Building Blocks to Write Effective Requirements

Four things a technical writer can do to craft effective requirements statements

Presented by David Hicks

What Are Requirements

- Requirements describe what, how well, and under what conditions (constraints) a product or service must achieve for a given purpose.
  - A product can be a computer system, an app, a car
  - A service can be bookkeeping, Uber ride, an oil change
  - A constraint on a product or service may include the cost, its weight or speed, a schedule, whether it can perform under wet or hot conditions

- Requirements are the building blocks of a contract—an agreement between a buyer and seller.

Before Crafting Requirements

- What is the purpose behind the requirements? What is the story?
  - What needs to be done, how well, and why?
  - Is what needs to be done doable at an affordable price?
  - Who or what is going to do it? If done successfully, will the need actually be met?
  - What must exist or be created in order to support what needs to be done?
- Who is the audience?
  - Buyer
  - Seller
  - Judge (worst-case scenario)

Consequences of Poorly Written Requirements

- Software requirements defects discovered once a system is fielded cost 50 to 200 times as much to correct than if found during the requirements evaluations (Boehm and Papaccio, 1988)
- Industry data suggests that approximately 50% of product defects originate in the requirements (Karl Wiegers, 2001)
- Fixing requirements errors accounts for 70% to 80% of rework costs (Leffignwell, 1997)
- Requirements defects cause over 40% of accidents, including fatalities, involving safety-critical systems (Health and Safety Executive, 1995)
- “Requirements errors are the single greatest source of defects and quality problems” (Schwaber, 2006; Weinberg, 1997; Nelson et al, 1999)

- **The primary cause of defective requirements is caused by ambiguity**

Types of Requirements

Acquisition
Availability
Design
Detail
Environmental
Functional
Hardware
Human Factors
Interface
Logistics
Maintainability
Performance
Process
Producibility
Program-unique
Reliability
Safety
Security
Software
System
Technical
Testing
Training
Upgradeability
User/End User
Validation
Verification

- These can be chunked into two primary types of requirements:
  - Task
  - Product

Task Requirements

- Requirements that define an individual activity needed to satisfy part of a contract:
  - “Conduct design review”
  - “Perform oil change”
  - “Conduct acceptance testing”
  - “Move equipment”
  - “Deliver a plan”
  - “Deliver a report”

Product Requirements

- Requirements that define what a product (hardware, software, system) must do:
  - Laptop
  - App
  - Drone
  - Ledger
  - Oil dispenser
  - Windshield wipers

Four Things a Writer Can Do to Help

- Understand your constraints.
- Follow a clear sentence structure.
- Point out ambiguities and seek clarity.
- Create an easy-to-read format, if allowed.

Understand Your Constraints

- Each field has its own conventions that should be followed:
    - Contract versus engineering specification versus website terms of use
    - Capitalization or format of defined terms
    - Naming convention being used—be consistent:
        - Supplier, vendor, provider, bidder
        - Buyer, company name
    - Use or nonuse of articles before names:
        - “Supplier shall” versus “The supplier shall”
    - Jargon/“Commonly used terms in *our* field *they* should already understand”
        - Engineering, business, legal, functional group
    - Auxiliary verb meanings:
        - “shall” – mandatory supplier tasks
        - “should” – suggested (nonmandatory) supplier tasks
        - “may” – optional supplier tasks
        - “will” – Buy or third-party tasks
        - Avoid replacing “shall” with “must”

Follow a Clear Sentence Structure

- Supplier shall perform a Safety Risk Assessment that includes the activities described in OSHA regulation 1910.132(d)(2). Supplier shall submit the assessment using Form SRA-001.
  - Avoid multiple uses of shall in a single requirement—split them out into separate requirement statements or use an itemized list if there are more than two.
  - Enforce the correct use of *that* and *which*—*which* introduces parenthetic clauses; *that* contains information essential for the sentence to make sense
- The Cafeteria POS System shall partition multiple separate Food Services Providers' content and data.
  Note: The intent is that Food Services Providers will not be able to view each other's information either through the user interface, reporting tools, or direct access to databases.
  - Don't embed related *useful information* in the requirement statement.

Point Out Ambiguities and Seek Clarity

acceptable
acceptably
accomplish
accommodate
accurate
accurately
achievable
adaptable
adequate
adversely affect
agreed-upon
all
always
and/or
and so forth
any
approximate
approximately
are
associated with
assist
average
be able to
be considered
be designed for
be designed so
be designed to
better
but not limited to
calculate
capability
capable of
compatible

consider
correct
consistent with
could
degraded
earliest
easy
easily
efficient
et cetera
etc
every
extremely
e.g.
fast
faster
fault tolerant
finish
flexible
flexibly
generally
given to
greatest extent possible
higher
highest
high fidelity
if required
inaccurate
inaccurately
inadequate
Inadequately
Include but not limited to

insufficient
insufficiently
infrequent
Instantaneous
it
its
i.e.
large
latest
less
likely
long-term
lower
maximize
maximum use of
may
might
minimize
minimum acceptable
minimum of
minimum number of
minimum required
minimum use of
modular
must
near-term
never
nominal
normal
optimize
possible
possibly

practical
practicable
probable
probably
provide
provided
quick
quicker
quickly
rapid
rapidly
reasonable
reasonably
safe
satisfactory
shall be
should
simple
simplify
simultaneous
slow
slower
slowly
small
such as
sufficient
sufficiently
support
synchronous
tba
tbd

tbr
tbw
tbs
timely
to the extent practical
to the extent required
to the extent specified
unacceptable
unacceptably
useable
user-friendly
very
when necessary
when required
where applicable
would

Other Things to Watch for That Cause Ambiguity

- Telling the bidder *how* to accomplish the task (e.g., over-specifying, focusing on the implementation and operations) instead of describing *what* is needed.
- Making bad assumptions:

  "They will understand what we mean."

  =

  They will understand it to mean what is best for their company,
  not what is best for our company.

- Using the slash (/)
  - What does "A/B" mean?
    - A or B
    - A and B
    - A divided by B
  - What does "and/or" mean?
    - Maybe one or the other, or both?

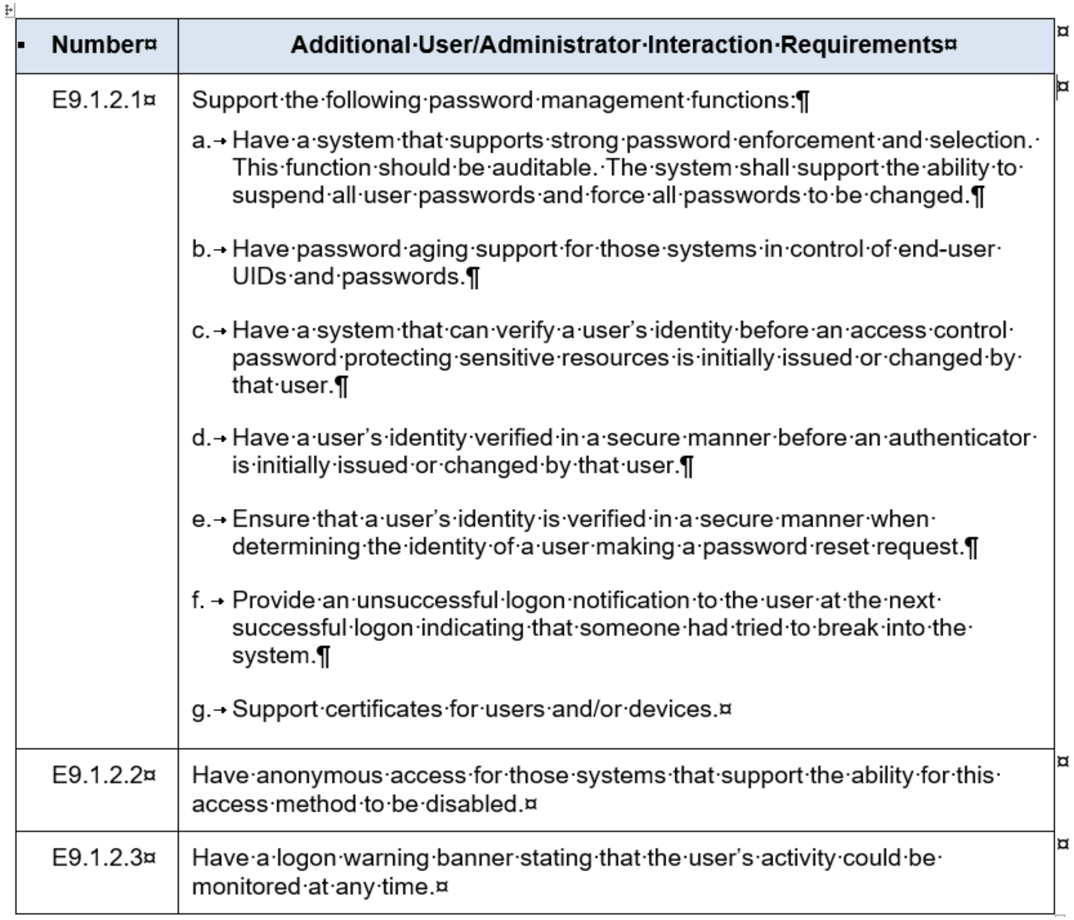
Other Things to Watch for… (Continued)

- Just like for documents with an international audience, watch those pronouns. When using *this*, *these*, *that*, and *those*, make sure it is clear what they are referring to (e.g., These [practices] must be actionable). Especially avoid using *this* as a pronoun to reference the meaning of an entire sentence or idea.
- Other pronouns to check: *it*, *its* (versus it's), *their*, *they*, and *them*.

- Remember: One purpose of having clear requirements is to avoid having a judge determine its meaning!

Create an Easy-to-Read Format, if Allowed

Provider shall support the following password management functions: (a) have a system that supports strong password enforcement and selection and is auditable and have the ability to suspend all user passwords and force all passwords to be changed; (b) have password aging support for those systems in control of end-user UIDs and passwords; (c) have a system that can verify a user’s identity before an access control password protecting sensitive resources is initially issued or changed by that user; (d) have a user’s identity verified in a secure manner before an authenticator is initially issued or changed by that user; (e) ensure that a user’s identity is verified in a secure manner when determining the identity of a user making a password reset request; (f) provide an unsuccessful logon notification to the user at the next successful logon indicating that someone had tried to break into the system; and (g) support certificates for users and/or devices. Provide anonymous access for those systems that support the ability for this access method to be disabled. Have a logon warning banner stating that the user’s activity could be monitored at any time.



Number	Additional User/Administrator Interaction Requirements
E9.1.2.1	Support the following password management functions: a. Have a system that supports strong password enforcement and selection. This function should be auditable. The system shall support the ability to suspend all user passwords and force all passwords to be changed. b. Have password aging support for those systems in control of end-user UIDs and passwords. c. Have a system that can verify a user’s identity before an access control password protecting sensitive resources is initially issued or changed by that user. d. Have a user’s identity verified in a secure manner before an authenticator is initially issued or changed by that user. e. Ensure that a user’s identity is verified in a secure manner when determining the identity of a user making a password reset request. f. Provide an unsuccessful logon notification to the user at the next successful logon indicating that someone had tried to break into the system. g. Support certificates for users and/or devices.
E9.1.2.2	Have anonymous access for those systems that support the ability for this access method to be disabled.
E9.1.2.3	Have a logon warning banner stating that the user’s activity could be monitored at any time.

Addition Considerations That May Make You a Hero if You Keep Them in Mind

- Each requirement must be evaluated
- Each requirement must be validated
- Each requirement must be verified
- Each requirement adds to the cost