

# A DISTRIBUTED INFORMATION PROCESSING SYSTEM

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## Abstract

This article introduces a new type distributed microcomputer information processing system for remote sensing mapping with 32 bits super microcomputer workstations, which is developed to process satellite image data, aerial photos and other image data for digital mapping, updating maps, GIS data acquisition and compiling thematic maps.

The system provides versatile and powerful application-oriented image and graphic processing functions, multiple independent display windows for analyzing image-image, image-map. System's application software is very easy to use, manage, extend and interface to data base.

A high efficient hardware environment is provided by Apollo workstations, the processing speed of center processing unit can offer from 4MIS to 25MIS, the distributed architecture feature can extend the workstations flexibly which are linked together with network for sharing the resource so it can be operated in pipeline mode and distributed network computing mode according to the function

specialization.

System's hardware configuration and software architecture are described in this paper.

### Introduction

Since 1972, the first landsat has been launched, computers are increasingly used to process remote sensing image.

There are many kinds of special image processing system being built, in which most of host computer type are minicomputers, such as HP3000, PDP 11/34, NOVA4D, VAX 780, PRIME 750 etc..

The average price of one set about 500 thousand U.S. dollars. The main shortcoming of these systems are very huge, complicate and it can not be suitable for remote sensing cartographic application. In such case, the Research Institute of Surveying and Mapping began to develop its own remote sensing cartographic image processing system based on PRIME 9650 superminicomputer and Pericolor 2000 Color Interactive system from the end of 1982, named PIPS. PIPS is more applicable than similar system, but even so the hardware environment is also very huge, Complicate and expensive. It tends to be limited to use such system in the wide application field in China.

Thanks to the supermicrocomputer develop rapidly. The computing world has been changed. The performance of supermicrocomputer is better than minicomputer in following area: development, extensibility, reliability, flexibility etc. The computers which are used in remote sensing processing are no longer expensive. The

personal workstations can be used instead of multi-user, time-shared machine and network technology makes single user system may access several machines which offer services which are to be shared among the users. It offer us an opportunity to develop a distributed microcomputer information processing system with high improvements in performance / price.

### DIPNET 880 family distributed information processing network system

DIPNET 880 family is supported by APOLLO DN3000 or DN4000 workstations It can be configured either a single workstation or multiple workstations which are linked by APOLLO Domain token ring. In such local network enviroment, any workstation can access system resources transparently, distributed computing and pipeline operating can be performed. User can select the system configuration according to the buget, because it is easy to extend without recompiling the system and remove workstation from or add workstation to the system without any influence.

DIPNET 880 family provide versatile and powerful application-oriented image/graphic processing software, which include all kinds of basic image processing, digital terrain model(DTM) acquisition, rectifying diferrent kinds of remote sensing imges into photomaps, orthophotomaps or geo-coded images, setting up control point files and sub-image library, digitizing and processing map elements and developing GIS with D3M data base.

#### Hardware configuration and software architechure

##### 1. Hardware configuration

The configuration of a single workstation: (figure 1,1)

It provides integrated 32-bit 25mhz MC68020 processor and 25mhz MC68881 floating point coprocessor deliver 4MIPS performance, 4M bytes to 32M bytes RAM and a bitmap monitor with high resolution which can display color image and graphic function rapidly, etc.. General and special peripherals can communicate with it through I/O bus.

The configuration of multiple workstations: (figure 1,2)

Every workstation can automatically perform a task for a project as a standalone machine. The workstations of the network can access global virtual memory system, so the users can share program, file and peripheral resource of the network system. It can communicate with other type computer through ETHERNET.

Comparing the hardware environment of DIPNET 880 family with PIPS the performance is obviously improvement. The processing rate increased from 1.2MIPS to more than 4MIPS, the main memory from 2M bytes to more than 4M bytes, the price is about 1/4 of PIPS. DIPNET is a top of desk machine, so the operator can very easy manage it.

## 2. System software architecture (figure 2)

The system is supported by APOLLO Aegis and Domain/IX(UNIX) operating system and graphic primitive(GPR). On the premise of high performance and low price we have developed a set of image display, graphic processing, image processing, geometric processing, data acquisition etc. software package for remote sensing

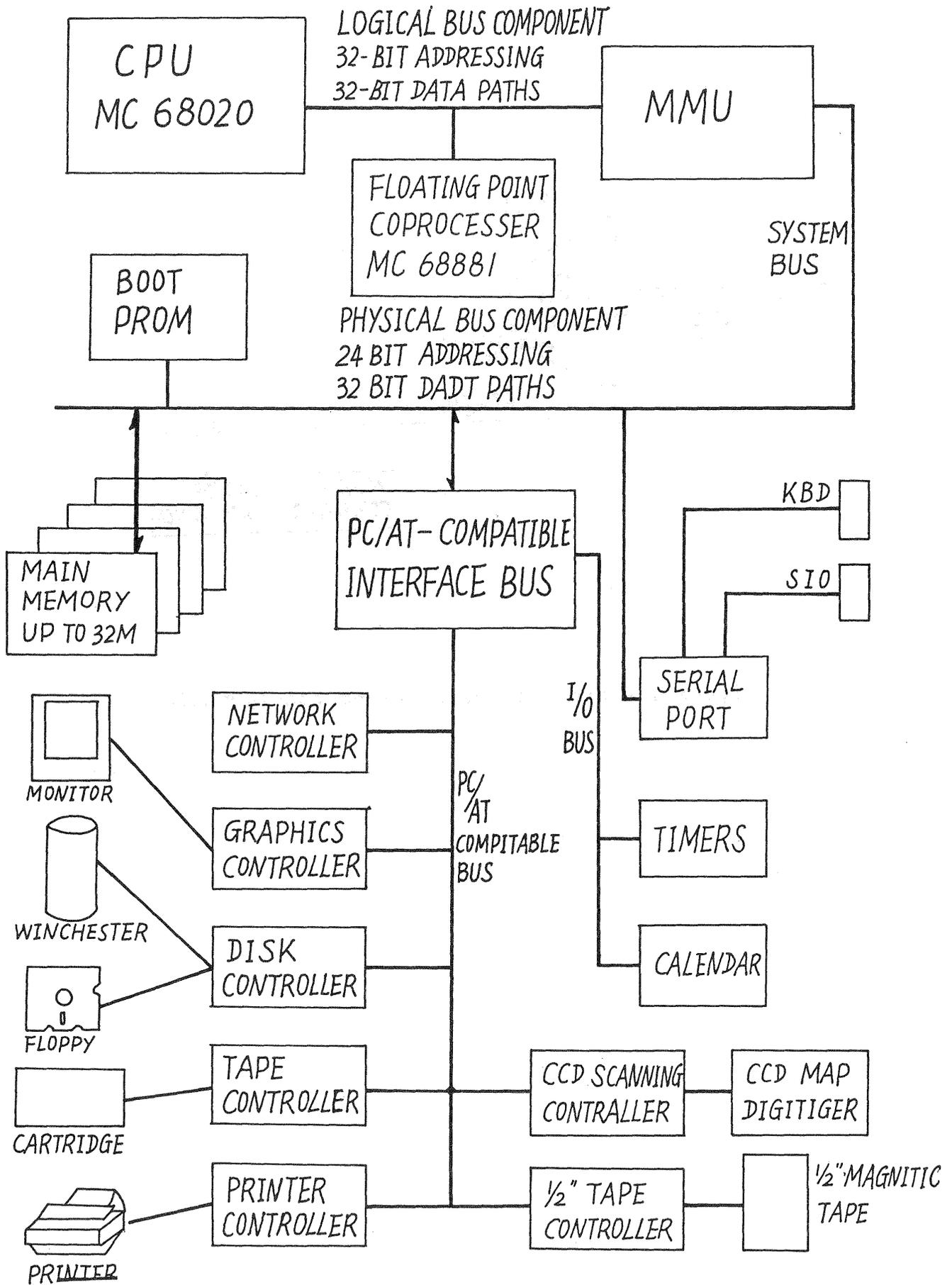


figure 1.1 hardware configuration (one workstation)

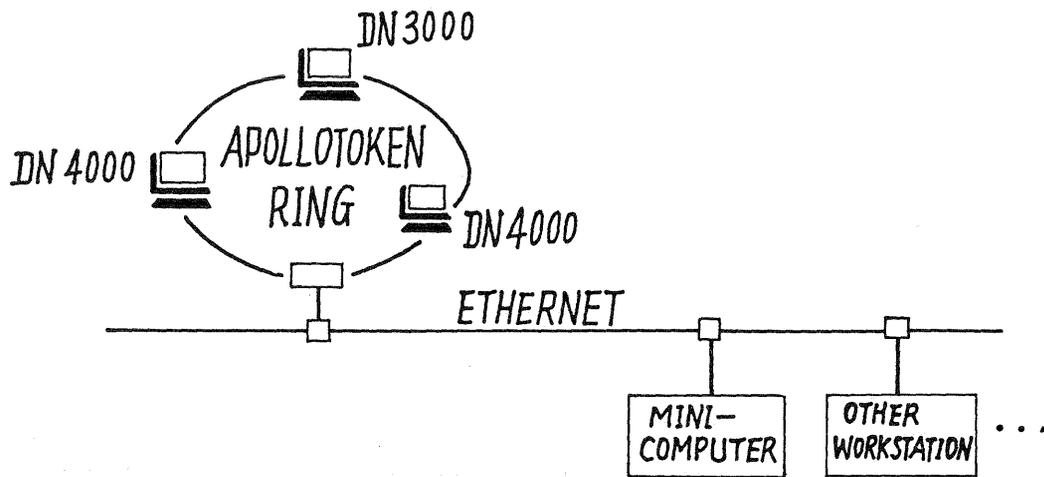


Figure 1.2 distributed hardware configuration

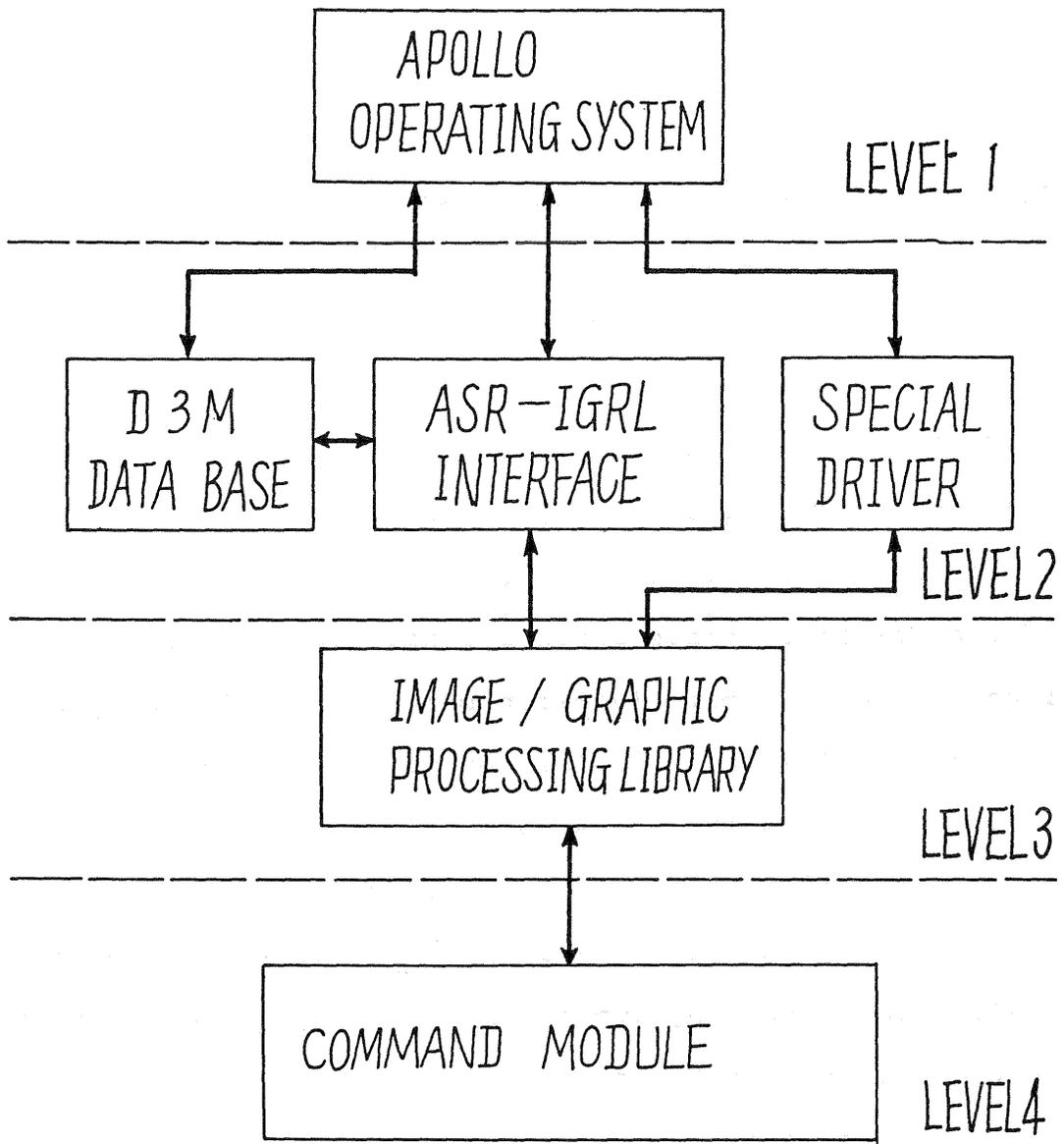


figure 2 DIPNET software architecture

cartographic application to form a application-oriented and user-friendly system.

The system is a kind of hierarchical structure. There are four levels in it.

The first level is APOLLO operating system which provides to access network file transparently, multiple window management and excellent distributed computing environment.

The second level consists of three parts:

- (1) APOLLO D3M data base which is supported to develop distributed GIS for cartographic application.
- (2) Special driver is developed to communicate with some special peripherals which are not supported by APOLLO driver such as CCD map digitizer which is developed by us to digitize map elements, acquire control point sub-image etc. and other photogrametric instruments.
- (3) APOLLO software resources-Image/graphic processing library (ASR-IGPL) interface is developed for program designer to develop remote sensing cartographic program very transparently.

There are three functions:

(a) Basic image display

ON the premise as mentioned above we have developed basic image display function with software instead of the image interactive method of traditional image processing system which costs a lot. We developed special algorithms which can perform displaying true color, stereo image and measuring coordinates of the stereo image. We use pixel

block transfer and bitmap functions to perform roaming, exchange different image displaying etc.

(b) File and data structure are easy to modify to interface with data base and different operating system without any influence to the image and graphic processing library.

(c) Program designer can use Pascal, Fortran and C languages etc. to develop application software transparently.

The third level consists of several hundred subroutines to perform remote sensing cartographic image processing algorithms which include public service programs, image enhancement and transformation, multispectral data classification, image map and orthophoto image map processing, terrain data acquisition and DTM generation, map elements digitizing and processing, automatic control CCD map digitizer.

The fourth level is the command module which is responsible for the interactive mode of image/graphic processing. It interprets commands from the keyboard or mouse and issues calls to the library to execute those commands.

### Conclusions

DIPNET 880 family is a new system which is The Research Institute of Surveying and Mapping in cooperation with MEDAS CO. LTD. The cartographic image processing application software has been developed on the basis of image processing software of PIPS. So it is a very reliable software package. We have optimized it further and combined it with APOLLO's efficient graphic functions and distributed environment, which make DIPNET 880 family stepping up to a new information

processing stage--application-oriented, compact configuration,  
high reliability, easy management.