

# Independent Verification and Validation Options



*U.S. Department of Health and Human Services  
Administration for Children and Families  
Office of Child Support Enforcement*

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# 1. Introduction

## 1.1 Definition

Software Verification and Validation (V&V) is a systems engineering discipline which helps the development organization build quality into the software during the software life cycle. Validation is concerned with checking that the software meets the customer's needs, and Verification is concerned with checking that the system is well engineered. This is sometimes expressed as "Are we building the right system?" and "Are we building the system right?"

The IEEE Standard for Software Verification and Validation Standard (IEEE Std 1012-1098) describes software V&V processes a determining if development products of a given activity conform to the requirements of that activity, and if the software satisfies the intended use and user needs. The determination includes assessment, analysis, evaluation, review, inspection, and testing of software products and processes. V&V processes assess the software in the context of the system, including the operational environment, hardware, interfacing software, operators and users. Software V&V is performed in parallel with software development, not at the conclusion of the software development.

The V&V provider is an extension of the program management and systems engineering team, and undertakes to proactively identify objective data about product quality, performance, and schedule compliance for the development organization. Early feedback results allow the development organization to modify the software products and processes quickly and reduce overall project cost and schedule.

Independent Verification and Validation (IV&V) is Verification and Validation activities performed by an agency that is not under the control of the organization that is developing the software. The definition of activities included under IV&V in the Code of Federal Regulations (CFR) paragraph 307.15(b)(10) is quite broad, including both technical and management activities (see Enclosure 1).

## 1.2 Triggers

The following criteria can trigger federally mandated IV&V assessment of a state child support enforcement system:

- (A) State does not have in place a statewide automated child support enforcement system that meets the requirements of the FSA of 1988
- (B) State has failed to meet a critical milestone, as identified in their APDs
- (C) State has failed to submit timely and complete APD updates
- (D) State's APD indicates the need for a total system redesign
- (E) State is developing systems under waivers pursuant to section 452(d)(3) of the Social Security Act
- (F) State's system development efforts are determined to be at risk of failure, significant delay, or significant cost overrun.

## 1.3 Preliminary Assessment

OCSE will conduct a preliminary IV&V on-site assessment to determine what IV&V services are required for a particular state. OCSE will select IV&V areas to investigate by using the options list in paragraph 1.4 *Options*.

If the State has missed a deadline or a critical milestone (Triggers A and B), OCSE will start its investigation at the phase the project is currently in, and work backward to find the phase where the project began to fall behind. This would involve, at least initially, the phase-ordered options in Part III of IV&V Options. The investigators will try to determine the root cause(s) of the delay, which may be an inadequate plan, process, or product.

If a general cause of the delay, such as “inadequate staffing” is suggested by the State, the assessors will investigate the activities, such as Project Planning, Project Organization, Project Personnel, and Developer Training, for the deficiencies that are the root cause of the problem. When the root cause(s) have been determined, the investigators will recommend the appropriate IV&V option(s) for the project. A root cause of delay may be a project-wide option (Part II), such as poor Configuration Management throughout the project causing small delays at each phase, causing a large overall delay.

If the state has missed an APD or APDU delivery (Trigger C), the investigators will focus on the planning IV&V options in Part I and recommend the appropriate IV&V planning option(s) for the project.

If a State is considering a new or alternative system configuration (Triggers D and E) , the investigators will consider all IV&V options, starting with the Part I planning options.

For States whose system development efforts are at risk of failure (Trigger F), investigators will start at the phase the project is currently in, and work backward to find the Part III phase where the project began to be at risk. The investigators will try to determine the root cause(s) of the risk as for Triggers A and B. When the root cause(s) have been determined, the investigators will recommend the appropriate IV&V option(s) for the project.

## 1.4 Options

These are the Independent Verification and Validation (IV&V) options which may be investigated at the preliminary IV&V review. They are divided into three parts to make it easier to select the appropriate areas to investigate in a particular project. There is necessarily a significant amount of overlap among these options.

Part I consists of the evaluation of project management issues and activities. For the most part, these activities should be completed before project development begins.

- Project Initiation
- Business Process Reengineering
- Project Planning and Reporting
- Project Estimating and Scheduling
- Project Personnel
- Project Organization
- Subcontractors and External Staff
  - Subcontractor Commitment
  - State Oversight
  - Acceptance and Turnover

Part II consists of evaluation of activities that have project-wide scope. They are activities that should be ongoing throughout the project development. Evaluation of a project's Quality Assurance process, for example, will involve evaluating QA processes, procedures and artifacts for every phase of the project - planning, analysis, design. code etc. Part II includes the following evaluation areas :

- Training and Documentation

- User Training and Documentation
- Developer Training and Documentation
- Process Definition and Product Standards
- Quality Assurance
- Configuration Management
- Requirements Management
- System Security
- System Capacity

Part III consists of separate evaluations of a specific phase, environment or product of the development process. These options are roughly in the chronological order they would occur in the project. Part III includes the following evaluation areas :

- Systems Engineering
  - Requirements Analysis
  - Interface Requirements
  - Requirements Allocation and Specification
  - Reverse Engineering
- Operating Environment
  - System Hardware
  - System Software
- Database Management
  - Database Software
  - Data Conversion
  - Database Design
- Development Environment
  - Hardware
  - Software
- Software Architecture
  - High-Level Design
  - Detailed Design
  - Job Control
- Code and Test
  - Code
  - Unit Test
  - Integration Test
  - Pilot Test

All the project-wide considerations of Part II should be a part of the Part III evaluations, i.e. Configuration Management of design documents, design Quality Assurance processes, the effects of design on system capacity, etc. should all be considered as part of a Detailed Design evaluation.

## **1.5 Outcome of IV&V Assessment**

After the IV&V assessment has been performed, the assessors will report on the extent of the IV&V services the State will be required to obtain. The assessment report will define specific areas and tasks that must be addressed by the IV&V provider. Typically the requirement will not be for continuous analysis and testing, but rather in-depth audits of specified aspects of the project at a specified interval.

IV&V services may be obtained from a contractor via RFP or from a State agency approved by OCSE. To qualify as an IV&V provider, a State agency must demonstrate to OCSE that it has both the technical capability to perform IV&V services and managerial independence from the Child Support Enforcement agency and from the system development agency.

If a contractor is used, the RFP and contract (or similar documents if IV&V is performed by another State agency) must be submitted to ACF for prior approval, regardless of the cost or thresholds. The contract must include the names and skills of key personnel who will actually perform the IV&V analysis. The Territory must submit an APD Update to include IV&V activities and costs eligible for Federal financial participation at the 80 or 66 percent matching rate.

The contractor or ACF-approved State agency will provide the following services as defined in CFR 307.15(b)(10):

- 1) Develop a project work plan. The plan must be provided directly to OCSE at the same time it is given to the State.
- 2) Review and make recommendations on both the management of the project, both State and vendor, and the technical aspects of the project. The results of this analysis must be provided directly to OCSE at the same time it is given to the State.
- 3) Consult with all stakeholders and assess the user involvement and buy-in regarding system functionality and the system's ability to meet program needs.
- 4) Conduct an analysis of past project performance (schedule, budget) sufficient to identify and make recommendations for improvement.

- 5) Provide a risk management assessment and capacity planning services.
- 6) Develop performance metrics which allow tracking of project completion against milestones set by the State.

## **2. Options Part I - Planning and Management**

### **2.1 Project Initiation**

The IV&V provider will verify that there is commitment to the project by the State IV-D management, the State Legislature, the State courts, the State Attorney General and District Attorneys, the State Information System organization, potential system users, and any other affected organizations. The IV&V provider will verify that all organizations required to cooperate in the development process have and open and efficient lines of communication with assigned points of contact identified. The IV&V provider will verify that the project is initiated soon enough to meet all applicable deadlines, including Federal Certification deadlines. If the IV-D project is part of a larger State system, or is dependent on the successful development of another system or systems, the IV&V provider will verify that contingency plans are developed to ensure that the IV-D system can be modified to run independently.

#### Documentation

- State Government Organization
- List of committed personnel

### **2.2 Business Process Reengineering**

The IV&V provider will evaluate the project's ability and plans to redesign business systems to achieve improvements in critical measures of performance, such as cost, quality, service, and speed. The IV&V provider will verify that the reengineering plan has the strategy, management backing, resources, skills and incentives necessary for effective change. The IV&V provider will verify that resistance to change is anticipated and prepared for by using principles of change management at each step (such as excellent communication, participation, incentives) and having the appropriate leadership (executive pressure, vision, and actions) throughout the reengineering process.

#### Documentation

- Business Process Reengineering Plan

### **2.3 Project Planning and Reporting**

The IV&V provider will review and make recommendations on project planning and reporting. The IV&V provider will verify that appropriate cost-benefit analyses and feasibility studies are performed for the project. The IV&V provider will evaluate the system's planned life-cycle development methodology or methodologies (waterfall, evolutionary spiral, rapid prototyping, incremental, etc.) to see if they are appropriate for

the system being developed. The IV&V provider will verify that State staff has responsibility for monitoring project cost and schedule. The IV&V provider will determine if appropriate development milestones and completion dates are planned, monitored, and met. The IV&V provider will evaluate the project reporting plan and actual project reports to verify that project status is accurately tracked using appropriate project metrics. The IV&V provider will evaluate the project's risk management procedures to verify that risks are identified and mitigated. The IV&V provider will evaluate if appropriate mechanisms are in place for project self-evaluation and process improvement.

#### Documentation

- Project Plans
- System Installation Plan
- System Implementation Plan
- Test Plans
- Training Plan
- CM Plan
- Quality Assurance Plan
- Risk Management Plan
- Data Conversion Plan
- Management Reports
- Project Financial Reports

## **2.4 Project Estimating and Scheduling**

The IV&V provider will evaluate and make recommendations on the estimating and scheduling process of the project to ensure that the project budget and resources are adequate for the work-breakdown structure and schedule. The IV&V provider will review schedules to verify that adequate time and resources are assigned for planning, development, review, testing and rework. The IV&V provider will look at historical data to determine if the project/department has been able to accurately estimate the time, labor and cost of software development efforts.

#### Documentation

- Project APDs
- Product Size Estimates
- Project Development Schedules
- Work Breakdown Structure
- Management Reports
- Project Budget
- Project Financial Reports

## **2.5 Project Personnel**

The IV&V provider will examine the job assignments, skills, training and experience of the personnel involved in program development to verify that they are adequate for the development task. The IV&V provider will evaluate the State's hiring plan for the project to verify that adequate human resources will be available for development and maintenance. The IV&V provider will evaluate the State's personnel policies to verify that staff turnover will be minimized.

Documentation -

- Work Breakdown Structure
- Organization Charts
- Staff Resumes

## **2.6 Project Organization**

The IV&V provider will verify that lines of reporting and responsibility provide adequate technical and managerial oversight of the project. The IV&V provider will verify that the project's organizational structure supports training, process definition, independent Quality Assurance, Configuration Management, product evaluation, and any other functions critical for the projects success.

Documentation -

- Organization Charts
- Organization Charter
- Staff Resumes

## **2.7 Subcontractors and External Staff**

The IV&V IV&V provider will evaluate the use of sub-contractors or other external sources of project staff (such as IS staff from another State organization) in project development.

### **2.7.1 Subcontractor Commitment**

The IV&V provider will verify that the obligations of sub-contractors and external staff (terms, conditions, statement of work, requirements, standards, development milestones, acceptance criteria, delivery dates, etc.) are clearly defined. The IV&V provider will verify that the subcontractors software development methodology and product standards are compatible with the system's standards and environment.

The IV&V provider will verify that the subcontractor has and maintains the required skills, personnel, plans, resources, procedures and standards to meet their commitment. This will include examining the feasibility of any offsite support of the project.

The IV&V provider will verify that any proprietary tools used by subcontractors do not restrict the future maintainability, portability, and reusability of the system.

Documentation -

- Requests for Proposals (RFPs)
  - Statement of Work
  - Contractor Qualification Statements
  - Contractor Software Development Plan
  - Organization Charts

### **2.7.2 State Oversight**

The IV&V provider will verify that State oversight is provided in the form of periodic status reviews and technical interchanges. The IV&V provider will verify that the State has defined the technical and managerial inputs the subcontractor needs (reviews, approvals, requirements and interface clarifications, etc.) and has the resources to supply them on schedule. The IV&V provider will verify that State staff has the ultimate responsibility for monitoring project cost and schedule.

Documentation -

- Organization Charts
- Status Review Schedule
- Software Development Plan

### **2.7.3 Acceptance and Turnover**

Acceptance procedures and acceptance criteria for each product must be defined, reviewed, and approved prior to test and the results of the test must be documented. Acceptance procedures must also address the process by which any software product that does not pass acceptance testing will be corrected.

The IV&V provider will verify that appropriate acceptance testing based on the defined acceptance criteria is performed satisfactorily before acceptance of software products.

The IV&V provider will verify that the acceptance test organization has an appropriate level of independence from the subcontractor.

The IV&V provider must verify that training in using the contractor-supplied software is on-going throughout the development process, especially if the software is to be turned over to State staff for operation.

Documentation -

- Acceptance Tests
- Acceptance Criteria

## **3. Options Part II - Project-Wide Process**

### **3.1 Training and Documentation**

#### **3.1.1 User Training and Documentation**

The IV&V provider will review and make recommendations on the training provided to system users. The IV&V provider will verify that training for users is instructor-led and hands-on and is directly related to the business process and required job skills. The IV&V provider will verify that user-friendly training materials and help desk services are easily available to all users. The IV&V provider will verify that all necessary policy and process and documentation is easily available to users. The IV&V provider will verify that all training is given on-time and is evaluated and monitored for effectiveness, with additional training provided as needed.

Documentation –

- User Training Plan
- Course outlines
- System User's Manual
- CBT media

#### **3.1.2 Developer Training and Documentation**

The IV&V provider will review and make recommendations on the training provided to system developers. The IV&V provider will verify that developer training is technically adequate, appropriate for the development phase, and available at appropriate times. The IV&V provider will verify that all necessary policy, process and standards documentation is easily available to developers. The IV&V provider will verify that all training is given on-time and is evaluated and monitored for effectiveness, with additional training provided as needed.

Documentation –

- Developer Training Plan
- Development Environment User's Manuals
- System User's Manual
- Product Standards

### **3.2 Process Definition and Product Standards**

The IV&V provider will review and make recommendations on all defined processes and product standards associated with the system development. The IV&V

provider will verify that all major development processes are defined and that the defined and approved processes and standards are followed in development. The IV&V provider will verify that the processes and standards are compatible with each other and with the system development methodology. The IV&V provider will verify that all process definitions and standards are complete, clear, up-to-date, consistent in format, and easily available to project personnel

Documentation -

- Software Development Plan
  - All defined project processes
  - All product standards
- Requirements Standards
- Database Standards
- Design Standards
- Code Standards
- Test Plan Standards

### **3.3 Quality Assurance**

Evaluate and make recommendations on the project's Quality Assurance plans, procedures and organization. The IV&V provider will verify that QA has an appropriate level of independence from project management. The IV&V provider will verify that the QA organization monitors the fidelity of all defined processes in all phases of the project. The IV&V provider will verify that the quality of all products produced by the project is monitored by formal reviews and sign-offs. The IV&V provider will verify that project self-evaluations are performed and that measures are continually taken to improve the process.

Documentation –

- QA policies, procedures, and artifacts

### **3.4 Configuration Management**

The IV&V provider will review and evaluate the configuration management (CM) plans and procedures associated with the development process. The IV&V provider will verify that all critical development documents, including but not limited to requirements, design, code and JCL are maintained under an appropriate level of control.

The IV&V provider will verify that the processes and tools are in place to identify code versions and to rebuild system configurations from source code. The IV&V provider will also verify that appropriate source and object libraries are maintained for training, test, and production and that formal sign-off procedures are in place for approving deliverables.

The IV&V provider will verify that appropriate processes and tools are in place to manage system changes, including formal logging of change requests and the review, prioritization and timely scheduling of maintenance actions.

The IV&V provider will verify that mechanisms are in place to prevent unauthorized changes being made to the system and to prevent authorized changes from being made to the wrong version.

The IV&V provider will review the use of CM information (such as the number and type of corrective maintenance actions over time) in project management.

Suggested Documentation –

- Configuration Management Plan
  - Change Records
  - Maintenance History
  - Trouble Reports/Problem Reports/ Error Tickets

### **3.5 Requirements Management**

The IV&V provider will evaluate and make recommendations on the project's process and procedures for managing requirements. The IV&V provider will verify that system requirements are well-defined and understood. The IV&V provider will evaluate the allocation of system requirements to hardware and software requirements. The IV&V provider will verify that software requirements can be traced through design, code and test phases to verify that the system performs as intended and contains no unnecessary software elements. The IV&V provider will verify that requirements are under formal configuration control.

Documentation

- System Requirements
  - Hardware Requirements
  - Software Requirements
  - Requirements Traceability Matrix

### **3.6 System Security**

The IV&V provider will evaluate and make recommendations on project policies and procedures for ensuring that the system is secure and that the privacy of client data is maintained. The IV&V provider will evaluate the projects restrictions on system and data access. The IV&V provider will evaluate the projects security and risk analysis. The IV&V provider will verify that processes and equipment are in place to back up client and project data and files and archive them safely at appropriate intervals.

#### Documents

- Security and Privacy Policy
- Security and Privacy Risk Analysis
- System Administration Procedures
- System back-up plans

### **3.7 System Capacity**

The IV&V provider will evaluate the existing processing capacity of the system and verify that it is adequate for current statewide needs for both batch and on-line processing. The IV&V provider will also evaluate the historic availability and reliability of the system including the frequency and criticality of system failure and make suggestions for improvements. The IV&V provider will evaluate the results of any volume testing or stress testing. The IV&V provider will evaluate any existing measurement and capacity planning program and will evaluate the system's capacity to support future growth.

The IV&V provider will make recommendations on changes in processing hardware, storage, network systems, operating systems, COTS software, and software design to meet future growth and improve system performance.

#### Supporting Documentation:

- Hardware Specifications
  - Memory Size and speed
  - CPU capacity (MIPS, FLOPS, SPECint, etc.)
  - I/O Bandwidth
  - LAN/WAN Bandwidth
  - Storage size and type
- System Operation Reports
  - System Restarts
  - Down Time
  - File Mounting Time
  - Equipment Errors
  - Operator Errors
  - Processor Activity
  - Device activity
  - Memory Allocations
  - Disk Allocation
  - File contentions
- System Performance Information
  - Number of Jobs processed
  - Turnaround Time
  - Throughput Rate

- Abnormal Job Termination Rate
- Processor Wait Time
- Device Wait Time
- Paging Rate
- Idle time
- Other Benchmarks

## **4. Options Part III - Environments, Phases, and Products**

### **4.1 Systems Engineering**

#### **4.1.1 Requirements Analysis**

The IV&V provider will verify that an analysis of client, State and federal needs and objectives has been performed to verify that requirements of the system are well understood, well defined, and satisfy federal regulations. The IV&V provider will verify that all stakeholders have been consulted to the desired functionality of the system, and that users have been involved in prototyping of the user interface. The IV&V provider will verify that all stakeholders have bought-in to all changes which impact project objectives, cost, or schedule.

Documentation -

- System Requirements
- Needs Analysis
- System Narrative
- Functional Specification
- System Flow Chart
- Information Flow Chart
- GUI Prototype

#### **4.1.2 Interface Requirements**

The IV&V provider will verify that all system interfaces are exactly described, by medium and by function, including input/output control codes, data format, polarity, range, units, and frequency. The IV&V provider will verify that approved interface documents are available and that appropriate relationships (such as interface working groups) are in place with all agencies and organizations supporting the interfaces.

Documentation -

- Interface Requirements Specification
- Interface Guidance Document

#### **4.1.3 Requirements Allocation and Specification**

The IV&V provider will verify that all system requirements have been allocated to either a software or hardware subsystem. The IV&V provider will verify that

requirements specifications have been developed for all hardware and software subsystems in a sufficient level of detail to ensure successful implementation.

#### Documentation

- Software Requirements
- Hardware Requirements
- Software Requirements Specification

### **4.1.4 Reverse Engineering**

If a legacy system or a transfer system is or will be used in development, the IV&V provider will verify that a well defined plan and process for reengineering the system is in place and is followed. The process, depending on the goals of the reuse/transfer, may include reverse engineering, code translation, re-documentation, restructuring, normalization, and re-targeting.

#### Documentation -

- Transfer Plan
- Reuse Plan
- Reverse Engineered Documents

## **4.2 Operating Environment**

### **4.2.1 System Hardware**

The IV&V provider shall evaluate new and existing system hardware configurations to determine if their performance is adequate to meet existing and proposed system requirements. The IV&V provider will also determine if hardware is compatible with the State's existing processing environment, if it is maintainable, and if it is easily upgradeable. This evaluation will include, but is not limited to CPUs and other processors, memory, network connections and bandwidth, communication controllers, telecommunications systems (LAN/WAN), terminals, printers and storage devices. Current and projected vendor support of the hardware will also be evaluated, as well as the State's hardware configuration management plans and procedures.

#### Documentation –

- System Hardware Diagram
- System Hardware Specifications
  - Memory Size and speed
  - CPU capacity (MIPS, FLOPS, SPECint, etc.)
  - I/O Bandwidth
  - LAN/WAN Bandwidth
  - Storage size and type

- Other Benchmarks

## **4.2.2 System Software**

The IV&V provider shall evaluate new and existing system software to determine if its capabilities are adequate to meet existing and proposed system requirements. The IV&V provider will also determine if the software is compatible with the State's existing hardware and software environment, if it is maintainable, and if it is easily upgradeable. This evaluation will include, but is not limited to, operating systems, middleware, and network software including communications and file-sharing protocols. Current and projected vendor support of the software will also be evaluated, as well as the States software acquisition plans and procedures.

Documentation -

- Software Specifications
- Version
- Installed Size
- Hardware requirements
- Standards compliance
- File formats

## **4.3 Data Management**

### **4.3.1 Database Software**

The IV&V provider shall evaluate new and existing database products to determine if their capabilities are adequate to meet existing and proposed system requirements. The IV&V provider will determine if the database's data format is easily convertible to other formats, if it supports the addition of new data items, if it is scaleable, if it is easily refreshable and if it is compatible with the State's existing hardware and software, including any on-line transaction processing (OLTP) environment. The IV&V provider will also evaluate any current and projected vendor support of the software, as well as the State's software acquisition plans and procedures.

Documentation -

- Database specifications
- Hardware requirements
- OLTP environment specifications

### **4.3.2 Data Conversion**

The IV&V provider shall evaluate the State's existing and proposed plans, procedures and software for data conversion. The IV&V provider will verify that procedures are in place to review the completed data for completeness and accuracy and to perform data clean-up as required. The IV&V provider will determine conversion error rates and if the error rates are manageable. The IV&V provider will make recommendations on making the conversion process more efficient and on maintaining the integrity of data during the conversion.

Documentation -

- Data conversion plans
  - Data conversion procedures
  - Data conversion software
  - Converted and unconverted data
  - Conversion error report

### **4.3.3 Database Design**

The IV&V provider shall evaluate new and existing database designs to determine if they meet existing and proposed system requirements. The IV&V provider will also suggest improvements to existing designs to improve data integrity and system performance. The IV&V provider will evaluate the design for maintainability, scalability, refreshability, concurrence, normalization (where appropriate) and any other factors affecting performance and data integrity. The IV&V provider will evaluate the project's process for administering the database, including backup, recovery, performance analysis and control of data item creation.

Documentation –

- Database Design
  - Tables
  - Indexes
  - Master Files
  - Data Dictionary
  - Entity-Relationship Diagrams

## **4.4 Development Environment**

### **4.4.1 Development Hardware**

The IV&V provider shall evaluate new and existing development hardware configurations to determine if their performance is adequate to meet the needs of system development. The IV&V provider will also determine if hardware is maintainable, easily upgradeable, and compatible with the State's existing development and processing environment. This evaluation will include, but is not limited to CPUs and other processors, memory, network connections and bandwidth, communication controllers,

telecommunications systems (LAN/WAN), terminals, printers and storage devices. Current and projected vendor support of the hardware will also be evaluated, as well as the State's hardware configuration management plans and procedures.

Documentation -

- System Hardware Diagram
- System Hardware Specifications
  - Memory Size and speed
  - CPU capacity (MIPS, FLOPS, SPECint, etc.)
  - I/O Bandwidth
  - LAN/WAN Bandwidth
  - Storage size and type
- Other Benchmarks

## **4.4.2 Development Software**

The IV&V provider shall evaluate new and existing development software to determine if its capabilities are adequate to meet system development requirements. The IV&V provider will also determine if the software is maintainable, easily upgradeable, and compatible with the State's existing hardware and software environment. The IV&V provider will also evaluate the environment as a whole to see if it shows a degree of integration compatible with good development.

This evaluation will include, but is not limited to, operating systems, network software, CASE tools, project management software, configuration management software, compilers, cross-compilers, linkers, loaders, debuggers, editors, LSEs and reporting software. Language and compiler selection will be evaluated with regard to portability and reusability (ANSI standard language, non-standard extensions, etc.) Current and projected vendor support of the software will also be evaluated, as well as the States software acquisition plans and procedures.

Documentation -

- Software Specifications
- Version
- Installed Size
- Hardware requirements
- ANSI Standard compliance
- File formats

## **4.5 Software Architecture**

### **4.5.1 High-Level Design**

The IV&V provider shall evaluate and make recommendations on existing high level design products to verify the design is workable, efficient, and satisfies all system and system interface requirements. The design products will also be evaluated for adherence to the project design methodology and standards. The design and analysis process used to develop the design will be evaluated and recommendations for improvements made. Design standards, methodology and CASE tools used will be evaluated and recommendations made.

The IV&V provider will verify that design requirements can be traced back to system requirements. The IV&V provider will verify that all design products are under configuration control and formally approved before detailed design begins.

Documentation -

- Software Development Plan
- Development Guidelines
- High-Level Design Document
  - Interface Document
  - Data Dictionary
  - Schema Listing

#### **4.5.2 Detailed Design**

The IV&V provider shall evaluate and make recommendations on existing detailed design products to verify that the design is workable, efficient, and satisfies all high level design requirements. The design products will also be evaluated for adherence to the project design methodology and standards. The design and analysis process used to develop the design will be evaluated and recommendations for improvements made. Design standards, methodology and CASE tools used will be evaluated and recommendations made.

The IV&V provider will verify that design requirements can be traced back to system requirements and high level design. The IV&V provider will verify that all design products are under configuration control and formally approved before coding begins.

Documentation -

- Software Development Plan
- Development Guidelines
- Functional Specification
- System Flow Chart
- Information Flow Chart
- Interface Document
- Detailed-Level Design Document
- Data Dictionary
- File Structure

- Schema Listing
- Design Metrics

### **4.5.3 Job Control**

The IV&V provider shall perform an evaluation and make recommendations on existing job control and on the process for designing job control. The IV&V provider will evaluate the system's division between batch and on-line processing with regard to system performance and data integrity. The IV&V provider will evaluate batch jobs for appropriate scheduling, timing and internal and external dependencies. The IV&V provider will evaluate the appropriate use of OS scheduling software. The IV&V provider will verify that job control language scripts are under an appropriate level of configuration control.

Documentation -

- Job Design Information
- Job Control Language Scripts

## **4.6 Code and Test**

### **4.6.1 Code**

The IV&V provider will evaluate and make recommendations on the standards and process currently in place for code development. The IV&V provider will also evaluate the existing code base for portability and maintainability, taking software metrics including but not limited to modularity, complexity and source and object size. Code documentation will be evaluated for quality, completeness (including maintenance history) and accessibility.

The IV&V provider will evaluate the coding standards and guidelines and the projects compliance with these standards and guidelines. This evaluation will include, but is not limited to, structure, documentation, modularity, naming conventions and format.

The IV&V provider will verify that developed code is kept under appropriate configuration control and is easily accessible by developers. The IV&V provider will evaluate the project's use of software metrics in management and quality assurance.

Documentation -

- Source Code
- JCL
- Software Metrics
- Coding Standards and Guidelines

## 4.6.2 Unit Test

The IV&V provider will evaluate the plans, requirements, environment, tools, and procedures used for unit testing system modules. The IV&V provider will evaluate the level of test automation, interactive testing and interactive debugging available in the test environment. The IV&V provider will verify that an appropriate level of test coverage is achieved by the test process, that test results are verified, that the correct code configuration has been tested, and that the tests are appropriately documented.

Documentation -

- Test plans
- Test scripts
- Test tools
- Test logs
- Test reports

## 4.6.3 System Integration Test

The IV&V provider will evaluate the plans, requirements, environment, tools, and procedures used for integration testing of system modules. The IV&V provider will evaluate the level of automation and the availability of the system test environment. The IV&V provider will verify that an appropriate level of test coverage is achieved by the test process, that test results are verified, that the correct code configuration has been tested, and that the tests are appropriately documented, including formal logging of errors found in testing. The IV&V provider will verify that the test organization has an appropriate level of independence from the development organization.

Documentation -

- Test plans
- Test scripts
- Test tools
- Test logs
- Test reports

## 4.6.4 Pilot Test

The IV&V provider will evaluate the plans, requirements, environment, tools, and procedures for pilot testing the system. The IV&V provider will verify that a sufficient number and type of case scenarios are used to ensure comprehensive but manageable testing and that tests are run in a realistic, real-time environment. The IV&V provider will verify that test scripts are complete, with step-by-step procedures, required

pre-existing events or triggers, and expected results. The IV&V provider will verify that test results are verified, that the correct code configuration has been used, and that the tests runs are appropriately documented, including formal logging of errors found in testing. The IV&V provider will verify that the test organization has an appropriate level of independence from the development organization.

Documentation -

- Test plans
- Test scripts
- Test tools
- Test logs
- Test reports

## 5. Summary Table of IV&V Options

<b>Part I - Project Management</b>
Project Initiation
Business Process Reengineering
Project Planning and Reporting
Project Estimating and Scheduling
Project Personnel
Project Organization
Subcontractors and External Staff
Subcontractor Commitment
State Oversight
Acceptance and Turnover

<b>Part II - Project-Wide Processes</b>
Training and Documentation
User Training and Documentation
Developer Training and Documentation
Process Definition and Standards
Quality Assurance
Configuration Management
Requirements Management
System Security
System Capacity

<b>Part III - Environments, Processes, and Products</b>
Systems Engineering
Requirements Analysis
Interface Requirements
Requirements Allocation and Specification
Reverse Engineering
Operating Environment
System Hardware
System Software
Data Management
Database Software
Data Conversion
Database Design
Development Environment
Hardware
Software
Software Architecture
High-Level Design
Detailed Design
Job Control
Code and Test
Code
Unit Test

<b>Part III - Environments, Processes, and Products</b>
Integration Test
Pilot Test

## 6. Acronym List

Acronym	Definition
ACF	Administration For Children And Families
ANSI	American National Standards Institute
APD	Advanced Planning Document
APDU	Advanced Planning Document Update
CASE	Computer Aided Software Engineering
CBT	Computer Based Training
CFR	Code Of Federal Regulations
CM	Configuration Management
CPU	Central Processing Unit
DCSIS	Division Of Child Support Information Systems
DHHS	Department Of Health And Human Services
FLOPS	Floating Point Operations Per Second
FSA	Family Support Act
GUI	Graphical User Interface
I/O	Input/Output
IEEE	Institute Of Electrical And Electronic Engineers
IS	Information Systems
IV&V	Independent Verification & Validation
IV-D	Title IV-D Of The Social Security Act - Child Support
JCL	Job Control Language
LAN	Local Area Network
LSE	Language Sensitive Editor
MIPS	Million Instructions Per Second
OCSE	Office Of Child Support Enforcement
OLTP	On-Line Transaction Processing
OS	Operating Systems
PRWORA	Personal Responsibility Work Opportunity Reconciliation Act
QA	Quality Assurance
RFP	Request For Proposals
SPECint	Standard Performance Evaluation Corporation rating
WAN	Wide Area Network