METEOROLOGICAL SERVICE SINGAPORE
GRAPHIC INFORMATION VISUALIZATION AND ACCESS SYSTEM

Tian-Kuay Lim
Meteorological Service Singapore
Republic of Singapore

1. INTRODUCTION

The Graphic Information Visualization and Access System allows users to access and visualise meteorological data and information using graphics workstations. The system is connected to various subsystems. These subsystems include the systems for weather satellite, radars, automated weather observation stations, Numerical Weather Prediction (NWP) models and various meteorological databases. The system operates within a computing environment that ranged from personal computers to workstations, minicomputers, mainframes, and supercomputer. A schematic diagram depicting the overall connection of the various systems is shown in Figure 1.

With systems integration, users can access and visualise the various sources of meteorological data and information on graphics workstations. Information visualization is the hallmark of the system. In the design of the visualisation applications software, efforts have been taken to ensure its portability on other platforms. Standardization of operating system, graphics routines and data structures are desired. The system utilises Unix-based file server and graphics workstations. X-lib graphics routines are used to ease portability across Unix-based workstations. In addition, users can also utilise other graphics applications softwares such as UNIRAS, Sun-XGL and SunVision. Data structures are standardized to facilitate easy dissemination, retrieval and visualisation of information.

The file server, SUN 470, and the graphics workstations were installed in mid 1991. Since then, in-house development of applications software has been in progress. The applications software will be developed and implemented in two stages. In the first stage, software will be developed to enable basic visualisation of meteorological data. Advance graphics features, highly processed information and various weather forecasting techniques will be incorporated in the second stage. The first stage is expected to be completed and commissioned for operational use in early 1992.

2. SYSTEM DESCRIPTION

The Graphic Information Visualization and Access System provides meteorological personnel at the weather forecast offices, airbases and base weather stations the capability to analyze, forecast, and access up-to-date meteorological information. The system enables meteorologists to generate and manipulate a wide variety of weather images and graphics on colour monitors, to perform in-depth analyses of changing weather patterns, and to produce hard copies of a wide variety of weather products. It presents weather charts, satellite images, and other detailed weather displays based on various worldwide graphic and alphanumeric data sources.

The hardware suite consists of 100 percent proven commercial off-the-shelf (COTS) products executing in-house developed applications software. Industry standards are used for easy expansion and growth. These standards include the IEEE (Institute of Electrical and Electronics Engineers) POSIX, National Institue of Standards and Technology POSIX FIPS 151, X/OPEN Portability Guide, AT & T System V Interface Definition and ANSI C. Communications are based on Ethernet, coaxial and telephone-modem links.

2.1 Hardware

The system incorporates SPARC, the Scalable Processor Architecture. The system comprises a Fujitsu S-4/470 file server and a number of graphics workstations which include the Fujitsu S-4/1 Plus GX, X-terminal and Silicon Graphics Personal IRIS.

The server, operating at 33 MHz with a computing power of 3.8 MFlops double-precision Linpack and a main memory of 32 MB, features the use of industry-standard IPI (Intelligent Peripheral Interface) mass-storage technology to deliver fast disk performance at the low cost. The 6-MB-per-second IPI disk controller uses a dedicated onboard processor with 1 MB of cache. The graphics workstations, S-4/1 Plus GX, offers accelerated desktop graphics performance, with 540,000 2-D vectors per second, 270,000 3-D vectors per second, real time dynamic motion, and 8-bit (upgradeable) colour.

A 2.3 GB tape drive is used to backup the system periodically and to archive and store historical data.

2.2 Modular Software

The system design features an open architecture based on industry standards. Both hardware and software are modular, loosely coupled "building blocks" that can be combined to meet varying operational needs. The software has five elements: communications, data management, alphanumerics, graphics, and utilities. These elements have well defined interfaces, executing independently of each other, thus allowing custom tailoring. Software is designed in a modular manner, whereby the overall system is composed of a number of logical subsystems. Each subsystem of the software performs a specific logical function.

2.3 Network

Data entering the system are generally from the world aviation and meteorological networks. Facsimile broadcasts and transmissions are also received through facsimile interfaces. In addition, local meteorological data, weather radar data, weather satellite data and NWP products are available for retreival (Figure 1).

Computer to computers transmissions are accomplished using DecNet, TCP/IP, Novell Lan and X.25 protocols. The file server S-470 is linked to local workstations, satellite system, facsimile interfaces and other devices through Ethernet LAN. Connection between the server and the main computer, Facom M360, is through a high-speed local connectivity via the SunLink link channel gateway through block multiplexer channel protocols. NWP results and products from the supercomputer, NEC SX 1A, are received through a high speed 64 Kbps line which is linked to the main computer. Weather information from UK Royal Meteorological Office are received through X.25 protocol. Workstations at the remote sites are linked to the server through modems which are connected to the normal voice grade telephone lines.

The network environment allows users to share the computing and data-storage resources of the SPARCserver and any workstations or systems on the network. This capability enhances the ease of use and increase the productivity for users of the entire system and workstations. Operation costs can be reduced by allowing entire networks of workstations to operate without local disks. Further productivity gains are realised by off-loading intensive computational tasks from workstations or other systems to powerful computing machines such as the supercomputer or the SPARCserver , freeing workstations or other systems for other applications.

3. FUNCTIONAL OVERVIEW

The system provides a meteorologist with the capability to perform work related to studying, analysing, forecasting and even the preparation of final product using the workstation. The functions of the software applications system on the workstations can be summarised as follows:

3.1 Computer Terminal Emulations

The workstation can function as multiple computer terminals. In the X-window environment, while using the workstation for other applications, one can also invoke additional windows for terminal emulations to access the main computer and the Micro Vax computer in the usual manner or to go into PC emulation if the need arises.

3.2 Graphic Weather Information Database

Through a real-time and on-line graphic database system, one can display and browse an assorted weather charts based on information received, products from NWP models as well as the information captured by, among others, the weather satellite, weather radar, and automated weather observations network.

3.3 Applications

Analysis and visualization of weather information can be interactively activated by the use of a menu-driven applications system. Some of the products include streamline, contouring of wind and other weather data, weather satellite and radar imageries. A sample of the available graphic products are shown in Figure 2.

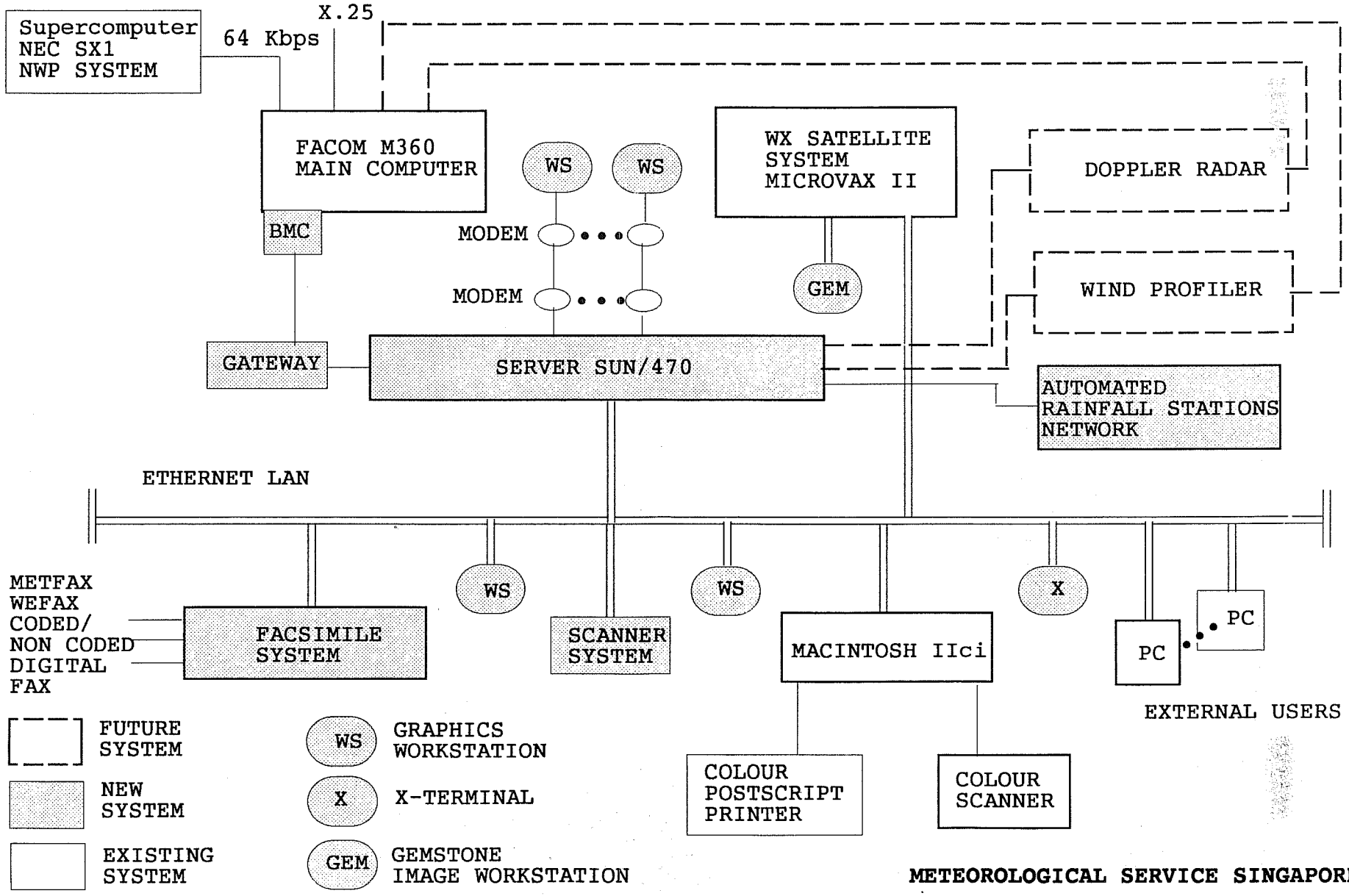
Apart from the capability to generate routine chores, such as the preparation of forecast charts, the workstation is a powerful tool for meteorologists in performing special processing and visualization of data. Fortran and C compilers and other graphics packages are also available, making the workstation a versatile tool for research and development work.

4. POTENTIAL

The hardware configuration is flexible. It has virtually unlimited growth potential. To service more concurrent users, it only requires the connection of additional database/user servicing CPU (or replace an existing CPU with a fully compatible higher capacity model) and an appropriate number of terminal servers to the Ethernet network. The baseline software can be readily modified for new functionality and a variety of applications.

FIGURE 1

GRAPHIC INFORMATION SYSTEM



METEOROLOGICAL SERVICE SINGAPORE

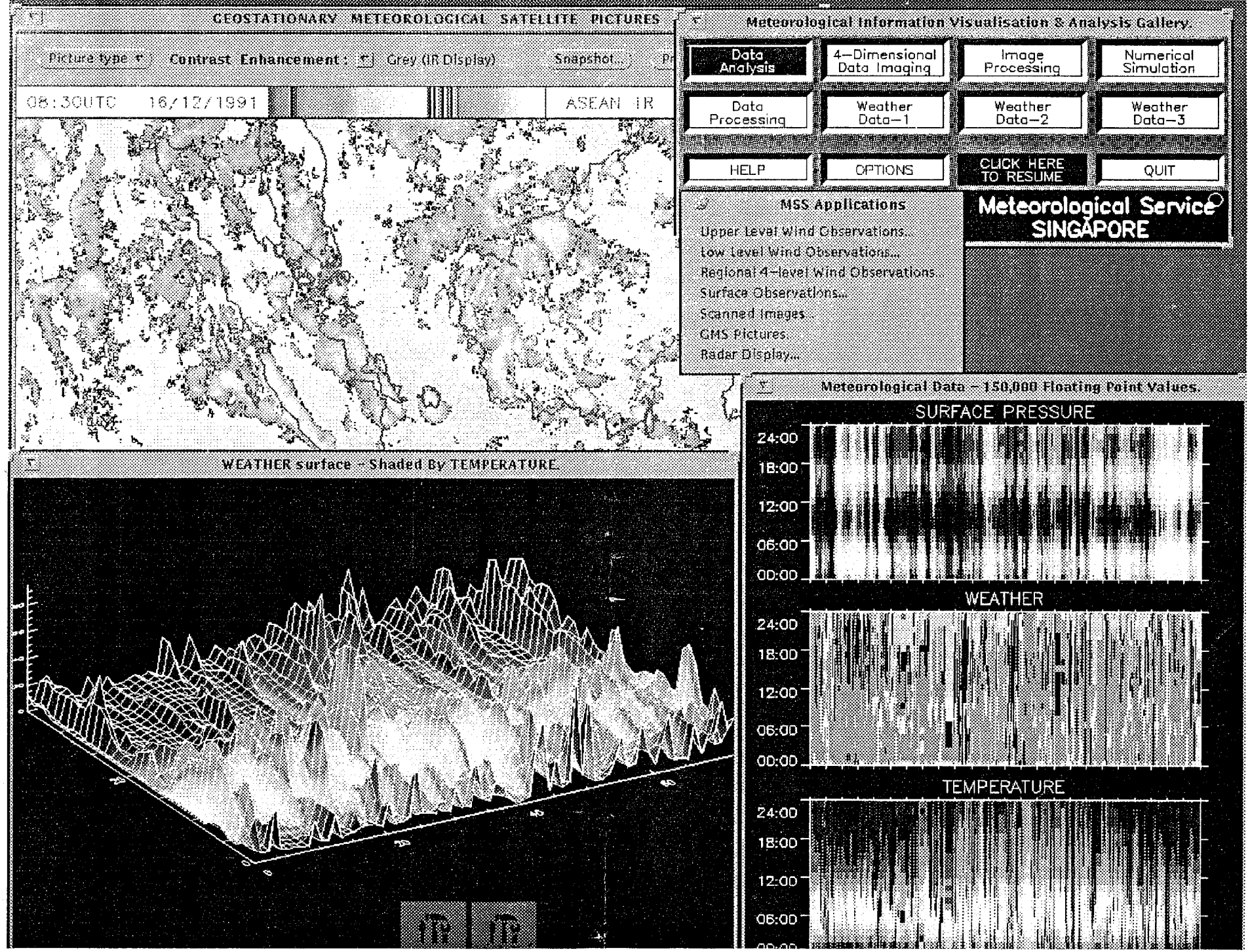

GEOSTATIONARY METEOROLOGICAL SATELLITE PICTURES
Picture type
Contrast Enhancement :
Grey (IR Display)
Snapshot...
08:30UTC 16/12/1991
ASEAN IR
Meteorological Information Visualisation & Analysis Gallery
Data Analysis
4-Dimensional Data Imaging
Image Processing
Numerical Simulation
Data Processing
Weather Data-1
Weather Data-2
Weather Data-3
HELP
OPTIONS
CLICK HERE TO RESUME
QUIT
MSS Applications
Upper Level Wind Observations...
Low Level Wind Observations...
Regional 4-level Wind Observations...
Surface Observations...
Scanned Images...
GMS Pictures...
Radar Display...
Meteorological Service SINGAPORE
WEATHER surface - Shaded By TEMPERATURE
Meteorological Data - 150,000 Floating Point Values.
SURFACE PRESSURE
WEATHER
TEMPERATURE
24:00
18:00
12:00
06:00
00:00

Fig. 2

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