Collaborative & **R**obust **E**ngineering using **S**imulation **C**apability **E**nabling **N**ext **D**esign **O**ptimisation

Innovations in collaborative modelling and simulation to deliver the Behavioural Digital Aircraft : A summary of results from the CRESCENDO project

Presented by:

Peter COLEMAN, CRESCENDO project coordinator, Airbus Operations Ltd

With contributions from the CRESCENDO consortium

COLLABORATIVE ROBUST ENGINEERING using SIMULATION CAPABILITY ENABLING NEXT DESIGN OPTIMISATION

CRESCENDO project key facts:

- ➢ FP7 2nd Call Integrated Project 234344
- ➢ May 2009 to October 2012
- ➢ 59 partners from 13 countries
- ➢ 55 M€ gross budget

Design lifecycle Scope:

- ➢ Preliminary => Detailed => Certification
- ➢ 17 Application Cases, covering:
  - o Value Generation
  - o Thermal Aircraft Behaviour
  - o Power Plant Integration
  - o Virtual Testing

Dissemination highlights:

- ➢ Toulouse FORUM event, June 2012
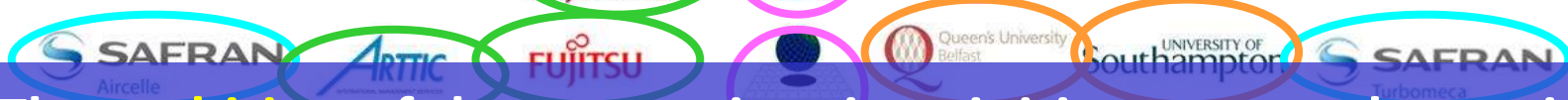- ➢ More than 50 publications overall in various conferences & journals

European focus ... Global outreach

http://www.crescendo-fp7.eu
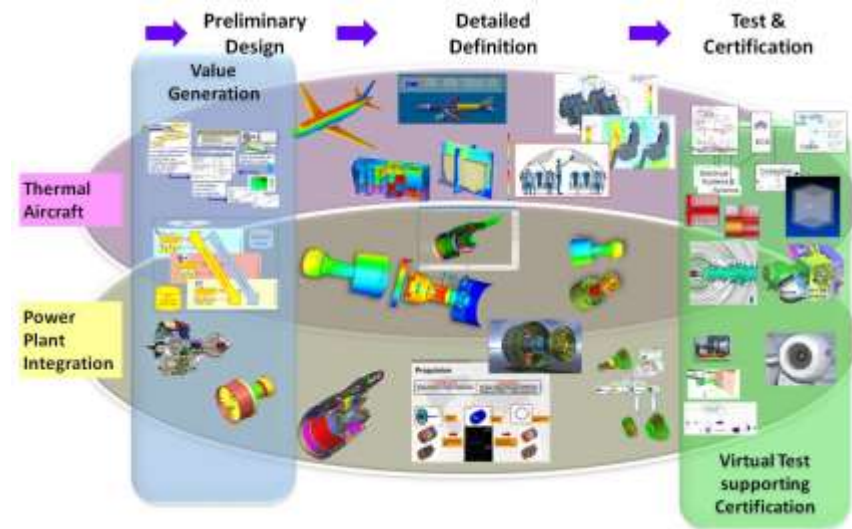
18 Aeronautic Industry partners	9 Research Centre partners	12 Academic partners	20 Solutions & Services partners

The **ambition** of the consortium is to initiate a step change in the way that **Modelling & Simulation** activities are carried out, by **multi-disciplinary** teams working as part of a **collaborative enterprise**, in order to develop new aeronautical products in a more **cost and time efficient** manner

- Developing more **complex products** with **shorter lead times**

- Understanding **customer expectations** and **value** contribution

- Managing **trade-off decisions** to assess impacts of new technologies on operational and functional behaviour

- Defining **behavioural characteristics** throughout the **development lifecycle**

- Working in multi-disciplinary teams across the **extended enterprise**

- Anticipating **testing** and **certification** through **simulation** to meet demanding regulatory requirements

Managing the evolution of the Behavioural Digital Aircraft dataset from concept to certification is key to achieve maturity at entry into service
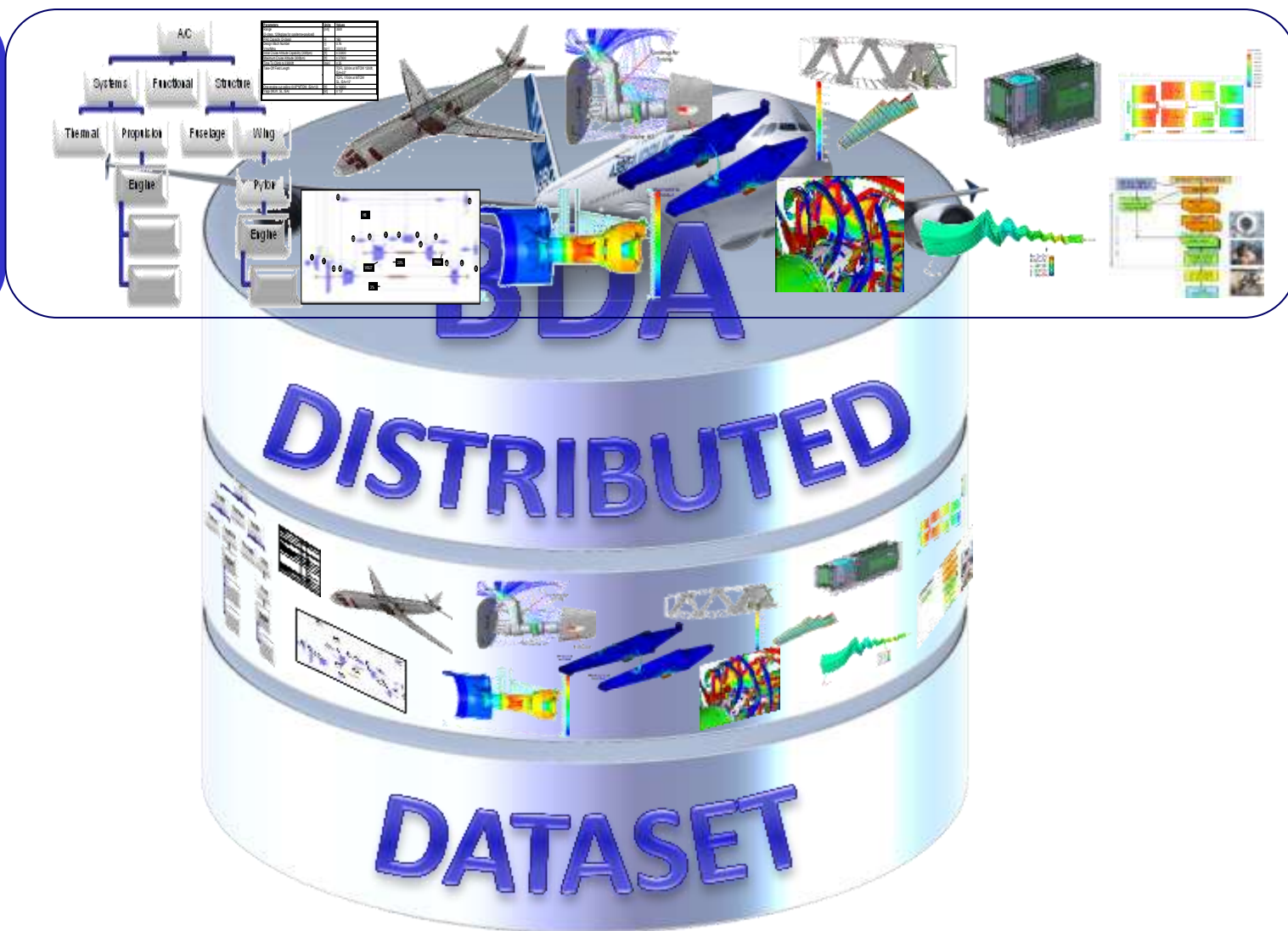
CRESCENDO takes up the challenge!

1 BDA Dataset
in Aircraft Programme context

10 – 100 BDA Platforms
across partner companies

Company A : OEM **Company B: Partner** **Company C: Supplier**

1000's BDA Engineers in Teams
across extended enterprise

Supplier xyz Engineers
Partner A Engineers
OEM Engineers

| A/C program architects & chief engineers | Process or M&T owners | A/C program collaboration manager | Design, M&S engineers | Quality managers | BDA IS/IT support |

1 BDA Dataset in Aircraft Programme context

CRESCENDO

1 BDA Dataset in Aircraft Programme context

Preliminary Design

Detailed Definition

Test & Certification

Value Generation

Thermal Aircraft

Power Plant Integration

Virtual Test supporting Certification

Multiple BDA platforms
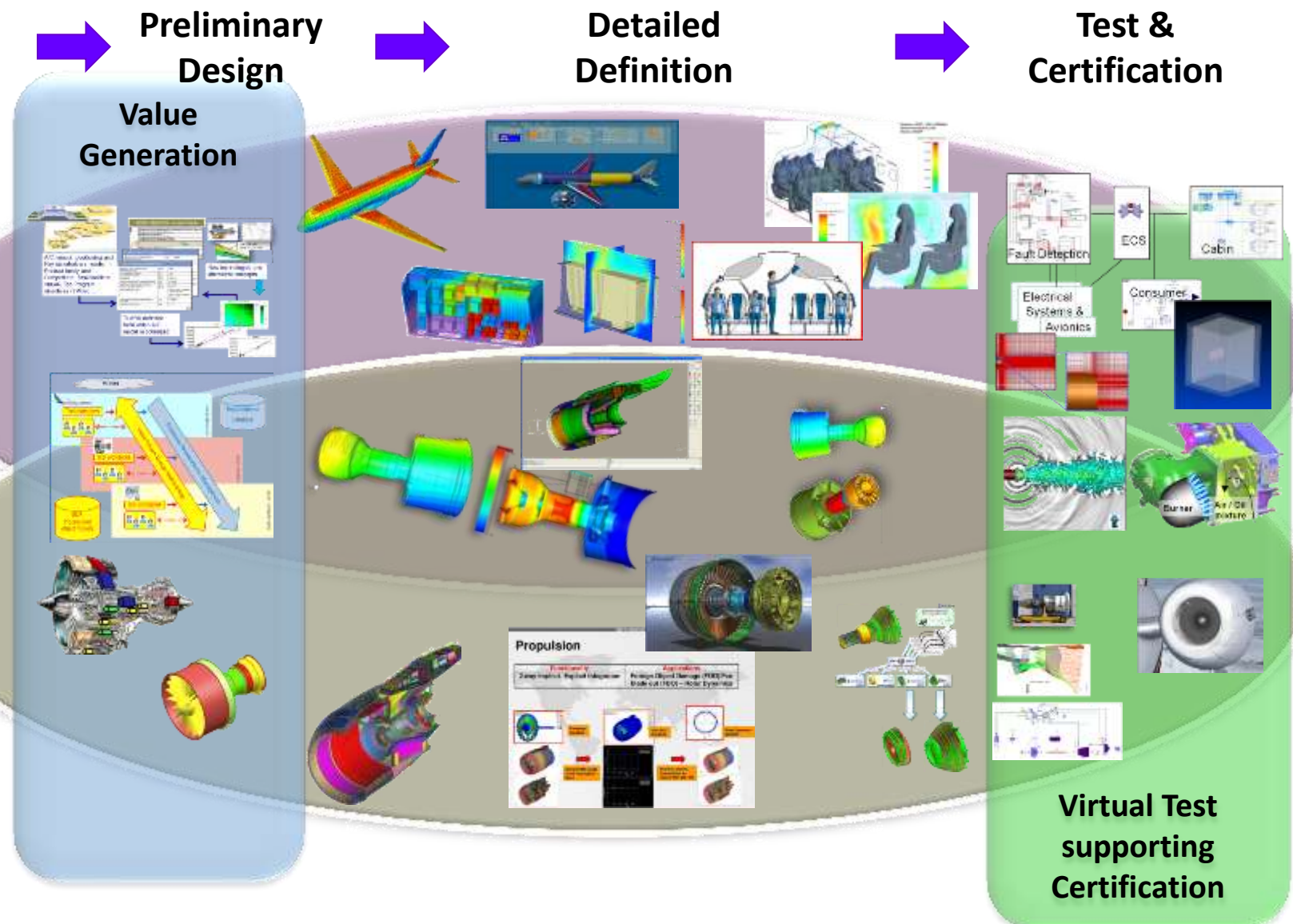
10 – 100 BDA Platforms across partner companies

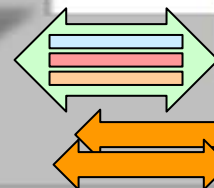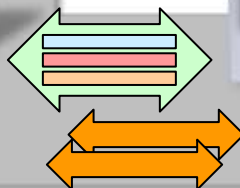**Company A : OEM**   e.g. MSC Software

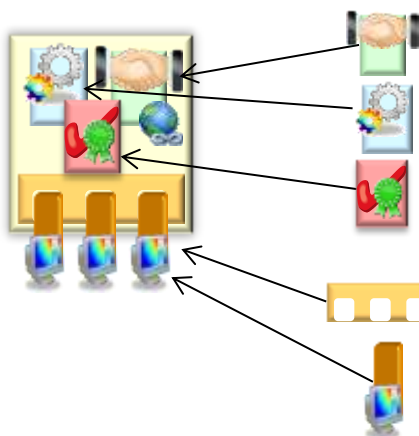**Company B: Partner**   e.g. DS SIMULIA

Company C: Supplier   e.g. TEAMCENTER

Collaboration Standard
• Connect & control global processes
• To be formalised as "SE" DEX mapped to AP233 & AP239/PLCS

Technical Standard(s) enabling exchange of detailed data e.g. AP209, AP242, neutral & vendor formats, ...

Multidisciplinary process orchestration, data management and collaboration services

Standard specification of BDA Functions supporting collaboration across companies

➔ *Generic BDA Platform Architecture Specification*

Behavioural multi-physics data generation, modelling methods And simulation tools

Specialised BDA Engineering Methods / Tools supporting different company roles

➔ *Multiple BDA Platforms Deployed*

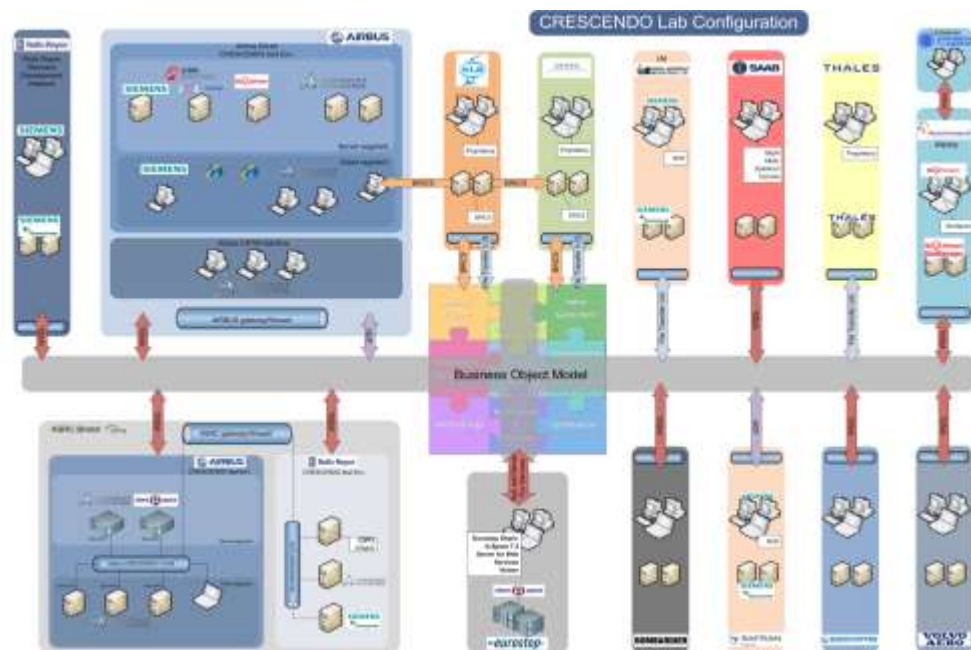# Federated Validation Platform

Network of industry labs:
– Test installation of the prototype solutions
– Verify functionality
– Validate application of the BDA collaborative capabilities and engineering methods
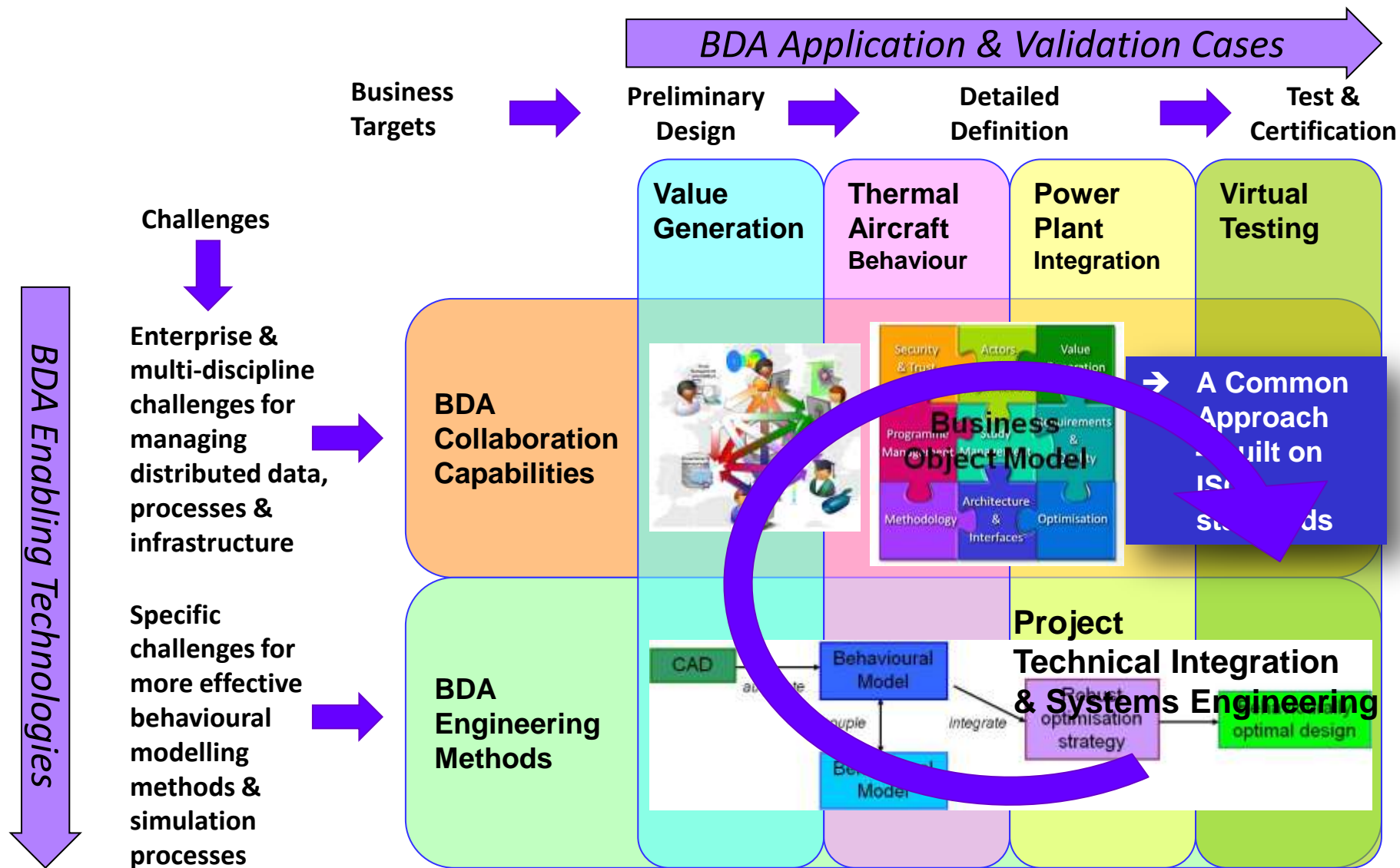– Run test case scenario processes in more realistic environments
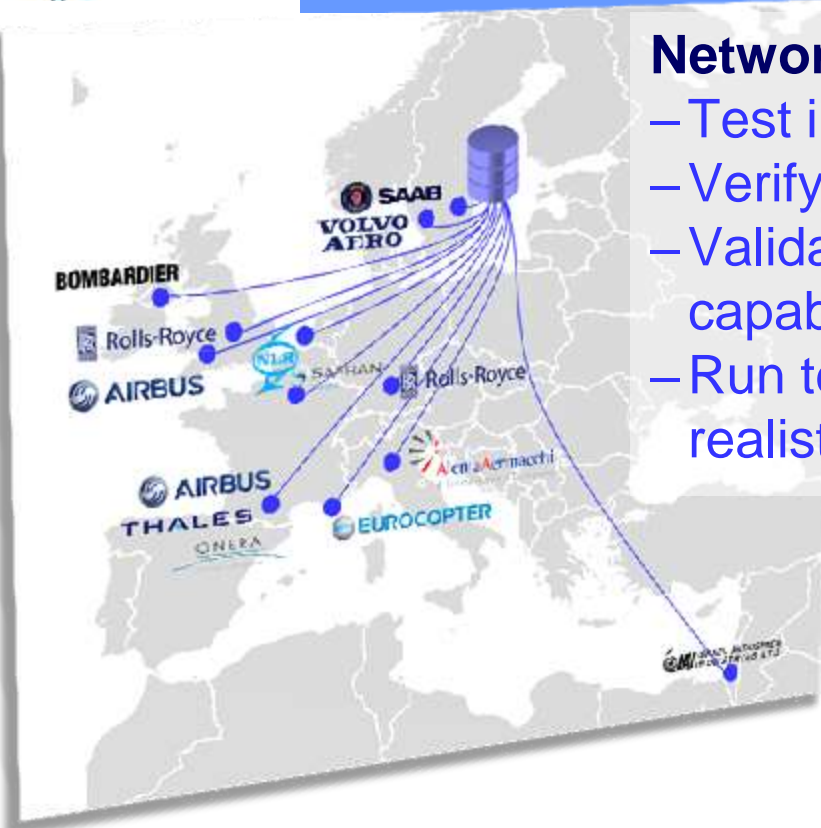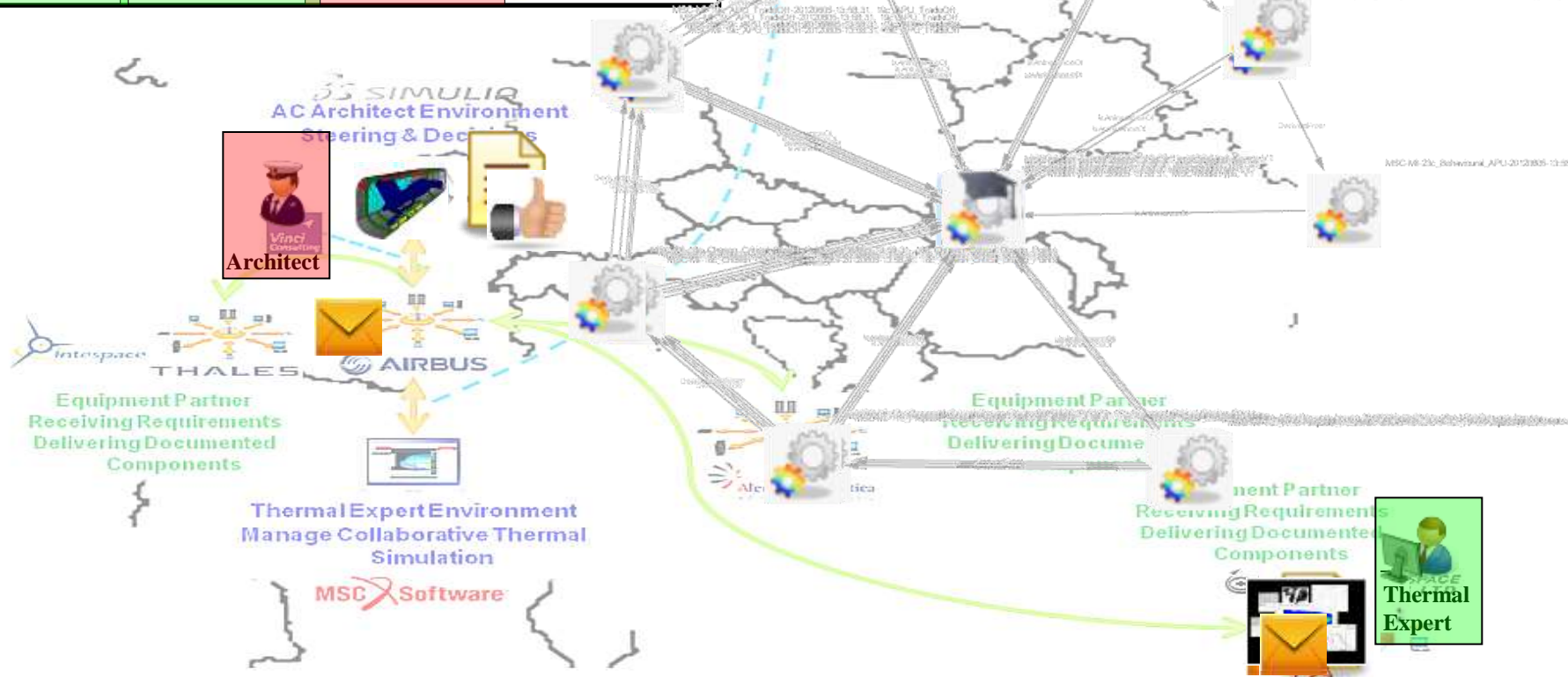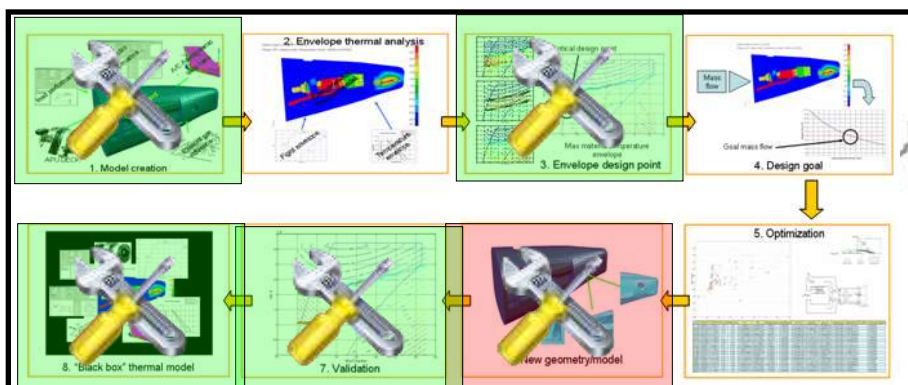
Communication formats:
– WSDL (XML based language)
– Manual file transfer (UI) + proprietary (sDM, BRICS, ...)

Main areas of interrelated technical results

BDA Application & Validation Cases

| Business Targets | → | Preliminary Design | → | Detailed Definition | → | Test & Certification |

Value Generation | **Thermal Aircraft** Behaviour | **Power Plant** Integration | **Virtual Testing**

Challenges

BDA Enabling Technologies

Enterprise & multi-discipline challenges for managing distributed data, processes & infrastructure → **BDA Collaboration Capabilities**

Business Object Model

→ A Common Approach built on ISO standards

Specific challenges for more effective behavioural modelling methods & simulation processes → **BDA Engineering Methods**

Project **Technical Integration & Systems Engineering**

APU Compartment Preliminary Thermal Design Process
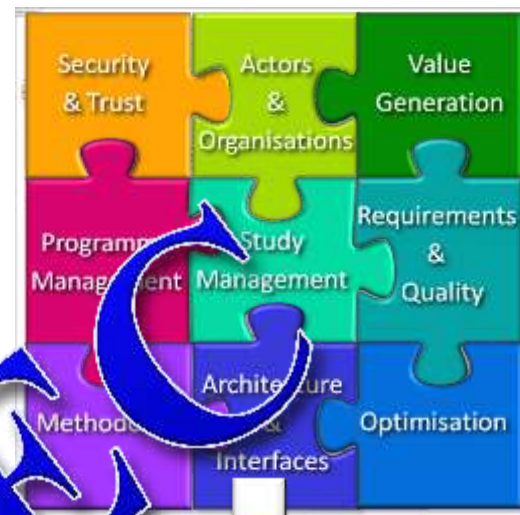
Anticipated benefits

- **CRESCENDO has enabled the BDA dataset**
  - New processes and engineering methods have been developed
    - **to enable value driven development and meet stakeholders expectations**
    - **to eliminate risk early in the design process**
    - **to accurately predict operational and functional behaviour through more sophisticated multi-physics analysis and optimisation**
    - **to reduce need for repeat physical testing**
    - **to prepare certification based on simulation**
- **CRESCENDO has enabled the BDA enterprise**
  - New collaboration capabilities have been developed
    - **to support multiple partners and multi-disciplinary teams working across the extended enterprise**
  - New software functionalities have been developed
    - **to impact the IS vendors' product roadmaps**

- **Business Object Model provides the vocabulary, grammar and syntax of the BDA Collaboration Standard**

- **The plan is to develop a <u>D</u>ata <u>EX</u>change specification [DEX] providing a simplified interpretation of ISO 10303-239 (PLCS) as the underlying standard**

  – Each Class defined in the BDA Object Model becomes a Template in the BDA DEX defined using OMG SysML

ISO 10303-239:2012
ISO 10303-239:2012