

# Software Metrics

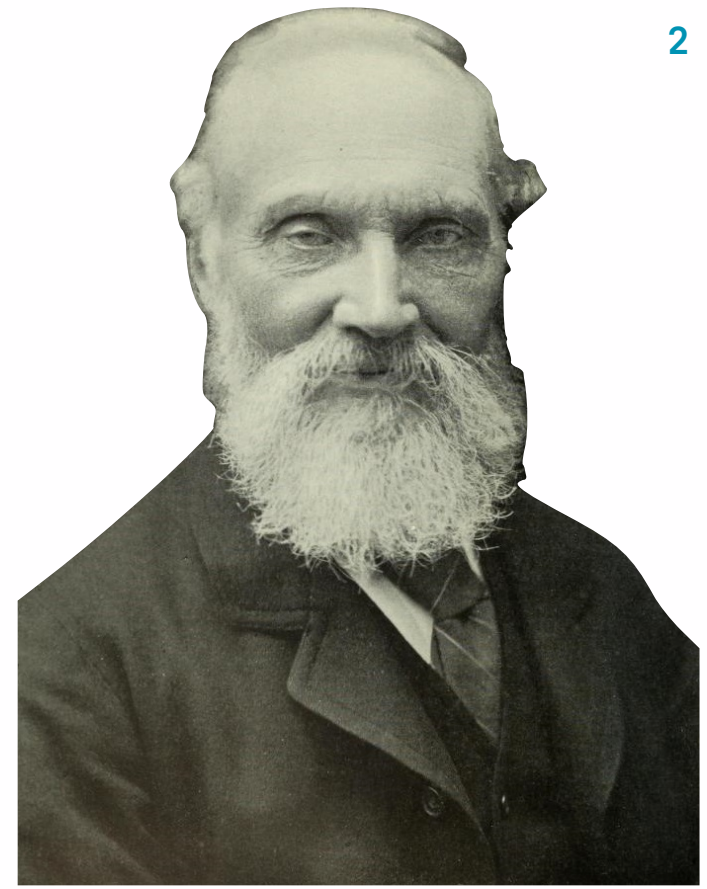
## Software Evolution – L3T3

Dr. Vadim Zaytsev aka @grammarware, February 2021



# Lord Kelvin, 1883

- *When you can **measure** what you are speaking about, and express it in **numbers**, you **know** something about it.*



# What's Measurement?

- A quantitatively expressed reduction of uncertainty based on one or more observations.
- Direct quantification = measurement
- Indirect quantification = calculation

# In the World without Measurement...

- There are no requirements
  - all software is “reliable”, “user friendly”, etc
- Component costs are fused
  - cost of design? code? test?
- No business promises
  - how fast/reliable will it be?
- Ads rule supreme
  - “guarantees 100% uptime”, “fastest”...

# Measurement Theory

- *How much must we know before we can start measuring?*
- *How do we know we have measured what we wanted to measure?*
- *What meaningful statements can we make with measurements?*
- *What meaningful operations can we perform on measures?*

# Evolution of Measurements

- [2000 BC] “hotter than” ranking by hand
- [1597 AD] Galileo’s thermoscope ranking
- [1724 AD] Fahrenheit’s thermometer scale
- [1742 AD] Celcius scale
- [1848 AD] Kelvin scale

# Measurement is a Mapping



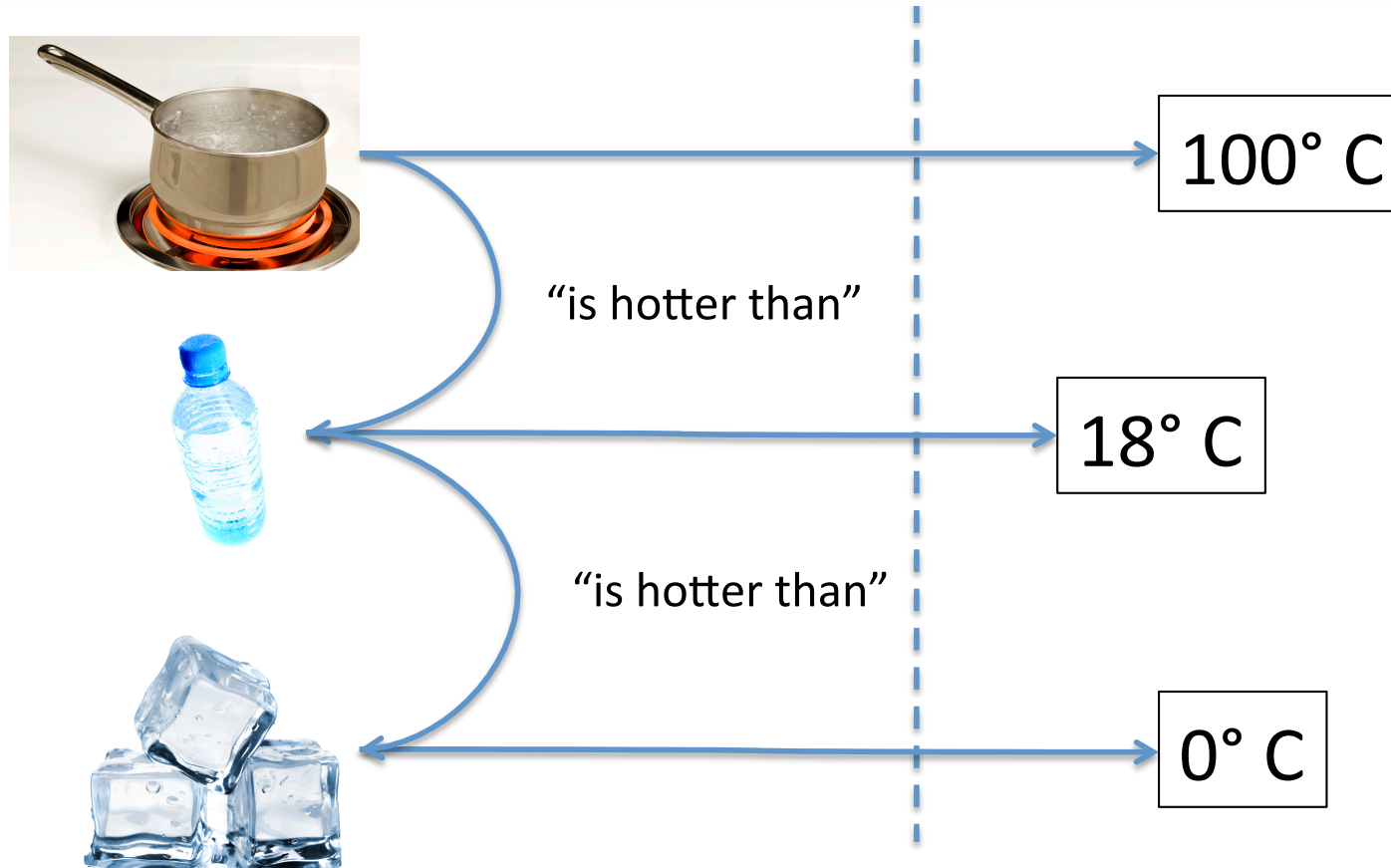
“is hotter than”



“is hotter than”

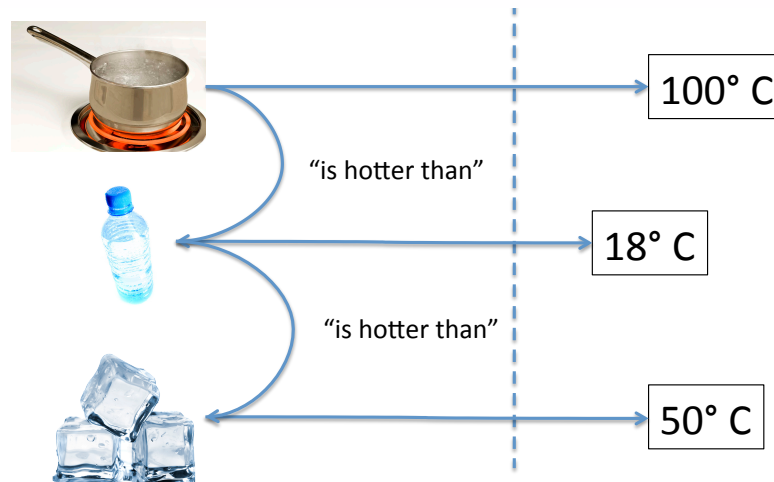


# Measurement is a Mapping

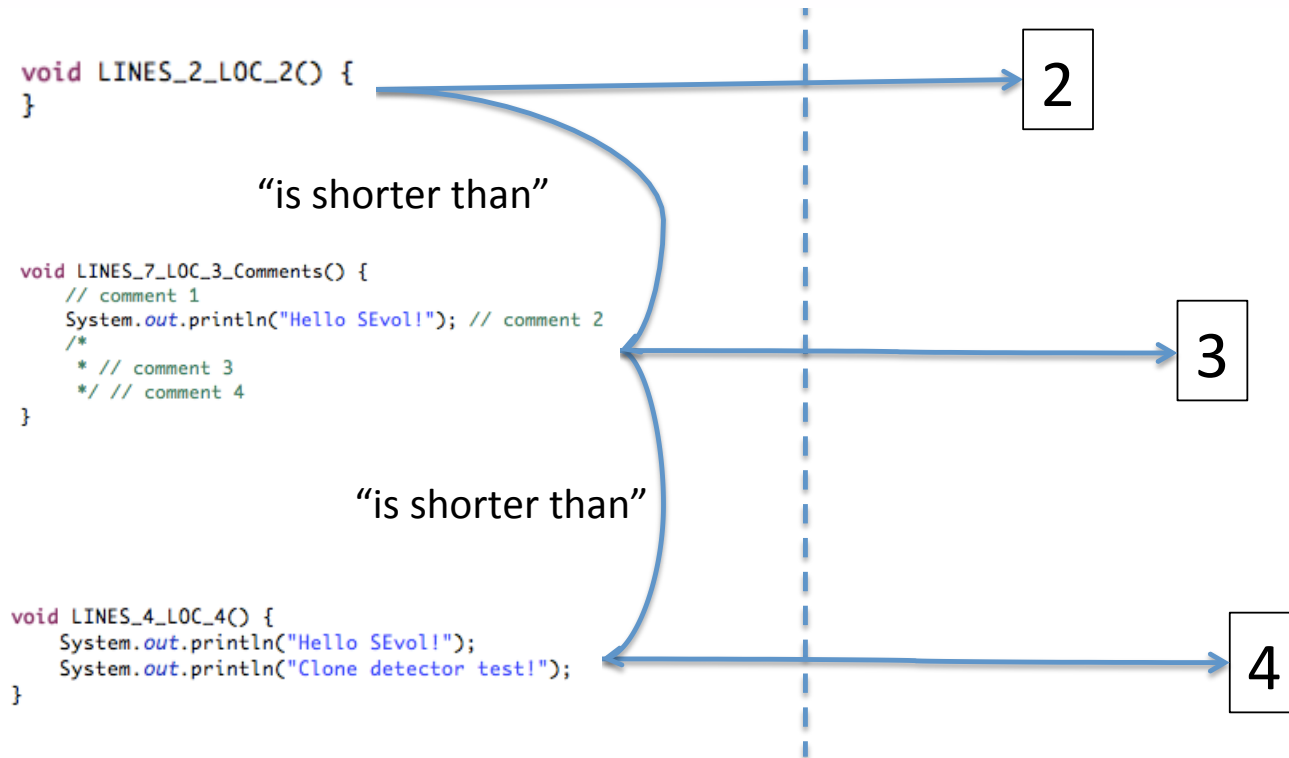


# Representation Condition

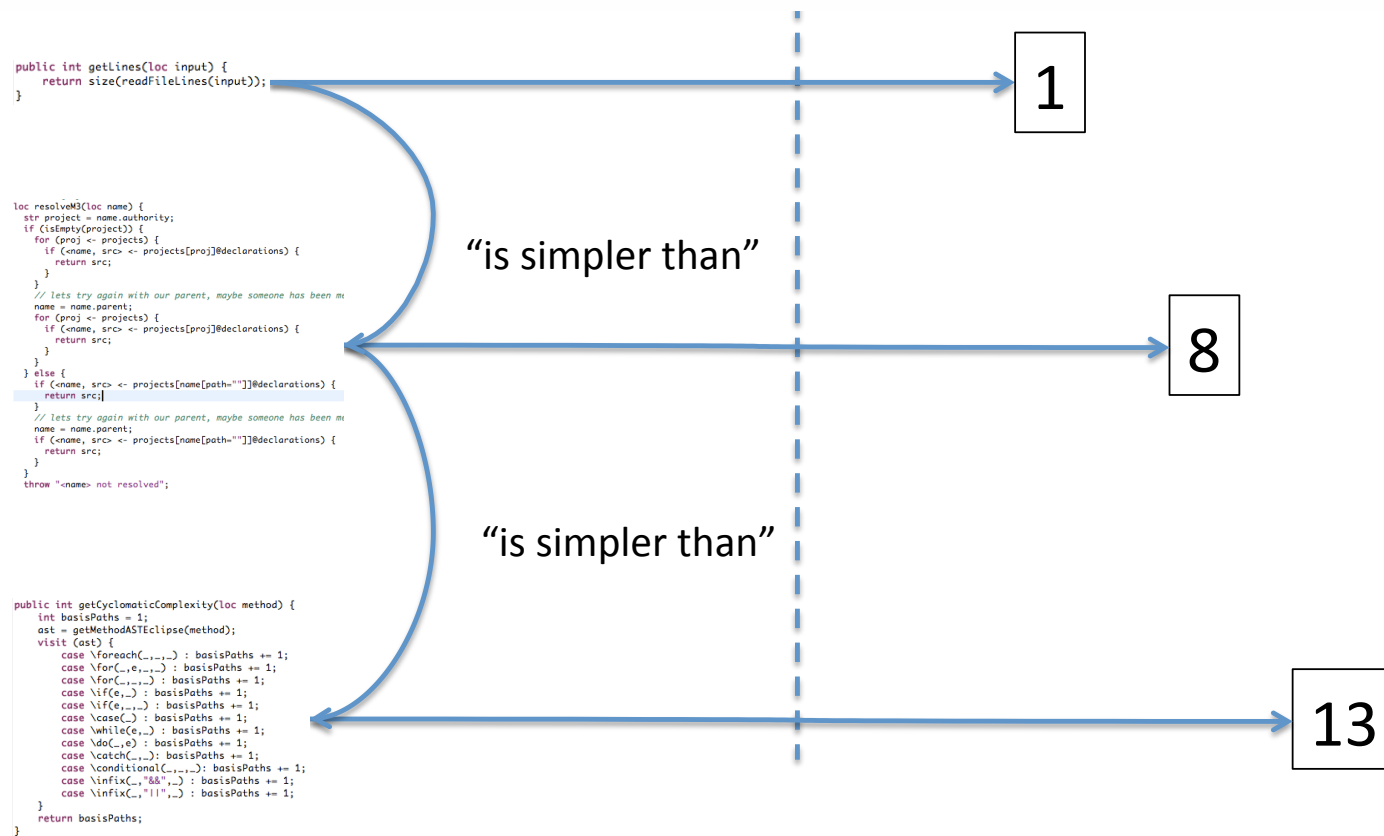
- Empirical relations (e.g. “hotter than”) must be **preserved** under the **mapping** done by the **measurement**.
- Invalid:



# Same in Software Engineering



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# Scales

- **Nominal**
  - classification without order
- **Ordinal**
  - classes with ranking
- **Interval**
  - explicit ordering and differences
- **Ratio**
  - ordering, difference, ratios
- **Absolute**
  - number of actual occurrences

# Conclusion

- Valid measurements preserve **empirical** relations
- Define **mappings** completely & unambiguously
- Metrics are based on **abstractions** (models)
- Q&A Sessions @ Canvas
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  - ⇒ <https://discord.gg/n7VQAPNBPD>

