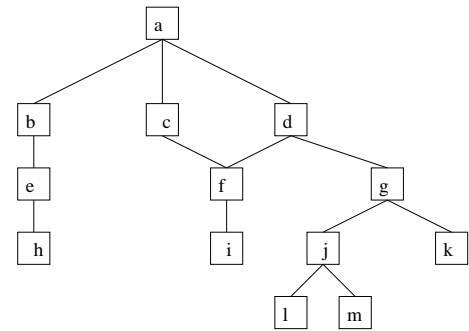


## Implementation and integration

In this chapter we will:

- Realize that the implementation and integration phases must be performed in parallel
- Discover the advantages and disadvantages of various techniques for the implementation and integration phase
- Learn about the distinct types of testing that are carried out during the implementation and integration phase



**Figure 10.1** Structure chart of a product.

If implementation and integration are performed sequentially then

**First,** Each function is implemented and tested on its own

**Second,** all functions are linked together and tested.

Suppose the result crashes. Where is the fault?

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Two problems of this scenario:

- It has poor error localization possibilities,
- It is hard to develop code and test it because it requires additional effort: implementation of test drivers and function stubs.

## Top-down implementation and integration

Gradually implement and test beginning at root and replacing stubs with functions.

Independent paths can be implemented and integrated separately.

How about error localization? We integrate a new function into a tested one (by replacing its stub). Suppose, that an error occurs. This is how we try to localize it:

- Error is in the new function
- if not, then it is in the interface
- if not, then it is in the old function.

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Additional benefit is early detection of design faults. Upper-level functions in the structure chart tend to be of logical nature rather than operational. If we discover and fix a logical error early, operations (lower blocks) must not be rewritten or discarded as it could occur with the sequential scenario.

Drawback of this scenario is that lower-level functions are tested less frequently than upper-level ones.

This is especially critical if lower-level functions are going to be included into a library of reusable functions.

**Question:** Why?

Hint: Lower-level functions are tested only via upper-level functions.

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## Bottom-up implementation and integration

Advantages:

- Good fault localization
- Thoroughly tested functions

Disadvantages: Design errors detected late.

To have the best of both scenarios: *sandwich implementation*.

**Question:** What is

- Top
- Bottom
- Filling

of the sandwich?

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## Product and acceptance testing

Product test is run by the SQA team and consists of

- Black-box test: does the product satisfy the specification?
- Robustness testing: how does the product react to stress situations or incorrect input?
- Check the constraints
- Check the documentation.

Customer performs acceptance test. Now the above points are run on actual data, no test data!

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## Maintenance phase

Types of maintenance

- Corrective maintenance
- Adaptive maintenance
- Perfective maintenance
- Enhancement

**Question:** Why is maintenance difficult?

Maintenance programmer must have

- Good skills in error localization, bug fix and testing
- Proper tools (e.g. version control).

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