AUTOMATIC TECHNICAL SELF CHECK SYSTEM FOR THE DWD WEATHER RADAR NETWORK

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Abstract

The German Meteorological Service (DWD) operates a network of 16 operational C-Band weather radars. Approx. 36.000 products are generated and disseminated fully automatic per day.

The technical status of the radars is recorded by a Built-In-Test-Equipment (BITE) while the status of the software and data processing system is gathered by SW-daemons. This includes the production and dissemination time for every product. All information is packed every 15 minutes and sent as standard radar product to the radar operation center in Hamburg.

Here the actual parameters (approx. 600 per station) are compared with reference values. The results are shown in HTML-pages with a color coding, depending on severity of differences. The availability of products is given in detail and as percentages. The parameters are grouped and the lowest status of each group is shown on a nationwide map.

Servicemen use this utility to see problems as soon as possible and for failure analysis. The tool is simple to implement and helps to improve the system and product availability.

1. Introduction

The German Meteorological Service (DWD) operates a network of 16 fully automatic weather radars. The systems are computer controlled and the operating mode can be configured widely without changes in source code. So the software on all systems is the same and only parameters may vary from site to site. To achieve optimum homogeneity throughout the network, the variance is restricted to device dependant values.

Beside the software parameters also the hardware, i.e. transmitter, receiver, server etc, must run in proper mode. Because all stations are unmanned they are serviced every 4 weeks and diverse HW-parameters are recorded by the software for technical monitoring.

The main goals for the automatic self check system in the DWD radar network is to alert the servicemen as soon as malfunction occurs and to provide information for quality management or data interpretation (metadata). The "Technical-Monitoring-Radar" (TeMonRa) started in 2000 and is continuously improved. Since the software on the radar computers (RMV from SIGMET/Lassen/EEC) will be replaced in 2005 by MURAN from GAMIC a major change is showing up, while the basic principle will be the same.

2. The radar system

The radar systems in DWD are standard C-band radars with well defined interfaces inside. Today two types are in operation: 5 DWSR-88 (EEC / DRS) and 11+1 METEOR 360 (Gematronik / AMS). The 12th METEOR is a research radar at Hohenpeissenberg. The 16 operational systems are evenly distributed over Germany, so that full coverage is achieved with 150 km radar range.

The general structure of both systems is given in Fig.1. The radom-covered dish is driven by a servo system while transmitter and receiver work in single polarisation with doppler capability. The HW is mainly controlled by the radar control computer and primary data acquisition is done by a signal processor (RVP-family from SIGMET). Diverse sensors in the HW give measures like forward and reverse power, several voltages and currents etc.

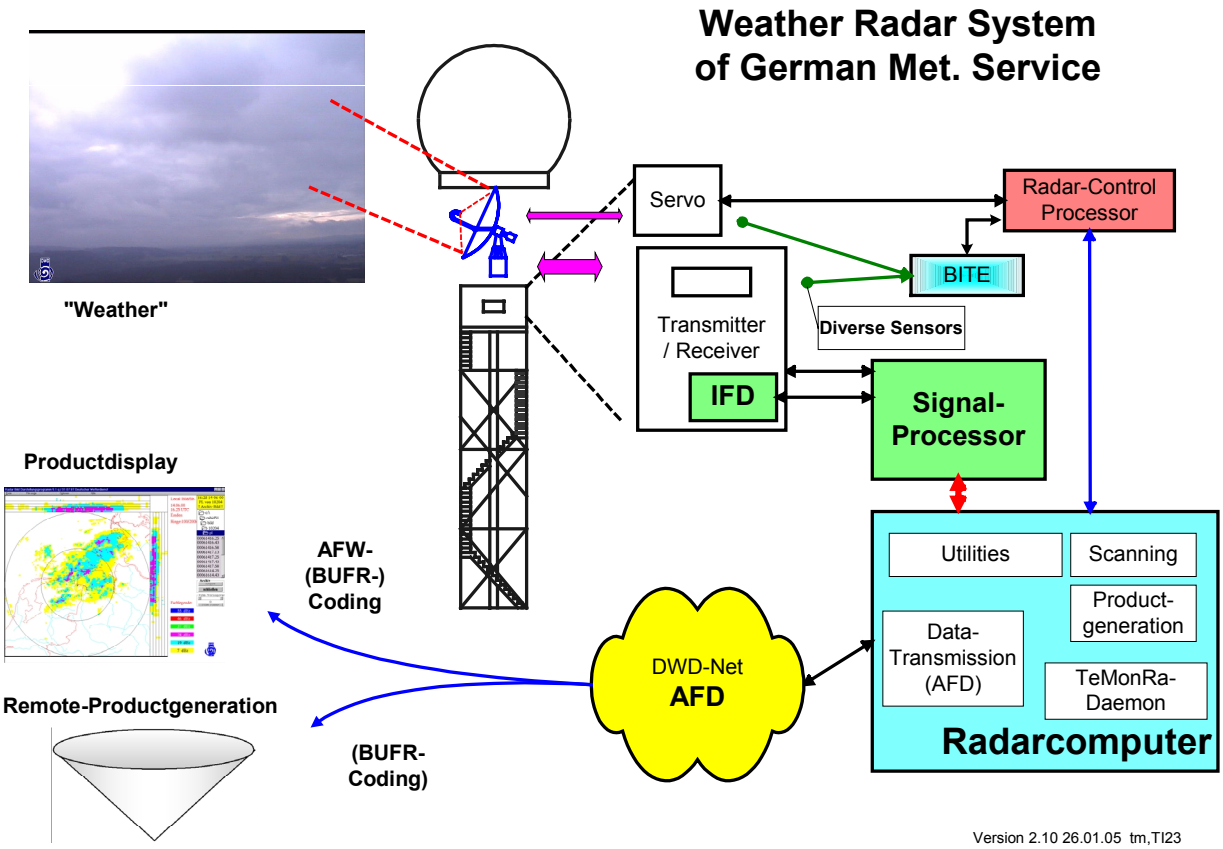


Fig. 1: General structure of the DWD weather radar system.

The radar computer holds utilities for calibration etc, software for making scans as well as products and an application for the transfer of data. Beside this typical radar software components there run some modules for the technical monitoring. The radar computers are part of the DWD-WAN (DWD-Net) and can be accessed over TCP/IP, i.e. also by cellular phone from any computer in DWD.

This year the radar computers will be switched from VAX/VMS (DEC) to Intel/Linux and run the Open Source Software AFD (Automatic File Distribution) as well as a webserver for http access. This opens more options for the technical monitoring.

3. Basic principle

The technical monitoring compares actual values of the parameters with a reference and displays the results as color coded HTML-tabels. It is conceived only for surveillance. The system does not allow any action on the radar, this is done by means of the radar software. TeMonRa consists of three main steps:

A. Manual configuration

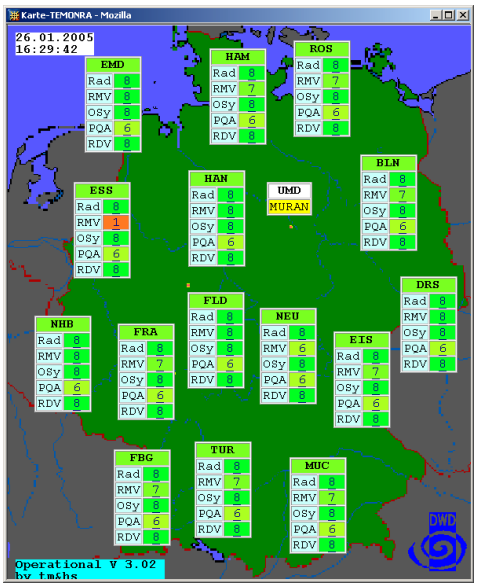
First the hard- and software is configured and calibrated manually. All parameters are set to required values, like transmit power, antenna position, pulse-repetition-frequencies or filters in the signal processor. After all (hundreds of) parameters have been checked, this gives the "reference parameter set".

B. Recording information

On each radar computer daemons gather all available meta information and code it into files every 15 minutes. The files are sent to the radar operation center in Hamburg per AFD.

C. Evaluation and Display

In Hamburg the actual data is compared to the "reference parameter set" from step A. The result is displayed in HTML-pages, where the state is color coded. See e.g. Figure 3. For a better overview the parameters are grouped and the bottom quality for each block is given in a nationwide overview for Germany, see Fig. 2.



Legend:

- for every radar site there is a small table
- parameters are grouped and the bottom quality of each block is shown
- the states go from 0=worst (red) to 8=best(green), with 9=no data (pink)
- each state-number is linked to a page with detailed information, see e.g. Fig 3.

Fig. 2: Nationwide overview of TeMonRa.

An example of the detailed views is shown in Fig. 3. The left frame gives links to the overview map and to the different blocks of every site. The right frame shows detailed information, here a part of the RMV scan definition. The left column gives a description of the parameter and the second column holds the actual values. The third column holds the reference values and gives differences to the actual data as color code. A severity of the parameter with respect to product quality is given as color from green, over yellow, orange to red.

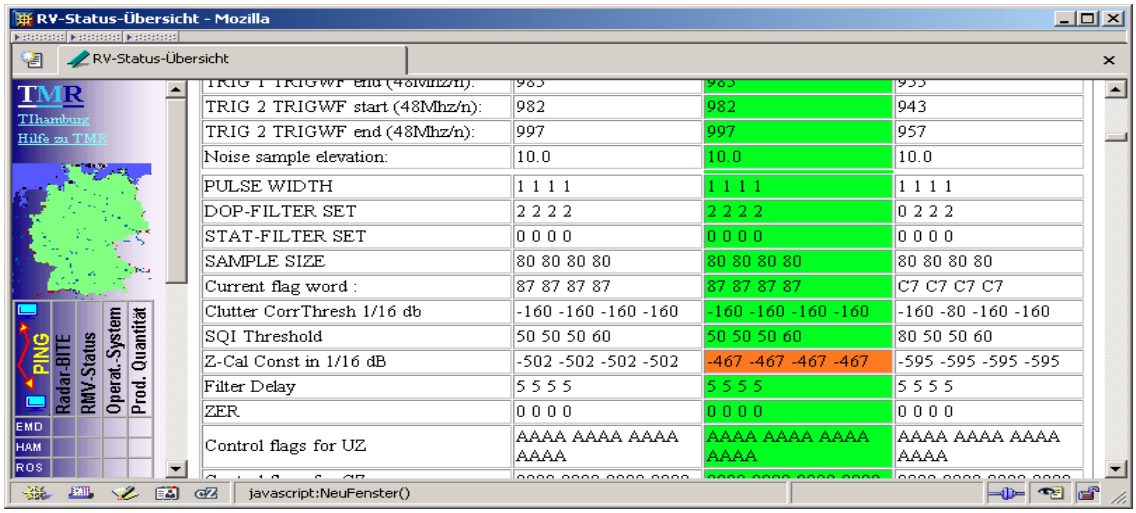


Fig. 3: Example for detailed view, here scanning parameters.

In future a comparison to the nationwide reference values in the 4th column is planned.

With the actual RMV-Software the monitoring data is gathered every 15 Minutes. As far as possible really used values are recorded, but not all parameters can be retrieved from the software after usage. Monitoring of configuration files is not included in the package.

4. Future aspects

In spring of 2005 the new MURAN software will be put into operation together with packages like AFD and BigBrother. In conjunction with web servers on each radar computer the capabilities of the monitoring can be expanded while keeping the basic principles:

- substantial logging of MURAN and AFD of actions allow detailed tracing

- specialized error analysis can be done on site through dynamic HTML-pages so that only part of the local information has to be transferred to Hamburg

- monitoring on operating system level will done by BigBrother, a powerful tool, which also shows information about other components like uninterrupted power supply

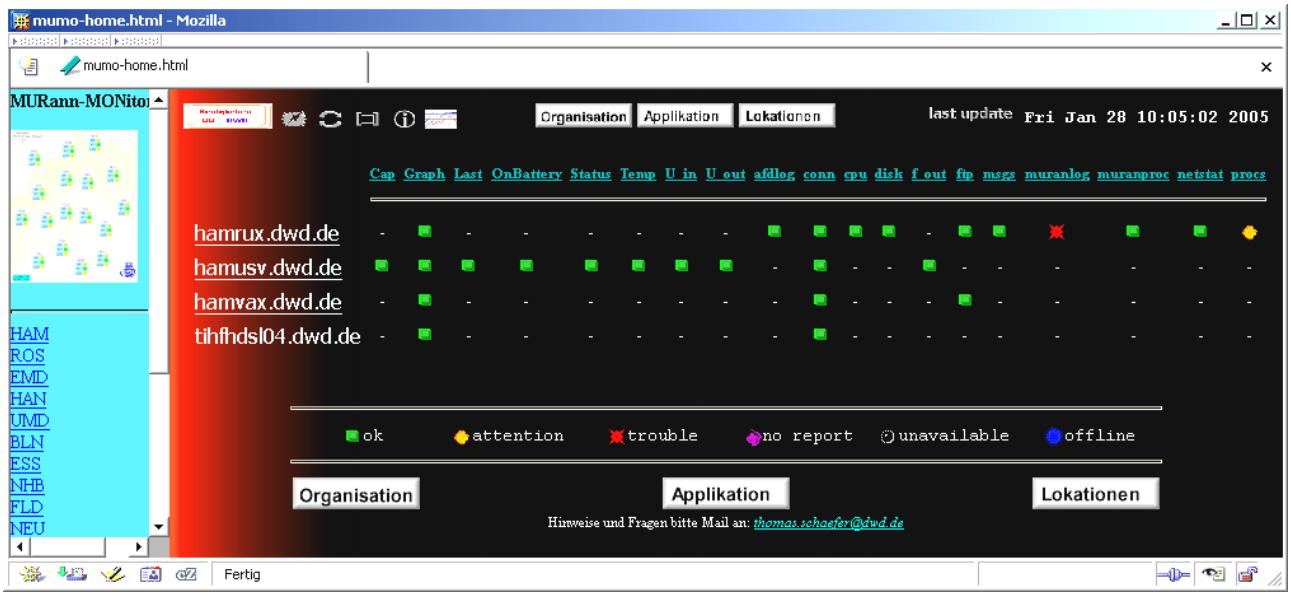


Fig. 4: BigBrother summary display of one site.

6. Summary

The web based, fully automatic self check system of the DWD weather radar network is a simple but powerful tool for technical surveillance. It gives overviews and detailed views that are accessible from every browser. Rapid update rates and checking of all available parameters signal malfunctions often before they become a severe problem or before the users recognize a problem in the data.

Because HTML-pages are very small, the servicemen on standby can use them even over cellular phone. The availability of all products is computed for quality management issues and all data are archived as metadata for detailed radar data analysis.