

Introduction to EARS

(Easy Approach to Requirements Syntax)

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Outline

About Mav

EARS users

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Generic EARS template

EARS patterns with examples

Lessons learned

Benefits of EARS

...and some stupid photos

MAVERICK





<http://www.rolls-royce.com/press/assets/prg.jsp>

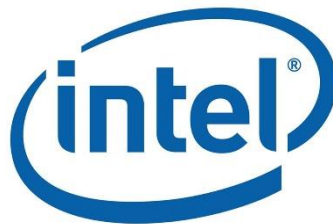
Why use EARS?

People like natural language

People want it easy



BOSCH



UNIVERSITÉ DU
LUXEMBOURG



TERADYNE



LOCKHEED MARTIN



DAIMLER



PHONAK

hearing systems



European Aeronautic Defence and Space Company



UNIVERSITY OF LEEDS



The
University
Of
Sheffield.



UNIVERSITY
of York



CITY UNIVERSITY
LONDON

SOPHIST



fortiss

Initial EARS development

Interpretation of *Certification Specification for Engines* (CS-E) to define the implied requirements on an engine control system

Cross-discipline team (systems, safety, requirements and airworthiness engineers, SMEs where necessary)

Started with loose set of rules

Incremental changes to ruleset, continuously tested and refined during the ongoing study

CS-E

Contains a “rich mixture” of...

Goals

Requirements

Requirements on other systems

Domain statements

Assumptions

Information

... (etc)



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<https://fanart.tv/fanart/music/bf0caafc-2b20-4e07-ab85-87e14ff430ce/artistbackground/spice-girls-50ab3033cd411.jpg>

EARS template

The template is made up of simple clauses

Clauses are in a specific order

The template has an underlying ruleset,
governing mandatory and optional clauses

Applying the template produces requirements
in a small number of patterns, depending on
the clauses that are used

EARS notation and ruleset

<> denotes a clause

Bold clauses are mandatory

Normal font indicates optional clauses

Superscripts are used to map clauses
between generic template and examples

Each requirement must have

Zero or many pre-conditions

Zero or one trigger

One system name

One or many system responses

Generic EARS syntax

*While <pre-condition(s)> when <trigger> the
<system name> shall <system response>*

Pre-conditions define conditions that must be true for a requirement to become active

Trigger defines a discrete event detected by the system that activates a requirement

System name must be explicit

System response defines what the system must do when requirement becomes active



<http://www.sep.com/sep-blog/files/2013/12/stop-collaborate-and-listen.jpg>

EARS requirement classes

Normal operation (“wanted” behaviour)

All interacting systems and users behave as expected to achieve the desired user outcome (*“sunny day”*)

Unwanted behaviour

Used to specify the required system response to any unexpected or undesired behaviour of interacting systems or users (*“rainy day”*)

Normal operation patterns

Ubiquitous

Requirement is always active

State-driven (keyword **While**)

Active whilst pre-condition holds

Event-driven (keyword **When**)

Required response to a triggering event

Complex

Use combinations of keywords

Option (keyword **Where**)

Simple mechanism to handle product or system variation

(Option is not covered in detail in this presentation)

Ubiquitous

The <system name>¹ shall <system response>²

Used to define system behaviour that must be active at all times (“continuous”)

The <ATM>¹ shall <use electrical supply from National Grid>²

The ATM shall use electrical supply from National Grid



State driven

*While <pre-condition(s)>¹, the <system name>²
shall <system response>³*

Requirement is active while a defined state
remains true

*While <Bank System is processing>¹, the <ATM>²
shall <display “processing, please wait”>³*

*While Bank System is processing, the ATM shall
display “processing, please wait”*

Event driven

When <trigger>¹, the <system name>² shall <system response>³

Initiated only when a triggering event is detected at the system boundary

When <Customer enters withdrawal amount>¹, the <ATM>² shall <check customer balance>³

When Customer enters withdrawal amount, the ATM shall check customer balance

Complex

While <pre-condition(s)>¹, when <trigger>², the <system name>³ shall <system response>⁴

Combinations of EARS keywords

While <a transaction is in progress>¹, when <cancel is pressed>², the <ATM>³ shall <return card and display “please take your card”>⁴

While a transaction is in progress, when cancel is pressed, the ATM shall return card and display “please take your card”

To make a withdrawal, please solve for x:
$$y = 264^{15} / 99xyz^* 2n + 1 - (\text{Pi} + \text{Phi})$$

Then press ENTER.

Time Remaining: 0:29



Unwanted behaviour (1 of 2)

Unwanted behaviour is a general term used to cover all undesirable situations, including

- Failures and disturbances

- Deviations from desired user behaviour

- Any unexpected behaviour of interacting systems

Defines the required response of the system to unwanted external events

Can be used with other keywords to specify more complex unwanted behaviours

Unwanted behaviour (2 of 2)

While <pre-condition(s)>¹ if <trigger>², then the <system name>³ shall <system response>⁴

A variation of event-driven requirement

If <withdrawal request exceeds balance>², then the <ATM>³ shall <display “balance exceeded”>⁴

If withdrawal request exceeds balance, then the ATM shall display “balance exceeded”

Requested: \$200



Sorry. We can not process your request. You are drunk
and you do not need to buy everyone in the bar shots.

Pay tab

Call cab

Remove your card

EARS lessons learned

Goal, Requirement, Domain, Information etc.

Challenge the EARS pattern

Look for “pairs”

Use EARS alongside models

Requirements evolve

Wanted, then Unwanted requirements

Should a requirement be split?

Coaching to embed the learning

See “Listens Learned” paper from RE16 for more detailed lessons learned

Selected benefits of EARS (1 of 2)

Reduces or eliminates common errors in Natural Language requirements

No new notation or tool to learn

Little training is needed

Consistent and universally understandable

Authors concentrate on semantics, not on syntax

Requirements are easier to review

Requirements are easier to verify

Requirements are judged on merit, not on style



Selected benefits of EARS (2 of 2)

Especially helpful for authors whose first language is not English, but who must write requirements in English

Clauses of EARS requirements identify any missing information

Requirements are *balanced* and written at the right level

Works well alongside models

Promotes black box systems thinking

An effective bridge between informal and formal

Stealth rigour

*“If you can’t write it in EARS, you don’t understand it”
(Senior Systems Engineer, US blue chip engineering company)*

S is for system

a Post-it[®]

presentation

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Why use EARS?

People like natural language

People want it easy

EARS is natural language

EARS is easy

The Easy Approach to Requirement Syntax paper from IEEE RE09 won Most Influential Paper Award at RE19



The adoption of EARS
would be logical

<http://people.csail.mit.edu/paulfitz/plank/vulcan/spock2.GIF>

Sales Pitch

EARS and general requirements engineering training, coaching and consulting

EARS and RE training

- One day Fundamentals of Requirements Engineering
- One day EARS
- Practice using EARS with requirements from own domain
- My training is effective, engaging and fun

Creativity and innovation in requirements engineering
Keynotes, invited presentations etc.

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