Gaining Leverage in Engineering by utilizing eCl@ss
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What Engineering? Efficiency gains must continue …

<table>
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<tr>
<th>Year</th>
<th>Hemisphere</th>
<th>Efficiency Gain</th>
<th>Source</th>
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<tbody>
<tr>
<td>1970</td>
<td></td>
<td>$C_E \approx 0,2 \ C_P$</td>
<td>Quelle: Deutsche Digitale Bibliothek</td>
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<td>$C_E \approx 0,1 \ C_P$</td>
<td>Quelle: CADcompany</td>
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<td>2030</td>
<td></td>
<td>$C_E \approx 0,05 \ C_P$</td>
<td>Quelle: Siemens</td>
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What Engineering? … and they will continue …

Open, virtual and networked operation. Digital workflow with TIA Portal

Reduce your time-to-market. Integrated engineering with TIA Portal

Increase your productivity. Transparent operation with TIA Portal

e.g. Siemens Offerings for the Digital Enterprise
TIA Portal, COMOS, TeamCenter, AutomationDesigner, ProcessDesigner, NX, Technomatix
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What Product Data Quality?
Theories … Standards … Empirics ➔ Simplified Heuristic

1 Standard (Norm)
DIN ISO 10303

2 Definition
Produktdateien haben eine hohe Qualität, wenn sie geeignet für ihre beabsichtigte Verwendung sind.

3 Interpretation
The big three C:
C₁ Completeness
C₂ Correctness
C₃ Coherence

Proposal
PDQ [0…1] = PDC₁ [0…1] × PDC₂ [0…1] × PDC₃ [0…1]
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Why integrate PDQ into Engineering?
Because of increasing workflow complexity and integration…

1. Automatic execution of engineering tasks
2. PLM integration to automation engineering
3. Efficient cloud-based engineering
4. Virtual commissioning
5. Integrated Energy Management
6. Machine and plant security
7. Data acquisition for Cloud Services
8. Communication networks to handle IIoT data

### Integrated Engineering
- **Mechanic**
- **Electric**
- **Automation**

### Digital Workflow
- **Simulation and Commissioning**

### Transparent Operation
- **MES/SCADA**
- **Energy Management**

### 8. Cloud

### 7. Maintenance and Optimization
- **Production**

Product Master Data, enhanced by dynamic Properties and Relations ➔ Distributed Digital Twin Repositories
Why integrate PDQ into Engineering? for NCC down

Third party applications
Cloud-based, open IoT operating system: MindSphere

1. Product design
2. Production planning
3. Production engineering
4. Production execution
5. Services

Collaboration platform: TeamCenter

Mediation Gateways, Mapping Services, Transposition Agents

NCC

PDQ
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What is the eCl@ss engineering impact formula?

\[ \text{NCC} = f \left( \frac{1}{\text{PDQ}} \right) \]

Cost (Effort) = f \[ \text{PDQ}_{\text{incr.}} \]

\[ \text{PDQ}^{[0\ldots1]} = \text{PDC}_1^{[0\ldots1]} \times \text{PDC}_2^{[0\ldots1]} \times \text{PDC}_3^{[0\ldots1]} \]
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What is needed to support 2030 Engineering?
A most comprehensive digital twin of any real world asset!

C_E ≈ 0.05 C_P

Quelle: Siemens
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What shall be possible, how are we striving?

eCl@ss ➔ the universal ontology for semantic repositories!