Transforming Standards Creation and Use with AI: A New Paradigm in Requirements Management

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Presenters Bio

Michael Arnold
Executive Director, Digital Innovation and Technology

Mike leads digital innovation and technology at Accuris focusing on AI enabled solutions to empower their customers to transform how they manage data through the engineering lifecycle. He has 13 years of experience integrating technology and business solutions across several industries including Healthcare, Consumer Retail, Energy, and Aerospace. His recent work in Regulatory Technology has resulted in two patents:

- U.S. Patent No 11,575,493 Methods for Dynamically Assessing Applicability of Product Regulation Updates to Product Profiles (issued Oct. 18, 2022)
- U.S. Patent Application No. 17/948,152 Systems and Methods for Dynamically Classifying Products and Assessing Applicability of Product Regulations (filed Sept. 19, 2022)

Marina Chernyshevich
Director of Data Science, PhD in Natural Language Processing

Marina leads the Research and Development of ML/AI technologies that bring intelligence into all Accuris products. She has 18 years of experience in building technologies and applications in areas of Natural Language Processing, Document Understanding, Computer Vision, Information Retrieval and Data Linking.

Marina and Accuris data science team published about 15 research papers and are often participating in top-tier AI conferences worldwide.

Abstract

Developing engineering documentation in PDF or Word format is a common practice in the engineering community. However, the subsequent lifecycle and utilization of these documents requires significant effort from engineers. These processes, hindered by related challenges such as human error, terminological ambiguity, and incomplete descriptions, are intensified by a loss of tribal knowledge, resulting in undesirable duplication, omissions, inconsistencies, or contradictions in requirements.

As digitization of document flows gains popularity, it requires the transformation of engineering documentation into a database of manageable requirements and engineering tasks that still present limitations. In this presentation, Accuris will outline a strategy for implementing a new engineering content management ecosystem, using a “digitalization layer” over existing engineering content. This approach contributes to the efficiency of the lifecycle of engineering documentation within engineering processes and workflows, including requirements authoring, change tracking, data interchange with existing engineering applications, compliance, and quality control.

Topics will include leveraging modern AI methodologies for Natural Language Processing, Document Understanding and Information Retrieval, the transformation of PDF documents to structured data, automated requirement extraction and. enrichment, assisted requirement authoring and similarity analysis, and requirements traceability

Accuris Overview

Accuris helps engineering and technical professionals enhance their workflows – embedding data, technology, and insights to transform the way innovation comes to life.

AI-Powered Technologies

Cognitive search, machine learning, and natural language processing capabilities that deliver answers.

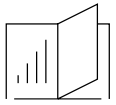
Technical Knowledge

The world's largest curated collection of technical knowledge.

Industry Leadership

Providing trusted solutions to engineers and technical professionals since 1959.

500+
Years combined AI experience.



650M+
Technical documents.

650k+
Active users worldwide at 6k+ companies.

350+
Partnerships serving 1.7M+ standards with global content organizations.

Accuris Portfolio of Solutions

Our products build off and complement one another to tackle the engineering lifecycle

Haystack
Mission delivery support for engineering, procurement, maintenance & repair workflows

Parts Solutions
Decision support for electrical component information in engineering and procurement workflows

Occupational Health & Safety Services
Researching and connecting knowledge to OHSIS workflows in the UK and Ireland

Knowledge Collections
Access to comprehensive library containing millions of technical documents, patents, journals, books and more

Goldfire
Researching and connecting enterprise & market knowledge to engineering workflows

Engineering Workbench
Researching and connecting trusted knowledge to engineering workflows

Construction Information Services
Exclusive single point of access for building regulations, standards, guidance, contracts in the UK and Ireland

ESDU
Software design support for aerospace engineering workflows

Customer Pain: Transforming Standards for Requirement Management

Developing engineering documentation in PDF or Word format is a common practice in the engineering community. However, the subsequent lifecycle and utilization of these documents requires significant effort from engineers. These processes are hindered by multiple challenges:

- **Human error**
- **Requirements ambiguity**
  - Duplication
  - Omission
  - Inconsistencies
  - Contradiction
  - Completeness
- **Loss of tribal knowledge**

Engineers need to locate, understand, and implement proper standards and codes in internal standards, design, and product specifications…

But searching through hundreds of documents to locate a specific value is time consuming (42% of their time), labor-intensive, and increases the factor for human error.

Teams need to quickly author, compare, and share standards and requirements as they change…

Identifying, communicating, and implementing changes can take days or weeks and if they miss a change, they risk production stoppage ($10M+), recalls ($2-5M) and litigation.

Mars Climate Orbiter Example

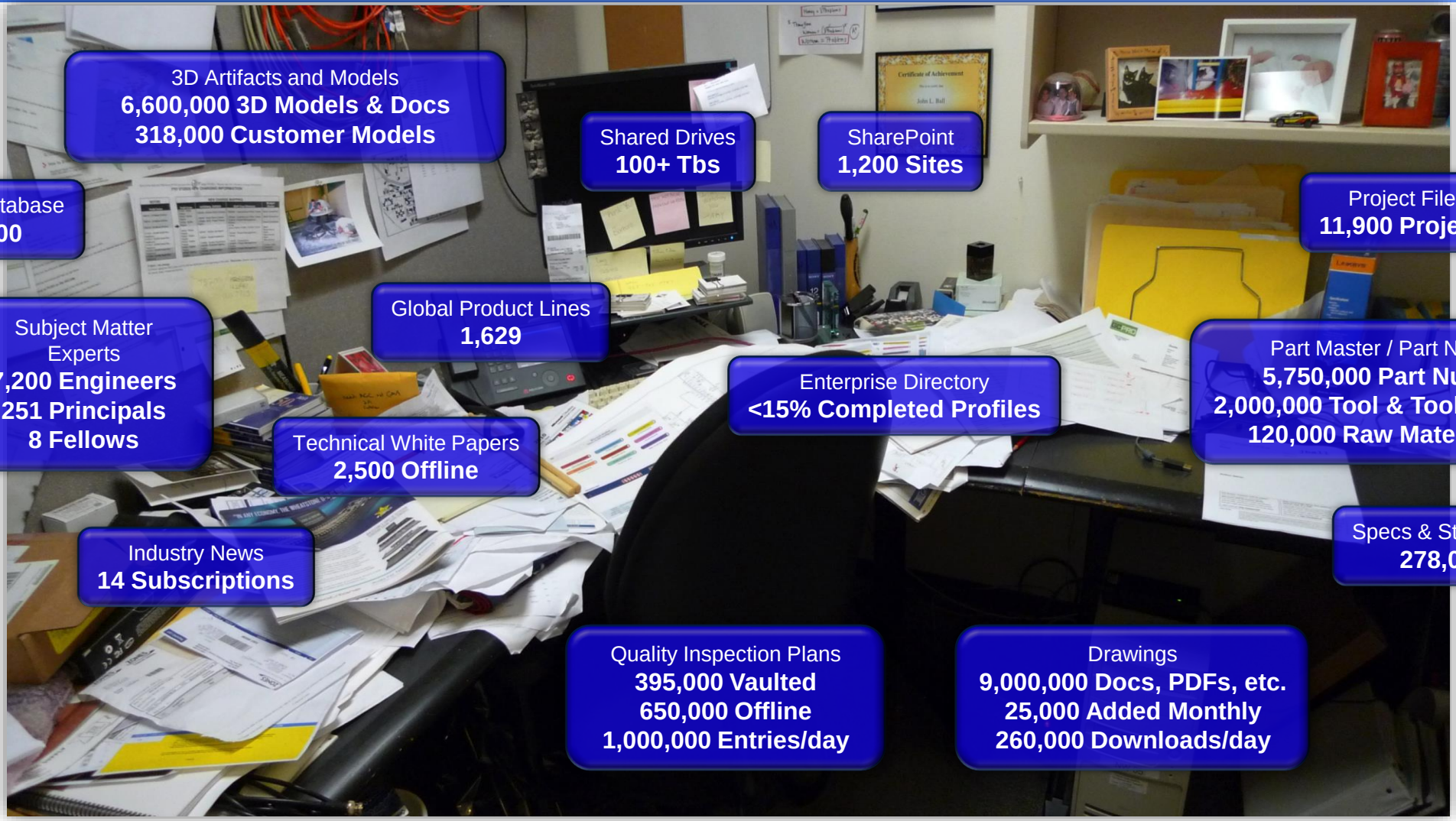
Mars Climate Orbiter's Destruction 1999

The issue wasn't even all that technical!

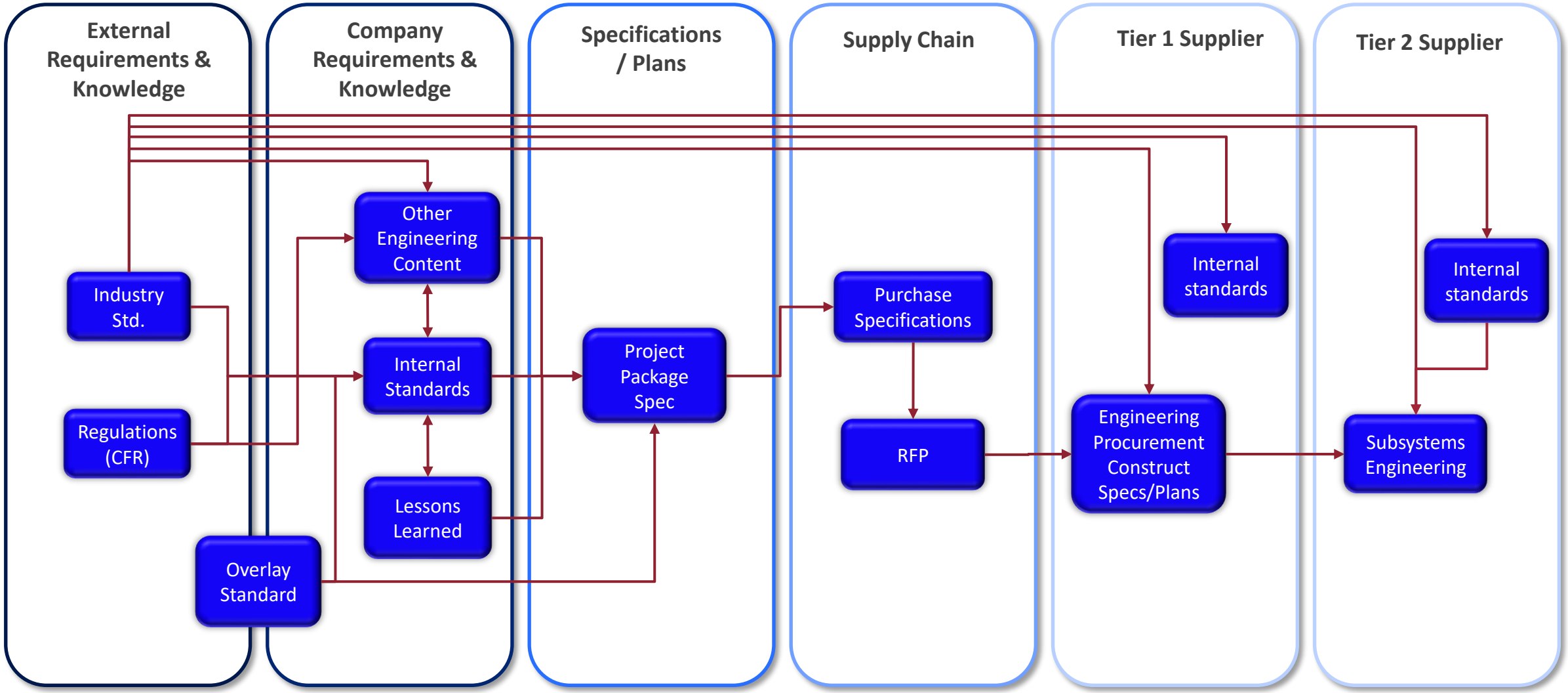
An investigation indicated that the failure resulted from a navigational error due to commands from Earth being sent in English units (in this case, pound-seconds) without being converted into the metric standard (Newton-seconds).

Correcting for inflation, it was an error that cost a cool $230 Million USD

The Engineer's desk today – a dispersion of knowledge

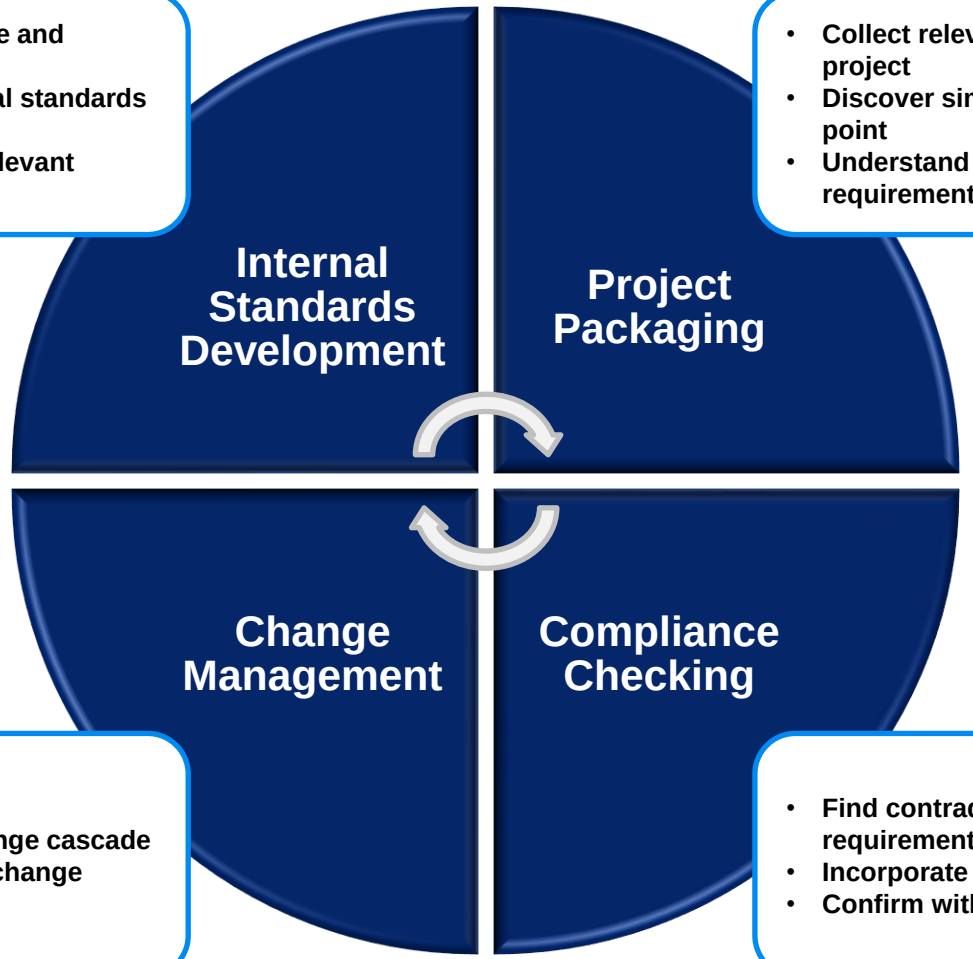


Living Requirements Traceability



Engineering Content Lifecycle Needs

- **Develop safe, cost-effective and comprehensive guidelines**
- **Minimize the size of internal standards library**
- **Deliver specifications to relevant consumers**



- **Collect relevant requirements for a project**
- **Discover similar projects as a starting point**
- **Understand the reason behind a requirement**

- **Update documents**
- **Trace the requirement change cascade**
- **Understand the reason of change**
- **Assess the cost of change**

- **Find contradicting or inconsistent requirements**
- **Incorporate lessons learned**
- **Confirm with test data**

Goals for a Digital Architecture of Requirements

Manageability

- Digitalize documents into manageable work items
- Identify and extract granular requirement objects
- Build data architecture through classification taxonomies

Simplicity

- De-duplicate excessive requirements
- Re-use requirements via references or transclusion
- Include out-of-the-box industry standards

Quality

- Unambiguous requirements language
- Consistency across all sources
- Missing references and dependencies

Traceability

- Search relevant requirements across all sources
- Detect non-compliance

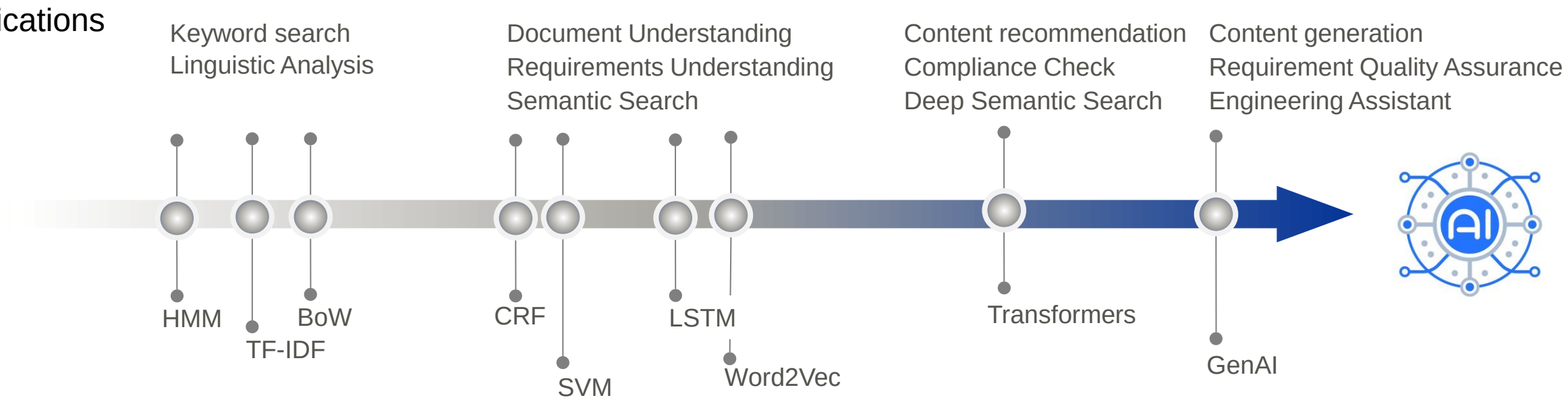
Discoverability

- Search relevant requirements across all sources
- Detect non-compliance

AI evolution and how it applies to intelligent content management

- **The ongoing evolution of AI technologies allows us to tackle new applications and solve previously challenging use cases.**

AI Applications



AI Technologies

Requirements Management Digital Architecture

Semantic Embeddings

Structured Data

Unstructured Data

Ingestion and Sync

Service APIs

Workflow Apps

Deep Information Retrieval

Language Model Index

Taxonomies

Requirements Repository

Feedback Loop

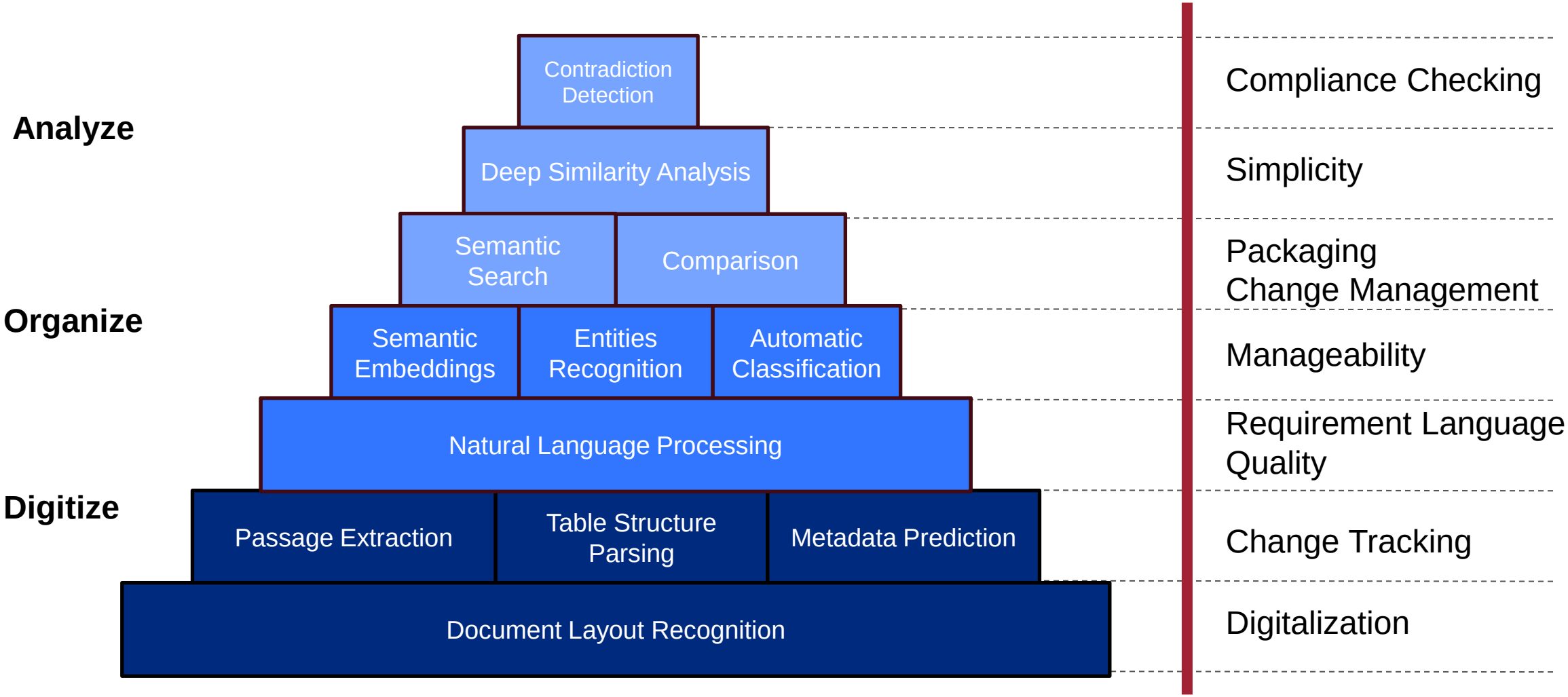
Decomposition

Data Connectors

User-Guided Updates

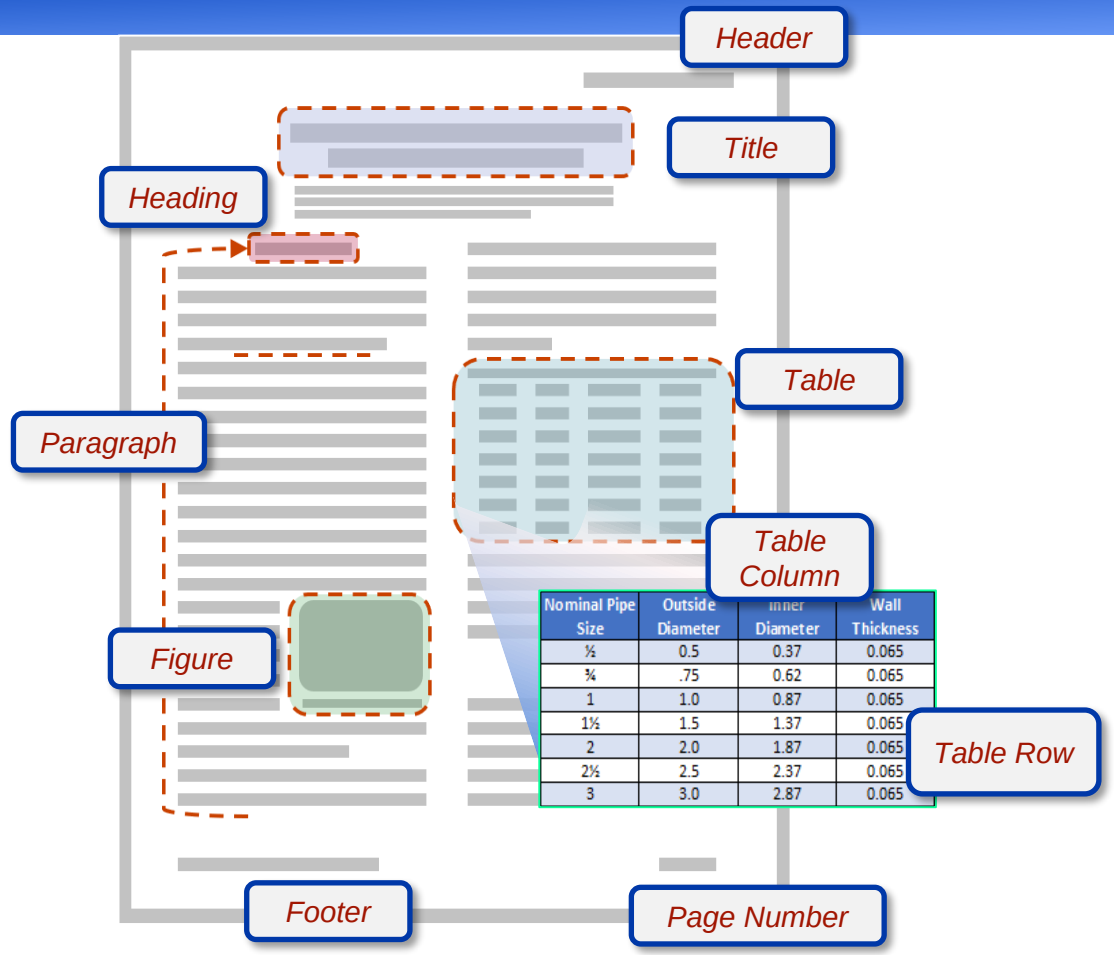
Semi-structured Data

AI Technology Landscape for Digital Architecture



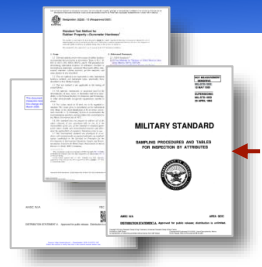
AI Technology Landscape: Digitize

- Any unstructured format
- Real, scanned PDFs
- Arbitrary document types (standards, books, datasheets, forms, invoices, presentations, CAD images etc)

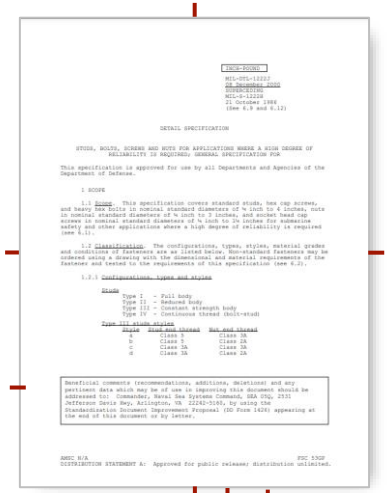


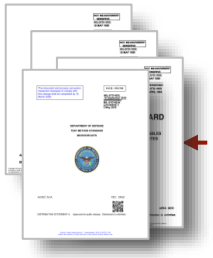
- Structure elements of document (paragraphs, tables, figures etc)
- Semantic elements of document (eg sections, clauses, requirements etc)
- Dependencies between elements (parent-child, cell-row-column)
- Classification according to different taxonomies

AI Technology Landscape: Organize & Connect



references





referenced by

requirement

meta: purpose

Safety

Req-1: The screw cap shall be ..

applies to

meta: equipment taxonomy

hex cap screw

meta: equipment taxonomy

Fasteners

meta: author

meta: author

Amy Plott

defines term

meta: type

meta: region

Standard

Canada

Hex Cap Screws - fasteners featuring a hexagonal ...

Enterprise Glossary

Parts Intelligence
by S&P Global

NSN: 5305-01-299-6601
NSN: 5305-01-674-5160
NSN: 5305-01-673-9246

used in

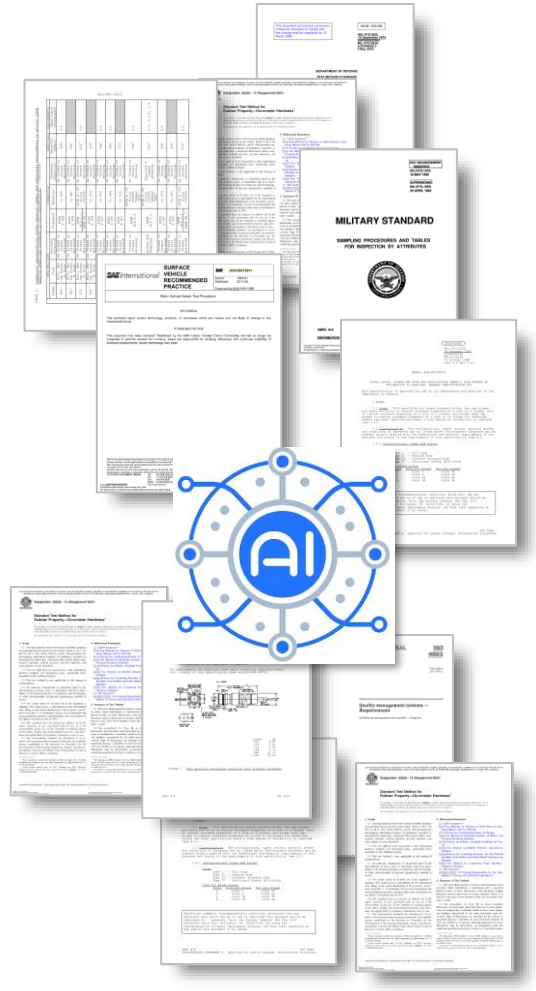
Physical Assembly

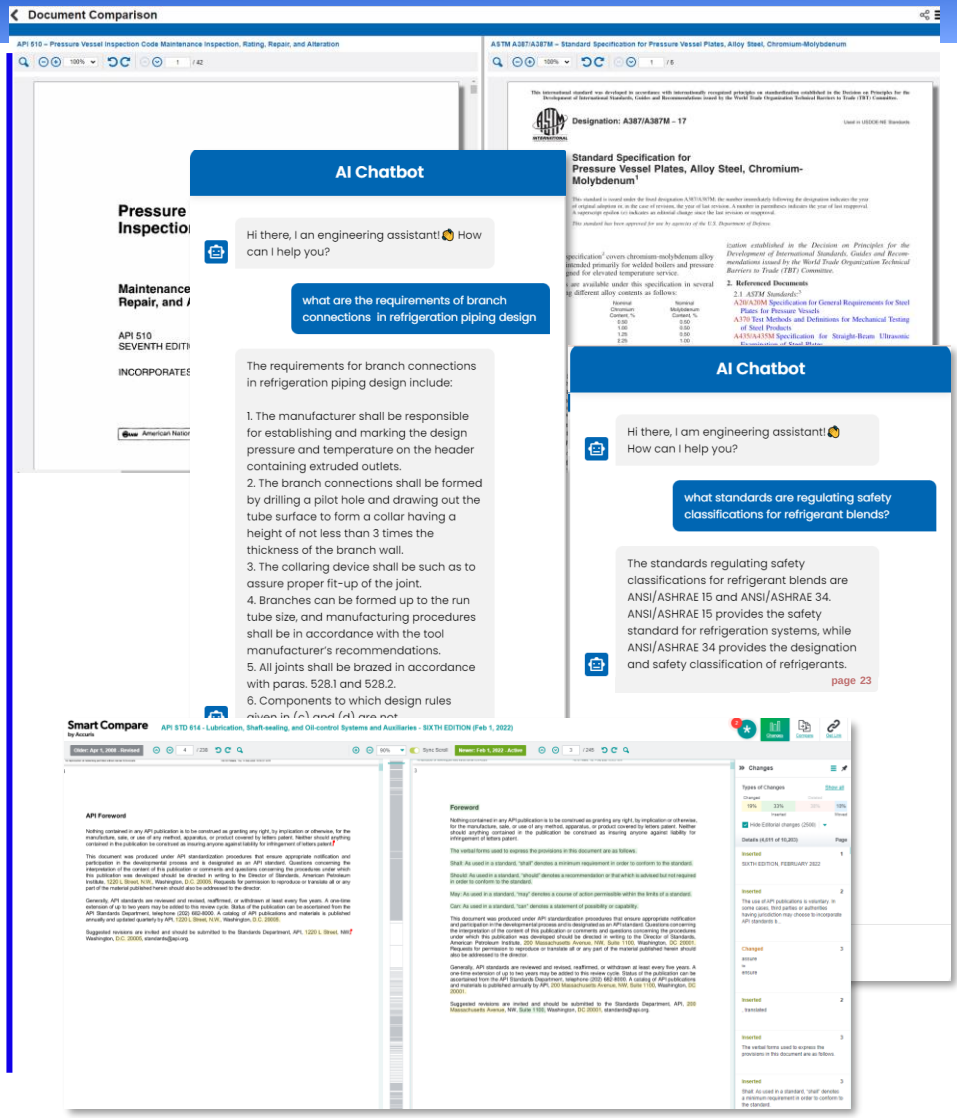
AI Technology Landscape: Analyze

What is the allowed elongation of the Tempered bolt with diameter ½ inch?

Who is manufacturing parts that are fitting into my design and comply with all specs?

A new revision of ASTM standard was published. What documents need to be reviewed?





Thank You

Questions?
Come by our booth or email: Mike.Arnold@ihsmarkit.com