

HARDWARE-INDEPENDENT AND SOFTWARE-INDEPENDENT IN SYSTEM DESIGN

Miao Liucheng

Su Jiangang

Feng Bingxuan

Beijing Institute of Tracking&Telecommunication Technology

ABSTRACT

Today, open technology has been widely used in computer and other field, including software and hardware. The “Open Technology” about hardware and software can be called “Hardware-Independent and Software-Independent”(For example, Open Operating System in Computer.). But, in telemetry technology field, the system design based on “Hardware-Independent and Software-Independent” is primary stage. In this paper, the following question will be discussed:

- a. Why telemetry system design needs “open technology”
- b. How to accomplish system design based on “Hardware-Independent and Software-Independent”
- c. The application prospect of “hardware-Independent and Software-Independent” in system design.

OPEN TECHNOLOGY

Now, open technology has been widely used in many fields. The open technology can be called “Hardware-Independent and Software-Independent”. The notable example is in computer field. It will be taken as an example to discuss what is the open technology.

The hardware-independent designs are obviously incarnated unified interface and control protocol in computer technology, including physical voltage and current and mechanical sizes. The hardware standards for computer have been published and accepted by all computer companies and peripheral equipment manufactory. So, we can buy a function card from any company and plug in our computer, and it can work smoothly. To achieve the function successfully, the software design is pivotal. First of all, software architecture must be standardized. Then the interface and control protocol and data format must be unified. In computer technologies, the interface, including program language and operating API, have been very well known for programmer. Other designs in computer software are as well as the interface. Because it is familiarized for technical staff, in this paper, we will not detailedly describe the theories and application.

“Hardware-Independent and Software-Independent” in telemetry system can be called “open technology” in telemetry system. It can be divided into three aspects:

- a. System design independent;
- b. Development independent;
- c. Using independent.

WHY TELEMETRY SYSTEM DESIGN NEEDS “OPEN TECHNOLOGY”

As we have known about the advantage for “open technology” in computer field. The fact that “Hardware-Independent and Software-Independent in Telemetry System Design”, will bring us the following advantages.

1. High System Reliability

By using standard hardware and software, the telemetry unit products can be designed better and better, the quality of system could be more reliable. So, the system reliability could be increased greatly.

2. Best System Maintainability

For a modular system, it is easy to detect the state of unit, and it will be easy to change certain function unit.

3. Easy Network Management

For the unified control and transfer command protocol, it will be easy to be managed through network link.

4. Low Cost of System Design

The cost of research would be greatly reduced for most subsystem as technology had been greatly opened.

5. Short Design Periods

Because the certain function unit is standard and all-purposed, so we build a telemetry system can be regarded as a “DIY” technology as in computer. So the design period of a new system will be shorter than ever.

SYSTEM DESIGN BASED ON “HARDWARE-INDEPENDENT AND SOFTWARE-INDEPENDENT”

In this paper, we will discuss the telemetry system design based on “Hardware-Independent and Software-Independent”. As an example, a simple ground telemetry system will be analyzed shown in fig.1.

The telemetry system (fig.1) is consisted of five units:

Antenna unit (Unit 1);

Receiver unit (Unit 2);

Recorder unit (Unit 3);

Video unit (Unit 4);

Signal simulator (Unit 5).

The working principle of the telemetry system is very familiar for expert at telemetry technology, and need not to be discussed. Today, telemetry technology (hardware and software) have been greatly knitted together with computer technology, most of (or all of) the parameter setting for signal channel and function control have been managed by central computer, and interior control of each unit also be accomplished by computer. So the constituent of each unit could be unitedly described as fig.2.

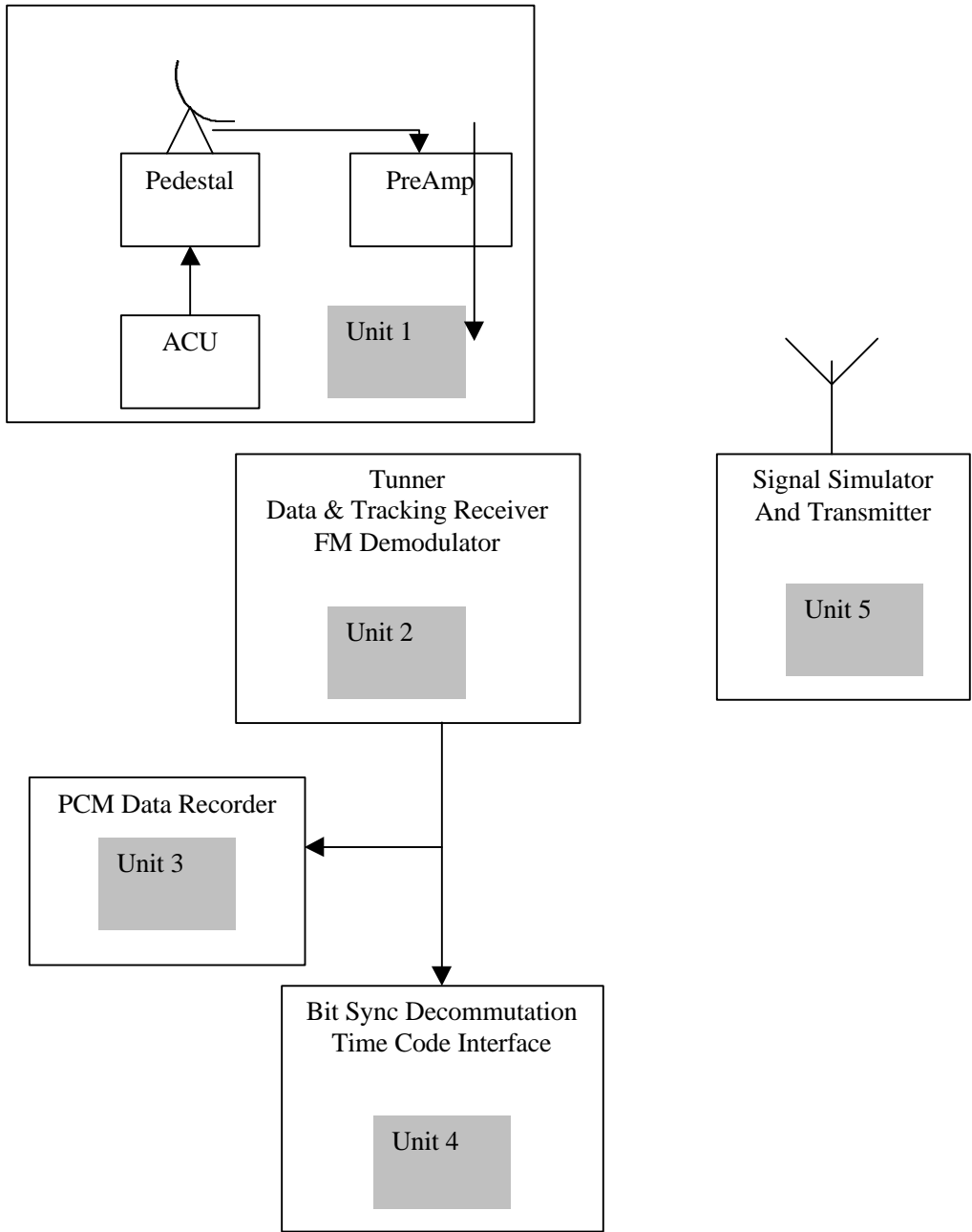


Fig.1 Ground Telemetry System Architecture

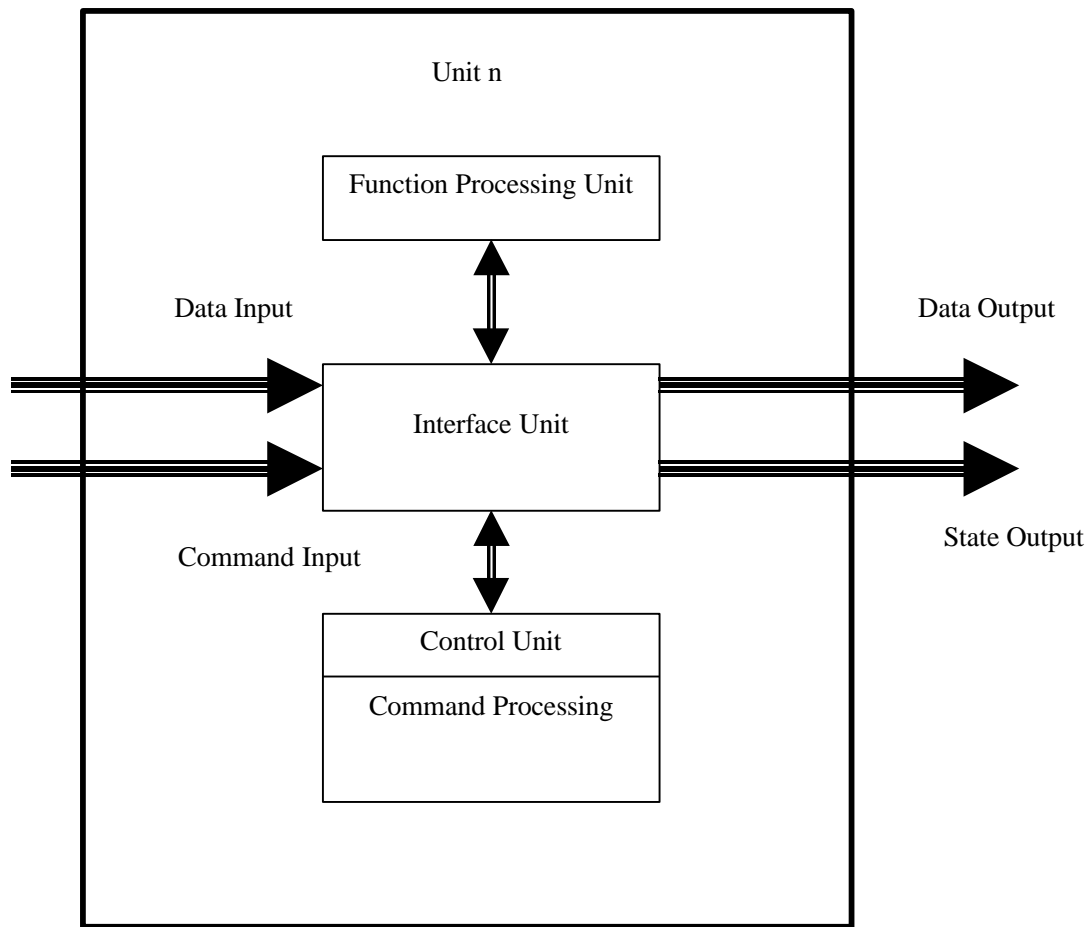


Fig.2 Independent Unit Design

In fig.2, unit n represents a unit described in fig.1. It looks like a “IPO” figure in software engineering for fig.2. The different between each function subsystem is the “Process” mode. “Input interface” and “Output Interface” are standard and unified.

The design conception described as above is based on software engineering. With the development of hardware and software technology, many function units, ever completely consisted by hardware, have been replaced (completely or partly) by software. A well-known example is “Software Radio Technology”. The other example is “Virtual Equipment Technology”. Both of the two technology have been widely used with many products in many country, the application fields include aviation and space flight and test instrument, etc. And more than that, many design conception in hardware field have been widely used with software design, on the other hand, many design conception in software field have been widely used with hardware design. System Independent design is based on the fusion conception described as above.

In order to design the function unit as described in fig.2, the following work must be completed firstly:

Establishing uniform “interface” standard;

Make the most telemetry producer and user to accept the standard.

The function units based on “Hardware-Independent and Software-Independent” can be described with several characters. Seeing table 1.

Table 1 Function Unit Character

Function Unit	Price	Main Performance	Extra Performance	Mounted Form
Unit 1	A 1	B 2	C 3	D 1
Unit 2	A 2	B 2	C 2	D 2
...
Unit n	A n	B n	C n	D n

As described in Table 1, A system designer will select the function unit according to the mission requirement and bearable cost and mounted form. The hardware and software of function unit are transparent to system designer, so the system performance and cost will be relatively clear at system preliminary design stage.

APPLICATION PROSPECT

The paper’s length is too short to detailedly discuss the “Hardware-Independent and Software-Independent” in telemetry system design. But it is very clear that open technology will be widely used in the next generation telemetry products, so it must be the trend to design a telemetry system with “Hardware-Independent and Software-Independent” technology. The application prospect includes the following items:

a. System designer

System designer will design the mission’s test plan and test performance figure. In telemetry system, if the design is based on “Hardware-Independent and Software-Independent”, the main design is to select the corresponding function unit which possess the performance figure and has the appropriate price. This will greatly reduce their work time and degree of difficulty.

b. Researching and producing organization

For the researcher and producer, most of the devotion is to increase the product performance. The cost and period to exploit a new product will be greatly reduced.

c. Telemetry User

The telemetry system based on “Hardware-Independent and Software-Independent”, that will make their maintenance work, upgrading work and repair work very easy. The adaptability of using the telemetry will be largely increased.