



Spectrum Management

Prospectus

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Document Purpose & Organization

This Prospectus acts as a way of disseminating information as well as stimulating feedback and comment from those interested in participating in the TM Forum's Spectrum Management project. TM Forum members are encouraged to help shape the direction and goals of this project by providing their views and input to this document.

Thus, TM Forum members are strongly encouraged to review this Prospectus and provide feedback on the following:

Scope: *Are we addressing the right issues – the most pressing problems?*

Business Value: *Is the Prospectus sufficiently defined to justify resourcing the project. If not, do you have suggestions on how to improve the way the business value is being articulated?*

Organization: *Is your company willing to become an active member and/or commit resources to the Spectrum Management project?*

Executive Summary:

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 NetOps.¹ These trends are driving factors in the need to standardize Spectrum Management architectures, processes, information and data models, applications, interfaces, and testing. As the world-class industry standards/best practices body for communications service providers and the surrounding business ecosystem, the TM Forum is committed to addressing all essential aspects of network operations and management in its frameworks. The goal of the Spectrum Management Initiative is to integrate spectrum management into these frameworks.

The need for standardization of spectrum management is well recognized within multi-national military operations, as illustrated by the development of the open standard, Spectrum Management Allied Data Exchange Format (SMADEF-XML) by NATO countries, which has been adopted in the US DoD as the Military Communications-Electronics Board (MCEB) Publication 8. At the November 2010 Management World Americas (MWA) conference, the US Defense Spectrum Organization (DSO) within the Defense Information Systems Agency (DISA), spearheaded an initial discussion on Integrated NetOps: Spectrum Management. The presentations at MWA 2010 addressed the US DoD web-service strategy and data exchange standardization for spectrum management. In addition, the efforts of the P1900.5 Working Group of the IEEE Dynamic Spectrum Access (DYSPAN) Standards Committee were presented, addressing advanced concepts for policy-based management of dynamic spectrum access (DSA), a key emerging spectrum sharing concept. In addition, MCEB Pub 8 was provided to the TM Forum Government and Defense community during the 2010 Team Action Week in Baltimore, MD.

The MWA 2010 presentations and the spectrum data exchange standard contributions were initial steps in the effort to crystallize TM Forum community interest in moving forward with related projects around which operators, systems integrators and developers can create, integrate and leverage a more flexible, standards-based spectrum management capability. Strong member commitments to this topic will expedite projects aimed at enriching the TM Forum Framework with Spectrum Management coverage. Ultimately, **the goal of the Spectrum Management Initiative is to ensure that the TM Forum Framework fully integrates spectrum management requirements, enabling the development of certifiable, standards-based, interoperable COTS products and solutions.**

¹ In the US DOD, NetOps is defined as consisting of three essential tasks: Enterprise Management, Network Defense, and Content Management, coupled with situational awareness and command and control.

Background

Spectrum management (SM) encompasses the set of capabilities used to coordinate and deconflict proposed uses of the electromagnetic spectrum resulting in the allocation, allotment and assignment of frequencies to authorized users and systems. From the perspective of the wireless telecommunications service provider (SP), spectrum is the primary resource required for service delivery. The SP architecture is designed to maximize spectrum re-use, and typically remains static over long periods of time. The primary concern of the SP, during operations, is to detect and eliminate interference from unauthorized transmissions. Due to the traditionally static nature of SM, a standardized solution has not been addressed in the TM Forum Framework to date.

Next generation wireless networks will leverage increased spectrum flexibility to dynamically adapt network resources to more efficiently meet customer demands. Fixed-Mobile Convergence (FMC) architectures being developed by the 3rd Generation Partnership Project (3GPP) and associated IP Multimedia Subsystems (IMS) are laying the foundation for increasingly flexible solutions for service delivery. Service providers are already leveraging dual-mode Wi-Fi enabled phones to deliver services through Wi-Fi hotspots, reducing congestion on licensed spectrum by offloading a portion of the customer base onto unlicensed spectrum resources. The trend towards femtocells will enable Service Providers to further extend licensed spectrum re-use into targeted areas, leveraging broadband internet access for backhaul.

The trends above can mitigate the spectrum congestion to some extent, but access to additional spectrum remains a key element to meeting future demand. Regulators are working hard to identify spectrum for use by growing wireless network operations. Spectrum sharing is likely to be a key component in the regulatory approach as illustrated by selected recent events:

- The US National Broadband Plan, calls for increased transparency in allocation and utilization and innovative access models
- The European Commission 5-year Radio Spectrum Policy Program states: “spectrum use must be made as flexible as possible.”
- The US FCC finalizes the rules addressing the shared access to TV white space channels. The CEPT publishes a report on similar solutions for the European Community
- The World Radiocommunication Conference 2012 will consider regulatory measures to enable the use of cognitive radio systems, a key technology in dynamic spectrum access solutions

Many more related events are taking place around the world. The increase in spectrum flexibility will drive the need for increased integration of spectrum management systems with more traditional network operations and management systems.

The deployment of next-generation networks, with increasingly agile spectrum access, and the growing pressure for spectrum sharing form the backdrop against which a standards-based approach to management of spectrum resources can be discussed. In November 2010, the Defense Spotlight at Management World Americas highlighted the need for Spectrum Management enhancements to the TM Forum Frameworks. **A series of presentations on topics such as DoD Strategy for Spectrum Management Web-Services, Spectrum Management Data Exchange Standardization, and the Policy-based Management of Dynamic Spectrum Access**– provided valuable insight into the evolution of spectrum management within the defense community. As these presentations highlighted, spectrum management is emerging from traditionally stovepiped solutions, toward a more flexible service-based approach that can better support future automated, standardized and dynamic solutions for managing and sharing critical spectrum resources. Within a

given organization, this trend will be important to improve integration of spectrum management with broader network management, increasing efficiency and improving service delivery. In the coordination of future spectrum sharing among multiple organizations, this trend will be critical to enabling improved access to spectrum for all stakeholders.

In October 2010, the TM Forum established a Spectrum Management Web Community to facilitate discussion, collaboration, and contributions. As of the writing of this Prospectus, the Spectrum Management community boasts over 20 member companies (from Government/Defense, Communication Service Providers, System Integrators, Equipment Vendors, Software Vendors, Defense Contractors). The DoD MCEB Pub 8 was contributed by DISA and forms an important element in the incorporation of spectrum related data into the TM Forum Information Framework.

In 2011, a series of events are being planned at which the growing TM Forum Spectrum Management Community can gather to discuss the role of TM Forum Framework in reducing the integration tax and promoting interoperability among solution components in the realm of integrating spectrum management with existing network operations and management. Team Action Week 2011 in Paris, will offer the first opportunity to identify areas in which spectrum management concepts can be integrated with existing processes, information and data models, applications, tools, and more. This can “set the stage” for the launch of future TM Forum Projects to develop, leverage and incorporate community contributions into the TM Forum Framework.

There is no need to re-invent the basics. Leveraging contributions from our members, who base their work on best practices and existing industry standards, the TM Forum has undertaken a Spectrum Management Initiative to enrich its Frameworks and certification processes with “full-spectrum” guidance concerning architecture, processes, information and data models, applications, interfaces, and testing.

Program Aim:

Historically, Spectrum Management has been addressed separately from traditional key elements in operations management. The main aims of the Spectrum Management Initiative are to:

- Enhance the TM Forum Framework with Spectrum Management concepts. Ensure that the TM Forum Framework becomes the model of record. In order to ensure coherence and stability – work efforts on Spectrum Management outside of the TM Forum should be minimized. Strong liaisons with other related industry groups will be established where productive.
 - While the defense industry will provide the initial motivation, contributions and related project activities, the TM Forum community of wireless network operators, integrators and developers, stand to benefit from the work.
- Ensure that the necessary **industry standard specifications, software, test tools and certification programs** exist in a timely fashion to enable new infrastructure roll-out based on common operational management standards.
- Educate network operators, infrastructure suppliers and software suppliers of the **business benefits of such standards** and help ensure a vibrant provider-consumer eco-system.
- Ensure that **management standards are fully compatible** across Spectrum Management technologies using common process and information models.
- Ensure that such standards allow for the needs of both suppliers and operators to allow for tailoring to ensure that specific mission requirements are accommodated.

- Provide **implementer support, tools and guidance and certification** to support these activities.
- Promote our Spectrum Management work efforts and successes to the industry through various communications channels, TM Forum and 3rd party events.

In order to **advance quickly**, we will:

- Leverage the increasing global demand for spectrum as our justification for enriching our Frameworks with in-depth Spectrum Management coverage at this time.
- Draw on existing applicable and legitimized Spectrum and wireless related standards to jump start viable content:
 - US DoD Standard Spectrum Resource Format (MCEB Pub 8)
 - NATO Standard SMADEF-XML
 - IEEE DYSpan Standards Committee
 - IEEE 802.22, 802.19
 - ETSI REG/ERM-RM, TG
 - ECMA
 - ITU-R SG8
 - ECC: PT1, SE42
- Seek both contributions and subject matter experts on a variety of Spectrum Management topics.
 - Advertise our Spectrum Management work efforts across our existing TM Forum membership.
 - Pursue industry liaisons to supply subject matter expertise that doesn't exist within the TM Forum.
 - Recruit prospective member companies who provide subject matter expertise unavailable in the TM Forum
- Incorporate Spectrum Management concepts into TM Forum multi-vendor technology demonstrators (Catalysts) as a way to prove concepts and/or provide valuable input to forthcoming projects to evolve standards and best practices.
- Pursue liaisons with other industry bodies and standards organizations working in this area to promote coherence in spectrum management concepts and development.
- Provide cross-team collaboration and support between Spectrum Management projects and related projects, such as the Policy Information Exchange Project.

In addition, we aim to **change the culture associated with Spectrum Management** within the TM Forum, so that spectrum is no longer an off-line process, but is an integrated feature of all designs/solutions/products. To do this, we need a coordinated, well thought out effort to:

- Secure endorsement and resource commitment from TM Forum executive leadership, Board of Directors (BoD), Advisory Council, Service Provider Leadership Council (SPLC), and the Technical Program Committee (TPC).
- Incorporate text into the existing TM Forum templates, such as our Project Charter and Catalyst proposal templates, to facilitate discussion and potential incorporation of Spectrum Management into projects.

The TM Forum is uniquely placed to drive this program, having a membership of over 700 companies in 185 countries across the entire spectrum from service providers to equipment suppliers, software suppliers and systems integrators. Our service provider members operate some of the largest networks in the world and many of our vendor members work in the spectrum management arena. We also operate a broad series of liaisons with other industry groups and intend to draw on their work as well as contribute our work to other relevant organizations to avoid duplication and fragmentation. One such example is our liaison with the 3GPP a key partner in the New Technologies initiative, working on the development of a converged wireless/wireline network management capability.

Key to success is the fact that TM Forum's work is driven and created by its members who undertake collaborative research and development in global online communities. This way of working brings together the world's experts together to focus on the problem at hand while ensuring that the outcome meets the strategic needs and objectives of its member companies. By getting involved, members help shape the project by driving the priority work items or contributing to the technical solutions we are producing.

Proposed Approach:

Ultimately, the aim is to enhance TM Forum Framework with Spectrum Management concepts, so that they become the de-facto standard for vendors to incorporate into their products.

It is anticipated that the deliverable-based approach will involve multiple projects, or a multi-phased project. The pace of the project(s) will be dependent on contributions and subject matter expert availability.

The preliminary set of deliverables is being developed. Example projects include:

1. Develop initial use cases which demonstrate the benefits to be achieved through the standardization and integration of spectrum management and network management.
2. Enhance the TM Forum Information Framework (SID) with an initial set of spectrum elements from the MCEB Publication 8 Standard Spectrum Resource Format before the close of 2Q11.
3. Incorporate spectrum management scenarios into current and future Government/Defense multi-vendor technology demonstrators (Catalyst projects for Management World Americas 2011)
4. Extend the remaining frameworks that are part of Framework (Business Process and Application Map) with spectrum concepts
 - o Incorporate Spectrum Management Level 1 processes into the TM Forum Business Process Framework (eTOM)
 - o Identify an initial set of Spectrum Management application types into the TM Forum Application Framework (TAM)

Resources Required for Success:

It is expected that several projects and/or a multi-phased approach, and will utilize dedicated resourced project team(s), the Spectrum Management Community, and TM Forum events and workshops for face-to-face development opportunities.

A Spectrum Management community web-page has been established to communicate this effort via the TM Forum web facility. Furthermore, a Spectrum Management marketing plan will be established to communicate these efforts to the broader TM Forum membership and industry at large.

The initial phase of this project will benefit from the following resource commitments:

- Committed Government/Defense Agencies and Service Providers (project champions)
- Spectrum Management Subject Matter Expert(s) (domain knowledge)
- Information Model (SID) Subject Matter Expert (expertise & liaison)
- Interface Program Liaison (expertise)
- Project Management (organization and task facilitation)
- Government/Defense Market Center (visibility and promotion)
- Catalyst (trial)
- Marketing (promotion and awareness)
- TM Forum Technical Committee (awareness)

Related TM Forum Projects and Liaisons:

The Policy Information Exchange Project could establish a useful framework for the sharing of Spectrum Management Policies.

A number of existing liaisons are directly relevant to this project include the 3GPP, and the Next Generation Mobile Networks (NGMN) liaisons. Additional liaisons are being considered, such as the Wireless Innovation Forum, but nothing has been established at the time of this writing.

Interested Companies:

Interested companies will be identified in the coming months as the Spectrum Community is established. It is expected that in addition to the defense community members involved to-date, wireless service providers, and wide range of integrators and developers will become active participants. In particular, vendors who offer Spectrum themed products/services will be identified and recruited for this effort.