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Siemens Corporate Technology | April 2013

Real-world Modeling Issues in Virtual Teams

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DISCLAIMER

This presentation is

- subjective
- just my personal opinion of what we have tried so far
- not an official statement of Siemens or any other organization
- intentionally ignorant of potential solutions and “best practices”

In other words

Q: “What is the plural of anecdote?”

A: “Data.”

My two goals:

1. Deliver a plain and simple description of real-world issues
2. Start a good discussion with my “cry for help”!

Agenda

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- Introduction to the RACE Project
- Modeling in Enterprise Architect
- Real-world Modeling Issues
- But There's a Silver Lining: What Worked for Us
- Summary

RACE: Robust and Reliant Automotive Computing Environment for Future eCars

Bundesministerium für Wirtschaft und Technologie

WIRTSCHAFT. WACHSTUM. WOHLSTAND.

- Funded by BMWi
- Project Start: January 2012
- Duration: 3 Years
- Project Budget: ~20 Mio. Euro

- Project Based on Study „Mehr Software (im) Wagen“

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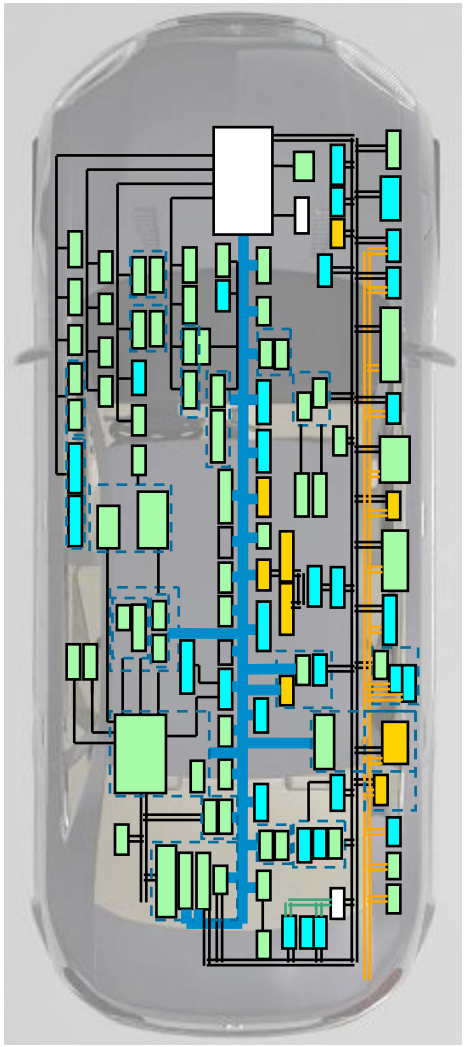
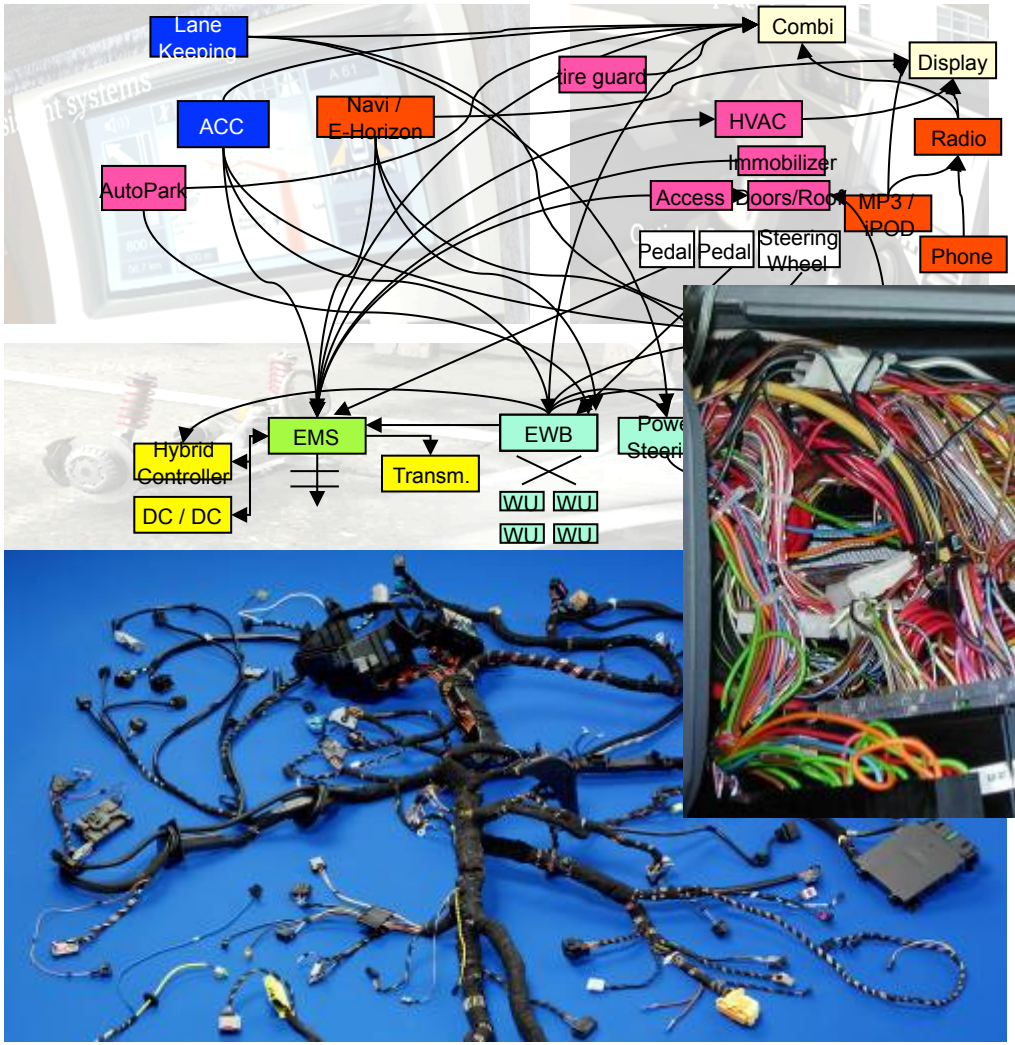
Universität Stuttgart | TUM | Fraunhofer AISEC | RWTH Rheinisch-Westfälische Technische Hochschule Aachen

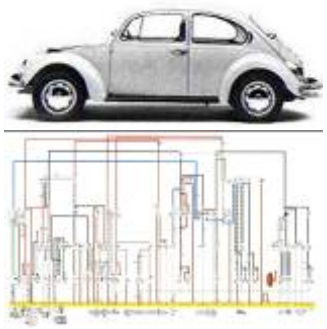
RACE Team

Information & Communication Technology (ICT)
Architecture „Today“

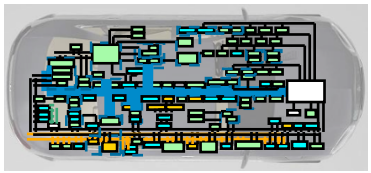




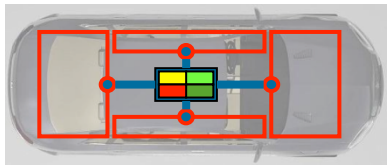
Time for a change – it happened before



Käfer 1971



Mittelklasse 2010



disruption

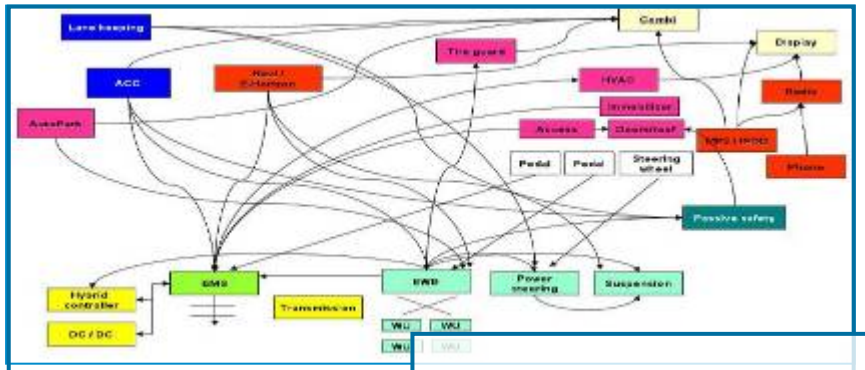
Information processing

Mechatronics

evolution

Mechanics

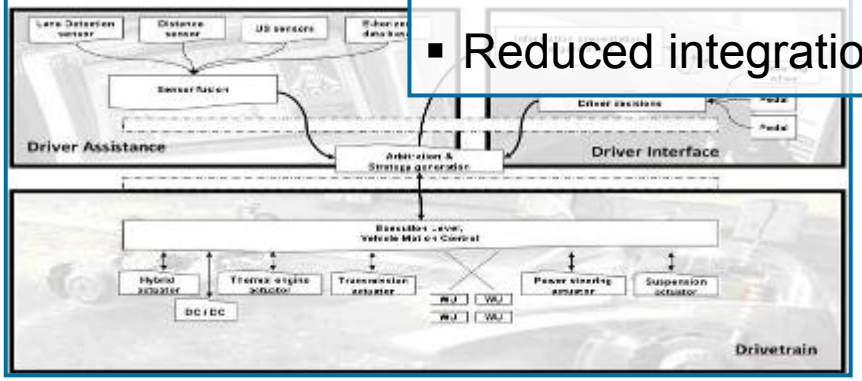
New ICT Architecture will add more functions without increasing complexity

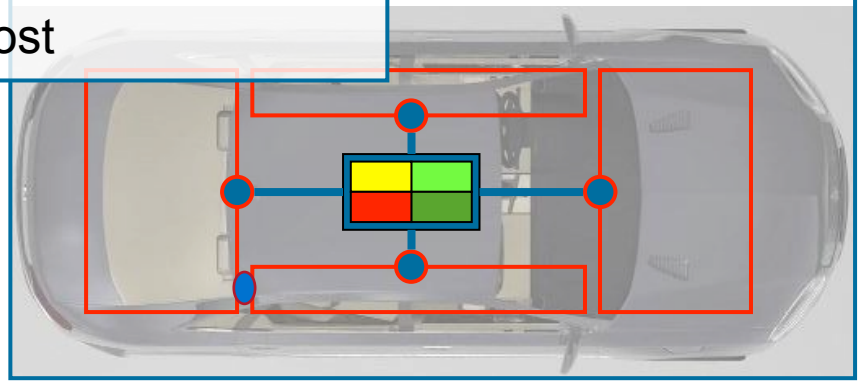


- Get rid of position oriented partitioning
- Well defined information flow
- Hierarchical decision making
- Plug & play capable

- Fewer controllers
- Easily less copper
- Fewer different connectors
- Plug & play capable

- Easier integration of new functions
- Advanced variant management
- Optimized development time
- Reduced integration cost

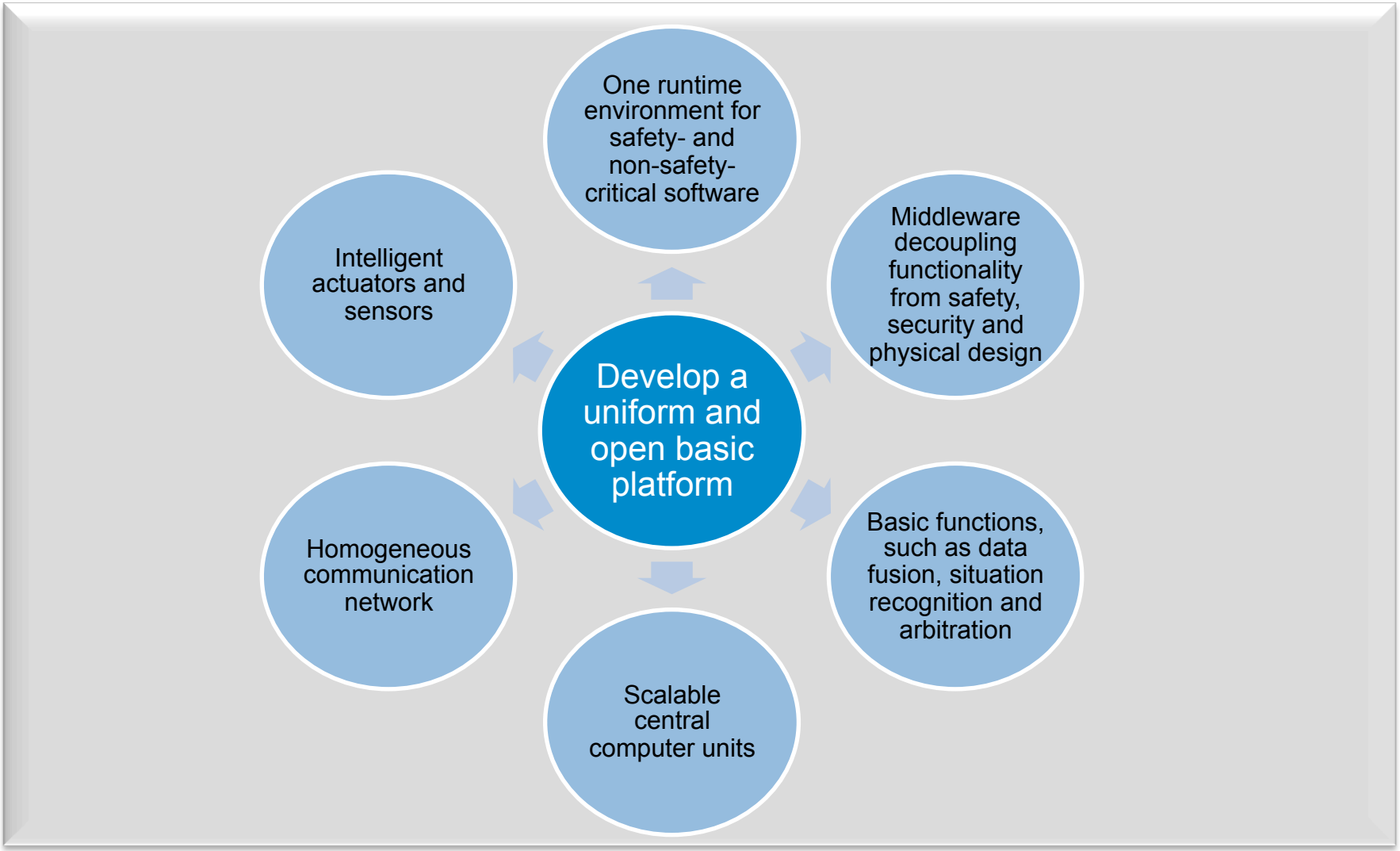




Project Goals

- Reduce the Complexity of the ICT Architecture
  (through a uniform and open basic platform)
- Support New and Complex Functions in the ICT Architecture
  (i.e. autonomous parking)
- Plug & Play Capability of the ICT Architecture
- Certification Capability of the ICT Architecture
  (e.g. ISO 26262 “Road vehicles – Functional safety”)
- Demonstrate a Migration Path

A Uniform and Open Basic Platform

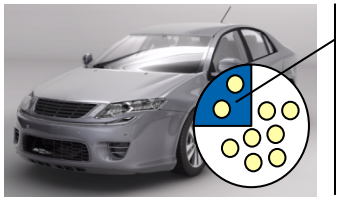


Two Prototypes

Reduce complexity + Proof of functionality

“Migration / Evolution Car”

- The car is based on a standard OEM vehicle.
- One block of functions (e.g. lateral dynamics, longitudinal dynamics, energy mgmt.) is realized with the new System Architecture.
- All other functions are still based on the conservative architecture.
- New System Architecture and standard Architecture are connected via gateway.

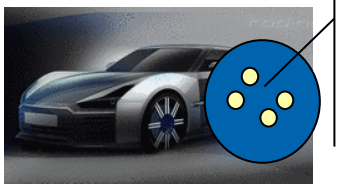


[Siemens]

All standard functions of a car are realized. But **just a selected amount** of functions is based on the **new System Architecture.**

“Revolution Car”

- The car is based on a new kind of car.
- All functions (e.g. accelerate, decelarate, energy mgmt., HMI) is realized with the new System Architecture.
- No integration of functions which are based on conservative architecture.
- Single hardware devices might be connected via gateway
- The goal is pure Drive-by-Wire with redundant electronics.



[Roding]

All functions are based on the **new System Architecture**. **But** just a **small amount** of possible functions are realized.

Agenda

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Introduction to the RACE Project

Modeling in Enterprise Architect

Real-world Modeling Issues

But There's a Silver Lining: What Worked for Us

Summary

Enterprise Architect (EA) by Sparx Systems

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Why EA?

- Seems to be quite popular nowadays
- Typically seen as a “low barrier” entry to modeling in general
- Licenses are comparatively cheap (~$300)
- Promises to be “one tool to rule them all”
- Somewhat “lowest common denominator”
  - PowerPoint & Visio users are welcome
  - Model-based capabilities

However

- GUI-equivalent of Unix command line options

```
usage: ls [-ABCFGHLOPRSTUW
abcdefghiklmnopqrstuwx1] [file ...]
```

Key Capabilities of EA for Virtual Teams

The Daily Routine of an EA User

An Ideal Modeling Cycle

Update

- Get all changes from a central repository

Understand

- Review what has been added or changed

Contribute

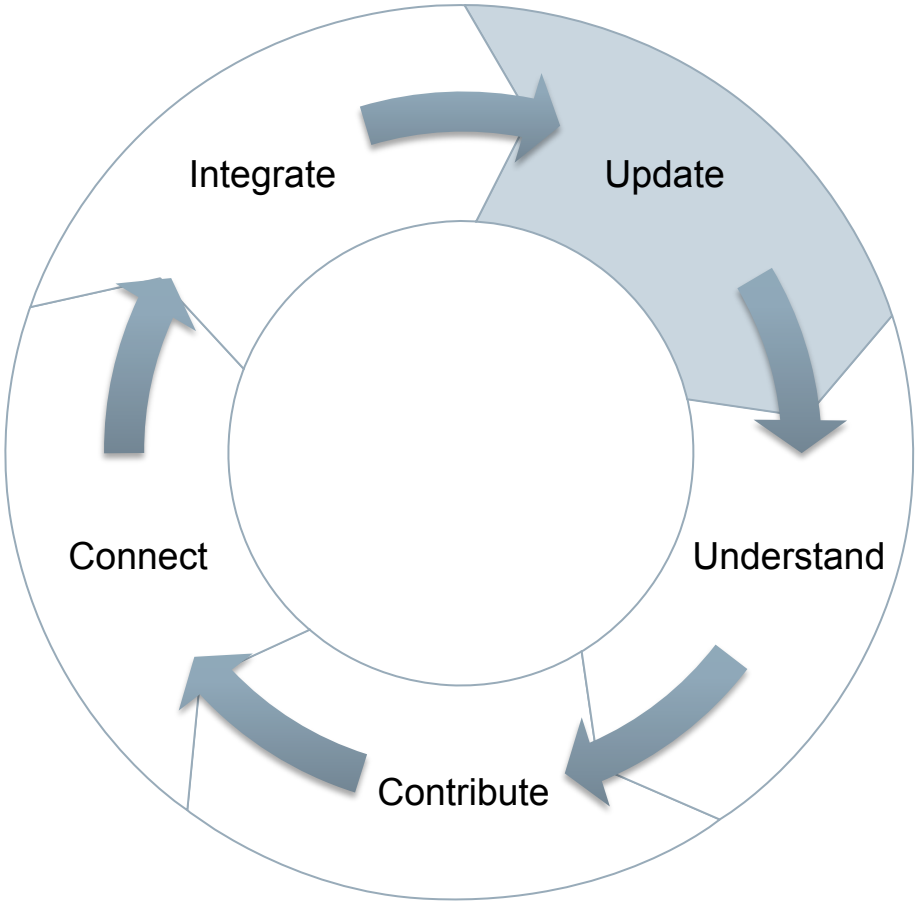
- Improve the existing model or add new model parts

Connect

- Ensure that traceability (up, down, sideways) is maintained

Integrate

- Commit changes to the central repository
- (Re-) Build all derived specifications



The Requirements-related Model Branches*

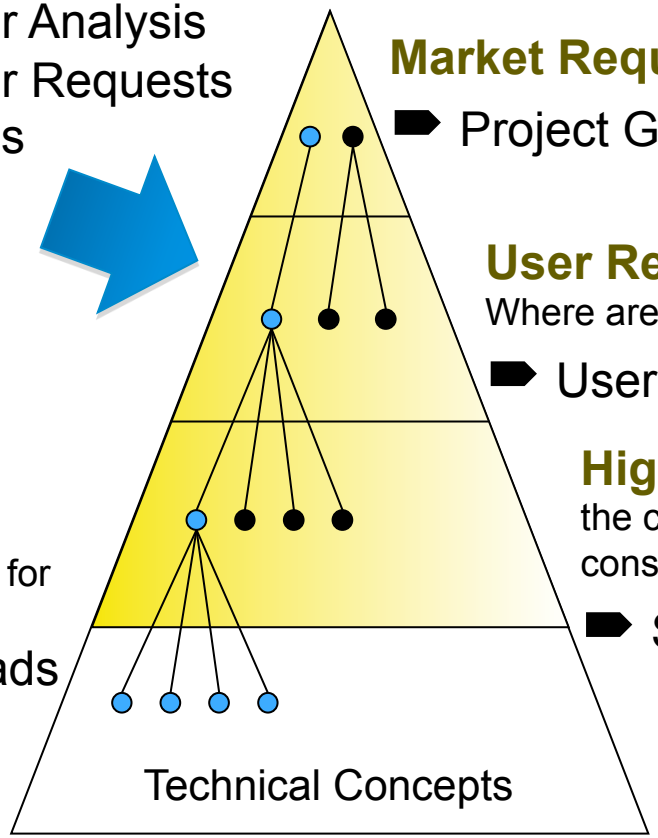
Requirements Engineering: How do we "write" requirements and why?

- Requirements Engineering Plan (some excerpts follow)

* in EA terminology

RE Input: What are our sources?

- Stakeholder Analysis
- Stakeholder Requests
- User Stories
- Scenarios
- Glossary



Market Requirements: Why are we developing the system?

- Project Goals, Vision and Scope

User Requirements: What will users do with the system? Where are the system boundaries?

- User Requirements Specification

High-level System Requirements: What are the core functions? What are the development goals and constraints?

- System Requirements Specification

Low-level System Requirements and Derived Design: How will we build the system?

- Architecture Specification

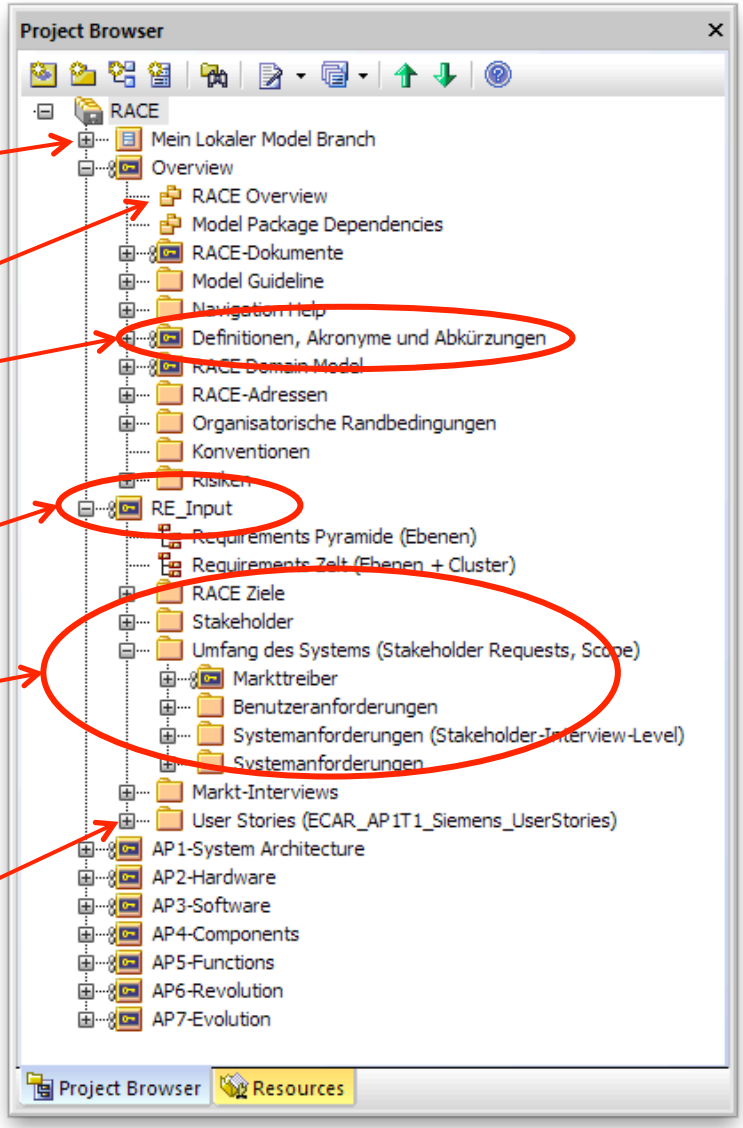
What are examples for **excluded** sources?

- E-Mail Threads
- Meeting Minutes

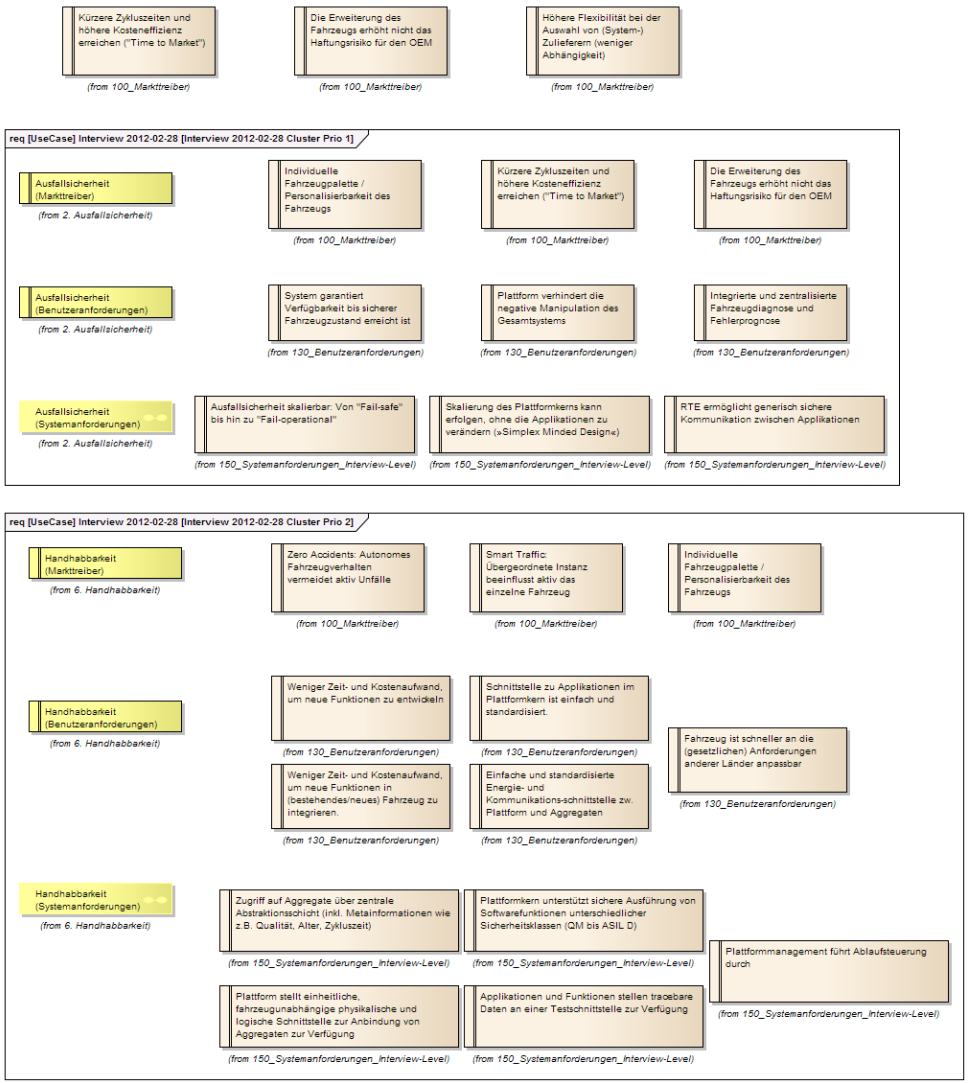
Model Organization (1/3)

Overview, RE_Input

- Recommended place for „thought-intensive“, local (not shared and version controlled) model **creation**
- Start diagram for RACE model „Overview“
- Project Glossary
- Requirements Input for our project shall be refined and used as rationale
  - RACE Goals
  - Stakeholder List
  - Stakeholder Requests
- Preliminary Work: „Siemens User Stories“

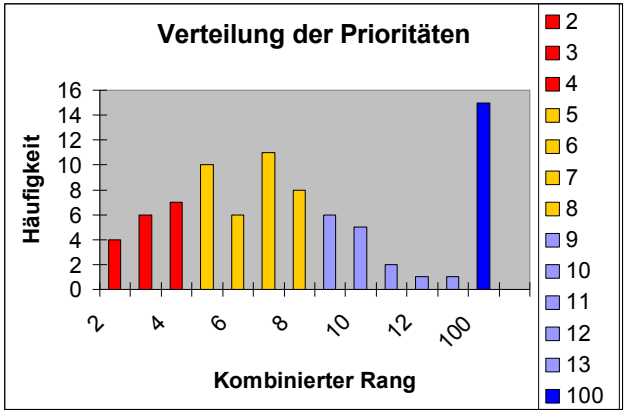


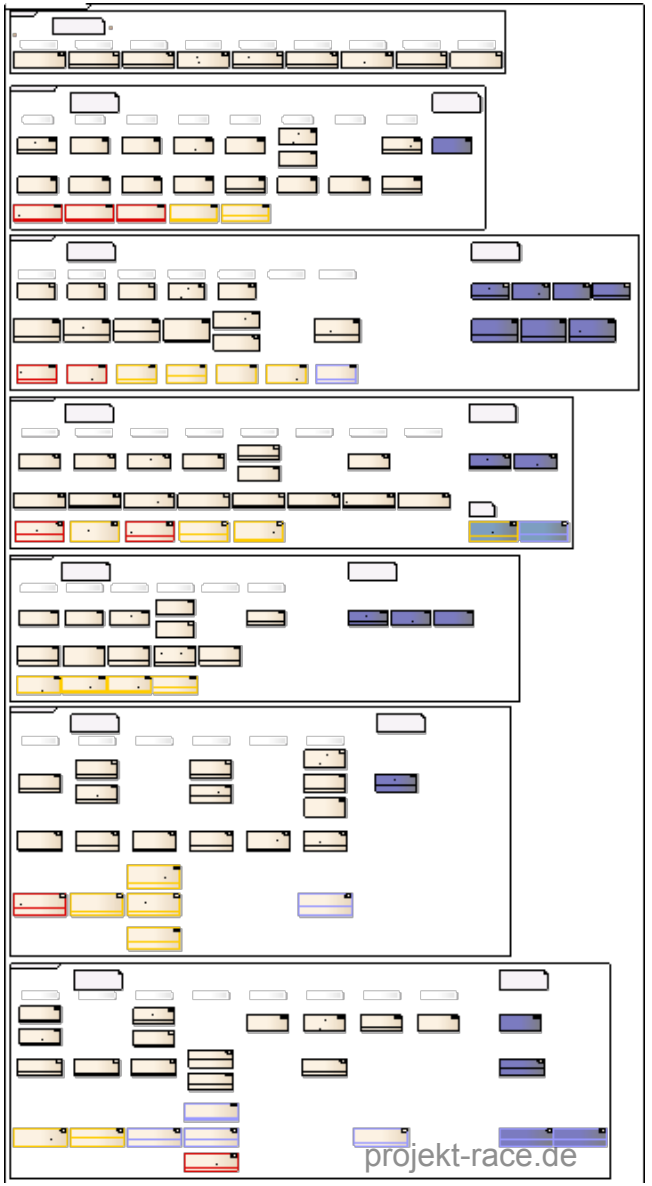
Sample Stakeholder Interview Results



Our Rankings Poster

- Requests are ranked from left to right by Interviewees
- 6 Quality Clusters are ranked top to bottom
- In each quality cluster there are our three levels of abstraction (market, user, and system)
- The colors on system level are coarse priorities derived from absolute ranking
- Eliminated requests are bluish/gray all the way to the right
- Sometimes requests have exactly the same rank

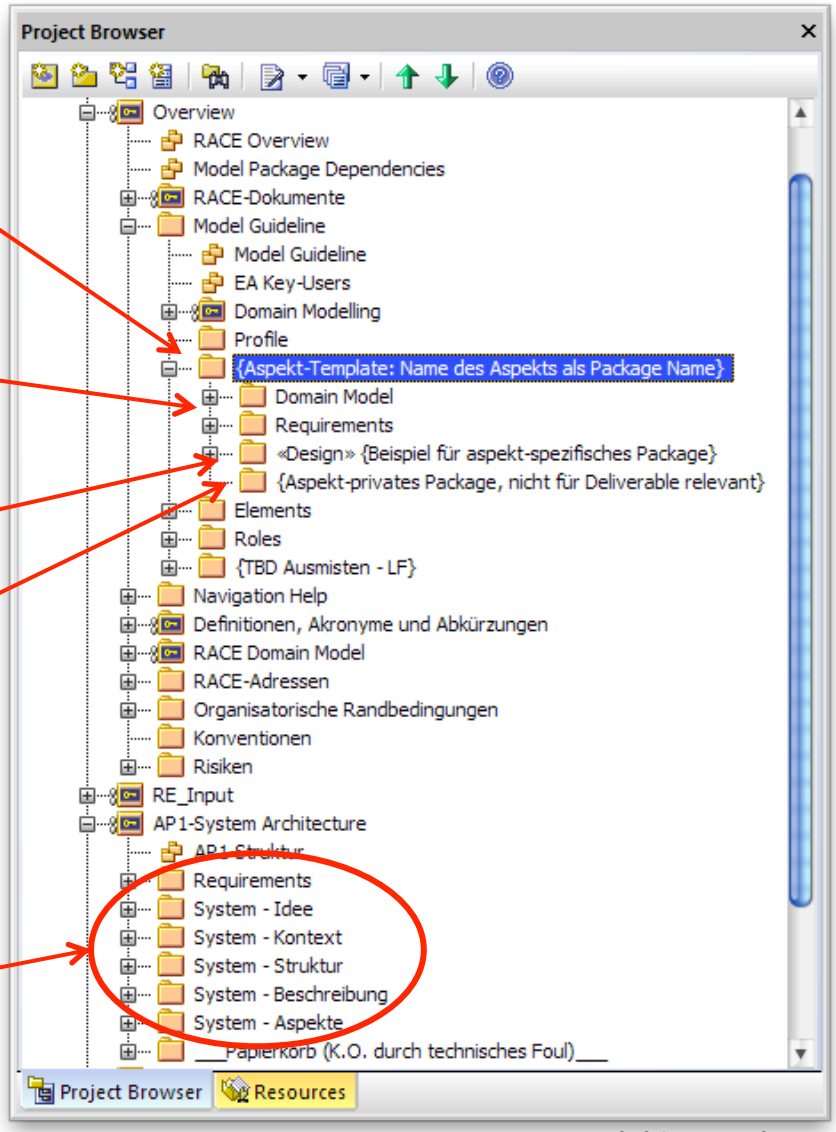




Model Organization (2/3)

Aspect Template, AP1

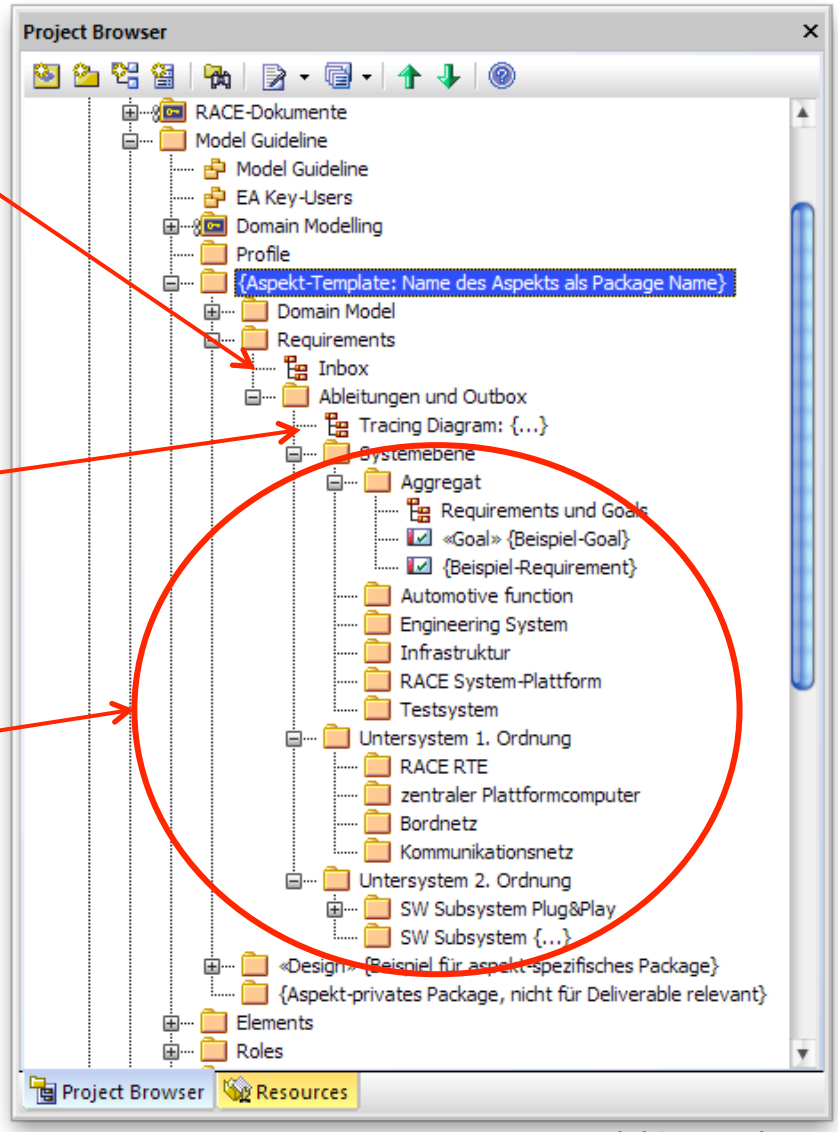
- Model Guideline shows template for model **Aspects**
- „Mandatory Subpackages“:
  - (Aspect-specific) **Domain Model**
  - **Requirements**
- «Design» Subpackages (Package Stereotype)
- {Temp for Drafts, TBDs, etc.}
- Workpackages (APs), e.g.: **AP1-System-Architecture**
  - AP1 Requirements (only Inbox)
  - System Description
  - Aspects



Model Organization (3/3)

Mandatory Subpackages in Requirements

- Inbox:
  - Contains model elements that should be processed
  - Results of refinements should be shown in a Tracing Diagram
- Refinements and Outbox:
  - Tracing Diagram(s), can be multiple if complex trace relationships
- Defined Outbox Structure:
  - Follows System Architecture (is just **one** aspect)



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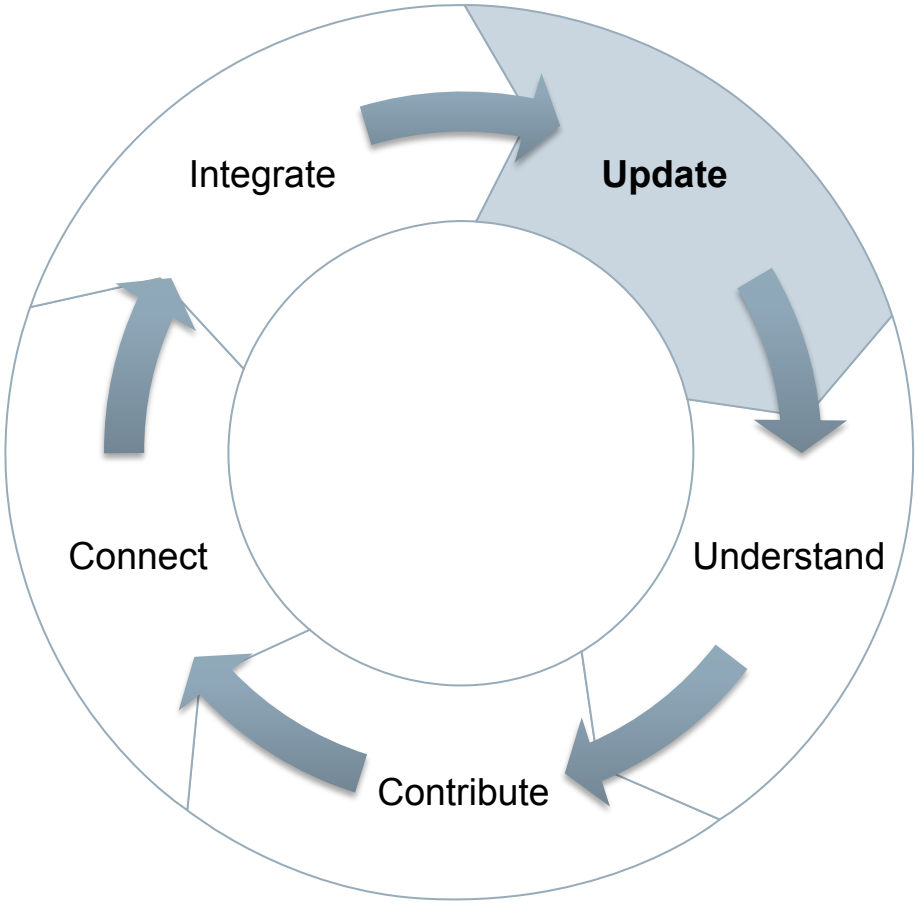
Issues when Updating the Model

The (almost) Daily WTFs[1)] of EA Users

Network and Security; (Circular) References

- Corporate **firewalls** necessitate proxy use, but proxies behave differently, sometimes
- Tools do not consistently react to **network issues**
- Corporate security tools **(virus protection)** interfere with local working copy
- Separate XMI files for various model branches can necessitate **complete rescan**
- Diagram contents are never stable, as shared elements may require **re-layouting** after updates
- “External Reference” = something went wrong
- Alternate images do not work consistently (Bitmap images can be used to decorate model elements, but are stored differently)



1) “Why The Face?”, of course…

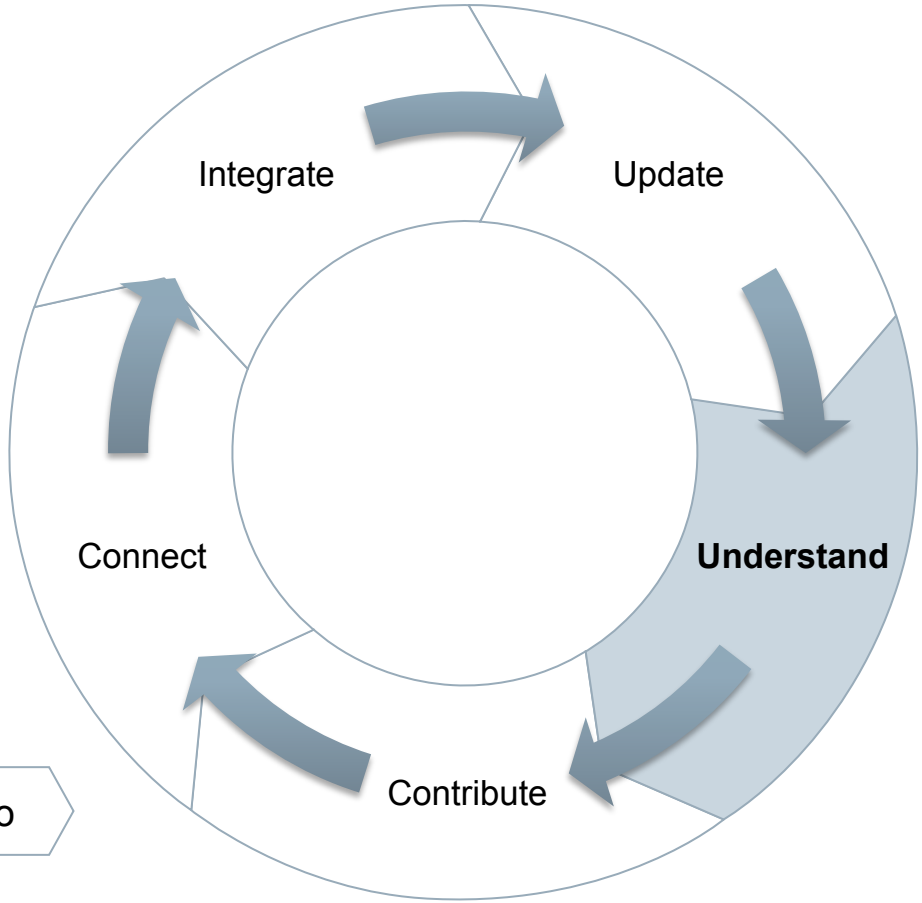
Issues Trying to Understand the Model

The (almost) Daily WTFs[1)] of EA Users

Culture; Tool Acceptance

- Software-, Electrical-, and Automotive-Engineering all use their **own (different)** models and notations
  - SysML is not (yet) a lingua franca
  - Even “model” means various things
- Company **culture and language** [cf. Hofstede]
  - Uncertainty Avoidance
  - Power Distance
- Consortium between Academia and Industry
- Spectrum of **tool acceptance:**

hostile → hesitant → embracing → gung-ho



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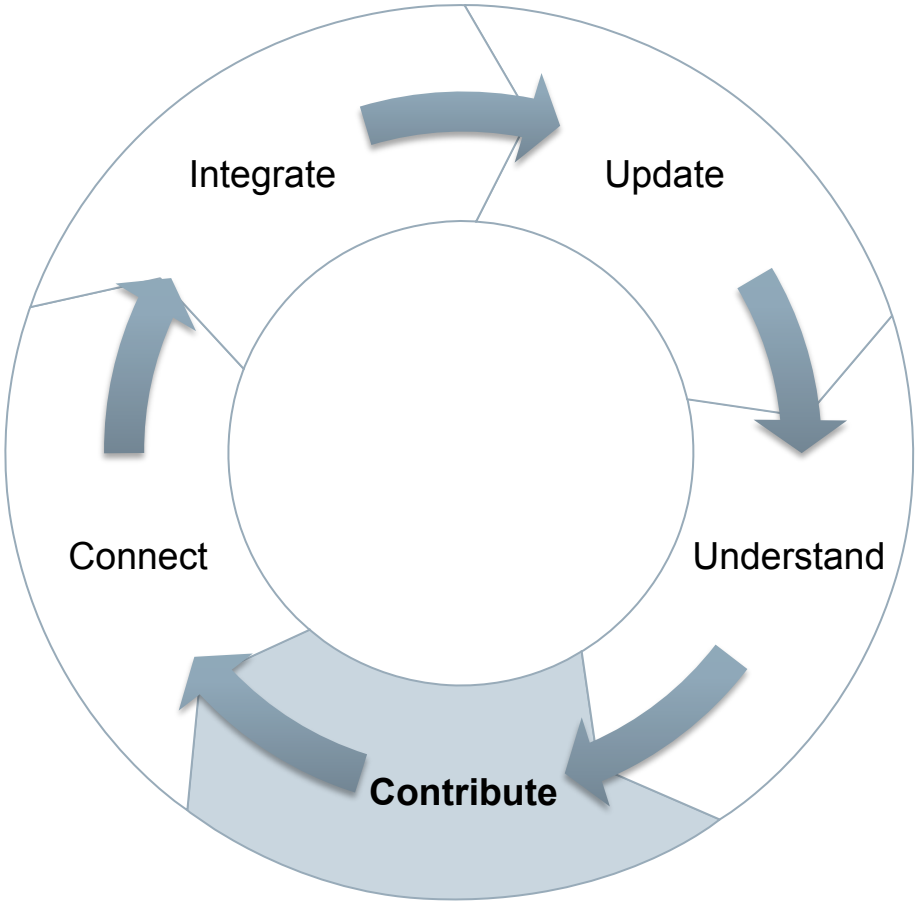
Issues when Contributing

The (almost) Daily WTFs[1)] of EA Users

Project Ramp-up; Status Tracking; Review

- Tool Configuration and Usage Guideline
  - cannot be completely **fixed a priori**
  - **too many options** to explore thoroughly
- Roles and Responsibilities
  - everybody waits
  - decision “process” undefined
  - role “creep” based on **personalities**
- Drafted, Discussed, and Decided model **elements live side-by-side**
  - how to distinguish them? (also in the specs)
- **Perception** of Progress
  - how far along are we?
  - writing and modeling is rarely the problem: who reads and **understands** the model?



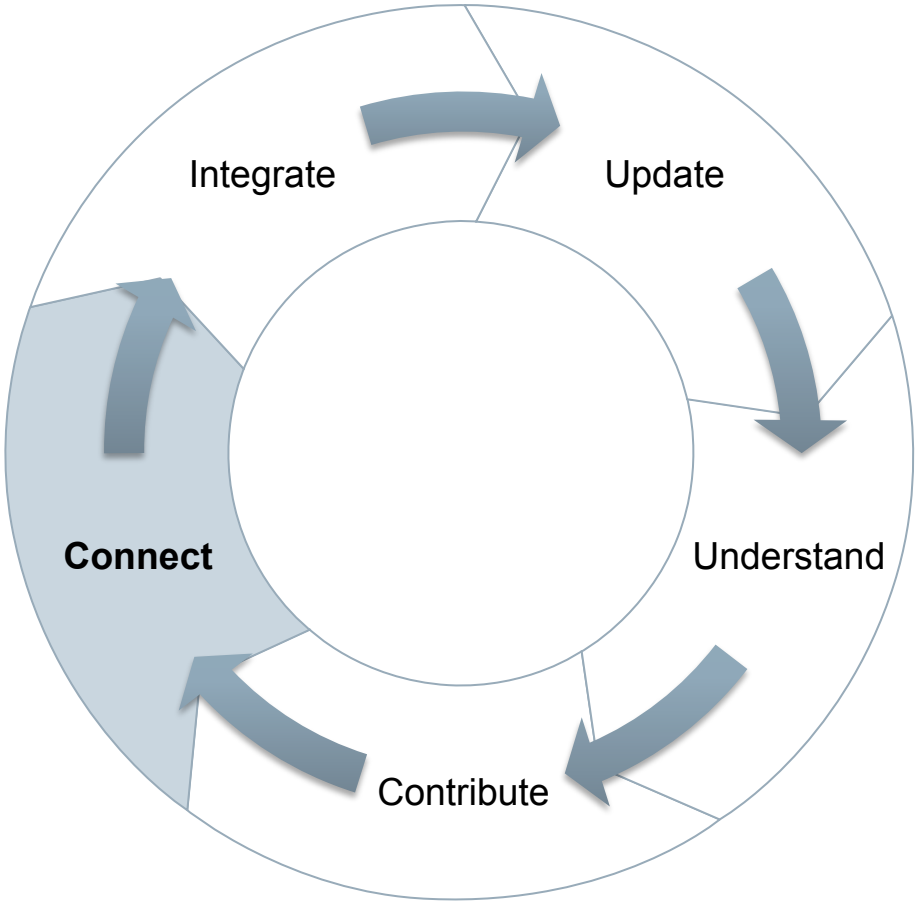
1) “Why The Face?”, of course…

Issues with Connecting to Existing Model Elements

The (almost) Daily WTFs[1)] of EA Users

Levels of Abstraction; Re-use of elements

- New and innovative systems of systems lack a **reference architecture** that effectively defines layers of abstraction
  - understandable across cultures (cf. above)
  - precise and concrete enough to add value
- Finding the appropriate element to re-use or even link to is **really difficult**
- **Quality criteria** of models degenerate quickly to formalisms that add little value



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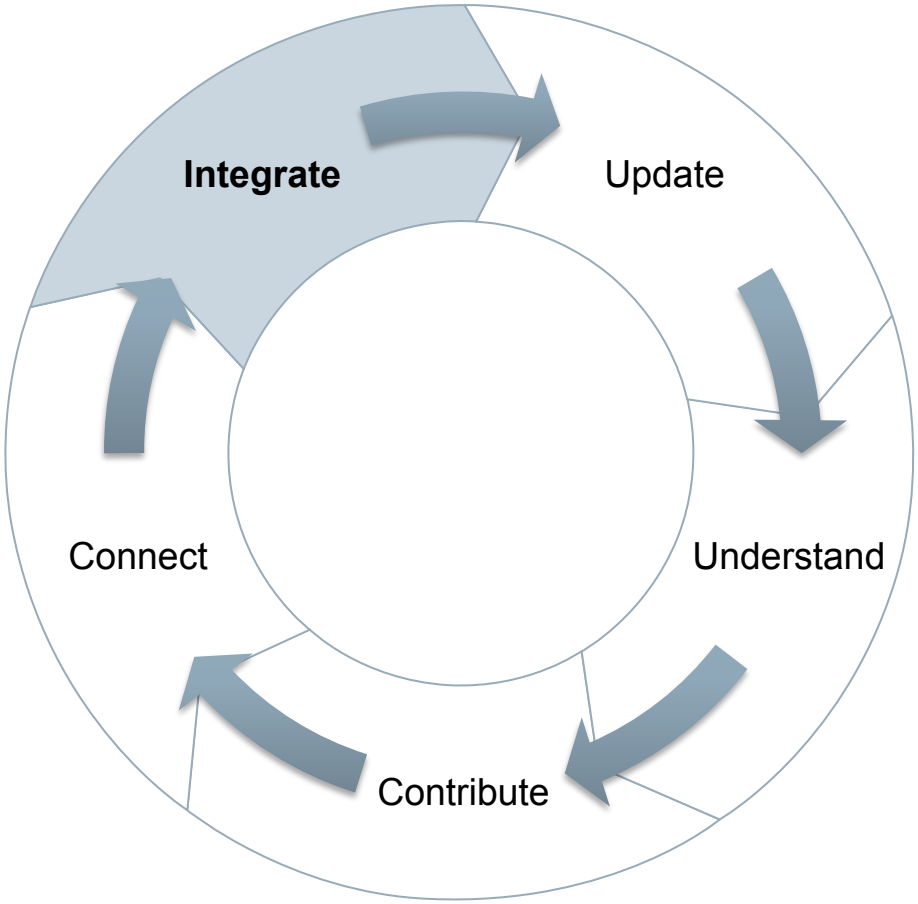
Issues when Integrating the Model

The (almost) Daily WTFs[1)] of EA Users

Readability; Multi-Purpose Models

- Linearization of tightly coupled model elements across multiple branches into **readable** documents is really hard
- One fully integrated model (every element exists exactly once) needs to serve **multiple purposes,** e.g.
  - structural decomposition
  - behavioral description
  - functional responsibilities
  - how can we keep all this **“as simple as possible”?**
- **How to demonstrate “quick wins”?**



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What Worked for Us

Our Lessons Learned

- Respect the differences in **culture**
- Focus on **friendly** collaboration
- Agree on an **index** (“single source”) for integration of documentation
- Expect the unexpected (tools are never perfect)
- Many different ideas and various perspectives can live concurrently in a “common” model
- Nothing is every easy.

Specialized Tools with Familiar Interfaces

- New and innovative systems have **many needs** for tool support
- People are familiar with a **variety of tools**
- Make a conscious trade-off between
  - **one for all** and
  - **one for each**

worrydream.com/ABriefRantOnTheFutureOfInteractionDesign/]

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Update	• Network and Security • (Circular) References
Understand	• Culture • Tool Acceptance
Contribute	• Project Ramp-up • Status Tracking • Review
Connect	• Levels of Abstraction • Re-use of elements
Integrate	• Readability • Multi-Purpose Models

Thank you for your attention.

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