

# CERTIFICATION ISSUES IN AUTOMOTIVE SOFTWARE

*Speaker: Mario Fusani*

Systems and Software Evaluation Centre

**ISTI – CNR, Pisa, Italy**

mario.fusani@isti.cnr.it

# CONTENTS

- Certification
  - What is certification?
    - Definitions
    - Objects, actors, schemes
  - Benefits and drawbacks
    - Standards: good things / so&so things
    - Confidence and risks
- Software / Automotive Software certification
  - Reference requirements / standards
  - Comments on some current reference requirements
- Conclusions

# WHAT IS CERTIFICATION?

[*Optimistic*] An **activity** that provides **demonstration** that specified requirements relating to an **object** {product, process, system, person or body} are fulfilled [ISO/IEC 2002]

[*Interested*] A way to to augment the **value** of a manufactured object [supplier point of view]

[*Need oriented*] A way to get more **confidence** (i. e., to know the associated risks) about an object and it associated services [consumer point of view]

[*Spoiling*] An illusion about an **unachievable** goal [some scientist's point of view especially in software]

## WHAT CERTIFICATION IS NOT

**A guarantee** that specified requirements relating to an object are satisfied

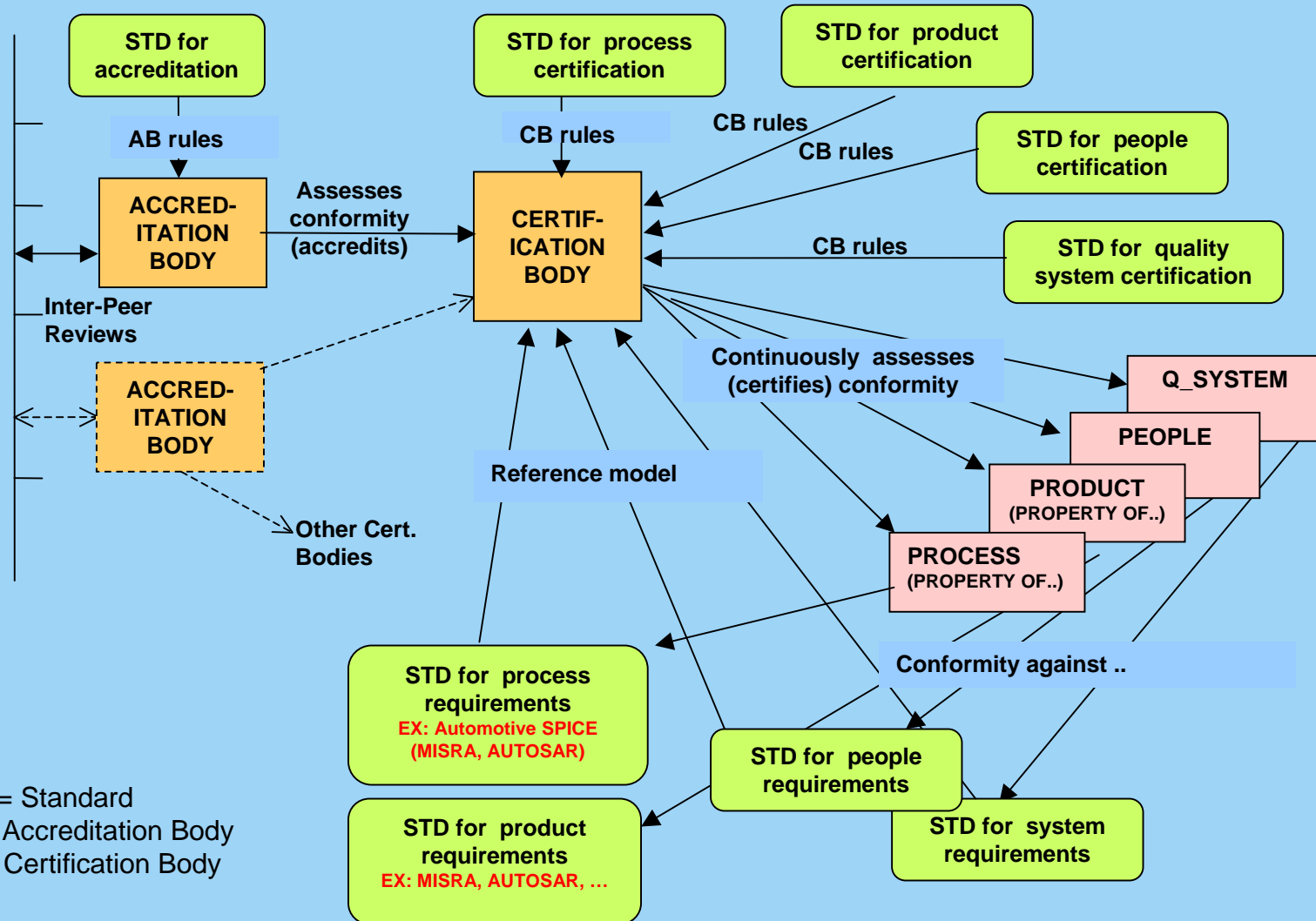
**A snapshot** or measure of a characteristic of an object

**An assertion of very severe** analyses and tests executed on an object

## QUESTIONS ABOUT CERTIFICATION

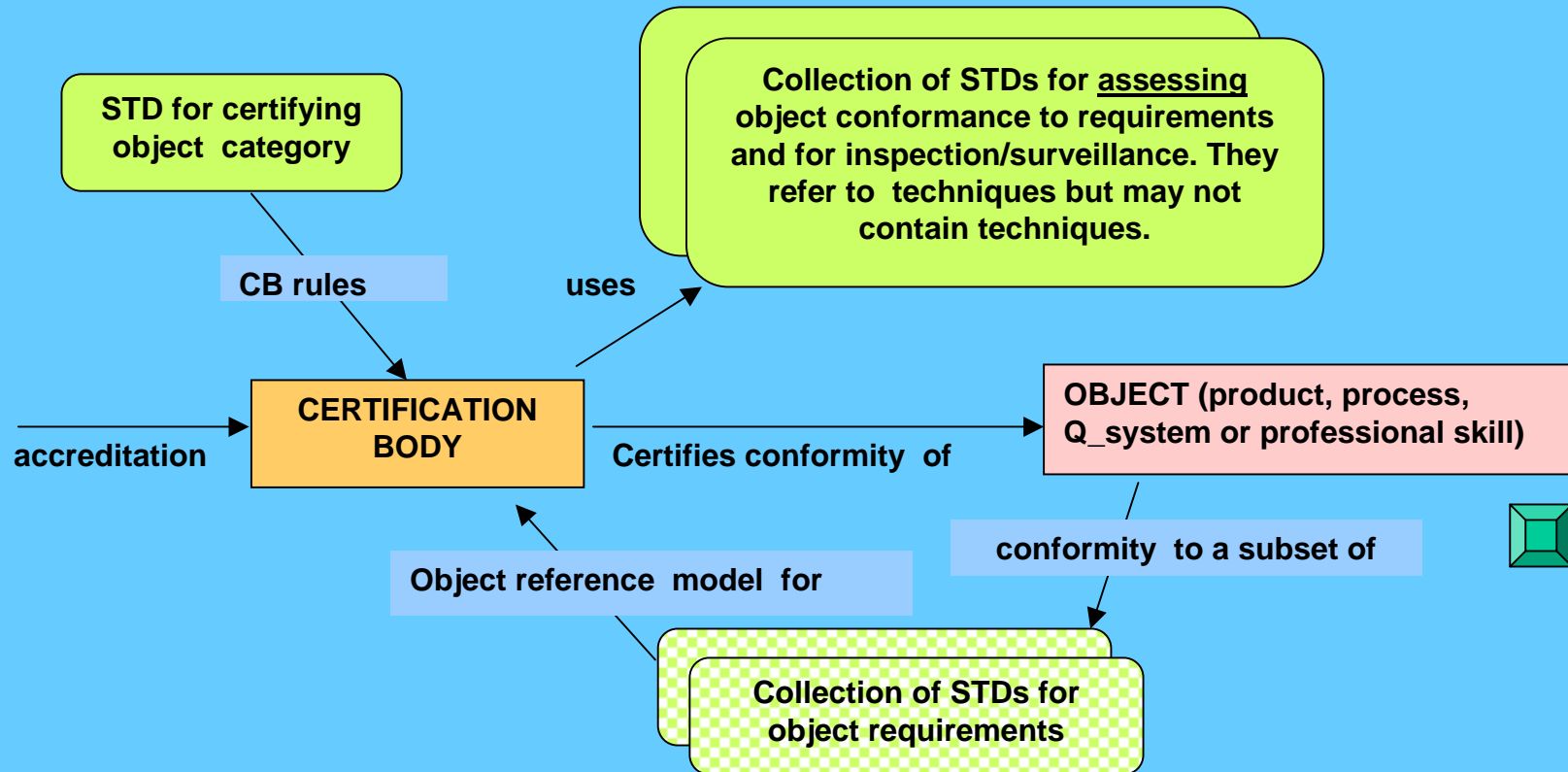
- What are the **objects** of certification (what is/can be certified)?
- What are the **actors** associated with the certification and how do they behave (duties, opportunities)?
- What is the **chain-of-confidence** around a certified object?
- What is the **added value** of certification?
- Who **benefits** from certification?

<b>ACTORS,</b> (Body level)	<b>OBJECTS,</b>	<b>STANDARDS</b>
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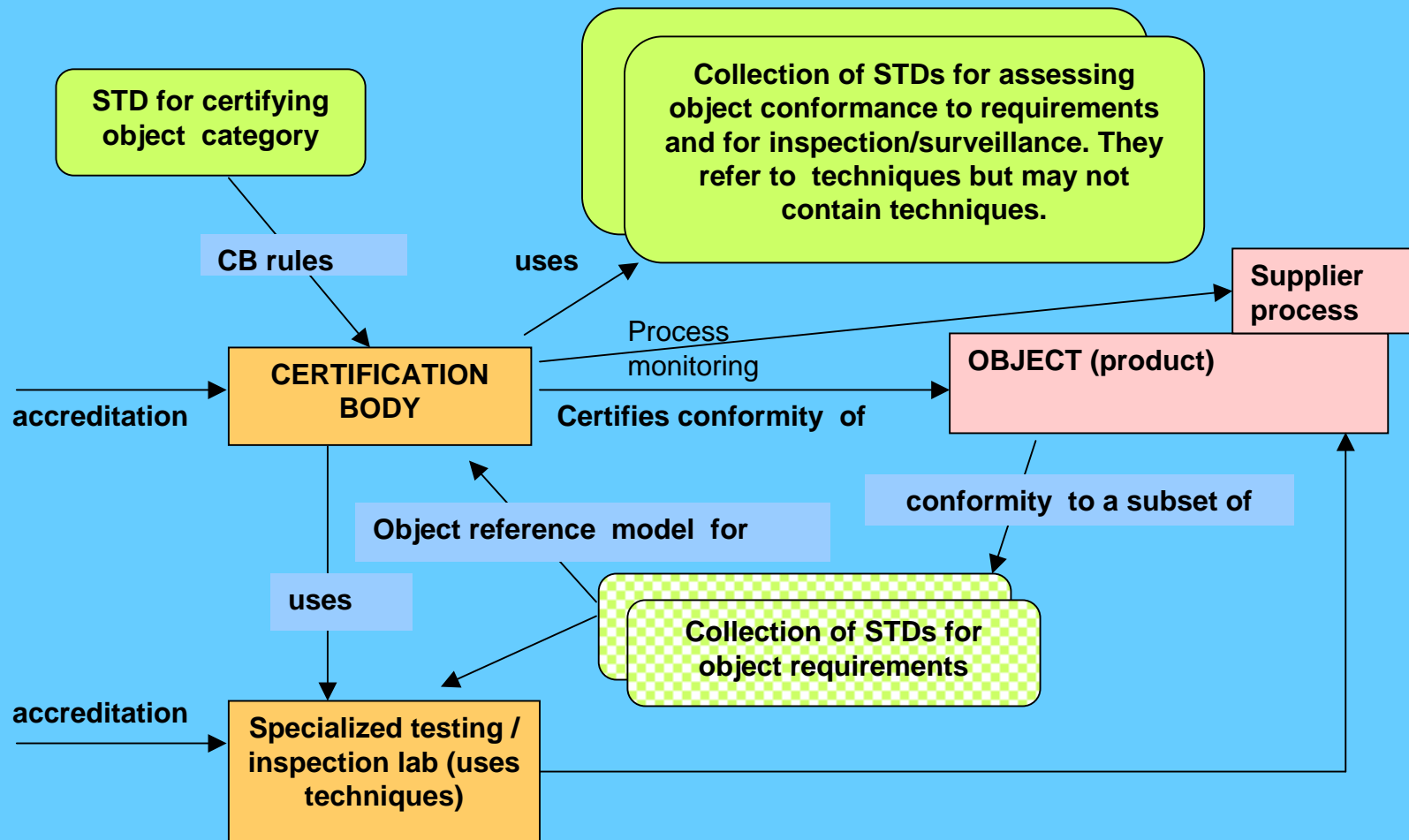
STD = Standard  
 AB = Accreditation Body  
 CB = Certification Body

# ROLE OF STANDARDS IN CERTIFICATION



# ROLE OF STANDARDS IN CERTIFICATION

## (case of product certification)





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  - **Benefits and drawbacks**
    - **Standards: good things and not so good ones**
    - Confidence and risks
- Software certification
  - Kinds of reference requirements or standards
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# ABOUT STANDARDS



- Object reqs. stds: public reference, allow comparability
- Cert. Process stds: allow repeatability / reproducibility
- Cost reduction in certification process

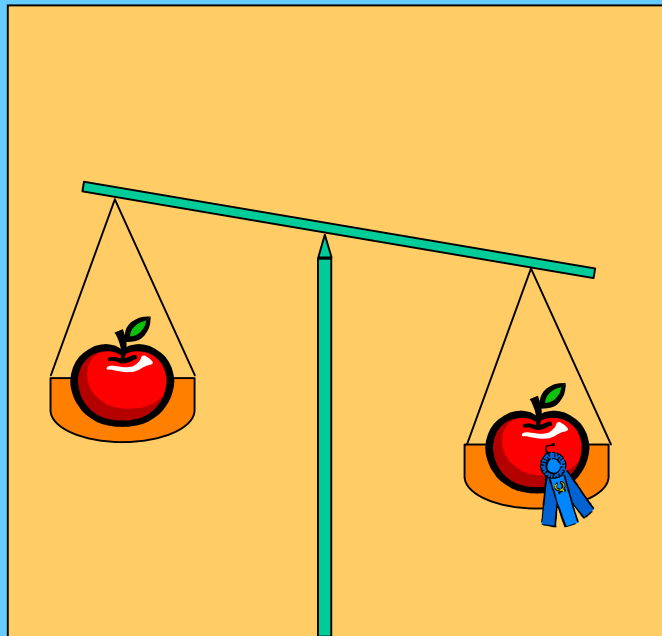


- Risk of introducing obsolete techniques (requirement-oriented stds may be exception)
- Risk of protecting corporate business
- With **cogent rules**, risk to pursue formal compliance and not real qualities (*safety*)

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# WHAT IS THE ADDED VALUE OF CERTIFICATION?



- More confidence on object (based on knowing its associated risks)
- How much would users pay for that?

## ADDED VALUE IS BASED ON:

- **Independency** of CB
- Accreditation chain: ability of **transferring confidence** to relevant stakeholders (CB itself is checked ! )
- Explicit **certification policy** (liability, certification process, scope, restrictions, duties)
- Good **coverage of the user needs** by the object requirements **standards** (conformance can be assessed and certified against requirements, not against needs)
- **Consensus** and adoption of standards by suppliers and customers
- **Up-to-date techniques** and methods used by CB and/or by n<sup>th</sup>-party labs
- Stakeholders **investment** (supplier: design for “certifiability”)

## WHO BENEFITS FROM CERTIFICATION

- Certification Bodies business
  - induced by suppliers investment / regulations / procurement policies
- Suppliers business
- Intermediate / **end users**
  - they often **can't judge by themselves** and must trust other parties (1st, 2nd, 3rd, ...), but are the final experimenters (for good or not) of services associated to the objects

## KEEP IN MIND

- Certification gives confidence on **compliance** to **standards** and not to implicit/explicit needs
- The latter is good-standardization job !
  - Need-capturing ability of STDs

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# SOFTWARE CERTIFICATION

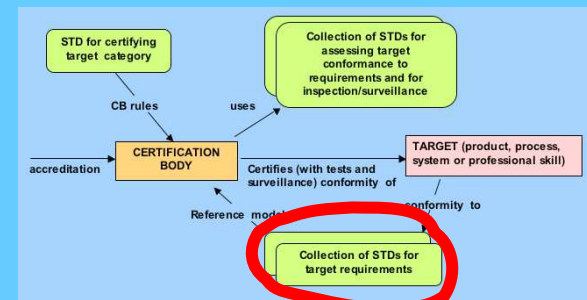
- Rather oriented to **system properties**
  - Difficult system/software properties separation
  - Security
  - Other sectored functional standards
  - Safety (search for system SW-independent safe states!)
- Very **high cost** for 3rd-party bodies
  - are the most expensive techniques the most effective ones?
  - “Certifiability”
- Lack of product requirement reference standards
  - Product standards (lack quality, little domain coverage)
  - Process standards (CMMI, SPICE, ISO/IEC 90003, ...)

# CONTENTS

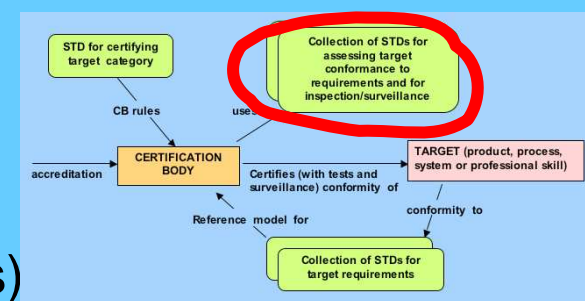
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# REFERENCE STANDARDS IN CERTIFICATION

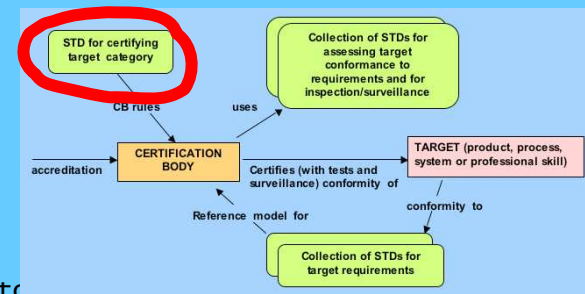
- requirements standards for software **products**
- requirements standards for software **processes**



- standards enabling a certification body to **assess conformance** (typically, of properties of products/processes to requirements)



- standards usable as **internal rules by certification bodies**



## **SUITABILITY CRITERIA FOR STANDARDS**

(both for object requirements and for certification process)

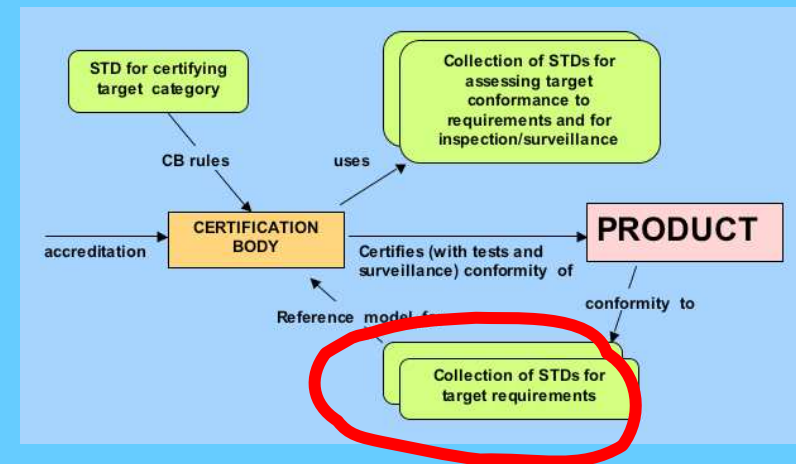
- Easy to understand and use
- Grounded on scientific bases
- Support evolving techniques
- Cost effective
- Ability to capture stakeholders (users?) needs

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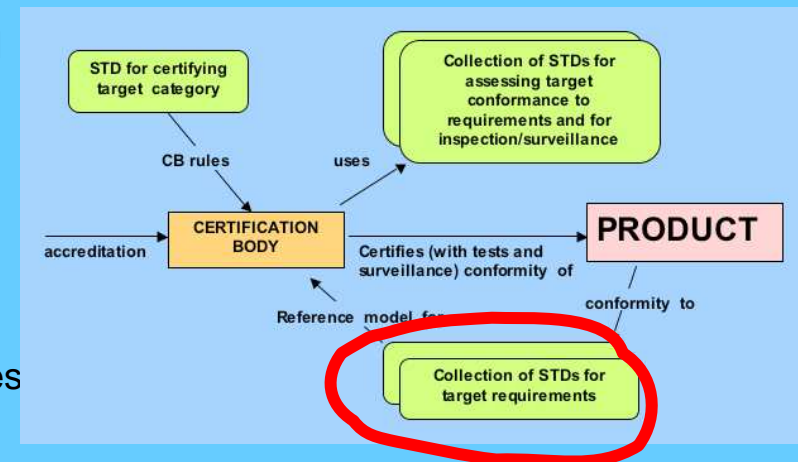
# REQUIREMENTS STANDARDS FOR SOFTWARE PRODUCTS

- Functional standards
  - general case (customer reqs): hardly unsuitable for **product** certification
  - compilers, protocols, graphic&sound, special domains: suitable but no market



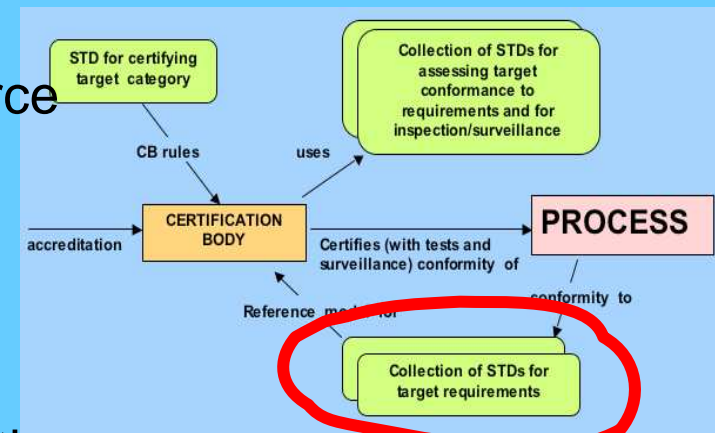
# REQUIREMENTS STANDARDS FOR SOFTWARE PRODUCTS (cont.)

- Quality standards
  - ISO/IEC 9126, SQUARE, IEEE, ...
    - partially suitable (standard makers claim), no policy available
  - Security (ITSEC, CC)
    - suitable enough (schemes exist), claimed by certification bodies (mostly UK CBs), good market, no policy available
  - Safety (MIL, IEC 61508, WD 26262 ... , corporate)
    - Avionics: suitable enough
    - On-rail vehicles: mostly mentioned
    - automotive: scarcely suitable, need process so far



# OBJECT REQUIREMENTS STANDARDS FOR SOFTWARE PROCESS

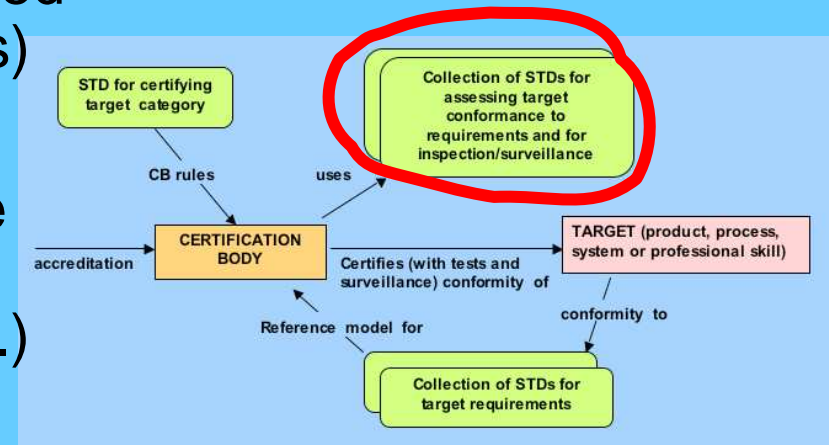
- CMM, CMMI
  - suitable for process certification (scarce certification policy availability)
- ISO/IEC 15504 (12207)
  - suitable for certification, but purpose disclaimed (projects exist for certification policy)
- IEEE, IEC 61508, WD 26262
  - partially suitable (document based, phased-project based, scarce technique assessment)





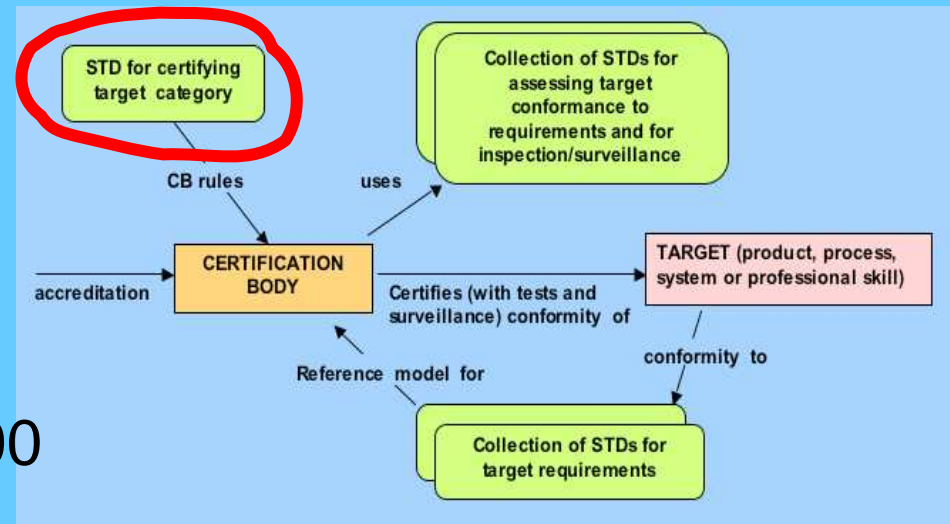
# STANDARDS FOR CERTIFICATION PROCESS

- CMM, CMMI
  - suitable in a certification scheme (not well distinguished from process reference. stds)
- ISO/IEC 15504
  - suitable enough but purpose disclaimed (well separated from process reference stds.)
- SQUARE (ISO/IEC 14598)
  - not yet suitable



# STANDARD FOR CERTIFICATION BODIES

- ISO Guides and
- EN 45000, ISO/IEC 17000 family
  - naturally suited: purposely written for certification schemes, explicitly recommend certification policy associated with certificate



# CONCLUSIONS

- **Common understanding needed** about certification and software certification (also in Automotive)
- **No guarantee, no ultra-severity, but higher confidence** on STD compliance and hopefully on object-associated services (also in Automotive)
- Build **added value** of certificate crucial as market drive (especially in Automotive)
- What can be certified is **not the outcomes of service** associated, **but conformance to standards**) (warning for Automotive safety)
- Successful software **product** certification still a **challenge** (especially in Automotive)
- **High variability of product** certification scenarios (application domain, scope, purpose, ...) (also in Automotive)
- **Costs** are a problem (cost reduction by supplier support, certifiability, user support, ...) (also in Automotive)