Test Integration Strategies

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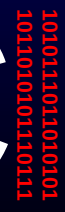
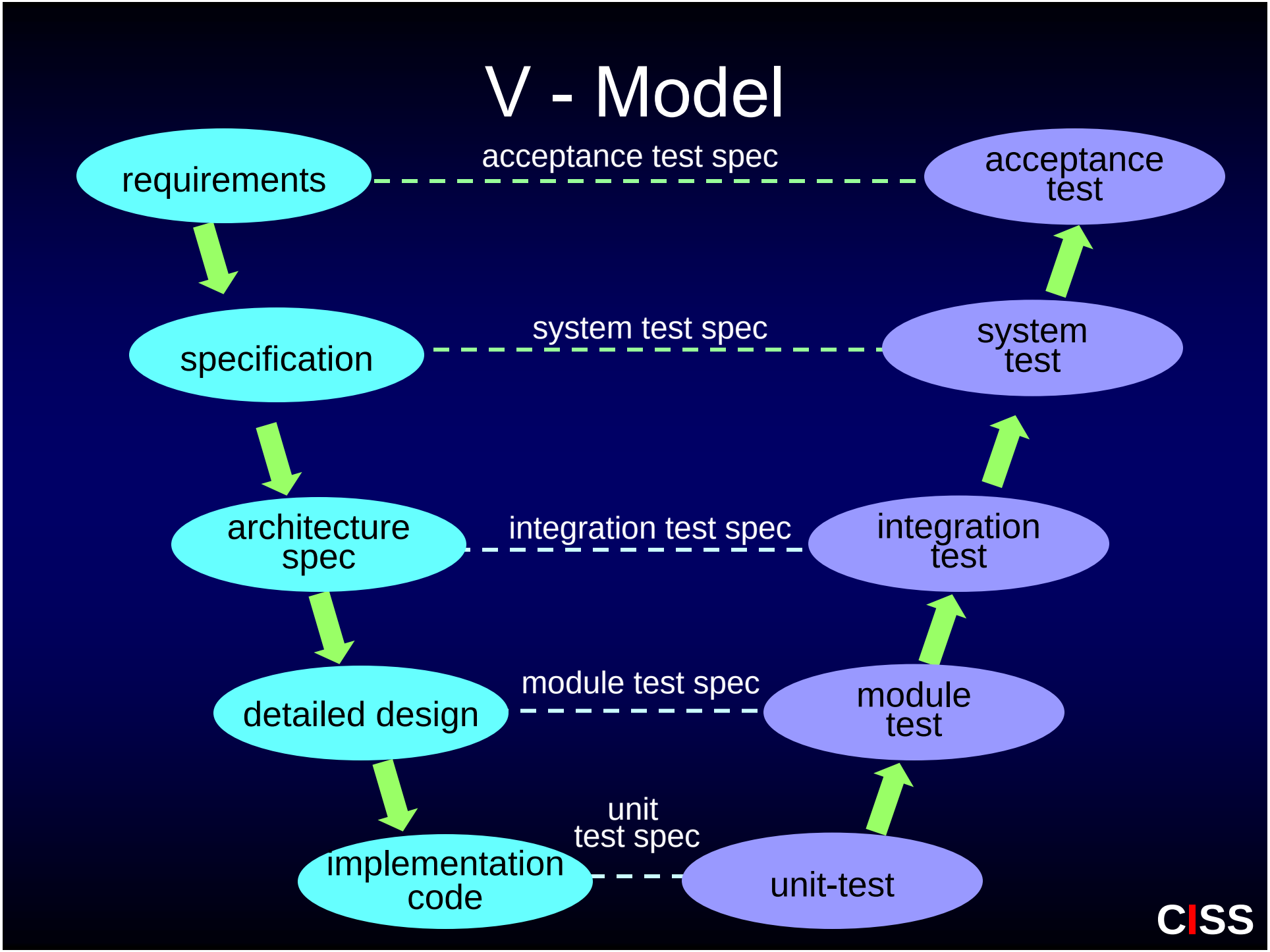
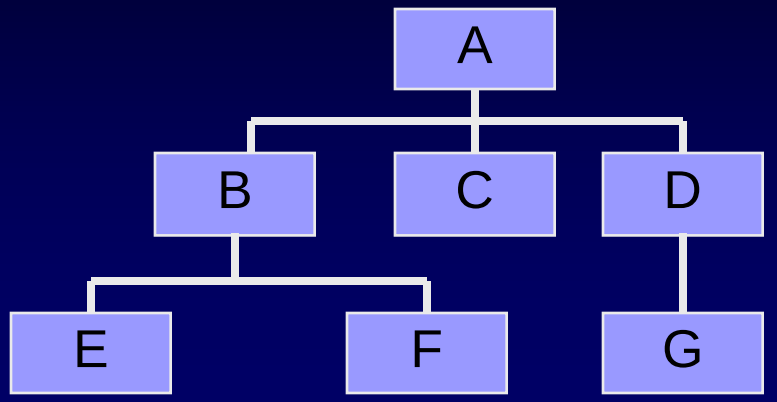



V - Model
requirements
acceptance test spec
acceptance test
specification
system test spec
system test
architecture spec
integration test spec
integration test
detailed design
module test spec
module test
implementation code
unit test spec
unit-test
CISS

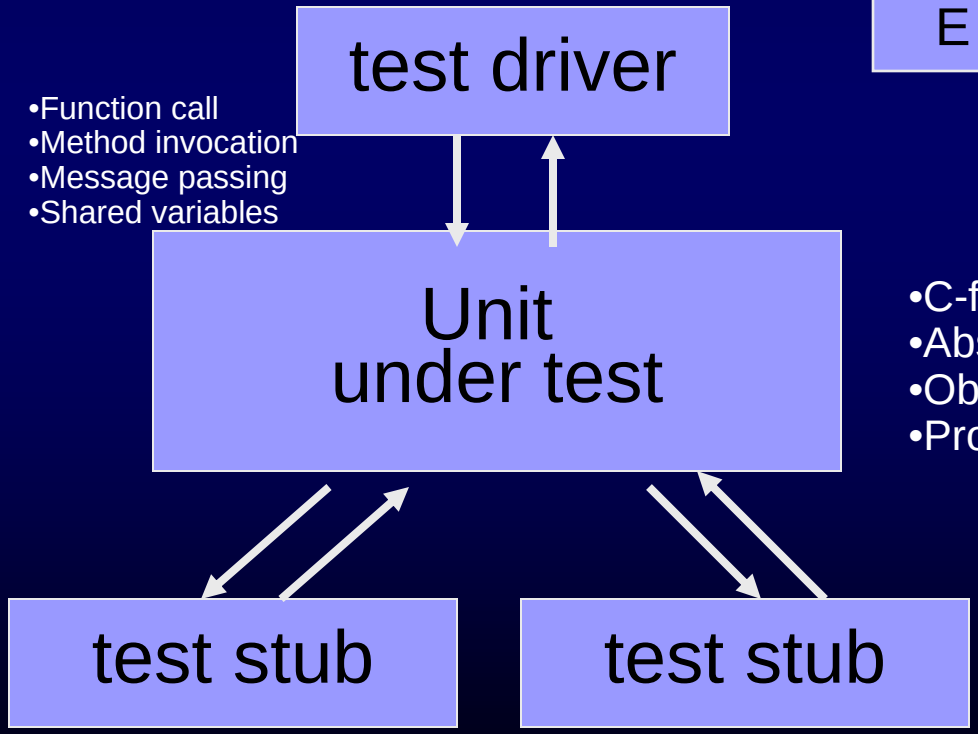
Unit test

Component Hierarchy



Driver: a code fragment that invokes the U-ut Simulate

- Supplies input data
- Invokes Unit
- Collects and compares results
- ~xUnit testing frame work



- Function call
- Method invocation
- Message passing
- Shared variables

- C-function
- Abstract Data Type
- Object
- Process / thread

Stub: a code fragment that simulates a missing unit

- Simulate
- Pre-programmed return values
- Simplified impl.

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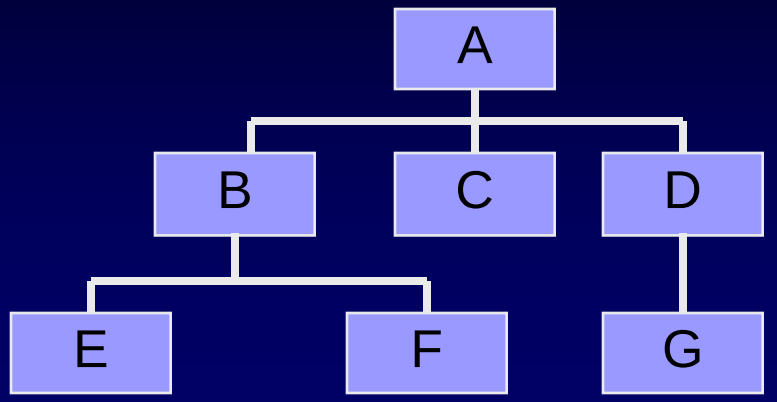
Integration Testing

- Goal: *Systematic construction of program structure and testing for interfacing errors*
  - Loss of data/information across interfaces
    - `int f(){ … g(y,x)…; }`
      `Int g(int x,y) {};`
  - Side-effects (shared data-structures)
  - Accumulation of errors (imprecision)
- Incremental
- Consider required cost and thoroughness
- Mostly blackbox, supplemented with white-box tests to ensure coverage

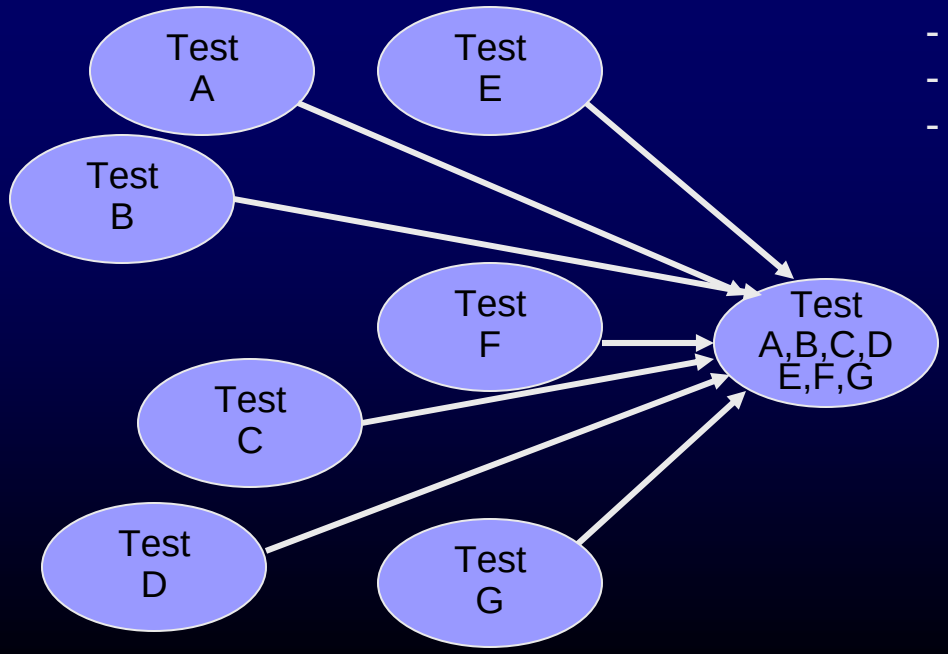
Big-bang integration

1. Test all components in isolation
2. Integrate all in one step

Component Hierarchy



Integration Order



- Stubs and drivers needed!
- Difficult to localize cause of errors
- Difficult to distinguish interface faults

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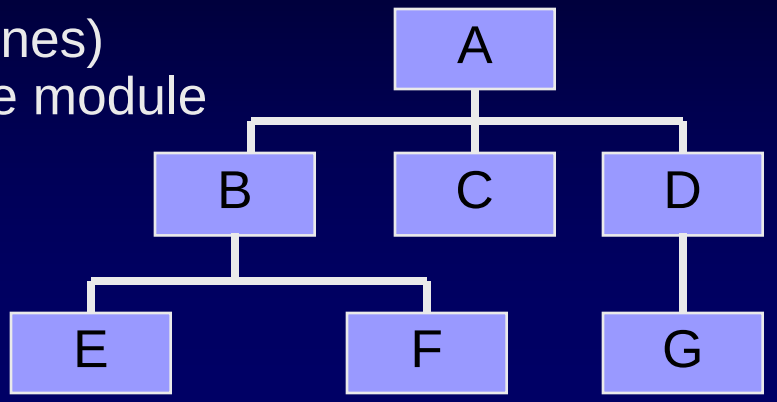
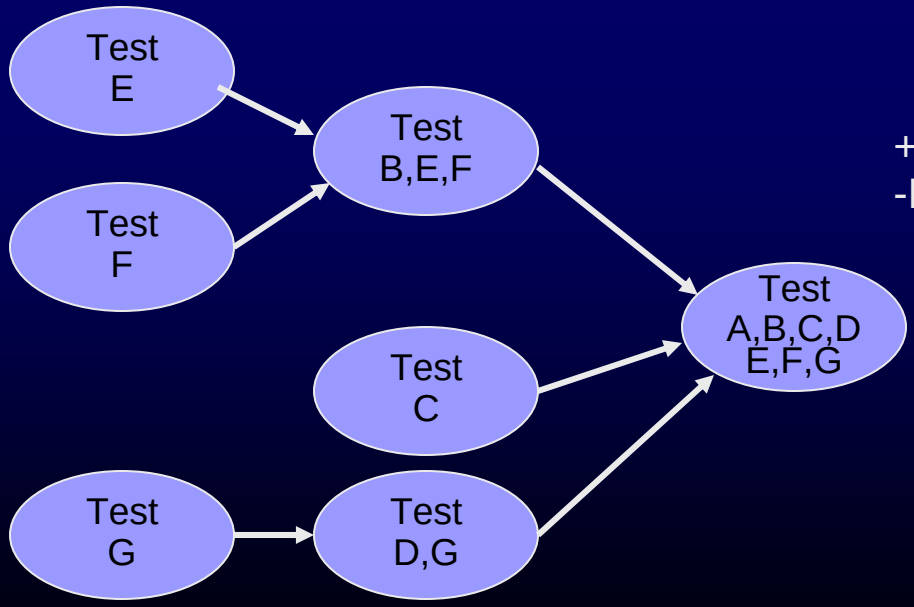
Buttom-Up integration

1. Test lower levels first (utility routines)
2. Implement driver (easy) to invoke module
3. Use tested modules as stubs

Component Hierarchy



Integration Order



+No stubs needed!

-Mundane low-level utilities tested first, but most important top level modules tested late

- Critical errors found late
- Main design problems are at higher-levels
- Timing determined by high-level modules

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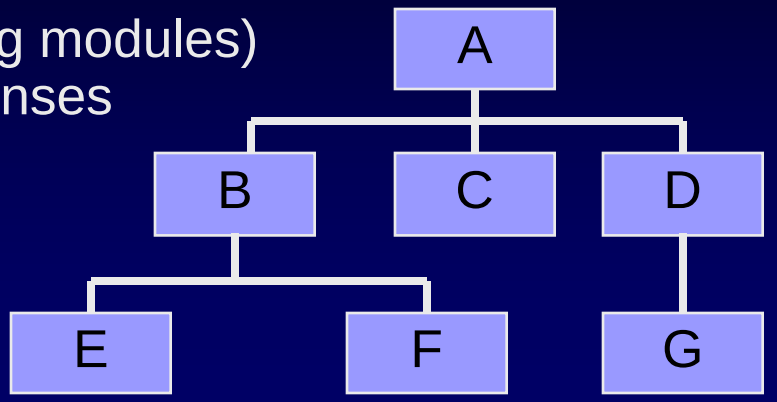
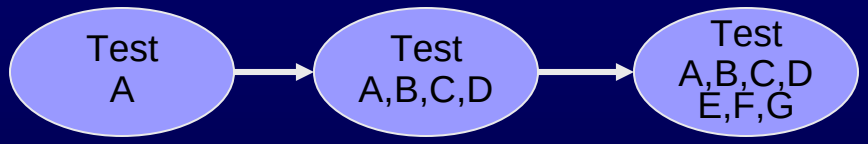
Top-Down integration

1. Test higher levels first (controlling modules)
2. Implement stubs to deliver responses
3. Use tested modules as drivers

Component Hierarchy

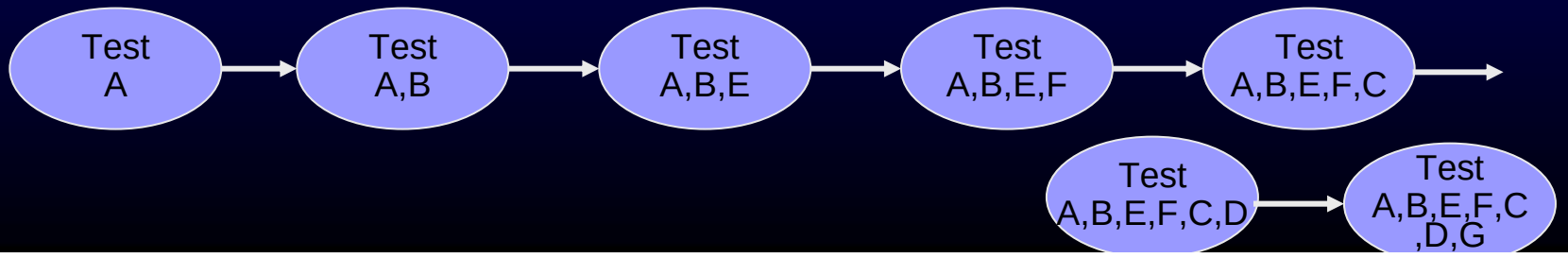


Breadth-First Integration Order



+No drivers needed!
-Many stubs may be neededed
-Stubs may be problematic to write
Must provide values as expected by tester
May require frequent alteration

Depth-First Integration Order



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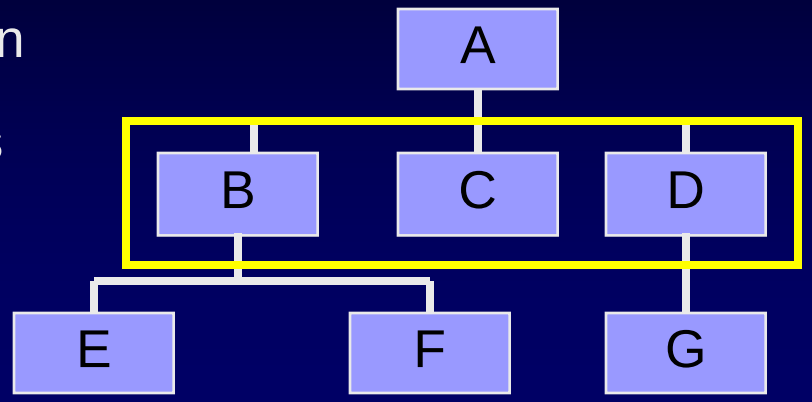
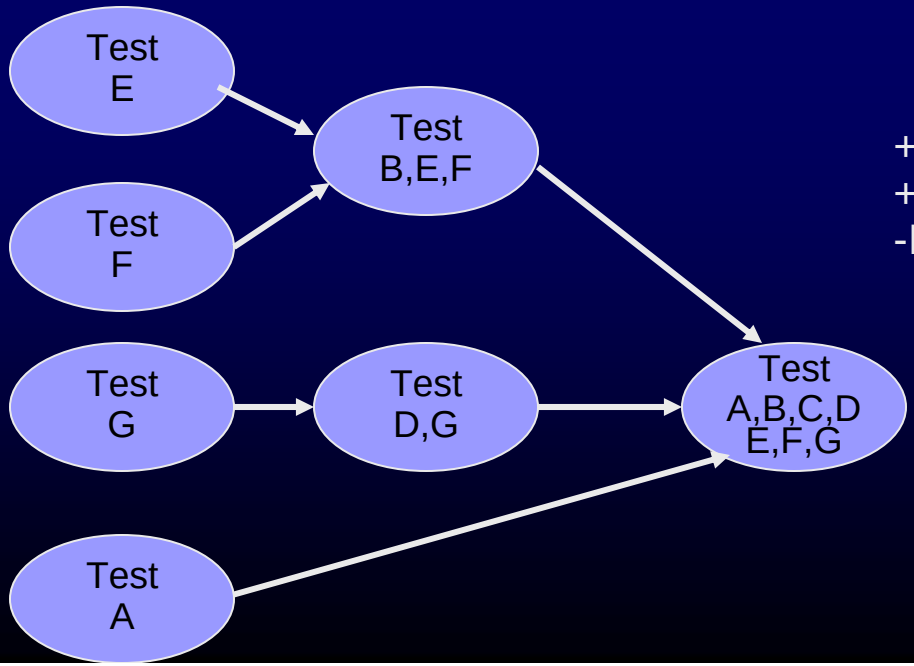
Sandwich integration

1. Combination of B-up and T-Down
2. Divide system into upper, middle (target), and lower levels
3. B-up in low-levels
4. T-Down in upper levels

Component Hierarchy



Integration Order



+ combines B-up and T-Dn
+ Integration possible early
-Individual components not tested thoroughly before integration, especially middle level

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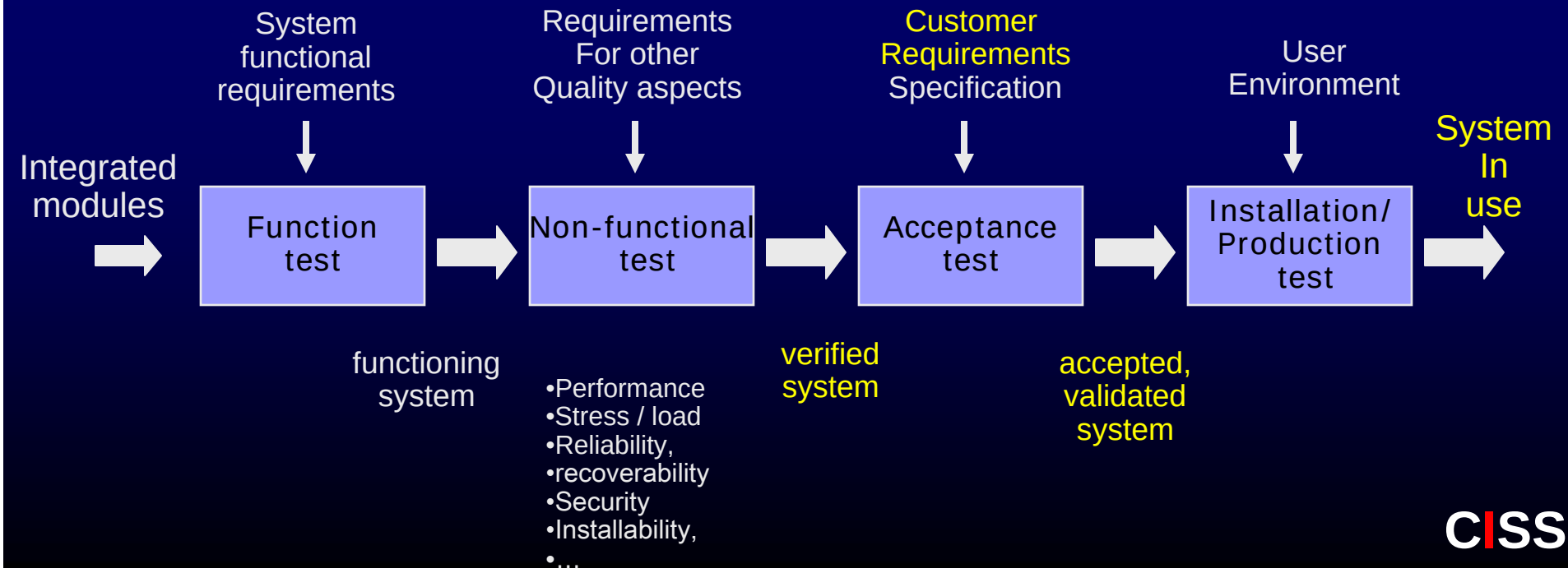
System Test (Pfleger)

- Unit & integration: code implements design correctly
- System testing: system does what customers expect
  - Constructed software tested against established requirements during requirements analysis
  - *Validation criteria* satisfied?
  - Are all *user-visible* functional, behavioral, performance requirements satisfied?



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Acceptance Test (Pfleger)

- By customers,
  - User's understanding of requirements
  - Customer writes, conducts, and evaluates acceptance tests
- Functional Acceptance Test (FAT)
- Production Acceptance Test (PAT)
- Techniques
  - Benchmark tests
  - Pilot tests ~ experimental, limited edition
    - Alpha test: in-house, controlled environment, developer supervised
    - Beta test: "live" test at customer sites, unsupervised
  - Parallel test: run concurrently with old system