

mat 

a world of materials

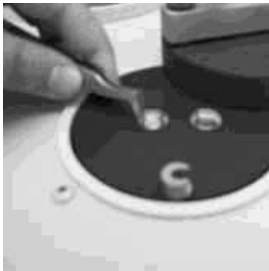
many products



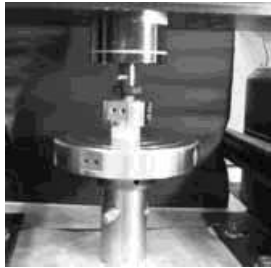
reality

each with its own reality

# material data



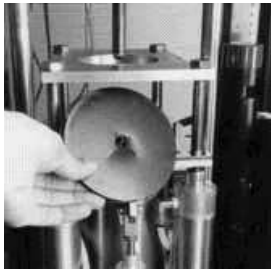
stress relaxation



compressive



viscosity



fatigue



conductivity



expansion

tensile



properties that describe reality



web services for material data

# Using Matereality as a Material Database for ABAQUS

Hubert Lobo



# Outline

- Needs Analysis
- Solution elements
- ABAQUS and Matereality
- Conclusions

# ABAQUS can do anything!

- NVH
- Stiffness/failure
- Crash/rate dependency
- Thermal/thermomechanical
- Forming/process simulation
- Large deformation-hyperelastic/hyperfoam
- Stress relaxation/creep-viscoelasticity

# Each app needs different data

- NVH- \*ELASTIC
- Stiffness-\*ELASTIC,\*PLASTIC
- Crash-\*PLASTIC, \*RATE DEPENDENT
- Thermal- \*THERMAL EXPANSION
- Large deformation-\*HYPERELASTIC
- Foam crushing- \*HYPERFOAM
- Stress relaxation- \*VISCOELASTIC



# Requirements

- CAE product development requires
  - Variety of simulations
  - Multiple materials
  - Variety of boundary conditions
  - With contact
- Data quality
  - Self consistent
  - Application appropriate
  - Complete ->No holes

## Problem

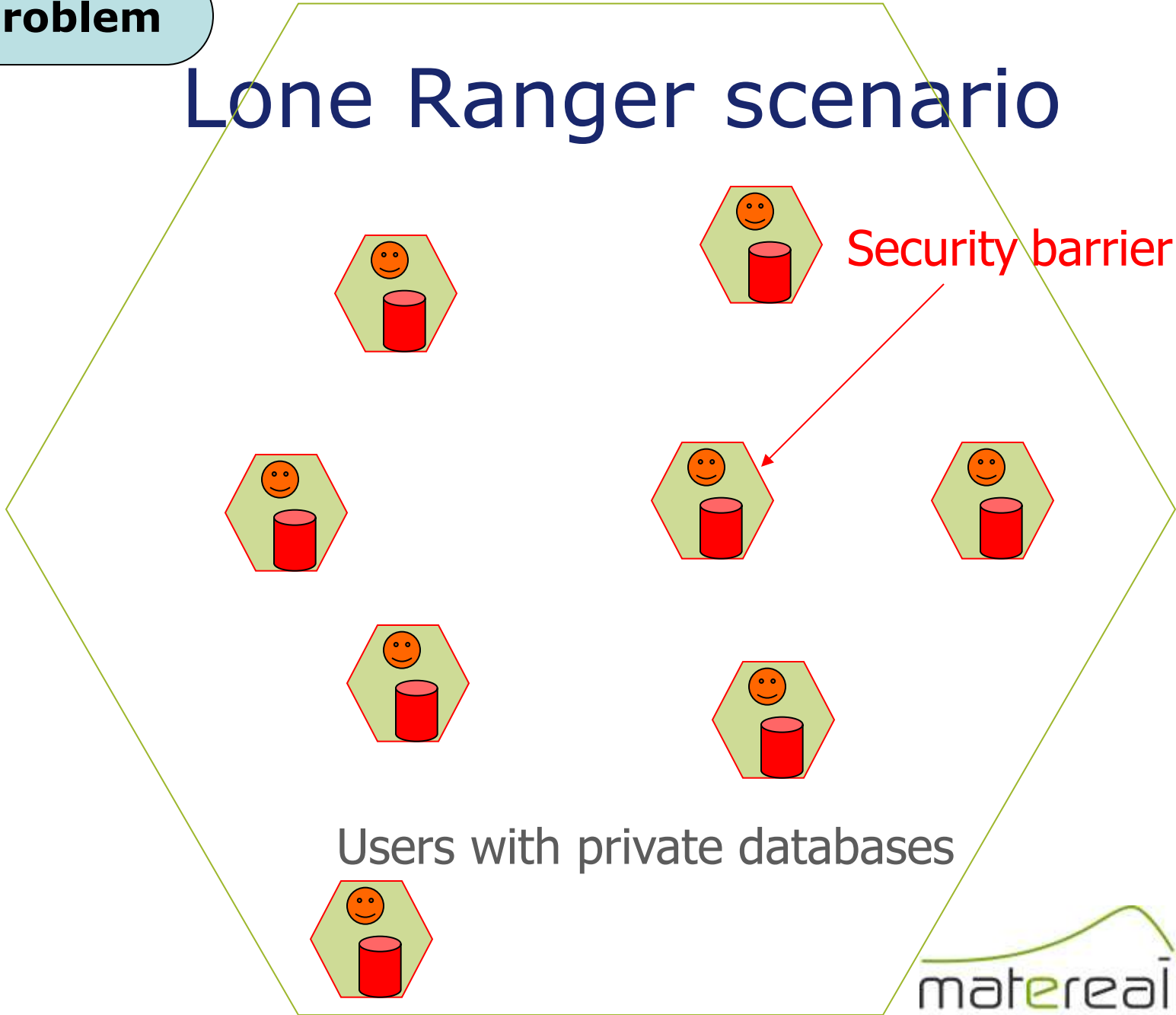
# Flaws in current situation

- No comprehensive data store
- Each user has own model collection
- User cannot judge its quality/authenticity
- Enterprise has fragmented access to data
- Sharing with collaborators is difficult
- Unavailable data=time & retest->big\$\$

**high risk, low efficiency**

**Problem**

# Lone Ranger scenario

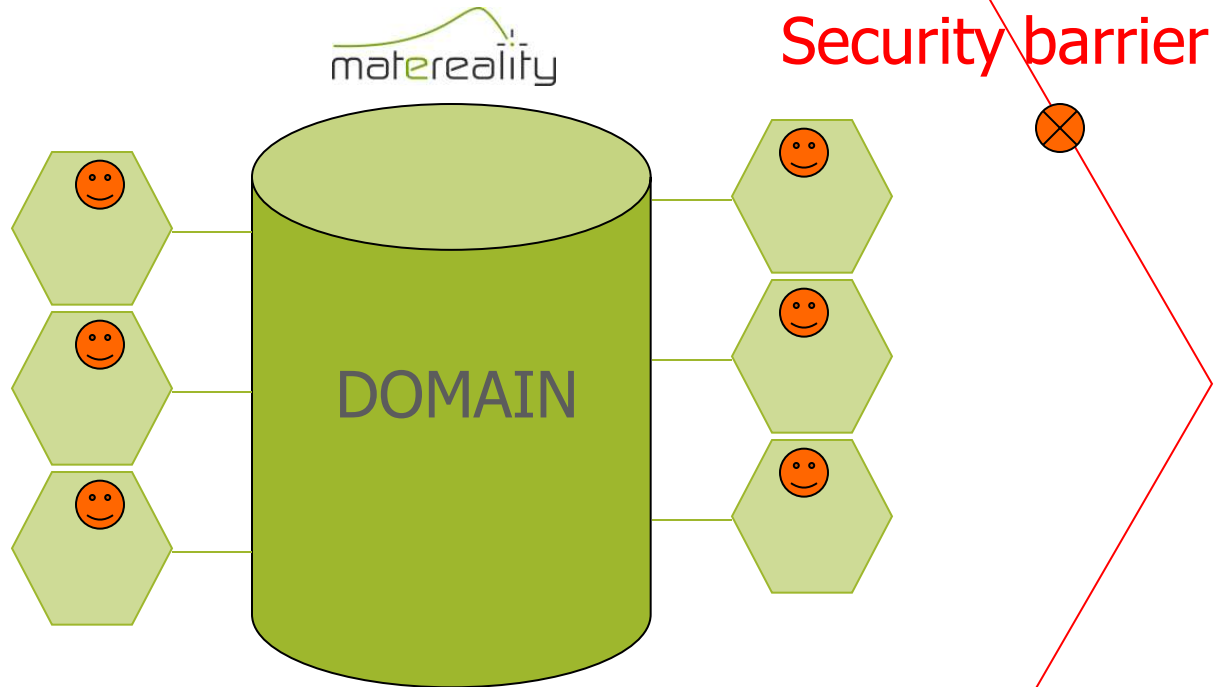


Security barrier

Users with private databases

## Solution

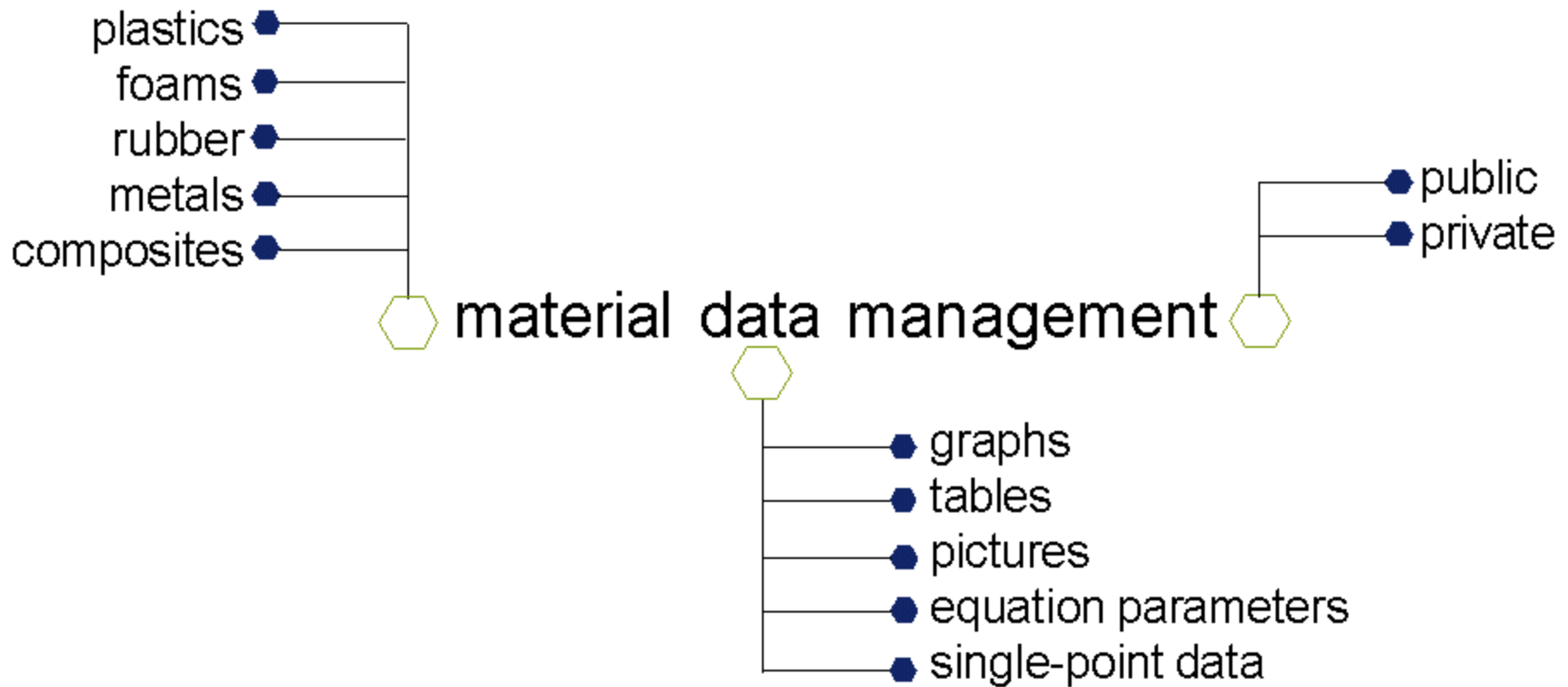
# Enterprise sharing



Shared or selectively-shared access

## Solution

# Storage of diverse data



# Search by material...



- my account
- my materials
- search
- new data
- contact us

default > searchengine

## Select Material

Class	Sub Class	Supplier
<input type="text" value="Any"/>	<input type="text" value="Any"/> Material Nomenclature System <input checked="" type="radio"/> ISO <input type="radio"/> ASTM	<input type="text" value="Any"/> Any Asahi Kasei Asahi Thermofil Basell Bayer Chevron Dow Automotive Dow Benelux Dow Chemical Ethicon GE Plastics Huntsman Corporation Huntsman Polymers Kraton Multibase Nova Chemical StaMax The Dow Chemical Company

search for material of interest

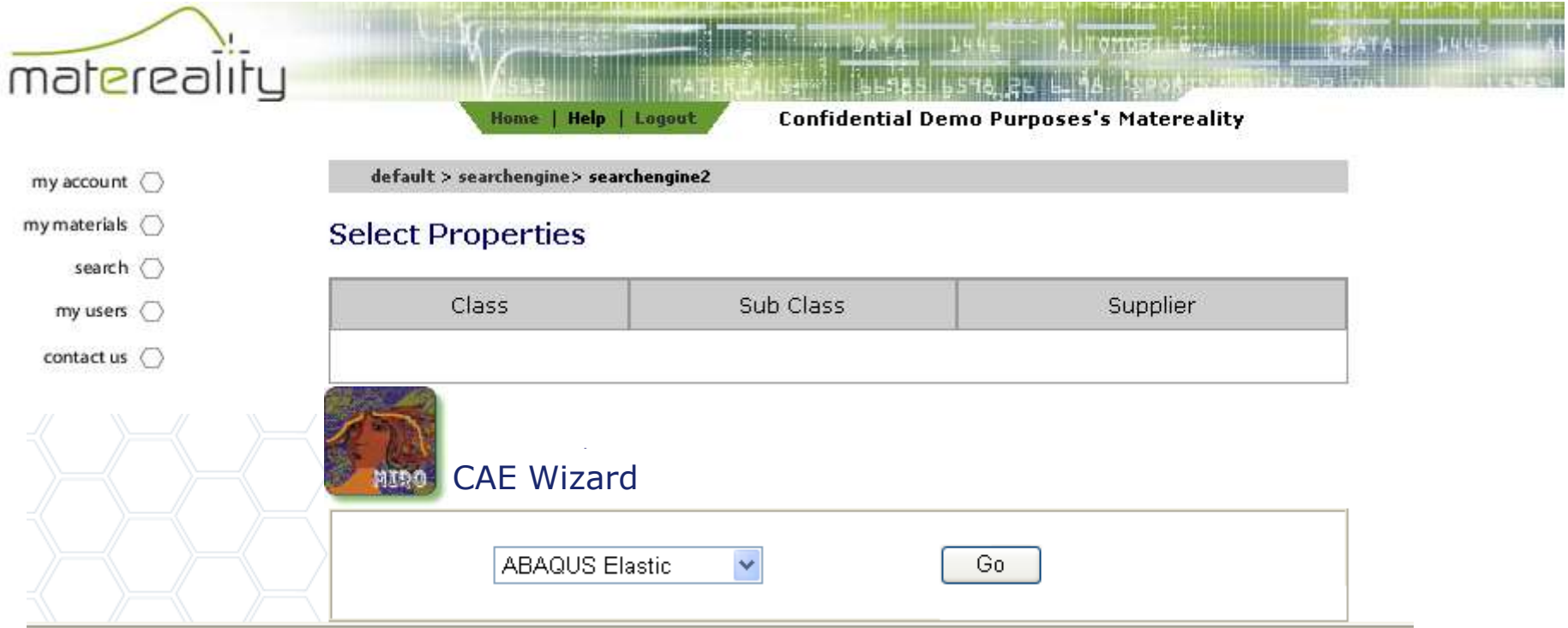
Property Search  
Search for properties

CAE Wizard  
Search for material  
model parameters

Datasheet Wizard  
Display datasheets



# Pick models of interest...



The screenshot shows the Matereality website interface. At the top left is the Matereality logo. A navigation bar contains links for Home, Help, and Logout, along with the text 'Confidential Demo Purposes's Matereality'. A breadcrumb trail reads 'default > searchengine > searchengine2'. The main heading is 'Select Properties'. Below this is a table with three columns: Class, Sub Class, and Supplier. The table is currently empty. Below the table, there is a search result for 'CAE Wizard' with a small image icon. Below the search result, there is a dropdown menu showing 'ABAQUS Elastic' and a 'Go' button.

matereality

Home | Help | Logout

Confidential Demo Purposes's Matereality

my account

my materials

search


my users

contact us

default > searchengine > searchengine2

### Select Properties

Class	Sub Class	Supplier
-------	-----------	----------

 CAE Wizard

ABAQUS Elastic

matereality

# Find relevant data



Home | Help | Logout

Confidential Demo Purposes's Matereality

- my account
- my materials
- search
- my users
- contact us

default > searchengine > searchengine2 > templatesearch

## Material Property Search: ABAQUS Elastic

Match 0

Makrolon 7435



[click to view collection of data sets](#)

Lustran 248





# View model parameters



[Home](#) | [Help](#) | [Logout](#)

Confidential Demo Purposes's Matereality

[my account](#)

[my materials](#)

[search](#)

[my users](#)

[contact us](#)

[default](#) > [searchengine](#) > [searchengine2](#) > [templaterearch](#) > [resgroupsummary](#)

## Makrolon 7435 > ABAQUS Elastic

Click on the property titles below to view data

### Tensile Properties

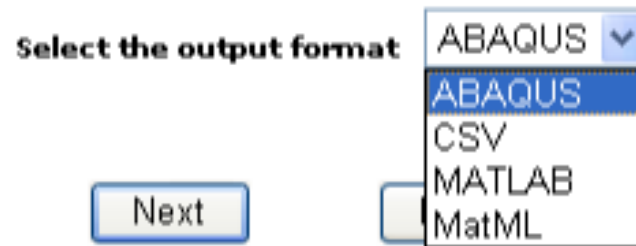
Poissons Ratio	0.4	crosshead speed : 39.62 mm/min
Tensile Modulus	1979.41841168584 MPa	crosshead speed : 39.62 mm/min
Tensile Modulus	2154.66071857014 MPa	crosshead speed : 152.4 mm/min
Tensile Modulus	2156.38738958753 MPa	crosshead speed : 1524 mm/min
Tensile Modulus	2444.88971008786 MPa	crosshead speed : 15240 mm/min

[Export](#)



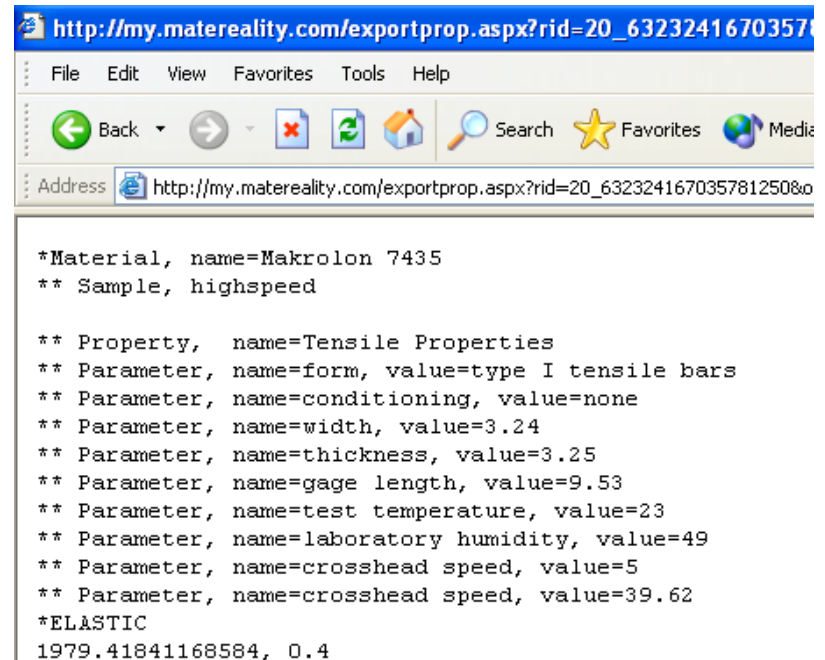
# Export data to ABAQUS

- ABAQUS input deck (current versions)
- CSV, Excel ready format
- MATLAB (for curve fitting)
- MATML (future use)



# ABAQUS input deck

- Preformatted
- Ready to use



```
*Material, name=Makrolon 7435
** Sample, highspeed

** Property, name=Tensile Properties
** Parameter, name=form, value=type I tensile bars
** Parameter, name=conditioning, value=none
** Parameter, name=width, value=3.24
** Parameter, name=thickness, value=3.25
** Parameter, name=gage length, value=9.53
** Parameter, name=test temperature, value=23
** Parameter, name=laboratory humidity, value=49
** Parameter, name=crosshead speed, value=5
** Parameter, name=crosshead speed, value=39.62
*ELASTIC
1979.41841168584, 0.4
```

# Variety of material models

## ● \*ELASTIC/\*PLASTIC

Tensile Modulus - Secant	2215 MPa
Poissons Ratio	0.4

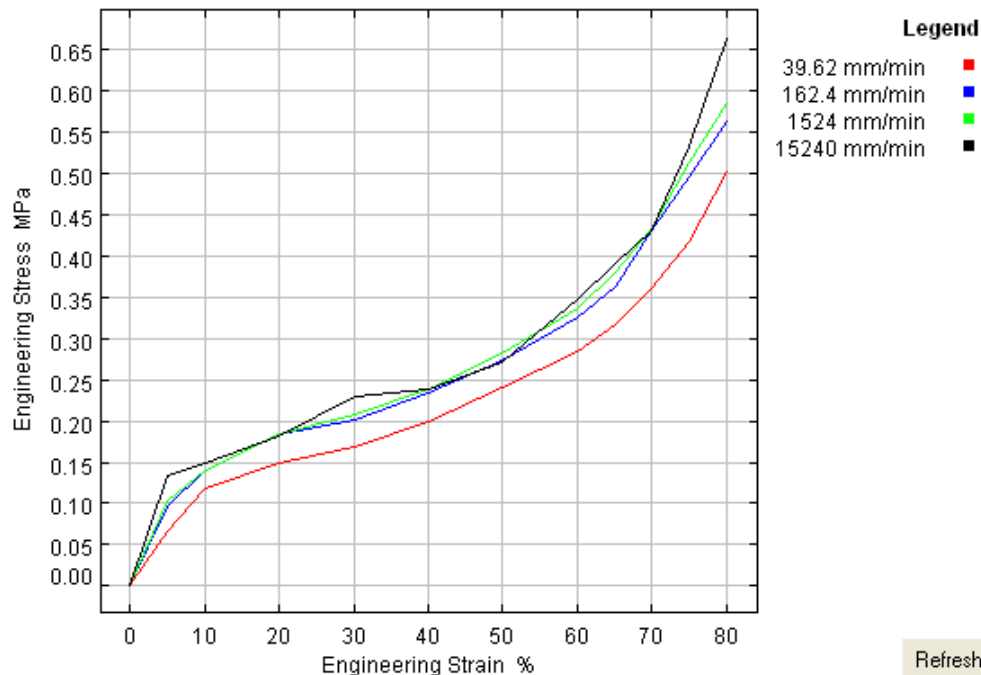
### Plasticity Data

Plastic Strain	True Stress (MPa)
0	19.72
0.00848	54.63
0.0217	58.87
0.0545	56.58
0.0772	51.85
0.11	50.3

# Variety of material data

Computer packaging > Compressive Properties  
Effect of crosshead speed

Engineering Compressive Stress-Strain Curves



x-log  y-log  Parsed 4 point sets

Refresh

Print | Export | Certificate | Update | Legal

# Ensuring confidence

- How do we know how good it is?
  - Data source
  - Variability
  - Pertinence to my application
  - Certification
    - all data is not created equal
    - conversely, some data cannot be used without certification

## View underlying data

0.026" Thick Sheet Metal > Tensile Properties

my materials

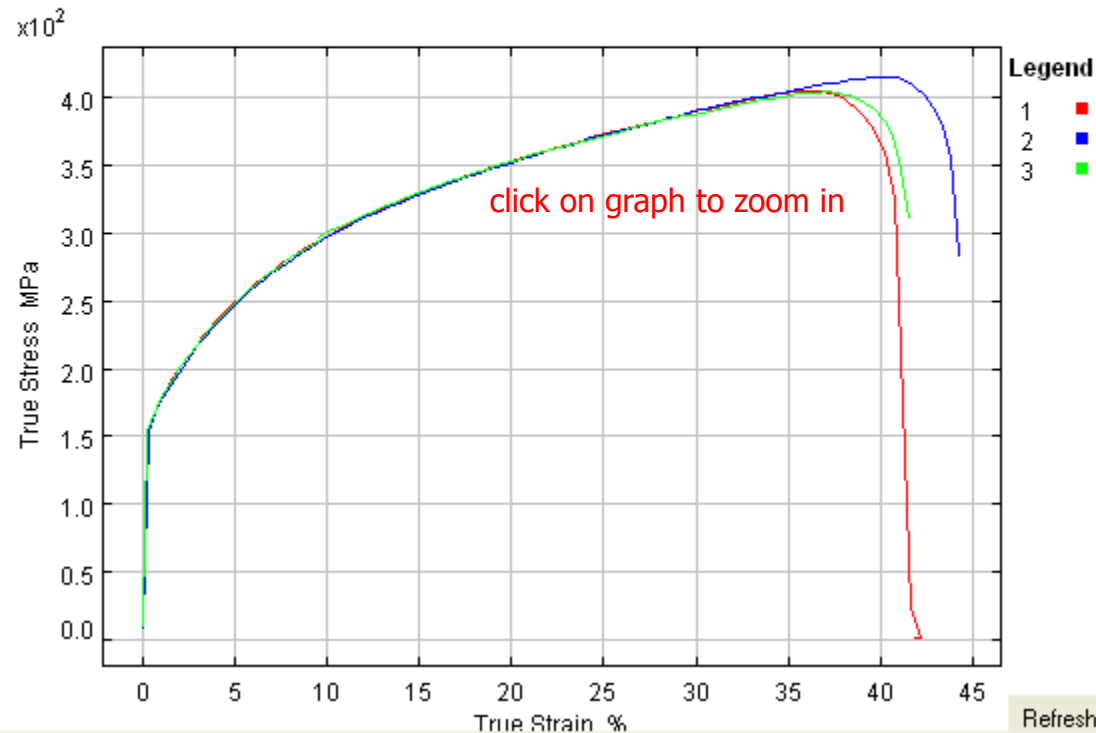
search

submit data

new data

contact us

True Tensile Stress-Strain Curves



## Examine variability of data...

### Tensile Modulus

117000 MPa	1
137500 MPa	2
128100 MPa	3
127500 MPa	Mean

### Tensile Strength at Yield

290.6 MPa	1
290.1 MPa	2
290 MPa	3
290.2 MPa	Mean

### Tensile Strain at Yield

53.38 %	1
51.05 %	2
49.13 %	3
51.19 %	Mean



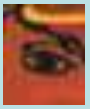
## View source of data...

### Data Certificate

Makrolon 6555 > Dynamic Mechanical Properties in Torsion

Technique	standards organization	ISO
	standard number	ISO 6721-7: 1996
	uncertainty analysis	per standard
Sample Details	ID	ma6555mer
	sample source	Bayer
Specimen Details	conditioning	none
	form	rectangular bar
	other preparation	cut to size
	thickness	4 mm
	width	10 mm
Test Parameters	frequency	1 Hz
Traceability	test laboratory	Bayer Bldg103Lab
	measurement date	1/1/1998
	accredited	No
	measurement instrument	unknown
	performed by	
	certified by	

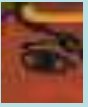
[Print](#) | [View Result](#) | [Legal](#)



**Beyond**

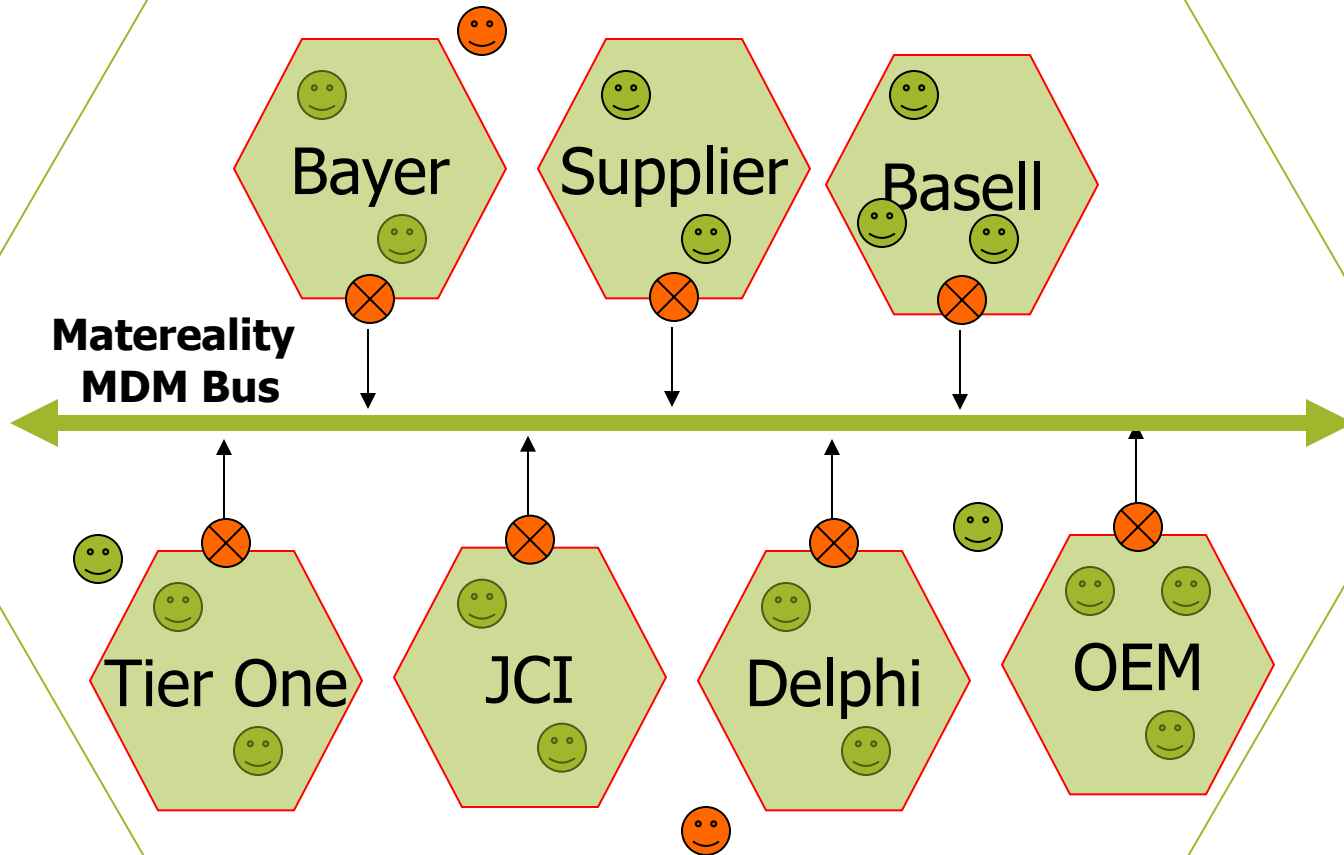
# MDMs are living entities

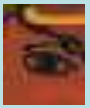
- A complete data store
  - Your archival data
  - Current data direct from test labs
  - Data from your material suppliers
  - Data from your collaborators



**Beyond**

# Collaborate globally

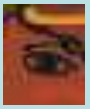




# Mine extensive data stores

Search by property name

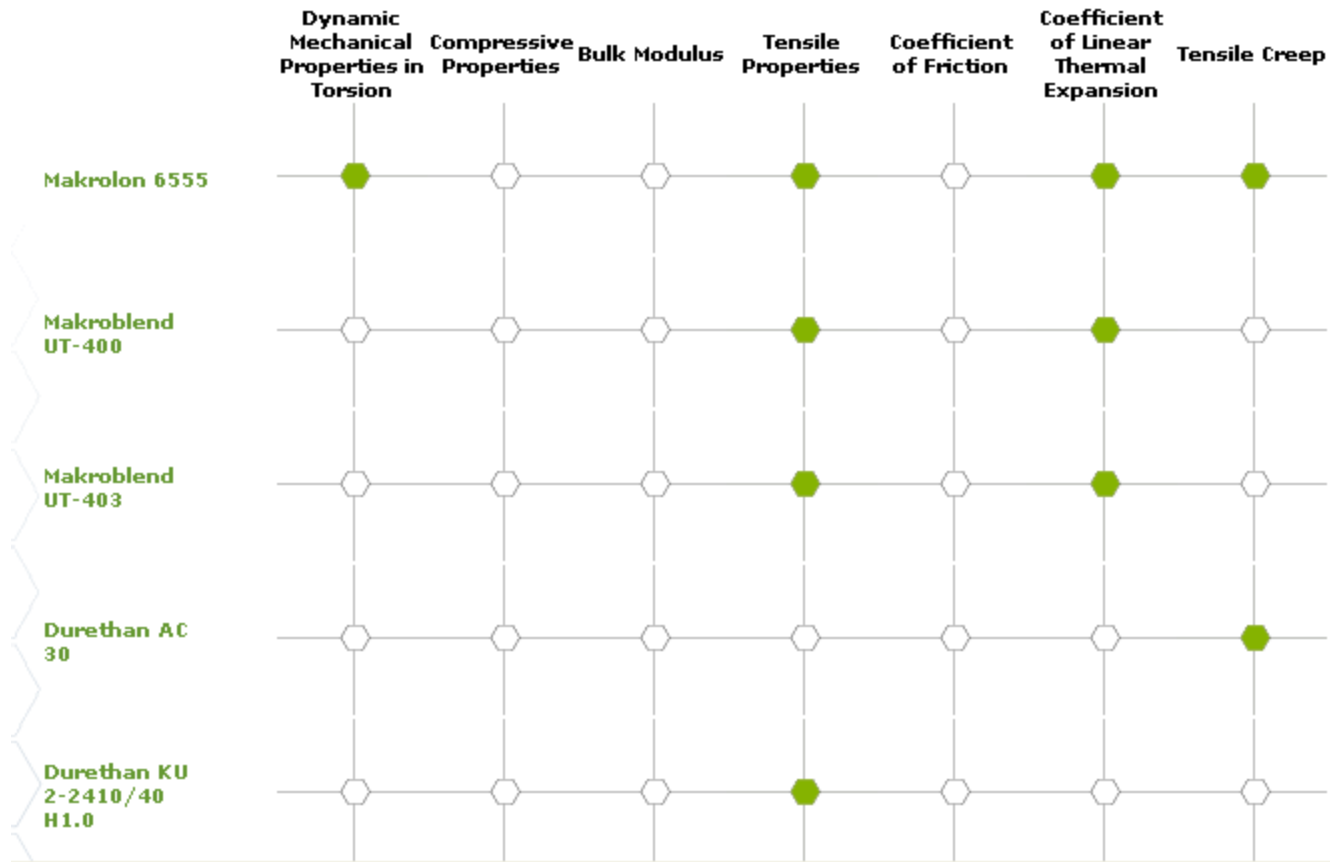
<input checked="" type="checkbox"/> Bulk Modulus	<input type="checkbox"/> Melt Density
<input type="checkbox"/> Capillary Viscosity	<input type="checkbox"/> Melt Elasticity
<input type="checkbox"/> Charpy Impact	<input type="checkbox"/> Melt Flow Rate
<input checked="" type="checkbox"/> Coefficient of Friction	<input type="checkbox"/> Melt Rheology by DMA
<input checked="" type="checkbox"/> Coefficient of Linear Thermal Expansion	<input type="checkbox"/> Moldflow Shrinkage
<input type="checkbox"/> Comparative Tracking Index	<input type="checkbox"/> Mould Shrinkage
<input type="checkbox"/> Compressive Fatigue	<input type="checkbox"/> No-Flow Temperature
<input checked="" type="checkbox"/> Compressive Properties	<input type="checkbox"/> Permittivity
<input type="checkbox"/> Dynamic Mechanical Properties in Tension	<input type="checkbox"/> Planar Tension
<input checked="" type="checkbox"/> Dynamic Mechanical Properties in Torsion	<input type="checkbox"/> Pressure-Volume-Temperature
<input type="checkbox"/> Electric Strength	<input type="checkbox"/> Solid Density
<input type="checkbox"/> Flammability	<input type="checkbox"/> Specific Heat
<input type="checkbox"/> Flexural Creep	<input checked="" type="checkbox"/> Tensile Creep
<input type="checkbox"/> Flexural Fatigue	<input checked="" type="checkbox"/> Tensile Properties
<input type="checkbox"/> Flexural Properties	<input type="checkbox"/> Thermal Analysis
<input type="checkbox"/> Fogging Characteristics	<input type="checkbox"/> Thermal Conductivity
<input type="checkbox"/> Heat Deflection Temperature	<input type="checkbox"/> Vicat Softening Temperature
<input type="checkbox"/> Instrumented Dart Impact	<input type="checkbox"/> Water Absorption
<input type="checkbox"/> Izod Impact	



# Beyond

# Instantly see what's there

## Search Results



# Conclusion

- ABAQUS needs enormous data diversity
- Need to locate ABAQUS-specific data
- Model visualization and validation
- Authentication of data
- Fidelity of usage
- Security and sharing

