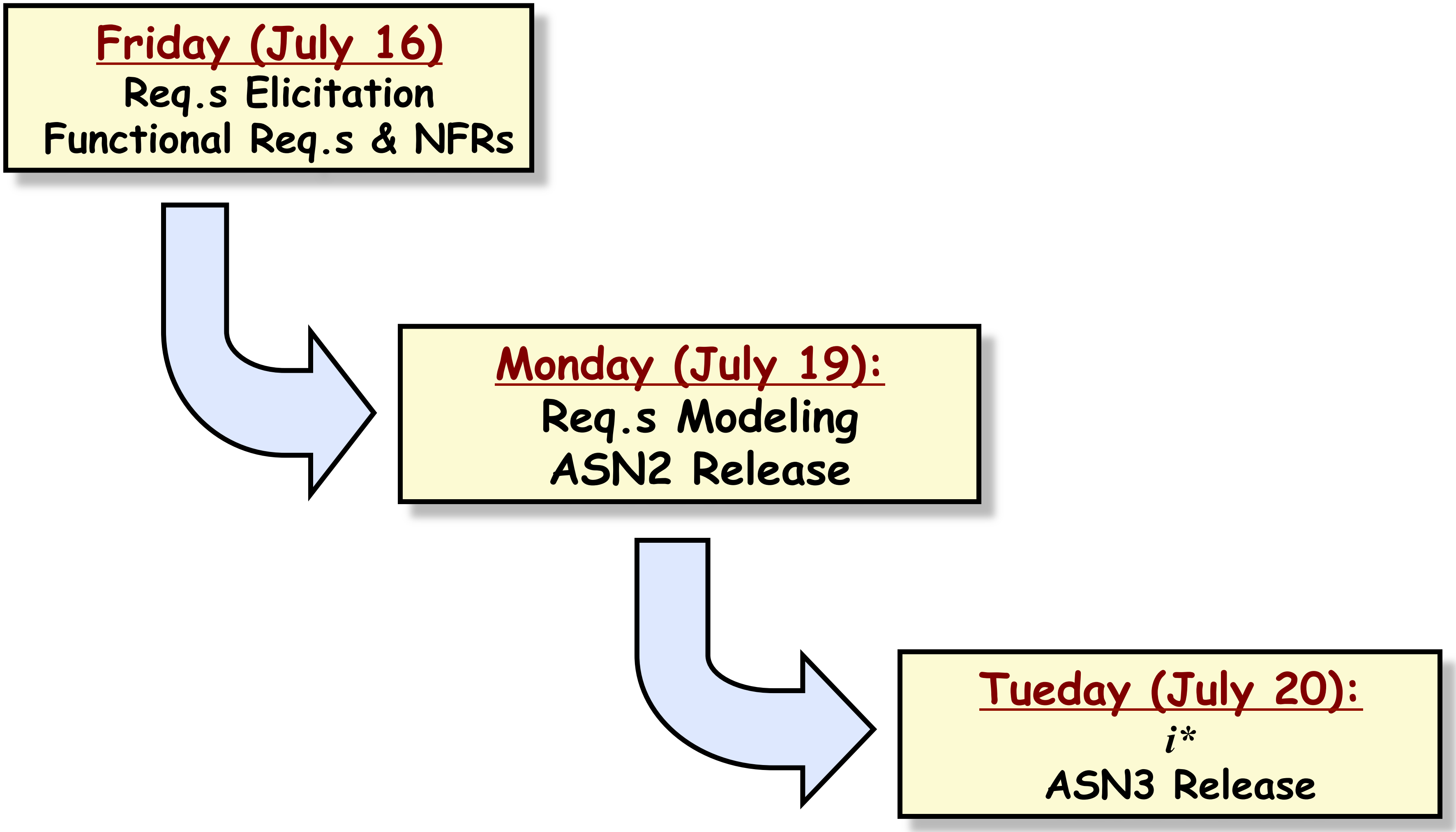
Requirements Engineering

(Summer 2021)

Prof. Nan Niu (nan.niu@uc.edu)

https://github.com/nanniu/RE-Summer2021

Today’s Menu



Friday (July 16)

Req.s Elicitation

Functional Req.s & NFRs

Monday (July 19):

Req.s Modeling

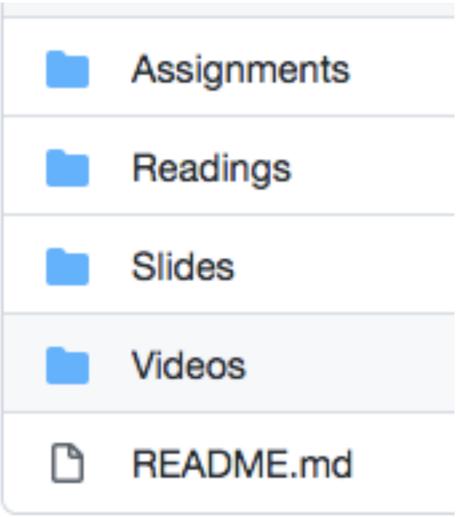
ASN2 Release

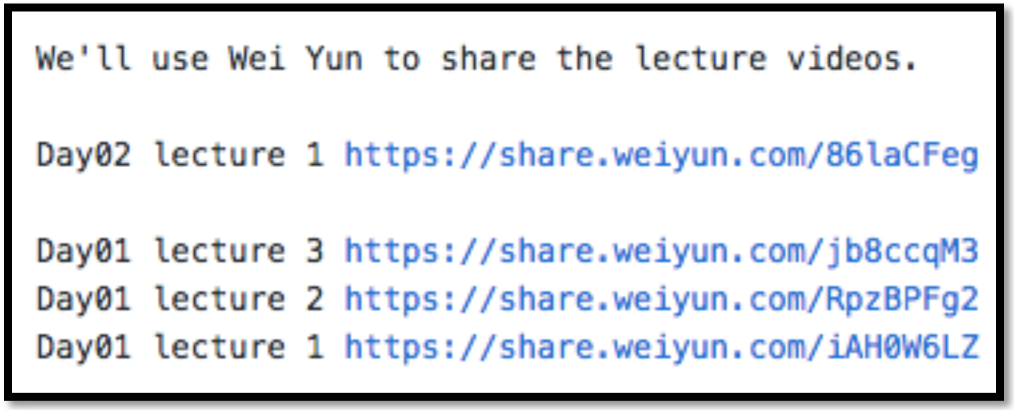
Tueday (July 20):

*i**

ASN3 Release

Website updates





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We'll use Wei Yun to share the lecture videos.

Day02 lecture 1 https://share.weiyun.com/86laCFeg

Day01 lecture 3 https://share.weiyun.com/jb8ccqM3
Day01 lecture 2 https://share.weiyun.com/RpzBPFg2
Day01 lecture 1 https://share.weiyun.com/iAH0W6LZ
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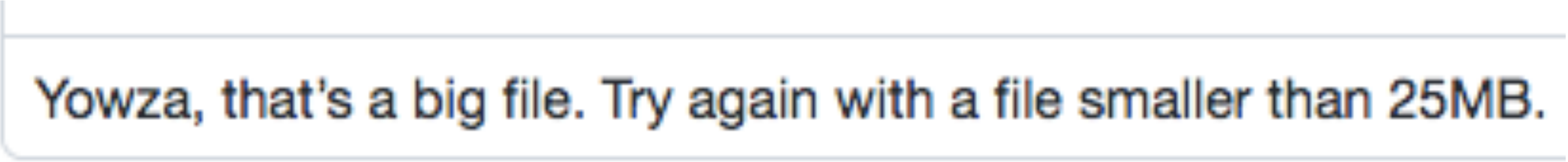
Take-away of the 1st week



Yowza, that's a big file. Try again with a file smaller than 25MB.

$$\boxed{\varepsilon, S \vdash R}$$

→ Meaning of requirements

- R: "instructor needs to share lecture videos with students"
- E: "videos are available", "video format is compatible", …
- S: "GitHub limits the file size to be 25MB for uploading"

Today's Take-Aways

→ Most common form of requirements is: _____

→ Characteristics of a good SRS are: _________

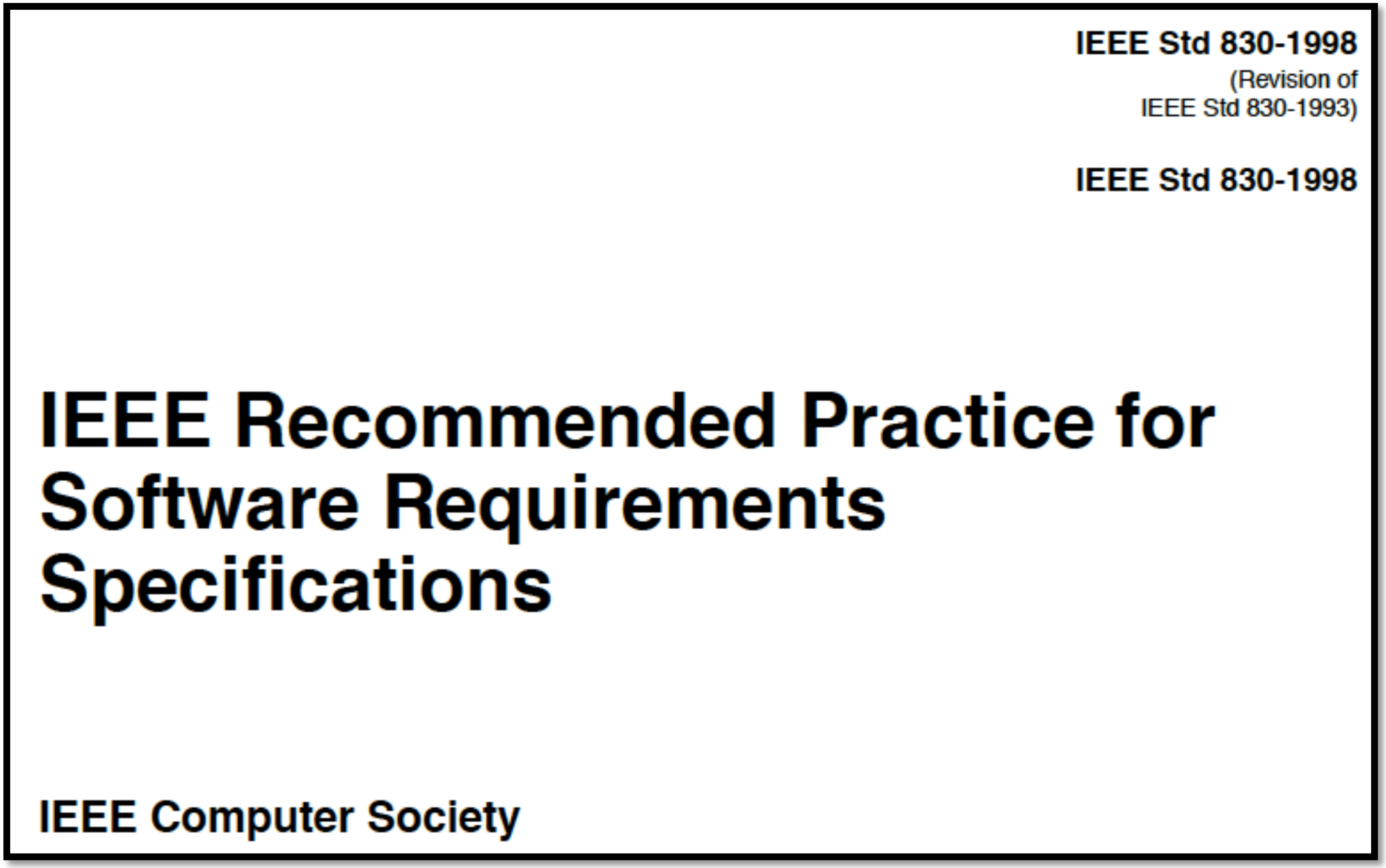
→ Agile req.s are often expressed in: _________

→ Assignment 2 is about: ______________________

The majority of req.s are written in

- →Natural language (e.g., English, Chinese)
  - ↳because text is used universally to convey information and to communicate
  - ↳J. Aranda, *et al.* "Requirements in the wild: how small companies do it", *RE'07*, pages 39-48
  - ↳J. Dag, *et al.* "A linguistic-engineering approach to large-scale requirements management", *IEEE Software*, 22(1): 32-39, 2005.
  - ↳M. Friedewald, *et al.* "Status of the software industry in Germany", *Informatik Spektrum*, 24(2): 81-90, 2001.

Reference in the course website



IEEE Std 830-1998

(Revision of
IEEE Std 830-1993)

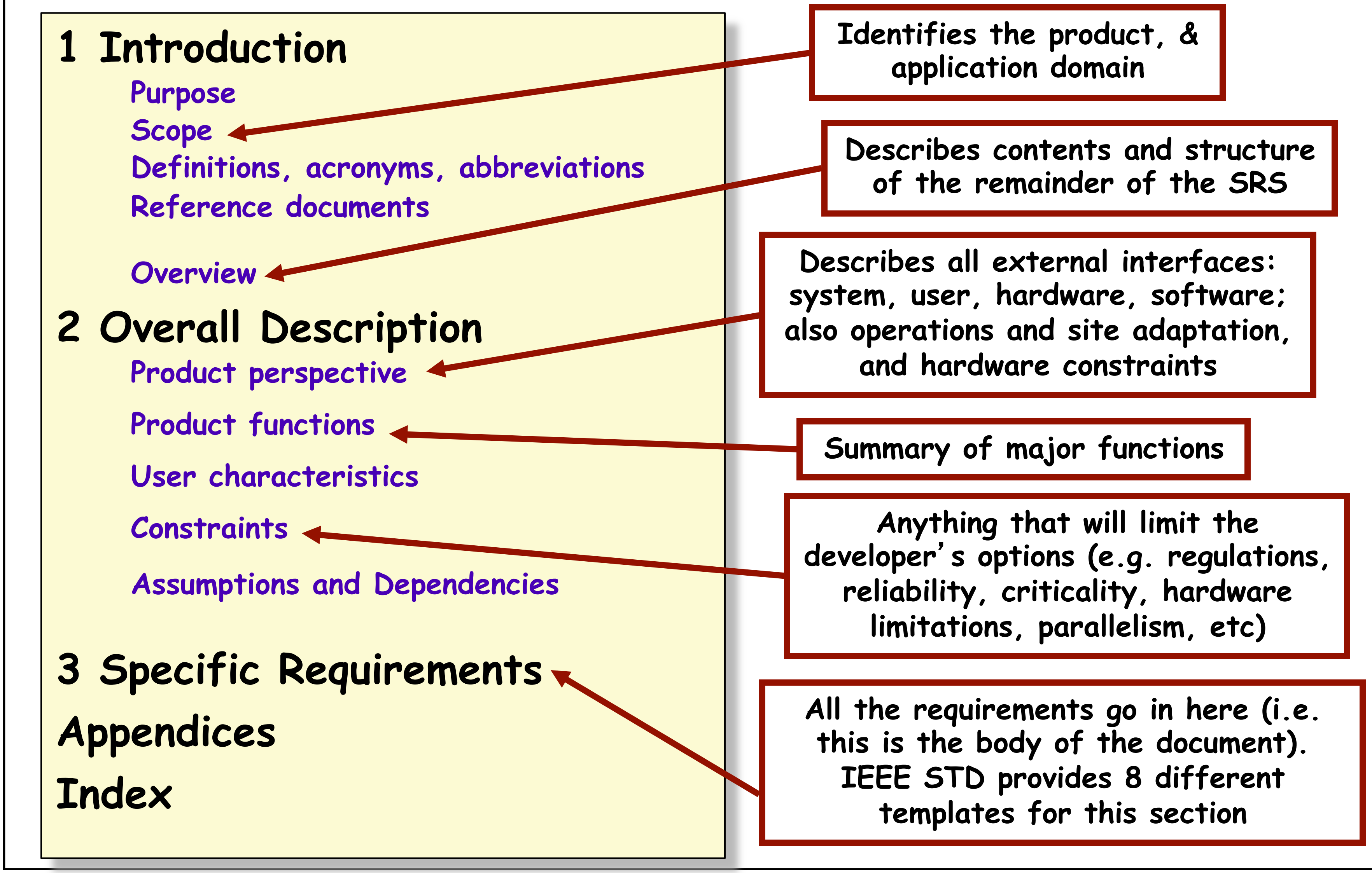
IEEE Std 830-1998

IEEE Recommended Practice for Software Requirements Specifications

IEEE Computer Society

IEEE Standard for SRS

Source: *Adapted from IEEE-STD-830-1993* ***See also****, Blum 1992, p160*



1 Introduction
- Purpose
- Scope
- Definitions, acronyms, abbreviations
- Reference documents
- Overview

2 Overall Description
- Product perspective
- Product functions
- User characteristics
- Constraints
- Assumptions and Dependencies

3 Specific Requirements

Appendices

Index

Identifies the product, & application domain

Describes contents and structure of the remainder of the SRS

Describes all external interfaces: system, user, hardware, software; also operations and site adaptation, and hardware constraints

Summary of major functions

Anything that will limit the developer's options (e.g. regulations, reliability, criticality, hardware limitations, parallelism, etc)

All the requirements go in here (i.e. this is the body of the document). IEEE STD provides 8 different templates for this section

IEEE STD Section 3 (example)

Source: *Adapted from IEEE-STD-830-1993.* ***See also****, Blum 1992, p160*

3.1 External Interface Requirements

3.1.1 User Interfaces
3.1.2 Hardware Interfaces
3.1.3 Software Interfaces
3.1.4 Communication Interfaces

3.2 Functional Requirements

this section organized by mode, user class, feature, etc. For example:

3.2.1 Mode 1

3.2.1.1 Functional Requirement 1.1

…

3.2.2 Mode 2

3.2.1.1 Functional Requirement 1.1

…

...

3.2.2 Mode n

...

3.3 Performance Requirements

Remember to state this in measurable terms!

3.4 Design Constraints

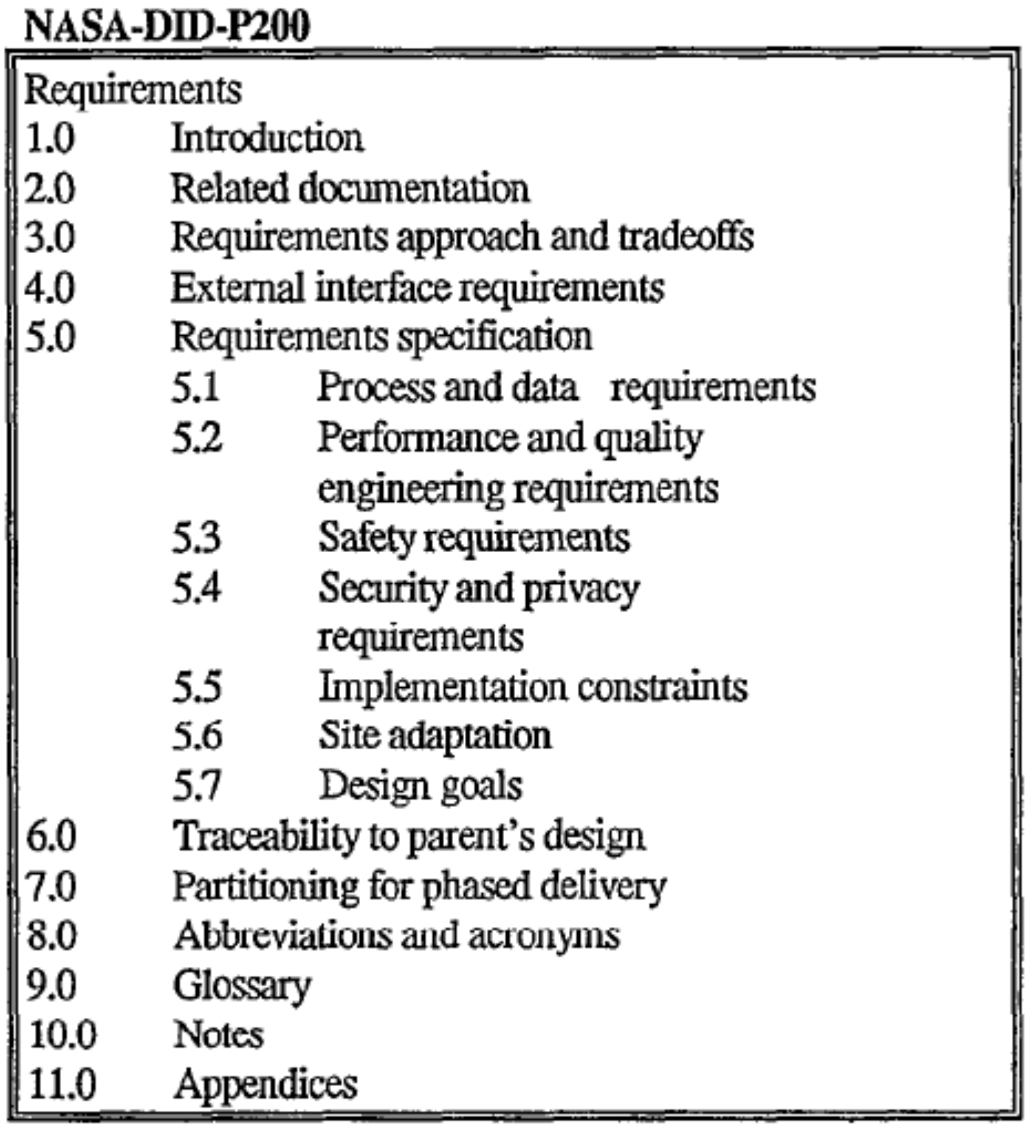
3.4.1 Standards compliance
3.4.2 Hardware limitations
etc.

3.5 Software System Attributes

3.5.1 Reliability
3.5.2 Availability
3.5.3 Security
3.5.4 Maintainability
3.5.5 Portability

3.6 Other Requirements

Other Standards



NASA-DID-P200

Requirements
1.0 Introduction
2.0 Related documentation
3.0 Requirements approach and tradeoffs
4.0 External interface requirements
5.0 Requirements specification
    5.1 Process and data requirements
    5.2 Performance and quality engineering requirements
    5.3 Safety requirements
    5.4 Security and privacy requirements
    5.5 Implementation constraints
    5.6 Site adaptation
    5.7 Design goals
6.0 Traceability to parent's design
7.0 Partitioning for phased delivery
8.0 Abbreviations and acronyms
9.0 Glossary
10.0 Notes
11.0 Appendices

NASA-STD-2100-91 29 July 1991

Military Standard, Software Development and Documentation

MIL-STD-498 5 Dec 1994

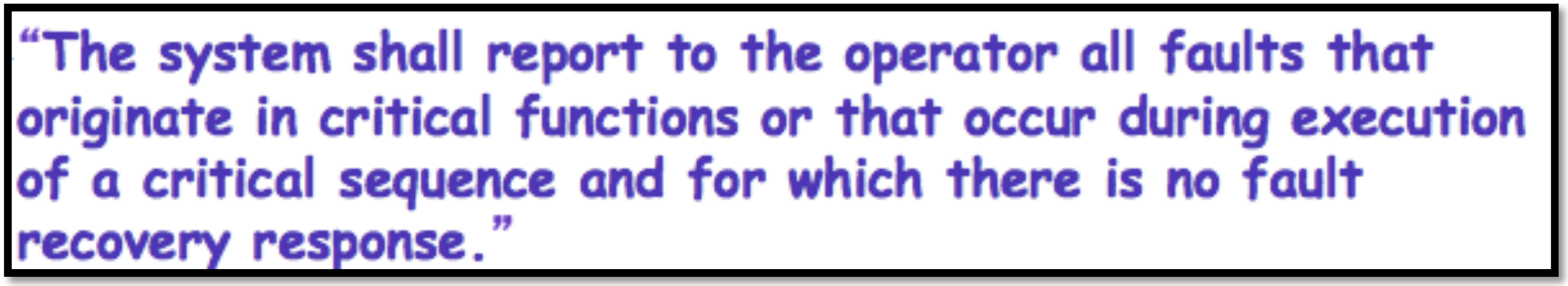
Military Standard, Software Development and Documentation

MIL-STD-1679A (Navy) 22 Oct 1983

Software Development

Natural language (NL) is natural, but …

→ Class participation: privately chat me in Webex the weakness(es) that you think of using NL to document requirements (= stakeholders' needs & desires)



"The system shall report to the operator all faults that originate in critical functions or that occur during execution of a critical sequence and for which there is no fault recovery response."

The app shall display the weather information for 2 hours.

NL can be imprecise *(hence ambiguous)*

- Natural Language
  - "The system shall report to the operator all faults that originate in critical functions or that occur during execution of a critical sequence and for which there is no fault recovery response."

    (adapted from the spec.s for the international space station)

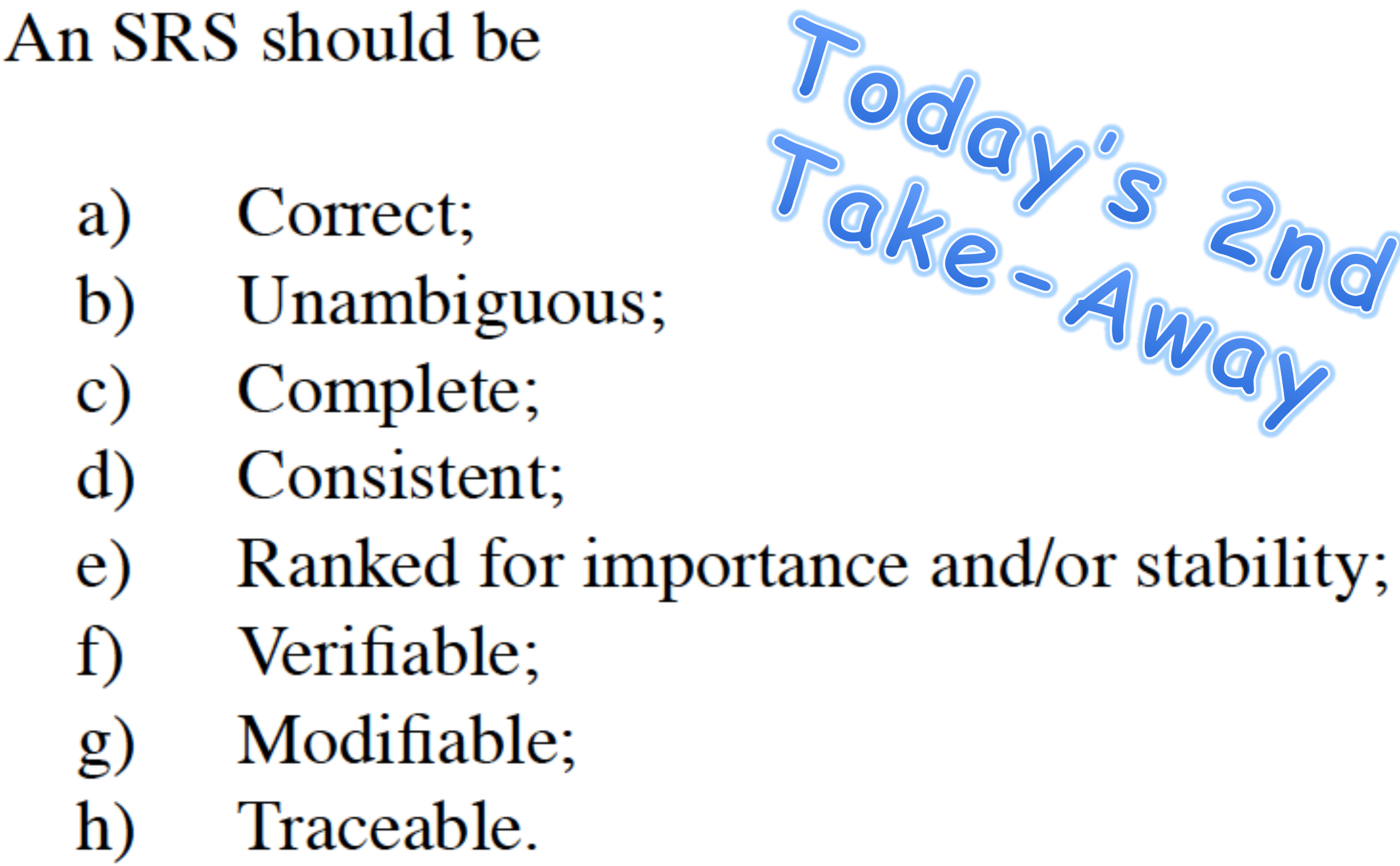
- A decision table: *Report or Not?*

Originate in critical functions	F	T	F	T	F	T	F	T
Occur during critical seqeunce	F	F	T	T	F	F	T	T
No fault recovery response	F	F	F	F	T	T	T	T
Report to operator?								

Source: *Adapted from Easterbrook & Callahan, 1997.*

Characteristics of a good SRS

Today's 2nd Take-Away



An SRS should be

a) Correct;
b) Unambiguous;
c) Complete;
d) Consistent;
e) Ranked for importance and/or stability;
f) Verifiable;
g) Modifiable;
h) Traceable.

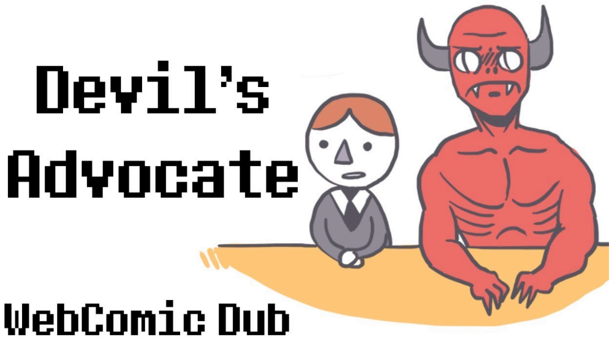
Source: IEEE STD 830

NL Requirements

→NL is the most common form of req.s & NL is *inherently ambiguous*

The app shall display the weather information for 2 hours.

2 hours of weather info.

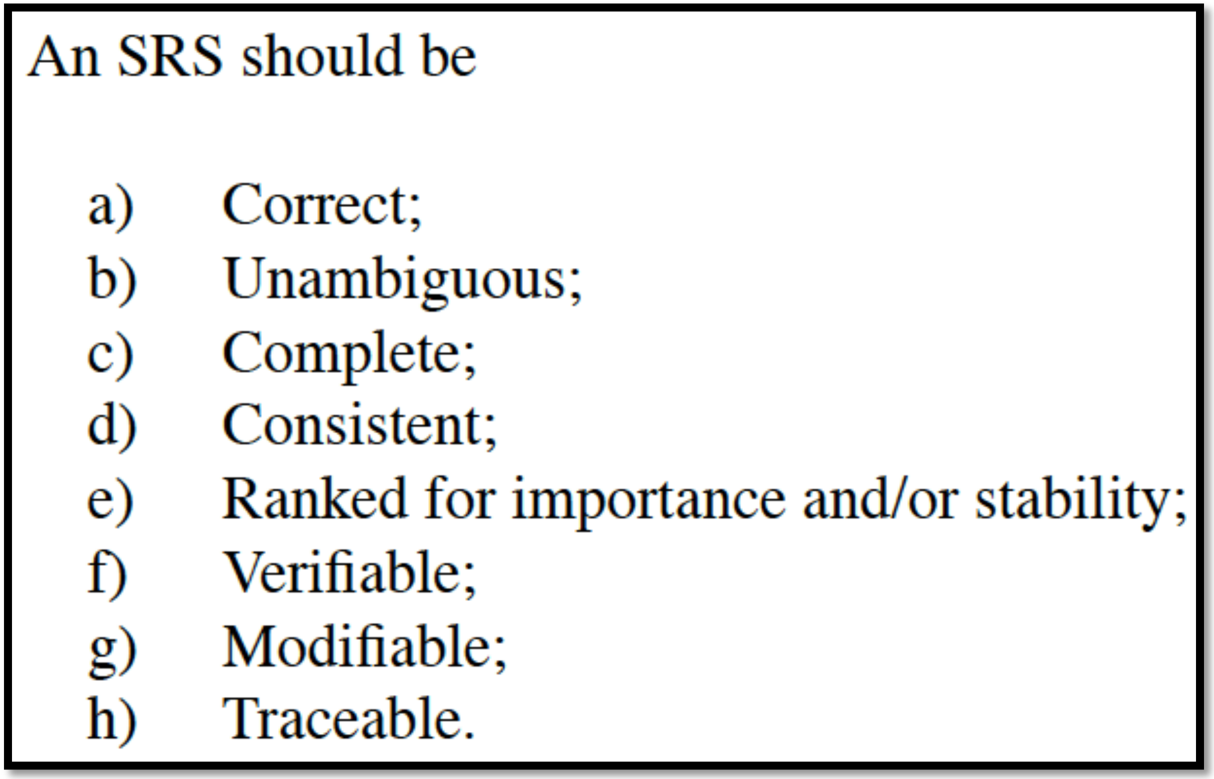


display for 2 hours

Today's Take-Aways: Recap

→Most common form of requirements is: NL

→Characteristics of a good SRS are: 8



An SRS should be

a) Correct;
b) Unambiguous;
c) Complete;
d) Consistent;
e) Ranked for importance and/or stability;
f) Verifiable;
g) Modifiable;
h) Traceable.

Which one (ones) are ambiguous to you?

- NL1: Melissa walked to the bank.
- NL2: Quickly read and discuss this tutorial.
- NL3: Fred and Emily are married.
- NL4: The boy told his father about the damage. He was very upset.

Source: https://doi.org/10.1109/RE.2014.6912250

US Dept. of Health & Human Services

- NL1: Melissa walked to the bank.
  - "Bank of America" or "Bank of Ohio River" lexical ambiguity

  "enable a user to … retrieve medication history for longitudinal care" [HITECH Act]
- NL2: Quickly read and discuss this tutorial.
  - Quickly: read, discuss, both? syntactic ambiguity

  "enable a user to electronically record, modify, and retrieve a patient's vital signs…" [HITECH Act]
- NL3: Fred and Emily are married.
  - Married to each other, or not? semantic ambiguity

  "enable a user to electronically compare two or more medication lists" [HITECH Act]
- NL4: The boy told his father about the damage. He was very upset. referential ambiguity

Source: *https://doi.org/10.1109/RE.2014.6912250 HITECH Act: The Health IT for Economic and Clinical Health Act*

Today's Take-Aways

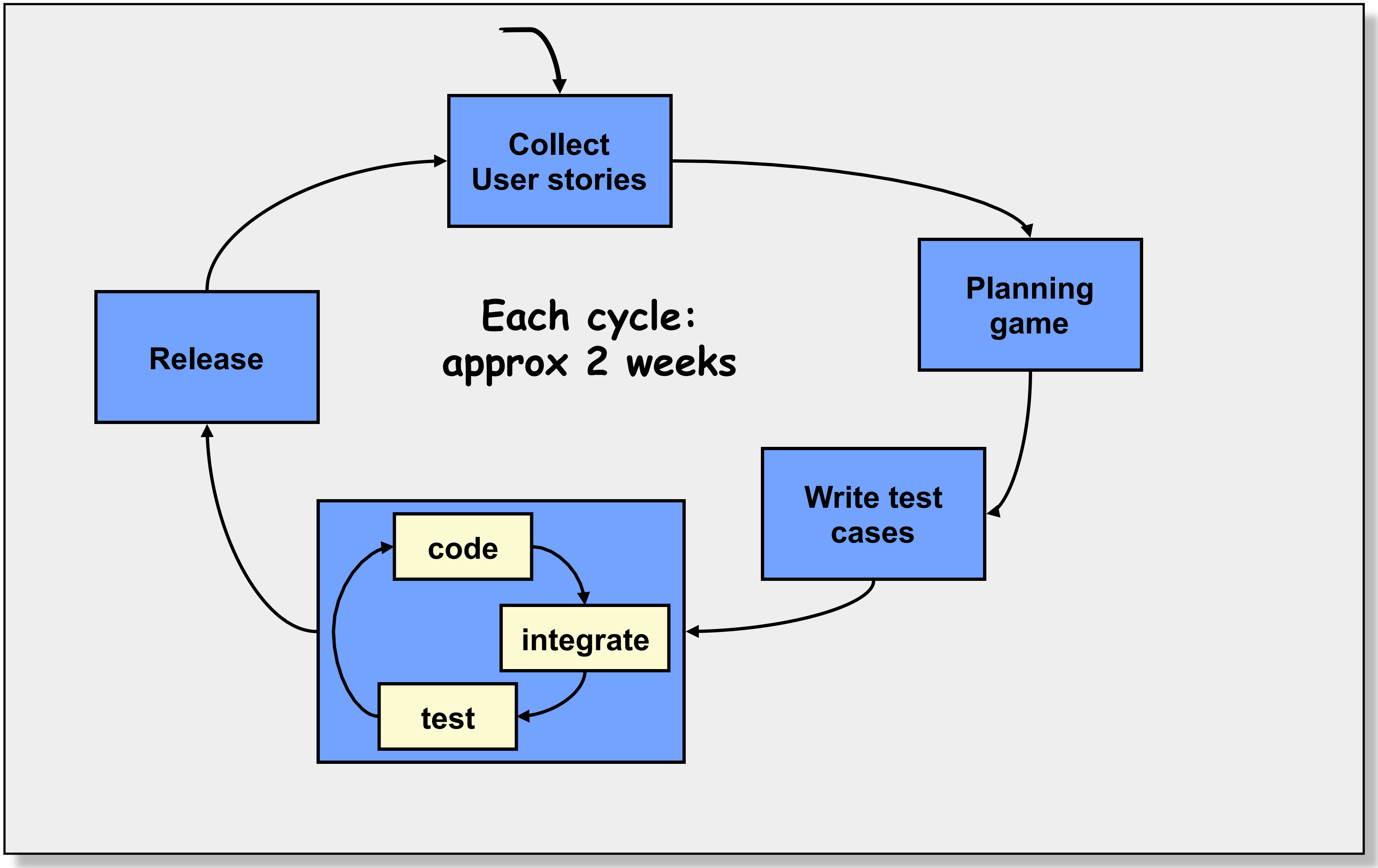
→Most common form of requirements is: NL

→Characteristics of a good SRS are: 8

→Agile req.s are often expressed in: ________

→Assignment 2 is about: ____________________

eXtreme Programming (XP)



Each cycle:
approx 2 weeks

User Stories

- Only capture the essential elements of a requirement
  - *who* it is for
  - *what* it expects from the system
  - (optionally) *why* it is important

  "As a <type of user>, I want <goal>, [so that <some reason>]"

  e.g., "As an administrator, I want to receive an email when a contact form is submitted, so that I can respond to it."

- Scholar@UC https://github.com/uclibs/scholar_use_cases
  - As a: repository submitter
  - I want: to be able to upload a video
  - So that: my content will be viewable
  - Done looks like: a format option in the input form that includes video

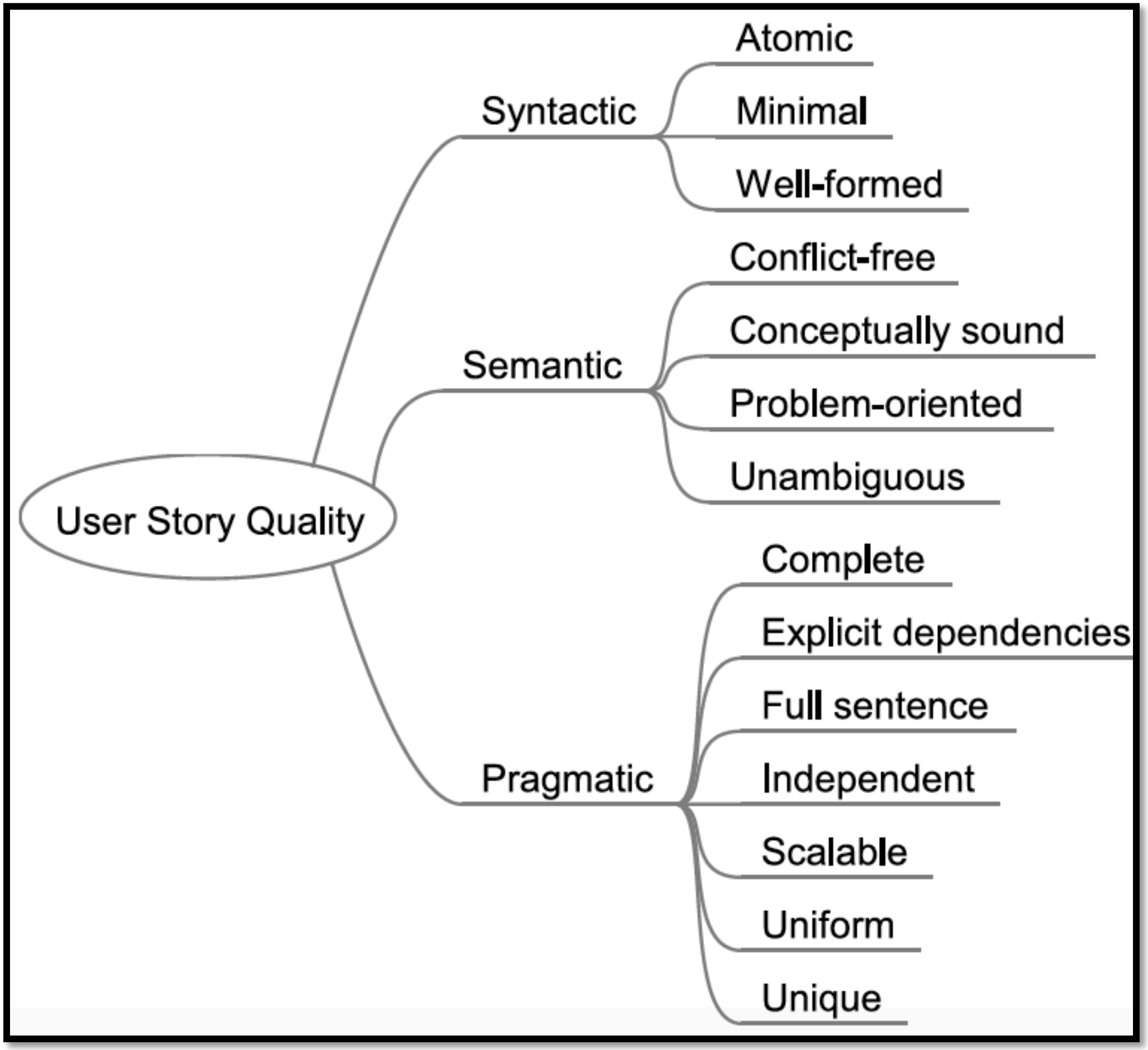
How many are of high quality?

- US_1: As a user, I'm able to click a particular location from the map and thereby perform a search of landmarks associated with that latitude longitude combination
- US_2: Add static pages controller to application and define static pages
- US_3: As a care professional I want to save a reimbursement – Add save button on top right (never greyed out)
- US4_a: As a user, I'm able to edit any landmark
- US4_b: As a user, I'm able to delete a landmark which I added

Forging High-Quality User Stories: Towards a Discipline for Agile Requirements

Universiteit Utrecht

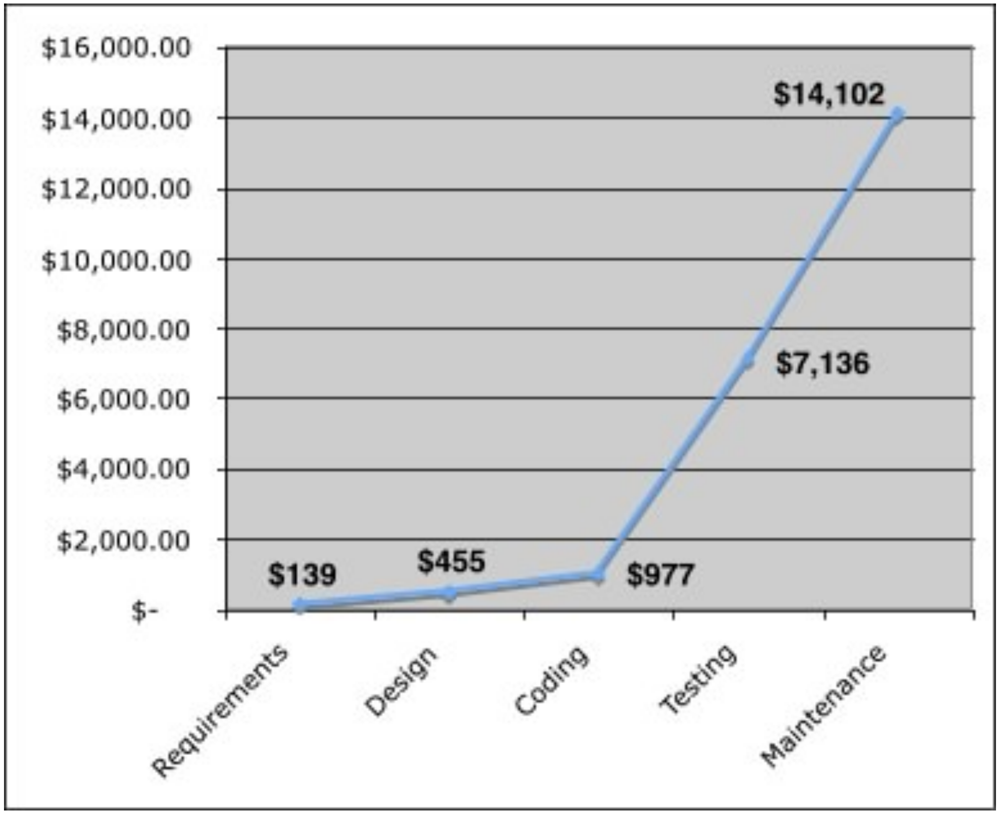
Source: *https://doi.org/10.1109/RE.2015.7320415*



Source: https://doi.org/10.1109/RE.2015.7320415

Quality of Req.s: Why bother?

because “doing RE right saves money”



Source: *R. Pressman, Software Engineering, 2010*

Today's Take-Aways

→ Most common form of requirements is: NL

→ Characteristics of a good SRS are: 8

→ Agile req.s are often expressed in: user stories

→ Assignment 2 is about: *Your RE story*

ASN2: Your RE Story

- 20% of the total grade
  - An oral presentation on Monday (July 26, 2021)
  - We'll start at 9am on July 26; a schedule will be posted on the course website ahead of the time
  - Each presentation is 5-10 minutes & real-time
  - You shall prepare very well the supporting materials, e.g., slides, photos, etc.
  - I will email your grade (out of 20), and my comments if any, shortly after July 26

Grading

YOUR

Source: *Google Images*

My RE Story

Nan's cell phone in 2009 versus today

> "People don't know what they want until you show it to them."
>
> *– Steve Jobs*
> en.wikiquote.org/Steve_Jobs

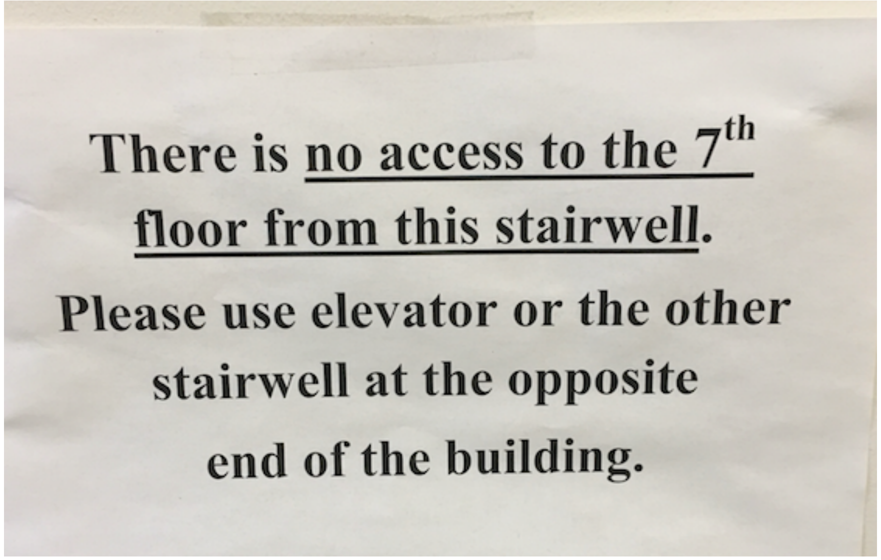
Source: *Google Images*

My RE Story #2

- Returning from FSE'16
  - Planned: SEA → MSP → CVG
  - Actual: SEA → MSN → MSP

    (→ CVG; missed)

My RE Story #3



There is no access to the 7th floor from this stairwell.

Please use elevator or the other stairwell at the opposite end of the building.

Source: *Google Images & My Photo Album*

RE Story Hints

- Leveraging the "take-aways"
  - Req.s, importance, RE
  - Meaning of req.s
  - Req.s are not butterflies
  - NL req.s may be natural, but can be inherently ambiguous