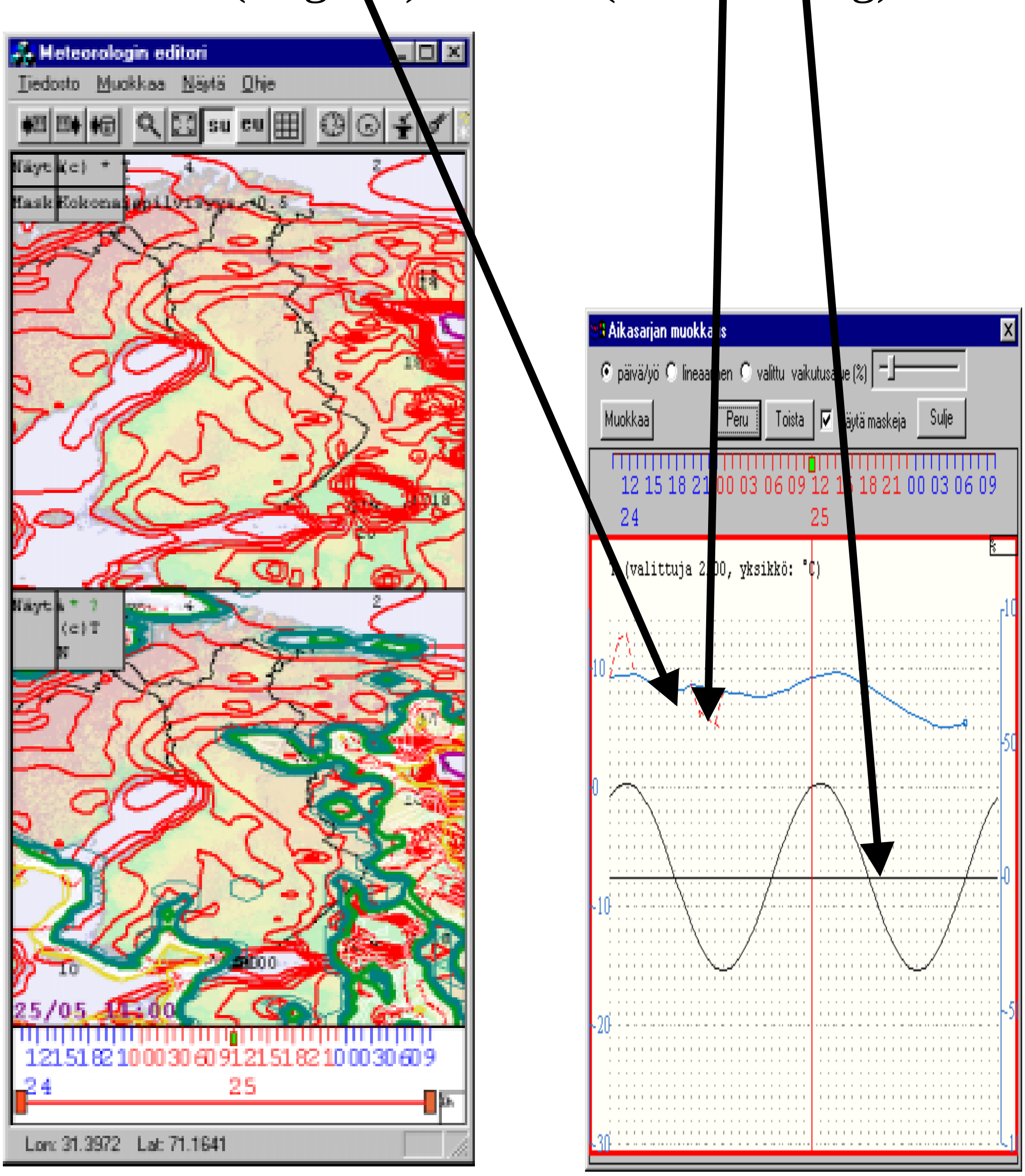


Time editing:

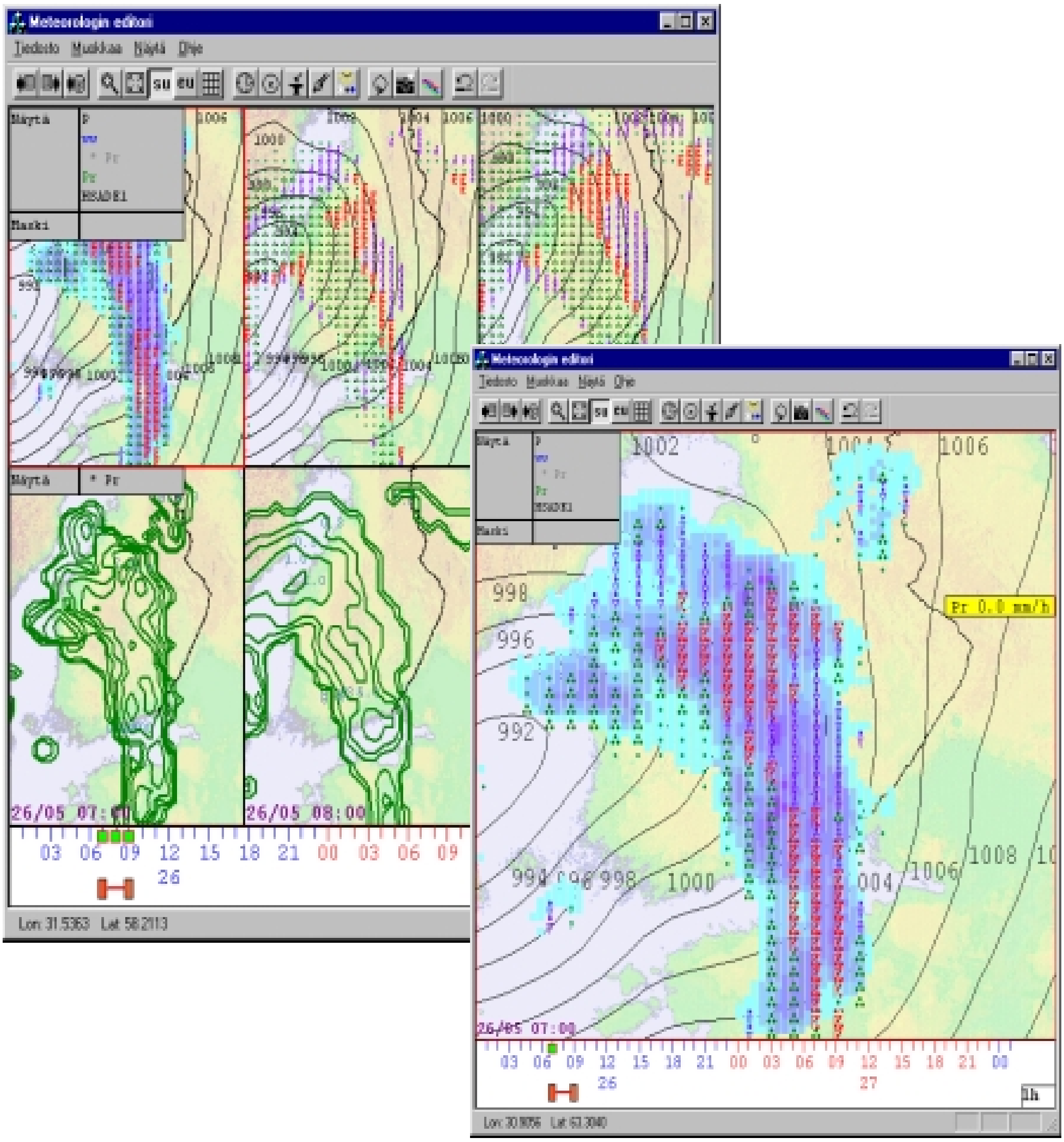
the whole data or individual variables can be moved in time; also smoothing in time available

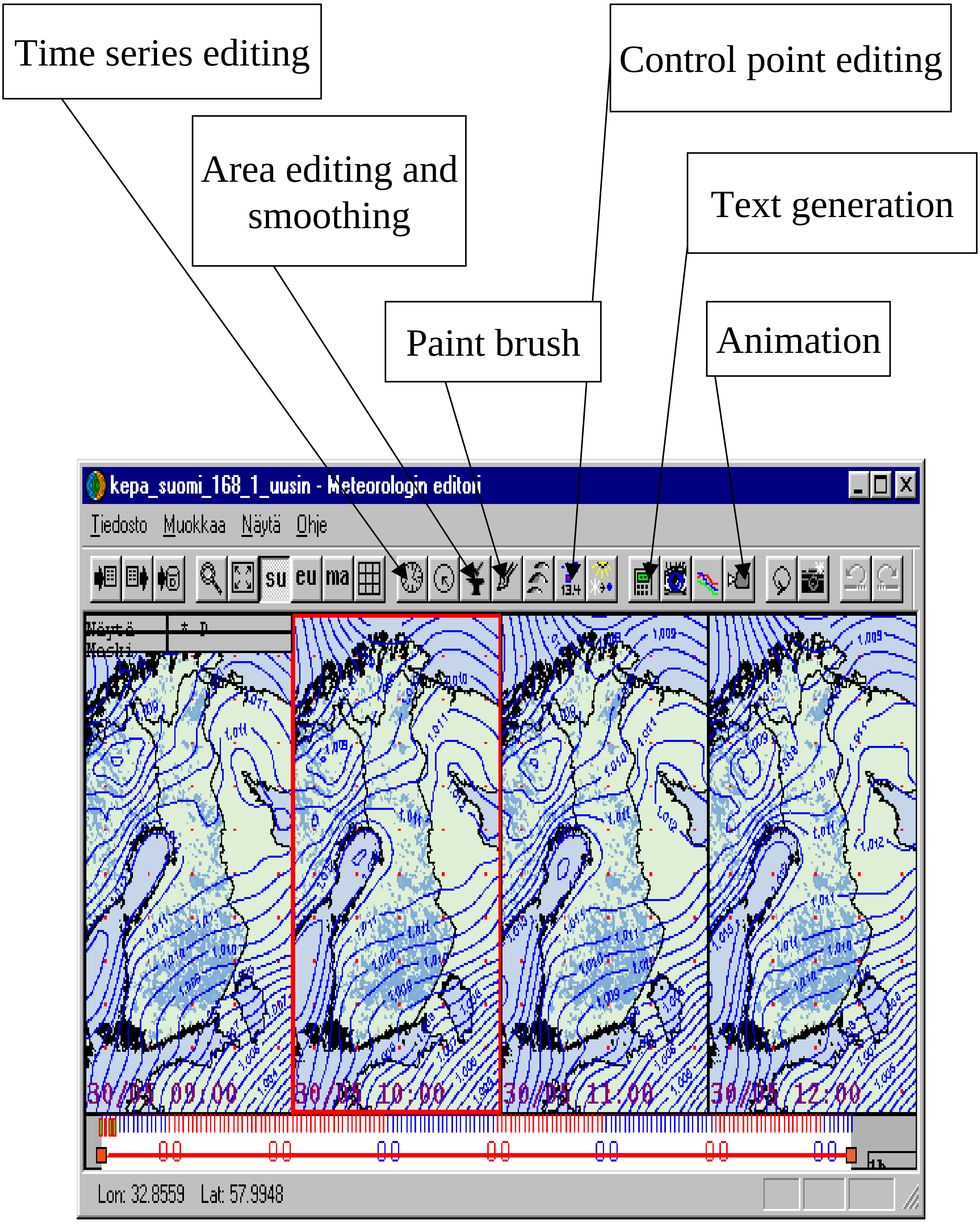
Time series editing:

a mask of cloudiness less than 5 octas has been chosen to increase the temperature on daytime and decrease the temperature during night (black curve), blue (original) and red (after editing).

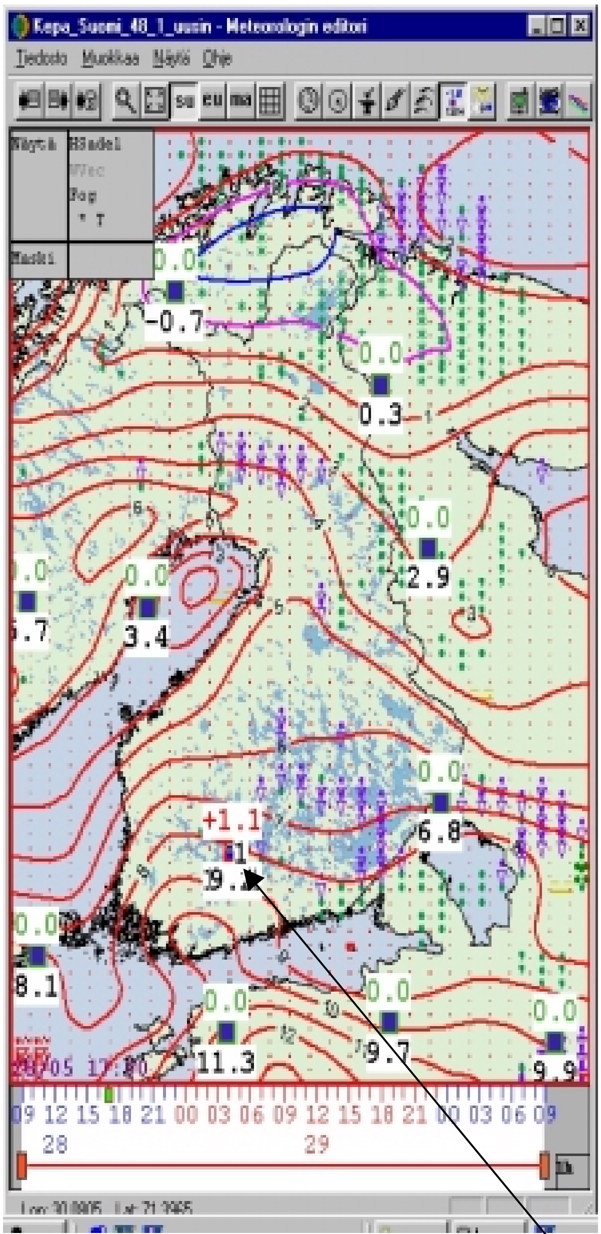


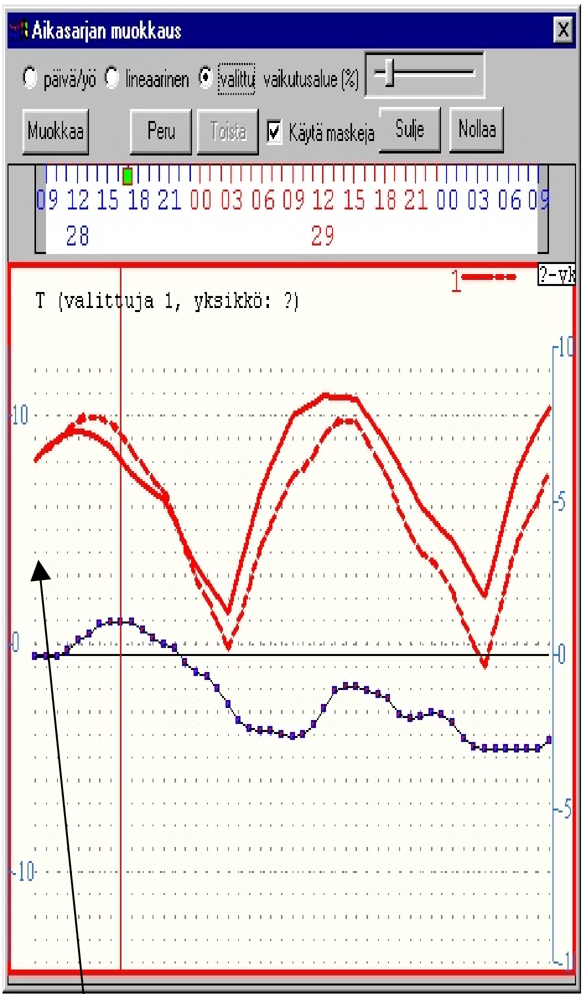
Example: Combining of model data and radar data




Time series editing
Control point editing
Area editing and smoothing
Text generation
Paint brush
Animation
kepa_suomi_168_1_uusin - Meteorologin editori
Tiedosto Muokkaa Näytä Ohje
su eu ma
30/05 09.00
30/05 10.00
30/05 11.00
30/05 12.00
Lon: 32.8559 Lat: 57.9948

Control point editing tool



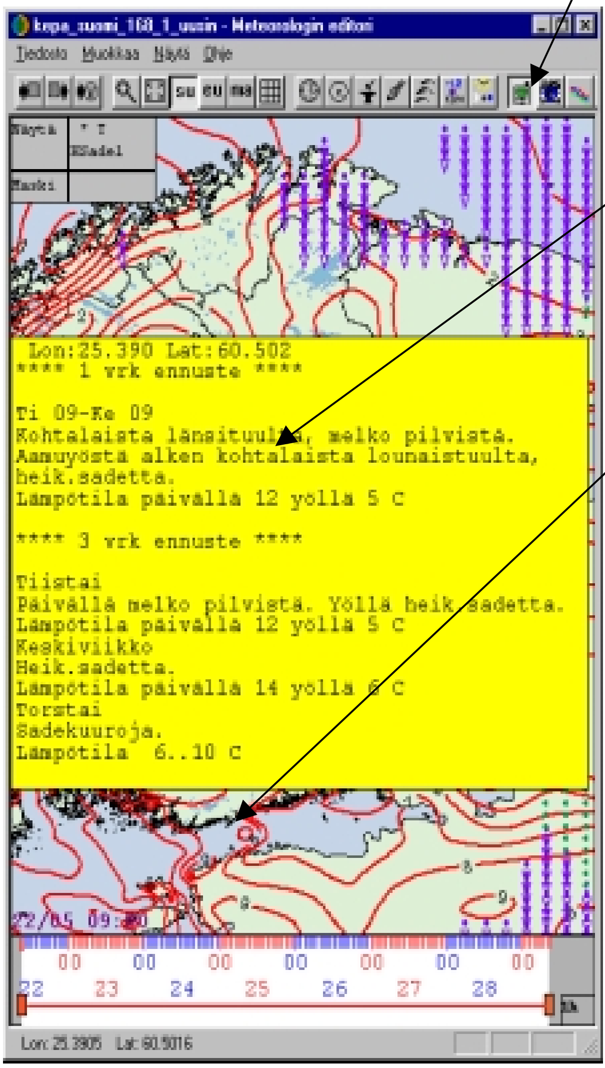


The time series of control points can be edited in detail before interpolation

The new text generation tool

Text generation tool:

Forecaster can see his edited data in text form. The 1 day and 3 day forecasts are shown from the location pointed by mouse and time window.

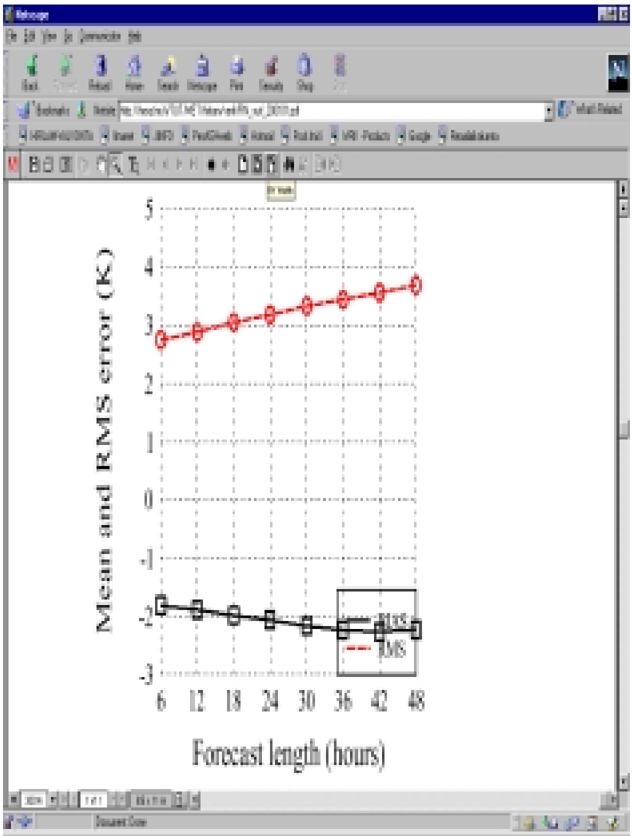


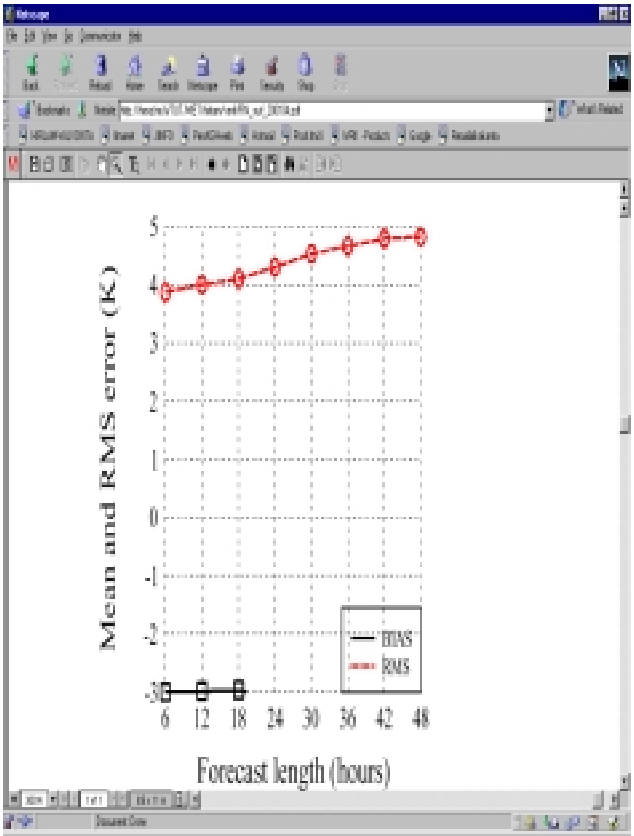
Verification results

- HIRLAM model had problems last winter
- ECMWF data was not available in 3 hour interval before March 2001 at FMI databases
- Forecasters were able to increase the quality of HIRLAM but did not reach the quality of ECMWF (temperature)
- Forecasters were not able to reach the quality of HIRLAM’s cloudiness forecasts (?)
- Now postprocessing of HIRLAM has been developed (PPM and MOS) to avoid the problems next winter

Verification results

- HIRLAM model had problems last winter





Jan 2001 Apr 2001

Verification results

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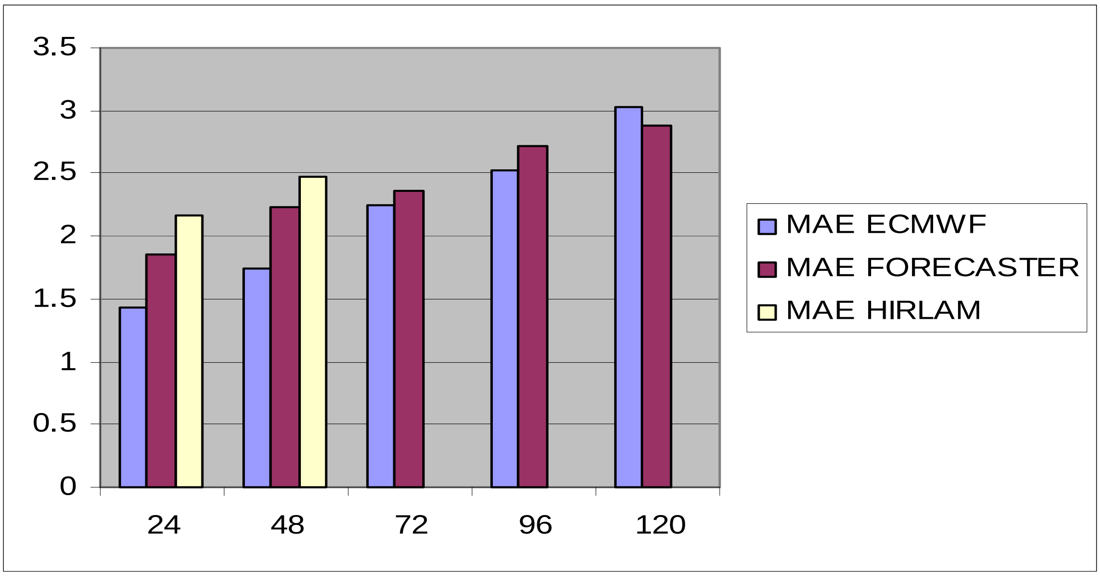
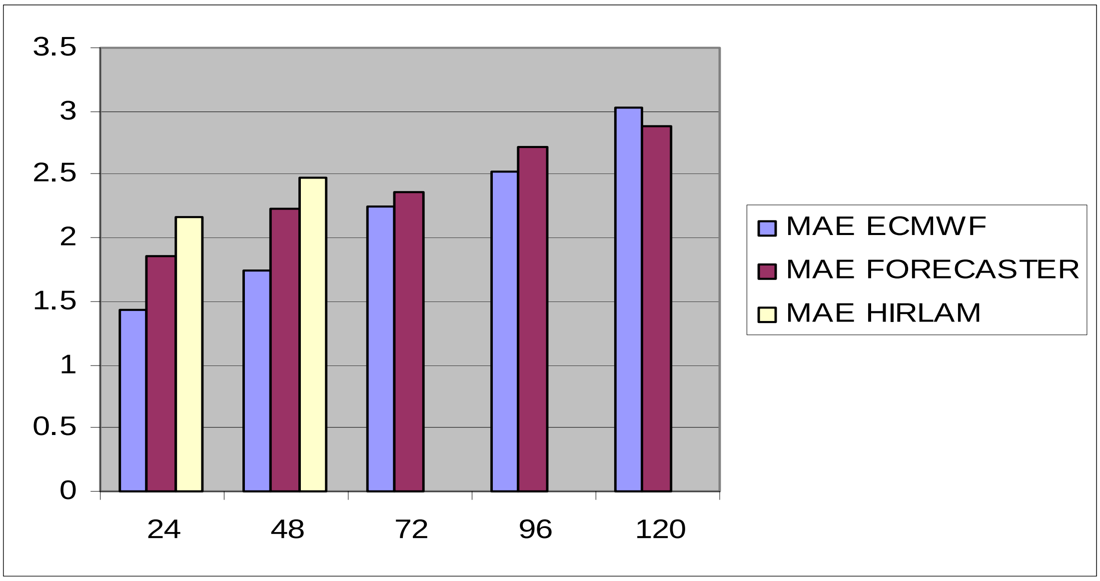
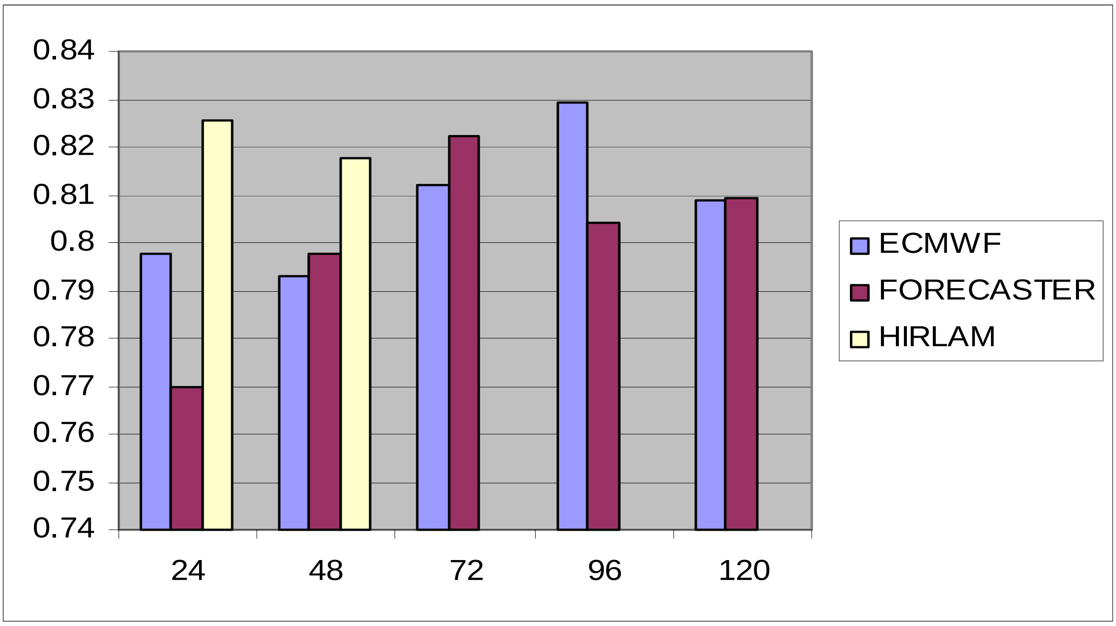


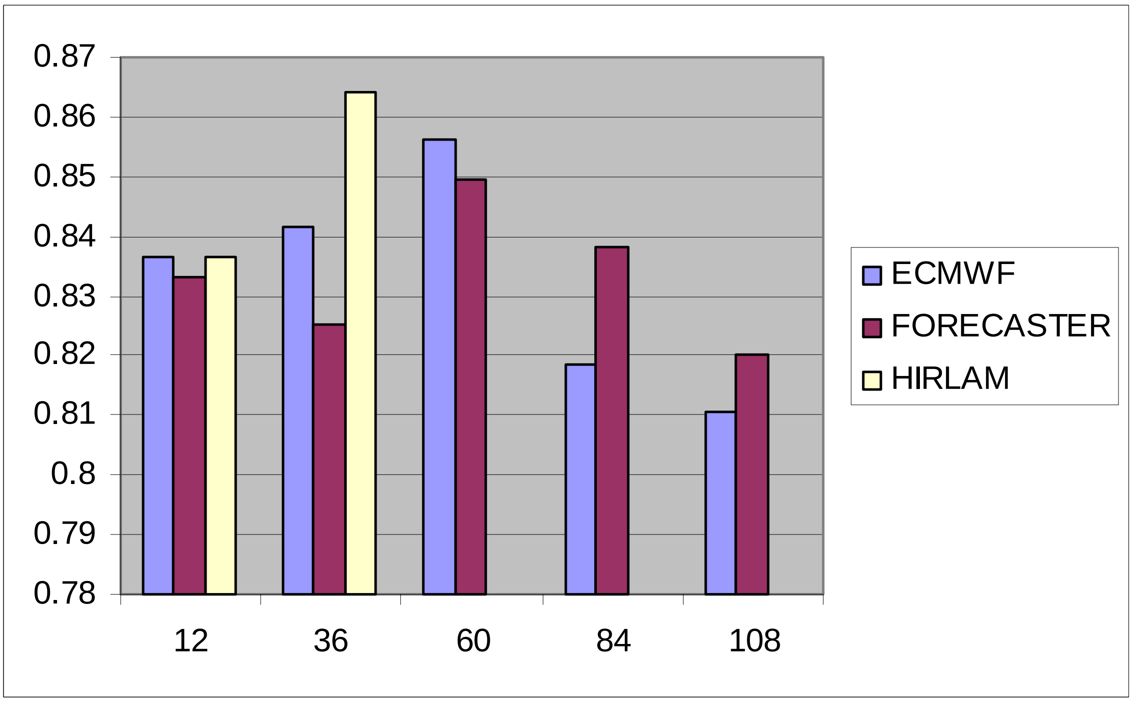
Mean Absolute Error of
Temperature forecasts
(12UTC)
About 120 cases/5 stations



Mean Absolute Error of
Temperature forecasts
(00UTC)



Hit rate of
Cloudiness forecasts
(12UTC)



Hit rate of
Cloudiness forecasts
(00UTC)

Verification results

- All these problems forced us to generate an alternative way to produce initial data for editing

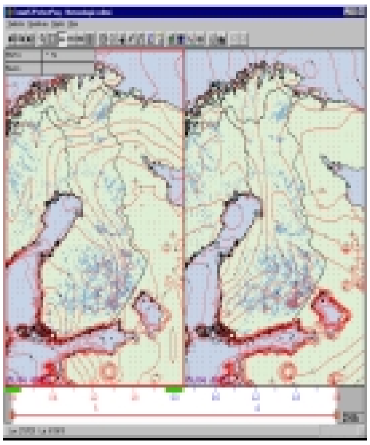
→ New postprocessing of HIRLAM has been developed

  → PPM for temperature (also min/max) and ground temperature (Tg)

  → MOS for temperature (also min/max) and ground temperature (Tg)

  → (also for ECMWF data)

- all in grid form



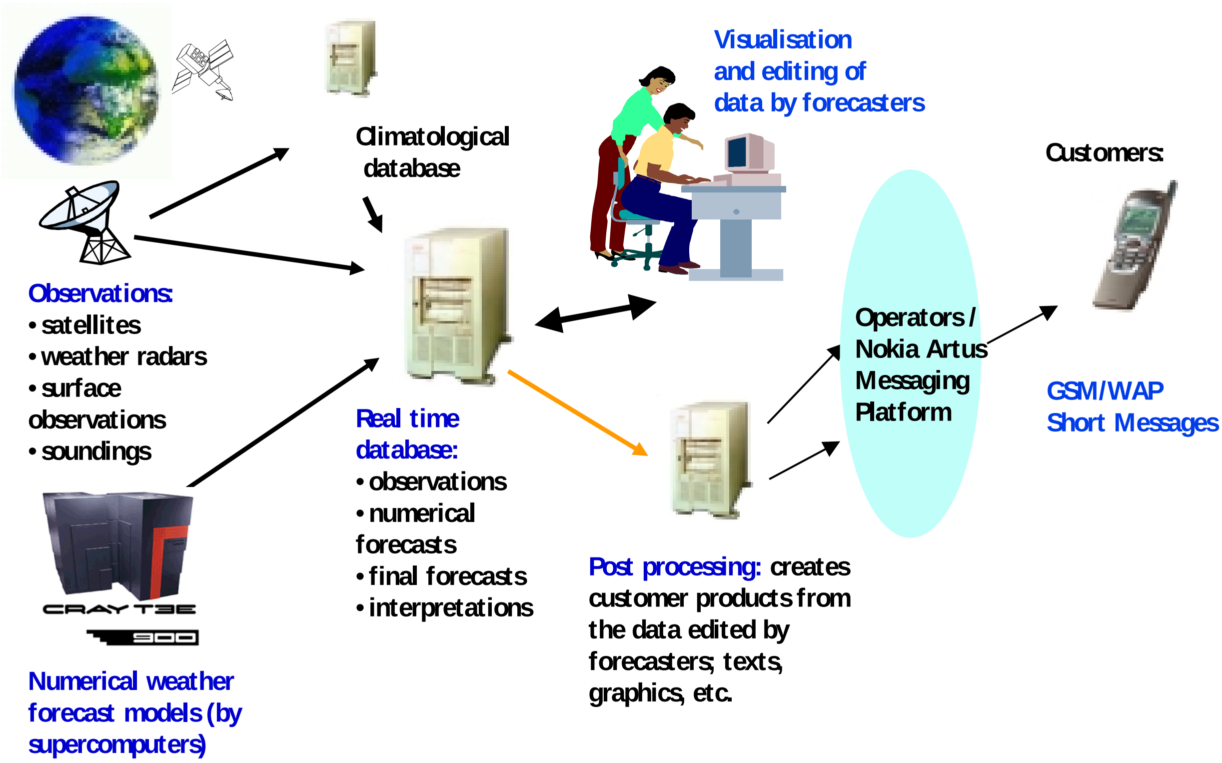
Re-engineering of the editor and the architecture

- The editor is too complicated for most forecasters
- The fields have to be edited after every new HIRLAM run (many fields are biased) and there was too much repeated work for forecasters
- Intelligent editing tools (with scripts and macro's) will be created (controlled by forecasters) and pre-processing for the fields will be made on the server side before editing (this idea is implemented also in GFE/IFPS)
- These changes make the GUI more easy for the forecaster
- Part of the code within the editor has to be moved to server side and major changes have to be made in object libraries

New mobile weather services

- About 10 operator customers for WAP and SMS in Finland
- About 10 WAP pilots outside Finland (a dozen of languages supported)
- A location based pilot weather service (network based navigation)
- WAP test with GPRS (GSM)
- WAP tests with TETRA (Professional Mobile Radio for rescue and other authorities)
- Pilot applications in 3G (EPOC)
- A new warning service: any kind of personalised weather warnings based on real time data

The system behind Mobile Weather



fetch.dat

```
<?xml version="1.0"?>
<!DOCTYPE wml PUBLIC "-//WAPFORUM//DTD WML 1.1//EN"
  "http://www.wapforum.org/DTD/wml_1.1.xml">

<wml>
<template ontimer="MainInformation.wml">
    <do type="options" name="Home" label="FMI" ><go href="Main.wml"/></do>
    <do type="prev"> <prev/> </do>
</template>

<card id="card1" ontimer="#card2" >
<timer value="20"/>
<p>
F I N N I S H <br/>
METEOROLOGICAL <br/>
I N S T I T U T E <br/>
</p>
</card>

<card id="card2" title="Finnish Met. Institute">
<p>
    <anchor>UK<go href="FmiUK.wml"/></anchor><br/>
    <anchor>Europe<go href="FmiEurope.wml"/></anchor><br/>
    <anchor>World<go href="FmiWorld.wml"/></anchor><br/>
    <anchor>Special<go href="FmiSpecial.wml"/></anchor><br/>
    <anchor>Information<go href="MainInformation.wml"/></anchor>
</p>
</card>


</wml>
```

Ln 1, Col 1

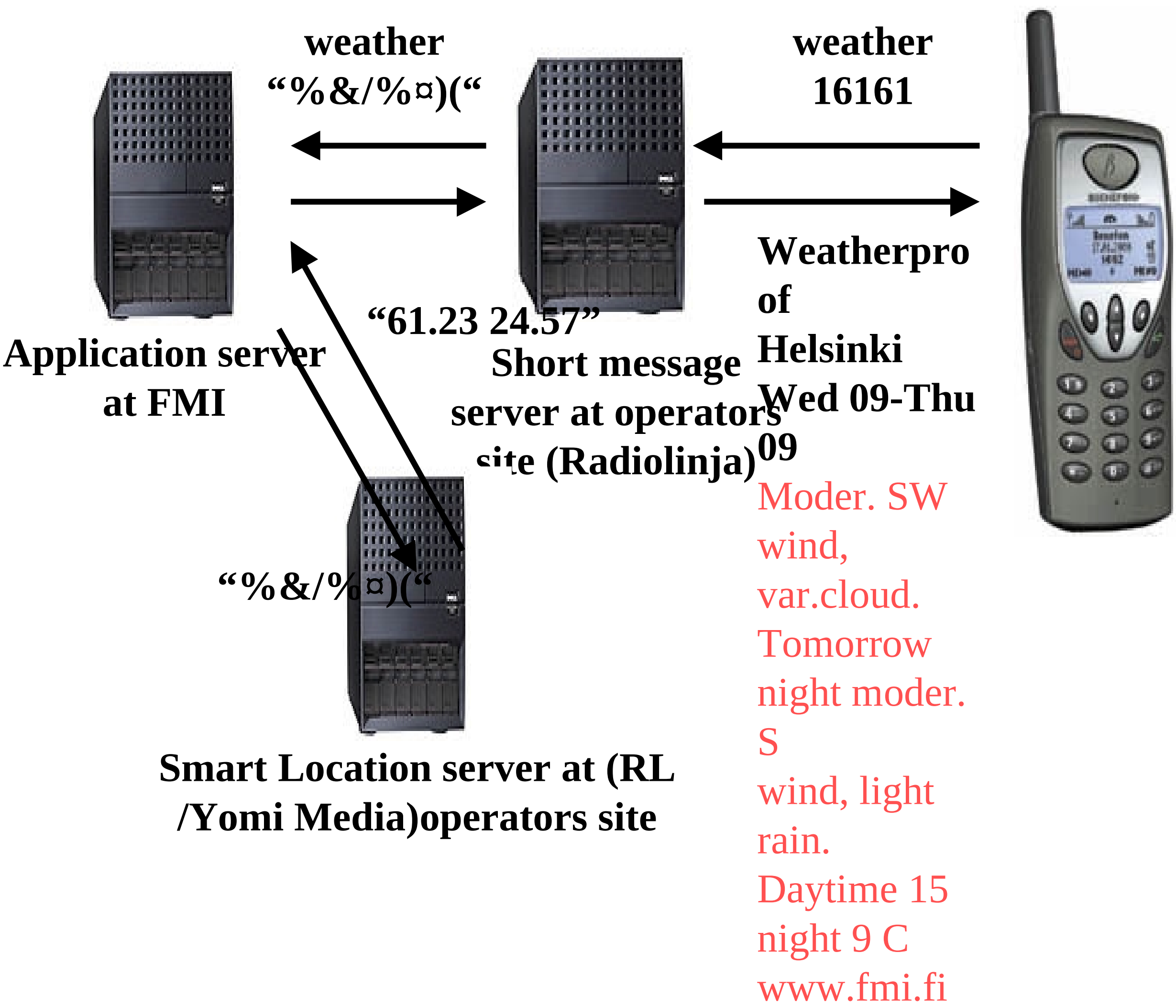
Zurich
Mittwoch
Am tag Regen. Nachts halb
wolkig. Temperatur 10..14 C
Donnerstag
Vielfach heiter.
Temperatur am tag 19 nachts 10 C
Freitag
Am tag wolkig. Nachts Regen. Temperatur am tag
23 nachts 12 C

Zurich
Mercol
Dur.il giorno pioggia.
N.notte parz.nuvol.
Temper 10..14 C
Giov
Piutt.ser.
Temper dur.il giorno 19 n.notte 10 C
Ven
Dur.il giorno piutt.cop.
N.notte pioggia.
Temper dur.il giorno 23 n.notte 12 C

Zurich
Miérc
Día lluv. Noche parcialm.nubl.
Temp 10..14 C
Jue
Relat.despej.
Temp día 19 noche 10 C
Vier
Día relat.nubl. Noche lluv.
Temp día 23 noche 12 C

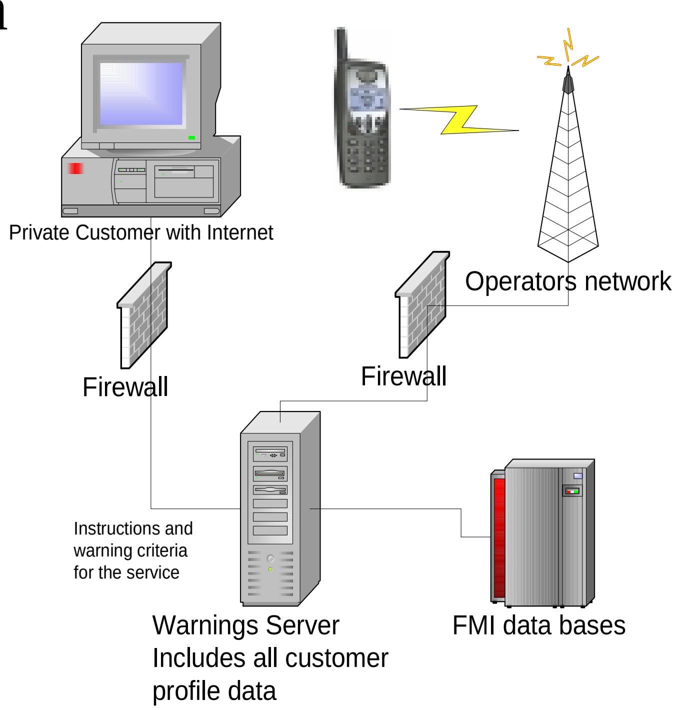
Zurich
On
Dag regn. Natt halvklart.
10..14 C
To
Mest klart.
dag 19 natt 10 C
Fr
Dag mest mulet. Natt regn.
dag 23 natt 12 C

Personal navigation and weather



New mobile weather services; WARNINGS

- The new warning service: any kind of personalised warnings based on real time weather data can be issued
- A new customer object is created by the customer and destroyed automatically
- Radar, extrapolated radar, lightning, wind, road condition etc.



Conclusions

- The main aspect of the editor development is earn the user satisfaction by making the editor user friendly; there is still much work left
- The automated processes make the work of forecasters more weather oriented and less production oriented; present number of automated products is several thousands
- The mobile services are one of our main target

Recent Developments at INM

Jorge Tamayo Carmona

At INM the Meteorological Operative System in forecast offices is based on McIdas Version 7.7. Late tools developed for operative purposes are related with the automatic diagnosis of convective phenomena type, and with the automatic identification, tracking, characterisation and extrapolation of convective cells, with 2D and 3D cell information. Also, the generation of new forecasting products, with a good presentation, is one of main requirements for operative departments at INM. This is why INM is looking for solutions that allow, at least in a semi-automatic way, to obtain different products good enough for its general diffusion. Whit this aim, INM has participated in the Multimeteo Project, in order to obtain an automatic generation of forecast texts in different languages. It is based on a data base obtained from a numerical weather prediction model, which could be modified by forecaster using the Modigraph application, and generating a forecast data base. Actually, INM is involved in the application of this system, to obtain, in a first stage, local forecasts, and in subsequent stages, to extend it at higher spatial areas.

Recent developments at IAFMS

Giovanni MARESCA

Italian Air Force Meteorological Service
General bureau for meteorology - Rome

EGOWS 2001
Zurich 11-06-2001

Outline

- Current Visualization System at CNMCA
- New Data Processing System - NSED
  - functional areas
  - technical features
  - Meteorological Operational Area - AOM
  - Remote site workstation - PLR

Current Visualization System - VisiMet

- "on the fly" graphical application that runs on Unix workstation
- Client side (graphical interface) written in JAVA
- Server side (plotting engine) based on MAGICS

VisiMet

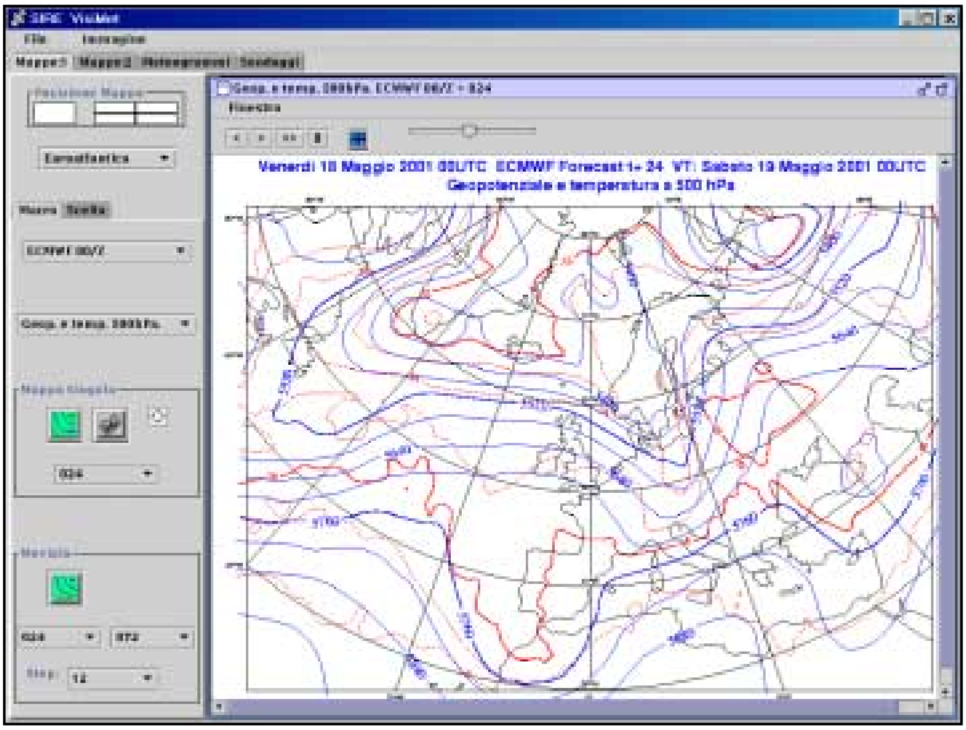
GUI requirements:

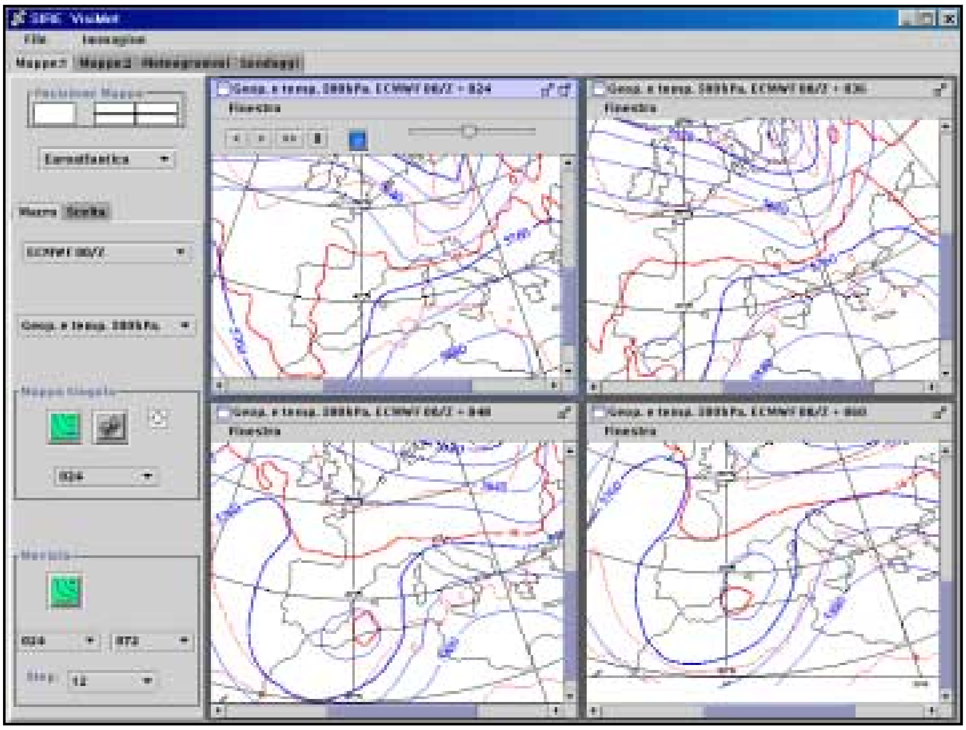
- access to routine information as soon as possible;
- comparison of different information in the same workspace

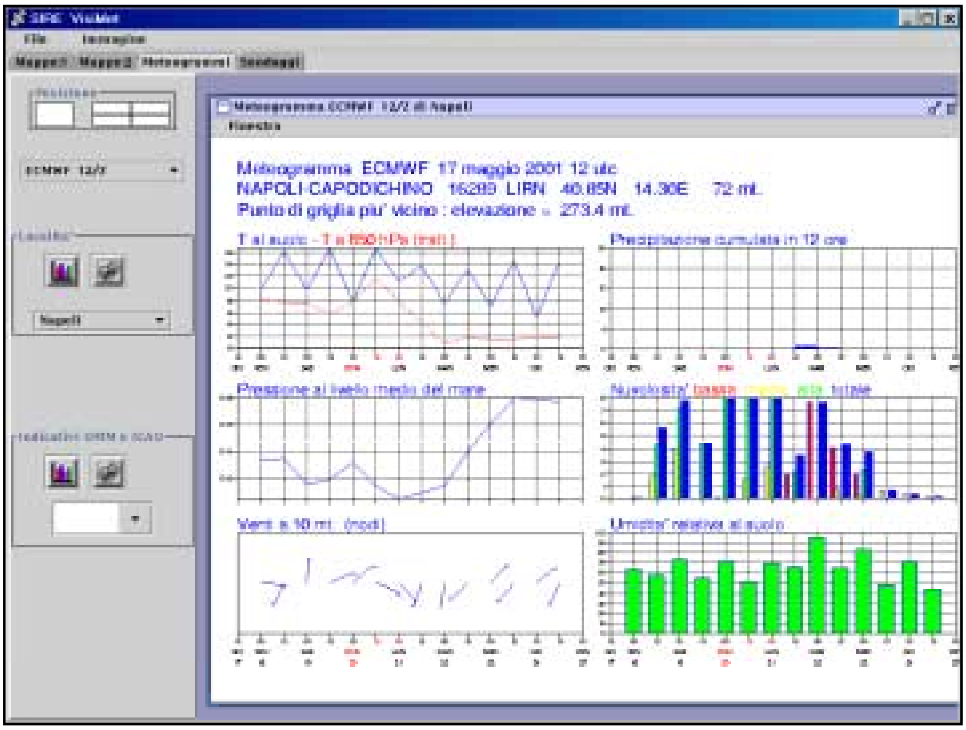
VisiMet

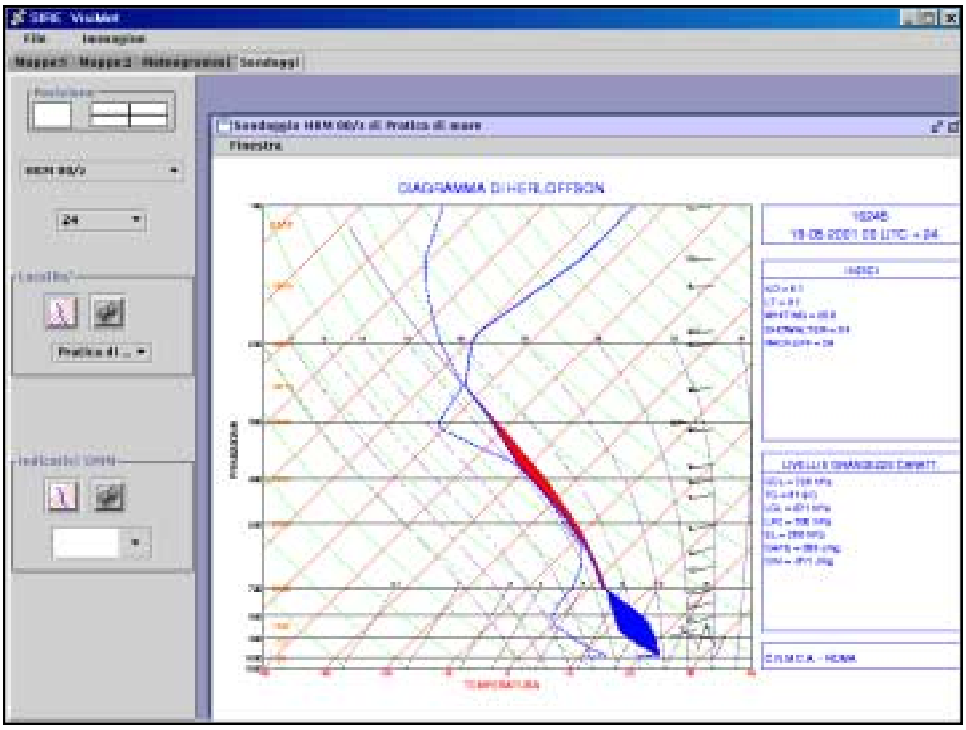
GUI features:

- Multiwindows in multiple workspaces;
- different type of information in different worspace;
- selection of information by two ways;
- free or fixed windows layout;
- move with multiwindows sequence capability

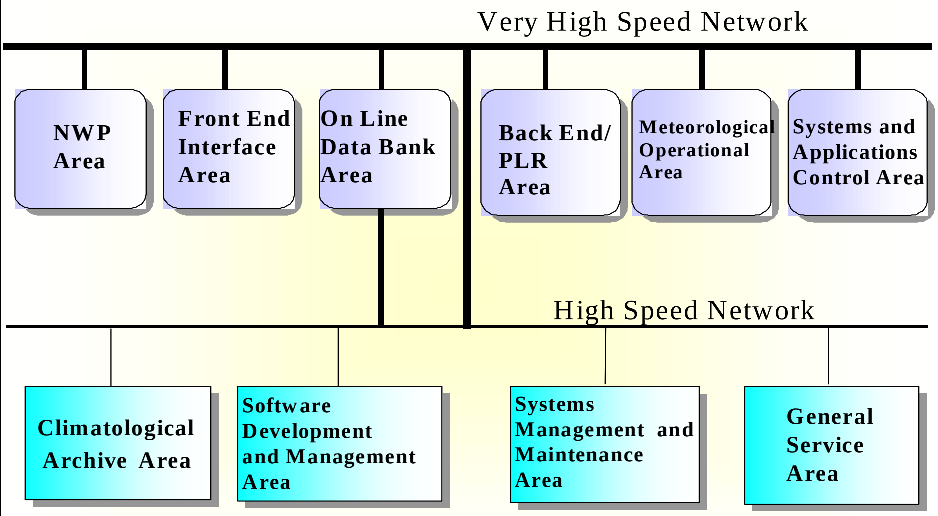




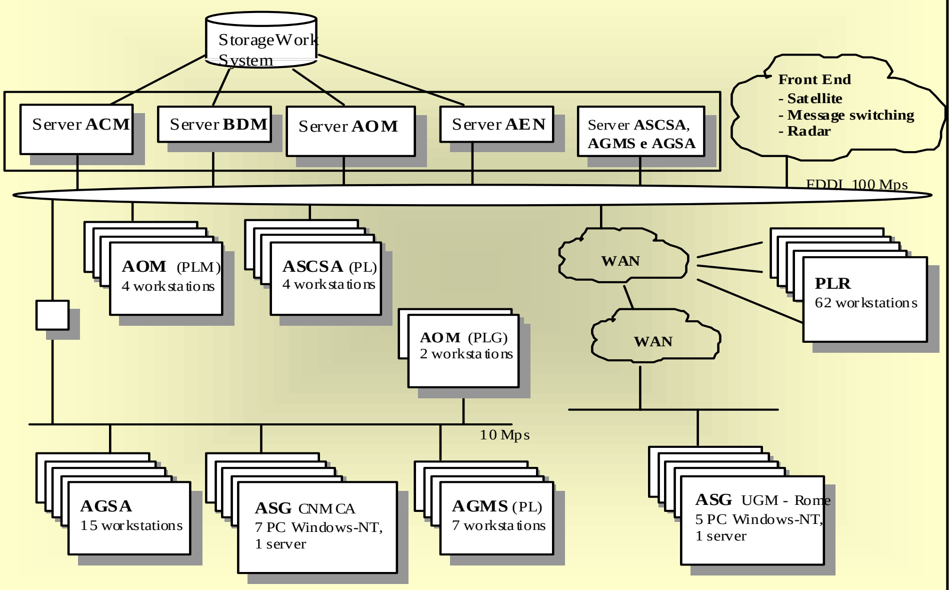

Meteogramma ECMWF 17 maggio 2001 12 utc
NAPOLI CAPODICHINO 16289 LIRN 40.85N 14.30E 72 mt.
Punto di griglia piu' vicino : elevazione = 273.4 mt.
Precipitazione cumulata in 12 ore
Pressione al livello medio del mare
Umidita' relativa al suolo



NSED - functional areas



NSED - Technical features

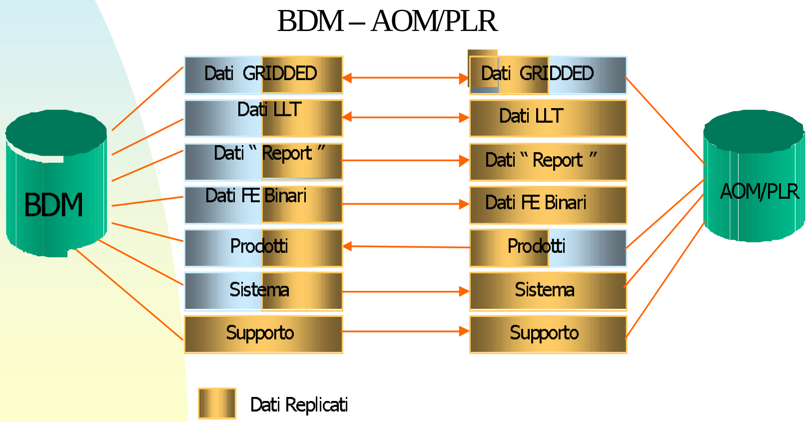


NSED - AOM

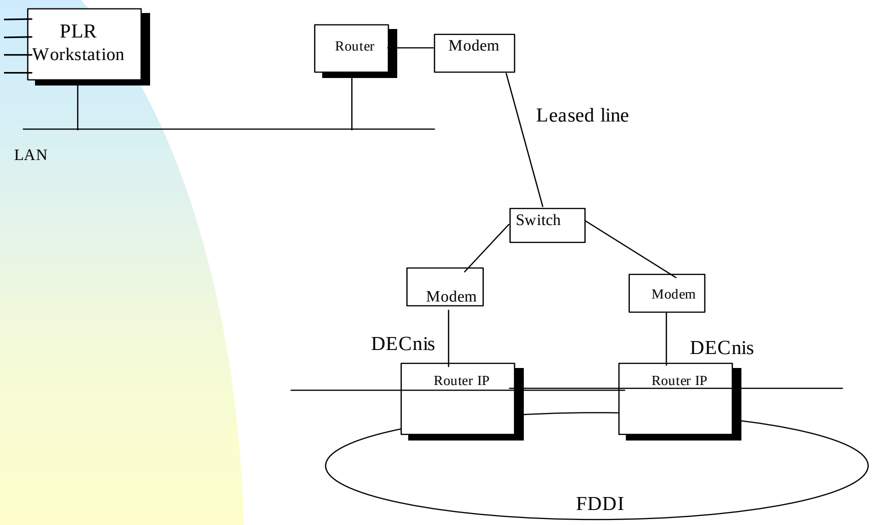
- AOM has to support the CNMCA production
  - automatic production on **AOM server**
  - manual or semiautomatic production
    - **video wall** (2x4 24” hi.res. flat screen) driven by **PLG** workstation
    - **PLM** workstations

NSED - AOM

- Informix as RDBMS
- BDM feeds AOM,PLR and ACM databases



NSED - PLR



NSED - GUI

- JAVA as development language;
- Client-server configuration using RMI methods;
- MAGICS as graphical engine;
- Multiple workspaces and multiwindows;
- Automatic windows layout;
- Objects management using XML;

Operational and Planned Java Applications at Deutscher Wetterdienst

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E-Mail: Ludger.Paus@ebp.de

Overview

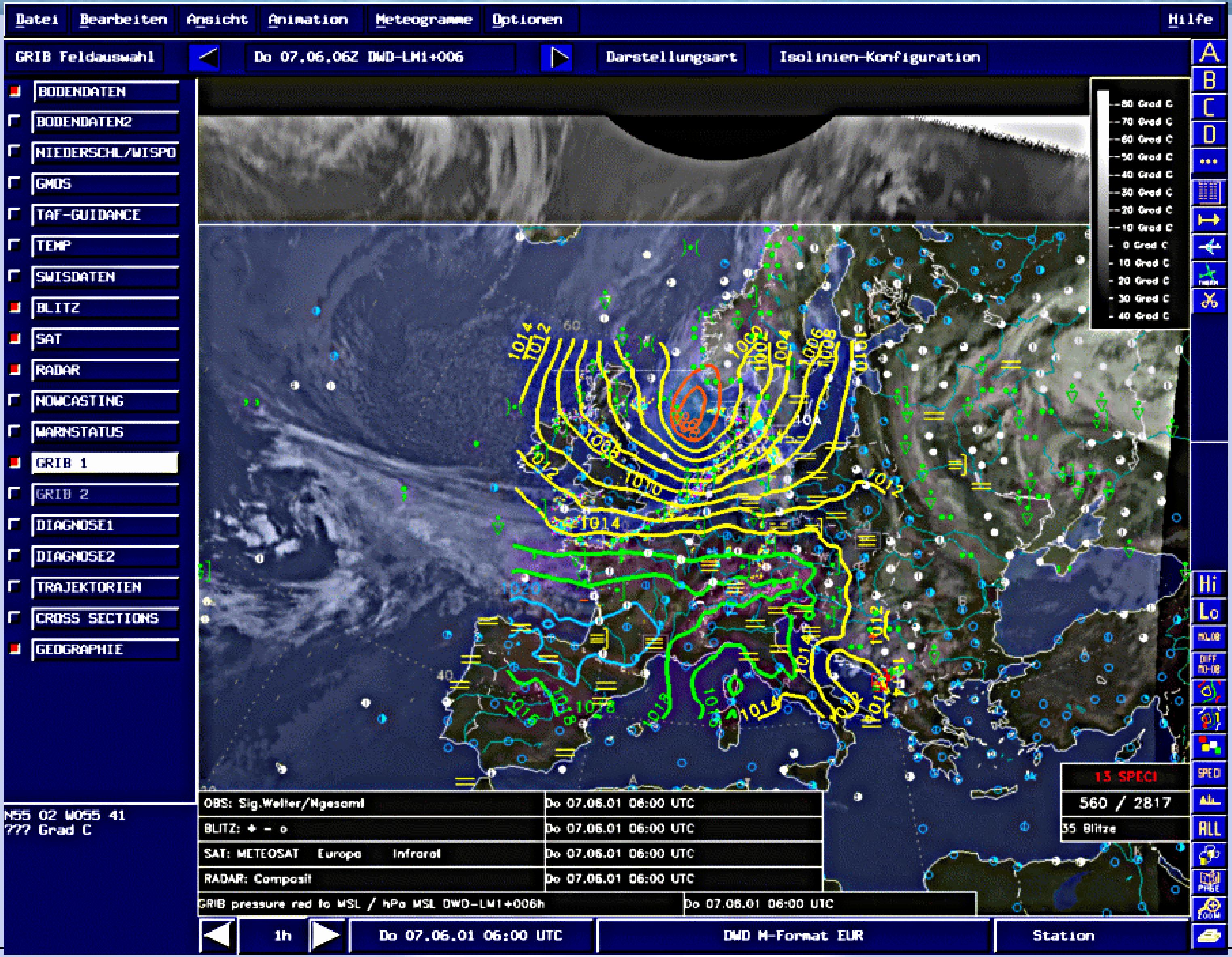
- Current Operational Environment (MAP...)
- Why Java?
- **JavaMAP**
  - Goals, Client, Server
- **QualiMET**
- **The Common Graphics System**
  - Goals
  - Team, Time Schedule
  - A Few Words on Performance
  - Architecture

Current Operational Environment
Systems

- Current Systems MAP, IGS in development/ use since 1990 on SGI-Platform
  - **MAP**:
    - display of observations, imagery, NWP-data ...
    - production and monitoring of warnings
    - Modified Model Output MMO
    - since start of CGS project only minor modifications, optimizations and maintenance
  - **IGS**
    - Interactive Significant Weather Charts
    - Interactive Application System (thematic maps)
  - Both systems meet end user´s requirements very well

Current Operational Environment

MAP



Current Operational Environment, *Shortcomings*

- MAP, IGS
  - tied to UNIX platform
  - getting somewhat difficult to maintain/extend
  - very few experts
  - lacks functionality
    - integrated interactive data/chart modification
    - 3D
    - GIS...
  - separate interactive chart production and 3D visualization

Why Java ?

- Portability
  - Java is an interpreted language (byte code): "Compile once, run everywhere".
- robustness/steep learning curve due to
  - no pointers
  - no multiple inheritance
  - no explicit memory management
  - exception handling
- Performance can be compared to C++ for 2D- and 3D- meteorological applications
  - new compiler technologies (JIT, Hot Spot)
- high productivity due to
  - large built-in libraries
- specialized libraries
  - JDBC, Java3D, JAI, JNI, RMI, Serialization

JavaMAP

Architecture

- client/server system to supply meteorological information to
  - lay people
  - people outside the operational weather forecasting environment
  - prepare reports
- based on Java2 (jdk 1.3, JFC, JCE, JDBC)
- C/S communication via the internet using sockets
- server side data access
  - flat file system
  - MAP database
  - RDBMS ORACLE

JavaMAP
Server

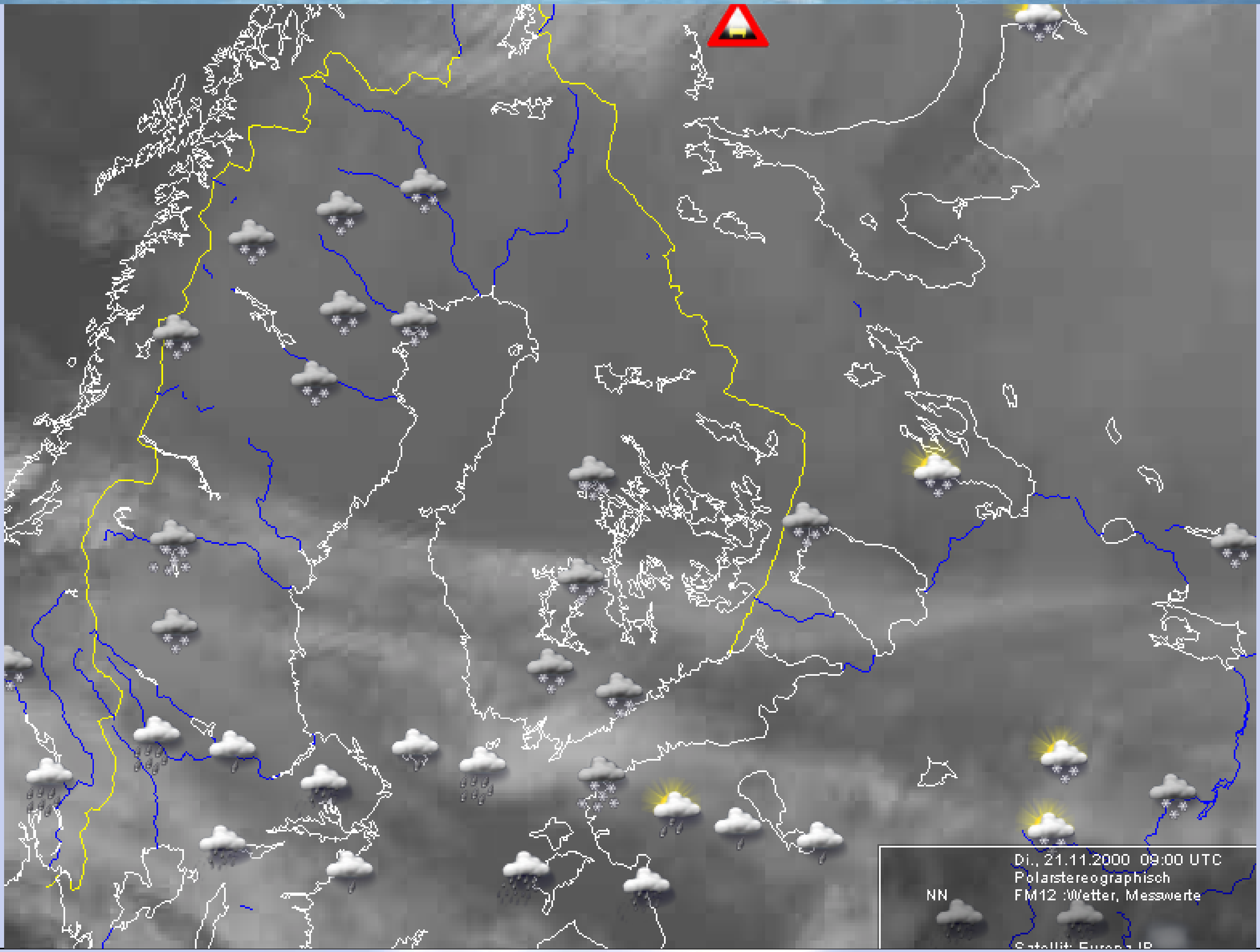
- Server Features
  - High performance due to optimised socket architecture
  - Multithreading using multiple server ports
    - Establishing server connections on standard port
    - Session ports allow authentication and request handling of multiple clients simultaneously
  - High level of security
    - public/private key encryption used for authentication and secure transmission of passwords
    - session keys enable secure handling of client requests

JavaMAP
Client

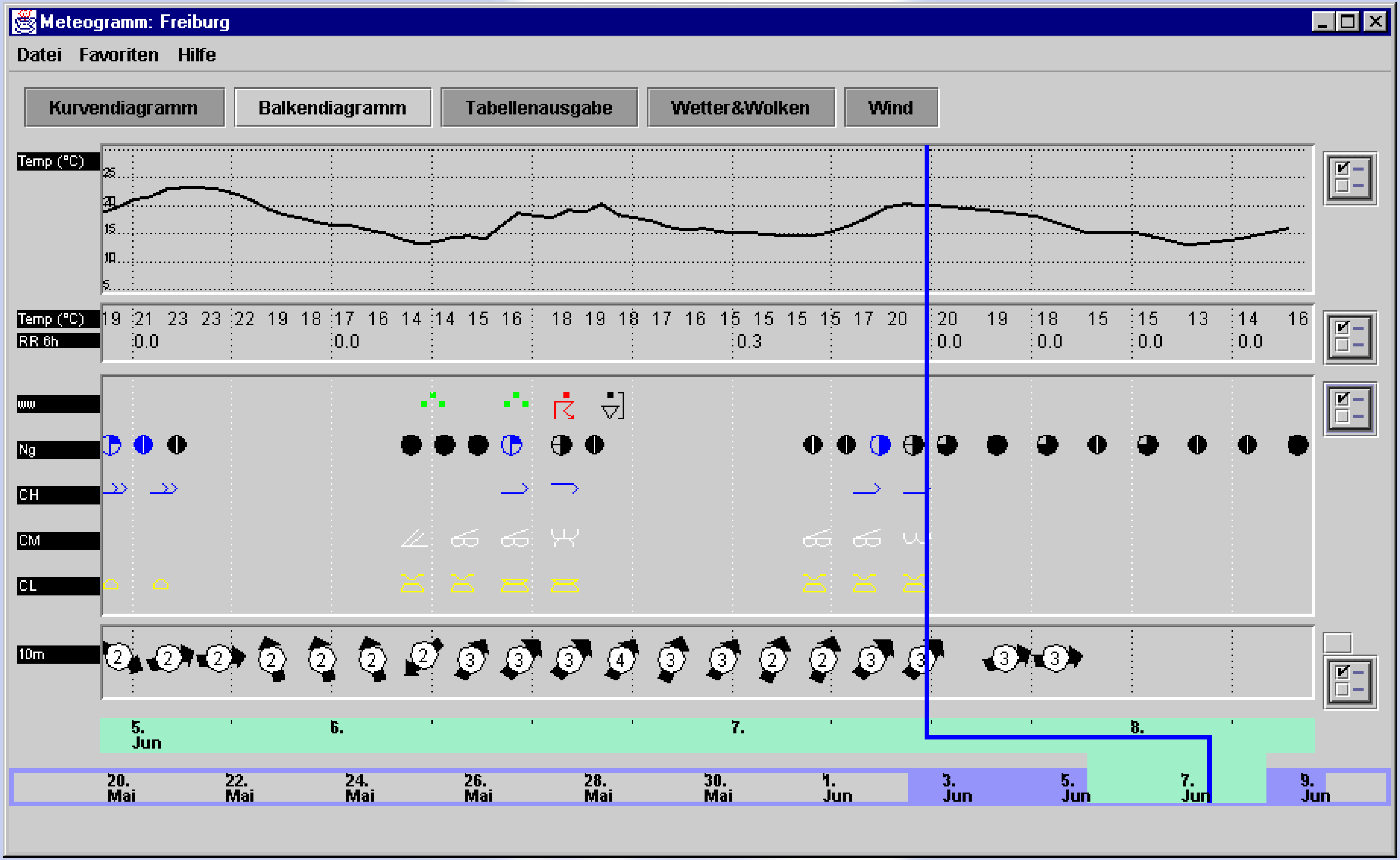
- Display/animation of meteorological data on maps or meteograms
- Geogr. Context (elevation, vector data)
  - adaptive selection of multiple resolution levels
- surface observations/forecasts:
  - FM 12, Kalman-filtered LM and GM_E
  - configurable depiction of all parameters
- imagery
  - radar
  - satellite (meteosat, world composite)
- NWP data
  - images only, produced by TriVis

JavaMAP

Client



JavaMAP
Client



QualiMET

Goals

- Distribution of centrally collected data of the new automated observation network “Messnetz 2000” to the regional offices for testing
- Seven regional offices
- Each regional office: about 300 stations,
  50 measured elements
- About 1.2 million measured values per day checked by each regional office with 125 individual examinations
- Interactive correction of erroneous or missing data supported by a specialized visualization program
- Feedback to the meteorological stations about failing/misbehaving sensors

QualiMET

Examination Procedure

1. checking completeness
- correction

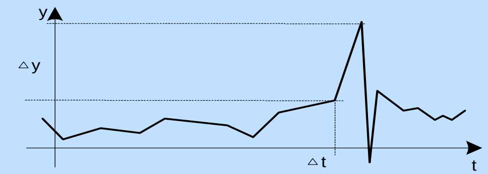
t1	1003
t2	1003
t3	**missing value**
t4	1002
t5	1002

2. checking climatic limits
- correction

January

Maximum temperature
in Munic = 25 C ??

3. checking consistency in time
- correction



4. checking inner consistency
- correction

CAVOC

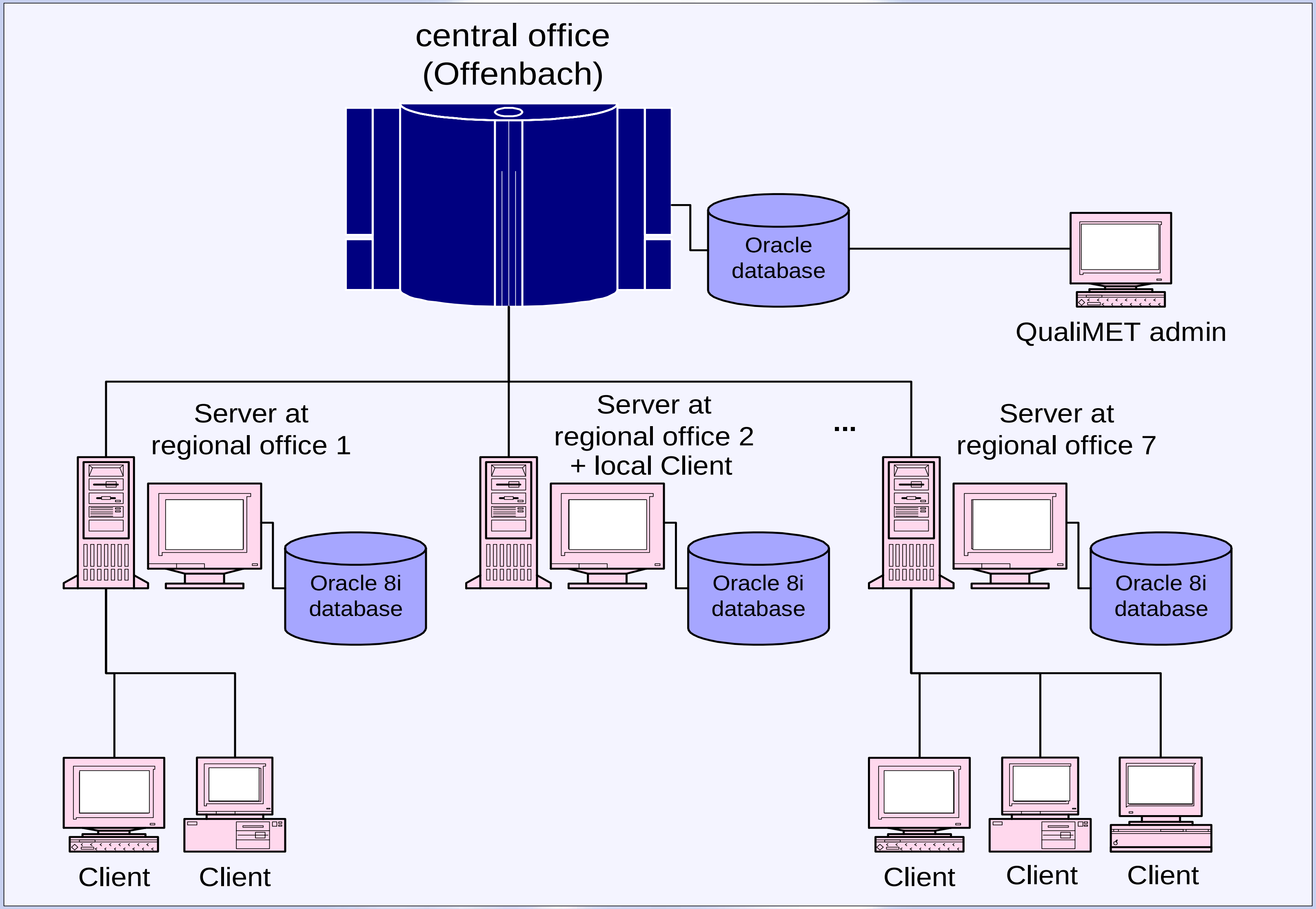
visibility
500m ??

5. checking consistency in space
- correction

• 1002
• 1003
• 1000
• **1024 ??**
• 1004
• 1005

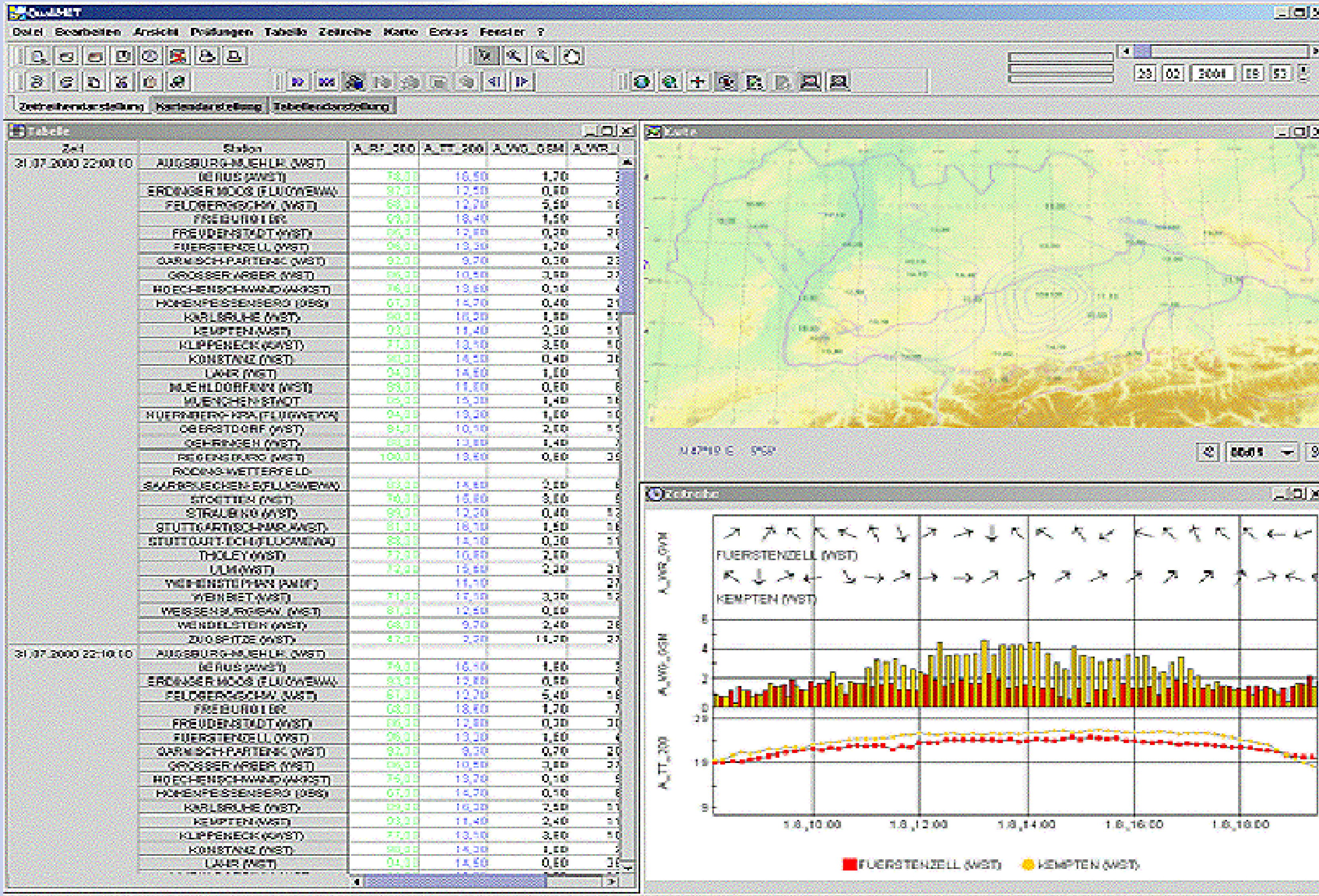
QualiMET

System Architecture



QualiMET

Current Operational Environment



Common Graphics System
Goals

- Design and build a new system, that ...
  - supports monitoring, nowcasting, forecasting, climatological reports, batch production, verification, and research
  - covers the requirements of MeteoSwiss, GMGO and DWD
  - merges and expands the functionalities of the current systems
  - replaces the old systems MAP, IGS, GeoBerT, IGSII
  - uses internal (MIRAKEL, GeoDB) and external standards
  - has a clear, open and expandable software architecture
  - is scalable and fault-tolerant
  - is not tied to a particular hardware / OS platform

Java Applications Around the World

- Meteorological Java Applications
  - MetApps, VMet
    - UCAR, 3D, based on VisAD
  - FXNet
    - FSL, 2D, internet client interface to AWIPS
    - very fast
  - AMFS (Automated Marine Forecast System)
    - BOM, 2D, based on VisAD, B. Hibbard is actively involved
  - JavaMAP
    - DWD, 2D
    - fast

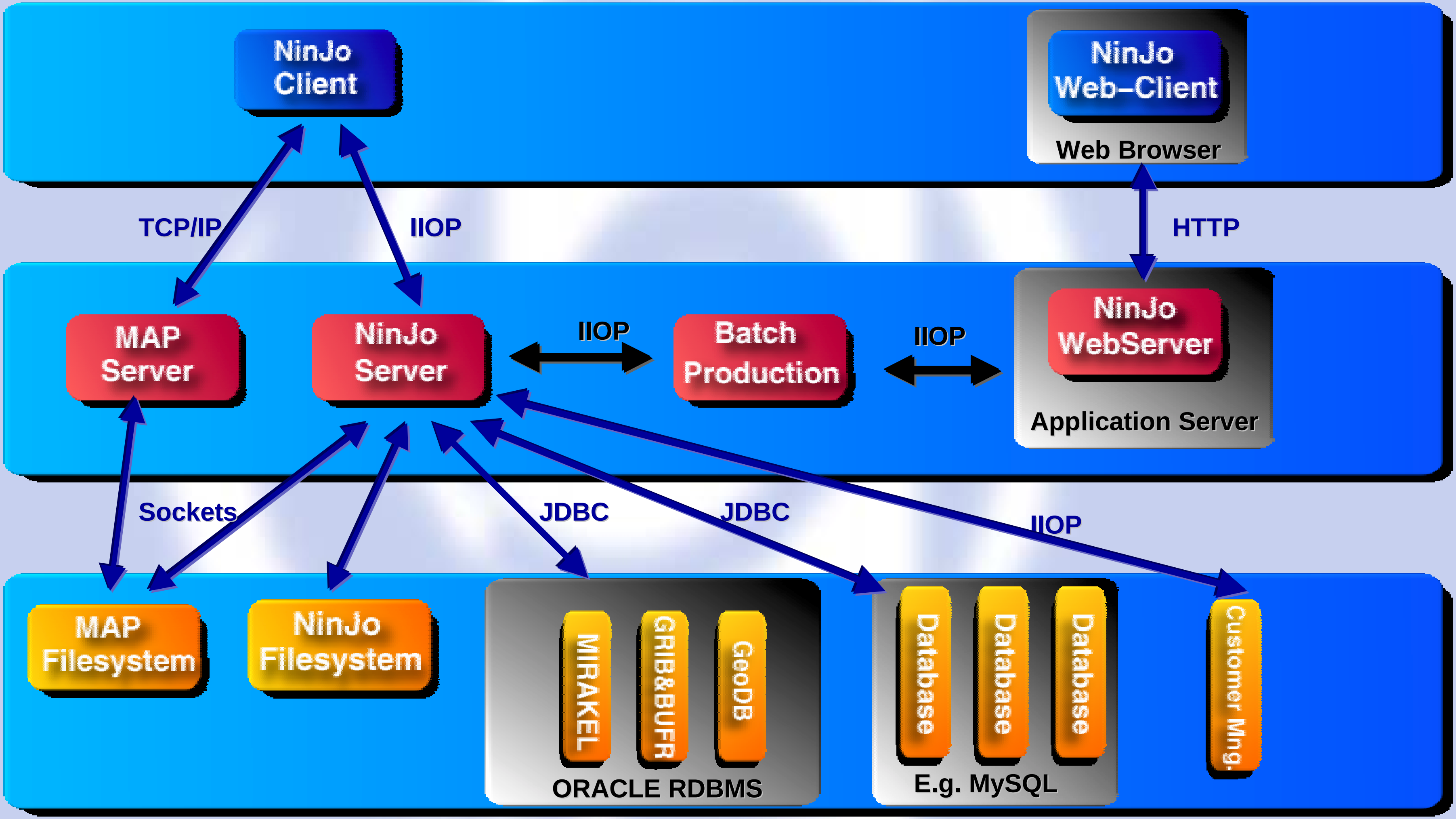
Common Graphics System
The Project

- joint project of 3 Organizations :
  DWD, GMGO, MeteoSwiss
- bundling of resources (5 → 1 Projects)
- team consists of
  - 15 (> 70%, mostly 100%)
  - 6 (~ 50 %)
  - 4 consultants (SD&M)
- time line
  - start of NinJo: **12/1999**
  - specification: 8/2000
  - decision on technologies,overall design 5/2001
  - final design and evolving prototype 1/2002
  - design, develop, integrate, test (Iterations) 1/2004
  - deploy **mid/late 2004**
- Case Tools: Sniff+, TogetherJ, Jprobe, Perforce

Common Graphics System
Architecture

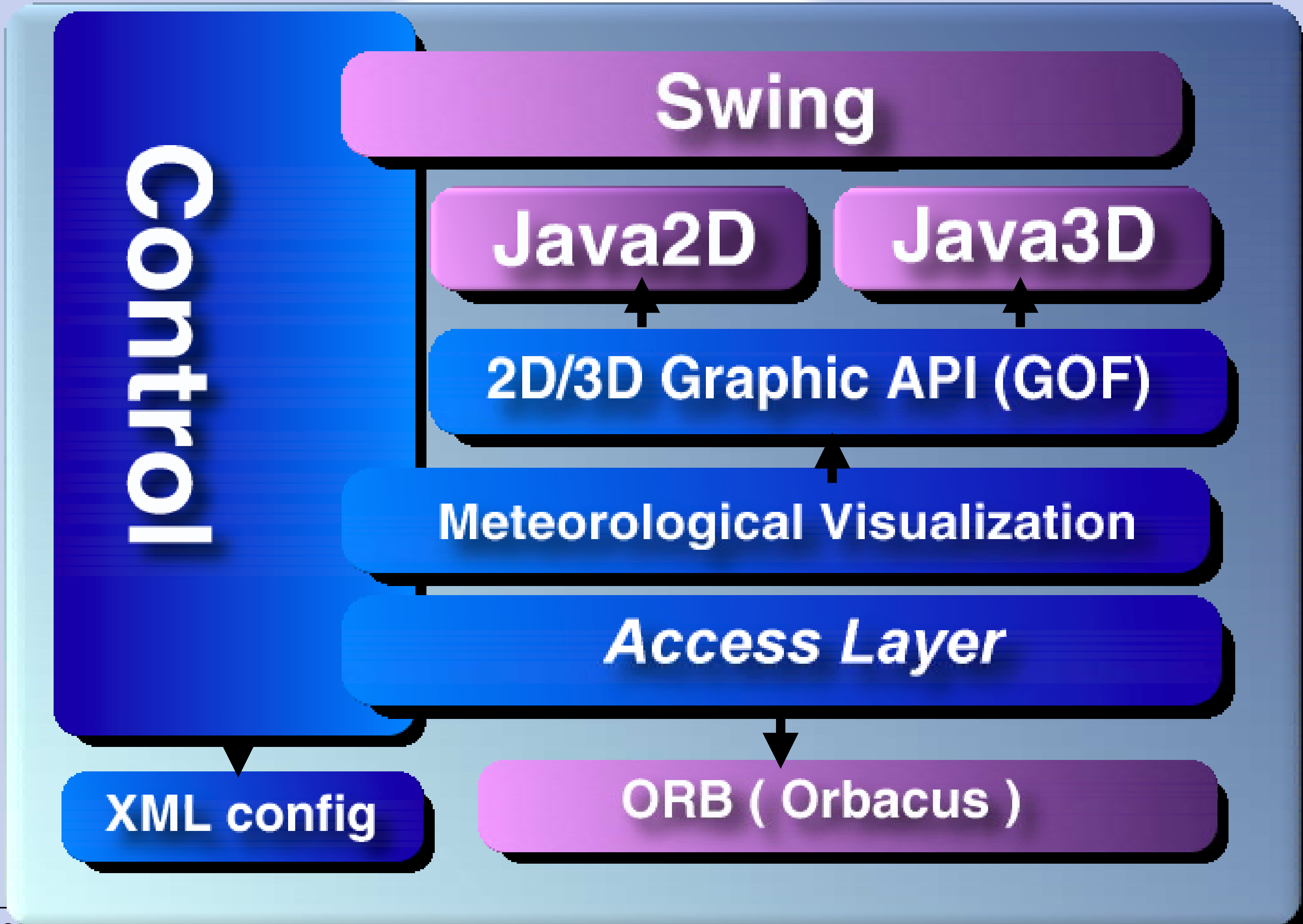
- programming environment
  - Java 1.3.1 development, target platform SDK1.4
  - graphik APIs
    - Java2d
    - Java3D
    - OpenGL
    - Java Advanced Imaging
  - GUI Toolkit
    - Swing
  - middleware and services
    - CORBA (Naming, Event, Transaction)
    - JDBC
  - file formats and processors
    - XML
    - GeoTIFF

Common Graphics System
Architecture: Overview

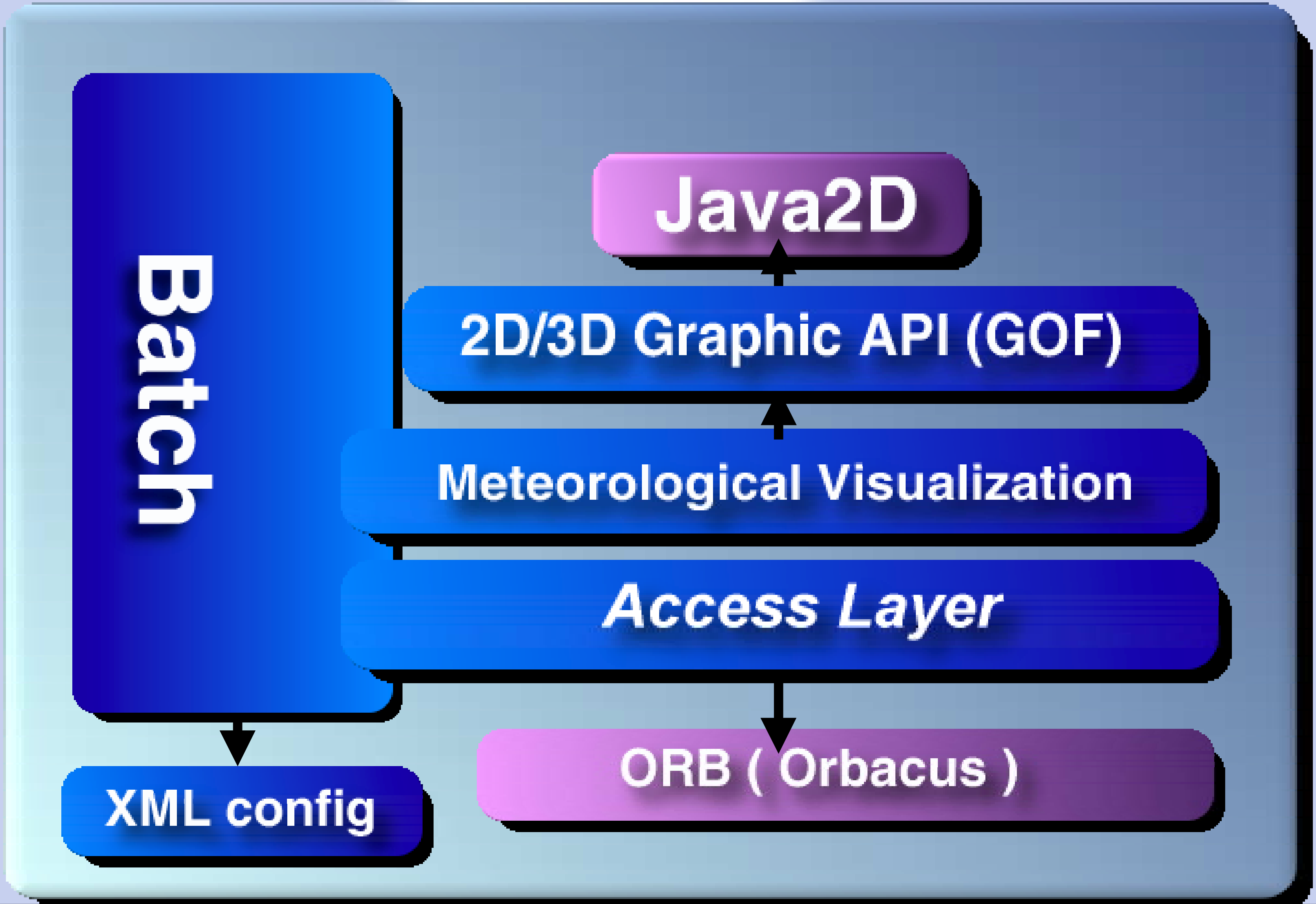


Common Graphics System

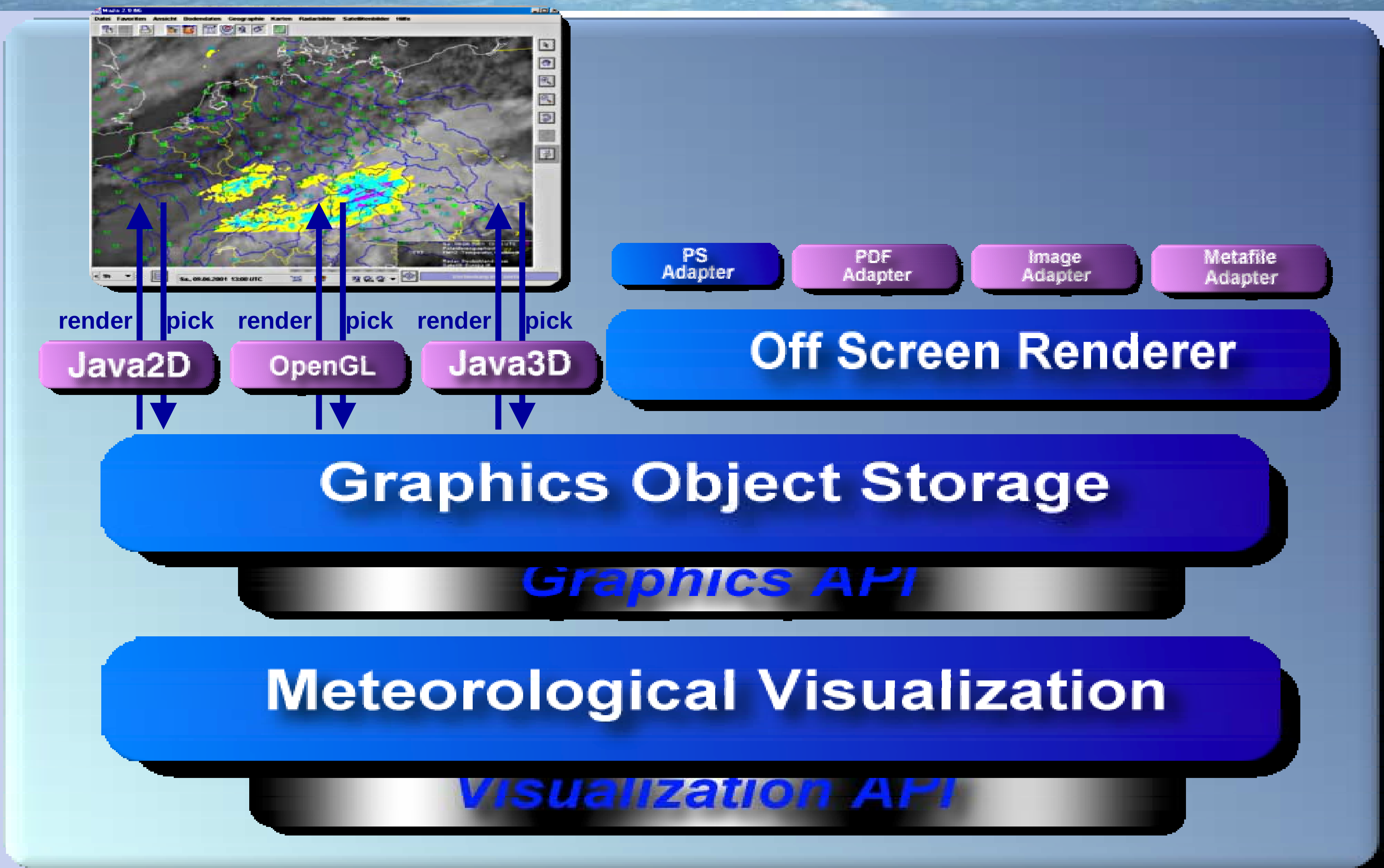
Architecture: NinJo Client



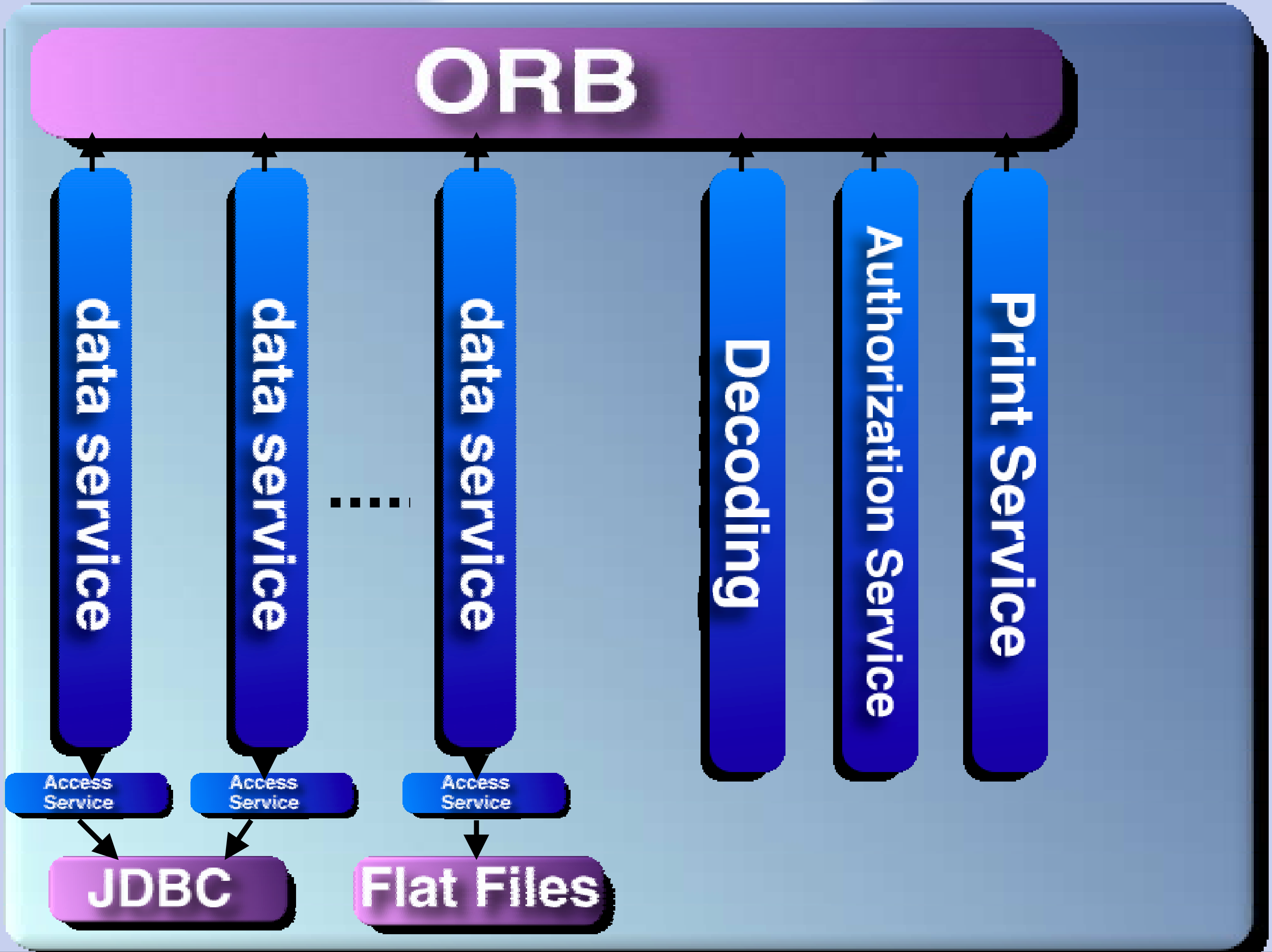
Common Graphics System
Architecture: Batch Client



Common Graphics System
Architecture: Visualization Framework



Common Graphics System
Architecture: Server

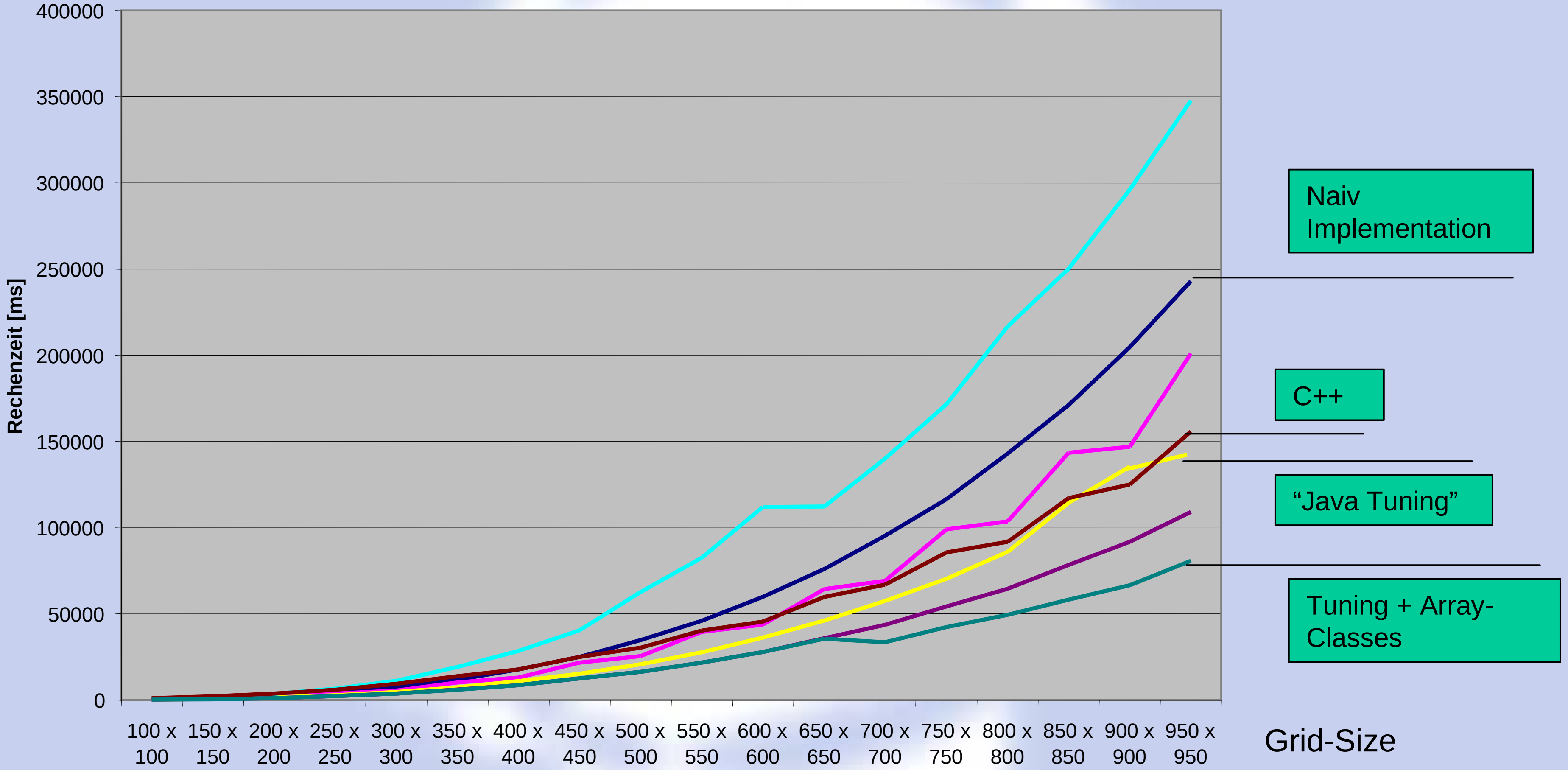


Common Graphics System
Architecture: Server

- The Access Layer
  - easily configurable through XML
  - communicates with any data source
    - local files
    - flat file systems somewhere in the net
    - RDBMS
    - to link a new datasource one has to implement the new Service Object only together with an entry in the XML config of course
  - abstracts from data sources
  - implements transactions for secure data storage
  - provides failover mechanisms
  - provides load balancing

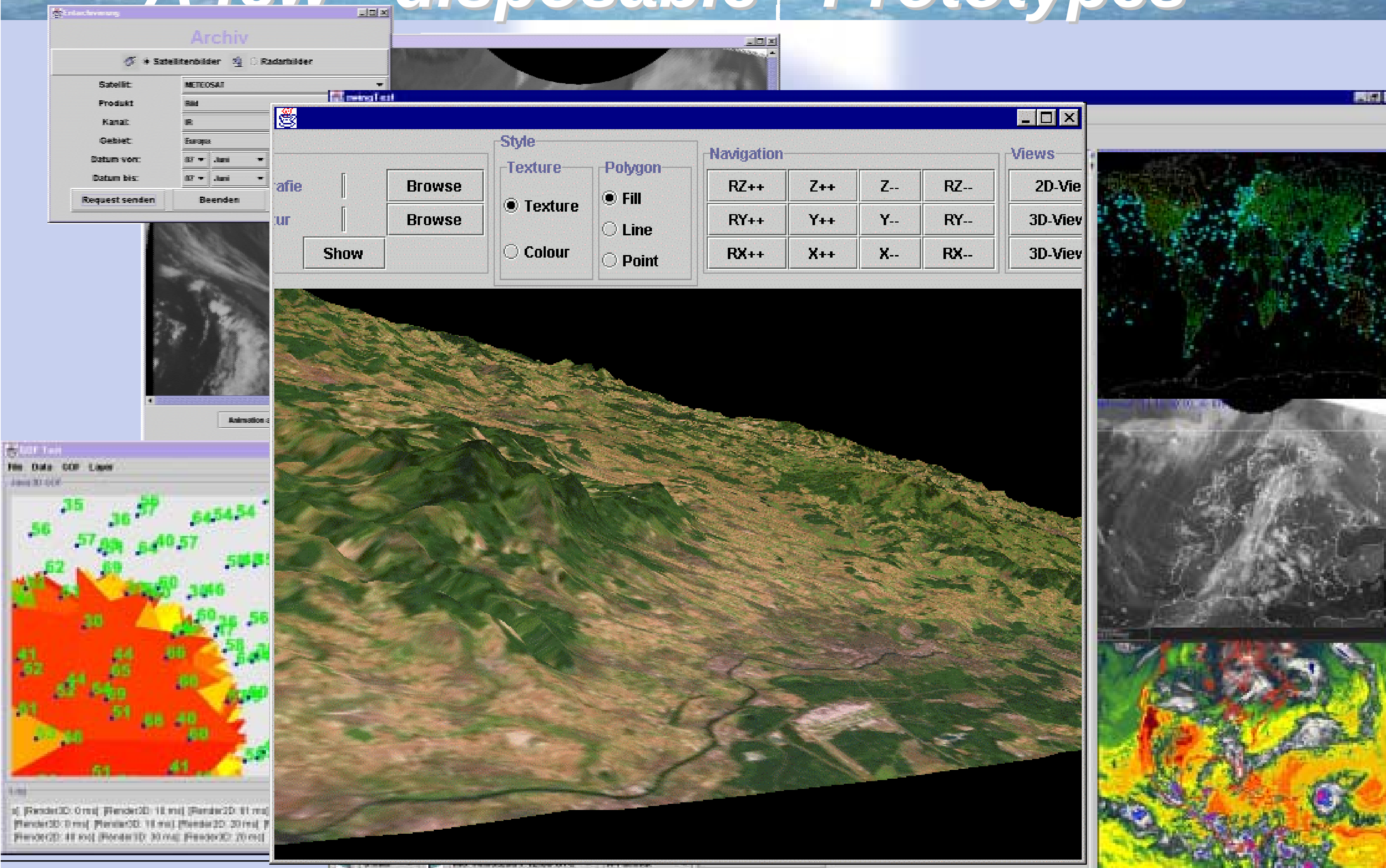
Common Graphics System
A Few Words on Performance

Solution of a boundary value problem (Helmholtz)



Common Graphics System

A few - disposable - Prototypes



Common Graphics System
Outlook

- The architecture of NinJo (CGS) is open and portable
- It can be expanded easily and it should be able to integrate all data sources and applications
- Till now our experiences with Java are quite promising
- The NinJo Project is well on schedule
- But, nevertheless we can’t be sure that the whole specified functionality will be there in 2004
- We hope that we’ll be able to present a prototype at EGOWS 2002 that integrates all the basic functionalities

Synergie Météo-France meteorological workstation improvements

Authors : M.F Voidrot, C.Berthou, M.Stoll

Synergie is the meteorological workstation of the National and Regional operational forecaster developed by Météo France since 1989. Beyond sophisticated visualisation tools, Meteo-France has introduced graphical interaction tools and expertise input user interfaces to help the forecasters formalize their value added in order to feed a numerical data base. These tools have bring new methodologies that take advantage from new computer technics to support co-operative work of remote forecasters in order to implement complex master plans. The expertise data base is then ready to be used by any system aiming at preparing predefined layouts fitted to end users. Synergie visualisation tools are still improving. The concept of numerical trajectories has been introduced giving path to new atmospheric and marine environmental applications, the data and messages watch has been operational for one year supporting nowcasting priorities, ... A new user interface has been developped to planify the automatic production of meteorological georeferenced images fitted to feed professional Geographical Information Systems. At last the political decision has been taken to deliver a Linux commercial release next year that should allow to face increasing commercial demands from National Meteorological Services.

Progress with Operational Met Office IT systems

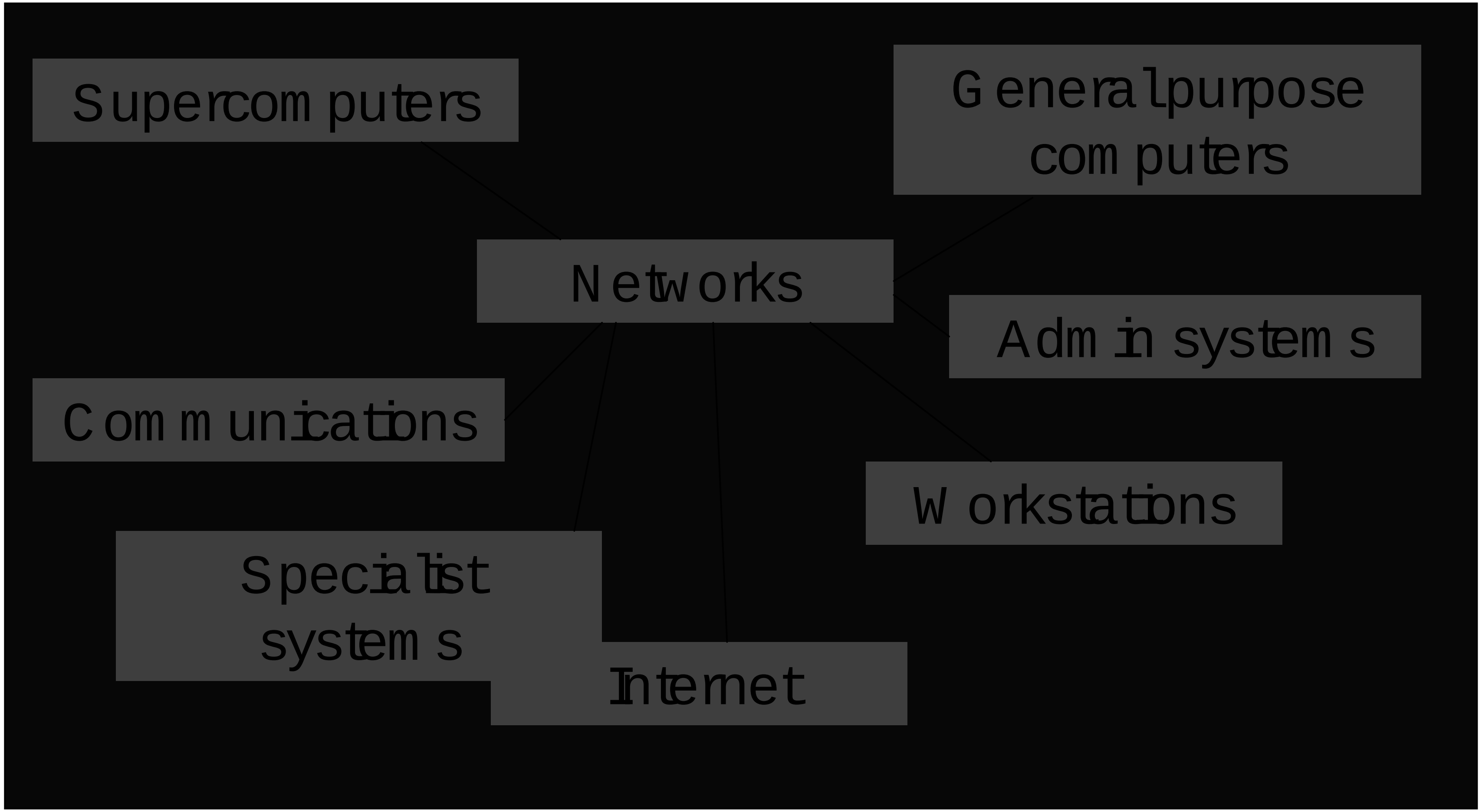
Steve Foreman

Head of Information Systems Development

Outline

- Forecaster workstations at the Met Office
- Support and development issues
- What does the future hold?

IT systems


Supercomputers
General purpose computers
Networks
Admin systems
Communications
Workstations
Specialist systems
Internet

Specialist systems

- Radarnet, Autosat - prepare imagery
- Nimrod - prepare nowcasts based on radar, satellite and mesoscale NWP
- FSSSI - site specific forecasts

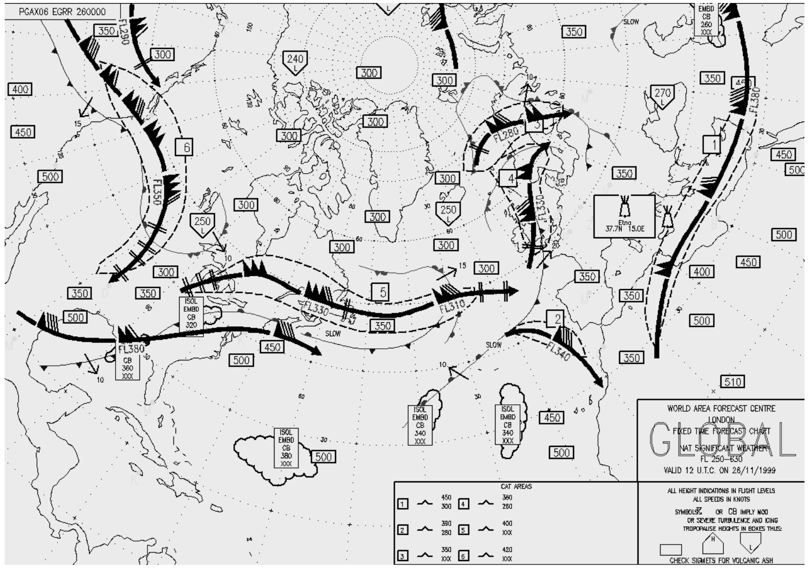
Met Office

Workstations

- Horace
  - "Guidance"
- Nimbus
  - "Production"
- MIST
  - "End user"

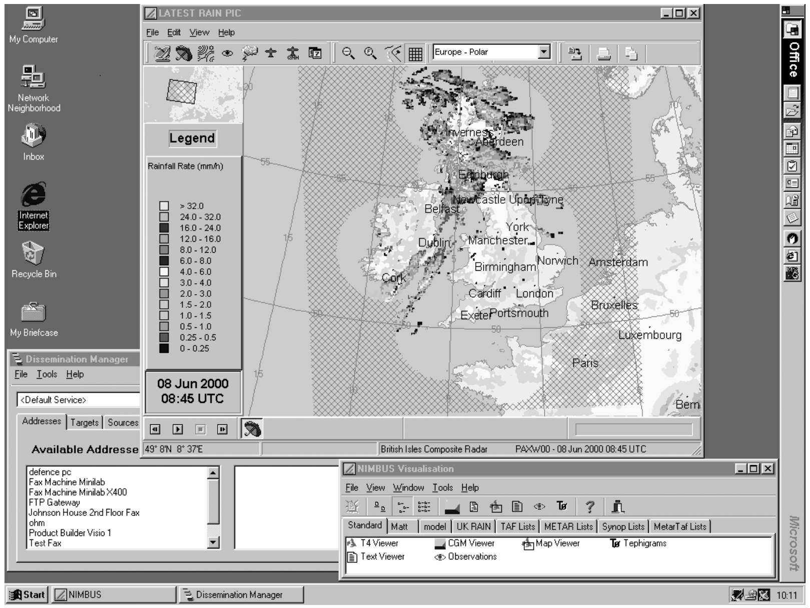
Horace

- Display
  - NWP, observations, satellite, radar …
- Manipulate
  - "field modification"
- Products
  - significant weather …
- Disseminate
  - limited



Nimbus

- PC based
- Display
  - regional
- Production
  - links to PC tools (Office, Visio)
  - “create once, use many”
- Dissemination
  - fax, email, …



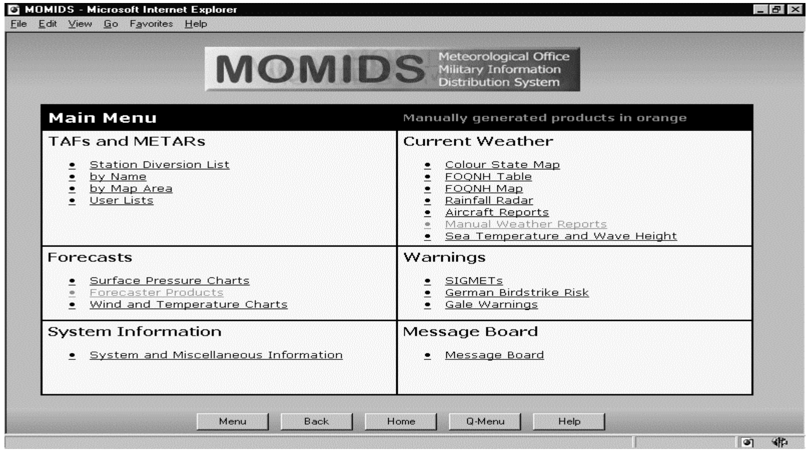
Met Office

MIST

- PC - aimed at end users
  - aviation
  - power industry
  - keen amateurs
- Limited graphics
- Pre-set data
  - dial-in to server

Browser

- Formal - MOMIDS
  - pre-generated products
  - use on customer LAN
  - needs add-ins at present
- Informal
  - images, data
  - often development systems

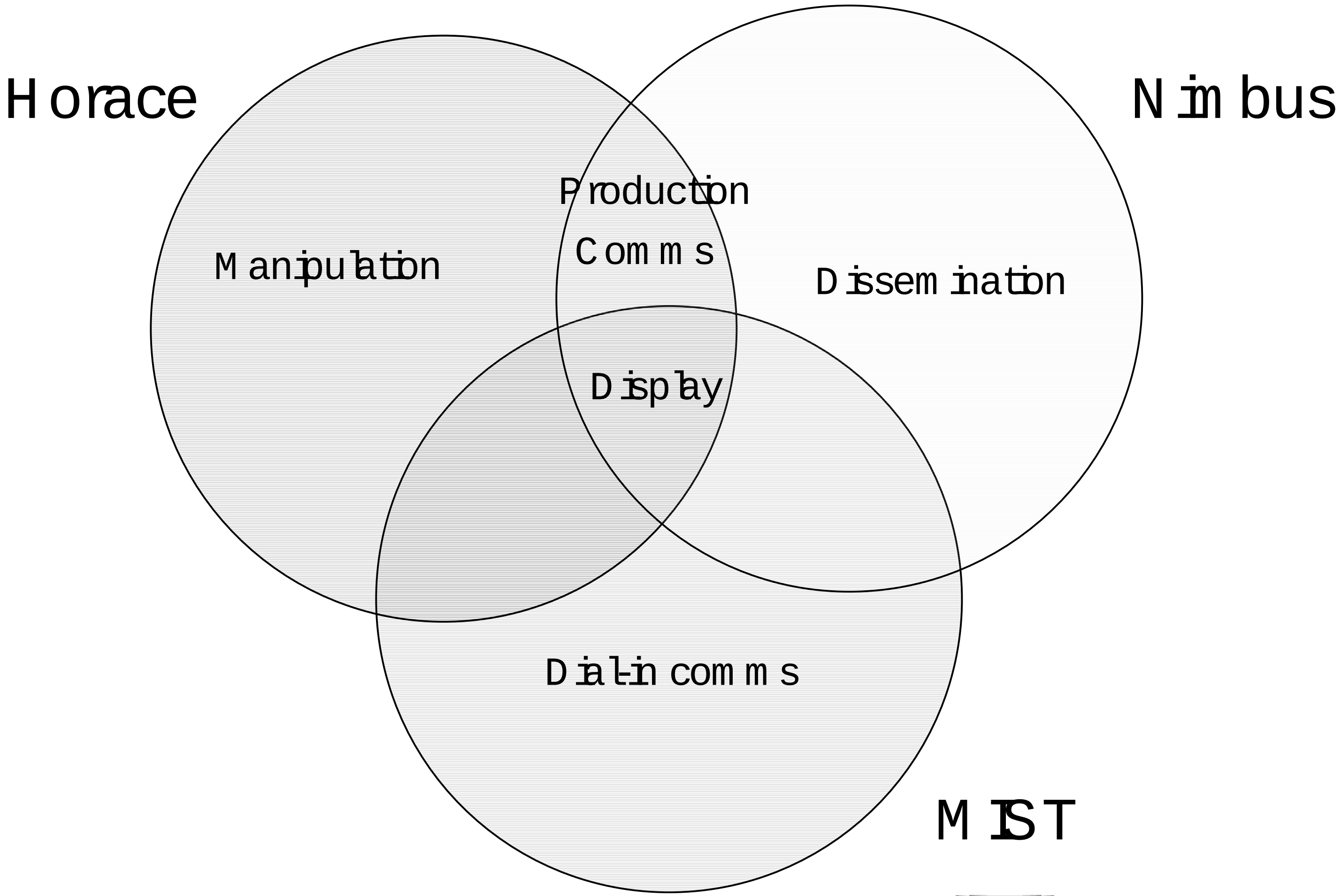


Support and Development

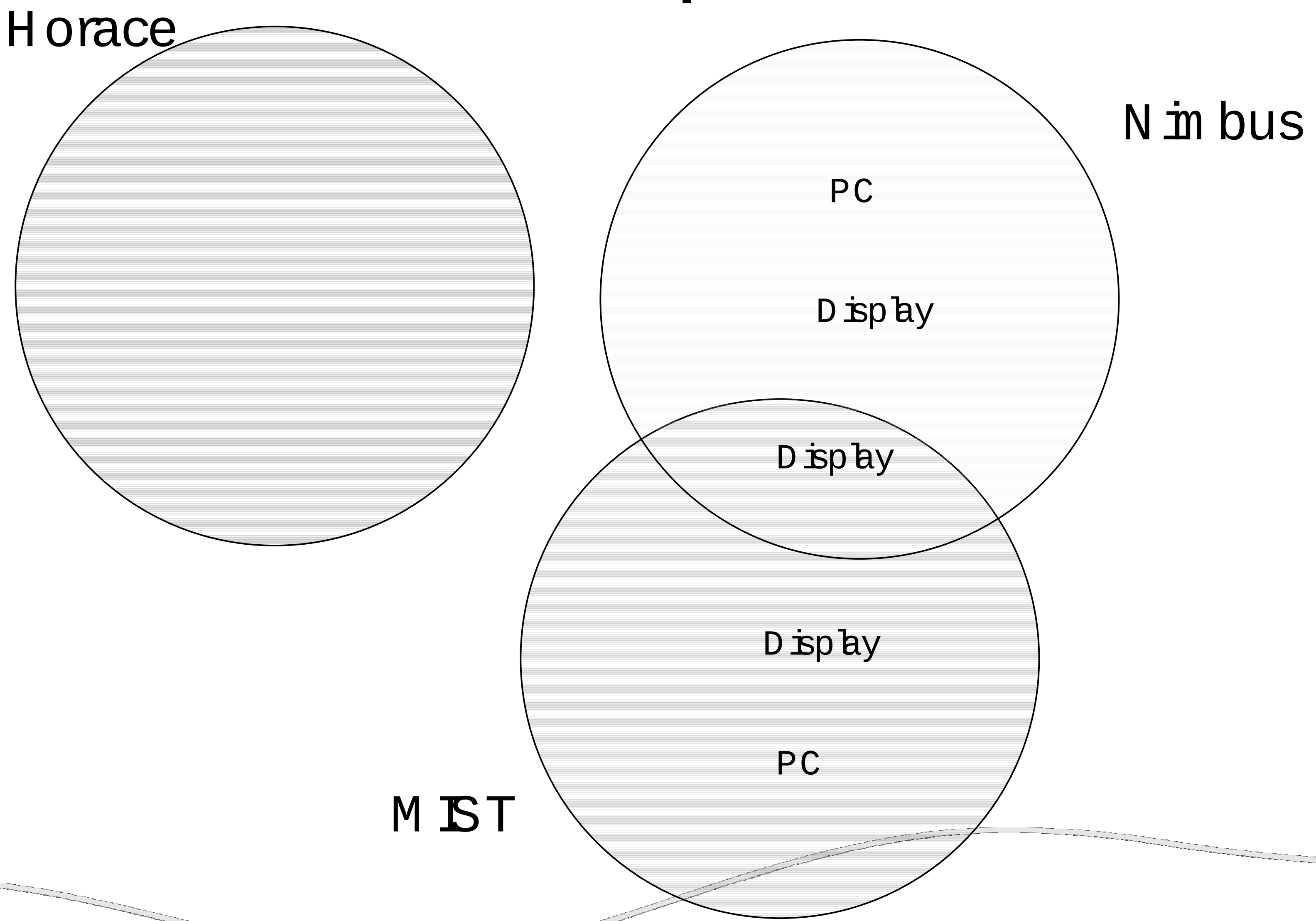
- Overlap between systems
- People with right skills
- Updating and supporting remote systems
- Complexity

Met Office

Overlap - functional



Overlap - code



Skills

- Horace
  - C, Unix, Fortran, GKS, X
- Nimbus
  - Windows NT, Delphi, Visual Basic
- MIST
  - Windows NT, Delphi, Visual Basic
    - » but knowledge of system being lost

Met Office

Remote sites

- Support
  - tools, bandwidth
- Changes
  - how install?
- Interactions
  - especially on PCs
- How enforce?
  - Move at pace of slowest

Met Office

Complexity

- Systems "grown"
- Add-ons
  - especially Nimbus
- Can't do "obvious"
  - because of original design

Met Office

Future requirements

- Role of forecasters
- Delivery of products
- Versatility

Role of forecasters

1950s: create forecast

1960s: create forecast

First NWP

1970s: create forecast

1980s: local forecasts

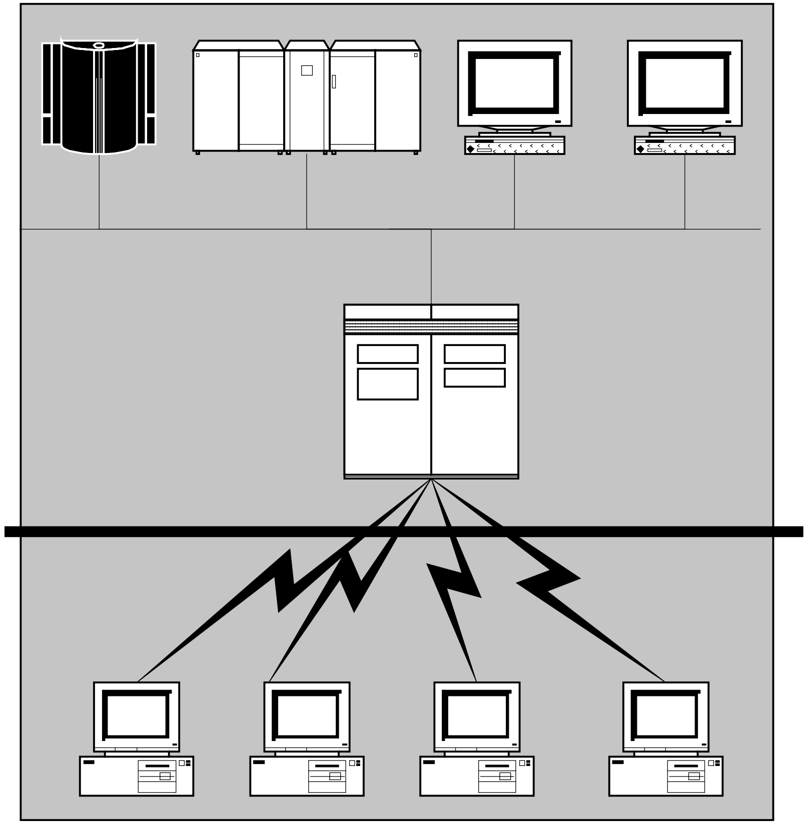
1990s: add relevance

2000s: quality control

2010s: ?

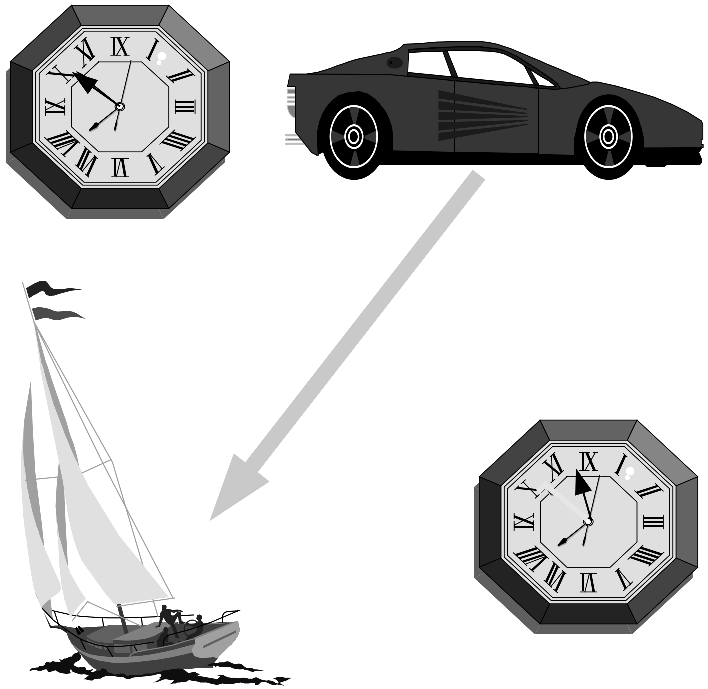
Delivery of products

- Internet
  - "self service" for users
  - how about forecasters?
- Bandwidth
  - increasing
- What?
  - Data?
  - Products?
  - Tools?



Versatile

- Products
  - change rapidly
- Not only weather
- Automated production
  - decision tools
  - text generation?
- Standards
  - XML …



Summary

- Many systems in use
- Support and development costs
- What will forecasters be doing in future?

Concorde

Magali Stoll, Météo France

Steve Foreman, Met Office

Concorde?

- Meteorology is expensive
- NMSs duplicate effort
- We cannot afford to do all we want to
- We do not have the people to do all we want
- So why not co-operate?

History

- February 2000
  - Leeds Castle, UK
- February 2001
  - Brides-les-Bains, France

Areas

- Nowcasting
- Oceanography
- NWP
- Environment and pollution
- Training
- Commercial Services
- Operational backup
- Satellite distribution system
- Africa
- Observations
- research aircraft
- Workstations

Workstations

- By 2006
  - common platform(s)
  - shared code
  - single "family" for both organisations

- to meet the needs of forecasters and technical users

A Linux-based Weather Forecasting System for the NWS

Herb Grote(1)
NOAA Forecast Systems Laboratory
Boulder, Colorado

Presented at
European Working Group on Operational Meteorological Workstations (EGOWS), June 11-14, 2001, Zurich, Switzerland.

1. Introduction

In the last decade the NWS (National Weather Service) has been especially active in modernizing its field offices and upgrading its observing systems. Advanced Doppler radars have been deployed across the country, an automated surface observation system has been fielded, satellites have been upgraded and all forecast offices have received a new system to integrate and display the many existing and new observational data sets. Although these systems are relatively new they are already feeling the effects of rapidly changing technology and increasing system requirements. Some of the current technology is becoming difficult to maintain and is being stressed to meet the additional demands on the system.

The scope of this discussion is limited to the proposed evolution of the workstations system in the field offices and does not address any planned upgrades of sensors and networks. The design challenge is to arrive at an architecture and hardware complement that will meet the long- term needs of the NWS and one that can be achieved by evolving the existing system.

2. Linux O/S

The Linux operating system has been used by scores of software developers for years. However, recently Linux is also gaining popularity with many other groups for web server, databases, and other applications. The Linux operating system is also being considered for the new AWIPS system architecture. Linux runs on a variety of computer platforms including the Intel-based PCs. Software developed for Linux is more likely to use ANSII-compliant compilers and eliminate the developer's temptation to use language extensions provided by the hardware vendor. Using vendor extensions may lead to reliance on one particular vendor's hardware, which can make it difficult to take advantage of technological advances and cost reductions offered by other vendors. Figure 1 provides a performance comparison between a Pentium 3 PC and the current AWIPS hardware. The average performance improvement for various typical AWIPS functions was double.. For some CPU intensive tasks, such as data decoders, the performance improvement was more than ten times better. This cursory test seems to indicate that PCs are capable of meeting the performance requirements for operational forecast systems.

3. System Components

The AWIPS system is broken down into five major components to help describe the key features of the new system architecture. The system at each forecast office consists of the display, data storage, application, data acquisition and local area network components.

3.1 AWIPS Display - The current AWIPS display software takes advantage of the hardware vendor's proprietary graphics card and operating system. To eliminate this dependency, the AWIPS software has been rewritten to work with most 24-bit (true color) graphics cards. The graphics displays are generated using the X11 library and the user interface uses the tcl scripting language and tk toolkit.

The proposed display consists of dual processor PCs with dual color monitors running Linux and the AWIPS-Linux software. A single mouse and keyboard will be used to enter data and control the display functions. Because of the need to buffer large amount of images and some raw data two gigabytes of memory are suggested. A separate PC and monitor are being considered for displaying text data. Each forecast office will have five, or more of these display system configurations.

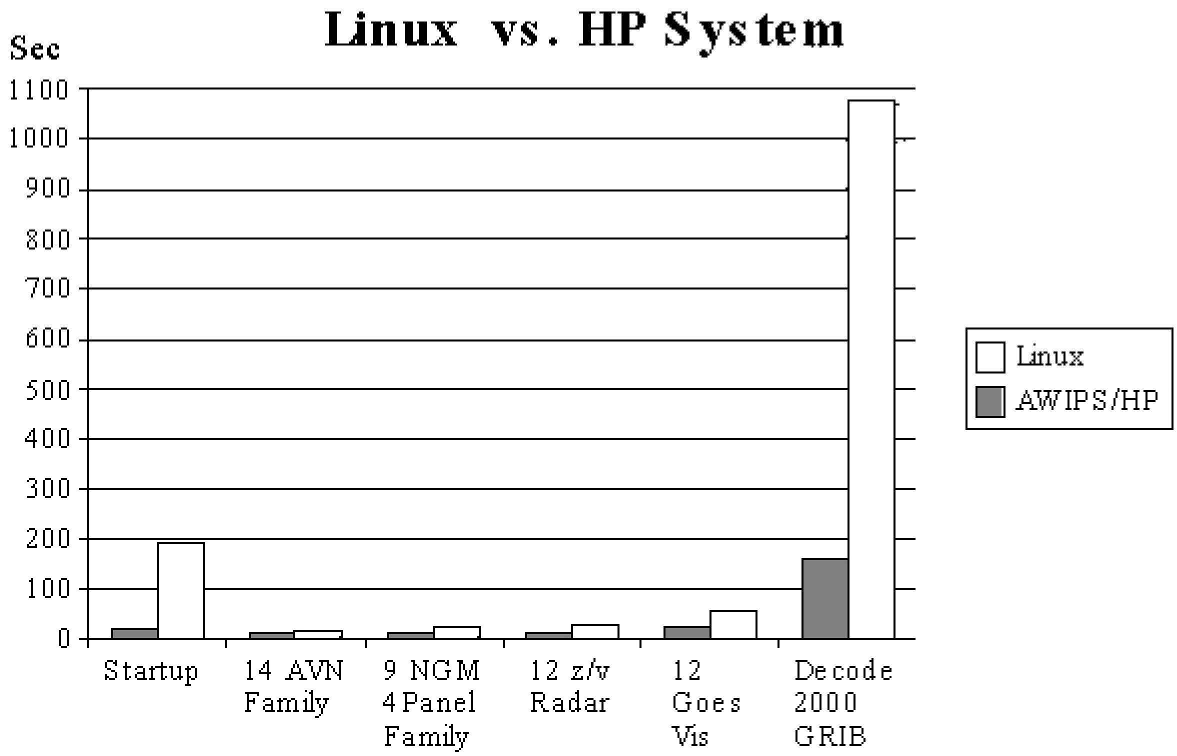


Fig 1. Processor Performance Comparison

3.2 Data Storage - With the exception of text data and some hydrological data sets (which are stored in a relational database) hydro-meteorological data is currently stored on redundant data servers in flat file format The use of a single data repository simplifies data management but may lead to a communications bottleneck as the data demand by workstations and applications increases.

The proposed data storage architecture consists of a Linux data server with dual processors, power supplies, and network cards; and RAID 5 data striping. In addition to storing data on the data server, which stores all meteorological data for a specified period of time, selected data will also be stored on each workstation and application processor. This will provide rapid access to a selected set of data since disk contention is reduced and data does not have to be transmitted over the network.

3.3 Application - AWIPS applications include a wide range of data processing from local forecast models, to storm tracking algorithms and decoders. Currently, AWIPS does not include local forecast models, and other applications are severely restricted by the limited amount of available processing.

Beowulf clusters consist of a number of Linux computers interconnected by a high-speed network, such as Myrnet. These clusters compete with more expensive high performance computers and are ideal for executing certain forecast models. These clusters are being evaluated at the Forecast Systems Laboratory for use with mesoscale forecast models.

To meet the high reliability requirements for an operational system several software packages exist to create High Availability Linux configurations. Two or more Linux computers can be configured to allow load leveling between machines or automatic fail-over should one of the computers fail. A dedicated heartbeat LAN between the computers detects when one of the computers fails. High availability Linux configurations are proposed for the applications processors in the new AWIPS architecture.

3.4 Network and Communications Protocol - The current AWIPS system uses FDDI to interconnect all workstations and servers, and a 10 Mb/s ethernet to attach data acquisition processors, printers and other peripheral devices. Redundant network switches (using the Spanning tree) route data between the FDDI and ethernet networks. FDDI technology is nearing obsolescence and the 10 Mb/s ethernet is actively being replaced by faster ethernets. The proposed LAN uses a network switch that supports 100 MB/s and 1 GB/s ethernet speeds. These communication speeds are expected to be adequate for the higher resolution national models and base radar data that are expected to be part of AWIPS.

A higher-level communications protocol that supports data broadcast, using a single transmission, will transmit real-time data to the local data caches on the various processors. The broadcast protocol allows for retransmission of data if one of the nodes did not receive the complete transmission.

3.5 Data Acquisition - The AWIPS national network consists of a Satellite Broadcast Network that broadcasts synoptic observations, satellite imagery, guidance products and other information. A WAN (Wide area network) is used to forward information to the network control facility and exchange information between sites. Special communications processors receive local data, such as radar and mesonet observations, are. These processors will also be replaced with Linux-based machines.

4. System Architecture

The following paragraphs describe the evolutionary change in the system architecture using these components.

4.1 Old Architecture - Figure 2 shows the system components as they are configured for the current AWIPS system architecture. HP (Hewlett Packard) is the manufacturer of the majority of the computer hardware. The HP data and applications servers are configured such that a failure of any one of these machines automatically results in another machine assuming the load of the failed machine. In this architecture, the FDDI ring interconnects the data and applications servers, and several HP. The ring interfaces to a lower speed 10 Mb/s ethernet that interconnects the "front end" data acquisition and communications processors.

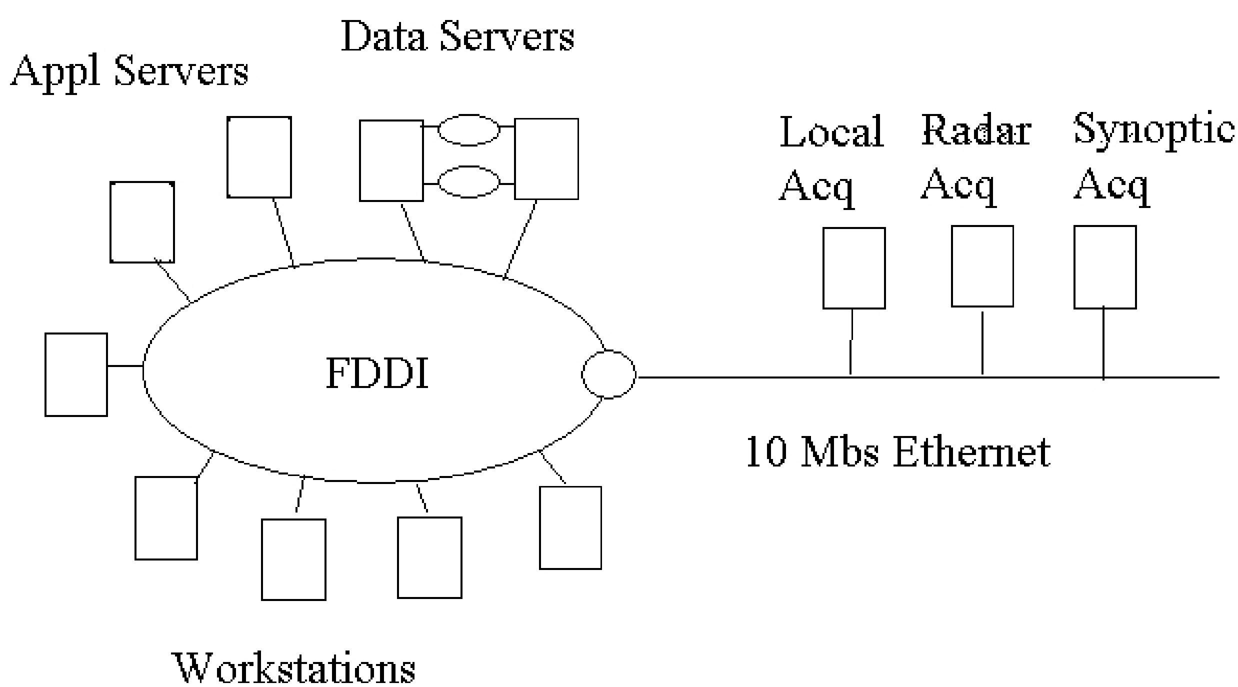


Fig 2. Old Pre-Linux Architecture

Real-time data flows from the acquisition and communications processor, through the network switch to the data servers, where the data is then decoded and stored. The workstations and other applications access the data on the servers as needed.

4.2 Transition Architecture - The transition architecture (Figure 3) includes a fast ethernet port on the existing network switch. This ethernet port is connected to another high-speed network switch that will be part of the advanced system architecture. All new hardware will be connected to this switch and will be able to communicate with the older machines on the other part of the network. As new machines are added to the network, older machines are removed and the older networks are slowly decommissioned.

With this enhanced architecture, the data flows from the Linux communications processors on the new high-speed network, to another Linux machine where the data is decoded and stored on its disks. Initially, only some of the data will be decoded on the Linux machine and the rest will be decoded on the HP server. A broadcast protocol will send the decoded data from the server to all of the workstations on the new high-speed network

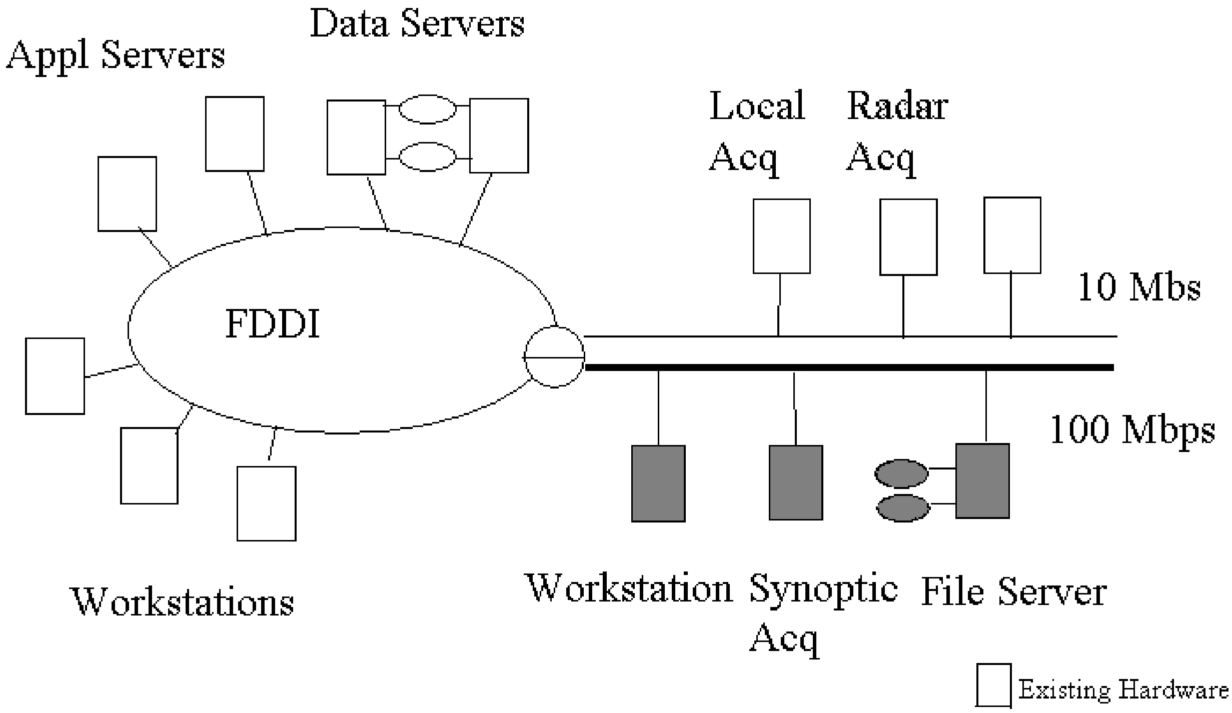


Fig 3. Linux "Transition" Architecture

4.3 Proposed Architecture - Figure 4 depicts the proposed final AWIPS system architecture. All of the original computers will be replaced with Linux computers connected to the new high-speed network. The old hardware, as well as the FDDI and low speed ethernet will be decommissioned. Additional application and acquisition processors will be added to accommodate specific new requirements.

It is envisioned that data will flow from the various ingest and communications processors on the high speed network to redundant Linux machines for decoding. The decoded data will then be stored on a network file server and also broadcast to all machines on the local network. The workstations and application processors will have most of the data stored on their local disks.

5. Implementation Status

The large majority of the display and data acquisition code has been ported to a Linux platform. The data decoders have been ported and are being tested for reliability and data accuracy after decoding. Also, the AWIPS contractor has converted the SBN communications processor code to run on a Linux platform and has provided initial systems to the NWS and FSL for evaluation.

Porting the hydrological applications (written mostly on FORTRAN) is a significant effort that is currently in progress and expected to be completed before the end of this year. In order to support the existing AWIPS configuration in the field and the transitional hardware, all code is being compiled each day for the HP-UX and the Linux platforms.

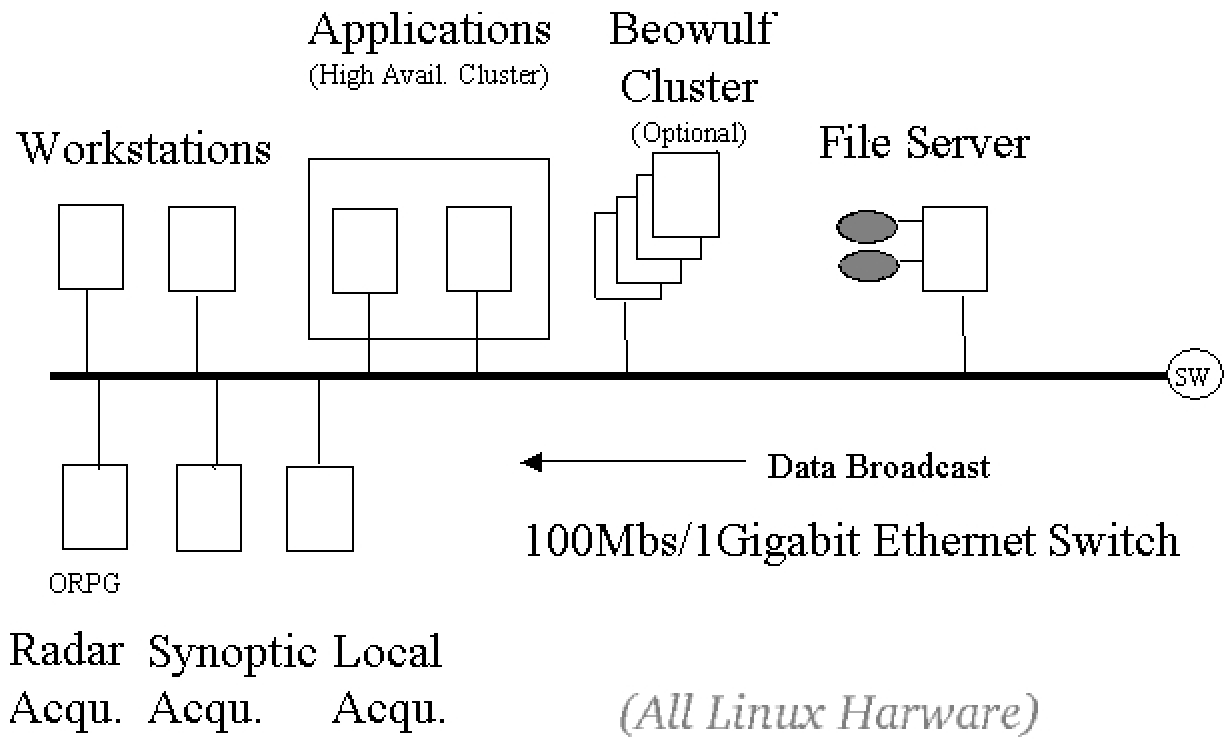


Fig 4. Proposed Linux Architecture

Several AWIPS/Linux workstations have been deployed to NWS field offices for evaluation. These systems are currently connected to the 10 Mb/s ethernet and therefore only see significant performance improvement for processes that do not require transfer of large amounts of data. However, tests performed at FSL using the transitional configuration with a 100 Mb/s ethernet show significant overall improvements in performance. The CP, 100 Mb/s ethernet switch, and decoder processor for the AWIPS transitional architecture will be installed at a larger number of field offices in the near future.

Implementation Issues - Although Linux has been widely used for web servers, data servers, and software development, it has not been used by government or industry for mission critical applications. There are a number of issues that concern potential Linux customers. Among these are maintenance and support, system configuration management, and security. Although, it will take time to satisfactorily answer these questions the risk appears manageable. A number of companies, including HP, IBM, and Red Hat, provide Linux support. Red Hat and other Linux distributors package Linux with other software, such as X-window software and drivers for a variety of equipment. Linus Torvalds the founder of Linux, controls the evolution of the Linux kernel. Rapidly changing technology and hardware can be a challenge for managing a large number of systems. This will require additional work from the software developers and integrators to insure that all software continues to work with new releases of hardware and software. Making large purchases, rather than small interactive purchases can help to reduce the variety of hardware that has to be maintained.

Footnotes

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STePP, a Current Co-ordinated Project Between SMHI and SAF

"Visualisation in Sweden's Co-ordinated Technical Production System"

Kjell Dennerstedt,SAF
Caje Jacobsson: SMHI

In Sweden there is an ongoing co-ordinated project between SMHI (Swedish Meteorological and Hydrological Institute) and SAF Weather (Swedish Armed Forces Weather Service). The objective is to create a new, co-ordinated technical production platform, based on a quality assured database. The foundation of the new system is the SMHI concept RiPP/ROAD, which has been developed during the latest years, and the experiences from the current visualisation tools in both SAF and SMHI. The project is also handling future developments.

This project is expected to run until at least 2004.

Orientations in Météo France on Meteorological and Production Workstations.

Magali STOLL, Direction of Production
Head of SYNERGIE Programme
Marie Françoise Voidrot, DirectionIT, Information System Management
Management of Synergie system
Stéphane Thomas, Direction IT, Information System Management
Quality, Methods and Tools

The principal realisations of the SYNERGIE Programme since the last EGOWS meeting in 2000 will be presented as well as the general orientations at short and medium ranges. They concern at first an enhancement of the general quality of the Programme, by operating a stronger priority on the specifications by the ensemble of Synergie users, linked with the general forecasting needs and projects in Météo France. They concern also the Synergie system maintenance and evolution processes as well as the convergence with other tools. Each Synergie release is now managed as a project with an annual frequency of delivery. Each release project covers two years between specification phase and final deployment. Thus, in 2000, the 3.3 Synergie release has been deployed for all Météo France users and the 3.4 release has been developed in parallel. The 3.4 factory acceptance has been made in march 2001 by the Forecasting Direction, and the on site acceptance will be finalised in may 2001 by the Information Systems Direction, to allow a complete deployment in 2001. With this planning, an outside Synergie user could get the last operational version one year after Météo France users. As the Synergie users and actors increased and is disseminated all over the world, a specific Synergie Intranet site is being developed to help the coordination of all transversal actions, to follow the planning, to phase with others projects, and to easy internal communication. This quality approach to manage the needs and the developments, and to capitalise the experience, will follow on 2001 for all the domains concerned by the SYNERGIE Programme. Through the SYNERGIE Programme and the Synergie Systems, Meteo France has now acquired and capitalised a long and solid experience on the management of operational meteorological information systems. The new Direction of Production in Météo France plans now to generalise and adapt this experience for the management of other kinds of tools used for the production activities (forecasting, climatology, end-users production). It will concern for example the ASPIC and PIC tools (regional nowcasting and local meteorological workstations), tools where the main functions are quite similar on Synergie (Visualisation, Graphical Interaction, Expertise formalisation, End users production). The technical questions as the mix of different operating systems (Unix, Linux, Windows NT) will be then studied with a good knowledge on the needs, and thus with a better positioning of each kind of tools. The main objective in Météo France is to be ready for the conception of the next generation of meteorological workstations, linked with the evolution of activities on production. All this work made in Météo France is a common preoccupation inside the European Meteorological Services. A bilateral reflex ion has began with the Met Office to see if a common way could be taken to cooperate. This announcement will be made at EGOWS with Steven Foreman, Head of Information Systems Development in MO.

Java application for issue- and monitoring TAF

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Danish Meteorological Institute (DMI)
Copenhagen, Denmark

1 Introduction

Back in the years of 1994-95 a TAF tool used to issue and monitor Danish TAFs was developed at the Danish Meteorological Institute. The TAF tool has been used with success by the Danish forecasters since 1995, but it was not able to handle conditions found in Greenland. In 1998 it was therefore decided to implement a modernised version called SPOT. In addition the DMI should participate in the European TIPS (TAF interactive Production System) project. It was believed, that some of the software developed by TIPS, could be used in SPOT. The TIPS project ran into some delays and it was decided to start the development of SPOT using Java. In this way, the SPOT application became one of the first major Java developments at DMI. It is still our hope, that the TAF verify software from TIPS, can be added although written in C.

2 Techniques and Platforms

The SPOT application was developed using JBuilder on a Windows-95 platform using techniques like:

- RMI (Remote Method Invocation)
- JDBC (Java Data Base Connectivity)
- JavaCC (Java Compiler Compiler)

SPOT has been tested on different Windows platforms, Solaris and Linux. It is now running operational on the Solaris platform.

3 Dataflow

The data is controlled by a MySQL database and a database demon. The demon is used to collect TAF and METARs on two database servers. When a SPOT application is started, one of the database servers is contacted in order to register the application as a subscriber for new data.

When data arrives into the database all present subscribers will be notified by a RMI call and the SPOT applications will be updated.

If the database daemon is no longer able to contact a SPOT server, the associated subscriber is removed from the database.

4 Features

The first version of SPOT has following major features:

- SPOT contains a time schedule which is easily updated
- SPOT has a TAF- and METAR viewer
- SPOT is a TAF monitor
- SPOT shows a TAF and related METARs in a graphical way including amendment limits
- SPOT has a TAF editor with a highly developed syntax control
- SPOT is highly configurable

5 Future

Next version of SPOT is planned to contain:

- Climatology (almost ready)
- HIRLAM forecasts
- TAF verification

Later versions will hopefully be able to incorporate a first guess TAF generator and a GAFOR generator.

6 Other recent Java developments

DMI has developed a Java library for common use. Some of the major classes are:

- Classes for handling date and time in a proper way
- Classes for handling world-wide maps and layers of graphics
- Classes for handling common GUI items
- Classes for TAF- and METAR parsers
- Classes for simple charts
- Classes for handling time-series of meteorological data

TIPS Status and Recent Development at DNMI

TIPS: The Taf Interactive Production System is now finished and released in an alpha version.
TIPS has been started in COST-78 in cooperation with several European countries. The work has been finished under the umbrella of EUMETNET. As a real child of the EGOWS the result of this work will be presented here.
TIPS has resultet in a ANSI-C software library which can be included and used by any TIPS-member. The library has an easy, string based interface and is able to parse TAFs and METARs, and can compare the resulting structures to each other (MONITORING and VERIFICATON). This corresponds to the TIPS tasks 4-6.
The system is strictly following the ICAO rules but can be modified by dynamic Amendment-Criteria which can be adapted to specific sites. TIPS does not take advantage of local rules for TAF storing/reading. The interface for TIPS is the TAF-string which is free for the specific aviation center to exchange with a database, file or user-interface.

Recent development:

The QUBA (QUality assurance dataBAse) is now operational. This system is able to process any kind of time-series forecast. The system is fully dynamic and able to process several forecasters at a time. The forecasters work against the same database. Everybody is through this able to control the forecasts of the other colleagues at realtime, which enhances the consistency of the national forecasts. The system is coupled to a product database which on one hand is used to process the resulting products and on the other hand informs the forecaster about what to forecast at which time/place.
The DIANA (DIgital ANAlysis) program will be operational in the very near future. DIANA is a system for interactive on-screen digital analysis. Fields and surface observations can be shown, as well as satellite images and products.
Starting with model data or previous analyses the forecaster produces an analysis by editing fields, and drawing fronts and weather symbols. The analyses from the regional forecasting centers are sent to a common database where they are distributed to the other centers. One of the centers will have the responsibility for combining the different analyses to produce the official DNMI analysis. The forecaster does this by moving the borders between the different regions and thus decide where the different analyses are used.

A Data Warehouse System for the Meteorological Data of MeteoSwiss

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2 Swiss Technology Consulting Group, Zurich, Switzerland

MeteoSwiss recently started a project to consolidate the various databases, data processing systems and quality control systems in a unified conceptual architecture. It was recongized that the presently implemented approach of an enterprise-wide database is not be suitable to fully meet the users needs. This is mainly because it is difficult to tune a database for online transaction processing (OLTP; e.g. online loading of data, quality control or correction of faulty values) as well as for online analytical processing (OLAP; e.g. production of meteorological services or climate research). In order to overcome this problem, considerations of the early nineties to separate these main tasks into different layers are reexamined in the light of definitions from the 'Data Warehouse' technology. This technology is mainly used in the business world to support management decisions. The conventional definition of a Data Warehouse System was adapted to the tasks and needs of a National Weather Service. Starting from an abstract reference architecture a conceptual architecture for MeteoSwiss was developed. This architecture consists of two core layers which are embedded between the data sources and the end user applications. The bottom layer is the so called 'staging area' containing work databases. These databases are mainly used to collect, transform, integrate and quality control the data. This layer contains complete datasets in original time and space resolution in a normalized database model and provides consistent and quality checked data. The upper layer is the so called 'data storage' area. It consists of an 'analytical database' (or data warehouse) and application and user specific 'data marts'. Here original and aggregated data are stored in a not normalized way according the different user's needs. The staging area is fed by the data sources (e.g. Global Telecommunication System, MeteoSwiss observation systems) whereas enduser applications are connected exclusively to the data storage area. The so called 'metadata repository' plays a key role in the whole system is of special significance for the database specialist as well for the meteorologist/climatologist. Quality control procedures are of utmost importance in this system. This topic will be treated in a separate contribution. The paper will discuss the basic defintions of Data Warehouse technology and their adaptations for the domain of weather and climate as well as the conceptual architecture. Examples for various data types (surface, upper air, satellite and radar etc).

Operational Applications Related to the Local Model at MeteoSwiss

Guy de Morsier

At MeteoSwiss the Local Model (LM) is the main numerical weather prediction (NWP) tool for the short range forecast.
This model is non-hydrostatic and has for the time being an horizontal resolution of 7 km. The Swiss configuration has 385x325 grid points in the horizontal and 45 levels. This domain covers a large portion of Western Europe. The boundary conditions used to integrate the LM are coming from the German Weather Service's (DWD) global model (GME) and has an horizontal resolution of 55 km.
Now we use less than 70 MB of input data for one run and produce more than 7 GB of output for a 48-hour forecast. And this is done twice a day. The implementation and use of the model is quite a complex task but we have more than 10 years of experience sharing a common model with the DWD and executing the model on an external computer.
This presentation will show how the data flows from the DWD to the NEC SX-5 supercomputer at the Swiss Center for Scientific Computing (CSCS) in Manno and back to MeteoSwiss.
Some of the tools and applications used to retrieve (MARS), assimilate, archive and display (Metview, IDL) the NWP data in operational mode will be illustrated. Also the future changes to the system will be indicated.

User Training on the Horace Workstation

Shelley Robinson
User Services Manager
Met Office

Training on the Horace workstations is provided for both internal and external customers of the Met Office.
There are two basic types of training requirements; basic training for new users of Horace and ongoing refresher courses for experienced users. Basic training takes the form of a one or two day course depending on the subsequent role of the user. This training will cover the essential applications and functionality which a new user will require to do his job. These courses are run on an adhoc basis at the request of the customer.
Refresher training is planned to run for a week to coincide with a new release of software, currently twice a year. Users can nominate themselves to take part in this week, normally for just one day. Pre course questionnaires are used to gauge the material which the user wishes to cover. These questionnaires are then used as a basis for the structure of the refresher course but new applications and functionality are also included.
Training needs analyses are carried out to ensure that Horace Training is tailored to the role of the trainees.
Trainees are asked to complete an online post course questionnaire which is used to make further improvements to the training process.

EGOWS 2001-Zuerich, 14-06-01

Report of the WG on Meteorological objects

The MO'WG had its third meeting since its creation th 13-06-01 during EGOWS 2001 in Zuerich.
It is reminded that its main goal is to propose a list of meteorological object to be submitted to WMO
As a future standard.

The work done by the WG since EGOWS 2000 has been presented and the WG considers that The workplan has been almost achieved. The WG has produced a list of meteorological objects which
Is a synthesis of the proposals received from its members. However, two points must be noted:

- the WG received only 3 contributions, which is undoubtedly too short for being sure that
  the list meets the needs of a large meteorological community
  the WG did not contact groups out of Europe as it was recommended last year.

Nevertheless, the WG considers that the present list acceptable as a first guess to be delivered to involved NMS for checking that it includes the objects the need for their present or future applications.
In the same time, the WG has to produce a detailed list of attributes for each identified object. To do that, it is recommended to refer to the existing WMO list of conceptual models supporting Sat Rep.
Then, it will be possible to create the corresponding XML objects. A graphic transcription of some objects from the different main classes would provide an interesting illustration for concretising our initiative.
The WG should profit my presenting its activities and progress on the web.

The following one-year workplan has been approved:

- the present list of meteorological objects will be sent to all WG members for checking that the list meets the needs of their NMS. Action by Dick Blaauboer an d Eric Brun.
  Responses from the WG members before the end of October
- Christian Csekits sends to the WG members a DC including the WMO pages about conceptual models used in Sat Rep. Action before the end of September.
- The work for defining the attributes for the meteorological objects will be shared by several WG members:
  - Christian Csektis: objects corresponding to Sat rep concepts
  - UKMO (to be confirmed) : objects from the class "Action Centres"
  - Juha Kilpinen and Uros Strajnar : objects from the class "Sensible weather"
  - DNMI (to be confirmed): objects from the class "Synoptic typical features"
  - MF: objects from the class "Others"
  - This work should be achieved before end of 2001

  - Dick Blaauboer an d Eric Brun will do the synthesis of the list of attributes and of the possible new objects before March 2002.
- Creation of XML corresponding objects and illustration to be done by Uros Strajnar and Ernst de Vreede before EGOWS 2002.
- The list of the WG members will be updated to take into account the changes that occur since the WG creation. Action Dick Blaauboer an d Eric Brun.

Visualization Techniques

1) Review of last year's report
2) Visualization techniques (textures)
3) Graphic API's (Scenegraph)
4) GIS

The general impression is that more intelligence is now entering the graphical forecast process.

1) Review of last year's report

No specific comments because most statements are still valid. The issue of 2D and 3D is still not solved (see below)

2) Visualization techniques

3D remarks:

- For monitoring the analysis procedure or for conceptuel model understanding 3D is valuable.
- Accuracy can be critical for hybrid vertical coordinate models because of the impact of terrain following model layers.
- Iso-surfaces can be used for easy and better definitions of cross-sections through pollution plumes.
- Rendering/depth viewing.
- Shadow casting, transparency and texture mapping can very much help navigation of 3D images.
- Textures could com from new techniques for wind (see key-note paper) or i.e. from satellite and digital elevation information.

Imaging:

- Gradients are or can be important and you should try to understand them and not smooth them out. This leads to a pixel or raster information display which is very well hardware supported.

  This image approach permits to compare radar, satellite and NWP data (UKMO, Nimrod) and prevents any over or under interpretation of isolined data. Image manipulation such as zooming, discriminating, slicing, stretching and web production are made much easier.

Implementation:

- There are definitely NO price or technical issues which prevent using 3D.
- 3D systems must be integrated, supported and fast for an operational use otherwise the forecaster goes to 2D and stays there.

3) Graphic API's (Scenegraph)

DWD are strongly using virtual reality scenegraphers.

KNMI and DWD are convinced that OpenGL is faster than GKS or X and use it.

UKMO: DELPHI for Windows and Unix

4) GIS
UKMO: ArchInfo and ArcView for real-time radar and web-based applications.
For the moment the meteorological information is passed to the GIS.
GIS would of course like to have the weather information in the system but the system must be fast so than it can be used.
Good to add value to any product (i.e. road, pollution, energy clients) because it makes the output much closer to the user's understanding.

Recommendations concerning visualization
Java2D, Java3D, OpenGL and XML
"Thinking in Java" in :www.brueceeckel.com

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Strategies in systems design and development , Zuerich 14/06/01

Subject	Organisation issues	Technical issues	Recommendations
ISO 9000	- Quality processes. - Already have informal quality processes. - Need to be compatible to exchange code.	- Description of processes and interfaces.	- Next EGOWS should have presentation on ISO 9000 issues (volunteer or experts expected). - Need to be clear on life cycles used.
Documentation	- Needed when staff change. - Helps avoid relying on key staff.	- Dr Genius (DNMI), Rational Rose (tried and rejected DNMI, FSL), ClearCase (ECMWF), TogetherJ (DWD, MeteoSwiss), Sniff (DWD, MeteoSwiss).	- Documentation must: exist, be updated and be available (e.g. intranet).
Configuration management	- Needed for quality process. - Reduce reliance on key individuals.	- Sniff (DWD, MeteoSwiss), Continuus (MO), ClearCase (ECMWF), PCMS (FSL), homemade (MF).	- Collaborators may need to use same system – depending on flexibility of tool.
Testing	- Needs significant effort, even when automated tools used. Key issue to maintain operations. - Testing reduces needs for post-release patches and also reduces disruption for users and operations.	- Need to keep testing scripts for tools up to date with code. - Need both unit and system testing. FSL have duplicate forecast office for testing. - Tools help to test intermediate builds. - Memory leak detection: Purify (ECMWD, MeteoSwiss), INSURE (DWD).	- Developers must plan and control testing carefully.
Communication	- Developers on different sites need to be able to synchronise their work and	- Even with a one year release cycle, frequent intermediate builds help co-	- Any method of communication should be tried!

	adapt to changes elsewhere in the project.	ordination (MF) - Frequent meetings (DWD) - Video tele-conferencing (FSL).	
Requirements management	- Must be clear on: specification, benefits, priorities. - Users must know how to introduce a new requirement request. An individual must be responsible for making sure a clear specification is produced.	- User Groups useful tool (MF, MO, FSL) – but issues with prioritisation across different types of user/requirements.	- Collaboration will need the partners to define this process across organisation.
Problem management	- Need to understand impact of problems – and concentrate on high impact patches – otherwise impact on development.	- Patch policies defined (MF, FSL, MO). - Use standard "helpdesk" reporting system to track progress with problems (MO).	- Clear patch policy needed (when to issue patches, make sure they, or other solutions, are built into future releases).
Standards needed	- Standards are essential for co-operation between organisations.	- Data formats – WMO - All use local extensions to WMO formats – but gets in the way of co-operation. - Middleware standards starting to be used (MF, DWD, CNMCA) and provide opportunity for sharing functionality without needing to integrate source code.	- Support WMO in developing and evolving standards for data formats, etc. including GRIB, BUFR, XML. - Next EGOWS investigate Eumetnet project to define middleware (e.g. CORBA, SOAP) standards for meteorology – this will need preparations and suggestions for experts welcome.

Participants in workgroup

Christoph Voisard, MeteoSwiss, Switzerland
Giovanni Maresca, Italian Air Fore Met Service
Uwe Herb Grote, NOAA/Forecast Systems Laboratori, USA
Kieran Commins, Met Eireann, Ireland
Juergen Schulze, DNMI, Norway
Dirk Heizenreder, DWD, Germany
Zdenk Kristufek, CHMI, Czech
Oldrich Spaniel, SHMI, Slovakia
Jens Daabeck, ECMWF
M-Fancoise Voidrot, MeteoFrance
Steve Foreman, Met Office, UK

Final discussion

At the end of the meeting the Working Groups results were presented (see reports in this proceedings).
Here some general remarks about possible future trends in EGOWS topics:

- Many issues are common with nowcasting developements: it could be interesting to share experience and knowledge between nowcasting and visualization.
- Visualization could/should include come kind of forecast methods.
- In the next years new kind of data will come (i.e. Meteosat Second Generation and derived SAF-Projects): it will necessary to develop new presentations and methods.
- Representation of EPS-data evolved over the years, i.e. EPS-Meteogram from ECMWF. Still a problem the presentation of wind direction.
- More integration between forecast (all ranges), production and visualization technology in the operational WS.
- The increasing amount of the data is a big challenge: how to extract the relevant information, how to find an ergonomic way to enhance the data. In the future the duty to screen all data to identify the relevant information could be moved to "intelligent" system working in background, giving some kind of guidance to the forecaster "where" to look.

The aim of the EGOWS meeting was always to find some kind of collaboration among the NWS. A necessity for the future should be the standardisation of formats, methods, objects, ...

A change in the organisation of the EGOWS meeting has been proposed:

1. Two kinds of presentation:
   - short (20 minutes incl. discussion)
   - long (40 minutes incl. discussion, possibly with some kind of demo)
2. Demos (just half a day)
3. More working groups or/and longer session
4. Several invited keynote speakers on relevant issues
5. A questionnaire to identify the relevant topics should be distributed with the announcement.
6. Some possible issues have been quoted:
   - Middleware
   - ISO 9000
   - Nowcasting
   - Forecast methods
   - New kind of data
   - 3D
   - Standards

Operational and Planned Java Applications at Deutscher Wetterdienst

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Overview

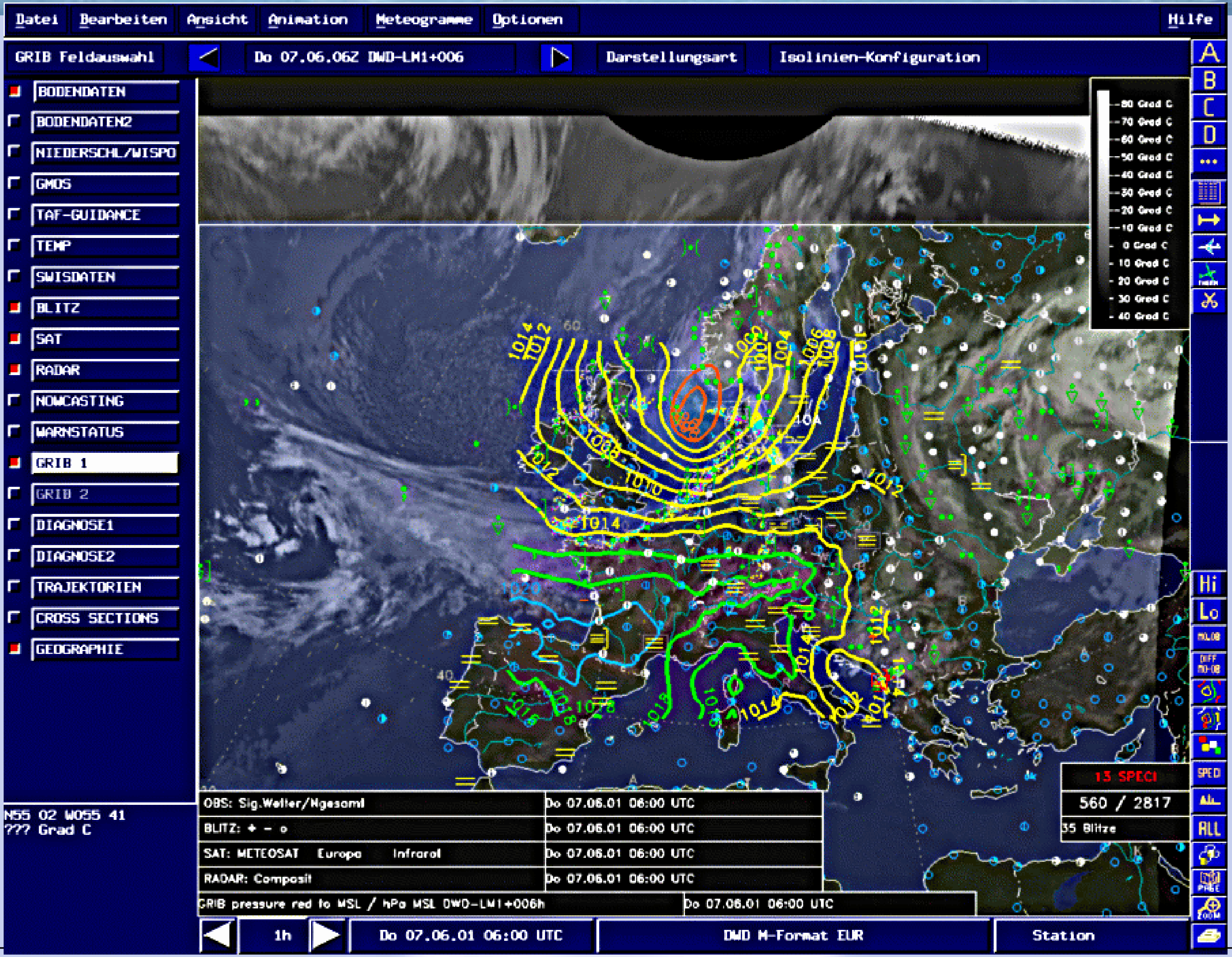
- Current Operational Environment (MAP...)
- Why Java?
- **JavaMAP**
  - Goals, Client, Server
- **QualiMET**
- **The Common Graphics System**
  - Goals
  - Team, Time Schedule
  - A Few Words on Performance
  - Architecture

Current Operational Environment
Systems

- Current Systems MAP, IGS in development/ use since 1990 on SGI-Platform
  - **MAP**:
    - display of observations, imagery, NWP-data ...
    - production and monitoring of warnings
    - Modified Model Output MMO
    - since start of CGS project only minor modifications, optimizations and maintenance
  - **IGS**
    - Interactive Significant Weather Charts
    - Interactive Application System (thematic maps)
  - Both systems meet end user´s requirements very well

Current Operational Environment

MAP



Current Operational Environment, *Shortcomings*

- MAP, IGS
  - tied to UNIX platform
  - getting somewhat difficult to maintain/extend
  - very few experts
  - lacks functionality
    - integrated interactive data/chart modification
    - 3D
    - GIS...
  - separate interactive chart production and 3D visualization

Why Java ?

- Portability
  - Java is an interpreted language (byte code): “Compile once, run everywhere”.
- robustness/steep learning curve due to
  - no pointers
  - no multiple inheritance
  - no explicit memory management
  - exception handling
- Performance can be compared to C++ for 2D- and 3D- meteorological applications
  - new compiler technologies (JIT, Hot Spot)
- high productivity due to
  - large built-in libraries
- specialized libraries
  - JDBC, Java3D, JAI, JNI, RMI, Serialization

JavaMAP
Architecture

- client/server system to supply meteorological information to
  - lay people
  - people outside the operational weather forecasting environment
  - prepare reports
- based on Java2 (jdk 1.3, JFC, JCE, JDBC)
- C/S communication via the internet using sockets
- server side data access
  - flat file system
  - MAP database
  - RDBMS ORACLE

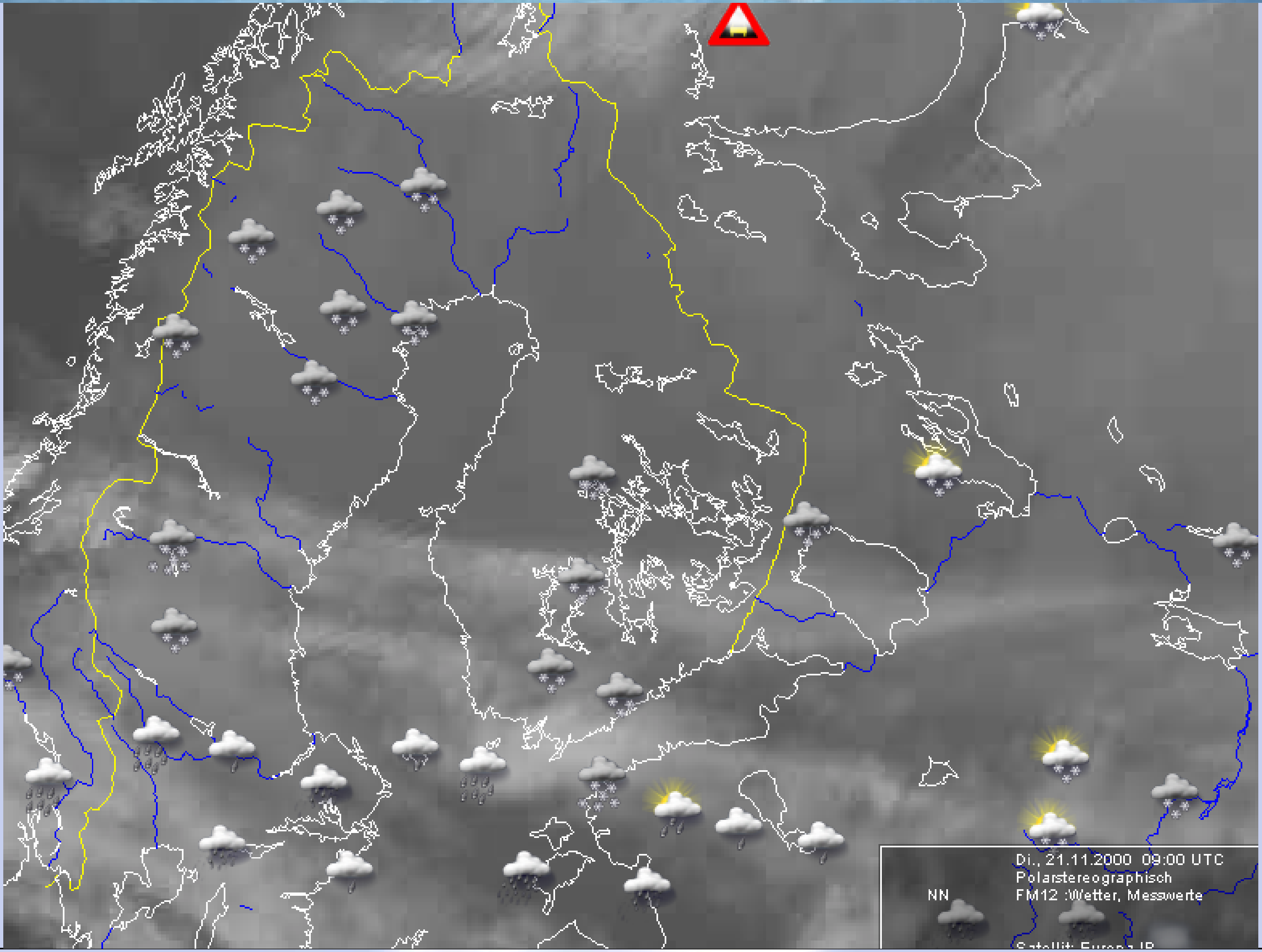
JavaMAP
Server

- Server Features
  - High performance due to optimised socket architecture
  - Multithreading using multiple server ports
    - Establishing server connections on standard port
    - Session ports allow authentication and request handling of multiple clients simultaneously
  - High level of security
    - public/private key encryption used for authentication and secure transmission of passwords
    - session keys enable secure handling of client requests

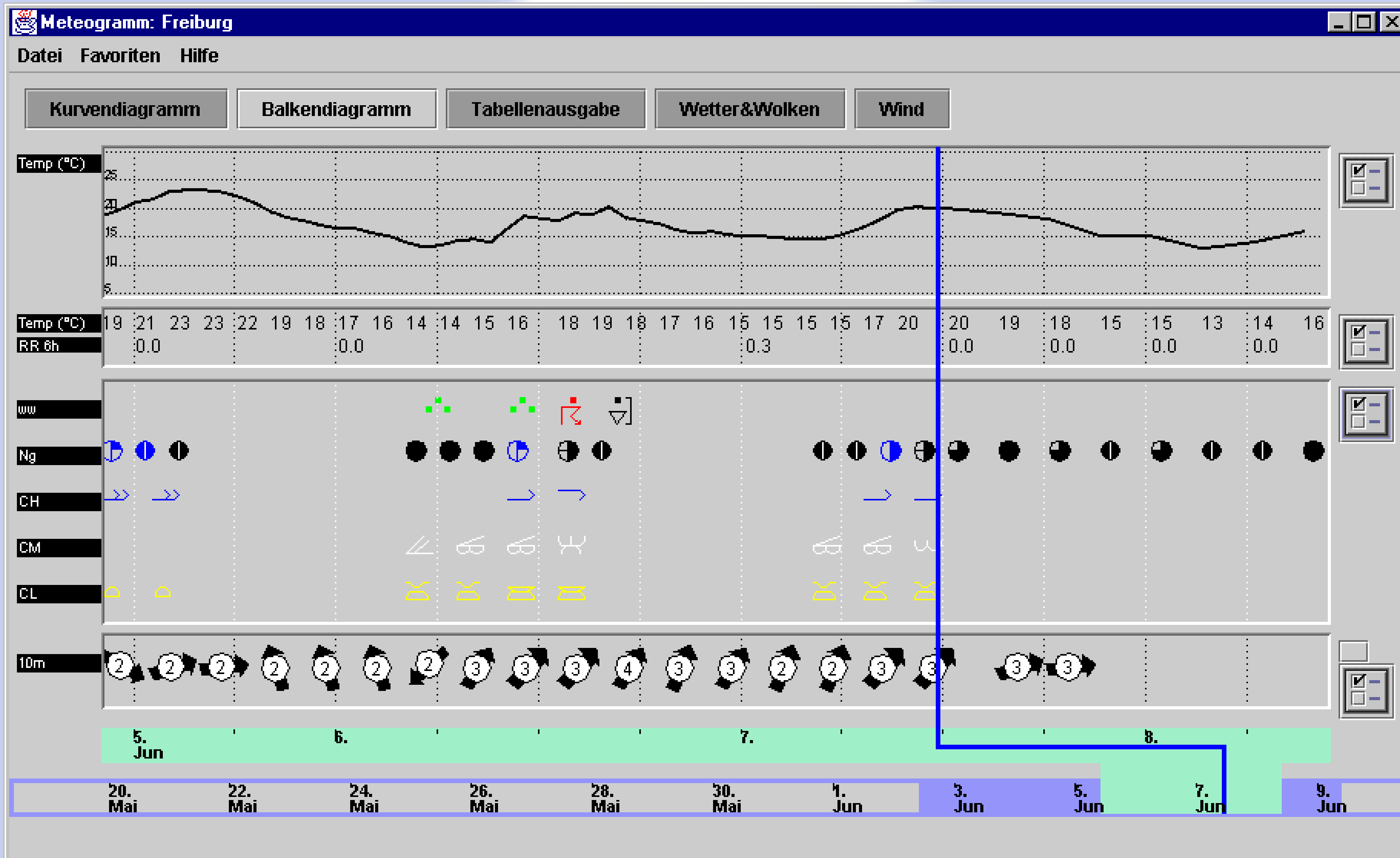
JavaMAP
Client

- Display/animation of meteorological data on maps or meteograms
- Geogr. Context (elevation, vector data)
  - adaptive selection of multiple resolution levels
- surface observations/forecasts:
  - FM 12, Kalman-filtered LM and GM_E
  - configurable depiction of all parameters
- imagery
  - radar
  - satellite (meteosat, world composite)
- NWP data
  - images only, produced by TriVis

JavaMAP
Client



JavaMAP
Client



QualiMET

Goals

- Distribution of centrally collected data of the new automated observation network “Messnetz 2000” to the regional offices for testing
- Seven regional offices
- Each regional office: about 300 stations,
  50 measured elements
- About 1.2 million measured values per day checked by each regional office with 125 individual examinations
- Interactive correction of erroneous or missing data supported by a specialized visualization program
- Feedback to the meteorological stations about failing/misbehaving sensors

QualiMET

Examination Procedure

1. checking completeness
correction

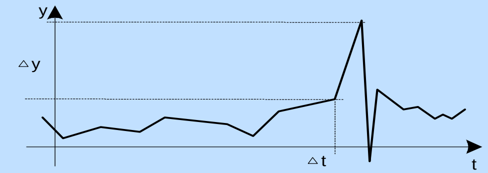
t1	1003
t2	1003
t3	**missing value**
t4	1002
t5	1002

2. checking climatic limits
correction

January

Maximum temperature
in Munic = 25 C ??

3. checking consistency in time
correction



4. checking inner consistency
correction

CAVOC

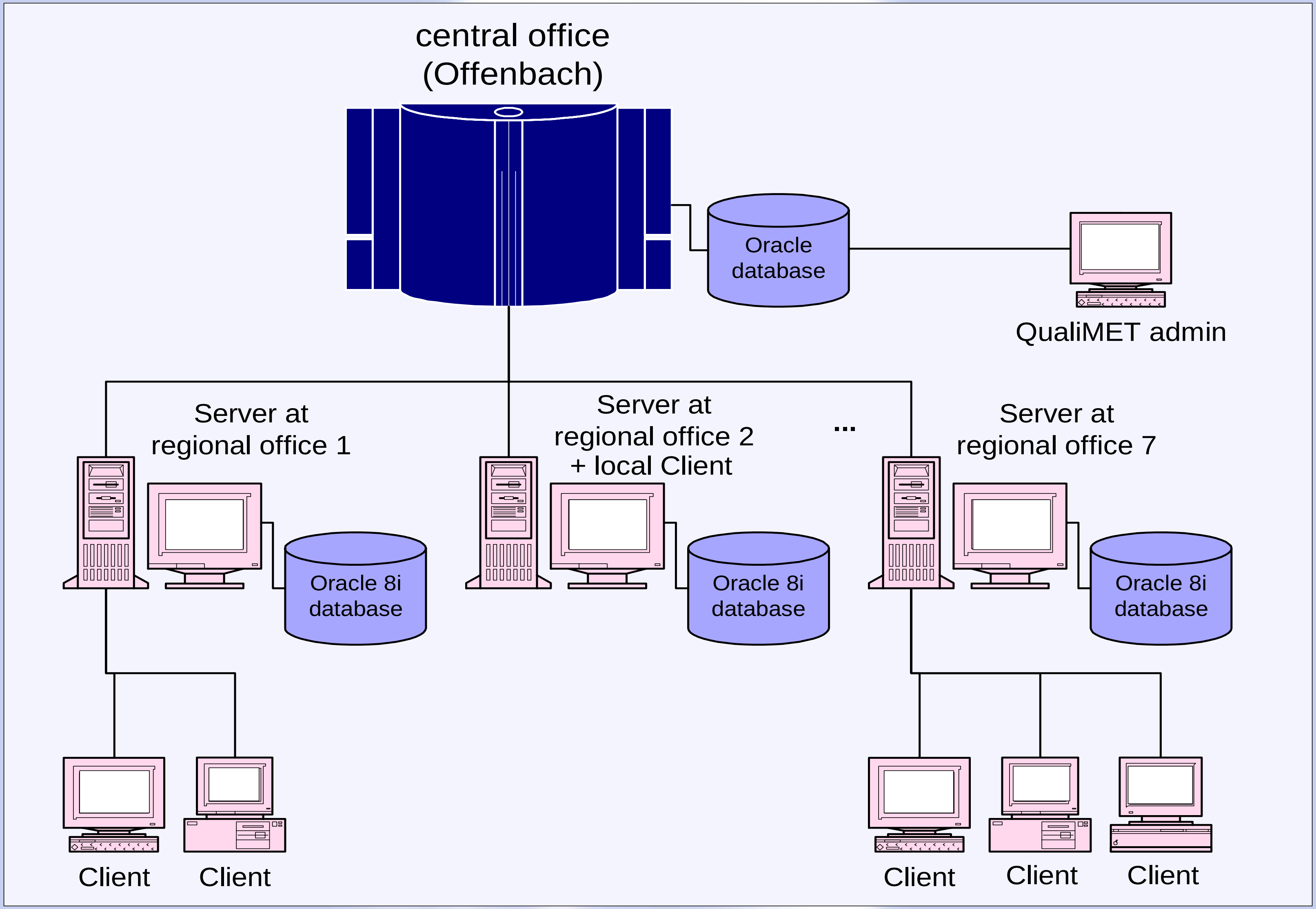
visibility
500m ??

5. checking consistency in space
correction

1002
1003
1000
1024 ??
1004
1005

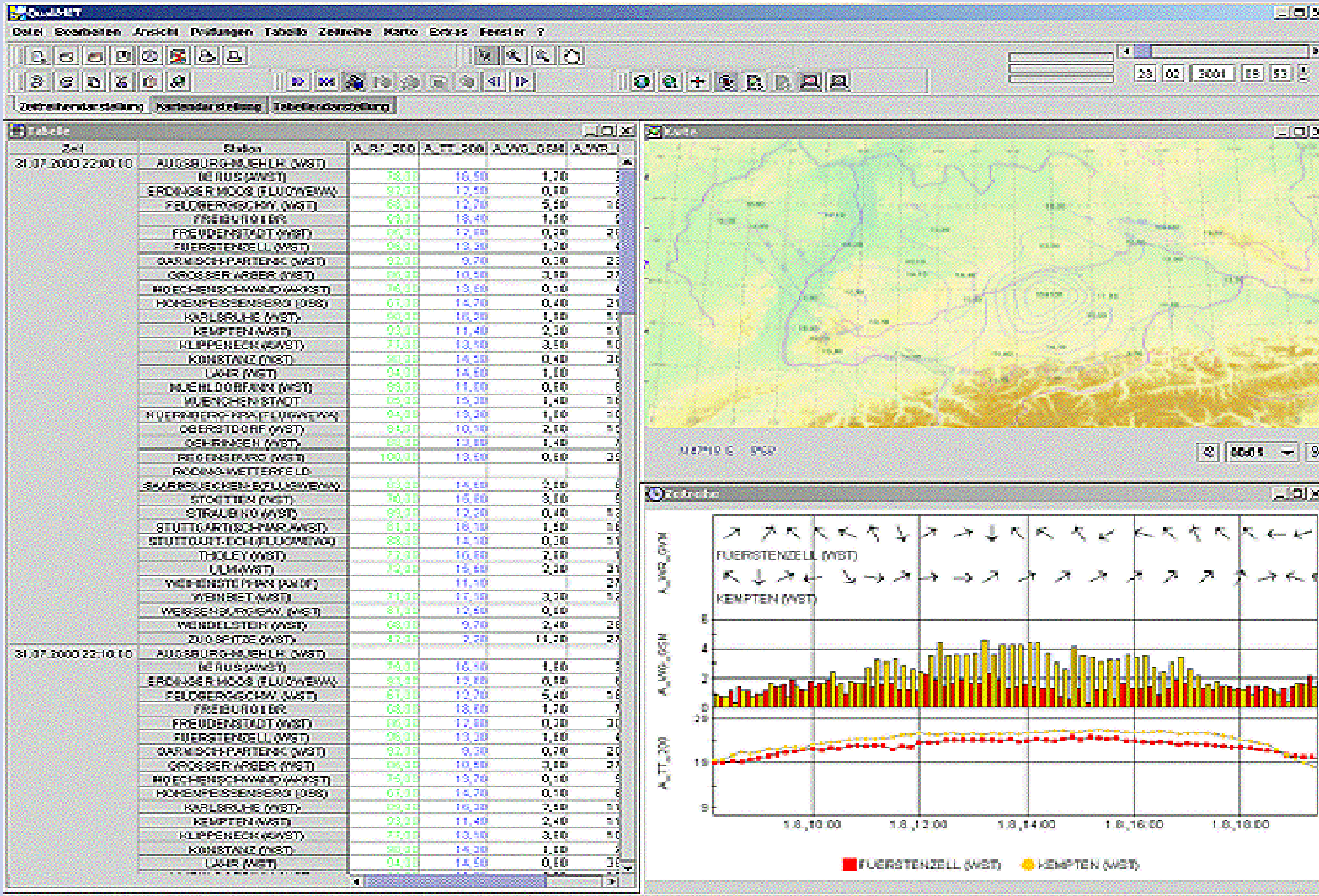
QualiMET

System Architecture



QualiMET

Current Operational Environment



Common Graphics System
Goals

- Design and build a new system, that ...
  - supports monitoring, nowcasting, forecasting, climatological reports, batch production, verification, and research
  - covers the requirements of MeteoSwiss, GMGO and DWD
  - merges and expands the functionalities of the current systems
  - replaces the old systems MAP, IGS, GeoBerT, IGSII
  - uses internal (MIRAKEL, GeoDB) and external standards
  - has a clear, open and expandable software architecture
  - is scalable and fault-tolerant
  - is not tied to a particular hardware / OS platform

Java Applications Around the World

- Meteorological Java Applications
  - MetApps, VMet
    - UCAR, 3D, based on VisAD
  - FXNet
    - FSL, 2D, internet client interface to AWIPS
    - very fast
  - AMFS (Automated Marine Forecast System)
    - BOM, 2D, based on VisAD, B. Hibbard is actively involved
  - JavaMAP
    - DWD, 2D
    - fast

Common Graphics System

The Project

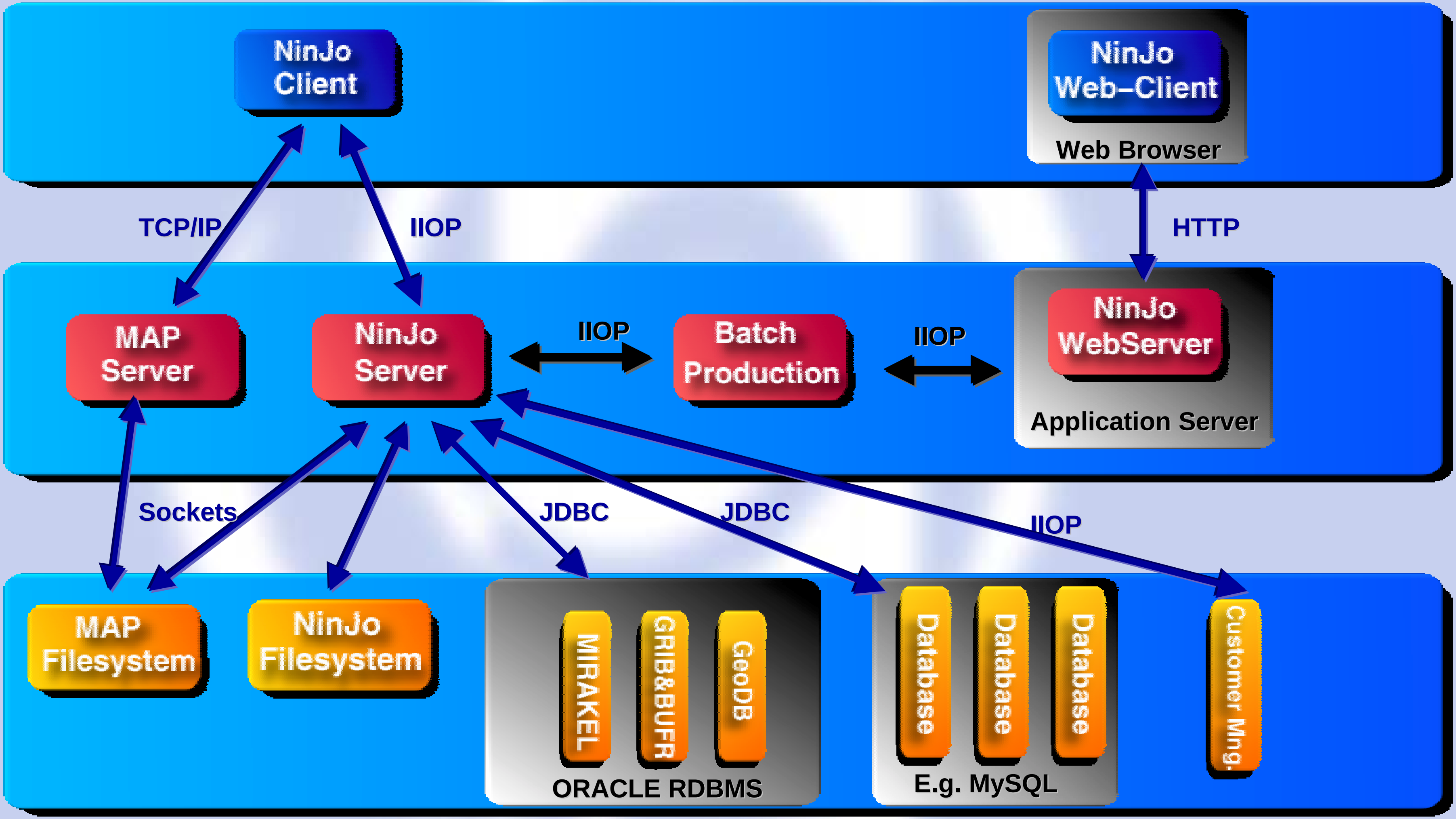
- joint project of 3 Organizations : DWD, GMGO, MeteoSwiss
- bundling of resources (5 → 1 Projects)
- team consists of
  - 15 (> 70%, mostly 100%)
  - 6 (~ 50 %)
  - 4 consultants (SD&M)
- time line
  - start of NinJo: **12/1999**
  - specification: 8/2000
  - decision on technologies,overall design 5/2001
  - final design and evolving prototype 1/2002
  - design, develop, integrate, test (Iterations) 1/2004
  - deploy **mid/late 2004**
- Case Tools: Sniff+, TogetherJ, Jprobe, Perforce

Common Graphics System
Architecture

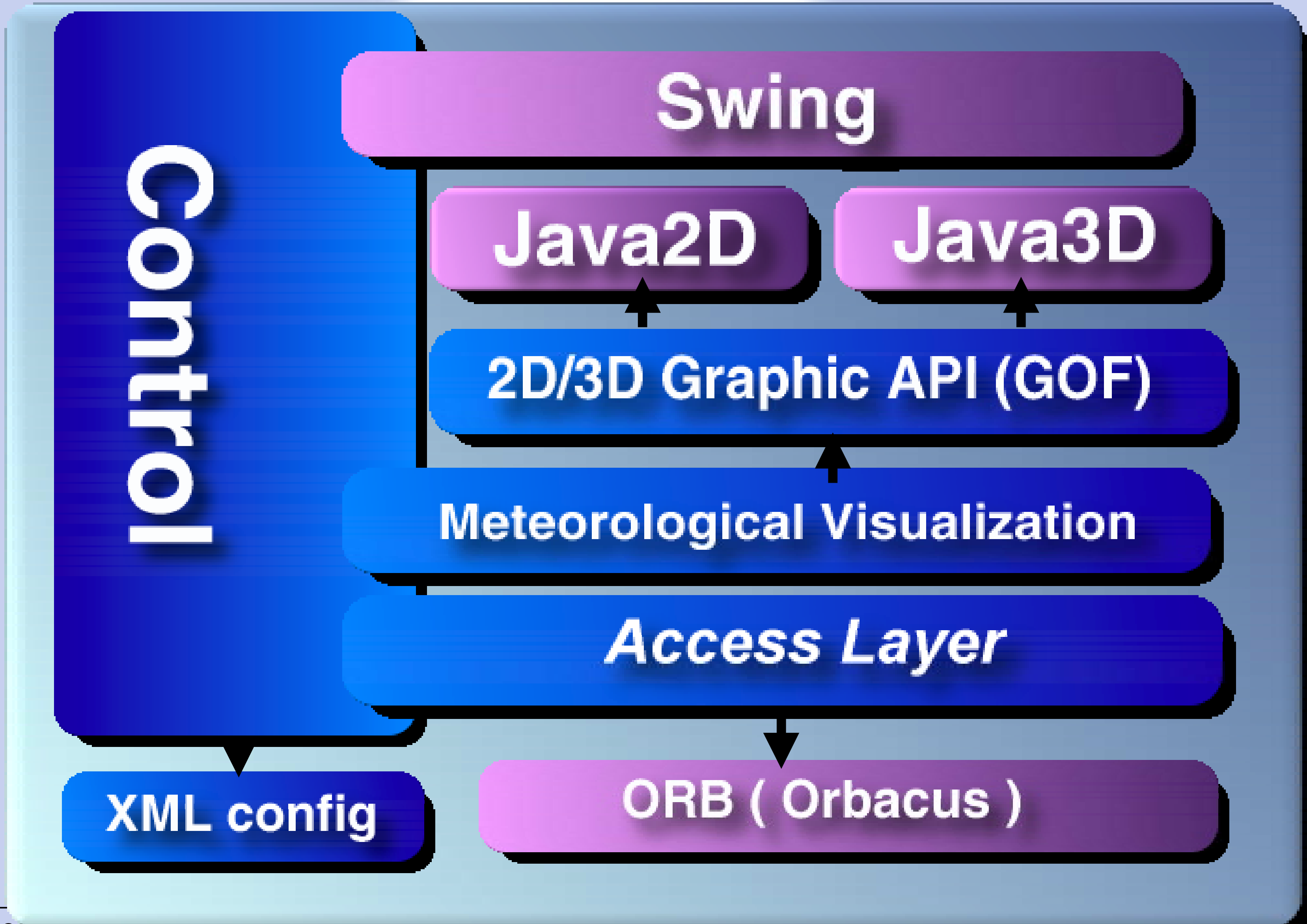
- programming environment
  - Java 1.3.1 development, target platform SDK1.4
  - graphik APIs
    - Java2d
    - Java3D
    - OpenGL
    - Java Advanced Imaging
  - GUI Toolkit
    - Swing
  - middleware and services
    - CORBA (Naming, Event, Transaction)
    - JDBC
  - file formats and processors
    - XML
    - GeoTIFF

Common Graphics System

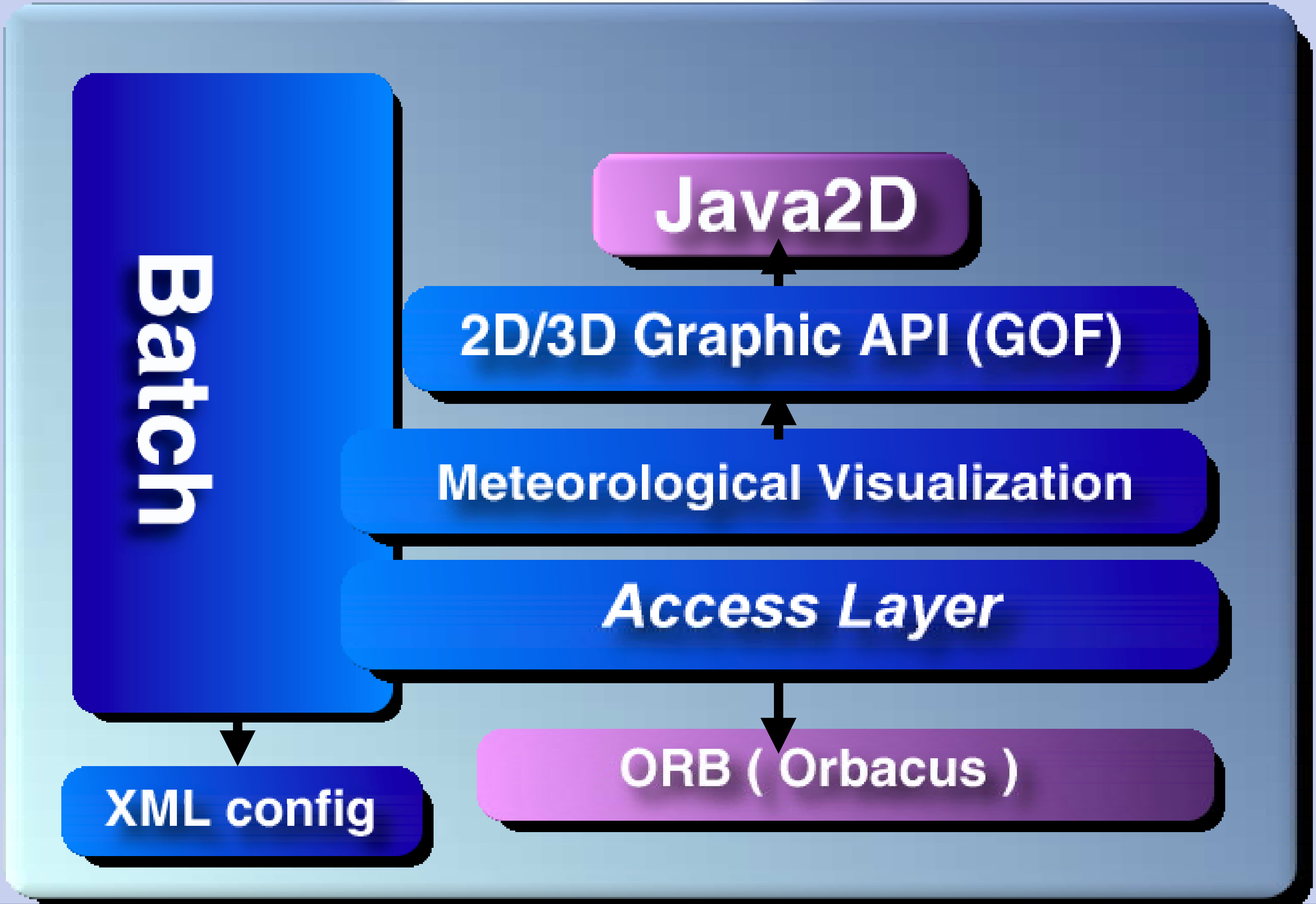
Architecture: Overview



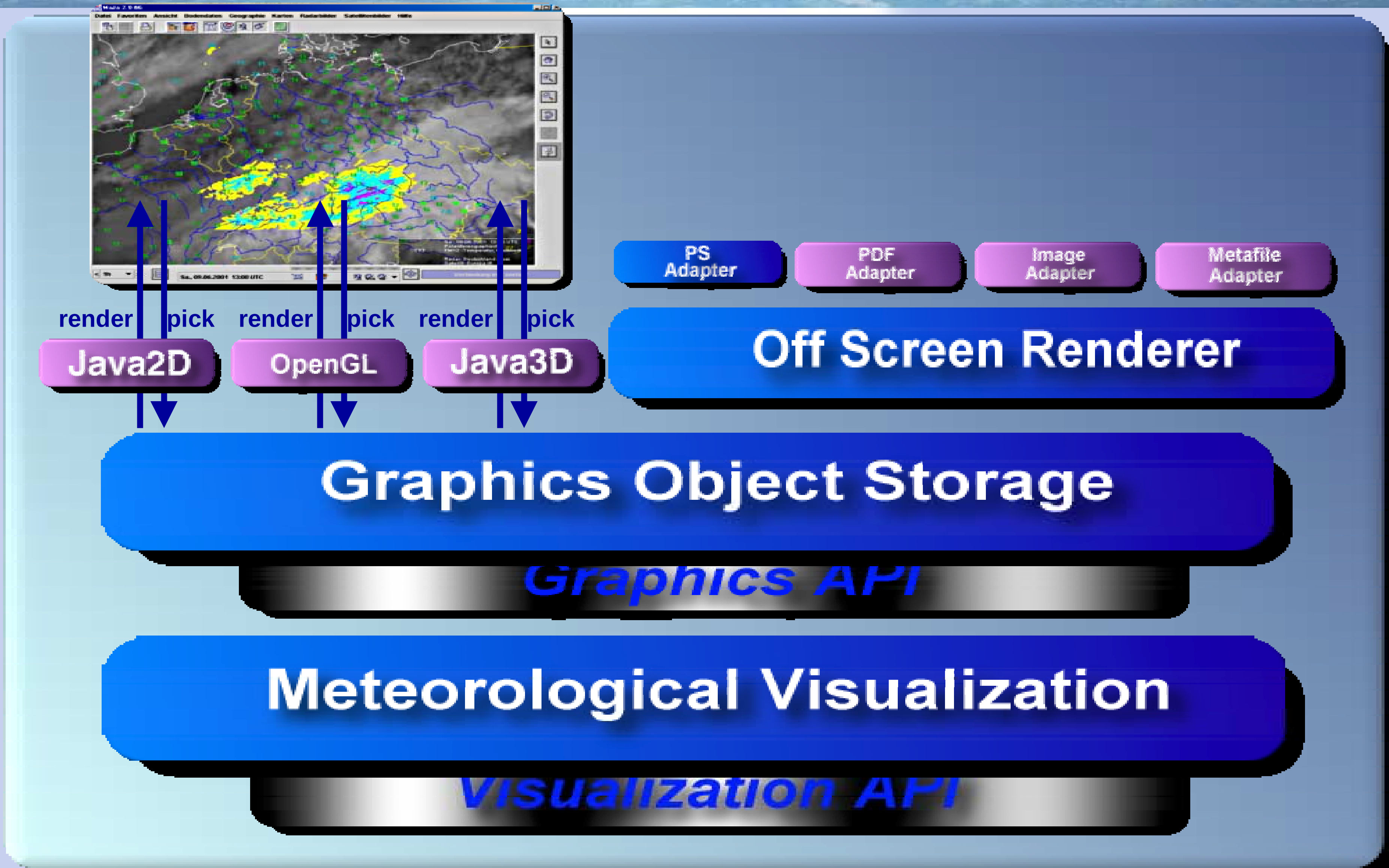
Common Graphics System
Architecture: NinJo Client



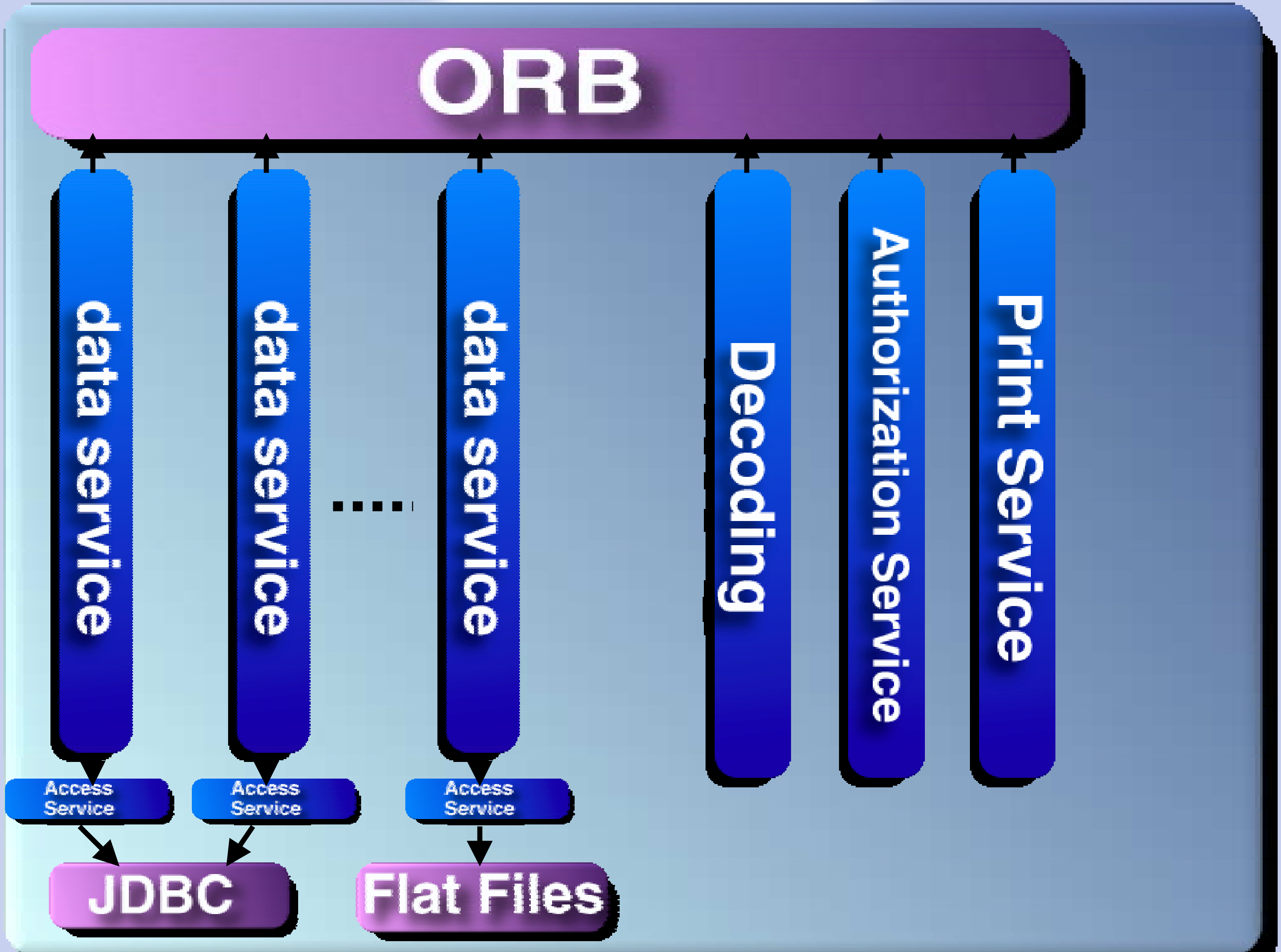
Common Graphics System
Architecture: Batch Client



Common Graphics System
Architecture: Visualization Framework



Common Graphics System
Architecture: Server



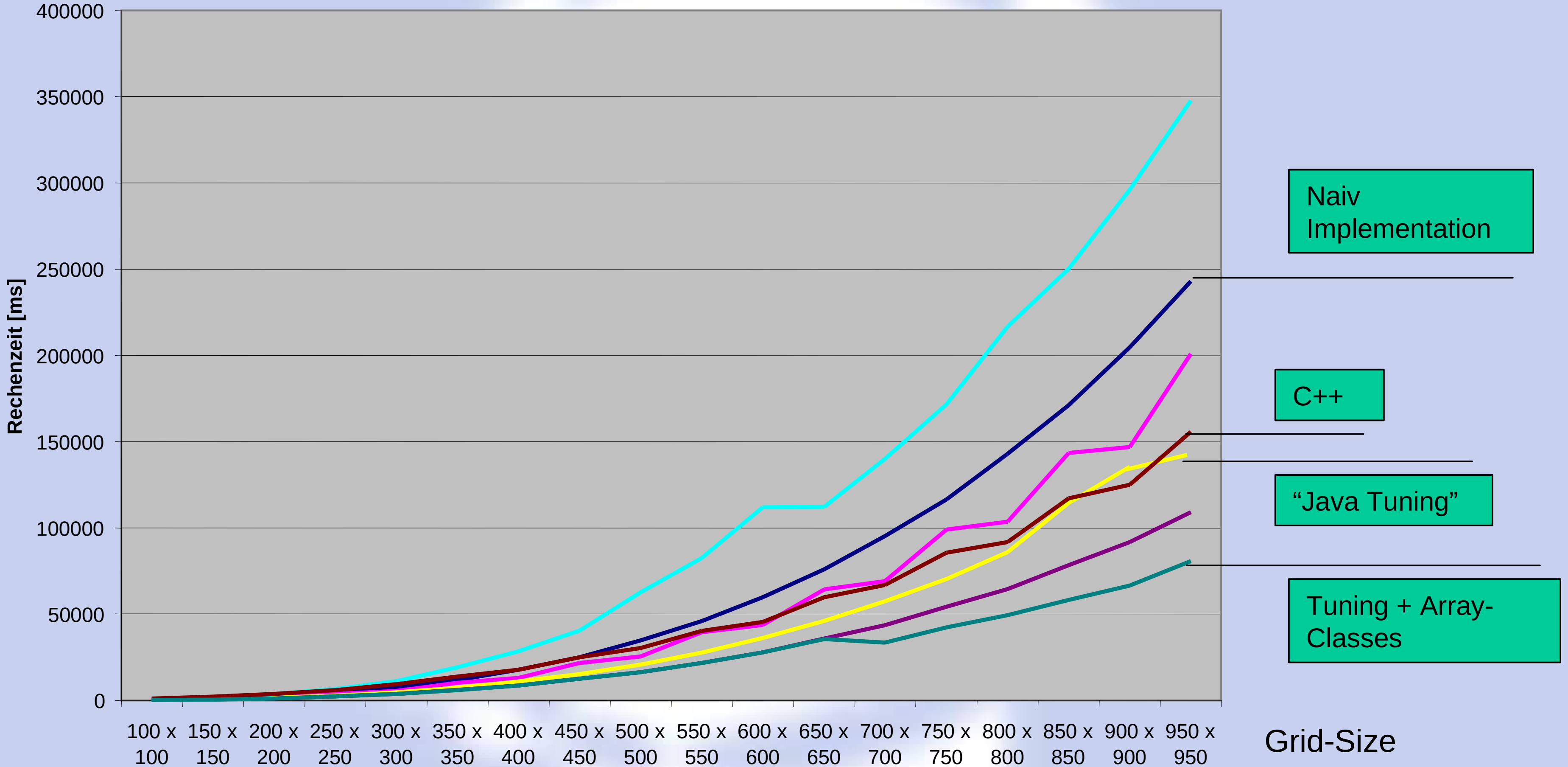
Common Graphics System
Architecture: Server

- The Access Layer
  - easily configurable through XML
  - communicates with any data source
    - local files
    - flat file systems somewhere in the net
    - RDBMS
    - to link a new datasource one has to implement the new Service Object only together with an entry in the XML config of course
  - abstracts from data sources
  - implements transactions for secure data storage
  - provides failover mechanisms
  - provides load balancing

Common Graphics System

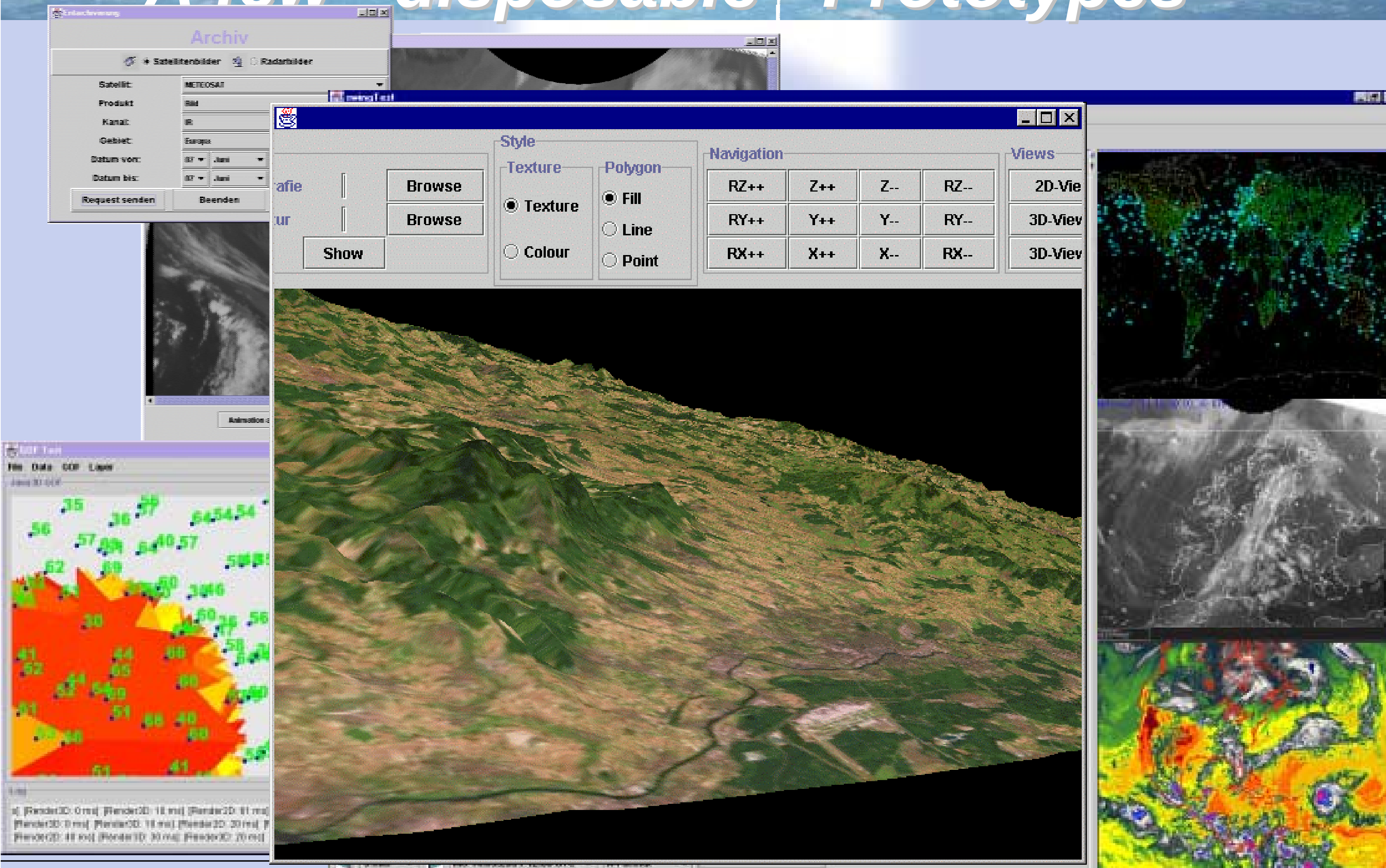
A Few Words on Performance

Solution of a boundary value problem (Helmholtz)



Common Graphics System

A few - disposable - Prototypes



Common Graphics System
Outlook

- The architecture of NinJo (CGS) is open and portable
- It can be expanded easily and it should be able to integrate all data sources and applications
- Till now our experiences with Java are quite promising
- The NinJo Project is well on schedule
- But, nevertheless we can’t be sure that the whole specified functionality will be there in 2004
- We hope that we’ll be able to present a prototype at EGOWS 2002 that integrates all the basic functionalities

Synergie Météo-France meteorological workstation improvements

Authors : M.F Voidrot, C.Berthou, M.Stoll

Synergie is the meteorological workstation of the National and Regional operational forecaster developed by Météo France since 1989. Beyond sophisticated visualisation tools, Meteo-France has introduced graphical interaction tools and expertise input user interfaces to help the forecasters formalize their value added in order to feed a numerical data base. These tools have bring new methodologies that take advantage from new computer technics to support co-operative work of remote forecasters in order to implement complex master plans. The expertise data base is then ready to be used by any system aiming at preparing predefined layouts fitted to end users. Synergie visualisation tools are still improving. The concept of numerical trajectories has been introduced giving path to new atmospheric and marine environmental applications, the data and messages watch has been operational for one year supporting nowcasting priorities, ... A new user interface has been developped to planify the automatic production of meteorological georeferenced images fitted to feed professional Geographical Information Systems. At last the political decision has been taken to deliver a Linux commercial release next year that should allow to face increasing commercial demands from National Meteorological Services.

Progress with Operational Met Office IT systems

Steve Foreman

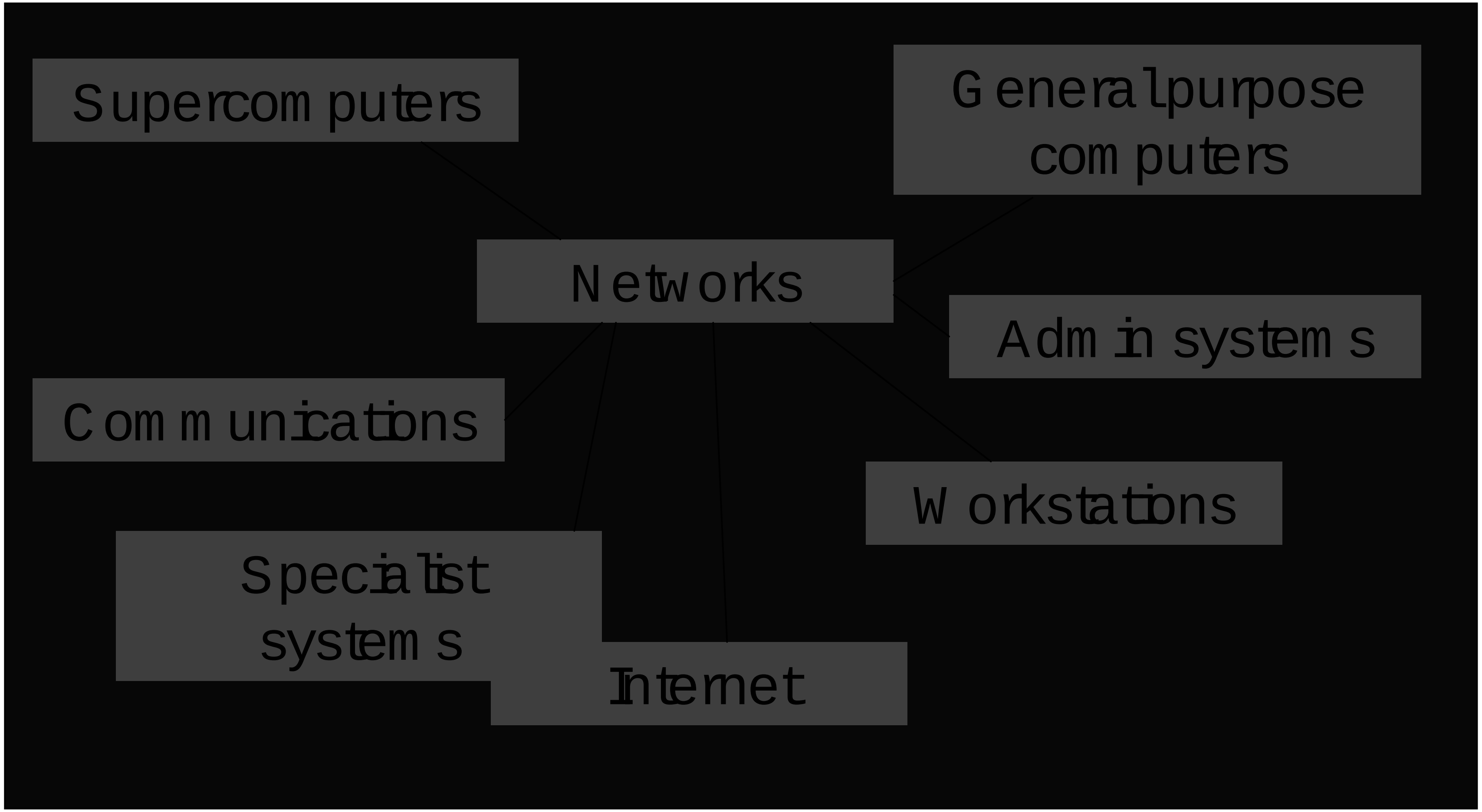
Head of Information Systems Development

Met Office

Outline

- Forecaster workstations at the Met Office
- Support and development issues
- What does the future hold?

IT systems


Supercomputers
General purpose computers
Networks
Admin systems
Communications
Workstations
Specialist systems
Internet

Specialist systems

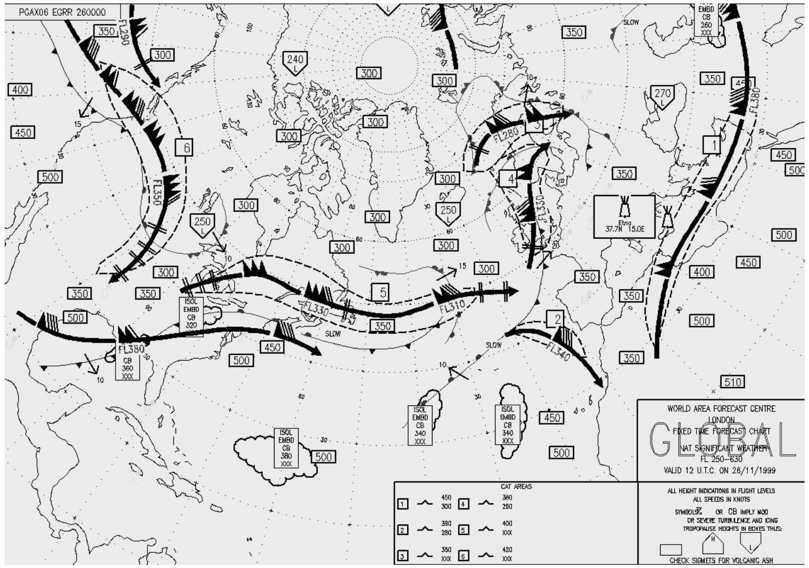
- Radarnet, Autosat - prepare imagery
- Nimrod - prepare nowcasts based on radar, satellite and mesoscale NWP
- FSSSI - site specific forecasts

Workstations

- Horace
  - "Guidance"
- Nimbus
  - "Production"
- MIST
  - "End user"

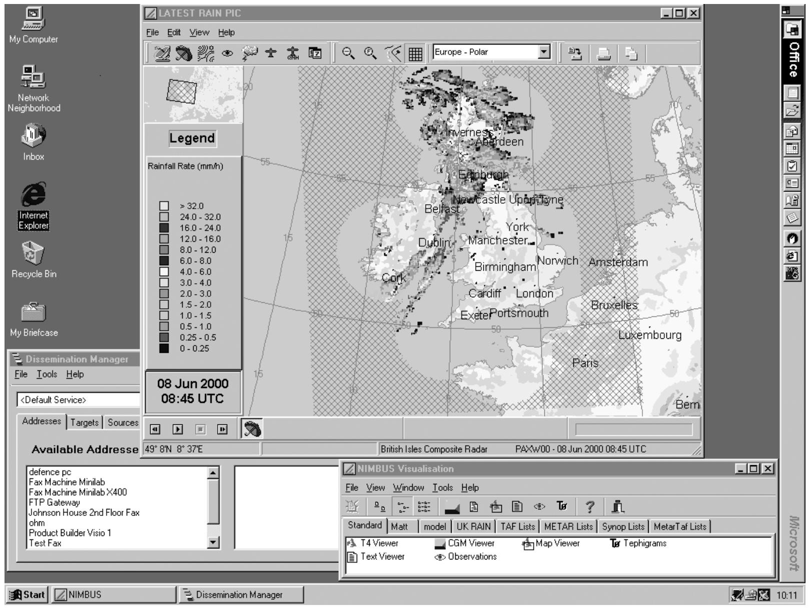
Horace

- Display
  - NWP, observations, satellite, radar …
- Manipulate
  - "field modification"
- Products
  - significant weather …
- Disseminate
  - limited



Nimbus

- PC based
- Display
  - regional
- Production
  - links to PC tools (Office, Visio)
  - “create once, use many”
- Dissemination
  - fax, email, …



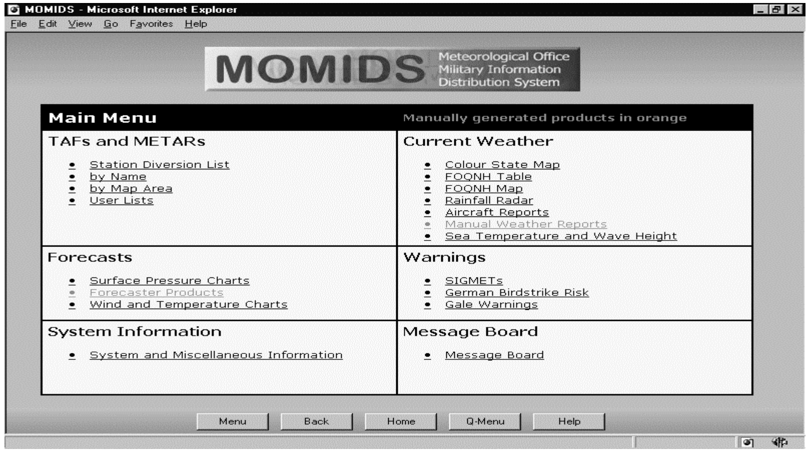
MIST

- PC - aimed at end users
  - aviation
  - power industry
  - keen amateurs
- Limited graphics
- Pre-set data
  - dial-in to server

Met Office

Browser

- Formal - MOMIDS
  - pre-generated products
  - use on customer LAN
  - needs add-ins at present
- Informal
  - images, data
  - often development systems

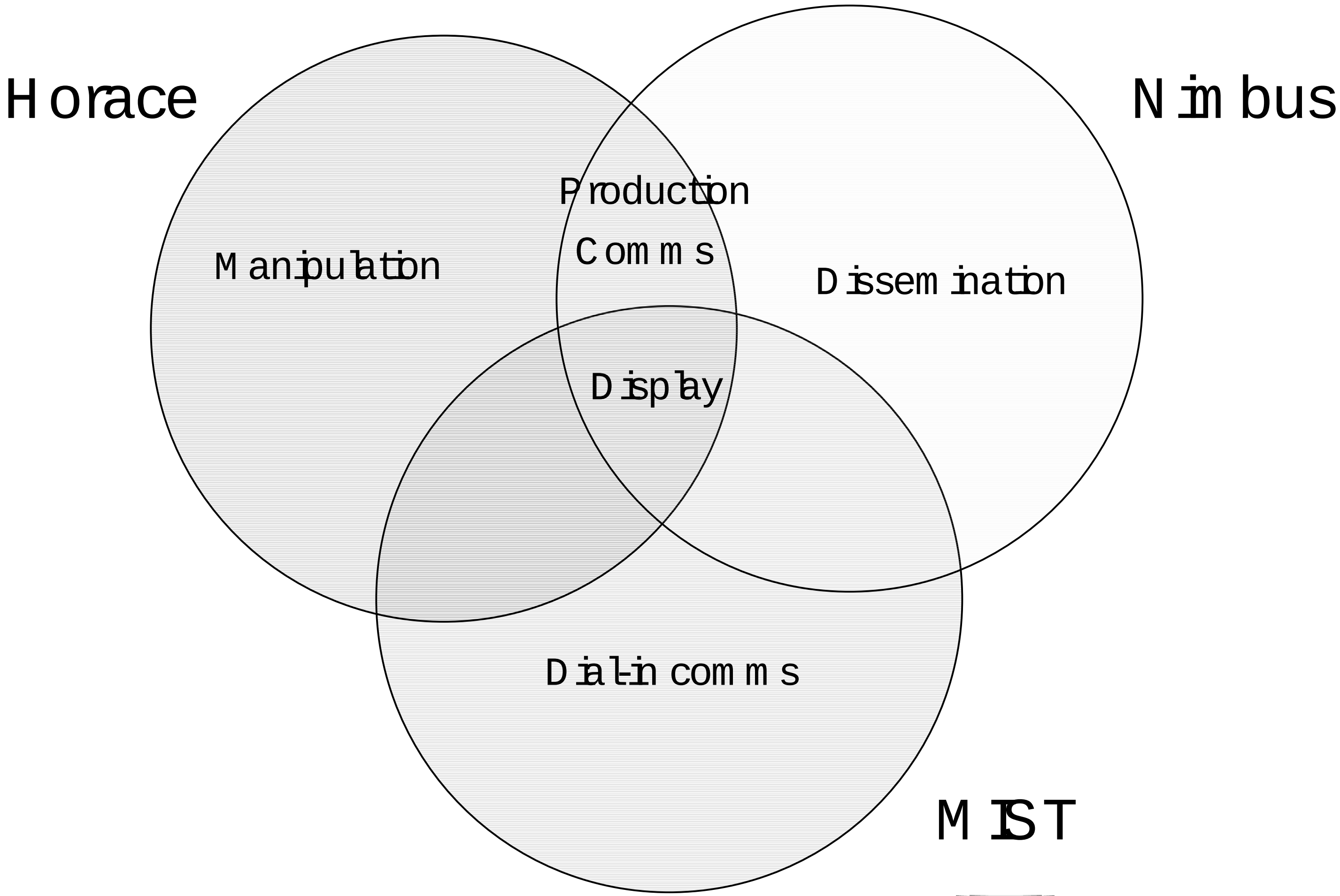


Met Office

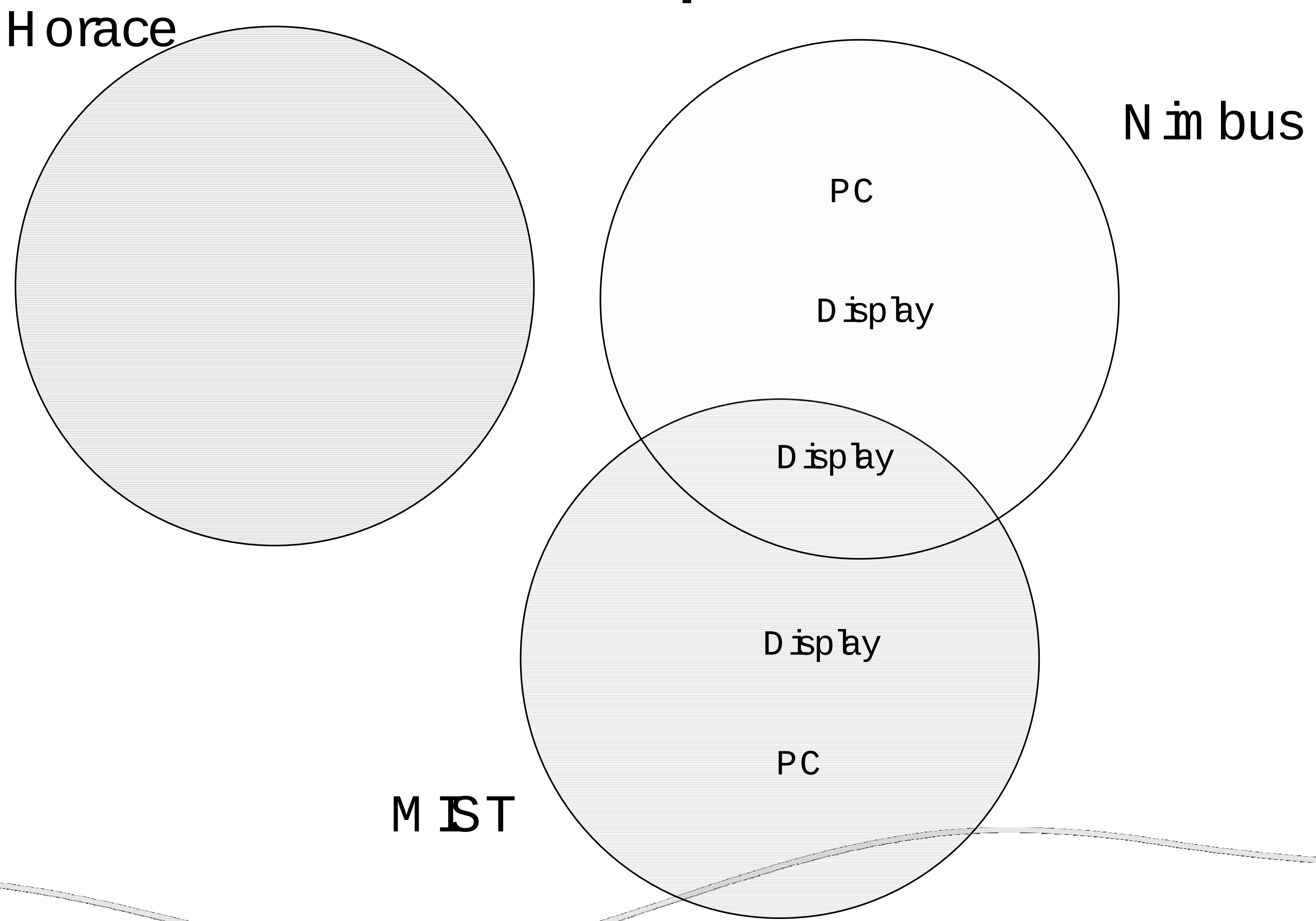
Support and Development

- Overlap between systems
- People with right skills
- Updating and supporting remote systems
- Complexity

Overlap - functional



Overlap - code



Skills

- Horace
  - C, Unix, Fortran, GKS, X
- Nimbus
  - Windows NT, Delphi, Visual Basic
- MIST
  - Windows NT, Delphi, Visual Basic
    - » but knowledge of system being lost

Remote sites

- Support
  - tools, bandwidth
- Changes
  - how install?
- Interactions
  - especially on PCs
- How enforce?
  - Move at pace of slowest

Met Office

Complexity

- Systems "grown"
- Add-ons
  - especially Nimbus
- Can't do "obvious"
  - because of original design

Met Office

Future requirements

- Role of forecasters
- Delivery of products
- Versatility

Role of forecasters

1950s: create forecast

1960s: create forecast

First NWP

1970s: create forecast

1980s: local forecasts

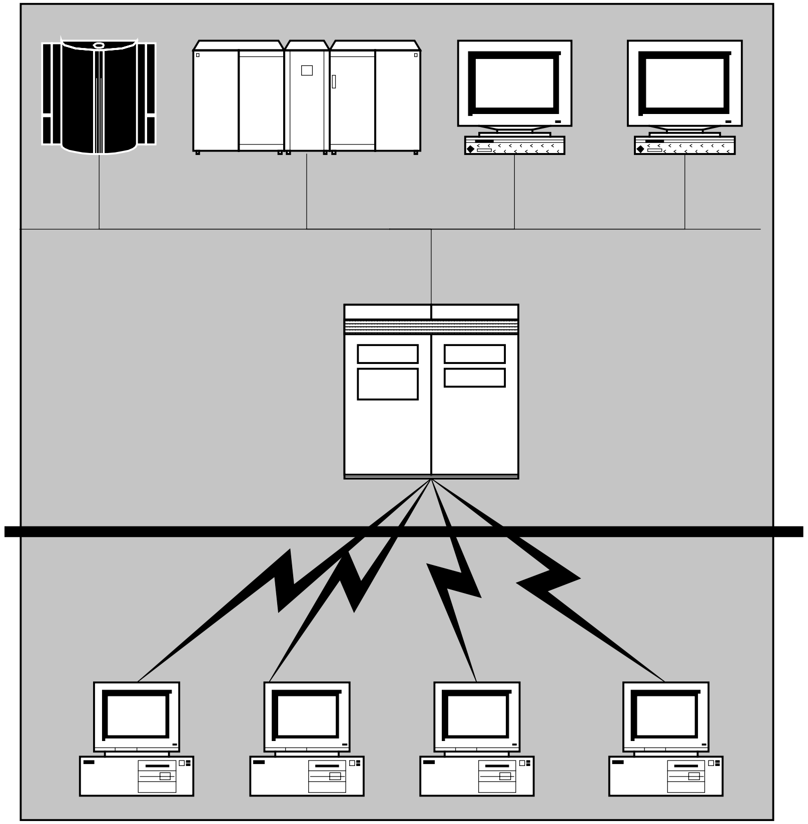
1990s: add relevance

2000s: quality control

2010s: ?

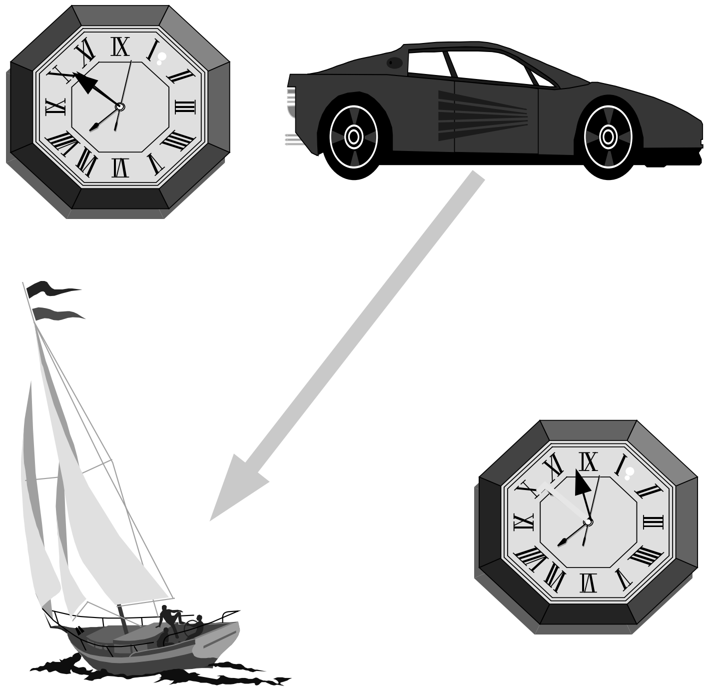
Delivery of products

- Internet
  - "self service" for users
  - how about forecasters?
- Bandwidth
  - increasing
- What?
  - Data?
  - Products?
  - Tools?



Versatile

- Products
  - change rapidly
- Not only weather
- Automated production
  - decision tools
  - text generation?
- Standards
  - XML …



Met Office

Summary

- Many systems in use
- Support and development costs
- What will forecasters be doing in future?

Concorde

Magali Stoll, Météo France

Steve Foreman, Met Office

Concorde?

- Meteorology is expensive
- NMSs duplicate effort
- We cannot afford to do all we want to
- We do not have the people to do all we want
- So why not co-operate?

Met Office

History

- February 2000
  - Leeds Castle, UK
- February 2001
  - Brides-les-Bains, France

Areas

- Nowcasting
- Oceanography
- NWP
- Environment and pollution
- Training
- Commercial Services
- Operational backup
- Satellite distribution system
- Africa
- Observations
- research aircraft
- Workstations

Workstations

- By 2006
  - common platform(s)
  - shared code
  - single "family" for both organisations
- to meet the needs of forecasters and technical users

A Linux-based Weather Forecasting System for the NWS

Herb Grote(1)
NOAA Forecast Systems Laboratory
Boulder, Colorado

Presented at
European Working Group on Operational Meteorological Workstations (EGOWS), June 11-14, 2001, Zurich, Switzerland.

1. Introduction

In the last decade the NWS (National Weather Service) has been especially active in modernizing its field offices and upgrading its observing systems. Advanced Doppler radars have been deployed across the country, an automated surface observation system has been fielded, satellites have been upgraded and all forecast offices have received a new system to integrate and display the many existing and new observational data sets. Although these systems are relatively new they are already feeling the effects of rapidly changing technology and increasing system requirements. Some of the current technology is becoming difficult to maintain and is being stressed to meet the additional demands on the system.

The scope of this discussion is limited to the proposed evolution of the workstations system in the field offices and does not address any planned upgrades of sensors and networks. The design challenge is to arrive at an architecture and hardware complement that will meet the long- term needs of the NWS and one that can be achieved by evolving the existing system.

2. Linux O/S

The Linux operating system has been used by scores of software developers for years. However, recently Linux is also gaining popularity with many other groups for web server, databases, and other applications. The Linux operating system is also being considered for the new AWIPS system architecture. Linux runs on a variety of computer platforms including the Intel-based PCs. Software developed for Linux is more likely to use ANSII-compliant compilers and eliminate the developer's temptation to use language extensions provided by the hardware vendor. Using vendor extensions may lead to reliance on one particular vendor's hardware, which can make it difficult to take advantage of technological advances and cost reductions offered by other vendors. Figure 1 provides a performance comparison between a Pentium 3 PC and the current AWIPS hardware. The average performance improvement for various typical AWIPS functions was double.. For some CPU intensive tasks, such as data decoders, the performance improvement was more than ten times better. This cursory test seems to indicate that PCs are capable of meeting the performance requirements for operational forecast systems.

3. System Components

The AWIPS system is broken down into five major components to help describe the key features of the new system architecture. The system at each forecast office consists of the display, data storage, application, data acquisition and local area network components.

3.1 AWIPS Display - The current AWIPS display software takes advantage of the hardware vendor's proprietary graphics card and operating system. To eliminate this dependency, the AWIPS software has been rewritten to work with most 24-bit (true color) graphics cards. The graphics displays are generated using the X11 library and the user interface uses the tcl scripting language and tk toolkit.

The proposed display consists of dual processor PCs with dual color monitors running Linux and the AWIPS-Linux software. A single mouse and keyboard will be used to enter data and control the display functions. Because of the need to buffer large amount of images and some raw data two gigabytes of memory are suggested. A separate PC and monitor are being considered for displaying text data. Each forecast office will have five, or more of these display system configurations.

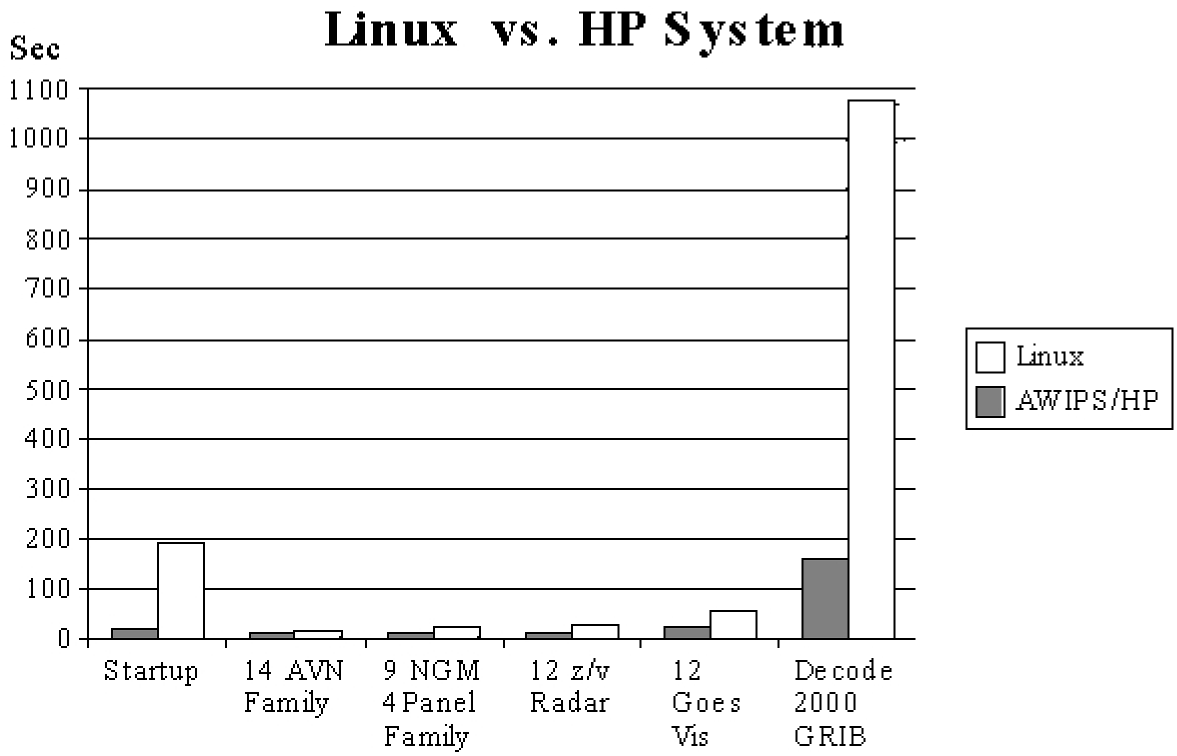


Fig 1. Processor Performance Comparison

3.2 Data Storage - With the exception of text data and some hydrological data sets (which are stored in a relational database) hydro-meteorological data is currently stored on redundant data servers in flat file format The use of a single data repository simplifies data management but may lead to a communications bottleneck as the data demand by workstations and applications increases.

The proposed data storage architecture consists of a Linux data server with dual processors, power supplies, and network cards; and RAID 5 data striping. In addition to storing data on the data server, which stores all meteorological data for a specified period of time, selected data will also be stored on each workstation and application processor. This will provide rapid access to a selected set of data since disk contention is reduced and data does not have to be transmitted over the network.

3.3 Application - AWIPS applications include a wide range of data processing from local forecast models, to storm tracking algorithms and decoders. Currently, AWIPS does not include local forecast models, and other applications are severely restricted by the limited amount of available processing.

Beowulf clusters consist of a number of Linux computers interconnected by a high-speed network, such as Myrnet. These clusters compete with more expensive high performance computers and are ideal for executing certain forecast models. These clusters are being evaluated at the Forecast Systems Laboratory for use with mesoscale forecast models.

To meet the high reliability requirements for an operational system several software packages exist to create High Availability Linux configurations. Two or more Linux computers can be configured to allow load leveling between machines or automatic fail-over should one of the computers fail. A dedicated heartbeat LAN between the computers detects when one of the computers fails. High availability Linux configurations are proposed for the applications processors in the new AWIPS architecture.

3.4 Network and Communications Protocol - The current AWIPS system uses FDDI to interconnect all workstations and servers, and a 10 Mb/s ethernet to attach data acquisition processors, printers and other peripheral devices. Redundant network switches (using the Spanning tree) route data between the FDDI and ethernet networks. FDDI technology is nearing obsolescence and the 10 Mb/s ethernet is actively being replaced by faster ethernets. The proposed LAN uses a network switch that supports 100 MB/s and 1 GB/s ethernet speeds. These communication speeds are expected to be adequate for the higher resolution national models and base radar data that are expected to be part of AWIPS.

A higher-level communications protocol that supports data broadcast, using a single transmission, will transmit real-time data to the local data caches on the various processors. The broadcast protocol allows for retransmission of data if one of the nodes did not receive the complete transmission.

3.5 Data Acquisition - The AWIPS national network consists of a Satellite Broadcast Network that broadcasts synoptic observations, satellite imagery, guidance products and other information. A WAN (Wide area network) is used to forward information to the network control facility and exchange information between sites. Special communications processors receive local data, such as radar and mesonet observations, are. These processors will also be replaced with Linux-based machines.

4. System Architecture

The following paragraphs describe the evolutionary change in the system architecture using these components.

4.1 Old Architecture - Figure 2 shows the system components as they are configured for the current AWIPS system architecture. HP (Hewlett Packard) is the manufacturer of the majority of the computer hardware. The HP data and applications servers are configured such that a failure of any one of these machines automatically results in another machine assuming the load of the failed machine. In this architecture, the FDDI ring interconnects the data and applications servers, and several HP. The ring interfaces to a lower speed 10 Mb/s ethernet that interconnects the "front end" data acquisition and communications processors.

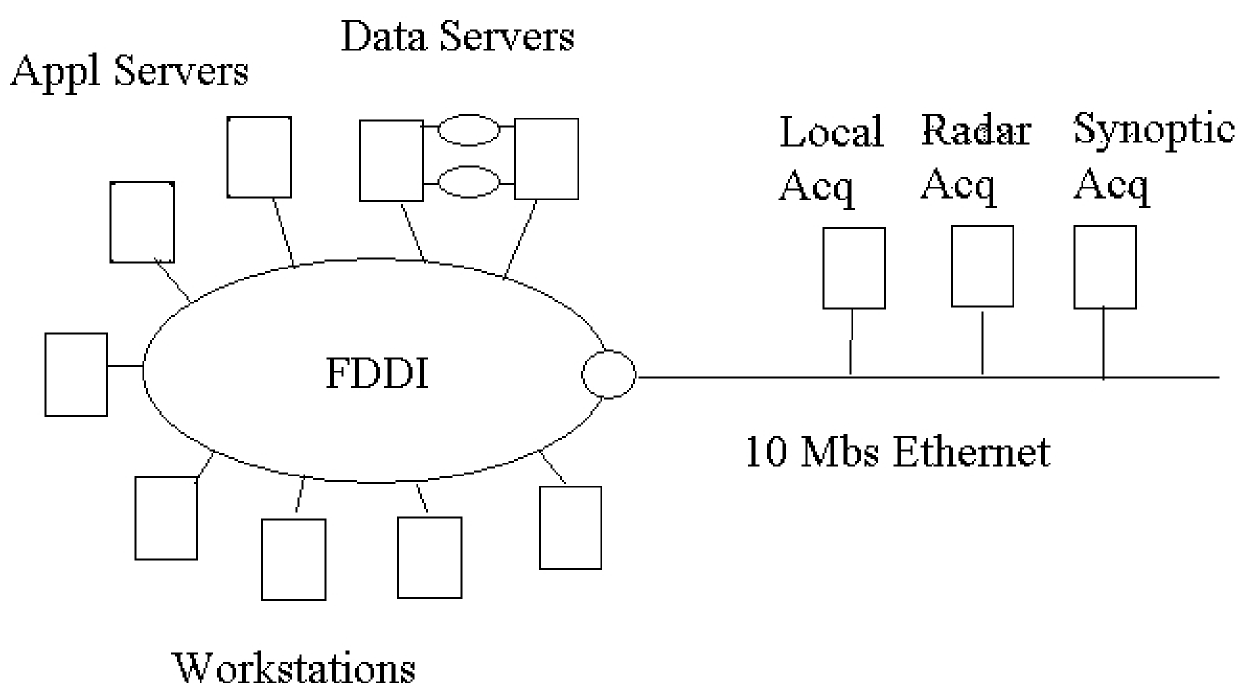


Fig 2. Old Pre-Linux Architecture

Real-time data flows from the acquisition and communications processor, through the network switch to the data servers, where the data is then decoded and stored. The workstations and other applications access the data on the servers as needed.

4.2 Transition Architecture - The transition architecture (Figure 3) includes a fast ethernet port on the existing network switch. This ethernet port is connected to another high-speed network switch that will be part of the advanced system architecture. All new hardware will be connected to this switch and will be able to communicate with the older machines on the other part of the network. As new machines are added to the network, older machines are removed and the older networks are slowly decommissioned.

With this enhanced architecture, the data flows from the Linux communications processors on the new high-speed network, to another Linux machine where the data is decoded and stored on its disks. Initially, only some of the data will be decoded on the Linux machine and the rest will be decoded on the HP server. A broadcast protocol will send the decoded data from the server to all of the workstations on the new high-speed network

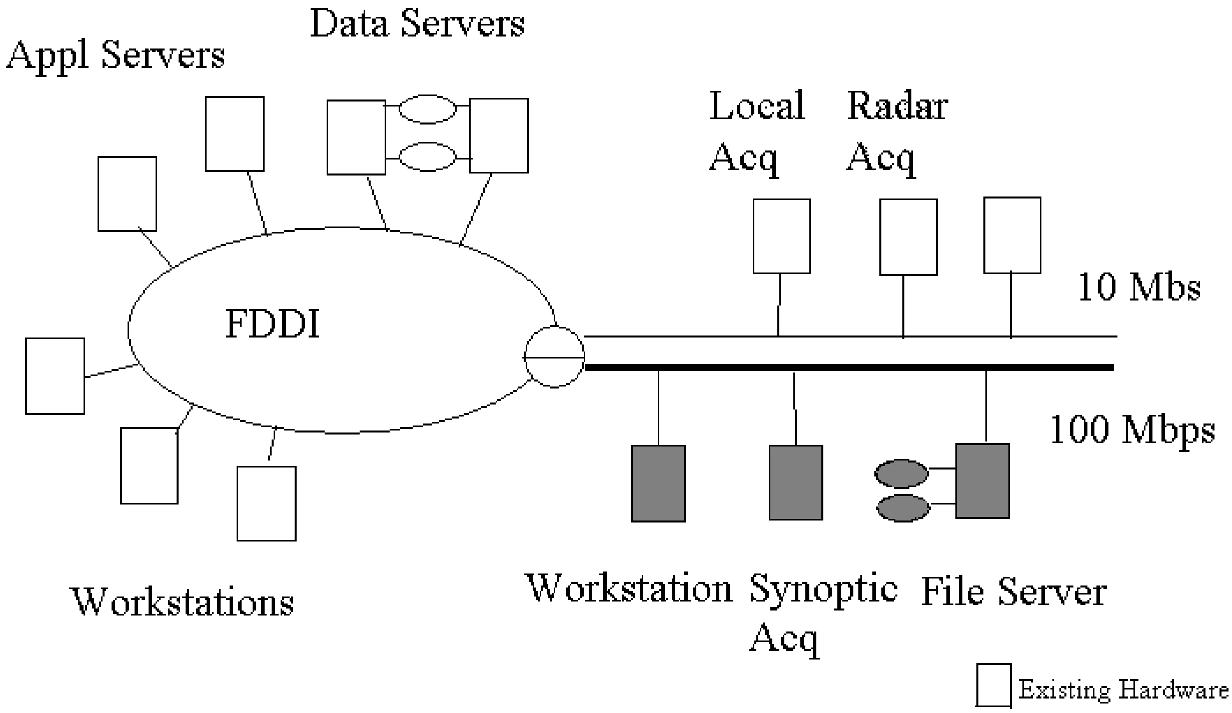


Fig 3. Linux "Transition" Architecture

4.3 Proposed Architecture - Figure 4 depicts the proposed final AWIPS system architecture. All of the original computers will be replaced with Linux computers connected to the new high-speed network. The old hardware, as well as the FDDI and low speed ethernet will be decommissioned. Additional application and acquisition processors will be added to accommodate specific new requirements.

It is envisioned that data will flow from the various ingest and communications processors on the high speed network to redundant Linux machines for decoding. The decoded data will then be stored on a network file server and also broadcast to all machines on the local network. The workstations and application processors will have most of the data stored on their local disks.

5. Implementation Status

The large majority of the display and data acquisition code has been ported to a Linux platform. The data decoders have been ported and are being tested for reliability and data accuracy after decoding. Also, the AWIPS contractor has converted the SBN communications processor code to run on a Linux platform and has provided initial systems to the NWS and FSL for evaluation.

Porting the hydrological applications (written mostly on FORTRAN) is a significant effort that is currently in progress and expected to be completed before the end of this year. In order to support the existing AWIPS configuration in the field and the transitional hardware, all code is being compiled each day for the HP-UX and the Linux platforms.

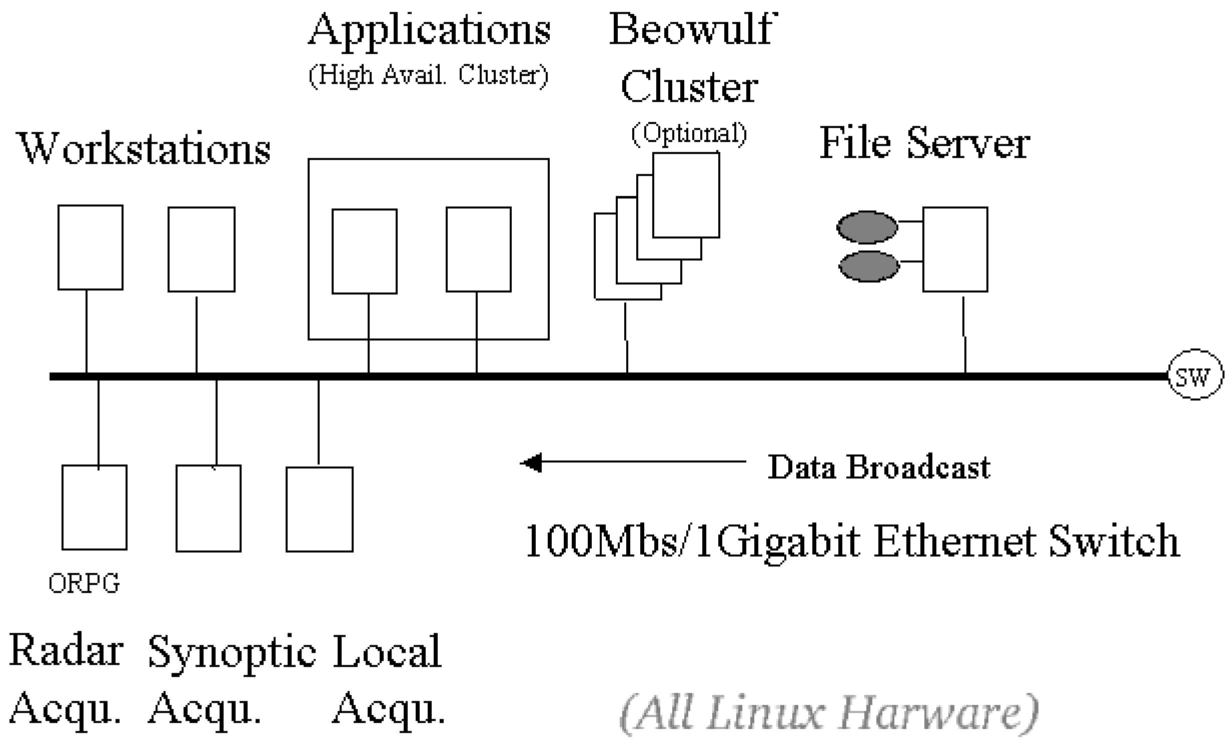


Fig 4. Proposed Linux Architecture

Several AWIPS/Linux workstations have been deployed to NWS field offices for evaluation. These systems are currently connected to the 10 Mb/s ethernet and therefore only see significant performance improvement for processes that do not require transfer of large amounts of data. However, tests performed at FSL using the transitional configuration with a 100 Mb/s ethernet show significant overall improvements in performance. The CP, 100 Mb/s ethernet switch, and decoder processor for the AWIPS transitional architecture will be installed at a larger number of field offices in the near future.

Implementation Issues - Although Linux has been widely used for web servers, data servers, and software development, it has not been used by government or industry for mission critical applications. There are a number of issues that concern potential Linux customers. Among these are maintenance and support, system configuration management, and security. Although, it will take time to satisfactorily answer these questions the risk appears manageable. A number of companies, including HP, IBM, and Red Hat, provide Linux support. Red Hat and other Linux distributors package Linux with other software, such as X-window software and drivers for a variety of equipment. Linus Torvalds the founder of Linux, controls the evolution of the Linux kernel. Rapidly changing technology and hardware can be a challenge for managing a large number of systems. This will require additional work from the software developers and integrators to insure that all software continues to work with new releases of hardware and software. Making large purchases, rather than small interactive purchases can help to reduce the variety of hardware that has to be maintained.

Footnotes

(1)Corresponding author address: U. Herb Grote, NOAA/OAR R/FS4, 325 Broadway, Boulder, CO 80305; e-mail: grote@fsl.noaa.gov.

STePP, a Current Co-ordinated Project Between SMHI and SAF

"Visualisation in Sweden's Co-ordinated Technical Production System"

Kjell Dennerstedt,SAF
Caje Jacobsson: SMHI

In Sweden there is an ongoing co-ordinated project between SMHI (Swedish Meteorological and Hydrological Institute) and SAF Weather (Swedish Armed Forces Weather Service). The objective is to create a new, co-ordinated technical production platform, based on a quality assured database. The foundation of the new system is the SMHI concept RiPP/ROAD, which has been developed during the latest years, and the experiences from the current visualisation tools in both SAF and SMHI. The project is also handling future developments.

This project is expected to run until at least 2004.

Orientations in Météo France on Meteorological and Production Workstations.

Magali STOLL, Direction of Production
Head of SYNERGIE Programme
Marie Franç oise Voidrot, DirectionIT, Information System Management
Management of Synergie system
Stéphane Thomas, Direction IT, Information System Management
Quality, Methods and Tools

The principal realisations of the SYNERGIE Programme since the last EGOWS meeting in 2000 will be presented as well as the general orientations at short and medium ranges. They concern at first an enhancement of the general quality of the Programme, by operating a stronger priority on the specifications by the ensemble of Synergie users, linked with the general forecasting needs and projects in Météo France. They concern also the Synergie system maintenance and evolution processes as well as the convergence with other tools. Each Synergie release is now managed as a project with an annual frequency of delivery. Each release project covers two years between specification phase and final deployment. Thus, in 2000, the 3.3 Synergie release has been deployed for all Météo France users and the 3.4 release has been developed in parallel. The 3.4 factory acceptance has been made in march 2001 by the Forecasting Direction, and the on site acceptance will be finalised in may 2001 by the Information Systems Direction, to allow a complete deployment in 2001. With this planning, an outside Synergie user could get the last operational version one year after Météo France users. As the Synergie users and actors increased and is disseminated all over the world, a specific Synergie Intranet site is being developed to help the coordination of all transversal actions, to follow the planning, to phase with others projects, and to easy internal communication. This quality approach to manage the needs and the developments, and to capitalise the experience, will follow on 2001 for all the domains concerned by the SYNERGIE Programme. Through the SYNERGIE Programme and the Synergie Systems, Meteo France has now acquired and capitalised a long and solid experience on the management of operational meteorological information systems. The new Direction of Production in Météo France plans now to generalise and adapt this experience for the management of other kinds of tools used for the production activities (forecasting, climatology, end-users production). It will concern for example the ASPIC and PIC tools (regional nowcasting and local meteorological workstations), tools where the main functions are quite similar on Synergie (Visualisation, Graphical Interaction, Expertise formalisation, End users production). The technical questions as the mix of different operating systems (Unix, Linux, Windows NT) will be then studied with a good knowledge on the needs, and thus with a better positioning of each kind of tools. The main objective in Météo France is to be ready for the conception of the next generation of meteorological workstations, linked with the evolution of activities on production. All this work made in Météo France is a common preoccupation inside the European Meteorological Services. A bilateral reflex ion has began with the Met Office to see if a common way could be taken to cooperate. This announcement will be made at EGOWS with Steven Foreman, Head of Information Systems Development in MO.

Java application for issue- and monitoring TAF

Ove Kjær (okj@dmi.dk)
Danish Meteorological Institute (DMI)
Copenhagen, Denmark

1 Introduction

Back in the years of 1994-95 a TAF tool used to issue and monitor Danish TAFs was developed at the Danish Meteorological Institute. The TAF tool has been used with success by the Danish forecasters since 1995, but it was not able to handle conditions found in Greenland. In 1998 it was therefore decided to implement a modernised version called SPOT. In addition the DMI should participate in the European TIPS (TAF interactive Production System) project. It was believed, that some of the software developed by TIPS, could be used in SPOT. The TIPS project ran into some delays and it was decided to start the development of SPOT using Java. In this way, the SPOT application became one of the first major Java developments at DMI. It is still our hope, that the TAF verify software from TIPS, can be added although written in C.

2 Techniques and Platforms

The SPOT application was developed using JBuilder on a Windows-95 platform using techniques like:

- RMI (Remote Method Invocation)
- JDBC (Java Data Base Connectivity)
- JavaCC (Java Compiler Compiler)

SPOT has been tested on different Windows platforms, Solaris and Linux. It is now running operational on the Solaris platform.

3 Dataflow

The data is controlled by a MySQL database and a database demon. The demon is used to collect TAF and METARs on two database servers. When a SPOT application is started, one of the database servers is contacted in order to register the application as a subscriber for new data.

When data arrives into the database all present subscribers will be notified by a RMI call and the SPOT applications will be updated.

If the database daemon is no longer able to contact a SPOT server, the associated subscriber is removed from the database.

4 Features

The first version of SPOT has following major features:

- SPOT contains a time schedule which is easily updated
- SPOT has a TAF- and METAR viewer
- SPOT is a TAF monitor
- SPOT shows a TAF and related METARs in a graphical way including amendment limits
- SPOT has a TAF editor with a highly developed syntax control
- SPOT is highly configurable

5 Future

Next version of SPOT is planned to contain:

- Climatology (almost ready)
- HIRLAM forecasts
- TAF verification

Later versions will hopefully be able to incorporate a first guess TAF generator and a GAFOR generator.

6 Other recent Java developments

DMI has developed a Java library for common use. Some of the major classes are:

- Classes for handling date and time in a proper way
- Classes for handling world-wide maps and layers of graphics
- Classes for handling common GUI items
- Classes for TAF- and METAR parsers
- Classes for simple charts
- Classes for handling time-series of meteorological data

TIPS Status and Recent Development at DNMI

TIPS: The Taf Interactive Production System is now finished and released in an alpha version.
TIPS has been started in COST-78 in cooperation with several European countries. The work has been finished under the umbrella of EUMETNET. As a real child of the EGOWS the result of this work will be presented here.
TIPS has resultet in a ANSI-C software library which can be included and used by any TIPS-member. The library has an easy, string based interface and is able to parse TAFs and METARs, and can compare the resulting structures to each other (MONITORING and VERIFICATON). This corresponds to the TIPS tasks 4-6.
The system is strictly following the ICAO rules but can be modified by dynamic Amendment-Criteria which can be adapted to specific sites. TIPS does not take advantage of local rules for TAF storing/reading. The interface for TIPS is the TAF-string which is free for the specific aviation center to exchange with a database, file or user-interface.

Recent development:

The QUBA (QUality assurance dataBAse) is now operational. This system is able to process any kind of time-series forecast. The system is fully dynamic and able to process several forecasters at a time. The forecasters work against the same database. Everybody is through this able to control the forecasts of the other colleagues at realtime, which enhances the consistency of the national forecasts. The system is coupled to a product database which on one hand is used to process the resulting products and on the other hand informs the forecaster about what to forecast at which time/place.
The DIANA (DIgital ANAlysis) program will be operational in the very near future. DIANA is a system for interactive on-screen digital analysis. Fields and surface observations can be shown, as well as satellite images and products.
Starting with model data or previous analyses the forecaster produces an analysis by editing fields, and drawing fronts and weather symbols. The analyses from the regional forecasting centers are sent to a common database where they are distributed to the other centers. One of the centers will have the responsibility for combining the different analyses to produce the official DNMI analysis. The forecaster does this by moving the borders between the different regions and thus decide where the different analyses are used.

A Data Warehouse System for the Meteorological Data of MeteoSwiss

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MeteoSwiss recently started a project to consolidate the various databases, data processing systems and quality control systems in a unified conceptual architecture. It was recongized that the presently implemented approach of an enterprise-wide database is not be suitable to fully meet the users needs. This is mainly because it is difficult to tune a database for online transaction processing (OLTP; e.g. online loading of data, quality control or correction of faulty values) as well as for online analytical processing (OLAP; e.g. production of meteorological services or climate research). In order to overcome this problem, considerations of the early nineties to separate these main tasks into different layers are reexamined in the light of definitions from the 'Data Warehouse' technology. This technology is mainly used in the business world to support management decisions. The conventional definition of a Data Warehouse System was adapted to the tasks and needs of a National Weather Service. Starting from an abstract reference architecture a conceptual architecture for MeteoSwiss was developed. This architecture consists of two core layers which are embedded between the data sources and the end user applications. The bottom layer is the so called 'staging area' containing work databases. These databases are mainly used to collect, transform, integrate and quality control the data. This layer contains complete datasets in original time and space resolution in a normalized database model and provides consistent and quality checked data. The upper layer is the so called 'data storage' area. It consists of an 'analytical database' (or data warehouse) and application and user specific 'data marts'. Here original and aggregated data are stored in a not normalized way according the different user's needs. The staging area is fed by the data sources (e.g. Global Telecommunication System, MeteoSwiss observation systems) whereas enduser applications are connected exclusively to the data storage area. The so called 'metadata repository' plays a key role in the whole system is of special significance for the database specialist as well for the meteorologist/climatologist. Quality control procedures are of utmost importance in this system. This topic will be treated in a separate contribution. The paper will discuss the basic defintions of Data Warehouse technology and their adaptations for the domain of weather and climate as well as the conceptual architecture. Examples for various data types (surface, upper air, satellite and radar etc).

Operational Applications Related to the Local Model at MeteoSwiss

Guy de Morsier

At MeteoSwiss the Local Model (LM) is the main numerical weather prediction (NWP) tool for the short range forecast.
This model is non-hydrostatic and has for the time being an horizontal resolution of 7 km. The Swiss configuration has 385x325 grid points in the horizontal and 45 levels. This domain covers a large portion of Western Europe. The boundary conditions used to integrate the LM are coming from the German Weather Service's (DWD) global model (GME) and has an horizontal resolution of 55 km.
Now we use less than 70 MB of input data for one run and produce more than 7 GB of output for a 48-hour forecast. And this is done twice a day. The implementation and use of the model is quite a complex task but we have more than 10 years of experience sharing a common model with the DWD and executing the model on an external computer.
This presentation will show how the data flows from the DWD to the NEC SX-5 supercomputer at the Swiss Center for Scientific Computing (CSCS) in Manno and back to MeteoSwiss.
Some of the tools and applications used to retrieve (MARS), assimilate, archive and display (Metview, IDL) the NWP data in operational mode will be illustrated. Also the future changes to the system will be indicated.

User Training on the Horace Workstation

Shelley Robinson
User Services Manager
Met Office

Training on the Horace workstations is provided for both internal and external customers of the Met Office.
There are two basic types of training requirements; basic training for new users of Horace and ongoing refresher courses for experienced users. Basic training takes the form of a one or two day course depending on the subsequent role of the user. This training will cover the essential applications and functionality which a new user will require to do his job. These courses are run on an adhoc basis at the request of the customer.
Refresher training is planned to run for a week to coincide with a new release of software, currently twice a year. Users can nominate themselves to take part in this week, normally for just one day. Pre course questionnaires are used to gauge the material which the user wishes to cover. These questionnaires are then used as a basis for the structure of the refresher course but new applications and functionality are also included.
Training needs analyses are carried out to ensure that Horace Training is tailored to the role of the trainees.
Trainees are asked to complete an online post course questionnaire which is used to make further improvements to the training process.

EGOWS 2001-Zuerich, 14-06-01

Report of the WG on Meteorological objects

The MO'WG had its third meeting since its creation th 13-06-01 during EGOWS 2001 in Zuerich.
It is reminded that its main goal is to propose a list of meteorological object to be submitted to WMO
As a future standard.

The work done by the WG since EGOWS 2000 has been presented and the WG considers that The workplan has been almost achieved. The WG has produced a list of meteorological objects which
Is a synthesis of the proposals received from its members. However, two points must be noted:

- the WG received only 3 contributions, which is undoubtedly too short for being sure that
  the list meets the needs of a large meteorological community
  the WG did not contact groups out of Europe as it was recommended last year.

Nevertheless, the WG considers that the present list acceptable as a first guess to be delivered to involved NMS for checking that it includes the objects the need for their present or future applications.
In the same time, the WG has to produce a detailed list of attributes for each identified object. To do that, it is recommended to refer to the existing WMO list of conceptual models supporting Sat Rep.
Then, it will be possible to create the corresponding XML objects. A graphic transcription of some objects from the different main classes would provide an interesting illustration for concretising our initiative.
The WG should profit my presenting its activities and progress on the web.

The following one-year workplan has been approved:

- the present list of meteorological objects will be sent to all WG members for checking that the list meets the needs of their NMS. Action by Dick Blaauboer an d Eric Brun.
  Responses from the WG members before the end of October
- Christian Csekits sends to the WG members a DC including the WMO pages about conceptual models used in Sat Rep. Action before the end of September.
- The work for defining the attributes for the meteorological objects will be shared by several WG members:
  - Christian Csektis: objects corresponding to Sat rep concepts
  - UKMO (to be confirmed) : objects from the class "Action Centres"
  - Juha Kilpinen and Uros Strajnar : objects from the class "Sensible weather"
  - DNMI (to be confirmed): objects from the class "Synoptic typical features"
  - MF: objects from the class "Others"
  - This work should be achieved before end of 2001

- Dick Blaauboer an d Eric Brun will do the synthesis of the list of attributes and of the possible new objects before March 2002.

- Creation of XML corresponding objects and illustration to be done by Uros Strajnar and Ernst de Vreede before EGOWS 2002.
- The list of the WG members will be updated to take into account the changes that occur since the WG creation. Action Dick Blaauboer an d Eric Brun.

Visualization Techniques

1) Review of last year's report
2) Visualization techniques (textures)
3) Graphic API's (Scenegraph)
4) GIS

The general impression is that more intelligence is now entering the graphical forecast process.

1) Review of last year's report

No specific comments because most statements are still valid. The issue of 2D and 3D is still not solved (see below)

2) Visualization techniques

3D remarks:

- For monitoring the analysis procedure or for conceptuel model understanding 3D is valuable.
- Accuracy can be critical for hybrid vertical coordinate models because of the impact of terrain following model layers.
- Iso-surfaces can be used for easy and better definitions of cross-sections through pollution plumes.
- Rendering/depth viewing.
- Shadow casting, transparency and texture mapping can very much help navigation of 3D images.
- Textures could com from new techniques for wind (see key-note paper) or i.e. from satellite and digital elevation information.

Imaging:

- Gradients are or can be important and you should try to understand them and not smooth them out. This leads to a pixel or raster information display which is very well hardware supported.

  This image approach permits to compare radar, satellite and NWP data (UKMO, Nimrod) and prevents any over or under interpretation of isolined data. Image manipulation such as zooming, discriminating, slicing, stretching and web production are made much easier.

Implementation:

- There are definitely NO price or technical issues which prevent using 3D.
- 3D systems must be integrated, supported and fast for an operational use otherwise the forecaster goes to 2D and stays there.

3) Graphic API's (Scenegraph)

DWD are strongly using virtual reality scenegraphers.

KNMI and DWD are convinced that OpenGL is faster than GKS or X and use it.

UKMO: DELPHI for Windows and Unix

4) GIS
UKMO: ArchInfo and ArcView for real-time radar and web-based applications.
For the moment the meteorological information is passed to the GIS.
GIS would of course like to have the weather information in the system but the system must be fast so than it can be used.
Good to add value to any product (i.e. road, pollution, energy clients) because it makes the output much closer to the user's understanding.

Recommendations concerning visualization
Java2D, Java3D, OpenGL and XML
"Thinking in Java" in :www.brueceeckel.com

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Strategies in systems design and development , Zuerich 14/06/01

Subject	Organisation issues	Technical issues	Recommendations
ISO 9000	- Quality processes. - Already have informal quality processes. - Need to be compatible to exchange code.	- Description of processes and interfaces.	- Next EGOWS should have presentation on ISO 9000 issues (volunteer or experts expected). - Need to be clear on life cycles used.
Documentation	- Needed when staff change. - Helps avoid relying on key staff.	- Dr Genius (DNMI), Rational Rose (tried and rejected DNMI, FSL), ClearCase (ECMWF), TogetherJ (DWD, MeteoSwiss), Sniff (DWD, MeteoSwiss).	- Documentation must: exist, be updated and be available (e.g. intranet).
Configuration management	- Needed for quality process. - Reduce reliance on key individuals.	- Sniff (DWD, MeteoSwiss), Continuus (MO), ClearCase (ECMWF), PCMS (FSL), homemade (MF).	- Collaborators may need to use same system – depending on flexibility of tool.
Testing	- Needs significant effort, even when automated tools used. Key issue to maintain operations. - Testing reduces needs for post-release patches and also reduces disruption for users and operations.	- Need to keep testing scripts for tools up to date with code. - Need both unit and system testing. FSL have duplicate forecast office for testing. - Tools help to test intermediate builds. - Memory leak detection: Purify (ECMWD, MeteoSwiss), INSURE (DWD).	- Developers must plan and control testing carefully.
Communication	- Developers on different sites need to be able to synchronise their work and	- Even with a one year release cycle, frequent intermediate builds help co-	- Any method of communication should be tried!

	adapt to changes elsewhere in the project.	ordination (MF) - Frequent meetings (DWD) - Video tele-conferencing (FSL).	
Requirements management	- Must be clear on: specification, benefits, priorities. - Users must know how to introduce a new requirement request. An individual must be responsible for making sure a clear specification is produced.	- User Groups useful tool (MF, MO, FSL) – but issues with prioritisation across different types of user/requirements.	- Collaboration will need the partners to define this process across organisation.
Problem management	- Need to understand impact of problems – and concentrate on high impact patches – otherwise impact on development.	- Patch policies defined (MF, FSL, MO). - Use standard "helpdesk" reporting system to track progress with problems (MO).	- Clear patch policy needed (when to issue patches, make sure they, or other solutions, are built into future releases).
Standards needed	- Standards are essential for co-operation between organisations.	- Data formats – WMO - All use local extensions to WMO formats – but gets in the way of co-operation. - Middleware standards starting to be used (MF, DWD, CNMCA) and provide opportunity for sharing functionality without needing to integrate source code.	- Support WMO in developing and evolving standards for data formats, etc. including GRIB, BUFR, XML. - Next EGOWS investigate Eumetnet project to define middleware (e.g. CORBA, SOAP) standards for meteorology – this will need preparations and suggestions for experts welcome.

Participants in workgroup
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Oldrich Spaniel, SHMI, Slovakia
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M-Fancoise Voidrot, MeteoFrance
Steve Foreman, Met Office, UK

Final discussion

At the end of the meeting the Working Groups results were presented (see reports in this proceedings).
Here some general remarks about possible future trends in EGOWS topics:

- Many issues are common with nowcasting developements: it could be interesting to share experience and knowledge between nowcasting and visualization.
- Visualization could/should include come kind of forecast methods.
- In the next years new kind of data will come (i.e. Meteosat Second Generation and derived SAF-Projects): it will necessary to develop new presentations and methods.
- Representation of EPS-data evolved over the years, i.e. EPS-Meteogram from ECMWF. Still a problem the presentation of wind direction.
- More integration between forecast (all ranges), production and visualization technology in the operational WS.
- The increasing amount of the data is a big challenge: how to extract the relevant information, how to find an ergonomic way to enhance the data. In the future the duty to screen all data to identify the relevant information could be moved to "intelligent" system working in background, giving some kind of guidance to the forecaster "where" to look.

The aim of the EGOWS meeting was always to find some kind of collaboration among the NWS. A necessity for the future should be the standardisation of formats, methods, objects, ...

A change in the organisation of the EGOWS meeting has been proposed:

1. Two kinds of presentation:
   - short (20 minutes incl. discussion)
   - long (40 minutes incl. discussion, possibly with some kind of demo)
2. Demos (just half a day)
3. More working groups or/and longer session
4. Several invited keynote speakers on relevant issues
5. A questionnaire to identify the relevant topics should be distributed with the announcement.
6. Some possible issues have been quoted:
   - Middleware
   - ISO 9000
   - Nowcasting
   - Forecast methods
   - New kind of data
   - 3D
   - Standards