

Experiences using a Process and Data Management System for CAE at AUDI

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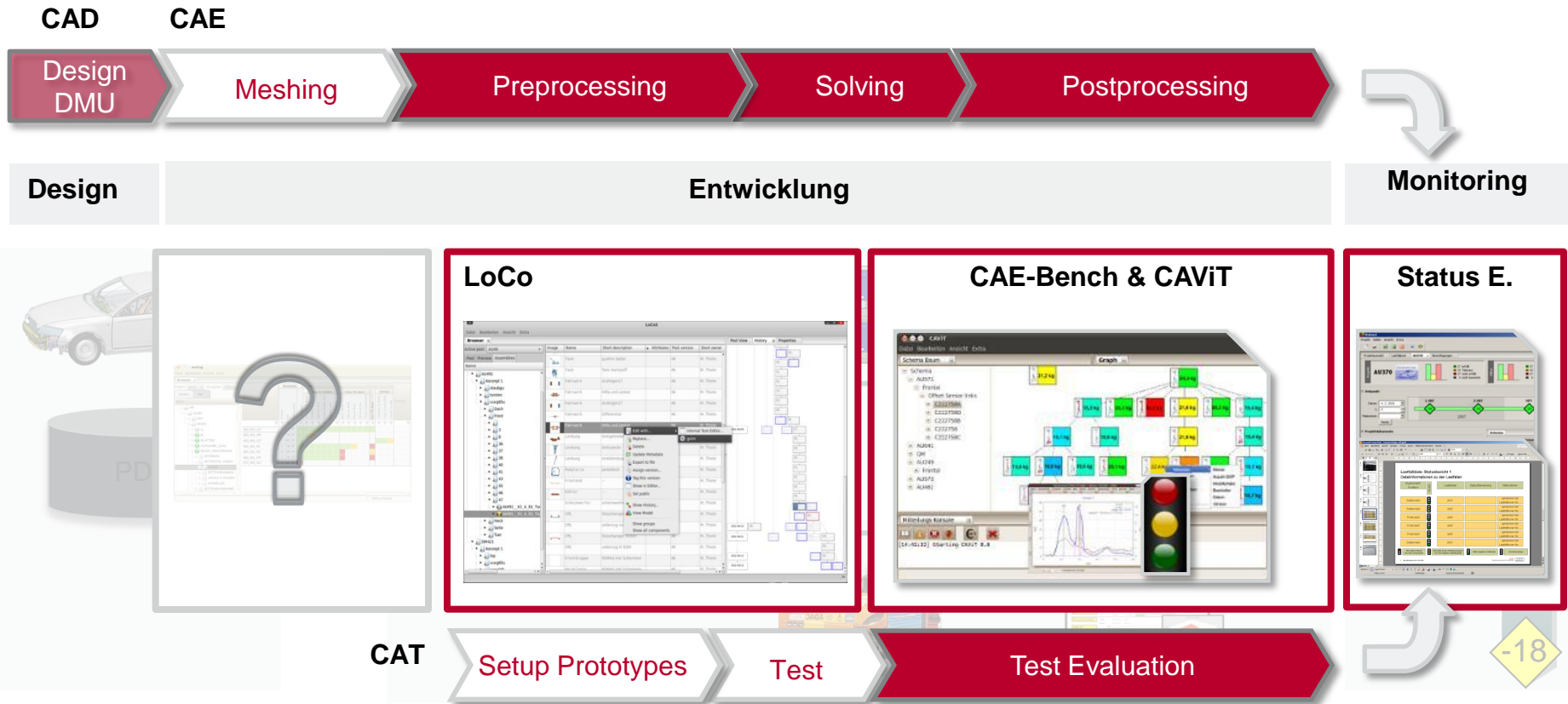
10.10.2012

Agenda

- ▶ Overview CAE process at AUDI
- ▶ Software Solution LoCo
- ▶ Modeling
- ▶ Current usage of LoCo
- ▶ Outlook



Overview CAE process at AUDI



Agenda

- ▶ Overview CAE process at AUDI
- ▶ Software Solution LoCo
- ▶ Modeling Aspects
- ▶ Current usage of LoCo
- ▶ Outlook



Software Solution: LoCo

Software System for handling of Input data for simulations

- ▶ Target group
 - ▶ CAE - Engineers
 - ▶ Project managers



- ▶ Motivation
 - ▶ **Synergy**
 - ▶ **Transparency**
 - ▶ **Consistency**
 - ▶ **Time savings**
 - ▶ **Homogeneity**

common access to common components

continuous documentation of all processing steps

synchronization of all data throughout the team

automation of many processing steps

standardizing the way of work

Software Solution: LoCo

▶ Key-Features of LoCo – *Load Case Composer*

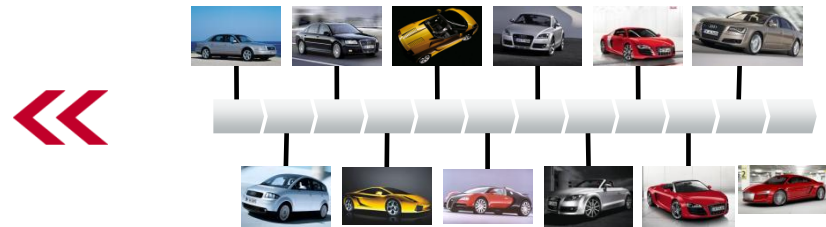
- ▶ **Team Work**
- ▶ **Handling vast amounts of Simulations**
- ▶ **Offline Usage**
- ▶ **Reuse of Components**
- ▶ **Parameterization**



Software Solution: LoCo

▶ Key-Features of LoCo – *Load Case Composer*

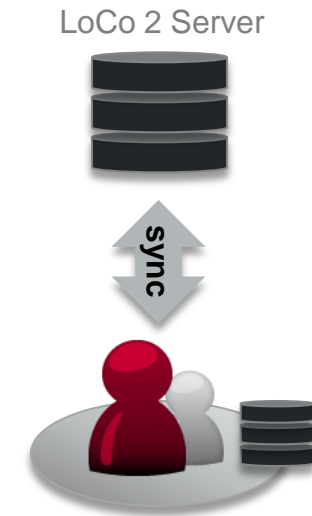
- ▶ Team Work
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Software Solution: LoCo

▶ Key-Features of LoCo – *Load Case Composer*

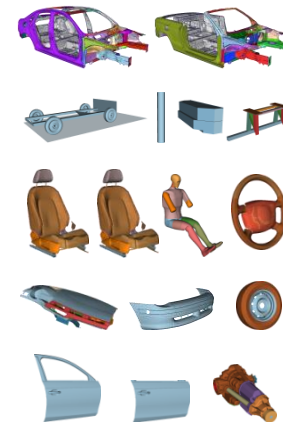
- ▶ Team Work
- ▶ Handling vast amounts of Simulations
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Software Solution: LoCo

▶ Key-Features of LoCo – *Load Case Composer*

- ▶ Team Work
- ▶ Handling vast amounts of Simulations
- ▶ Offline Usage
- ▶ Reuse of Components
- ▶ Parameterization



Software Solution: LoCo

▶ Key-Features of LoCo – *Load Case Composer*

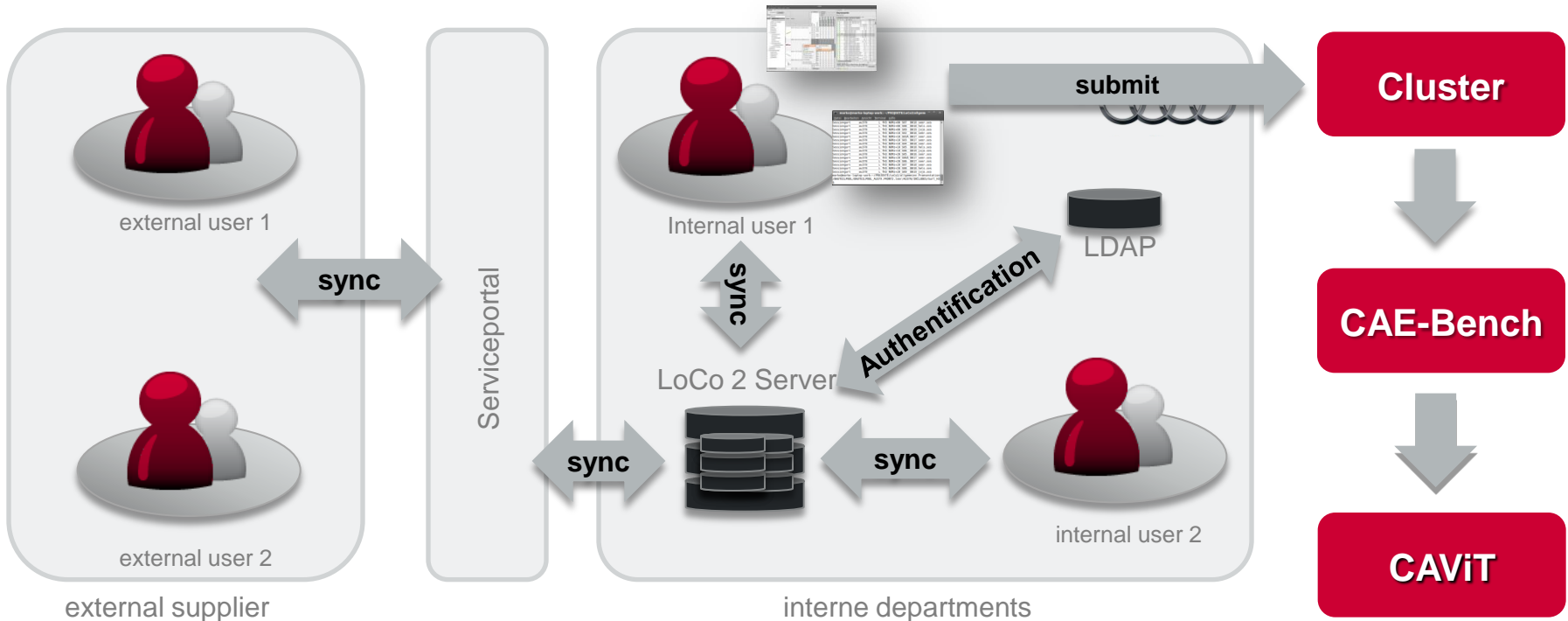
- ▶ Team Work
- ▶ Handling vast amounts of Simulations
- ▶ Offline Usage
- ▶ Reuse of Components
- ▶ Parameterization



airbag TTF	15ms
vent area	15ms
sheet thickness	1.2mm
calc time	100.1
friction	0.1

Software Solution: LoCo

► Workflow, Teamwork and Synchronization



Sync

decentralized

- Central data storage, but synchronization with local cache
- Offline handling of components (**RichClient**)

Offline

performance

- Users/Teams are independent of servers and infrastructure
- Users work with local data
- Better performance while using standard preprocessing tools



Software Solution: LoCo

► Reuse of components, parameterization and optimization

component pool



component parameters

airbag TTF	1.0mm
vent area	...
sheet thickness	... mm
calc time	1.4mm
friction	

►► Assembly of multiple derivatives / loadcases



►► Setup of parameter studies and optimizations

- Define parameter, range and objective
- Build multiple models at a stroke of a key



Software Solution: LoCo

► Innovative rich client technology for optimal performance

recognizability

- usability similar to standart tools
- same look and feel for everybody

Image	Name	Parent	Version	Author
	Tank			
	Tank			
	Fahrwerk			
	Fahrwerk			
	Fahrwerk	Alufelgen17	46	M. Thiele
	Fahrwerk	Differential	46	M. Thiele
	Fahrwerk	HiRa und Lenker	46	M. Thiele
	Lenkung	lenkgetriebe		
	Lenkung	lenksaeule		
	Lenkung	lenkteleskop		
	Pedalerie	pedalbock		
	Frontend	--		
	Kuehler	--		
	Scheinwerfer	scheinwerfer		
	CMS	Stossfaenger		
	CMS	ueberzug vo		
	CMS	Stossfaenger hinten	46	M. Thiele
	CMS	ueberzug hi NSM	46	M. Thiele
	Frontklappe	NSMAS inkl Scharniere	46	M. Thiele
	Heckklappe	NSMAS inkl Scharniere	46	M. Thiele



Software Solution: LoCo

► Innovative rich client technology for optimal performance

The screenshot displays the LoCo2 software interface. On the left, a 'Browser' pane shows a hierarchical tree of components under 'Active pool: AU49'. The main area features a table listing components with columns for Image, Name, Short description, Attributes, Pool version, and Short owner. A context menu is open over the table, listing actions such as 'Edit with...', 'Replace...', 'Delete', 'Update Metadata', 'Export to file', 'Assign version...', 'Tag this version', 'Show in Editor...', 'Set public', 'Show History...', 'View Model', 'Show groups', and 'Show all components'. On the right, a 'Pool View' pane shows a hierarchical diagram of components. A callout box highlights the 'clear arrangement' feature, listing 'listing of all relevant components' and 'thumbnails for easy perception'.

Image	Name	Short description	Attributes	Pool version	Short owner
	Tank	quattro Sattel		46	M. Thiele
	Tank	Tank Hamstoff		46	M. Thiele
	Fahrwerk	Alufelgen17		46	M. Thiele
	Fahrwerk	HiRa und Lenker		46	M. Thiele
	Fahrwerk	Alufelgen17		46	M. Thiele
	Fahrwerk	Differential		46	M. Thiele
	Fahrwerk	HiRa und Lenker		46	M. Thiele
	Lenkung	lenkgetriebe			
	Lenkung	lenksaeule			
	Lenkung	lenkteleskop			
	Pedalerie	pedalbock			
	Frontend	--			
	Kühler	--			
	Scheinwerfer	scheinwerfer			
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	Frontklappe	NSMAS inkl Schamiere		46	M. Thiele
	Heckklappe	NSMAS inkl Schamiere		46	M. Thiele

Software Solution: LoCo

► Innovative rich client technology for optimal performance

The screenshot displays the LoCo2 software interface. On the left is a 'Browser' pane showing a hierarchical tree of CAD models under 'Active pool: AU49'. The main area contains a table of parts with columns for Image, Name, Short description, Attributes, Pool version, and Short owner. A context menu is open over the 'HiRa und Lenker' part, listing actions such as 'Edit with...', 'Replace...', 'Delete', 'Update Metadata', 'Export to file', 'Assign version...', 'Tag this version', 'Show in Editor...', 'Set public', 'Show History...', and 'View Model'. A callout box points to the 'View Model' action, stating 'intuitive' and '► context sensitiv actions'.

Image	Name	Short description	Attributes	Pool version	Short owner
	Tank	quattro Sattel		46	M. Thiele
	Tank	Tank Hamstoff		46	M. Thiele
	Fahrwerk	Alufelgen17		46	M. Thiele
	Fahrwerk	HiRa und Lenker		46	M. Thiele
	Fahrwerk	Alufelgen17		46	M. Thiele
	Fahrwerk	Differential		46	M. Thiele
	Fahrwerk	HiRa und Lenker		46	M. Thiele
	Lenkung	lenkgetriebe			
	Lenkung	lenksaeule			M. Thiele
	Lenkung	lenkteleskop			M. Thiele
	Pedalerie	pedalbock			M. Thiele
	Frontend	--			M. Thiele
	Kühler	--			M. Thiele
	Scheinwerfer	scheinwerfer			M. Thiele
	CMS	Stossfaenger			M. Thiele
	CMS	ueberzug vo			M. Thiele
	CMS	Stossfaenger hinten		46	M. Thiele
	CMS	ueberzug hi NSM		46	M. Thiele
	Frontklappe	NSMAS inkl Schamiere		46	M. Thiele
	Heckklappe	NSMAS inkl Schamiere		46	M. Thiele

Software Solution: LoCo

► Innovative rich client technology for optimal performance

The screenshot displays the LoCo2 software interface. On the left, a 'Browser' pane shows a tree view of components under 'Active pool: AU49'. The main area contains a table with columns: Image, Name, Short description, Attributes, Pool version, and Short owner. On the right, a 'Pool View' pane shows a hierarchical tree of components, and a 'History' pane shows a timeline of actions from 2011 KW 09 to 2011 KW 13. A context menu is open over the table, listing options: Show History..., View Model, Show groups, and Show all components. A text box with the word 'traceability' and three bullet points is overlaid on the interface.

Image	Name	Short description	Attributes	Pool version	Short owner
	Tank	quattro Sattel		46	M. Thiele
	Tank	Tank Harnstoff		46	M. Thiele
	Fahrwerk	Alufelgen17		46	M. Thiele
	Fahrwerk	HiRa und Lenker		46	M. Thiele
	Fahrwerk	Alufelgen17		46	M. Thiele
	Fahrwerk	Differential		46	M. Thiele
	Scheinwerfer	Scheinwerfer			M. Thiele
	CMS	Stossfaenger			M. Thiele
	CMS	ueberzug vo			M. Thiele
	CMS	Stossfaenger hinten		46	M. Thiele
	CMS	ueberzug hi NSM		46	M. Thiele
	Frontklappe	NSMAS inkl Scharniere		46	M. Thiele
	Heckklappe	NSMAS inkl Scharniere		46	M. Thiele

traceability

- consistent documentation of each action
- comprehensive visualization of history
- cronologic presentation

Context menu options:

- Show History...
- View Model
- Show groups
- Show all components



Software Solution: LoCo

► Innovative rich client technology for optimal performance

The screenshot displays the LoCo2 software interface. On the left, a 'Browser' pane shows a hierarchical tree of assembly components, including 'AU491', 'Konzept 1', and various sub-components like 'Dach', 'Front', and 'Tuer'. The main window shows a table of parts with columns for Image, Name, Short description, Attributes, Pool version, and Short owner. A context menu is open over a selected part, showing options like 'Edit with...', 'Replace...', 'Delete', 'Update Metadata', and 'Export to file'. On the right, a 'Pool View' window displays a detailed BOM for 'V4.0 Barriere'. This window includes a table with columns for Component, Images, Comments, Reports, BOM, S, D, PID, PName, Thickr, and TotalMas. A summary at the bottom of the BOM window indicates 'Number of parts: 14' and 'Total: ?' with a breakdown of selection masses.

S	D	PID	PName	Thickr	TotalMas
✓		9807001	Deckplatte Stahl	...	20.00
✓		9807999	RIGIDWALL	1.00	68.688
✓	↑	9807002	Anschlussplatte Stahl	...	1.20
✓		9999000	Part Versionsnummer	1.00	3.915
✓		9808001	STAHL BAR Messbalken mit...	-	2.779
✓		9805001	DECKBLECH VORN	...	0.81
✓		9805002	DECKBLECH OBEN	...	0.81
✓		9805003	DECKBLECH UNTEN	...	0.81
✓		9806001	BUMPER-DECKBLECH	...	0.81
✓		9899003	TIED Part Klebekontakt Barr...	-	0.000
✓		9899002	TIED Part Klebekontakt Bu...	-	0.000
✓		9899001	TIED Part Klebekontakt Bu...	-	0.000
✗		9801001	BLOCK	...	-
✗		9802001	BUMPER	...	-

Bill of Materials

- overview for all parts and their respective masses
- „on the fly“ adjustments for thicknesses

Number of parts: 14
Total: ?
Total (Selection): 1.3 kg (S: 1.319 kg / N: 0.000 kg), dM: +0.000 kg



Software Solution: LoCo

► Innovative rich client technology for optimal performance

The screenshot displays the LoCo2 software interface. On the left, a 'Browser' pane shows a tree view of components under 'AU491'. The main area features a table with columns: Image, Name, Short description, Attributes, Pool version, and Short owner. A context menu is open over the 'HiRa und Lenker' component. On the right, a 'Pool View' window shows a detailed view of the 'Fahrwerk' component, including thumbnails and a large 3D model.

Image	Name	Short description	Attributes	Pool version	Short owner
	Tank	quattro Sattel		46	M. Thiele
	Tank	Tank Harnstoff		46	M. Thiele
	Fahrwerk	Alufelgen17		46	M. Thiele
	Fahrwerk	HiRa und Lenker		46	M. Thiele
	Fahrwerk	Alufelgen17		46	M. Thiele
	Fahrwerk	Differential		46	M. Thiele
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	Lenkung	lenkgetriebe			M. Thiele
	Lenkung	lenksaeule			M. Thiele
	Lenkung	lenkteleskop			M. Thiele
	Pedalerie	pedalbock			M. Thiele
	Frontend	--			M. Thiele
	Kühler	--			M. Thiele
	Scheinwerfer	scheinwerfer			M. Thiele

previews / thumbnails

- integrated generation of component pictures
- automatic tracking of changed parts



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Modeling Aspects

► A uniform model structure for all departments

► Components are at the same place for everybody

► Not everybody can edit any component (e.g. Materials)

► Responsible persons are in charge of

- Material
- Barriers
- Impactors
- Engiens
- Dummies
- ...

► Joint components where ever possible

Modeling Aspects

► A uniform model structure for all departments

The screenshot shows the LoCo2 software interface. On the left, a tree view displays a hierarchy of model components. The 'Barrieren' folder is highlighted, and its contents are listed below it. On the right, a table displays a list of barrier entries with various attributes. Red arrows point from the tree view to the corresponding rows in the table.

Name	Short owner	Image	Name	Short description	Attributes	Version	Creation time	Short
Datenbanken	14 M. Hasselbusch		Barriere	Dachstempel rechts	d -- -- d inc -- -- -- AU 1 49 -- --	4	03.05.2011 11:17	G. G
Material	16 M. Thiele		Barriere	Dachstempel links	d -- -- d inc -- -- -- AU 3 49 -- --	5	04.05.2011 17:36	G. G
Impaktoren	9 M. Hasselbusch		Barriere	ODB v40 Master	o -- -- f inc -- -- -- AU -- 49 -- --	3	03.05.2011 11:28	G. G
Barrieren	24 G. Geißler		Barriere	Wand	o -- -- f inc 56 -- u AU -- 49 -- --	2	08.04.2011 17:34	M. T
Positionierung Dachstempel	2 G. Geißler		Barriere	Wand Master	o -- -- f inc 56 -- u AU -- 49 -- --	3	03.05.2011 11:32	G. G
Positionierung	2 G. Geißler		Barriere	AZT 10 Grad f	z -- -- f inc 15 -- z AU -- 49 -- l	2	08.04.2011 17:34	M. T
Fahrbahn	9 M. Thiele		Barriere	AZT 10 Grad M	z -- -- f inc 15 -- z AU -- 49 -- l	3	03.05.2011 11:47	G. G
			Barriere	NHTSA-Heck Wagen V401	h -- -- h inc 80 -- f AU -- 49 -- r	2	08.04.2011 17:34	M. T
			Barriere	NHTSA-Heck L	h -- -- h inc 80 -- f AU -- 49 -- r	2	08.04.2011 17:34	M. T
			Barriere	NHTSA-Heck Master	h -- -- h inc 80 -- f AU -- 49 -- r	3	03.05.2011 11:57	G. G
			Barriere	AZT 10 Gr Heck Master	y -- -- h inc 15 -- z AU -- 49 -- l	3	03.05.2011 11:59	G. G
			Barriere	AZT 10 Gr Heck f	y -- -- h inc 15 -- z AU -- 49 -- l	2	08.04.2011 17:34	M. T
			Barriere	RCAR BUMPER Defoelem	r -- -- f, h inc 10 -- -- AU -- 49 -- m	2	08.04.2011 17:34	M. T
			Barriere	RCAR BUMPER Master	r -- -- f, h inc 10 -- -- AU -- 49 -- m	3	03.05.2011 11:51	G. G
			Barriere	EEVC Defoelem	e -- -- s inc 50 -- e AU -- 49 -- --	5	08.04.2011 17:34	M. T
			Barriere	EEVC Defoelem	e -- -- s inc 55 -- j AU -- 49 -- --			
			Barriere	EEVC Defoelem	e 6 -- s inc 50 -- -- AU -- 73 EU --			
			Barriere	EEVC Defoelem	e 6 -- s inc 55 -- -- AU -- 73 JP --			
			Barriere	EEVC Master	e -- -- s inc 50 -- e AU -- 49 -- --	3	03.05.2011 12:02	G. G
			Barriere	EEVC Master	e -- -- s inc 55 -- j AU -- 49 -- --			
			Barriere	EEVC Master	e -- -- s inc 55 -- j AU -- 49 -- --			
			Barriere	EEVC Master	e 6 -- s inc 50 -- -- AU -- 73 EU --			
			Barriere	EEVC Master	e 6 -- s inc 55 -- -- AU -- 73 JP --			
			Barriere	EEVC Wagen	e -- -- s inc 50 -- e AU -- 49 -- --	3	03.05.2011 12:40	G. G
			Barriere	EEVC Wagen	e -- -- s inc 55 -- j AU -- 49 -- --			



Modeling Aspects

Common modeling practice

▶ Goal

- ▶ Interchanging includes without the need of adaption
- ▶ Pushing cooperative use of common parts in simulations

▶ Motivation

- ▶ Less effort
- ▶ Less cost
- ▶ Faster responses

→ just agreement on numbering conventions will not do the job!



Modeling Aspects

How to achieve a common modeling practice?

▶ Numbering conventions

- ▶ The most important aspect and a good start, but left alone this will not suffice...

▶ Isolating individual components (Includes)

- ▶ Most important Rule:

A component shall never reference to something that is not defined within that same component!

- ▶ Conventions for standardized interfaces
 - ▶ Connectivity
 - ▶ Contact
- ▶ Clear rules for modeling
 - ▶ How to use barriers
 - ▶ How to do mass trim
 - ▶ ...



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Current usage of LoCo

240 registered users

▶ AUDI

- ▶ structural crash
- ▶ cockpit, seat, door trim
- ▶ occupant safety, sensory, out of position

▶ VW

- ▶ in preparation

▶ SEAT

- ▶ structural crash
- ▶ occupant safety

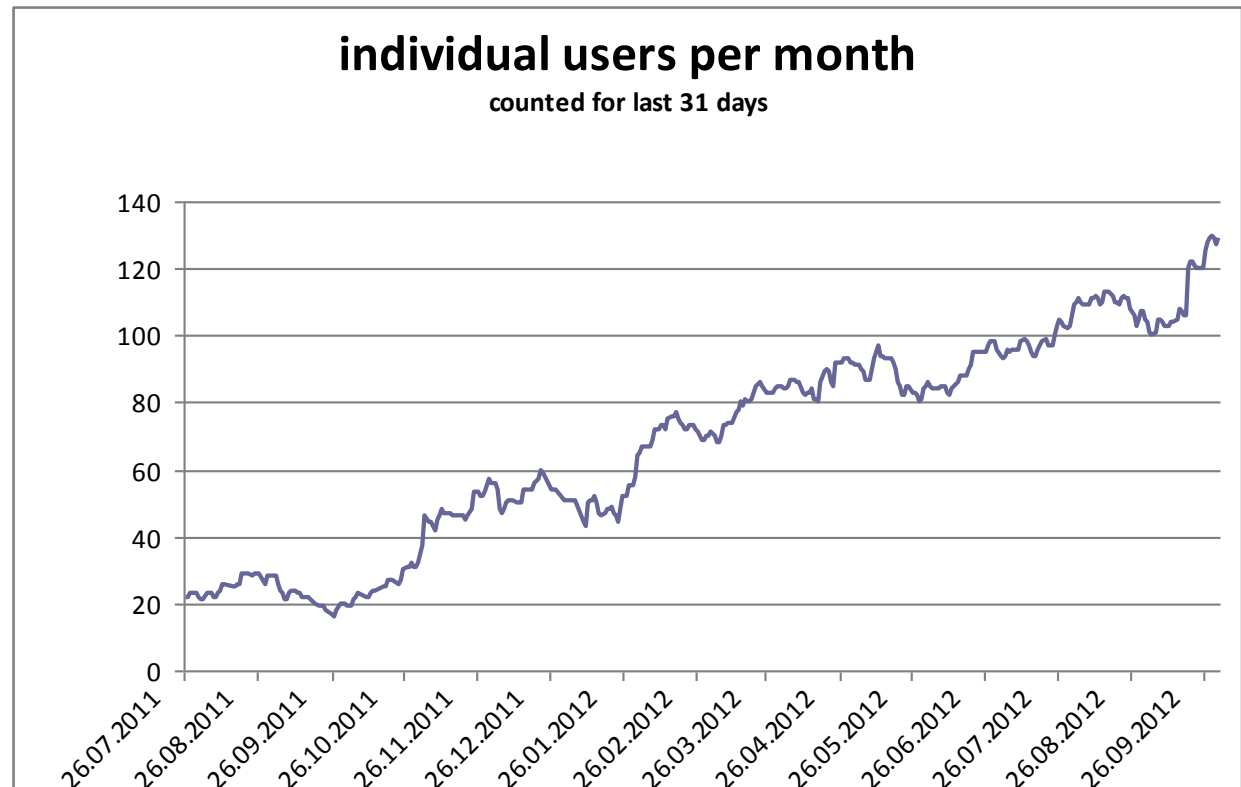
▶ VW-Osnabrück

- ▶ structural crash for AUDI

▶ Italdesign

- ▶ structural crash
- ▶ occupant safety, cockpit

▶ External suppliers



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Outlook

- ▶ Enforcing quality management
 - ▶ more checks
 - ▶ more restricted areas (e.g. barriers)
- ▶ Establishing a common project infrastructure
 - ▶ Throughout various projects
 - ▶ Including different disziplins
- ▶ Further increasing usability and performance of the LoCo rich client
- ▶ Using it together with the other brands of VW for platform development
- ▶ Support for meshing



Vielen Dank.