# Porting iocCore onto m-ITRON real-time kernel

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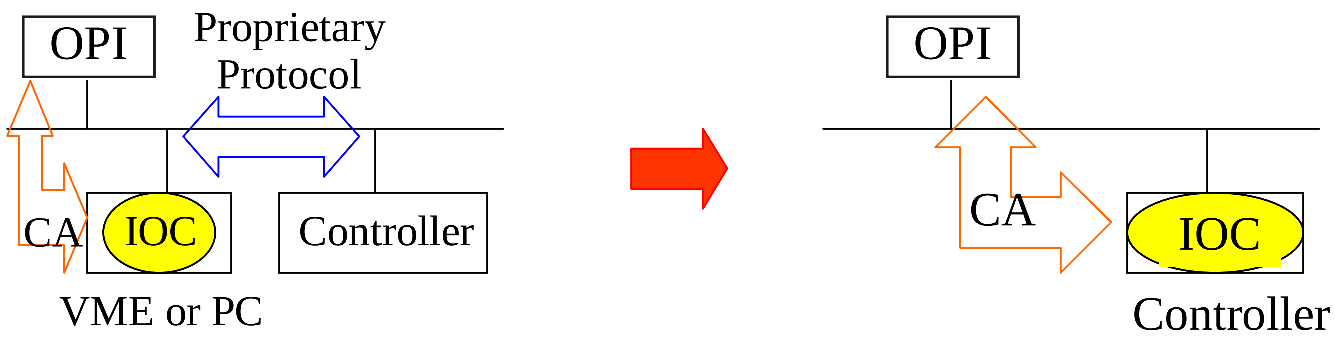
# *What is m-ITRON?*

- *An API-specification of real-time kernel*
  - *Developed by Prof. Ken Sakamura of Tokyo Univ.*
  - *Many different implementations of products are available on the market*
  - *Widely used in consumer electronics fields in Japan*
    - *Mobile phones*
    - *TV-games*
    - *Automobile Navigation System*
  - *Details : See*
    - *http://tron.um.u-tokyo.ac.jp/TRON/ITRON/home-e.html*

# Why m-ITRON?

- Running iocCore on intelligent device controllers
  - Many intelligent device controllers come with an Ethernet interface
  - Many of those have an SHx CPU and enough ROM/RAM capacity to run iocCore
  - Many of those run m-ITRON



# *Intelligent device controllers running m-ITRON*

- *Commercial Devices*
  - *PLC*
    - *Yokogawa FA-M3, used for Ion-source, vacuum etc.*
  - *WE7000 measurement station*
    - *Digital oscilloscope (100kS/s, 1MS/s, 100MS/s and 1GS/s)*
- *Custom Device Controllers*
  - *EMB-LAN100*
    - *Initially designed for the Power supplies of DTL Q-magnet*
  - *NDIM (Network Device Interface Module)*
    - *Developed by RIKEN for various control/monitoring*

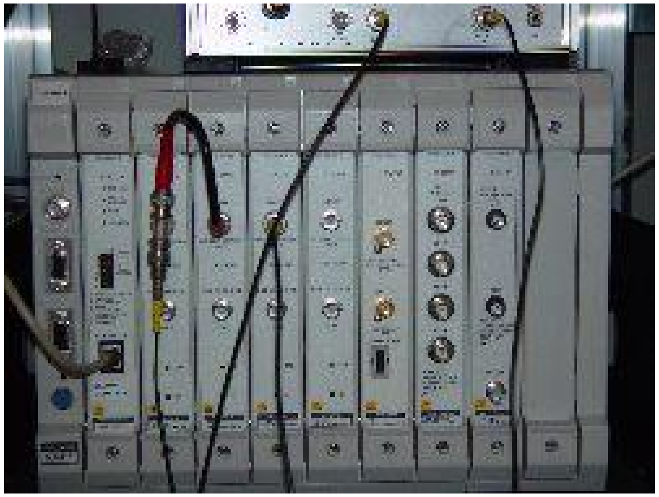
# Commercial devices

*FA-M3 PLC*

*(Made by Yokogawa)*

*WE7000*

*(Made by Yokogawa)*



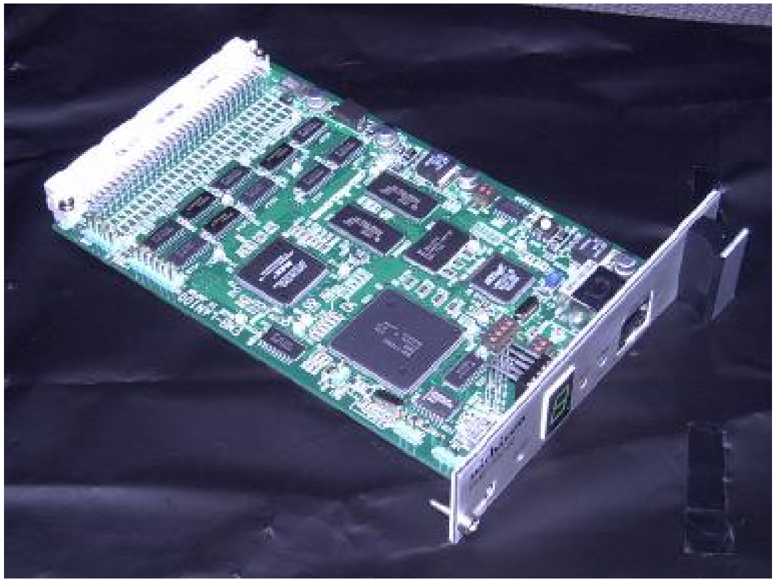
# Custom device controllers

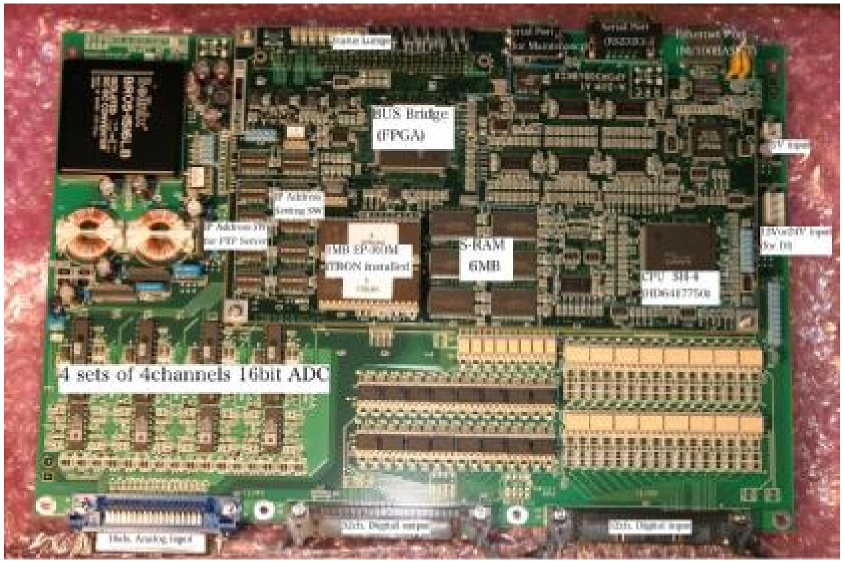
*EMB-LAN100*

*(Developed by KEK)*

*N-DIM*

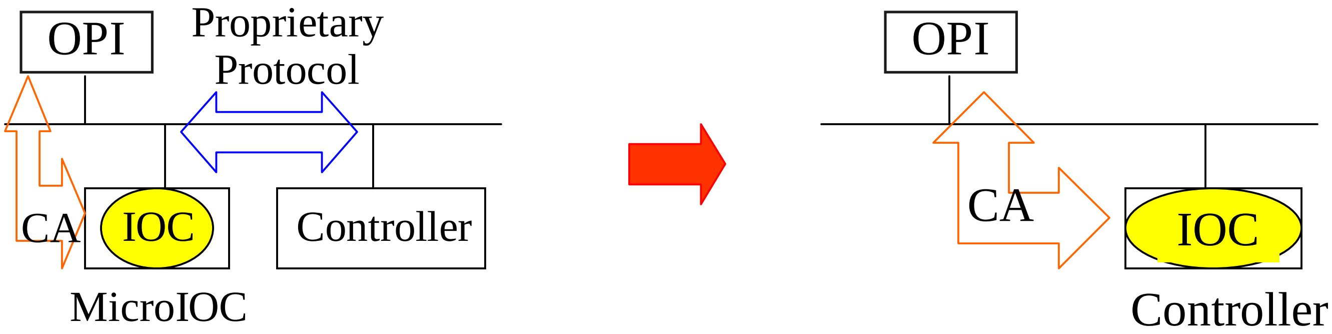
*(Developed by RIKEN)*





# What are the benefits?

- More distributed
  - More load distribution
  - More robust
- Flatter hierarchy
  - Save IOCs being used as “protocol transformer”
  - No need for asynchronous driver



# *What’s available on the market*

- *The kernel, NORTi4, from MISPO*
- *Development environment*
  - *SHC (Super Hitachi Compiler) with a standard C/C++ library*
  - *Cygwin on Windows*
- *Kasago TCP/IP + BSD socket library, from Elmic Systems, Inc.*
- *We assume BSPs are available from the HW-manufactures*

# How hard is it?

- *We have implemented OSD libraries (not yet tested)*
- *We have asked Elmic Systems, Inc. to port the TCP/IP + BSD socket onto our target board*
- *There are some missing functions in STC library needed by iocCore*
- *Recent versions of EPICS base use lots of C++ codes*
  - *We have gotten linkage errors with some of those*

# OSD implementation

- *m-ITRON has abundant functions for synchronization and communication*
- *It’s relatively easy*
- *For example:*

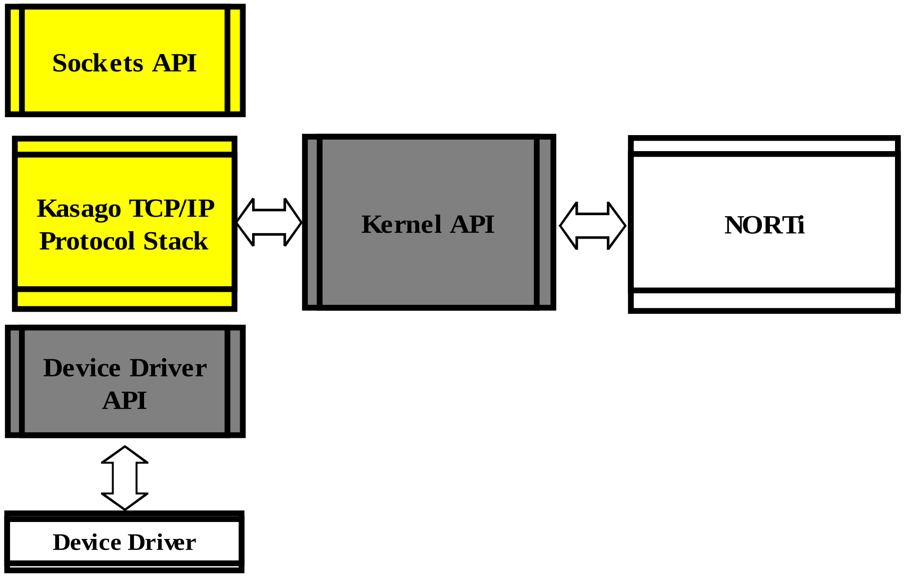
*itron case:*

```
const T_CMTX cmtx = {TA_TINHERIT,0,""};
struct epicsMutexOSD *
epicsMutexOsdCreate(void)
{
  ID id;
  ER ercd;
  ercd = acre_sem(&cmtx);
                ...
}
```

*Vxworks case:*

```
struct epicsMutexOSD *
epicsMutexOsdCreate(void)
{
    return((struct epicsMutexOSD *)
semMCreate(SEM_DELETE_SAFE|SEM_INVERSI
ON_SAFE|SEM_Q_PRIORITY));
}
```

# BSD socket library



*Elmic Systems, Inc. is going to develop libraries which interface their TCP/IP protocol stack with m-ITRON/LAN controller driver*

# Missing functions in STC library

```
extern FILE *fdopen(int handle, const char * tmp) {...}

extern char *getenv (char * tmp) {...}

extern int putenv (char * tmp) {...}

extern char *tmpnam (char * tmp) {...}

extern FILE *tmpfile (void) {...}

extern int atexit (void (*function)(void)) {...}

extern void exit(int status) {...}

void abort(void) {...}
```

# Building problems with C++ code

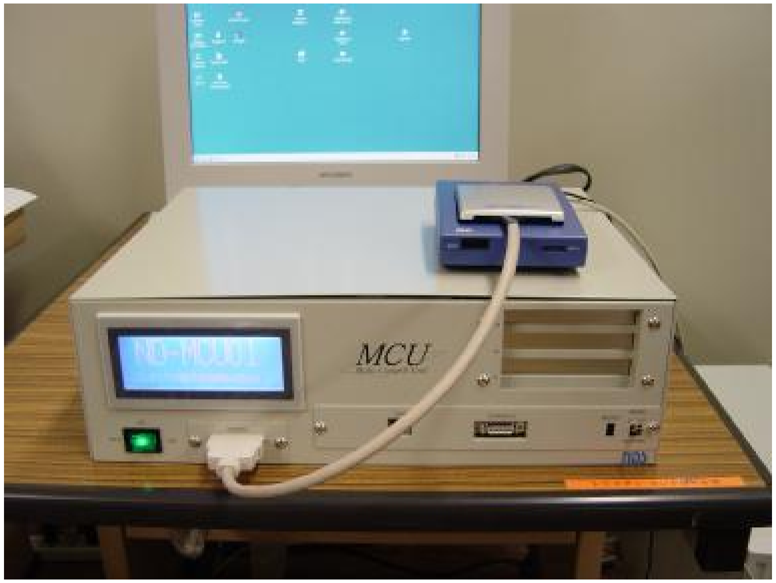
- *iocCore uses some methods not in SHC’s STD C++ library*
  - *logic_error::logic_error();*
- *Some of external references can’t be resolved*
  - *Related with class*
  - *Related with template*
  - *Related with inline function*

# *Status and future plans*

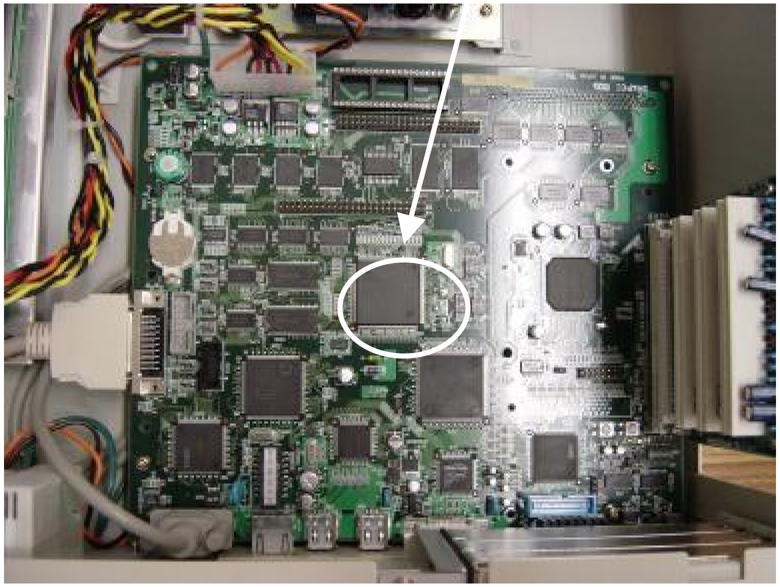
- *We are trying to solve the linkage problems with C++ code*
- *If not, we are going to try another compiler exeGCC, based on gcc*
  - *We lose support from the companies on BSP&BSD socket library*
- *We hope we can succeed in running iocCore on a target board before Mar. 2005*

# MCU made by Nichizou

*MCU running m-ITRON*



*SH4 (SH7751R-200 MHz)*



*FLASH ROM 16MB*
*SDRAM 64MB*