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SCADE for AIRBUS critical avionics systems
Agenda

- Airbus Context
- SCADE use
- Automatic Code Generation
Strategy for the systems: Make or Buy?

- AIRBUS has defined a strategy for the development of its Aircraft systems:

  - **“Make” or “in house” development**: Systems are designed, developed and manufactured by Airbus internal centre.

  - **“Buy” or “out sourced” development**: Systems are designed and manufactured by system vendor (or sub-contractor).
Systems development overview

• **System design**:  
  ‣ Define system and computer requirements,  
  ‣ Provide validation plans  
  ‣ Provide models

• **Avionics products manufacturer**:  
  ‣ Provide hardware equipments  
  ‣ Provide software with functional applications

• **Test & Simulation**:  
  ‣ Development simulation  
  ‣ Training simulation
Avionics products overview

Flight Control system:
- Flight control Primary computer
- Flight control Secondary computer
- Data Concentrator function
- Backup Control Unit function
- Weight and Balance Backup Computation

Flight Warning system:
- Flight Warning function
- System Data Acquisition
- Ecam Control Panel

Maintenance system:
- Centralised Maintenance function
- Bite function

Air/Ground Digital communication system:
- Air Traffic Services Unit
- Air Traffic Communication Function

A380
A319/A320/A321
A400M
A330/A340
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SCADE modelling with SCADE-Suite

At System Design level: Model definition and verification

- **System functional definition**
  - Textual system requirements
  - Validation Plan

- **Function Modelling**
  - SCADE Editor
  - Local verification with SCADE simulator & SCADE quick check

- **Verification**
  - Environments
  - Other applications
  - Global verification with specific simulators
  - Checked & Verified models
At avionics products manufacturer level: From SCADE model to “code transformation” and “Software integration”
System validation

At Test and Simulation level: Application integration and validation

- Unitary validation of applications
- Validation of systems integration
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ACG - Key drivers

The main challenges:

- Flight control for civil aircraft need high level of safety
- Certification under the DO178B standard
- New software delivery in 48 hours
- Application defined with more than 5000 SCADE nodes
- More than 30 software releases before “Entry Into Service”
- 30 to 50 years of maintenance in operational condition
- Systems global cost reduction

Airbus strategy

Model Based development and Qualified Automatic Code Generation using in house ACG (strategic internal expertise) and ESTEREL Technologies toolset
Airbus ACG toolset including SCADE-KCG for all internal avionics embedded software

- ACG toolset are DO178B qualified
- Specific AIRBUS internal expertise domain
- Delivery of a new software standard in 48 hours
- Generated code customized for the hardware target
- Contribution to a lean software production process

A significant competitive advantage for Airbus
ACG – Airbus organization impacts

Why code customization?

- Specific hardware target
- Target languages
- CPU & Compiler usage
- Capability of verification

Customization should be done without impact on model
ACG tools customization: how?

Scade Models → ACG toolset

Symbols transformation rules
Source file templates
Optional functions

SCADE-KCG → Intermediate files → Post-Processing

Qualified Airbus ACG toolset

Other files
Source files

Airbus toolset allow to customize source code at software level
Airbus in house avionics software production observed results

Several Millions of lines of code produced for 15 critical avionics software

60% of the embedded software produced automatically

Time development (including verification activities) divided by 3 compared to a process without ACG (observed results for typical modification on FCS software)

Never experienced any bug in flight in our FCS software produced automatically

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