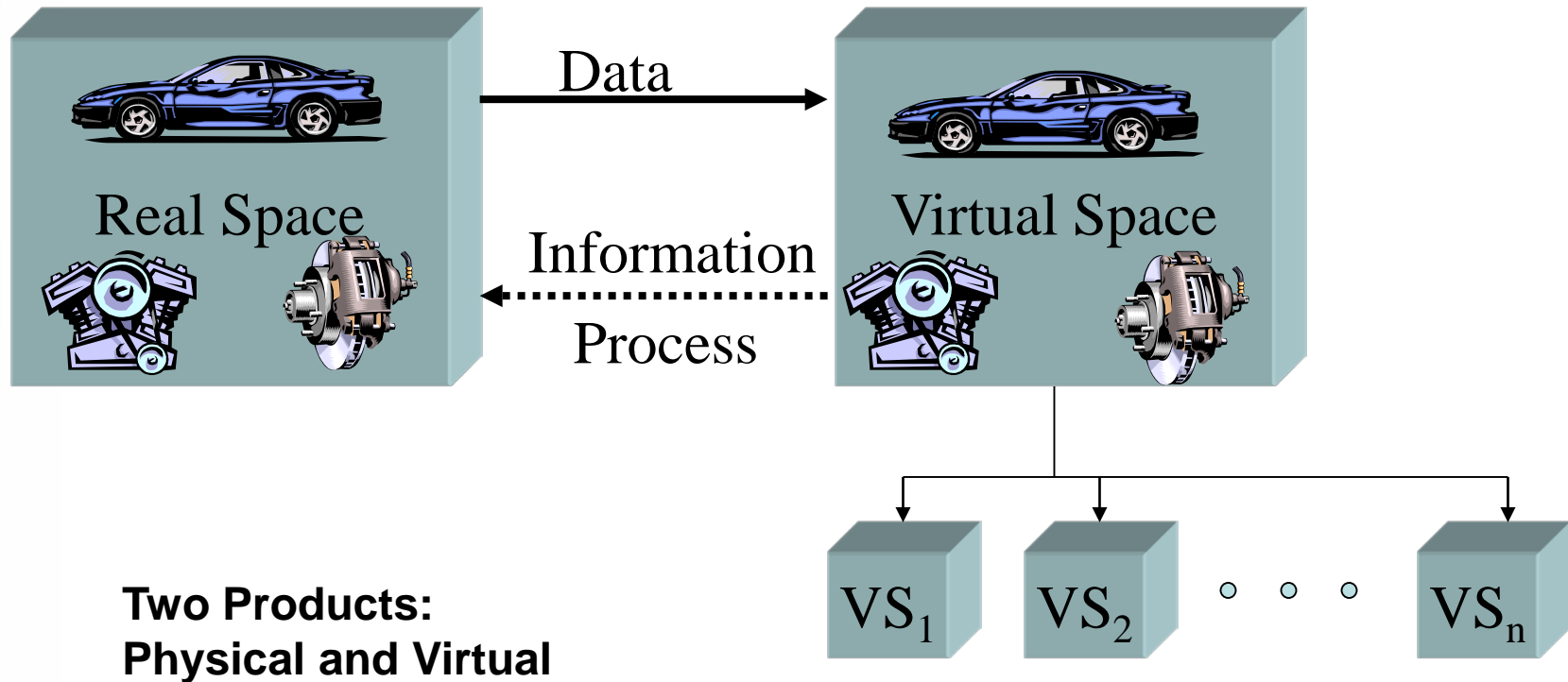# Product Virtuality: Concepts and Tests
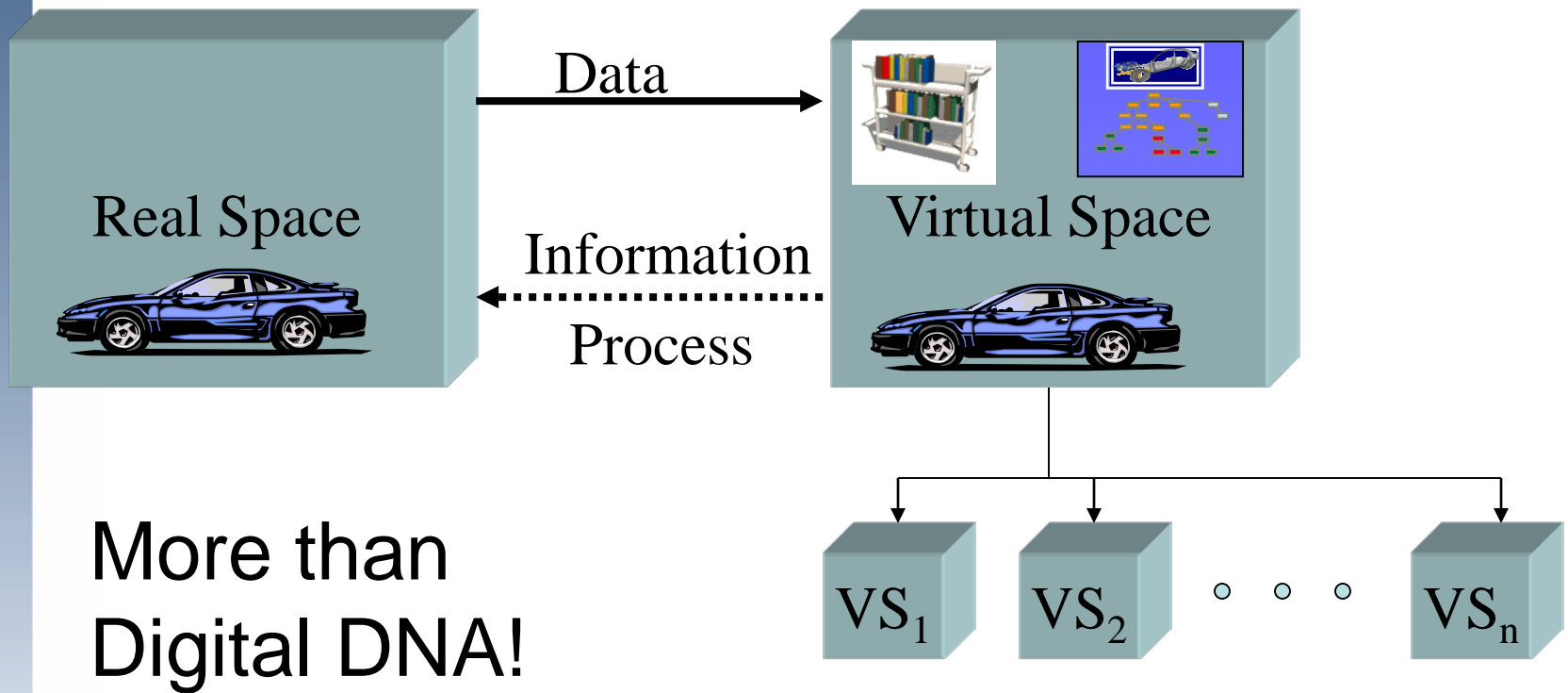
Dr. Michael Grieves

mgrieves@attglobal.net

Conceptual Ideal for PLM Information Mirroring
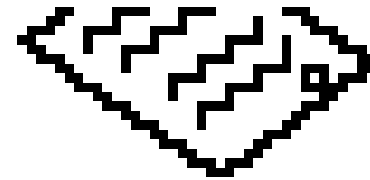

Real Space

Data

Virtual Space

Information

Process

VS_1 VS_2 $\circ$ $\circ$ $\circ$ VS_n

**Two Products:
Physical and Virtual**

Informational Mirroring - History and Processes

Real Space

Data →

Virtual Space

← Information Process

More than Digital DNA!

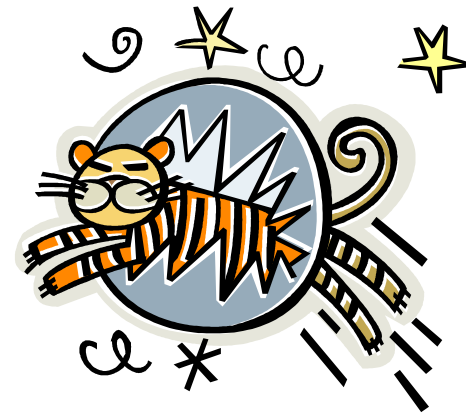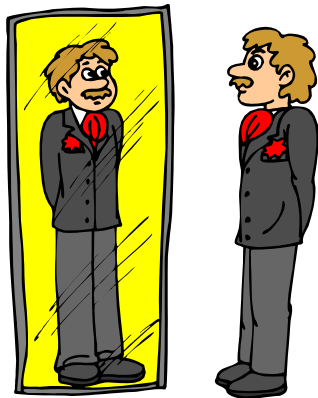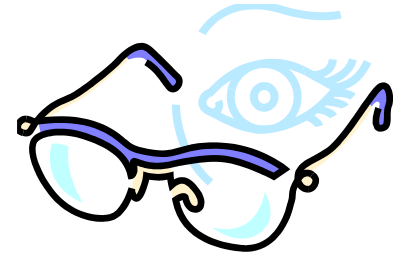VS$_1$ VS$_2$ ∘ ∘ ∘   VS$_n$

PLM Information Characteristics

- Singularity

- Correspondence

- Cohesion

- Traceability
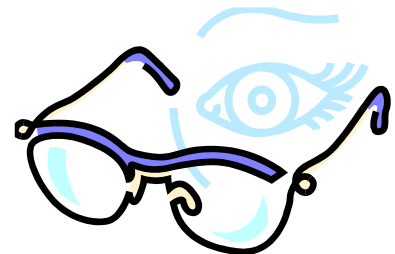
- Reflective

- Cued availability

Information Mirroring Model Tests

- Grieves Visual Test

- Grieves Performance Test

- Grieves Reflectivity Test

Grieves Visual Test

- Observer
- Two windows
  - Real space
  - Virtual space
- Perform any geospatial operation
- Inability to discern difference - pass

Visual Progress

- Manuals
- Marketing Collateral / Packaging
- Video advertisement
- Manufacturing as-builts
- Supply chain visibility

Grieves Performance Test

- Same conditions
- Perform any physical operation
- Inability to detect difference – pass
- Two variations:
  - Product focus (CAT)
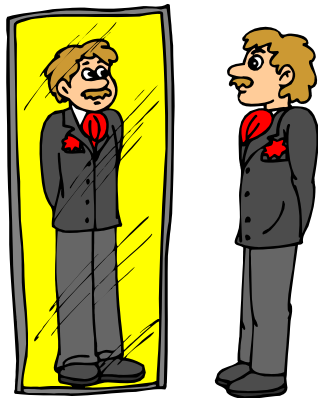 - Environment focus (DM)

Performance Progress

- Feature abstraction (Pur/Eng)
- CAT Component → System simulation
- Integrated solvers
- Tool→Cell →Line →Factory Simulation
- Human ergonomics and performance simulation
- Manufacturing to Engineering feedback
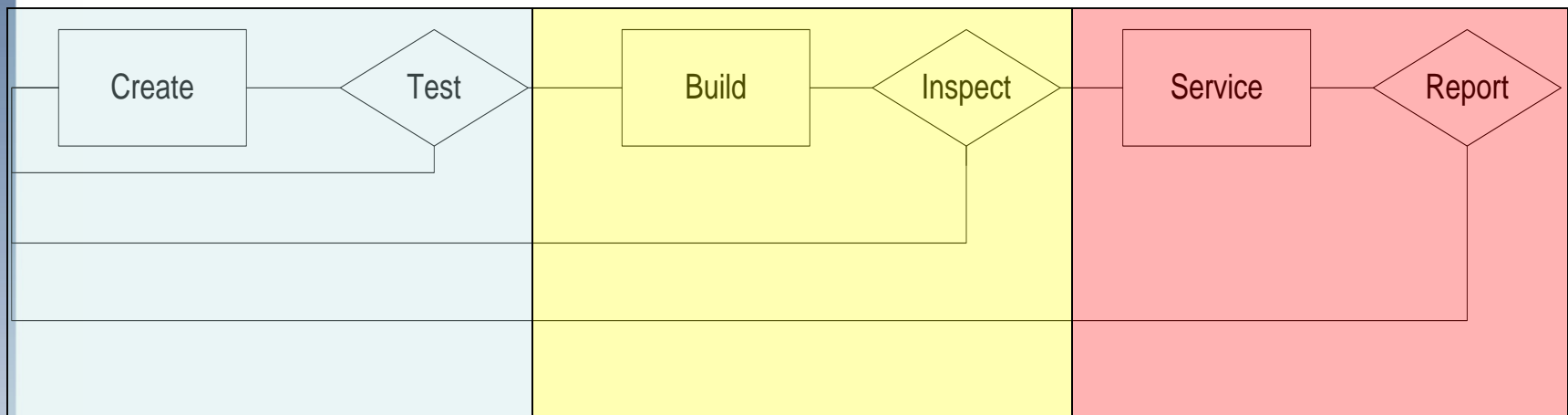
Grieves Reflectivity Test

- Same conditions

- Product at any time its life

- Inability to discern difference - pass
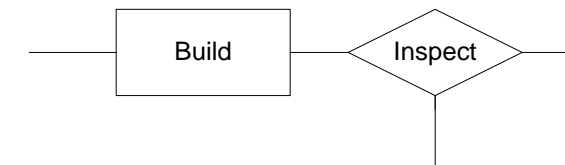
Reflectivity Progress

- Remote diagnostics

- Prognostics

- Remote updates

- Virtual maintenance logs

- In-use feedback
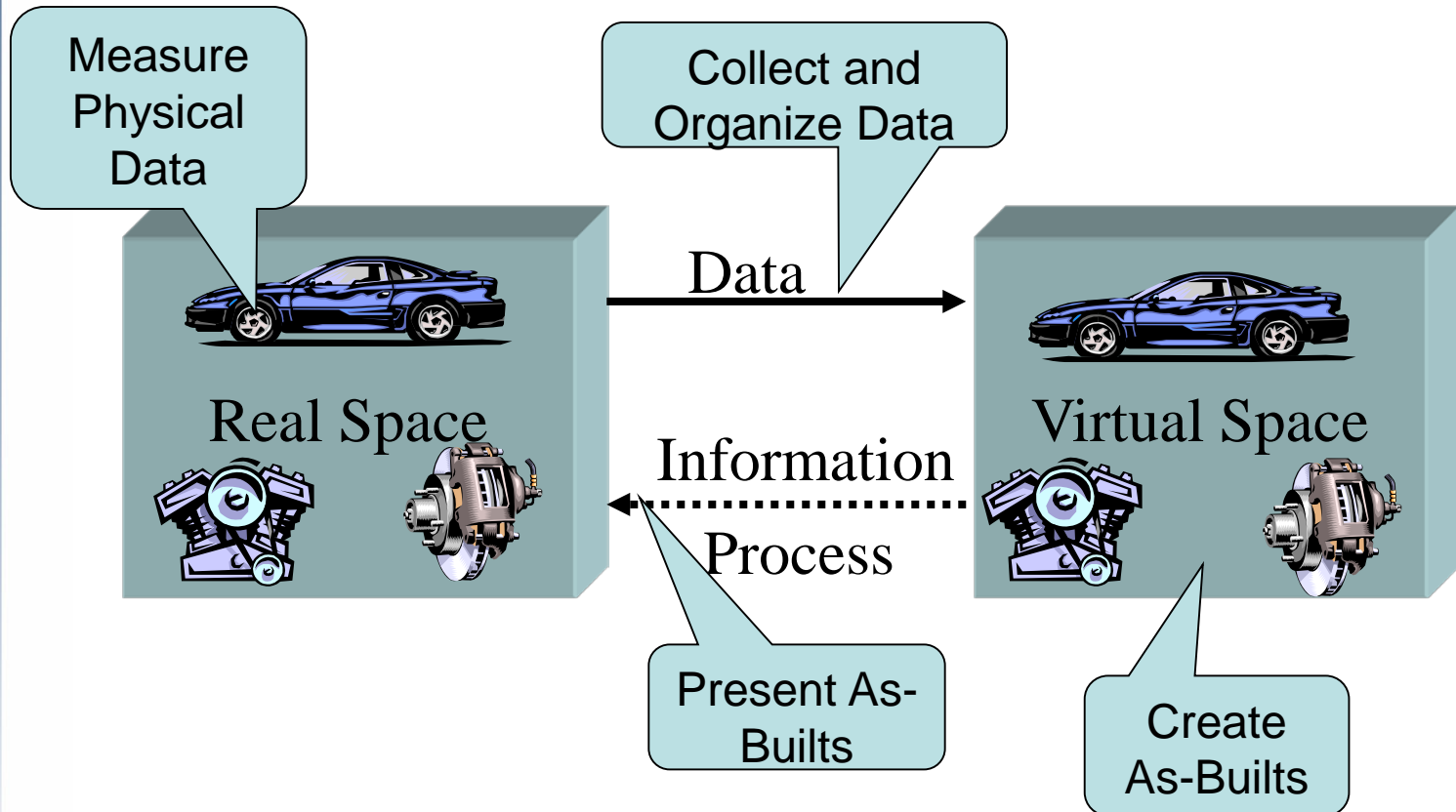
- Network effects

PLQ Feedback Loops

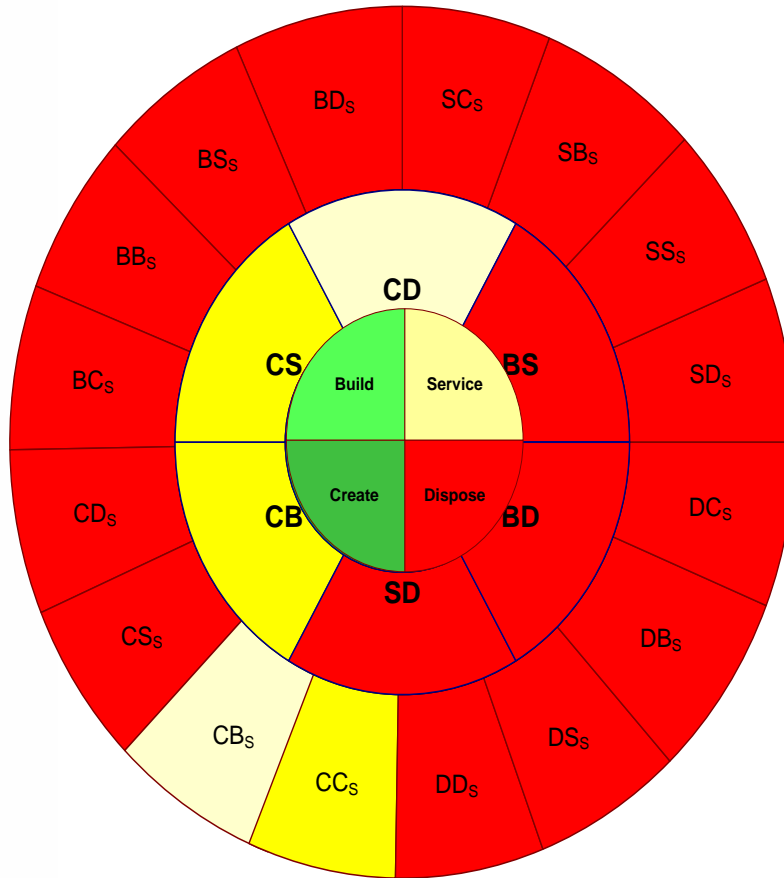| Create | Test | Build | Inspect | Service | Report |

MES Inspection Uses

- Pass / Fail

- Specification trend (SPC)

- As-builts

- Supply "chain" communication & verification

- Longitudinal design validation

```
[ Build ]———< Inspect >
```

Components of PSM:
Creating As-Builts

Measure Physical Data

Collect and Organize Data

Data

Real Space

Virtual Space

Information

Process

Present As-Builts

Create As-Builts

State of PLM

Intra-Functional

Inter-Functional

Extra-Organizational

☐ Impacted

🟨 Some Impact

🟥 No Impact

Thank You!

Dr. Michael Grieves

mgrieves@attglobal.net