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Efficient Safety Critical Systems Development

Is FLOSS the only answer?

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Class 12 - FLOSS for Safety Related Systems

Embedded World Conference 2011

Let's imagine...

- A cooperative and open framework for the development of certifiable software
- Competitors who work together to share costs
- Software that is easy to certify and to recertify

Weird idea, isn't it?

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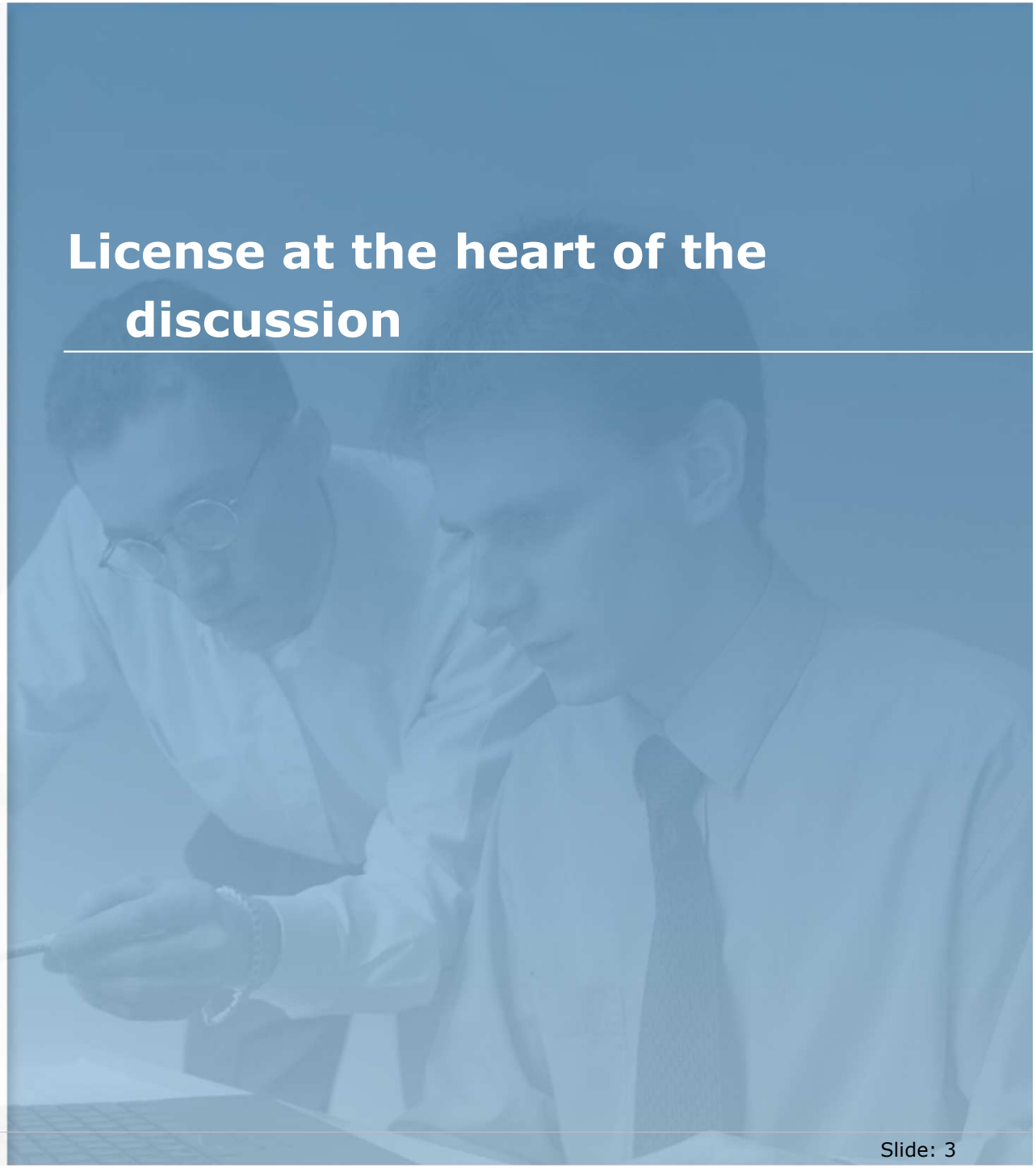
License at the heart of the discussion



FLOSS is just about software license

- **FLOSS = Free/Libre/Open Source Software**
- **Free/Libre/Open Source:**

  properties of a license provided by the copyright owner

FLOSS License

- **Free to run**
- **Free to look at the sources**
- **Free to change**
- **Free to redistribute**

FLOSS and Restrictive Licenses – The Common Base

- The software is copyrighted
- It cannot be copied or used without a license
- The license allows certain rights to copy and use the software

FLOSS and Restrictive Licenses – The Differences

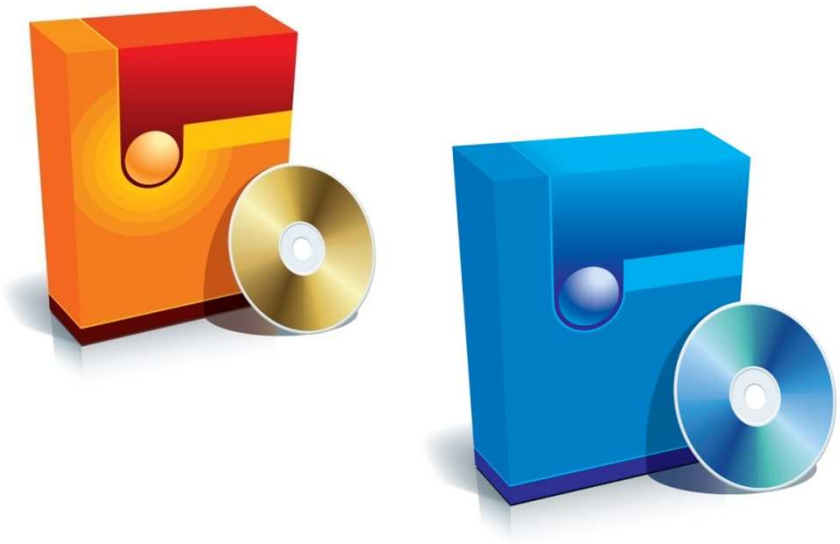
- **In the license terms:**
  - License conditions are very different
  - Restrictive License: strictly limits usage and copying
  - FLOSS License: far more liberal, less restrictions (usage and copying rights are a superset of Restrictive Licenses)

Topics to consider for both FLOSS & Restrictive Licenses

- Provenance (trust)
- Support
- Product evolution
- Maintenance
- The price to pay for the combination of: software, support, and license

Is FLOSS appropriate for safety related systems?

- At worst, license is neutral
- Most probably, a FLOSS License provides an advantage over a Restrictive License



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COTS vs. Bespoke

COTS – Commercial Off-The-Shelf – Product

The market answer for sharing costs for the

Creation

Industrialization

Support

Maintenance

Repair

Evolution

of software amongst users having similar needs

The License of a COTS

Restrictive License

FLOSS License

A High Demanding Customer Base

LOCKHEED MARTIN

MDA

NATS

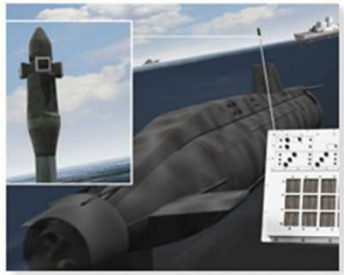
Raytheon
Integrated Defense Systems

AnsaldoSTS

Martin-Baker

THALES

THALES



Atos Origin™

BOEING

EADS Astrium

EADS CASA

BAE SYSTEMS

The Job of a FLOSS Vendor

- **COTS is often made of SW from many SW communities**
  - Need for integration
  - Need for version management
  - Need for QA

- **Ability to interact & participate to these communities**
  - To maintain the SW
  - To make the SW evolve
  - To integrate new features

- **Understand licensing**

FLOSS Gives You Many Options

Getting the FLOSS

- Buy the FLOSS from a vendor

  => COTS

- Download the FLOSS as-is

  => Bespoke

Getting help

- Do nothing
- Build in-house expertise
- Become part of the development community
- Purchase Services

Your Choices with FLOSS

- Download the FLOSS and use it
- Build in-house expertise
- Become part of the development community
- Purchase COTS

COST vs. RISK analysis

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Safety Related Software is NOT just Software

What is Safety-Critical Software?

Context:

- **Safety-related piece of software**
- **Definition of a Safety-Integrity Level**
- **Certification standard, like:**
  - Avionic: DO-178B
  - Railway transportation: IEC 61508
  - Automotive: ISO 26262 (forthcoming)

Corollary:

- **Establishment of a development process (requirements, test, verification, etc.)**
- **Documentation artifacts aka. Software Certification Artifacts**

What Safety-Critical Software Looks Like

Software Code

- **Object code/Executable**
- **Source code**

Certification Evidence

- **PSAC** (plan for software aspects of certification)
- **SDP** (SW development plan)
- **SVP** (SW verification plan)
- **…**

Reverse-Engineering of Existing SW into Safety-Critical SW

A risky operation

- Safety properties often carried by SW architecture and design
- Stringent requirements adapted to the SIL
- The result of a well-defined development process

FLOSS and Safety Related Systems

- **FLOSS**
  - The freedom to choose the best approach (Bespoke vs. COTS)
  - As a COTS: additional safeguards compared to restricted licensed SW
  - In the context of safety related systems:
    - Access to source code eases the handling of certification evidence
- **Safety Related Systems**
  - Source code: only part of the equation
  - How to handle certification evidence?

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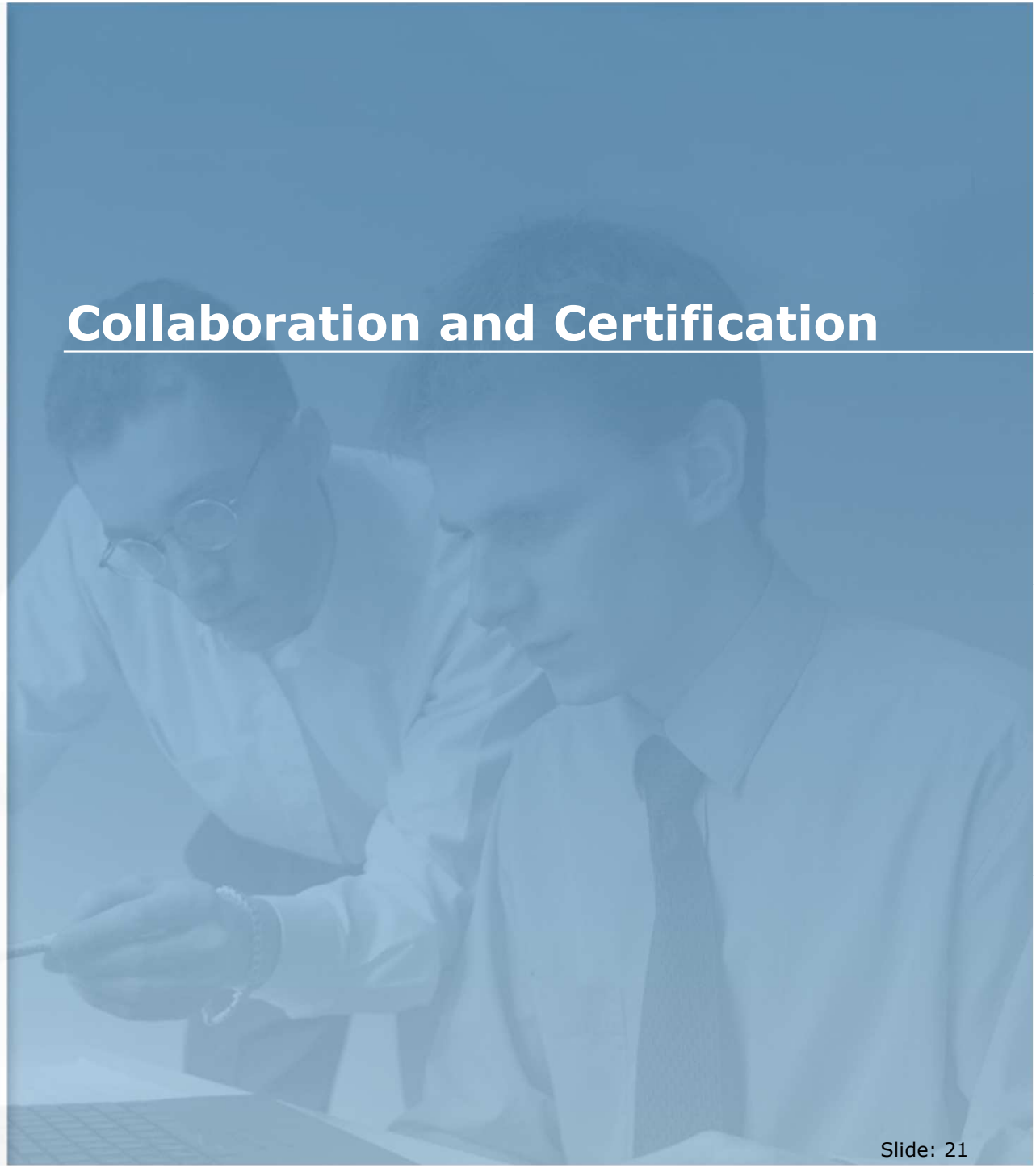
Collaboration and Certification



The Open-DO Initiative

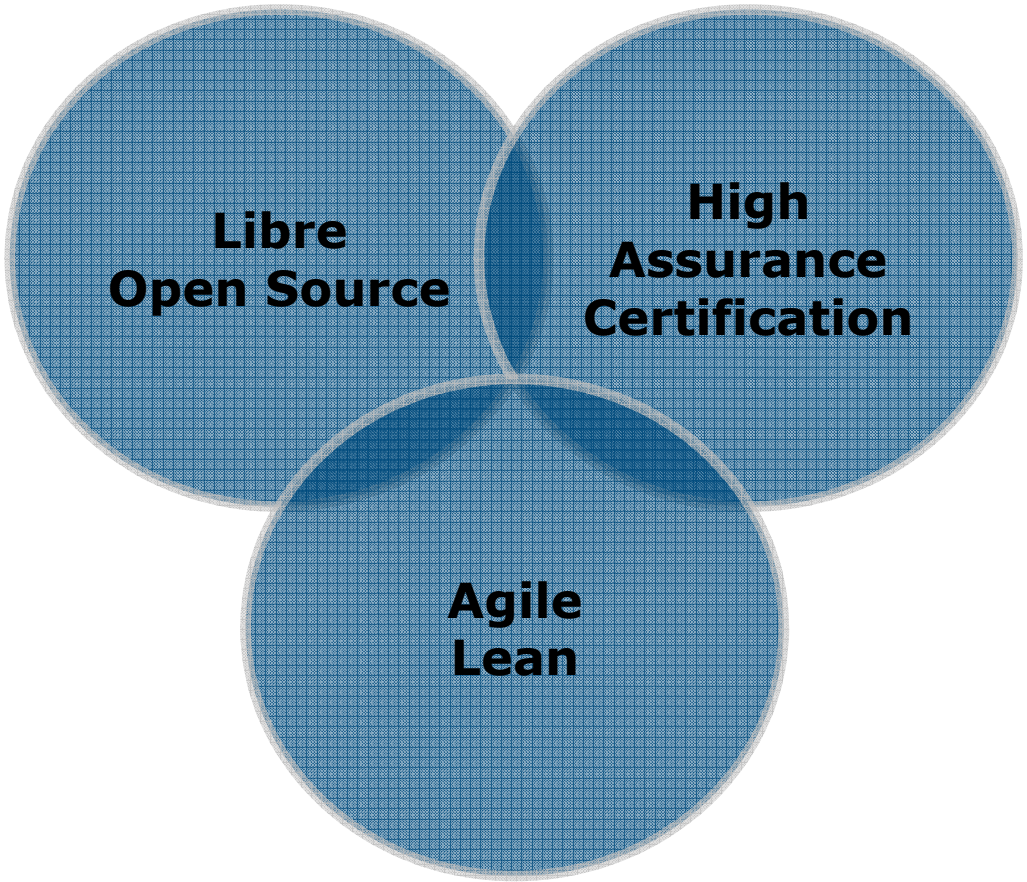
openDO

- Towards Cooperative & Open Framework for the development of certifiable SW
- FLOSS model to share costs
- FLOSS that encompasses certification artifacts
- Agile methods at the heart of its development process

⇒ Towards continuous certification

http://www.open-do.org

Open-DO – At the Crossroad of 3 Worlds



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Highlight on the Qualifying Machine

Why Qualifying/Certifying?

- **Tool qualification**
  - Substitute manual activities with a tool
  - No need to verify the output of the tool
  - Ex: checking for a coding standard, coverage analysis, model-based code generation, …
- **COTS certification**
  - Reuse a certification kit across different projects
  - Ex: Ada run-time library, XML library, …
- **Problem: The Big Freeze**
  - Qualification/Certification = Baselining
  - How can you evolve a technology which requires qualification?

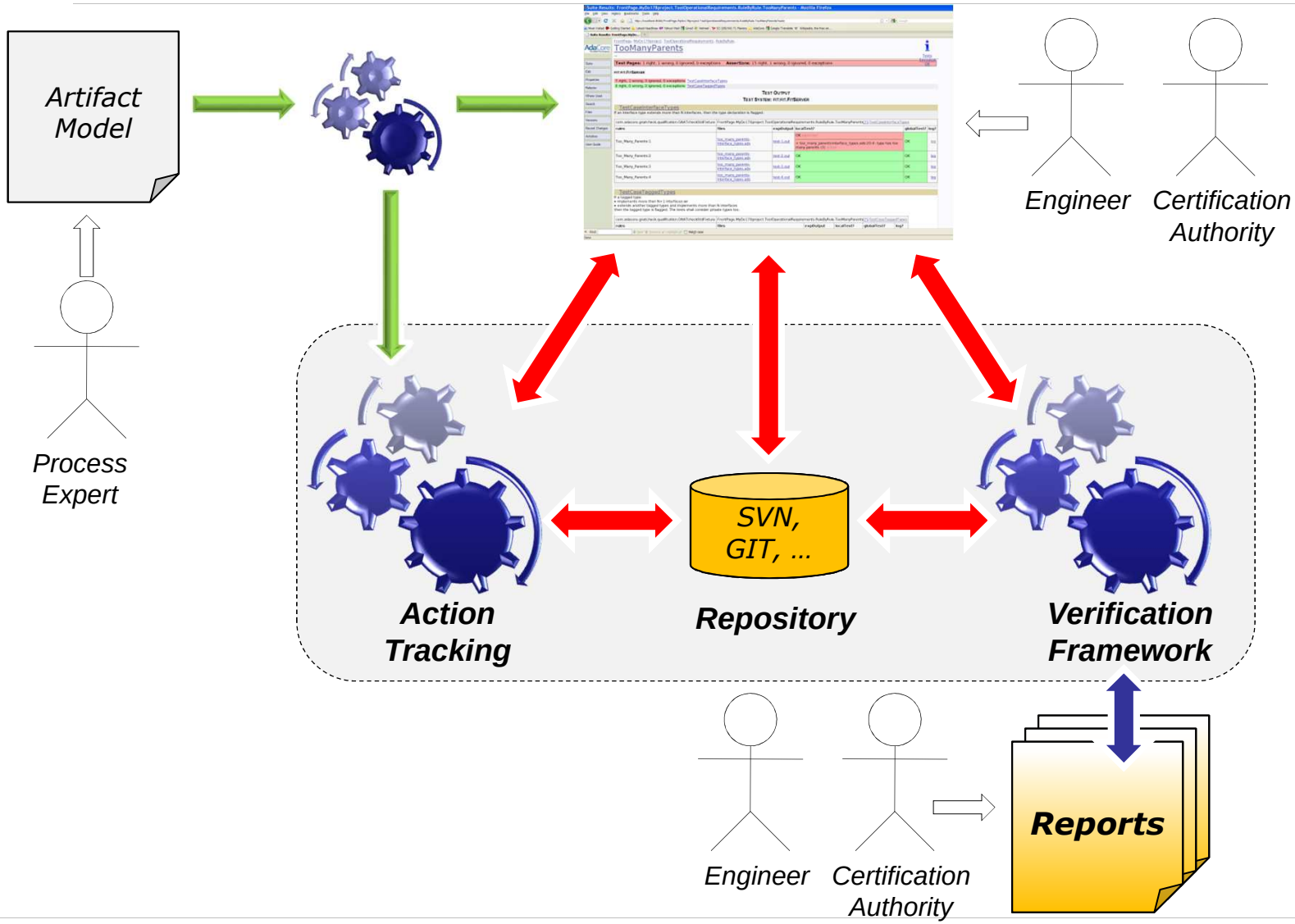
Qualification Machine: the goals

- **Delta qualification**
  - A new requirement arises on an already qualified tool
  - What is the minimum effort to re-achieve qualification?

- **Continuous qualification**
  - A tool shall always be in a "semi-qualifiable" status
  - Mirror the "continuous integration" concept
  - At any time, you should know:
    - Which artifacts shall be produced to achieve qualifiability
    - Which activities shall be performed to achieve qualifiability

- **Automation**
  - Automatic production of (part-of) qualification evidence
  - Focus on traceability, coverage and workflow management/tracking

The Qualifying Machine



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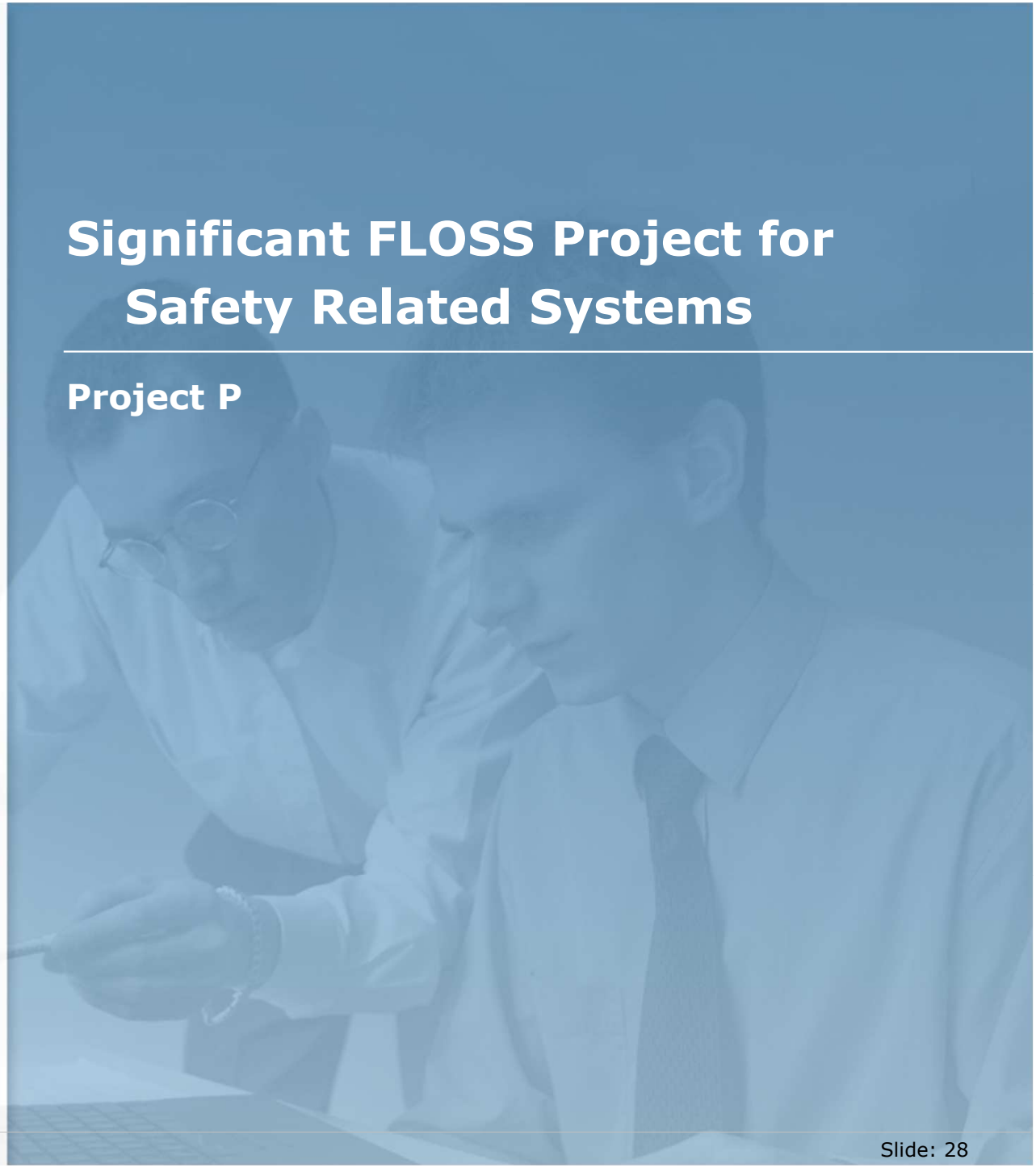
Significant FLOSS Project for Safety Related Systems

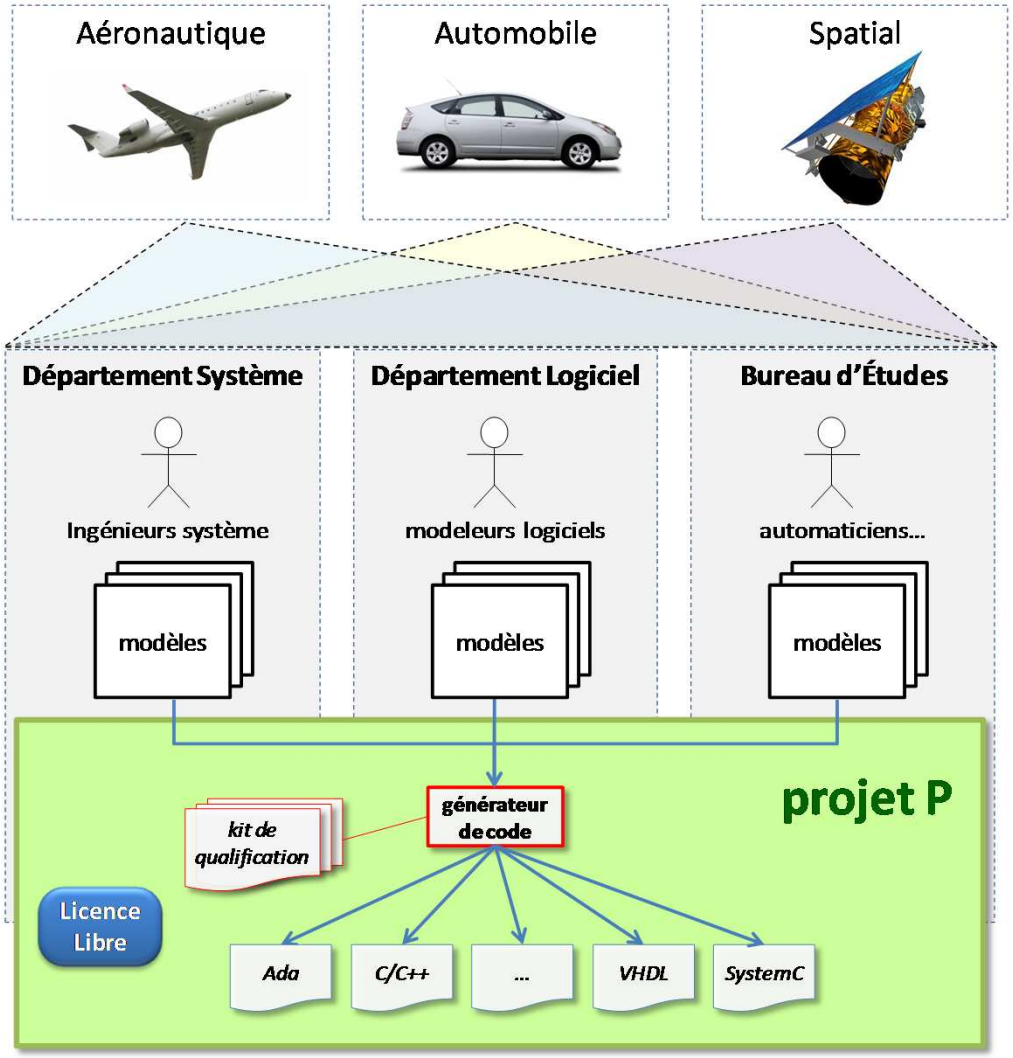
Project P



Project P in a Nutshell

- Cooperative development supported by the French government (official announcement: March 1st, 2011)
- FLOSS license
- Eases the development of real-time safety-critical systems
- Leverages on model oriented engineering seconded by automatic code generator
- Development of a qualification kit for the code generator

Project P in a Nutshell



Project P - FLOSS for Safety Related Systems

- **Duration: 36 months**
- **Investment: nearly 10 million euros**
- **19 partners, including:**
  - AdaCore
  - Airbus
  - Astrium
  - Atos Origin
  - Continental
  - Rockwell Collins France
  - SAGEM Defense
  - Thales Alenia Space
  - Thales Avionics
  - …

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Thank you for your attention

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