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Document Title:	Testing and Integration Strategy
Document Type:	Strategy
Release:	N/A
Abstract:	This document defines the overall strategic approach to be adopted for the testing and integration of Pathway products. Its scope extends beyond just the application software, to cover the entire Pathway Solution, from the code reviews and unit testing of individual software modules, through integration of software and hardware, to trials of the fully configured operational systems. It addresses the areas of functional conformance, system performance and resilience, end to end architectural integration, system operability, and business integrity. It also provides a framework for the allocation of specific areas of responsibility. It excludes the detailed verification of the many bulk standard proprietary software packages and hardware items (shrink wrapped and off-the shelf goods) other than in the context of their specified usage by the Pathway Solution. This document is not specific to a given release, or a given system (e.g. Network Banking). It provides a strategic framework for the testing and integration of all releases, spanning all the systems comprising the overall Pathway Solution. It is expected that this document will be updated periodically to reflect the lessons learned from successive releases.
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0.0 Document Control

0.1 Document History

Version	Date	Reason
0.1	05/01/96	Initial draft – general framework – issued for review, key Pathway personnel only
0.2	19/01/96	Internal version only – not issued
0.3	02/02/96	Internal version only – not issued
0.4	16/02/96	Final draft – full document – issued for wider review, Pathway personnel across programme
1.0	01/05/96	1st approved issue, following final review
1.5	07/09/96	Revised and presented for PDA Acceptance Review
2.0	30/09/96	2nd issue, following acceptance by the PDA
2.1	09/04/02	Draft, revised for internal review
2.9	24/05/02	Final Draft, comments applied, for final internal review
2.10	03/06/02	This document was issued informally at version 3.0 but version 3.0 will now represent the baseline version after customer comment.
3.0	16/07/02	Approved version updated with external review comments.

0.2 Review Details

Review Comments by :	
Review Comments to :	

Mandatory Review Authority	Name
Customer representatives	andrew.w.Thompson GRO
Programmes Director	Peter Jeram
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0.3 Associated Documents

Ref.	Library Ref.	Description or Title	Source
[1]	VI/POL0001	General Testing Policy	Pathway
[2]	DE/PRO/003	ICL Pathway Development Directorate Processes	Pathway
[3]	VI/STR006	Revisions to the Testing & Integration Approach for Pathway Release 2	Pathway
[4]	VI/STR010	Revisions to the Testing & Integration Approach for Pathway Release CSR+	Pathway
[5]	TD/RAC/001	Technical Environment Description	Pathway
[6]	Un-referenced document	Consignia Network Banking Automation End to End testing strategy	POL
[7]	Un-referenced document	POL Network Banking Automation High Level Testing Strategy	POL
[8]	Un-referenced document	NBA Release 1 Integration Testing Plan	POL
[9]	Un-referenced document	NBA Release 1 non-functional Testing Plan	POL

Unless a specific version is referred to above, reference should be made to the current approved versions of the documents.

0.4 Abbreviations/Definitions

Abbreviation	Definitions
AIS	Application Interface Specification (see also EPID)
AP	Automated Payments
API	Application Program Interface
APS	Automated Payment Service
BIT	Business Integration Test
BRTS	Business Release Test Strategy
CM	Configuration Management
CP	Change Proposal
CR	Change Request
CSR	Core System Release – the main contractual release of the Pathway Solution
CSR+	A significant (contractual) release supplementing CSR
DIT	Direct Interface Test

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DWH	Data Warehouse
E2E	End-to-End (sometimes used to refer to E2E Interface Testing)
EMC	Electro-Magnetic Conformance
EMR	Electro-Magnetic Radiation
EPID	External Physical Interface Definition (see also AIS)
HCI	Human Computer Interface
HLTP	High Level Test Plan
LLTS	Low Level Test Script
LST	Live Support Test
LT	Live Trial
NBE	Network Banking Engine
NFR	Non Functional Requirement
OBCS	Order Book Control Service
OHE	Output Handling Equipment
PAT	Product Acceptance Test
PIT	Product Integration Test
RT	Release Test
SCO	Single Counter Outlet
SLA	Service Level Agreement
ST	System Test
STS	System Test Strategy
TED	Technical Environment Description [5]
UCT	User Confidence Trial (used generically here to refer to Customer Testing)
UT	Unit Test
VIT	Volume & Integrity Test

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0.5 Changes in this Version

Version	Changes
3.0	All comments from external reviews considered and revisions applied accordingly.

0.6 Changes Expected

Changes
Next version will reflect the results of the ongoing review of the PIT and Tivoli Packaging areas. (Will principally affect section 6.3.)

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1. INTRODUCTION and MANAGEMENT SUMMARY

1.1 This document defines the overall strategic approach to be adopted for the testing and integration of products by Pathway, as required in section 3.3 of the General Testing Policy [1]. This document is subordinate to the General Testing Policy [1] and describes how the testing and integration activities will apply that policy.

1.2 At a high level it describes the stages of testing and integration to be carried out. It does not describe the detailed processes to be adopted, which are documented in the Development Directorate processes [2]. As such it is intended to provide a strategic framework within which to plan the testing and integration that may be required for each release of the Pathway Solution. It is expected that following each release a review will be conducted to assess the effectiveness of the testing and integration activities, and that periodically this document will be updated to reflect any lessons learned.

1.3 This document sits within a family of documents, as illustrated below. Implementation of this strategic approach is achieved via the production of the detailed subordinate documents, which serve as the vehicles to enhance and refine the approach described here, and to add further appropriate detail as it becomes available during the development lifecycle. Together they unambiguously define the objectives, scope, coverage, and success criteria for all the testing necessary for each major release of the Pathway systems. In this way it can be tailored to best suit the particular requirements of each release. The following diagram maps out this family of documents and their inter-relationships. It is intended to be an example rather than a definitive statement of the documents that will be produced, which will vary based from release to release. Some may not always need to be produced. Nor does it preclude the production of additional,

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more detailed documents, should these be deemed necessary from time to time.

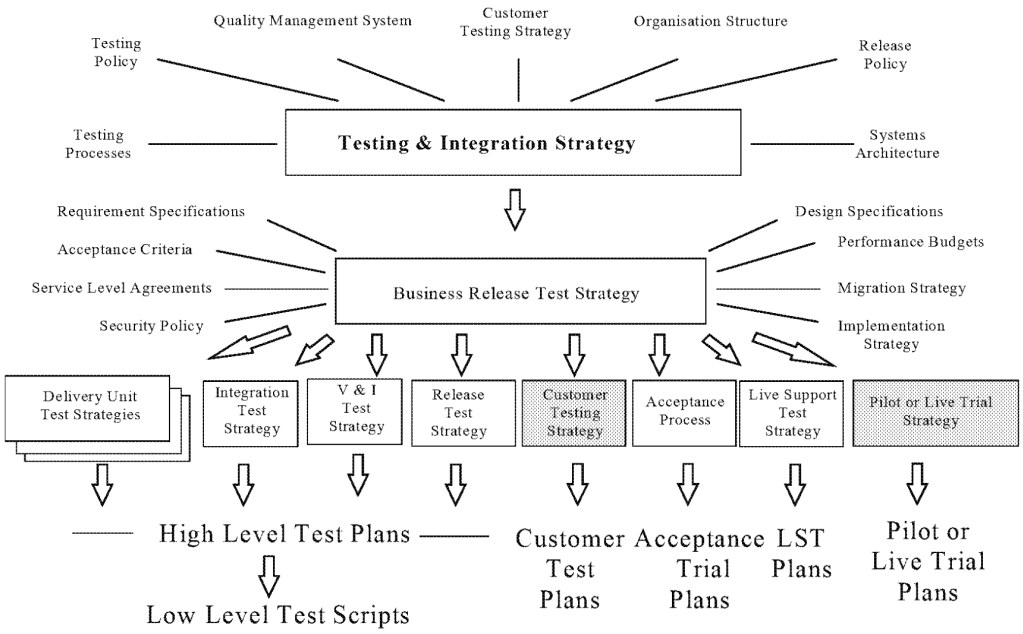

Figure 1.1 - Family of Documents defining Test Coverage
(Shaded boxes indicate areas of Customer Ownership)

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1.4 The principal inputs used in formulating this approach have been its immediate document predecessors – version 2.0 of this document, and the main changes agreed since then in VI/STR006 [3] and VI/STR010 [4], which this version consolidates and brings up to date. These earlier documents were in turn very much shaped by the underlying Systems Architecture described in the Technical Environment Description [5], and by Pathway's Release Policy at that time.

1.5 The Pathway Organisation Structure and its associated roles and responsibilities for conducting the various stages of testing and integration has a significant bearing on exactly how this approach is implemented, and this document should be revised periodically to reflect the evolving organisation in order to better promote understanding of these responsibilities.

1.6 Similarly, the Customer's own approach to testing (as defined currently in documents [6], [7], [8] &[9]) must be properly taken into account, and where necessary this approach needs to be maintained to ensure continuing alignment.

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1.7 Each major release of the Pathway systems may have different Requirement and Design Specifications, with different associated Service Level Agreements and Acceptance Criteria. These may include new Performance or Security features, and may require special Migration actions. Some of these release specific attributes are likely to require special testing and integration attention. This will be documented and agreed in a Business Release Test Strategy (BRTS) for that release, which will, at a high level, describe the peculiarities concerned, the special testing attention they require, and any release specific tailoring of this general approach which may be beneficial for the release in question. For example, the specific testing requirements of the Network Banking Service will be defined in the BRTS for the NWB release known as BI3.

1.8 The BRTS will be expanded down into specific testing strategies and High Level Test Plans (HLTPs) to cover each of the stages of testing. These will detail the specific scope, coverage, objectives and success criteria that apply. In this high level test planning process the detailed test objectives are formally documented and agreed (via reviews) by both the Customer and by Pathway. With Pathway and the Customer working together specific test plans are formulated to satisfy the combined objectives. These HLTPs will thus encompass all Pathway test objectives, and all Customer test objectives. (Note: whilst this does not preclude the separate running of certain tests by the Customer, it does ensure that the tests run (either jointly or singly) by Pathway will encompass both Pathway and Customer test objectives, and so provides an opportunity to avoid duplication of effort.)

1.9 Finally, when sufficient detailed information becomes available (e.g. the Design Specifications), the 'logical' HLTPs can be translated into 'physical' Low Level Test Scripts (LLTSs) and the supporting test data can be created, ready for test execution when the software products become available.

1.10 Throughout the test execution period, regular checkpoints will be taken (typically by the taking of physical database dumps and the preserving of associated flatfile and configuration data) at suitable quiescent points. This allows tests to be restarted, at a point prior to the point of failure, on receipt of a fix, or to re-run appropriate segments of a test when regression testing becomes necessary because of changes to the system. This is particularly important during the running of any particularly lengthy tests suites, where the cost of such re-testing would otherwise quickly become prohibitive.

1.11 In addition during the test execution period, the test results of formal test runs, which are retained for examination by the test manager, will be kept as an audit trail for each 'final' run.

1.12 The general approach to testing is one of staged, systematic verification, with progressive integration of software and hardware components, first stabilising the environment and business functionality, then system, performance, operability, security, etc., and culminating in overall service validation of the fully configured system in a Live-like environment.

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1.13 The system is subjected to testing against three principal test life-cycles, for Functional Conformance, Architectural Conformance and Business Integrity. These give rise to a number of separate stages of testing - Unit Test, Product Integration Test, System Test, Direct Interface Test, Business Integration Test, Volume & Integrity Test, Release Test, Customer Testing, and Live Support Test. There may also be a Pilot or and Live Trial. (Note: Customer Testing, some DIT phases, and Pilot or Live Trial, are owned by the Customer, not Pathway.) It is important to note that some traditional test activities such as 'performance testing' and 'security testing' do not exist as discrete activities under this approach, but rather they are integrated into each progressive stage of testing and integration.

1.14 Unit Test (UT) deals with the detailed verification of individual modules and their low level linking to form basic products. It is performed explicitly for all products developed in-house. An equivalent level of testing is assumed to have been performed as a minimum for any 3rd party products (the level of testing that 3rd party products are subjected to before interception into Pathway is resolved on a product by product basis). It comprises Prototyping & Design Feedback, Code Review, Module Test, and Link Test. It is normally confined to a single architectural layer (e.g. the Counter Platform). In addition, for key 3rd party products, a Product Acceptance Test may be run.

1.15 Product Integration Test (PIT) is concerned with the initial integration of unit tested products, configuring them correctly in appropriate test environments, according to their respective platform specifications, to form whole systems for use in later stages of testing.

1.16 System Test (ST) serves to validate the software against the requirement, concentrating on functional conformance. It operates the products in conjunction with each other, across the different architectural layers (e.g. from Counter through Agent to Host) but is normally confined to a single business application (e.g. APS) or infrastructure system (e.g. KMS).

1.17 Direct Interface Test (DIT) is concerned with early verification of the various interfaces between the Pathway systems and external systems (e.g. Customer systems, such as TIP, and Client systems, such as for Automated Payments).

1.18 Business Integration Test (BIT) exercises the system product set in a realistic environment in terms of platform architecture and business operation. The testing focuses on the interaction and data flows across the product set. Emphasis is given to the system's points of reporting, either a designed system report or an output to an external interface, to enable an end to end reconciliation of the systems operation.

1.19 Volume and Integrity Test (VIT) is concerned with the end-to-end data flow of volumes of data through individual system components and across the end-to-end architecture of the system. Data integrity and system resilience/recovery under load is proven. Measurements on throughput/performance are taken for modelling purposes.

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1.20 Release Test (RT) provides an environment for the migration and implementation activities to be successfully rehearsed in a Live-like environment. The associated build scripts, operational procedures and release documentation are tried and proven before live usage.

1.21 Live Support Test (LST) is concerned with the interception of software changes to be delivered to the live system outside the scope of a full or interim release. The necessary change-specific tests, together with selected and more general regression tests, are executed for targeted areas of the Pathway Solution. LST is upgraded with all full and interim releases, at a point just before the software goes live, so it can continue to act as the live support environment.

1.22 Each successive stage of testing is conducted in appropriate types of test environment, which progressively get larger, more shareable, less simulated, more life-like and under stricter CM control from stage to stage. This helps to concentrate test activity in more affordable and more appropriate environments and so avoids unnecessary escalation of machine resource costs.

1.23 In addition to the testing and integration activities performed and controlled by Pathway, there will normally also be a range of Customer Testing. This will be defined, and controlled by the Customer. Pathway will build and maintain the test environments for this activity, and the requirements for this will need to be agreed in advance. The management of the system and/or the running of the tests themselves may also require Pathway support. Again, requirements for this will need to be agreed in advance. This testing will focus on the end-to-end integrity of the overall business system, including Customer systems, and any 3rd Party systems which may be involved, and taking into account all ancillary materials which complement the software systems. These will include: business, IT support, end-user, and operational procedures; help systems; training materials.

1.24 A Pilot or Live Trial approach is usually adopted to limit the initial exposure of the Live Estate to the new release, and so affords the opportunity to reduce the likely business impact of any potential bugs remaining in the systems. Where practical, it is highly desirable to include some gradual ramp-up of volume, to avoid unexpected performance issues.

1.25 As a general philosophy, it is important to accept that no system can ever be confirmed as completely error-free. It is not possible to prove it. Tests can prove that an error exists. They can prove that a previous error has been corrected. They cannot prove that no further errors remain. However, by concentrating on the important characteristics of the system operation, tests can be used to demonstrate the progressive removal of errors to the point where these characteristics are seen to conform to expectation. So, testing can be seen as a method (the primary method) of reducing the risk of serious defects remaining in important areas of the system. We say the system is 'Acceptable' or 'Fit for Purpose'. The cost of this error finding and removal process follows a course of increasing cost and diminishing return. The equation is one of Cost versus Risk. Different systems can abide varying levels of risk. These are defined in the agreed Acceptance Criteria for the system.

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1.26 Therefore, testing and integration will be managed, throughout both the planning and execution phases, on a strict cost benefit basis. A pragmatic approach is essential in maintaining the correct balance - Cost versus Risk. During test analysis it will become apparent that certain areas of the system are deserving of more scrutiny than others, because of the inherent risks they entail (complexity, sensitivity, potential impact, etc.). Similarly certain areas will be deserving of less scrutiny, being of relatively low risk impact. Also, during the course of test execution, as the characteristics of the components under test are revealed, problems encountered, and priorities revised, again the tests planned for certain areas may be reviewed, supplementing them where risk outweighs cost, and deferring or discarding them where cost outweighs risk. In general this process will be at the discretion of the Test Manager concerned, though where this leads to a deviation from the agreed scope and coverage, then this must also be agreed with the programme.

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2. SCOPE OF TESTING

2.1 The scope of testing and integration activities encompassed by this document and its subordinate test strategies includes the entire application software system (both 3rd party supplied and in-house developed products) and its integration with the supporting hardware, support products and services, and infrastructure software platform.

2.2 It does not cover specific detailed testing of the platform (which is expected and assumed to be of Assured Status) other than in respect of its support of the software system and in satisfying the various Service Level Agreements (SLAs) and Non Functional Requirements (NFRs). So, for example, it is not expected that the proprietary Operating Systems, Database Management Systems, Messaging Systems, Network Management Systems, etc. will be subject to verification, but only that the Pathway systems intended use of those components is supported as intended.

2.3 It does not cover the testing activities of the 3rd party suppliers. It is expected and assumed that all products supplied will be appropriately tested prior to delivery to ensure that they meet the supplied specifications. However, it is not assumed that these suppliers will have integrated and proven their various products together, excepting where a supplier is charged with producing inter-linking products, where link testing is expected prior to delivery.

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3. HIGH LEVEL TEST OBJECTIVES

3.1 Specific

For each release, tests are to be engineered to demonstrate the following:

a) To provide the necessary design feedback information by conducting informal trial runs of early software releases and hardware platforms, to allow the design and development of the related products to be completed prior to their entry into the later testing stages, and so to reduce the level of disruption to those stages which may otherwise result from consequent late changes to the design (Unit Test – Technical Evaluation)

b) each module developed in-house to be compliant with the corresponding module specification and to link correctly with co-operating modules in that product. (Unit Test – Code Review, Module Test, Link Test).

c) key bespoke software products provided by a 3rd party supplier, to be compliant with its Product Specification. (Unit Test - Product Acceptance Test).

d) software and hardware components to be correctly configured to support testing and subsequent live running. (Product Integration Test)

e) software products to operate successfully in conjunction with one another to form application or infrastructure systems which satisfy the relevant Requirement and Design Specifications (System Test).

f) Pathway systems to interface correctly, on an individual basis, with external systems, in compliance with the external interface specifications. (Direct Interface Test)

g) that products are that are unchanged at a release are not affected by the introduction of new system features, achieved through the execution of adequate regression testing (System testing, Business Integration Test, Volume and Integrity Test)

h) software systems to operate and co-operate successfully together on the target hardware and infrastructure software platform, and to interface correctly together, satisfying the Requirement Specifications, including any SLAs and NFRs. Application and system data integrity to be proven within all points of reporting through controlled E2E data flow. This to include verification of Output Handling Equipment (OHE) operation as required by the system, such as card production, use of 'slip printers' at the counters and all associated stationery and materials, where products are available. (Business Integration Test, Volume and Integrity Test)

i) to validate the end-to-end technical architecture employed. (Business Integration Test, Volume & Integrity Test, Release Test)

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j) to demonstrate that the system meets the specified and agreed levels of functionality and performance, and so is fit for service. (Business Integration Test, Volume & Integrity Test)

k) the migration and implementation activity to be successfully rehearsed in a Live-like environment, including verifying timings and schedules, and to validate (through usage) the supporting systems management and software distribution facilities. (Release Test)

l) to successfully operate following agreed procedures (business, user, operational), help systems, and training materials (Customer Testing)

m) all systems comprising the overall business system (including Customer systems and 3rd party systems) to operate and co-operate correctly on an end-to-end basis, maintaining integrity (outputs, system data, financial status) throughout a cycle of events (Customer Testing)

n) confirm that all necessary preparations have been made to go-live, and that the support environment is properly configured. (LST)

o) system to successfully support the 'Live Trial' in verifying user procedures, training material, support mechanisms, and help desk procedures, and to confirm the migration and implementation prior to nationwide rollout and usage. (Live Trial).

3.2 General

For each release tests are to be engineered with particular regard to the following areas of good general practice:

a) to ensure that as much testing as possible is performed as early as possible in the lifecycle, to reduce defect correction costs and avoid unwelcome schedule disruption late in the lifecycle.

b) to arrange for as much testing as possible to be of an automated and re-runable nature, to reduce regression test costs, to speed test execution times, and to avoid unnecessary levels of human error.

c) to comply with the General Testing Policy [1].

d) to adopt a joint (Pathway and Customer) approach to testing, combining test objectives, high level test planning, and test execution activities wherever practicable, attacking multiple objectives in combined tests and so reducing duplication of effort and minimising the overall elapsed time required for effective testing.

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4. APPROACH

4.1 The approach is one of staged, systematic verification, with progressive integration of the wide ranging system components, culminating in overall validation of the fully configured system within a near-Live environment, followed where practicable with a period of Pilot or Live Trial running. It is a continuous process, spanning the whole development lifecycle, commencing with test analysis and the production of formal test material, and progressing through to test execution, result checking, and defect removal. Static Testing techniques are also employed where advantageous (e.g. Code Review).

A partnership approach between Pathway and Customer is key in securing the most efficient and effective means of testing and integrating the system. Pooling skills will enable clearer focus on test objectives at the outset, will promote higher quality test planning and scripting, and will help reduce the elapsed time necessary for test execution through co-operative effort and reduced duplication.

The component products are moved through distinct, separately planned and executed stages of testing, each designed to progress the products to a higher level of assurance. Once a stage of testing has been completed or has reached an agreed point for a particular product set, then that product set moves to 'Assured Status' and is deemed to be ready for use in the next stage and for progressively wider integration with their co-operating product sets. A proportion of the products that make up the system are provided by 3rd party suppliers. So, the emphasis in testing can be toward 'black box' techniques. That is, the detailed inner workings of supplied products are not examined and put under test, but rather their gross behaviour is verified in the context of the services they are required to perform.

4.2 It is therefore particularly important that the Business Requirement is firmly understood at the outset. Here, the Business Requirement is taken as being encompassed by the agreed Requirement Specification and System Design Specification, and any associated Service Level Agreements and Acceptance Criteria. It is of paramount importance that these be maintained under strict Change Control, with the testers being included in the impact assessment process for any and all changes to this baseline.

Similarly it is important that an 'Independent' approach be adopted to maintain objectivity in developing the 'black box' tests necessary to successfully verify and integrate the mixed product set. That is, that products be treated alike, irrespective of whether they be supplied by a third party or developed in-house, with formal product handover into testing being established via formal handover mechanisms.

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4.3 Given the condensed timescales typically available, it is also important that test planning commences at the earliest opportunity. Testers must be involved throughout the development lifecycle, starting with high level 'logical' test planning, based on the business requirements, and progressively developing these into 'physical' test scripts, so that the test material is ready and approved in good time for use in test execution when the products are handed over into test.

This is consistent with the general recognition that testing follows a lifecycle closely interwoven with that of development. This is best embodied in the well established lifecycle 'V' diagrams, where development progresses down the left leg of the 'V' with analysis, design and construction, and then up the right leg of the 'V' with unit test, function test and system test execution. The horizontal relationships between left and right legs indicate the test analysis, planning and preparation required against each phase.

4.4 There are three distinct lifecycles of verification and validation deployed on this programme, each bringing a different perspective. The **'Functional Conformance'** of the system must be evaluated. That is, on a purely functional level, confirming that the services required of the system by the Customers, as defined in the functional requirements, are being met. The **'Architectural Conformance'** of the system, both software and hardware must be evaluated. That is, the underlying system architecture employed, with extensive infrastructure software and mixed hardware platforms, must be trialed under stress to confirm service attributes such as performance, operability and security. The **'Business Integrity'** must be evaluated. Here it is necessary to demonstrate integrity across the breadth of the whole business system, encompassing not only the hardware and software components but also the ancillary technical and business components (e.g. business procedures, help and training materials, user guides, operations manuals, target reference data, etc.).

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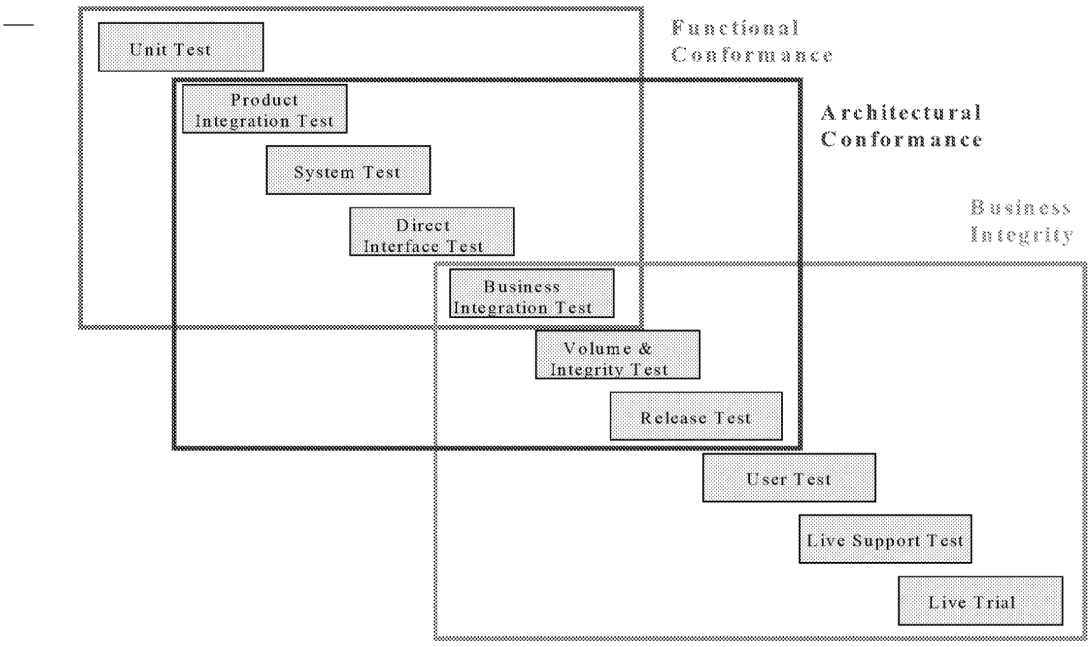

Figure 4.1 - Mapping of Testing Lifecycles onto the Stages of Testing

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These three testing lifecycles - Functional Conformance, Architectural Conformance, and Business Integrity – are not themselves testing activities, conducted as separate activities, but rather they are perspectives that each testing stage must take account of. They map onto each other as shown above.

For a given release, test analysis should start in parallel with formulating/agreeing the business requirements, contract schedules, acceptance criteria, and system requirements. The emphasis at this stage is twofold - to develop a thorough understanding of the overall business system and how the Pathway Solution is expected to contribute, and to influence the system design to promote testability. (If any of these key inputs are late in production, or are subject to significant late change, then it is likely to severely hamper this early and crucial test planning activity, resulting in significant rework.)

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Following this strategic framework, the Business Release Test Strategy (BRTS) is produced. This is specific to the release, and describes any special characteristics it may have (from a testing perspective) and what changes/additions to the general approach are required. For example, a release may introduce new business applications on the desktop, perhaps extending the memory footprint occupied, and so may require particular tests to recalibrate the performance model for the counter platform. Or, there may be fundamental changes being made to a sensitive piece of the infrastructure, such as the Riposte Message Server, which will require significant system-wide regression testing. Or, concerns may have been raised, or 'hot-spots' identified in particular areas of the system, which will require specific attention in testing. All such release-specific adjustments to the strategic approach will be documented and agreed in the BRTS.

4.5 **Functional Conformance.**

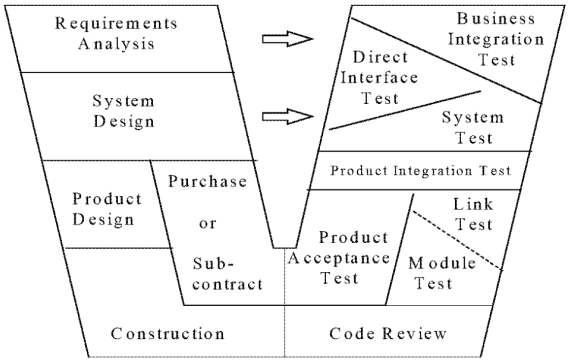

Figure 4.2 - The 'Functional Conformance' Testing Lifecycle

The Pathway Solution comprises a mixture of bespoke, in-house developed products, and 3rd party products. These 3rd party products may be shrink-wrapped, commercial off-the-shelf products, or they may be bespoke products commissioned from a 3rd party developer.

Products developed in-house will follow the established Pathway Unit Test processes, with selected modules being subject to formal Code Review, all modules being subject to Module Test, and where appropriate closely associated modules being subject to Link Test.

Products supplied by a 3rd party supplier, whether they are bespoke developments, or off-the-shelf products, are expected to have been appropriately tested by the supplier prior to delivery to Pathway. Selected 3rd party products will in addition be subject to Product Acceptance Test, which may involve verifying that agreed acceptance criteria have been met.

These activities are all collectively classed as Unit Test UT). This brings all products up to a common level of trusted status whereby all in-house products will conform to their Low Level designs (LLDs), and 3rd party products will satisfy their acceptance criteria. At this stage they are placed under formal CM control.

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Before the products can be deployed ready for System Test, they need to be correctly configured on their target platforms, which in turn need to be correctly built. This detailed technical integration is achieved by Product Integration Test (PIT).

Each system, whether an application system (e.g. APS) or an infrastructure system (e.g. KMS) is typically made up of a number of products operating across a number of platforms. This cross platform integration is achieved by System Test (ST). It is normally here that a system can first be run as a whole, and the principal objective is to demonstrate that it conforms to the functional requirements specified for the system. System Test will normally proceed following the established 3-Pass model. The '1st Pass' is run in a relatively informal fashion, forcing the tests through where necessary. It is intended to stabilise the system, the test environment, the test scripts and test data. This will identify the majority of 'stoppers' for correction prior to running the 'Main Pass'. The main pass is typically run in an iterative fashion. The 'Main Pass' is the principal defect removal work horse of System Test. Once the system is demonstrated to be more or less conformant to the functional requirements, then the 'Final Pass' is run to capture a formal audit trail.

As soon as the system has become stable then work can commence on verifying the external interfaces. This is achieved by Direct Interface Test (DIT). This is a jointly planned and executed activity. (Jointly with the owners of the interfacing systems.)

Once the majority of the serious defects have been corrected and the system(s) are becoming more and mores conformant to the functional requirements (i.e. about half way through ST Main Pass) then work can start on bringing all the infrastructure and application systems together to form the integrated Pathway Solution. This is achieved by Business Integration Test (BIT). This also normally follows the 3-Pass Model. The executed cycles operate end-to-end (within the confines of the Pathway Solution) to confirm all the various components operate correctly together to satisfy all the functional requirements.

This completes the Functional Conformance testing.

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4.6 **Architectural Conformance.**

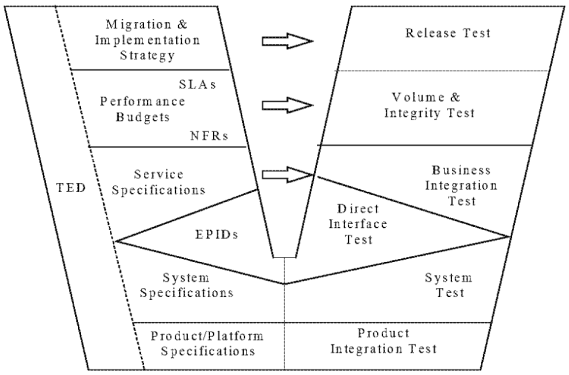

Figure 4.3 - The 'Architectural Conformance' Testing Lifecycle

PIT, ST, DIT, and BIT, in addition to their roles in Functional Conformance (see 4.5 above) also play a role in Architectural Conformance. When these tests are planned, any relevant Non-Functional Requirements (NFRs) are also taken into account.

In PIT, the technical characteristics of the run-time platform, as specified in the TED [5], must be correctly applied, or where not defined explicitly, they may have to be prototyped. Of particular importance here is any security requirements of the build.

In DIT, the volume, throughput, and performance characteristics specified, and any operational SLAs that may have been agreed for the interface, should be observed, though the limited nature of the DIT environment precludes any stress testing.

In ST and particularly in BIT, the scope and coverage of the tests should be extended to cover all explicitly defined NFRs, except for volume, throughput, and performance (excluding counter performance which is within the remit of BIT). These should include HCI, output handling, operability, usability, security, fail-over, fall-back, recovery, archiving, audit, and systems management (all subject to the limitations of the test environments concerned).

In addition, in BIT, special provision is made to cover volume, throughput, and performance for the counter platform (i.e. up to the ISDN interface). A special 'large outlet' configuration of 20 counters has been included in the primary BIT test rig for this purpose, and tooling has been developed to allow automated activity following configurable transaction profiles.

Once BIT has stabilised the systems, allowing the Pathway Solution to be run as a whole (i.e. after BIT 1st Pass) then work can start on conducting large scale volume tests and stressing the system in other ways (e.g. major recovery operations, loading the ISDN network, and the external interfaces, saturating batch windows, etc.) to confirm that the overall system and data integrity is maintained, and SLAs are satisfied. This is achieved by Volume & Integrity Test (VIT).

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In parallel with this, the Migration and Implementation activities are rehearsed, including regression, and the Pathway Solution is operated in a Live-like fashion, employing the target systems management facilities, and confirming that the introduction of any new or changed infrastructure does not de-stabilise the established architecture. This is achieved by Release Test (RT).

This completes the Architectural Conformance testing.

4.7 **Business Integrity.**

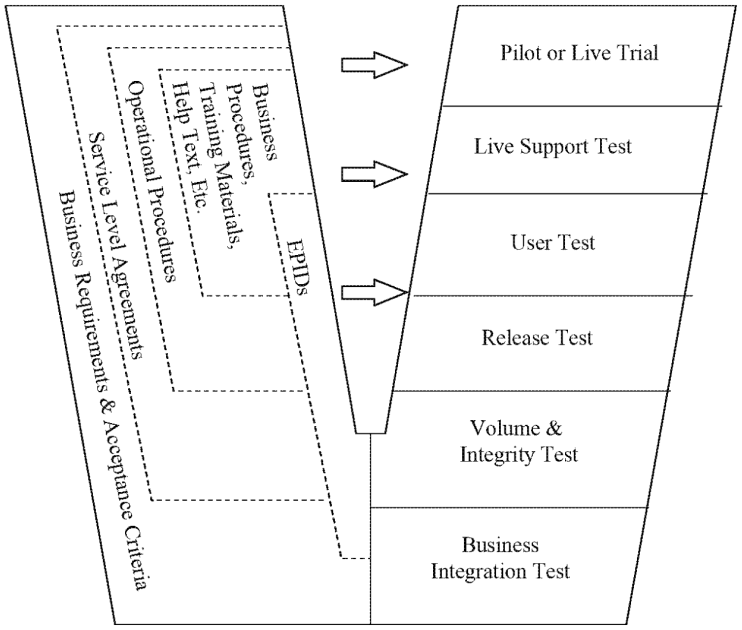

Figure 4.4 - The 'Business Integrity' Testing Lifecycle

BIT, VIT, and RT, in addition to their roles in Architectural Conformance (see 4.6 above) also play a role in Business Integrity. This is implicit, because the Pathway Solution forms such a large proportion of the overall business system, and is in many respects pivotal in this area.

In addition, extensive reconciliation facilities are built into the Pathway Solution, and proving their functional conformance goes a long way toward providing assurance that end-to-end financial integrity is achieved.

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When BIT is nearing completion (about two-thirds through BIT Main Pass) then the Pathway Solution is sufficiently stable to support Customer Testing, which will explicitly test the end-to-end integrity of the overall business system. This will involve running the Pathway Solution together with all other contributing systems (Customer systems and 3rd party system), and employing all ancillary materials (such as procedures, help systems, training, user guides, etc.).

Just before the release is implemented, LST is upgraded so it can then support the live system post go live. This upgrade acts as a final migration test and also proves the live keys.

The Pilot or Live Trial provides a final opportunity to identify any failures in business integrity by operating a full Live service for a restricted number of outlets, before the release is rolled out nationwide.

This completes the Business Integrity testing.

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5. RESPONSIBILITIES

5.1 This section lays out a general framework of responsibilities for testing of the Pathway Solution. The terms and roles used are intended to be generic rather than reference individual job titles, which will change from time to time during the course of a large project. For example, the roles of Quality Manager and Risk Manager may well be encompassed by a single individual or job title, whilst Development Manager may conversely be distributed over many individuals.

Role	Responsibilities
Customer Testing/Release Manager	Review Test Strategies and provide input to High Level Test Plans. Be involved in witnessing some later stages of testing. Review Pathway testing results. Plan, control, and perform Customer Testing. Plan, control, and co-ordinate Pilot or Live Trial. Accept the System.
Pathway Testing Manager	Review/Sign-off Strategies and Plans. Project Management of testing and integration activities. Interface with all areas.
Pathway Development Manager	Review/Sign-off Testing and Integration Strategy. Recognise testing dependencies in project plans. Provision of resources. Setting of Priorities. Agreement of changes to scope/coverage. Provide adequate bug-fix turnaround.
Pathway Architecture Manager	Review/Sign-off test plans for performance and other NFR coverage. Specify technical platform requirements.
Pathway Operations Manager	Set operational requirements. Review/Sign-off test plans for service management and operability. Close involvement in running of later stages.
Pathway Quality Manager	Apply QMS in development and testing areas. Confirm handover process. Check conduct of tests. Collect and interpret quality metrics. Check quality records.
Pathway Risk Manager	Conduct risk assessments. Approve cost versus risk evaluations. Produce residual risk report. Input to acceptance process.
Pathway CM Manager	Conduct handovers. Review environmental status against and confirm integrity of configurations.
Pathway	Review/Sign-off test plans for security and access coverage. Confirm data

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Security Manager	retention periods. Check security status for different environments / data usage.
Supplier Manager	Ensure acceptable product quality on supply. Provide adequate bug-fix turnaround

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6. DELIVERY UNIT TEST

6.1 Composition

Unit Test

Code Review

Module Test

Link Test

Product Acceptance Test

Product Integration Test

System Test

Direct Interface Test

(note: DIT may on occasions be performed by PTU rather than Development)

6.2 Unit Test

6.2.1 Code Review

6.2.1.1 Context

Optional, at the discretion of the Delivery Unit Manager, though recommended for complex areas of code. Normally performed by a peer developer or team leader within the Delivery Unit concerned. Applies to products developed in-house only. Requires no Customer involvement. Results formally recorded and retained.

6.2.1.2 Objectives

To identify obvious discrepancies between the module code as implemented and the detailed Module and API Specifications in the Low Level Design.

To confirm that the agreed coding standards have been followed

To assess the maintainability of the code in question

6.2.1.3 Overview

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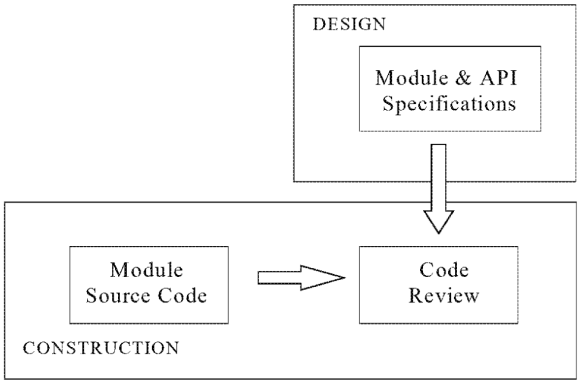

Figure 6.1 - Schematic Overview of Code Review

6.2.2 Module Test

6.2.2.1 Context

Mandatory. Normally performed by developer of the module concerned. Applies only to products developed in-house. Requires no Customer involvement. Formally planned, though data may be ad hoc. Results formally recorded and retained.

6.2.2.2 Objectives

To demonstrate that each module developed in-house conforms to the detailed module specification in the Low Level Design.

To demonstrate that the unit conforms to the relevant HCI where applicable.

To provide an economic basis for ongoing regression testing of each module as and when they are subject to change.

6.2.2.3 Overview

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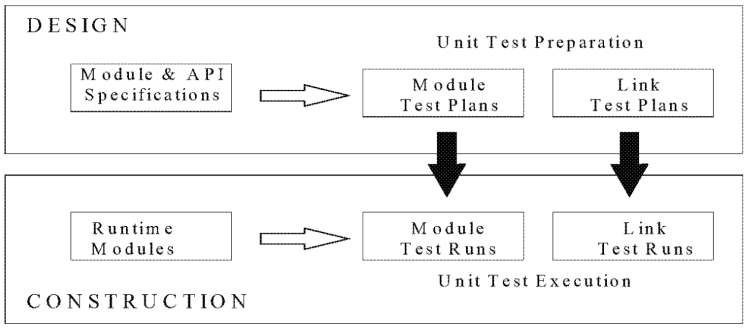

Figure 6.2 - Schematic Overview of Module & Link Test

6.2.3 Link Test

6.2.3.1 Context

Mandatory. Normally performed by (one of) the developer(s) of the linking modules concerned. Applies only to products developed in-house. Requires no Customer involvement. Results formally recorded and retained.

6.2.3.2 Objectives

To pre-integrate co-operating modules within a product by demonstrating that their APIs are implemented correctly and so that the modules link together as specified and co-operate properly as an integrated unit.

6.2.3.3 Overview

(See figure 6.2 at section 6.2.2.3)

6.2.4 Product Acceptance Test

6.2.4.1 Context

Optional, at the discretion of the Delivery Unit Manager, though strongly recommended. Normally performed by a developer of a related product, or by a tester with experience of a related product. Applies only to products developed by 3rd party suppliers. Requires no Customer involvement. Formally planned. Results formally recorded and retained. May have contractual significance.

6.2.4.2 Objectives

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To confirm that the 3rd Party supplied product is fit for entry into wider Pathway Testing, being sufficiently stable to cause no disruption, and conforming broadly to specification.

(Where there are formal or contractual acceptance criteria agreed between Pathway and the 3rd Party supplier concerned) to confirm that the product satisfies the specified acceptance criteria.

6.2.4.3 Overview

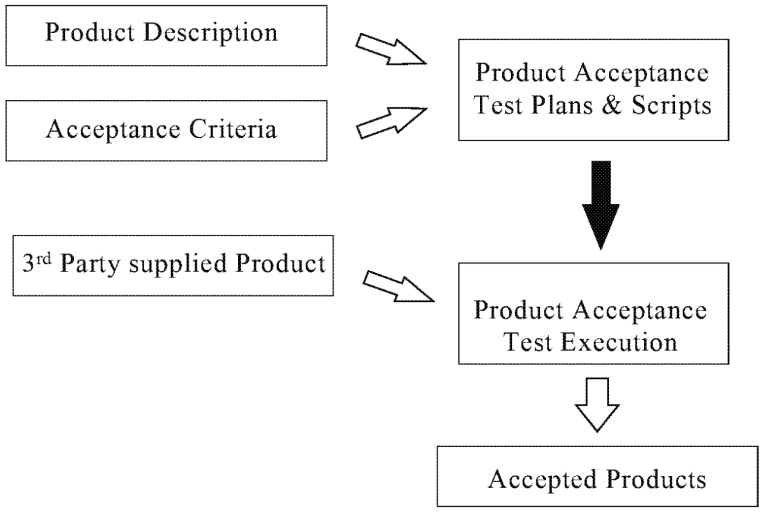

Figure 6.3 - Schematic Overview of Product Acceptance Test

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6.3 Product Integration Test

6.3.1 Context

Mandatory. Performed by PIT team. Applies to all products whether developed in-house or supplied by 3rd Party, whether Application or Infrastructure, whether Software or Hardware. Requires no Customer involvement. Formally planned. Results formally recorded and retained.

6.3.2 Objectives

To establish and prove the correct build instructions for each testing platform

To integrate products onto these platforms accordingly and so establish their configuration

To prove their environmental stability

To enforce correct initial configuration management of the testing environments

To intercept change to these environments, reintegrating and reproving the configuration as appropriate

6.3.3 Overview

The processes used in PIT and related activities in the CM, SPTS, and Tivoli Packaging areas are presently under review. The results of this review will be reflected in this document at version 4.0, together with any other changes that may be required following its review by the Customer. In the meantime, the following diagram is extracted from VI/STR/010 [4] to serve as a brief summary of the current strategic approach. For further detail, refer to the parent document. However, it should be noted that this is likely to be subject to change, and may not match current

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practice.

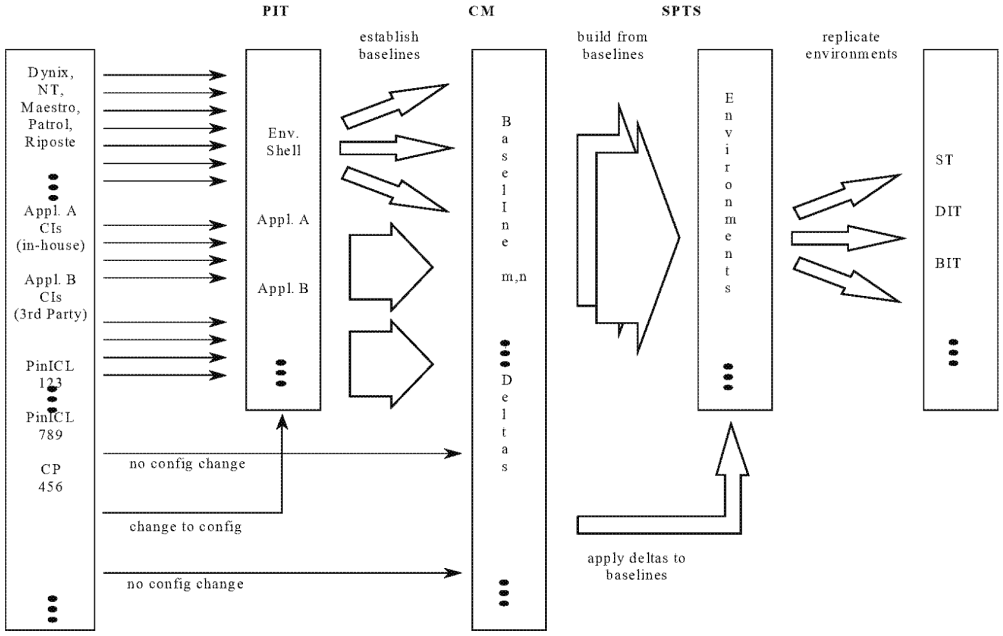

Figure 6.4 - Schematic Overview of Product Integration Test

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6.4. System Test

6.4.1 Context

Mandatory. Applies to all systems comprising the Pathway Solution, irrespective of origin. Performed by the System Test Team within the Delivery Unit concerned, on receipt (via CM) of products from Unit Test and/or PIT. Formally planned, scripted and executed, preferably in re-runnable fashion. Test Results formally recorded and retained.

6.4.2 Objectives

To demonstrate, through a series of comprehensive business driven scenarios, that the software system concerned, functionally conforms with the agreed Requirements.

To expose the Infrastructure software to use by the application, and to demonstrate that within the limitations of a reduced hardware platform it provides the application with the specified support.

To perform initial verification of OHE requirements where available equipment, stationery and other materials allow.

To demonstrate simple recovery and resilience features of the system within the bounds of the platform in use.

To form a comprehensive system regression pack for later use, and to prepare the way for full system integration in the following stages of testing.

6.4.3 Overview

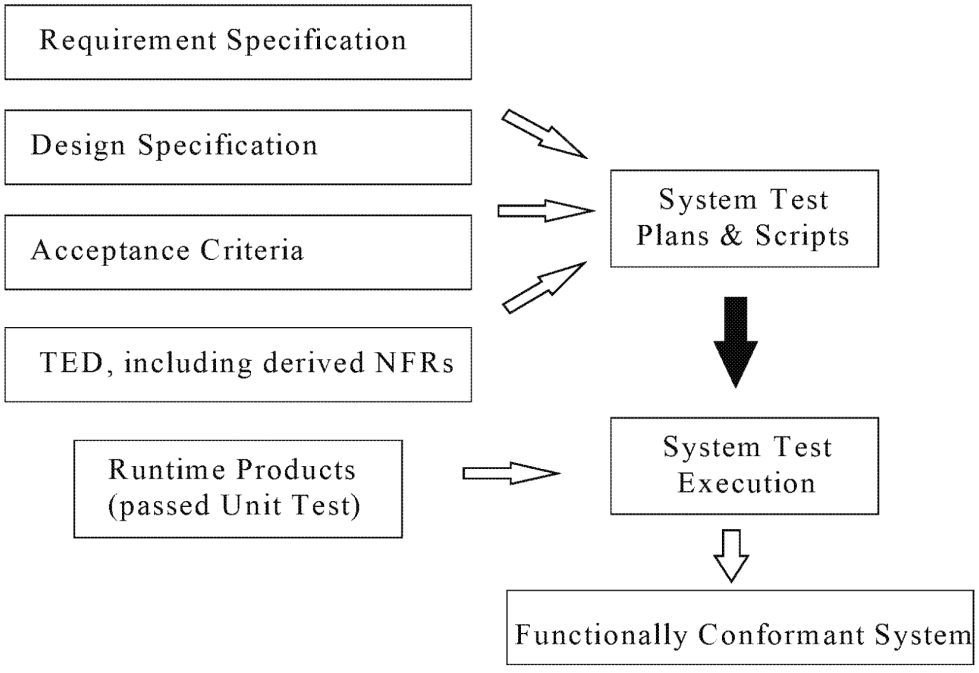

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Figure 6.5 - Schematic Overview of System Test

6.5 Direct Interface Testing

6.5.1 Context

Optional. Applies when the AIS or EPID for a defined interface changes or a new interface is introduced. Usually performed by the Delivery Unit concerned (or on occasion by PTU, whichever is best placed to conduct the tests under the prevailing circumstances. This would be specified in the BRTS for the release concerned.) Formally planned, scripted and executed. Test Results formally recorded and retained. Completed once the sending/receiving systems have declared that the system's are in a state of readiness for DIT to be commenced. (DIT may actually be planned and co-ordinated by POL, but supported by Fujitsu and the other relevant supplier domains.).

6.5.2 Objectives

That the interface under scrutiny has been correctly interpreted within the system changes or new requirements defined.

That operational integrity of the interface under test will be maintained.

If required, that the defined interface can handle the required volume/throughput and satisfy any SLAs specific to the interface.

6.5.3 Overview

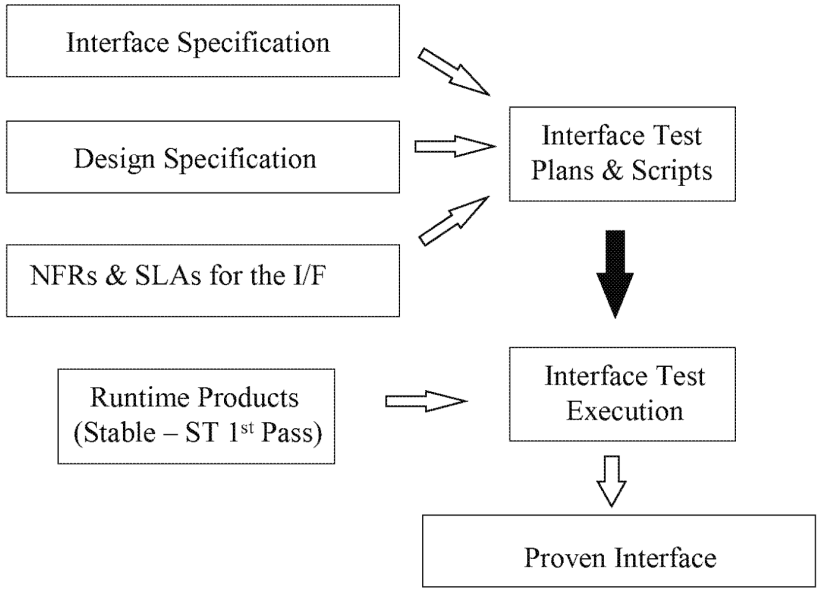

Figure 6.6 - Schematic Overview of Direct Interface Testing

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7. PTU TESTING

7.1 Composition

Business Integration Test (BIT)

Volume & Integrity Test (VIT)

Release Test (RT)

Live Support Test (LST)

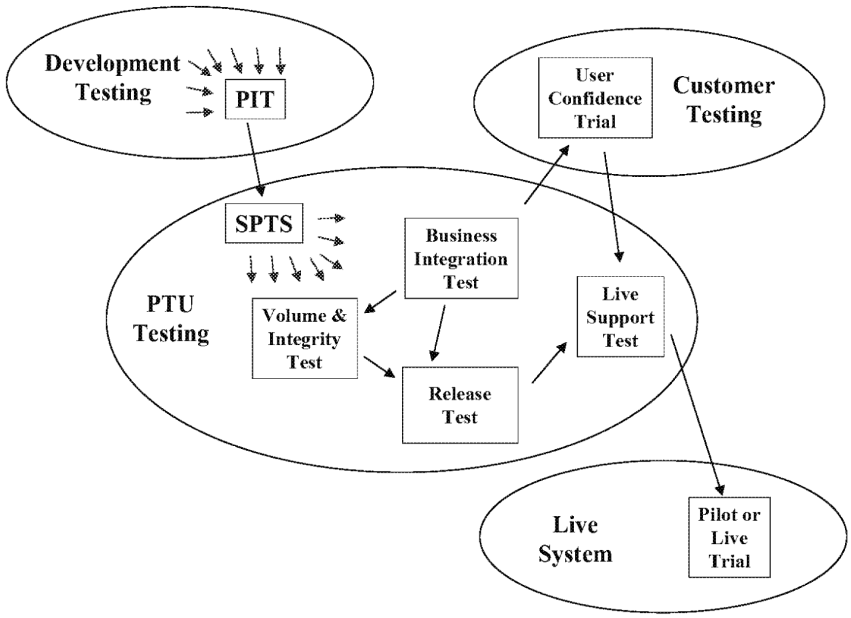

Figure 7.1 – PTU Context Overview(Major or Interim Releases)

7.1.1 Business Integration Test

7.1.1.1 Context

Mandatory. Performed on receipt (via CM) of products from System Test Teams. Formally planned, scripted and executed, preferably in re-runnable fashion. Test Results formally recorded and retained. Customer involved in the test construction

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process (providing input, reviewing HLTPs), and the execution cycles (witnessing tests, reviewing results).

7.1.1.2 Objectives

To demonstrate the successful integration of the software and hardware system, verifying all components that exist within the Pathway domain.

To exercise end to end data flows, to demonstrate maintained data integrity and the semantics underlying the external interfaces.

To prove all of the system's points of reporting and financial reconciliation including the full set of reports generated via the counter, the host systems and the DWH.

To complete performance testing up to the point of data leaving the post office (at which point responsibility is passed to the volume testing team). Performance measurements extend to the complete range of available counter functionality.

To perform verification of OHE requirements where available equipment, stationery and other materials allow.

To ensure the system successfully operates against the varying office configurations, large offices, medium sized offices, SCOs and mobiles. This extends to office working patterns (stock unit configuration and transaction mixes) as well as available physical hardware.

To demonstrate successful execution of acceptance criteria that have been designated for proving during this stage.

To ensure that the implementation of full and interim releases does not destabilise the existing application product set, this is achieved through the establishment of a comprehensive system regression testing pack, which can be deployed selectively or in a blanket fashion.

Produce a closure report detailing the results of the integration test phase, distribute to relevant parties including the customer.

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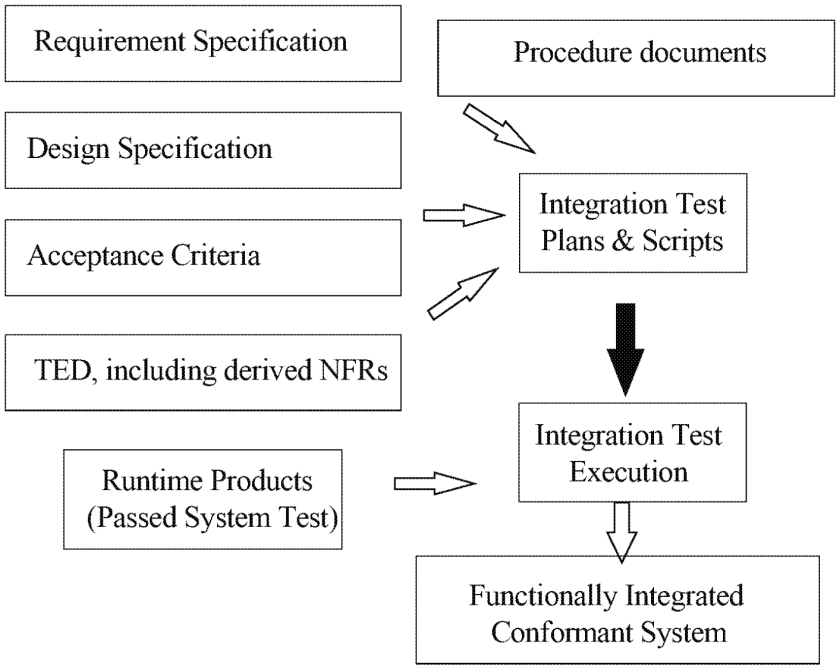

7.1.1.3 Overview

Figure 7.2 - Schematic Overview of Business Integration Test

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7.2 **Volume & Integrity Test**

7.2.1.1 Context

Optional, depending upon the requirements of the release. If the release introduces a new transaction that did not change record structures and was simply going to increase live volumes, but remain within understood levels, then volume testing would not be required. Performed on receipt (via CM) of products which have been through the early stages of Business Integration Testing. Formally planned, scripted and executed, preferably in re-runnable fashion. Test Results formally recorded and retained. Customer involved in the test construction process (providing input) and the test execution (reviewing results).

7.2.1.2 Objectives

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To ensure that the technical solution can support the target number of Post Office outlets.

To ensure contractual SLAs are not breached and the system is compliant.

To demonstrate successful execution of acceptance criteria that have been designated for proving during this stage.

To ensure system/data integrity is maintained with volume data processing.

To ensure system/data integrity is maintained in the case of platform or system failure.

To ensure that the system can support the processing of projected volumes (host to outlet and outlet to host).

7.2.1.3 Overview

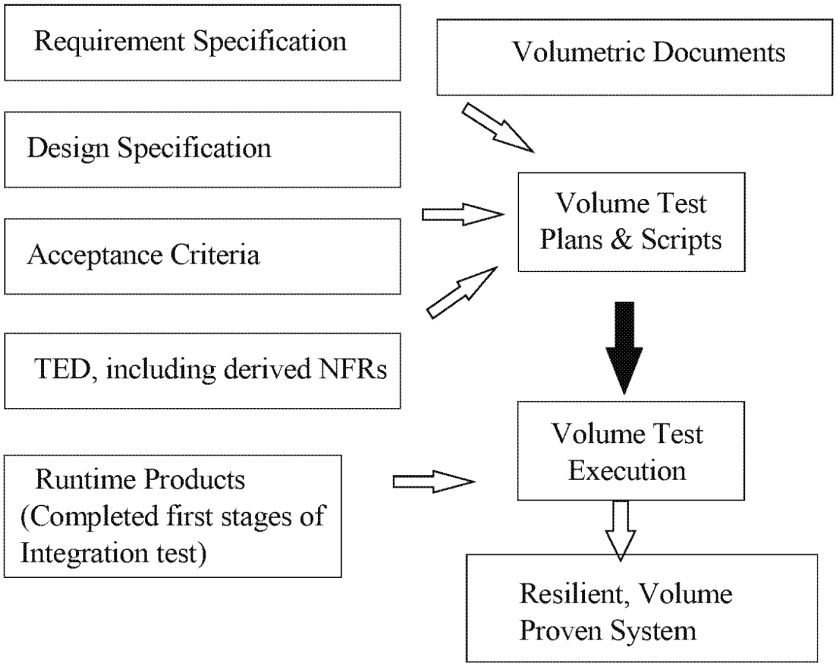

Figure 7.3 - Schematic Overview of Volume & Integrity Test

7.3 **Release Test**

7.3.1.1 Context

Mandatory. Performed on receipt (via CM) of products which have been through initial stages of Business Integration Testing and volume testing. Final phases, with

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the code delivered within Tivoli wrappers, run after completion of system integration and volume testing. Formally planned, scripted and executed, preferably in re-runnable fashion. Test Results formally recorded and retained. Customer involved in the test construction process (providing input) and in the test execution (reviewing results).

7.3.1.2 Objectives

To ensure that upgrades to existing services (hardware, software or database) do not de-stabilise infrastructure components or application products.

To ensure that operational integrity is maintained during and post the applications release into live.

To ensure that support documentation is updated to reflect the changes for a particular release.

To demonstrate successful execution of acceptance criteria that have been designated for proving during this stage.

To ensure the migration and implementation activities are tested and proven to maintain data integrity.

To ensure new system features are introduced in a cohesive fashion.

To ensure the various (defined) combinations of upgraded campus to existing or upgraded outlets functions correctly.

To ensure regression paths work and system/data integrity is maintained

7.3.1.3 Overview

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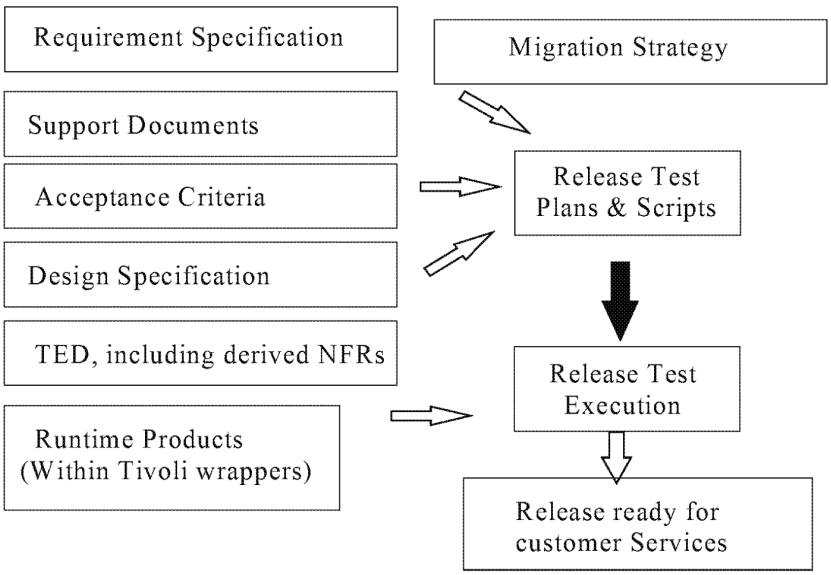

Figure 7.4 - Schematic Overview of Release Test

7.4 **Live Support Test (LST)**

7.4.1.1 Context

Mandatory. Applies to all releases, whether a major release, an interim release, or individual bug-fixes. Performed by the LST team, immediately prior to Live Implementation. For Major/Interim releases, the Pathway Solution will have been subject to the full range of Pathway and Customer Testing before being passed to LST. When simple system changes/bug-fixes are required to be delivered to live outside of the normal defined release windows, then typically they will pass directly from Development Testing into LST. Tests are based on stored regression packs as well as tests generated for the specific changes. Results are formally stored and recorded. No Customer involvement required.

7.4.1.2 Objectives

Verification of changes that are required to be intercepted outside of normal release windows.

Environment for investigation and attempted reproduction of issues being investigated within live.

Live Support testing also act as the last verification point for all releases. The support environment must intercept the release before live, to enable support to continue. As this is performed as the final planned activity before a release goes live it also acts as a final verification point.

7.4.1.3 Overview

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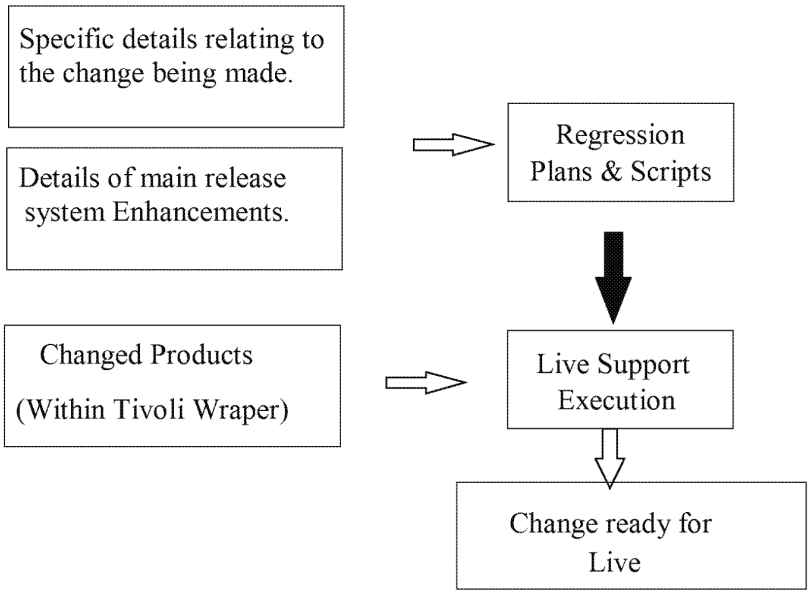

Figure 7.5 - Schematic Overview of Live Support Test

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8. CUSTOMER TESTING

8.1 The Pathway Solution is not alone in forming the Customer's overall business system. There are also a number of Customer systems, and some other 3rd part systems. These must all co-operate together correctly to maintain end-to-end integrity. Pathway is responsible (jointly with the owners of the interfacing systems) in conducting tests to prove that its external interfaces conform to specification. But this is not sufficient. Wider tests must be performed to demonstrate that these disparate systems do indeed co-operate correctly and that end-to-end integrity is maintained. This is of particular importance with regard to the financial status of the systems.

8.2 There are also a large number of ancillary components that complement the IT systems in making up the overall business system. These include materials like manuals, procedures, help texts, training, call centres, paper systems, etc. It is not sufficient to test that the Pathway Solution meshes correctly with these components. It is necessary to confirm that they do so on an end-to-end basis, all operating in concert to satisfy the overall business system requirements.

8.3 These aspects of testing are the responsibility of the Customer. For the purposes of this strategic framework it is sufficient to recognise that Customer Testing of this nature will normally be required, and that a suitable test environment with appropriate technical support will need to be provided. (This should be the subject of agreement at an early stage.)

8.4 The precise approach adopted by the Customer in conducting these tests is outside Pathway's control. It will be defined in one or more test strategies produced by the Customer, such as those produced for the Network Banking Service [6] & [7]. For the purposes of this strategic framework, the Customer Testing activity will simply be referred to as a User Confidence Trial (UCT). A UCT was in fact performed for the CSR+ release, but the customer may well adopt different terminology for future releases. This can be clarified in the BRTS.

8.5 The extent to which Pathway will be expected to provide technical support will vary from release to release, depending on the complexity of operation. For some releases it may be necessary for Pathway to do no more than provide the test environment, and carry out the system management activities required for safe operation. For other releases it may be necessary for Pathway to provide much greater support, perhaps even having to perform the tests on behalf of the Customer. It is expected that the level of support required will be defined in the Customer's testing strategies.

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9. PILOT or LIVE TRIAL

8.6 Each major release of software is normally trialed before exposure to the full live estate. The complexity of the release and the timescales that it is required to be delivered in should drive the duration and scope of this trial.

8.7 Typically, before full committal, a small number of outlets, ideally ramping up from a mere handful to 200 or 300, should perform live business with counters migrated to the target application. These offices should be closely monitored during the trial period and the results analysed before national rollout of the new release proceeds.

8.8 A ramp up of outlets is desirable in order to gain the maximum benefit from running the trial. By commencing with just a handful of outlets, the potential impact of and serious failure is limited to the bare minimum, effectively shielding the majority of the national network of users from any adverse affects. By then increasing the number of outlets in the trial to a few hundred, it is more likely to reveal any unforeseen volume/performance problems, whilst still sheltering under the protection of a closely monitored and controlled trial, and without impacting the rest of the network.

8.9 For similar reasons the target offices should cover a wide range of configurations. Variables considered should include location (if the changes made have a variance based on location), typical transaction volumes, office size and office connectivity type.

8.10 The first stage of the trial may be to prove that the counter application can be regressed back to it's previous software baseline if required. The subsequent stages should be designed to ensure that operational integrity is maintained within the target offices and that the application changes made have been successfully implemented.

8.11 On successful completion of the trial, agreement having been reached that any erroneous events that may have occurred during the trial have either been addressed successfully, or do not require immediate resolution, the software can be rolled out nationwide across the whole network.

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9 MAINTENANCE & REGRESSION TESTING

10.1 The test plans drawn up for each part of the system and for each stage of testing are, wherever practicable, designed to be re-runnable test packs, including the necessary test scripts, test data, and expected results.

10.2 When a change is made to the system, this is either as a result of a fix being applied to address an incident (a PinICL), or following the approval of a Change Request (CR) and/or a Change Proposal (CP). Both PinICL and CP changes are formally controlled. Part of the lifecycle of a PinICL is the planning of the testing required to satisfy it. Part of the lifecycle of a CP is the impact assessment, which includes planning of the testing required to satisfy it.

10.3 In both situations, the testing required normally breaks down into two distinct types.

The testing of the change itself – often conducted as targeted testing, and no different to any already described in the rest of this strategy.

The testing required to confirm that the change has not caused the rest of the system to regress (has not inadvertently introduced some unwanted side-effect) – regression testing.

10.4 The change may introduce new components, or may change existing components, or may remove existing components, or some combination of these. The targeted tests are satisfied by introducing, changing, or removing test conditions (or adjusting the expected results) relating to these components accordingly. The regression testing is satisfied by identifying the neighbouring/interfacing components surrounding the change, and in turn identifying appropriate tests which will exercise these areas of the system. Typically this will involve scripts from each major stage of testing through the lifecycle.

10.5 Consider 3 examples:

a) A minor change in a discrete application on the counter platform

Regression testing can be restricted to the application itself.

b) A significant change to a host application including a schema change

Regression testing should be considered across the host application, and any others sharing that Schema, which may include related Agent applications. Where the affected systems include an external interface, then DIT regression runs should also be considered. Where the affected systems have critical performance factors (or other NFRs) which may be compromised, then runs targeted at re-proving these factors should be considered.

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c) Major changes to fundamental pieces of system infrastructure, highly invasive in nature

Blanket regression testing should be considered across the whole solution.

10.6 The extent of regression testing required is a matter of judgement, and in turn is dependent on the extent of the changes applied, and the nature of the product(s) concerned. The use of test automation can be a factor in reducing the required timescale to execute the defined regression tests (re: Section 14).

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11. EXTERNAL CERTIFICATION

11.1 Certain products employed by in the Pathway Solution will from time to time require external certification before they can be used operationally, for legal reasons. For example, the weigh-scales on the counter needed to be examined in operation, in conjunction with their software, and certified by HM Weights & Measures, before they could be used legally in live operation. Similarly, all electrical and electronic equipment in the workplace (including the Pathway counters, their keyboards, printers, PIN-Pads, etc.) need to pass Health and Safety regulations regarding EMR emission levels, which requires EMC testing to be performed to obtain the certification. Any significant changes to such configurations will require re-benchmarking and re-certification.

11.2 All such products will be formally identified for each release, together with the authorising bodies concerned, in the BRTS for that release, and the External Certification activity will be included in the project plans, and monitored accordingly.

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12. TEST SCRIPTING

12.1 Test Scripting is an area that has benefited from regular and ongoing process improvements. During CSR and CSR+ timescales the differing Pathway testing areas attempted to implement universal standards for format and content of the test scripts produced. It has since been recognised that at times sections of scripts were being produced for the sake of production rather than for any great level of added value. This is because the testing approaches within the Delivery Units and PTU have matured and evolved to become more focused, and with less common ground remaining to benefit from a universally applied approach. This is appropriate based on the differing requirements of functional conformance, architectural conformance and business integrity testing. It is also a sign that the differing testing areas are now strongly complementing rather than duplicating each other. The same fundamental principles are however applied within each area. The product is put through a full test analysis process, resulting in the generation of HLTPs. These are then further broken down, through the addition of detailed operations, expected results and test data, into an executable script in the form of LLTSs.

12.2 The different testing areas will continue to utilise and enhance their individual analysis methodologies. Enforced conformance to a defined generic methodology which attempted to retrospectively cover each areas differing requirements would only lead to redundancy and omissions within the generated scripts. Each area's methodologies will however not evolve without independent review. The actual approach to be adopted will be described within the subordinate test strategies generated for each release and will be open to critical review.

12.3 The methodologies in use will be free to mature but will be required to maintain the following underlying principles and objectives:

The differing stages of the process e.g. test condition construction, scenario generation and LLTS line definition should contain as little duplication as possible in order to minimise the overall man day effort required.

A review should be completed early in the test construction process to avoid costly re-work if significant errors are discovered.

The tests should be presented in a format that makes them easy to understand and therefore easy to review, execute, and check results.

For appropriate test stages the documentation should allow acceptance criteria to be easily mapped to the defined tests to avoid unnecessary duplication of effort in having to construct separate acceptance test trials..

When generating the execution material care must be taken to satisfy the original testing intent expressed in the associated test condition(s), and not to allow the test(s) to become corrupted.

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12.4 Tooling to assist the analysis process has now been trialed and proven through the use of Test Director to hold the Business Integration Test scripts. It has been shown that Test Director assists the test analysis process through creating a consistent structure and framework to script within. Although it does not necessarily reduce the effort or elapsed time for the test analysis process it does allow easy manipulation of the generated data, for example for the purposes of generating regression scripts. Further benefits are also found when the test scripts are executed within Test Director. Based on the success of this initial implementation Test Director will be assessed for use in other testing areas.

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13 TEST AUTOMATION / TOOLING

13.2 In the early stages of Pathway testing the technology in use was in advance of the test automation tools available. The test automation market has matured considerably over the last few years and this has been exploited with a number of test automation initiatives being implemented.

13.2 The most mature use of automation on the project is that of bulk office loading. A large office configuration (typically a 20 counter outlet) is used in conjunction with an automated harness to replicate the day to day activity of such an office. The harness 'drives' the application through it's screen sequences to complete the required transaction. No data is generated other than by the application itself. The benefits of this implementation are obvious. The harness, operated by one user, can simulate the whole office being used by a complete set of clerks.

13.3 The harness has been matured so that the pause between transactions and the speed that a transaction can be completed within can be manipulated to simulate different working patterns. In addition the harness can be easily configured so that the percentage that each transaction type represents of all the overall transactions performed can be changed. This means that different office locations can be simulated e.g. rural offices completing a higher level of AP transactions than central city locations. Most importantly the harness has been maintained to include new transaction types e.g. post office local collect and OBCS bar coded foils. The harness will be continually matured to include all new transaction types including network banking transactions. It is important that a realistic transaction mix performed in a live like manner can be run via automation to ensure that large office configurations continue to operate successfully.

13.4 The most significant advancement in the utilisation of automation has been the introduction of replay and edit scripts. A pilot study was commissioned to evaluate the effectiveness of such scripts as a regression tool. The study concluded that a series of easy wins were achievable where the time taken to automate particular areas of functionality would show significant benefits over the time currently being taken to run manual tests, an example area of functionality would be counter time out tests. It was also concluded that some form of automated blitz testing script would be a powerful tool to quickly ascertain the quality of a build or of a new code drop. In addition although areas beyond the easy wins would not show the same benefits, it was obvious that gains could be achieved by automating large elements of the counter testing.

13.5 An automated script was constructed and is now in use as a blitzing tool. This blitz script executes the counter application's main functionality and quickly discloses any major failings. In two hours of automated execution four hours of manual execution can be completed. The script works on the basis of a transaction or function no longer operating in the sequence it previously performed to.

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13.6 The automation scripts have also been matured to perform capture and compare. These scripts take screen shots at any point required and compare the image to one previously stored. Based on the originals having been verified as being correct then any change in the image is highlighted. The image can either be the screen captured at any point during a transaction flow or a print preview of a receipt or a cash account. In this way any change, either very significant or just a change in sequence on a report, is automatically highlighted as a discrepancy.

13.7 The capture and compare scripts are powerful when used as a regression tool against stable elements of the system. Significant quantities of scripts have been produced to date. The automated regression pack currently consists of in excess of 3000 checks with each check representing one point in the system where the screen content is compared back to a previously baselined screen shot. These scripts have been successfully used during BI2 counter regression activities. It is envisaged that the pack would need to contain between 25 to 30,000 checks to represent a counter regression pack which was comprehensive enough to replace a significant element of the currently executed manual counter regression pack. Development of this pack is to continue with the long term aim being the reduction of the project's cost of performing a full counter regression test.

13.8.1 A Pathway forum has sought to identify additional automation initiatives. Automated performance benchmarking scripts have been developed which compare timings for previous counter actions against the same actions at a new release. These scripts are proving a powerful tool in the early identification of potential performance issues. The level of accuracy is not mature enough to replace the video benchmarking exercise but it is enough to identify potential performance regression within a release. In addition automated Application Performance Matrix scripts have been developed. These scripts allow a system function to become a trigger which is then executed in turn before a series of effects, which are defined range of system functions. The trigger is then automatically varied and the cycle repeated. In this way if any effect is recorded as running slower, after being trigged by a particular function, then the trigger can be identified as containing a potential performance issue.

13.8.2 The further development of the automated tooling already in place and the continuing commissioning of new automated initiatives is a prime driver to developing a reliable and repeatable test pack. Continued increased use of automation is a key element in the maturity of the overall Pathway testing strategy.

13.8.3 On occasion, bespoke (in-house developed) testing tools will be necessary/desirable. The decision whether or not to commission the development of a bespoke testing tool must be taken on a cost benefit basis, and must also take into account issues like development lead-times, ongoing maintenance of the tool, potential problems with reliability, and what testing will be required to validate the correct working of the tool. One good example of where a bespoke testing tool is all but essential is in the Network Banking Service. Here the Pathway system has to interface with a 3rd party system – the Network Banking Engine (NBE). As this 3rd party system will not be generally available for test use until near the end of the programme timescales, then it

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was agreed that a simulator for the NBE should be developed. This allows Pathway testing to progress independently from that of the NBE.

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APPENDICES

A1. GLOSSARY OF TERMS

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APPENDIX 1

GLOSSARY OF TERMS

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Term	Meaning
Acceptance Criteria	The document(s) agreed between the Customer and the Service Provider which lay down the criteria against which the system will be measured at agreed points during the course of testing in judging whether the system is to be formally accepted by the Customer.
Architectural Conformance	The testing lifecycle wherein the test objectives are oriented toward demonstrating that the system and its components conform to their architectural specification, including aspects such as structure, performance, security, operability, resilience, recovery, and other NFRs.
Assured Status	The state a system or its components have reached on successful completion of a particular stage of testing - e.g. 'System Test Assured Status' following successful completion of System Test.
POL	The Customer
Black Box Testing	Testing of a system or its components which is planned and conducted without knowledge of the inner workings, looking only at the input, the specification of the system, and the output.
Blitz Testing	A process of crashing a series of representative tests through, in an informal fashion, without much attention for accuracy, or data integrity. The objective being to quickly and cheaply identify the majority of the 'stoppers' so that they can be corrected, so stabilising the runtime environment sufficient to allow more formal tests to be run without so high a level of disruption. This technique is particularly useful in stabilising new test environments and getting new software components to bed down together.
Business Integrity	The testing lifecycle wherein the test objectives are oriented toward demonstrating that the overall system satisfies the business need and when used in context and together with the associated business products, retains overall business integrity.
Business Procedures	The document(s) defining the business activity surrounding and controlling the use of the computer system by the Customer and their staff.
Customer	POL
EPIDs	Unambiguous definitions of the physical nature of an

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	interface between the system under test and an external system.
Functional Conformance	The testing lifecycle wherein the test objectives are oriented toward demonstrating that the system and its components conform to their functional specification.
Fujitsu Services	The Service Provider.
National Rollout	(see also Rollout) The phase of the programme where, following Live Trial, the system is subject to rollout on a nation-wide basis according to an agreed timetable.
Operating Instructions	The document(s) defining the operational control of the system, such as batch schedule control, recovery control, etc.
Output Handling Equipment	Ancillary equipment associated with the computer system or its output, which extends the service offered. For example, equipment used in conjunction with computer printers, to say collate and envelope and frank output targeted for posting.
Real Time	Here used to differentiate between modes of test execution, not to be confused with Real-time systems. It means where test teams do not manipulate the time during the running of a test, but rather operate the test in 'real' time.
Regression Testing	The process of demonstrating that a system and its components have not regressed to a 'worse' state following a change (usually to the software).
Rollout	The process of packaging and distributing the system out to the various locations at which it will operate and be used (see also National Rollout).
Service Level Agreement	The document(s) agreed between the Customer and the Service Provider which lay down the minimum operational criteria to which the service must be run and maintained.
Service Provider	Pathway - providing the service of development, maintenance and operational running of the system, according to agreed requirements and Service Level Agreements.
Stoppers	Defects which effectively prohibit a particular line(s) of testing continuing as planned. These defects are said to 'Stop' the test(s). Hence 'Stoppers'.
Supplier	one of the suppliers of Pathway - a 3rd party providing goods or services to Pathway, or one its direct sub-contractors working to specification by and on behalf of Pathway.
Validation	The process of evaluating products (at the end of a given phase) to demonstrate compliance with their specified requirements.

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Verification	The process of evaluating the products of a given phase to ensure correctness and consistency with respect to the products and standards provided as input to that phase.
White Box Testing	Testing of a system or its components which exploits knowledge of or interrogates the inner workings.

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END OF DOCUMENT

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