

mat 

a world of materials

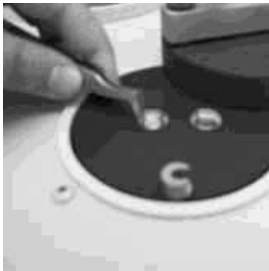
many products



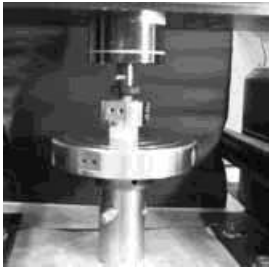
reality

each with its own reality

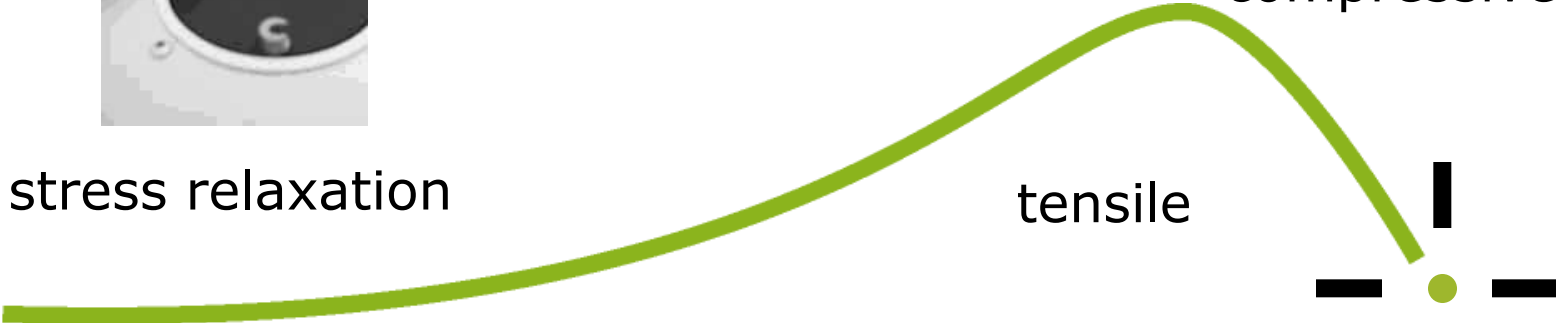
material data



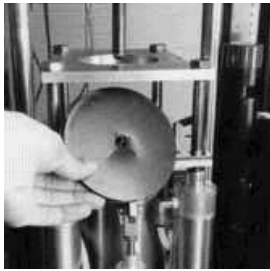
stress relaxation



compressive



viscosity



fatigue



conductivity



expansion

properties that describe reality



web services for material data

Can Material Property Databases Meet the Needs of Global Enterprises

Hubert Lobo

Outline

- Needs Analysis
- Solution elements
- Solution implementation
- Conclusions

Requirements

- Enormous data diversity
- Search for data
- Authentication of data
- Selective global access
- Security
- Visualization and connectivity

Material properties differ...

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

Data is application-specific

- The correct material property for a particular use may not be the right one for another application
 - Many property measurements
 - Each applicable for its stage in the product life cycle

Example

Specificity of material data

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

The case in singular

- I need to store a variety of properties
- On the materials that I use most
- Which must be pertinent to my class of applications

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

a major mess...

Problem

Typical current scenarios

- Many limited data stores
 - Region specific
 - Company specific
 - Application specific
 - Material specific
 - Property specific
- No common data interchange

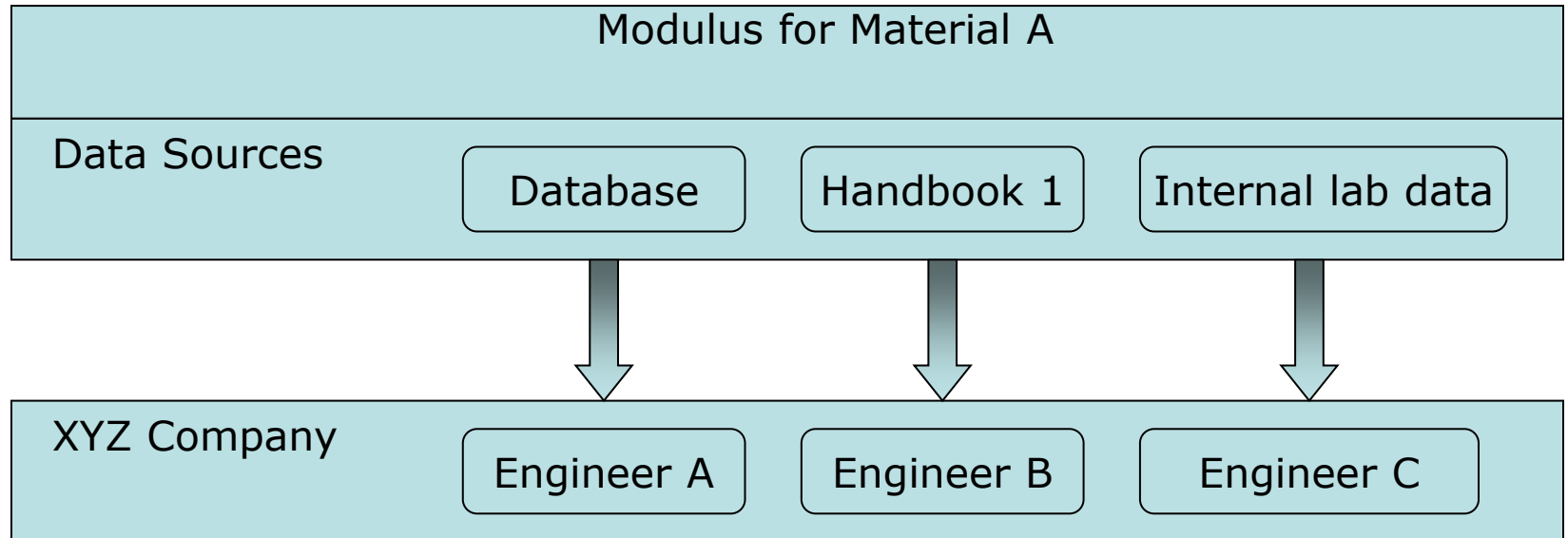
Finding the right data

- 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...

Ensuring trust

- 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

Data access and security

- Highly collaborative
- Many stakeholders
 - Material suppliers
 - Part suppliers
 - Consultants
 - CAE vendors
- Selective sharing is essential

Summary

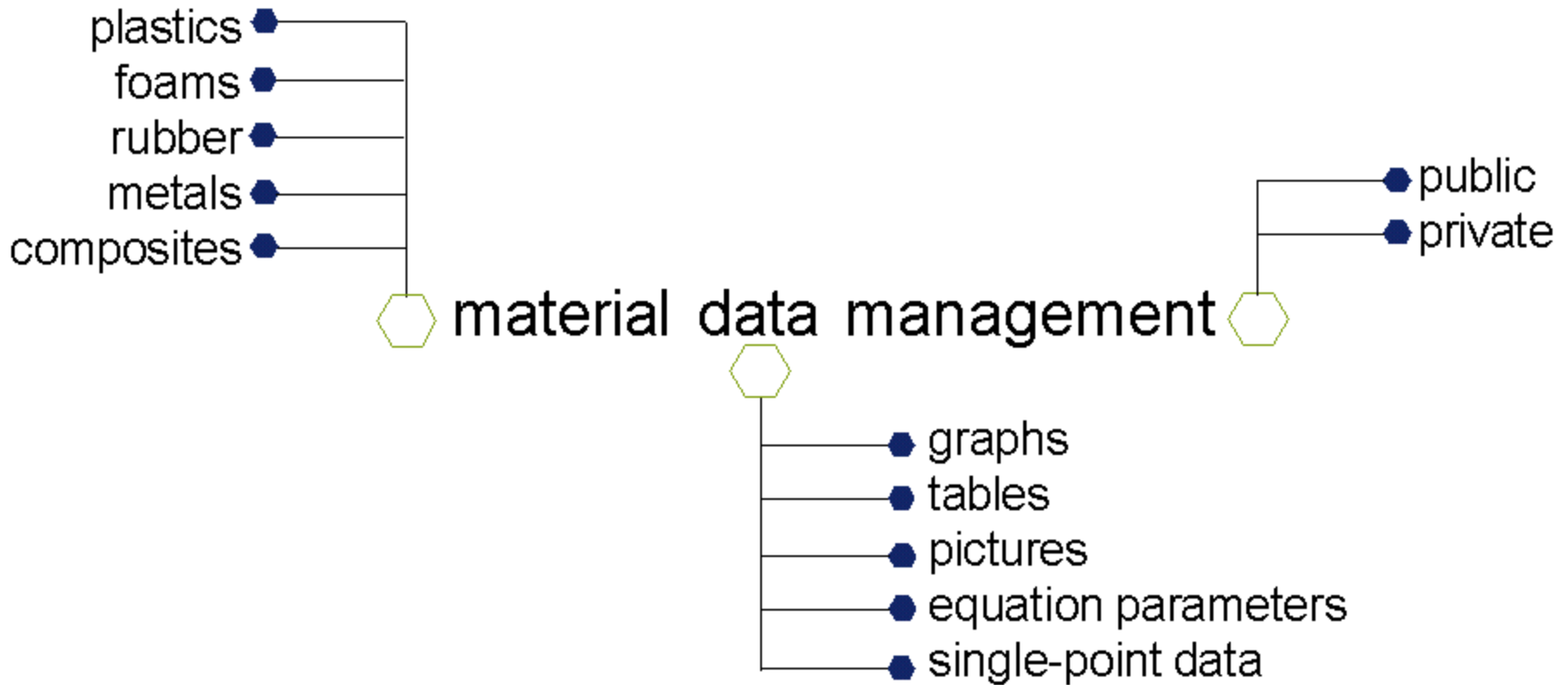
- Piecewise data stores are inefficient
- Enterprise has only limited access to data
- Sharing with collaborators is difficult
- Unavailable data = retest
- High risk, lost time and money

Basis of a solution

- Collaborative engineering
- Common framework
 - Share data selectively
 - Eliminate duplication of testing
 - Eliminate inconsistent use of data
 - Permit data authentication
 - Track activity

Solution

What is MDM?



Basis of MDM

- Material data specific data structures
 - Store diverse data, simple or complex
 - Handle all types of data used throughout product life cycle
- Within a PDM type framework
 - Share data selectively, securely
 - Extensible to entire product life cycle

Solution

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

Solution

and comprehensive!

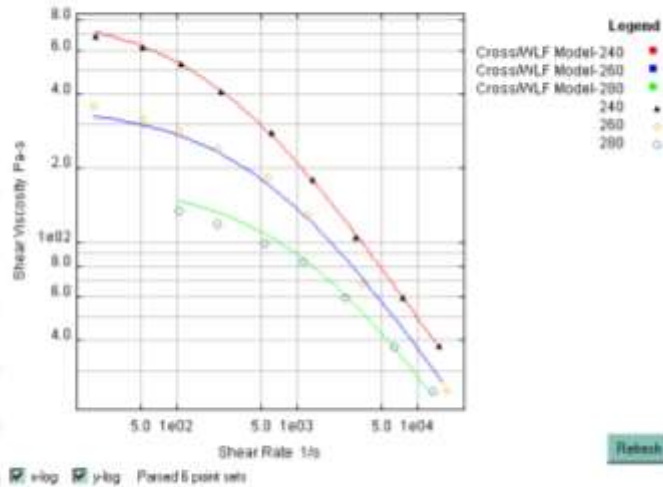
- Data is purposed for
 - Design
 - Process simulation
 - Material/product certification
 - Manufacturing
 - Failure studies
- Any kind of data- simple to complex

Solution

Handles data diversity

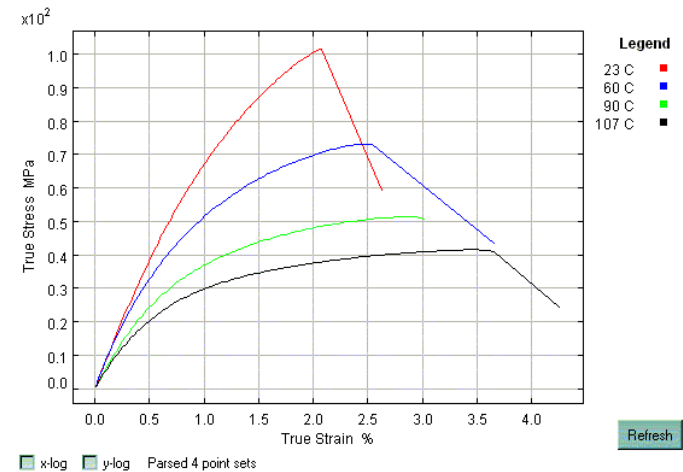
EMERGE 7550 - Capillary Viscosity

Cross/WLF Model



StaMax40YM240 > Tensile Properties
Effect of test temperature

True Tensile Stress-Strain Curves



Solution

Stores pertinent data

The screenshot shows the Matereality website interface. At the top left is the Matereality logo. Below it is a navigation menu with links for 'my materials', 'search', 'submit data', 'new data', and 'contact us'. The main content area displays a breadcrumb trail: 'default > searchengine > searchengine2 > searchengine3'. Below this is the 'Material Property Search' section, which features a table of material properties. The table has columns for 'No-Flow Temperature', 'Capillary Viscosity', 'Tensile Properties', 'Specific Heat', 'Coefficient of Linear Thermal Expansion', 'Pressure-Volume-Temperature', and 'Ther Condu'. The rows list materials: QUESTRA * WA 7020 (2942-040-2), INSPIRE * DTF 1803.02S, QUESTRA * WA 7010 (2942-040-1), EMERGE * 7550, STYRON * A-Tech 1173, and PULSE * 920 MGA. Each cell in the table contains a green dot indicating the presence of data or a white circle indicating its absence.

| | No-Flow Temperature | Capillary Viscosity | Tensile Properties | Specific Heat | Coefficient of Linear Thermal Expansion | Pressure-Volume-Temperature | Ther Condu |
|--------------------------------|---------------------|---------------------|--------------------|---------------|---|-----------------------------|------------|
| QUESTRA * WA 7020 (2942-040-2) | ● | ● | ● | ● | ● | ● | ● |
| INSPIRE * DTF 1803.02S | ● | ● | ○ | ● | ○ | ● | ● |
| QUESTRA * WA 7010 (2942-040-1) | ● | ● | ● | ● | ● | ● | ● |
| EMERGE * 7550 | ● | ● | ○ | ● | ○ | ● | ● |
| STYRON * A-Tech 1173 | ● | ● | ○ | ● | ○ | ● | ● |
| PULSE * 920 MGA | ● | ● | ○ | ● | ○ | ● | ● |

Material names are trademark of Dow Chemical



Solution

Records traceability

The screenshot displays the Matereality website interface. At the top left is the Matereality logo. Below it are navigation links: Home, Help, Logout. On the right, it says "Datapoint Labs's Matereality". A breadcrumb trail reads: default > searchengine > searchengine2 > searchengine3 > prepsummary > prepresult > prepresultparams. The main heading is "Measurement Details for EMERGE *550 - Capillary Viscosity". On the left side, there are links: mymaterials, search, submit data, new data, and contact us. The central content is a table with the following data:

| | | |
|------------------|------------------------|---|
| 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 |
| Traceability | measurement instrument | Goettfert Rheograph 2003 Capillary Rheometer |
| | performed by | JA |
| | certified by | TB |

At the bottom of the table area, there are links: Print, Report, View Result, Update, Legal.

Material names are trademark of Dow Chemical



Solution

Displays variability

Tensile Modulus - Youngs

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

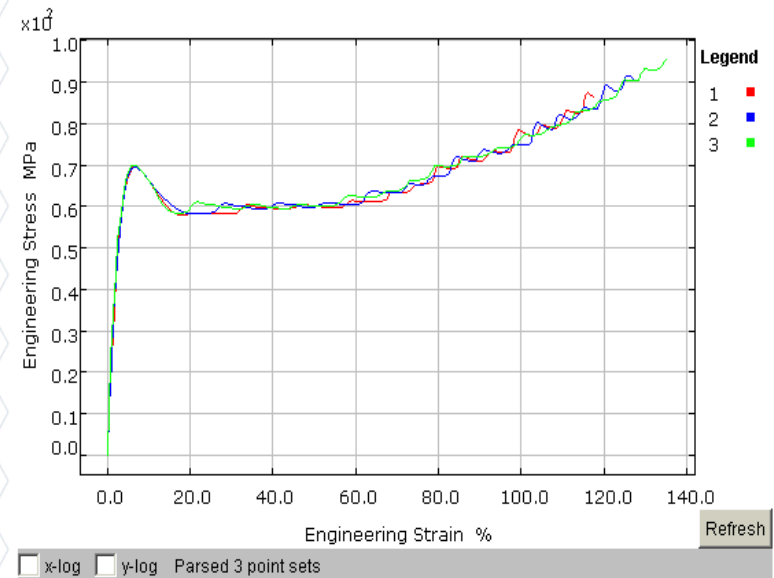
Offset Yield Stress in Tension

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

Offset Yield Strain in Tension

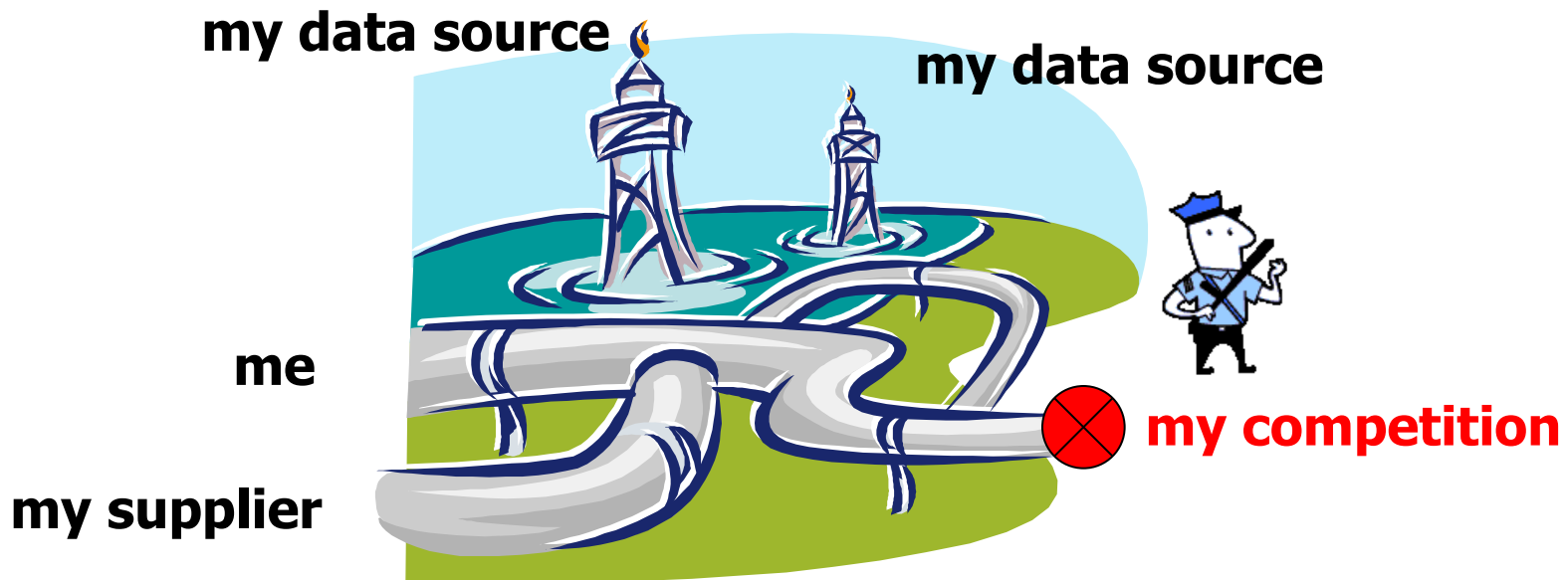
| | |
|----------|---|
| 2.12 MPa | 1 |
| 2.24 MPa | 2 |

Engineering Tensile Stress-Strain Curves



MDM is collaborative,

- Highly efficient data pipelines



Collaborate

secure!



knowledge

Sharing is easy with MDM

- Publish your data
 - To all
 - To your own group
 - To your company
 - To selected persons/companies
- Request access to data from others

follow your business practice

Helping you keep track

- All transactions are recorded
 - Who accessed what
 - Access requests
 - Changes to classification
 - Changes to status of data

Conclusions

- Global enterprises need to manage their material data
 - Securely for collaboration
 - Diverse material data on one platform
 - Have an authoritative source of data
 - Have interoperability for data exchange
 - Means to monitor usage of their data
- Conventional databases are inadequate

Conclusions

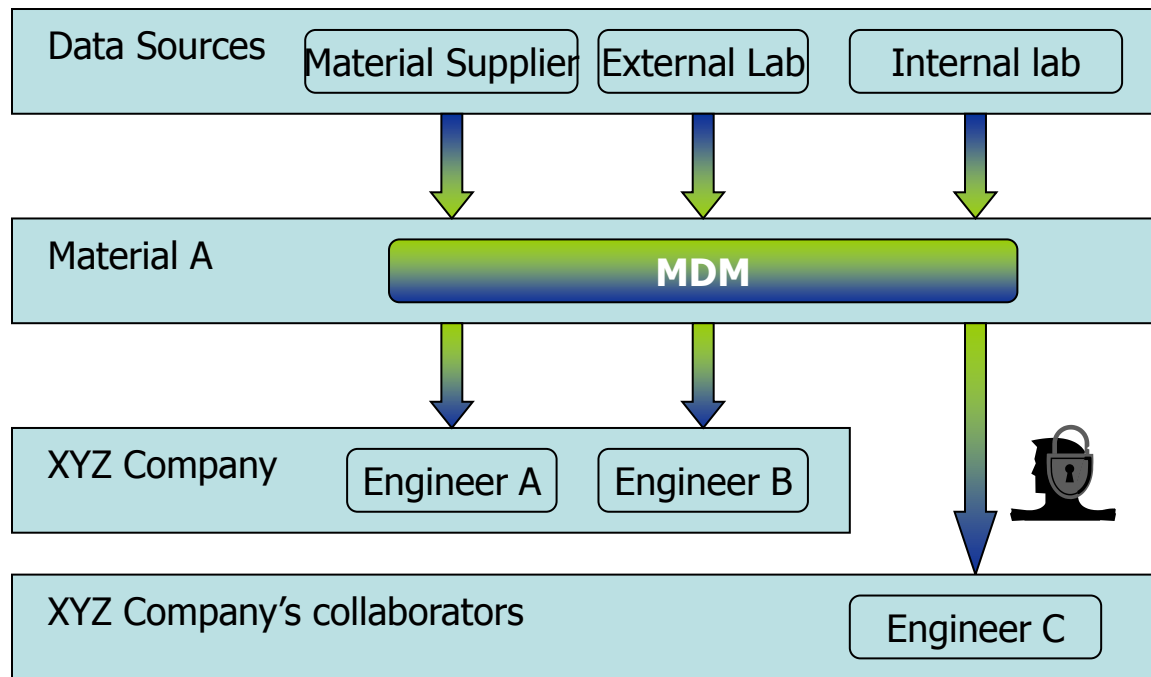
- Paperless MDM provides the solution
 - Authoritative data source for the enterprise
 - Selectively shareable by stakeholders
 - Handles any kind of material data
 - Means to authenticate all property data
 - Means to track all transactions
 - Ability to export to third party applications
 - Applicable to entire product life cycle

Questions?

www.matereality.com/FAQ



Matereality applied consistently



Characteristics of matereality

- A matereality is defined in the context of its end use
- A matereality is self-consistent
- Properties of one matereality may not be applicable to another matereality
- Misuse of properties in a matereality can fracture the matereality

Features of materreality

- Pertinent
 - All properties represent the behavior under consideration
- Traceable
 - The source and quality of the data must be assessable
- Describes variability
 - An understanding of the statistical spread of the representative property