9 Data Flow and Management

as of 15 July 1999

All data gathered during the MAP field phase will be stored and made available by the MAP Data Centre (MDC). In special case of real-time data there are centres where the data will be available to the forecaster group. The centres are: MAP Operation Centre (MOC) in Innsbruck, Austria, Project Operation Centre Radar (POC) in Milano, Italy, MAP Network Centre (MNC) located at MDC in Zurich, Switzerland and Co-Ordination Centre Rhine-Valley (COC) in Bad Ragaz, Switzerland.

9.1 Computer networking

9.1.1 MAP Database cluster

The computer network for the MAP field phase is based on the know how of the MAP Data Centre. We will use the same database and websoftware and access strategy as well. Figure 9-1 shows an overview of the database cluster during the MAP field phase. MDC stores all MAP data (episodes, seasons, GOP and SOP) except real-time data. The database link between MDC and MNC is undirectional and will be used to archive the real-time surface and radiosonde data at MDC. The contents of the database at MOC, POC and MNC will be real-time data for forecasters and on-site scientists.

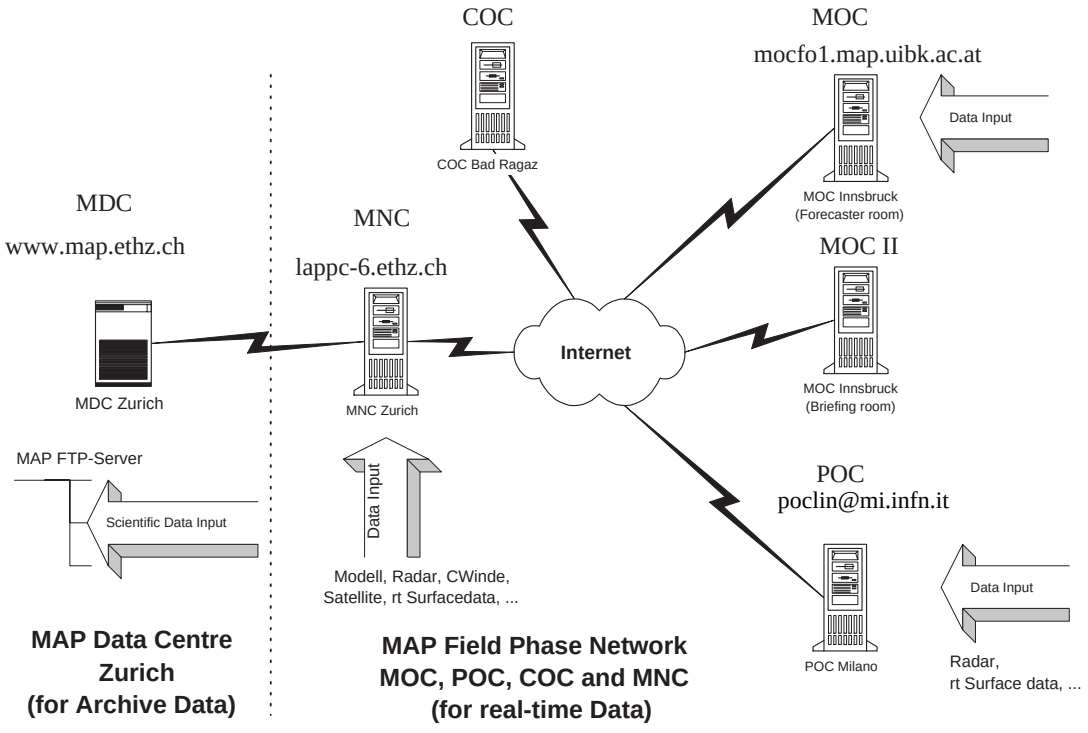

FIGURE 9-1. MAP field phase Web- and Database Server Network overview.

9.1.2 MOC, POC, COC and MNC Network

A Web and Database server are located at each MAP field phase Centre in Innsbruck, Milano, Bad Ragaz and Zurich. Data access through the local network (Intranet) at each centre allows a dramatic reduction of data traffic over the Internet. Thus we will have all information available and accessible through a high performance Intranet at each location. Figure 9-2 shows the MAP field phase Network overview from the point of view of users and data providers.

Real-time data are available at the centres in Innsbruck, Milano, Bad Ragaz and Zurich. All data gathered during the SOP will be stored at MDC. With a MDC account you will have access to SOP data, for real-time data a forecaster account is needed. Data processing of real-time data takes place at each centre depending on data and provider.

9.1.3 MAP field phase network

All real-time data (surface data, radar, satellite images, model data fields, etc.) will be replicated to all the centres. Every user located at one of these centres is able to access all the data through the local area network (Intranet). The centres are connected together over the Internet. Figure 9-2 shows the technical overview of the MAP field phase network. The Internet connection depends on the centre: MOC and POC are connected through a fixed ISDN line, COC will be connected through a dial up connection and MNC (MDC) is connected directly to the Internet. If the capacity of the Internet is too low, so that we will get the real-time products too late, we can connect the MOC, POC and MNC directly via ISDN. But on the other hand most real-time data are sent to the corresponding centre by ftp over the Internet. So if the Internet is broken or too slow we do not receive most of the real-time data anyway.

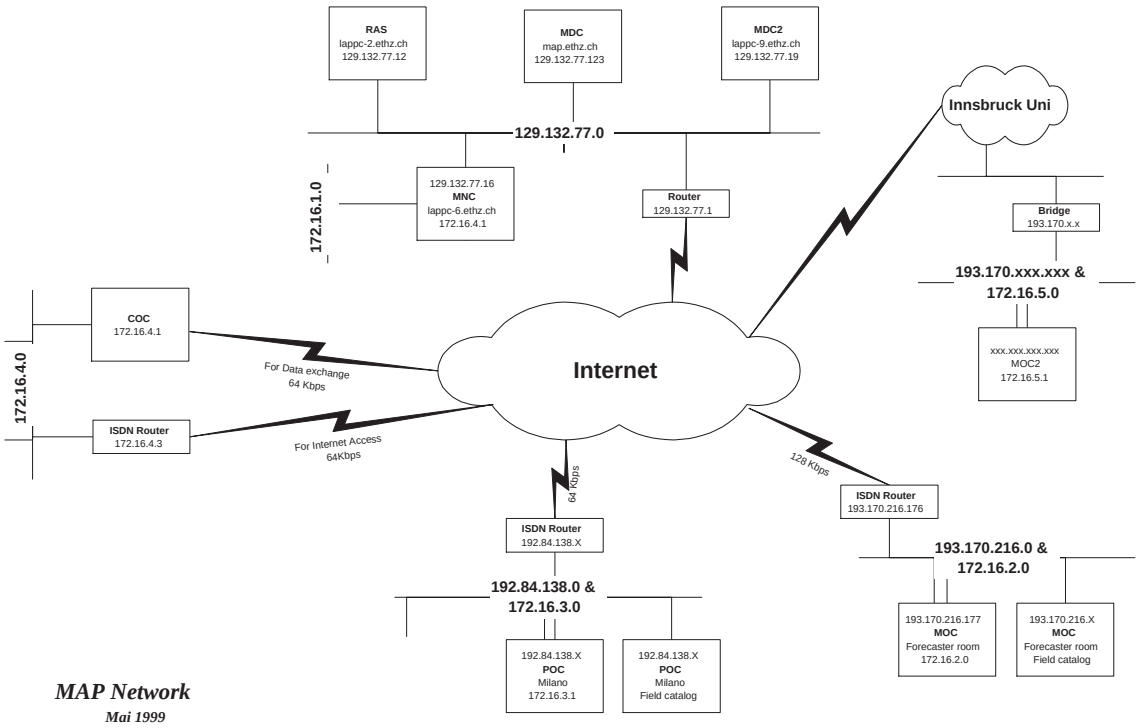

FIGURE 9-2. MOC, POC,COC and MNC Network technical overview.

The first test of a month worth of data interchange between Innsbruck and Zurich showed that the Internet is fast enough for data replication (see network capacity test).
All users physically connected to one of the MAP field phase network server at one centre can use the computer resources of the centres as well. Each Network server (Windows NT) is connected through a Routing and Remote Access Service (RRAS) to the Internet. Using the Point to Point Tunnelling Protocol (PPTP) the Intranet of each centre are connected together. This configuration allows us to use special non-routable IP-addresses within the MAP field phase network. That means, each Network server has two IP-addresses: a MAP network address and a real Internet address. For example, the MNC server in Zurich is reachable through the **Internet** by lappc-6.ethz.ch or 129.132.77.16 and through the **Intranet** by 172.16.1.1. If you try to access the MNC server through the Internet with the address 172.16.1.1, you will never get an answer from the server.

The Webserver Intranet (MAP field phase network) addresses are:

TABLE 9-1. MAP field phase network IP addresses.

Server name and location		**Intranet IP-Address**	**Internet IP Address**
MNC	Server Zurich	172.16.1.1	lappc-6.ethz.ch
MOC	Server Innsbruck (Forecaster room)	172.16.2.1	mocfo1.uibk.ac.at
MOC II	Server Innsbruck (Briefing room)	172.16.5.1	?
POC	Server Milano	172.16.3.1	?
COC	Server Rhine Valley	172.16.4.1	none

Important: All these IP-addresses are only valid when you are connected physically and directly to one of the MAP Network servers.

9.1.4 Network backup system

If the capacity of the Internet is very slow or if the Internet connection between one and the other centre is broken, we have the possibility to use the MAP Network backup system (Fig. 9-3). The ISDN modems at MOC and POC are configured for incoming and outgoing data streams. We do never switch from normal operation to backup operation automatically. The backup systems will use international telephone lines and we have to be aware of the communication costs. The MNC has more than 3 input ISDN lines at a time.

For the network backup system we will need an additional ISDN at each centre. Under normal conditions we can us this line for other users. It is also possible to use the ISDN line for the voice and video communication during the briefings between MOC and POC.

9.1.5 Network capacity test

The network connection between MOC Innsbruck and MNC Zurich is working now since four months. The file system and the database synchronisation works well. In this month we did two stress data tests. In both cases, we sent 1 GB of data from Innsbruck to Zurich.

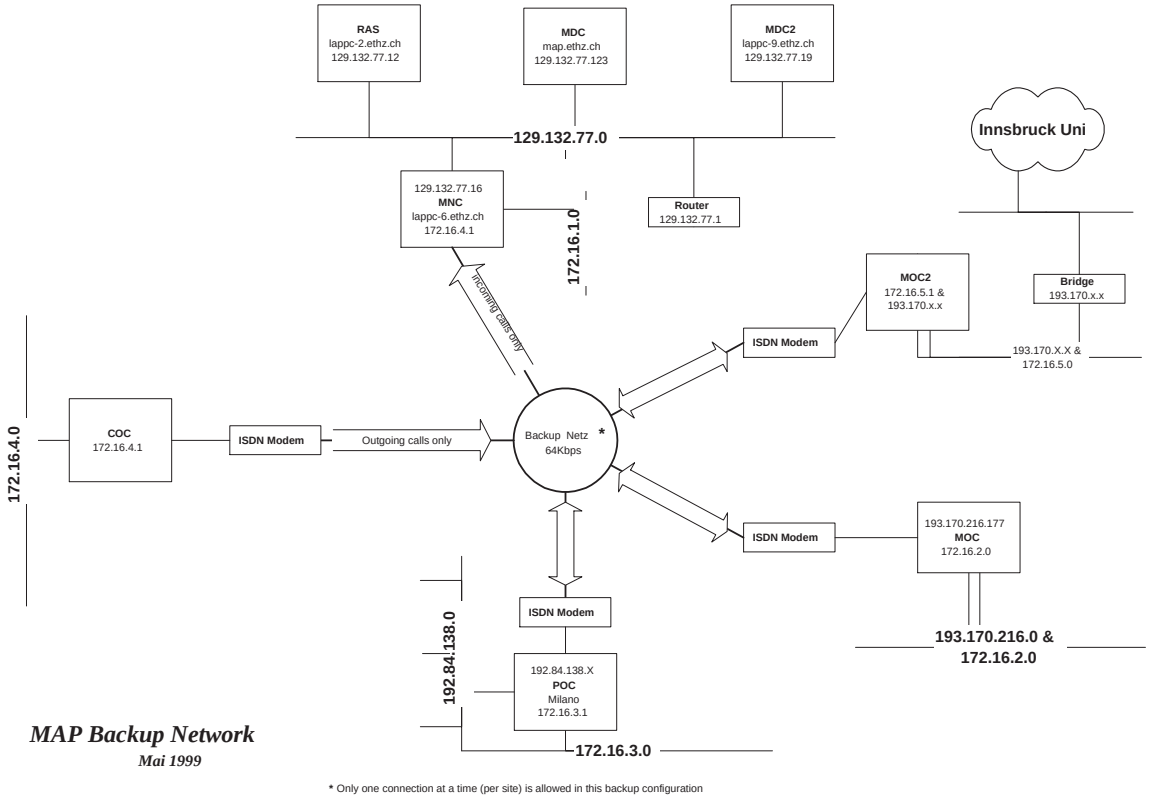

FIGURE 9-3. MAP field phase Backup Network technical overview.

TABLE 9-2. Transfer rate between MOC Innsbruck and MNC Zurich

Data size	Data transfer time	Data transfer average
1.1 GB	11 h 59’	1.50 MB/min
1.2 GB	14 h 44’	1.31 MB/min

During the tests the replication of the centres runs as well without any problems. Now we have to make more tests, but in general we can say that the Internet connection between Innsbruck and Zurich is fast enough for the MAP field phase.

During the last two months we checked the response time of the network connection between MOC Innsbruck and MNC Zurich (see Fig. 9-4). The hourly average response time is less than 300 ms. For normal Internet operation (Replication and synchronisation) is this fast enough.

9.1.6 Status of MAP Network installation

MDC is running since 1995 and is well known and reachable through the Internet address *www.map.ethz.ch*. The MNC Server in Zurich (MNC) is running since Mai ‘98 and the MOC server in Innsbruck since January ’99. That means the replication mechanism between Innsbruck and Zurich is now running four months under real conditions. Full remote control

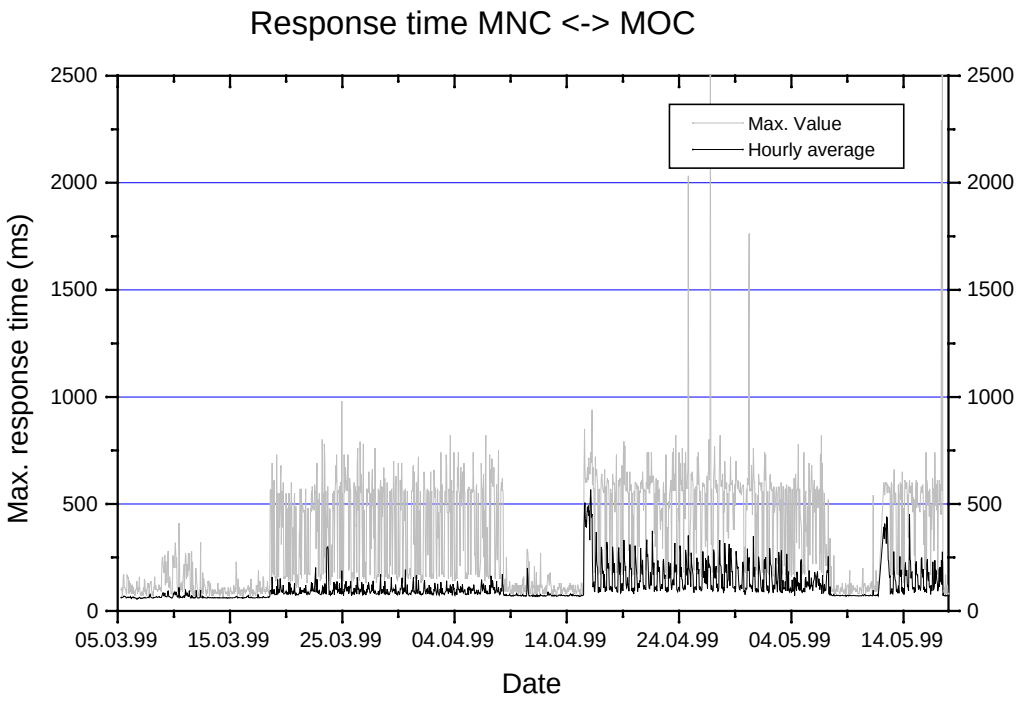

FIGURE 9-4. Network response time between MNC and MOC

of the MOC server in Innsbruck from Zurich over the Internet is also possible. The first test of voice communication over the Internet was a success, as well. A voice and/or video communication over the Internet seems to be possible. But we have to do more tests to get a definitive answer.

9.2 Security concept

The MAP data security at MDC, MOC, POC, COC and MNC is divided into different parts.

9.2.1 Security at MDC

The MDC Web sites are divided into a public and a member area. The public area is reachable by everybody without any restrictions. For the MAP member area you need an account with username and password. ORACLE Application Server (see Fig. 9.1) handles the authentification mechanism. For more details about the MAP data access policies, see http://www.map.ethz.ch/DataAccessPolicy.htm.

9.2.2 Security at MOC, POC and COC

The **Internet accesses** for MOC, POC and COC are similar to the Internet access of MDC itself. Each Webserver has a public and a member area. The public part is for everybody and the member area is reserved for forecaster and authorised scientific people. Each Oracle

Application Server handles the authentification mechanism at each site. Only forecasters will automatically get an account at each site.

On the other hand the **Intranet access** is open to every Intranet user. The restriction is that only users on a computer with a MAP field phase Network IP-number and connected physically and directly on the Intranet will get access to the MAP field phase Network. From the technical point of view, physically and directly means there is no router or switch between the user workstation and the server of the centre. To get a MAP field phase Network IP-number please contact the Network administrator at the corresponding centre.

9.3 POC-internal networking concept

The POCLAN: (Fig. 9-5) is controlled by a Windows NT 4.0 Server, is based on an Alpha 3000 Workstation (CPU Alpha 21164 - 400MHz, 256MB RAM, HD 9.1GB + HD 4.3GB), and can be accessed via an Ethernet with RJ45 connectors (UTP) by a maximum of 30 users. Hub/Switch systems and cables/connectors are available in each room at almost every desk.

The Oracle 7DB (ODB) and the MAP file server, installed by MNC and mirror of those installed in Zurich (MNC) and Innsbruck (MOC), are resident on the Server and locally accessible by every user. Information will be fed into the DB also by the CMRLAN, which is directly linked with the Italian National Meteorological Centre in Pratica di Mare (CNMCA).

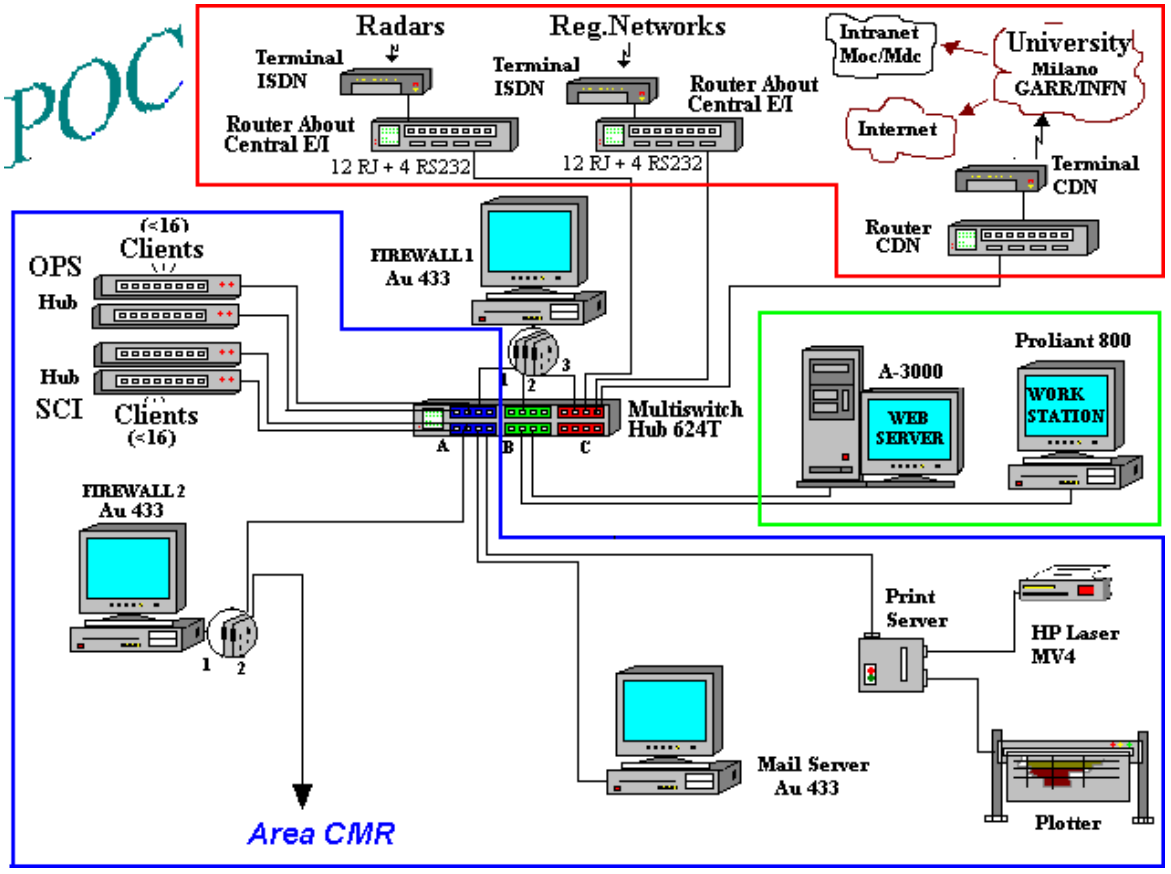

FIGURE 9-5. Layout of POCLAN, the POC Local Area Network.

Security: the POCLAN is external to the local operational network (CMRLAN). A double Firewall system assures the necessary physical and logical separation (see Fig. 9-5). Therefore, POC users can access only the POC server and some printers, but no other part of the local network. They can also access Internet services on request. On the other hand, locally available relevant information can be passed directly to POCLAN from CMRLAN.

9.4 On-line MAP Field Catalogue

The on-line field catalogue implementation for MAP is coordinated by the UCAR Joint Office for Science Support (JOSS). The catalogue will assist all MAP participants in documenting the project throughout the SOP. Available information will include reports, weather products, in-field analyses of IOP activities and other information useful to operations support activities.

The catalogue's core is based on a fully dynamic web page generation and works best as a stand-alone system. It can be "taught" some SQL commands to effectively interface with the Oracle server for MAP. Therefore, JOSS proposes to develop and implement a demonstration MAP on-line catalogue at JOSS for use by MAP investigators. It will be freely accessible across the Web.

JOSS will implement a system to meet the MAP needs. This includes populating the catalogue with products from MNC and MDC, special products from the PIs generated during the SOP and availability of forms and resultant reports for important SOP activities. These include forecast discussions, sample operations summaries, instrument status, and other

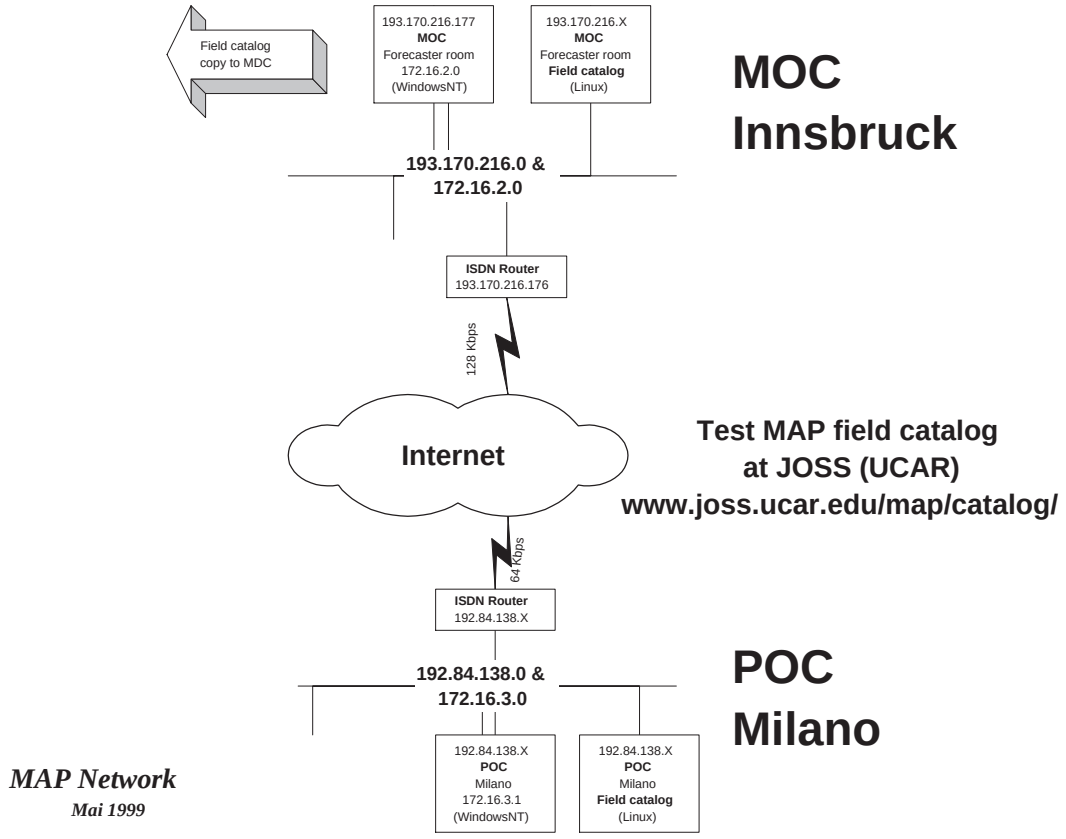

FIGURE 9-6. MAP field catalogue overview.

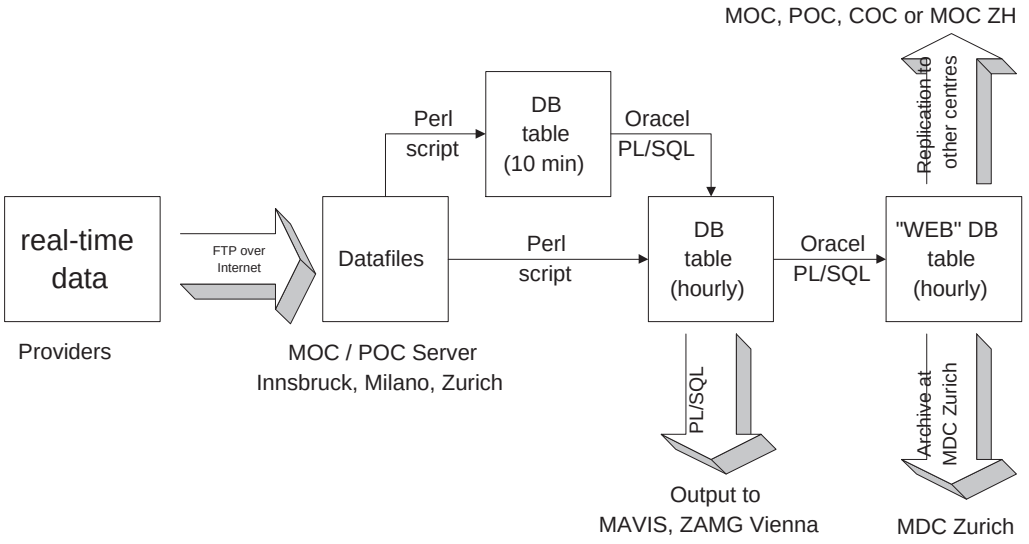

FIGURE 9-7. GOP real-time data flow at MOC, POC and MNC.

information that might be useful. The catalogue is now under construction and may be reached via the WWW at http://www.joss.ucar.edu/map/catalog/.

One important feature of the catalogue will be the ability to automatically accept reports and products from participants in the field. Information sent via ftp, email of disk transfer. The process of product submission is described in Section 9.4.1 below.

Operational implementation and checkout of the catalogue will be completed in late August / early September 1999 just prior to the start of the MAP SOP. The catalogue will run on machines provided by JOSS and connected to the LANs of both the MOC and POC. JOSS staff would provide set-up support. Maintenance of the catalogue should be minimal in the field. The provision of data products to the catalogue will be the responsibility of the Operations Support Staff at the MOC and POC.

9.4.1 MAP Field Catalogue Users Guide

9.5 Reception and Dissemination of real-time products

The real-time data flow is divided into several independent modules. There are communication, scripting and database modules. Figure 9-7 shows an overview of real-time data flow at each centre of MAP field phase network.

The first step is sending the real-time data from each provider to the MOC or POC server by FTP over the Internet or ISDN. The data format is ASCII. Each provider got an FTP account on a corresponding Server. The result of step one is a data file in real-time on the MOC or POC server. The time resolution of surface data is 10 minutes or 1 hour.

Then, we store the real-time data in database tables. All converting programs are written in Perl and use the ODBC database connection. Hourly and 10 minutes data are stored in different tables. A PL/SQL program produces hourly data from 10 minutes values. (Average or sum from 50' to 40'). In the next step we produce a file with hourly data. The data visualisation is taken in MAVIS at ZAMG in Vienna. The real-time data are copied to the

surface data table. This table together with the radiosonde table are replicated to the other centres by Oracles replication option. Finally, we archive the real-time data at the MDC.

At the moment (i.e. May 1999) we receive the following real-time data:

TABLE 9-3. Real-time data available at MOC, POC and MNC

Data type	**Providers**
Surface data:	- INM - LWTi - SMI
Radiosonde data	- INM - SHMU (Slovakia) - HMIS (Slovenia)
Radar	- SMI composite
Satellite	- IR, VIS, WV from SMI - Rapid scans from Eumetsat
Windprofiler	- Vienna through C.W.I.N.D.E.
Model	- ECMWF 12 UTC (SMI/LAPETH) - SM 00 UTC (SMI/LAPETH) - SM 12 UTC (SMI/LAPETH) - Aladin 00 UTC (CHMI, CZ) - Aladin 12 UTC (CHMI, CZ) - MC2 special cases only (ETH)

9.6 MDC Archives

The last critical part of the MAP data management system is the long term archive now in existence at the MDC. This location already contains much of the preliminary data and documentation from the numerous studies leading up to the SOP. Important details of the archive structure are provided in Appendix I:.

All data gathered during the MAP field phase will be stored at MDC in Zürich. Data access will be through the MDC's Web interface. In general all data will be available in "Internet like format". That means ASCII tables for surface, radiosonde data etc. and GIF-images for radar, satellite images etc. Row data for example radar data will not be accessible on-line.

It is also possible that data will be accessed from other repositories using the MDC interface. In this way, MAP retains flexibility with a distributed archive structure and permits investigators most familiar with their data to provide access to the latest versions.