

An Overview of Independent Verification and Validation Services for Child Welfare Information Systems Development

Federal regulations related to IV&V requirements are found at: 45 CFR 95.626; 45 CFR 95.610; 45 CFR 95.611; and 45 CFR 1355.50-5995.626

What are IV&V services?

Independent verification and validation (IV&V) services are support services that provide a completely independent assessment of the work products and progress of a system development project. The overarching purpose of IV&V services is to verify and validate that a system will comply with its stated requirements and organizational standards and meet its users' needs.

A key attribute of IV&V is the autonomy and independence of the IV&V service provider. IV&V services are typically provided by an independent entity that is separate from the organization responsible for system development. An independent provider can conduct an unbiased review of an information system's processes, products, and results.

Note: The Administration for Children and Families (ACF) requires total independence of the service provider, where the IV&V service provider must maintain organizational independence and autonomy from the project's organization.

Are IV&V services required?

IV&V services may be mandated in a systems development project for which a Federal Department of Health and Human Services (DHHS) agency provides Federal financial participation (FFP) in system costs. Federal regulations allow a DHHS funding agency to mandate IV&V services for a project that meets certain risk criteria or for an agency with past failures.

The eight conditions that individually may prompt a Federal oversight agency to require IV&V services for a State or Tribal system development project include the following criteria:

1. Agency is at risk of missing statutory or regulatory deadlines for automation that is intended to meet program requirements.
2. Agency is at risk of failing to meet a critical milestone.
3. Agency indicates the need for a new project or total system redesign.
4. Agency is developing systems under waivers pursuant to the Social Security Act.
5. Agency is at risk of failure, major delay, or cost overrun in their systems development efforts.
6. Agency fails to timely and completely submit Advance Planning Document updates or other required systems documentation.
7. The State's or Tribe's procurement policies put the project at risk, including a pattern of failing to pursue competition to the maximum extent feasible.
8. The State's or Tribe's fail to adequately involve the relevant program offices in the development and implementation of the project.

Why are IV&V services useful for child welfare agencies?

An IV&V provider can help an agency's project staff identify and overcome obstacles to success by quickly detecting problems or issues that can derail project progress. Outputs and reports from the IV&V provider can also inform agency leadership of process or product risk that requires timely intervention or close monitoring. Periodic, recurring IV&V activities can help title IV-E agencies achieve timely delivery of a product or software service. These activities may:

- ▶ Alert project staff to schedule risks
- ▶ Provide early notification of software quality issues through continual review of deliverables and processes
- ▶ Track completion requirements

The inclusion of IV&V services is recommended as a part of large-scale system development projects by many computer science, engineering, and technology organizations.

- ▶ The Institute of Electrical and Electronics Engineers (IEEE) and the Capability Maturity Model Integration Institute (CMMI) are among the professional technical standards organizations that define and promote IV&V as a best practice. (IEEE, 1998; CMMI, 2007).
- ▶ The Clinger-Cohen Act of 1996, which addressed Federal technology acquisition and use, included a recommendation to “outsource for IV&V support” in its Project Management Handbook for Mission Critical Systems. (The United States Information Technology Resources Board, 1998).
- ▶ The General Accountability Office (GAO) has consistently recognized the use of IV&V as a leading practice for Federal agencies in the acquisition of programs that are variously complex, large-scale, or high risk. (GAO, 2011, 2014).
- ▶ The Department of Homeland Security (DHS) cites the value of IV&V in providing project management with “an objective assessment of processes, products, and risks” throughout the system development life cycle and its ability to promote “conformance to program performance, schedule, and budget targets” in its report on information technology. (GAO, 2014).

How can IV&V services help child welfare information systems projects?

IV&V services give a project development team timely notice of system issues, provide an ongoing analysis of the progress and quality of the development effort, and monitor that the product under development—a new system or system module—will meet the business needs of its users.

An effective IV&V provider will:

- ▶ Provide an impartial assessment of every aspect of a systems development project
- ▶ Address managerial status, technology performance, and product design and usability aspects of system development
- ▶ Identify problems and risks associated with the project as they happen or as they are likely to occur
- ▶ Identify risks early so the agency's project team can mitigate risk or develop appropriate contingency planning

The minimum regulatory expectations for a federally required IV&V provider include the following tasks:

- ▶ Develop a project work plan, which must be provided directly to ACF at the same time it is given to the state
- ▶ Review and make recommendations on the State and vendor management of the project as well as the technical aspects of the project

- ▶ Give the results of its analysis directly to the Federal agencies that required the IV&V at the same time it reports to the state
- ▶ Consult with all stakeholders and assess user involvement and buy-in regarding system functionality and the system's ability to support program business needs
- ▶ Conduct an analysis of past project performance sufficient to identify and make recommendations for improvement
- ▶ Provide risk management assessment and capacity planning services
- ▶ Develop performance metrics that will allow the tracking of project completion against milestones set by the state

The title IV-E agency may choose to require or request additional services that expand or complement the required elements of IV&V.

From a Federal funding standpoint, the IV&V process provides assurance that the title IV-E agency's system development project receives a neutral assessment, that risks are identified with adequate lead time, and that risk mitigation can take place before excessive time and money are spent following a project approach that will not lead to success.

In cases where ACF requires that a title IV-E agency obtain IV&V services as part of a system development project, the provider also represents the interest of the Federal Government, by reporting system development progress against the established project timeline and budget and by assessing the functionality of the system and its intended value to its users. IV&V reports will alert ACF to risks or issues that may result in schedule or resource expansion, possibly increasing overall project costs and thus the Federal share of expenditures.

Elements of IV&V Services

IV&V Services are *Independent*

The IV&V partner should not be part of the same management structure as the system development project unless the title IV-E agency receives an exception from ACYF. There should be no organizational oversight and control shared between the system project and the IV&V provider.

An IV&V provider could be an external contractor or another State or Tribal agency that is administratively separate from the title IV-E agency. State and Tribal agencies seeking an IV&V provider can seek independence in two ways:

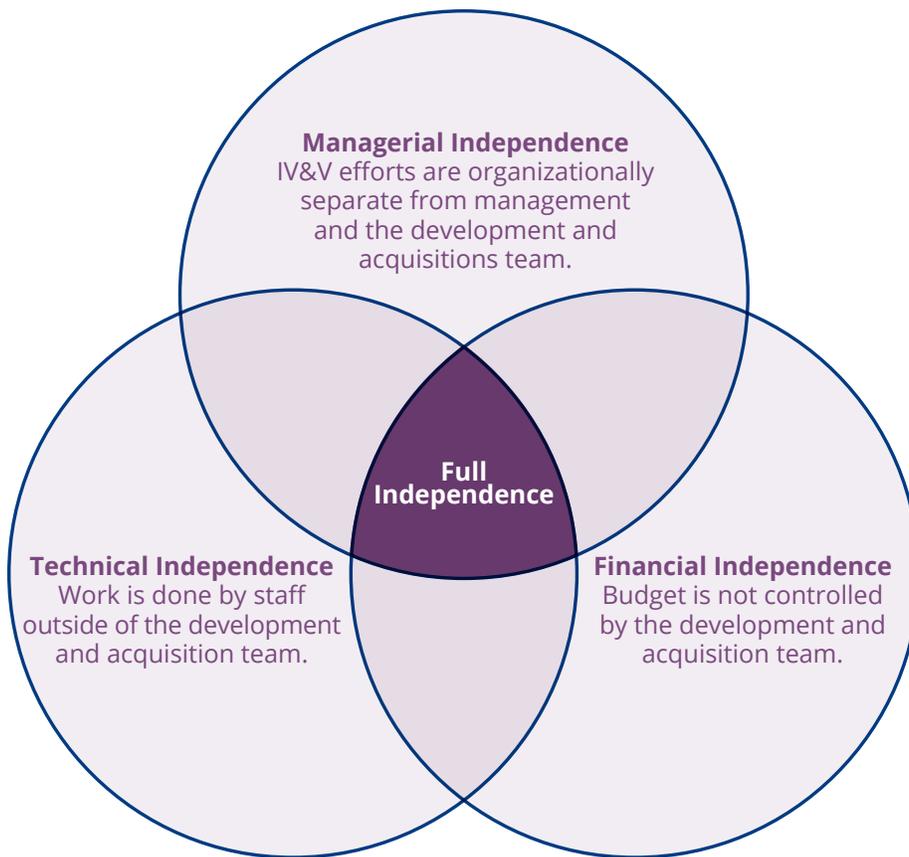
- ▶ By contracting with a provider entity that is separate from the system design, development, and implementation vendor
- ▶ By securing the IV&V services of another governmental unit that is not part of the same agency and that does not share administrative leadership with the agency building the automated system

If the system development project is under the oversight of a State's technology department, the IV&V contract could be awarded to the State auditor or the budget and management office if they are organizationally independent of the technology department.

If the IV&V contract is awarded to a provider outside of the governmental structure, the IV&V provider's staff must not have a role in system development and must not have responsibility for tasks such as requirements definition, system design, and software development.

While IV&V staff might engage in software testing as part of their independent assessment, the IV&V contractor should not be responsible for software testing within the development project, engage in user training, or perform other implementation support tasks under the direction of the development project's structure. The IV&V vendor should also be excluded from application hosting.

In defining IV&V independence, the GAO cites three aspects for government system development projects to consider:



- Managerial independence, in which IV&V work is organizationally separate from the system development project's management and development teams
- Technical independence, in which IV&V work is performed by staff who are not part of the system development team
- Financial independence, in which the project budget for IV&V is funded separately from the development project and is not under the control of the development entity
- The IV&V provider should feel able to provide objective judgments or conclusions about project progress and outcomes without fear of financial pressure or withdrawal of funding support.

IV&V Services Provide *Verification*

The purpose of verification is to determine whether the project outputs and the software meet the established requirements for completeness and accuracy during each phase of the development lifecycle and that they satisfy the requirements, specifications, and conditions that govern the development effort.

Verification activities assess and evaluate that the system under development is appropriately engineered and built to industry standards, conforms to project requirements, and meets performance expectations. Verification activities may include:

- ▶ Evaluating the system or its components against defined requirements
- ▶ Reviewing requirement specifications against the related elements in the project's procurement documents or project charter
- ▶ Verifying the design against specifications
- ▶ Examining the developed code against defined agency or industry standards
- ▶ Examining products or artifacts prepared by the development vendor
- ▶ Conducting code reviews or walkthroughs

- ▶ Examining the project management processes that provide guidance and oversight over development tasks to evaluate if these practices meet defined requirements

IV&V Services Provide *Validation*

Validation evaluates whether the system and related products and artifacts accomplish their intended result. Validation activities confirm that the system or components will do what the user expects them to do.

Validation activities may include confirmation that:

- ▶ The requirements are adequately defined
- ▶ The system's design conforms to its requirements
- ▶ Documentation will meet its intent in scope and usage
- ▶ The system will fulfill its intended purpose

Additionally, as part of validation activities, the service provider may independently undertake unit, system, and integration testing activities, to confirm that the system components are working as designed. This testing activity does not substitute for the developer's testing role.

Are IV&V services reimbursable?

Federal funding is available for approved IV&V activities in accordance with Federal regulations and relevant statutes governing Federal programs. Expenses may be reimbursable:

- ▶ When title IV-E costs for IV&V services may be claimed via the quarterly claims submission on Form CB-496
- ▶ When a title IV-E agency must submit the request for proposals (RFP) or other acquisition documents and the IV&V contract to ACF for prior approval
- ▶ If another State agency will act as the IV&V Provider; in this case, a copy of the Interagency Agreement or Memorandum of Understanding outlining the services to be provided must be submitted to ACF for review
- ▶ When the IV&V services do not duplicate services provided through other funding

As with system development costs, title IV-E agencies will not be reimbursed with Federal funding for duplicative services. For instance, if a State's legislature mandates IV&V services to be provided by a public entity for projects over a certain cost threshold and an agency has already contracted with an IV&V provider, the costs of both IV&V efforts will not be reimbursed with Federal funding unless it can be clearly demonstrated how these services are not duplicative and how the overall approach is cost effective.

IV&V services in waterfall and agile project approaches

The focus and timing of IV&V services may vary with the project approach.

Waterfall Methodology

Classic IV&V services were developed to correspond with the standard waterfall methodology: a sequential, linear approach to the systems development lifecycle. Each stage has a start and end point, and a new stage proceeds when the previous one is complete. Each stage has its own standard processes and deliverables. A waterfall approach to system development is typically well-documented, with standard artifacts produced for specific project stages.

IV&V for waterfall projects typically responds to the project stages: the IV&V schedule follows the project schedule, and review processes are timed to coincide with major phase completion and submission of major project deliverables. Two characteristics of waterfall projects with implications for IV&V are:

- ▶ Waterfall projects typically address a full set of requirements established at the project's inception.
- ▶ It is difficult to significantly change course after a project has begun.

For IV&V, this means the understanding of project intent, business fit, and user value are relatively fixed. The plan is set, processes and procedures are established, and the expectation for the timing of project events and outputs is set at its inception. The IV&V provider can easily establish a work plan that reflects or follows the project's work plan and expect that little deviation will occur. Technology stakeholders and the business users can be engaged according to their interaction with the project stages. Given a relatively fixed schedule and a core set of requirements set early in the project lifespan, the IV&V provider can easily plan for resource allocation based on the level of effort required in each stage of the project.

To the extent that project stages follow the expected timeframe, the work of the IV&V provider can follow with little variation from the work plan. Typical IV&V tasks such as schedule and progress monitoring, risk identification, and deliverable or product review will follow the standard system development lifecycle. IV&V activities may also focus on the considerable documentation and multiple outputs that waterfall projects typically produce.

IV&V reports are expected at specific intervals or after specific events or product delivery, and both timing and output may be defined in the contract and work plan. IV&V vendors may not have a consistent onsite presence, but rather may send staff for periodic scheduled visits and conduct some review activities offsite.

Agile Approach

Agile projects are intended to operate with more flexibility to respond to changing business needs. The agile approach is more focused on the delivery of working software and the ability to adapt and shift directions based upon what the project team learns as users provide timely feedback on functionality deployed frequently and incrementally. In an agile project, the planning-development-delivery work repeats over multiple, sequential cycles in compressed timeframes. Unlike a waterfall project, the complete set of requirements is not defined upfront, but emerges with user involvement. Agile project development requires tracking requirements, defect monitoring, and rigorous testing over the project lifespan, rather than at discrete stages of the project.

The overall agile project schedule may be set, but the generation of outputs follows emerging requirements and an evolving, adjustable task timetable. Thus, an agile project generates a different kind of planning and documentation that is typically more process-focused. The IV&V vendor may expect to review the process of conducting user research, developing user stories, conducting testing, or deploying software. The IV&V vendor may also assess the ability of the team to effectively manage the "backlog list," to combine complex user stories into larger coordinated "epics," or to effectively respond to user needs throughout the deployment process.

Similarly, feedback from the IV&V contractor may be more process focused. Rather than seeking post-submission review comments on a succession of major deliverables, an agency with an agile project may wish IV&V input in real time, with a continuing focus on user fit and ongoing monitoring of a rapidly moving deployment schedule. Rather than after-the-fact review, the contractor may be expected to anticipate or forecast risks and issues with relatively rapid identification of process improvements. The "did we build it

the right way” assessment—the verification tasks—should be a continuing, rather than a one-time process. The IV&V contractor may also be expected to participate in stage or gate reviews, contributing to decisions about whether the project is ready to move forward. The expectations of the IV&V vendor may be for more frequent delivery of timely, useful feedback that responds to individual sprints or team outputs, rather than product delivery reflecting a fixed longer-term deployment schedule. Assurance that the system under construction will respond to agency business need and support users may require the IV&V vendor to obtain continuing input from the user community throughout the project.

IV&V provider responsibilities

IV&V staff will perform services for the title IV-E agency as defined in the scope of the statement of work (SOW) in the acquisition document and executed contract. These services may include such contact with the project as:

- ▶ Attendance at project meetings or events to observe process
- ▶ Review of documents or products
- ▶ Independent testing or operation of software
- ▶ Inspection of project operations and artifacts
- ▶ Conversations or interviews with project staff

The IV&V provider should maintain independence and make active efforts to avoid any conflicts of interest throughout the period of performance for its work. The IV&V contractor must not participate in project management, design, development, or implementation tasks related to the project on which IV&V services are being delivered.

The IV&V provider staff should adhere to the schedule for the timely delivery of their products and outputs. A key role for the IV&V provider, whether for a waterfall or agile project, is to identify the risks or impediments to project success and to provide early detection of project, product, quality, or process variance that can affect the project’s cost, resource demands, and timelines.

It is important to recognize that federally required IV&V assessments, reviews, and recommendations are made to the agency and to ACF. The IV&V provider submits reports simultaneously to the State or Tribal project staff and to the Federal Government. The IV&V provider is not expected to influence or control the performance of a development or implementation contractor or to perform testing that substitutes for the vendor’s or agency’s test responsibilities.

The IV&V provider project team should:

- ▶ Be skilled and prepared to deliver the full range of services
- ▶ Understand project management, the agency’s selected development methodology, and the technology and architectural approach
- ▶ Be able to interact productively with staff at all levels of the project organization and with program and technology staff
- ▶ Understand the job performance-based perspective of the system users and the project performance expectations of agency leadership
- ▶ Be able to clearly communicate their observations, findings, and recommendations to the agency and, if applicable, to ACF

If a change in key staff is necessary, the IV&V provider should give timely notification to the agency and provide resumes of substitute personnel with equal or superior qualifications and experience. If it is neces-

sary for the contractor to replace key staff, the agency should promptly review resumes or skill statements to approve replacement personnel.

Title IV-E agency responsibilities

Whether the agency chooses to include IV&V services as part of its system development effort or ACF required the services, the agency and its staff must support that effort as part of the operations and management of its project.

The agency's role, at a minimum, should include the following planning, support, and response actions:

- ▶ Plan for the roles and responsibilities of the IV&V provider and develop a statement of work (sow) that can be used in the acquisition process, as part of the vendor evaluation process, and as a part of contract development
- ▶ Establish qualifications for the prospective IV&V vendor, spelling out minimum expectations for practical work experience and the skills, knowledge, and experience of staff proposed to conduct IV&V work
- ▶ Secure funding that allows full performance of the SOW by the IV&V provider
- ▶ Determine the best acquisition approach to identify candidate vendors
- ▶ Select a qualified services provider by examining qualifications, approach, and cost
- ▶ Provide continuing, complete, and timely access to the project's products, deliverables, data, and activities, to enable IV&V task performance
- ▶ Respect the continuing independence of the IV&V service provider and take steps to assure that no control is exercised over the IV&V activities and no attempt is made to modify or influence the IV&V provider's findings or products
- ▶ Monitor the timely and complete performance of the activities of the IV&V provider as specified in the scope of services statement in the acquisition documents and contract
- ▶ Respond to IV&V service provider findings and recommendations in a timely and appropriate manner; and, as applicable, track the status of associated issue or risk resolution
- ▶ Distribute IV&V reports as they are issued to appropriate agency leadership
- ▶ Incorporate findings in the project's documentation of "lessons learned"
- ▶ Retain IV&V reports within the project records
- ▶ Provide the IV&V service team with workspace, network access, and basic office supplies as needed
- ▶ Inform federal agency partners of how the IV&V findings will be addressed

Identifying an IV&V provider

Title IV-E agencies generally have two options in seeking the services of an IV&V provider:

- ▶ Services may be obtained from an external entity via a procurement that follows State or Tribal policies and regulations regarding such aspects as competition, pricing, solicitation, and award.
- ▶ Services may be obtained via Interagency Agreement or a Memorandum of Understanding with another public entity, such as a separate governmental agency or a public university, assuming such non-competitive arrangements comply with State or Tribal procurement practices.

In either process, the independence of the IV&V provider remains a key factor. An external entity may not hold a participatory role in the project under the direction of the development vendor. A public partner in IV&V services must operate independently from the child welfare agency and/or the organizational division responsible for the system development effort.

The RFP or other acquisition solicitation may need to be reviewed and approved by ACF, as would the contract for award.

A title IV-E agency seeking an IV&V provider via acquisition must disseminate the IV&V SOW and an acquisition document according to agency procurement policy. The agency should review all proposals meeting the basic requirements of the procurement. At a minimum, the RFP should specify that the IV&V contractor should be knowledgeable about both the business and technical aspects of the system development effort. The prospective vendor should also demonstrate the qualifications to perform reviews of overall project management, agency business processes and IT service management processes, and reviews of design, databases, applications, and security.

IV&V providers for the agile project environment

Just as the use of an agile development approach is new to many agencies, performing IV&V in an agile environment may also be a new undertaking, even for vendors with a long history of providing these services in the traditional waterfall environment.

As an agency develops an acquisition solicitation for IV&V services for an agile project, the expectations for the tasks and their timing should be clearly stated. In the fast-moving agile project environment, validation must be a concurrent task, rather than an assessment of a completed general system design document.

The title IV-E agency may find that bidders with a long history of IV&V work have limited experience with agile projects or limited access to staff that are certified in agile methods. When developing an RFP or other acquisition solicitation, the IV-E agency may wish to ask that bidders specifically outline how their approach to IV&V with an agile project would differ from their more traditional waterfall work.

Procuring IV&V services

IV&V services should be obtained through competitive procurement according to the agency's procurement policies or by agreement with another State or Tribal agency, which is independent of the organization overseeing the development project. Once services are procured, the work of the IV&V contractor should begin no later than requirements are validated and continue through at least the completion of acceptance testing tasks.

A title IV-E agency may contract with IV&V services prior to the inception of the system development effort and engage the IV&V vendor in preparatory tasks. These tasks may include project management coaching or assistance with project estimates. The IV&V vendor may also assist with requirements analysis, project scoping, and alternatives analysis, to aid in independent proposal evaluation and scoring.

The RFP or acquisition document

At a minimum, the RFP or other acquisition document should specify in its requirements that the selected contractor should perform the tasks and functions listed in the regulation at 45 CFR 95.626 (b)(1-6) (see "How can IV&V help child welfare information systems" section above for complete list) within an established timeline.

The RFP should allow prospective bidders to understand the timeframe for performance, the tasks and deliverables or outputs suggested, and expectations for the timing of key tasks and their alignment with system development and implementation tasks. The expected artifact reviews and periodic progress reports by the IV&V vendor must properly align with task performance by the development vendor, and any specific deliverables or products should be detailed.

RFPs for agile and waterfall environments: In an agile environment, certain standard deliverables may have a different name than in a waterfall approach; for example, terms such as “product backlog” may represent work planning activity in the agile approach. Expectations for project milestones may differ, but the services outlined in regulation, however they are named, should be included in the RFP. Title IV-E agencies that undertake an agile, rather than a waterfall, approach should clearly detail expectations about the timing of vendor responses to verification and validation reviews. While in a traditional waterfall approach IV&V review activity may be tied to the submission of finished development products, in an agile project, the agency may require multiple iterations of such assessment tasks as each segment of development is completed.

For either project approach, a key element of IV&V is to demonstrate that program office involvement is a continuing part of a system development project. The acquisition documents should clearly establish an expectation that the IV&V provider will consult with all stakeholders, including the system’s end users and business partners, to assess the user involvement and buy-in regarding system functionality and the ability of the system to support program business needs.

The acquisition document should also define expectations regarding the experience and skills of the key personnel proposed for the IV&V analysis and request that key staff be named in the acquisition response. Although IV&V is an established discipline, it may be helpful to set requirements for experience that reflect understanding of the child welfare business environment and human services information systems, so that the contractor can more readily assess the relationship between the system under development and its support for users’ and the agency’s business needs.

The agency may also include other tasks deemed necessary by its business needs in its procurement documents.

If IV&V services are mandated by the Federal oversight agency, Federal regulations require that the acquisition document and contract for selecting the IV&V provider (or similar service definition documents if IV&V services are to be provided by another State or Tribal agency) be submitted to ACF for prior written approval.

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