PLAN DESIGN IMPLEMENT FRAMEWORK TOOL FOR NCE

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Abstract—Every project delivery involves significant amount of repeatable and replicable work, for example Customer Requirement Document(CRD), High Level Design(HLD), Low Level Design(LLD), Network Implementation Plan(NIP) and Network Ready For Use(NRFU) documentation. Repeatable work constitutes over 20% of the total transactional project efforts. Depending on the Service Contract the individual Network Consulting Engineer (NCE) may be responsible for network Prepare, Planning, Design, Implementation, Operation and Optimization (PPDIOO) [1]. This may include remote or on-site: infrastructure design, implementation planning, proof-of-concept testing, network auditing/sizing, pre-configuration, deployment planning and acceptance of product in execution or advisory/assistance or support models. For this there is a large potential for automating the low intellect works and to provide more bandwidth for NCE for high value work [2]. Since NCE works in all the phases of the project documentation there is a need for end to end flow of huge amount of information without any errors. There is a need to automate the generation of dynamic contents and to replicate the contents in all phase documents. The main intention is to reduce NCE hours for an organizational benefit. The aim of this paper is to introduce an innovative Plan Design Implement tool. The tool uses the business intelligence to auto generate the dynamic contents in the CRD, HLD, LLD and NIP documents.

Keywords-customer requirement document; intellect; template; Implementation plan; network ready for use;

INTRODUCTION

The primary goal of the PDI Tool is to automate the creation of dynamic content in Customer Requirement Document, High Level Design document, Low Level Design document and other documents and to automate the replication of content across multiple documents. It is also aimed to create rule-based logic to auto-generate dynamic content in all the documents. Currently there are applications for low level design tool for specific domain which generate the low level design document but not cover any other phases like customer requirements, high level design and network implementation [4]. The current state challenge is different teams will be using different templates for the document generation and so much of the work is being replicated and the information collected in one phase is not being reused in the next phase. The existing systems are template dependent. Plan Design Implement Tool is the complete framework that covers all the phases of project lifecycle. The look and feel of the Plan Design Implement Tool is better than the existing systems. Currently the customer requirement collection, High level design and Network planning are being done manually by the network consulting engineer which consumes 20% of the overall project efforts. Plan Design Implement (PDI) Tool creates rule-based logic to auto-generate dynamic content in these documents. There is a large potential for automating such tasks resulting in significant benefits to an organization. PDI Tool is envisaged as a tool which will allow NCE to create all these documents in 30% to 50% less time than current thresholds [2]. The PDI tool mainly targets at productivity savings such as reduction in NCE hours, potential annual cost savings and margin improvement. PDI Automation eliminates the possibility of manual errors while working on voluminous information. It relieves NCE of de-motivating tedious and low-intellect work and provides more bandwidth to NCE to focus on high-value work like design, consultancy and advisory and technical development. Templates are the place holders for the contents collected by the tool. These are used as base templates for all the deliverables. NCEs of any grades are expected to generate standard project documents using the templates and develop comprehensive test plans. NCEs will execute all phases of project delivery.

NETWORK DESIGN METHODOLOGY

Cisco uses a methodology known as PPDIOO as part of designing networks. PPDIOO is an acronym that describes some of the major elements in a network design process, namely: prepare, plan, design, implement, operate, optimize. As shown in the fig 1, the PPDIOO lifecycle phases are separate, yet closely related [1]. Following are the six phases of project lifecycle which the tool is considering:

Prepare Phase: ***Business agility starts with preparation: anticipating the broad vision, requirements, and technologies needed to build and sustain a competitive advantage.***

Plan Phase: ***Successful technology deployment depends on an accurate assessment of company's current network, security state, and overall readiness to support the proposed solution. The company then develops a detailed project plan to identify resources, potential difficulties[5], individual responsibilities, and critical tasks necessary to deliver the final project on time and on budget.***

Design Phase: ***Developing a detailed design is essential to reducing risk, delays, and the total cost of network deployments. The design phase can also guide and accelerate successful implementation with a plan to stage, configure, test, and validate network operations.***

Implement Phase: ***A network is essential to any successful organization, and it must deliver vital services without disruption. In the implement phase, a company works to integrate devices and new capabilities in accordance with the design without compromising network availability or performance [6]. After identifying and resolving potential problems, the company attempts to speed return on investment with an efficient migration and successful implementation including installing, configuring, integrating, testing, and commissioning all systems.***

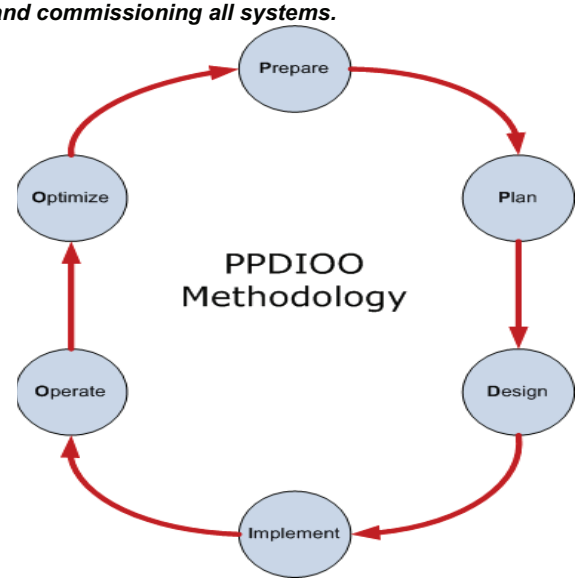


Fig. 1 PPDIOO life cycle

The Fig 1 depicts the organizational PPDIOO lifecycle. The cycle starts with prepare phase and ends with optimize phase. All the projects follow the same life cycle.

Operate Phase: ***Network operations represent a significant portion of IT budgets, so it is important to be able to reduce operating expenses while continually enhancing performance. Throughout the operate phase, a company proactively monitors the health and vital signs of the network to improve service quality; reduce disruptions; mitigate outages; and maintain high availability, reliability, and security. By providing an efficient framework and operational tools to respond to problems, a company can avoid costly downtime and business interruption. Expert operations also allow an organization to accommodate upgrades, moves, additions, and changes while effectively reducing operating costs.***

Optimize Phase: ***A good business never stops looking for a competitive advantage. As an organization looks to optimize its network and prepares to adapt to changing needs, the lifecycle begins a new continually evolving the network and improving results.***

CURRENT CHALLENGES

Studies on networks have shown that misconfigurations are common and can significantly affect the correct operations of networks. Manual configuration changes, while time-consuming and error-prone, is extremely common. This suffers from various disadvantages. So the networking projects should have proper documentation. This documentation should maintain consistency throughout the project lifecycle. This documentation will be voluminous in large organizations. Currently there are no tools to help the NCE in this regard. Following are the major challenges on which the to be developed tool targets:

- Template independence
- Requirement traceability
- Individual template upload

The tool should provide the flexibility for an individual to upload his own template. It also should maintain the data consistency throughout the project lifecycle like CRD, HLD, LLD, NIP and NRFU [2]. Template independence is the main focus since different NCE uses different templates for documentation of different projects. Fig 2 shows the NCE roles. Following are the roles and responsibilities of an NCE:

- Performs analysis, design and diagnosis of most complex networking problems.
- Acts as the technical specialist for the most complex deployments.
- Identifies skills and business shortfalls and establishes programs to address them.
- Collaborates proactively with other NCEs to ensure optimal use of resources to meet customer needs.
- Produce reusable Intellectual collateral, share and re-use stored collateral and leading practices documentation.

Fig. 2 Poles and Responsibilites of NCE

SOLUTION

The Solution for the current state challenges is to develop a Plan Design Implement Tool. The Plan Design Implement Tool targets at the above mentioned challenges. The PDI Tool concentrates on template independent document generation which adds the innovative idea. Thus the Plan Design Implement Tool relieves this burden of NCEs and provides impressive and interactive look and feel user interface to the user. The tool provides interesting options based on the requirements. The tool requires CEC authentication to use it.

PDI TOOL PHASES

Each phase of the PDI tool itself is a tool which performs the phase specific tasks. There are five phases of PDI tool.

Customer Requirement Document Tool

The CRD is the planning phase tool that collects the information from the customer by providing great flexibility to them. To collect information the domain specific questions can be triggered based on the specific domain and customer interest. This level produces the xml or world document which contains all the information collected by the customer. This Planning and Design Questionnaire is used to collect information from the customer for a network project. The information in this document is required for the planning, design and implementation of the project and will be also used by the organization as the input to the project Low Level Design (LLD). It should be noted that every project is different, even if based on the same solution. This document should be modified for each customer as appropriate and information may need to be added or removed. This document may also need to be modified during the low level design phase as new requirements are brought to light during the design process.

High Level Design Tool

The HLD phase tool takes the input from the Card's output. The input can also be given directly. The purpose of this phase is to identify the detailed requirements needed to develop a High Level Design. The output of HLD is the world document or xml document. This document is intended for organizations Engineers who are responsible for the design and implementation of a new solution. The information requested in this document should be obtained from the customer during the discovery & analysis phase of the engagement. The document focuses on the overall topology and features/services provided by the solution. The document starts by describing the various design requirements for the network project infrastructure at customer site. The document then provides an overview of the design, including the logical topology and traffic flows.

Low Level Design

Input to LLD phase Tool is Held's output. The input can also be given directly if the user wishes to add. The document has separate sections on the network architecture – physical and logical topology, device naming, etc. and on Network Services running on the Network. This document will provide configuration templates that can be used to derive actual configurations for use in the forthcoming deployment/ migration phases of the deployment. The output of LLD is the world document or xml document. The output of HLD is given as the input to the NIP. This document aims to cover all areas necessary to build and deploy the network infrastructure. The document begins by providing a brief overview of the project, including the scope and high-level project schedule. The scalability and limitations of the proposed design are described next, focusing on both network and application Services components of the solution. Considerations for future services and features are also discussed in this section. Finally, software recommendations for the relevant network components (specific to transparent interception) and application Services software are provided. These recommendations serve as the minimum software versions required to successfully deploy the proposed solution. The information in this document is based on data collected through meetings, interviews, documentation, and other

information provided by customer. Manual entry of this huge data is difficult. PDI tool automates the data collection and report generation. The following Fig 3 shows an example of LLD.

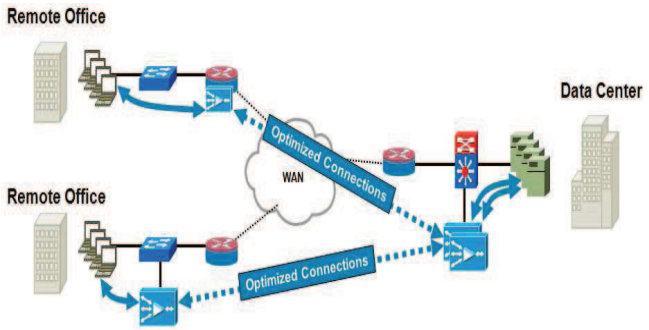


Fig. 3 Example for Low Level Design

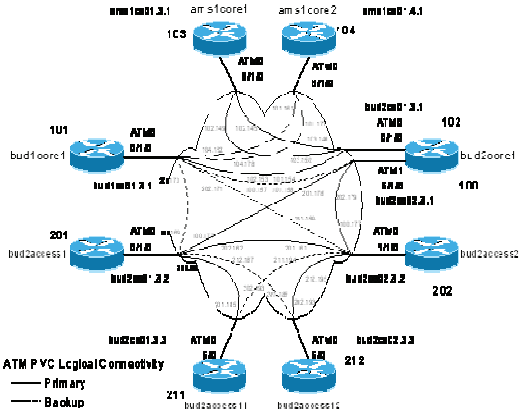


Fig. 4 Example for Network Implementation Plan

Network Implementation Plan

The NIP phase tool takes the input from the output of the LLD and generates the configuration that can be applied on the real machine. NIP is the implementation phase document. This document is intended for use by projects design, implementation and support teams, partner implementation and support teams as well as the organizations design and implementation teams [2]. This document describes the Network Implementation Plan of the deliverable. Fig 4 shows an example for NIP.

Network Ready For Use

The purpose of this document is to define and record the specific actions that are necessary to test the Customer network and to declare that it is ready for use. The Network Ready For Use (NRFU) tests will demonstrate that the network equipment has been correctly configured and that the network will operate in a manner that will enable customer to accept it as a working system and proceed with the process of adding production connectivity and traffic. The network ready for use is very important phase of the project life cycle since it checks all the requirements. If all the test cases are passes then the network is ready to use. The documentation contains test numbers, description and the test results.

The purpose of the Standard Tests in this document is to assess the overall functionality of the network as a single entity and of the implemented services that will be operational at the time of hand-over. The primary aim of these tests is to show the reliability and resilience of the network and thereby deeming the network ready to carry live traffic.

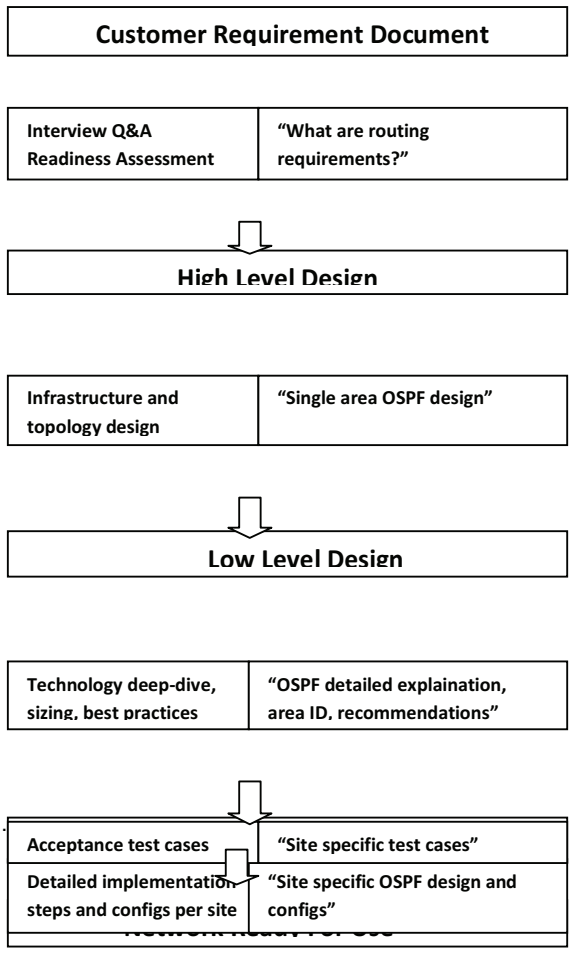
PRODUCT PERSPECTIVE AND FUNCTIONS

It very important for any Organization to monitor analysis, design, implementation configuration and NRFU test result documentation. The documents must be Policy compliant and follow a template. Regularly retaining the compliance of the documentation even after changes have been made can effectively reduce the issues raised by the customers. The template compliance can be achieved by uploading required templates. In order to maintain the accuracy and consistency effectively the following functions must be met by the PDItool:

- The PDI Tool shall be able to consider all the domains of organization.
- It shall generate detailed report on dynamic contents after each stage of the tool.
- Shall support all the NCEs and provide good performance.
- The PDI Tool provides the function of template compliance jobs.

PRODUCT DEVELOPMENT METHODOLOGY

This project would follow Water Fall Approach since requirements will not change during the development and requirements are well understood. This would enable the product to be built using water fall approach. The most important aspect of the waterfall model is that none of the stages can be started off with before the preceding stage is completed. The software life cycle has to follow the sequence - Specification of Requirements, Design, Construction, Integration, Testing and Debugging, Installation and Maintenance. There are five phases in this project CRD, HLD, LLD, NIP and NRFU. The output of previous phase is given as input to the next phase. This is the heart of PDI framework. That is, for example, the output of the CRD is given as input to the HLD and the output of the HLD is given as input to the LLD. Fig 5 shows the overall framework [2]. In each phase the details are added. This process continues throughout the development.



CONTENT	EXAMPLE

Fig. 5 Overall PDI Framework

The application is developed using Spring Framework. The Spring Framework is an open source application framework for the Java platform. The core features of the Spring Framework can be used by any Java application, but there are extensions for building web applications on top of the Java EE platform. Although the Spring Framework does not impose any specific programming model, it has become popular in the Java community as an alternative to, replacement for, or even addition to the Enterprise JavaBeans (EJB) model.

Central to the Spring Framework is its Inversion of Control container, which provides a consistent means of configuring and managing Java objects using callbacks. Decoupling or loose coupling between the classes is another important feature of Spring MVC [3]. Fig 6 shows the single user interface for complete PDI framework so that user can jump to any phase directly [2].

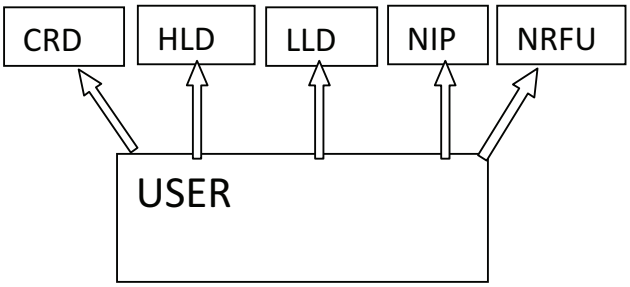


Fig. 6 Common User Interface for PDI Tool

SYSTEM ARCHITECTURE

The PDI Framework can be modularized into following modules. These module appears in almost all five phases of the PDI tool. The user logs on to the system using the credentials and user can perform the functionalities for which he is entitled for. Admin users will have the authorization to register the users to the system and give appropriate access rights to the registered user. The Fig 7 shows the complete low level design of the PDI Tool.

Capture: ***The Capture component in the PDI will provide UI to the user to create a new document by giving project title and selecting the template type and giving values for metadata. This will provide Rich Text Editor to the user. System validates the various inputs***

like project title, type, content, recommendation, NCE type etc., for the successful creation of document. It provides the user a flexible way to upload, add/edit data. The captured requirement can be saved, edited and sent to next phase of development.

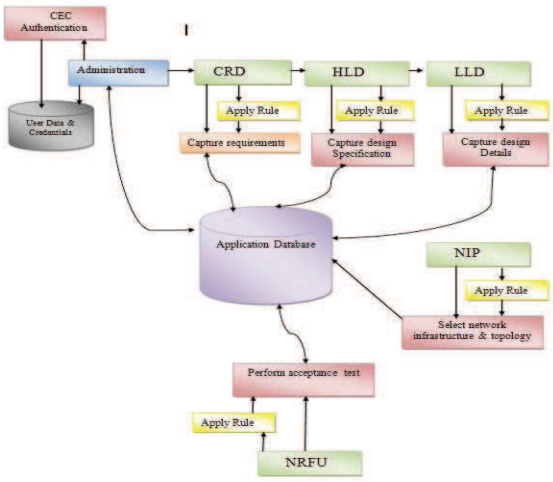


Fig. 7 System Architecture

Search*: The Search component of PDI framework will search the previously generate documents based on the user name or project name provided by the user and lists the fetched documents. User can use this search option to find the required document.*

View*: The View component of PDI framework will be invoked by the results page of Search component of the PDI*

Download: *The download component of PDI framework will be invoked by the results page of Search component of the PDI framework, which will allow the user to download the full reports.*

Admin: *Allows the admin to manage the hierarchical questionnaire. The Admin can add the questions at any level. The questionnaire should propagate throughout the framework.*

CONCLUSION

PDI tool reduces the NCEs effort in the voluminous document creation. Errors and redundant data can be eliminated. The NCE can concentrate on the high value work with more bandwidth without worrying about the low intellect work. The tool also provides template independence flexibility feature to the NCE thus any category NCE can use the tool independent of the tool. Plan Design Implement tool reduces 30% of the NCE hours on the project. The tool also provides requirement traceability which performs the replication of contents across the multiple documents automatically. Hence this great flexibility and advanced features of the PDI tool makes the PDI tool as the NCEs basic need in the future.

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