

MultiCAD (I-deas, NX, Catia V5) & MultiSite Collaboration using Teamcenter Engineering

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Date:-30 April 2006

Premium Partners:



Microsoft

Company Profile

- Company Name: Mahindra & Mahindra Ltd.
- Division: Automotive Sector
- URL: www.mahindraworld.com
- Location (s): India
- 2005 Revenues / Turnover: \$ 3.0 Bn.
- Number of Employees: Approx.15000
- Ownership profile (public / private): Public

Product and / or service lines

Mahindra Group

Mahindra & Mahindra

Mahindra Group Turnover \$3 bn

Other Group Companies

Automotive Sector



- Nasik ➔ SUV
- Kandivl ➔ UV
- Zaheerabad ➔ LCV

Farm Equipment



- Kandivl
- Nagpur
- Satellite
- MUSA

Trade & Fin



- MMFSL
- Mahindra Inter.
- MSSC

Infrastructure Development



- MHRIL
- GES
- MIPL

Information Technology



- MB
- MC
- BPO

MSAT



- MES
- Musco Steel
- Musco Stampings
- Siroplast
- Engines
- Gears &

STRATEGY Niche - UV focus
Exports growth

- total solutions
- global thrust
- local

MMFSL
-reach 200 branches
-focus semi-urban/rural mkts. for Auto/FES

MHRIL-grow Gold Standard segment, launch silver
GESCO-increase managed

Niche - Telecomm.
- SCM, SAP, BPO - focus on telecom

Leverage low cost mfg. and engg.skills

Mahindra Group Global presence

USA

Mahindra USA selling tractors in the US for over a decade; it sold 8000 for a 4% market share in 2004.



URUGUAY

M&M launched Bolero, renamed Simeron, in the country in early 2004 and sold 500 (the company is now eyeing Argentina and Brazil)

ITALY

in mid 2004, M&M launched Scorpio, renamed Goa, in the country; will serve as Europe HQ for the company (next move: Spain and France).

SERBIA

M&M's door into the booming Eastern European agriculture market (next stop: Bulgaria and Romania).



RUSSIA

M&M hopes to use the country as its base for operations in CIS markets where it hopes to sell utility vehicles.



CHINA

M&M has an 80% stake in Jiangling Tractors (capacity: 15000 vehicles a year); apart from serving the booming Chinese market, this will be the company's base for exports to West Asia, Australia and the US.

WEST ASIA

M&M exports engine to Turkey, body shells to Iran and utility vehicles and tractors in the Arabian Peninsula.

SOUTH AFRICA

M&M South Africa Pty. Ltd., a fully owned subsidiary, has sold over 2000 vehicles in less than 12 months; it will serve as a beachhead for the company's African play.



AUSTRALIA

M&M has entered the tractor segment, and is targeting hobby farmers like MUSA initially did.

Design scenario Between 1998 - 2004

- Multi site Design locations
- Global collaboration with suppliers
- Multiple Vehicle variants
- Implementation of Automated manufacturing lines
- New complex vehicle regulation norms & related process

PLM Tools used during 1998-2004

Concept phase

- V **ALIAS** lisation
- Styling data de **File System**

Details design Phase

- Co **CATIA V4**
- alte **File System**
- analys **IDEAS**
- Manufacturab **I-deas TDM**
- Serveciability analysis **TC Enterprise**
- System design specs finalisation
- Failure mode analysis

Validation phase

- CA **Hypermesh**
- Co **Nastran**
- Pro **File System**
- val **I-deas** **TC Enterprise**
- Pro **LS-Dyna** ment

Launch Phase

- Releasing all components for production
- BOM creatio **TC Enterprise**
(Service) **SAP**
- Variants management
- Production Rampup

Post Launch phase

- Engineering change management
- BOM management
- Standards manage
- Part family manage **TC Enterprise**
- Standards manage **SAP**
- Regulatory data management

CAD Limitations

Data exchange issues

- I-deas does not support multi TDM automatic data exchange
- Multiple Copies of Files/Parts all over the Sector get created - Single master cannot be maintained
- Limitation on controlling of object level access
- Difficult to Manage complex relationships of engineering data
- No data management system available for CATIA V4/ V5/ UGNX

Data translation issues

- Auto run Translators are not available for all the requirements
- No procedures/best practices established for translating the data using particular translator
- Use of different co-ordinate systems in & across vehicle programs and across different departments

Agenda

Challenges

Achievements

Technical details

MultiCAD & Multi site Challenges

Seamless CAD Integration

- With UG-NX for Powertrain development
- With Catia V5 for Body Design
- With I-deas for Legacy Data

Seamless Design Environment

- Multi site Design locations
- Global collaboration with suppliers

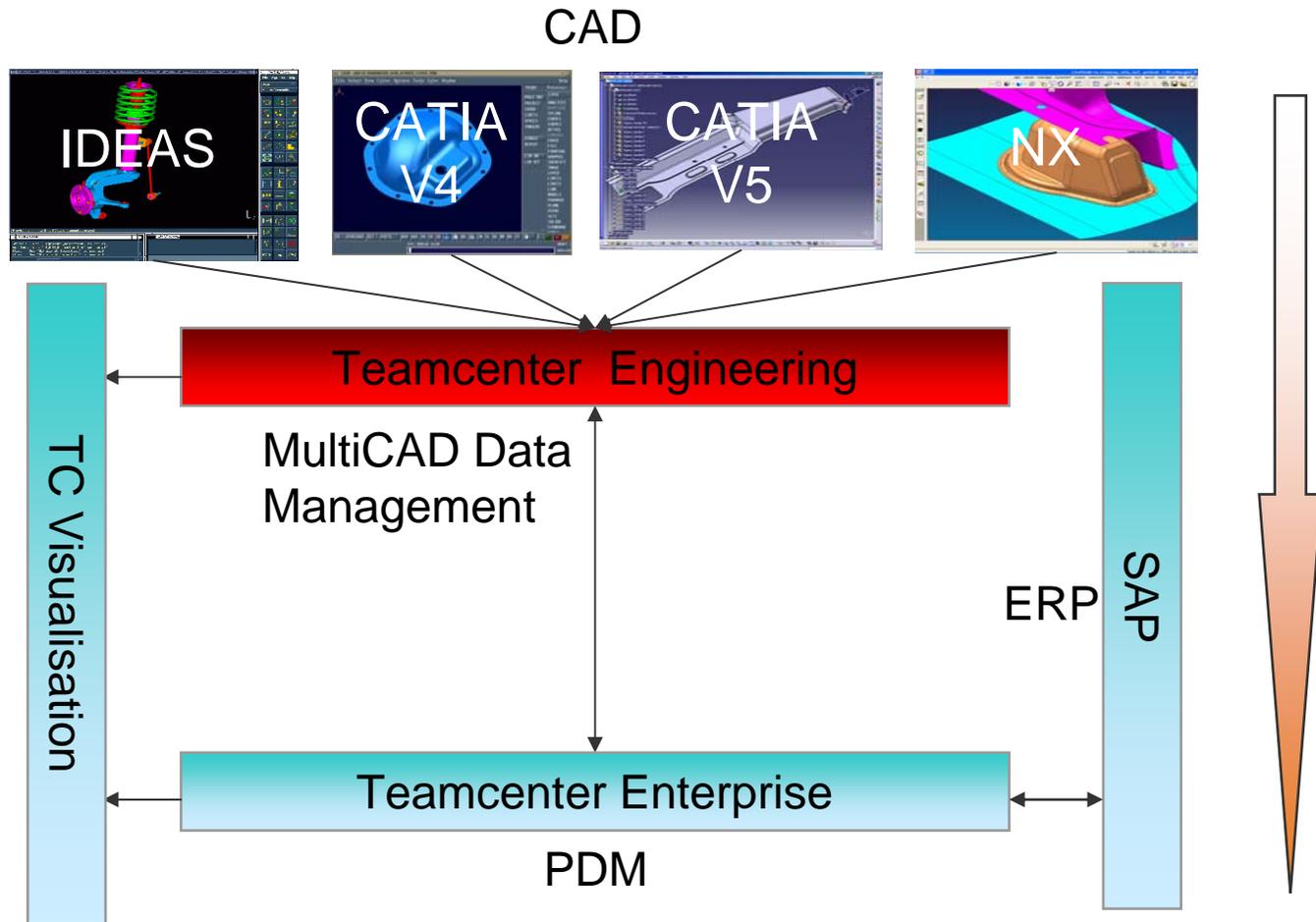
Design Team expectation

- The complete vehicle data from any CAD systems should be available in DMU for reviews
- The DMU should be available at all the sites
- Supplier Integration
- Elimination of 2 D Drawing

Expectations from Teamcenter Engineering ?

- To manage CATIA V5, CATIA V4 , I-deas & UG-NX data in single database
- To support MultiCAD DMU.
- To implement Content Migration Manager tool integrated with Engineering to migrate the existing feature based I-deas data to UG-NX
- To connect TC Engineering with TC Enterprise resulting seamless integration between CAD (PD) & PDM(Manufacturing, Vendor development etc...)

Design scenario from 2005



Agenda

Challenges

Achievements

Technical details

How We Achieved the Expectations

- All Sites connected with Global i-MAN
- I-deas Manager, Catia Manager, NX Manager configured for CAD data management
- Data Synchronized across all sites
- Automatic data translation for Multi-CAD usage
- Effective use of PMI for 2D drawing elimination
- Access controls for group level & Project level data security
- Full service supplier integration
- Vehicle analysis for clearance, interference, serviceability & MRO applications
- Integration with Teamcenter Enterprise for part design, BOM Management, Variants management, Change management & document Management

Agenda

Challenges

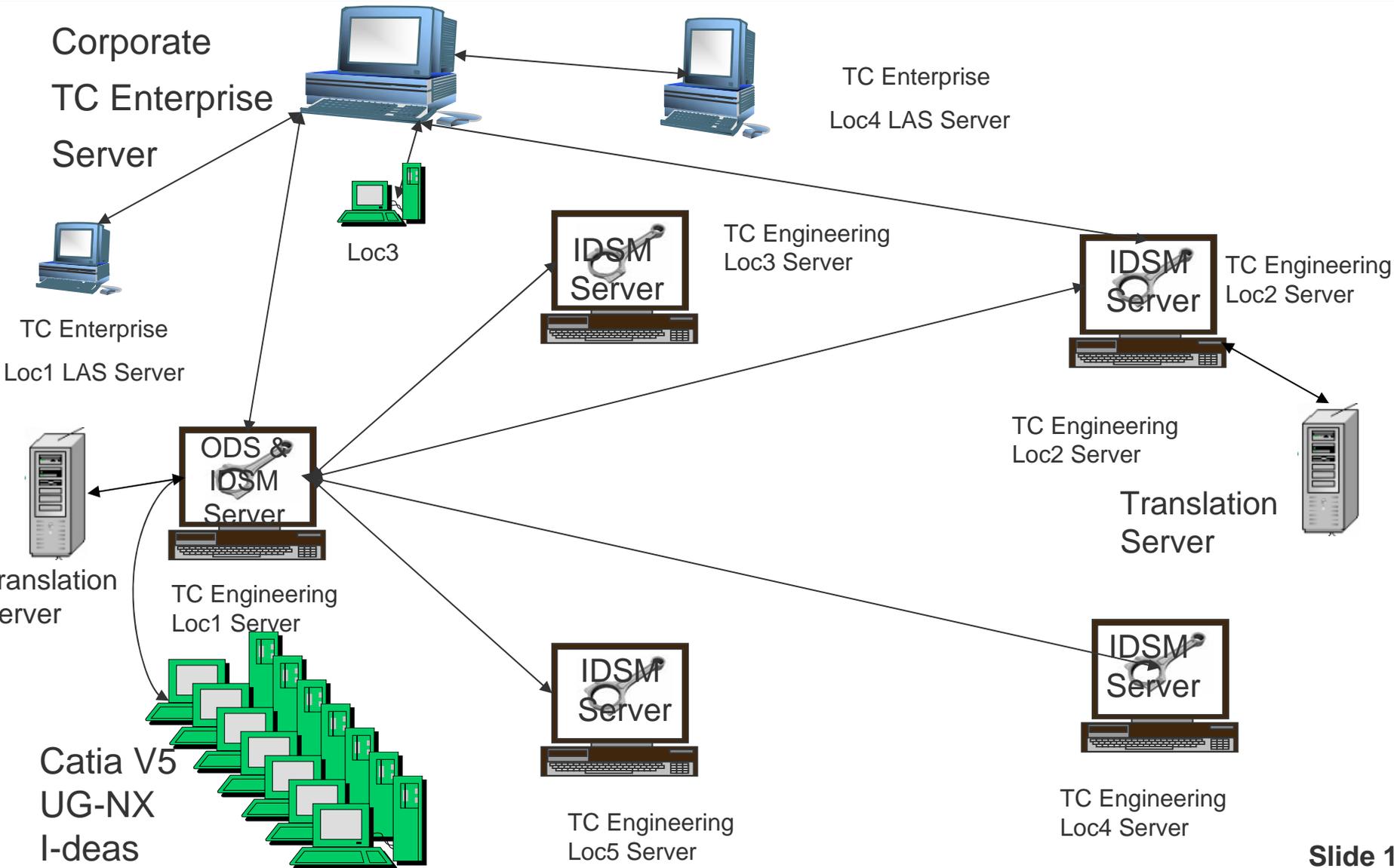
Achievements

Technical details

Software Integrated

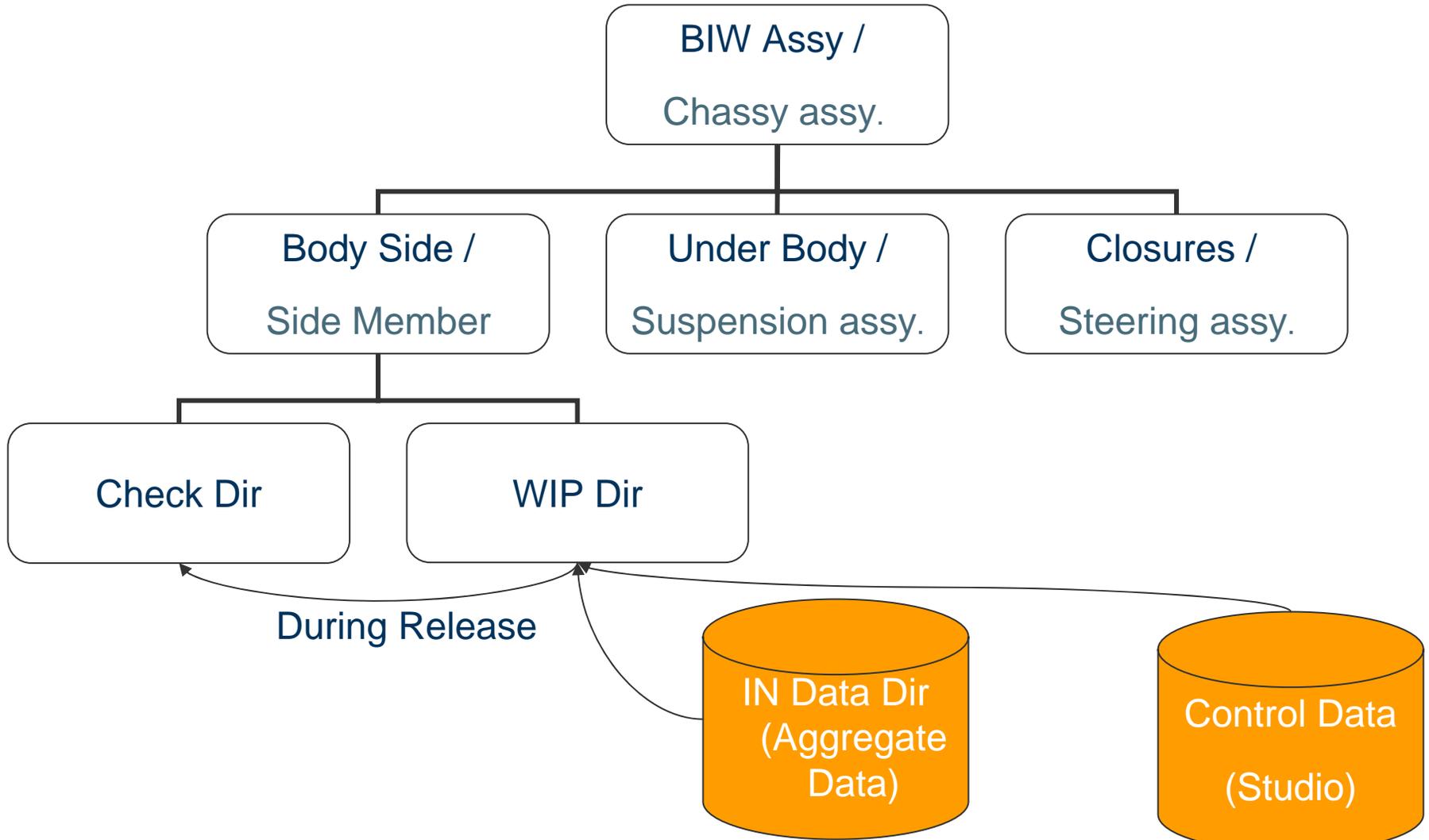
- NX 4
- I-deas 11 M4
- Catia V5 R14 sp3
- Catia Manager 4.1.10
- I-deas manager 3.1.2.2
- Teamcenter Engineering 9.1.2.9

Systems Architecture



CAD Development using Catia & NX without DM

Using File System access controls



Data is used by Designers

BIW Development - With Catia & TC Engg.

| Item ID and Description (Metaphase) | | |
|-------------------------------------|-----|-------------------|
| Item ID | Rev | Description |
| 0302AB0050N | 001 | Front Door Outer |
| 0301AB0050N | 001 | Front Door Inner |
| 0301AB0040N | 001 | Front Door Hinges |

| Release Status | NX Manager Attributes | |
|----------------|-----------------------|-----|
| | Proposal ID | WIP |
| MP | PROP1 | 005 |
| MP | PROP3 | 002 |
| MP | PROP1 | 001 |

WIP Dir

Check Dir

PROJECT ABC - BIW ASSY

REAR FLOOR

FRONT DOOR ASSY

FRONT DOOR OUTER

FRONT DOOR INNER

FRONT DOOR HINGES

REAR DOOR

DESIGN CONTEXT ASSEMBLY
FRONT DOOR INNER

CLASS A

GLASS SURFACE

TECHNOLOGY PART

FRONT DOOR OUTER

FRONT DOOR INNER

CONTROL STRCUTURE

CLASS A

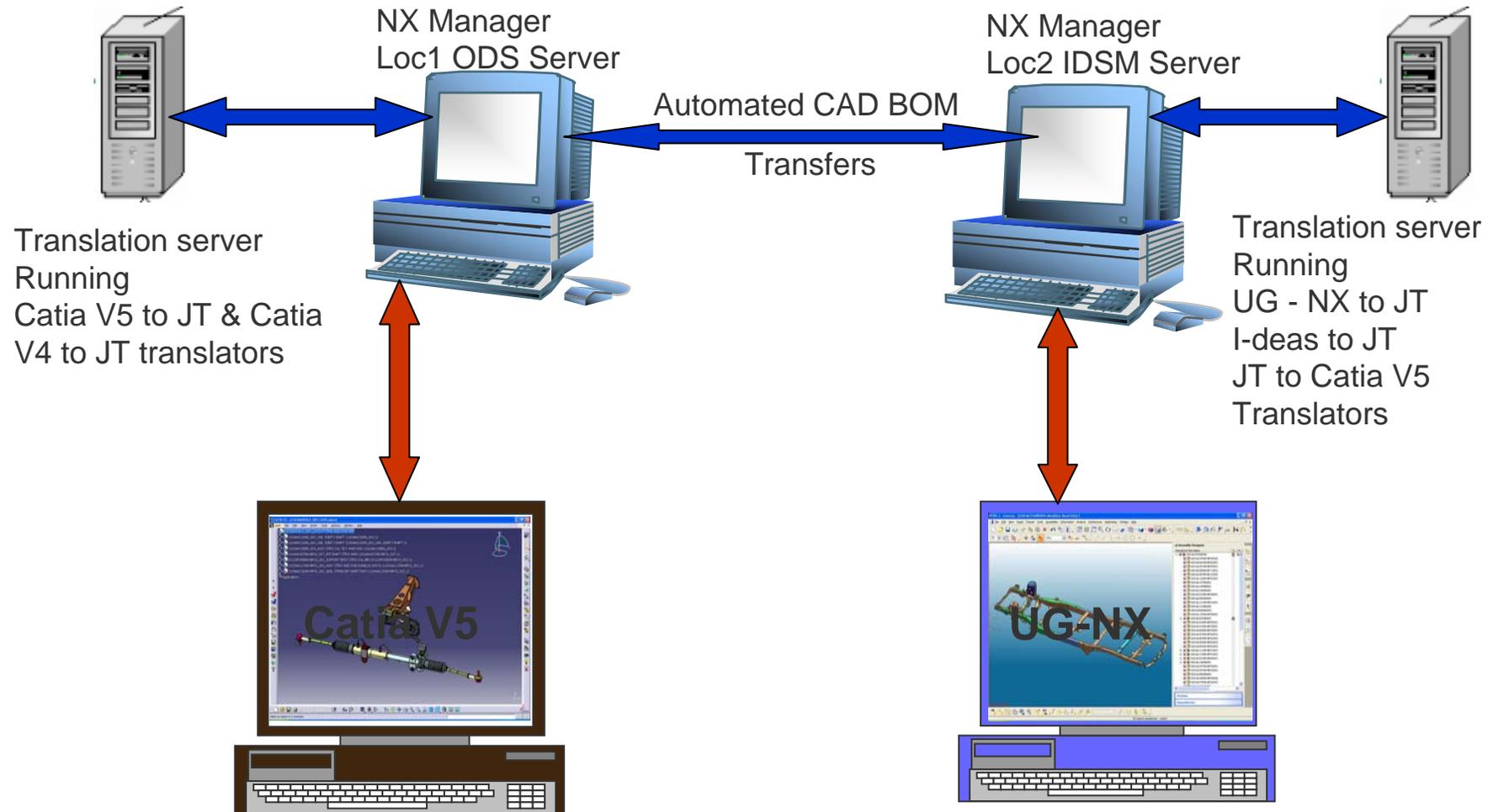
GLASS SURFACE

AB LINES

IN Data Dir &
Control Data

-  Attribute Synchronization
-  Instance Collector
-  Design

Automated Data Translation & Sharing



Designer pastes required revisions of items into "TOLOC2" folder available into site1 for Catia V5 to JT conversion

Designer pastes required revisions of items into "TOLOC1" folder available into site2 for NX to JT & JT to V5 conversion

UG to JT Data translation

JT data is created after completion of the release process only. This ensures that all checks have been made & data is frozen for tessellation.

Important option set are

```
pmiOption = "PART_AND_ASM"  
partMonitor = false  
compression = true  
advCompression = true  
seamSewing = false  
includeBrep = true  
brepPrecision = "DOUBLE"  
autoNameSanitize = true  
deleteUnusedParts = false  
updateChangedPartsOnly = false  
verboseReporting = false  
writeAsciiAssembly = false  
singlePartsNoAssem = false  
autoLowLODgeneration = true  
smartLODgeneration = false
```

Catia V5 to JT Data translation

Catia to JT Configuration Options (key points)

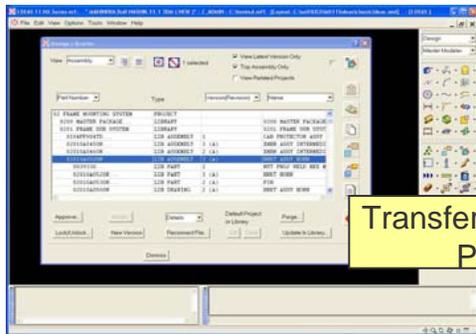
- Include BREP
- All PMI (GD&T)

Important option set are

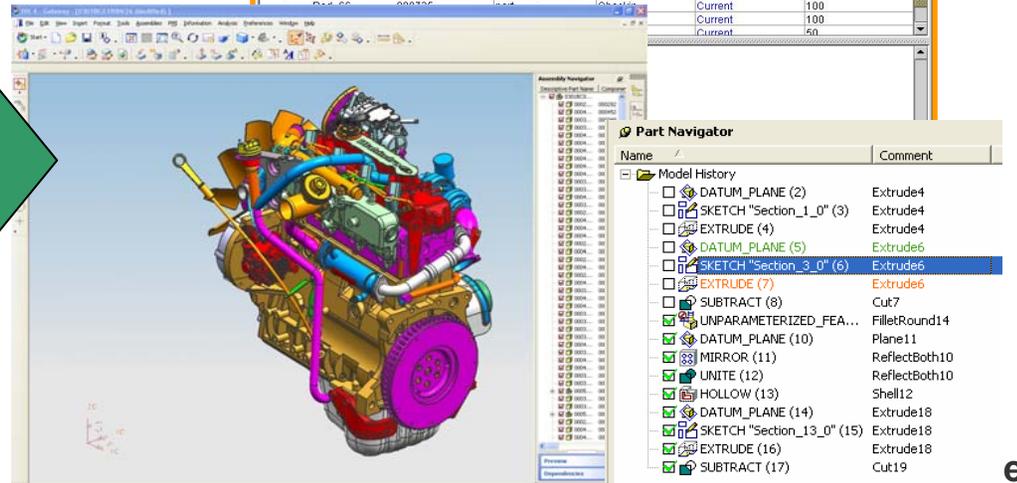
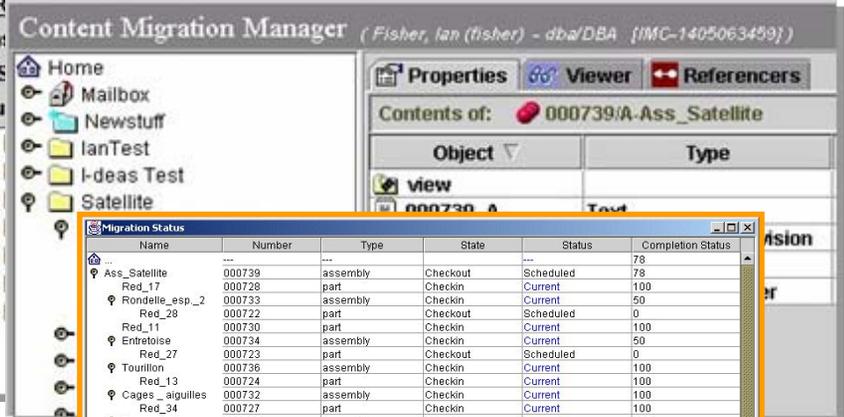
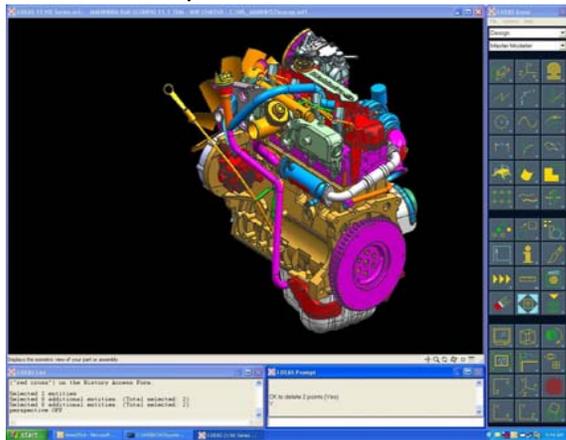
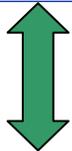
```
PartHierarchy = "collapsetopart"  
Translate_Bodies = true  
Translate_OpenBodies = "all"  
Translate_Curves = false  
Translate_Surfaces = true  
Translate_Points = false  
Translate_InactiveLayerEntities = false  
Translate_NoShowEntities = false
```

JT is attached to the item revision with a relation as
iman_rendering

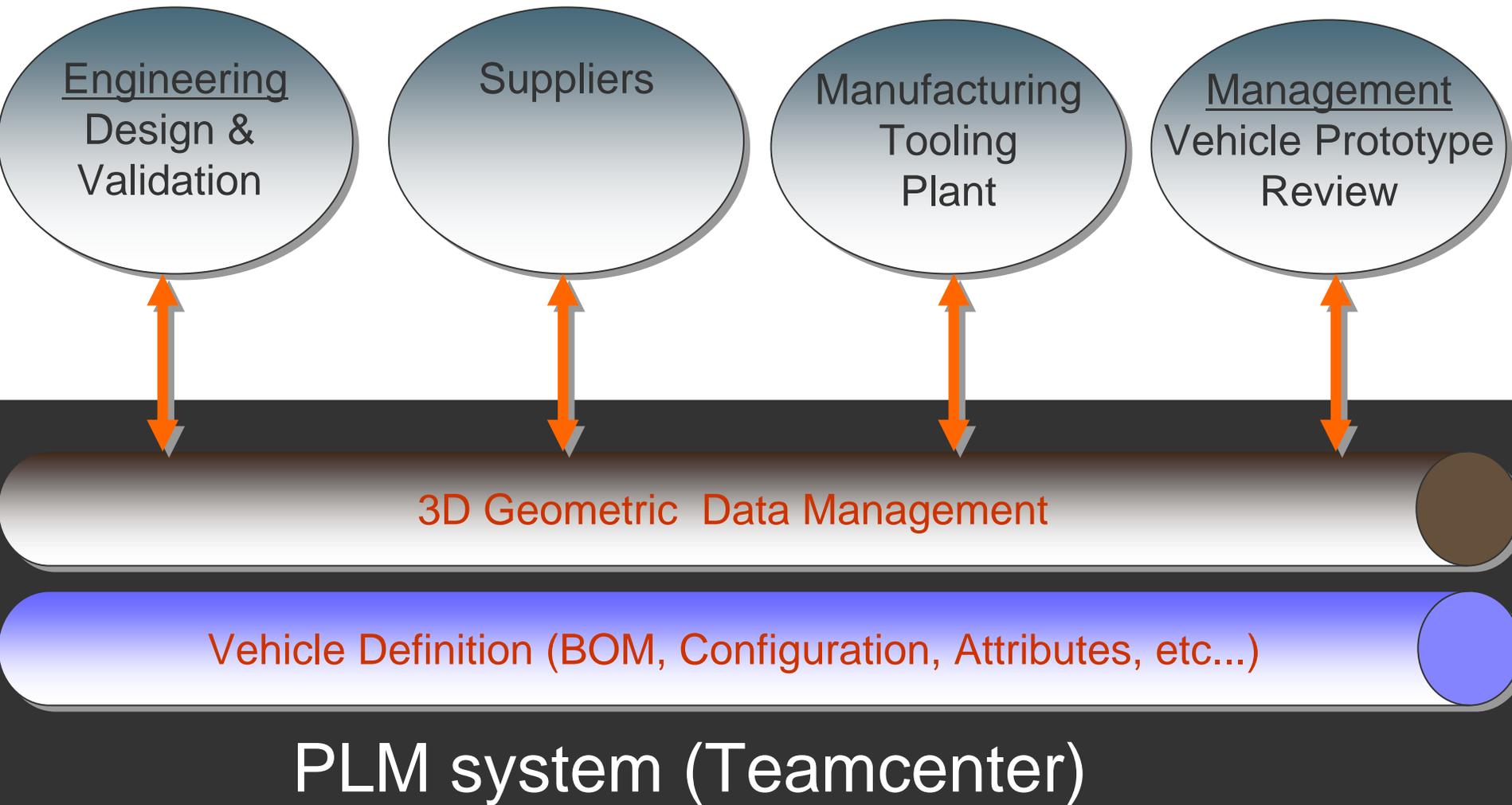
Data migration from I-deas TDM to NX



Transfer data using
PKG



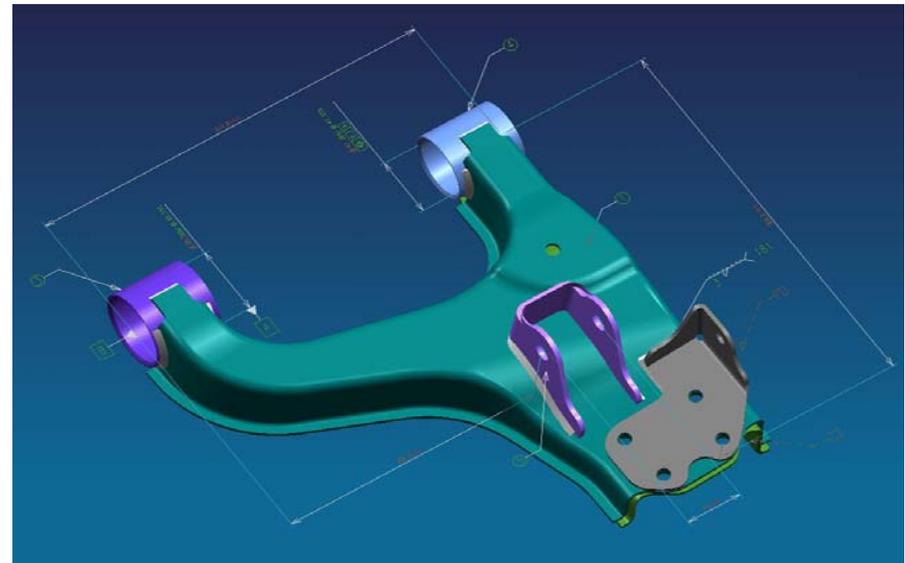
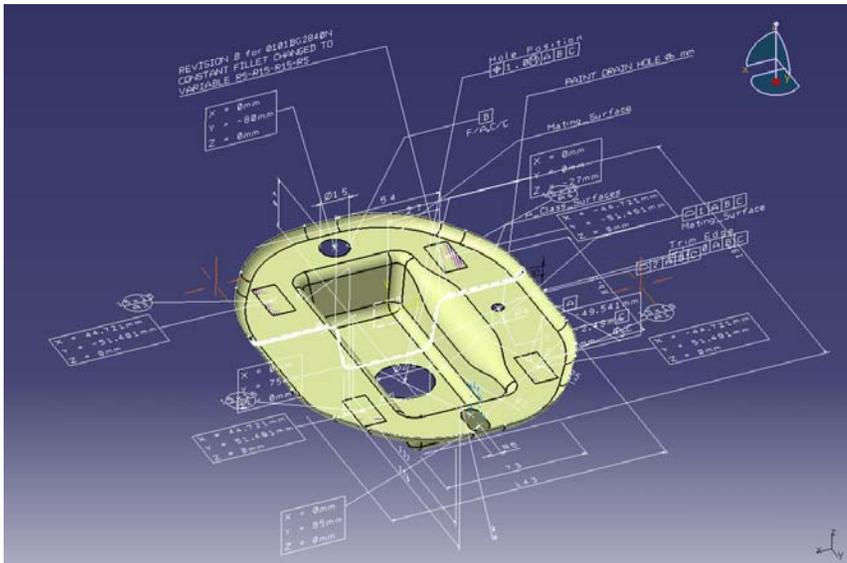
3D Geometric Data Management



Manufacturing & Processing Information Captured In 3D Model

Advantages of PMI on 3D

- The time required to define PMI information is very less compared to create the drawing
- Save time required to search information in drawings
- Avoid case like, Part updated but not the drawing
- Feature identifications in 3D : class a surface, trim edges, Mating surface , change information, PLP, surface locators
- Automatic updates of parameters: weight, Surface area, mating area, painted area
- Automating process by creating templates using Powercopies, UDFs etc....
- Step towards Paperless Office



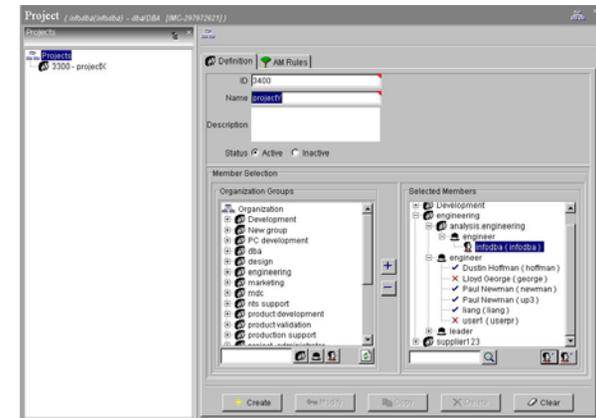
Project Data security

Access control list are defined in following order

- In Project("ProjectID")
- Owning Group("GroupPattern")
- Owning Group Has Security("SecurityValue")

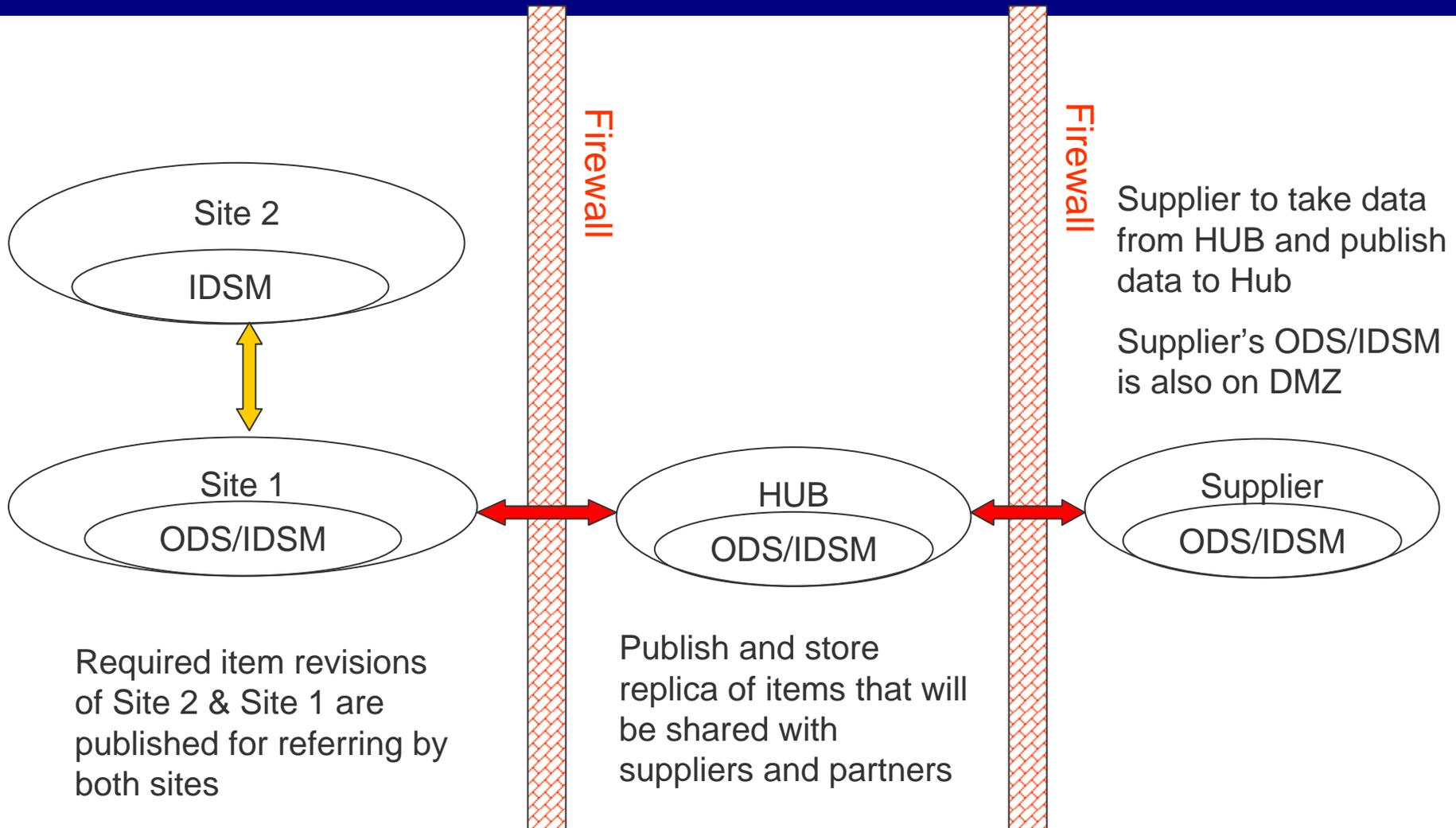
Results

- Data is visible only to selected project members
- Very restricted access to Vendor personal



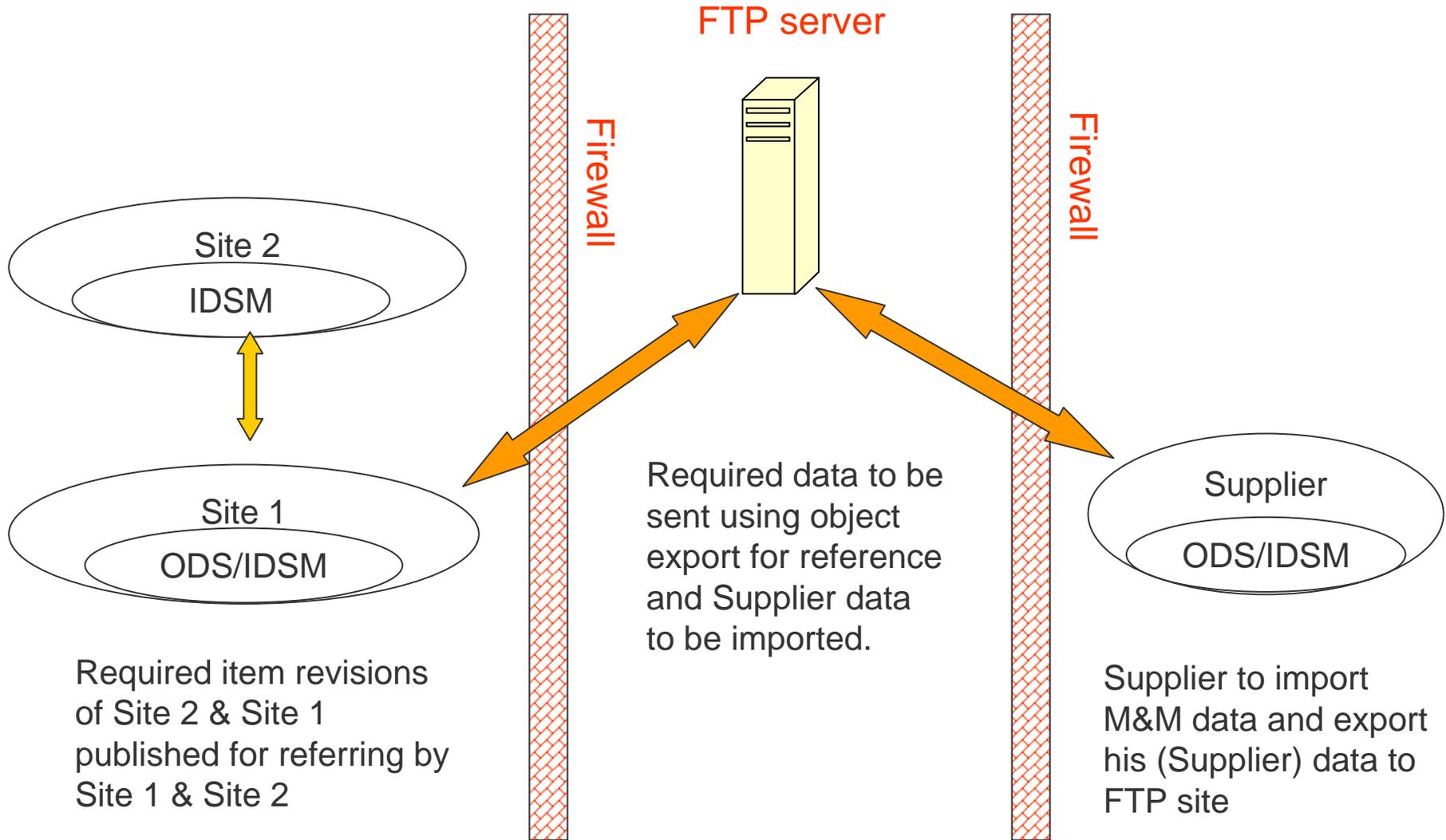
Data Sharing process with Tier 1 Suppliers

Method 1



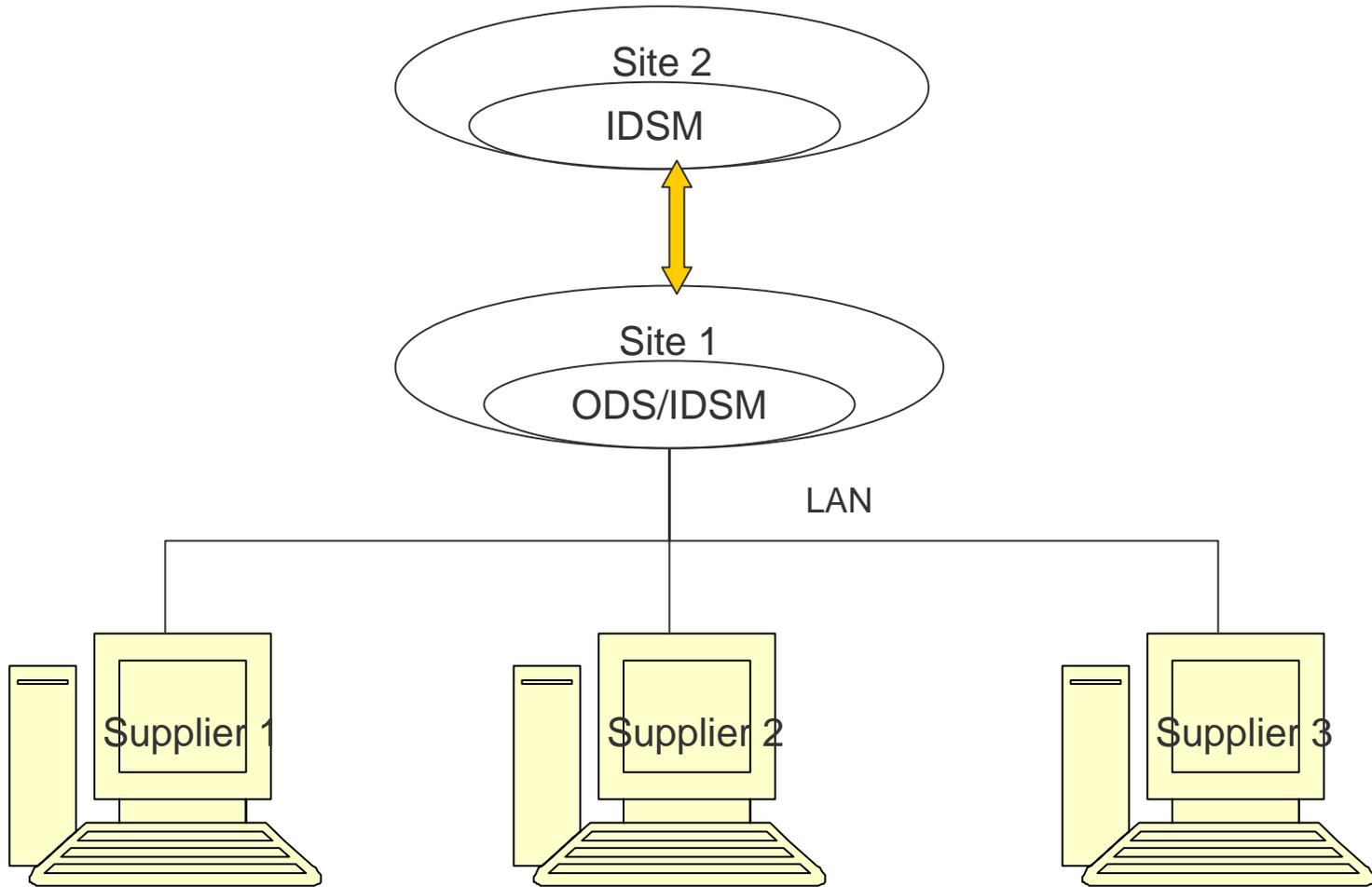
Data Sharing process with Tier 2 & Tier 3 Suppliers

Method 2



Supplier Integration

Method 3

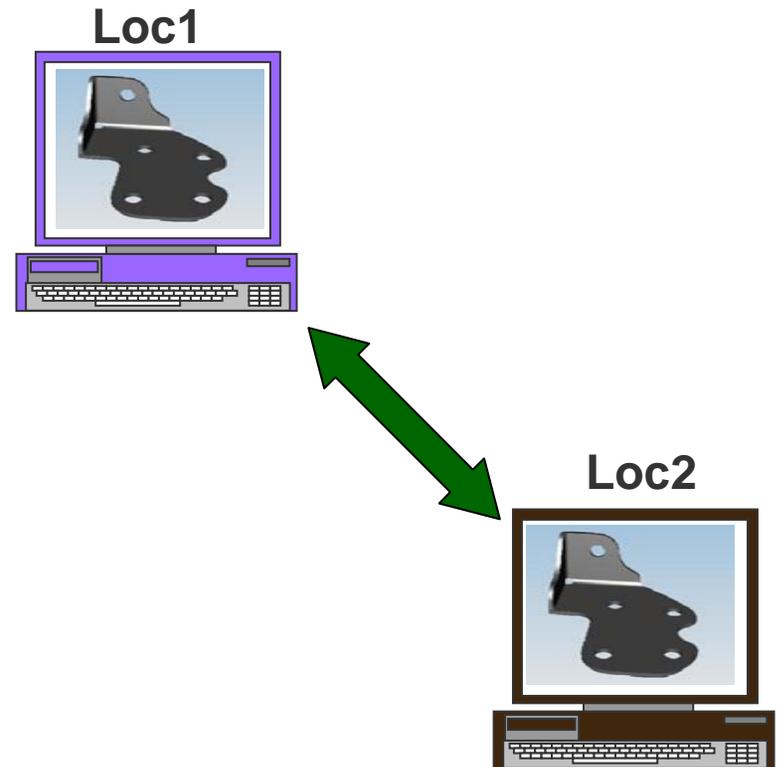


- Suppliers are sitting inside within LAN.with Security
- Respective Suppliers can refer parts attached to their projects & to limited ref. Data.
- Object based ACLs' are defined for data security

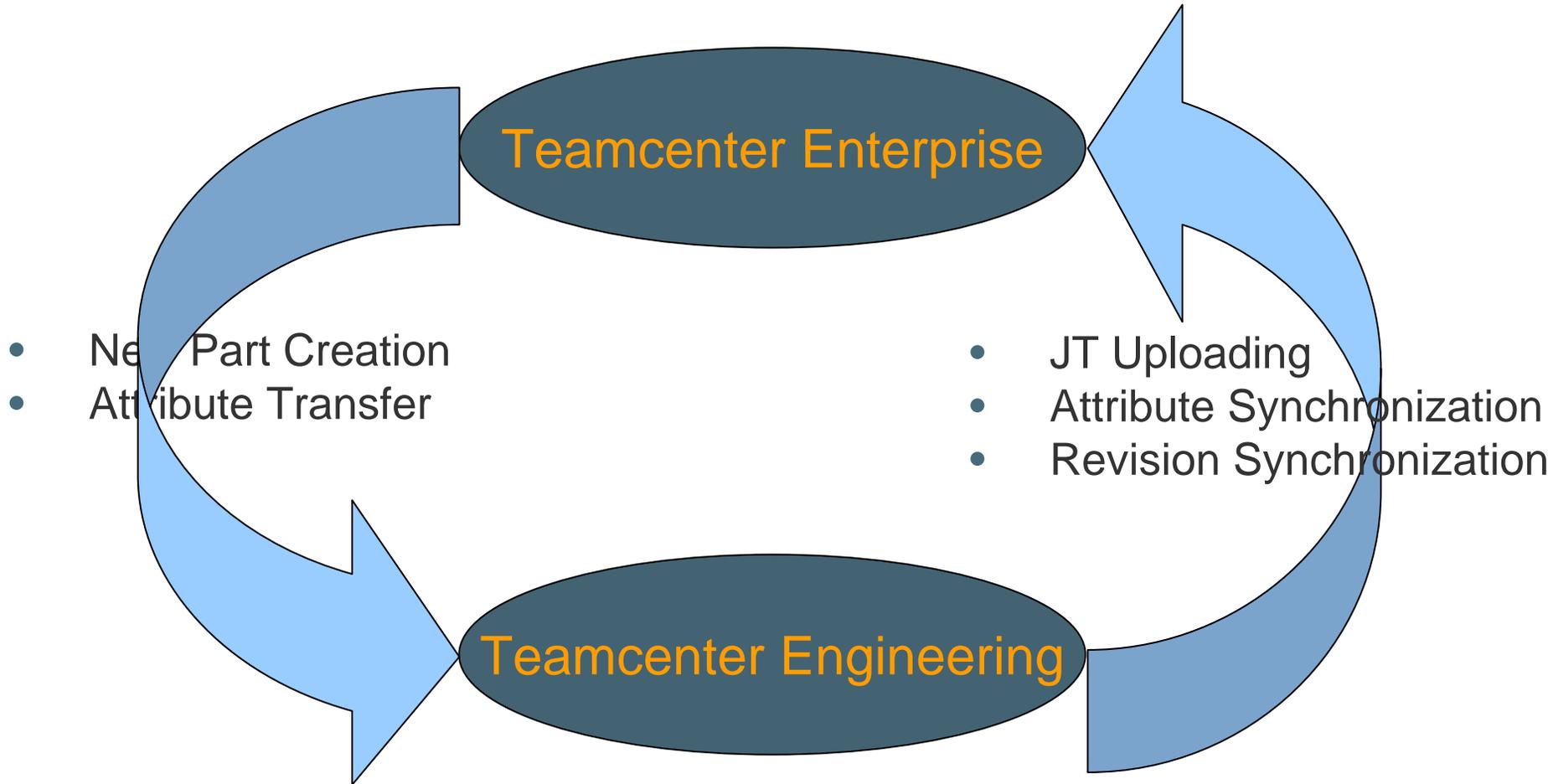
Multilocational Design reviews using Vis Mock-up

Designer from location 1 creates a conference, manually sends data, notifies participants and uses his/her computer as the conference host.

- Basic View Navigation
- Measurement
- 2D Markup
- Cross-section & Measure
- 3D Markup
- PMI

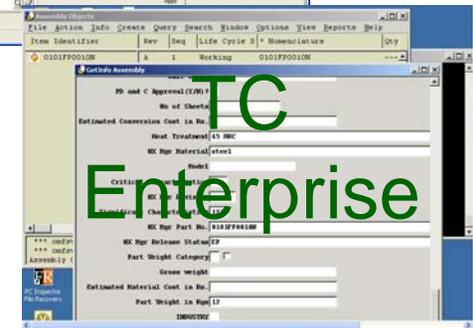
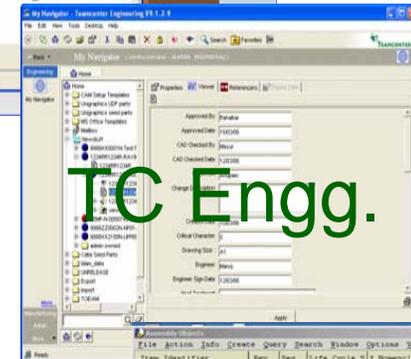
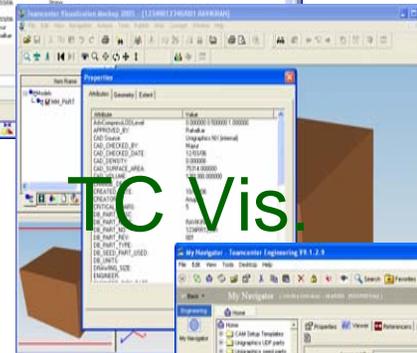
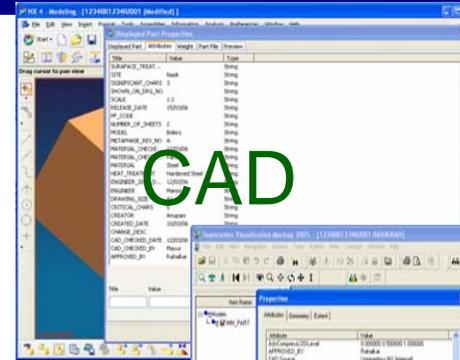


TC Engineering & TC Enterprise Integration



Attribute Synchronisation

- **Defining attributes in NX Manager**
Material, Heat Treatment, Surface Treatment, ...
- **Defining attributes in NX PMI**
Significant, Critical Characteristics, Surface Finish
- **Attributes Synchronization**
NX PMI, NX Manager, Metaphase
- **Attribute Transfer**
*.jt, *.prt



Multi CAD DMU

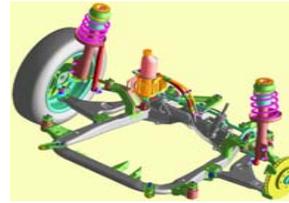
- DMU Structure contains all Project Data
- DMU includes all Project specific Variants of Engine- / Transmission, Body Styles, LHD- / RHD, etc.
- DMU is Data Pool for Simultaneous Design, Simulation, Analysis and Manufacturing Engineering activities
- Prototypes shown in separate Structures

JT Usability at diff. stages of Product Life Cycle

Design



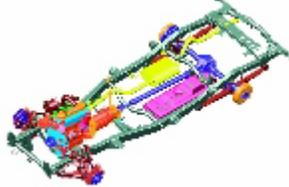
Kinematics



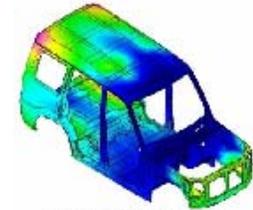
Ergonomics



Packaging



Vehicle DMU



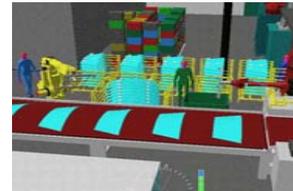
Simulation



Styling



Supplier Integration



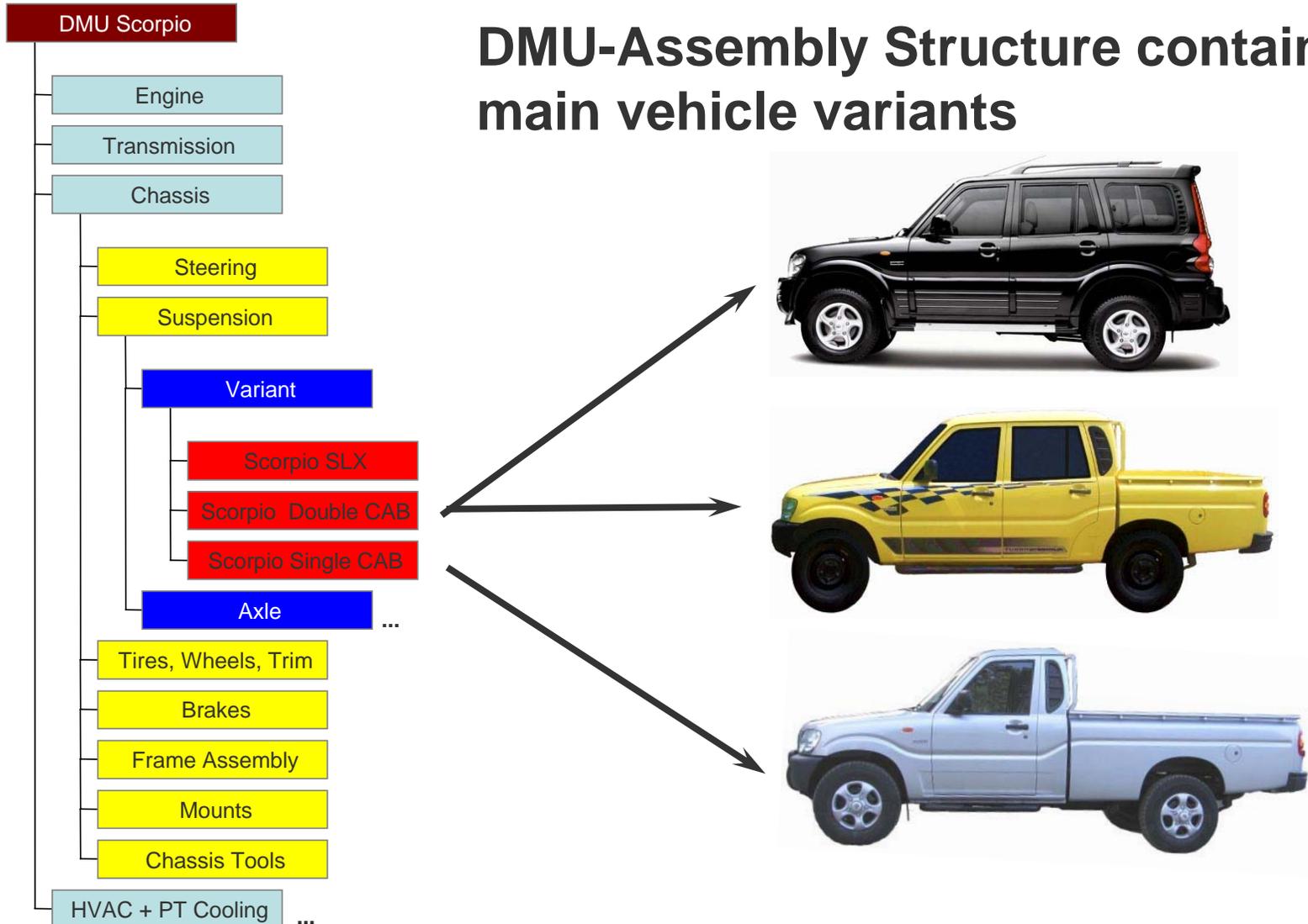
Assembly Line



Die Engineering

DMU - Assembly Structure

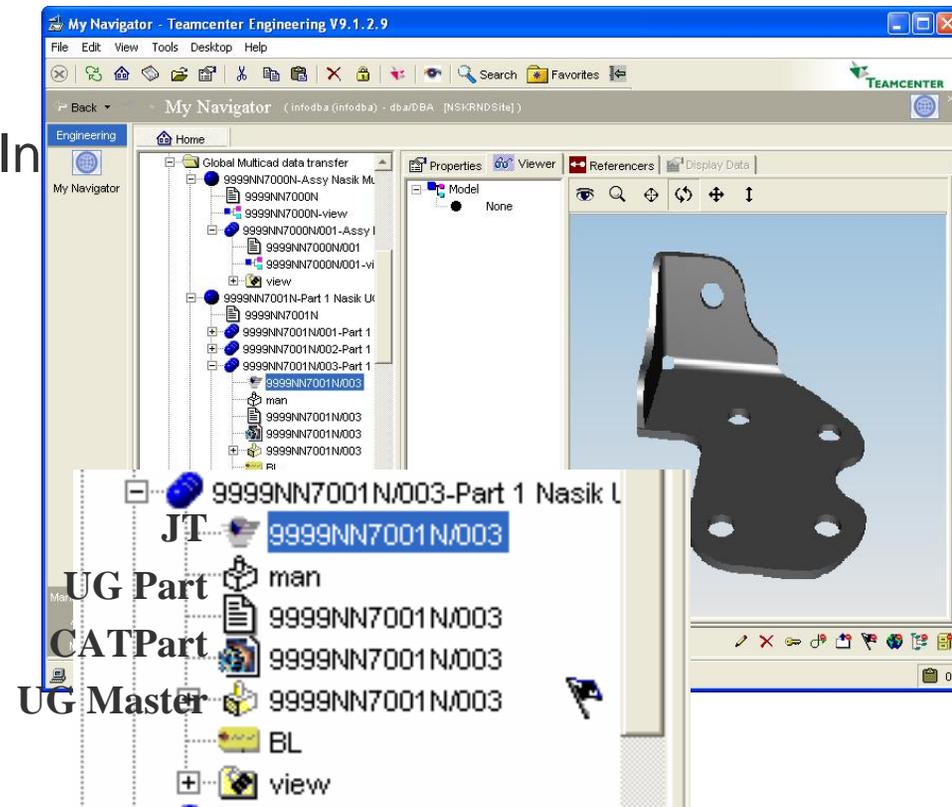
DMU-Assembly Structure contains main vehicle variants



CAD Managers – Benefits Achieved

Work in progress CAD support

- Familiar CAD User interface
- Extended Cad management
- Open, Save, Checkout/Check-In
- Synchronise, Release
- Attribute Mapping
- Create/Edit product structure
- Resolve Key Collisions
- Import / Export data
- Granular CAD relation support
- Support CAD Objects



MultiCAD – Benefits Achieved

MultiCAD product structure

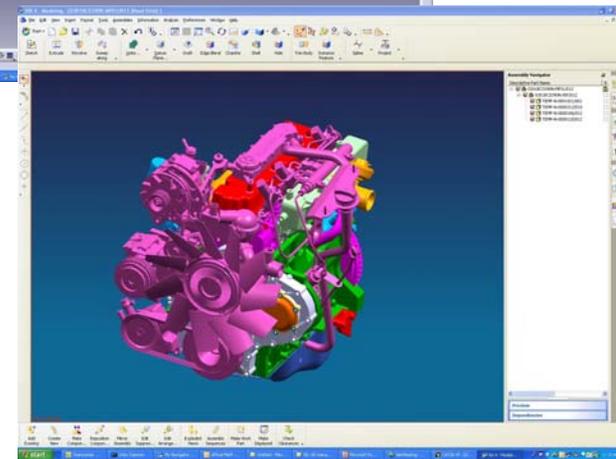
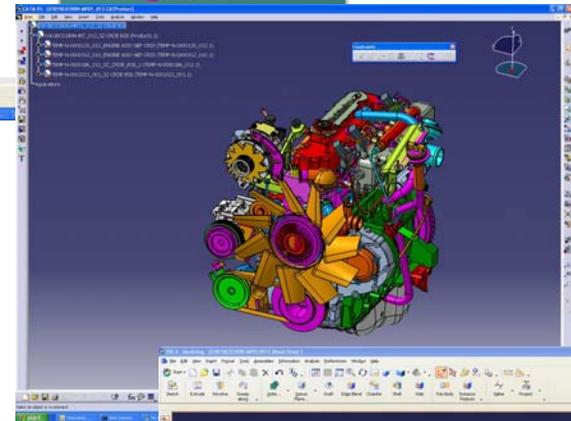
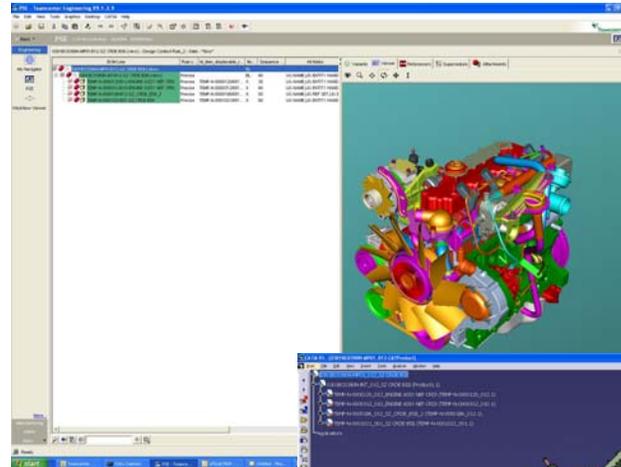
- Embedded JT Visualization
- Digital Validation

CAD Tool Specific Features

- Inter--part relations
 - Wave, MML
 - Catia Published elements

Design in Context

- Use of JT for Non native CAD
 - NX
 - I-deas
 - Catia V5



Results Achieved

- Realtime concurrent engineering in Multisite & MultiCAD data management
- Design process synchronization with TC Enterprise
- User interface integration with TC Enterprise
- Prototype Design & release time reduced by 30%
- Realtime DMI integration with TC Enterprise
- Release process synchronization with TC Enterprise
- Supplier collaboration integration with TC Enterprise

Thank You

Date:-30 April 2006

Premium Partners:



Microsoft