Natural Language Processing to Extract Contextual Structure from Requirements

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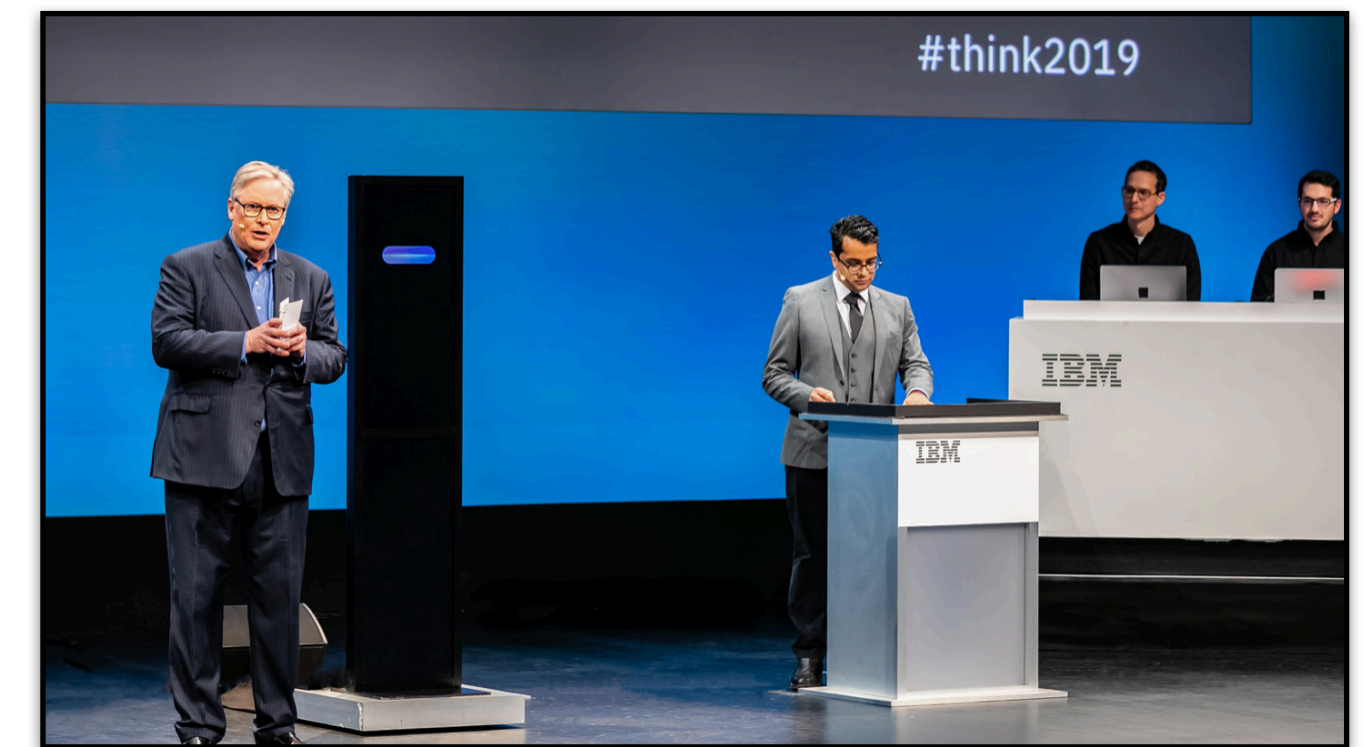# A Brief Walk Through NLP History
…We Have Come a Very Long Way…

[1]

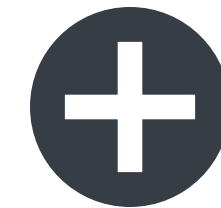**1950s:**
IBM 701

[2]

2011:
Apple's Siri

[3]

2019:
IBM's Project Debater

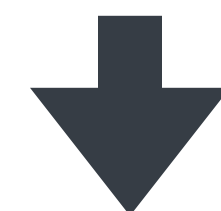# BUT… We Are Not There Yet

NLP

+

**Fragmentation &
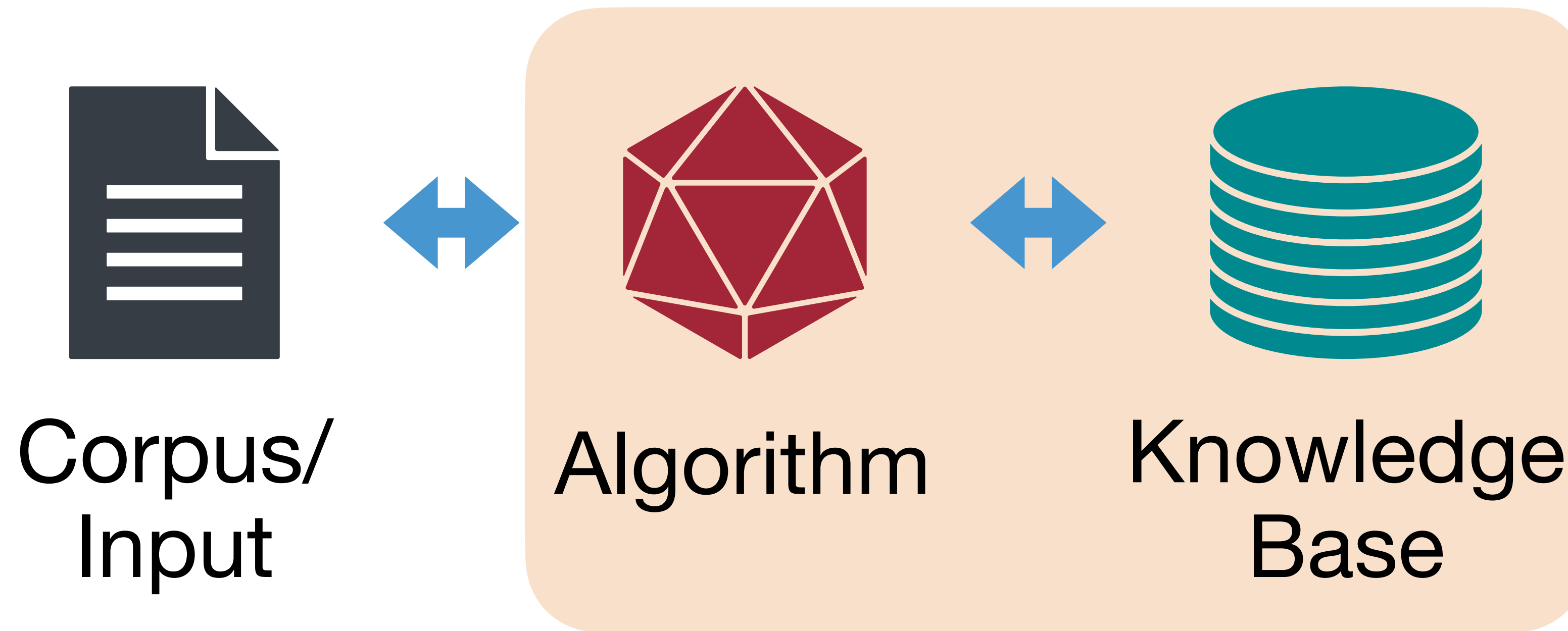Lack of Open-Source!!!** [4]

Requirements Engineering
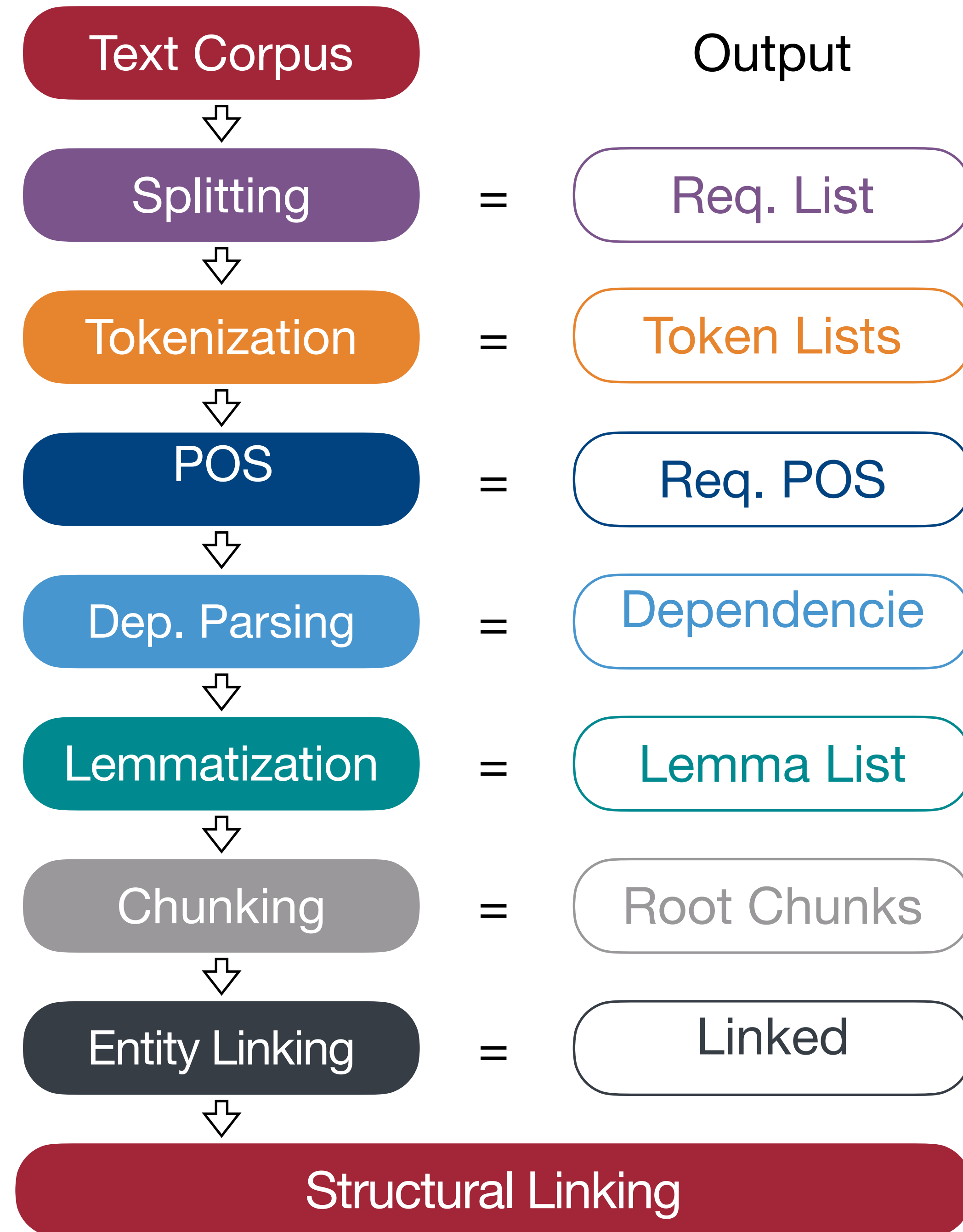
Information & Structure Extraction **+ Context**

Evaluation & Analysis Possibilities

Framework Concept

Corpus/Input ↔ Algorithm ↔ Knowledge Base

⇨ **Modularity + Independence**

Process

		Output
Text Corpus		
Splitting	=	Req. List
Tokenization	=	Token Lists
POS	=	Req. POS
Dep. Parsing	=	Dependencie
Lemmatization	=	Lemma List
Chunking	=	Root Chunks
Entity Linking	=	Linked
Structural Linking		

4

Process

#	Entity	Connection	Object	Check
1	laptop	have	display	✓
2	laptop	have	storage	✓
3	chassis	made	material	✓
4	display	have	resolution	✓
5	storage	have	redundancy	✓
…	…	…	…	…

Text Corpus

Splitting
Tokenization
POS Tagging
Dep. Parsing
Lemmatization
Chunking
Entity Linking

Structural Linking
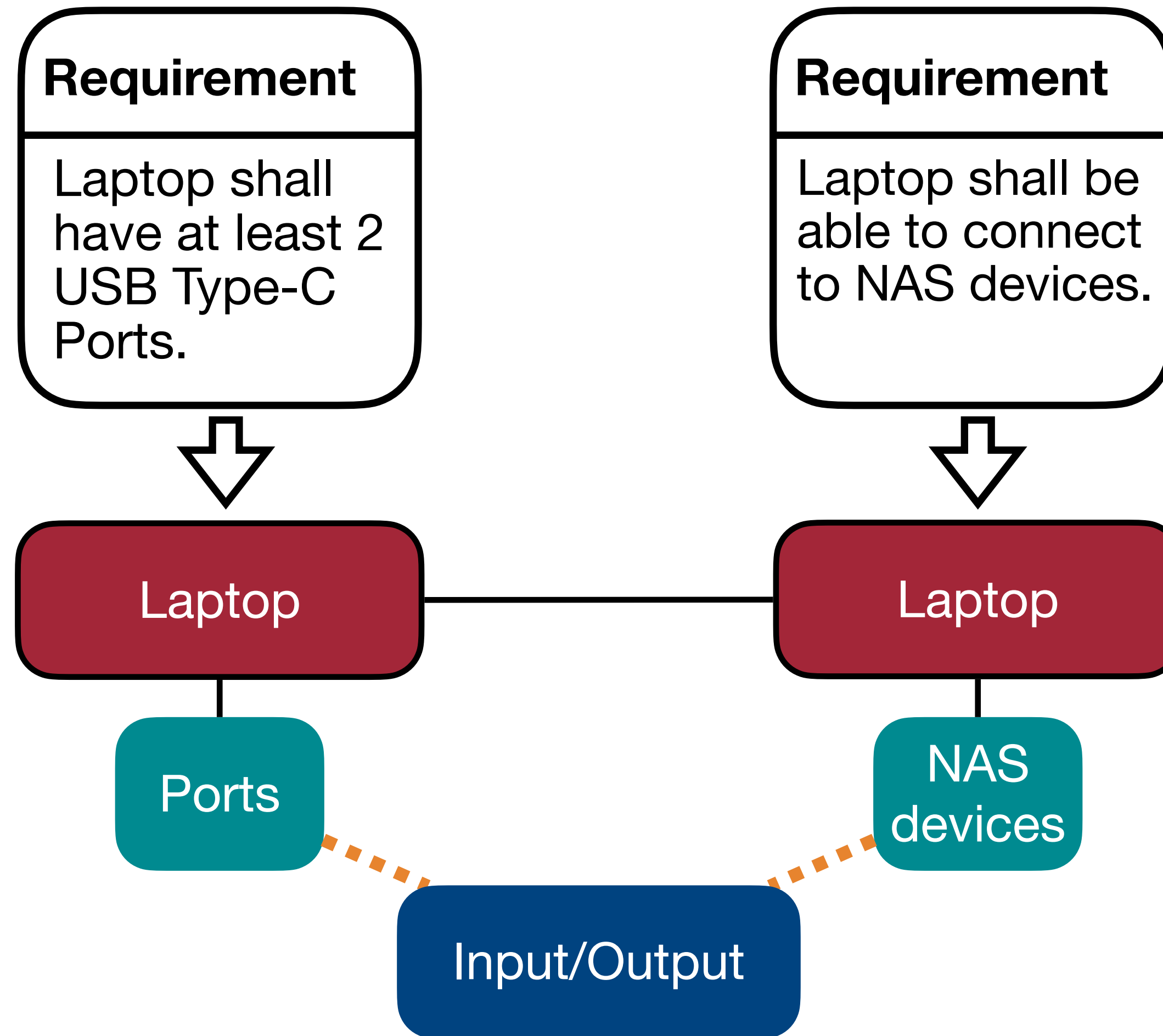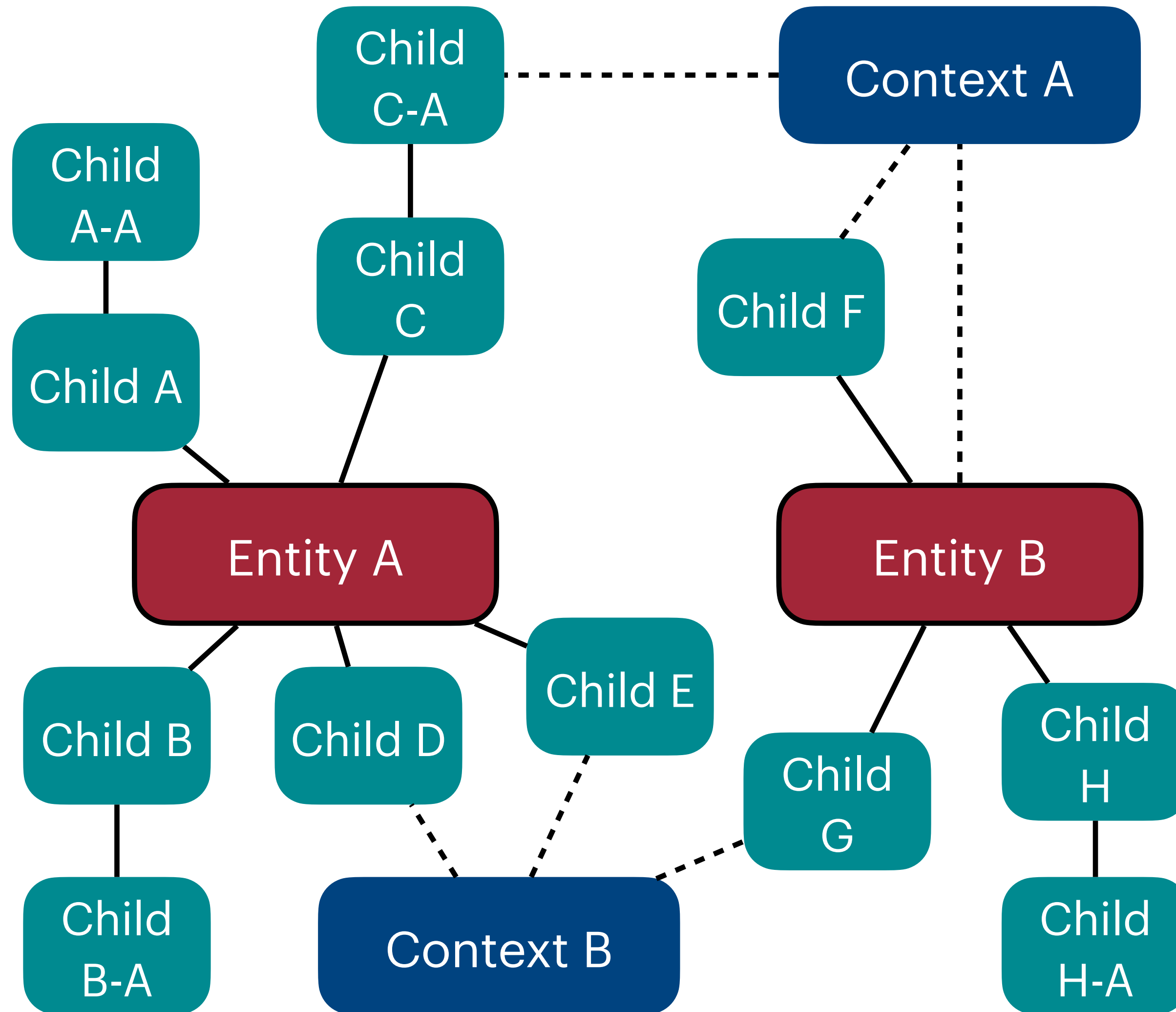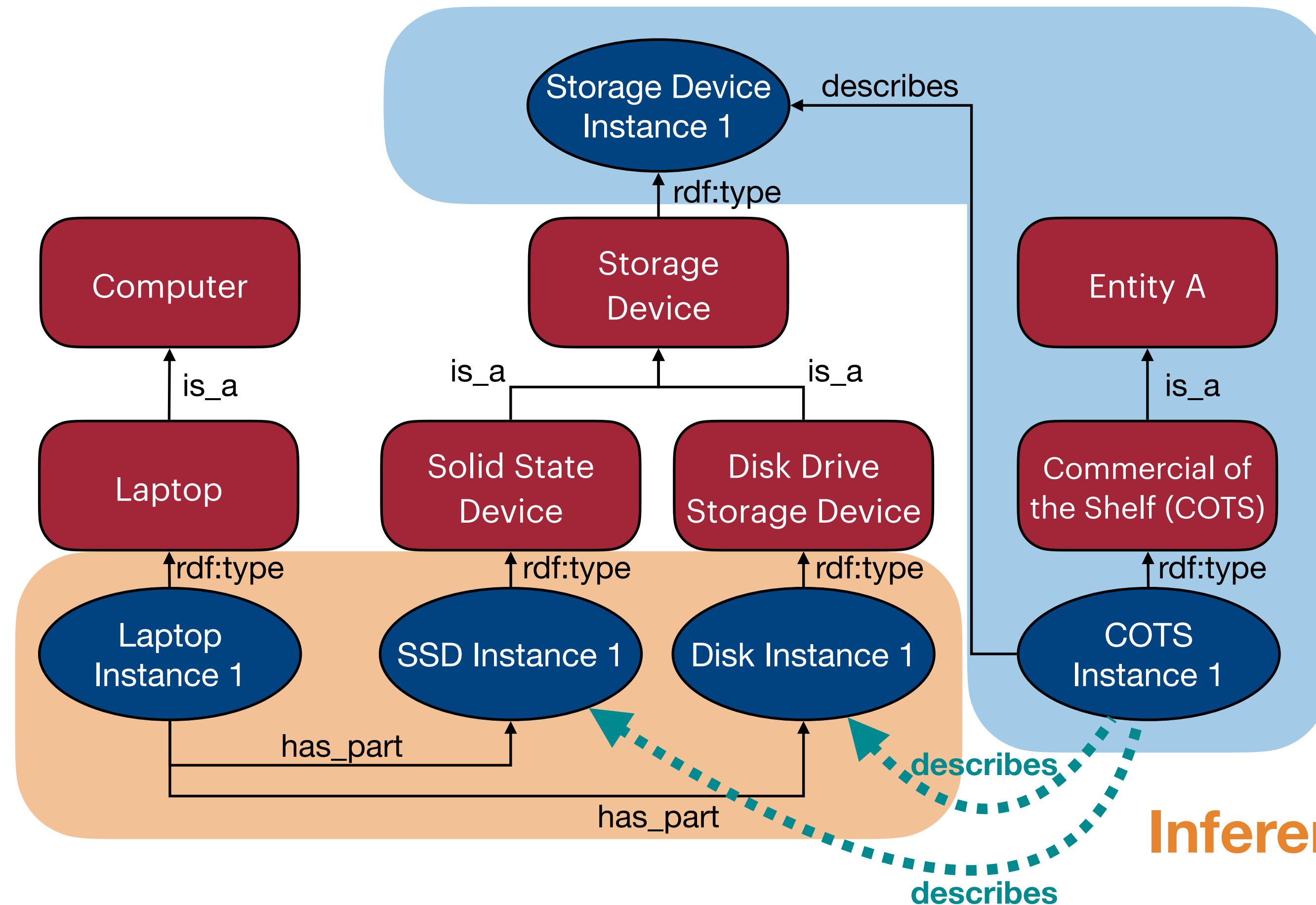
Concept of Context

Inclusion of Context

Implementation of Context

Knowledge Base = Ontology

Inference ⇨ Context

7

Current State and Limitations

✓ Functional Algorithm

✓ Validation With Small and Public Sample Sets [5]

✓ Conceptual Proof of Ontology Inference

⇩ Susceptible to Ambiguities and Input Quality

⇩ Dependence on Ontology/Knowledge Base Existence

⇩ Scaling Tests and Concomitant Validity Pending

Summary and Conclusion

!   Extraction of Structure From Requirements Difficult

!   NLP and Requirements Engineering Field Fragmented [4]

⇨ **Creation of a Structural Extraction Approach Incl. Context**

+   Concept Developed and Validated on a Small Scale

+   Inference and Context via Ontologies Possible

Next: • Scaling and Comprehensive Validation

       • Application and Use Case Test

References and Bibliography

[1]   "IBM 701." IBM. https://www.ibm.com/ibm/history/exhibits/701/701_intro.html (accessed March 22, 2022).

[2]   "Apple Special Event 2011 - Siri Introduction." https://www.youtube.com/watch?v=agzItTz35QQ (accessed March 24, 2022).

[3]   "Project Debater." IBM. https://research.ibm.com/interactive/project-debater/ (accessed March 22, 2022).

[4]   M. Vierlboeck, C. Lipizzi, and R. Nilchiani, "Natural Language in Requirements Engineering for Structure Inference - An Integrative Review," 2022, arXiv:2202.05065.

[5]   "JSC 29948B, ISS IBM THINKPAD SERIES A31P LAPTOP HARDWARE PROJECT TECHNICAL REQUIREMENTS SPECIFICATION." EverySpec.
        http://everyspec.com/NASA/NASA-JSC/NASA-JSC-PUBS/JSC-29948B_29701/ (accessed February 08, 2022).