Experiment Control System

&

Electronics Upgrade

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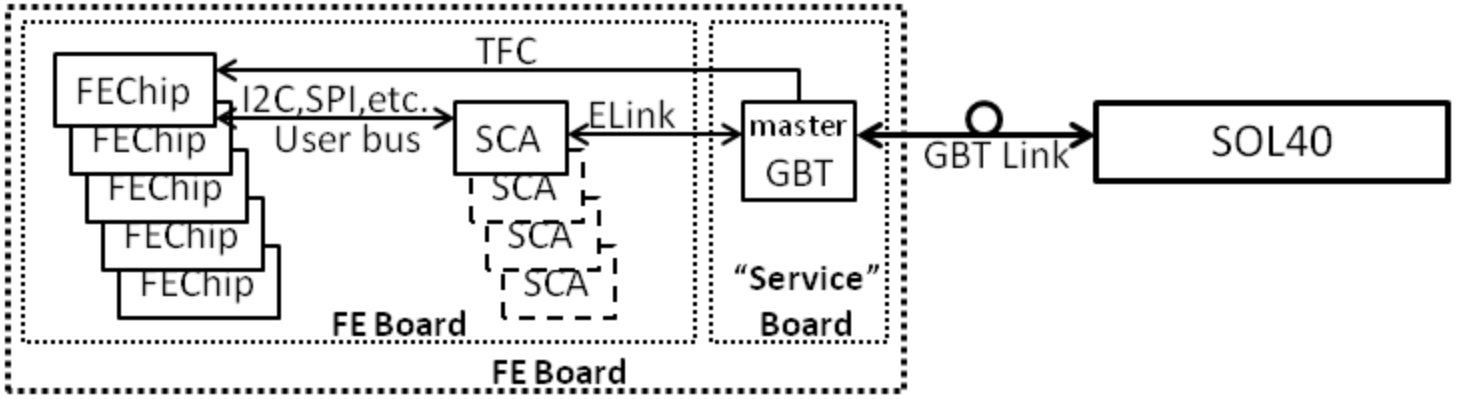
ECS & Upgrade Electronics

- **ECS Design doesn't change (in principle)**
  - Same tools:
    - Communications: DIM
    - Supervision: WinCC-OA (ex-PVSS II)
    - Sequencing and Automation (FSM): SMI++
  - Same philosophy:
    - Generic tools to describe the hardware (FwHw)
      - Board Types -> "chips" -> registers => Boards
    - Operation tools to Configure/Monitor boards
      - "Recipes" for different configuration modes
      - Stored in Configuration DB
  - New electronics will be interfaced like before

Electronics Interface

Interface to FE Electronics

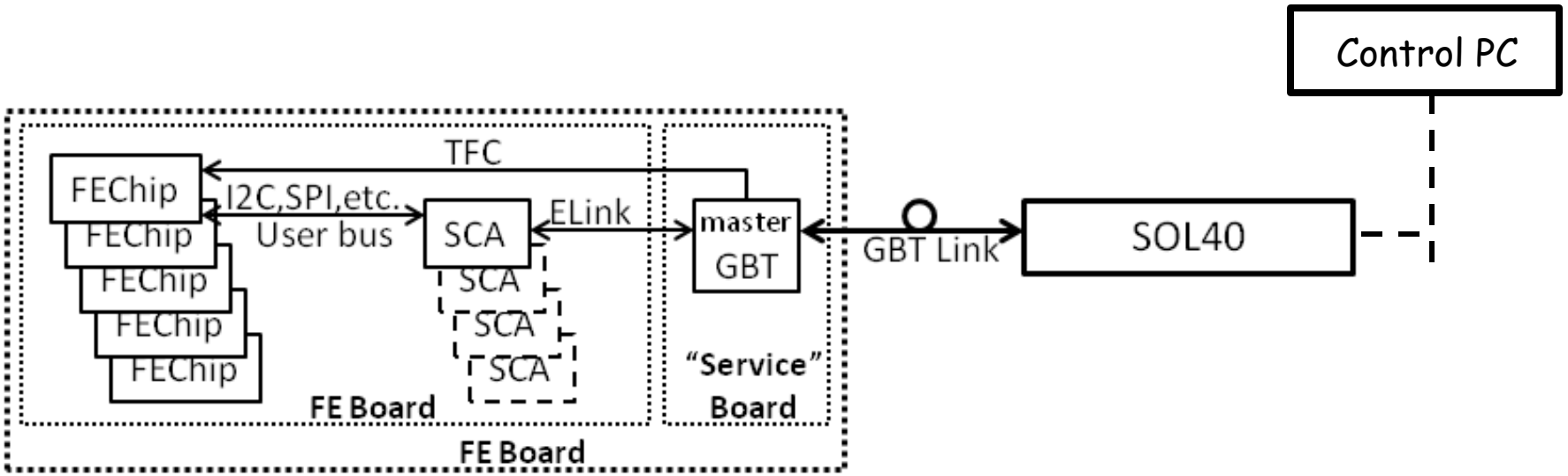


- Two Architectures envisaged:
  - FE electronics in one single FE board
  - FE electronics accessed via a "Service" board (masterGBT <-> SCA via "long" Elink)

FE Board Protocols

- **Interface to the FE Chips**
  - The GBT-SCA provides the following protocols:
    - 16 x I2C master controllers
    - 1 x JTAG master controller
    - 32 x ADC channels (multiplexed)
    - 1 x Memory bus (32 bits) controller
    - 4 x PIA (Parallel Interface Adapter) controllers
    - 1 x SPI (Serial Peripheral Interface) bus
    - 4 x DAC channels
  - **Recommended protocols (for bulk transfers) are:**
    - I2C
    - SPI using independent chip selects (daisy chained SPI not allowed)

FE Addressing

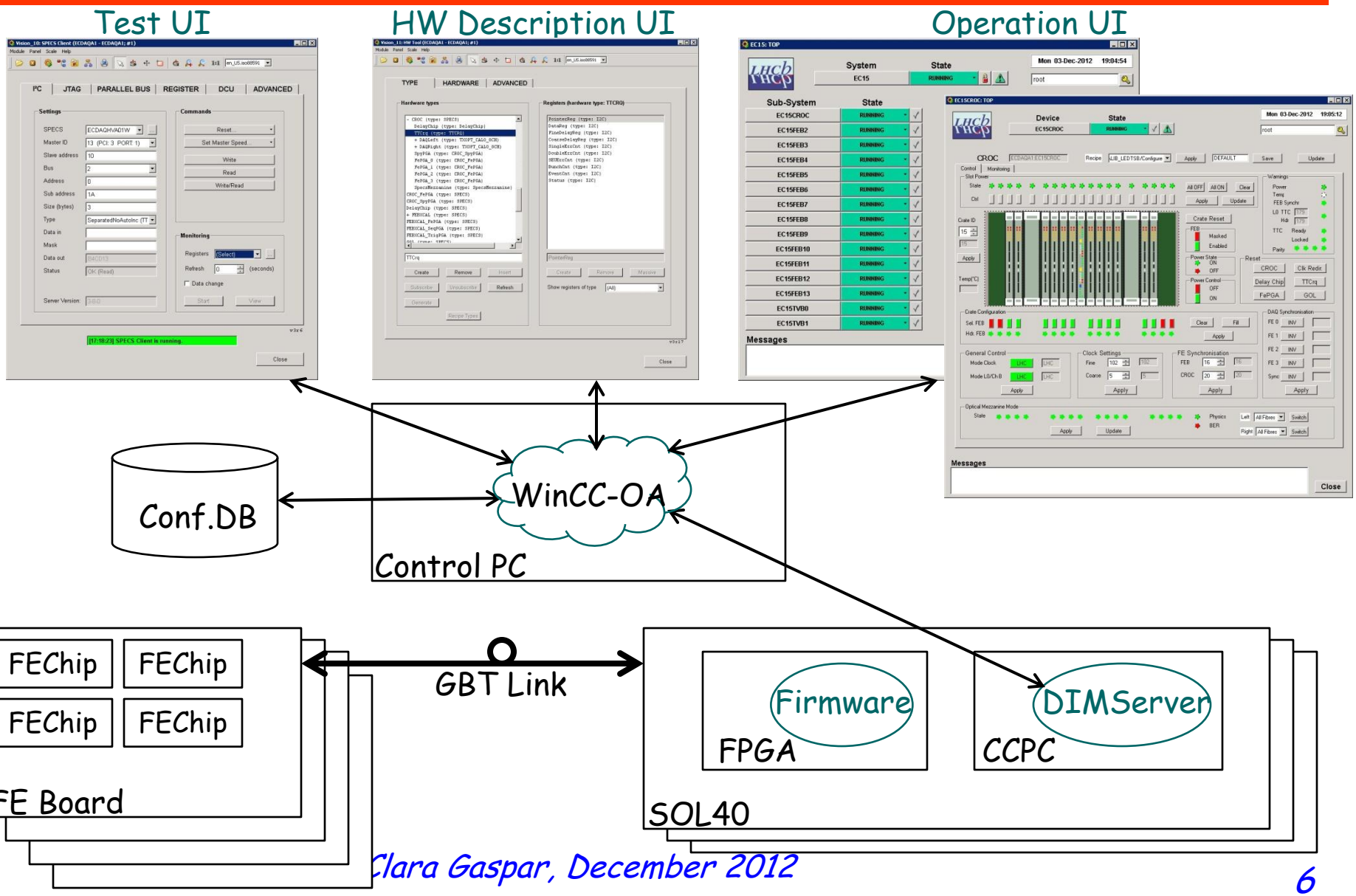


- **FE Chip Register Address:**

<SOL-ip><GBT-i><SCA-j><ProtoCode><I2C-k><I2C-add>[<I2C-s.add>]

fixed | variable

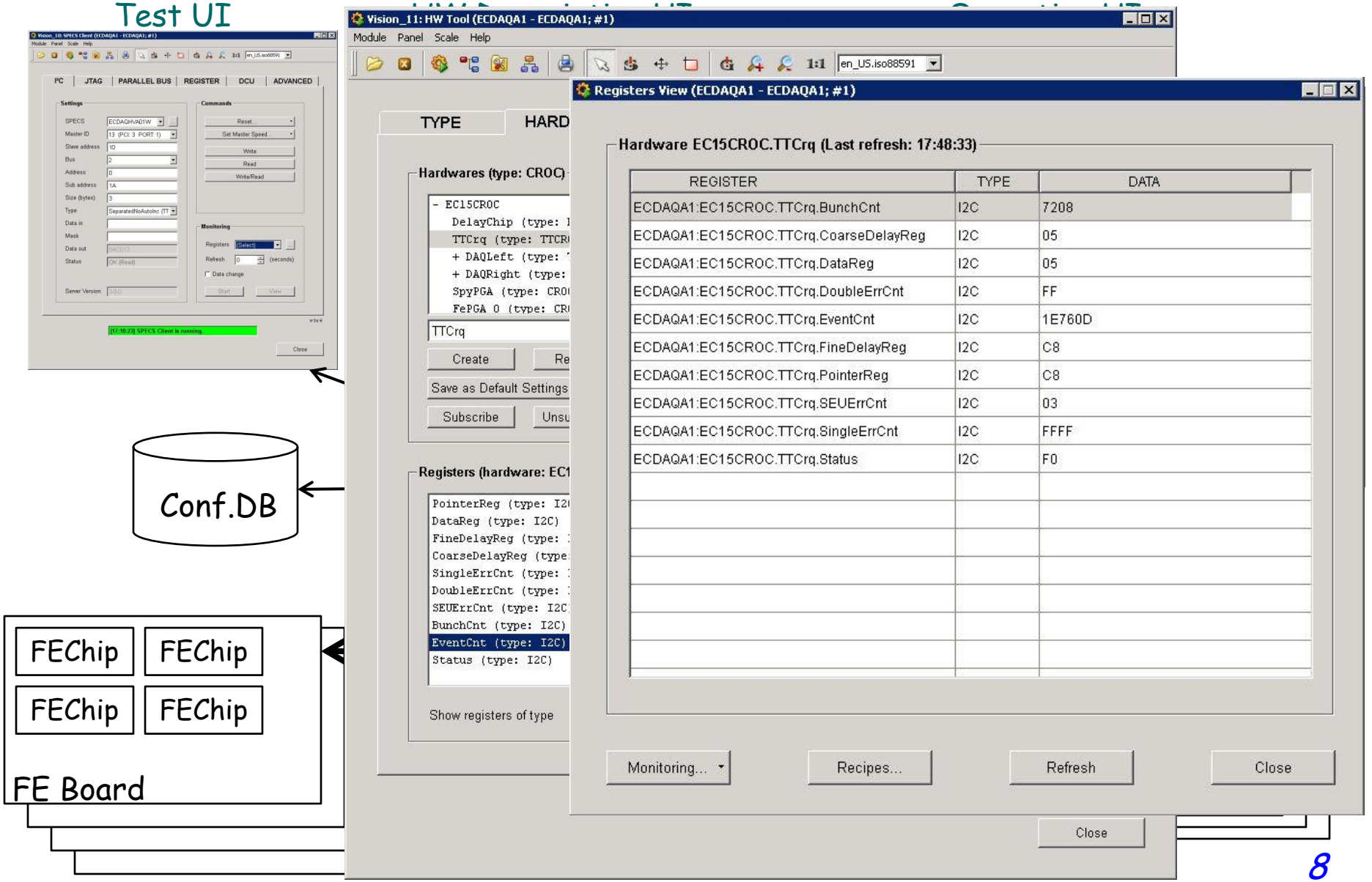
ECS FE Dataflow



ECS Software/firmware

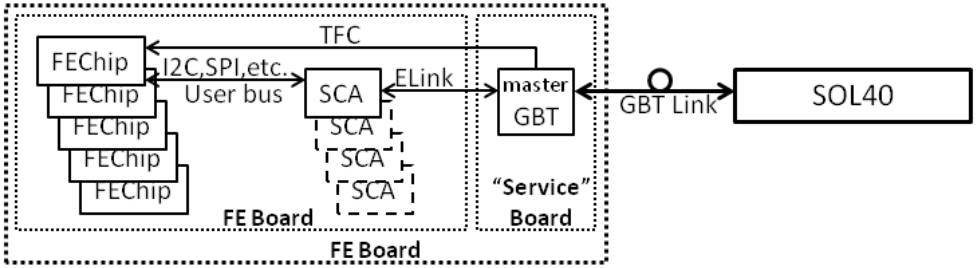
- **Will be centrally provided:**
  - The FPGA firmware for the SOL40 board
    - Will prepare, send and receive the GBT-SCA frames for the various user protocols
      - Should take load away from CCPC as much as possible
  - Low-level libraries and command-line tools for the CCPC in the SOL40
    - Will allow accessing the different FE chips
  - A DIM server running on the SOL40 CCPC
    - Will implement higher-level commands to configure and monitor the FE chips
  - A WinCC-OA component
    - Providing the high-level description and access of all electronics components

ECS Dataflow



ECS FE Design

- 1st Steps
  - Understand the needs
  - Identify bottlenecks
  - Questionnaire Sent:
    1. Sub-detector:
    2. Number of GBT Links:
    3. Number of FE Boards (/Service Boards):
    4. Number of SCA chips per masterGBT:
    5. Number of User buses per SCA chip:
    6. Type of User buses used:
    7. Number of "registers" per FE Board:
    8. Data volume per FE Board for configuration:
    9. Data volume per FE Board for monitoring (and how often):



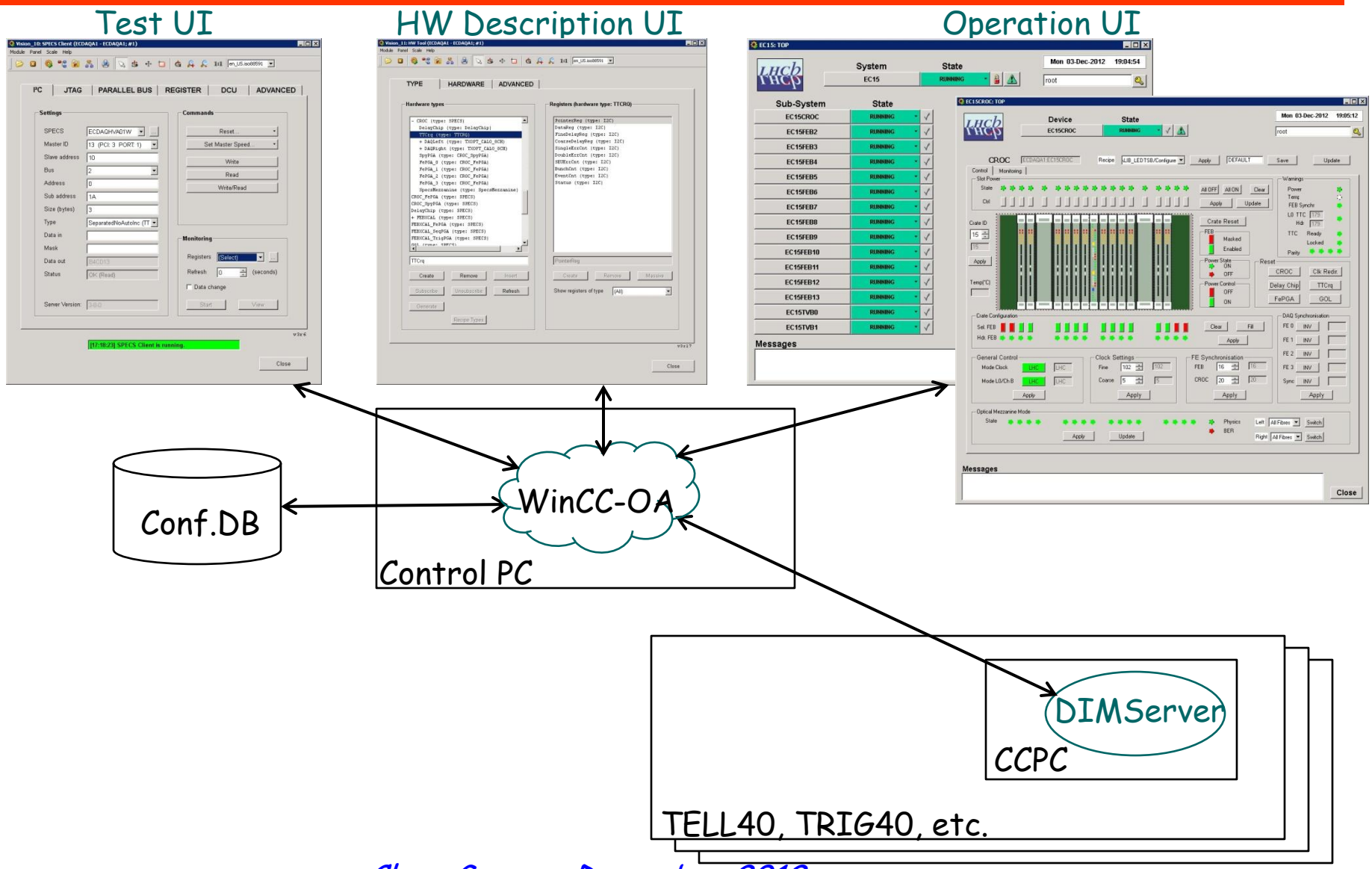
Scalability & Efficiency

- **Configuration and Monitoring speed**
  - Is not just data size / bandwidth
  - Depends on:
    - How the data is distributed, for ex.:
      - A few large registers or many small ones
    - Are blocking operations needed, for ex.:
      - A register needs to be set and read-back before configuring the next one
      - or read-modify-write operations that need to be done by the back-end
    - Which user protocol is used and how it is used, for ex.:
      - Some I2C devices needed an extra I2C operation to write a sub-address before the block of data could be written
      - Some did not implement auto-increment so block transfer could not be used
  - Try to influence hw design early enough…

BE Board Interface

- **Physically only one board type (ATCA40/AMC40): TELL40, S-ODIN, TRIG40, SOL40**
  - But logically different types (different "registers")
- **Similar Tools will be provided centrally:**
  - Low-level libraries and command-line tools for the CCPC in the board
    - Will allow accessing the different registers (PCIexpress)
  - A DIM server running on the CCPC
    - Will implement higher-level commands to configure and monitor the board components
  - A WinCC-OA component
    - Providing the high-level description and access of all electronics components

ECS BE Dataflow



Infrastructure Control

- **The control & monitoring of the crates (& boards) will also be provided centrally**
  - ATCA provides a standard for the control and monitoring of power, voltages, temperatures etc.: -> IPMI
  - A WinCC-OA component will be provided.