

mat 

a world of materials

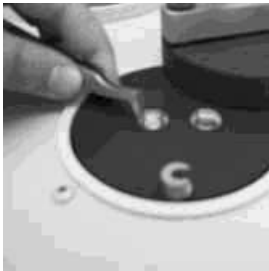
many products



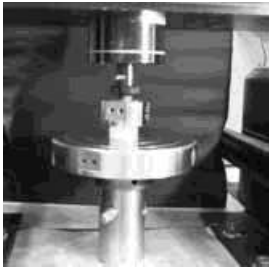
reality

each with its own reality

# material data



stress relaxation



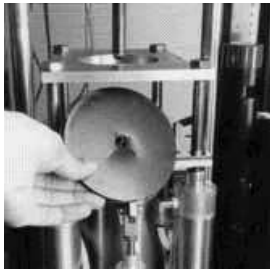
compressive



tensile



viscosity



fatigue



conductivity



expansion

properties that describe reality



web services for material data

# A collaborative MDM System that meets the needs of VPD

Hubert Lobo



## Problem

# Why all this?

Except for simple cases....

- Material properties are not definitive!
- Handbook values are typical, not representative
- You cannot possibly measure all the possible nuances of a materials behavior- nor would you be interested

## Problem

# Material properties differ...

- Properties depend on the application
  - on test conditions:
    - temperature
    - rate
    - time
    - environmental exposure
  - the samples
  - the test specimens

## Problem

# What's good for selection...

- The correct material property for a particular use may not be the right one for another application
- Conversely, it is pointless developing properties outside the context of an application

**can be bad for VPD!**



## Example

# Case 1

- Automotive- Fuel Tank
  - Material : Polyethylene (PE)
  - Deformation: large, low temp failure
  - Model: \*ELASTIC/\*PLASTIC
  - Data needed: stress-strain curve:
    - fuel soaked specimens
    - -40C
  - Typical data: taken on virgin resin at 23C
- Reality:
  - Data at -40C is needed
  - Much stiffer, brittle failure?

## Problem

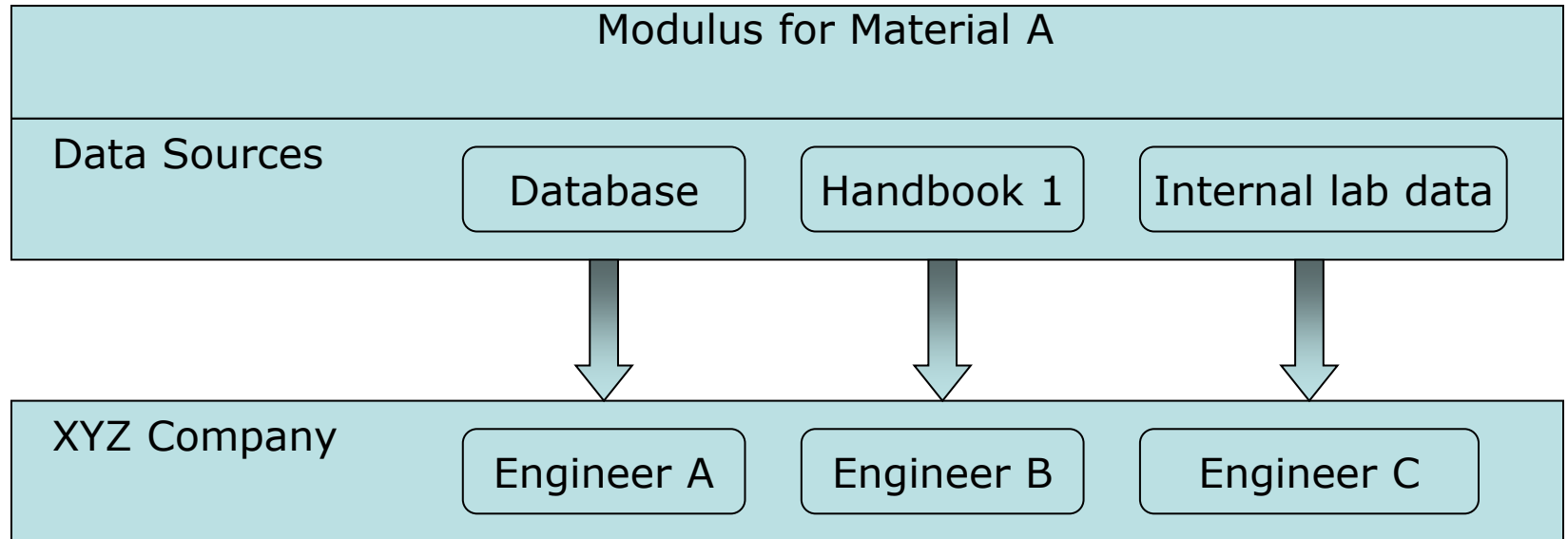
# Finding the right data

- Imagine wading through enormous swamps looking for the right data
  - Handbooks
  - Internet
  - Databases
  - File cabinets
  - Colleagues and co-workers



## Problem

# Inconsistent use of data

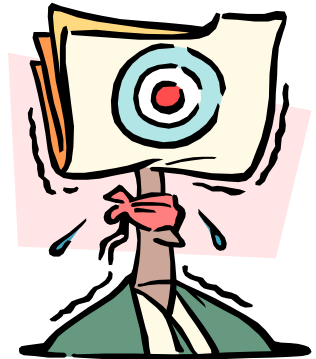


the six sigma killer...

## Problem

# Poor properties can be fatal

- Property no longer represents the behavior being simulated
- Can be a root cause of error in CAE
- Presents a serious credibility problem for analyst, CAE tool, and VPD



## Solution

# How to avoid this?

- Understand the environment that is being simulated
- Translate the behaviors into a set of measurable property requirements
- Pay heed to the underlying assumptions
- Develop representative properties
- Use consistently across VPD platform

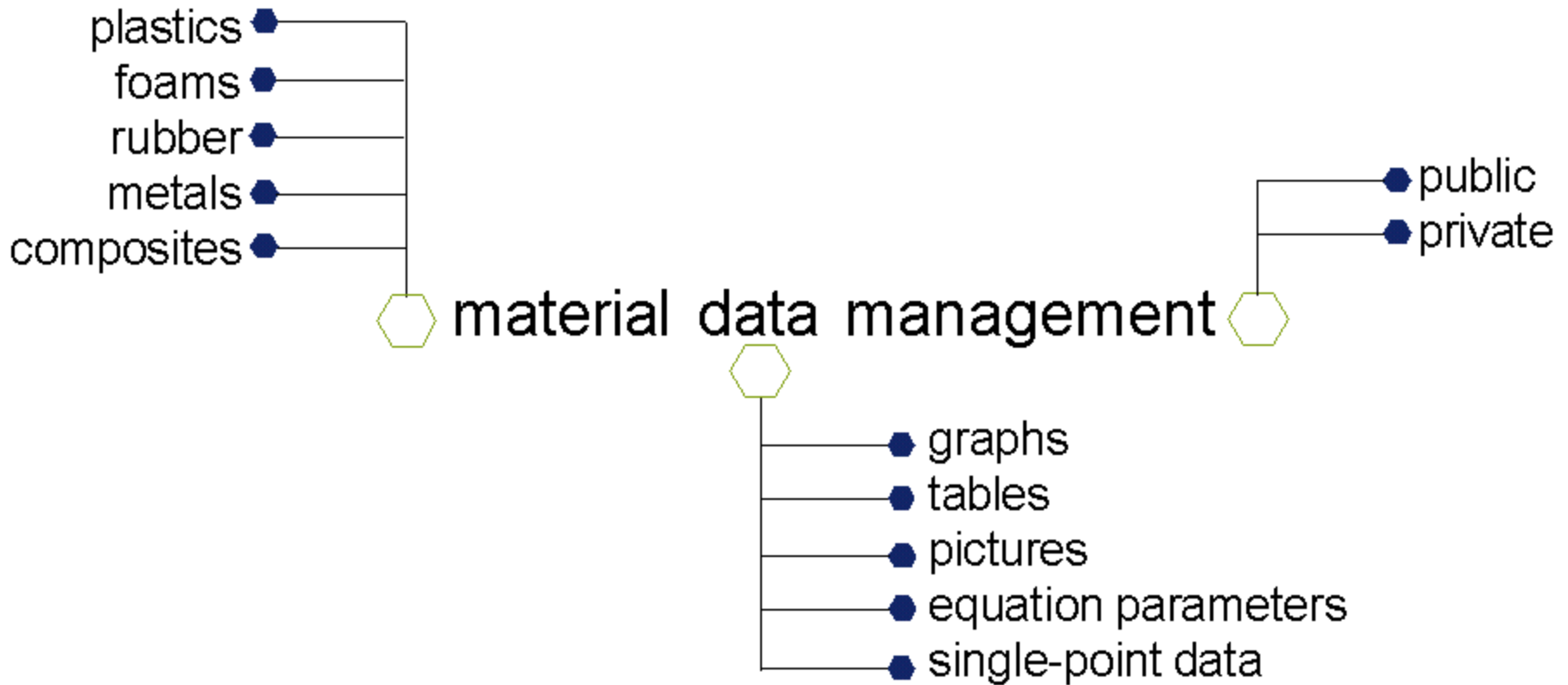
# The big picture

- We need to store a multitude of varied properties
- Which depend on the end use application
- For diverse applications
- For diverse material types
- Useable in a variety of CAE solutions

**a major mess...**

## Solution

# Introducing Matereality

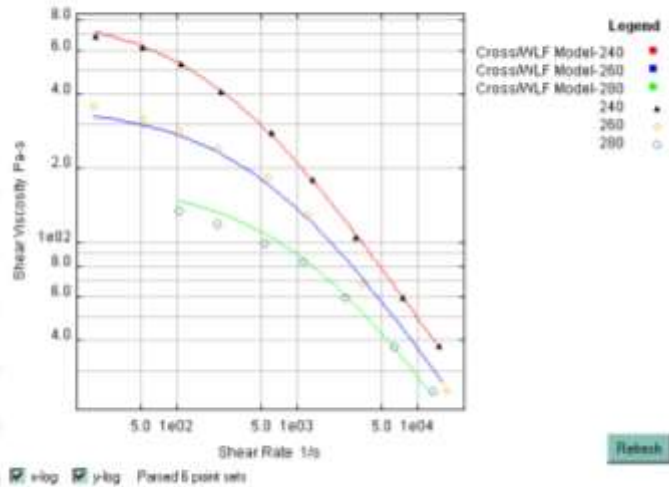


# Solution

## Handles data diversity

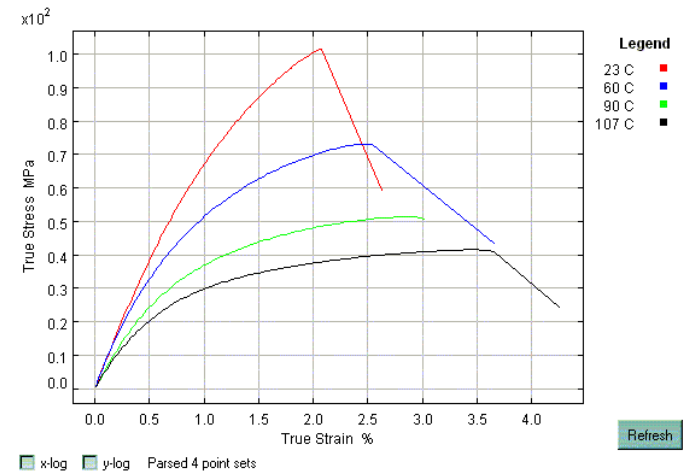
EMERGE 7550 - Capillary Viscosity

Cross/WLF Model



StaMax40YM240 > Tensile Properties  
Effect of test temperature

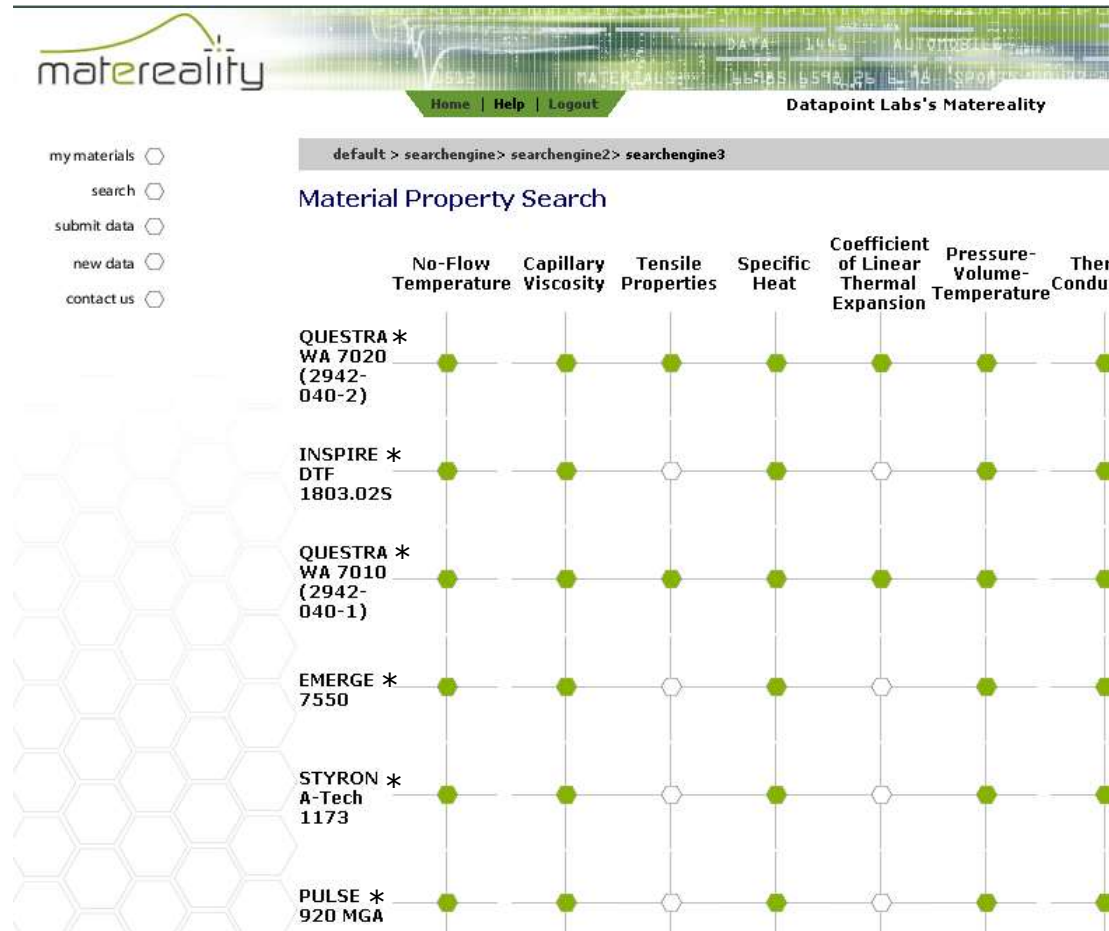
True Tensile Stress-Strain Curves





# Solution

## Stores pertinent data



Material names are trademark of The Dow Chemical Company



# Solution

## Records traceability

The screenshot displays the Matereality website interface. At the top, the logo "matereality" is visible, along with navigation links for Home, Help, and Logout. The page title is "Datapoint Labs's Matereality". Below the navigation, there are links for my materials, search, submit data, new data, and contact us. The main content area shows the breadcrumb trail: default > searchengine > searchengine2 > searchengine3 > prepuncsury > prepresdt > prepresdtparams. The title of the page is "Measurement Details for EMERGE \*550 - Capillary Viscosity".

Technique	standards organization	ASTM
	standard number	D3835-96
	uncertainty analysis	per standard
Sample Details	identification	5209
	source	client
Corrections	data correction	Rabinowitsch
Specimen Details	drying	none
	form	pellets
	other preparation	none
Test Parameters	barrel diameter	12 mm
	die diameter	1 mm
	die entry angle	180 deg
	die length	20 mm
	preheat time	6 min
	test temperature	240 C
Traceability	test temperature	260 C
	test temperature	280 C
	measurement date	3/4/2002
	accredited	Yes
	measurement instrument	Goettfert Rheograph 2003 Capillary Rheometer
	performed by	JA
	certified by	TB

At the bottom of the page, there are links for Print, Report, View Result, Update, and Legal.

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# Solution

## Displays variability

### Tensile Modulus - Youngs

2223 MPa	1
2138 MPa	2
2229 MPa	3
2197 MPa	Average

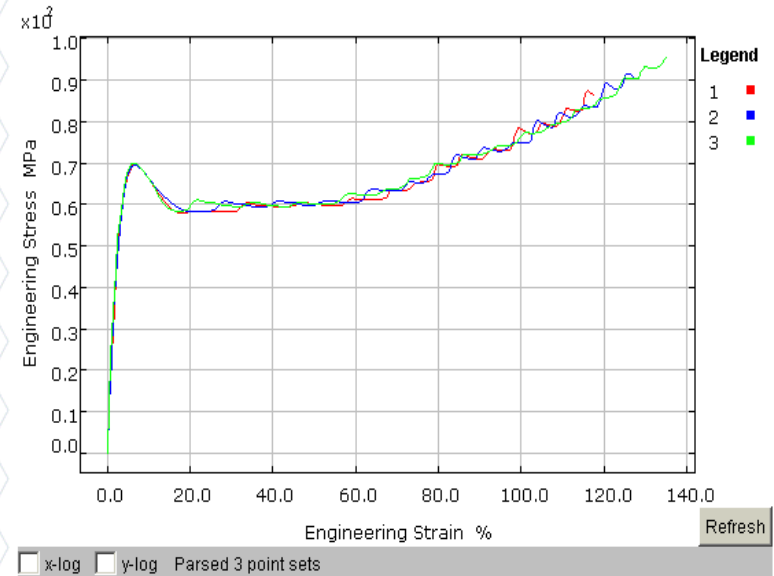
### Offset Yield Stress in Tension

44.27 MPa	1
46.04 MPa	2
41.07 MPa	3
43.79 MPa	Average

### Offset Yield Strain in Tension

2.12 MPa	1
2.24 MPa	2

### Engineering Tensile Stress-Strain Curves



## Example

# Application to VPD and beyond

### Part designer's matereality

- Stress-strain data
- Impact data
- Refractive index

### Moldflow analyst's matereality

- Viscosity
- Thermal conductivity
- Melt density
- Specific heat
- No-flow temperature

### Molder's matereality

- Melt flow rate
- Izod strength

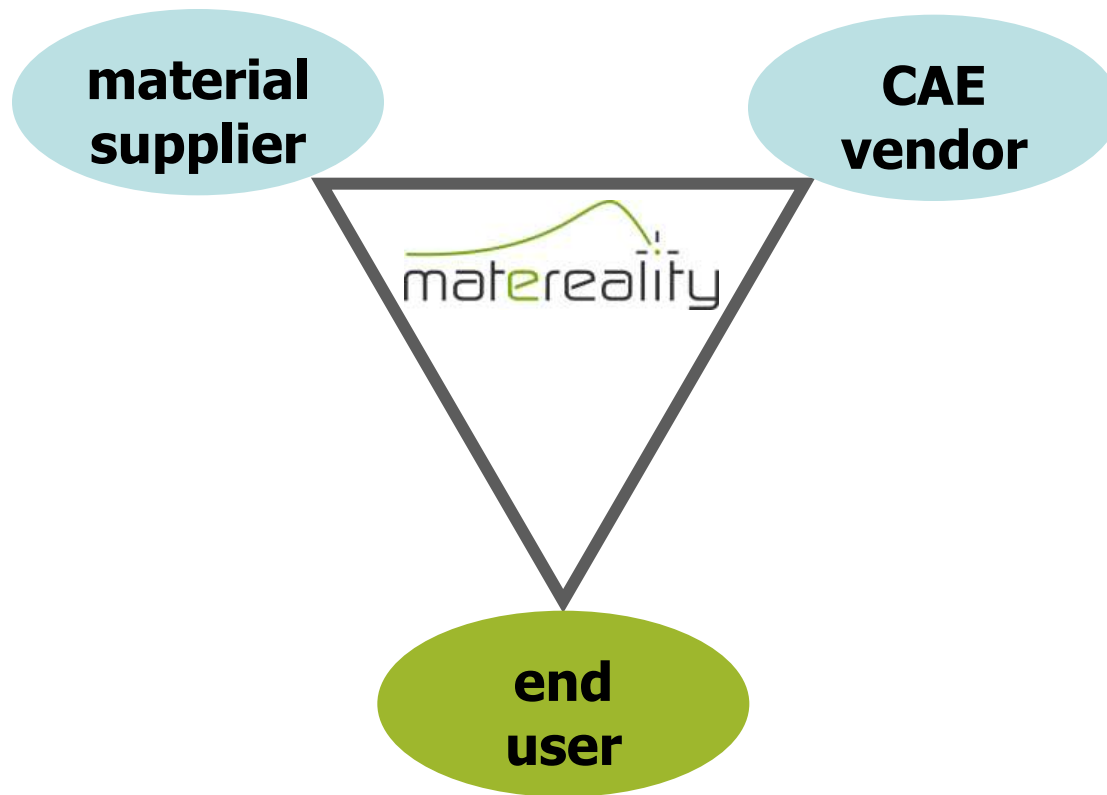
Product: safety glasses



Material: polycarbonate

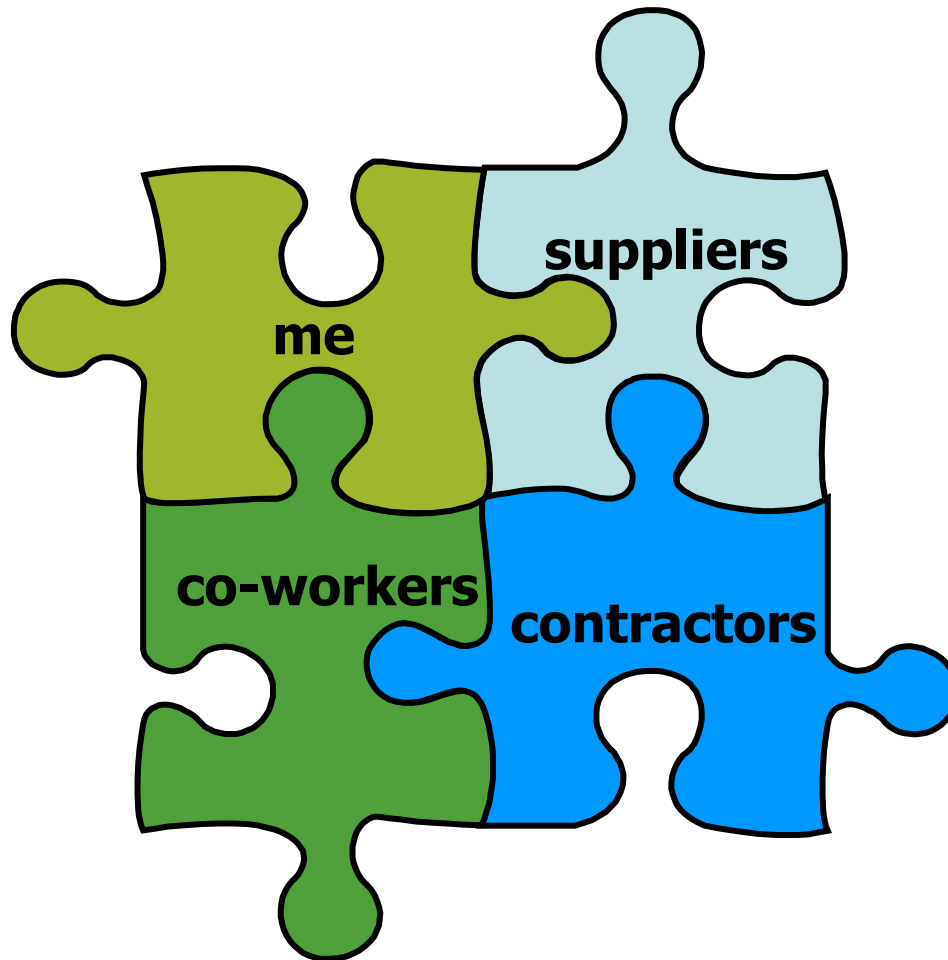
**Collaborate**

# Stakeholders in VPD



**Collaborate**

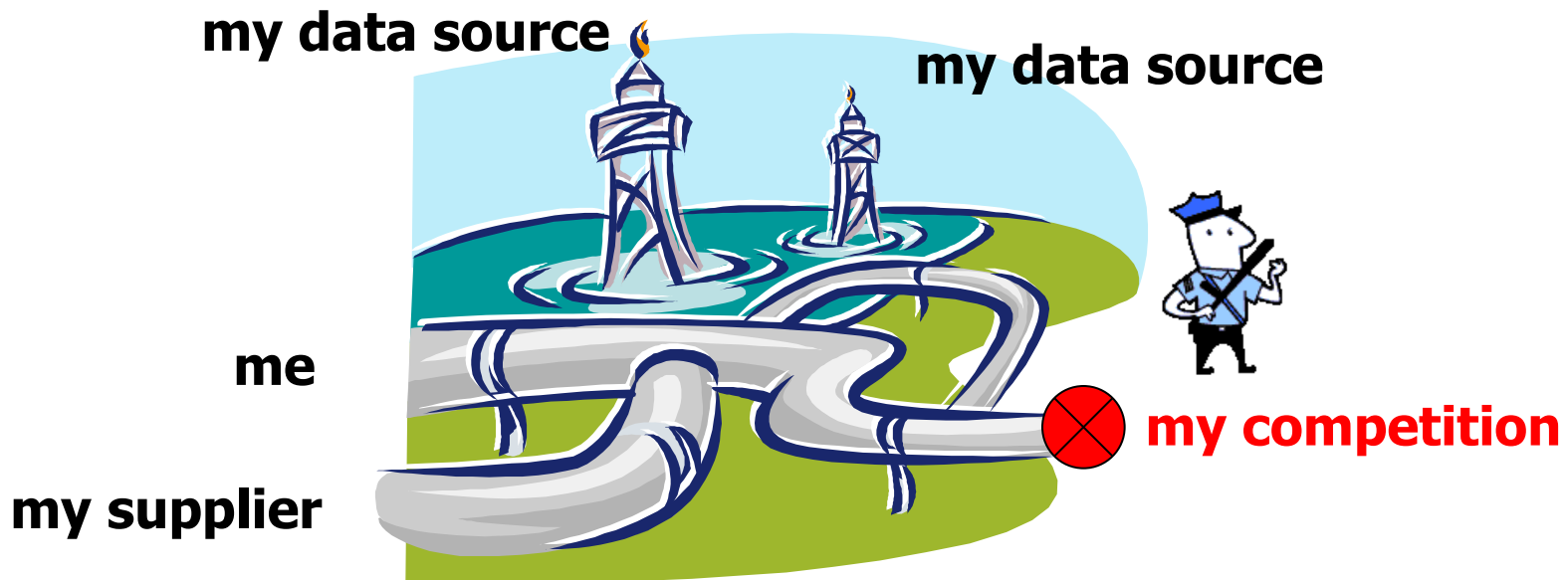
Matereality is collaborative,



# Collaborate

## flexible,

- Highly efficient data pipelines



**Collaborate**

secure!



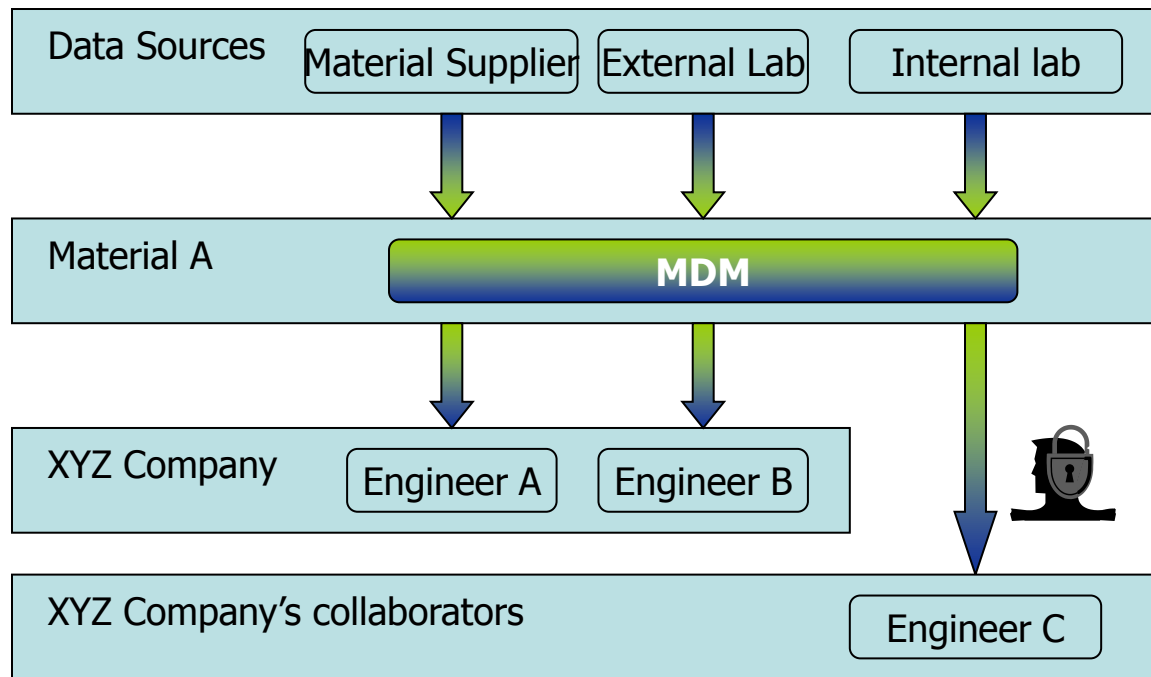




matereality

creates **secure**, flexible networks

# Matereality applied consistently



# Cost savings

- Only the properties needed are measured
- Once measured, properties are shared by all stakeholders
- Reduced risk- no searching in dubious places for data

# Conclusions

- Authoritative source of material data for the enterprise
- Handles any kind of material data
- Selectively shareable by stakeholders
- Achieves cost benefits
- Reduces risk
- Extensible to entire product life cycle