

# Software Architecture: Principles and Practices (SAPP) Examination

## Question 1

The term 'enterprise architecture' describes ...

- A.) software elements of a system.
- B.) hardware elements and how they are interconnected.
- X C.) business structures and how they are interconnected.
- D.) both the hardware and software elements of a system.

## Question 2

Enterprise and system architecture...

- A.) provide an environment in which software operates.
- B.) provide requirements and constraints to which software architecture must adhere.
- C.) are likely to be associated with one or more software architectures.
- x D.) all of the above
- E.) none of the above

## Question 3

Which of the following is a concern of software architecture?

- x A.) Software elements of the system
- B.) Human elements of the system
- C.) Hardware elements of the system
- D.) All of the above
- E.) None of the above

## Question 4

Software architecture is an abstraction of a system that...

- x A.) suppresses details of what software elements do internally.
- B.) shows how software elements will be implemented.
- C.) describes the algorithms and data structures used by software elements.
- D.) identifies the public and private interfaces of software elements.

## Question 5

The 'externally visible properties' of a software architecture's elements refers to all of the following *except*...

- A.) quality attributes of those elements.
- x B.) "as is" design of those elements.
- C.) functions and services provided by those elements.
- D.) resources provided and used by those elements.

## Question 6

Which of the following is *not* true concerning software architecture?

- A.) An architecture comprises many different structures.
- x B.) An architecture is best described by a single, coherent structure.
- C.) An architectural structure might show runtime elements and relationships.
- D.) An architectural structure might show non-runtime elements and relationships.

## Question 7

Which of the following is true concerning software architecture?

- A.) Architecture is concerned primarily with the private details of element interfaces.
- B.) An architecture is composed of a fixed set of candidate structures.
- x C.) Every system has an architecture, explicit or implicit.
- D.) A software architecture is the planned implementation of a system.

## Question 8

Which of the following *cannot* be inferred from the description of a software architecture's elements?

- A.) How many elements a system has
- x B.) The design of individual elements
- C.) Commonalities between system elements
- D.) Relationships between system elements

## Question 9

Which of the following is *not* true of architectural patterns?

- A.) They are often selected to promote various quality attribute properties.
- B.) They are well-known solutions to recurring design problems.
- x C.) They are industry-defined standards for software design.
- D.) They are often selected in the early stages of architectural design.

## Question 10

Which of the following would *not* be part of a reference model?

- A.) What major functions a system is expected to perform
- x B.) How system functions are allocated to software elements
- C.) What data flows to, from, and between system functions
- D.) Which functions are mandatory and which are optional

## Question 11

Which of the following would *not* be part of a reference architecture?

- A.) Elements of the architecture and their externally visible properties
- B.) Relationships between elements and the properties of those elements
- C.) Which elements, relationships, and properties are optional in any given implementation of the architecture
- x D.) How to instantiate the architecture for a particular application

## Question 12

There are three primary reasons why a software architecture is important. Which of the following is *not* one of them?

- A.) It reveals early design decisions about a system.
- B.) It enables communication among stakeholders regarding the system.
- x C.) It ensures implementation conformance to a defined specification.
- D.) It is a transferable, reusable abstraction of a system.

## Question 13

Software architecture provides a common frame of reference for all of the following *except*...

- A.) negotiating requirements with stakeholders.
- B.) keeping the customer informed of progress and cost.
- x C.) minimizing the amount of time spent in component design.
- D.) deciding how to structure the development organization and allocate resources.

## Question 14

Which of the following is *least* likely to be imposed on the implementation by software architecture?

- x A.) Test procedures
- B.) Process-scheduling priorities
- C.) Elements and interactions
- D.) Data sharing

## Question 15

Which of the following processes within a development organization is *not* affected by software architecture?

- A.) Budgeting and scheduling
- B.) Partitioning and assigning work
- x C.) Performing user testing
- D.) Planning testing and deployment

## Question 16

Software architecture allows us to predict...

- A.) how much the system will impact the technological environment.
- x B.) how well quality attributes will be achieved.
- C.) how satisfied customers will be with the product.
- D.) how often requirements will change.

## Question 17

Architecture helps us to reason about and manage change, because it partitions all changes into these three classes of change:

- A.) requirements, design, and implementation changes.
- x B.) local, nonlocal, and architectural changes.
- C.) high-level design, detailed design, and coding changes.
- D.) life-cycle, process, and practice changes.

## Question 18

Once an architecture has been defined, it can be analyzed and prototyped as a skeletal system. Which of the following is *not* a benefit of this approach?

- A.) Elements can be plugged into a skeletal framework of the architecture.
- B.) Risky elements can be identified and prototyped.
- C.) The system is executable early in the product's life cycle.
- x D.) Development can proceed before the architectural mismatches have been identified.

## Question 19

Which of the following is *false* regarding software architecture?

- A.) Software architecture enables more accurate cost and schedule estimates.
- B.) Software architecture enables more accurate project planning and tracking.
- x C.) Software architecture enables more accurate process conformance estimates.
- D.) Software architecture enables more accurate predictions of resource usage.

## Question 20

Software architecture can serve as the basis of a strategic reuse agenda that includes reuse of all of the following *except*...

- x A.) product-specific functionality and qualities.
- B.) work breakdown structures and requirements.
- C.) project personnel and experience.
- D.) components and standards.

## Question 21

Architecture-based development...

- x A.) focuses on composing elements rather than programming them.
- B.) relaxes constraints on which third-party products can be incorporated into the system.
- C.) avoids implementation standards to promote flexibility.
- D.) inhibits component interchangeability.

## Question 22

Architecture enables template-based development. Which of the following *isnot* true of this type of development?

- A.) Templates can be used to localize how elements interact.
- B.) Templates can be used to code element interaction frameworks.
- C.) Templates speed up development and increase reliability.
- x D.) Templates promote standardization but reduce performance.

## Question 24

Which of the following structures is *most* likely to be of interest in determining how modifiable software is in terms of supporting a new hardware platform?

- x A.) Uses structure
- B.) Shared-data repository structure
- C.) Implementation structure
- D.) Work assignment structure

## Question 25

Which of the following structures is *most* likely to be of interest in determining how secure a system is from unauthorized external access?

- A.) Implementation structure
- x B.) Deployment structure
- C.) Class/generalization structure
- D.) Decomposition structure

## Question 26

Which of the following structures is *most* likely to be of interest in determining how well a system will perform when faced by simultaneous access by 1,000 users?

- A.) Layered structure
- x B.) Process structure
- C.) Work assignment structure
- D.) Implementation structure

## Question 27

Architects primarily focus on designing whatever structures will provide them with the most leverage in achieving...

- A.) the functional requirements of the system.
- B.) the operational requirements of the system.
- x C.) the quality attributes requirements of the system.
- D.) all of the above
- E.) none of the above

## Question 28

The Architecture Business Cycle *best* refers to...

- x A.) the business, social, and technical influences on an architecture.
- B.) the influence of architecture on cost, schedule, and resource allocation.
- C.) the cyclic nature of architecture-centric development.
- D.) the ideal lifecycle model for architecture-based development.
- E.) none of the above

## Question 29

Which of these factors is *least* likely to influence the design of a software architecture?

- A.) The architect's background and experience
- B.) The technical environment in which the system is developed
- x C.) The way in which the architecture is represented
- D.) The structure of the development organization

## Question 30

Why should software architects involve stakeholders early in the life cycle of a system?

- A.) To inform stakeholders of the system's priorities
- B.) To limit the real constraints of a system
- x C.) To manage stakeholder expectations
- D.) To discuss design alternatives

## Question 31

Which of the following might be an organizational influence on software architectures?

- A.) Available expertise
- B.) Organizational structure
- C.) Investment in existing assets
- x D.) All of the above
- E.) None of the above

## Question 32

The existing technical environment will...

- A.) be the most influential cost driver of the system.
- B.) be a key factor in minimizing the constraints imposed on a system.
- x C.) likely influence the design of an architecture.
- D.) have the least impact on the cost of the system.

## Question 33

The design choices made by a software architect might be influenced by his or her...

- A.) past experience in designing service-oriented architectures.
- B.) personal goals and objectives.
- C.) education and training.
- x D.) all of the above
- E.) none of the above

## Question 34

The design of an architecture is *least* likely to influence...

- A.) the formation of development teams.
- B.) development, test, and integration activities.
- x C.) conformance to project tracking and reporting practices.
- D.) resource allocation in schedules and budgets.

## Question 35

Software architecture does *not* offer which of the following benefits?

- A.) Allowing the company to enter a specific market segment
- x B.) Guaranteeing that implementations will conform to the architecture specification
- C.) Providing a basis for resource allocation and budgeting
- D.) Enabling efficient production and deployment of similar systems

## Question 36

Occasionally, a system or architecture will introduce itself into the technical environment in a way that will impact the architectural design of many systems for the foreseeable future. All of the following are examples of this *except* for:

- A.) The World Wide Web
- x B.) C++
- C.) Service-oriented architecture
- D.) Windows operating system

## Question 37

Understanding the influences described by the Architecture Business Cycle helps the architect to do many things. Which of the following is *not* one of them?

- A.) Realize that system requirements are not the only influence on architectural design
- x B.) Determine when and how these influences will occur during the life cycle
- C.) Actively look for and assess the impact of such influences on the architecture
- D.) Prepare for and manage these influences throughout the life cycle

## Question 38

Which of the following architectural influences can affect customer requirements?

- A.) Customers perceive the benefit of existing architectures and want similar kinds of architectures for their systems.
- B.) Customers will alter their requirements based on the availability of existing systems and components.
- C.) Customers ask for features that are available on existing systems.
- x D.) All of the above
- E.) None of the above

## Question 39

Which of the following offers the best example of a non-operational description of a quality attribute requirement?

- A.) Modifiability: "Developers must be able to port the software to a Mac within six months."
- B.) Performance: "The software must outperform competing software by a factor of 20."
- x C.) Usability: "The system shall be easy for operations personnel to learn and use."
- D.) Security: "The system shall prevent all unauthorized access to top-secret records."

## Question 40

Which of the following best describes "quality attributes?"

- x A.) Properties of work products or goods by which their quality will be judged by stakeholders
- B.) Properties of software systems that drive how systems will be partitioned to achieve the desired functionality
- C.) Properties of work products or goods that determine their marketability
- D.) Properties of software systems that are well defined by industry standards and used as a basis for determining whether a system is "fit for purpose"

## Question 41

Quality attributes requirements are derived from...

- x A.) stakeholder concerns.
- B.) industry standards.
- C.) functional requirements.
- D.) architectural structure.

## Question 42

Which of the following is *not* true concerning quality attributes?

- A.) Quality attributes have a significant influence on the architecture of a system.
- B.) Architectural decisions are often made to promote various quality attributes.
- x C.) Architecture provides the foundation for achieving quality attributes and guarantees that those qualities will be met in the final implementation of the system.
- D.) Changes in an architecture to promote one quality attribute may have a negative impact on other quality attributes.

## Question 43

Which of the following is *not* true concerning the functional requirements of a system?

- A.) We can achieve functional requirements using any architecture.
- B.) Functional requirements often have associated quality attribute requirements.
- C.) We can achieve functional requirements yet fail to meet quality attribute requirements.
- x D.) Functional requirements have a significant influence on the architecture of a system.

## Question 44

Failing to understand the quality attribute requirements for a system is often the result of...

- A.) ignoring industry-standard definitions for those requirements.
- x B.) wide variation in the vocabulary used to describe those requirements.
- C.) a lack of tool support for recording and tracking those requirements.
- D.) following a life-cycle model that does not accommodate those requirements.

## Question 45

A "quality attribute scenario" is...

- A.) the relationship between different qualities of a system.
- B.) a list of all quality attributes relevant to some part of a system.
- C.) a short description of how a user will interact with some part of a system.
- x D.) a short description of how a system should respond to some stimulus.

## Question 46

Which of the following is *not* part of a quality attribute scenario?

- A.) Environment
- B.) Response measure
- x C.) Evaluation
- D.) Stimulus source

## Question 47

The main purpose of developing quality attribute scenarios is to...

- x A.) better understand quality attributes requirements.
- B.) select architectural patterns.
- C.) unveil conflicting stakeholder requirements.
- D.) select architectural tactics.

## Question 48

Which of the following statements is true?

- A.) A general scenario is an instantiation of a concrete scenario.
- x B.) A concrete scenario is an instantiation of a general scenario.
- C.) Concrete scenarios are system independent.
- D.) General scenarios are formed by combining concrete scenarios.

## Question 49

Which of the following statements is *not* true?

- A.) General scenarios can help stakeholders communicate more effectively about quality attribute requirements.
- x B.) General scenarios are system-specific but domain-independent scenarios.
- C.) General scenarios can help stakeholders develop concrete scenarios.
- D.) General scenarios can be developed for any quality attribute.

## Question 50

The Quality Attribute Workshop (QAW) engages stakeholders to...

- A.) evaluate the design of a system.
- x B.) discover the quality attribute requirements for a system.
- C.) determine whether a system is "fit for purpose".
- D.) propose and select system design alternatives.

## Question 51

The Quality Attribute Workshop (QAW) is best used...

- x A.) before architectural design.
- B.) during architectural design.
- C.) after architectural design but before non-architectural design.
- D.) during non-architectural design.

## Question 52

Which of the following results from the Quality Attribute Workshop (QAW)?

- A.) Improved allocation of project resources
- B.) Consensus on the non-architectural design for a system
- C.) Reduced and better control over stakeholder communication
- x D.) Increased stakeholder communication

## Question 53

Which of the following best describes the relationship between architectural patterns and architectural tactics?

- A.) Any tactic implements different patterns.
- B.) Patterns and tactics are equivalent.
- x C.) A pattern may employ one or more tactics.
- D.) Tactics and patterns are unrelated.

## Question 54

Which of the following is *not* part of describing or determining an architectural pattern?

- x A.) Implementation details
- B.) Interaction mechanisms or connectors
- C.) Semantic constraints
- D.) Element types

## Question 55

The purpose of applying patterns in software architecture is to...

- A.) build multiple related systems.
- B.) address one or more architectural tactics.
- C.) isolate one or more quality attributes.
- x D.) promote one or more quality attributes.

## Question 56

The purpose of identifying patterns in a software architecture is to...

- A.) improve stakeholder communication.
- x B.) help predict specific qualities in an architecture.
- C.) enable reuse of legacy systems.
- D.) help build multiple products in a product line.

## Question 57

A software architecture view is...

- A.) an opinion regarding software architecture.
- x B.) a representation of a structure found in a software system.
- C.) a collection of UML diagrams.
- D.) a list of elements in a software system.

## Question 58

Documenting a software architecture is *best* described as a process of...

- A.) documenting the structures, elements, and relationships that will best support non-architectural design.
- x B.) documenting relevant views and then adding information that applies to more than one view.
- C.) documenting runtime interactions and behaviors and their impact on quality attributes requirements.
- D.) documenting the module structures that will best support the development and management teams.

## Question 59

Which type of architectural view shows sets of code units?

- A.) Allocation views
- x B.) Module views
- C.) Component-and-connector views
- D.) User action/feedback views

## Question 60

Which type of architectural view shows the runtime interactions of sets of elements?

- A.) Allocation views
- B.) Module views
- x C.) Component-and-connector views
- D.) User action/feedback views

## Question 61

Which type of architectural view shows how software and non-software elements are related within a system?

- A.) Allocation views
- B.) Module views
- C.) Component-and-connector views
- D.) User action/feedback views

## Question 62

A process view of a system's software architecture would most likely be used to reason about which of the following quality attribute properties of that system?

- A.) Maintainability and buildability
- B.) Performance and reliability
- C.) Security and modifiability
- D.) Reusability and availability

## Question 63

An allocation view of a software architecture shows...

- A.) runtime behavior and interactions of elements.
- B.) code units that implement functionality.
- C.) user interactions with system elements.
- D.) relationships between software elements to environment elements.

## Question 64

A deployment view of a system's software architecture would most likely be used to reason about which of the following quality attribute properties of that system?

- A.) Modifiability and security
- x B.) Availability and affordability
- C.) Reusability and reliability
- D.) Interoperability and subsetability

## Question 65

One of the most important factors to consider when deciding which views to develop for an architecture is...

- A.) what life-cycle model will be followed during the course of development.
- B.) what notation and process will be used for creating and verifying the correctness of views.
- C.) what tools are available for view creation, dissemination, and maintenance.
- x D.) which views will best serve stakeholder needs.

## Question 66

Views often include information about all of the following *except* for...

- A.) a primary presentation, element catalog, and context diagram.
- B.) driving architectural requirements and design rationale.
- C.) results of design-related analysis, prototyping, and experimentation.
- x D.) pseudo descriptions for key algorithms and database schemata.

## Question 67

Beyond views, it is useful to describe all of the following when documenting an architecture *except* for...

- A.) a system overview and documentation roadmap.
- B.) the major architectural approaches taken and their relationship to key requirements.
- x C.) the relationship between implementation constructs and architectural elements.
- D.) a mapping between architectural elements and key requirements.

## Question 68

One should not proceed with architectural design until...

- x A.) architectural drivers are known with some confidence.
- B.) functional requirements have been documented and validated.
- C.) quality attribute requirements have been documented and validated.
- D.) design constraints have been documented and validated.

## Question 69

Which of the following is true?

- A.) Non-architectural design should begin only after the completion of architectural design.
- B.) Architectural design should not begin before the completion of requirements analysis.
- x C.) Non-architectural design may begin before the completion of architectural design.
- D.) Architectural design should begin before requirements analysis.

## Question 70

Attribute-Driven Design (ADD) is an approach to defining software architecture where decomposition is based on...

- A.) minimizing interactions between architecturally significant elements.
- B.) recursive decomposition of functional partitions to maximize architectural cohesion.
- x C.) applying architectural patterns and tactics to satisfy quality attribute requirements.
- D.) compartmentalizing functions and behaviors to maximize architectural coherence.

## Question 71

Which of the following is *not* an input of the ADD method?

- A.) Quality attribute requirements
- x B.) Module decomposition requirements
- C.) Functional requirements
- D.) Design constraints

## Question 72

Which of the following is *least* likely to be a benefit of architecture evaluations?

- A.) They provide input into where an architecture can be improved.
- B.) They provide a forum for identifying and discussing unclear, missing, or invalid requirements.
- x C.) They allow immediate stakeholder input about how to redesign an architecture to correct problems.
- D.) They result in improved communications between stakeholders.

## Question 73

Which of the following is the *least* desirable point in the software life cycle to perform an architecture evaluation?

- A.) When acquiring a system
- B.) When building a system
- x C.) When the system is first released
- D.) When substantial changes are proposed for a system

## Question 74

Which of the following is unlikely to be a cost associated with architecture evaluations?

- A.) Managing an organization's architecture evaluation capability
- B.) Training the evaluation team
- x C.) Excessive communication among stakeholders
- D.) Loss of productivity for senior designers

## Question 75

Architecture evaluation methods generally fall into what two categories?

- A.) Scenario verification and prototyping techniques
- x B.) Questioning and measuring techniques
- C.) Simulation-based and questionnaire-based techniques
- D.) Checklist and quantitative techniques

## Question 76

In questionnaire-based evaluation techniques...

- x A.) the architect answers a prepared list of questions.
- B.) detailed sets of yes/no questions focus on particular qualities.
- C.) the quality of the design process is measured.
- D.) specific interactions between a system and stakeholder are described.

## Question 77

In scenario-based evaluation techniques...

- A.) the architect answers a prepared list of questions.
- B.) detailed sets of yes/no questions focus on particular qualities.
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## Question 78

In checklist-based evaluation techniques...

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- x B.) detailed sets of yes/no questions focus on particular qualities.
- C.) the quality of the design process is measured.
- D.) specific interactions between a system and stakeholder are described.

## Question 79

In an architectural evaluation, the term "metrics" means...

- A.) quantitative and observable measures of an architecture.
- B.) numeric measures of the quality of the design process.
- C.) numeric measures of the quality of the evaluation process.
- D.) standardized but qualitative measures of an architecture.

## Question 80

Which of the following is *not* a focus of metric-based architecture evaluations?

- A.) Results of applying metrics.
- B.) Choosing a set of metrics
- C.) Comparing different sets of metrics
- D.) Assumptions underlying the metrics

## Question 81

Which of the following is *not* a typical output from an architectural evaluation?

- A.) Detailed implementation plans
- B.) Enhanced system documentation
- C.) Sets of scenarios for future use
- D.) Sets of ranked risks or issues

## Question 82

The purpose of the ATAM is to...

- A.) discover the right architecture for a system.
- x B.) assess the consequences of architectural decisions.
- C.) provide precise analyses.
- D.) compare competing architectural designs for a system.

## Question 83

A quality attribute utility tree...

- A.) facilitates the derivation of quality attribute scenarios from architectural tradeoffs.
- B.) measures the utility of proposed design alternatives.
- C.) maps architectural patterns to quality attributes.
- x D.) prioritizes a list of quality attribute scenarios.

## Question 84

In the context of software architecture evaluations, which of the following best describes "a risk?"

- x A.) A potentially problematic architectural decision
- B.) An architectural decision that affects one or more quality attribute responses positively while negatively affecting others
- C.) An architectural decision that is positively correlated to at least one quality attribute response measure
- D.) A good architectural decision implicit in the architecture

## Question 85

In the context of software architecture evaluations, which of the following best describes "a tradeoff?"

- A.) A potentially problematic architectural decision
- x B.) An architectural decision that affects one or more quality attribute responses positively while negatively affecting others
- C.) An architectural decision that is positively correlated to at least one quality attribute response measure
- D.) A good architectural decision implicit in the architecture

## Question 86

In the context of software architecture evaluations, which of the following best describes "a sensitivity point?"

- A.) A potentially problematic architectural decision
- B.) An architectural decision that affects one or more quality attribute responses positively while negatively affecting others
- x C.) An architectural decision that is positively correlated to at least one quality attribute response measure
- D.) A good architectural decision implicit in the architecture

## Question 87

In the context of software architecture evaluations, which of the following best describes "a nonrisk?"

- A.) A potentially problematic architectural decision
- B.) An architectural decision that affects one or more quality attribute responses positively while negatively affecting others
- C.) An architectural decision that is positively correlated to at least one quality attribute response measure
- x D.) A good architectural decision implicit in the architecture

## Question 88

Which of the following is *not* characteristic of a software product line?

- A.) A software product line comprises a set of similar software systems.
- B.) Products in a software product line share a common, managed set of features.
- x C.) A software product line minimizes constraints on product variation.
- D.) Products in a software product line are developed from a common set of core assets.

## Question 89

Software product line architectures epitomize strategic, planned reuse that might very well include reuse of all of the following *except* for...

- A.) architectural designs, code, and test plans.
- B.) requirements, performance models, and network load analyses.
- C.) work breakdown structures, project plans, and project schedules.
- x D.) user documentation, product-specific features, and development tools.

## Question 90

The "scope" of a product line architecture refers to...

- A.) what stakeholders will be involved in defining the product line.
- x B.) which products are included in the product line and which are not.
- C.) what markets and users will be targeted by the product line.
- D.) how product variations will impact the development schedule.
- E.) none of the above

## Question 91

The scope of a product line should be...

- A.) as narrow as possible to maximize the benefit we get from developing the product line.
- x B.) not too narrow and not too broad to justify the investment in development and to minimize maintenance efforts.
- C.) as broad as possible to maximize the number of stakeholder needs we are able to satisfy.
- D.) defined broadly until the first product is released.
- E.) none of the above

## Question 92

Variation between two or more products in a software product line might include differences in...

- A.) functional and quality attribute requirements.
- B.) target platforms and product configurations.
- C.) target markets and user interfaces.
- x D.) all of the above
- E.) none of the above

## Question 93

Which of the following answers is *false*? It is particularly important to evaluate a product line architecture because...

- A.) a good architecture may be critical to the success of the organization.
- x B.) products that deviate from the core asset base can be identified and developed separately.
- C.) many software systems will depend on the architecture.
- D.) the investment is greater than the investment in creating the architecture for a single product.

## Question 93

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- D.) the investment is greater than the investment in creating the architecture for a single product.

## Question 94

Which of the following is *not* true for product lines?

- A.) Tools and processes must be robust.
- x B.) Architecture must support variation between skills of development team members.
- C.) Software components must be designed to be general.
- D.) Architecture must support variation between products.

## Question 95

The World Wide Web case study illustrates all of the following *except*...

- A.) the Architecture Business Cycle in action.
- x B.) how technological advances tend to stabilize attribute requirements.
- C.) the influence an architecture can have on the technical, business, and social environment.
- D.) how architectural decisions lead to the achievement of quality attribute requirements.

## Question 96

Which of the following factors contributed the *least* to the success of Celsius Tech's software product line architecture?

- A.) Domain knowledge and experience with similar systems
- B.) Building similar systems in parallel
- x C.) Coding expertise in command and control systems
- D.) Emphasis on information hiding and encapsulation