

Metadata Standardization in Wireless Communications

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WIRELESS COMMUNICATIONS

is a method of transmitting information from one point to another, without wires.



Wireless Communications produce an incredibly large amount of metadata: information about frequency bands, locations, power levels, signal processing parameters, and many others. But different applications have different metadata standards. How do we ensure interoperability?

I have a question: What is Metadata?

Metadata is Data about Data (roughly)

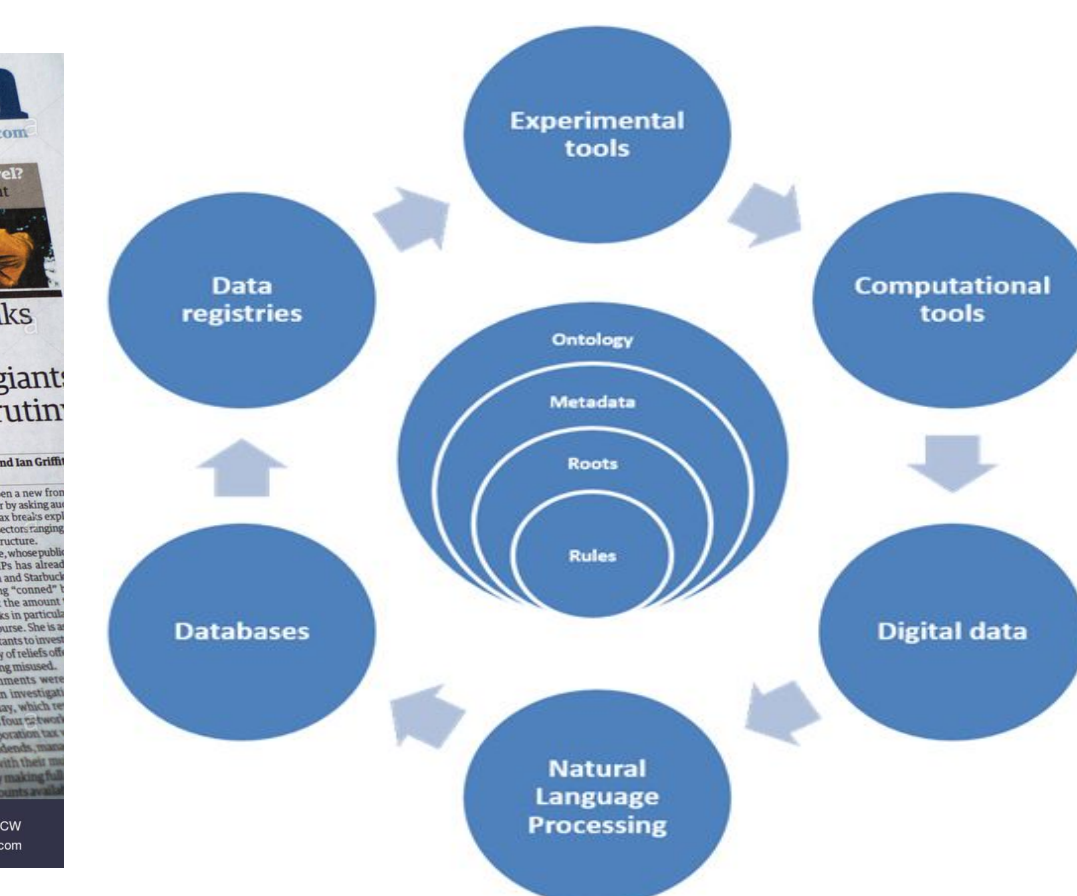
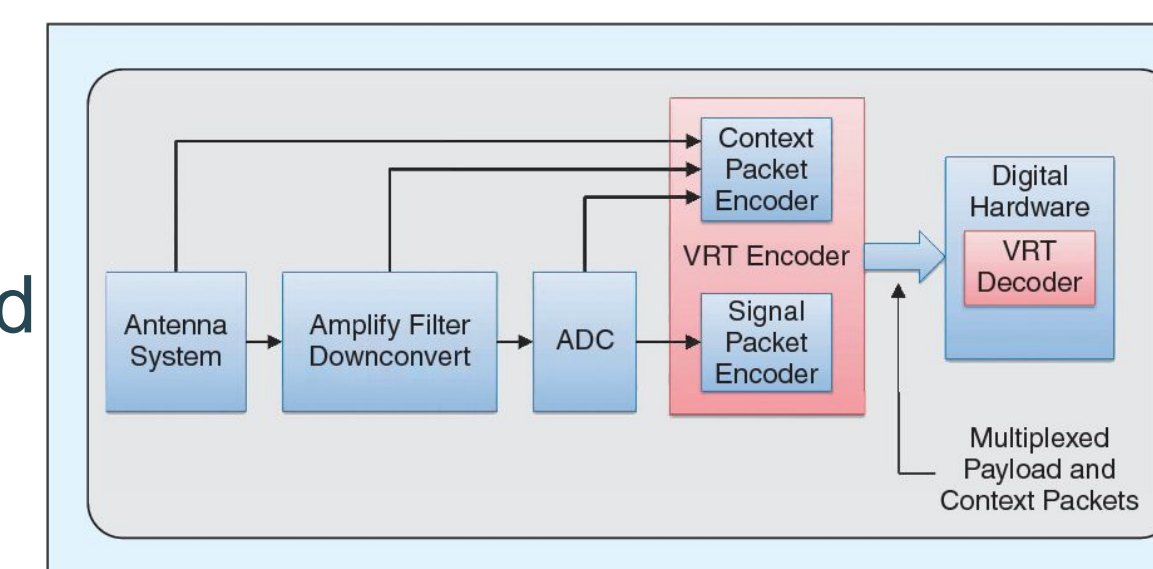


Librarians have been describing things for over 2000 years mainly for the purpose of storage and retrieval. On the left a picture of The Great Library of Alexandria, Egypt (from Wikipedia).

How much about Data can we infer from Metadata?

This question gained public attention in 2013 when Edward Snowden leaked NSA highly classified information.

A radio receiver architecture based on VITA 49.



A natural language processing (NLP) approach to information indexing and searching (modified from NIST.gov)

Metadata Standard Conversion ...

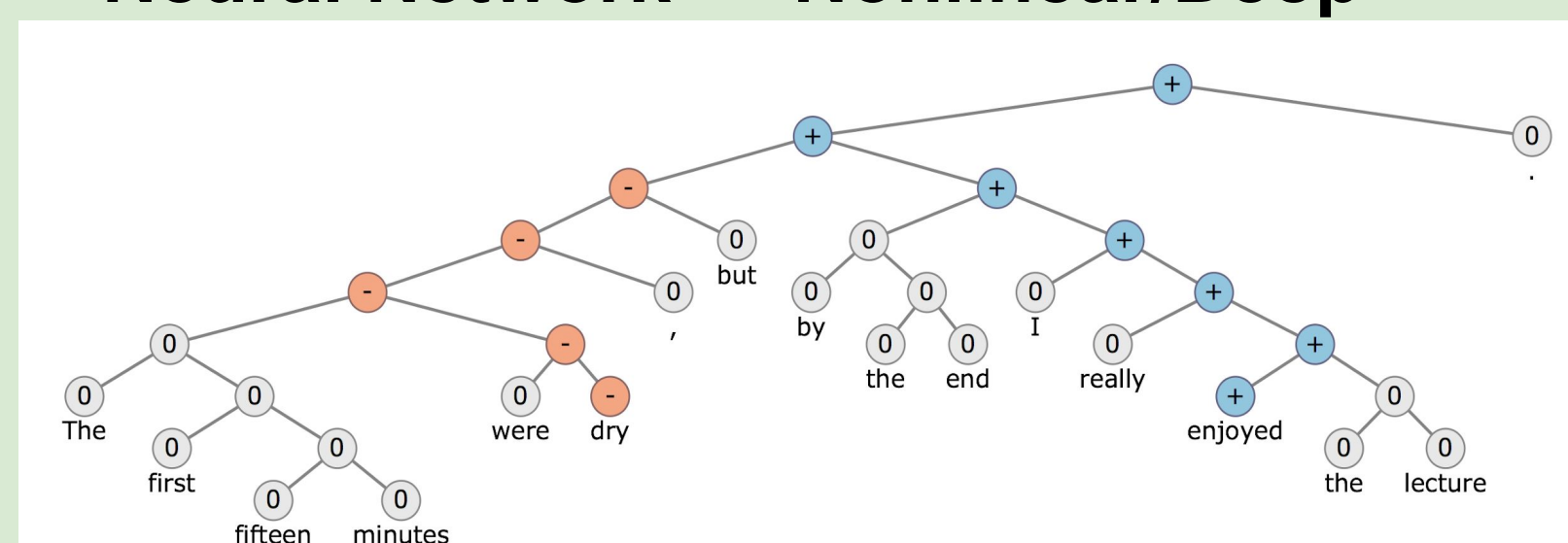
Since different radio platforms and algorithms use different metadata standards, it is necessary to convert between these different representations of both format and meaning.

Format vs Meaning

$$P_{\pi} = \begin{bmatrix} \mathbf{e}_{\pi(1)} \\ \mathbf{e}_{\pi(2)} \\ \mathbf{e}_{\pi(3)} \\ \mathbf{e}_{\pi(4)} \\ \mathbf{e}_{\pi(5)} \end{bmatrix} = \begin{bmatrix} \mathbf{e}_1 \\ \mathbf{e}_4 \\ \mathbf{e}_2 \\ \mathbf{e}_5 \\ \mathbf{e}_3 \end{bmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & 1 & 0 \\ 0 & 1 & 0 & 0 & 0 \\ 0 & 0 & 0 & 0 & 1 \\ 0 & 0 & 1 & 0 & 0 \end{bmatrix}$$

from Wikipedia

Neural Network → Nonlinear/Deep



from <https://cs224d.stanford.edu/>

... in Wireless Communications

The two standards VITA 49.2 (capturing RF data) and IEEE 1900.5.2 (controlling RF devices) are closely related, but at the semantic level there is a level of incompatibility. Even if conversion between the formats for frequency is somehow defined, conversion between the semantics may not be ordinarily possible. We propose to use Machine Learning in the interface for automated and real time metadata representation conversion.

References

1. M. Sherman and T. Cooklev. (2018). Abstract Descriptions of Spectrum: VITA 49 and IEEE 1900.5.2, *IEEE Communications Standards Magazine*, 2 (4), 43-48.
2. J. Pomerantz MOOC-1 <https://www.youtube.com/user/jppomera>
3. T. Cooklev, R. Normoyle, and D. Clendenen. (2012). The VITA 49 RF-digital interface, *IEEE Circuits Systems Magazine*, 12 (4), 21-32.

Acknowledgements

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Next: NLP in WC?