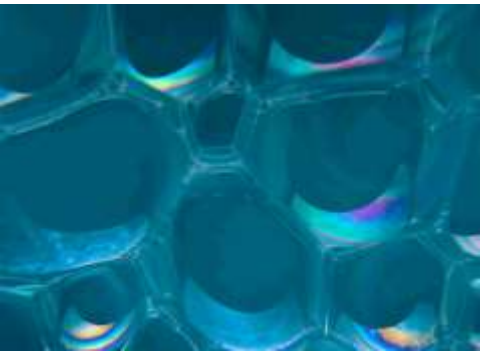
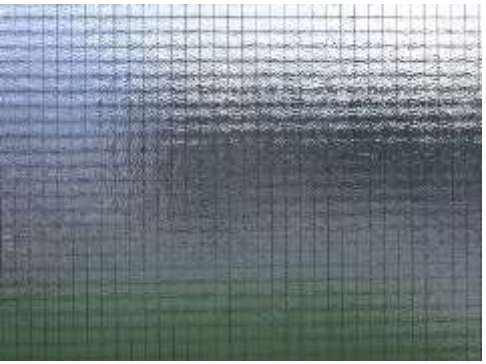




mat

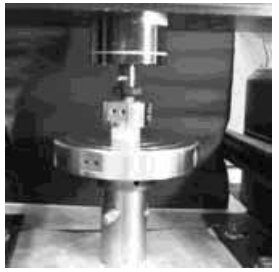
a world of materials

many products

reality

each with its own reality

material data



compressive

stress relaxation

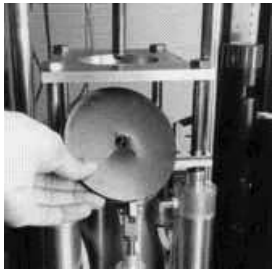
tensile

conductivity

expansion

fatigue

viscosity



properties that describe reality

web services for material data

Using Matereality as a Material Database for ABAQUS

Hubert Lobo

matereality

Outline

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

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Diversity

ABAQUS can do anything!

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

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Diversity

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

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Needs

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

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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

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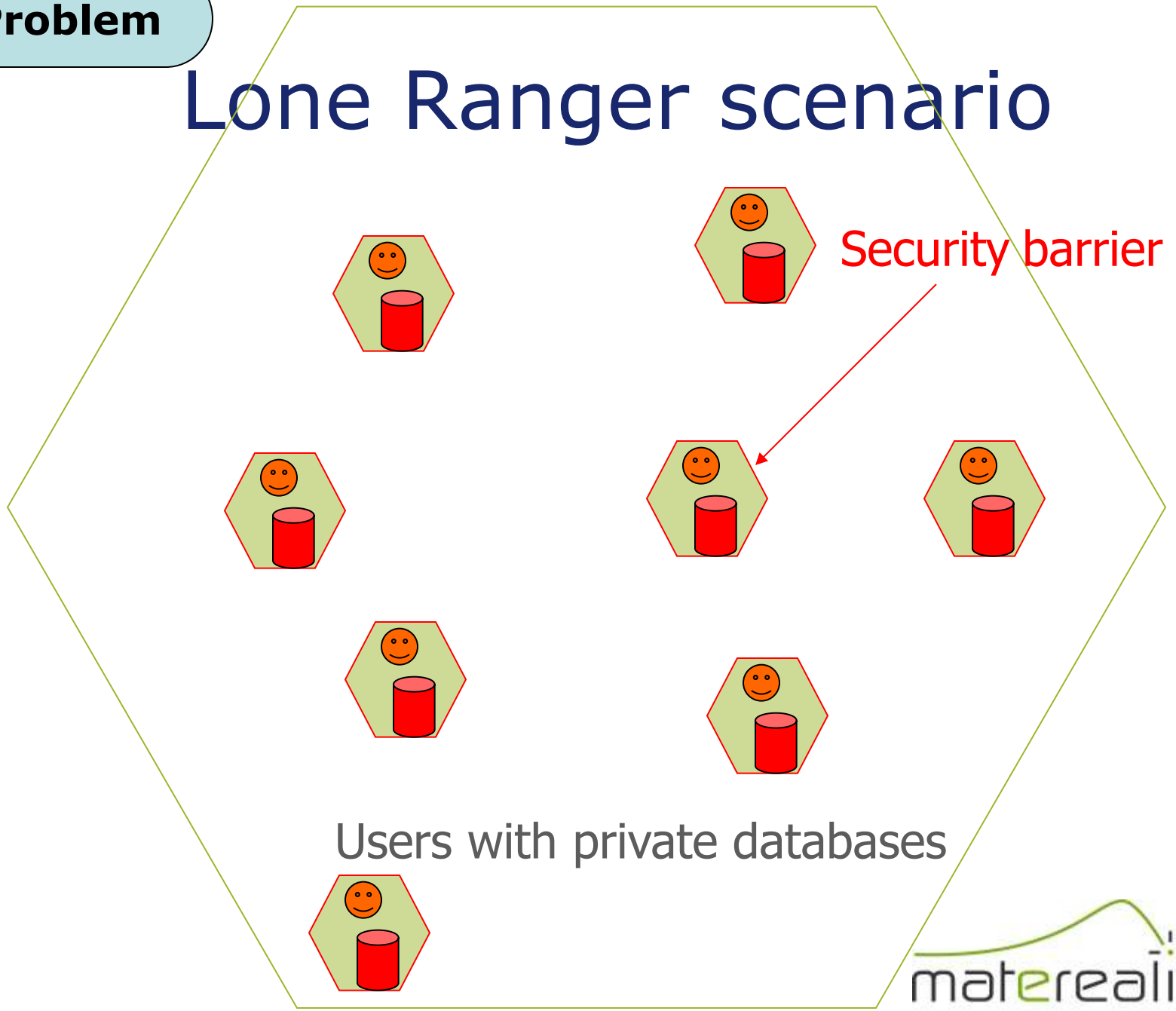
Problem

Lone Ranger scenario



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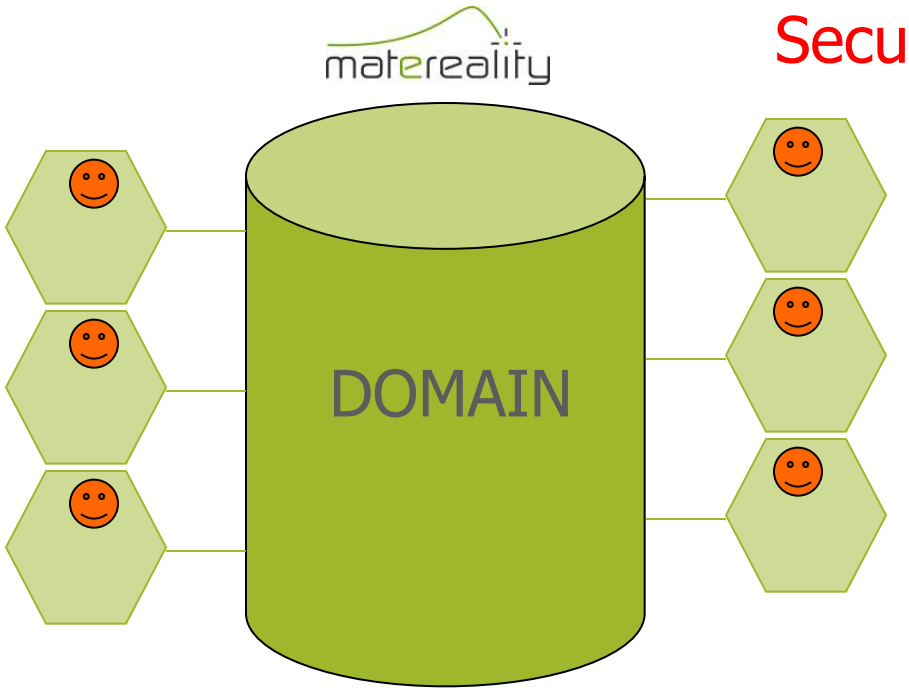
Solution

Enterprise sharing



Shared or selectively-shared access

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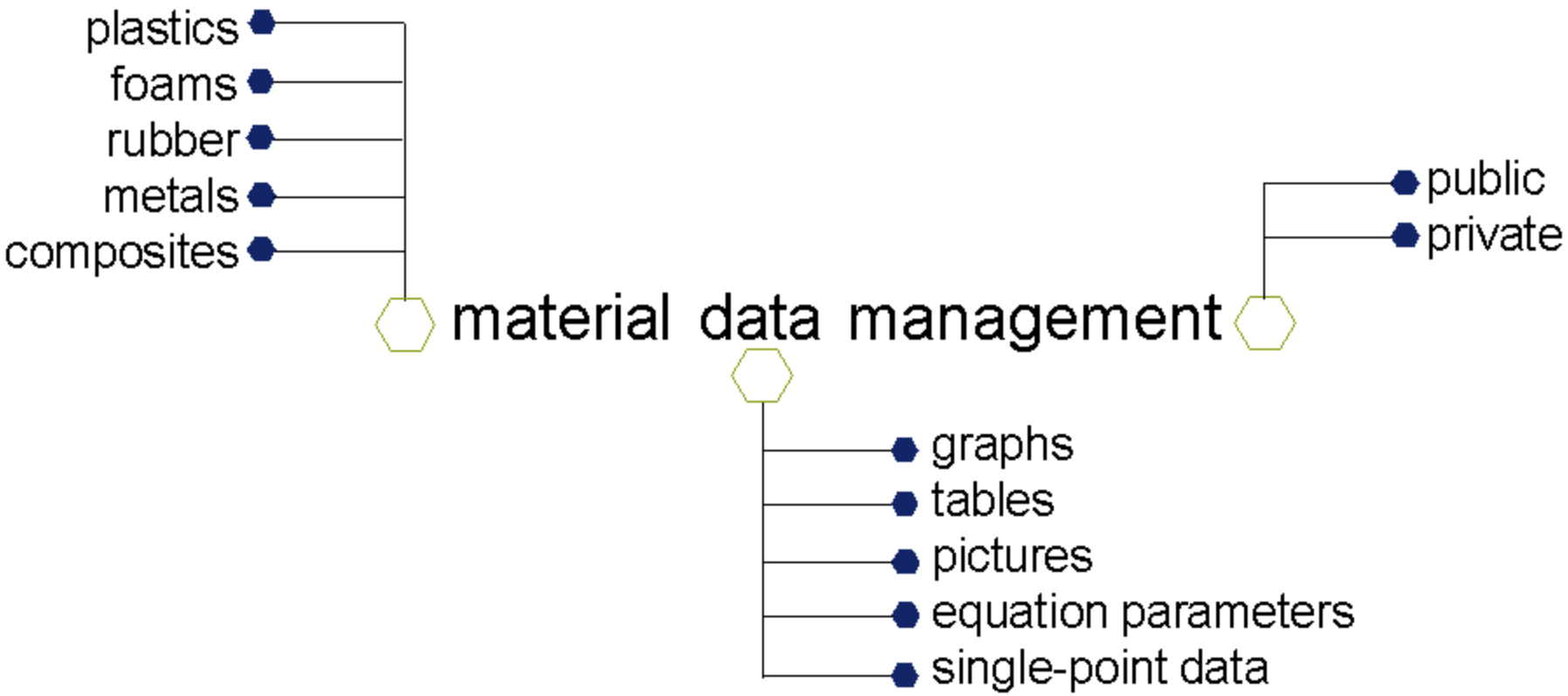
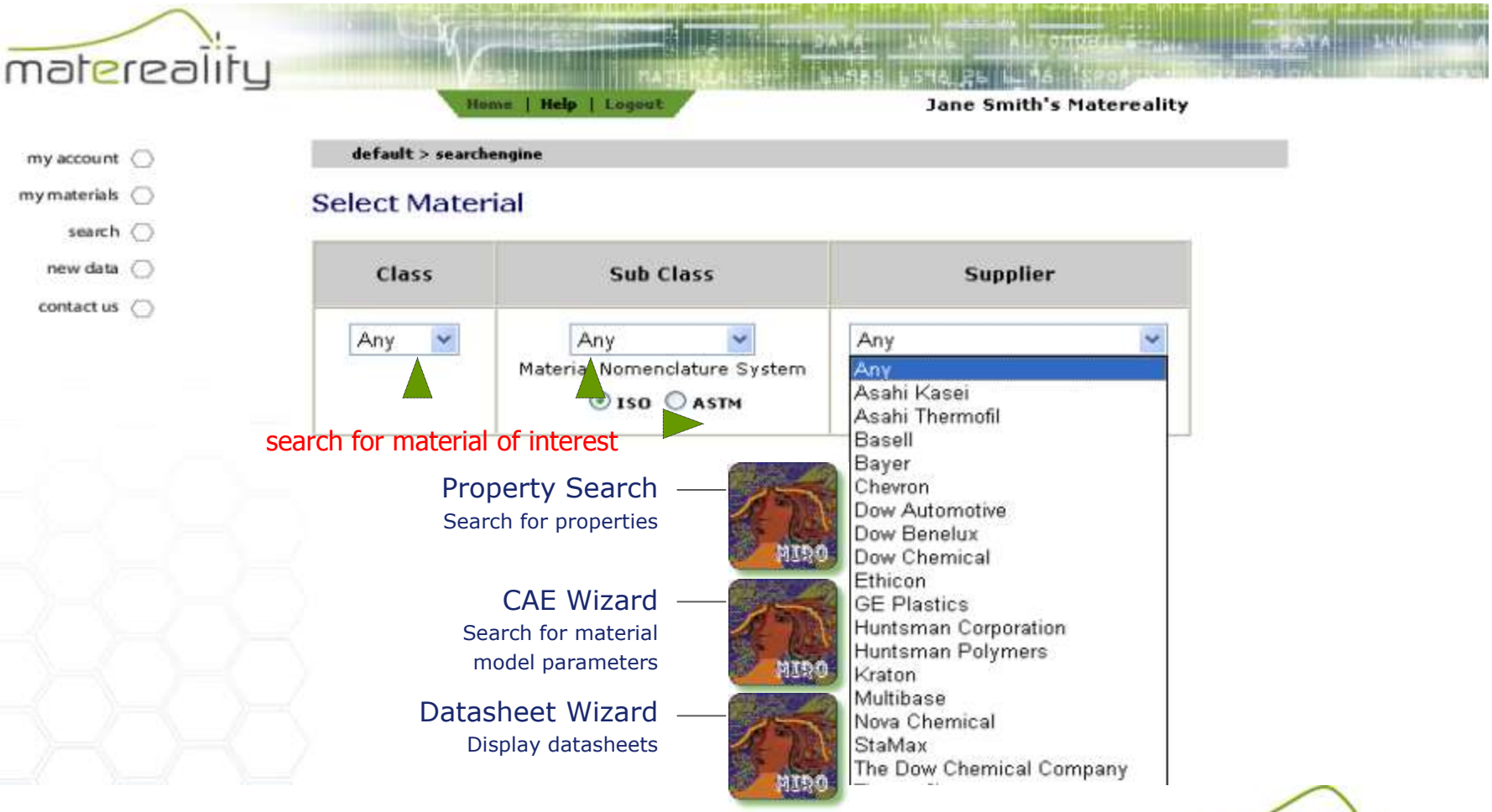
Solution

Storage of diverse data

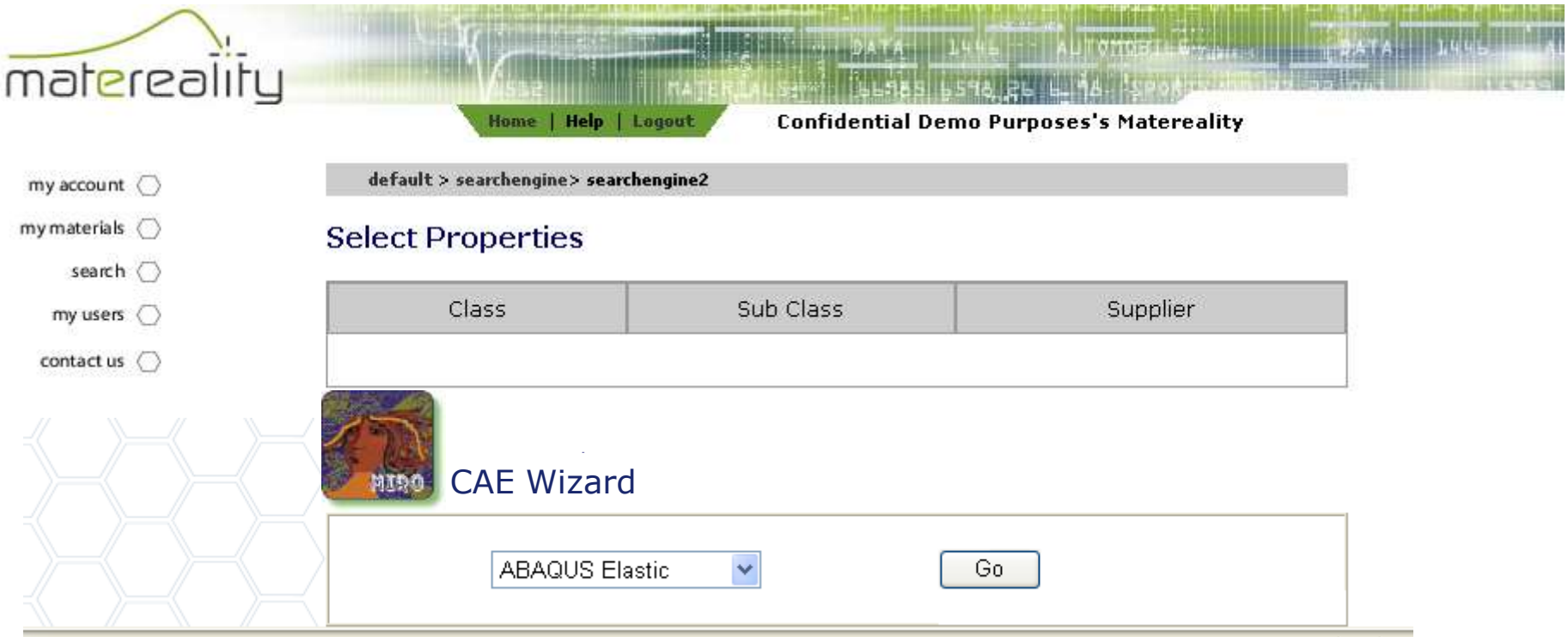


matereality

Search by material…



Pick models of interest…



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Find relevant data

matereality

View model parameters

my account
my materials
search
my users
contact us

default > searchengine> searchengine2> templatesearch> resgroupsummary

Makrolon 7435 > ABAQUS Elastic

Click on the property titles below to view data

Tensile Properties

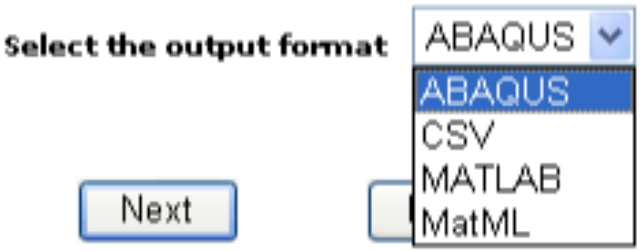
Poissons Ratio	0.4	crosshead speed : 39.62 mm/min
Tensile Modulus	1979.41841168584 MPa	crosshead speed : 39.62 mm/min
Tensile Modulus	2154.66071857014 MPa	crosshead speed : 152.4 mm/min
Tensile Modulus	2156.38738958753 MPa	crosshead speed : 1524 mm/min
Tensile Modulus	2444.88971008786 MPa	crosshead speed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

Export

matereality

Export data to ABAQUS

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



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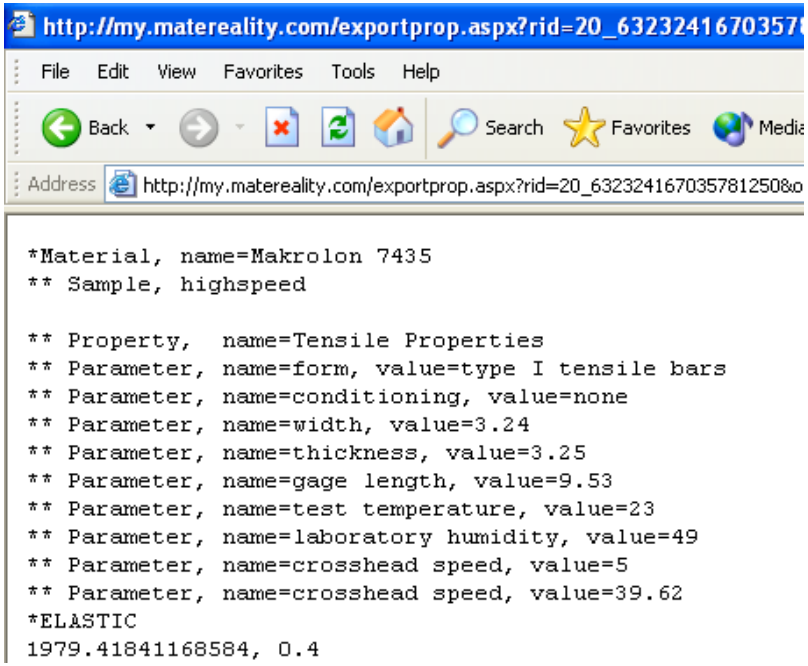
ABAQUS input deck

- Preformatted
- Ready to use



matereality

Variety of material models

- *ELASTIC/*PLASTIC

Tensile Modulus - Secant	2215 MPa
Poissons Ratio	0.4

Plasticity Data

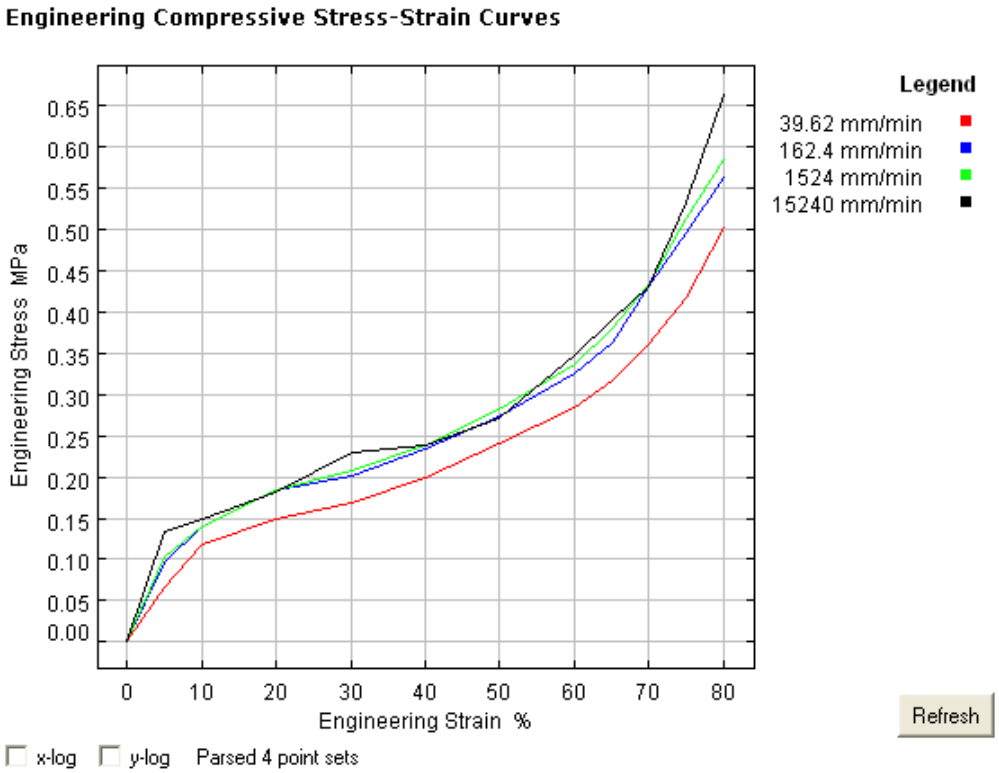
Plastic Strain	True Stress (MPa)
0	19.72
0.00848	54.63
0.0217	58.87
0.0545	56.58
0.0772	51.85
0.11	50.3

matereality

Variety of material data

Computer packaging > Compressive Properties

Effect of crosshead speed



Print | Export | Certificate | Update | Legal

matereality

Authenticity

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

matereality

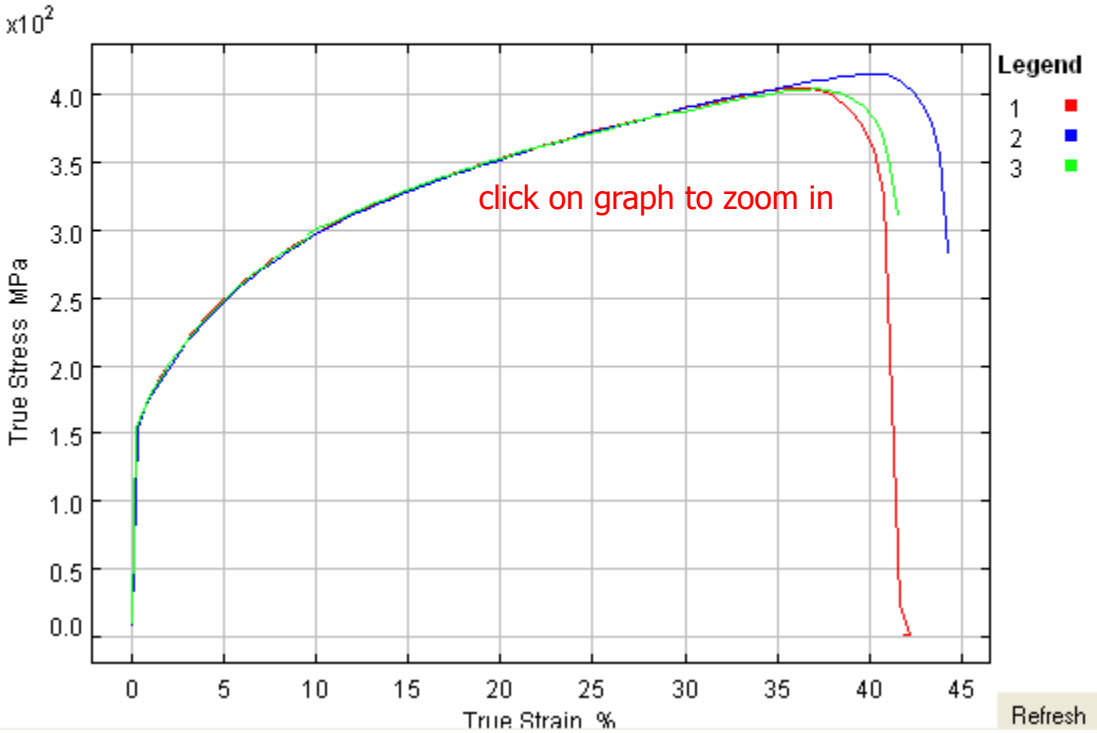
Authenticity

View underlying data

my materials
search
submit data
new data
contact us

0.026" Thick Sheet Metal > Tensile Properties

True Tensile Stress-Strain Curves



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Authenticity

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

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Authenticity

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

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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

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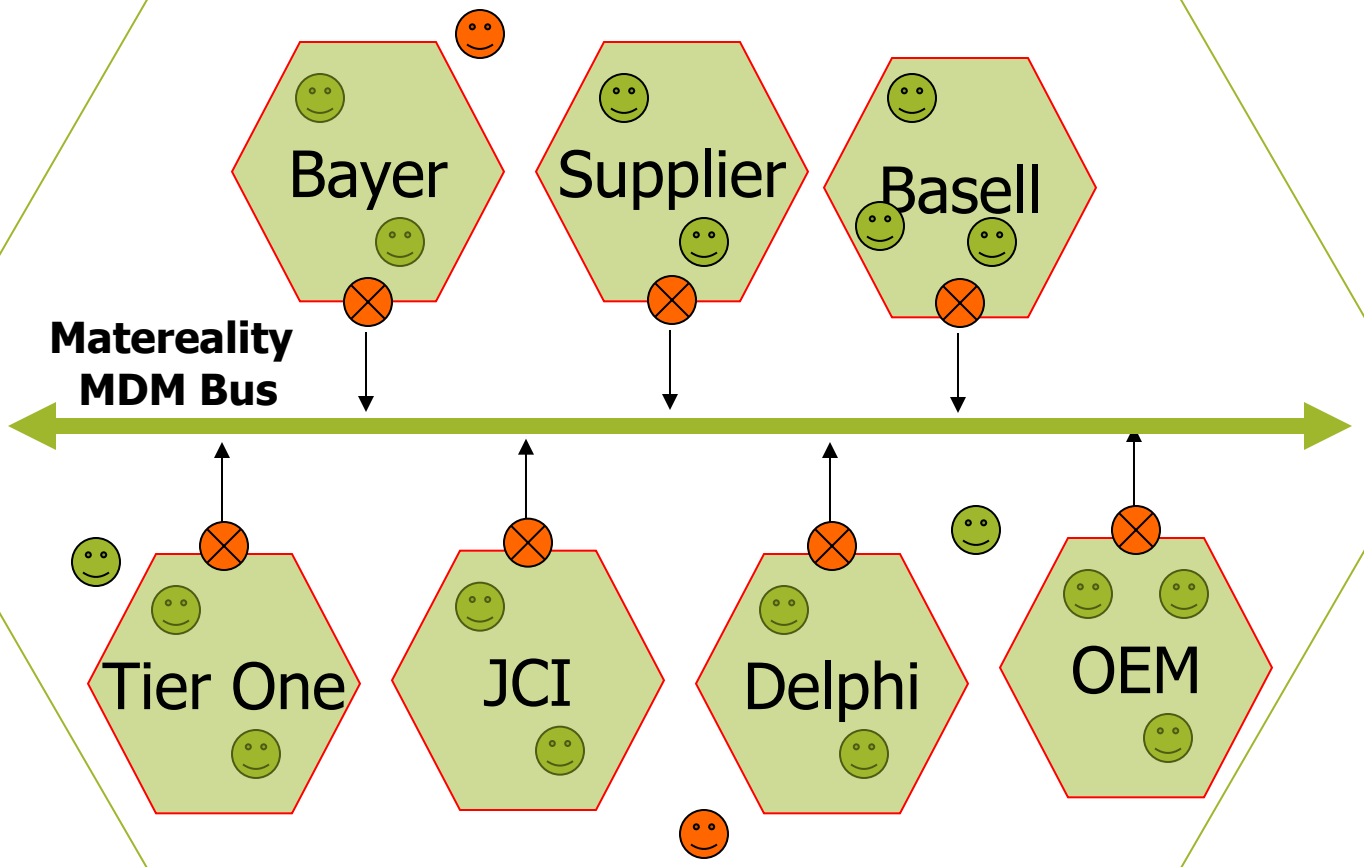
Beyond

Collaborate globally



matereality

Mine extensive data stores

Search by property name

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

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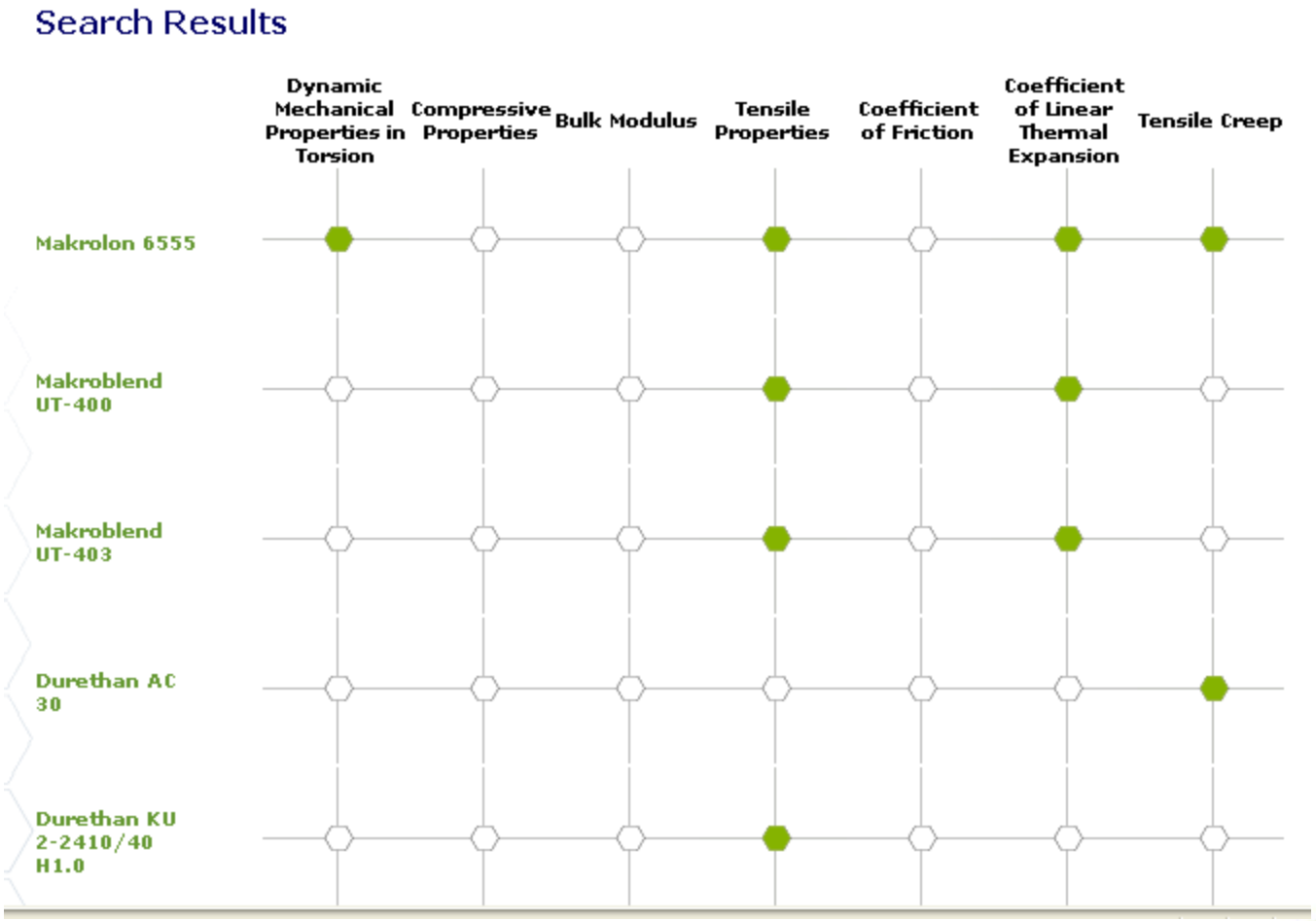
Beyond

Instantly see what's there



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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

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