

Requirements and Specifications (Part 1/2)

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Requirements and Specifications (Part 1)

Today's agenda:

- **Reading Quiz**
- What are specifications, and why do we care?
- In-class exercise

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Announcements:

- all IP1 submissions should be graded (let me know if yours wasn't)
- team formation survey out (link [here](#) or on CampusWire)
- IP2 autograder is open (many students struggled on IP1 because they waited until the last minute)

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Specifications tell you **what** to do (but not **how** to do it)

- **A perfect implementation is no good if it solves the wrong problem**
- **It's difficult to create a specification that is**
 - complete
 - consistent
 - precise
 - concise

Bundestag Sound System, 1992

- **No sound from speakers in new building**
 - system requirement: no feedback
 - new all-glass room
- **"This glass does not absorb the sound. The computers, detecting feedback, turn down the volume. A steady state is only achieved when the microphones are turned off."**

Dr. Debora Weber-Wulff

[with thanks to Michael D. Ernst for the GroupThink Specification Exercise]

Ariane 5 launch vehicle, 1996

- **Went off course during launch**
 - Ariane 4 guidance software reused in Ariane 5
 - Ariane 5 accelerated much faster
 - velocity variable overflowed, computer crashed
- **"The failure of the Ariane 501 was caused by the complete loss of guidance and attitude information... due to specification and design errors in the software."**

ESA Inquiry Board

Mars Polar Lander, 1999

- **Crashed while landing on Mars**
 - sensor transient when legs deployed
 - software thought vehicle had landed
 - engine shut down during descent
- **"There was no software requirement to clear spurious signals prior to using the sensor information to determine that landing had occurred."**

Mars program independent assessment team

Specifications matter

- **A specification:**
 - connects customer and engineer
 - ensures parts of implementation work together
 - defines correctness of implementation
- **Therefore everyone must understand specs**
 - Designers, implementers, testers, managers, marketing, technical support, ... users!
- **Good specifications are essential**

[with thanks to Michael D. Ernst for the GroupThink Specification Exercise]

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Groupthink Specification Exercise

[with thanks to Michael D. Ernst for the GroupThink Specification Exercise]

Groupthink game

As a group, specify behavior of a desktop telephone

Individually, answer questions about its behavior

Goal: all group members give same answer

- No defaults based on the game
(e.g., “always A”)

The winning group receives a prize

[with thanks to Michael D. Ernst for the GroupThink Specification Exercise]

Desktop telephone

Handset (speaker and microphone)

Keypad

talk

redial

ansmachine

end

24-character display

Answering machine

Phone jack

[with thanks to Michael D. Ernst for the GroupThink Specification Exercise]

Requirements

Display indicates current functionality

- caller ID
- number being called
- "Answering machine"
- "Ready"

Answering machine picks up after 2 rings

You decide other aspects of system behavior

Definitions

Lineidle: phone is on-hook ("hung up")

- sent from phone to phoneline

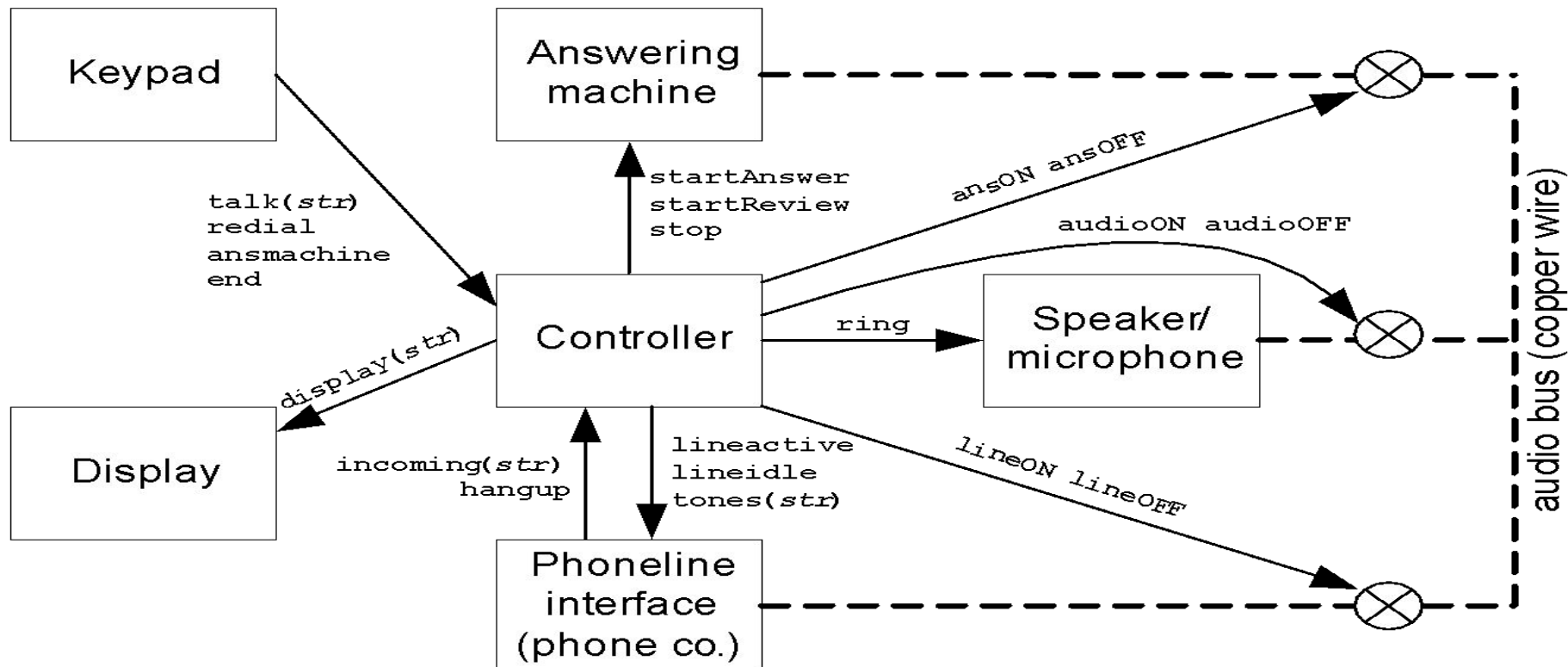
Lineactive: phone is off-hook ("picked up")

- sent from phone to phoneline

Ring signal: causes phone to ring once

- sent from phoneline to phone

System architecture



[with thanks to Michael D. Ernst for the GroupThink Specification Exercise]

Sample question

**The user is connected to an outside party.
The outside party hangs up. What state
is the phoneline in?**

- A. Lineactive (the user hears dialtone)
- B. Lineidle (the user does not hear dialtone)