

# Unlocking Knowledge in Maintenance Work Orders with Echidna and Redcoat

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TLP Community of Interest Workshop,  
2021 Model-Based Enterprise Summit, NIST, April 12 - 16, 2021

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# Outline

1. Overview and Motivation
2. **Echidna** - a knowledge graph that supports the visualisation and querying of maintenance work orders
3. **Redcoat** – an annotation tool supporting technical language processing

# Overview

- » Maintenance management systems capture a significant amount of important **structured information**, such as:
  - » Functional Locations (FLOCs)
  - » Costs
  - » Dates
  - » Downtime events

# Overview

- » However, a **significant volume of knowledge** in a MWO is **unstructured** and therefore inaccessible – it is buried within the **short text description**.
- » The short text often contains indicators of **failure modes**, and **end of life events** which are directly tied to **mean time to failure (MTTF)** values.
- » Short text is **seldom used to support routine analysis**, despite the significant information held within.

# Example Maintenance Work Orders

StartDate	FuncLocDesc	ShortText
10/07/2005	hydraulics	repair cracked hydraulic tank
27/07/2005	engine	engine wont start
15/01/2008	air conditioning system	a/c blowing hot air

# Motivation

- » **Knowledge graphs** are the perfect tool for combining structured and unstructured data.
- » Constructing a knowledge graph that captures the knowledge in the unstructured text and structured fields allows for vital information to be **highly accessible**, such as:
  - » How many times have pumps in <location> been replaced in the last month?
  - » Are the pumps failing in ways we didn't expect?

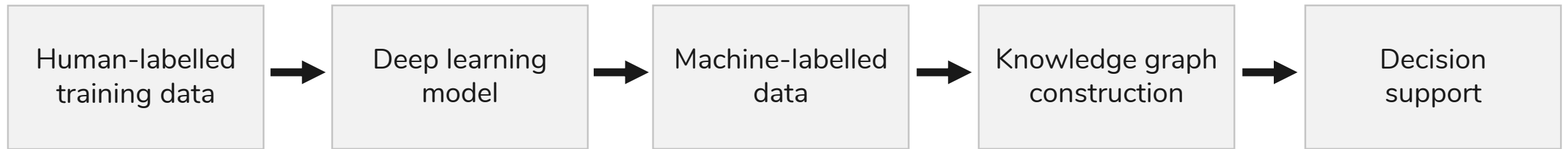
# Echidna – Knowledge Graph for Maintenance



<https://nlp-tlp.org/echidna>

# The need for labelled training data

- » To build the knowledge graph and provide decision support, the underlying model must be fed **high quality labelled data**.





# Redcoat – a Collaborative Annotation Tool

The screenshot displays the Redcoat interface for an annotation task. The top header shows the Redcoat logo and the group name "Annotating group: 'OffLugSpanner'". The left sidebar contains a text snippet about "lube system" with a "Read more" link, a "Modify categories" button, a search bar, and a list of 15 categories including "Item", "Activity", "Location", "Time", "Attribute", and "Cardinality". The main workspace shows three lines of text with annotations:

- Line 3: "lower bull hose swivel not greasing". The words "bull hose" are enclosed in a green box labeled "Item".
- Line 4: "lube system not cutting out". "lube system" is in a green box labeled "Item". "not" is in a yellow box labeled "Observation" and "Observation/Observed\_state". "cutting out" is in a yellow box labeled "Observation/Observed\_state".
- Line 5: "lug broken off deck spanner". "lug" is in a green box labeled "Item". "broken" is in a yellow box labeled "Observation" and "Observation/Observed\_state". "off" is in a yellow box labeled "Observation/Observed\_state". "deck spanner" is in a green box labeled "Item".
- Line 6: "machine loseing electrical power." (Note the typo "loseing").

<https://nlp-tlp.org/redcoat>

# Conclusion

- » In this presentation we have presented our work on unlocking maintenance knowledge via two powerful tools: **Echidna** and **Redcoat**.
- » These tools create a knowledge graph that provides reliability engineers with the ability to **easily access** and **query** their maintenance work orders, providing unprecedented decision support.

# Thank you

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**CTMTDS**

<https://maintenance.org.au>

**UWA NLP-TLP Group**

<https://nlp-tlp.org>

**Echidna – Demo**

<https://nlp-tlp.org/echidna>

**Redcoat – Demo**

<https://nlp-tlp.org/redcoat>