A General Purpose Fieldbus Controller (GPFC)

Alexander Sytin
IHEP, Protvino

The GPFC (General Purpose Fieldbus Controller), is a pocket book sized single board computer (SBC), supporting the IndustryPack® I/O interface.

The GPFC is designed under the IHEP/DESY joint project.

It is equiped with the Motorola's ColdFire™ CPU and runs the VxWorks® operating system from WindRiver Systems.

Being a low power compact device, the GPFC can be embedded within a controlled equipment or used as a standalone controller. Its modular and scalable architecture allows various configurations to be mplemented -including multiboard- opening the way to a wide range of applications.

The GPFC's CPU and memory resources enable it to run non-trivial real-time applications: the basic single board configuration provides 2 or 4 MB DRAM, and the extension board, currently under design, will add 4 - 16 MB.

A 32-pin socket allows up to 1 MB EPROM or 512 KB FLASH memory to be installed, thus providing ample onboard software storage. Critical data can be stored in 16 KB SEEPROM pool.

The I/O resources (the main board) include 2x IP (IndustryPack) modules, 2x UART channels, 2x timers, 4x external interrupt inputs, 8-bit parallel I/O port (with a separate pin programming for IN/OUT) and an 8-bit parallel input port.

The extension board carries 2 additional IP modules, so that the dual board GPFC configuration can support as many as 4 IP's.

The GPFC's stackable architecture allows for adding other extension boards to further extend the system's functionality. One can consider, e.g.: implementing non-IP I/O interface (PCI/PCM ?), advanced Ethernet controller with direct CPU bus interfacing, very large memory pool, etc.

The VxWorks's ColdFire BSP (Board Support Package) has been ported to the GPFC, thus allowing the full power of VxWorks to be used, including network services. Currently, Ethernet connection is supported with the IP_Lance module from GreenSpring and (modified) software driver from Compware. WindRiver's Tornado tools and DiabData's C-compiler are used for software development.

The programming model of ColdFire CPU looks much like as the one of it's predecessor: the well known M68k. That means, porting software currently running on M68k is easy and straightforward. As an illustration, the above mentioned Ethernet driver has been ported in as little as a few days. Application developers will hardly see the difference as all hardware specificities are hidden in a few low level system components and I/O drivers.

Currently, the VxWorks/GPFC BSP supports the following I/O drivers:

- terminal and serial communications (VxWorks standard)
- RAM_disk (VxWorks standard)
- Ethernet (for IP_Lance from GreenSpring) + TCP/IP suite

Porting the CDI/CAN driver for TEWS TIP-810 is in progress. This list will grow further on with the development of real GPFC applications, like a SEDAC crate controller and EPICS's IOC that is expected to be released soon.

The first GPFC small series will be released in the beginning of 1998 as a single board configuration. An extension board (2x IPs and more DRAM) is expected to be ready for production in summer 1998.

GPFC production for use in academy labs is currently being discussion.

A Russian National Network of Supercomputers for Science and Education

V.Kotov
JINR/LCTA

Russia has setup a federal program for creating a national network of supercomputers for science and education. In that program JINR (Dubna) will be representing the Russian HEP research institutes, while it will also be one of these centers.

In conformity with the cooperation agreement for this programme and according to the workplan that was efined by the High Performance Computing Center in JINR, the Laboratory for Computing Techniques and Automation (LCTA, also at JINR), has prepared a proposal for a project named "Monitoring and Control System for Distributed Computing".

The objective is to develop a processing & resource management system for distributed computing (Resource Manager Distributed System, RMDS). This project should benefit from the experience LCTA made when developing the Resource Manager (RM) for the distributed Data AcQuisition (DAQ) of the ATLAS experiment in collabo-ration with CERN, and cooperation with Control group SPS/LEP division CERN Geneve. This project complies with the ESA-PSS-05 standards (Software Engineering Standard) of the European Space Agency (ESA) that are accepted by the LHC collaborations at CERN. The design of this system is based on Object Oriented technologies and Object Modeling techniques (OMT).

The Resource Management System (RMS) has a multi-level architecture. The low level is connected to the hardware and supports the Simple Network Management Protocol (SNMP) for a wide set of hardware standards, including Fieldbusses. It complies with the monitoring possibilities provided by HP Open View, that also relies on the SNMP.

Overall, the system architecture corresponds to an object-oriented approach and permits to use CASE-techniques in the various development phases: from STP/OMT to code generators and SNIFF++ as programming environment for C and C++ .

To solve the communication problems, the RMS is based on the Adaptive Communication Environment (ACE), that permits to develop a network based on CORBA and to use a wide set of protocols such as e.g. TCP/IP, SNMP etc. Object-oriented ideology of ACE offers a platform-independent API for different types of IPC mechanisms (such as SystemV IPCs, high-level communication protocols - TCP/IP, TLI, etc.) and for system resources as well - usual and real-time extended signal handling, multi-thread and multi-process management. ACE allows to build dynamically reconfigurable distributed multi-component software system where different parts of the system could be connected to ordisconnected from the system "in flight" without recompilingor even rebooting the entire system. All these features of ACE allow to consider it as a very powerful tool for the development of the software for the management system of network.

Considering the key position networks play overall in the modern information systems market, an efficient use of the network resources is of paramount importance when realising any project in this field.

Knowledge Based Event-oriented Approach in Control Systems

Alexei Vaguine
Radiotechnical Institute, MSU

1 Objective

The objective of this appraoch of "Knowledge based event-oriented approach in control systems" was discussed; it was felt that the reliability and safety of control systems should be improved by using incremented knowledge database.

Means to achieve this objective: informational feedback.

2 Objections ?

Several reasons have been invoked as objection against using such a technology.

The main reasons are:

- the knowledge used within the control system is distributed through the bearer (carrier);
- there is no systematical knowledge increment in the control system;
- the existing informational system has no capabilities to be fullfilled by the new knowledge.

3 What should be done as a first step

We therefore suggest to proceed along the following steps:

- formal description of incidents: classify unfavorable events, classify cause-consequence relation;
- implement a knowledge processing system: statistical analysis, mathematical processing;
- estimate safety: define the complex parameters describing safety state of control object, evaluate the bandwidth of such set of parameters;
- forecast and prophilactic measures.

4 Conclusion

This technology looks promising and should be tried out first on small scale projects, as there may be social - technical limitation for large control systems. Indeed, for large control systems it is practically impossible to take into account all the technical and human factors that influence the uncertainty of the behaviour of the control system. As an example, for some complex incidents arrising in a railway system, the amount of distorted information exceeded 30 %.