7ª SESIÓN

PLCopen
for efficiency in automation

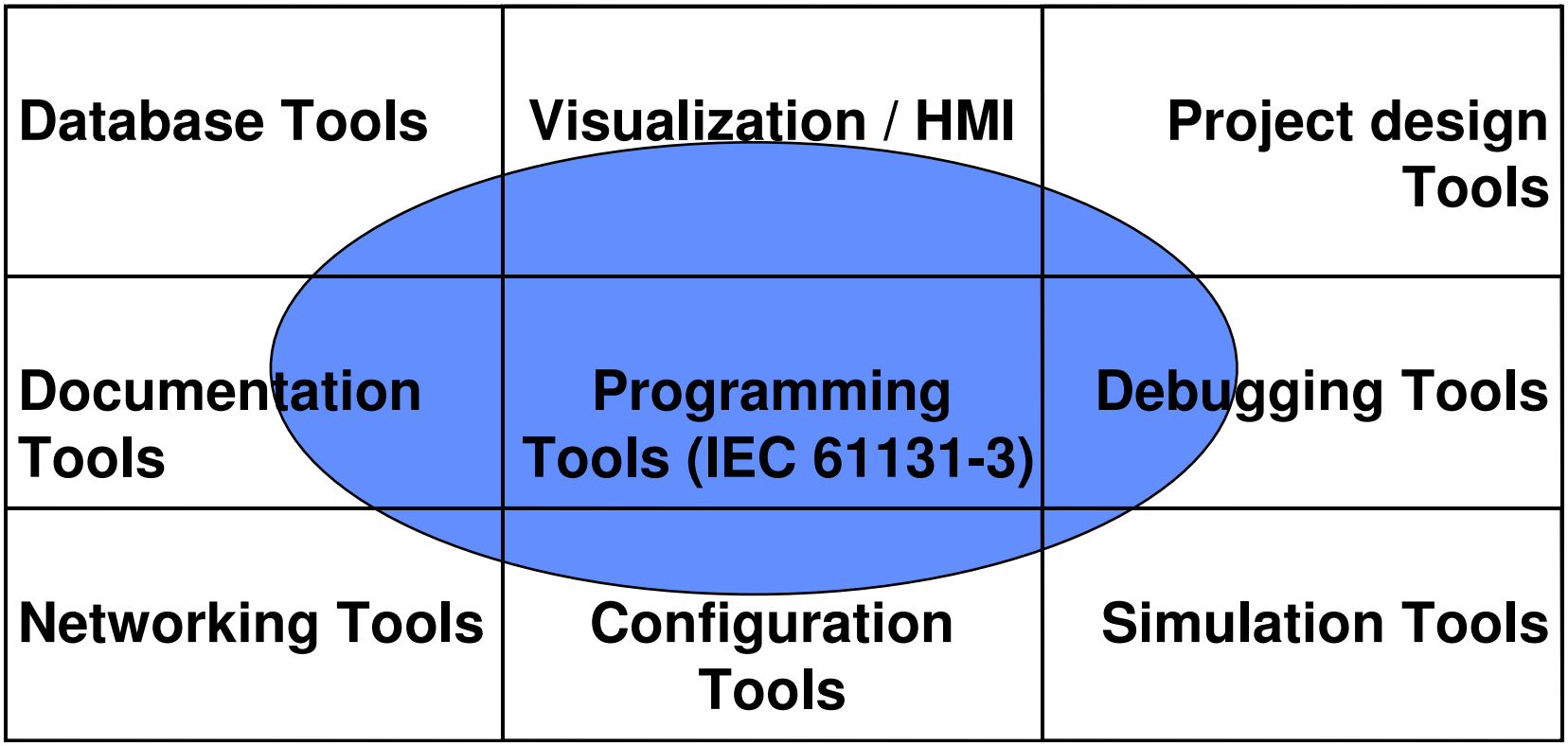
JUEVES 18, 16:00-16:35

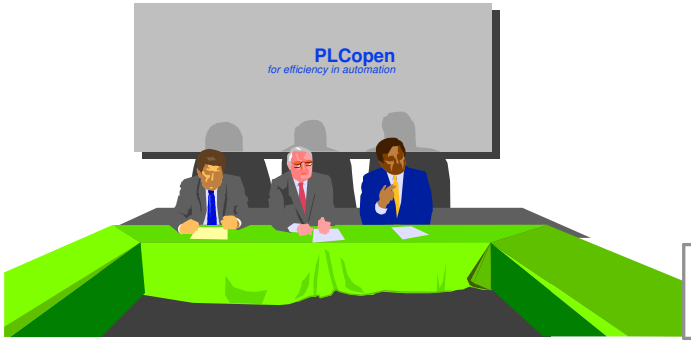
PLCopen
For efficiency in automation

Ponente:

- **René Simon**
  (Board of management, PLCopen)

Industrial Control Programming





Organization

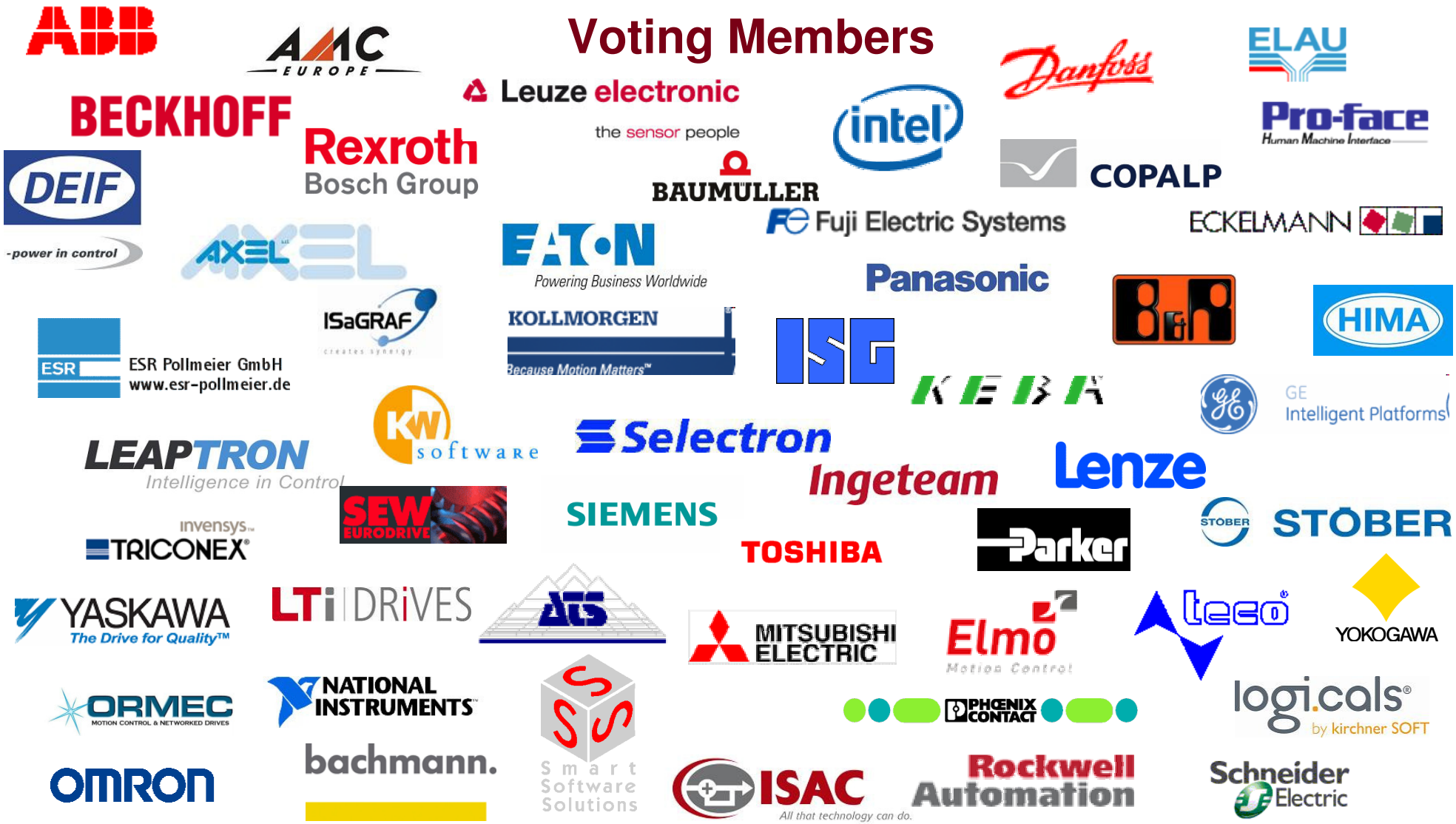
General Meeting, BOM, MD

TC1 **TC2** **TC3** **TC4** **TC5** **TC6** **PC1** **PC2** **PC3** **PC4** **PC5**

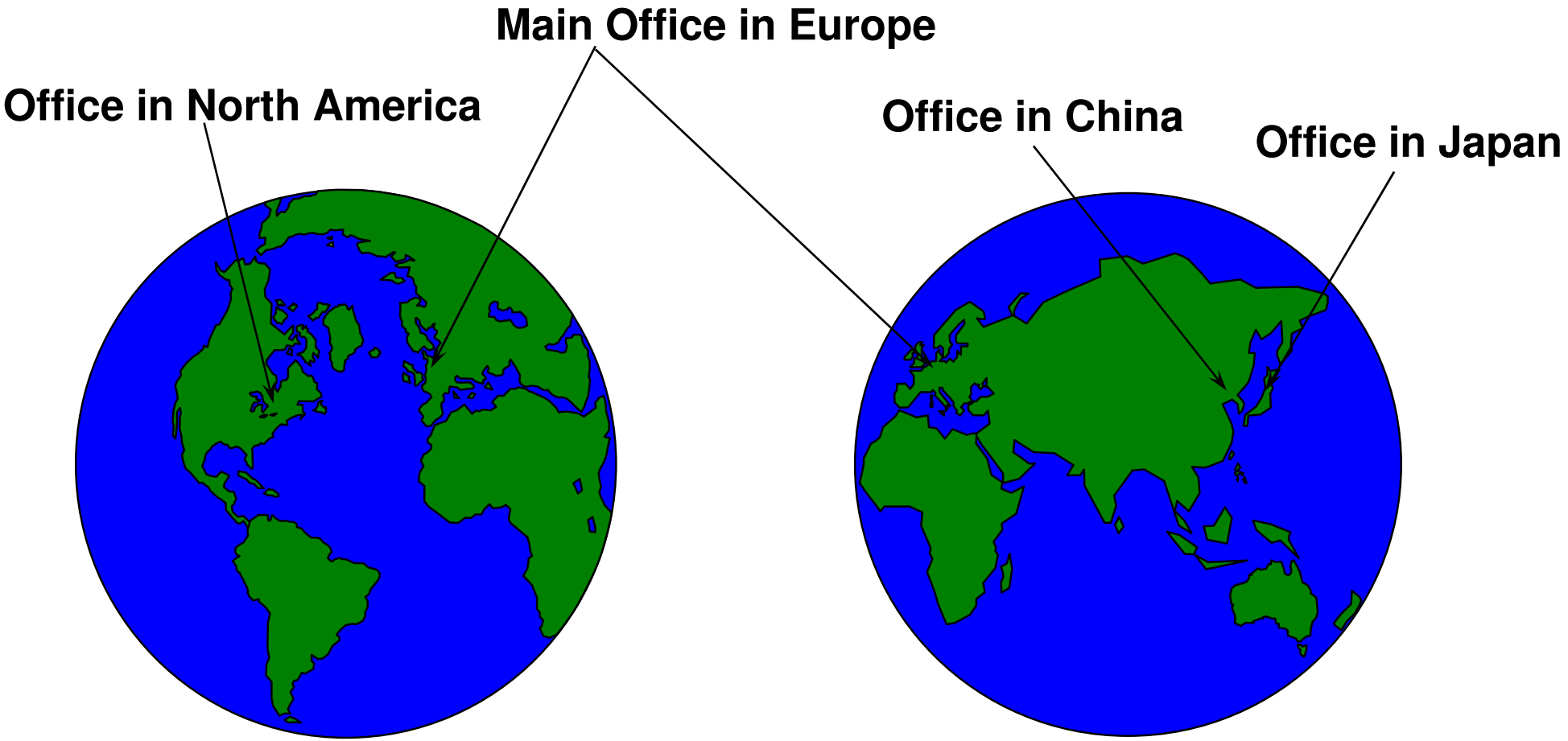
TECHNICAL **PROMOTIONAL**

COMMITTEES

Voting Members



PLCopen as a World-wide association



General Promotion

- PC1: General Promotion
- PC3: Promotion North America
- PC4: Promotion Japan
- PC5: Promotion China

PC2: Common training program

- **The effect of training is often underestimated**
- **Standardization can be very useful and provide a better interface between study and reality**
- **PC2 defined common basics for training..**
- **.. for instance: a IEC 61131-3 training guideline is published**
- **Training facilities fulfilling basic requirements can be certified and listed / referenced to (see website for listing)**

TC1 – Standards

- **development of joint PLCopen position for IEC**
- **communication of information from IEC to PLCopen**
- **PLCopen is official liaison of IEC**
  - since 2006
- **3rd edition of the standard under way**
  - completed 2012
  - PLCopen change requests submitted
  - object orientation is main new topic

TC2 – TF Motion Control

- **integration of different technologies: logic and motion**
  - ongoing now for many years
  - Part 1 implemented in about 30 products
- **Part 1 (Basics) and 2 (Extensions)**
  - merged
- **Part 3 – User Guidelines**
- **Part 4 – Coordinated Motion**
- **Part 5 – Homing Procedures**
- **Part 6 – Fluid Power**
  - new initiative
- **Logic, Motion and Safety**
  - published document provides examples and guidance (Version 0.41)

TC3 – Certification

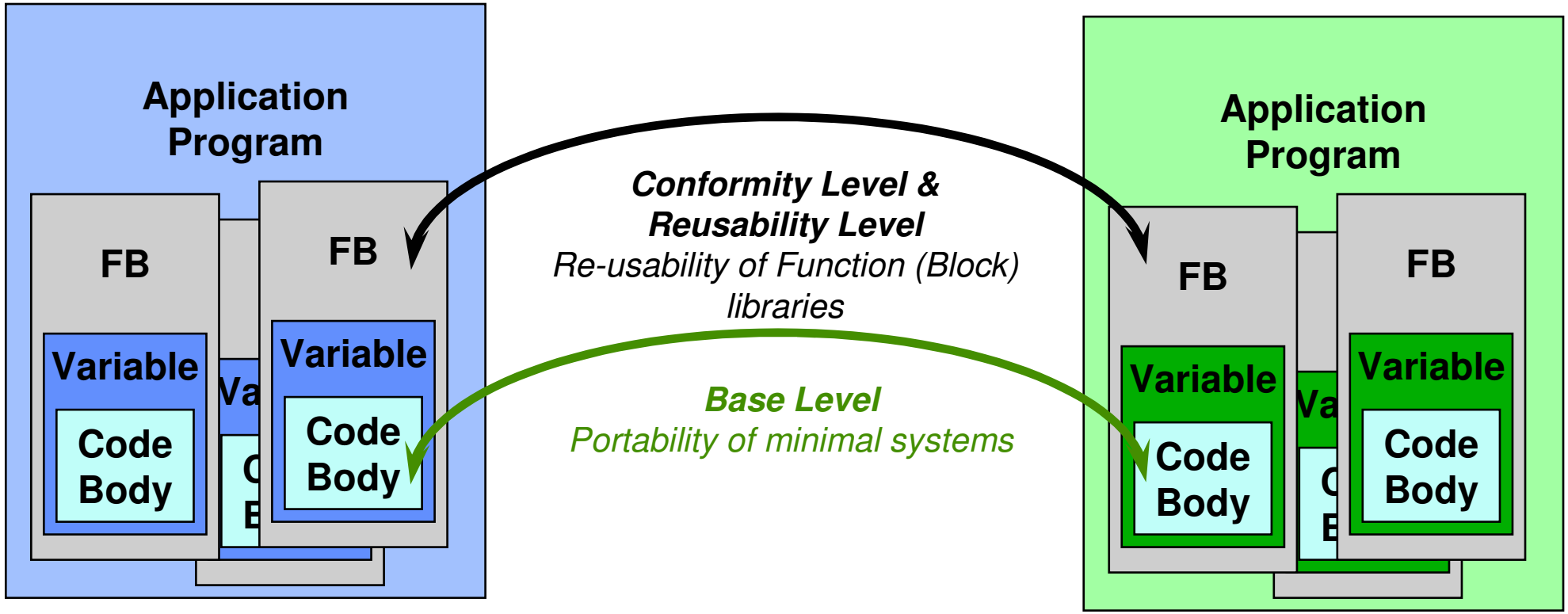
- **… without testing there is no standard …**

- **Version 1.0 released 1998**
- **Version 2.0 released March 2009**
  - simplified

- **test institutes**
  - i*f*ak (Europe)
  - Shenyang Institute of Automation (China)
  - … (Japan)

TC3 – Certification (2)

- **Compliance Levels**



TC3 – Certification – TF Benchmarking

- **reproducible, portable test to measure the performance of a given system**
  - in comparison to other systems

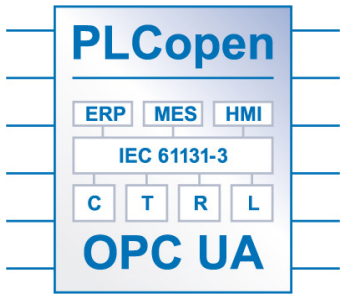
- **use cases**
  - PLC manufacturer: Internal in-house tests for benchmarking different CPUs
  - PLC manufacturer/Software suppliers: Internal in-house tests for different code generators
  - PLC manufacturer/Software suppliers: generate test suites for their customers
  - End-user (automotive industry, process industry…): will compare PLCs from different suppliers
  - Machine builder: is looking for a PLC which fits to a special application
  - Machine builder: needs to support different brands and wants guidance
  - Independent Test Labs: supply and sell test results to everybody

- **technical specification released for comments in 2005**
- **creation of test scripts**
  - still topics concerning the test script generator that have to be addressed and clarified
- **latest working document version 0.8**

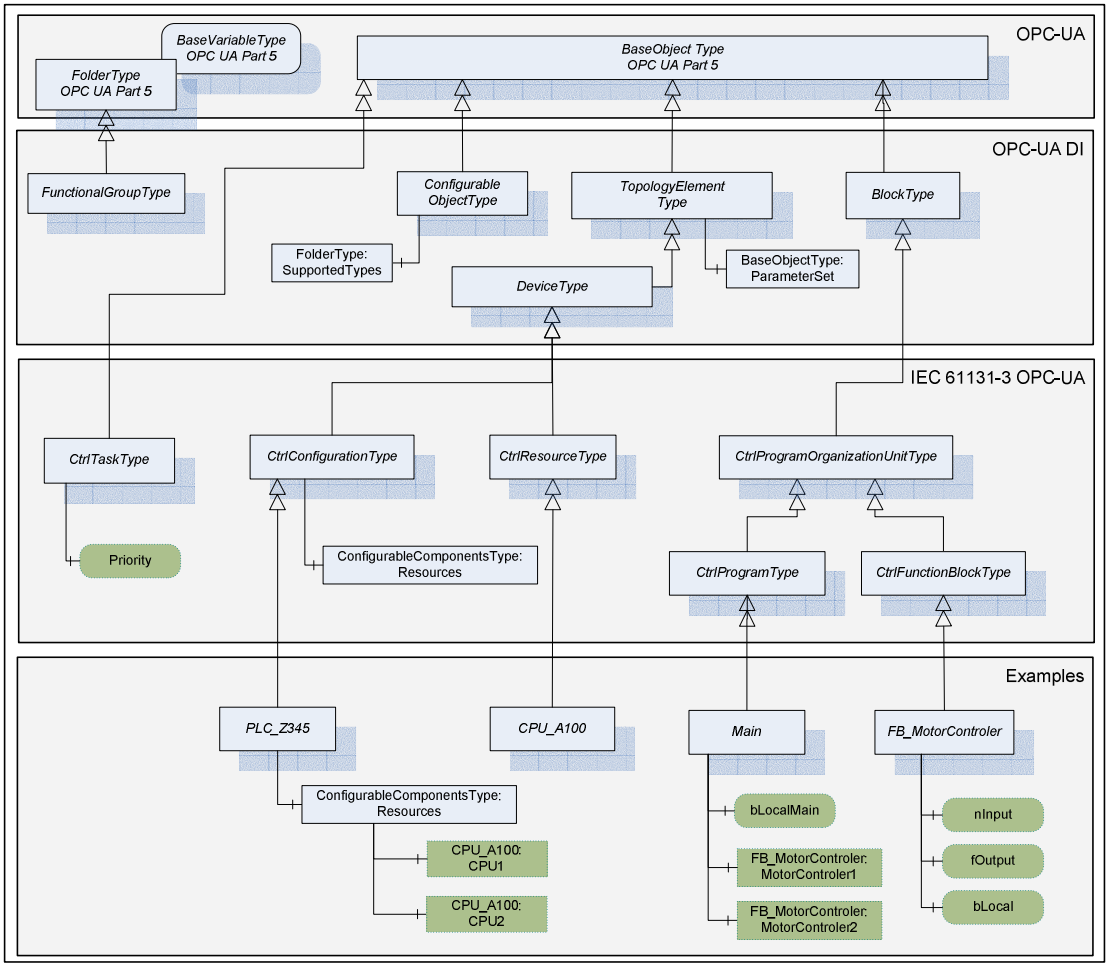
TC4 – Communication

- **IEC 61131-5: Communication Function Blocks (CFBs)**
  - Mapping to Profibus and CANopen has been done

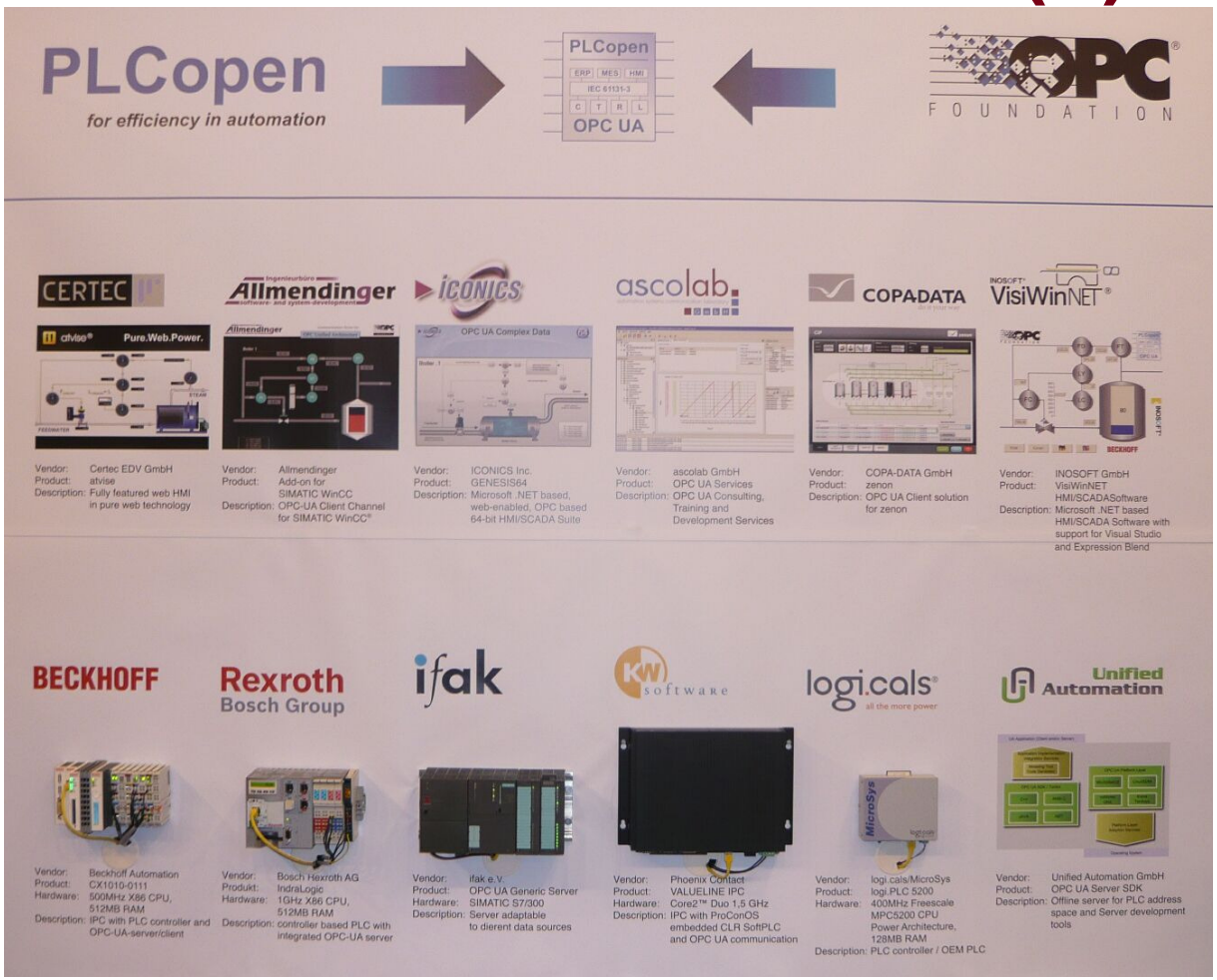
- **cooperation / joint working group with OPC Foundation**
  - based on OPC Unified Architecture (UA)
  - kick-off meeting at October 14, 2008
  - objective: define a common information model based on IEC 61131-3
  - additional part of the overall OPC UA specification
  - OPC UA servers will represent their underlying manufacturer specific PLCs in a similar IEC 61131-3 based manner
    - substantial advantage for client applications
  - results
    - final document released as version 1.0
    - combined booth at the SPS/IPC/Drives (boiler demo)



TC4 – Communication (2)



TC4 – Communication (3)



TC5 – Safety

- **Part 1 – Concepts and Function Blocks**
  - published in February 2006 as version 1.0
- **Part 2 – User guidelines**
  - published in March 2008 as version 1.0
- **Part 3 – Extensions**
  - under development
- **Part 4 – Extension for presses**
  - under development

TC6 – XML

- **definition of XML schemes for all the IEC languages**
- **representation of graphical information**
- **basis for distribution of Function Block libraries**

- **Version 1.0 released April 2005**
  - feedback not only from Europe but also from Japan

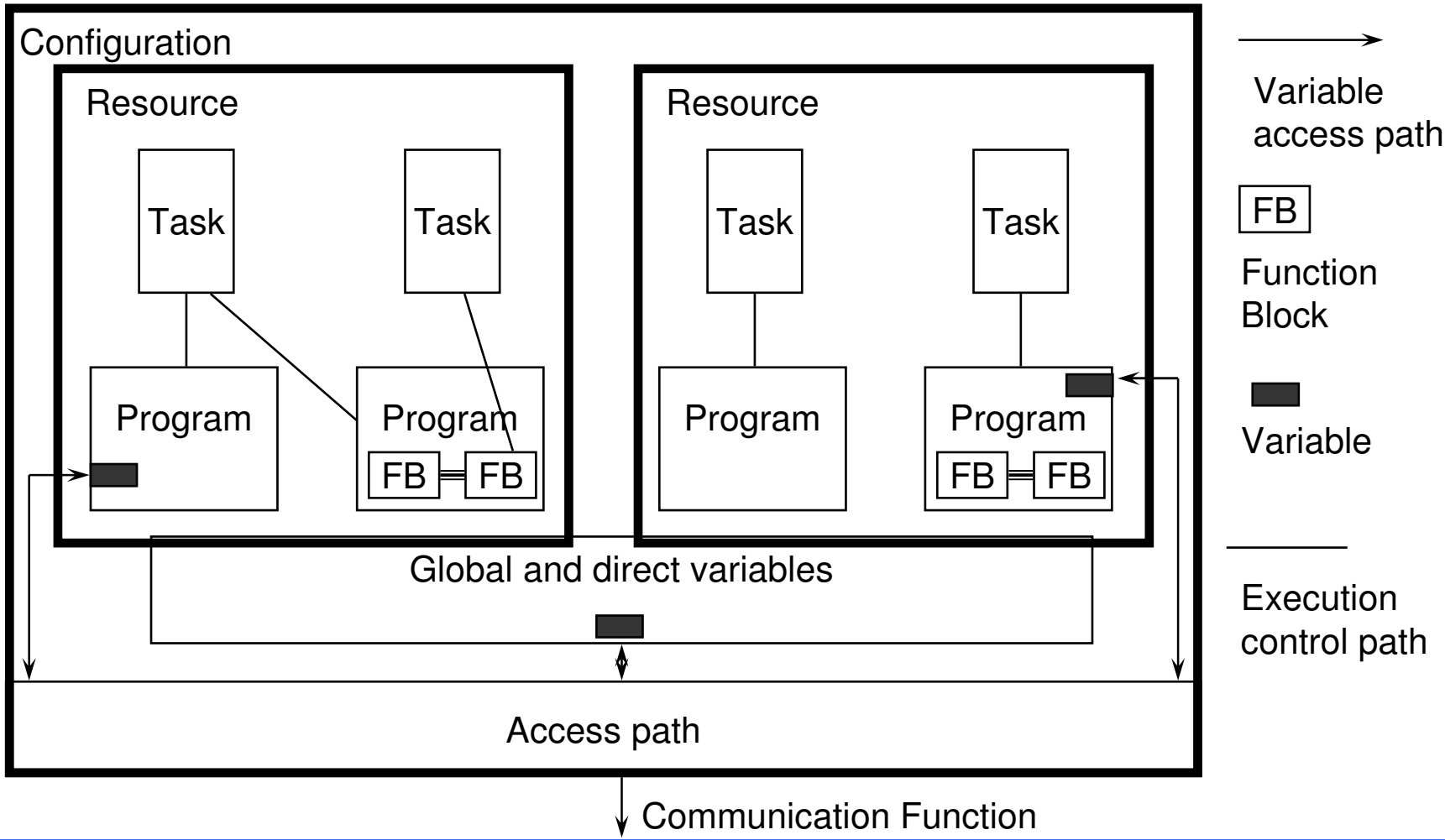
- **new initiative called AutomationML**
  - e. g. Daimler, ABB, KUKA, Rockwell, Siemens, …
  - intermediate format for the Digital Factory
  - PLCopen XML accepted as format for the sequencing

- **Version 2.0 released December 2008**
  - Version 2.01 released June 2009 (minor change to 2.0)

More Information ...

www.plcopen.org

IEC 61131-3 Software Model



The IEC 61131-3 Programming Languages

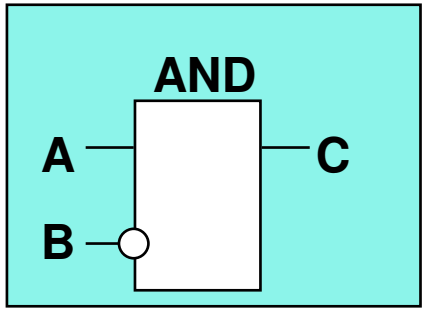
Instruction List

```
LD      A
ANDN    B
ST      C
```

Structured Text

```
C:= A   AND  NOT B
```

Function Block Diagram

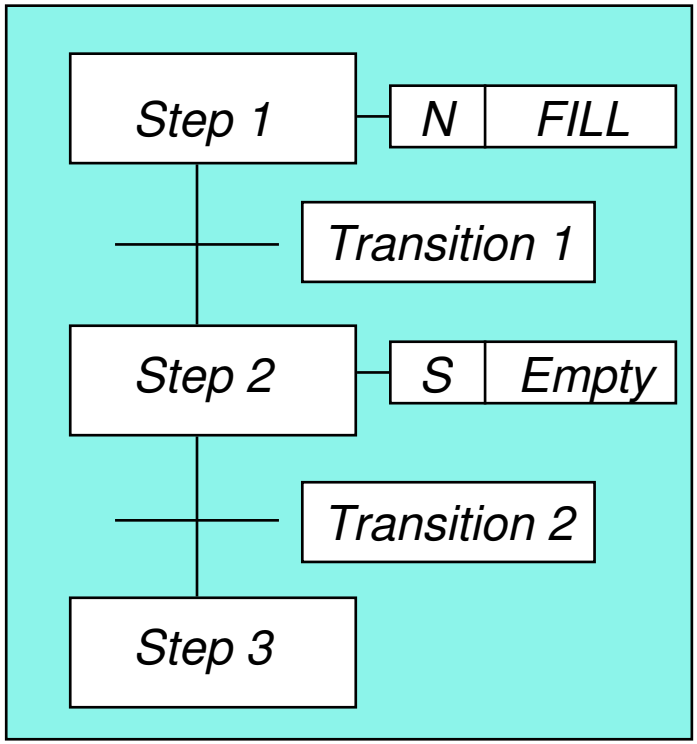


Ladder Diagram

```
A   B                C
-| |--|/|---------------(  )
```

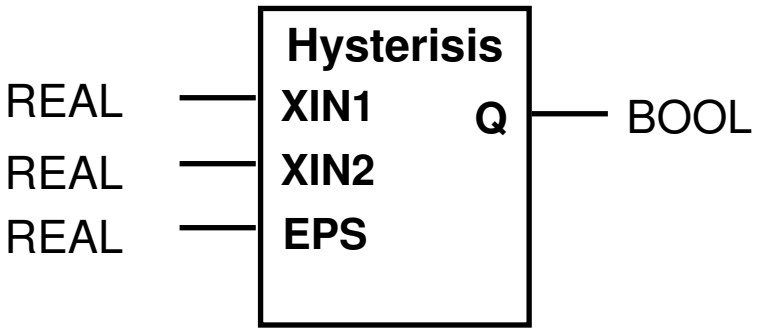
Sequential Function Chart

- Powerful graphical technique for describing the sequential behaviour of a control program
- Used to partition a control problem
- Shows overview, also suitable for rapid diagnostics
- The basic elements are STEPS with ACTION BLOCKS and TRANSITIONS
- Support for alternative and parallel sequences



Functions & Function Blocks

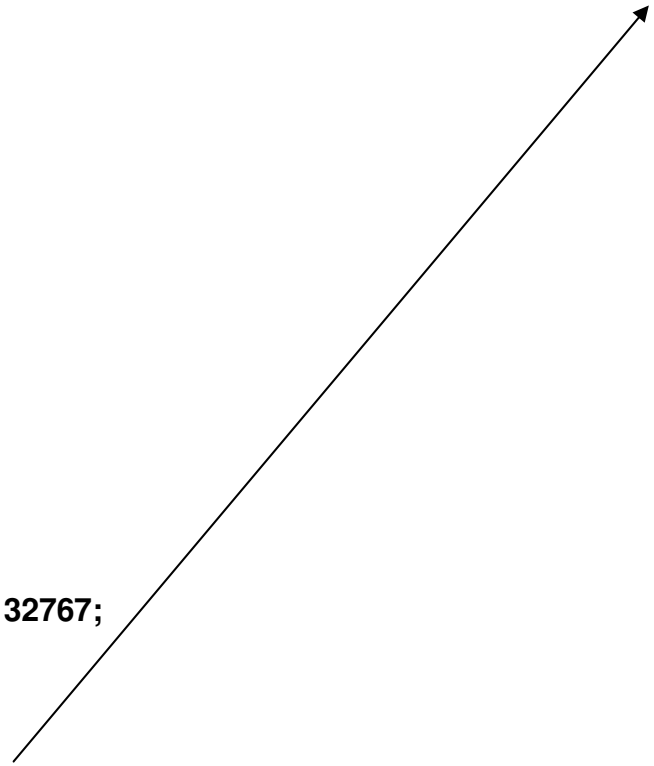
- **highly re-usable in same program, different programs or project**
- **e. g.**



- **standard**
- **additionally supplied (PLC vendor)**
- **own definitions (vendor or project specific)**

Function Block example (declaration)

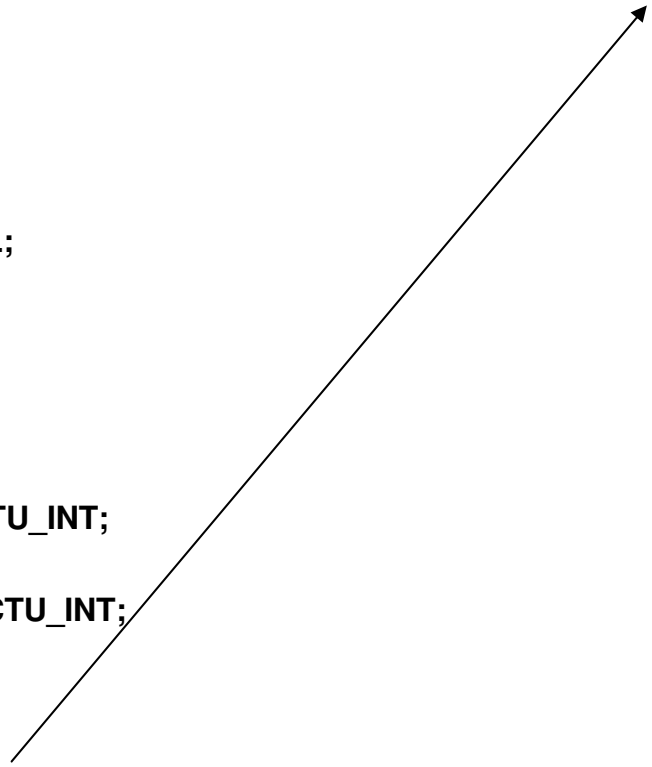
```
FUNCTION_BLOCK CTU_INT

VAR_INPUT

  CU: BOOL;

  R: BOOL;

  PV: INT;

END_VAR

VAR

  PVmax: INT := 32767;

END_VAR
```



```
VAR_OUTPUT

  Q: BOOL;

  CV: INT;

END_VAR

  IF R THEN

    CV := 0;

  ELSIF CU AND (CV < PVmax) THEN

    CV := CV + 1;

  END_IF ;

  Q := (CV >= PV);

END_FUNCTION_BLOCK
```

Function Block example (instantiation and usage)

```
PROGRAM MyTestProgram

VAR_INPUT

 Signal: BOOL;

 Signal2: BOOL;

END_VAR

VAR

 MyCounter: CTU_INT;

 MyCounter2: CTU_INT;

END_VAR
```



```
VAR_TEMP

 QTemp: BOOL;

 CVTemp: INT;

END_VAR


MyCounter(CU := Signal, R := FALSE, PV := 24);

 QTemp := MyCounter.Q;                    // FALSE

 CVTemp := MyCounter.CV;                  // 11


 MyCounter2(CU := Signal2, R := FALSE, PV := 19);

 QTemp := MyCounter2.Q;                   // TRUE

 CVTemp := MyCounter2.CV;                 // 74


END_PROGRAM
```

TC3 – Certification (3)