

STARS ON PLC

T. Kosuge, K. Nigorikawa, KEK, Japan

Abstract

The Simple Transmission and Retrieval System (STARS) [1][2] is a message transfer software for small-scale control systems having TCP/IP sockets; STARS can work on various types of operating systems. In this study, we have successfully run the STARS server and client on the F3RP61 (Yokogawa Electric Corporation).

At present, PLCs are used for beamline interlock systems (BLISs) and PCs are used for monitoring and permission control system (CCS) of BLISs at the Photon Factory. Running STARS on a PLC makes the integration of BLIS and CCS possible. This paper provides a detailed description of the process of running STARS on a PLC.

BLIS AND CCS

Over 20 beamlines are in use at the Photon Factory and each beamline has a beamline interlock system (BLIS) for ensuring radiation safety and maintaining a vacuum environment in the beamline (Fig. 1). A PLC is used as a controller for the BLIS; it controls the beamline components (beam shutters, experimental hatches, gate valves, vacuum gases, etc.).

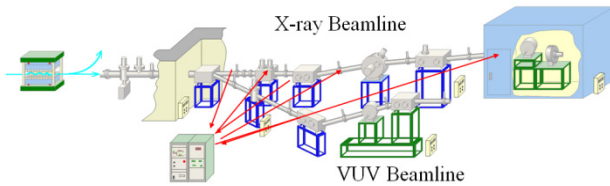


Figure 1: Beamline and BLIS.

The CCS monitors the status of BLIS and controls the permission signal, which permits beamline usage, through the PLC interface installed in each beamline (Fig. 2).

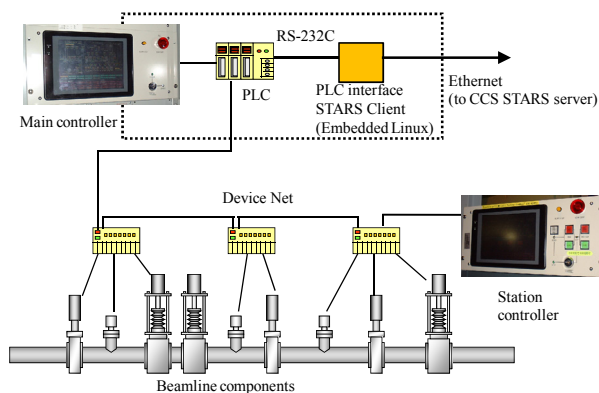


Figure 2: BLIS and PLC interface of CCS.

At present, the RS-232C is used for communication between the BLIS and PLC interfaces. The number of monitoring points that the CCS can support is limited because of the low speed of communication. Integration of the BLIS and PLC interfaces is one of the solutions to this problem.

F3RP61

F3RP61 (e-RT3 2.0/Linux) is a CPU module that can be installed on the Yokogawa FA-M3, which also has EPICS running on it [3]. In this study, we used F3RP61-2L as a test bench (Fig. 3).

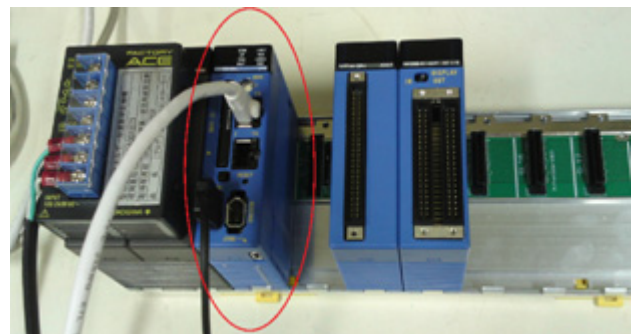


Figure 3: F3RP61 on FA-M3.

STARS

STARS is an extremely simple software for small-scale control systems having TCP/IP sockets as well as the provision for text-based message transfers (Fig. 4). A STARS server can work on various types of operating systems (the STARS server is written in Perl).

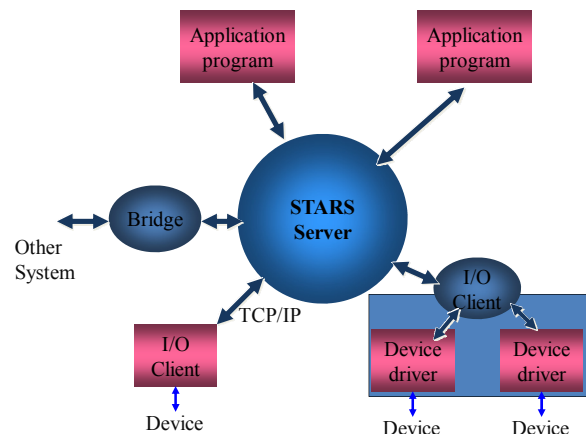


Figure 4: STARS server and clients.

STARS consists of client programs (STARS clients) and a server program (STARS server). Each client is

connected to the server via a TCP/IP socket. STARS users can upgrade the system by writing client programs, and STARS clients can participate in the system at any time without system stoppage. Recently, STARS was used for the CCS, beamline control system (see Table 1), and access control system of the experimental hall at the Photon Factory.

Table 1: Installation Status of STARS-based Beamline Control System (as on September 2010)

Category	Installed Beamline
PF-2.5GeV Ring X-ray	BL-1A, BL-3A, BL-4B, BL-5A, BL-6A, BL-6C, BL-7C, BL-8A, BL-8B, BL-9A, BL-9C, BL-12C, BL-14A, BL-17A, BL-18B
PF-2.5GeV Ring VUV and Soft X-ray	BL-2A, BL-11B, BL-13A, BL-16A, BL-19A, BL-20B
PF-AR	NE-1A, NE-3A, NW-2A, NW-10A, NW-12A, NW-14A
Other	Slow Positron Facility

STARS SERVER ON F3RP61

Various scripting languages are available for installation by means of RPM packages. In this study, we used Perl as our scripting language because the STARS server is written in Perl and therefore, it would not be necessary to modify the server program code.

STARS CLIENT ON F3RP61

STARS C Library

The Yokogawa Electric Corporation provides C libraries that enable access to IO devices or other CPUs available on the FA-M3. In addition, the C language is used for the development of a STARS client that can access IO devices available on the FA-M3.

STARS uses TCP/IP sockets and can only handle text-based messages. Skilled programmers will not find it difficult to program the STARS client. In addition, the task of programming is made easier with the availability of the STARS C library. The various functions that are part of the STARS C library are shown below.

- `stars_alloc`: Allocates memory for a STARS connection.
- `stars_open`: Opens a connection to a STARS server.
- `stars_free`: Releases the memory allocated for a STARS connection.
- `stars_close`: Closes a STARS connection.
- `stars_set_timeout`: Sets a time out value for the “receive” function.
- `stars_get_timeout`: Gets the time out value for the “receive” function.

- `stars_get_handle`: Gets the file handle value for a STARS connection.
- `stars_send`: Sends a message to a STARS server.
- `stars_receive`: Receives a message from the STARS server.
- `stars_add_callback`: Sets the function pointer for a STARS call-back function.
- `stars_mainloop`: Starts a call-back sequence.

STARS IO Client in C Language

A STARS client program that handles hardware is called an “IO client.” The IO client waits for commands from a STARS server and executes methods on receiving such a command. Fig. 5 shows the flow chart of the IO client program.

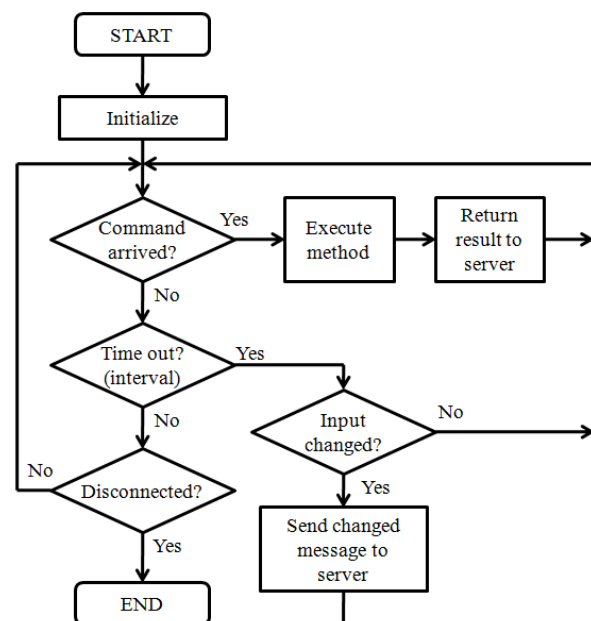


Figure 5: Flow chart of IO client.

STARS Perl Client

The STARS client program written in Perl is also available on the F3RP61. If the IO hardware of the FA-M3 cannot be accessed using the Perl program directory, then it can be accessed by the program using the STARS IO client written in C.

EXAMPLE OF APPLICATION

We have coded a simple example using the F3RP61 as a test bench (Fig. 6). A STARS server and an IO client written in C are running on the F3RP61 and a GUI is running on the PC (Windows 7 Professional).

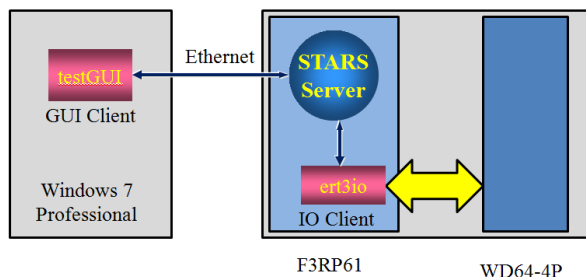


Figure 6: Overview of test bench.

When the GUI client named “testGUI” sends a command to the IO client named “ert3io” through the STARS server, the IO client executes the method that corresponds to the command and returns a result message to the GUI client through the STARS server.

The GUI is written in VB.NET and can also run on a Linux OS having MONO. Fig. 7 shows a snapshot of the GUI.

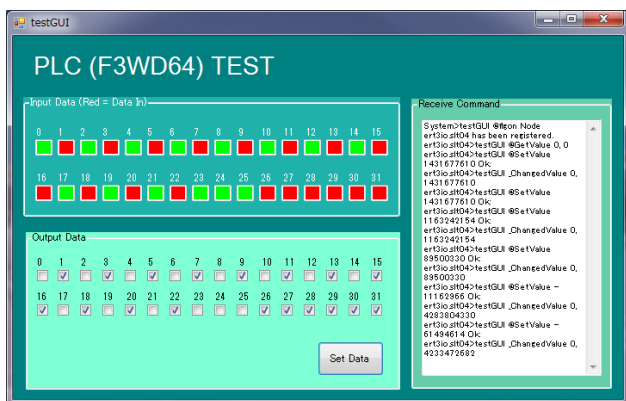


Figure 7: Snapshot of test GUI.

CONCLUSION

In this study, we have successfully run a STARS server and STARS clients on the F3RP61. In addition, we have verified that the STARS IO client written in the C language works efficiently on the F3RP61. Therefore, it can be concluded that the use of STARS on a PLC represents an effective solution for the integration of the BLIS and CCS at the Photon Factory.

REFERENCES

- [1] Takashi Kosuge, Yuuki Saito, “RECENT PROGRESS OF STARS,” Proceedings of PCaPAC2005, Hayama, Japan, 2005.
- [2] <http://strs.kek.jp>
- [3] J. Odagiri, et al., “APPLICATION OF EPICS ON F3RP61 TO ACCELERATOR CONTROL” Proceedings of ICALEPCS2009, Kobe, Japan.