ITIL® V3: Managing Application and Infrastructure Changes
Preface

IT service providers need to offer services that deliver new business opportunities whilst increasing levels of availability, controlling risks and reducing costs. Well-performing organizations have effective change management practices and high levels of availability and performance. These organizations plan, test, coordinate and schedule application and IT infrastructure changes using an integrated configuration management database (CMDB) and automated tools. This enables people to understand the relationships and dependencies between the IT infrastructure, application, IT services, business process and stakeholders whilst also providing an auditable record of changes and recovery points.

This paper provides you with practical guidance based on the practices in ITIL® V3 that will help you manage application and infrastructure changes and configurations.

About the author

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Shirley is Vice Chair of the British Computer Society (BCS), Configuration Management Specialist Group, and she represents the BCS on the BSI IT Service Management committee that developed the IT service management standard, ISO/IEC 20000. She co-authored the BSI publication “A Manager’s Guide to IT Service Management” and the BSI series on “Achieving ISO/IEC 20000” with Jenny Dugmore. Shirley authored the ITIL V2 configuration management chapter and is a co-author of the OGC’s ITIL V3 Service Transition best practices with Ivor Macfarlane.

About Tideway

Tideway Systems is a private company that develops software products for large IT organizations. Tideway was founded by Richard Muirhead in 2002. By the end of 2005, it had grown to 80 employees, 22 customers, and had closed over $12M in bookings for the year. Tideway is rated a category leader by both Gartner and Forrester. Tideway is backed by Apax, a leading venture capital firm, and operates from offices in London and New York. Tideway’s customers include Wachovia, Dresdner Kleinwort, ING, BT, LogicaCMG, British American Tobacco, Dimension data, Co-operative bank, Lastminute.com, BSkyB, GSK, Mizuho and Linklaters. Tideway’s partners include IBM, Sun, HP, BMC, Managed Objects, Interlink, Oracle, Microsoft, Citrix, BEA and Sybase.
Many organizations are adopting ITIL as part of a framework to deliver better quality IT services. The new version of ITIL V3, launched in June, is an important evolutionary step that enables organizations to build on their successes with ITIL V2. ITIL V3 raises the bar for IT Service Management (ITSM) by establishing the integration of business strategy with IT service strategy. It recognizes the need to manage complex services in dynamic, high-risk, volatile and rapidly changing business environments.

Why ITIL V3?

Throughout the last decade global organizations have become increasingly dependent on the help of IT services to enable the communication, coordination and control of business across a heterogeneous and increasingly virtualized environment. During this period, IT organizations have been reducing costs through consolidation, transformation, automation, standardization, shared services, managed services, outsourcing, global and multi-sourcing strategies, virtualization and service oriented architecture (SOA) initiatives. ITIL V3 reflects the way that ITSM needs to respond effectively and efficiently to keep up with changing business and technology environments.

Organizations today need to be ready for transformation and rapid change, as there are often mergers, acquisitions, legislation, sourcing decisions, competition, technology innovations and changes in customer needs. Business managers also want assurance that applications and the infrastructure will support new business initiatives and meet corporate governance requirements. ITIL V3 shows how applying service management principles can address these challenges.

Some organizations have implemented IT controls in order to comply with ISO/IEC 20000 and regulatory requirements, such as the Sarbanes-Oxley Act. Many of these organizations have demonstrated that implementing repeatable and auditable processes improves predictability and service performance. Whilst ITIL V2 focused on being proactive, ITIL V3 moves the IT industry toward being predictive. For example, it helps predict the impact of change.

The architecture of the core library combines the process-based view of ITIL with a service lifecycle approach, shown in Figure 1. This reflects the reality of most organizations where the objectives for those responsible for the design, development and improvement of service management processes are best achieved using a process view of the organization.

The ITIL V3 core books are:

- **Introduction to the Service Lifecycle**: As an introduction to ITSM, ITIL and why the service lifecycle approach is best practice, the book provides a general overview of the detail contained within each of the core books.
- **Service Strategy**: Covers service management strategy and value planning, linking IT service strategy to business needs; service economics; planning and implementing service strategy.
- **Service Design**: Takes new or changed business requirements and develops a solution designed to meet the current and future business requirements. It provides guidance on the production and maintenance of IT policies, architectures, and documents for the design of appropriate IT services solutions and processes.
- **Service Transition**: Covers the broader, long-term change, configuration, knowledge management, release and deployment practices, so that risks, benefits, delivery mechanisms and the ease of ongoing operations of service are considered. It provides guidance for the transition of services into the business environment.
- **Service Operation**: Details the business as usual activities to operate the services and infrastructure, including the Service Desk, IT Operations Management, Technical Management and Application Management and practices for operations, management, control and measurement.
- **Continual Service Improvement**: Provides an overall view of all the other elements and guidance on the business and technology drivers for improvement and the ways that the overall process and service provision can be improved.

The ITIL V3 core practices are supported by more detailed complementary content specific to industry, stakeholder and practice topics. This makes the library more practical, easier to use, and it provides guidance specific to various stakeholder viewpoints to help gain further traction in ITSM. For example, specific case studies on using change management processes and tools in the regulated financial sector can be added.
Service providers need to manage changes to their services, applications and infrastructure more effectively in order to increase the change success rate. The implementation of ITIL® V3 change management processes can have a significant impact on an IT organization’s operating performance and ability to deliver quality services. However, there can be many challenges in doing this, such as:

1. **Increasing process compliance by avoiding overly bureaucratic processes.** People are less likely to follow processes if there are many manual administrative steps, or if these steps are overly bureaucratic. The detection of unauthorized changes that have not followed defined change processes, as well as being able to back these out, is a critical success factor in establishing process compliance.

2. **Providing accurate configuration information that is accessible and accurate.** People need quick and easy access to accurate information on the IT configurations before, during and after a change. Decisions and actions are often delayed if the right information is not available at the right time and presented in an understandable format. In the worst case, a poor decision may be taken.

3. **Simplifying the IT configurations to enable change.** Detecting and eliminating poor quality assets and unnecessarily complex configurations that are non-standard or non-compliant standardizes the IT estate. Detecting and backing out unauthorized changes, whether accidental or intentional, is also important to help to minimize unknown dependencies from building up over time and increasing risk.

4. **Predicting the impact of implementing change.** As more business processes are IT enabled, more stakeholder groups are impacted by changes, including different customers, users, programs, projects, suppliers and partners. Predicting the full impact and risk of implementing a change for complex systems across many stakeholders can be difficult, especially in highly volatile environments.

5. **Identifying the critical dependencies between applications and the infrastructure.** Unknown dependencies across legacy systems, new technology, human elements and the supply chain results in poor design of new or changed service components and inadequate impact assessment. This leads to failed changes and errors that increase incidents, risk and re-work.

6. **Verifying that a change has been implemented correctly.** To prevent degradation in the applications and infrastructure configurations, each change needs to be verified before and after implementation into test environments and production. It is important to ensure that there are no unintended side effects when a change is made.

7. **Restoring service quickly after a failed change.** Reducing the mean time to repair or restore service after a failed change is a key performance indicator. Without an accurate starting configuration baseline, repeatable rebuild procedures and tested remediation/continuity plans, restoration after a failed change will be slow, if not impossible.
Enabling better management of change with ITIL V3

Some of the key concepts that enable organizations to improve the management of application and infrastructure changes are:

- **The Service Lifecycle**: The approach helps to improve the management of changes to applications and IT infrastructures as well as the IT services that they support.
- **The Service Portfolio**: A repository containing comprehensive details of all services that are in the pipeline and in the service catalogue (a list of the live IT services and those ready for deployment). It enables all aspects of each planned and production service and their dependencies to be easily viewed and controlled, and forms part of the Configuration Management System (CMS).
- **Service Design Practices**: The Service Design book provides guidance on designing a new or changed service, as well as any changes to the capabilities and resources required to manage and operate the service. For example, a new business critical service should be designed with a change and configuration management solution from the outset.
- **Service Architectures and Models**: Describes how service assets and Configuration Items (CIs) make up a service and how they interact with customer assets and processes. Many of the examples in Service Design are based on a Service Oriented Architecture, as shown in Figure 2. These diagrams help people to understand complex configurations and breakdown the relationships between the application and infrastructure configurations.
- **A Service Design Package (SDP)**: Used to define all aspects of an IT Service and its requirements through each stage of its lifecycle, it is produced for each new IT Service, major change or IT Service retirement. From a control perspective, it defines the set of deliverables that will be managed through Service Transition and into Service Operation and Continual Service Improvement. The SDP contains a baseline of the current service.

Fig 2: Planning and designing changes for a Service Oriented Architecture
Managing changes and configurations through the service lifecycle

Service Transition practices cover the broader, long-term change, configuration, knowledge management, release and deployment practices so that risks, benefits and delivery mechanisms for the transition of services into the business environment are well-managed.

The scope in ITIL V3 has been expanded to cover changes to services in the service portfolio at a strategic, tactical and operational level. Some organizations implemented ITIL V2 for operational changes only and other changes were implemented through projects. This often created gaps in the control processes that led to errors and increased risk. The service transition practices make it possible, at each and every stage through the service lifecycle, to plan, track and confirm the planned and actual services, releases, configurations and changes, not just for one service but across them all.

Key improvements include:

- **Managing assets and configurations**: ITIL V3 has more focus on optimizing the lifecycle management of assets and the performance of service configurations.
- **The configuration management process**: Covers how to systematically break down, identify and manage complex systems and services. It provides guidance on establishing configuration baselines, snapshots and releases, building configurations, performing configuration audits, comparing baselines, (before and after a change), and identifying deviations from the planned configuration.
- **Key control points**: Are identified through the service lifecycle where requests for change and baselines can be taken, as illustrated by the baseline points in Figure 3.
- **Service Validation and Testing**: Establishes assurance of the planned and actual service changes and deliverables to ensure they are fit for purpose and use before entering Service Operation.
- **The change management process**: Is more granular to fit different situations. For example, implementing a major change requires a different level of control to implementing standard operational changes. The change evaluation, planning and implementation activities are integrated with work order activities that ensure there is a closed loop mechanism to track a change through configuration control procedures. For example, build, test and installation.
- **Managing organizational change**: Provides guidance on managing organizational change, training people, knowledge transfer and testing that processes and procedures work in practice. For example, in addition to training users, it is important to test that an engineer is competent enough to perform an installation and IT staff know how to operate the service.

![Fig 3: Managing changes and baselines through Release and Deployment](image-url)
Knowledge Management and the Configuration Management System

Knowledge Management is the process responsible for gathering, analyzing, storing and sharing knowledge and information within an organization. The primary purpose of Knowledge Management is to improve efficiency by reducing the need to rediscover knowledge. ITIL V3 presents a way of understanding the relationships between data, information, knowledge and wisdom by showing how each builds on the others. The set of tools and databases that are used to manage knowledge and information is called the Service Knowledge Management System (SKMS). The SKMS provides access to customer, supplier and service provider information in an understandable format that enables effective decision making by people to perform their service management activities.

The SKMS contains the Configuration Management System (CMS) that in turn contains the Configuration Management Database (CMDB), as shown in Figure 4. The CMS provides the definitive source of information for each configuration item, whether historical, current or planned. It provides detailed configuration and change documentation, including the information, audit history and evidence to meet corporate governance and regulatory compliance.

The CMS includes one or more CMDBs, repositories and supporting tools, such as reporting, audit and discovery. It is maintained by configuration management and a representation based on four logical layers:

- **Presentation Layer**: For different roles to search, browse, retrieve, update, publish, subscribe and collaborate with other parties.
- **Knowledge Processing Layer**: Analytical, reporting performance management, modelling and visualization tools.
- **Information Integration Layer**: An integrated view that provides the information on how service assets and configuration items are related.
- **Data and Information Services and Tools**: Capturing and maintaining accurate data and information at source.

The last two layers are often referred to as the federated CMDB, and sometimes vendors refer to the whole CMS as a federated CMDB.

The primary purpose of Knowledge Management is to improve efficiency by reducing the need to rediscover knowledge.
The role of Tideway Systems in managing changes and support for the CMS

Accurate configuration management information for an end to end IT service, as illustrated in Figure 2, provides the necessary foundation for an effective change management process. To plan, record and approve a change it is necessary to understand the current state and the planned state. Inaccurate configuration data will have an adverse impact on the change process which will in turn adversely impact IT services. Maintaining accurate configuration data in any medium to large scale IT estate requires a level of automation to address many of the challenges discussed earlier.

The reasons for automating include:

1. The combination of a high number of Configuration Items (CIs) with high numbers of changes (often interrelated) sets an update pace and complexity level that manual processes are unable to handle effectively and efficiently.
2. Relationship data often bridges different organizations and their change processes. Often the only practical way to control and synchronize these changes is to automate the process and data updates.
3. Some relationships are changed automatically with virtualization and fail over systems. In these cases there is no manual process to control the updates.

Tideway Foundation performs scans of the IT estate and records the current discoverable configurations. This discovered data and information can be supplemented through the addition of non-discoverable data such as stakeholder information. By applying specialized knowledge this data is then processed and recorded as CIs with interdependency and communication relationships. The result is a configuration baseline of the IT estate including CI records with relationships of business applications and hardware components providing a mapping of the application architecture to the physical world. It is also possible to target CIs, or groups of CIs, to capture change baselines.

Figure 5 shows how Tideway Foundation supports the CMS by providing meaningful and actionable knowledge of the underlying IT infrastructure.

Fig 5: Tideway’s role in supporting the ITIL® Configuration Management System (CMS)
Tideway Foundation supports the different layers of the CMS as follows:

- **Presentation Layer**: For general users this is primarily provided by other tools such as business service management, service desk or change management tools. Information and data from Tideway Foundation can be integrated to enable people with a change management role to identify risks, dependencies and drill down to detailed configuration information. For specialist users, access can be provided direct via the Tideway Foundation user interface.

- **Knowledge Processing Layer**: Tideway Foundation provides query, analysis, reporting and visualization functions that can be used to interrogate and analyze the discovered configuration information.

- **Information Integration Layer**: Tideway Foundation enables the creation of meaningful business information in this layer. Tideway Foundation APIs and adaptors provide a standard mechanism for integration to feed CMDBs. These include:
  1. **Schema mapping**: Foundation Adaptors provide schema mapping for the integration information layer. For off-the-shelf CMDB products, such as BMC Atrium, Foundation ships with standard mappings that are easily customizable.
  2. **Data reconciliation**: Tideway Foundation can reconcile data from third party data sources, such as network inventory.

- **Data and Information Services and Tools**: Tideway Foundation’s reasoning engine creates detailed configuration item and dependency information that is stored in Foundation’s configuration database. This provides a record of configuration snapshots or configuration baselines.

Information and data from Tideway Foundation can be integrated to enable people with a change management role to identify risks.
A major change to an existing IT service is proposed, approved and entered into the Service Portfolio via the project and change management process. During Service Design the current ‘As-Is’ service configuration is retrieved from the CMS and captured in an ‘As-Is’ configuration baseline. The configuration is then checked:
- To see if there have been any unauthorized or unintended changes that need to be addressed before the new change is implemented;
- To determine the impact on IT policies and standards;
- To determine the impact on current and planned IT services, applications and infrastructure configurations.

A Request for Change is raised to implement a change through the release management process. Figure 6 shows the relationship of change management and configuration management processes for the subsequent steps. It is based on a diagram in the ITIL V3 Service Transition book.

This end-to-end process from request to review helps drive visibility across the Change Schedule (CS), increase the consistency of change, minimize risk and increase the likelihood of the release process working the first time, therefore reducing back-out activities. Many different types of Tideway Foundation reports can be generated to support the process. Examples include showing all changes that have taken place within a release or comparison of baselines.

The following steps illustrate how Tideway Foundation supports the change process:

**Step 1: Record and review the Request for Change**
By referring to CI record(s) that have been verified by Tideway Foundation, or attaching the current baseline as captured by a Foundation baseline report, a change can be registered with the current configuration state of the CI(s) to be changed. The change record should also include the planned state of the configuration so that reviewers and approvers are clear about the scope of the proposed change.

**Step 2: Assess and evaluate change and impact**
The change can be assessed by viewing the relationships to other CIs and therefore the risk and impact can be fully understood. By using business contextual dependency relationships it is also possible to automate the identification of reviewers and approvers for the Change Advisory Board (CAB) by pulling affected CI stakeholders related to the CI(s) to be changed.

**Step 3: Schedule and authorise change**
Once all necessary approvers have been identified and consulted, the change can be authorized or rejected and the change record updated.

**Step 4: Oversee and co-ordinate change implementation**
If approved, the implementation of the change needs to be coordinated with other changes to ensure that no conflicts exist. It may even be necessary to capture a new baseline to ensure the actual configuration is as expected. The easier it is to capture the configuration baseline, the less overhead and user resistance there will be to the change process. If the change is for a release moving into production, a baseline should be taken of all target CIs. Tideway Foundation can simplify this baseline process.

**Step 5: Review and close change**
Once implemented, the change should be reviewed. Ideally, this takes the form of a final baseline to show that the new state reflects the approved change. The configuration should be audited to check that no other changes have taken place since the first baseline. Tideway Foundation can be used to perform before and after scans and will graphically show differences between CIs, making it easy to confirm changes have been applied correctly, and that no unapproved changes have happened.

Following the review, the change can be closed with the relevant closure code and the configuration management records checked to ensure they reflect the closed change. By using Tideway Foundation’s automated discovery and application mapping, the new state will be automatically detected and can be used to quickly verify the change and the configuration records.

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**Fig 6: How the change and configuration management processes work together**

<table>
<thead>
<tr>
<th>Change management</th>
<th>Record and review Request for Change (with baseline)</th>
<th>Assess and evaluate change and impact</th>
<th>Schedule and authorize change</th>
<th>Oversee and co-ordinate change implementation</th>
<th>Review and close change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Configuration management</td>
<td>Repeat configuration information; do audit capture baseline</td>
<td>Identify affected configuration items and other changes</td>
<td>Update records and communicate changes</td>
<td>Update records and capture versions, releases and baselines</td>
<td>Audit and verify change and configuration records are updated</td>
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Configuration Management System CMS
Adopting ITIL V3 service management practices and the service lifecycle approach enables organizations to successfully deliver higher volumes of effective change, as there is more focus on the design, planning and testing of changes. It helps an organization to address the challenges discussed earlier in this paper. Reinforcing and automating these practices with application dependency mapping tools such as Tideway Foundation will significantly increase the accuracy of information, reduce error, speed up the effective throughput of change and ensure a better utilization of resources.

Specifically, the key benefits are:

1. Higher change success rate by ensuring process compliance and by improving the design, impact and risk assessment of change.
2. Increased service availability by reducing outages caused by untested, unapproved changes that produce unexpected consequences.
3. Increased productivity by reducing unplanned work, failed changes and therefore service disruption, defects and re-work for IT staff and the business.
4. More effective and faster decision making by providing accessible and accurate configuration information at the right time for people in many different roles.
5. Optimization and simplification of the IT estate through better design, detection and management of poor quality/non-standard configurations and unauthorized change.
6. Reduced mean time to restore a service or build after a failed change or unauthorized change.
7. Automation of verification that a change has been implemented correctly, preventing errors and the unintended side effects of change that can increase risks building up over time.
8. Improved use of resources and budget by fixing defects early in the service lifecycle where the cost is cheaper.
9. Increased compliance with governance, legal, contractual and regulatory requirements by improving the traceability of changes.
10. Contributions to better estimations of the quality, time and cost of change.

Conclusion

Change management has a significant impact on an IT organization’s operating performance and ability to add value to the business. Adopting the ITIL® V3 service transition practices with appropriate automation will enable your organization to achieve a higher change success rate, optimize the cost of release and deployment of changes and significantly enhance the accuracy of the picture of the IT infrastructure.

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