The evolution of the Elettra Control System

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Summary

- where we started from (1991-1993)
- from 3 tier to 2 tier (1998)
- network evolution (1999-2001)
- preparing for new projects (2003)
- moving to new tools – Tango
- keeping old and new together
What is Elettra?

- a third generation synchrotron light source
- commissioned in 1993
- operates as user facility: 24x7 operations
the 1990-91 choices

- VME bus, Motorola 68000/68010 cpu
- HP workstations, PA-RISC cpu, 48/64 MB
- MIL-1553 field bus, 1 Mbit/s
- Ethernet, 10 Mbit/s, shared (yellow cable)
the standard model

Fig. 1 ELETTRA control and data acquisition system. The dashed line defines the real time environment.
the standard model
the 1990-91 choices

- OS9
- HPUX – Unix from HP
- C language
- X11 and Motif
- RPC over TCP/IP and socket library
  - based on published or de facto standards
  - source code availability
1998: first evolution

- new VME systems use Motorola 68040
- I/O front end directly connected to the network: 2 tier architecture
- local database + poller architecture for field servers
  - asynchronous readings improved overall performances
  - client access to equipment unchanged
1999-2001: going faster

- HP workstations upgrade
  - model C200, 256 MB of memory
- fully switched network
  - star topology
  - 1 Gbit/s fiber backbone
  - 100 Mbit/s host connection
- firewall for filtering unwanted and harmful traffic
2 tier architecture
2003: new projects

- new booster injector project launched
- shrinking budgets
- changing markets
  - OS9 disappeared
  - Unix workstations almost disappeared
  - standard PC became powerful enough
- open source software!
- old software architecture limits became too restrictive
2003: new projects

- extensive inquiry to select new hardware platform for field level computers
  - CompactPCI or VME64?
  - VME64 was selected:
    - wide choice of boards
    - compatible with our legacy equipment
2003: new projects

- Motorola MVME 51xx CPU boards
  - Power PC series processor
  - up to 2 on-board PCI mezzanine card (PMC)
  - AltiVec processor
- Industry Pack (IP) board support on dedicated carriers
MVME 51xx CPU
PMC and IP cards
New operating systems

- Linux chosen for VME boards
  - RTAI real time extensions where needed

- Linux chosen for operator consoles

- Cut in licensing and maintenance costs
  - We migrated (ported) all the control system software to Linux
  - Smooth process, no disruption of services

- We have all the sources!
new development tools

- Object oriented
- Distributed Object Model
  - CORBA based
- compatibility with existing C libraries:
  
- C++ as main programming language
- Qt library for GUI programming
  - worked also on HP-UX during transition phase
from RPC to Tango

- Tango has been chosen as our D.O.O. system
- Elettra joined the Tango collaboration at the beginning of 2004

- Device model  
- generic interface  
- event support  
- central database  
- multithreaded  
- open source  
- performances  
- C++, Java, Python,...  
- collaboration
since 2004 we used Tango for the renovation of several plants of the storage ring (RF distribution, injection)

we can map the semantics of old RPC calls to equivalent Tango calls

a configurable Tango to RPC bridge server has been written: all legacy applications work without any modifications
Summary

- Elettra control system has evolved during the last 15 years
  - some of its parts are still the original ones
  - improved performances, reduced costs
- we always ensured smooth transitions
  - we have the sources!
  - we selected tools with a degree of backward compatibility