

Business Process Framework (eTOM)

For The Information and Communications Services Industry

Addendum Y:

Application Note: Use Cases for Commercial Spectrum
Management

GB921 Addendum Y

Version 12.2



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Executive Summary

The objective of this document is to gather Use Cases identified as significant for Security Management within enterprises. The contents have been developed by the Spectrum Management-Network Management Integration team within TM Forum, and published as Technical Report TR171 “Commercial Spectrum Management Use Cases”. This has now been contributed to the Business Process Framework to provide insight into how security management is handled, and as a stimulus for further work, e.g. the development of process flows that address these use cases, material to help refine and enhance existing process definitions, etc. It is being published here as part of the Business Process Framework document suite to further widen its visibility and to position it as a basis for further work, as noted above.

This document is an Application Note, aiming to document an approach based on industry experience that can be used by an organization to help address security management as an aspect of its overall business needs.

Note that, as an Application Note, this material should not be read as normative – i.e. a single standardised approach – but rather as a representative mechanism that provides a useful base for others to build on. Other approaches are also possible. It is the goal of work like this to assist convergence for the industry, but not to impose a single approach, where there are other variations and alternatives that make sense.

1. Introduction

Spectrum management is a critical element of wireless network operations management. In the past, spectrum management has been addressed as an independent physical layer aspect of the wireless service provider network architecture. The growing demand for wireless services worldwide is creating congestion which will demand increasing spectrum flexibility, transparency, sharing, and integration with network management systems and processes. These trends are driving factors in the need to standardize spectrum management architectures, processes, information and data models, applications, interfaces, and testing.

The need for standardization of spectrum management data exchange is well recognized within multi-national military operations community, as illustrated by the development by NATO countries of the open standard, Spectrum Management Allied Data Exchange Format (SMADEF). SMADEF has been adopted in the US as the Department of Defense Standard Spectrum Resource Format (SSRF). In addition, the defense community has well established spectrum management business processes, owing to the complex environment in which the military operates.

As commercial operators face increasing pressure to deliver more advanced services in a constrained spectrum environment, they face some of the same challenges as the defense community. The use cases in this document are intended to highlight the situations in which commercial operators must factor spectrum constraints to an increasing degree. The objective is to identify common processes employed by the commercial service provider (CSP) community to ensure that the TM Forum Business Process Framework adequately captures the requisite processes across the board. It should be noted that spectrum is one of many challenges facing the CSP. The impact of backhaul architecture on service delivery is an equally critical aspect of network operations; however, for the purposes of this report, backhaul is not being considered as a constraint.

This report is organized around six use cases in which spectrum management processes play key roles. Each use case is presented as a process flow, leveraging existing processes from the eTOM, down to Level 3. The intent is not to capture the entirety of the complex process flow for each use case, but rather to capture those processes in the flow in which spectrum management plays a key role. In addition, each use case is supported by a process flow diagram overlaid on the eTOM graphic. Actors listed for each use case are derived from the eTOM vertical end-end process groupings, based on the expectation that process functionality for spectrum is implemented in systems that align with these process groupings.

The Use Cases that were evaluated during this mapping exercise include:

1. Initial Network Planning
2. Interference Reporting and Resolution
3. Surge Event Planning and Network Reconfiguration
4. Congestion Driven Service Strategy Revision
5. Next Generation Technology Migration
6. Disaster Event – Network Recovery

In addition to delivering this Technical Report, the project team will open a change request to address Spectrum Management context specific recommendations for improvement to the Business Process Framework (eTOM) team.

This document is intended to be a starting place for Commercial Spectrum Use Cases. Depending on member interest, future projects may address other Use Cases and/or Business Process (eTOM) mapping to level 3 or 4 processes.

2. Use Case 1: Initial Network Planning

Use Case 1: Initial Network Planning

2.1. Characteristic Information

The following information characterizes this particular use case. Each piece of information is important and crucial to communicating the necessary understanding regarding the purpose of this Use Case.

In planning a new service offering in a new market, the wireless commercial service provider must engage in a range of planning and acquisition processes to design, acquire and develop the infrastructure. These processes include the planning for spectrum acquisition. The utilization of the spectrum resource will depend on a number of factors that strive to balance market coverage, service pricing and performance, and cost of the physical plant against projected revenue. Spectrum planning and re-use are examples of key factors that must be taken into account.

Type:	Business View
Scope:	Spectrum Management
Level:	Mapped to Business Process Framework (eTOM) Levels 0, 1, 2, and in some cases 3
Audience:	Commercial Wireless Service Providers
Primary Actor(s):	Strategic Planning; Regulatory Relations
Supporting Actor(s):	Network Engineering
Stakeholder Goals:	Optimize the utilization of spectrum resources to achieve objectives of business plan
Policies Used:	NA
Processes Used:	See Main Success Scenario process mapping (below)
Pre-Conditions:	Successful Initial Investment to Pursue
Post-Conditions:	Successful Licensing of Commercial-use Spectrum
Triggers:	Announcement of planned spectrum auction

2.2. Main Success Scenario

This Scenario describes the steps that are taken from trigger event to goal completion when everything works without failure. It also describes any required cleanup that is done after the goal has been reached. The steps are listed below:

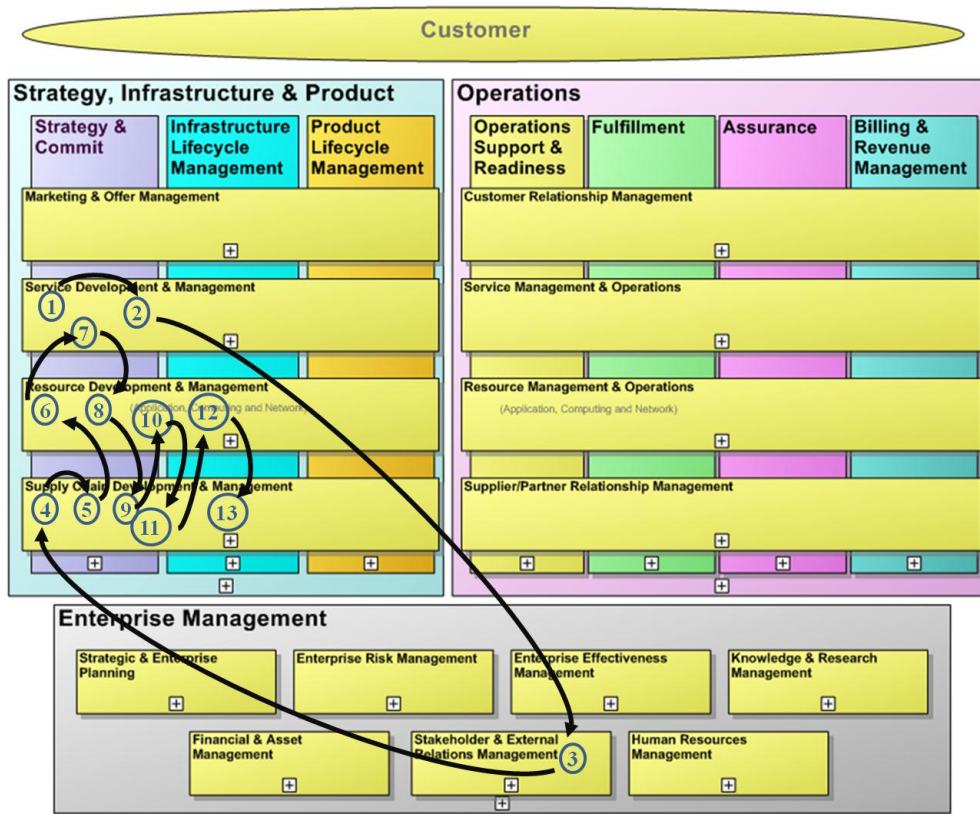


Figure 1 - Initial Network Planning Use Case Illustration

<u>Step</u>	<u>Actor</u>	<u>Action Description</u>
1	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Service Development & Management (2) Service Strategy & Planning (3) Establish Service Strategy and Goals</p> <p>The first step in this use case involves defining the strategy and goals associated with the wireless communications services to be developed. Key aspects of strategy may involve the service level discriminators with existing competition in the market. Examples of discriminators may include: optimizing for data service delivery; maximizing coverage; minimizing call blocking; and many others. The strategy and goals provide critical inputs into the development of infrastructure plans to deliver services. Central to this will be the ability to leverage the available spectrum (anticipated to be available) to achieve the service goals.</p>
2	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Service Development & Management (2) Service Strategy & Planning (3) Produce Service Business Plans</p> <p>A business strategy is developed in coordination with the service strategy, to ensure that a valid business proposal underlies the proposed service strategy. The business plan provides key inputs to subsequent processes which include targeted markets and user profiles.</p>

3	Enterprise Management	<p>(0) Enterprise Management (1) Stakeholder & External Relations Management (2) Regulatory Management</p> <p>As a wireless service provider, the CSP must establish early on the necessary stakeholder relationship with the national regulator, to ensure that regulatory considerations are fully understood in the development of subsequent plans and goals. This enterprise relationship is important in understanding the regulatory and technical details associated with the triggering event, the auction of new spectrum.</p>
4	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Supply Chain Development & Management (2) Supply Chain Strategy & Planning (3) Gather and Analyze Supply Chain Information</p> <p>Information is gathered and a thorough analysis is conducted on the spectrum auction (spectrum supply chain). This establishes a well-developed foundation of regulatory and technical constraints which must be taken into account throughout subsequent processes.</p>
5	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Supply Chain Development & Management (2) Supply Chain Strategy & Planning (3) Establish Supply Chain Strategy and Goals</p> <p>Based on the information and analysis developed in the previous step, a strategy is developed to pursue the acquisition of the spectrum through the national regulatory auction proceedings.</p>
6	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Strategy & Planning (3) Establish Resource Strategy and Architecture</p> <p>With the necessary service strategy and business plan in place and with the required technical and regulatory constraints on the target spectrum, a strategy is developed along with a resource architecture that can deliver the service goals with the anticipated available spectrum. This provides the first evidence of the full scope of resources required and the expected utilization and re-use of the target spectrum. This provides necessary input to develop the remaining elements of the business plan</p>
7	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Service Development & Management (2) Service Strategy & Planning (3) Gain Enterprise Commitment to Service Strategies</p> <p>At this step, the necessary business proposal and supporting evidence are available to the enterprise authority for committing the required resources to execute the plan.</p>
8	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Strategy & Planning (3) Produce Resource Business Plans</p> <p>Upon approval of the service strategy, a resource business plan is developed to establish the timetable and logistics for new resource capability introduction. In the case of wireless services, this process produces the guiding vision for infrastructure deployment and service roll-out.</p>
9	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Supply Chain Development & Management (2) Supply Chain Strategy & Planning</p>

		<p>(3) Produce Supply Chain Business Plans Upon approval of the service strategy, a plan is developed to guide the bid and proposal effort required to pursue the award of a spectrum license.</p>
10	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Strategy & Planning (3) Gain Enterprise Commitment to Resource Plans Prior to committing to spectrum acquisition, the resource plan must be reviewed and approved.</p>
11	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Supply Chain Development & Management (2) Supply Chain Strategy & Planning (3) Gain Enterprise Commitment to Supply Chain Plans The final approval step is the commitment to the supply chain plan for pursuit and acquisition of the necessary spectrum.</p>
12	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Capability & Delivery (3) Gain Resource Capability Investment Approval With all the requisite plans in place and approved, the enterprise is ready to make the decision regarding the investment in resources. One of the most significant of which will be the spectrum resource.</p>
13	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Supply Chain Development & Management (2) Supply Chain Capability Delivery (3) Gain Tender Decision Approval This step reflects the final approval prior to the submission to the regulator of the enterprise spectrum auction bid.</p>

2.3. Scenario Extensions

This is a listing of how each step in the Main Success Scenario can be extended. Another way to think of this is how can things go wrong. The extensions are followed until either the Main Success Scenario is rejoined or the Failed End Condition is met. The Step refers to the Branch Step in the Main Success Scenario and has a letter associated with it. I.E if Step 3 branches the Extension Step is 3a.

<u>Step</u>	<u>Condition</u>	<u>Action Description</u>
	Regulator adjusts technical or other constraints during the auction planning process in response to marketplace feedback on proposed auction conditions	TBD in future version
	Spectrum valuation is impacted during the initial planning process by external factors, which may include regulatory actions in other bands at the national or international level	TBD in future version



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2.4. Open Issues

The following table provides insight to any unresolved problems or questions. These are the things that seem to apply but could not be fit into this use case on this pass.

<u>Issue ID</u>	<u>Issue Description</u>
1	Based on review of the current eTOM, it is not clear whether regulatory processes identified in this use case are appropriately addressed as Supplier/Partner processes. The relationship with the regulator is different from the typical supplier/partner relationship, as evidenced by the presence of the unique process in the Enterprise Management domain for establishing and maintaining the Regulatory Management relationship.



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3. Use Case 2: Interference Reporting and Resolution

Use Case 2: Interference Reporting and Resolution

3.1. Characteristic Information

The following information characterizes this particular use case. Each piece of information is important and crucial to communicating the necessary understanding regarding the purpose of this Use Case.

Once a commercial wireless service provider has established an operational infrastructure, operations management must certainly take into account the potential for electro-magnetic interference at the air-interface. Interference could be identified through equipment performance monitoring, or through a higher level service monitoring function in the OSS. Once identified, the interference may dictate immediate mitigation processes or service/resource reconfiguration as a work around. Reconfiguration could necessitate re-planning of spectrum to isolate the degraded channel(s) while still maintaining a consistent, albeit reduced level of service across the coverage area. A process is initiated to identify and resolve the source of the interference. The resolution process may require coordination through the national agency which has regulatory authority over the spectrum.

Type:	Business View
Scope:	Spectrum Management
Level:	Mapped to Business Process Framework (eTOM) Levels 0, 1, 2, and in some cases 3
Audience:	Commercial Wireless Service Providers
Primary Actor(s):	Network Operations
Supporting Actor(s):	Network Engineering
Stakeholder Goals:	Minimize the impact of interference on the delivery of services
Policies Used:	NA
Processes Used:	See Main Success Scenario process mapping (below)
Pre-Conditions:	Successful delivery of services
Post-Conditions:	Successful resolution of interference
Triggers:	Resources Performance Degradation; Service performance degradation

3.2. Main Success Scenario

This Scenario describes the steps that are taken from trigger event to goal completion when everything works without failure. It also describes any required cleanup that is done after the goal has been reached. The steps are listed below:

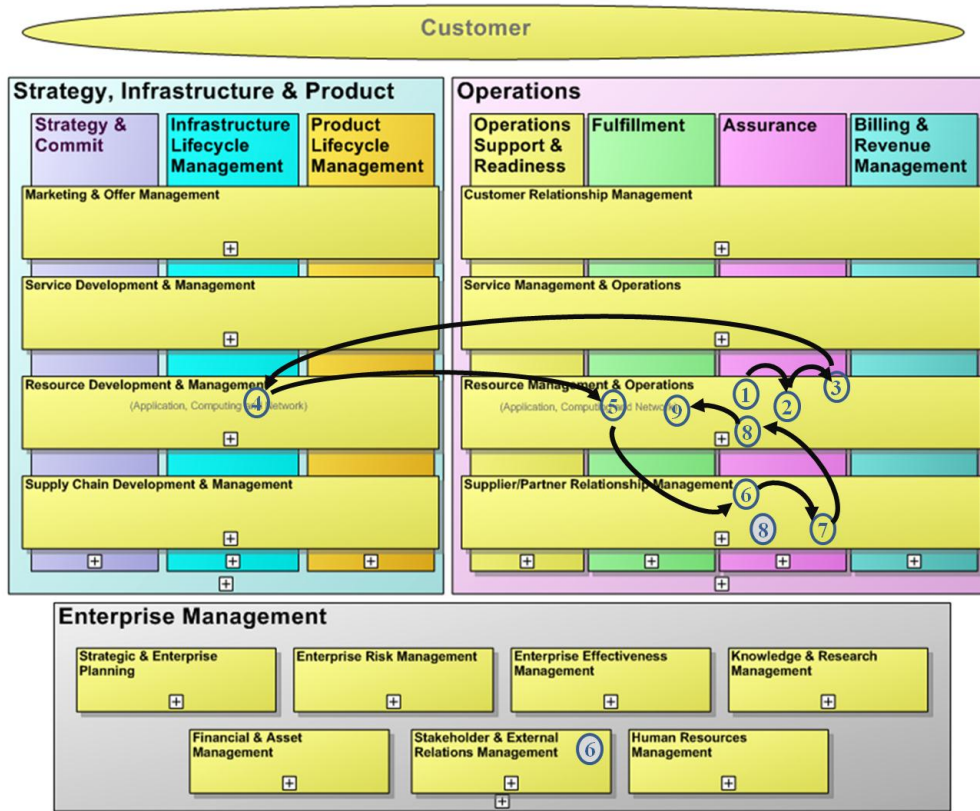


Figure 2 – Interference Reporting and Resolution Use Case Illustration

<u>Step</u>	<u>Actor</u>	<u>Action Description</u>
1	Assurance	<p>(0) Operations (1) Resource Management & Operations (2) Resource Performance Management (3) Create Resource Performance Degradation Report</p> <p>This use case begins at the creation of a resource degradation report, which may be triggered by a number of processes from either RM&O or SM&O. In the context of spectrum interference, the impact may be initially observed in the degradation of service experienced by the user. Alternatively, there may be a simultaneous alert generated by a performance degradation in a specific resource element, in particular, the transmit/receive equipment supporting the air-interface that is impacted by the interference. In any event, the result will be the creation of a resource degradation report.</p>
2	Assurance	<p>(0) Operations</p>

		<p>(1) Resource Management & Operations (2) Resource Performance Management (3) Analyze Resource Performance</p> <p>Following the reporting of degraded performance, analysis is initiated to determine the underlying root cause of the degradation. In the case of spectrum interference, the root cause lies outside the infrastructure under the immediate control of the operator. Resolution of interference will necessarily involve the coordination with external actors to resolve.</p>
3	Assurance	<p>(1) Operations (2) Resource Management & Operations (3) Resource Performance Management (4) Track and Manage Resource Performance Resolution</p> <p>Following the determination that the issue does not originate within the control of the CSP, a process is needed to develop relevant situational awareness that can provide insight into external factors that underlie the resource performance degradation. In the case of spectrum interference, the CSP may be able to utilize existing resource management data to correlate with the degradation report for the purpose of narrowing the scope of the resolution process. The output of this process is expected to expedite the resolution. In addition, a better estimate of the anticipated duration of the degraded performance is expected to result. In selected cases, this process may lead directly to external relations activities which can quickly result in the elimination of the spectrum interference.</p>
4	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure, & Product (1) Resource Management & Operations (2) Resource Capability Delivery (3) Design Resource Capabilities</p> <p>If the resolution of the interference is not immediately achievable, as is often the case, resource re-configuration may be required to address the shortfall in coverage resulting from the loss of frequency channels due to interference. An engineering process is initiated to determine an alternate resource configuration that most effectively distributes the remaining spectrum across the physical infrastructure to maximize coverage, capacity, or other key performance criteria based on the service strategy and business plan.</p>
5	Fulfillment	<p>(0) Operations (1) Resource Management & Operations (2) Resource Provisioning (3) Configure and Activate Resource</p> <p>Based on the resource re-engineering, the operational support systems execute the necessary configuration changes to implement the temporary mitigation to the spectrum interference.</p>
6	Assurance	<p>(0) Operations (1) Supplier/Partner Relationship Management (2) Supplier/Partner Problem Reporting & Management (3) Initiate Supplier/Partner Problem Report</p> <p>Due to the external nature of the spectrum interference identified, a process is needed to address the coordination with the resource supplier, which in the case of spectrum, is the national regulatory authority. The role of enforcement ultimately resides with the regulator. An alternate home for this process would be :</p> <p>EM: S&ERM: Regulatory Management</p>
7	Assurance	<p>(0) Operations (1) Supplier/Partner Relationship Management</p>



		<p>(2) Supplier/Partner Performance Management (3) Track and Manage Supplier/Partner Problem Resolution After initiating the problem report to the regulator, the subsequent process is needed to maintain interaction with the regulator throughout the problem resolution timeframe.</p>
8	Assurance	<p>(0) Operations (1) Resource Management & Operations (2) Resource Performance Management (3) Close Resource Performance Degradation Report Upon the successful resolution of the spectrum interference, associated issue reports are closed</p>
9	Fulfillment	<p>(0) Operations (1) Resource Management & Operations (2) Resource Provisioning (3) Configure and Activate Resource The final process is taken to restore the configuration of resources to the original configuration based on resource capability design developed during initial network planning.</p>

3.3. Scenario Extensions

This is a listing of how each step in the Main Success Scenario can be extended. Another way to think of this is how can things go wrong. The extensions are followed until either the Main Success Scenario is rejoined or the Failed End Condition is met. The Step refers to the Branch Step in the Main Success Scenario and has a letter associated with it. I.E if Step 3 branches the Extension Step is 3a.

<u>Step</u>	<u>Condition</u>	<u>Action Description</u>
	None for this version	

3.4. Open Issues

The following table provides insight to any unresolved problems or questions. These are the things that seem to apply but could not be fit into this use case on this pass.

<u>Issue ID</u>	<u>Issue Description</u>
1	Based on review of the current eTOM, it is not clear whether regulatory issues identified in this use case are appropriately addressed as Supplier/Partner processes. The relationship with the regulator is different from the typical supplier/partner relationship, as evidenced by the presence of the unique process in the Enterprise Management domain for establishing and maintaining the Regulatory Management relationship. This issue is highlighted in step 6 of this use case.

4. Use Case 3: Surge Event Planning and Network Reconfiguration

Use Case 3: Surge Event

4.1. Characteristic Information

The following information characterizes this particular use case. Each piece of information is important and crucial to communicating the necessary understanding regarding the purpose of this Use Case.

In the course of network operations, there may be planned events which will drive the network traffic load beyond the limits anticipated when the network was originally designed. An example of this might be a sporting event, in which large numbers of people converge in a small area for relatively short periods of time. An example of this type of event would be the International Olympics. In these cases, the service provider may need to deploy additional infrastructure (e.g. Cell-on-Wheels), which would necessitate the re-planning of spectrum resources to enable increased service capacity.

Type:	Business
Scope:	Spectrum Management
Level:	Mapped to Business Process Framework (eTOM) Levels 0, 1, 2, and in some cases 3
Audience:	Commercial Wireless Service Providers
Primary Actor(s):	Network Operations
Supporting Actor(s):	Network Engineering
Stakeholder Goals:	Increase the number of wireless users that the network can support, in a localized geographic region
Policies Used:	NA
Processes Used:	See Main Success Scenario process mapping (below)
Pre-Conditions:	Network fully operational for original target market
Post-Conditions:	Network architecture enhancements are fully operational to support increased number of users and volume of traffic in the location of the event
Triggers:	A high capacity event has been planned

4.2. Main Success Scenario

This Scenario describes the steps that are taken from trigger event to goal completion when everything works without failure. It also describes any required cleanup that is done after the goal has been reached. The steps are listed below:

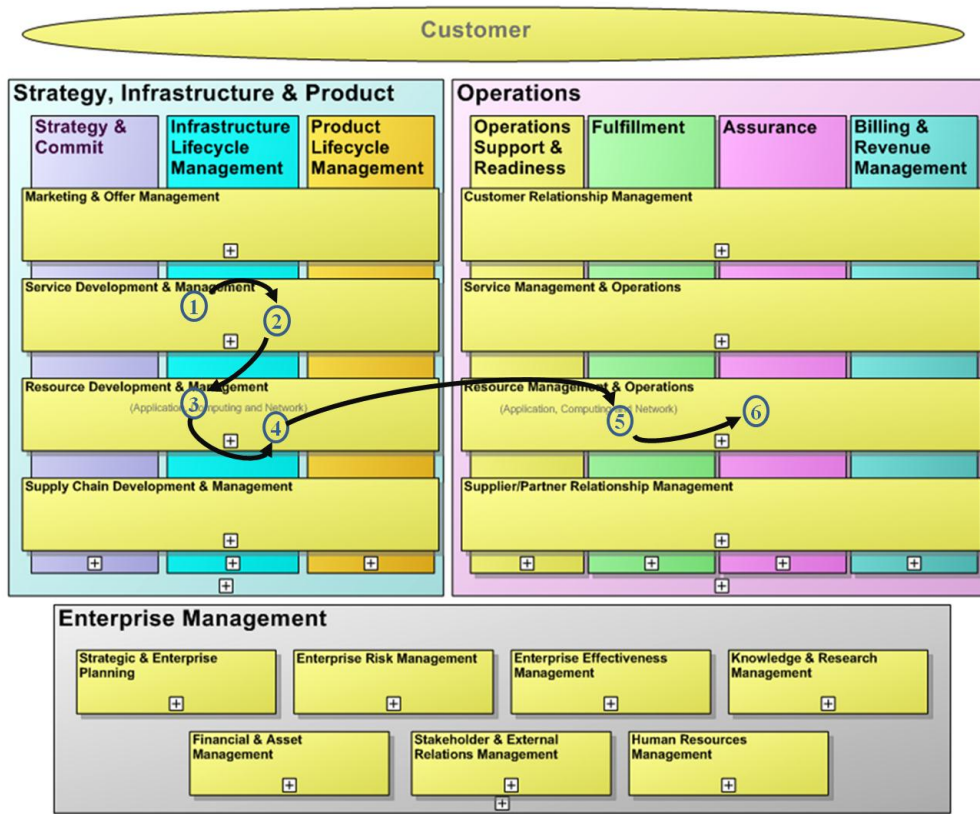


Figure 3 – Surge Event Use Case Illustration

<u>Step</u>	<u>Actor</u>	<u>Action Description</u>
1	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Service Development & Management (2) Service Capability Delivery (3) Map & Analyze Service Requirements</p> <p>In this use case, following the announcement of a large event in the service provider’s coverage area, a process is initiated to determine the anticipated stress that would be placed on the existing services and additional requirements that would need to be addressed to maintain the service as defined in the original service strategy and goals.</p>
2	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Service Development & Management (2) Service Capability Delivery (3) Capture Service Capability Shortfalls</p> <p>Based on the requirements analysis, a shortfall in capability to deliver services is identified.</p>
3	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Capability Delivery (3) Capture Resource Capability Shortfalls</p> <p>Based on the service shortfall, analysis is conducted to determine the shortfall in terms of resources required to maintain services. In many cases, the spectrum resource is a limiting factor, which cannot be</p>



		addressed directly through resource acquisition. As a result, the focus in this process is on the necessary resources that would enable increased spectrum utilization within the constrained geographic area of the event.
4	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Capability & Delivery (3) Design Resource Capability</p> <p>Based on the resource capability shortfall, a design process is initiated to determine the architectural enhancements in the network required to support the service shortfall. Given the fact that spectrum is a constrained resource, the enhancement of the network in the target area will require adjustments to spectrum utilization in the surrounding area as well. A key output of this process would be a revised spectrum plan for the entire impacted area. There are additional processes required to acquire the necessary resources, but these are skipped over for now since they do not directly impact spectrum.</p>
5	Fulfillment	<p>(0) Operations (1) Resource Management & Operations (2) Resource Provisioning (3) Configure and Activate Resources</p> <p>The configuration and activation of the architecture enhancement would require a complex process of bringing new transmitters/receivers on-line, while simultaneously adjusting the configuration of adjacent operations. Prior to full service activation over the newly installed infrastructure, a test resource process is needed to ensure service delivery. This process completes with the full activation of the service delivery.</p>
6	Assurance	<p>(0) Operations (1) Resource Management & Operations (2) Resource Performance Management (3) Monitor Resource Performance</p> <p>In the case of this type of temporary architecture augmentation, the monitor resource performance process is even more critical, given the challenges of limited ability to fully test the augmentation before activating services.</p>

4.3. Scenario Extensions

This is a listing of how each step in the Main Success Scenario can be extended. Another way to think of this is how can things go wrong. The extensions are followed until either the Main Success Scenario is rejoined or the Failed End Condition is met. The Step refers to the Branch Step in the Main Success Scenario and has a letter associated with it. I.E if Step 3 branches the Extension Step is 3a.

<u>Step</u>	<u>Condition</u>	<u>Action Description</u>
	None for this version	

4.4. Open Issues

The following table provides insight to any unresolved problems or questions. These are the things that seem to apply but could not be fit into this use case on this pass.

<u>Issue ID</u>	<u>Issue Description</u>
	None for this version.

5. Use Case 4: Congestion Driven Service Strategy Revision

Use Case 4: Service Strategy Revision

5.1. Characteristic Information

The following information characterizes this particular use case. Each piece of information is important and crucial to communicating the necessary understanding regarding the purpose of this Use Case.

As user traffic continues to increase, creating congestion at the air-interface and possibly in the backhaul infrastructure, a process flow is initiated to begin strategic planning for the revision of service strategy. The goal is to reduce congestion at the air-interface through changes in service pricing, quality of service (QoS) differentiation and the incorporation of alternative service delivery mechanisms that leverage unlicensed spectrum through WiFi access points. Strategic considerations include the customer incentives, tiered pricing structures, additional infrastructure required, time to roll out new features, and the resulting impact in terms of reduced congestion in the licensed spectrum.

Type:	Business View
Scope:	Spectrum Management
Level:	Mapped to Business Process Framework (eTOM) Levels 0, 1, 2, and in some cases 3
Audience:	Commercial Wireless Service Providers
Primary Actor(s):	Strategic Planning; Regulatory Relations
Supporting Actor(s):	Network Engineering
Stakeholder Goals:	Optimize the utilization of spectrum resources to achieve objectives of business plan
Policies Used:	NA
Processes Used:	See Main Success Scenario process mapping (below)
Pre-Conditions:	Network fully operational
Post-Conditions:	Successful reduction in congestion, increased service delivery overall
Triggers:	Service Performance Monitoring indicates increasing congestion at the air-interface

5.2. Main Success Scenario

This Scenario describes the steps that are taken from trigger event to goal completion when everything works without failure. It also describes any required cleanup that is done after the goal has been reached. The steps are listed below:

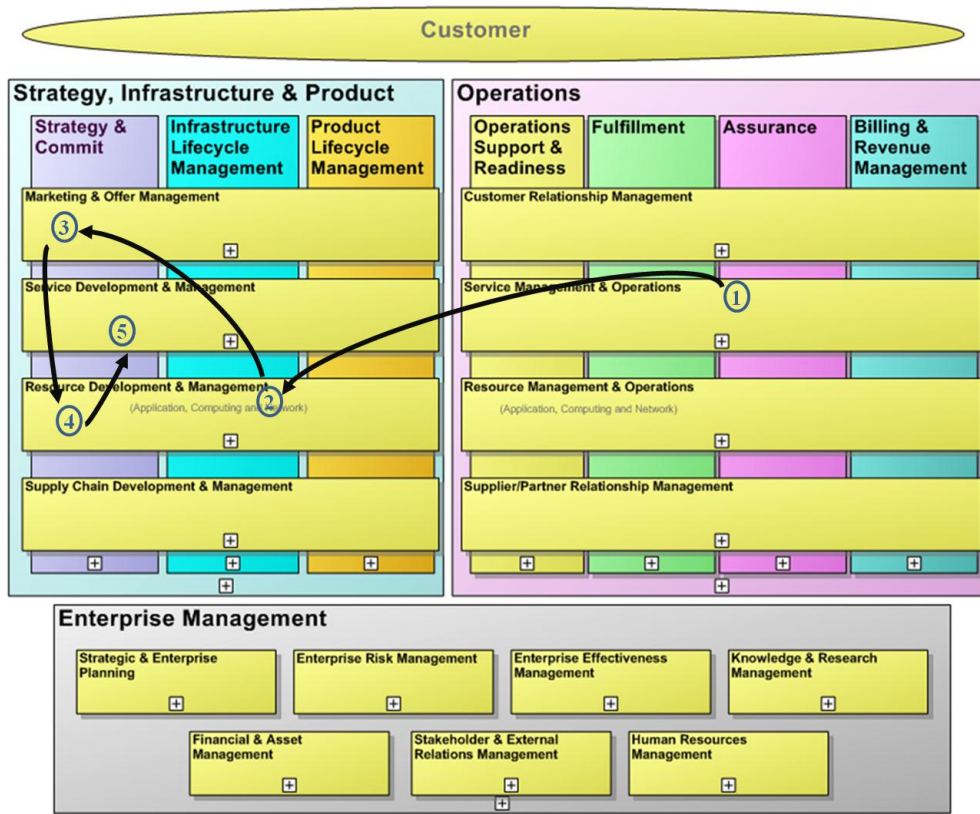


Figure 4 – Service Strategy Revision Use Case Illustration

<u>Step</u>	<u>Actor</u>	<u>Action Description</u>
1	Assurance	<p>(0) Operations (1) Service Management & Operations (2) Service Quality Management (3) Report Service Quality Performance</p> <p>This use case begins with early indications of declining service quality that directly points to congestion on the air-interface. Indications may include increased delay in data delivery, or increased dropped calls, handover failures, or increased delay in time to process new calls. While increased latency in data transport may result from backhaul congestion, it is anticipated that service quality monitoring could resolve the two cases to correctly identify the instances when the root cause results from congestion on the air-interface. As part of this process, the determination is made that the service quality trend is not related to short term fluctuations in traffic, but represents a persistent trend over a long timeframe.</p>
2	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Capability Delivery (3) Map & Analyze Resource Requirements</p> <p>The decline in service quality triggers a process to review the resource requirements to determine the extent to which an architectural change in the wireless infrastructure can increase spectrum re-use in areas of</p>

		highest user density and mitigate the decline in service quality.
3	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Marketing & Offer Management (2) Market Strategy & Policy (3) Gather & Analyze Market Information</p> <p>In parallel with the resource requirements analysis, market analysis is developed to correlate the declining service quality with anticipated trends in the market place.</p>
4	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Strategy & Planning (3) Establish Resource Strategy and Architecture</p> <p>Long-term trends in the market are compared with the benefits of network architecture modification to determine the extent to which the modifications will address these trends. As a result it is concluded that changes in the network architecture will only provide short term benefits in the face of overall market trends. The conclusion is that overall service strategy needs to be reviewed.</p>
5	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Service Development & Management (2) Service Strategy & Planning (3) Establish Service Strategy and Goals</p> <p>Based on input from market analysis and current architecture capabilities, a revised strategy is developed to enhance service offerings to include broadband data services through WiFi enabled handsets. Alternatives are also considered to alter customer use profiles through tiered pricing plans coupled with tiered QoS service level definitions. Analysis is performed to balance the costs of service modifications and the timeframe for new product deployments against the anticipated market trend and resulting off-loading of traffic onto unlicensed spectrum. The final analysis is the anticipated improvement in service delivery over licensed spectrum over the timeframe of the available market projections.</p>

5.3. Scenario Extensions

This is a listing of how each step in the Main Success Scenario can be extended. Another way to think of this is how can things go wrong. The extensions are followed until either the Main Success Scenario is rejoined or the Failed End Condition is met. The Step refers to the Branch Step in the Main Success Scenario and has a letter associated with it. I.E if Step 3 branches the Extension Step is 3a.

<u>Step</u>	<u>Condition</u>	<u>Action Description</u>
	None for this version	

5.4. Open Issues

The following table provides insight to any unresolved problems or questions. These are the things that seem to apply but could not be fit into this use case on this pass.

<u>Issue ID</u>	<u>Issue Description</u>
	None for this version.

6. Use Case 5: Next Generation Technology Migration

Use Case 5: Technology Migration

6.1. Characteristic Information

The following information characterizes this particular use case. Each piece of information is important and crucial to communicating the necessary understanding regarding the purpose of this Use Case.

Technology advances rapidly in the area of mobile communications. Competition drives the service providers to continually invest in the upgrading of infrastructure to support new technology which enables increased capacity for delivery of services. The deployment of new infrastructure to support next generation technology requires the operator to re-plan spectrum to allow the coexistence of infrastructure that supports both the current and the next generation technology. The reassignment of spectrum to new technology must be done on a gradual basis, ensuring that as new end-user devices are sold, sufficient spectrum resources are assigned to support the new traffic loads, while maintaining adequate service delivery to the existing customer base. It is often the case that new technology is deployed over newly licensed spectrum, providing in effect a clean slate for design. This use case intends to capture the processes associated with the inevitable transition within existing spectrum from old to new technology solutions.

Type:	Business View
Scope:	Spectrum Management
Level:	Mapped to Business Process Framework (eTOM) Levels 0, 1, 2, and in some cases 3
Audience:	Commercial Wireless Service Providers
Primary Actor(s):	Strategic Planning; Network Engineering
Supporting Actor(s):	Regulatory Relations
Stakeholder Goals:	Optimize the utilization of spectrum resources to support the migration to next generation technology for advanced service delivery
Policies Used:	NA
Processes Used:	See Main Success Scenario process mapping (below)
Pre-Conditions:	Network fully operational
Post-Conditions:	Coordinated migration of user devices and network infrastructure while maintaining service performance for both existing and new technology users.
Triggers:	Updated service strategy to deploy next generation technology and enhanced services.

6.2. Main Success Scenario

This Scenario describes the steps that are taken from trigger event to goal completion when everything works without failure. It also describes any required cleanup that is done after the goal has been reached. The steps are listed below:

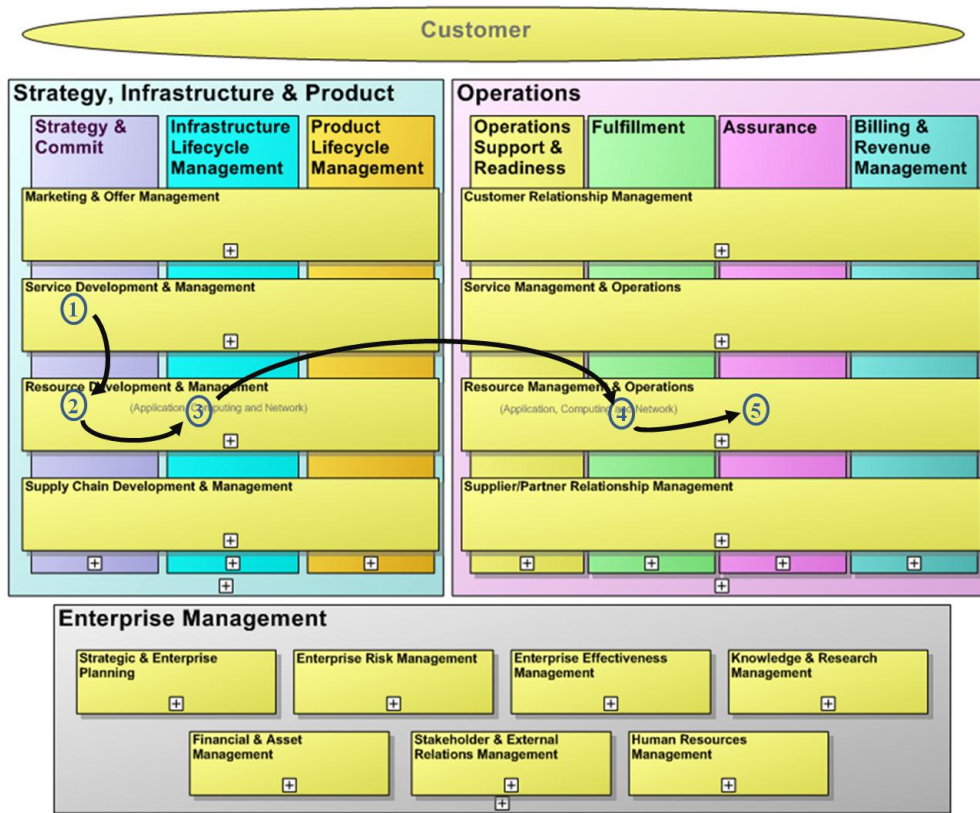


Figure 5 – Technology Migration Use Case Illustration

<u>Step</u>	<u>Actor</u>	<u>Action Description</u>
1	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Service Development & Management (2) Service Strategy & Planning (3) Establish Service Strategy & Goals</p> <p>In this use case, based on the evolving marketplace, a strategy is created to develop and deliver enhanced services. A key aspect of this process is the consideration of spectrum resources required to deliver the enhanced services. The main success scenario of this process flow assumes that no additional spectrum is required</p>
2	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Strategy & Planning (3) Establish Resource Strategy & Architecture</p> <p>A strategy is developed to revise the existing infrastructure architecture</p>



		to support next generation technology. The Spectrum assignment to new technology is planned. A phased approach is developed to support expected migration of user population from existing to next generation devices. As the enhanced services and supporting devices grow and replace older devices/services, the smooth migration of spectrum assignment from the old infrastructure to the new one must be considered.
3	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Capability Delivery (3) Design Resource Capabilities</p> <p>Based on the approval of the service and resource strategies, a detailed engineering process is initiated to develop the infrastructure architecture necessary to deliver the enhanced services. Detailed spectrum analysis and planning is a critical element in this process. The locations of transmitters and power levels required to support the new services over the target coverage area are examples of the key spectrum-related constraints to the design.</p>
4	Fulfillment	<p>(0) Operations (1) Resource Management & Operations (2) Resource Provisioning (3) Configure and Active Resource</p> <p>Once the enhanced infrastructure is installed, the resources must be configured and activated for operation. While the detailed engineering analysis was performed to plan spectrum assignment for new resources, the activation of new wireless equipment requires a careful process of bringing transmitters on-line and confirming that propagation and spectrum re-use/interference analyses were correct.</p>
5	Assurance	<p>(0) Operations (1) Resource Management & Operations (2) Resource Performance Management (3) Monitor Resource Performance</p> <p>Following the activation of the new services, a heightened level of activity is expected in the monitoring process to ensure that unanticipated conditions do not degrade the delivery of new services, or negatively impact the delivery of the legacy infrastructure.</p>

6.3. Scenario Extensions

This is a listing of how each step in the Main Success Scenario can be extended. Another way to think of this is how can things go wrong. The extensions are followed until either the Main Success Scenario is rejoined or the Failed End Condition is met. The Step refers to the Branch Step in the Main Success Scenario and has a letter associated with it. I.E if Step 3 branches the Extension Step is 3a.

<u>Step</u>	<u>Condition</u>	<u>Action Description</u>
	Initial strategy planning determines that additional spectrum resources are required	TBD in future version
	Activation of new service infrastructure results in	TBD in future version

	unanticipated spectrum interference	
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6.4. Open Issues

The following table provides insight to any unresolved problems or questions. These are the things that seem to apply but could not be fit into this use case on this pass.

<u>Issue ID</u>	<u>Issue Description</u>
	None for this version.

7. Use Case 6: Disaster Event – Network Recovery

Use Case 6: Network Recovery

7.1. Characteristic Information

The following information characterizes this particular use case. Each piece of information is important and crucial to communicating the necessary understanding regarding the purpose of this Use Case.

In severe disaster scenarios, communications infrastructure can be severely impacted or destroyed. In the face of reduced infrastructure resources, spectrum re-planning may be required to exploit available resources to extend coverage to the maximum extent possible, using limited wireless infrastructure. In areas where infrastructure has been destroyed, close coordination with first responder organizations may be required to enable the use of licensed spectrum to support emergency/disaster relief operations using non-service provider owned equipment.

Type:	Business View
Scope:	Spectrum Management
Level:	Mapped to Business Process Framework (eTOM) Levels 0, 1, 2, and in some cases 3
Audience:	Commercial Wireless Service Providers
Primary Actor(s):	Network Engineering
Supporting Actor(s):	Strategic Planning
Stakeholder Goals:	Recover as quickly as possible from a disaster event that may cripple or destroy critical resources in the infrastructure
Policies Used:	NA
Processes Used:	See Main Success Scenario process mapping (below)
Pre-Conditions:	Network fully operational
Post-Conditions:	Limited restoration of operations, based on critical priorities dictated by strategic planning (e.g. coverage over capacity) and external stakeholder coordination
Triggers:	Cascading alarms from OPS processes in service and resource management processes, in the aftermath of a regional disaster event

7.2. Main Success Scenario

This Scenario describes the steps that are taken from trigger event to goal completion when everything works without failure. It also describes any required cleanup that is done after the goal has been reached. The steps are listed below:

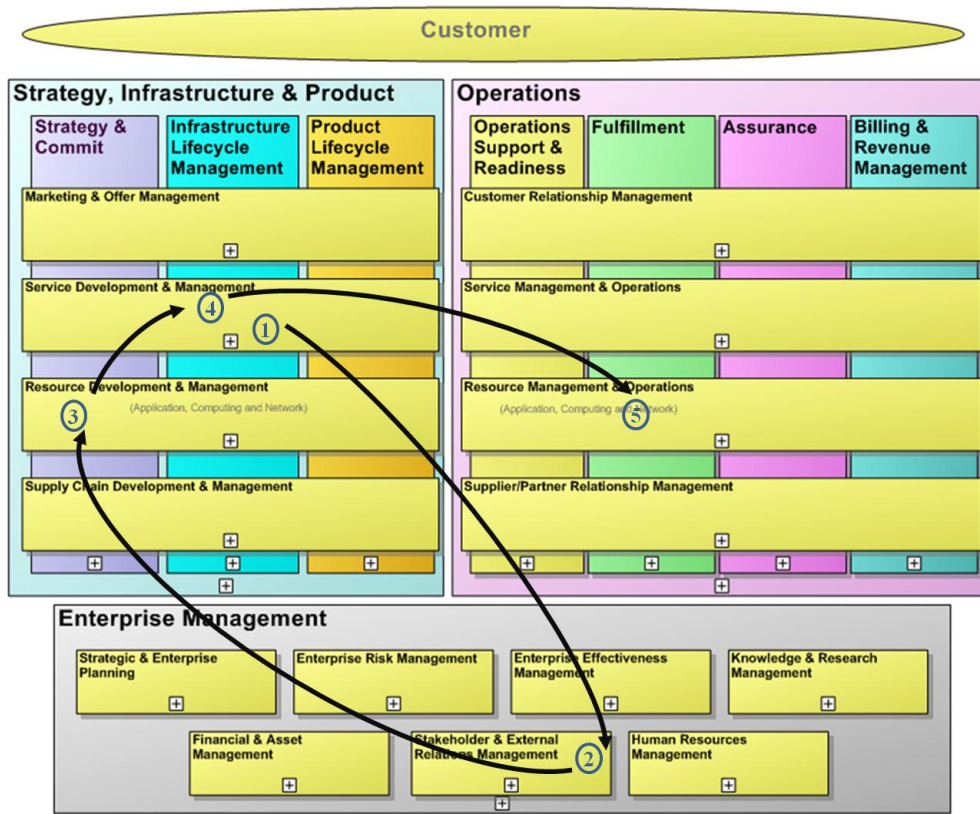


Figure 6 – Network Recover Use Case Illustration

<u>Step</u>	<u>Actor</u>	<u>Action Description</u>
1	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Service Development & Management (2) Service Capability Delivery (3) Manage Handover to Service Operations</p> <p>This use case begins with cascading alarms which are expected to result in the initiation of many of the same process elements that were executed during the handover to service operations. A determination is made regarding the extent to which the remaining service infrastructure is capable of continuing service delivery and in conjunction a determination is made of the region of operations where service delivery capability has been impacted.</p>
2	Enterprise Management	<p>(0) Enterprise Management (1) Stakeholder & External Relations Management (2) Regulatory Management</p> <p>Given the critical nature of wireless communications in supporting the first responder activity in the aftermath of a disaster, close coordination with appropriate local and federal authorities is expected regarding the nature of the event, anticipated first responder activity and related disaster impact that may hinder the restoral of operations during the disaster response period. External stakeholders may include Government disaster response and management organizations and the spectrum regulator.</p>



3	Strategy and Commit	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Strategy & Planning (3) Establish Resource Strategy and Architecture</p> <p>Based on the impacted area, spectrum re-planning is evaluated along with other options to extend service delivery using available resource capability. Based on coordination with external authorities, deployable resources are considered to restore infrastructure. Spectrum planning will be a key element to enabling the maximum coverage area, with the minimum set of resources in the near-term. Long-term restoral planning is initiated, but will likely extend beyond the immediate restoral of limited service. This process continues the coordination with external stakeholder's that may be able to provide deployable resources to enable service restoral. The strategy may include secondary usage of spectrum by disaster response and management for limited time.</p>
4	Infrastructure Lifecycle Management	<p>(0) Strategy, Infrastructure & Product (1) Resource Development & Management (2) Resource Capability Delivery (3) Design Resource Capabilities</p> <p>Based on the Resource strategy, detailed engineering analysis is performed to support the deployment of new resources. Careful interference analysis is required to ensure that deployable resources do not result in unintended interference.</p>
5	Fulfillment	<p>(0) Operations (1) Resource Management & Operations (2) Resource Provisioning (3) Configure & Activate Resource</p> <p>The final step to limited service restoral involves the careful activation of deployed resources and the close monitoring of initial limited service delivery.</p>

7.3. Scenario Extensions

This is a listing of how each step in the Main Success Scenario can be extended. Another way to think of this is how can things go wrong. The extensions are followed until either the Main Success Scenario is rejoined or the Failed End Condition is met. The Step refers to the Branch Step in the Main Success Scenario and has a letter associated with it. I.E if Step 3 branches the Extension Step is 3a.

<u>Step</u>	<u>Condition</u>	<u>Action Description</u>
	First responder activities request access to licensed spectrum to support initial relief efforts	TBD in future version

7.4. Open Issues

The following table provides insight to any unresolved problems or questions. These are the things that seem to apply but could not be fit into this use case on this pass.

<u>Issue ID</u>	<u>Issue Description</u>
1	Based on review of the current eTOM, it is not clear whether regulatory issues identified in this use case are adequately covered by the existing Regulatory processes under Enterprise Management. In this use case, regulatory interactions extend beyond the spectrum regulator and address the potential interactions in support of disaster response management authorities, which may influence the spectrum management processes of the CSP in the aftermath of the event.

8. Administrative Appendix

8.1. About this document

This document is an Application Note, aiming to document an approach based on industry experience that can be used by a company and adapted to its business needs.

Note that it repackages the content from the Spectrum Management-Network Management Integration team within TM Forum, and published as Technical Report TR171 “Commercial Spectrum Management Use Cases.”

8.2. Document History

8.2.1. Version History

Version Number	Date Modified	Modified by:	Description of changes
12.1	Mar 2012	Mike Kelly	Document launch – repackaging of TR171 from Spectrum/ Network Management as Business Process Framework Application Note
12.2	Apr 2012	Alicja Kawecki	Minor formatting, cosmetic corrections prior to posting for Member Evaluation

8.2.2. Release History

Release Number	Date Modified	Modified by:	Description of changes
12.0	Mar 2012	Mike Kelly	Document launch – repackaging of TR171 from Spectrum/ Network Management as Business Process Framework Application Note